

# I-87211W

## User Manual v2.6



 **High Quality, Industrial Data Acquisition, and Control Products**

## Warranty

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

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Version	Date	Author	Description
1.0	2010/2/1	Anold	Release version

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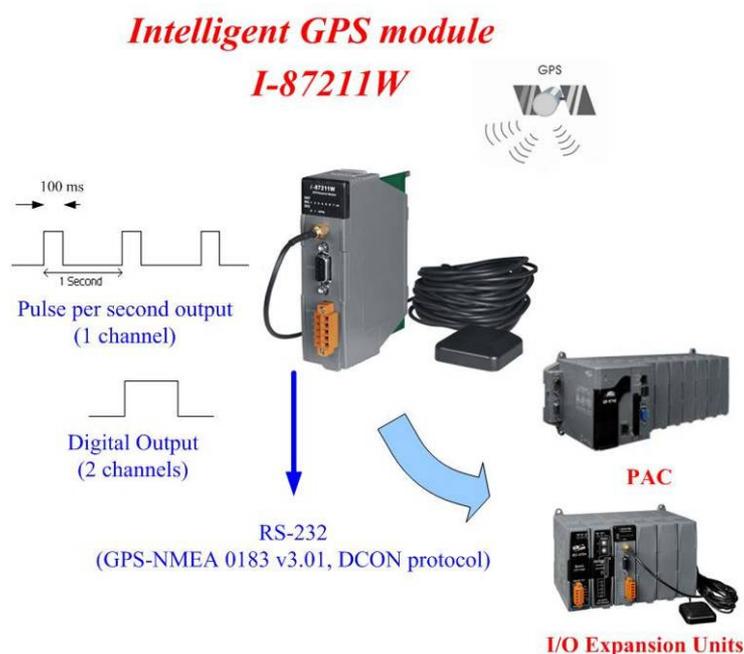
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# 1 Introduction

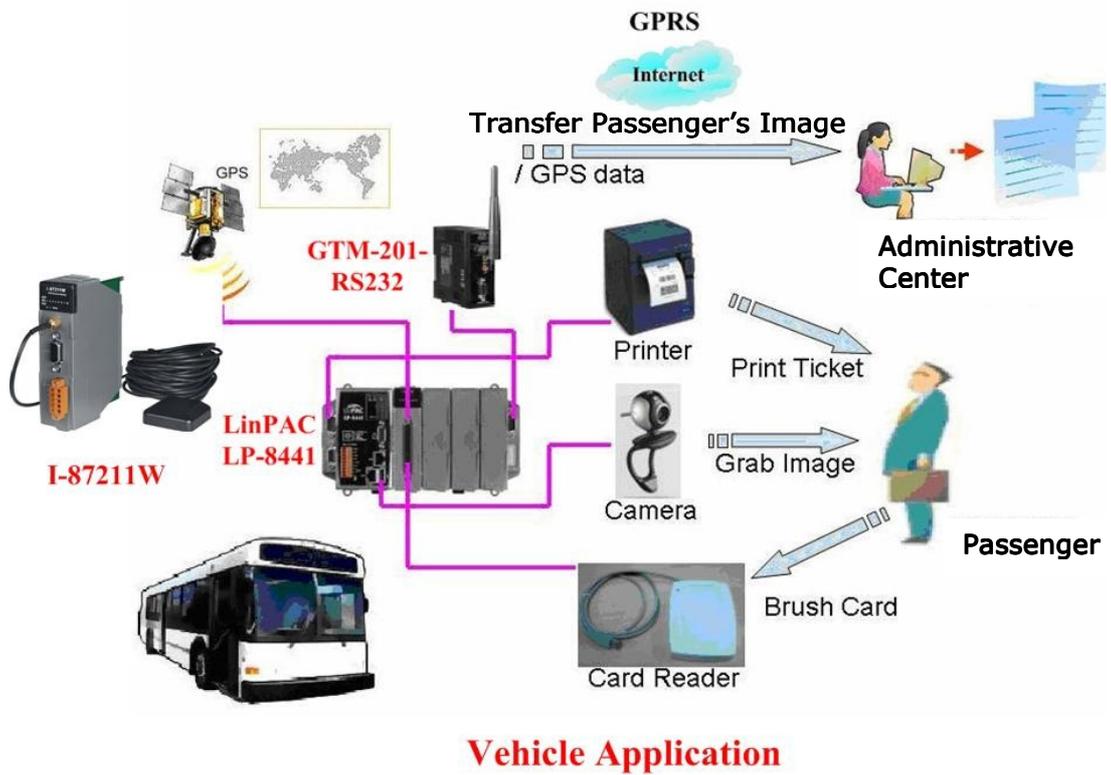
The I-87K Series of modules from ICP DAS can support either MCU or I/O expansion units. The I-87211W features high sensitivity and low power, and an ultra small form factor and includes DCON and GPS protocols. The internal GPS module is powered by a MediaTek solution and can provide superior sensitivity and performance, even in as urban canyon environment or an environment with dense foliage environment. Except for the GPS data, I-87211W includes a 2-channel DO and a 1-channel PPS for user applications. The Pulse Per Second (PPS) is an electrical signal that very precisely indicates the start of a second, and can be used for precise timekeeping and time measurement. The PPS functionality can be combined with another time source that provides the full date and time in order to ascertain the time both accurately and precisely.

Consequently, the I-87211W can act as a powerful GPS module as well as a general purpose GPS module with an RS-232 interface for use with PACs and remote I/O expansion units. It can also be implemented in automotive navigation system, personal positioning and navigation system, marine navigation and satellite time correction system, etc.



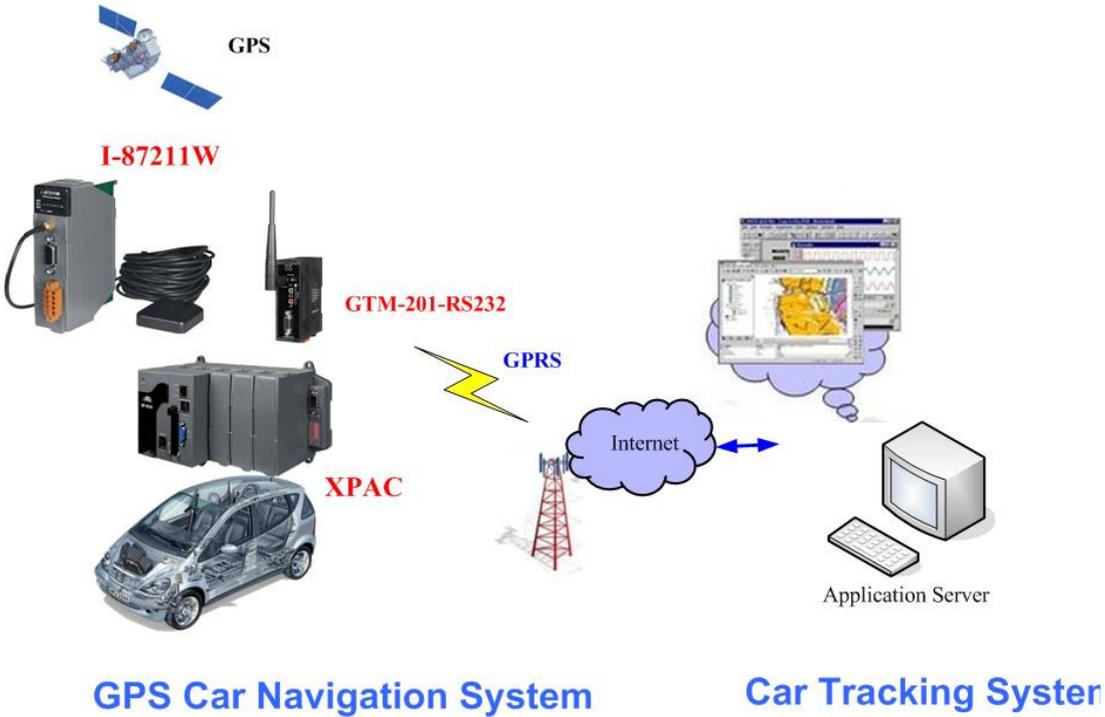
**Applications:**

- Automotive navigation
- Personal positioning and navigation
- Marine navigation
- Satellite time correction
- Precise timekeeping and time measurement





### Time Calibration for PACs



## 1.1 Features

Supports PACs and Remote I/O expansion units by ICP DAS

- MediaTek high-sensitivity GPS solution
- Supports 66-channel GPS and NMEM v0183 v3.01
- RS-232 supports NEMA v0183 v3.01 format or the DCON protocol
- Built-in 2-channel DO, 1-channel PPS (1 pulse per second), 1 RS-232 port
- PPS: 100 ms pulse output/sec for precise timekeeping and time measurement
- Various system LED indicators
- DIN Rail mounting

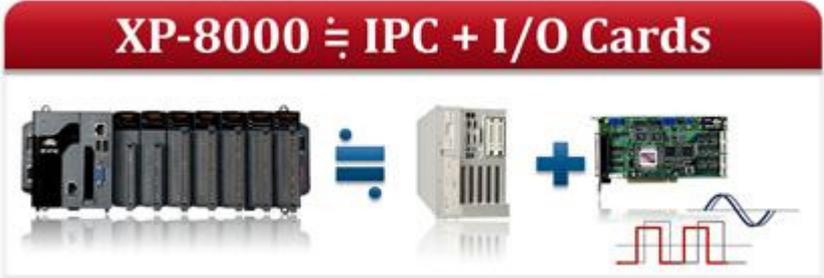
## 1.2 Supports ICP DAS Units

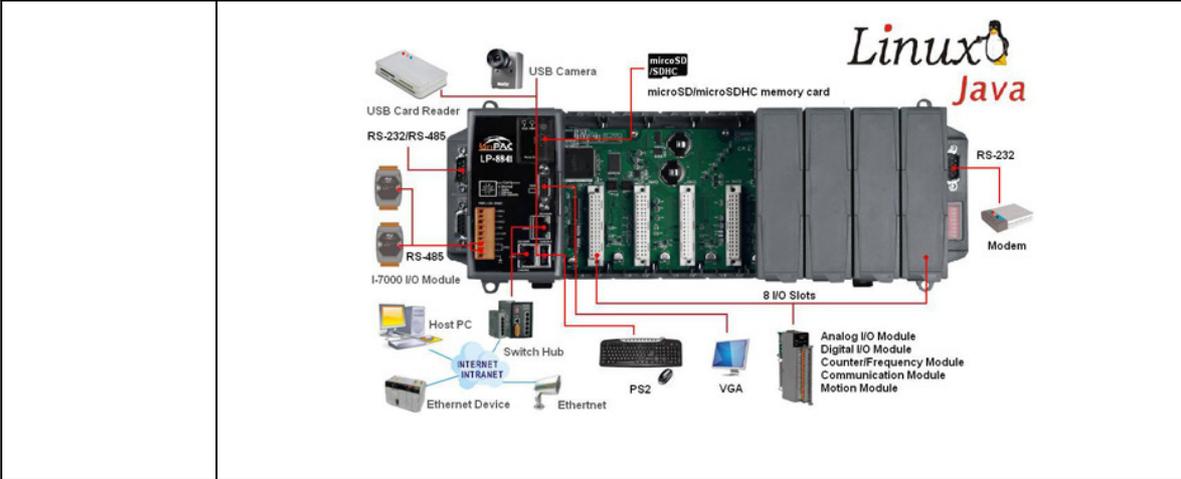
- PAC Units:

ICP DAS provides a series of PAC (Programmable Automation Controller) units that are especially suited for industrial control systems in harsh environments. The I-87211W can be inserted into these PACs for applications such as vehicle navigation, Marine navigation and Satellite time correction system, etc. For detailed information regarding PACs, please visit:

<http://www.icpdas.com/products/Products-list.htm#P1>

Item	Description
<b>XPAC</b>	Equipped with an AMD LX 800 CPU (500MHz) running the Windows Embedded Standard 2009 operating system, a variety of connectivity types (VGA, USB, Ethernet, RS-232/RS-485) with 3/7 slots for high performance parallel I/O modules (high profile I-8K series) and serial-type I/O modules (high profile I-87K I/O modules). <b>Windows Embedded Standard 2009</b>

	
<p><b>XPAC-CE6</b></p>	<p>Equipped an AMD LX 800 CPU (500MHz) running the Windows Embedded Standard 2009 operating system, a variety of connectivity types (VGA, USB, Ethernet, RS-232/RS-485) with 3/7 slots for high performance parallel I/O modules (high profile I-8K series) and serial-type I/O modules (high profile I-87K I/O modules).</p> <p><b>Windows Embedded CE 6.0</b></p> 
<p><b>WinPAC</b></p>	<p>WinPAC is equipped with a PXA270 CPU (520MHz) running the Windows CE.NET 5.0 operating system, a variety of connectivity types (VGA, USB, Ethernet, RS-232/485) with 1/4/8 slots for high performance parallel I/O modules (high profile I-8K series) and serial-type I/O modules (high profile I-87K I/O modules).</p> <p><b>Windows CE 5.0</b></p>
<p><b>LinPAC</b></p>	<p>LinPAC-8000 gives users all of the best features of both traditional PLCs and Windows capable PCs. The LinPAC-8000 includes a VGA port allowing users to choose a regular LCD monitor for the display of HMI application, a USB port to connect with a Keyboard, Mouse, a USB device for storage or touch monitor, and micro SD/microSDHC memory for storage of programs and data.</p> <p><b>Linux OS</b></p>



**ViewPAC**

ViewPAC is an innovative product developed by ICP DAS. It is a PAC that combines display, operation and control in a single unit. ViewPAC provides the perfect solution to integrating HMI, data acquisition and control in a single PAC.

**OS: Windows CE 5.0, MiniOS7**



The iPAC-8000 is a new family of compact, modular, intelligent and rugged, distributed I/O (input/output) systems, designed for data acquisition and control in manufacturing, research and education.

**OS: MiniOS7**

**iPAC**

**iPAC-8000 Compact Embedded Controller Contents**

The iPAC-8000 is a new family of compact, modular, intelligent and rugged, distributed I/O (input/output) systems.



● Remote I/O Expansion Units

ICP DAS provide remote I/O Expansion Units to enable users to extend I/O applications using RS-485, Ethernet or USB interfaces. The I-87211W can also be installed in these units. For more details, please visit:

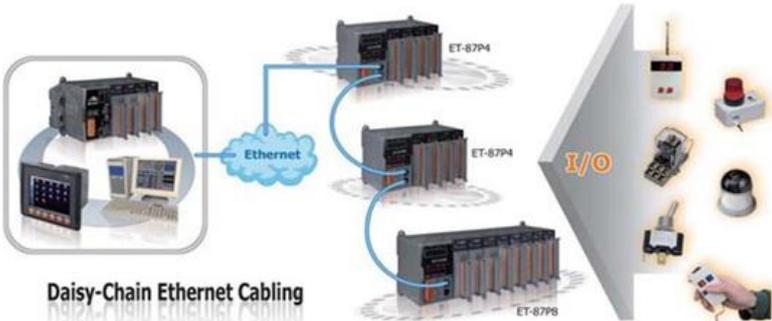
[http://www.icpdas.com/products/io\\_expansion\\_unit/IO\\_Expansion\\_Unit.htm](http://www.icpdas.com/products/io_expansion_unit/IO_Expansion_Unit.htm)



RS-485 I/O Expansion units



USB I/O Expansion units



Intelligent Ethernet I/O Expansion

Item	Description
<b>RU-87Pn</b>	<b>Intelligent RS-485 I/O expansion unit</b> The RU-87Pn series is a remote intelligent I/O expansion unit that can be used to expand I-87K series I/O modules connected to an RS-485 network for industrial monitoring and control applications.
<b>I-87Kn</b>	<b>RS-485 I/O expansion unit</b> This unit is only equipped with a single power module, a single RS-485 interface and several I/O slots. It can be used to expand I/O modules via the RS-485 interface.
<b>USB-87Pn</b>	<b>Intelligent USB I/O expansion unit</b> This unit can be used to expand I-87K series I/O modules via the RS-485 interface. It is equipped with a single power module, 1 USB interface, 1 CPU module and several I/O slots.
<b>ET-87Pn</b>	<b>Intelligent Ethernet I/O expansion unit</b> This unit can be used to expand I-87K series I/O modules via an Ethernet interface. It is equipped with a single power module, 2 Ethernet ports, 1 CPU module and several I/O slots.

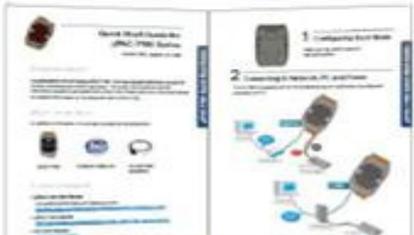
### 1.3 Package List



One I-87211W Module



Software Utility CD



Quick Start Guide

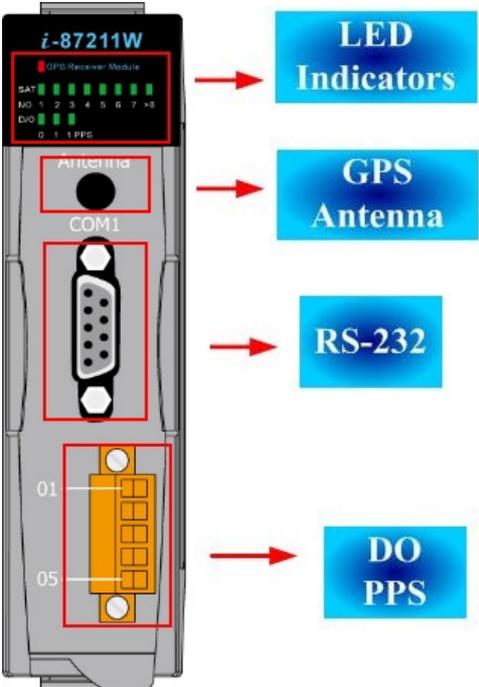


RS-232 Cable

Item	Quantity
I-87211W	1
External GPS antenna (ANT-115-03, Length: 5m)	1
RS-232 Cable (CA-0915)	1
Product CD	1
Quick Start Guide	1

Please check that the items above are contained in the package after receiving your I-87211W. If there are any problems, contact the supplier of the module.

# 1.4 Hardware



## Specifications

### General specifications:

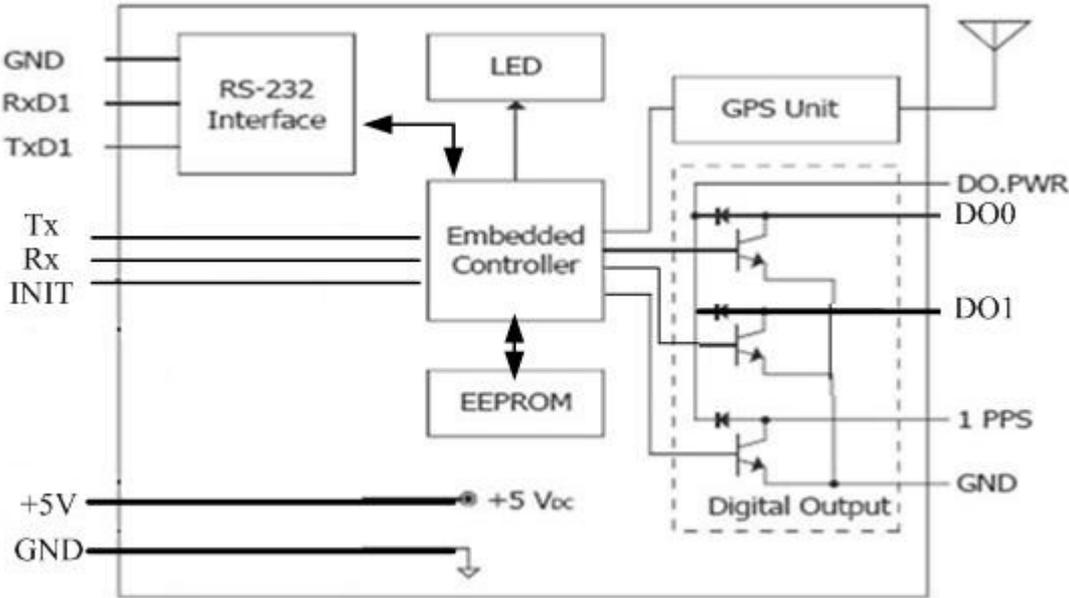
<b>GPS Receiver</b>	
Chip	MediaTek solution
Frequency	L1 1575.42 MHz, C/A code
Supported Channels	32
Position Accuracy	Capable of SBAS (WAAS, EGNOS, MSAS)
Max. Altitude	<18,000 m
Max. Velocity	<515 m/s
Acquisition Time	Cold Start (Open Sky) = 42 s (typical)
Sensitivity	Tracking=Up to -158 dBm Cold start=Up to -142 dBm
Protocol Support	NMEA 0183 version 3.01
<b>GPS Antenna (default)</b>	
Length	5 m
Frequency Range	1575.42 ± 1.023 MHz.
Gain	At 90° 30 ± 4.5dBi – (cable loss) Mounted on the 60mm*60mm ground plane.
Output Impedance	50Ω
VSWR	2.0 Max
<b>GPS Output</b>	
1 PPS	Pulse per second output (Default 100 ms pulse/sec)
RS-232 Interface	GPS information output
<b>LED Indicators</b>	
Power/Communication	1 LED
GPS	8 LEDs
DO	2 LEDs
PPS	1 LED
<b>Power</b>	
Protection	Power reverse polarity protection
Frame Ground for ESD	Yes
<b>Protection</b>	
Power Consumption	0.6 W
<b>Mechanical</b>	
Dimensions (W x H x D)	30 mm x 102 mm x 115 mm
Weight	200 g

Housing	Plastic
<b>Environment</b>	
Operating Temperature	-25 °C ~ +75 °C
Storage Temperature	-40 °C ~ +80 °C
Humidity	5 ~ 95% RH, non-condensing

### **I/O specifications**

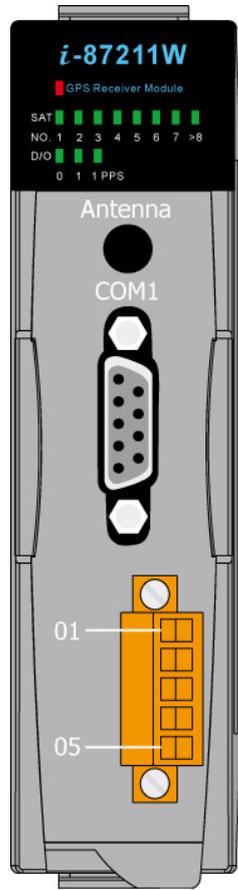
<b>Digital Output</b>	
Output Channel	2 (Sink)
Output Type	Non-isolated Open Collector
Output Current	100 mA per channel
Load Voltage	+10 VC ~ +30 VC

### Block Diagram for the I-87211W



## Pin assignments and LED Indicators

### ● Pin assignments



Pin Assignment	Terminal No.	Pin Assignment
-	01	-
GPS_TxD	02	-
GPS_RxD	03	-
-	04	-
GND	05	-

COM1 9-Pin Female D-Sub Connector

Terminal No.	Pin Assignment
01	DO.PWR
02	DO_0
03	DO_1
04	1 PPS
05	GND

### ● LED indicators

LED	status	Description
GPS (red)	ON	Module is operating / functioning correctly.
	OFF	There is an error with the module. The module has encountered an error.
SAT (green)	ON	Indicates how many GPS satellites are in View.
	OFF	
DO0 (green)	ON	Digital Output 0 is active.
	OFF	Digital Output 0 is off.
DO1 (green)	ON	Digital Output 1 is active.
	OFF	Digital Output 1 is off.
1 PPS (green)	ON	The PPS is on.
	OFF	The PPS is off.

## Operation modes

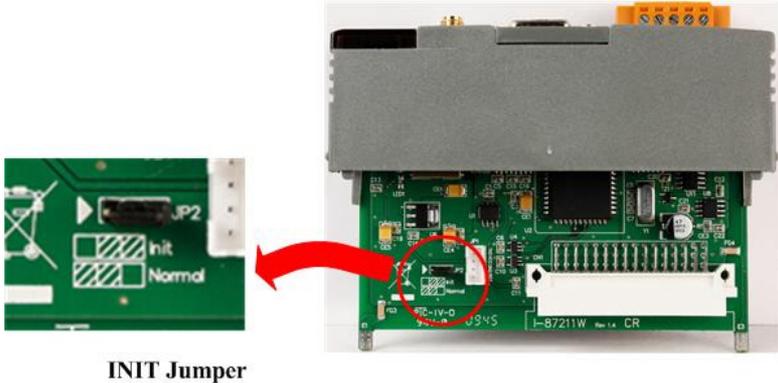
The I-87211W has two operation modes (INIT and normal modes) that can be determined using the switch mechanism on the I/O expansion unit.

**Note:**

- 1. Users should refer to the manual for the various remote I/O expansion units to understand how to operate the I-87211W in INIT or normal modes.
- 2. When plugging the I-87211W module into a PAC, the module is always in INIT mode. A description of each mode and a diagram are below.

Mode	Description
INIT	After setting the module to “INIT” mode and restarting, users can establish a connection using the default address and communication settings can then be set. New parameters for the module. INIT mode: <ul style="list-style-type: none"><li>● Protocol: DCON</li><li>● Module address: 00</li><li>● Communication Baud Rate: 9600bps</li><li>● Checksum: Disabled</li></ul> Note: The DCON command used to configure the address, Baud Rate and checksum of the module is %AANNTTCCFF. Refer to Section 2.1 for details.
Normal	In this mode, the module is running by user’s settings.

### INIT Pin (JP2)



INIT Jumper



## Wiring Recommendations

- Use 26-12 AWG wires for signal connections.
- Strip the wire to a length of 7±0.5mm.
- Use a crimp terminal for wiring.
- Avoid high-voltage cables and power equipment as much as possible.

## Wiring

### ● DO wiring

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

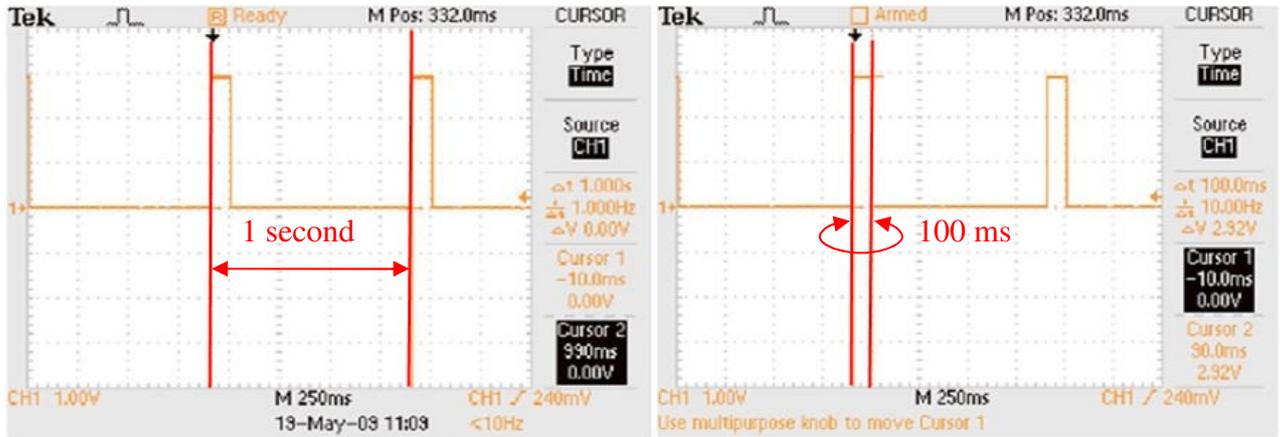
### ● PPS wiring

Output Type	ON State	OFF State
	Relay ON	Relay Off
Drive Relay		
Resistance Load		

The PPS will output a single 100 ms pulse per second when receiving effective GPS signals. See the figure B below for details.

Figure A.

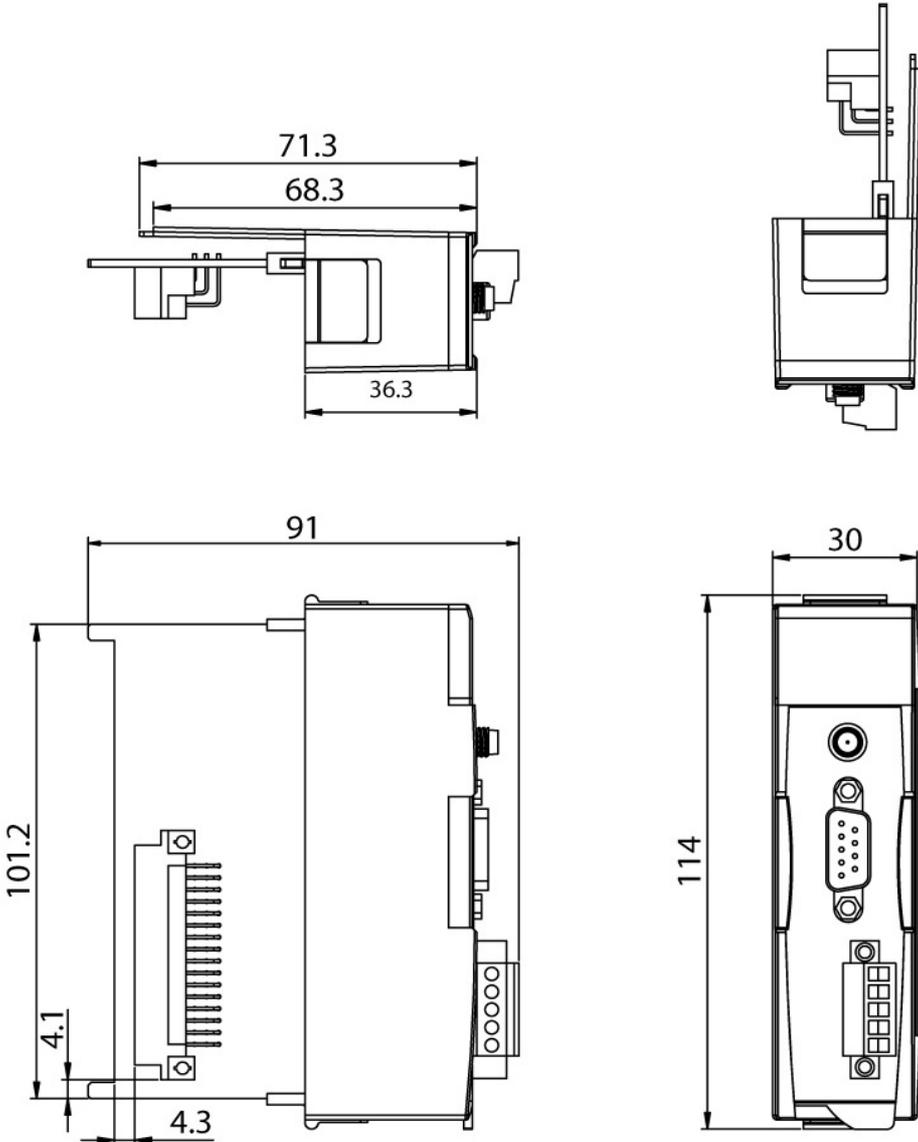
Figure B.



The figure A is represented by outputting a signal in 1 second cycle.

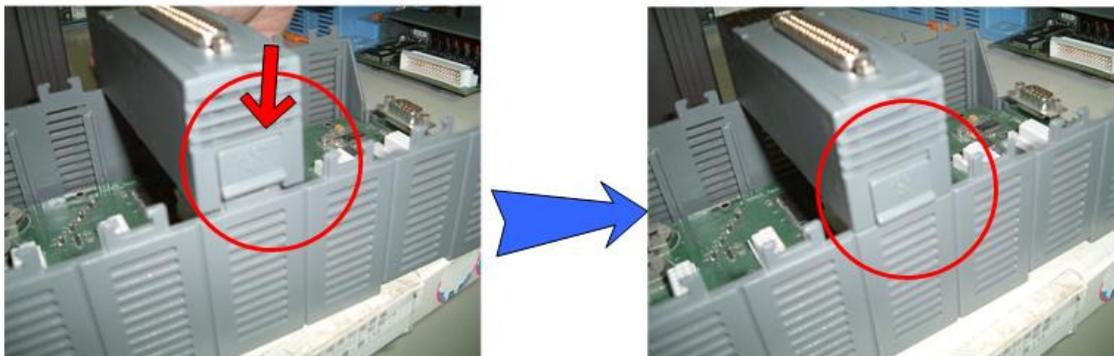
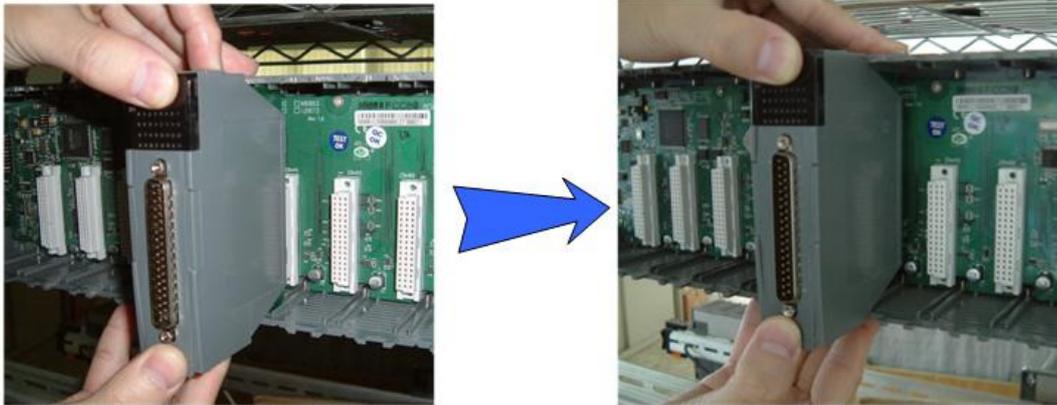
Note: A pulse per second (PPS) is an electrical signal that can be used to precisely indicate the start of a second. PPS signals can be used for precise timekeeping and time measurement. PPS functionality can be combined with another time source that provides the full date and time in order to accurately and precisely ascertain the correct time.

# 1.5 Dimensions



## 1.6 Installation

Use the figures below as a guide to installing your I-87211W in a PAC.



**Note:**

If the I-87211W is not able to receive GPS signals, check the position of the antenna or install the GPS antenna in an open environment.

## 1.7 Configuration Table

- Baud Rate Setting (CC)

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

- Type Code Setting (TT)

Note: The Type Code is fixed at 40.

- Data Format Setting (FF)

7	6	5	4	3	2	1	0
(0)	CS	(0)			(0)		

Key	Description
CS	Checksum 0: Disabled 1: Enabled

## 1.8 Technical Support

Should you encounter any problems while using your I-87211W module, and are unable to find help in this manual or on our website, please contact ICP DAS Product Support.

Email: [service@icpdas.com](mailto:service@icpdas.com)

Website: <http://www.icpdas.com/sevices/support.htm>

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

1. Module name and serial number: The serial number can be found printed on the barcode label attached to the cover of the module.
2. Firmware version: See Sections 2.15 for information regarding the command used to identify the firmware version.
3. Host configuration (type and operating system)
4. If the problem is reproducible, please give full details describing the procedure used to reproduce the problem.
5. Any specific error messages displayed. If a dialog box with an error message is displayed, please include the full text of the dialog box, including the text in the title bar.
6. If the problem involves other programs or hardware devices, please describe the details of the problem in full.
7. Any comments and suggestions related to the problem are welcome.

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

## 2 DCON Protocol

All communication with I-87K modules consists of commands generated by the host and responses transmitted by the I-87K modules. Each module has a unique ID number that is used for addressing purposes and is stored in nonvolatile memory. The ID is 00 by default and can be changed using a user command. All commands to the modules contain the ID address, meaning that only the addressed module will respond. The only exception to this are the commands #\*\* (Section 2.2) and ~\*\* (Section 2.27), which are sent to all modules, but in both of these cases, the modules do not reply to the command.

### Command Format

Leading Character	Module Address	Command	[CHKSUM]	CR
-------------------	----------------	---------	----------	----

### Response Format

Leading Character	Module Address	Data	[CHKSUM]	CR
-------------------	----------------	------	----------	----

**CHKSUM** A 2-character checksum which is present when the checksum setting is enabled. See Sections 1.10 (Data Format Setting) and 2.1 for details.

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

---

## Checksum Calculation:

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

### Example :

Command string: \$012(CR)

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

Response string: !01200600(CR)

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

Note: All characters should be in upper case.

**DCON Table**

<b>General Command Sets</b>			
<b>Command</b>	<b>Response</b>	<b>Description</b>	<b>Section</b>
%AANNTTCCFF	!AA	Sets the Module Configuration	2.1
#**	No Response	Synchronized Sampling	2.2
#AA	!AA(Data)	Reads UTC Time, latitude, longitude, and the number of GPS satellite signals	2.3
#AAN	!AA(Data)	Reads UTC Time, latitude, longitude, date and the number of GPS satellite signals individually	2.4
#AA00(Data)	>	Sets the Digital Output	2.5
#AA0A(Data)	>	Sets the Digital Output	2.6
#AA1c(Data)	>	Sets the Digital Output	2.7
#AAAc(Data)	>	Sets the Digital Output	2.8
\$AA2	!AANNTTCCFF	Reads the Module Configuration	2.9
\$AA4	!S(Data)	Reads the Synchronized Data	2.10
\$AA5	!AAS	Reads the Reset Status	2.11
\$AA6	!AA(Data)	Reads the Digital Output Status	2.12
\$AAC	!AA	Clears the Latched DO Status	2.13
\$AAD	!AA	Save the current date temporarily	2.14
\$AAF	!AA(Data)	Reads the Firmware Version	2.15
\$AAM	!AA(Data)	Reads the Module Name	2.16
\$AALS	!AA(Data)	Reads the Latched DO Status	2.17
@AA	>(Data)	Reads the Digital I/O Status	2.18

@AA(Data)	>	Sets the Digital Output Channels	2.19
~AAO(Name)	!AA	Sets the Module Name	2.20
~AAD	!AAF	Reads the DI/O active status.	2.21
~AADVV	!AA	Sets the DI/O active status.	2.22
~AAI	!AA	Sets the soft INIT	2.23
~AATnn	!AA	Sets the soft INIT timeout value	2.24

<b>Host Watch Dog Command Sets</b>			
<b>Command</b>	<b>Response</b>	<b>Description</b>	<b>Section</b>
~**	No Response	Host OK (The address in this command is zero and can clear the watch dog counter.)	2.25
~AA0	!AASS	Reads the Status	2.26
~AA1	!AA	Resets the Status	2.27
~AA2	!AAVV	Reads the Timeout Settings	2.28
~AA3EVV	!AA	Sets the Timeout Settings	2.29
~AA4V	!AA(Data)	Reads the Power On/Safe Value	2.30
~AA5V	!AA	Sets the Power On/Safe Value	2.31

## 2.1 % AANNTTCCFF

### Description:

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

### Syntax:

#### **%AANNTTCCFF[CHKSUM](CR)**

%	Delimiter character
AA	Address of the module to be configured in hexadecimal format (00 to FF)
NN	New address of the module in hexadecimal format (00 to FF)
TT	Type Code (Refer to Section 1.9 configuration table) The type Code of the GPS-721 is fixed as 40
CC	Refer to the module section 1.9 configuration table. The BaudRate is not set when the modules is not in Init mode
FF	0

### Response:

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

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

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)

Note: 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: %0109400600

Response: !09

Sets the address from 01 as 09. The response “!09” indicates that the command is valid.

Command: \$092

Response: !09400600

Success to read the configuration of this module.

Command: %0905400940

Response: ?05

Changes the Baud Rate of module 01 to 57600bps. The module returns an invalid command because it is not in INIT\* mode.

Command: %0905400940

Response: !05

Changes the Baud Rate of module 01 to 57600bps and the module returns a valid response.

**Related Commands:**

Refer to Section 2.9 \$AA2, Section 2.23 ~AAI, and Section 2.26 ~AATnn

**Note:**

1. Changes to the address settings take effect immediately after a valid command is received. Changes to the Baud Rate and checksum settings take effect on the next power-on reset.
2. In order to change the Baud Rate, checksum settings or others, the module needs to be in Init mode. Another way is to send the following commands beforehand.
  - I. Send command ~AATnn (Refer to Section 2.27)
  - II. Send command ~AAI (Refer to Section 2.26\_)
  - III. Send command %AANNTTCCFFIf these commands are valid, the Baud Rate, checksum or others will take effect after the module responds with “!AA”.

## 2.2 #\*\*

### Description:

When the command is received, it allows all modules to read the data and stores the data for later retrieval.

### Syntax:

#\*\*[CHKSUM](CR)

# Delimiter character

\*\* Synchronized sampling command

### Response:

Valid Command: There is no response with this command. To access the data, another command, \$AA4, must be sent.

### Examples:

Command: #\*\*

Response: No response

Sends the synchronized sampling command to all modules.

Command: \$014

Response: !1060000

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

Digital Output: 0x06

Command: \$014

Response: !0060000

Sends a command to read the synchronized data.

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

Digital Output: 0x06 °

**Related Commands:**

Refer to Section 2.10 \$AA4

## 2.3 #AA

### Description:

This command is used to read UTC Time, latitude, longitude, the quantity and other GPS satellite signal information.

### Syntax:

#### #AA[CHKSUM](CR)

#	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)

### Response:

Valid Command:	!AATTTTTT.TTT,LLLL.LLLL,C,NNNNN.NN NN,C,P,S
!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)
TTTTTT.TTT	UTC Time
LLLL.LLLL	Latitude
C	N or S (North or South)
NNNNN.NNNN	Longitude
C	E or W (East or West)
P	P=Position Fix Indicator 0=No fix, invalid 1=GPS SPS Mode, fix valid

2=Differential GPS,SPS Mode, fix valid

6=Estimated (DR) fix

S

S=Number of the satellites in view: Range

0~12

If there are not enough GPS satellites in view, the data will be set as 9.

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

### Examples:

Command: #01

Response: !01999999.999,9999.9999,9,99999.9999,9,0,00

Reads the UTC time, latitude, longitude, mode and number of satellites in view for a module, and the module returns a valid response. The response shows the GPS data is invalid.

### Example:

Command: #01

Response: !01035035.00,2451.70629,N,12100.98908,E,1,9

Sends a command to read the following information and the module replies with a valid response.

UTC Time: 035035.000

Latitude, Longitude: 2451.7056, N,12100.9903, E

Position Fix Indicator: 1

Satellites in view: 9

### Related Commands:

Section2.4 #AAN

## 2.4 #AAN

### DESCRIPTION:

This command is used to individually read the UTC time, latitude, longitude, date and the number of satellites in view.

### Syntax:

#### #AAN[CHKSUM](CR)

#	Delimiter character
AA	Address of the module in hexadecimal format(00 to FF)
N	0: The GPRMC sentence 1: UTC Time 2: Latitude and longitudes 3: Number of Satellites in view 4: Date 5: Speed over ground in knots 6: Track angle in degrees True

### Response:

N=0 :	!AA[Data]
N=1 :	!AATTTTTTT.TTT
N=2 :	!AALLLL.LLLL,C,NNNNN.NNNN,C
N=3 :	!AAS
N=4 :	!AADDMMYY
N=5 :	!AAP.P
N=6 :	!AAG.G

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)
TTTTTT.TTT	UTC time
LLLL.LLLL	Latitude
C	N or S (North or South)
NNNN.NNNN	Longitude
C	E or W (East or West)
S	S=The satellites in view: Range 0~12
DDMMYY	Date: D (day), M (month), Y (year)
P	Speed in knots
G	Angle in degrees True

If there are not enough GPS satellite signals, the data will be set as 9.

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

### Examples:

Command: #011

Response: !01999999.999

Reads the UTC time of module 01 and the module returns a valid response. The response shows the GPS data is invalid.

Command: #012

Response: !012451.7057,N,12100.9904,E

Reads the Latitude and longitude for module 01.

Latitude, Longitude: 2451.7056,N,12100.9903,E ◦

Command: #013

Response: !019

Reads the number of satellites in view for module 01  
and indicates that there are 9.

Command: #014

Response: !01280308

Indicates that the current date is 3/28/2008. The  
\$AAD command needs to be sent to update the  
date before using this command.

**Related Commands:**

Section 2.3 #AA, Section 2.13 \$AAD

## 2.5 #AA00(Data)

### Description:

This command is used to set the digital output value of the module.

### Syntax:

#### #AA00(Data)[CHKSUM](CR)

#	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
00	Command to set the digital output value of the lower eight channels
(Data)	A two-digit hexadecimal value Bit 0 corresponds to DO0 and Bit 1 corresponds to DO1 A bit value 1 of denotes that the digital output channel is on and a bit value of 0 denotes that the digital output channel is off

### Response:

Valid Command: >[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

Ignored Command: ![CHKSUM](CR)

> Delimiter for a valid command

? Delimiter for an invalid command

! Delimiter for an ignored command:

If a Host WatchDog Timeout occurs, the module

---

will reset to safe mode and the DO output  
command will be ignored

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: #010001

Response: >

Sets DO0 of the module with address 01 and the  
module returns a valid response.

Command :#010016

Response: ?01

Sets DO0 and DO3 to Off, DO1 and DO2 to On  
DO6, DO7 and DO8 to Off and DO5 to On ◦

This module only includes one DO channel, so the  
command is invalid.

Command: #010001

Response: !

A Host WatchDog Timeout was occurred and so the  
DO output command is ignored.

**Related Commands:**

Section 2.6 #AA0A (Data)

Section 2.12 \$AA6

Section 2.7 #AA1cDD

Section 2.18 @AA

Section 2.8 #AAAcDD

Section 2.19 @AA(Data)

## 2.6 #AA0A(Data)

### Description:

This command is used to set the digital output value of the module.

### Syntax:

#### #AA0A(Data)[CHKSUM](CR)

#	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
0A	Command to set the digital output value for the lower eight channels
(Data)	A two-digit hexadecimal value Bit 0 corresponds to DO0 and Bit 1 corresponds to DO1 A bit value 1 denotes that the digital output channel is on and a bit value of 0 denotes that the digital output channel is off

### Response:

Valid Command: >[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

Ignored Command: ![CHKSUM](CR)

> Delimiter for a valid command

? Delimiter for an invalid command

! Delimiter for an ignored command:

If a Host WatchDog Timeout occurs, the module will reset to safe mode and the DO output

---

command will be ignored

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: #010A01

Response: >

Sets the DO0 of the module with address 01 to On, and the module returns a valid response.

Command: #010A01

Response: !

A Host WatchDog Timeout was occurred and so the DO output command is ignored.

Command: #060A00

Response: !

A Host WatchDog Timeout has occurred and so the DO output command is ignored.

**Related Commands:**

Section 2.5 #AA00(Data)      Section 2.12 \$AA6

Section 2.7 #AA1cDD      Section 2.18 @AA

Section 2.8 #AAAcDD      Section 2.19 @AA(Data)

## 2.7 #AA1cDD

### Description:

This command is used to set a single digital output channel for the lower eight channels.

### Syntax:

#### #AA1cDD[CHKSUM](CR)

#	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
1	Command to set a single digital output channel for the lower eight channels
c	Specifies the digital output channel to be set (ranging from 0 to 7)
DD	00: sets the digital output channel to off 01: sets the digital output channel to on

### Response:

Valid Command: >[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

Ignored Command: ![CHKSUM](CR)

> Delimiter for a valid command

? Delimiter for an invalid command

! Delimiter for an ignored command:

If a Host WatchDog Timeout occurs, the module will reset to safe mode and the DO output

---

command will be ignored

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: #011001

Response: >

Sets the DO0 of the module with address 01 to On, and the module returns a valid response.

Command: #011400

Response: ?01

Sets DO4 to Off. This module only include on DO0 channel, so the command is invalid.

Command: #011201

Response: !

A Host WatchDog Timeout has occurred and so the DO output command is ignored.

**Related Commands:**

Section 2.5 #AA00(Data)

Section 2.12 \$AA6

Section 2.6 #AA0A(Data)

Section 2.18 @AA

Section 2.8 #AAAcDD

Section 2.19 @AA(Data)

## 2.8 #AAAcDD

### Description:

This command is used to set a single digital output channel for the lower eight channels.

### Syntax:

#### #AAAcDD[CHKSUM](CR)

#	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
A	Command to set a single digital output channel for the lower eight channels
c	Specifies the digital output channel to be set (ranging from 0 to 7)
DD	00: set the digital output channel to off 01: set the digital output channel to on

### Response:

Valid Command: >[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

Ignored Command: ![CHKSUM](CR)

> Delimiter for a valid command

? Delimiter for an invalid command

! Delimiter for an ignored command:

If a Host WatchDog Timeout occurs, the module will reset to safe mode and the DO output

---

command will be ignored

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: #01A001

Response: >

Sets the DO0 of the module with address 01 to On, and the module returns a valid response.

Command: #01A000

Response: >

Sets the DO0 of the module with address 01 to Off, and the module returns a valid response.

Command:#01A001

Response: !

A Host WatchDog Timeout has occurred and so the DO output command is ignored.

**Related Commands:**

Section 2.5 #AA00(Data)

Section 2.12 \$AA6

Section 2.6 #AA0A(Data)

Section 2.18 @AA

Section 2.7 #AA1cDD

Section 2.19 @AA(Data)

---

## 2.9 \$AA2

### Description:

This command is used to read the module configuration.

### Syntax:

#### **\$AAN[CHKSUM](CR)**

\$	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
2	Command to read the module configuration

### Response:

Valid Command: !AATTCCFF[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)
TT	Type code for the module 40 indicates a DO Module
CC	The BaudRate code for the module. See Section 1.9 for details
FF	Setting for the checksum and the direction of the counter update for the module. See Section 1.9 for details

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

**Examples:**

Command: \$012

Response: !01400A00

Reads the configuration of module 01.

BaudRate: 115200, Checksum: Disabled.

Command: \$052

Response: !05400940

Reads the configuration of module 05.

BaudRate: 57600, Checksum: Enabled.

**Related Commands:**

Section 1.9 Configuration Table

Section 2.1 %AANNTTCCFF

---

## 2.10 \$AA4

### Description:

This command is used to read the synchronized data that was retrieved by the last #\*\* command.

### Syntax:

#### \$AA4[CHKSUM](CR)

\$	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
4	Command to read the synchronized data

### Response:

Valid Command: !S[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)
S	Status of the synchronized data 1: First read 0: Not the first read
(Data)	Synchronized data. See Section 1.9 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: No response

Send the synchronized data command. There is no response to this command.

Command: \$014

Response: !1010000

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

Command: \$014

Response: !0010000

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

**Related Commands:**

Section 2.2 #\*\*

## 2.11 \$AA5

### Description:

This command is used to reads the reset status of a module.

### Syntax:

#### **\$AA5[CHKSUM](CR)**

\$	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
5	Command to read the module reset status

### Response:

Valid Command: !AAS[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)
S	The reset status of the module
1:	This is the first time the command has been sent since the module was powered on
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

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 response shows 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 response shows that there has been no module reset since the last \$AA5 command was sent.

## 2.12 \$AA6

### Description:

This command is used to read the status of the digital input/output channels

### Syntax:

#### **\$AA6[CHKSUM](CR)**

\$	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
6	Command to read the digital input/output channels

### Response:

Valid Command: !AA(Data)[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)
(Data)	The status of the digital input/output channels, 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: \$016

Response: !011

Reads the digital input/output channel status of module 01. The module returns 0F0000h, which denotes that the Digital Output is on.

Command: #076

Response: ?07

Reads the digital input/output channel status of module 07. The command is invalid because no module with the specified address exists.

**Related Commands:**

Section 2.5 #AA00(Data)	Section 2.8 #AAAcDD
Section 2.6 #AA0A(Data)	Section 2.18 @AA
Section 2.7 #AA1cDD	Section 2.19 @AA(Data)

## 2.13 \$AAC

### Description:

This command is used to clear the status of the latched digital output channel.

### Syntax:

#### **\$AAC[CHKSUM](CR)**

\$	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
C	Command to clear the status of the latched digital output channels

### Response:

Valid Command: !AA[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the module in hexadecimal format (00 to FF)

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

**Examples:**

Command: @011

Response: >

Sets DO0 of module 01 to ON.

Command: \$01C

Response: !01

Sends a command to clear the status of the latched digital output channels of module 01 and returns a valid response.

Command: \$01L0

Response: !010

Sends a command to read the status of the low latched digital output channel of module 01 and return 0.

Command: \$01L1

Response: !011

Sends a command to read the status of the high latched digital output channel of module 01 and return 0.

**Related Commands:**

Section 2.17 \$AALS

## 2.14 \$AAD

### Description:

The \$AAD command is used to update the current date of the module. Command #AA4 is use to read the current date. It takes 2 seconds to read the date.

### Syntax:

#### \$AAD[CHKSUM](CR)

\$	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
D	Command to update the current date

### Response:

Valid Command: !AA[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the module in hexadecimal format (00 to FF)

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

**Examples:**

Command: \$01D

Response: !01

Updates the current date and temporarily saves the date in the module.

Command: #014

Response: !0199,99,9999

Reads the current date.

**Related Commands:**

Section 2.4 #AAN

## 2.15 \$AAF

### Description:

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

### Syntax:

#### \$AAF[CHKSUM](CR)

\$	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
F	Command to read the firmware version

### Response:

Valid Command: !AA(Data)[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)
(Data)	Firmware version of the module as string

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: \$01F

Response: !0101.20

Reads the firmware version of module 01, and shows that it is version 1.2.

## 2.16 \$AAM

### Description:

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

### Syntax:

#### \$AAM[CHKSUM](CR)

\$	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
M	Command to read the module name

### Response:

Valid Command: !AA(Data)[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command
?	Delimiter for an invalid command.
AA	Address of the module in hexadecimal format (00 to FF)
(Data)	Name of the module as string

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: \$01M

Response: !01GPS721

Reads the module name of module 01 and returns the name "GPS721".

## 2.17 \$AALS

### Description:

This command is used to read the status of the latched digital output channels.

### Syntax:

#### \$AALS[CHKSUM](CR)

\$	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
L	Command to read the latched status
S	0: Reads the low latched status 1: Reads the high latched status

### Response:

Valid Command: !AA(Data)[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)
(Data)	Status of the latched digital output channel as a single digit hexadecimal value followed by 0

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

**Examples:**

Command: @011

Response: >

Sets the DO channel of module 01 to on.

Command: \$01C

Response: !01

Clears the latched status of a DO channel.

Command: \$01L0

Response: !010

Sends a command to read the status of the low latched digital output channel of module 01 and return 0.

Command: \$01L1

Response: !011

Sends a command to read the status of the high latched digital output channel of module 01 and return 0.

**Related Commands:**

Section 2.13 \$AAC

## 2.18 @AA

### Description:

The command is used to read the status of the digital input/output ports.

### Syntax:

#### @AA[CHKSUM](CR)

@	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)

### Response:

Valid Command: >(Data)[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

>	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the module in hexadecimal format (00 to FF)
(Data)	The status of the digital input/output ports as a four-digit hexadecimal value The highest byte represents Digital Output and the last byte is reserved

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: @01

Response: >0100

Reads the digital input/output port status of module 01.

Response: >0100, where 01 is the status of the DO channel.

**Related Commands:**

Section 2.5 #AA00(Data)

Section 2.6 #AA0A(Data)

Section 2.7 #AA1cDD

Section 2.8 #AAAcDD

Section 2.12 \$AA6

Section 2.19 @AA(Data)

## 2.19 @AA(Data)

### Description:

The command is used to set the digital output channels of the module.

### Syntax:

#### @AA(Data)[CHKSUM](CR)

@	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
(Data)	The data to be written to the digital output channels. A single-digit hexadecimal value. Bit 0 of the value corresponds to the DO channel. A bit value of 1 denotes that the digital output channel is on, and a bit value of 0 denotes that the digital output channel is off.

### Response:

Valid Command: >[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

Ignored Command: ![CHKSUM](CR)

> Delimiter for a valid command

? Delimiter for an invalid command

! Delimiter for an ignored command:

If a Host WatchDog Timeout occurs, the module will reset to safe mode and the DO output

---

command will be ignored

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

**Examples:**

Command: @011

Response: >

Sets the DO channel of the module to On

The response indicates that the command was successful

Command: @019

Response: ?01

The output value is not valid because the DO channel doesn't exist.

**Related Commands:**

Section 2.5 #AA00(Data)

Section 2.8 #AAAcDD

Section 2.6 #AA0A(Data)

Section 2.12 \$AA6

Section 2.7 #AA1cDD

Section 2.18 @AA

## 2.20 ~AAO(Name)

### Description:

The command is used to set the name of the module.

### Syntax:

**~AAO(Name)[CHKSUM](CR)**

- ~ Delimiter character
- AA Address of the module in hexadecimal format (00 to FF)
- O Command to set the module name
- (Name)** The new name of the module (max. 6 characters)

### Response:

Valid Command: !AA[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

- ! Delimiter for a valid command
- ? Delimiter for an invalid command
- AA Address of the module in hexadecimal format (00 to FF)

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

**Examples:**

Command: \$01M

Response: !01GPS721

Reads the name of module 01 and returns the name "GPS721".

Command: ~01O87000

Response: !01

Sets the name of module 01 to "87000" and returns a valid response.

Command: \$01M

Response: !0187000

Reads the name of module 01 and returns the name "87000".

## 2.21 ~AAD

### Description:

The command is used to read the Digital Output active status of a module.

### Syntax:

**~AAD[CHKSUM](CR)**

- ~ Delimiter character
- AA Address of the module in hexadecimal format (00 to FF)
- D Command to read the DO Active status

### Response:

Valid Command: !AAVV[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

- ! Delimiter for a valid command
- ? Delimiter for an invalid command
- AA Address of the module in hexadecimal format (00 to FF)
- VV Two hexadecimal digits that represent the miscellaneous settings, shown below (00,02)

7	6	5	4	3	2	1	0
Reserved						OAS	

Key	Description
OAS	DO Active Status 0: Output value 1 indicates that the relay is active Output value 0 indicates that the relay is inactive 1: Output value 0 indicates that the relay is active Output value 1 indicates that the relay is inactive

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: ~01D02

Response: !0102

Sets the DO active status of module 01 and returns a valid response.

Command: ~01D

Response: !0102

Reads the miscellaneous settings of module 01 and returns 02.

### Related Commands:

Section 2.22 ~AADVV

## 2.22 ~AADVV

### Description:

The command is used to reads the miscellaneous settings of a module.

### Syntax:

**~AADVV[CHKSUM](CR)**

- ~ Delimiter character
- AA Address of the module in hexadecimal format (00 to FF)
- D Command to set the miscellaneous settings
- VV Two hexadecimal digits that represent the miscellaneous settings, as follows shown below (00,02)

### Response:

Valid Command: !AA[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

- ! Delimiter for a valid command
- ? Delimiter for an invalid command
- AA Address of the module in hexadecimal format (00 to FF)

7	6	5	4	3	2	1	0
Reserved						OAS	

Key	Description
OAS	<p>DO Active Status</p> <p>0: Output value 1 indicates that the relay is active  Output value 0 indicates that the relay is inactive</p> <p>1: Output value 0 indicates that the relay is active  Output value 1 indicates that the relay is inactive</p>

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: ~01D00

Response: !0100

Sets the DO active status of module 01 and returns a valid response.

Command: ~01D

Response: !0100

Reads the miscellaneous settings of module 01 and returns 00.

### Related Commands:

Section 2.21 ~AAD

## 2.23 ~AAI

### Description:

This command enables “Soft INIT” function which cause the module to temporarily enter initialization mode. The “~AATnn” (See Section 2.26) command can then be used to set the duration of the “Soft INIT” mode. During that time, can be changed the BaudRate and checksum of the module by using the “%AANNTTCCFF” command (See Section 2.1).

### Syntax:

#### ~AAI[CHKSUM](CR)

~	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
I	Command to enable the Soft INIT function

### Response:

Valid Command: !AA[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)

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

**Examples:**

Command: ~01I

Response: !01

Sets the “Soft INIT” function on module 01 to enable.

Command: %0107400780

Response: ?01

Because the “Soft INIT” duration has not been set using the “~AATnn” command, the module returns an invalid response.

Command: ~01T10

Response: !01

Sends a command to set the “Soft INIT” duration to 16 (0x10) seconds. The module returns a valid response.

Command: ~01I

Response: !01

Sets the “Soft INIT” function on module 01 to enable. The module returns a valid response.

Command: %0107400740

Response: !01

Sends a command to change the BaudRate and checksum. The module returns a valid response.

**Related Commands:**

Section 2.26 ~AATnn

## 2.24 ~AATnn

### Description:

This command is used to set the “Soft INIT” duration. The command “~AAI” must be send to set the module to “INIT” mode before using this command (See Section 2.23). The BaudRate and checksum can then be changed using the “%AANNTTCCFF” command (See Section 2.1).

### Syntax:

#### ~AATnn[CHKSUM](CR)

~	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
T	Command to set the Soft INIT duration
nn	Two hexadecimal digits that represent the Soft INIT duration
	The maximum duration is 60 seconds
	Example: a value of 10 = 16 seconds

### Response:

Valid Command: !AA[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)

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

**Examples:**

Command: ~01I

Response: !17

Command to set module 01 to Soft INIT mode and the module returns a valid response.

Command: %0107400780

Response: ?01

Sends a command to change the BaudRate and checksum. The module returns an invalid response because the “~AATnn” command has not been used to set the Soft INIT duration .

Command: ~01T10

Response: !01

Sends the “~AATnn” command to set the Soft INIT duration to 16 seconds and the module returns a valid response.

Command: ~01I

Response: !01

Command to set module 01 to Soft INIT mode and the module returns a valid response.

Command: %0107400740

Response: !01

After sending the “~AATnn” and “~AAI” commands, this command can be used to change the BaudRate and checksum. The module returns a valid response.

**Related Commands:**

Section 2.23 ~AAI

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## 2.25 ~\*\*

### Description:

If the module enables the WatchDog function, this command informs all modules that the host is OK. This command would clear the counter of WatchDog to avoid the module entering safe mode. The module would enter safe mode without receiving ~\*\* command during WatchDog timeout to avoid unexpected accident.

### Syntax:

~\*\* [CHKSUM](CR)

~                   Delimiter character

\*\*                   Host OK command

### Response:

Valid Command:    No response

### Example:

Command:~010

Response:!0180

Read the Host WatchDog status of module 01 and it returns a valid response. It shows WatchDog is enabled and no Host WatchDog timeout is occurred.

### Related Commands:

Section 2.28 ~AA0 、 2.29 ~AA1 、 2.30 ~AA2  
2.31 ~AA3EVV 、 2.32 ~AA4V 、  
2.33 ~AA5V ◦

## 2.26 ~AA0

### Description:

The command is used to read the Host WatchDog status of the module.

### Syntax:

**~AA0[CHKSUM](CR)**

- ~ Delimiter character
- AA Address of the module in hexadecimal format (00 to FF)
- 0 Command to read the status of the module.

### Response:

Valid Command: !AASS[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

- ! Delimiter for a valid command
- ? Delimiter for an invalid command
- AA Address of the module in hexadecimal format (00 to FF)
- SS Two hexadecimal digits that represent the Host WatchDog status, where:
  - Bit 7: 0 indicates that the Host WatchDog is disabled, and 1 indicates that the Host WatchDog is enabled.
  - Bit 2: 1 indicates that a Host WatchDog timeout has occurred, and 0 indicates that no Host

---

WatchDog timeout has occurred.

The Host WatchDog status is stored in EEPROM and can only be reset by using the ~AA1 command.

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

**Examples:**

Command: ~010

Response: !0104

Reads the Host WatchDog status of module 01 and the response shows that a Host WatchDog timeout has occurred.

Command: ~070

Response: !0700

Reads the Host WatchDog status of module 07 and the response shows that a Host WatchDog on the module is disabled and timeout has not occurred.

**Related Commands:**

Section 2.27 ~\*\*

Section 2.31 ~AA3EVV

Section 2.29 ~AA1

Section 2.32 ~AA4V

Section 2.30 ~AA2

Section 2.33 ~AA5V

## 2.27 ~AA1

### Description:

The command is used to reset the Host WatchDog timeout status of a module.

### Syntax:

**~AA1[CHKSUM](CR)**

~	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
1	Command to reset the Host WatchDog timeout status

### Response:

Valid Command: !AA[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the module in hexadecimal format (00 to FF)

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

### Examples:

Command: ~070

Response: !0704

Reads the Host WatchDog status of module 01 and the response shows that a Host WatchDog timeout has occurred.

Command: ~071

Response: !07

Resets the Host WatchDog timeout status of module 07 and the module returns a valid response.

**Related Commands:**

Section 2.27 ~\*\*

Section 2.31 ~AA3EVV

Section 2.28 ~AA0

Section 2.32 ~AA4V

Section 2.30 ~AA2

Section 2.33 ~AA5V

## 2.28 ~AA2

### Description:

This command is used to read the Host WatchDog timeout value of a module.

### Syntax:

**~AA0[CHKSUM](CR)**

~	Delimiter character
AA	Address of the module in hexadecimal format(00 to FF)
2	Command to read the Host WatchDog timeout value

### Response:

Valid Command: !AAEVV[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format(00 to FF)
E	0: the Host WatchDog is disabled 1: the Host WatchDog is enabled
VV	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.

**Example:**

Command: ~012

Response: !011FF

Reads the Host WatchDog timeout value of module 01 and returns a value of 64, which denotes that the Host WatchDog is enabled and the Host WatchDog timeout value is 25.5 seconds.

**Related Commands:**

Section 2.27 ~\*\*

Section 2.31 ~AA3EVV

Section 2.28 ~AA0

Section 2.32 ~AA4V

Section 2.29 ~AA1

Section 2.33 ~AA5V

## 2.29 ~AA3E VV

### Description:

This command is used to enable/disable the Host WatchDog and sets the Host WatchDog timeout value of a module. If a WatchDog timeout has occurred, the WatchDog will be disabled.

### Syntax:

#### ~AA3E VV[CHKSUM](CR)

~	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
3	Command to set the Host WatchDog
E	1: enables the Host WatchDog 0: disables the Host WatchDog
VV	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

### Response:

Valid Command: !AA[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

! Delimiter for a valid command

? Delimiter for an invalid command

AA Address of the module in hexadecimal format (00 to FF)

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

**Examples:**

Command: ~013164

Response: !01

Enables the Host WatchDog of module 01 and sets the Host WatchDog timeout value to 10.0 seconds. The module returns a valid response.

Command: ~010

Response: !0104

Reads the Host WatchDog status of module 01 and shows that a Host WatchDog timeout has occurred.

Command: ~010

Response: !0180

Reads the Host WatchDog status of module 01 and shows that a Host WatchDog is enabled.

**Related Commands:**

Section 2.27 ~\*\*

Section 2.30 ~AA2

Section 2.28 ~AA0

Section 2.32 ~AA4V

Section 2.29 ~AA1

Section 2.33 ~AA5V

## 2.30 ~AA4V

### Description:

This command is used to read the power-on DO value or the safe DO value of the module.

### Syntax:

**~AA4V[CHKSUM](CR)**

~	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
4	Command to read the power-on DO value or the safe DO value.
V	P: Power-on DO Value S: Safe DO Value

### Response:

Valid Command: !AA(Data)[CHKSUM](CR)

Invalid Command: ?AA[CHKSUM](CR)

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)
(Data)	Power-on DO Value or Safe DO Value

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

**Examples:**

Command: ~014P

Response: !011

Reads the power-on DO value of module 01 and the module returns a value of 1.

Command: ~014S

Response: !010

Reads the safe DO value of module 01 and the module returns 0.

**Related Commands:**

Section 2.33 ~AA5V

## 2.31 ~AA5V

### Description:

This command is used to set the current DO value as the power-on DO value or the safe DO value.

### Syntax:

**~AA5V [CHKSUM](CR)**

~	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
5	Command to set the power-on DO value or the safe DO value
V	P: Power-on DO Value S: Safe DO Value

### Response:

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

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

!	Delimiter for a valid command
?	Delimiter for an invalid command
AA	Address of the module in hexadecimal format (00 to FF)

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

**Examples:**

Command: ~015P

Response: !01

Sets the power-on DO value and the module returns a valid response.

Command: @011

Response: >

Sets the DO value of module 01 to 1, and the module returns a valid response.

Command: ~015S

Response: !01

Sets the safe DO value and the module returns a valid response.

Command: @010

Response: >

Sets the DO value of module 01 to 0, and the module returns a valid response.

Command: ~014S

Response: !010

Reads the safe DO value of module 01. The module returns 5500, which denotes that the safe DO value is 0.

**Related Commands:**

Section 2.32 ~AA4V

## **Appendix1 Dual Watchdog Operation**

Dual WatchDog = Module Watchdog + Host WatchDog

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

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

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

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