GPS-721

User Manual v2.0

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

Table of Contents

1 Introduction

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

GPS-721 module features high sensitivity, low power and ultra small form factor with DCON and GPS protocols. The inside GPS module is powered by MediaTek solution and it can provide you with superior sensitivity and performance even in urban canyon and dense foliage environment. Except for the GPS data, GPS-721 includes 1 channel DO and 1 channel PPS for users to apply. A Pulse per second (PPS) is an electrical signal that very precisely indicates the start of a second. PPS signals can be used for precise timekeeping and time measurement. One can combine the PPS functionality with another time source that provides the full date and time in order to ascertain the time both accurately and precisely.

Therefore, GPS-721 can be a powerful GPS remote module as well as a general purpose GPS module with RS232 interface. It can also be applied in Automotive navigation, Personal positioning and navigation, Marine navigation, Satellite time correction and etc…

1.1 Features

- MediaTek high-sensitivity GPS solution

- Supports 66-channel GPS and NMEM v0183 v3.01

- RS-485 supports the DCON protocol

- RS-232 supports NEMA v0183 v3.01 format or the DCON protocol

- Built-in 1 channel DO, 1 channel PPS (1 pulse per second), 1 RS-485 port and 1 RS-232 port

- PPS: 100 ms pulse output/sec for precise timekeeping and time measurement

- 10 ~ 30V DC – (Power reverse polarity protection)

- System LED indicators

- DIN Rail design

1.2 Applications

- Automotive navigation

- Personal positioning and navigation

- Marine navigation

- Satellite time correction

- Precise timekeeping and time measurement

1.3 Package List

One GPS-721 Module

Software Utility CD

Quick Start Guide

RS-232 Cable

Item	Quantity
GPS-721	1
External GPS antenna (ANT-115-03, Length: 5m)	1
RS-232 Cable (CA-0910)	1
Product CD	1
Quick Start Guide	1

Please check that these items and contained in your GPS-721 package. If there are any problems, contact the supplier of the module.

Hardware
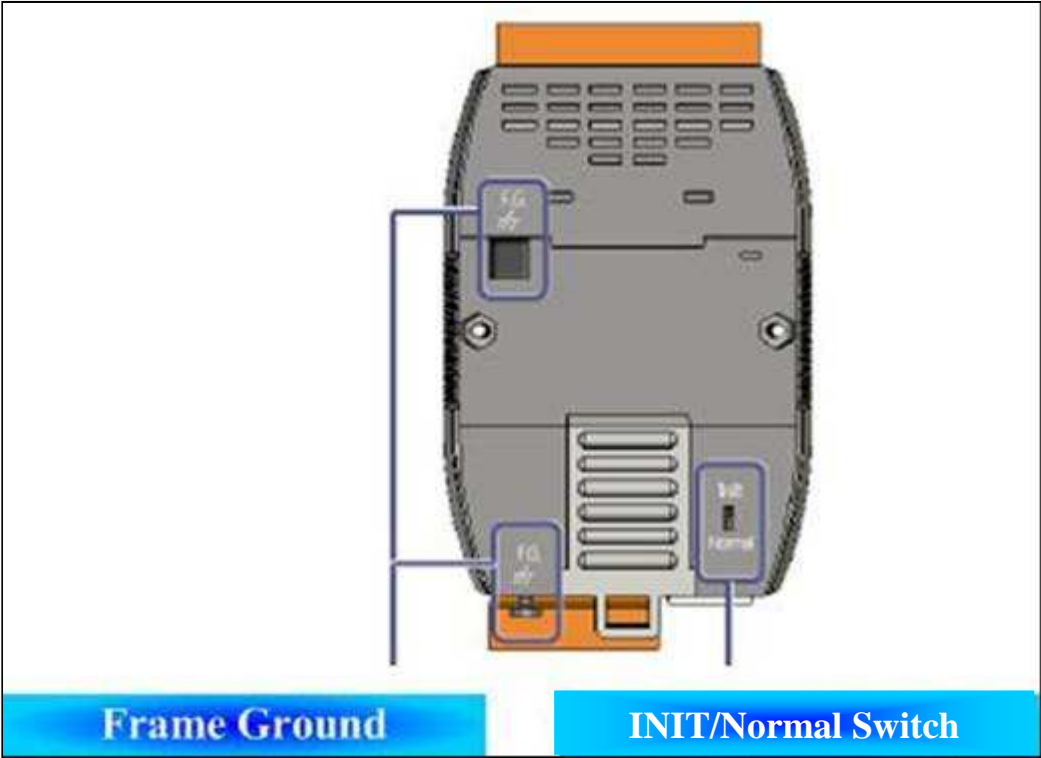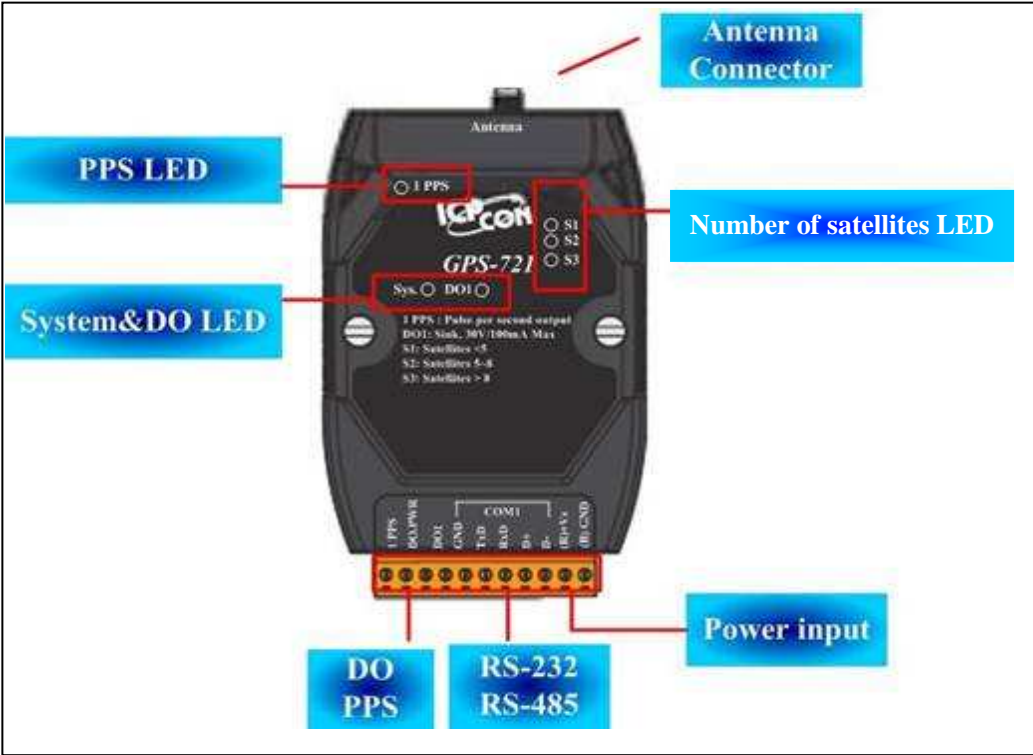
1.3.1 Specifications

General specifications:

GPS Receiver	
Chip	MediaTek solution
Frequency	L1 1575.42 MHz, C/A code
Support Channel	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
GPS Antenna (default)	
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
GPS Output	
1 PPS	Pulse per Second Output (Default 100 ms pulse/sec)
RS-232 Interface	GPS Information Output
LED Indicators	
Power/Communication	1 LED
GPS	3 LEDs
Power	
Protection	Power reverse polarity protection
Frame Ground for ESD	Yes
Protection	
Required Supply Voltage	+10 V DC ~ +30 V DC (non-regulated)
Power Consumption	2.5 W
Mechanical	
Dimensions (W x H x D)	72 mm x 117 mm x 35 mm
Weight	200 g
Housing	Plastic

Environment	
Operating Temperature	-25℃ ~ +75℃
Storage Temperature	-40℃ ~ +80℃
Humidity	5 ~ 95% RH, non-condensing

I/O specification

Digital Output	
Output Channel	1 (Sink)
Output Type	Non-isolated Open Collector
Output Current	100 mA
Load Voltage	+5 V DC ~ +30 V DC

1.3.2 Block Diagram for the GPS-721
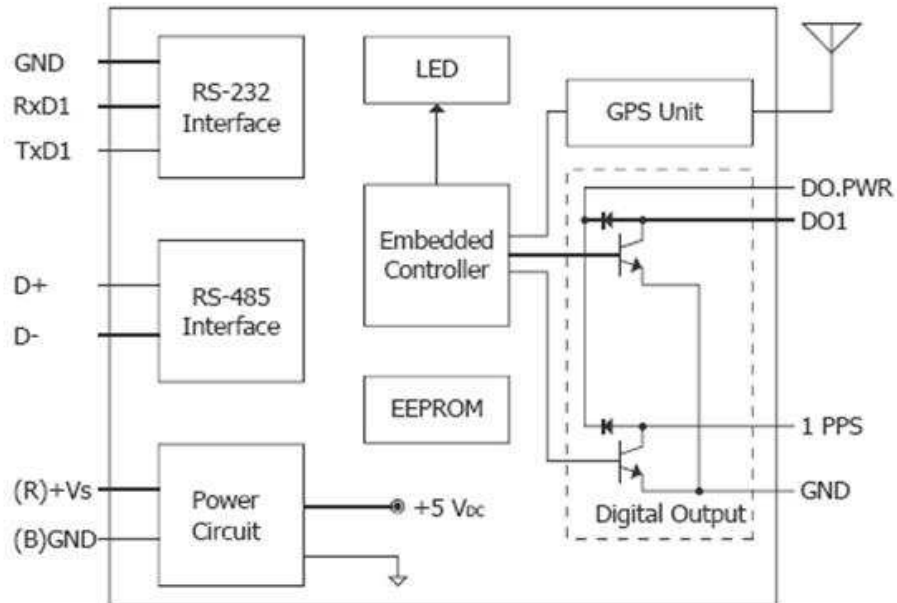
1.3.3   Pin assignments and LED indicators

● **Pin assignments**

Terminal No.	Pin Assignment
01	1 PPS
02	DO.PWR
03	DO1
04	GND
05	RxD
06	TxD
07	D+
08	D-
09	(R)+Vs
10	(B)GND

● **LED indicators**

LED	Status	Description
Sys.	ON	The module is operating / functioning correctly.
	OFF	There is an error with the module. The module has encountered an error.
DO1	ON	Digital Output is active.
	OFF	Digital Output is off.
S1	ON	The number of signals received from GPS satellites is less than 5.
	OFF	Module can't receive any GPS signals.
S2	ON	The number of signals received from GPS satellites is 5 ~ 8 or above.
	OFF	The number of signals received from GPS satellites is less than 5.
S3	ON	The number of signals received from GPS satellites is more than 8.
	OFF	The number of signals received from GPS satellites is less than 8.
1 PPS	ON	The PPS is on.
	OFF	The PPS is off.

1.3.4 Operation modes

The GPS-721 back panel contains the frame ground and Init/Normal Switch. The module has two operation modes (init and normal modes), which can be determined by the switch mechanism on the chassis. The description and figure are as follows.

Mode	Description
Init	After setting the module to "INIT" mode and restart the module, a connection can be established using the default module address and communication settings, allowing new parameters for the module to be set. Init mode: ● Protocol: DCON ● Module Address: 00 ● Communication Baud Rate: 9600bps ● Checksum: Disabled Note: The DCON command to set the address, BaudRate and checksum is %AANNTTCCFF. Refer to section 2.1 for details.
Normal	In Normal mode, the module will operate based on the user's settings.

1.3.5 Wiring Recommendations

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

1.4 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	DO.PWR / DOx / DO.GND	DO.PWR / DOx / DO.GND
Resistance Load	DO.PWR / DOx / DO.GND	DO.PWR / DOx / DO.GND

● PPS wiring

Output Type	ON State	OFF State
	Relay ON	Relay Off
Drive Relay	1 PPS / DO.PWR / GND	1 PPS / DO.PWR / GND
Resistance Load	1 PPS / DO.PWR / GND	1 PPS / DO.PWR / GND

The PPS would output the pulse when receiving effective GPS signals. That would output 100 ms pulse per second. The figure is as follows.
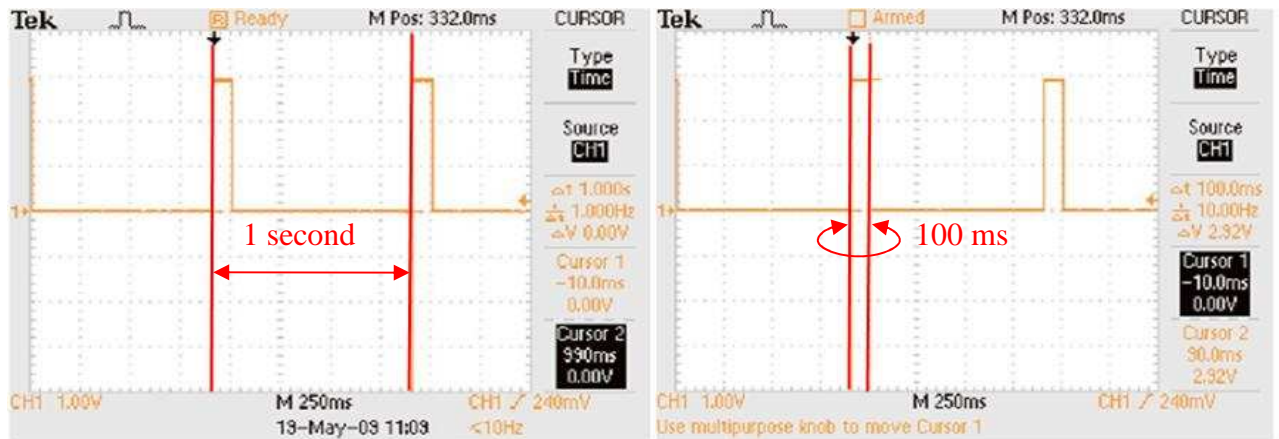
Note: A Pulse per second (PPS) is an electrical signal that very precisely indicates the start of a second. PPS signals can be used for precise timekeeping and time measurement. one can combine the PPS functionality with another time source that provides the full date and time in order to ascertain the time both accurately and precisely.

1.5 Dimensions
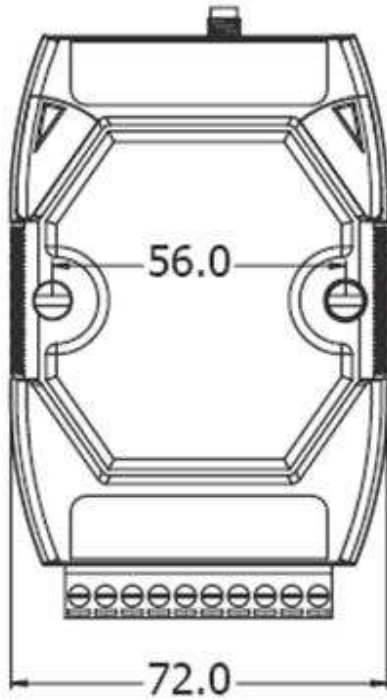
Front View

Rear View

Top View

2-SCREW M3
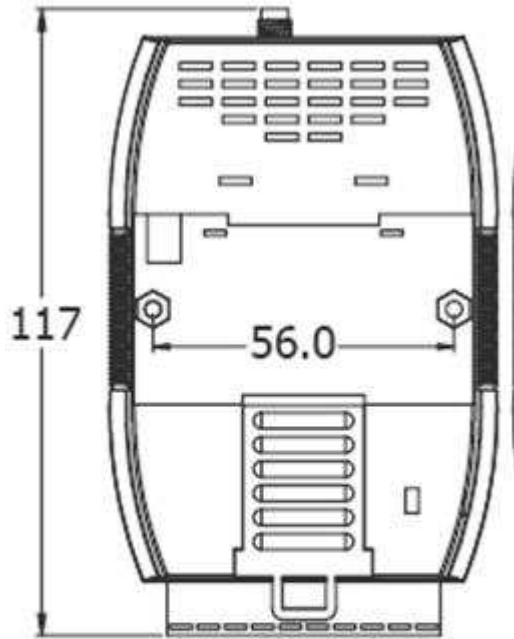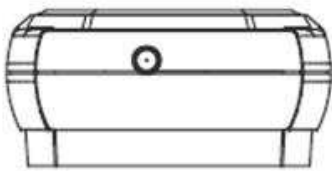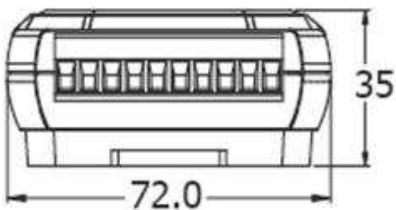
Bottom View
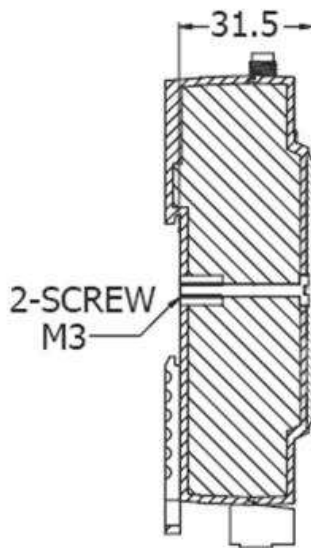
Side View
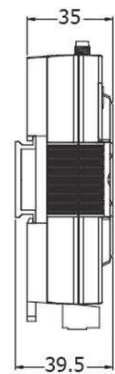
Din-Rail Mounting Bracket

1.6 Mounting

The GPS-721 can be mounted on a DIN rail, a wall or it can be piggybacked to other modules using the bottom of the chassis.

● **DIN-Rail Mounting**
   The GPS-721 has simple rail clips for reliable mounting on a standard 35 mm DIN rail.
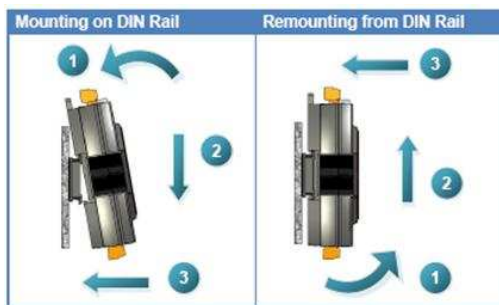
There are three new DIN rail models available. Each is made of stainless steel, which is stronger than those made of aluminum. There is a screw at one end, and a ring terminal is included so that it can be easily connected to the earth ground. The three new DIN rail models are as follows:

Part number	Maximum number of modules	Dimensions
DRS-125	2	125 mm x 35 mm
DRS-240	3	240 mm x 35 mm
DRS-360	5	360 mm x 35 mm

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

to earth ground

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

to earth ground

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

to earth ground

Note: It is recommended that a 16 – 14 AWG wire is used to connect the DIN rail to the earth ground.

● **Piggyback Mounting**

The GPS-721 has two holes on both sides of the module to enable piggyback mounting. Refer to the figure below for an illustration of how to piggyback the modules.
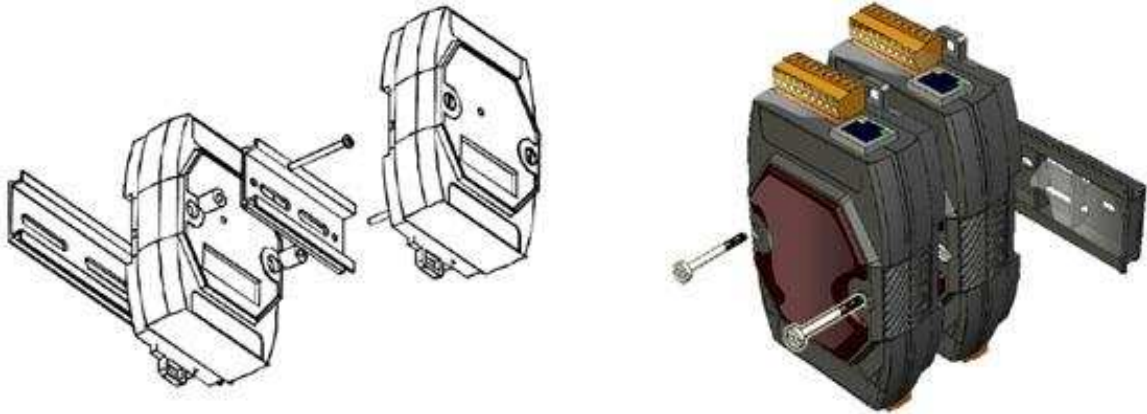
1.7 Frame Ground

Electronic circuits are constantly vulnerable to Electro-Static Discharge (ESD), which becomes worse in a continental climate area. Some I-7K and M-7K series modules feature a new design for the frame ground, which provides a path for bypassing ESD, allowing enhanced static protection (ESD) capabilities and ensures that the module is more reliable. Either of the following options will provide a better protection for the module:

1. If the module is DIN-rail mounted, connect the DIN rail to the earth ground because the DIN rail is in contact with the upper frame ground, as shown in the figure below.
2. Alternatively, connect the lower frame ground terminal to a wire and connect the wire to the earth ground, as shown in the figure below.
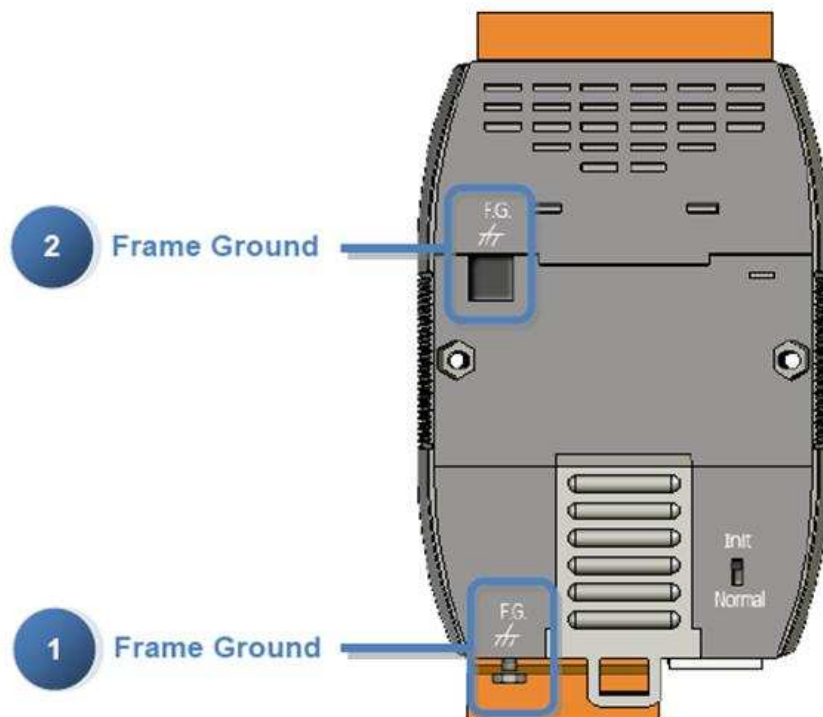
New DIN rail models are available that can easily be connected to the earth ground. Each is made of stainless steel, which is stronger than those made of aluminum. There is a screw at one end, and a ring terminal is included, as shown in the figure below. Refer to Section 1.7 for more information about the new DIN rail models.
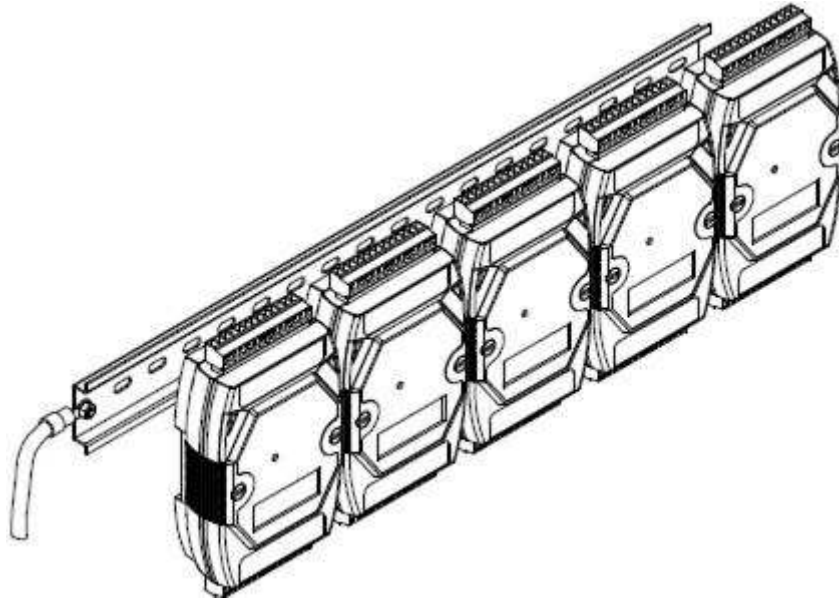
1.8 Configuration Table

● 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)

Type Code is fixed as 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

1.9 Quick Start

This section describes the installation of the GPS-721. And provides details how to guiding and officiating begin to use the module.

1. Refer to Section 1.4.3 for details of the terminal assignments, and Section 1.5 for details of how to installing the power and antenna.

2. Connect the module to the RS-485 network using the DATA+ and DATA- terminals. See Section 1.4.3 for details of the terminal assignment. If the host is only equipped with an RS-232 interface, then an RS-232 to RS-485 converter will be required. The GPS-721 supports RS-232 connections. Refer to the "I-7000 Bus Converter User Manual" for more information.

Default address and communication parameters:
- **Protocol: DCON**
- **Module address: 01 (INIT mode: 00)**
- **Communication Baud Rate: 9600 bps**
- **Checksum: Disabled**

3. Configure the module by sending the %AANNTTCCFF command. See Section 2.1 for details.

   ICP DAS provides two free tools, the DCON Utility and Send232.exe, witch can be downloaded from http://ftp.icpdas.com/pub/cd/8000cd/napdos/

4. You can implement the functions of the modules using the following DCON commands. Please refer to chapter 2.

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

Note 1: The DCON Utility is provided for sending commands to the GPS-721. The graphic setting of the GPS-721 is not supported by the DCON Utility.

Note 2: If GPS-721 can't receive a GPS signal, check the position of the antenna and if the problem persists, try installing the GPS antenna outside.

1.10 Technical Support

Should you encounter any problems while using the GPS-721 module, and are unable to find the help in this manual or on our website, please contact ICP DAS Product Support.

Email: 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 Section 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-7000 modules consists of commands generated by the host and responses transmitted by the I-7000 modules. Each module has a unique ID number that is used for addressing purposes and is stored in 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 is 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 Settings) 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

General Command Sets			
Command	**Response**	**Description**	**Section**
%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
~AAM	!AASC	Reads with the RS-232 communication mode of the module is NMEA 0183 or DCON	2.24
~AAMN	!AA	Sets the RS-232 communication mode of the module to either NMEA 0183 or DCON	2.25
~AATnn	!AA	Sets the soft INIT timeout value	2.26

Host WatchDog Command Sets			
Command	**Response**	**Description**	**Section**
~**	No Response	Host OK (The address in this command is zero and can clear the WatchDog counter.)	2.27
~AA0	!AASS	Reads the Status	2.28
~AA1	!AA	Resets the Status	2.29
~AA2	!AAVV	Reads the Timeout Settings	2.30
~AA3EVV	!AA	Sets the Timeout Settings	2.31
~AA4V	!AA(Data)	Reads the Power On/Safe Value	2.32
~AA5V	!AA	Sets the Power On/Safe Value	2.33

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 chang 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 %AANNTTCCFF If 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.NNNN,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	1: UTC Time
	2: Latitude and longitudes
	3: Number of Satellites in view
	4: Date

Response:

N=1：	!AATTTTTT.TTT
N=2：	!AALLLL.LLLL,C,NNNNN.NNNN,C
N=3：	!AAS
N=4：	!AADDMMYY
!	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)
S	S=The satellites in view: Range 0~12
DDMMYY	Date: D (day), M (month), Y (year)

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:	
>	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 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:

>	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:	
>	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:	
>	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 became no module with the specified address exits

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 2.8   #AAAcDD

Section 2.6 #AA0A(Data)   Section 2.12 $AA6

Section 2.7 #AA1cDD   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:

>   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 exit.

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	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: ~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 ~AAM

Description:

The command is used to read the transmission protocol of the module, which can be either DCON or GPS protocols. In GPS mode, no message can be send via the RS-485 port.

Syntax:

~AAM[CHKSUM](CR)

~	Delimiter character
AA	Address of the module in hexadecimal format (00 to FF)
M	Command to read the transmission mode of RS-232 port

Response:

Valid Command: !AASC[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	Transmission modes Supported by the module
	0: DCON
	3: DCON\GPS mode
C	Code to indicate the mode
	0: DCON
	1: GPS

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: ~03M

Response: !0330

Reads the transmission protocol of module 03 and the module returns a valid response. The response shows that this module supports both DCON and GPS modes. The protocol is the DCON protocol.

Command: ~03M1

Response: !03

Sets the transmission mode to GPS mode and returns a valid response.

(This command needs the module to be set to INIT mode. The new setting will become effective after the module is reset).

Command: ~03M

Response: !0331

Reads the transmission mode of module 03 and the module returns a valid response. The response shows that module is in GPS transmission mode.

The module needs to be restarted before the new transmission protocol is effective.

Related Commands:

Section 2.25 ~AAMN

2.25 ~AAMN

Description:

The command is used to set the transmission protocol of the module. The GPS-721 supports either the DCON or GPS transmission protocol. In GPS mode no messages can be sent via the RS-485 port.

Syntax:

~AAMN [CHKSUM](CR)

~   Delimiter character

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

M   Command to set the transmission protocol.

N   Code to indicate the transmission protocol

            0: DCON

            1: GPS

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: ~03M

Response: !0330

> Reads the transmission mode of module 03 and the module returns a valid response. The response shows that module supports both DCON and GPS modes. The protocol is DCON mode.

Command: ~03M1

Response: !03

> Sets the transmission mode to GPS protocol and the module returns a valid response.
>
> (This command needs the module to be set to INIT mode. The new setting will become effective after the module is reset).

Command: ~03M

Response: !0331

> Read the transmission mode of module 03 and the module returns a valid response. The response shows that module is in GPS transmission protocol.
>
> The module needs to be restarted before the new transmission protocol is effective.

Command: ~03M1

Response: ?03

Sets the transmission mode to GPS protocol and the module returns an invalid response. Before changing the communication protocol, module needs to be set to INIT mode.

Related Commands:

Section 2.24 ~AAM

2.26 ~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

2.27 ~**

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。

2.28 ~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

2.29 ~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

2.30 ~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

2.31 ~AA3EVV

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:

~AA3EVV[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

2.32 ~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

2.33 ~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.

Appendix2 Node Information Area

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