

# **CB-7011/CB-7011D, CB-7018 User's Manual**



**MEASUREMENT  
COMPUTING™**

# Table of Contents

|                                 |           |
|---------------------------------|-----------|
| <b>1. Introduction .....</b>    | <b>5</b>  |
| 1.1 More Information.....       | 5         |
| 1.2 Pin Assignment .....        | 6         |
| 1.3 Specifications .....        | 8         |
| 1.4 Block Diagram .....         | 11        |
| 1.5 Wire Connection.....        | 12        |
| 1.6 Quick Start .....           | 14        |
| 1.7 Default Setting .....       | 14        |
| 1.8 Jumper Setting .....        | 14        |
| 1.9 Calibration .....           | 15        |
| 1.10 Configuration Tables ..... | 16        |
| <b>2. Command .....</b>         | <b>20</b> |
| 2.1 %AANNTTCCFF .....           | 22        |
| 2.2 #** .....                   | 23        |
| 2.3 #AA .....                   | 24        |
| 2.4 #AAN .....                  | 25        |
| 2.5 \$AA0 .....                 | 26        |
| 2.6 \$AA1 .....                 | 27        |
| 2.7 \$AA2 .....                 | 28        |
| 2.8 \$AA3 .....                 | 29        |
| 2.9 \$AA4 .....                 | 30        |
| 2.10 \$AA5VV .....              | 31        |

|      |                   |    |
|------|-------------------|----|
| 2.11 | \$AA6 .....       | 32 |
| 2.12 | \$AA8 .....       | 33 |
| 2.13 | \$AA8V .....      | 34 |
| 2.14 | \$AA9(Data) ..... | 35 |
| 2.15 | \$AAB .....       | 36 |
| 2.16 | \$AAF .....       | 37 |
| 2.17 | \$AAM.....        | 38 |
| 2.18 | \$AAZ(Data) ..... | 39 |
| 2.19 | ~AAO(Data) .....  | 40 |
| 2.20 | ~AAEV .....       | 41 |
| 2.21 | @AADI.....        | 42 |
| 2.22 | @AADO(Data).....  | 44 |
| 2.23 | @AAEAT .....      | 45 |
| 2.24 | @AAHI(Data) ..... | 46 |
| 2.25 | @AALO(Data) ..... | 47 |
| 2.26 | @AADA .....       | 48 |
| 2.27 | @AACA .....       | 49 |
| 2.28 | @AARH .....       | 50 |
| 2.29 | @AARL .....       | 51 |
| 2.30 | @AARE .....       | 52 |
| 2.31 | @AACE .....       | 53 |
| 2.32 | ~** .....         | 54 |
| 2.33 | ~AA0 .....        | 55 |
| 2.34 | ~AA1 .....        | 56 |

|                                           |           |
|-------------------------------------------|-----------|
| 2.35 ~AA2 .....                           | 57        |
| 2.36 ~AA3EVV .....                        | 58        |
| 2.37 ~AA4 .....                           | 59        |
| 2.38 ~AA5PPSS .....                       | 60        |
| <b>3. Application Note.....</b>           | <b>61</b> |
| 3.1 INIT* pin Operation .....             | 61        |
| 3.2 Module Status .....                   | 61        |
| 3.3 Dual Watchdog Operation .....         | 62        |
| 3.4 Digital Input and Event Counter ..... | 62        |
| 3.5 Digital Output.....                   | 62        |
| 3.6 High/Low Alarm .....                  | 63        |
| 3.7 Thermocouple Measurement.....         | 63        |

# 1. Introduction

CB-7000 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 CD-7011/CB-7011D, CB-7018 are as follows:

- 3000VDC isolated analog input
- 24-bits sigma-delta ADC to provide excellent accuracy
- Thermocouples are directly connected with built-in CJC
- Software calibration

The CB-7011 is a single channel analog input module. The CB-7011D is the CB-7011 with a 4½ digit LED display. The CB-7018 is a 8-channel analog input module. The CB-7011P/11PD/18P are enhanced versions of CB-7011/11D/18. The CB-7011P/11PD/18P support two additional thermocouple types and enhance the measurement range of some types.

## 1.1 More Information

Refer to “**CB-7000 Bus Converter User Manual**” chapter 1 for more information as following:

**1.1 CB-7000 Overview**

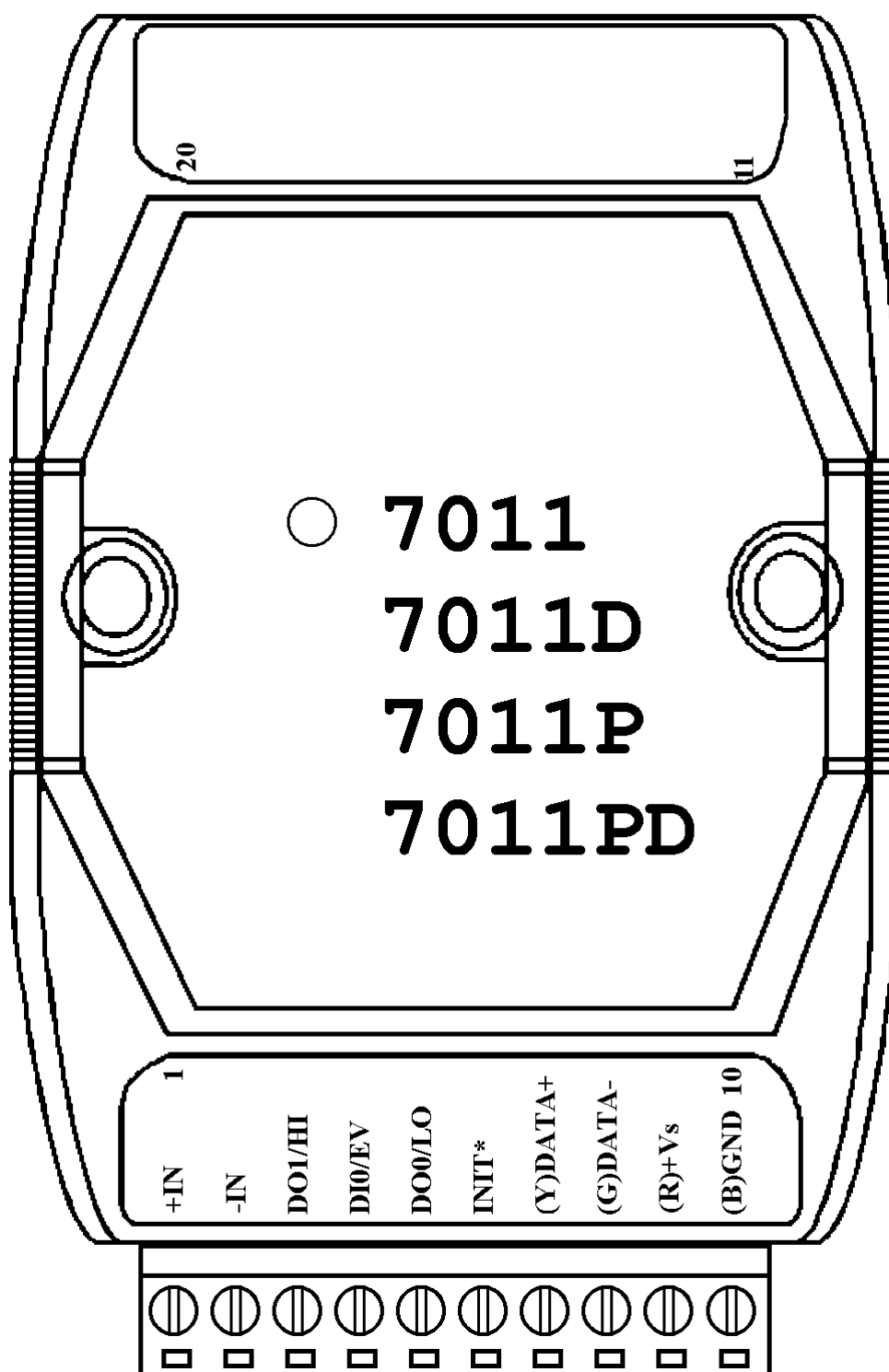
**1.2 CB-7000 Related Documentation**

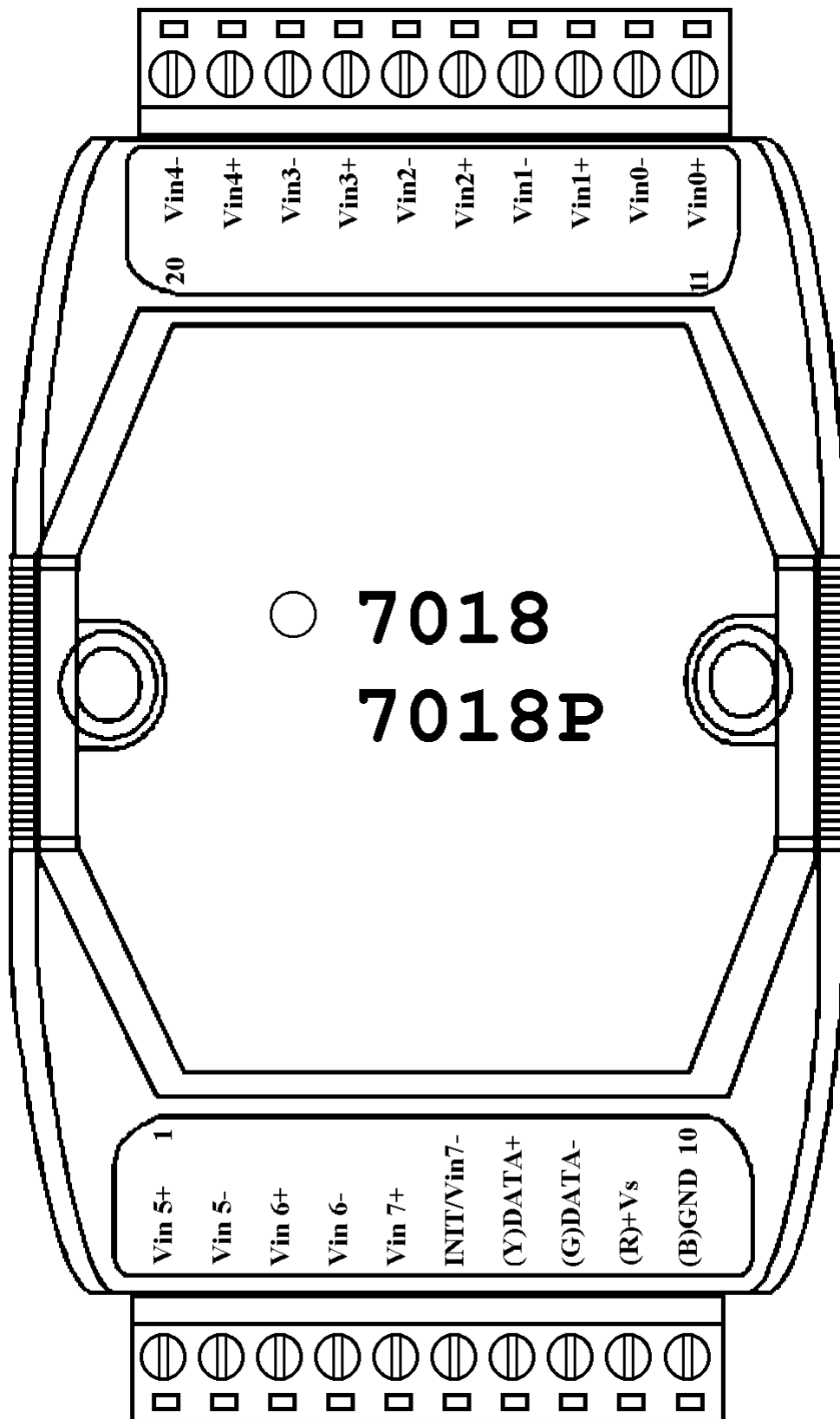
**1.3 CB-7000 Command Features**

**1.4 CB-7000 System Network Configuration**

**1.5 CB-7000 Dimensions**

## 1.2 Pin Assignments





# 1.3 Specifications

## CB-7011/CB-7011D

### *Analog Input*

Input Channel: 1

Input Type:

mV, V, mA (with external  
125 ohm resistor)

Thermocouple: Type J, K,  
T, E, R, S, B, N, and C

Sampling Rate:

10 Samples/Second

Bandwidth: 5.24 Hz

Accuracy:  $\pm 0.05\%$

Zero Drift:  $0.5\mu\text{V}/^\circ\text{C}$

Span Drift: 25 ppm/ $^\circ\text{C}$

CMR@50/60Hz: 150dB

NMR@50/60Hz: 100dB

Input Impedance: 20M Ohms

Isolation: 3000VDC

### *Digital Output*

2 channel

Open Collector to 30V

Output Load: sink 30 mA max

Power Dissipation: 300 mW

### *Digital Input*

1 channel

Logic Level 0: +1V max

Logic Level 1: +3.5 to 30V

### *Event Counter*

Max Input Frequency: 50 Hz

Min. Pulse Width: 1 ms

### *Displayed LED*

4½ digits (for CB-7011D)

### *Power Supply*

Input: +10 to +30 VDC

Consumption:

0.9 W for CB-7011

1.5 W for CB-7011D

## **CB-7011P/CB-7011PD**

### ***Analog Input***

Input Channel: 1

Input Type:

mV, V, mA(with external  
125 ohms resistor)

Thermocouple: Type J, K,  
T, E, R, S, B, N, C, L, M

Sampling Rate:

10 Samples/Second

Bandwidth: 5.24 Hz

Accuracy:  $\pm 0.05\%$

Zero Drift:  $0.5\mu\text{V}/^\circ\text{C}$

Span Drift:  $25\text{ppm}/^\circ\text{C}$

CMR@50/60Hz: 150dB

NMR@50/60Hz: 100dB

Input Impedance: 20M Ohms

Isolation: 3000VDC

### ***Digital Output***

2 channel

Open Collector to 30V

Output Load: sink 30mA max

Power Dissipation: 300mW

### ***Digital Input***

1 channel

Logic Level 0: +1V max

Logic Level 1: +3.5 to 30V

### ***Event Counter***

Max Input Frequency: 50 Hz

Min. Pulse Width: 1 ms

### ***Displayed LED***

4½ digits (for CB-7011PD)

### ***Power Supply***

Input: +10 to +30 VDC

Consumption:

0.9W for CB-7011P

1.5W for CB-7011PD

## **CB-7018**

### ***Analog Input***

Input Channel:

8 differential or 6 differential and 2 single-ended.  
Jumper select.

Input Type:

mV, V, mA(with external 125 ohms resistor)

Thermocouple: Type J, K, T, E, R, S, B, N, C

Sampling Rate:

10 Samples/Second

Bandwidth: 15.7 Hz

Accuracy:  $\pm 0.1\%$

Zero Drift:  $0.5\mu\text{V}/^\circ\text{C}$

Span Drift:  $25\text{ppm}/^\circ\text{C}$

CMR @ 50/60Hz: 150dB

NMR @ 50/60Hz: 100dB

Input Impedance: 20 MOhms

Overvoltage Protection:  $\pm 35\text{V}$

Isolation: 3000VDC

### ***Power Supply***

Input: +10 to +30 VDC

Consumption: 1.0W

## **CB-7018P**

### ***Analog Input***

Input Channel:

8 differential or 6 differential and 2 single-ended.  
Jumper-selected.

Analog Input Type:

mV, V, mA(with external 125 ohms resistor)

Thermocouple: Type J, K, T, E, R, S, B, N, C, L, M

Sampling Rate:

10 Samples/Second

Bandwidth: 15.7 Hz

Accuracy:  $\pm 0.1\%$

Zero Drift:  $0.5\mu\text{V}/^\circ\text{C}$

Span Drift:  $25\text{ppm}/^\circ\text{C}$

CMR @ 50/60Hz: 150dB

NMR @ 50/60Hz: 100dB

Input Impedance: 20 MOhms

Overvoltage Protection:  $\pm 35\text{V}$

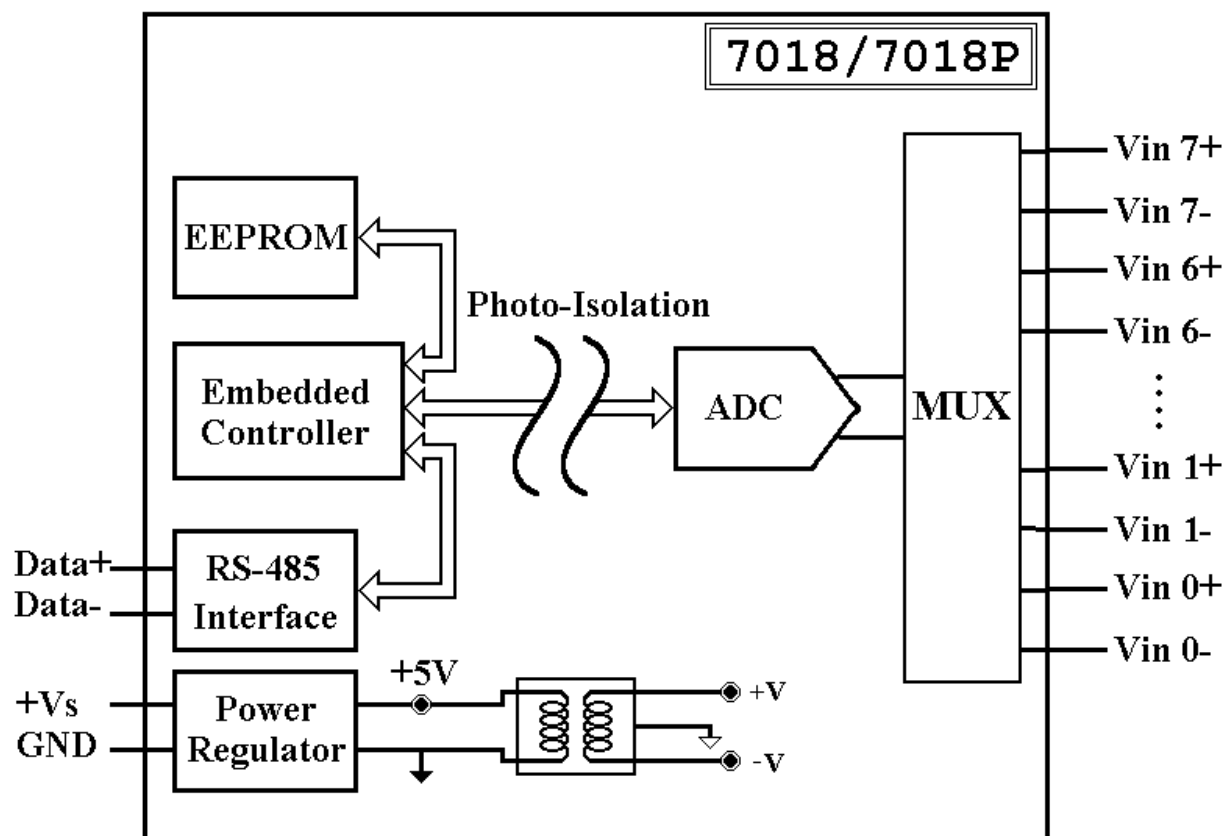
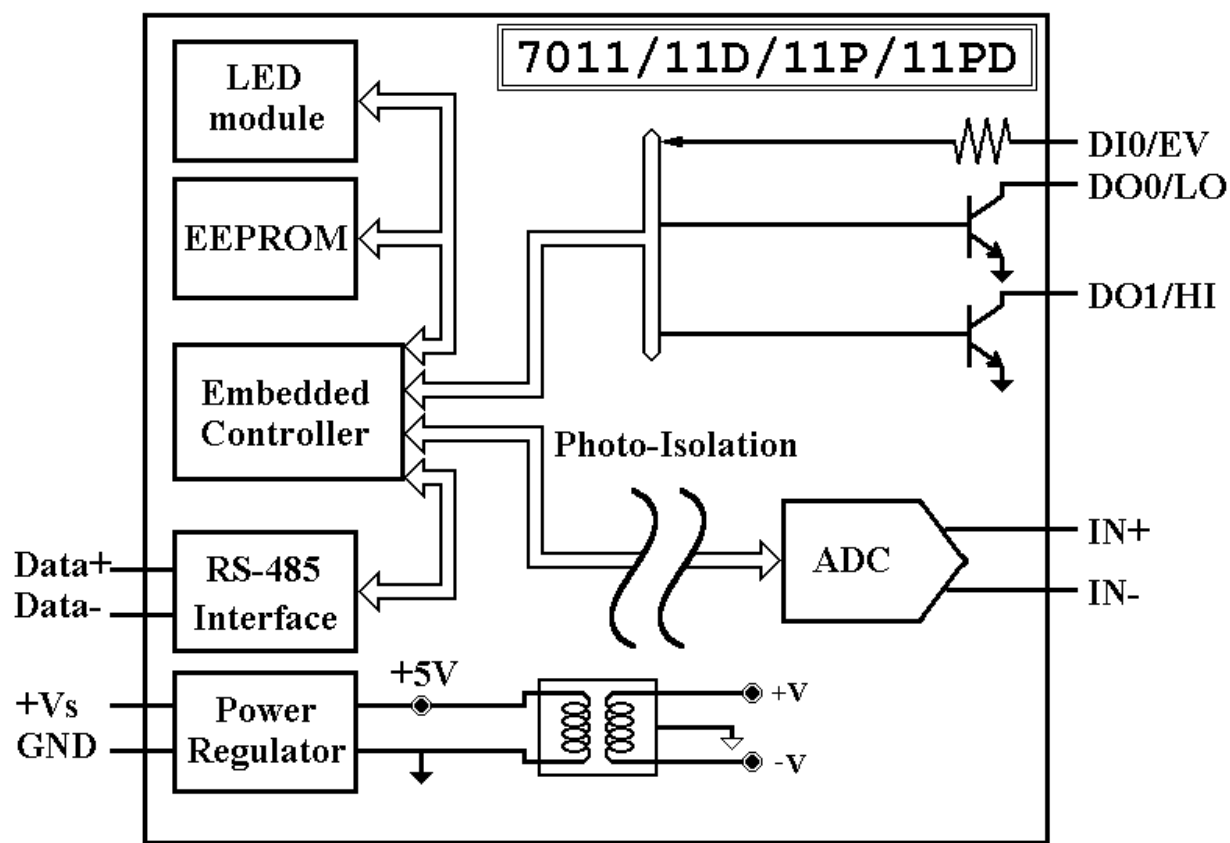
Isolation: 3000VDC

### ***Power Supply***

Input: +10 to +30 VDC

Consumption: 1.0W

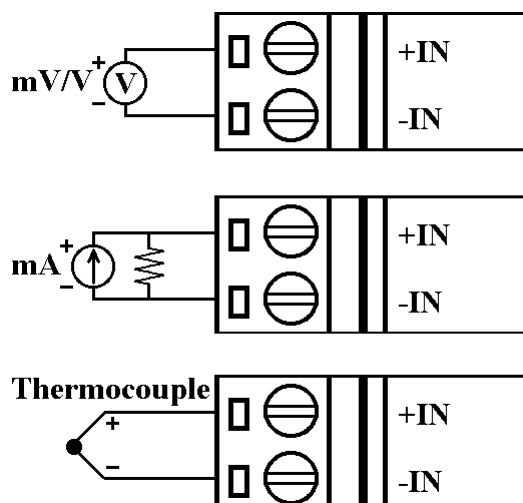
## 1.4 Block Diagram



# 1.5 Wire Connection

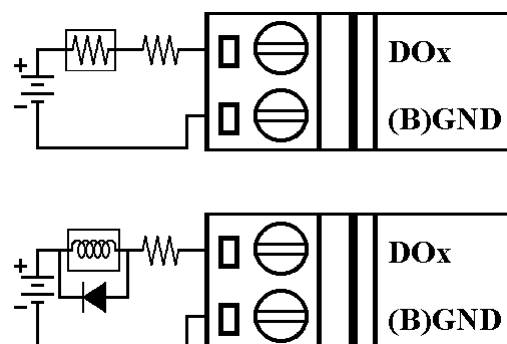
## CB-7011/11D/11P/11PD

Analog Input Wire Connection



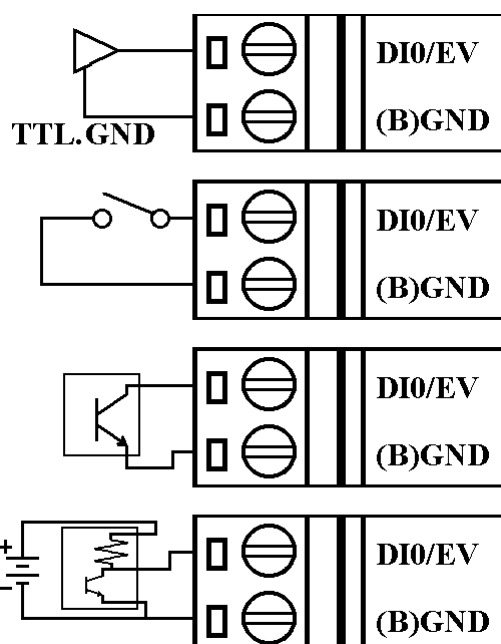
## CB-7011/11D/11P/11PD

Digital Output Wire Connection



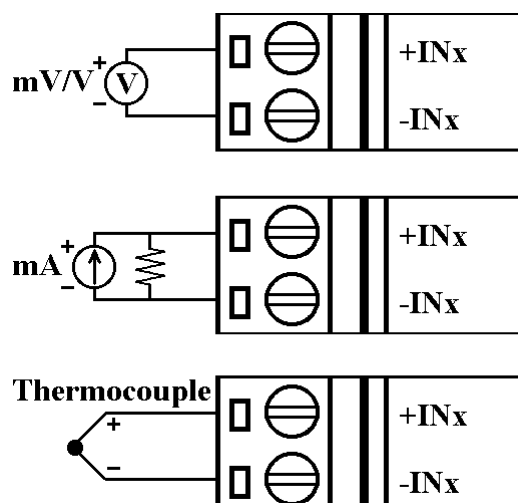
## CB-7011/11D/11P/11PD Digital

Input Wire Connection



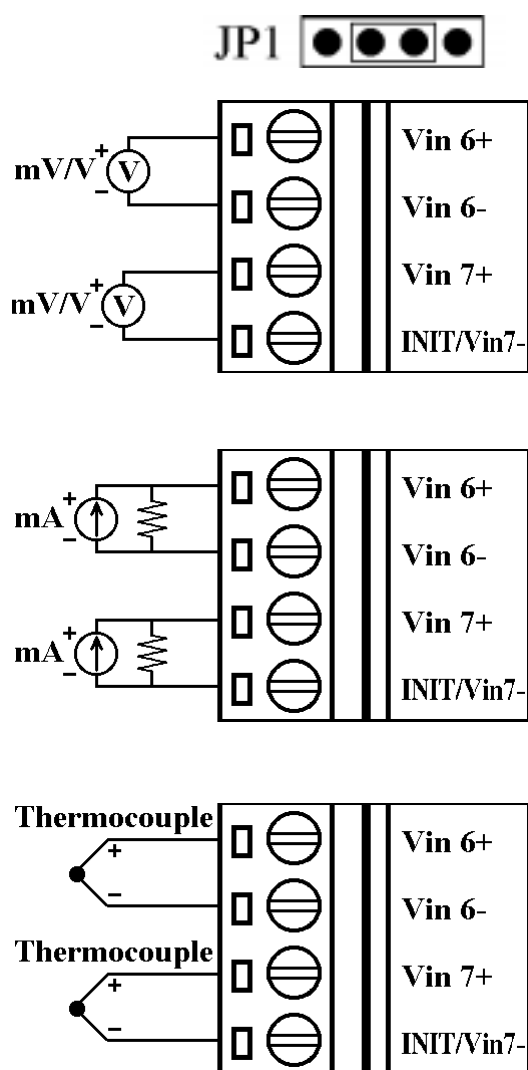
## CB-7018/18P Analog Input

Channel 0 to 5 Wire Connection

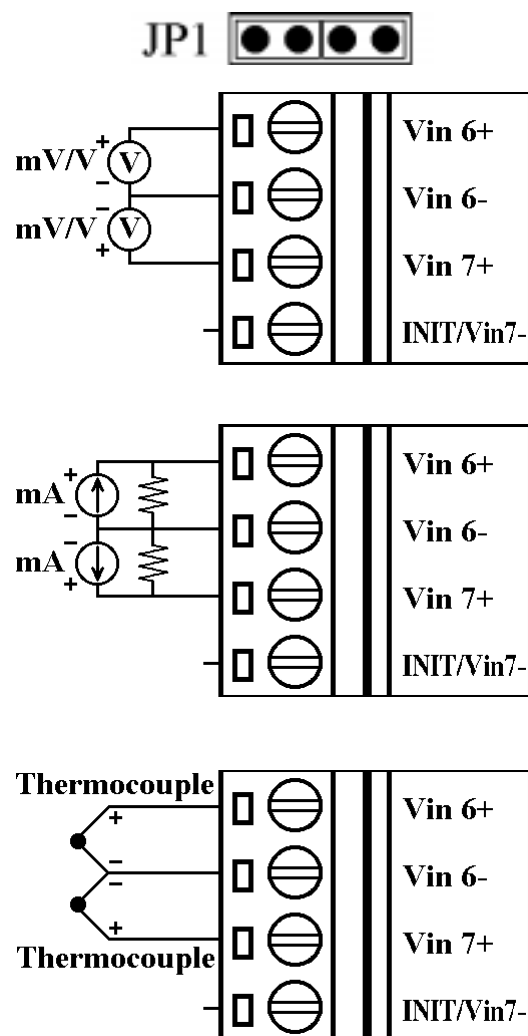


**CB-7018/18P** Analog Input Channel 6 and 7 Wire Connection, while the jumper JP1 setting is 8 differential mode.

(Remove the cover to gain access to jumper JP1.)



**CB-7018/18P** Analog Input Channel 6 and 7 Wire Connection, while the jumper JP1 setting is INIT\* mode.



## 1.6 Quick Start

Refer to “**CB-7000 Bus Converter User Manual**” and “**Getting Start**” for more details.

## 1.7 Default Setting

Default setting for CB-7011/11D/11P/11PD/18/18P:

- Address: 01
- Analog Input Type: Type 05, -2.5 to +2.5 V
- Baud rate: 9600 bps
- Checksum disable, 60 Hz rejection, engineering unit format
- CB-7018/18P set as INIT\* mode; there are six differential and two single-ended analog inputs.

## 1.8 Jumper Setting

CB-7018/18P: Jumper JP1 for select the pin INIT\*/Vin 7-

Select 8 differential mode; the pin INIT\*/Vin7- is set to Vin7-

JP1 

Select INIT\* mode; the pin INIT\*/Vin7- is set to INIT\*

JP1 

# 1.9 Calibration

## Read Carefully Before Performing Calibration

Calibration Requirement for CB-7011/11D/11P/11PD/18/18P:

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

Notification:

1. When calibrating a type 06, connect an external shunt resistor, 125 ohms, 0.1% (Ref Sec. 1.5).
2. Connect calibration voltage (or current) signal to module's input. For CB-7018/18P, connect to channel 0. (For wire connection reference, see Sec. 1.5)
3. Before calibration, warm-up the module for about 30 minutes to improve the accuracy.

Example Calibration Sequence for Type 00:

1. Set Type to 00. Refer to Sec. 2.1.
2. Enable Calibration. Refer to Sec. 2.20.
3. Apply Zero Calibration Voltage (0 mV)
4. Perform Zero Calibration Command Refer to Sec. 2.6.
5. Apply Span Calibration Voltage (15mV)
6. Perform Span Calibration Command Refer to Sec. 2.5.
7. Repeat step 1 to step 6 three times.

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

# 1.10 Configuration Tables

Configuration Table of CB-7011/11D/11P/11PD/18/18P:

## Baud rate 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)

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

|                                                |     |      |      |      |      |      |      |      |      |      |      |
|------------------------------------------------|-----|------|------|------|------|------|------|------|------|------|------|
| Type Code                                      | 0E  | 0F   | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18   |
| TC Type                                        | J   | K    | T    | E    | R    | S    | B    | N    | C    | L    | M    |
| Min Temp                                       | 0   | -200 | -200 | -200 | 0    | 0    | 0    | -270 | 0    | -200 | -200 |
| Max Temp                                       | 750 | 1250 | 350  | 900  | 1450 | 1450 | 1700 | 1300 | 2320 | 800  | 100  |
| The temperatures shown are in degrees Celsius. |     |      |      |      |      |      |      |      |      |      |      |

T.C. Type L and M for CB-7011P/11PD/18P only.

## Data Format Setting (FF)

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

\*1: Filter Select: 0 = 60 Hz rejection

1 = 50 Hz rejection

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

\*3: 00 = Engineering Unit Format

01 = Percent Format

10 = 2's Complement HEX Format

# Analog Input Type and Data Format Table

| Type Code | Input Range     | Data Format        | +F.S.   | Zero    | -F.S.   |
|-----------|-----------------|--------------------|---------|---------|---------|
| 00        | -15 to +15 mV   | Engineer Unit      | +15.000 | +00.000 | -15.000 |
|           |                 | % of FSR           | +100.00 | +000.00 | -100.00 |
|           |                 | 2's complement HEX | 7FFF    | 0000    | 8000    |
| 01        | -50 to +50 mV   | Engineer Unit      | +50.000 | +00.000 | -50.000 |
|           |                 | % of FSR           | +100.00 | +000.00 | -100.00 |
|           |                 | 2's complement HEX | 7FFF    | 0000    | 8000    |
| 02        | -100 to +100 mV | Engineer Unit      | +100.00 | +000.00 | -100.00 |
|           |                 | % of FSR           | +100.00 | +000.00 | -100.00 |
|           |                 | 2's complement HEX | 7FFF    | 0000    | 8000    |
| 03        | -500 to +500 mV | Engineer Unit      | +500.00 | +000.00 | -500.00 |
|           |                 | % of FSR           | +100.00 | +000.00 | -100.00 |
|           |                 | 2's complement HEX | 7FFF    | 0000    | 8000    |
| 04        | -1 to +1 V      | Engineer Unit      | +1.0000 | +0.0000 | -1.0000 |
|           |                 | % of FSR           | +100.00 | +000.00 | -100.00 |
|           |                 | 2's complement HEX | 7FFF    | 0000    | 8000    |
| 05        | -2.5 to +2.5 V  | Engineer Unit      | +2.5000 | +0.0000 | -2.5000 |
|           |                 | % of FSR           | +100.00 | +000.00 | -100.00 |
|           |                 | 2's complement HEX | 7FFF    | 0000    | 8000    |
| 06        | -20 to +20 mA   | Engineer Unit      | +20.000 | +00.000 | -20.000 |
|           |                 | % of FSR           | +100.00 | +000.00 | -100.00 |
|           |                 | 2's complement HEX | 7FFF    | 0000    | 8000    |

| Type Code | Input Range                              | Data Format        | +F.S.   | Zero    | -F.S.   |
|-----------|------------------------------------------|--------------------|---------|---------|---------|
| 0E        | J Type<br>-210 to 760<br>degree Celsius  | Engineer Unit      | +760.00 | +00.000 | -210.00 |
|           |                                          | % of FSR           | +100.00 | +000.00 | -027.63 |
|           |                                          | 2's complement HEX | 7FFF    | 0000    | DCA2    |
| 0F        | K Type<br>-270 to 1372<br>degree Celsius | Engineer Unit      | +1372.0 | +00.000 | -0270.0 |
|           |                                          | % of FSR           | +100.00 | +000.00 | -019.68 |
|           |                                          | 2's complement HEX | 7FFF    | 0000    | E6D0    |
| 10        | T Type<br>-270 to 400<br>degree Celsius  | Engineer Unit      | +400.00 | +000.00 | -270.00 |
|           |                                          | % of FSR           | +100.00 | +000.00 | -067.50 |
|           |                                          | 2's complement HEX | 7FFF    | 0000    | A99A    |
| 11        | E Type<br>-270 to 1000<br>degree Celsius | Engineer Unit      | +1000.0 | +000.00 | -0270.0 |
|           |                                          | % of FSR           | +100.00 | +000.00 | -027.00 |
|           |                                          | 2's complement HEX | 7FFF    | 0000    | DD71    |
| 12        | R Type<br>0 to 1768<br>degree Celsius    | Engineer Unit      | +1768.0 | +0000.0 | +0000.0 |
|           |                                          | % of FSR           | +100.00 | +0000.0 | +0000.0 |
|           |                                          | 2's complement HEX | 7FFF    | 0000    | 0000    |
| 13        | S Type<br>0 to 1768<br>degree Celsius    | Engineer Unit      | +1786.0 | +0.0000 | +0000.0 |
|           |                                          | % of FSR           | +100.00 | +000.00 | +0000.0 |
|           |                                          | 2's complement HEX | 7FFF    | 0000    | 0000    |
| 14        | B Type<br>0 to 1820<br>degree Celsius    | Engineer Unit      | +1820.0 | +00.000 | +0000.0 |
|           |                                          | % of FSR           | +100.00 | +000.00 | +0000.0 |
|           |                                          | 2's complement HEX | 7FFF    | 0000    | 0000    |
| 15        | N Type<br>-270 to 1300<br>degree Celsius | Engineer Unit      | +1300.0 | +00.000 | -0270.0 |
|           |                                          | % of FSR           | +100.00 | +000.00 | -20.77  |
|           |                                          | 2's complement HEX | 7FFF    | 0000    | E56B    |

| Type Code                                       | Input Range                             | Data Format        | +F.S.   | Zero    | -F.S.   |
|-------------------------------------------------|-----------------------------------------|--------------------|---------|---------|---------|
| 16                                              | C Type<br>0 to 2320<br>degree Celsius   | Engineer Unit      | +2320.0 | +00.000 | +00.000 |
|                                                 |                                         | % of FSR           | +100.00 | +000.00 | +000.00 |
|                                                 |                                         | 2's complement HEX | 7FFF    | 0000    | 0000    |
| 17*1                                            | L Type<br>-200 to 800<br>degree Celsius | Engineer Unit      | +800.00 | +00.000 | -200.00 |
|                                                 |                                         | % of FSR           | +100.00 | +000.00 | -025.00 |
|                                                 |                                         | 2's complement HEX | 7FFF    | 0000    | E000    |
| 18*1                                            | M Type<br>-200 to 100<br>degree Celsius | Engineer Unit      | +100.00 | +000.00 | -200.00 |
|                                                 |                                         | % of FSR           | +050.00 | +000.00 | -100.00 |
|                                                 |                                         | 2's complement HEX | 4000    | 0000    | 8000    |
| *1 : Only available for 7011P, 7011PD and 7018P |                                         |                    |         |         |         |

## 2. Command

Command Format: **(Leading)(Address)(Command)[CHK](cr)**

Response Format: **(Leading)(Address)(Data)[CHK](cr)**

**[CHK]** 2-character checksum

**(cr)** end-of-command character, character return(0x0D)

| General Command Sets |             |                                  |                 |
|----------------------|-------------|----------------------------------|-----------------|
| Command              | Response    | Description                      | Section         |
| %AANNTTCCFF          | !AA         | Set Module Configuration         | <i>Sec.2.1</i>  |
| #**                  | No Response | Synchronized Sampling            | <i>Sec.2.2</i>  |
| #AA                  | >(Data)     | Read Analog Input                | <i>Sec.2.3</i>  |
| #AAN                 | >(Data)     | Read Analog Input from channel N | <i>Sec.2.4</i>  |
| \$AA0                | !AA         | Perform Span Calibration         | <i>Sec.2.5</i>  |
| \$AA1                | !AA         | Perform Zero Calibration         | <i>Sec.2.6</i>  |
| \$AA2                | !AATTCCFF   | Read Configuration               | <i>Sec.2.7</i>  |
| \$AA3                | >(Data)     | Read CJC Temperature             | <i>Sec.2.8</i>  |
| \$AA4                | >AAS(Data)  | Read Synchronized Data           | <i>Sec.2.9</i>  |
| \$AA5VV              | !AA         | Set Channel Enable               | <i>Sec.2.10</i> |
| \$AA6                | !AAVV       | Read Channel Status              | <i>Sec.2.11</i> |
| \$AA8                | !AAV        | Read LED Configuration           | <i>Sec.2.12</i> |
| \$AA8V               | !AA         | Set LED Configuration            | <i>Sec.2.13</i> |
| \$AA9(Data)          | !AA         | Set CJC Offset Value             | <i>Sec.2.14</i> |
| \$AAB                | !AAS        | T.C. Open Detection              | <i>Sec.2.15</i> |
| \$AAF                | !AA(Data)   | Read Firmware Version            | <i>Sec.2.16</i> |
| \$AAM                | !AA(Data)   | Read Module Name                 | <i>Sec.2.17</i> |
| \$AAZ(Data)          | !AA         | Send LED Data                    | <i>Sec.2.18</i> |

| <b>General Command Sets (Continued)</b>                           |             |                                   |                 |
|-------------------------------------------------------------------|-------------|-----------------------------------|-----------------|
| ~AAO(Data)                                                        | !AA         | Set Module Name                   | <b>Sec.2.19</b> |
| ~AAEV                                                             | !AA         | Enable/Disable Calibration        | <b>Sec.2.20</b> |
| <b>Digital Input/Output, Alarm and Event Counter Command Sets</b> |             |                                   |                 |
| @AADI                                                             | !AASOOII    | Read Digital I/O and Alarm Status | <b>Sec.2.21</b> |
| @AADO(Data)                                                       | !AA         | Set Digital Output                | <b>Sec.2.22</b> |
| @AAEAT                                                            | !AA         | Enable Alarm                      | <b>Sec.2.23</b> |
| @AAHI(Data)                                                       | !AA         | Set High Alarm                    | <b>Sec.2.24</b> |
| @AALO(Data)                                                       | !AA         | Set Low Alarm                     | <b>Sec.2.25</b> |
| @AADA                                                             | !AA         | Disable Alarm                     | <b>Sec.2.26</b> |
| @AACA                                                             | !AA         | Clear Latch Alarm                 | <b>Sec.2.27</b> |
| @AARH                                                             | !AA(Data)   | Read High Alarm                   | <b>Sec.2.28</b> |
| @AARL                                                             | !AA(Data)   | Read Low Alarm                    | <b>Sec.2.29</b> |
| @AARE                                                             | !AA(Data)   | Read Event Counter                | <b>Sec.2.30</b> |
| @AACE                                                             | !AA         | Clear Event Counter               | <b>Sec.2.31</b> |
| <b>Host Watchdog Command Sets</b>                                 |             |                                   |                 |
| ~**                                                               | No Response | Host OK                           | <b>Sec.2.32</b> |
| ~AA0                                                              | !AASS       | Read Module Status                | <b>Sec.2.33</b> |
| ~AA1                                                              | !AA         | Reset Module Status               | <b>Sec.2.34</b> |
| ~AA2                                                              | !AAVV       | Read Host Watchdog Timeout Value  | <b>Sec.2.35</b> |
| ~AA3EVV                                                           | !AA         | Set Host Watchdog Timeout Value   | <b>Sec.2.36</b> |
| ~AA4                                                              | !AAPPSS     | Read PowerOn Value and Safe Value | <b>Sec.2.37</b> |
| ~AA5PPSS                                                          | !AA         | Set PowerOn Value and Safe Value  | <b>Sec.2.38</b> |

## 2.1 %AANNTTCCFF

**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           new type for setting module (Ref. *Sec. 1.10*)

CC           new baudrate for setting module (Ref. *Sec. 1.10*)

FF           new data format for setting module (Ref. *Sec. 1.10*)

When changing the baud rate or checksum, it is necessary to short the INIT\* pin to ground.

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

Invalid Command: ?AA[CHK](cr)

A syntax error or communication error may yield no response.

!           delimiter for valid command

?           delimiter for invalid command. If you change baud rate or checksum setting without shorting INIT\* to ground, the module will return invalid command.

AA           address of response module (00 to FF)

**Example:**

Command:     %0102050600           Receive: !02

Change address from 01 to 02, return success.

**Related Command:**

\$AA2 (*Sec. 2.7*)

**Related Topics:**

Configuration Tables (*Sec. 1.10*), INIT\* pin Operation (*Sec. 3.1*)

## 2.2 #\*\*

**Description:** Synchronized Sampling

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

# a delimiter character

\*\* synchronized sampling command

**Response:** No response

**Example:**

Command: \$014                      Receive: ?01

Read synchronized sampling data, returns no valid data .

Command: #\*\*                      No response

Send synchronized sampling command.

Command: \$014                      Receive: >011+025.123

First read, get status=1, first read.

Command: \$014                      Receive: >010+025.123

Second read, get status=0, read verified.

**Related Command:**

\$AA4 (Sec. 2.9)

## 2.3 #AA

### Description: Read Analog Input

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

# delimiter character

AA      address of reading module(00 to FF)

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

Syntax error or communication error may yield no response.

> delimiter for valid command

(Data) analog input value, reference *Sec. 1.10* for its format.

For CB-7018/18P, the data is the combination for each channel respectively.

### Example:

Command: #01                      Receive: >+02.635

Read address 01, return data success.

Command: #02                      Receive: >4C53

Read address 02, return data in HEX format success.

## Command: #04

Receive:        >+05.123+04.153+07.234-02.356+10.000-  
                 05.133+02.345+08.234

Module address 04 is CB-7018. Read address 04, get analog input data of eight channels.

### Related Command:

%AANNTTCFF (Sec. 2.1), \$AA2 (Sec. 2.7)

## Related Topics:

## Configuration Tables (Sec. 1.10)

## 2.4 #AAN

**Description:** Read Analog Input from channel N

**Note:** The command is for CB-7018/18P only.

**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, reference *Sec. 1.10* for its format

**Example:**

Command: #032                      Receive: >+02.513

Read address 03 channel 2, get data success.

Command: #029                      Receive: ?02

Read address 02 channel 9, return error channel number.

**Related Command:**

%AANNTTCCFF (*Sec. 2.1*), \$AA2 (*Sec 2.7*)

**Related Topics:**

Configuration Tables (*Sec. 1.10*)

## 2.5 \$AA0

**Description:** Perform Span Calibration

**Syntax:** \$AA0[CHK](cr)

\$ delimiter character

AA address of setting module (00 to FF)

0 command for performing span calibration

**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 or the calibration is not enabled

AA address of response module(00 to FF)

**Example:**

Command: \$010                      Receive: !01

Perform address 01 span calibration, return success.

Command: \$020                      Receive: ?02

Perform address 02 span calibration, return the calibration is not enabled before perform calibration command.

**Related Command:**

\$AA1 (Sec. 2.6), ~AAEV (Sec. 2.20)

**Related Topics:**

Calibration (Sec. 1.9)

## 2.6 \$AA1

### Description: Perform Zero Calibration

### Syntax: \$AA1[CHK](cr)

\$ delimiter character

AA      address of setting module (00 to FF)

1 command for performing zero calibration

**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 or the calibration is not enabled

AA      address of response module(00 to FF)

### Example:

Command: \$011                      Receive: !01

Perform address 01 zero calibration, return success.

Command: \$021                      Receive: ?02

Perform address 02 zero calibration, return the calibration is not enabled before perform calibration command.

### Related Command:

\$AA0 (*Sec. 2.5*), ~AAEV (*Sec. 2.20*)

## Related Topics:

## Calibration (*Sec. 1.9*)

## 2.7 \$AA2

### Description: Read Configuration

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

\$ delimiter character

AA      address of reading module (00 to FF)

2 command for reading configuration

**Response:** Valid Command:

**!AATTCCFF[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 (reference <i>Sec. 1.10</i> ) |
|----|---------------------------------------------------|

CC      baudrate code of module (reference *Sec. 1.10*)

|    |                                                     |
|----|-----------------------------------------------------|
| FF | data format of module (reference <i>Sec. 1.10</i> ) |
|----|-----------------------------------------------------|

### Example:

Command: \$012

Receive: !01050600

Read address 01 configuration, return success.

Command: \$022

Receive: !02030602

Read address 02 configuration, return success.

### Related Command:

### %AANNTTCFF (Sec. 2.1)

## Related Topics:

### Config. Tables (Sec. 1.10), INIT\* pin Operation (Sec. 3.1)

## 2.8 \$AA3

### 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 in degrees Celsius.

### Example:

Command: \$033                      Receive: >+0025.4

Read address 03 CJC temperature, return 25.4°C.

### Related Command:

\$AA9(Data) (Sec. 2.14)

## 2.9 \$AA4

**Description:** Read Synchronized Data

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

\$ delimiter character

AA address of reading module (00 to FF)

4 command for reading synchronized data

**Response:** Valid Command: >AAS(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 or the module does not receive command #\*\* before the command \$AA4.

AA address of response module(00 to FF)

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

(Data) synchronized data, format reference *Sec. 1.10*

**Example:**

See example of *Sec. 2.2 #\*\**

**Related Command:**

*Sec. 2.2 #\*\**

## 2.10 \$AA5VV

**Description:** Set Channel Enable

**Note:** The command is for CB-7018/18P only.

**Syntax:** \$AA5VV[CHK](cr)

\$            delimiter character

AA          address of setting module (00 to FF)

5           command for setting 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 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 enable and channel 0,2,5,7 disable.

**Related Command:**

\$AA6 (Sec. 2.11)

## 2.11 \$AA6

**Description:** Read Channel Status

**Note:** The command is for CB-7018/18P only.

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

\$            delimiter character

AA           address of reading module (00 to FF)

6            command for reading 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: \$015A5                    Receive: !01

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

Command: \$016                      Receive: !01A5

          Read address 01 channel status, return channel 0,2,5,7 enable and channel 1,3,4,6 disable.

**Related Command:**

\$AA5VV (*Sec. 2.10*)

## 2.12 \$AA8

**Description:** Read LED Configuration

**Note:** The command is for CB-7011D/11PD only.

**Syntax:** \$AA8[CHK](cr)

\$            delimiter character

AA           address of reading module (00 to FF)

8            command for setting LED configuration

**Response:**    Valid Command:            !AAV[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)

V            LED configuration

                1=module control, 2=host control

**Example:**

Command: \$018

Receive: !011

                Read address 01 LED configuration, return module control.

Command: \$028

Receive: !012

                Read address 02 LED configuration, return host control.

**Related Command:**

\$AA8V (*Sec. 2.13*), \$AAZ(Data) (*Sec. 2.18*)

## 2.13 \$AA8V

**Description:** Set LED Configuration

**Note:** The command is for CB-7011D/11PD only.

**Syntax:** \$AA8V[CHK](cr)

\$            delimiter character

AA          address of setting module (00 to FF)

8           command for setting LED configuration

V           1=Set LED to module, 2=Set LED to host

**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: \$0182                            Receive: !01

          Set address 01 LED to host control, return success.

Command: \$0281                            Receive: !02

          Set address 02 LED to module control, return success.

**Related Command:**

\$AA8 (Sec. 2.12), \$AAZ(Data) (Sec. 2.18)

## 2.14 \$AA9(Data)

**Description:** Set CJC Offset Value

**Syntax:** \$AA9(Data)[CHK](cr)

\$            delimiter character

AA          address of setting module (00 to FF)

9            command for setting CJC offset value

(Data)      CJC offset value comprises a sign and 4 hexadecimal digits, from -1000 to +1000, each count is 0.01°C.

**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: \$019+0010            Receive: !01

              Set address 01 CJC offset increase 16 counts (+0.16°C), return success.

**Related Command:**

\$AA3 (Sec. 2.8)

## 2.15 \$AAB

**Description:** Thermocouple Open Detection

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

\$            delimiter character

AA          address of reading module (00 to FF)

B           command for reading thermocouple open 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           0=close-loop detection

1=open-circuit detection, need to check the thermocouple

**Example:**

Command: \$01B

Receive: !010

Read address 01, thermocouple open status, return the thermocouple is close-loop.

## 2.16 \$AAF

### Description: Read Firmware Version

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

\$ delimiter character

AA      address of reading module (00 to FF)

F command for reading 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.

Command: \$02F                      Receive: !01B1.1

Read address 02 firmware version, return version B1.1.

## 2.17 \$AAM

**Description:** Read Module Name

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

\$            delimiter character

AA          address of reading module (00 to FF)

M          command for reading 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: !017018

Read address 01 module name, return name 7018.

Command: \$03M                      Receive: !037011D

Read address 03 module name, return name 7011D.

**Related Command:**

~AAO(Data) (*Sec. 2.19*)

## 2.18 \$AAZ(Data)

**Description:** Set LED Data

**Note:** The command is for CB-7011D/11PD only.

**Syntax:** \$AAZ(Data)[CHK](cr)

\$            delimiter character

AA          address of setting module (00 to FF)

Z          command for setting LED data

(Data)     data for show on the LED, from -19999. to +19999. The data need sign, 5 digits and decimal point.

**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 or LED not set to host control

AA          address of response module (00 to FF)

**Example:**

Command: \$01Z+123.45            Receive: !01

Send address 01 LED data +123.45, return success.

Command: \$02Z+512.34            Receive: ?02

Send address 02 LED data +512.34, return the LED is not setting in the host mode.

**Related Command:**

\$AA8 (Sec. 2.12), \$AA8V (Sec. 2.13)

## 2.19 ~AAO(Data)

**Description:** Set Module Name

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

~            delimiter character

AA          address of setting module (00 to FF)

O          command for setting module name

(Data)     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: ~01O7018                      Receive: !01

Set address 01 module name to 7018, return success.

Command: \$01M                          Receive: !017018

Read address 01 module name, return 7018.

**Related Command:**

\$AAM (*Sec. 2.17*)

## 2.20 ~AAEV

**Description:** Enable/Disable Calibration

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

~            delimiter character

AA          address of setting module (00 to FF)

E           command for enable/disable calibration

V          1=enable calibration, 0=disable calibration

**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: ?01

Perform address 01 span calibration, return it is not ready for calibration.

Command: ~01E1                      Receive: !01

Set address 01 to enable calibration, return success.

Command: \$010                      Receive: !01

Preform address 01 span calibration, return success.

**Related Command:**

\$AA0 (Sec. 2.5), \$AA1 (Sec. 2.6)

**Related Topic:**

Calibration (Sec. 1.9)

## 2.21 @AADI

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

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

@ delimiter character

AA address of reading module (00 to FF)

DI command for reading digital I/O and alarm status

**Response:** Valid Command: !AASOOII[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 alarm enable status, 0=alarm disable, 1=momentary alarm enabled, 2=latch alarm enabled.

OO digital output status, 00=DO0 off, DO1 off, 01=DO0 on, DO1 off, 02=DO0 off, DO1 on, 03=OD0 on, DO1 on.

II digital input status, 00=input low level, 01=input high level.

### Example:

Command: @01DI                      Receive: !0100001

Read address 01 digital I/O status, return alarm disable, digital outputs all off, and digital input high level.

Command: @02DI                      Receive: !0210100

Read address 02 digital I/O status, return momentary alarm

enable, high alarm is clear, low alarm is set, and digital input is high.

**Related Command:**

@AADO(Data) (Sec. 2.22), @AAEAT (Set. 2.23), @AADA (Sec. 2.26 )

**Related Topic:**

Digital Input and Event Counter (Sec. 3.4), Digital Output (Sec. 3.5), High/Low Alarm (Sec. 3.6)

## 2.22 @AADO(Data)

**Description:** Set Digital Output

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

@ delimiter character

AA address of setting module (00 to FF)

DO command for setting digital output

(Data) output value, 00=DO0 off, DO1 off, 01=DO0 on, DO1 off, 02=DO0 off, DO1 on, 03=DO0 on, DO1 on

**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. When the alarm is enabled, the command will return invalid.

AA address of response module(00 to FF)

**Example:**

Command: @01DO00                      Receive: !01

Set address 01 digital output 00, return success.

**Related Command:**

@AADI (Sec. 2.21), @AAEAT (Set. 2.23), @AADA (Sec. 2.26)

**Related Topic:**

Sec. 3.5 Digital Output

## 2.23 @AAEAT

**Description:** Enable Alarm

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

@ delimiter character

AA address of setting module (00 to FF)

EA command for enable alarm.

T alarm type, M=momentary alarm, L=latch alarm.

**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: @01EAM                      Receive: ?01

Set address 01 momentary alarm, return success.

**Related Command:**

@AADA (Sec. 2.26), @AACA (Sec. 2.27) **Related Topic:**

High/Low Alarm (Sec. 3.6)

## 2.24 @AAHI(Data)

**Description:** Set High Alarm

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

@ delimiter character

AA address of setting module (00 to FF)

HI command for setting high alarm value

(Data) high alarm values, data format is in engineer unit format.

**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: @01HI+2.5000 Receive: !01

Set address 01 high alarm +2.5000, return success.

**Related Command:**

@AAEAT (Sec. 2.23), @AARH (Sec. 2.28)

**Related Topic:**

High/Low Alarm (Sec. 3.6)

## 2.25 @AALO(Data)

**Description:** Set Low Alarm

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

@ delimiter character

AA address of setting module (00 to FF)

LO command for setting high alarm value

(Data) high alarm values, data format is in engineer unit format.

**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: @01LO-2.5000 Receive: !01

Set address 01 low alarm -2.5000, return success.

**Related Command:**

@AAEAT (Sec. 2.23), @AARL (Sec. 2.29)

**Related Topic:**

High/Low Alarm (Sec. 3.6)

## 2.26 @AADA

**Description:** Disable Alarm

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

@ delimiter character

AA address of setting module (00 to FF)

DA command for disable alarm

**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: @01DA                      Receive: !01

Disable address 01 alarm, return success.

**Related Command:**

*Sec. 2.23 @AAEAT*

**Related Topic:**

*Sec. 3.6 High/Low Alarm*

## 2.27 @AACA

**Description:** Clear Latch Alarm

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

@ delimiter character

AA address of setting module (00 to FF)

CA command for clear latch alarm

**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: @01DI                      Receive: !0120101

Read address 01 digital input, return latch alarm mode, low alarm is set.

Command: @01CA                      Receive: !01

Clear address 01 latch alarm, return success.

Command: @01DI                      Receive: !0120001

Read address 01 digital input, return latch alarm mode, both alarms are clear.

**Related Command:**

*Sec. 2.21 @AADI, Sec. 2.23 @AAEAT, Sec. 2.26 @AADA*

**Related Topic:**

*Sec. 3.6 High/Low Alarm*

## 2.28 @AARH

**Description:** Read High Alarm

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

@            delimiter character

AA           address of reading module (00 to FF)

RH           command for reading high alarm

**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)      high alarm value in engineer unit format.

**Example:**

Command: @01RH                      Receive: !01+2.5000

Read address 01 high alarm, return +2.5000.

**Related Command:**

*Sec. 2.24 @AAHI(Data)*

**Related Topic:**

*Sec. 3.6 High/Low Alarm*

## 2.29 @AARL

**Description:** Read Low Alarm

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

@            delimiter character

AA           address of reading module (00 to FF)

RL           command for reading low alarm

**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)      low alarm value in engineer unit format.

**Example:**

Command: @01RL                      Receive: !01-2.5000

Read address 01 low alarm, return -2.5000.

**Related Command:**

Sec. 2.25 @AALO(Data)

**Related Topic:**

Sec. 3.6 High/Low Alarm

## 2.30 @AARE

**Description:** Read Event Counter

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

@ delimiter character

AA address of reading module (00 to FF)

RE command for reading event counter

**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) event counter value, from 00000 to 65535.

**Example:**

Command: @01RE                      Receive: !0101234

Read address 01 event counter, return 1234.

**Related Command:**

*Sec. 2.31 @AACE*

**Related Topic:**

*Sec. 3.4 Digital Input and Event Counter*

## 2.31 @AAACE

**Description:** Clear Event Counter

**Note:** The command is for CB-7011/11D/11P/11PD only.

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

@ delimiter character

AA address of setting module (00 to FF)

CE command for clear event counter

**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: @01RE                      Receive: !0101234

Read address 01 event counter, return 1234.

Command: @01CE                      Receive: !01

Clear address 01 event counter, return success.

Command: @01RE                      Receive: !0100000

Read address 01 event counter, return 0.

**Related Command:**

*Sec. 2.30 @AARE*

**Related Topic:**

*Sec. 3.4 Digital Input and Event Counter*

## 2.32 ~\*\*

**Description:** Host OK.

Host sends this command to all modules for broadcasting the information “Host OK”.

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

 $\sim$  delimiter character

**\*\*** command for all modules

**Response:** No response.

## Example:

Command: ~\*\* No response

## Send Host OK to all modules

## Related Command:

*Sec. 33 ~AA0, Sec. 2.34 ~AA1, Sec. 2.35 ~AA2, Sec. 2.36 ~AA3EVV, Sec. 2.37 ~AA4, Sec. 2.38 ~AA5PSS*

## Related Topic:

## Sec. 3.2 Module Status, Sec. 3.3 Dual Watchdog Operation

## 2.33 ~AA0

**Description:** Read Module Status

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

~ delimiter character

AA address of reading module (00 to FF)

0 command for reading 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. The status will store into EEPROM and only may reset by the command ~AA1.

|    |          |   |   |   |    |          |   |
|----|----------|---|---|---|----|----------|---|
| 7  | 6        | 5 | 4 | 3 | 2  | 1        | 0 |
| *1 | Reserved |   |   |   | *2 | Reserved |   |

\*1: Host watchdog status, 0=Disable, 1=Enable

\*2: Host watchdog timeout flag, 0=Clear, 1=Set

**Example:**

Command: ~010

Receive: !0104

Read address 02 module status, return 04, host watchdog timeout flag is set.

**Related Command:**

Sec. 2.34 ~AA1

**Related Topic:**

Sec. 3.2 Module Status, Sec. 3.3 Dual Watchdog Operation

## 2.34 ~AA1

### Description: Reset Module Status

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

 $\sim$  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)

### Example:

Command: ~010

Receive: !0104

Read address 01 module status, return 04, host watchdog timeout flag is set.

Command: ~011

Receive: !01

Reset address 01 module status, return success.

Command: ~010

Receive: !0100

Read address 01 module status, return 00, Module Status is clear.

### Related Command:

*Sec. 2.32 ~\*\*, Sec. 2.33 ~AA0*

### Related Topic:

### Sec. 3.2 Module Status, Sec. 3.3 Dual Watchdog Operation

## 2.35 ~AA2

**Description:** Read Host Watchdog Timeout Interval

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

~            delimiter character

AA          address of reading module (00 to FF)

2           command for reading host watchdog timeout interval

**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          timeout interval in HEX format, each count for 0.1 second, 01=0.1 second and FF=25.5 seconds

**Example:**

Command: ~012

Receive: !01FF

Read address 01 host watchdog timeout interval, return FF, host watchdog timeout interval is 25.5 seconds.

**Related Command:**

*Sec. 2.32 ~\*\*, Sec. 2.36 ~AA3EVV*

**Related Topic:**

*Sec. 3.2 Module Status, Sec. 3.3 Dual Watchdog Operation*

## 2.36 ~AA3E VV

**Description:** Set Host Watchdog Timeout Interval

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

~            delimiter character  
AA          address of setting module (00 to FF)  
3            command for set host watchdog timeout interval  
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: ~013164                      Receive: !01

Set address 01 enable host watchdog and timeout interval is 64 (10.0 seconds), return success.

Command: ~012                          Receive: !0164

Read address 01 host watchdog timeout interval, return timeout interval is 64 (10.0 seconds).

**Related Command:**

*Sec. 2.32 ~\*\*, Sec. 2.35 ~AA2*

**Related Topic:**

*Sec. 3.2 Module Status, Sec. 3.3 Dual Watchdog Operation*

## 2.37 ~AA4

**Description:** Read PowerOn Value and Safe Value

**Note:** The command is for CB-7011/11D/11P/11PD only

**Syntax:** ~AA4[CHK](cr)

~            delimiter character

AA           address of reading module (00 to FF)

4            command for reading PowerOn Value and Safe Value

**Response:** Valid Command:        !AAPPSS[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)

PP           PowerOn Value, 00=DO0 off, DO1 off, 01=DO0 on, DO1 off, 02=DO0 off, DO1 on, 03=DO0 on, DO1 on

SS           Safe Value, data format is same as PP

**Example:**

Command: ~014

Receive: !010000

Read address 01 Power-On/Safe Value, return Power-On Value is DO0 off, DO1 off, Safe Value is DO0 off, DO1 off.

**Related Command:**

*Sec. 2.38 ~AA5PPSS*

**Related Topic:**

*Sec. 3.2 Module Status, Sec. 3.3 Dual Watchdog Operation*

## 2.38 ~AA5PPSS

**Description:** Set PowerOn Value and Safe Value.

**Note:** The command is for CB-7011/11D/11P/11PD only.

**Syntax:** ~AA5PPSS[CHK](cr)

~            delimiter character

AA          address of setting module (00 to FF)

5           command for setting PowerOn Value and Safe Value

PP          PowerOn Value, 00=DO0 off, DO1 off, 01=DO0 on, DO1off, 02=DO0 off, DO1 on, 03=DO0 on, DO1 on

SS          Safe Value, data format is same as PP

**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: ~0150003

Receive: !01

Set address 01 PowerOn Value is DO0 off, DO1 off, Safe Value is DO0 on, DO1 on, return success.

**Related Command:**

*Sec. 2.37 ~AA4*

**Related Topic:**

*Sec. 3.2 Module Status, Sec. 3.3 Dual Watchdog Operation*

# 3. Application Note

## 3.1 INIT\* pin Operation

Each CB-7000 module has a build-in EEPROM to store configuration information such as address, type, baud rate and other information. Sometimes, the user may forget the configuration of the module. Therefore, the CB-7000 has a special mode named “INIT mode”, to help the user resolve the problem. The “INIT mode” is setting as Address=00, baud rate = 9600 bps, no checksum.

To enable INIT mode, please follow these steps:

Step 1. Power-down the module.

Step 2. Connect the INIT\* pin to the GND pin.

Step 3. Set Power on.

Step 4. Send command \$002(cr) in 9600 bps to read the configuration stored in the module’s EEPROM.

Refer to “CB-7000 Bus Converter User Manual” *Sec. 5.1* and “Getting Started” for more information.

## 3.2 Module Status

**Power-On Reset** or **Module Watchdog Reset** will put all outputs to the **Power-On Value**. The module may accept the host’s command to change the output value.

**Host Watchdog Timeout** will put all digital outputs to the **Safe Value**. The host watchdog timeout flag is set, and the output command will be ignored. The module’s LED will go to flash and user must reset the Module Status via command to restore normal operation.

## 3.3 Dual Watchdog Operation

**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 go down by the external noise signal. The circuit may let the module continue to work and never halt.

The Host Watchdog is a software function to monitor the host's operating status. Its purpose is to prevent the network/communication problem or a halted host from causing a dangerous situation. While the timeout occurred, the module will place all outputs to the safe state to prevent from unexpected problem of controlled target.

The CB-7000 module with Dual Watchdog makes the control system more reliable and stable.

## 3.4 Digital Input and Event Counter

The digital input DI0 can work as event counter. The counter increments when the input changes from high level to low level. The counter has 16 bits and is useful for low speed counting at frequencies lower than 50 Hz.

## 3.5 Digital Output

When the module powers-on, the host watchdog timeout flag is checked first. If the status is set, the digital outputs (DO0 and DO1) of module are set to the Safe Value. If the flag is clear, the digital outputs are set to the Power-On Value.

If the host watchdog timeout flag is set, the module will

ignore the digital output command @AADO(Data).

## 3.6 High/Low Alarm

Some analog input modules, such as the CB-7011, are equipped with a high/low alarm function. When the alarm function is enabled, the digital output DO0 is the low alarm indicator, DO1 is the high alarm indicator, and the digital output command for changing digital outputs DO0, DO1 is ignored. The alarm function is to compare the analog input value with given high alarm value and low alarm value. And there are two alarm types as follows:

**Momentary alarm:** the alarm status is cleared when the analog input is not over the alarm value.

If Analog Input Value  $>$  High Alarm, DO1 (High alarm) is on, otherwise DO1 is off.

If Analog Input Value  $<$  Low Alarm, DO0 (Low alarm) is on, otherwise DO0 is off.

**Latch Alarm:** the alarm is cleared only the user send command to clear.

If Analog Input Value  $>$  High Alarm, DO1(High alarm) is on, else if Analog Input Value  $<$  Low Alarm, DO0(Low alarm) is on.

## 3.7 Thermocouple Measurement

When two wires composed of dissimilar metal are joined at one end and heated, the open circuit voltage is a function of the junction temperature and the composition of the two metals. All dissimilar metals exhibit this effect. The voltage is called Seebeck voltage". For small changes in temperature the Seebeck voltage is

linearly proportional to temperature.

To measure the Seebeck voltage directly is not available because we must first connect a voltmeter to the thermocouple, and the voltmeter leads themselves create a new thermoelectric (cold) junction. Therefore we need to eliminate the junction thermoelectric to measure the correct Seebeck voltage, and this is called “Cold Junction Compensation”.

For most thermocouples, the Seebeck voltage is 0V while at 0°C. One simple way to cancel the junction voltage is to put the junction into 0°C environment and the junction voltage is 0V. Normally, this is not a good method for most applications. The typical method is to measure the junction temperature with a thermistor, and measure the junction voltage from the junction temperature. Then we can get the Seebeck voltage from measured thermocouple voltage and junction voltage, and we can calculate the temperature from the Seebeck voltage.

For Your Notes

## For Your Notes

## EC Declaration of Conformity

We, Measurement Computing Corp., declare under sole responsibility that the product:

CB-7011/CB-7011D, Thermocouple Input Modules  
CB-7018

Part Number

Description

to which this declaration relates, meets the essential requirements, is in conformity with, and CE marking has been applied according to the relevant EC Directives listed below using the relevant section of the following EC standards and other normative documents:

**EU EMC Directive 89/336/EEC:** Essential requirements relating to electromagnetic compatibility.

**EU 55022 Class B:** Limits and methods of measurements of radio interference characteristics of information technology equipment.

**EN 50082-1:** EC generic immunity requirements.

**IEC 801-2:** Electrostatic discharge requirements for industrial process measurement and control equipment.

**IEC 801-3:** Radiated electromagnetic field requirements for industrial process measurements and control equipment.

**IEC 801-4:** Electrically fast transients for industrial process measurement and control equipment.

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