

# 1. Introduction

EX9066D/9066D series provides 7 PhotoMOS Relay output channels. all output channels are differential with individually common . (see sec. 1.2.1 Block diagram). For High-speed inspection machines/Telephone equipment/ Data communication equipment Application.

## Specifications

Interface : RS-485, 2 wires  
Speed : 1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K,115.2K  
Output channels: 7 PhotoMOS output channels with Normal Open (Form A)  
Load Current: 0.13A  
Load Voltage: 350V Max  
Isolation Voltage: 5000VDC  
Operate Time: 0.7mS typ  
Release Time: 0.05mS typ  
Power Input: +10V to +30VDC.  
LED: 7 output status LED  
Power input : +10V to +30VDC  
Power Consumption : 1.9W

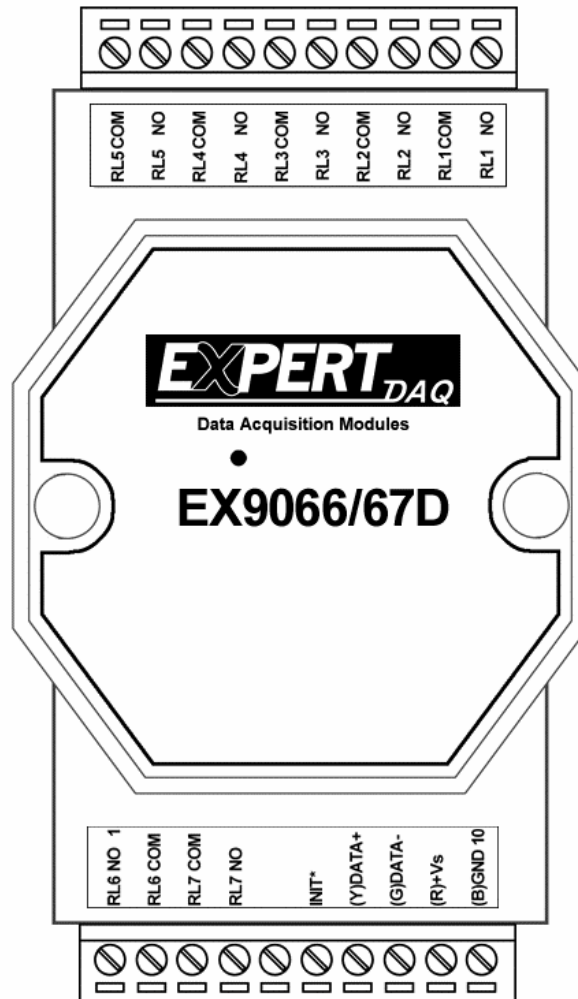
EX9067D series provides 7 relay output channels. all relay output channels are differential with individually common . (see sec. 1.2.1 Block diagram)

## Specifications

Interface : RS-485, 2 wires  
Speed : 1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K,115.2K  
Output channels: 7 relay output channels with Normal Open (Form A)  
Relay contact rating : 0.5A/120Vac, 1.0A/24Vdc  
Surge strength: 1500V  
Operate Time: 5mS max.  
Release Time: 2mS max.  
Min Life: 10<sup>5</sup> ops.  
LED: 7 output status LED  
Power input : +10V to +30VDC  
Power Consumption : 1.9W

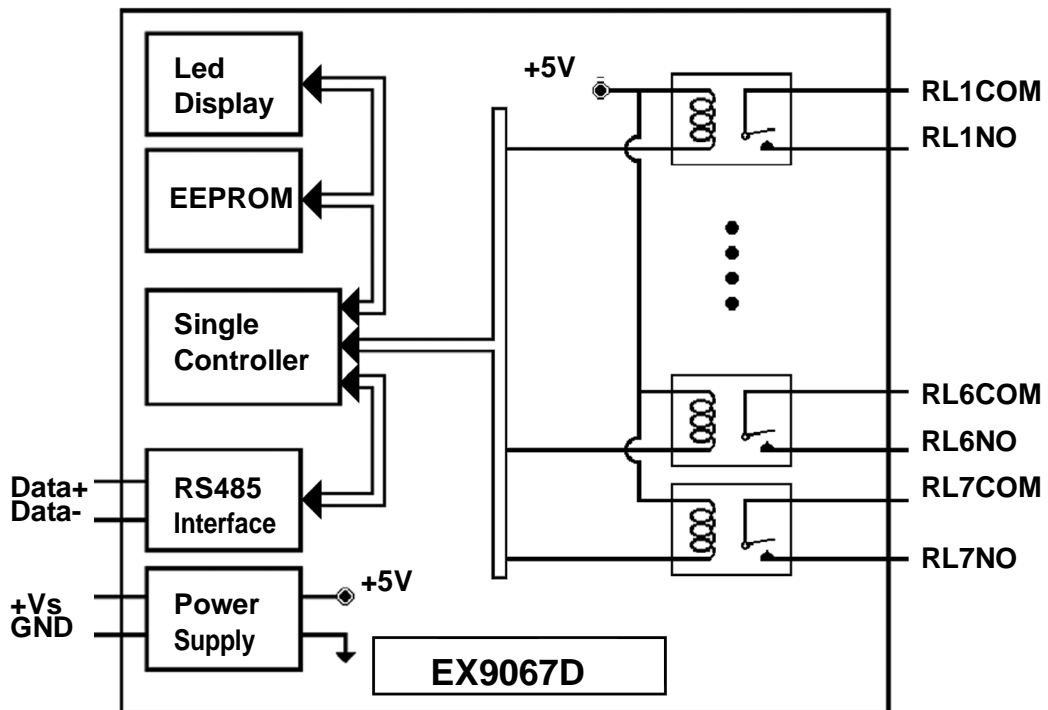
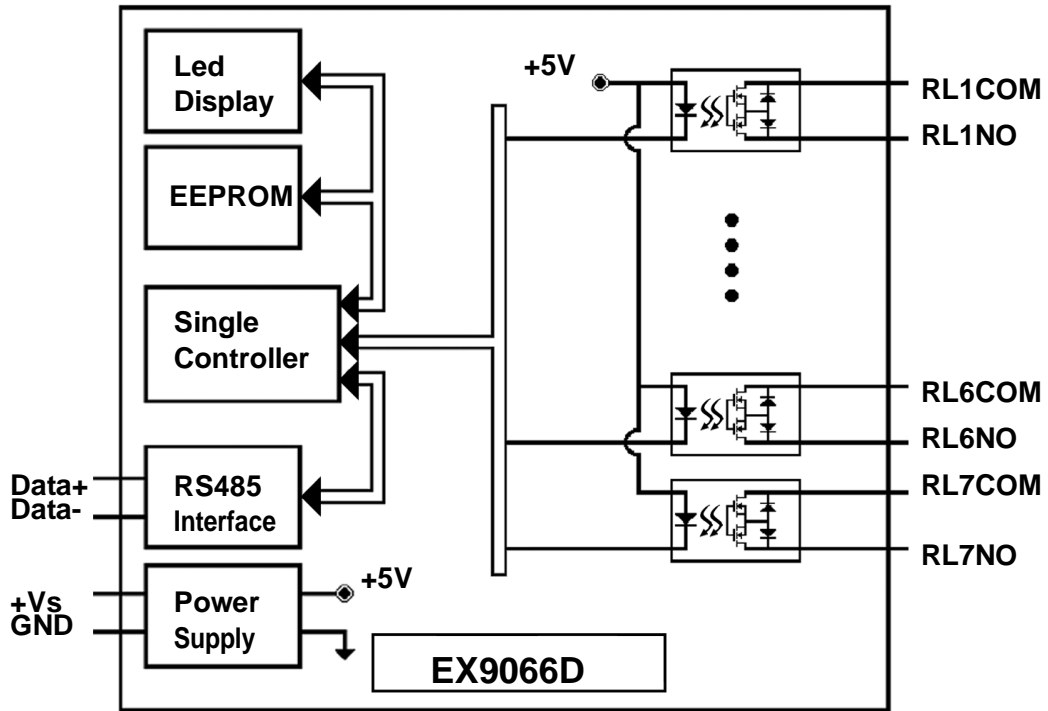
# 1.1 Specifications

	EX9066D	EX9067D
Digital Output	7 PhotoMOS Output	7 Relay Output
Output Channels	Form A	
Relay Type	Load Current: 0.13A Load Voltage: 350V Max Isolation Voltage: 5000VDC Operate Time: 0.7mS typ Release Time: 0.05mS typ	Contact Rating: 0.5A@120VAC 1.0A@24VDC Surge Strength: 1500V Operate Time: 5mS Max Release Time: 2mS Max Min. Life: 10 <sup>5</sup> ops
Environment		
Power Requirement	+10 to +30 VDC	
Power Consumption	1.9W	
Operating Temperature	-25°C to +75°C	
Storage Temperature	-30°C to +75°C	



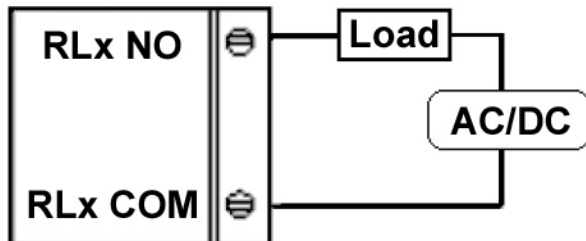
# 1.2 Wire connection

## 1.2.1 Block Diagrams



## 1.2.2 Wiring diagram for the EX9066D/67D

### Relay output



## 1.3 Default Settings

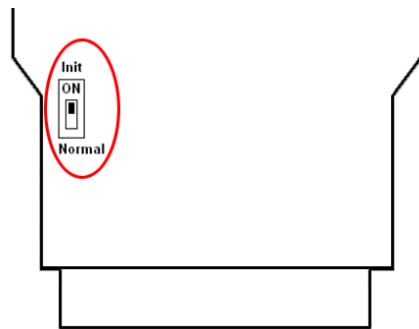
Default settings for the EX9066D/9067D modules are as follows:

- . Module Address: 01
- . DIO Type: 40
- . Baud Rate: 9600 bps
- . Protocol: ASCII command.

## 1.4 INIT\* Mode Operation

Each EX9000 module has a build-in EEPROM to store configuration information such as address, type, baudrate and other information. Sometimes, user may forget the configuration of the module. Therefore, the EX9000 have a special mode named "INIT\* mode" to help user to resolve the problem. The "INIT\* mode" is setting as Address=00, Baudrate=9600bps, no Checksum .

Originally, the INIT\* mode is accessed by connecting the INIT\* terminal to the GND terminal. New EX9000 modules have the INIT\* switch located on the rear side of the module to allow easier access to the INIT\* mode. For these modules, INIT\* mode is accessed by sliding the INIT\* switch to the Init position as shown below.



To enable INIT\* mode, please following these steps:

Step1. Power off the module

Step2. Connect the INIT\* pin with the GND pin.

(or sliding the INIT\* switch to the Init\* ON position)

Step3. Power on

Step4. Send command \$002 (cr) in 9600bps to read the Configuration stored in the module's EEPROM.

There are commands that require the module to be in INIT\* mode.

They are:

1. %AANNTTCFF when changing the Baud Rate and checksum settings. See Section 2.1 for details.
2. \$AAPN, See relative Modbus Manual for details.

## 1.5 Module Status for DIO, AIO

**Power On Reset** or **Module Watchdog Reset** will let all output goto **Power On Value**. And the module may accept the host's command to change the output value.

**Host Watchdog Timeout** will let all output goto **Safe Value**. The module's status(readed by command~AA0) will be 04, and the output command will be ignored.

## 1.6 Dual Watchdog Operation for DIO, AIO

**Dual Watchdog=Module Watchdog + Host Watchdog**

The Module Watchdog is a hardware reset circuit to monitor the module's operating status. While working in harsh or noisy environment, the module may be down by the external signal. The circuit may let the module to work continues and never halt.

The Host Watchdog is a software function to monitor the host's operating status. Its purpose is to prevent the network from communication problem or host halt. When the timeout interval expired, the module will turn all outputs to predefined Safe Value. This can prevent the controlled target from unexpected situation.

The EX9000 module with Dual Watchdog may let the control system more reliable and stable.

## 1.7 Reset Status

The Reset Status is set while the module power on or reset by module watchdog and is cleared while the command read Reset Status (\$AA5) applied. This is useful for user to check the module's working status. When the Reset Status is set means the module is reset and the output may be changed to the PowerOn Value. When the Reset Status is clear means the module is not resetted and the output is not changed.

## 1.8 Digital O/P

The module's output have 3 different situation:

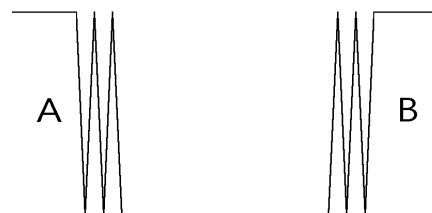
<1>**Safe Value.** If the host watchdog timeout status is set, the output is set to Safe Value. While the module receive the output command like @AA(Date) or #AABBDD, the module will ignore the command and return "!". And will not change the output to the output command value. **The host watchdog timeout status is set and store into EEPROM while the host watchdog timeout interval expired and only can be cleared by command ~AA1.** If user want to change the output it need to clear the host watchdog timeout status firstly and send output command to change the output into desired value.

<2>**PowerOn Value.** Only the module reseted and the host watchdog timeout status is clear, the module's output is set to predefined Power On Value.

<3> **Output Command Value.** If the host watchdog timeout status is clear and user issue a digital output command like @AA (Data) or #AABBDD to module for changing the output value. The module will reponse success (receive>).

## 1.9 Latch Digital I/P

For example, use connect the key switch to Digital input channel of a digital input/output module and want to read the key stroke. The Key input is a pulse digital input and user will lost the strike. While reading by command \$AA6 in A and B position, the response is that no key stroke and it will lose the key stroke information. Respectly, the read latch low digital input command \$AAL0 will solve this problem. When issue \$AAL0 command in A and B position, the response denote that there is a low pulse between A and B position for a key stroke.



## 1.10 Configuration Tables

### Baud Rate Setting (CC)

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

### Data Format Setting (FF)

7	6	5	4	3	2	1	0
*1	*2	*3					

**\*1:** Counter Update Direction: 0 =Falling Edge,  
1=Rising Edge.

**\*2:** Checksum Bit : 0=Disable, 1=Enable.

**\*3:** The reserved bits should be zero.

Read Digital Input/Output Data Format table

Data of \$AA6,\$AA4,\$AALS:(**First Data**)(**Second Data**)00

Data of @AA:(**First Data**)(**Second Data**)

Note: Both the First Data and the Second Data are in two hexadecimal digitals format.

Module	The First data		The Second data
EX9066D/67D	DO1~DO7	00~7F	00



## 2.0 Command Sets

### 2.1 %AANNTTCCFF

**Description:** Set Module Configuration.

**Syntax:** %AANNTTCCFF[CHK](cr)

% a delimiter character  
AA address of setting/response module(00 to FF)  
NN new address for setting/response module(00 to FF)  
TT type 40 for DIO module  
CC new baudrate for setting module.  
FF new data format for setting module.

If the configuration with new baudrate or new checksum setting, before using this command, it is needed to short the INIT\* to ground (or sliding the INIT\* switch to the Init ON position of rear side). The new setting is saved in the EEPROM and will be effective after the next power-on reset.

**Response:** Valid Command: !AA  
Invalid Command: ?AA

#### **Example:**

Command: %0102240600                      Receive: !02  
Set module address 01 to 02, return Success.

## 2.2 #\*\*

**Description:** Synchronized Sampling

**Syntax:** #\*\*[CHK](cr)

# delimiter character

\*\* synchronized sampling command

**Response:** No response

### **Example:**

Command: #\*\* No response

Send synchronized sampling command to all modules.

Command: \$014 Receive: !10F0000

Read synchronized data from address 01, return S=1, first read and data is 0F0000

Command: \$014 Receive: !00F0000

Read synchronized data from address 01, return S=0, have readed and data is 0F0000

## 2.3 #AABBDD

**Description:** Digital Output

**Syntax:** #AABBDD[CHK](cr)

# delimiter character

AA address of reading/response module(00 to FF)

BBDD Output command and parameter

For output multi-channel, the BB=00, 0A or 0B the select which output group, and the DD is the output value

Parameter for Multi-Channel Output					
	Output Channels	DD for command #AABBDD			
		BB=00/0A		BB=0B	
EX9042D	13	00 to FF	DO(0~7)	00 to 1F	DO(8~12)
EX9043D	16	00 to FF	DO(0~7)	00 to 1F	DO(8~15)
EX9044D	8	00 to FF	DO(0~7)	NA	NA
EX9050D	8	00 to FF	DO(0~7)	NA	NA
EX9055D	8	00 to FF	DO(0~7)	NA	NA
EX9060D	4	00 to 0F	RL(1~4)	NA	NA
EX9063D	3	00 to 07	RL(1~3)	NA	NA
EX9065D	5	00 to 1F	RL(1~5)	NA	NA
EX9066D	7	00 to 7F	RL(1~7)	NA	NA
EX9067D	7	00 to 7F	RL(1~7)	NA	NA
EX9068D-M	8	00 to FF	RL(1~8)	NA	NA

For output single-channel, the BB=1c, Ac or Bc where c is the selected channel, and the DD must be 00 to clear output and 01 to set output.

Parameter for Single-Channel Output				
	Single channel output command #AABBDD			
	c for BB=1c/Ac		c for BB=Bc	
EX9042D	0 to 7	DO(0~7)	0 to 4	DO(8~12)
EX9043D	0 to 7	DO(0~7)	0 to 7	DO(8~15)
EX9044D	0 to 7	DO(0~7)	NA	NA
EX9050D	0 to 7	DO(0~7)	NA	NA
EX9055D	0 to 7	DO(0~7)	NA	NA
EX9060D	0 to 3	RL(1~4)	NA	NA
EX9063D	0 to 2	RL(1~3)	NA	NA
EX9065D	0 to 4	RL(1~5)	NA	NA
EX9066D	0 to 6	RL(1~7)	NA	NA
EX9067D	0 to 6	RL(1~7)	NA	NA
EX9068D-M	0 to 7	RL(1~8)	NA	NA

**Response:** Valid Command: >

Invalid Command: ?

Ignore Command: !

Delimiter for ignore the command. The module's host watchdog timeout status is set, and the output is set to Safe Value.

**Example:**

Command: #021001

Receive: >

Assume module is EX9067D-M, set address 02 output channel 0 on, return success.

Command: #021001

Receive: >

Assume module is EX9067D-M, set address 02 output channel 0 on, return ignore, The module's host watchdog timeout status is set, and the output is set to Safe Value.

## 2.4 \$AA2

**Description:** Read configuration.

**Syntax:** \$AA2[CHK](cr)

\$ delimiter character

AA address of reading/response module (00 to FF)

2 command for read configuration

**Response:** Valid Command: **!AATTCFF**

Invalid Command: **?AA**

TT type code of module, it must be 40

CC baudrate code of module

FF data format of module

### **Example:**

Command: \$012

Receive: !01400600

Read the configuration of module 01, return DIO mode, baudrate 9600, no checksum.

**Note: check configuration Tables**

## 2.5 \$AA4

**Description:** Reads the synchronized data

**Syntax:** \$AA4[CHK](cr)

\$ delimiter character

AA address of reading/response module (00 to FF)

4 command to read the synchronized data

**Response:** Valid Command: **!S(Data)**

Invalid Command: **?AA**

S status of synchronized data, 1=first read, 0=been readed

(Data) synchronized DIO value. See section 1.5 for data format.

### Example:

Command: \$014

Receive: ?01

Read address 01 synchronized data, return no data available.

Command: #\*\*

no response

Send synchronized sampling to all modules.

Command: \$014

Receive: !1070000

Read address 01 synchronized data, return S=1, first read, and synchronized data 0700

## 2.6 \$AA5

**Description:** Read Reset Status

**Syntax:** \$AA5[CHK](cr)

\$ delimiter character

AA address of reading/response module (00 to FF)

5 command for read reset status

**Response:** Valid Command:     **!AAS**

                  Invalid Command:   **?AA**

S reset status, 1=the module is been reset, 0=the module is not been rested

### **Example:**

Command: \$ 015

Receive: !011

Read address 01 reset status, return module is been reset

Command: \$ 015

Receive: !010

Read address 01 reset status, return no reset occurred.



## 2.7 \$AA6

**Description:** Read Digital I/O Status

**Syntax:** \$AA6[CHK](cr)

\$ delimiter character

AA address of reading/response module (00 to FF)

6 command for read channel status

**Response:** Valid Command: **!(Data)**

Invalid Command: **?AA**

(Data) **(First Data)(Second Data)00**

Note: Both the First Data and the Second Data are in two hexadecimal digitals format.

Module	The First data		The Second data
EX9066D/67D	DO1~DO7	00~7F	00

### Example:

Command: \$016

Receive: !0F0000

Assume module is EX9067D-M, read address 01 DIO status, return 0F00, digital output channel 1~4 are on.

## 2.8 \$AAF

**Description:** Read Firmware Version

**Syntax:** \$AAF[CHK](cr)

\$ delimiter character

AA address of reading/response module (00 to FF)

F command for read firmware version

**Response:** Valid Command: **!AA(Data)**

Invalid Command: **?AA**

(Data) Firmware version of module

### **Example:**

Command: \$01F

Receive: !01D03.11

Read address 01 firmware version, return version D03.11

## 2.9 \$AAM

**Description:** Read Module Name

**Syntax:** \$AAM[CHK](cr)

\$ delimiter character

AA address of reading/response module (00 to FF)

M address of reading/response module(00 to FF)

**Response:** Valid Command: **!AA(Data)**

Invalid Command: **?AA**

(Data) Name of module

### **Example:**

Command: \$01M

Receive: !019067

Read address 01 module name, return name 9067

## 2.10 @AA

**Description:** Read Digital I/O Status

**Syntax:** @AA[CHK](cr)

@ delimiter character

AA address of reading/response module (00 to FF)

**Response:** Valid Command: >(Data)

Invalid Command: ?AA

(Data) (First Data)(Second Data)

Note: Both the First Data and the Second Data are in two hexadecimal digitals format.

Module	The First data		The Second data
EX9066D/67D	DO1~DO7	00~7F	00

### Example:

Command: @01

Receive: >0F00

Assume module is EX9067D-M, read address 01 DIO status, return 0F00, digital output channel 1~4 are on.

## 2.11 @AA(Data)

**Description:** Set Digital I/O Status

**Syntax:** @AA(Data)[CHK](cr)

@ delimiter character

AA address of reading/response module (00 to FF)

(Data) output value, the data format is following:

(Data) is one character for output channel less than 4

For EX9060D, from 0 to F

For EX9063D, from 0 to 7

(Data) is two characters for output channel less than 8

For EX9044D/50D/55D, from 00 to FF

For EX9065D, from 00 to 1F

For EX9066D/67D/68DM, from 00 to FF

(Data) is four characters for output channel less than 16

For EX9042D, from 0000 to 1FFF

For EX9043D, from 0000 to FFFF

**Response:** Valid Command: >

Invalid Command: ?

Ignore Command: !

! delimiter for ignore command. The module is in Host Watchdog Timeout Mode, and the output is set to safe value.

Example:

Command: @01F Receive: >

Output address 01 value F, return success.(The example is suitable for EX9067D-M's digital output channel 1~4 are on)



## 2.13 ~\*\*

**Description:** Host OK

Host send this command to all modules for send the information “Host OK”

**Syntax:** ~\*\*[CHK](cr)

~ delimiter character

\*\* command for all modules

**Response:** No response

**Example:**

Command: ~\*\*

No response

## 2.14 ~AA0

**Description:** Read Module Status

**Syntax:** ~AA0[CHK](cr)

~ delimiter character

AA address of reading/response module (00 to FF)

0 command for read module status

**Response:** Valid Command: **!AASS**

Invalid Command: **?AA**

SS module status, 00=host watchdog timeout status is clear,04=host watchdog timeout status is set. The status will store into EEPROM and only may reset by the command ~AA1.



## 2.15 ~AA1

**Description:** Reset Module Status

**Syntax:** ~AA1[CHK](cr)

~ delimiter character

AA address of reading/response module (00 to FF)

1 command for reset module status

**Response:** Valid Command:     !**AA**

Invalid Command:    ?**AA**

## 2.16 ~AA2

**Description:** Read the Host Watchdog Timeout Value

**Syntax:** ~AA2[CHK](cr)

~ delimiter character

AA address of reading/response module (00 to FF)

2 command for read host watchdog timeout value

**Response:** Valid Command:     !**AAEVV**

Invalid Command:    ?**AA**

E host watchdog enable status, 1=Enable, 0=Disable

VV timeout value in HEX format, each count is 0.1 second  
01=0.1 second and FF=25.5 seconds

## 2.17 ~AA3E VV

**Description:** Set host Watchdog Timeout Value

**Syntax:** ~AA3E VV[CHK](cr)

~ delimiter character  
AA address of reading/response module (00 to FF)  
3 command for set host watchdog timeout value  
E 1=Enabled / 0=Disable host watchdog  
VV timeout value, from 01 to FF, each for 0.1 second

**Response:** Valid Command: !AA

Invalid Command: ?AA

### **Example:**

Command: ~010 Receive: !0100

Read address 01 modules status, return host watchdog timeout status is clear.

Command: ~013164 Receive: !01

Set address 01 host watchdog timeout value 10.0 seconds and enable host watchdog, return success.

Command: ~012 Receive: !01164

Read address 01 host watchdog timeout value, return that host watchdog is enabled, and time interval is 10.0 seconds.

Command: ~\*\* No response

Reset the host watchdog timer. Wait for about 10 seconds and don't send command~\*\*, the LED of module will go to flash. The flash LED indicates the host watchdog timeout status is set.

Command: ~010

Receive: !0104

Read address 01 module status, return host watchdog timeout status is set.

Command: ~012

Receive: !01064

Read address 01 host watchdog timeout value, return that host watchdog is disabled, and time interval is 10.0 seconds.

Command: ~011

Receive: !01

Reset address 01 host watchdog timeout status, return success And the LED of this module stop flash.

Command: ~010

Receive: !0100

Read address 01 module status, return host watchdog timeout status is clear.

## 2.18 ~AA4V

**Description:** Read Power On/Safe Value

**Syntax:** ~AA4V[CHK](cr)

~ delimiter character  
AA address of reading/response module (00 to FF)  
4 command for read Power On/Safe value  
V P= read Power On Value, S= read Safe Value

**Response:** Valid Command:     !**AA(Data)**

Invalid Command:    ?**AA**

(Data) Power On Value or Safe Value

For EX9042D/43D(Data) is **VVVV**,

where **VVVV** is the Power On Value (or Safe Value).

For other modules, (Data) is **VV00**,

where **VV** is the Power On Value(or Safe Value).

### **Example:**

Command: @0100 Receive: >

Output address 01 Value 00, return success.

Command: ~015S Receive: !01

Set address 01 Safe Value, return success.

Command: @01FF Receive: >

Output address 01 Value FF, return success..

Command: ~015P Receive: !01

Set address 01 Power On Value, return success.

Command: ~014S Receive: !0100  
Read address 01 Safe Value, return 00.

Command: ~014P Receive: !01FF  
Read address 01 Power On Value, return FF.

## 2.19 ~AA5V

**Description:** Set Power On/Safe Value

**Syntax:** ~AA5V[CHK](cr)

~ delimiter character

AA address of reading/response module (00 to FF)

5 command for set Power On/Safe value

V P= set current output as Power On Value, S= set current output as Safe Value

**Response:** Valid Command:     !AA

Invalid Command:     ?AA

### **Example:**

Command: @017   Receive: >

Output address 01 Value 7, return success.

Command: ~015P   Receive: !01

Set address 01 Power On Value, return success.

Command: @011   Receive: >

Output address 01 Value 1, return success.

Command: @015S   Receive: !01

Set address 01 Safe Value, return success..

Command: ~014P   Receive: !010700

Read address 01 Power On Value, return 07.

Command: ~014S   Receive: !010100

Read address 01 Safe Value, return 01.