1. Specification

1.1 AIO(Analog I/O Module)

Analog O/P Module Table

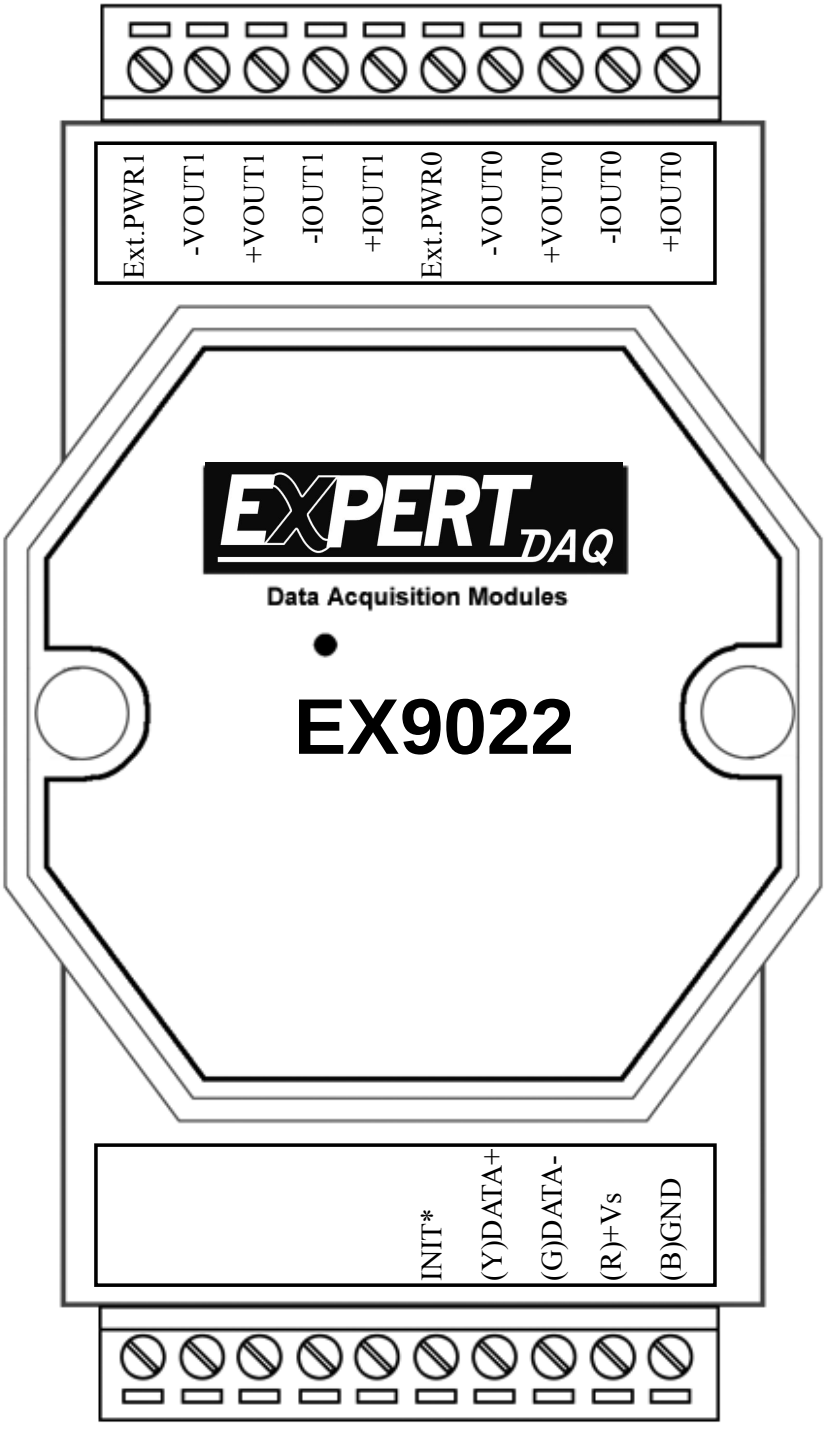
	Analog O/P Module				
		EX9021	**EX9021P**	**EX9022**	**EX9024**
Analog O/P	Resolution	12bit	16bit	12bit	14bit
	O/P channels	1	1	2	4
	Voltage O/P	0~10V	0~10V	0~10V	±10V 0~10V ±5V,0~5V
	Current O/P	0~20mA 4~20mA	0~20mA 4~20mA	0~20mA 4~20mA	0~20mA 4~20mA
	Voltage Output	10mA max	10mA max	10mA max	5mA max
	Current Load Resistance	Internal power: 500 ohms External 24V: 1050 ohms	Internal power: 500 ohms External 24V: 1050 ohms	Internal power: 500 ohms External 24V: 1050 ohms	External 24V: 1050 ohms
Safe Value (when host fail/comm. fail)		v	v	v	v
Power on Value		v	v	v	v
Dual WDT (watchdog timer)		v	v	v	v
Power Consumption		2W	2W	2W	2W

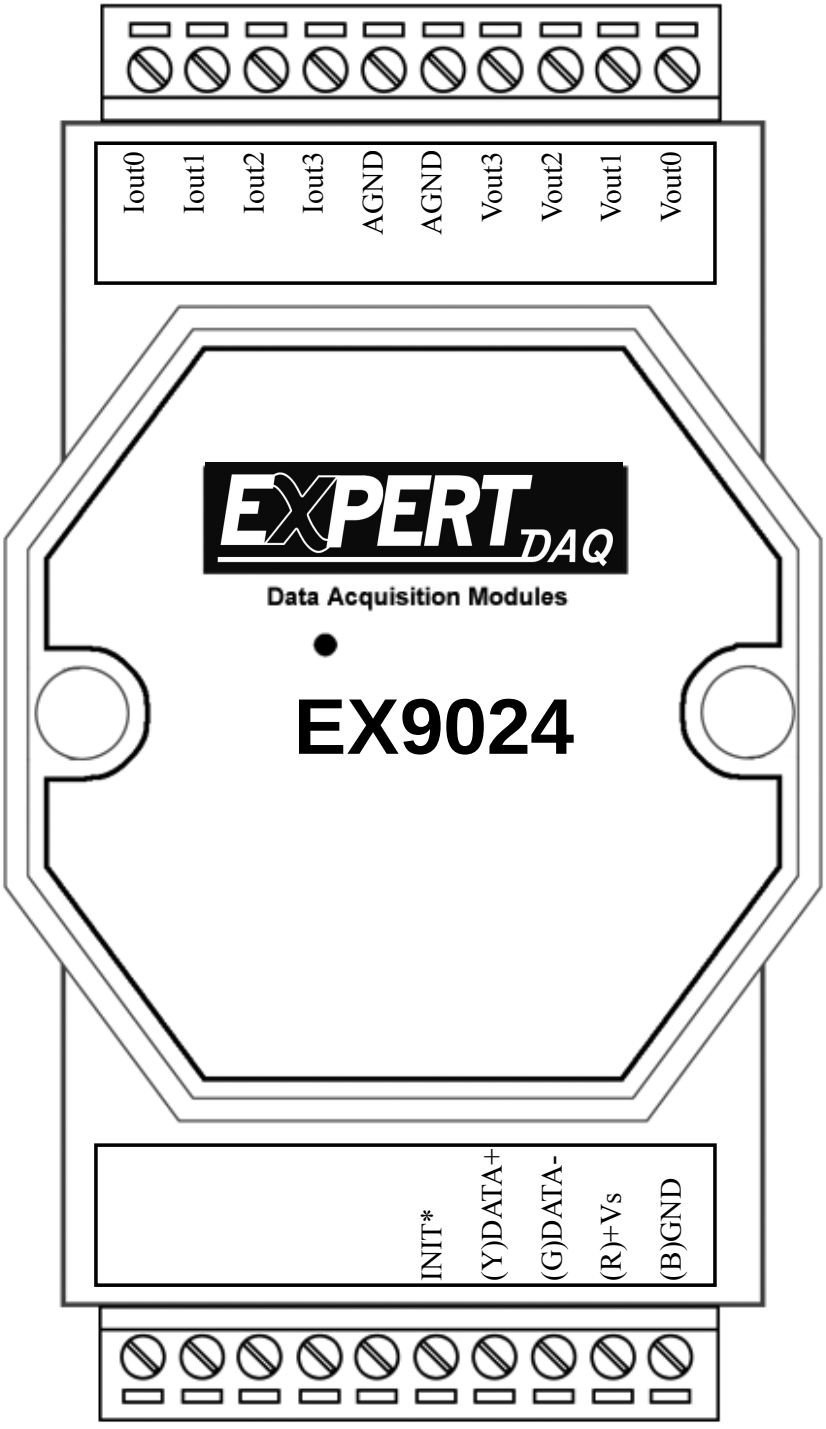
Note:

Select internal power of module : default setting, may **drive load up to 500 ohms**.

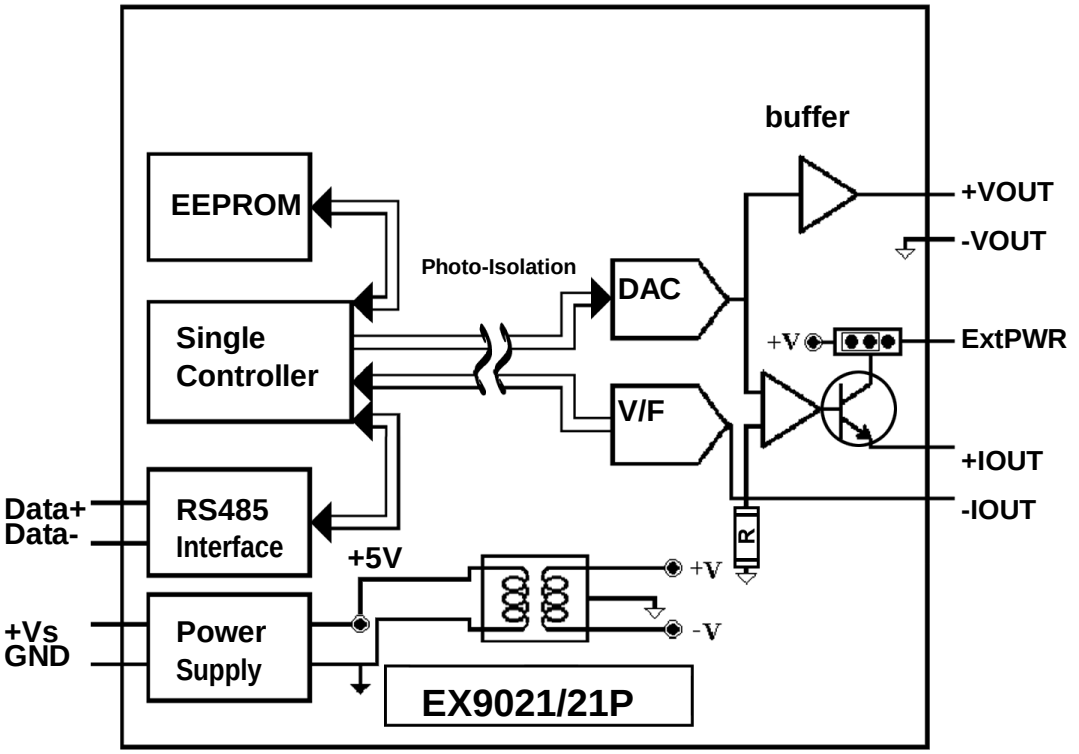
Select external power of module : may drive larger load with **24V power, may drive 1050 ohms.**

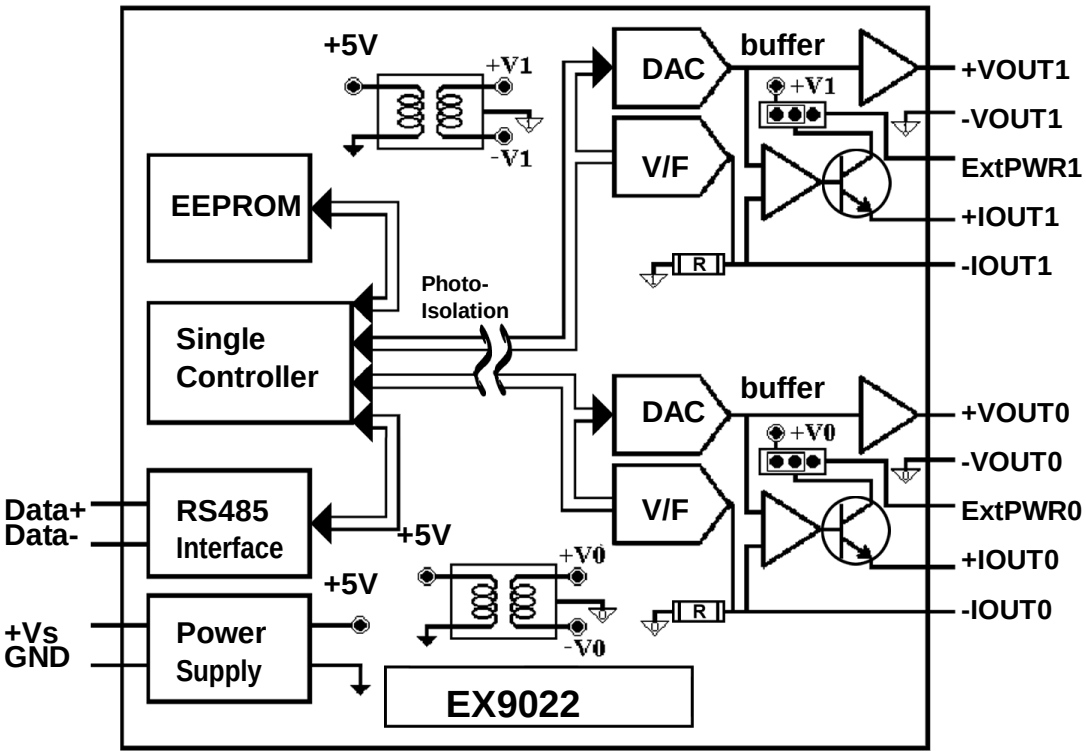
1.2 Pin Assignment

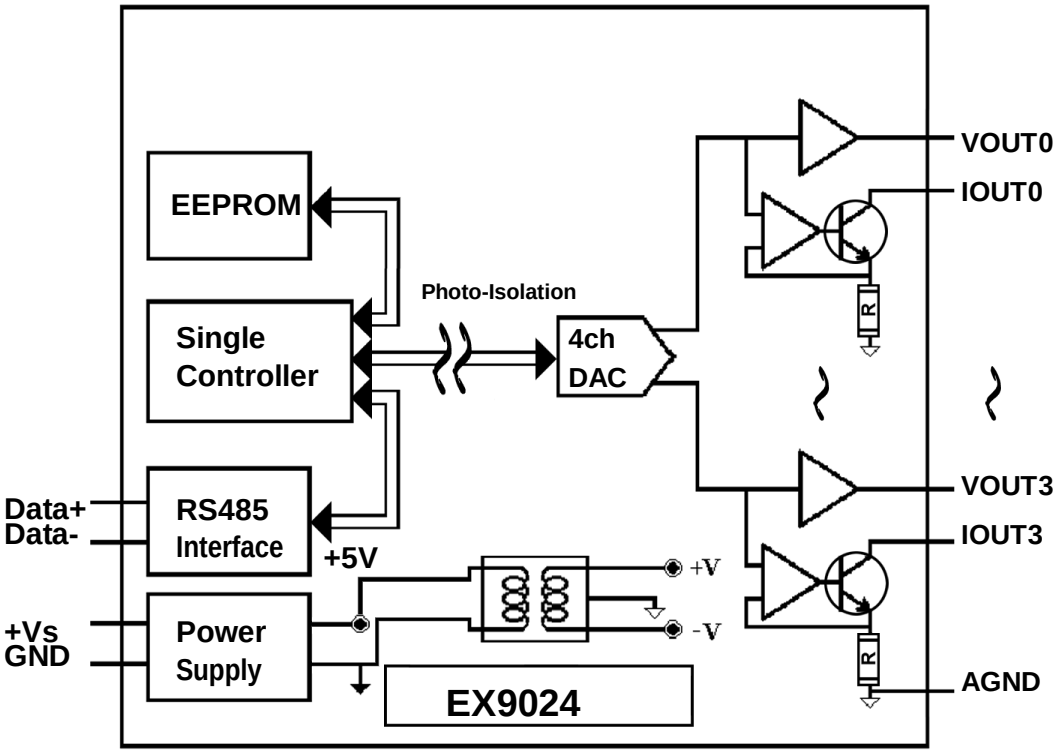

Ext.PWR1
-VOUT1
+VOUT1
-IOUT1
+IOUT1
Ext.PWR0
-VOUT0
+VOUT0
-IOUT0
+IOUT0
EXPERT DAQ
Data Acquisition Modules
EX9022
INIT*
(Y)DATA+
(G)DATA-
(R)+Vs
(B)GND


Iout0
Iout1
Iout2
Iout3
AGND
AGND
Vout3
Vout2
Vout1
Vout0
EXPERT DAQ
Data Acquisition Modules
EX9024
INIT*
(Y)DATA+
(G)DATA-
(R)+Vs
(B)GND

1.3 Block Diagram

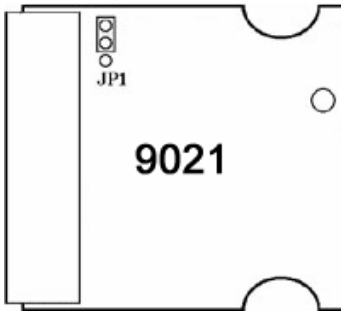


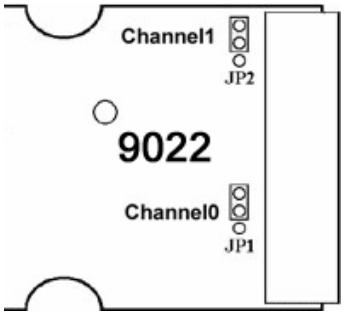



EEPROM
Single Controller
RS485 Interface
Power Supply
Photo-Isolation
4ch DAC
+5V
+V
-V
EX9024
Data+
Data-
+Vs
GND
VOUT0
IOUT0
VOUT3
IOUT3
AGND
R
R

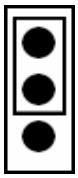
1.4 Jumper Setting & Wire Connection

EX9021/21P/22 Current output wire connection

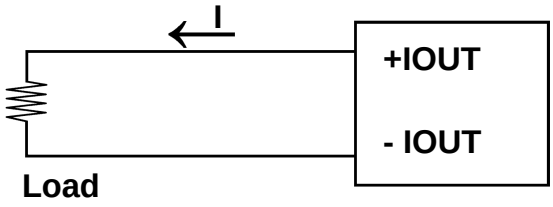




JP1/2

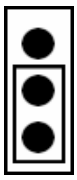


Select
Internal Power



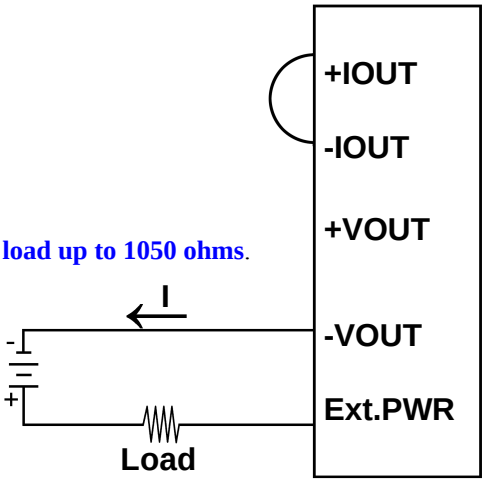
Note : default setting, may **drive load up to 500 ohms**.

JP1/2

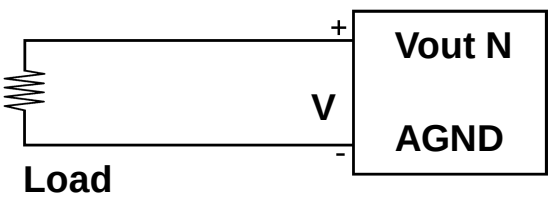


Select
External Power

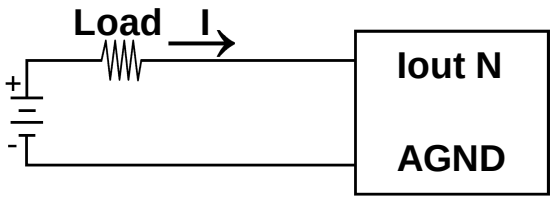
Note : External Power setting, may **drive load up to 1050 ohms**.



EX9024 Voltage output wire connection



EX9024 Current output wire connection



Note : External Power setting, may **drive load up to 1050 ohms**.

2. EX9000 AIO series-EX9021/EX9022/EX9024

2.1 Default Setting for EX9021/22/24

Address:01
Analog O/P Type: 0-10V(JP1 for internal Power) for EX9021/21p
: 0-10V for EX9024 four channels & for EX9022 two channels (JP1,JP2 for internal Power) .
Baudrate : 9600bps ; Checksum disable ; Immediate change ; Engineer unit format

2.2 Calibration

2.2.1 Calibration Requirement for EX9021/21P

Notification:

1. While calibrate type 30, need connect external shunt resister 250ohms, 0.01% between -Iout and +Iout for 4mA/20mA calibration.
2. Between -Vout and +Vout connect multi meter for 10V type 32 calibration.
3. Before calibration, warm-up module about 30 minutes for accuracy.
4. **Warning : pls don't calibrate before you really understand .**

Example calibration sequence for type 30(4mA/20mA); 32(10V).

1. Setting type to 30, 32
   %0101300600 (for type 30) Receive:!01
   %0101320600 (for type 32) Receive:!01
2. #0104.000 (for 4mA) Receive:>
   #0120.000 (for 20mA) Receive:>
   #0110.000 (for 10V) Receive:>
3. $013VV (VV: trim value) Receive:!01
4. $010 (Perform for 4mA) Receive:!01
   $011 (Perform for 20mA) Receive:!01
   $017 (Perform for 10V) Receive:!01
5. Repeat step 3 three/five times

Warning: Please don't calibrate before you really understand.

2.2.2 Configuration Table

Configuration Table for EX9021/21P

Analog O/P type code setting(TT)

TT	Output Range
30	0 to 20mA
31	4 to 20mA
32	0 to 10V

Baudrate Setting(CC)

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

Data Format(FF)

7	6	5	4	3	2	1	0
Set to 0	checksum 0=disable 1=enable	**Slew Rate Control** **code voltage current** 0000: immediate change 0001: 0.0625 V/sec 0.125 mA/sec 0010: 0.125 V/sec 0.250 mA/sec 0011: 0.250 V/sec 0.500 mA/sec 0100: 0.500 V/sec 1.000 mA/sec 0101: 1.000 V/sec 2.000 mA/sec 0110: 2.000 V/sec 4.000 mA/sec 0111: 4.000 V/sec 8.000 mA/sec 1000: 8.000 V/sec 16.000 mA/sec 1001: 16.00 V/sec 32.000 mA/sec 1010: 32.00 V/sec 64.00 mA/sec 1011: 64.00 V/sec 128.00 mA/sec 1100: 128.0 V/sec 256.00 mA/sec 1101: 256.0 V/sec 512.00 mA/sec 1110: 512.0 V/sec 1024.0 mA/sec				00→engineering unit 01→% of FSR 10→hexadecimal	

Slew Rate Control ref. sec. 4.1

Analog O/P type code setting

TT	Output Rang	Format	MAX	MIN
30	0 to 20 mA	Engineering Unit	20.000	00.000
		% of FSR	+100.00	+000.00
		Hexadecimal	FFF	000
31	4 to 20 mA	Engineering Unit	20.000	04.000
		% of FSR	+100.00	+000.00
		Hexadecimal	FFF	000
32	0 to 10V	Engineering Unit	10.000	00.000
		% of FSR	+100.00	+000.00
		Hexadecimal	FFF	000

2.3.1 Calibration Requirement for EX9024

Notification:

1. 0 mA calibration need connect external shunt resister 250 ohms, 0.01% between Iout0 & AGND
2. 20 mA Calibration need connect external resister 250ohms, 0.01% and DC power between Iout0 & AGND
3. –10V/+10V calibration need connect multi meter between Vout0 & AGND
4. **Warning : pls don't calibrate before you really understand .**

Example Calibration Sequence for type 30(0mA/20mA), type 33(-10V/10V)

1. Setting type to 30, 33
   % 0101300600 (for type 30) Receive:!01
   % 0101330600 (for type 33) Receive:!01

2. #010+00.000 (for 0mA) Receive:>
   #010+20.000 (for 20mA) Receive:>
   #010-10.000 (for –10V) Receive:>
   #010+10.000 (for +10V) Receive:>

3. $0130VV(VV: trim value) Receive:!01

4. $0100(Perform for 0mA) Receive:!01
   $0110(Perform for 20mA) Receive:!01
   $0100(Perform for - 10V) Receive:!01
   $0110(Perform for +10V) Receive:!01

5. Repeat step 3 three/five times

Warning: Please don't calibrate before you really understand.

2.3.2 Configuration Table

Configuration Table for EX9024

Analog O/P type code setting(TT)

TT	Output Range
30	0 to 20mA
31	4 to 20mA
32	0 to 10V
33	-10 to 10V
34	0 to 5V
35	-5 to 5V

Baudrate Setting(CC)

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

Data Format(FF)

7	6	5	4	3	2	1	0
Set to 0	checksum 0=disable 1=enable	**Slew Rate Control** **code voltage current** 0000: immediate change 0001: 0.0625 V/sec 0.125 mA/sec 0010: 0.125 V/sec 0.250 mA/sec 0011: 0.250 V/sec 0.500 mA/sec 0100: 0.500 V/sec 1.000 mA/sec 0101: 1.000 V/sec 2.000 mA/sec 0110: 2.000 V/sec 4.000 mA/sec 0111: 4.000 V/sec 8.000 mA/sec 1000: 8.000 V/sec 16.000 mA/sec 1001: 16.00 V/sec 32.000 mA/sec 1010: 32.00 V/sec 64.00 mA/sec 1011: 64.00 V/sec 128.00 mA/sec 1100: 128.0 V/sec 256.00 mA/sec 1101: 256.0 V/sec 512.00 mA/sec 1110: 512.0 V/sec 1024.0 mA/sec 1111: 1024.0 V/sec 2048.0 mA/sec				00→engineering unit	

Slew Rate Control ref. sec. 4.1

Analog O/P type code setting (TT)

TT	Output Rang	Format	MAX	MIN
30	0 to 20 mA	Engineering Unit	+20.000	+00.000
31	4 to 20 mA	Engineering Unit	+20.000	+04.000
32	0 to 10V	Engineering Unit	+10.000	+00.000
33	-10 to 10V	Engineering Unit	+10.000	-10.000
34	0 to 5 V	Engineering Unit	+05.000	+00.000
35	-5 to 5V	Engineering Unit	+05.000	-05.000

2.4.1 Calibration Requirement for EX9022

Notification: If (TT) is 3F by Configuration Table then Analog Output Type (T) & Slew Rate Control (S) should be ref. sec. 2.4.3 DA Configuration of EX9022

1.While calibrate type 0(0 to 20mA), need connect external shunt resister 250ohms, 0.01% between –Iout0 and +Iout0 for 0 to 20mA calibration.
2.Between -Vout0 and +Vout0 connect multimeter for 0 to 10V type 2 calibration.
3.Before calibration, warm-up module about 30 minutes for accuracy.
4.**Warning : pls don't calibrate before you really understand .**

Example calibration sequence for type 0(0 to 20mA);type 2(0 to 10V).

1. Setting type to 3F(TT)	
%01013F0600 (for EX9022)	Receive:!01
2. $019000(for setting type to 0, o to 20mA)	Receive:!01
$019020(for setting type to 2, o to 10V)	Receive:!01
3. #010+04.000 (for 4mA)	Receive:>
#010+20.000 (for 20mA)	Receive:>
#010+10.000 (for 10V)	Receive:>
4. $0130VV (VV: trim value)	Receive:!01
5. $0100 (for 4mA)	Receive:!01
$0110 (for 20mA)	Receive:!01
$0170 (for 10V)	Receive:!01
6. Repeat step 4 three/five times	

Warning: Please don't calibrate before you really understand.

2.4.2 Configuration Table

Configuration Table for EX9022

Analog O/P type code setting(TT)

TT	Output Range
3F	-

Baudrate Setting(CC)

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

Data Format(FF)

7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Set to 0	checksum 0=disable 1=enable	**Slew Rate Control set to 0000**				00:engineeringunit(EX9021/22/24) 01:% of FSR(for EX9021/22) 10:hexadecimal(for EX9021/22)	

Slew Rate Control ref. sec. 4.1

2.4.3 DA Configuration of EX9022

Analog O/P type (T)

T	Output Range
0	0 to 20mA
1	4 to 20mA
2	0 to 10V

Slew Rate Control(S)

code	**voltage**	**current**
0000:	immediate change	
0001:	0.0625 V/sec	0.125 mA/sec
0010:	0.125 V/sec	0.250 mA/sec
0011:	0.250 V/sec	0.500 mA/sec
0100:	0.500 V/sec	1.000 mA/sec
0101:	1.000 V/sec	2.000 mA/sec
0110:	2.000 V/sec	4.000 mA/sec
0111:	4.000 V/sec	8.000 mA/sec
1000:	8.000 V/sec	16.000 mA/sec
1001:	16.00 V/sec	32.000 mA/sec
1010:	32.00 V/sec	64.00 mA/sec
1011:	64.00 V/sec	128.00 mA/sec
1100:	128.0 V/sec	256.00 mA/sec
1101:	256.0 V/sec	512.00 mA/sec
1110:	512.0 V/sec	1024.0 mA/sec

3. Command(For EX9021/21P, EX9022, EX9024)

3.1 #AA(data)(For EX9021/21P only)

Description: Analog Output Value
Syntax: #AA(data)[CHK](cr)
delimiter character
AA address of reading/response module(00 to FF)
(data): Analog Output Value
Response: Valid Command: **>**
Out of range: **?**
Command ignore: **!**

Example:
Command: #0112.345 Receive: >
Output value 12.345mA
Command: #0210.000 Receive: >
Maybe 10.000mA or 10.000 V depend on output type
Command: #0330.000 Receive: ?03
Out of range and output will go to the most close value

3.2 #AAN(data)(For EX9022, EX9024)

Description: Output Analog Value for Channel N
Syntex: #AAN(data)[CHK](cr)
delimiter character
AA address of reading/response module(00 to FF)
(data): Analog Output Value
N=Channel No. (from 0 to 3)(data)
Response: Valid Command: **>**
Out of range: **?AA**
Command ignore: **!**

Example:
Command: #010+12.345 Receive: >
Module address 01, Channel 0 Current output : 12.345mA
Command: #023-02.500 Receive: >
Module address 02, Channel 3 voltage output: -2.5V
Command: #020+30.000 Receive: ?02
Out of range and output value will go to the most close value

3.3 $AA0(For EX9021/21P)

Description: Perform 4mA calibration

Syntax: $AA0[CHK](cr)

$ delimiter character

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

0 command for performing 4mA calibration

Response: Valid Command: **!AA**

Invalid Command: **?AA**

Example:

Command: $010 Receive: !01

address 01 perform 4mA calibration

Command: $020 Receive: !02

address 02 perform 4mA calibration

Warning: Please don't calibrate before you really understand.

3.4 $AA0N(For EX9022/EX9024)

Description: Perform -10V/0mA calibration for channel N of EX9024.
Perform 4mA calibration for channel of EX9022 .

Syntax: $AA0N[CHK](cr)

$ delimiter character

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

0 command for perform 4mA (or 0mA/-10V) calibration

N=Channel No. (0 to 1 for EX9022, 0 to 3 for EX9024)

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

Example:

Command: $0201 Receive: !02
Module address 02, Channel 1, perform -10V/0mA for EX9024;4mA for EX9022 calibration.

Warning: Please don't calibrate before you really understand.

3.5 $AA1 (For EX9021/21P)

Description: Perform 20mA calibration.

Syntax: $AA1[CHK](cr)

$ delimiter character

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

1 command for performing 20mA calibration

Response: Valid Command: **!AA**

Invalid Command: **?AA**

Example:

Command: $011 Receive: !01

address 01 perform 20 mA calibration

Command: $021 Receive: !02

address 02 perform 20 mA calibration

Warning: Please don't calibrate before you really understand.

3.6 $AA1N(For EX9022/EX9024)

Description: Perform 20mA calibration for channel N of EX9022.
Perform +10V/20mA calibration for channel N of EX9024.

Syntax: $AA1N[CHK](cr)

$ delimiter character
AA address of reading/response module(00 to FF)
1 command for performing 20mA/+10V calibration
N channel to calibration (9022: 0 to 1, 9024:0 to 3)

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

Example

Command: $0112 Receive: !01
Module address 01, channel 2, perform +10V/20mA calibration
Command: $2010 Receive: !02
Module address 02, channel 0, perform +10V/20mA for EX9024;20mA for EX9022 calibration.

Warning: Please don't calibrate before you really understand.

3.7 $AA3VV(For EX9021/21P)

Description: Trim the analog output for calibration.

Syntax: $AA3VV[CHK](cr)

$ delimiter character

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

3 command for trimming calibration

VV 2'complement hexadecimal to trim the analog output value,
1 count=4.88uA or 2.44mV
00 to 5F: increase analog output 0 to 95 counts
FF to A1: decrease analog output 1 to 95 counts

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

Example:

Command: $01302 Receive: !01
Increase analog output 2 count=2*4.88 uA or 2*2.44 mV, depend on output type.

Command: $023FE Receive: !02
Decrease analog output 2 count=2*4.88 uA or 2 *2.44mV, depend on output type.

Warning: Please don't calibrate before you really understand.

3.8 $AA3NVV(For EX9022/EX9024)

Description: Trim the analog output for calibration for channel N.

Syntax: $AA3NVV[CHK](cr)

$ delimiter character

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

3 command for trimming calibration

N channel to trim (9022:0 to 1, 9024:0 to 3)

VV 2'complement hexadecimal to trim the analog output value,
for 9022 1 count=0.3uA or 0.15mV
for 9024 1 count=2.44uA or 1.22mV
00 to 5F: increase analog output 0 to 95 counts
FF to A1: decrease analog output 1 to 95 counts

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

Example:

Command: $013202 Receive: !01
For channel 2, to increase analog output 2 count=2*2.44 uA or 2*1.22 mV, depend on output type.

Command: $0231FE Receive: !02
For channel 1, to decrease analog output 2 count=2*2.44 uA or 2*1.22 mV for EX9024;to decrease analog output 2 count=2*0.3uA or 2*0.15 mV for EX9022 , depend on output type.

Warning: Please don't calibrate before you really understand.

3.9 $AA4(For EX9021/21P)

Description: Set Power-on value

Syntax: $AA4[CHK](cr)

$ delimiter character

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

4 command for set the output value to Power-on value

Response: Valid Command: **!AA**

Invalid Command: **?AA**

Example:

Command: #0212.345 Receive: >

Address 02 analog output as 12.345 mA

Command: $024 Receive: !02

To set the Power-on value 12.345mA

3.10 $AA4N(For EX9022/EX9024)

Description: Set Power-on value for channel N.

Syntax: $AA4N[CHK](cr)

$ delimiter character

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

4 command for set the output value to Power-on value

N channel to set Power-on value (9022:0 to 1, 9024:0 to 3)

Response: Valid Command: **!AA**

Invalid Command: **?AA**

Example:

Command: #020-01.234 Receive: >

Channel 0 analog output -1.234V

Command: $0240 Receive: !02

To set the Power-on value for channel 0 as -1.234V

3.11 $AA6(For EX9021/21P)

Description: Last Value Readback

Syntax: $AA6[CHK](cr)

$ delimiter character

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

6 command for read last output command value

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

Invalid Command: **?AA**

(Data) the last output command value. If no output applied to the module that the (data) is the Power-on value of the module

Example:

Command: #0212.345 Receive: >

Address 02 analog output as 12.345 mA

Command: $026 Receive: !0212.345

Read last output command value 12.345mA

3.12 $AA6N(For EX9022/EX9024)

Description: Last value Readback of Channel N

Syntax: $AA6N[CHK](cr)

$ delimiter character

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

6 command for read last output command value

N Channel to readback (9022:0 to 1, 9024:0 to 3)

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

Invalid Command: **?AA**

(Data) the last output command value. If no output applied to the module that the (data) is the Power-on value of the module

Example:

Command: #010+12.345 Receive:>

The analog output for channel 0 is 12.345mA

Command: $0160 Receive: !010+12.345

Last output command value 12.345mA

3.13 $AA7(For EX9021/21P)

Description: Perform +10V calibration.

Syntax: $AA7[CHK](cr)

$ delimiter character

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

7 command for perform +10V calibration

Response: Valid Command: **!AA**

Invalid Command: **?AA**

Example:

Command: $017 Receive: !01

address 01 perform +10V calibration

Command: $027 Receive: !02

address 02 perform +10V calibration

Warning: Please don't calibrate before you really understand.

3.14 $AA7N(For EX9024)

Description: Read the power-on output value of channel N.

Syntax: $AA7N[CHK](cr)

$ delimiter character

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

7 command for read power-on value

N channel to readback (0 to 3)

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

Invalid Command: **?AA**

(Data) the last output command value

Example:

Command: #020-01.234 Receive: >

Channel 0 analog output –1.234V

Command: $0240 Receive: !02

To set power-on value for channel 0 as –1.234V

Command: #020-03.456 Receive: >

Channel 0 analog output –3.456V

Command: $0270 Receive: !02-01.234

The read power-on value of channel 0 is –1.234V

Command: $0260 Receive: !02-03.456

The last output value of channel 0 is –3.456V

3.14.1 $AA7N(For EX9022)

Description: Perform +10V calibration for Channel N.

Syntax: $AA7N[CHK](cr)

$ delimiter character

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

7 command for Perform +10V calibration

N channel to readback (0 to 1)

Response: Valid Command: **!AA**

Invalid Command: **?AA**

Example:

Command: $0170 Receive: !01

address 01 perform +10V calibration for Channel 0

Command: $0270 Receive: !02

address 02 perform +10V calibration for Channel 0

Warning: Please don't calibrate before you really understand.

3.15 $AA8(For EX9021/21P)

Description: Current Readback .
Read back the analog output value through the current path. This command can read back the voltage or current output depended on the output type.

Syntax: $AA8[CHK](cr)

$ delimiter character
AA address of reading/response module(00 to FF)
8 command for read Current Readback

Response: Valid Command: **!AA(Data)**
Invalid Command: **?AA**
(Data) the current output value

Example:

Command: $018 Receive: !0112.345
Current value 12.345mA (depend the output Type)
Command: $028 Receive: !0210.000
Current value 10.000mA
Command: $032 Receive: !03320600
Output Type 0-10V range
Command: $038 Receive: !0301.234
Current value 1.234V

3.16 $AA8N(For EX9022/EX9024)

Description: Current Value Readback of Channel N .
When sending a command to assign the analog output value for a specific channel of EX9022/24. The analog output is updated gradually at the specific slew rate until the desired output value is reached. This command can read the analog value during updating process.

Syntax: $AA8N[CHK](cr)

$ delimiter character
AA address of reading/response module(00 to FF)
8 command for read Current Value Readback of Channel N
N channel to readback (9022:0 to 1, 9024:0 to 3)

Response: Valid Command: **!AA(Data)**
Invalid Command: **?AA**
(Data) the last output command value

Example:

Command: $012 Receive: !0132060C
The configuration for this EX9024 as follows:
Output range: 0 to 10V, slew rate: 0.25V/sec
Checksum: Disable
Command: #010+01.000 Receive:>
Set channel 0 output value to 1.000V
Command: #010+09.800 Receive:>
Set channel 0 output value to 9.800V
Command: $0180 Receive:!01+01.372
Read back value is 1.372V
Command: $0180 Receive:!01+04.821
The reading back value is 4.821V
Command: $0180 Receive:!01+06.772
The reading back value is 6.772V
Command: $0180 Receive:!01+08.291
The reading back value is 8.291V
Command: $0180 Receive: !01+09.800
The reading back value is 9.800V

3.17 $AA9N(For EX9022)

Description: Read DA Configuration of Channel N

Syntax: $AA9N[CHK](cr)

$ delimiter character

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

9 command for read DA configuration of channel N

N channel to read DA configuration (0 to 1)

Response: Valid Command: **!AATS**

Invalid Command: **?AA**

the last output command value

T analog output Type ref. sec. 2.4.2 & 2.4.3 for format

S analog output Slew rate ref. sec. 2.4.2 & 2.4.3 for format

Example:

Command: $0190 Receive: !0110

Read address 01 channel 0 DA configuration & 4 to 20mA output Type and change immediate .

3.17.1 $AA9NTS (For EX9022)

Description: Set DA Configuration of Channel N

Syntax: $AA9NTS[CHK](cr)

$ delimiter character

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

9 command for set DA configuration

N channel to set DA configuration (0 to 1)

T analog output Type ref. sec. 2.4.2 & 2.4.3 for format

S analog output Slew rate ref. sec. 2.4.2 & 2.4.3 for format

Response: Valid Command: **!AA**

Invalid Command: **?AA**

Example:

Command: $019121 Receive: !01

Set address 01 channel 1 DA configuration & 0 to 10V output Type and Slew rate 0.625 V/Second .

3.18 ~AA4(For EX9021/21P)

Description: Read the Safe Value
When the module is first power-on, all output channels will go to their power on value.

Syntax: ~AA4[CHK](cr)

~ delimiter character
AA address of reading/response module(00 to FF)
4 command for read Safe Value

Response: Valid Command: **!AA(Data)**
Invalid Command: **?AA**
(Data) Save Value of module

Example:
Command: ~014 Receive: !0102.000
Safe Value as 2.0V
Command: ~024 Receive: !0200.000
Safe Value as 0V

3.18.1 ~AA4N(For EX9022/EX9024)

Description: Read the safe value of channel N.

Syntax: ~AA4N[CHK](cr)

~ delimiter character

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

4 command for read Safe Value

N channel to read (9022:0 to 1, 9024: 0 to 3)

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

Invalid Command: **?AA**

(Data) Save Value of module

Example:

Command: ~0140 Receive: !01+02.000

The safe value of channel 0 is 2.000V

Command: ~0141 Receive: !01+01.234

The safe value of channel 1 is 1.234V

3.19 ~AA5(For EX9021/21P)

Description: Set Safe Value.

Syntax: ~AA5[CHK](cr)

~ delimiter character

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

5 command for store current output value as Safe Value

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

Invalid Command: **?AA**

Example:

Command: #0100.000 Receive: !01

Output address 01 value as 0.000V

Command: ~015 Receive: !01

Set address 01 Safe Vale

3.20 ~AA5N(For EX9022/EX9024)

Description: Set Safe Value of Channel N.

Syntax: ~AA5N[CHK](cr)

~ delimiter character

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

5 command for store current output value as Safe Value

N channel to set (9022:0 to 1, 9024:0 to 3)

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

Invalid Command: **?AA**

Example:

Command: #010+12.345 Receive: !01

Output channel 0 address 01 value as +12.345mA

Command: ~0150 Receive: !01

To set Safe Value of Channel 0 address 01 to 12.345mA

3.21 Host Watch Dog related Command Sets

3.21.1 ~**

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.

3.21.2 ~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 timeout status is set. The status will store into EEPROM and may reset by the command ~AA1.

3.21.3 ~AA1

Description: Reset Module Status.

Syntax: ~AA1[CHK](cr)

~ delimiter character

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

1 command for reset modules status

Response: Valid Command: !AA

Invalid Command: ?AA

3.21.4 ~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: !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.

3.21.5 ~AA3EVV

Description: Set host watchdog Timeout value

Syntax: ~AA3EVV[CHK](cr)

~ delimiter character

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

3 command for set host watchdog timeout value

E 1=Enable/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 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.

3.22 General Command Sets

3.22.1 %AANNTTCCFF

Description: Set Module Configuration

Syntax: %AANNTTCCFF[CHK](cr)

% delimiter character

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

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

TT new type for setting module (sec. 2.2.2 & 2.3.2 & 2.4.2 for format)

CC new baudrate for setting module. (sec. 2.2.2)

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

FF new data format for setting module. (sec. 2.2.2 & 2.3.2 & 2.4.2 for format)

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

Response: Valid Command: !AA

Invalid Command: ?AA

Example:

Command: %0102300600 Receive: !02

Set module address 01 to 02,

Analog output type: 0 to 20mA

Baudrate: 9600bps

Dataformat: No checksum, Engineer unit, slew rate is immediate

return success.

3.22.2 $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: !AATTCCFF
Invalid Command: ?AA
TT type code of module (sec. 2.2.2 & 2.3.2 & 2.4.2 for format)
CC baudrate code of module (sec. 2.2.2 & 2.3.2 & 2.4.2 for format)
FF data format of module (sec. 2.2.2 & 2.3.2 & 2.4.2 for format)

Example:
Command: $012 Receive: !01306000
Read address 01 status, return
Analog output type: 0 to 20mA
Baudrate: 9600bps
Dataformat: No checksum, Engineer unit, slew rate is immediate

3.22.3 $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 reseted

Example:
Command: $015 Receive: !011
Read address 01 reset status, return first read.
Command: $015 Receive: !010
Read address 01 reset status, return no reset occurred.

3.22.4 $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: $02F Receive: !01A1.4
Read address 02 firmware version, return version A1.4.

3.22.5 $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

3.22.6 ~AAO(Data)

Description: Set Module Name
Syntax: ~AAO(Data)[CHK](cr)
~ delimiter character
AA address of reading/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: ~01O9084 Receive: !01
Set address 01 module name 9084, return success.
Command: $01M Receive: !019084
Read address 01 module name, return name 9084

4.1 Slew Rate Control

Slew rate control is to adjust the O/P slope . Most analog O/P change is instantaneously . In many applications that this characteristics is undesirable and a gradual controlled output Slew rate is more appropriate. The EX9021/21P/22/24 allows programmable Slew rate control. While the O/P command is sent to EX9021/22P/22/24 to change the analog value , the O/P will automatically slope to the new value at the special Slew rate .The EX9021/21P/22/24 update the analog value at approximately 100 conversions per second . The O/P is smoothly stepped until the final O/P value is reached .

4.2 Current Readback

The EX9021/21P/22 have the analog to digital converter to monitor the current O/P signal . The current Readback may find the fault of improper wiring or loads while thr Readback value is far from the O/P value .
The EX9024 don’t have the analog to digital converter to monitor the current O/P signal . But the EX9024 may response the current digital value transferring to the Digital /Analog Converter . It can’t indicate the real Digital / Analog Converter O/P value and can’t detect the fault of improper wiring or loads .