

# 1. Introduction

EX-9044D/9044D-M provides 8 isolated digital output(open collector) channels and 4 isolated digital input channels. All output channels are single-ended with common power. (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 : 8 isolated output channels with common power

Isolation Voltage: 3750Vrms

Output characteristic: open collector transistor(NPN)

Max output Load voltage: 30 VDC

Maximum output current sink: 375mA

Input channels : 4 isolated input channels with common source

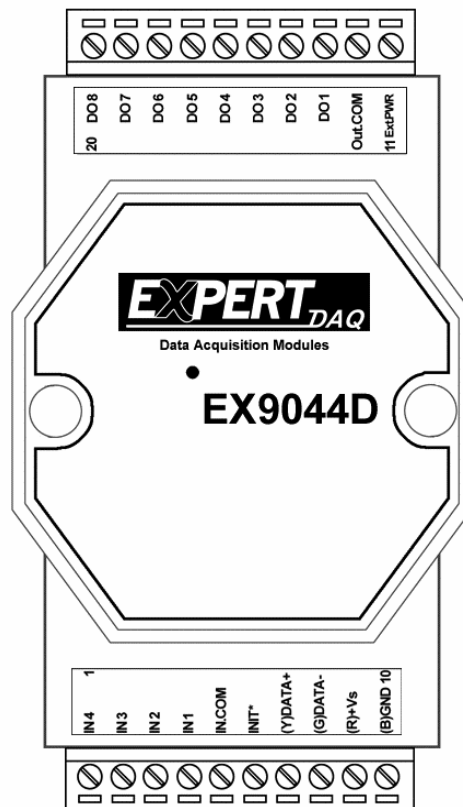
Input impedance: 3K ohms

Logical level 0 : +1VDC Max.Logical level 1: +4.0V ~ +30VDC

LED: 12 digital input/output status LED

Power input : +10V to +30VDC

Power Consumption : 1.5W

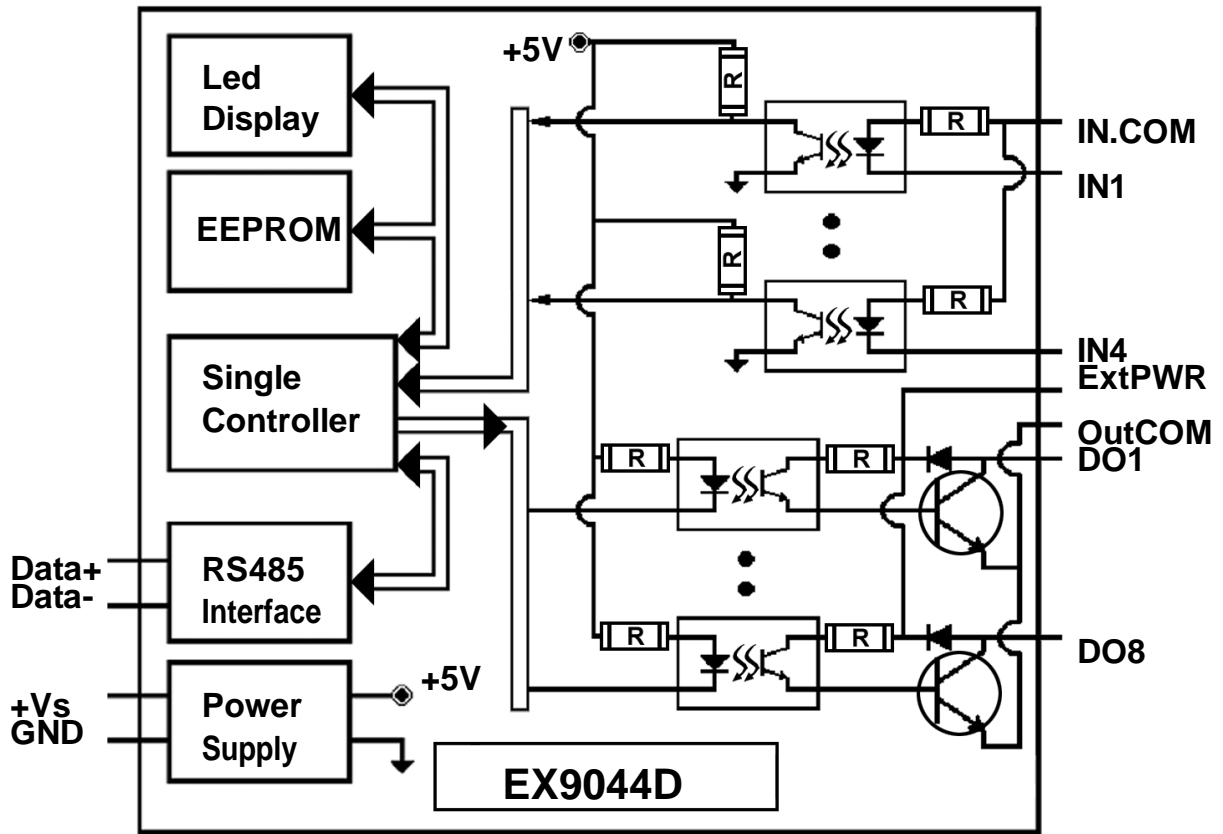


# 1.1 Specifications

|                       | EX-9044D                                     | EX-9044D-M |
|-----------------------|--|------------|
| <b>Digital Output</b> |  |            |
| Output Channels       | 8 isolated output channels with common power |            |
| Output Type           | Open collector transistor                    |            |
| Load Voltage          | +30VDC                                       |            |
| Max Load Current      | 375mA max                                    |            |
| Isolation Voltage     | 3000VDC                                      |            |
| <b>Digital Input</b>  |  |            |
| Input Channels        | 4 isolated input channels with common source |            |
| Logical Level 1       | +4V to +30VDC                                |            |
| Logical Level 0       | +1V Max                                      |            |
| Input Impedance       | 3K Ohms                                      |            |
| Photo Isolation       | 3750 Vrms                                    |            |
| Isolation Voltage     | 3000VDC                                      |            |
| <b>Environment</b>    |  |            |
| Modbus RTU            | Not support                                  | Support    |
| Power Requirement     | +10 to +30 VDC                               |            |
| Power Consumption     | 1.7W   |            |
| Operating Temperature | -25°C to +75°C                               |            |
| Storage Temperature   | -30°C to +75°C                               |            |

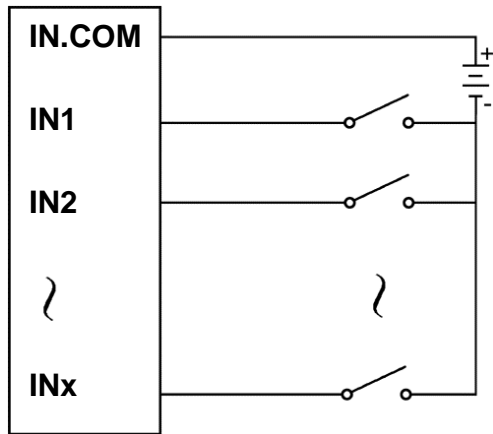
# 1.2 Wire connection

## 1.2.1 Block Diagrams

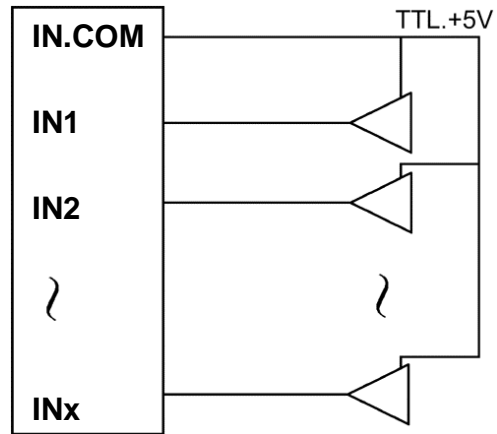


## 1.2.2 Wiring diagram for the EX-9044D

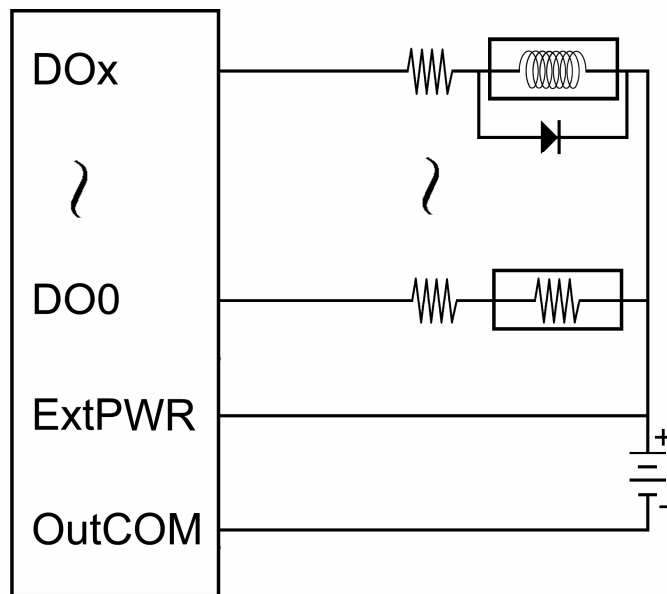
### Dry Contact Input



### TTL/CMOS Input



### Digital Output



## 1.3 Default Settings

Default settings for the EX-9044D modules are as follows:

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

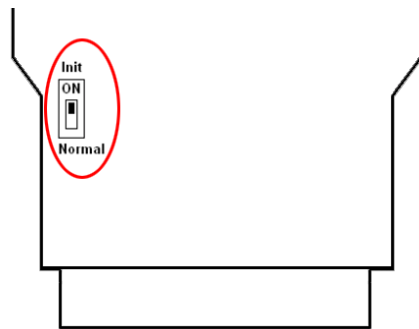
Default settings for the EX-9044D-M modules are as follows:

- . Protocol: Modbus RTU
- . Module Address: 01
- . DIO Type: 40
- . Baud Rate: 9600 bps

## 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 Section 2.18 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(read 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 rested and the output is not changed.

## 1.8 Digital O/P

The module's output have 3 different situation:

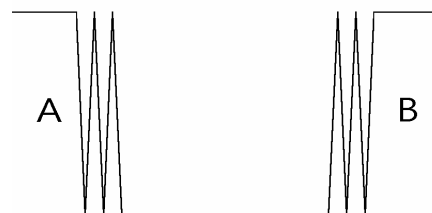
<1>**Safe Value.** If the host watchdog timeout status is set, the output is set to Safe Value. While the module receive the output command like @AA(Date) or #AABBDD, the module will ignore the command and return "!". And will not change the output to the output command value. **The host watchdog timeout 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 reset 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 response 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 stoke. 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 |       |
|----------|----------------|-------|-----------------|-------|
| EX9044/M | DO0~DO7        | 00~FF | DI0~DI3         | 00~0F |



## 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       |

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       |

**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 EX9044D, set address 02 output channel 0 on, return success.

Command: #021001

Receive: >

Assume module is EX9044D, 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 #AAN

**Description:** Read Digital Input Counter from channel N

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

# delimiter character

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

N channel to read

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

Invalid Command: ?AA

(Data) digital input counter value in decimal, from 00000 to 99999

### **Example:**

Command: #032

Receive: !0300103

Read address 03 digital input counter value of channel 2, return value 103.

Command: #025

Receive: ?02

Read address 02 digital input counter value of channel 5, return the channel is not available.

## 2.5 \$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: **!AATCCFF**

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**



## 2.6 \$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 1.10 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: !10F0000

Read address 01 synchronized data, return S=1, first read, and synchronized data 0F00

## 2.7 \$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.

## 2.8 \$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 |       |
|--------|----------------|-------|-----------------|-------|
| EX9044 | DO0~DO7        | 00~FF | DI0~DI3         | 00~0F |

### Example:

Command: \$016

Receive: !FF0000

Assume module is EX9044, read address 01 DIO status, return 0F00, digital input channel 0~3 are off, digital output channel 0~7 are on.

## 2.9 \$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: !01D03.07

Read address 01 firmware version, return version D03.07

## 2.10 \$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: !019044M

Read address 01 module name, return name 9044M

## 2.11 \$AAC

**Description:** Clear Latched Digital Input

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

\$ delimiter character

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

C command for clear latched digital input

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

Invalid Command:    ?**AA**

### **Example:**

Command: \$01L0

Receive: !01FFFF00

Read address 01 latch-low data, return FFFF.

Command: \$01C

Receive: !01

Clear address 01 Latched data, return success.

Command: \$01L0

Receive: !000000

Read address 01 latch-low data, return 0000.







## 2.14 @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 |       |
|---------|----------------|-------|-----------------|-------|
| EX9044M | DO0~DO7        | 00~FF | DI0~DI3         | 00~0F |

### Example:

Command: @01

Receive: >FF00

Assume module is EX9044M, read address 01 DIO status, return 0F00, digital input channel 0~3 are off, digital output channel 0~7 are on.

## 2.15 @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, from 00 to 7F

(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: @0107 Receive: >

Output address 01 value 7, return success.(The example is suitable for EX9044M's digital output channel 0~2 are on)



## 2.17 \$AAP (only for EX9044M)

**Description:** Read protocol information of Module

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

\$ delimiter character

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

P command for read protocol information of module

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

Invalid Command: **?AA**

S The protocol supported by the module

10: the protocol set in EEPROM is Normal mode

11: the protocol set in EEPROM is ModbusRTU mode

### **Example:**

Command: \$01P

Receive: !0110

Reads the communication protocol of module 01 and returns a response of 10 meaning the protocol that will be used at the next power on reset is normal mode.

Command: \$01P1

Receive: !01

Sets the communication protocol of module 01 to Modbus RTU and returns a valid response. And the next power on reset is in ModbusRTU mode.

## 2.18 \$AAPN (only for EX9044M)

**Description:** Set the protocol information of Module

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

\$ delimiter character

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

P command for set protocol information of module

N The protocol supported by the module

0: the protocol set in EEPROM is Normal mode

1: the protocol set in EEPROM is ModbusRTU mode

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 protocol is saved in the EEPROM and will be effective after the next power-on reset.

**Response:** Valid Command:     !AA

Invalid Command:     ?AA

### Example:

Command: \$01P1

Receive: !01

Sets the communication protocol of module 01 to Modbus RTU and returns a valid response. And the next power on reset is in ModbusRTU mode.

## 2.19 ~\*\*

**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

## 2.20 ~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.

## 2.21 ~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**



## 2.22 ~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



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.

## 2.24 ~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.

## 2.25 ~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: @01AA Receive: >

Output address 01 Value AA, return success.

Command: ~015P Receive: !01

Set address 01 Power On Value, return success.

Command: @0155 Receive: >

Output address 01 Value 55, return success.

Command: @015S Receive: !01

Set address 01 Safe Value, return success..

Command: ~014P Receive: !01AA00

Read address 01 Power On Value, return AA.

Command: ~014S Receive: !015500

Read address 01 Safe Value, return 55.

## **EX9044-M Quick Start**

- 1. The default setting is MODBUS mode after Power On.**
- 2. Using INIT pin to contact with GND pin then Power On will enter Normal mode.**
- 3. Command: \$00P0 is set EX9044-M to Normal mode after Repower On.**  
**On normal mode, user can set other setting like Address, Baudrate, .....**  
**(Please check the EX9000 user manual)**
- 4. Command: \$AAP1 is set to MODBUS mode after Repower On.**
- 5. Under Normal mode that Command: \$AAP can check which mode it is after Repower On.**

**Response:**

**!AA10=Normal**

**!AA11=MODBUS**

## 01(0x01) Read Digital Input/Output Value

### Request

|       |                              |         |   |
|-------|------------------------------|---------|---|
| 00    | Address                      | 1 Byte  | 1-247   |
| 01    | Function code                | 1 Byte  | 0x01  |
| 02~03 | Starting channel             | 2 Bytes | 0x0000~0x0007 for DO readback value<br>0x0020~0x0023 for DI readback value<br>0x0040~0x0043 for DI Latch high value<br>0x0060~0x0063 for DI Latch low value<br><b>0x0080~0x0087 for DO safe value</b><br><b>0x00A0~0x00A7 for DO power-on value</b> |
| 04~05 | Input/Output channel numbers | 2 Bytes | Input: 0x0001~0x0004<br>Output: 0x0001~0x0008   |

### Response

|    |                                     |        |   |
|----|-------------------------------------|--------|---|
| 00 | Address                             | 1 Byte | 1-247   |
| 01 | Function code                       | 1 Byte | 0x01  |
| 02 | Byte count                          | 1 Byte | 1   |
| 03 | Input/Output channel readback value | 1 Byte | 0x00~0x0F<br>A bit corresponds to a channel. When the bit is 1 it denotes that the value of the channel that was set is ON. if the bit is 0 it denotes that the value of the channel that was set is OFF. |

### Error Response

|    |                |        |  |
|----|----------------|--------|--|
| 00 | Address        | 1 Byte | 1-247  |
| 01 | Function code  | 1 Byte | 0x81   |
| 02 | Exception code | 1 Byte | Refer to the Modbus standard for more details. |



## 02(0x02) Read Digital Input Value

### Request

|       |                       |         |               |
|-------|-----------------------|---------|---------------|
| 00    | Address               | 1 Byte  | 1-247         |
| 01    | Function code         | 1 Byte  | 0x02          |
| 02~03 | Starting channel      | 2 Bytes | 0x0000~0x0003 |
| 04~05 | Input channel numbers | 2 Bytes | 0x0001~0x0004 |

### Response

|    |                              |        |  |
|----|------------------------------|--------|--|
| 00 | Address                      | 1 Byte | 1-247  |
| 01 | Function code                | 1 Byte | 0x02   |
| 02 | Byte count                   | 1 Byte | 1  |
| 03 | Input channel readback value | 1 Byte | 0x00~0x0F<br>A bit corresponds to a channel. When the bit is 1 it denotes that the value of the channel that was Input response. if the bit is 0 it denotes that the value of the channel that was no Input response . |

### Error Response

|    |                |        |  |
|----|----------------|--------|--|
| 00 | Address        | 1 Byte | 1-247  |
| 01 | Function code  | 1 Byte | 0x82   |
| 02 | Exception code | 1 Byte | Refer to the Modbus standard for more details. |

## 03(0x03) Read Digital Input Count Value

### Request

|       |                       |         |               |
|-------|-----------------------|---------|---------------|
| 00    | Address               | 1 Byte  | 1-247         |
| 01    | Function code         | 1 Byte  | 0x03          |
| 02~03 | Starting channel      | 2 Bytes | 0x0000~0x0003 |
| 04~05 | Input channel numbers | 2 Bytes | 0x0001~0x0004 |

### Response

|     |                           |                |  |
|-----|---------------------------|----------------|--|
| 00  | Address                   | 1 Byte         | 1-247  |
| 01  | Function code             | 1 Byte         | 0x03   |
| 02  | Byte count                | 1 Byte         | N* x 2   |
| 03~ | Input channel count value | N* x 2<br>Byte | Each channel can record a maximum count value up to 65535(0xFFFF). |

**N\*=Number of input channels**

### Error Response

|    |                |        |  |
|----|----------------|--------|--|
| 00 | Address        | 1 Byte | 1-247  |
| 01 | Function code  | 1 Byte | 0x83   |
| 02 | Exception code | 1 Byte | Refer to the Modbus standard for more details. |

## 04(0x04) Read Digital Input Count Value

### Request

|       |                       |         |               |
|-------|-----------------------|---------|---------------|
| 00    | Address               | 1 Byte  | 1-247         |
| 01    | Function code         | 1 Byte  | 0x04          |
| 02~03 | Starting channel      | 2 Bytes | 0x0000~0x0003 |
| 04~05 | Input channel numbers | 2 Bytes | 0x0001~0x0004 |

### Response

|     |                           |                |  |
|-----|---------------------------|----------------|--|
| 00  | Address                   | 1 Byte         | 1-247  |
| 01  | Function code             | 1 Byte         | 0x04   |
| 02  | Byte count                | 1 Byte         | N* x 2   |
| 03~ | Input channel count value | N* x 2<br>Byte | Each channel can record a maximum count value up to 65535(0xFFFF). |

**N\*=Number of input channels**

### Error Response

|    |                |        |  |
|----|----------------|--------|--|
| 00 | Address        | 1 Byte | 1-247  |
| 01 | Function code  | 1 Byte | 0x84   |
| 02 | Exception code | 1 Byte | Refer to the Modbus standard for more details. |

## 05(0x05) Write Digital Output/Clear DI count Value (Single channel)

### Request

|       |                       |         |  |
|-------|-----------------------|---------|--|
| 00    | Address               | 1 Byte  | 1-247  |
| 01    | Function code         | 1 Byte  | 0x05   |
| 02~03 | Output channel number | 2 Bytes | 0x0000~0x0007 for output channel<br>0x0107 to clear the latch value<br>0x0200~0x0203 to clear the DI counter value                   |
| 04~05 | Output value          | 2 Bytes | A value of 0xFF00 sets the output to ON.<br>A value of 0x0000 set it to OFF. All other values are illegal and won't affect the coil. |

### Response

|       |                        |         |  |
|-------|------------------------|---------|--|
| 00    | Address                | 1 Byte  | 1-247  |
| 01    | Function code          | 1 Byte  | 0x05   |
| 02~03 | Output channel numbers | 2 Bytes | The value is the same as byte 02 and 03 of the Request |
| 04~05 | Output value           | 2 Bytes | The value is the same as byte 04 and 05 of the Request |

### Error Response

|    |                |        |  |
|----|----------------|--------|--|
| 00 | Address        | 1 Byte | 1-247  |
| 01 | Function code  | 1 Byte | 0x85   |
| 02 | Exception code | 1 Byte | Refer to the Modbus standard for more details. |

## 15(0x0F) Write Digital Output/Clear DI count Value (Multi channel)

### Request

|       |                                   |         |  |
|-------|-----------------------------------|---------|--|
| 00    | Address                           | 1 Byte  | 1-247  |
| 01    | Function code                     | 1 Byte  | 0x0F   |
| 02~03 | Starting channel                  | 2 Bytes | 0x0000~0x0007 for output channel<br>0x0200~0x0203 to clear the DI counter value<br>0x0080~0x0087 for <b>Safe value</b><br>0x00A0~0x00A7 for <b>Power-on value</b>  |
| 04~05 | Input/Output channel numbers      | 2 Bytes | Input: 0x0001~0x0004<br>Output: 0x0001~0x0008  |
| 06    | Byte count                        | 1 Byte  | 1  |
| 07    | Output value/Clear DI count value | 1 Byte  | 0x00~0xFF<br><b>A bit corresponds to a channel. When the bit is 1 it denotes that the value of the channel that was set is ON. if the bit is 0 it denotes that the value of the channel that was set is OFF.</b> |

### Response

|       |                        |         |  |
|-------|------------------------|---------|--|
| 00    | Address                | 1 Byte  | 1-247  |
| 01    | Function code          | 1 Byte  | 0x0F   |
| 02~03 | Starting channel       | 2 Bytes | The value is the same as byte 02 and 03 of the Request |
| 04~05 | Output channel numbers | 2 Bytes | The value is the same as byte 04 and 05 of the Request |

### Error Response

|    |                |        |  |
|----|----------------|--------|--|
| 00 | Address        | 1 Byte | 1-247  |
| 01 | Function code  | 1 Byte | 0x8F   |
| 02 | Exception code | 1 Byte | Refer to the Modbus standard for more details. |

## 01(0x01) Read WDT timeout status

### Request

|       |                         |         |        |
|-------|-------------------------|---------|--------|
| 00    | Address                 | 1 Byte  | 1-247  |
| 01    | Function code           | 1 Byte  | 0x01   |
| 02~03 | Starting channel        | 2 Bytes | 0x010D |
| 04~05 | Read WDT timeout status | 2 Bytes | 0x0001 |

### Response

|    |                         |        |   |
|----|-------------------------|--------|---|
| 00 | Address                 | 1 Byte | 1-247   |
| 01 | Function code           | 1 Byte | 0x01  |
| 02 | Byte count              | 1 Byte | 1   |
| 03 | Read WDT timeout status | 1 Byte | 0x00 The WDT timeout status is clear<br>0x01 The WDT timeout status is enable |

### Error Response

|    |                |        |  |
|----|----------------|--------|--|
| 00 | Address        | 1 Byte | 1-247  |
| 01 | Function code  | 1 Byte | 0x81   |
| 02 | Exception code | 1 Byte | Refer to the Modbus standard for more details. |

## 03(0x03) Read WDT timeout Value

### Request

|       |                        |         |        |
|-------|------------------------|---------|--------|
| 00    | Address                | 1 Byte  | 1-247  |
| 01    | Function code          | 1 Byte  | 0x03   |
| 02~03 | Starting channel       | 2 Bytes | 0x01E8 |
| 04~05 | Read WDT timeout value | 2 Bytes | 0x0001 |

### Response

|     |                        |        |   |
|-----|------------------------|--------|---|
| 00  | Address                | 1 Byte | 1-247   |
| 01  | Function code          | 1 Byte | 0x03  |
| 02  | Byte count             | 1 Byte | 2   |
| 03~ | Read WDT timeout value | 1 Byte | 0x0000~0x00FF WDT timeout value, 0~255, in 0.1 second |

### Error Response

|    |                |        |  |
|----|----------------|--------|--|
| 00 | Address        | 1 Byte | 1-247  |
| 01 | Function code  | 1 Byte | 0x83   |
| 02 | Exception code | 1 Byte | Refer to the Modbus standard for more details. |

### **03(0x03) Send Host OK**

#### **Request**

|       |                  |         |        |
|-------|------------------|---------|--------|
| 00    | Address          | 1 Byte  | 1-247  |
| 01    | Function code    | 1 Byte  | 0x03   |
| 02~03 | Starting channel | 2 Bytes | 0x3038 |
| 04~05 | Send Host OK     | 2 Bytes | 0x0000 |

#### **No Response**

### **04(0x04) Send Host OK**

#### **Request**

|       |                  |         |        |
|-------|------------------|---------|--------|
| 00    | Address          | 1 Byte  | 1-247  |
| 01    | Function code    | 1 Byte  | 0x04   |
| 02~03 | Starting channel | 2 Bytes | 0x3038 |
| 04~05 | Send Host OK     | 2 Bytes | 0x0000 |

#### **No Response**



## 05(0x05) Set WDT timeout /Clear WDT timeout status

### Request

|       |               |         |  |
|-------|---------------|---------|--|
| 00    | Address       | 1 Byte  | 1-247  |
| 01    | Function code | 1 Byte  | 0x05   |
| 02~03 | WDT timeout   | 2 Bytes | 0x0104 Set WDT timeout enable/disable<br>0x010D Clear WDT timeout status                               |
| 04~05 | WDT timeout   | 2 Bytes | 0xFF00 for WDT timeout enable<br>0x0000 for WDT timeout disable<br>0xFF00 for Clear WDT timeout status |

### Response

|       |               |         |  |
|-------|---------------|---------|--|
| 00    | Address       | 1 Byte  | 1-247  |
| 01    | Function code | 1 Byte  | 0x05   |
| 02~03 | WDT timeout   | 2 Bytes | The value is the same as byte 02 and 03 of the Request |
| 04~05 | WDT timeout   | 2 Bytes | The value is the same as byte 04 and 05 of the Request |

### Error Response

|    |                |        |  |
|----|----------------|--------|--|
| 00 | Address        | 1 Byte | 1-247  |
| 01 | Function code  | 1 Byte | 0x85   |
| 02 | Exception code | 1 Byte | Refer to the Modbus standard for more details. |

## 06(0x06) Set WDT timeout Value

### Request

|       |                   |         |   |
|-------|-------------------|---------|---|
| 00    | Address           | 1 Byte  | 1-247   |
| 01    | Function code     | 1 Byte  | 0x06  |
| 02~03 | Starting channel  | 2 Bytes | 0x01E8  |
| 04~05 | WDT timeout value | 2 Bytes | 0x0000~0x00FF WDT timeout value, 0~255, in 0.1 second |

### Response

|       |                   |         |  |
|-------|-------------------|---------|--|
| 00    | Address           | 1 Byte  | 1-247  |
| 01    | Function code     | 1 Byte  | 0x06   |
| 02~03 | WDT timeout value | 2 Bytes | The value is the same as byte 02 and 03 of the Request |
| 04~05 | WDT timeout value | 2 Bytes | The value is the same as byte 04 and 05 of the Request |

### Error Response

|    |                |        |  |
|----|----------------|--------|--|
| 00 | Address        | 1 Byte | 1-247  |
| 01 | Function code  | 1 Byte | 0x86   |
| 02 | Exception code | 1 Byte | Refer to the Modbus standard for more details. |

## Modbus Mapping Table:

### EX9044M (DI\*4, DO\*8)

| ADDR        | Item                                 | Attribute |
|-------------|--------------------------------------|-----------|
| 00033~00036 | Digital Input channel for DI0~3      | R         |
|             |                                      |           |
| 00065~00068 | DI Latch high value for DI0~3        | R         |
| 00097~00100 | DI Latch low value for DI0~3         | R         |
| 00264       | Clear the Latch value                | W         |
|             |                                      |           |
| 30001~30004 | Digital input counter for DI0~3      | R         |
| 00513~00516 | Clear the DI counter value for DI0~3 | W         |
|             |                                      |           |
| 00001~00008 | Digital output channel for DO0~7     | R/W       |