

Default setting for Ex9000 DIO modules:

- . Address :01
- . Baudrate:9600bps
- . Type: Type 40 for DIO mode
- . Checksum Disable

Default configuration:

EX9044D:01400600

EX9060D:01400601

Configuration Tables

Configuration Table of EX9000 DIO modules

Baudrate Setting(CC)

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

Type Setting(TT)

TYPE=40 for DIO mode

Data Format Setting(FF)

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

*1: Counter update direction: 0=falling edge, 1=rising edge.

*2: Checksum bit: 0=disable, 1=enable

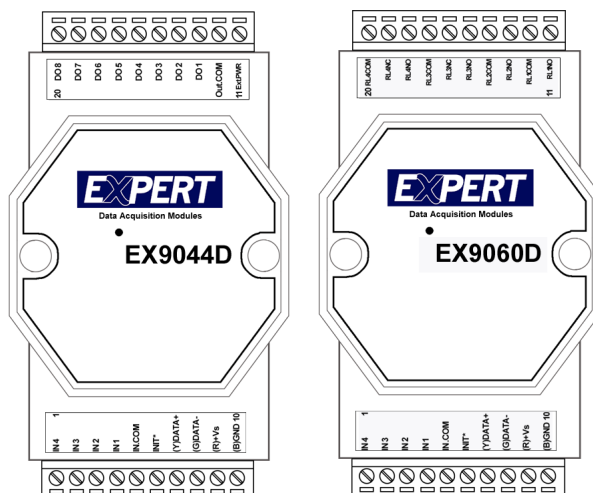
*3: 9044=(000), 9060=(001)

Read Digital Input/Output Data Format

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

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

	First Data		Second Data	
EX9044	DO(1-8)	00 to FF	DI(1-4)	00 to 0F
EX9060	DO(1-4)	00 to 0F	DI(1-4)	00 to 0F



General Command Sets			
Command	Response	Description	Page
%AANNTTCCFF	!AA	Set Module Configuration	P.17
###	No Response	Synchronized Sampling	P.18
#AABBDD	>	Digital Output	P.19
#AAN	!AA(Data)	Read Digital input counter	P.22
\$AA4	!S(Data)	Read Synchronized Data	P.24
\$AA6	!(Data)	Read Digital I/O States	P.26
\$AAC	!AA	Clear Latched Digital Input	P.29
\$AACN	!AA	Clear Digital input Count	P.30
\$AALS	!(Data)	Read Latched Digital Input	P.31
@AA	>(Data)	Read Digital Input	P.32
@AA(Data)	>	Set Digital Output	P.33

Command(For EX9000 DIO)

%AANNTTCCFF(For DIO, AIO)

Description : Set Module Configuration

Syntax:%AANNTTCCFF[CHK](cr)

%: a delimiter character

AA: address of setting module(00 to FF)

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

TT: type 40 for DIO 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 [CHK](CR)

Invalid Command: ?AA [CHK](CR)

Syntax error or communication error may get no response.

! delimiter for valid command

? Delimiter for invalid command

AA address of response module(00 to FF)

Example:

Command :%0102400600 Receive:!02

Set module address 01 to 02, return Success.

###(For DIO, AIO)

Description : Synchronized Sampling

Syntax:###[CHK](cr)

a delimiter Character

** synchronized sampling command

Response : No response

Example:

Command : ### No response

Send synchronized sampling command to all modules.

\$AA4(For DIO, AIO)

Description : Read Synchronized Data

Command : \$AA4[CHK](cr)

\$ delimiter character

AA address of reading module(00 to FF)

4 command for read synchronized data

Response : Valid Command: !S(Data)[CHK](cr)

Invalid Command. ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

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

(Data) synchronized DIO value

Example :

Command : #014 Receive : ?01

Read address 01 synchronized data, return no data available.

Command : #** Receive : no response

Send synchronized sampling to all modules.

Command : \$014 Receive:!1000F00

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

#AAN

Description : Read Digital Input Counter from channel N

Command : #ANN[CHK](cr)

#: delimiter character

AA: address of reading module(00 to FF)

N: channel to read

Response : Valid Command: !AA(Data)[CHK](cr)

Invalid Command. ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

(Data): digital input counter value in decimal, from 00000 to 65535

Example :

Command : #032 Receive : !0300103

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

\$AACN

Description : Clear Digital Input Counter

Command : \$AACN[CHK](cr)

\$: delimiter character

AA: address of setting module(00 to FF)

C: command for clear digital input counter

N: digital counter channel N to clear

Response : Valid Command: !AA[CHK](cr)

Invalid Command. ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

Example :

Command : #010 Receive : !0100123
Read address 01 input channel 0 counter value, return 123
Command : \$01C0 Receive : !01
Clear address 01 input channel 0 counter value, return success.

\$AA2(For DIO, AIO)

Description : Read Configuration

Command : #AA2[CHK](cr)

#: delimiter character

AA: address of reading module(00 to FF)

2: command for read configuration

Response : Valid Command: !AATCCFF[CHK](cr)

Invalid Command. ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

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 address 01 status, return DIO mode, baud 9600, no checksum.

\$AA5

Description : Read Reset Status

Command : \$AA5[CHK](cr)

#: delimiter character

AA: address of reading module(00 to FF)

5: command for read reset status

Response : Valid Command: !AAS[CHK](cr)

Invalid Command. ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

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.

\$AAF(For DIO, AIO)

Description : Read Firmware Version

Command : \$AAF[CHK](cr)

#: delimiter character

AA: address of reading module(00 to FF)

F: command for read firmware version

Response : Valid Command: !AA(Data)[CHK](cr)

Invalid Command. ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

(Data): firmware version of module

Example :

Command: \$01F Receive : !01A2.0

Read address 01 firmware version, return version A2.0.

\$AAM(For DIO, AIO)

Description : Read Module Name

Command : \$AAM[CHK](cr)

\$: delimiter character

AA: address of reading module(00 to FF)

M: command for read module name

Response : Valid Command: !AA(Data)[CHK](cr)

Invalid Command. ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

(Data): Name of module

Example :

Command : \$01M Receive : !019042

Read address 01 module name, return name 9042.

@AA

Description : Read Digital Input/Output Status

Command : @AA[CHK](cr)

@: delimiter character

AA: address of reading module(00 to FF)

Response : Valid Command: >(Data)[CHK](cr)

Invalid Command. ?AA[CHK](cr)

Syntax error or communication error may get no response.

>: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

(Data): readed DIO status

Example :

Command : @01 Receive : >0F00

Read address 01 DIO status, return 0F00.

@AA(Data)

Description : Set Digital Output

Command : @AA(Data)[CHK](cr)

@: delimiter character

AA: address of setting 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/63AD/63BD, from 0 to 7

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

For EX9044D/50D,from 00 to FF

For EX9065D/65AD/65BD, 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: >[CHK](cr)
Invalid Command: ?[CHK](cr)
Ignore Command: ![CHR](cr)
Syntax error or communication error may get no response.
>: delimiter for valid command
?: delimiter for invalid command
!: delimiter for ignore command. The module is in Host Watchdog Timeout Mode, and the output is set to safe value.
Example :
Command : @0200 Receive : >
Output address 01 value 00, return success. (The example is suitable for EX9044D/50D/65D/65AD/65BD/66D/67D)

~AAO(Data)(For DIO, AIO)

Description : Set Module Name
Command : ~AAO(Data)[CHK](cr)
~: delimiter character
AA: address of setting module(00 to FF)
O: command for set module name
(Date) new name for module, max 6 characters
Response : Valid Command: !AA[CHK](cr)
Invalid Command: ?AA[CHK](cr)
Syntax error or communication error may get no response.
!: delimiter for valid command
?: delimiter for invalid command
AA: address of response module(00 to FF)
Example :
Command:~01O9050 Receive :!01
Set address 01 module name 9050, return success.

Dual Watchdog Operation For DIO, AIO

Dual Watchdog=Module Watchdog+Host Watchdog

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

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

Host Watchdog command sets			
Command	Response	Description	Page
~**	No response	Host OK	P.36
~AA0	!AASS	Read Module States	P.37
~AA1	!AA	Reset Module States	P.38
~AA2	!AAVV	Read Host Watchdog Timeout Value	P.39
~AA3Evv	!AA	Set Host Watchdog Timeout Value	P.40
~AA4V	!AA(Data)	Read PowerOn/Safe Value	P.42
~AA5V	!AA	Set PowerOn/Safe Value	P.44

***:PowerOn/Safe Value function only for DO & AO Module**

Host Watchdog(For DIO, AIO)

~**

Description : Host OK.

Host send this command to all modules for send the information "Host OK"

Command : ~**[CHK](cr)

~ delimiter character

** command for all modules

Response : No response

Example :

Command:~** No response

~AA0

Description : Read Module Status.

Command : ~AA0[CHK](cr)

~: delimiter Character

AA: address of reading module(00 to FF)

0: command for read module status

Response : Valid Command: !AASS[CHK](cr)

Invalid Command: ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

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.

~AA1

Description : Reset Module Status.

Command : ~AA1[CHK](cr)

~: delimiter Character

AA: address of setting module(00 to FF)

1: command for reset module status

Response : Valid Command: !AA[CHK](cr)

Invalid Command: ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

~AA2

Description : Read Host Watchdog Timeout Value

Command : ~AA2[CHK](cr)

~ delimiter Character

AA: address of reading module(00 to FF)

2: command for read host watchdog timeout value

Response : Valid Command: !AAEVV[CHK](cr)

Invalid Command: ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

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

~AA3E VV

Description : Set Host Watchdog Timeout Value

Command : ~AA3E VV[CHK](cr)

~ delimiter Character

AA: address of setting 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[CHK](cr)

Invalid Command: ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

Example :

Command : ~010 Receive : !0100

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

Command : ~013164 Receive : !01

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

Command : ~012 Receive : !01164

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

Command : ~** No response

Reset the host watchdog timer.

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

Command : ~010 Receive : !0104

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

Command : ~012 Receive : !01064

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

Command : ~011 Receive : !01

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

Command : ~010 Receive : !0100

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

~AA4V

Description : Read Power On/Safe Value.

Command : ~AA4V[CHK](cr)

~ delimiter Character

AA: address of reading 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)[CHK](cr)

Invalid Command: ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

(Data): Power On Value or Safe Value

Example :

Command :~014S Receive : !010000

Read address 01 Safe Value, return 0000.

Command : ~014P Receive : !01FFFF

Read address 01 Power On Value, return FFFF

~AA5V

Description : Set Power On/Safe Value

Command : ~AA5V[CHK](cr)

~ delimiter Character

AA: address of setting module(00 to FF)

5: command for set Power On/Safe value

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

Response : Valid Command: !AA[CHK](cr)

Invalid Command: ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

Example :

Command : ~015P Receive : !01

Set address 01 Power On Value, return success

Command : ~015S Receive : !01

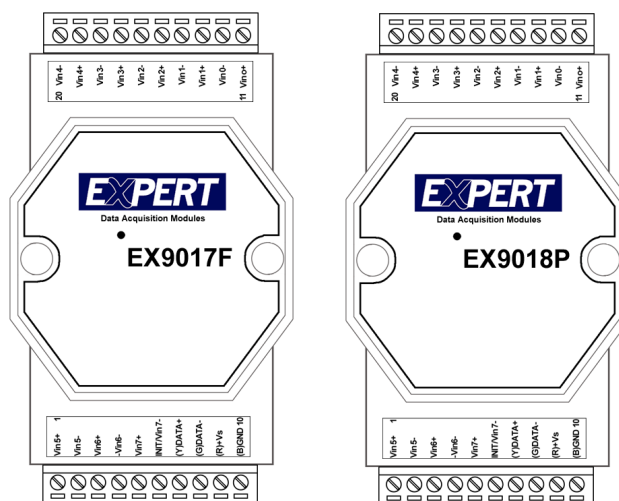
Set address 01 Safe Value, return success.

AI/O

EX-9000 is a family of network data acquisition and control modules. They provide analog-to –digital, digital-to analog, digital input/output, timer/counter and other functions. These modules can be remote controlled by a set of commands. The common features of EX9011/11D/11P/11PD/18/18P are given as following:

- **300VDC Isolated analog input**
- **24-bits sigma-delta ADC to provide excellent accuracy**
- **Thermocouple direct connect with build-in CJC**
- **Software calibration**

The EX9011 is a single channel analog input module. The EX9011D is the EX9011 with a 4½ digit LED display. The EX9018 is a 8-channel analog input module. The EX9011P/11PD/18P is the enhanced version of EX9011/11D/18. The EX-9011P/11PD/18P support more thermocouple types and enhanced the Measure range of some types.



General Command Sets			
Command	Response	Description	Page
%AANNTTCCFF	!AA	Set Module Configuration	P.17
###	No Response	Synchronized Sampling	P.18
#AA	>(Data)	Read Analog Input	P.64
#AAN	!AA(Data)	Read Analog input from channel N	P.65
\$AA0	!AA	Perform Span Calibration	P.66
\$AA1	!AA	Perform Zero Calibration	P.67
~AAEV	!AA	Enable/Disable Calibration	P.76
\$AA3	>(Data)	Read CJC Temperature(for 9018)	P.113
\$AA4	!S(Data)	Read Synchronized Data	P.24
\$AA5VV	!AA	Set Channel Enable	P.70
\$AA6	!AAVV	Read Channel States	P.71
\$AA9(Data)	!AA	Set CJC Offset Value(for 9018P)	P.114

Default Setting

Default setting for EX9014FD/17F

- Address:01
- Analog Input Type:Type 08, -10 to +10 V
- Baudrate:9600bps
- 60 Hz filter rejection, Checksum disable, engineer unit format
- EX9017F set as 6 differential and 2 single-ended mode
- EX9017F set as Fast Mode

Default setting for EX9011PD/18P

- Address:01
- Analog Input Type:Type 05, -2.5 to +2.5 V
- Baudrate:9600bps
- Checksum disable, 60HZ rejection, engineer unit format EX9018P set as INIT* mode, and the analog input is 6 differential and 2 single-enabled.

Default configuration:

EX9017: 01800600

EX9018P: 01050600

Configuration Tables

Baudrate Setting(CC)

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

Analog Input Type Setting(TT) for 9014/17

Type Code	08	09	0A	0B	0C	0D
Min. Input	-10V	-5V	-1V	-500mV	-150mV	-20mA
Max. Input	+10V	+5V	+1V	+500mV	+150mV	+20mA

Analog Input Type Setting(TT) for 9018P

Type Code	00	01	02	03	04	05	06
Min. Input	-15mV	-50mV	-100mV	-500mV	-1V	-2.5V	-20mA
Max. Input	+15mV	+50mV	+100mV	+500mV	+1V	+2.5V	+20mA

Type Code	0E	0F	10	11	12	13	14	15	16	17	18
T.C. Type	J	K	T	E	R	S	B	N	C	L	M
Min Temp	-210	-270	-270	-270	0	0	0	-270	0	-200	-200
Max Temp	760	1372	400	1000	1768	1768	1820	1300	2320	800	100
The temperature is shown in degree Celsius											

Data Format Setting(FF)

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

*1: 0=60Hz rejection

1=50 Hz rejection

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

*3:Fast/Normal Bit:0=Normal, 1=Fast (For EX9017F only)

*4:00=Engineer Unit Format

01=Percent Format

10=2's Complement HEX Format

Calibration (Don't Perform Calibration Until You Really Understand)

For EX9017F/14FD

Calibration Requirement for EX9017F

While calibrate type 0D, the EX9017F need

connect external shunt resistor, 125 ohms, 0.1%

Type Code	08	09	0A	0B	0C	0D
Zero Input	0V	0V	0V	0mV	0mV	0mA
Span Input	+10V	+5V	+1V	+500mV	+150mV	+20mA

Calibration Sequence:

1. Connect calibration voltage/current to module's input.

For EX9017F, connect to channel 0.

2. Warm-Up for 30 minutes

3. Setting type to 08

4. Enable Calibration

5. Apply Zero Calibration Voltage

6. Perform Zero Calibration Command

7. Apply Span Calibration Voltage

8. Perform Span Calibration Command

9. Repeat step4 to step 8 three times.

For EX9018P

Calibration Requirement for EX9018P

Type Code	00	01	02	03	04	05	06
Min. Input	0mV	0mV	0mV	0mV	0V	0V	0mA
Max. Input	+15mV	+50mV	+100mV	+500mV	+1V	+2.5V	+20mA

Notification:

1. While calibrate type 06, need connect external shunt resistor, 125 ohms, 0.1%

2. Connect calibration voltage(or current)signal to module's input. For EX9018P, connect channel 0.

3. Before calibration, warm-up module about 30 minutes for better accuracy.

Example Calibration Sequence for type 00:

1. Setting type to 00

2. Enable Calibration

3. Apply Zero Calibration Voltage(0m V)

4. Perform Zero Calibration Command

5. Apply Span Calibration Voltage(15mV)

6. Perform Span Calibration Command

7. Repeat step 1 to step 6 three times.

Calibration sequence for other type is similar but different in step 1 to set different type.

Command(For EX9000 AIO)

#AAN

Description : Read Analog Input from channel N

Syntax : #AAN[CHK](cr)

#: delimiter character

AA: address of reading module(00 to FF)

N: channel to read, from 0 to 7

Response : Valid Command: >(Data)[CHK](cr)

Invalid Command: ?AA[CHK](cr)

Syntax error or communication error may get no response.

>: delimiter for valid command

?: delimiter for invalid command

AA: address of response module (00 to FF)

(Data): analog input value for its format

Example :

Command :#32 Receive : >+02.513

Read address 03 channel 2, get data successfully.

\$AA5VV

Description : Set Channel Enable

Syntax : \$AA5VV[CHK](cr)

\$: delimiter character

AA: address of setting module (00 to FF)

5: command for set channel enable

VV: channel enable/disable, 00 is all disabled and FF is all enabled.

Response : Valid Command: !AA[CHK](cr)

Invalid Command: ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module (00 to FF)

Example :

Command :\$0155A Receive : !01

Set address 01 to enable channel 1,3,4,6 and disable channel 0,2,5,7 return success.

Command : \$016 Receive : !015A

Read address 01 channel status, return channel 1,3,4,6 are enabled and channel 0,2,5,7 are disabled.

\$AA6

Description : Read Channel Status

Syntax : \$AA6[CHK](cr)

\$: delimiter character

AA: address of reading module (00 to FF)

6: command for read channel status

Response : Valid Command: !AAVV[CHK](cr)

Invalid Command: ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module (00 to FF)

VV: channel enable/disable, 00 is all disabled and FF is all enabled.

Example :

Command : \$016 Receive : !01A5

Read address 01 channel status, return channel 0,2,5,7 are enabled and channel 1,3,4,6 are disabled.

\$AA3 (for EX9011PD, EX9018P)

Description : Read CJC Temperature

Syntax : \$AA3(CHK)(cr)

\$: delimiter character

AA: address of reading module (00 to FF)

3: command for reading CJC temperature

Response : Valid Command: >(Data)[CHK](cr)

Invalid Command: ?AA[CHK](cr)

Syntax error or communication error may get no response.

!: delimiter for valid command

?: delimiter for invalid command

AA: address of response module(00 to FF)

(Data): CJC temperature degree Celsius.

Example :

Command:\$033 Receive:>+0025.4

Read address 03 CJC temperature, return 25.4°C

Command for Calibration

~AAEV

Description : Enable/Disable Calibration

Syntax : ~AAEV[CHK](cr)

~ delimiter character

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

E command for enable/disable calibration

V 1=Enable/0=Disable calibration

Response : Valid Command: !AA

Invalid Command: ?AA

Example :

Command :\$010 Receive : ?01

Perform address 01 span calibration, return the command is invalid before enable calibration.

Command :~01E1 Receive : !01

Set address 01 to enable calibration, return success.

Command :\$010 Receive : !01

Perform address 01 span calibration, return success.

\$AA0

Description : Perform Span Calibration

Syntax : \$AA0[CHK](cr)

\$ delimiter character

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

0 command for performing span calibration

Response : Valid Command: !AA

Invalid Command: ?AA

Example :

Command :\$010 Receive : !01

Perform address 01 span calibration, return success.

Command : \$020 Receive : ?02

Perform address 02 span calibration, return not enable calibration before perform calibration command.

3.10.4 \$AA1

Description : Perform Zero Calibration

Syntax : \$AA1[CHK](cr)

\$ delimiter character

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

1 command for performing zero calibration

Response : Valid Command: !AA

Invalid Command: ?AA

Example :

Command :\$011 Receive : !01

Perform address 01 zero calibration, return success.

Command : \$021 Receive : ?02

Perform address 02 zero calibration, return not enable calibration before perform calibration command.