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1. Introduction

EX-9000 is a family of network data acquisition and control modules.

They provide A/D, D/A, DI/O, Timer/Counter and other functions. These modules can be remote controlled by a set of commands.

The common features of EX-9080R/RD/EX-9080R-M/RD-M

are given as following :

- 2 independent 32-bit counter, counter 0& counter1
- Input signal can be isolated or non-isolated
- Programmable alarm output
- Input frequency measurement up to 100KHz
- 7 SEG Display
- Modbus function

1.1 Pin Assignment

Isolated Input



Non-isolated Input

1.2 Specifications

EX9080R/RD: Counter/Frequency module.

Counter Input

- Channels: Two independents 32-bit counters, counter 0 & 1
- Input signal: Isolated or non-isolated
- Isolation input levels:
 - Logic level 0: +1V max.
 - Logic level 1: +3.5V to +30V**
- Isolation voltage: 3750 Vrms
- Non-isolation input level:
 - Logic level 0: 0 to +1V
 - Logic level 1: +3.5V to +5V
- Maximum count: 32-bit (4,294,967,295)
- Alarming: alarm on counter 0 or counter 0 & 1, programmable

Frequency Measurement

- Input frequency: 1 Hz to 100K Hz max.
- Programmable built-in gate time: 1.0/0. 1sec

Digital Output

- 2 channels, open-collector to 30V, 30mA max. load
- Power dissipation: 300mW

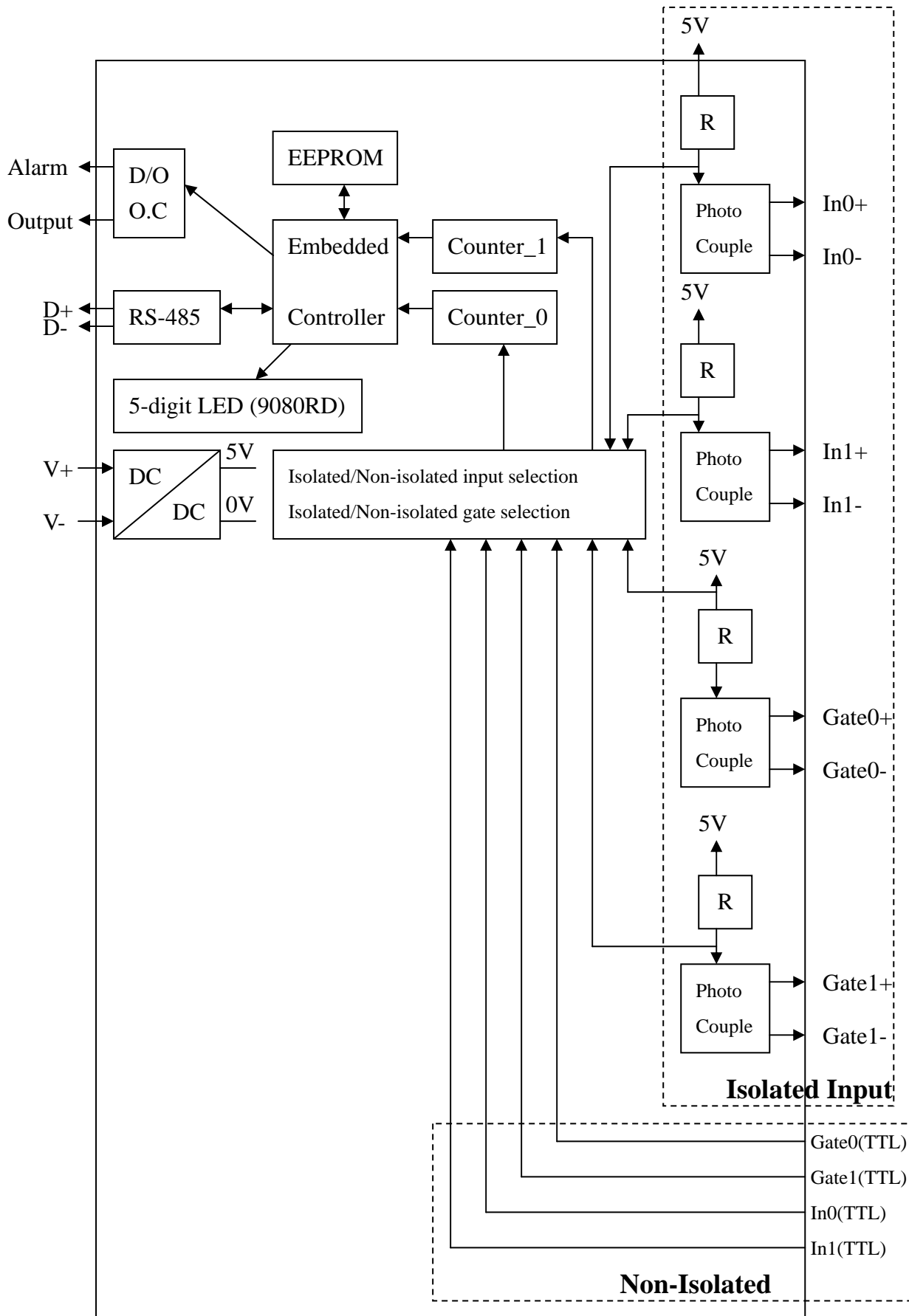
Power

- Power requirement: +10V to 30V (non-regulated)
- Power consumption: 2W for EX9080R

7 SEG for Display

Modbus function support

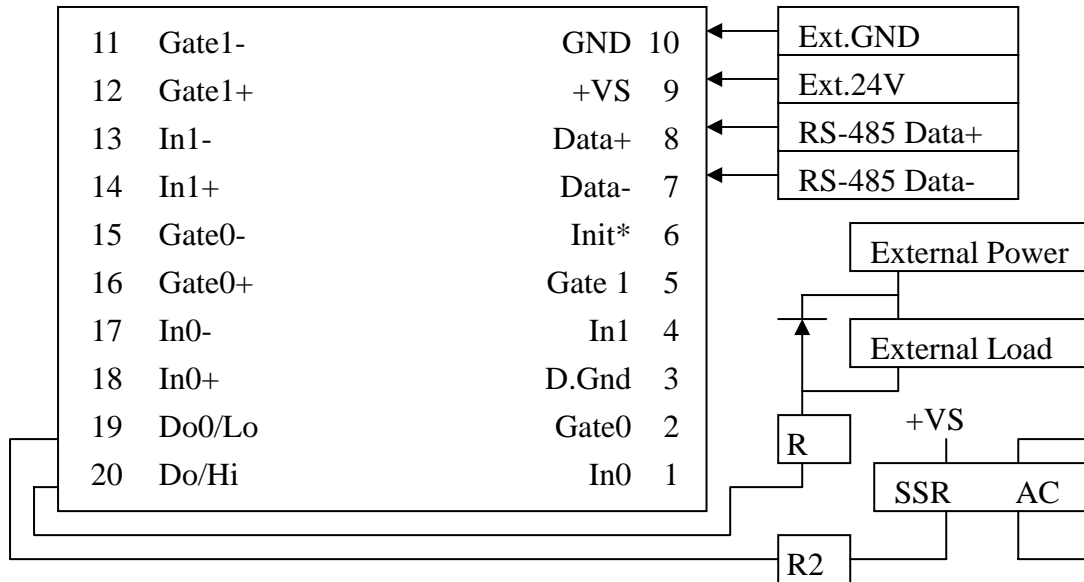
1.3 Block Diagram



1.4 Application Wiring

1.4.1 Output Drive SSR or Other Load

EX9080R

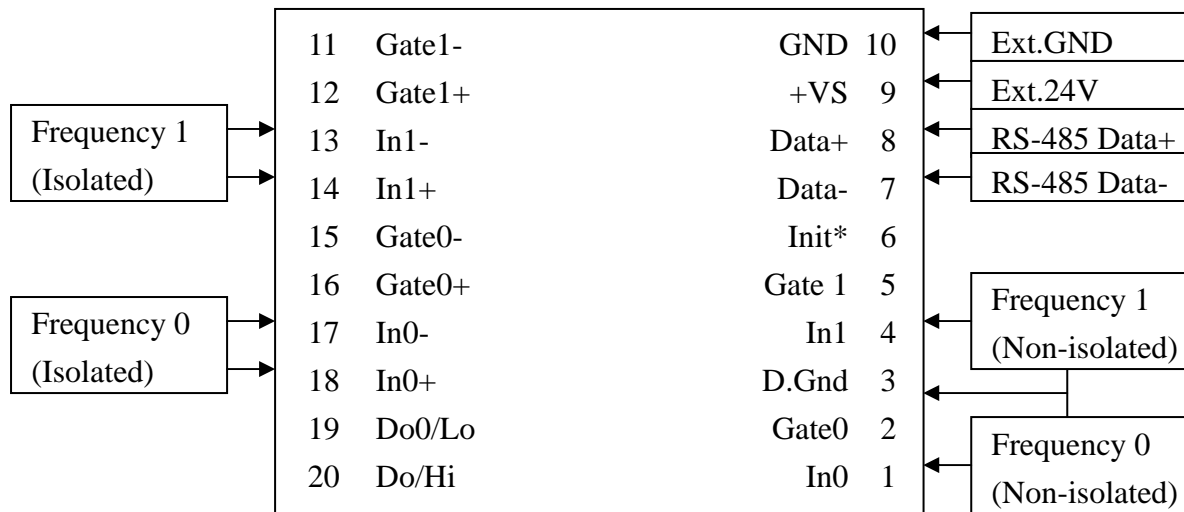


Note:

- If the external load is resistive load, the 1N4001 can be omitted.
(transistor, lamp, resistor,.....)
- If the external load is inductive load, the 1N4001 can't be omitted.
(relay, coil,.....)

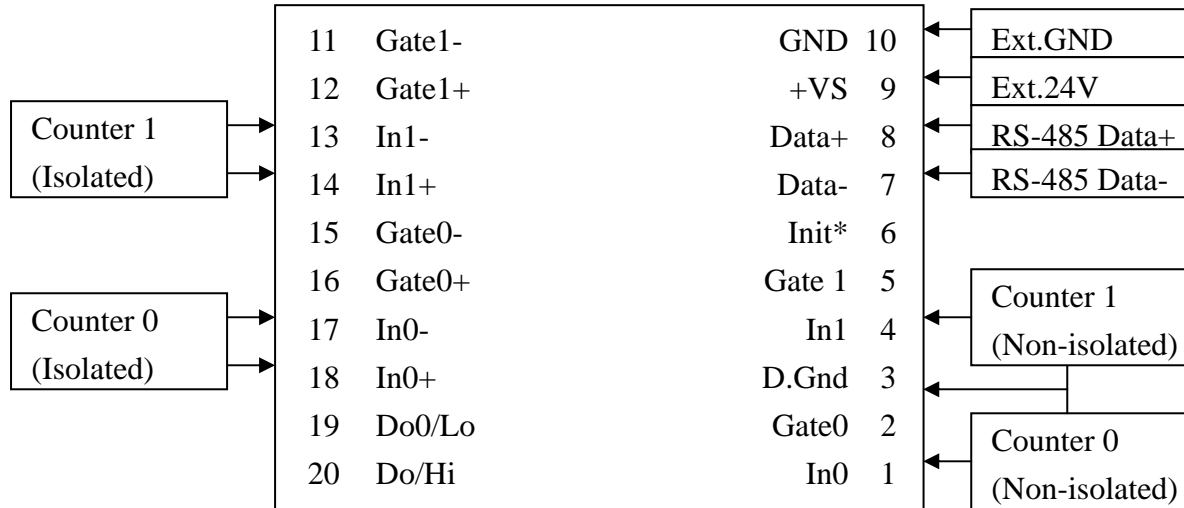
1.4.2 Frequency Input

Use \$AABS command to select isolated/non-isolated input.



EX-9080

1.4.3 Counter Input



EX-9080

1.5 Default Setting

The default setting is given as following:

- Address:01
- Baud rate: 9600
- Checksum disable
- Data: 1 start + 8 data+1 stop(no parity)
- Type: 50 counter input
- Alarm: hi alarm on counter 0 & Counter 1.

1.6 Application Notes

1.6.1 Counter/Frequency Input Mode Selection

The counter/Frequency input can be selected from isolated or non-isolated signal. The channel 0 & channel 1 can be selected separately. There are 4 different input mode given as following: These four input modes can be used in EX9080R

Input Mode	Command	Channel 0	Channel 1
Input mode 0	\$AAB0	Non-isolated	Non-isolated
Input mode 1	\$AAB1	Isolated	Isolated
Input mode 2	\$AAB2	Non-isolated	Isolated
Input mode 3	\$AAB3	Isolated	Non-isolated

1.6.2 Counter Alarm Mode Selection

There are two counter alarm mode, alarm mode 0 & alarm mode 1, These two alarm modes can be used in both of EX9080R.

The **alarm mode 0** is designed for two-channel application as following:

Select alarm mode 0: ~AAA0 (for both channels)

- Enable channel 0: @AAEA0
- Disable channel 0: @AADA0
- Set high alarm limit of channel 0: @AAPA(data)
- If (counter 0 >= alarm limit 0) D/O 0 turn ON
- If (counter 0 < alarm limit 0) D/O 0 turn OFF

- Enable channel 1: @AAEA1
- Disable channel 1: @AADA1
- Set high alarm limit of channel 1: @AASA(data)
- If (counter 1 >= alarm limit 1) D/O 1 turn ON
- If (counter 1 < alarm limit 1) D/O 1 turn OFF

The **alarm mode 1** is designed for single-channel application as following:

- Select alarm mode 1: ~AAA1(for channel 0 only)
- Enable channel 0: @AAEAT
- Disable channel 0: @AADA
- Clear latch alarm: @ACA
- Set high alarm limit: @AAPA(data)
- Set high-high alarm limit: @AASA(data)

	D/O 0	D/O 1
Counter 0 < high alarm	OFF	OFF
High alarm <= counter 0 & counter 0 < high-high alarm	ON	OFF
High-high alarm <= counter 0	ON	ON

Note: High-high alarm must greater than high-alarm.

1.6.3 Digital Output Application Notes

The D/O 0 & D/O 1 can be used as D/O or alarm output as following:

- Can be used as D/O in the frequency mode.
- Can be used as D/O in the counter mode & alarm disable (by @AADA or @AADAN command)
- Can be used as alarm output in the counter mode & alarm enable (by @AAEAT or @AAEAN command)

	D/O 0	D/O 1
Frequency mode	D/O 0	D/O 1
Counter mode & alarm disable	D/O 0	D/O 1
Counter mode & alarm enable (alarm mode 1, ~AAA1)	High-alarm on counter 0	High-high alarm on counter 0
Counter mode & alarm enable (alarm mode 0, ~AAA0 & @AAEA0)	Alarm on counter 0	D/O 1 or alarm on counter 1
Counter mode & alarm enable (alarm mode 0, ~AAA0 & @AAEA1)	D/O 0 or alarm on counter 0	Alarm on counter 1

1.6.4 Gate Control Setting

The gate control will be ignored in frequency mode (51).

The gate control is default disable in counter mode (50). The user can use command to enable/disable the gate control as following:

- \$AAA0 = gate input must be low to enable counter.
- \$AAA1 = gate input must be high to enable counter.
- \$AAA2 = gate input is ignored. The counter will be always enable.

1.6.5 Frequency Input Applications

Type=51

	Frequency 0	Frequency 1
\$AAB0 = input mode 0	Non-isolated channel 0	Non-isolated channel 1
\$AAB1 = input mode 1	Isolated channel 0	Isolated channel 1
\$AAB2 = input mode 2	Non-isolated channel 0	Isolated channel 1
\$AAB3 = input mode 3	Isolated channel 0	Non-isolated channel 1

The steps to measure frequency are given as following:

1. Use \$AAB? To select the mode (this command will clear the current frequency first)
2. Use #AA? To perform frequency measurement.

1.6.6 Counter Input Applications

Type=50

	Counter 0	Counter 1
\$AAB0 = input mode 0	Non-isolated channel 0	Non-isolated channel 1
\$AAB1 = input mode 1	Isolated channel 0	Isolated channel 1
\$AAB2 = input mode 2	Non-isolated channel 0	Isolated channel 1
\$AAB3 = input mode 3	Isolated channel 0	Non-isolated channel 1

1.7 Tables

Configuration Code Table: CC

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

Configuration Code : FF, 2-char (for all)

7	6	5	4	3	2	1	0
0	Checksum 0=disable 1=enable	0			Frequency gate time 0:0.1 second 1:1.0 second	0	

Configuration Code Table: TT

TT	Input Rang
50	Counter
51	Frequency

2. Command

2.1 %AANNTTCCFF

Description: Set Module Configuration

Syntax: %AANNTTCCFF[CHK](cr)

% delimiter character

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

NN new address for setting response module(00 to FF)

TT new type for setting module

CC new baudrate for setting module.

It is needed to short the INIT* to ground while change baudrate.

FF new data format for setting module.

It is needed to short the INIT* to ground to change checksum setting.

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: %0102500600 Receive: !02

Set module address 01 to 02,Baudrate: 9600bps, counter .

Command: %0202510600 Receive: !02

Change to frequency mode

2.2 #AAN

Description: Read Digital Input Counter/ frequency from Channel N

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

delimiter character

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

N 0 = channel 0 of counter /frequency

1 = channel 1 of counter /frequency

Response: Valid Command: >AA(Data)

Invalid Command: No response

(Data) 8 character data in HEX format.

Example:

Command: \$012 Receive: !01500600

Command: #010 Receive: >0000001E

Counter 0 = 0X1E = 30 (in decimal)

Command: \$022 Receive: !02510600

Command: #021 Receive: >0000001E

frequency 1 = 0X1E Hz = 30 Hz (in decimal)

2.3 ~**

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: ~** Receive: No response

Send Host OK to all modules.

2.4 ~AA0

Description: Read Module Status.

Syntax: ~AA0[CHK](cr)

~ delimiter character

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

0 command for read modules 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.

2.5 ~AA1

Description: Reset Module Status.

Syntax: ~AA1[CHK](cr)

~ delimiter character

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

1 command for reset modules status

Response: Valid Command: !AA

Invalid Command: ?AA

2.6 ~AA2

Description: Read 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: !AASTT

Invalid Command: ?AA

S Host watchdog enable status, 1=Enable, 0=Disable.

TT Timeout value in HEX format, Each count is 0.1 second, 01=0.1 second and FF=25.5 seconds.

2.7 ~AA3ETT

Description: Set host watchdog Timeout value

Syntax: ~AA3ETT[CHK](cr)

~ delimiter character

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

3 command for set host watchdog timeout value

E 1=Enable/0=Disable host watchdog

TT 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 intervals 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

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

2.8 ~AAO(Data)

Description: Set Module Name

Syntax: ~AAO(Data)[CHK](cr)

~ delimiter character

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

O command for set module name

(Data) new name for module, max 6 characters

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: ~01O9050 Receive: !01

Set address 01 module name 9050, return success.

Command: \$01M Receive: !019050

Read address 01 module name, return name 9050

2.9 \$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

CC baudrate code of module

FF data format of module

Example:

Command: \$012 Receive: !01500600

Read address 01 status, return counter mode, 9600bps, no checksum

Command: \$022 Receive: !02510700

Read address 02 status, return frequency, 19200bps, no checksum

2.10 \$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: !01R1.4

Read address 01 firmware version, return version R1.4.

Command: \$01F Receive: !01A1.4

Read address 01 firmware version, return version A1.4.

2.11 \$AAM

Description: Read Module Name

Syntax: \$AAM[CHK](cr)

\$ delimiter character

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

M command for read module name

Response: Valid Command: !AA(Data)

Invalid Command: ?AA

(Data) Name of module

Example:

Command: \$01M Receive: !019021

Read address 01 module name, return name 9021.

Command: \$03M Receive: !029024

Read address 03 module name, return name 9024

2.12 ~AAAS

Description: Set counter alarm mode.

Syntax: ~AAAS[CHK](cr)

~ delimiter character

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

S 0 = alarm mode 0.

1 = alarm mode 1.

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: ~01A0 Receive: !01

Set alarm mode = 0

Command: ~02A1 Receive: !02

Set alarm mode = 1

2.13 \$AA6N

Description: Reset counter 0 or counter 1 to the preset value & clear the overflow flag.

Syntax: \$AA6N[CHK](cr)

\$ delimiter character

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

N 0 = counter 0

1 = counter 1

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: @01G0 Receive: !0100000000

Preset value = 0

Command: \$0160 Receive: !01

Reset counter 0 to preset value 0

Command: @01G1 Receive: !010000ABCD

Preset value = 0xABCD

Command: \$0161 Receive: !01

Reset counter 1 to preset value 0xABCD

2.14 \$AA7N

Description: Read the overflow flag of counter. The user can use \$AA6S command to reset counter & clear overflow flag.

Syntax: \$AA7N[CHK](cr)

\$ delimiter character

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

N 0 = counter 0

1 = counter 1

Response: Valid Command: **!AAS**

Invalid Command: **?AA**

S 0 = no overflow

1 = is overflow

Example:

Command: \$0170 Receive: !011

Counter 0 is overflow.

Command: \$0160 Receive: !01

Clear the overflow flag.

Command: \$0171 Receive: !010

Counter 1 is OK.

2.15 \$AAA

Description: Read gate control mode.

Syntax: \$AAA[CHK](cr)

\$ delimiter character

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

Response: Valid Command: **!AAG**

Invalid Command: **?AA**

G 0 = gate is low active.

1 = gate is high active.

2 = gate is disable

Example

Command: \$01A Receive: !010

Gate is low active.

Command: \$02A Receive: !021

Gate is high active

Command: \$03A Receive: !032

Gate is disable (always active)

2.16 \$AAAG

Description: Set gate control mode.

Syntax: \$AAAG[CHK](cr)

\$ delimiter character

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

G 0 = gate is low active.

1 = gate is high active.

2 = gate is disable.

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: \$01A0 Receive: !01

Gate is low active.

Command: \$02A1 Receive: !02

Gate is high active.

Command: \$03A2 Receive: !03

Gate is disable (always active)

2.17 \$AAB

Description: Read input mod.

Syntax: \$AAB[CHK](cr)

\$ delimiter character

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

Response: Valid Command: !AAS

Invalid Command: ?AA

S 0= channel 0 is non-isolated, channel 1 is non-isolated.

1= channel 0 is isolated, channel 1 is isolated.

2= channel 0 is non-isolated, channel 1 is isolated.

3= channel 0 is isolated, channel 1 is non-isolated.

Example:

Command: \$01B Receive: !010

Counter/frequency channel 0 is non-isolated, channel 1 is non-isolated

Command: \$02B Receive: !021

Counter/frequency channel 0 is isolated, channel 1 is isolated

Command: \$03B Receive: !032

Counter/frequency channel 0 is non-isolated, channel 1 is isolated

2.18 \$AABS

Description: Set input mode.

Syntax: \$AABS[CHK](cr)

\$ delimiter character

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

S 0= channel 0 is non-isolated, channel 1 is non-isolated.

1= channel 0 is isolated, channel 1 is isolated.

2= channel 0 is non-isolated, channel 1 is isolated.

3= channel 0 is isolated, channel 1 is non-isolated.

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: \$01B0 Receive: !01

Counter/frequency channel 0 is non-isolated, channel 1 is non-isolated

Command: \$02B1 Receive: !02

Counter/frequency channel 0 is isolated, channel 1 is isolated

Command: \$03B2 Receive: !03

Counter/frequency channel 0 is non-isolated, channel 1 is isolated

2.19 @AADI

Description: Read D/O and Alarm Status.

Syntax: @AADI[CHK](cr)

@ delimiter character

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

DI command for reading digital output and alarm status

Response: Valid Command: !AAS0D00

Invalid Command: ?AA

D 0 = D/O0 = D/O1 = OFF

1 = D/O0 = ON, D/O1 = OFF

2 = D/O0 = OFF, D/O1 = ON

3 = D/O0 = D/O1 = ON

S(alarm mode 0)0 = counter 0 alarm = disable, counter 1 alarm = disable.

1 = counter 0 alarm = enable, counter 1 alarm = disable.

2 = counter 0 alarm = disable, counter 1 alarm = enable.

3 = counter 0 alarm = enable, counter 1 alarm = enable.

S(alarm mode 1)0 = counter 0 alarm = disable.

1 = counter 0 alarm = enable & MOMENTARY mode.

2 = counter 0 alarm = enable & LATCH mode.

Example:

Command: @01DI Receive: !0100000

Alarm disable. D/O0= D/O1=OFF.

Command: @02DI Receive: !0230100

Alarm enable. D/O0=ON, D/O1=OFF.

2.20 @AADO0D

Description: Set digital output.

Syntax: @AADO0D[CHK](cr)

@ delimiter character

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

D 0=DO0 off, DO1 off,
1=DO0 on, DO1 off,
2=DO0 off, DO1 on,
3=DO0 on, DO1 on.

Response: Valid Command: !AA
Invalid Command: ?AA
Alarm is enable: ?AA

Example:

Command: @01DO00 Receive: !01

Turn all D/O OFF.

Command: @02DO01 Receive: !02

Turn D/O 0 ON, Turn D/O 1 OFF.

NOTE: If the alarm is enable, the D/O 0 & D/O 1 will be always controlled by module. Therefore the following D/O commands will be ignored.

1. Power-on value is changed to hi/lo condition immediately
2. The @AADO0D command is ignored.

2.21 @AAEAN

Description: Enable counter alarm (for alarm-mode 0).

Syntax: @AAEAN[CHK](cr)

@ delimiter character

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

N 0 = enable counter 0

1 = enable counter 1

Response: Valid Command: !AASS

Invalid Command: ?AA

Example:

Command: @01EA0 Receive: !01

Enable counter 0

Command: @01EA1 Receive: !02

Enable counter 1

2.22 @AAEAT

Description: Enable counter alarm (for alarm-mode 1).

Syntax: @AAEAT[CHK](cr)

@ delimiter character

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

T M = momentary alarm

L = latch alarm

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: @01EAL Receive: !01

Latch alarm

Command: @02EAM Receive: !02

Momentary alarm.

NOTE: If the alarm is enable, the D/O 0 & D/O 1 will be always controlled by module. Therefore the following D/O commands will be ignored.

- 1.Power-on value is changed to hi/lo condition immediately
- 2.The @AADO0D command is ignored.

2.23 @AACCA

Description: Clear latch alarm (for alarm-mode 1)

Syntax: @AACCA[CHK](cr)

@ delimiter character

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

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: @01CA Receive: !01

Clear latch alarm.

Command: @02CA Receive: !02

Clear latch alarm.

2.24 @AADA

Description: Disable alarm(for alarm-mode 1)

Syntax: @AADA[CHK](cr)

@ delimiter character

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

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: @01DA Receive: !01

Disable alarm

Command: @02DA Receive: !02

Disable alarm

2.25 @AADAN

Description: Disable alarm (for alarm-mode 0)

Syntax: @AADAN[CHK](cr)

@ delimiter character

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

N 0= disable counter 0

1 = disable counter 1

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: @01DA0 Receive: !01

Disable counter 0 alarm.

Command: @02DA1 Receive: !02

Disable counter 1 alarm.

2.26 @AAPA(data)

Description: Set alarm limit of counter 0 (for alarm-mode 0)

Syntax: @AAPA(data)[CHK](cr)

@ delimiter character

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

(Data) 8 character data in HEX format.

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: @01PAFFFF0000 Receive: !01

The alarm limit of counter 0 is FFFF0000.

Command: @02PA0000FFFF Receive: !02

The alarm limit of counter 0 is 0000FFFF.

2.27 @AAPA(data)

Description: Set Hi-alarm limit of counter 0 (for alarm-mode 1)

Syntax: @AAPA[CHK](cr)

@ delimiter character

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

(data) 8-character HEX value.

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: @01PAFFFF0000 Receive: !01

The Hi-alarm limit of counter 0 is FFFF0000.

Command: @02PA0000FFFF Receive: !02

The Hi-alarm limit of counter 0 is 0000FFFF.

2.28 @AASA(data)

Description: Set alarm limit of counter-1(for alarm-mode 0)

Syntax: @AASA[CHK](cr)

@ delimiter character

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

(data) 8-character HEX value.

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: @01SAFFFF0000 Receive: !01

The alarm limit of counter 1 is FFFF0000.

Command: @02SA0000FFFF Receive: !02

The alarm limit of counter 1 is 0000FFFF.

2.29 @AASA(data)

Description: Set Hi-Hi-alarm limit of counter 1(for alarm-mode 1)

Syntax: @AASA[CHK](cr)

@ delimiter character

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

(data) 8-character HEX value.

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: @01SAFFFF0000 Receive: !01

The Hi-Hi-alarm limit of counter 1 is FFFF0000.

Command: @02SA0000FFFF Receive: !02

The Hi-Hi-alarm limit of counter 1 is 0000FFFF.

2.30 @AARP

Description: Read alarm limit of counter 0 (for alarm-mode 0)

Syntax: @AARP[CHK](cr)

@ delimiter character

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

Response: Valid Command: !AA(Data)

Invalid Command: ?AA

(Data) 8-character HEX value.

Example:

Command: @01RP Receive: !01FFFF0000.

The alarm limit of counter 0 is FFFF0000.

Command: @02RP Receive: !020000FFFF.

The alarm limit of counter 0 is 0000FFFF.

2.31 @AARP

Description: Read Hi-alarm limit of counter 0 (for alarm-mode 1)

Syntax: @AARP[CHK](cr)

@ delimiter character

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

Response: Valid Command: !AA(Data)

Invalid Command: ?AA

(Data) 8-character HEX value.

Example:

Command: @01RP Receive: !01FFFF0000.

The Hi-alarm limit of counter 0 is FFFF0000.

Command: @02RP Receive: !020000FFFF.

The Hi-alarm limit of counter 0 is 0000FFFF.

2.32 @AARA

Description: Read alarm limit of counter 1 (for alarm-mode 0)

Syntax: @AARA[CHK](cr)

@ delimiter character

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

Response: Valid Command: !AA (data)

Invalid Command: ?AA

(data) 8-character HEX value.

Example:

Command: @01RA Receive: !01FFFF0000

The alarm limit of counter 1 is FFFF0000.

Command: @02RA Receive: !020000FFFF.

The alarm limit of counter 1 is 0000FFFF.

2.33 @AARA

Description: Read Hi-Hi-alarm limit of counter 1 (for alarm-mode 1)

Syntax: @AARA[CHK](cr)

@ delimiter character

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

Response: Valid Command: !AA (data)

Invalid Command: ?AA

(data) 8-character HEX value.

Example:

Command: @01RA Receive: !01FFFF0000

The Hi-Hi-alarm limit of counter 1 is FFFF0000.

Command: @02RA Receive: !020000FFFF.

The Hi-Hi-alarm limit of counter 1 is 0000FFFF.

2.34 \$AA8

Description: Read the LED configuration.

Syntax: \$AA8[CHK](cr)

\$ delimiter character

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

8 command for read the LED configuration

Response: Valid Command: !AAS

Invalid Command: ?AA

S 0 = show counter/frequency channel 0

1 = show counter/frequency channel 1

2 = Host control

Example:

Command: \$018 Receive: !010

Address 01 module's LED show the value of channel 0.

Command: \$038 Receive: !032

Host control the Address 03 module's LED.

Command: \$048 Receive: !041

Address 04 module's LED show the value of channel 1.

2.35 \$AA8V

Description: Select LED configuration.

Syntax: \$AA8V[CHK](cr)

\$ delimiter character

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

V 0 = LED show counter/frequency channel 0

1 = LED show counter/frequency channel 1

2 =Host control LED

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: \$0180 Receive: !01

Select address 01 module's LED show the value of channel 0.

Command: \$0382 Receive: !03

Select host control the Address 03 module's LED.

2.36 \$AA9(data)

Description: Send data to LED display.

Syntax: \$AA9(data)[CHK](cr)

\$ delimiter character

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

9 command for send data to LED display

(data) 0 = 5 decimal digit + 1 decimal point
min: 0.0000 ~ max: 99999.

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

Example:

Command: \$0188888. Receive: !01

Set address 01 module's LED display = 88888.

Command: \$0312.345 Receive: !03

Set address 03 module's LED display = 12.345

Note: Before Send data to LED display of EX-9080R/RD, user must make sure the LED configuration is select to Host Control (P.2.34/2.35)

3. Operations Principle & Application Notes

3.1 INIT*_pin Operation Principle

All EX9000 modules contain an EEPROM to store configuration information. Therefore the user is difficult to find out the status of the EX9000 module. The user can connect the INIT*_pin to GND_pin and power on the module. The EX9000 modules will go to the factory default setting without changing the EEPROM data. The factory default setting is given as following:

Address = 00

Baud rate = 9600

Checksum = DISABLE

Data format = 1 start + 8 data bits + 1 stop bit

If the user disconnect the INIT*_pin and GND_pin, the EX9000 module will be auto configured according to the EEPROM data. The user is easy to find the EEPROM configuration data in the default setting. The steps are shown as following:

Step 1: Power off and connect INIT*_pin to GND_Pin.

Step 2: Power on.

Step 3: Send command string \$002 (0x0D) to the module, the module will return back the EEPROM data.

Step 4: Record the EEPROM data of this EX9000 module.

Step 5: Power off and disconnect INIT*_Pin and GND_Pin.

Step 6: Power on.

3.2 D/O Operation Principle

1. The D/O output of EX9080R modules will be turn OFF after first power on.
2. The D/O output will be changed to the desired state if the @AADO command is received. Then all these D/O will keep in the same states until next @AADO command.
3. If the host watchdog is active all the D/O will not change and the module status is set to 04. If the host computer send out @AADO to those modules now, those modules will ignore this command and return ! as warning information. The host can use ~AA1. command to clear the module status to 0 ,than the EX9080R module will accept the @AADO again.
4. If the D/O output is configured as alarm output, the module will control the ON/OFF state automatically. Therefore the “@AADO” command will be ignored in this condition.

4.EX9080R-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: \$00R0 is set EX9080R-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: \$AAR1 is set to MODBUS mode after Repower On.**

The Modbus protocol was originally developed for Modicon controllers by Modicon Inc. Detailed information can be found at <http://www.modicon.com/techpubs/toc7.html>. Visit <http://www.modbus.org> to find more valuable information.

9000M series modules support the Modbus RTU protocol. The communication Baud Rates range from 1200bps to 115200bps. The parity, data bits and stop bits are fixed as no parity, 8 data bits and 1stop bit. The following Modbus functions are supported.

01(0x01) Read Digital Output Value

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x01
02~03	Starting channel	2 Bytes	0x0010~0x0011 for DO readback value
04~05	Input/Output channel numbers	2 Bytes	0x0001~0x0002

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	0x00~0x03 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 Output Value

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x02
02~03	Starting channel	2 Bytes	0x0010~0x0011 for DO readback value
04~05	Input/Output channel numbers	2 Bytes	0x0001~0x0002

Response

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x02
02	Byte count	1 Byte	1
03	Input/Output channel readback value	1 Byte	0x00~0x03 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 for channel 0 starting 0x0002 for channel 1 starting
04~05	Input channel numbers	2 Bytes	0x0002 for one channel (2 words) 0x0004 for two channels (4 words)

Response

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x03
02	Byte count	1 Byte	N* x 4
03~	Input channel count value	N* x 4 Byte	Return data

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 for channel 0 starting 0x0002 for channel 1 starting
04~05	Input channel numbers	2 Bytes	0x0002 for one channel (2 words) 0x0004 for two channels (4 words)

Response

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x04
02	Byte count	1 Byte	N* x 4
03~	Input channel count value	N* x 4 Byte	Return data

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 (Single channel)

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x05
02~03	Output channel number	2 Bytes	0x0010~0x0011
04~05	Output value	2 Bytes	A value of 0xFF00 sets the output to ON. 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.

06(0x06) Clear Digital Input Count Value

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x06
02~03	Input channel number	2 Bytes	0x0000 for channel 0 0x0002 for channel 1
04~05	Clear channel count	2 Bytes	0x0000 for clear

Response

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x06
02~05	Byte count	1 Byte	The value is the same as byte 02 ~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.

15(0x0F) Write Digital Output

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x0F
02~03	Starting channel	2 Bytes	0x0010~0x0011
04~05	Output channel numbers	2 Bytes	0x0001~0x0002
06	Byte count	1 Byte	1
07	Output value	1 Byte	0x00~0x03 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.

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.

Modbus Mapping Table:

9080R-M/9080RD-M					
Address	Hex	Channel	Content	Attribute	Note
40001~40002	0H~1H	0	Analog input Value	Read/Write	Function code 6 clear CH0 01 06 00 00 00 00 crch crcl
40003~40004	2H~3H	1	Analog input Value	Read/Write	Function code 6 clear CH1 01 06 00 02 00 00 crch crcl
0017	10H	0	Digital Output Value	Read/Write	
0018	11H	1	Digital Output Value	Read/Write	