Warranty

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1. Introduction

8000 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 DIO modules support TTL signal, photo-isolated digital input, relay contact output, solid-state relay output, PhotoMOS output and open-collector output. Reference Sec. 1.3 for detail information.

1.1 More Information

Refer to “8000 Bus Converter User Manual” chapter 1 for more information as following:

1.1 8000 Overview
1.2 8000 Related Documentation
1.3 8000 Command Features
1.4 8000 System Network Configuration
1.5 8000 Dimension
1.2 Pin Assignment

[Diagram of pin assignments for 8041, 8050, 8043, 8052]
# 1.3 Specifications

<table>
<thead>
<tr>
<th></th>
<th>Digital Input Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8041</td>
</tr>
<tr>
<td><strong>Input Channels</strong></td>
<td>14</td>
</tr>
<tr>
<td><strong>Isolation</strong></td>
<td>Isolation with Common Source</td>
</tr>
<tr>
<td><strong>Isolation Voltage</strong></td>
<td>3750 Vrms</td>
</tr>
<tr>
<td><strong>Digital Level 0</strong></td>
<td>+1V max</td>
</tr>
<tr>
<td><strong>Digital Level 1</strong></td>
<td>+4 to +30 V</td>
</tr>
<tr>
<td><strong>Input Impedance</strong></td>
<td>3K ohms</td>
</tr>
<tr>
<td><strong>Power Input</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Power Consumption</strong></td>
<td>0.2W (8041)</td>
</tr>
<tr>
<td>Open Collector Output Modules</td>
<td>8043</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Output Channels</td>
<td>16</td>
</tr>
<tr>
<td>Isolation</td>
<td></td>
</tr>
<tr>
<td>Isolation Voltage</td>
<td></td>
</tr>
<tr>
<td>Load Voltage</td>
<td></td>
</tr>
<tr>
<td>Load Current</td>
<td>100mA</td>
</tr>
<tr>
<td>Input Channels</td>
<td></td>
</tr>
<tr>
<td>Isolation</td>
<td></td>
</tr>
<tr>
<td>Isolation Voltage</td>
<td></td>
</tr>
<tr>
<td>Digital Level 0</td>
<td></td>
</tr>
<tr>
<td>Digital Level 1</td>
<td></td>
</tr>
<tr>
<td>Input Impedance</td>
<td></td>
</tr>
<tr>
<td>Power Input</td>
<td></td>
</tr>
<tr>
<td>Power Consumption</td>
<td>0.4W (8043)</td>
</tr>
<tr>
<td>Relay Output Modules</td>
<td>8060</td>
</tr>
<tr>
<td>----------------------</td>
<td>------</td>
</tr>
<tr>
<td><strong>Output Channels</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>Relay Type</strong></td>
<td>RL1, RL2: Form A&lt;br&gt;RL3, RL4: Form C</td>
</tr>
<tr>
<td><strong>Contract Rating</strong></td>
<td>0.6A @125VAC&lt;br&gt;2A @30VDC</td>
</tr>
<tr>
<td><strong>Surge Strength</strong></td>
<td>500V</td>
</tr>
<tr>
<td><strong>Operate Time</strong></td>
<td>3mS</td>
</tr>
<tr>
<td><strong>Release Time</strong></td>
<td>2mS</td>
</tr>
<tr>
<td><strong>Min. Life</strong></td>
<td>$5 \times 10^5$ ops</td>
</tr>
<tr>
<td><strong>Input Channels</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>Isolation</strong></td>
<td>Isolation with Common Source</td>
</tr>
<tr>
<td><strong>Isolation Voltage</strong></td>
<td>3750 Vrms</td>
</tr>
<tr>
<td><strong>Digital Level 0</strong></td>
<td>+1 V max</td>
</tr>
<tr>
<td><strong>Digital Level 1</strong></td>
<td>+4 to +30 V</td>
</tr>
<tr>
<td><strong>Input Impedance</strong></td>
<td>3K ohms</td>
</tr>
<tr>
<td><strong>Power Input</strong></td>
<td>+10 to +30 VDC</td>
</tr>
<tr>
<td><strong>Power Consumption</strong></td>
<td>1.3W (8060)</td>
</tr>
</tbody>
</table>
1.4 Block Diagram

- LED module
- EEPROM
- Embedded Controller
- RS-485 Interface
- Power Regulator

8041
+5V
IN.COM
IN0
IN1
IN13

8043
+5V
DO0
DO14
DO15

Data+
Data-
+Vs
GND
1.5 Wire Connection

Dry Contact signal input

8052

+IN+  +IN-

8050/53

(B)GND  DI0  DI1  ...  DIx

8041/60

IN.COM  IN1  IN2  ...  INx

TTL/CMOS signal input

8052

+IN+  +IN-

8050/53

(B)GND  DI0  DI1  ...  DIx

8041/60

IN.COM  IN1  IN2  ...  INx

TTL+5V

TTL.GND
Open Collector signal input

8052/

8050/53

8041/60
Open Collector output

8050

Note: while connect inductive load (for example to drive relay), the diode is needed for prevent the counter EMF.

8043
1.6 Quick Start

Refer to “8000 Bus Converter User Manual” and “Getting Start” for detail.

1.7 Default Setting

Default setting for 8000 DIO modules:
- Address: 01
- Baudrate: 9600 bps
- Type: Type 40 for DIO mode
- Checksum Disable
- 8053 jumper setting at INIT*
- 8043 jumper setting at INIT

1.8 Jumper Setting

8043: Jumper J3 for select the pin INIT*/DO15
Select DO15  DO15 [●●●] INIT*
Select INIT*  DO15 [●●●] INIT* (default)

8053: Jumper J1 for select the pin INIT*/DI15
Select DI15  DI15 [●●●] INIT*
Select INIT*  DI15 [●●●] INIT* (default)

1.9 Configuration Tables

Configuration Table of 8000 DIO modules

Baudrate Setting (CC)
Type Setting (TT)
Type = 40 for DIO mode

Data Format Setting (FF)

<table>
<thead>
<tr>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>*1</td>
<td>*2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>*3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 : Counter Update Direction : 0=Falling Edge, 1=Rising Edge
*2 : Checksum Bit : 0=Disable, 1=Enable
*3 : 8050 = 0 (Bit[2.1.0] = 000), 8060 = 1 (Bit[2.1.0] = 001)
     8052 = 2 (Bit[2.1.0] = 010), 8053 = 3 (Bit[2.1.0] = 011)

Read Digital Input/Output Data Format
Data of $AA6,$AA4,$AALS : (First Data)(Second Data)00
Data of @AA : (First Data)(Second Data)

<table>
<thead>
<tr>
<th></th>
<th>First Data</th>
<th>Second Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>8041</td>
<td>DI(8-13)</td>
<td>00 to 3F</td>
</tr>
<tr>
<td>8043</td>
<td>DO(8-15)</td>
<td>00 to FF</td>
</tr>
<tr>
<td>8050</td>
<td>DO(0-7)</td>
<td>00 to FF</td>
</tr>
<tr>
<td>8052</td>
<td>DI(0-7)</td>
<td>00 to FF</td>
</tr>
<tr>
<td>8053</td>
<td>DI(8-15)</td>
<td>00 to FF</td>
</tr>
<tr>
<td>8060</td>
<td>DO(1-4)</td>
<td>00 to FF</td>
</tr>
<tr>
<td>8067</td>
<td>DO(0-7)</td>
<td>00 to FF</td>
</tr>
</tbody>
</table>
2. Command

Command Format : \textbf{(Leading)(Address)(Command)[CHK](cr)}
Response Format : \textbf{(Leading)(Address)(Data)[CHK](cr)}

[CHK] 2-character checksum

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

Calculate Checksum :
1. Calculate ASCII sum of all characters of command(or response) string except the character return(cr).
2. Mask the sum of string with 0ffh.

Example :

Command string : $012\text{(cr)}$

Sum of string = ‘$’+‘0’+‘1’+‘2’ $= 24h+30h+31h+32h = B7h$

The checksum is B7h, and [CHK] = “B7”

Command string with checksum : $012B7\text{(cr)}$

Response string : !01400600\text{(cr)}

Sum of string : ‘!’+‘0’+‘1’+‘4’+‘0’+‘0’+‘6’+‘0’+‘0’
$= 21h+30h+31h+34h+30h+30h+36h+30h+30h = 1ACh$

The checksum is ACh, and [CHK] = “AC”

Response string with checksum : !01400600AC\text{(cr)}
### General Command Sets

<table>
<thead>
<tr>
<th>Command</th>
<th>Response</th>
<th>Description</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>%AANNTCCFF</td>
<td>!AA</td>
<td>Set Module Configuration</td>
<td>Sec.2.1</td>
</tr>
<tr>
<td>#**</td>
<td>No Response</td>
<td>Synchronized Sampling</td>
<td>Sec.2.2</td>
</tr>
<tr>
<td>#AABBDD</td>
<td>&gt;</td>
<td>Digital Output</td>
<td>Sec.2.3</td>
</tr>
<tr>
<td>#AAN</td>
<td>!AA(Data)</td>
<td>Read Digital Input Counter</td>
<td>Sec.2.4</td>
</tr>
<tr>
<td>$AA2</td>
<td>!AATTCCFF</td>
<td>Read Configuration</td>
<td>Sec.2.5</td>
</tr>
<tr>
<td>$AA4</td>
<td>!S(Data)</td>
<td>Read Synchronized Data</td>
<td>Sec.2.6</td>
</tr>
<tr>
<td>$AA5</td>
<td>!AAS</td>
<td>Read Reset Status</td>
<td>Sec.2.7</td>
</tr>
<tr>
<td>$AA6</td>
<td>!(Data)</td>
<td>Read Digital I/O Status</td>
<td>Sec.2.8</td>
</tr>
<tr>
<td>$AAF</td>
<td>!AA(Data)</td>
<td>Read Firmware Version</td>
<td>Sec.2.9</td>
</tr>
<tr>
<td>$AAM</td>
<td>!AA(Data)</td>
<td>Read Module Name</td>
<td>Sec.2.10</td>
</tr>
<tr>
<td>$AAC</td>
<td>!AA</td>
<td>Clear Latched Digital Input</td>
<td>Sec.2.11</td>
</tr>
<tr>
<td>$AACN</td>
<td>!AA</td>
<td>Clear Digital Input Count</td>
<td>Sec.2.12</td>
</tr>
<tr>
<td>$AALS</td>
<td>!(Data)</td>
<td>Read Latched Digital Input</td>
<td>Sec.2.13</td>
</tr>
<tr>
<td>@AA</td>
<td>&gt;(Data)</td>
<td>Read Digital Input</td>
<td>Sec.2.14</td>
</tr>
<tr>
<td>@AA(Data)</td>
<td>&gt;</td>
<td>Set Digital Output</td>
<td>Sec.2.15</td>
</tr>
<tr>
<td>~AAO(Data)</td>
<td>!AA</td>
<td>Set Module Name</td>
<td>Sec.2.16</td>
</tr>
</tbody>
</table>

### Host Watchdog Command Sets

<table>
<thead>
<tr>
<th>Command</th>
<th>Response</th>
<th>Description</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>~**</td>
<td>No Response</td>
<td>Host OK</td>
<td>Sec.2.17</td>
</tr>
<tr>
<td>~AA0</td>
<td>!AASS</td>
<td>Read Module Status</td>
<td>Sec.2.18</td>
</tr>
<tr>
<td>~AA1</td>
<td>!AA</td>
<td>Reset Module Status</td>
<td>Sec.2.19</td>
</tr>
<tr>
<td>~AA2</td>
<td>!AAVV</td>
<td>Read Host Watchdog Timeout Value</td>
<td>Sec.2.20</td>
</tr>
<tr>
<td>~AA3EVV</td>
<td>!AA</td>
<td>Set Host Watchdog Timeout Value</td>
<td>Sec.2.21</td>
</tr>
<tr>
<td>~AA4V</td>
<td>!AA(Data)</td>
<td>Read PowerOn/Safe Value</td>
<td>Sec.2.22</td>
</tr>
<tr>
<td>~AA5V</td>
<td>!AA</td>
<td>Set PowerOn/Safe Value</td>
<td>Sec.2.23</td>
</tr>
</tbody>
</table>
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: type 40 for DIO module
- CC: new baudrate for setting module (Ref Sec.1.9). It is needed to short the INIT* to ground while change baudrate. (Ref Sec.3.1)
- FF: new data format for setting module (Ref Sec.1.9). It is needed to short the INIT* to ground to change checksum setting. (Ref Sec.3.1)

**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

**Example**: Command: %0102400600 Receive: !02

Set module address 01 to 02, return success.

**Related Command**: Sec.2.5 $AA2

**Related Topics**: Sec.1.9 Configuration Tables, Sec.3.1 INIT* pin Operation
2.2 #**

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.

Command : $014 
Receive : !10F0000
Read synchronized data from address 01, return S=1, first read and data

Command : $014 
Receive : !00F0000
Read synchronized data from address 02, return S=0, have readed and data.

Related Command :
Sec.2.6 $AA4
2.3 #AABBDD

**Description**: Digital Output

**Command**: #AABBDD[CHK](cr)

- `#` delimiter character
- `AA` address of reading module (00 to FF)
- `BBDD` output command and parameter

For output multi-channel, the `BB = 00, 0A or 0B` the select which output group, and the `DD` is the output value.

<table>
<thead>
<tr>
<th>Parameter for Multi-Channel Output</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output Channels</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>8043</td>
</tr>
<tr>
<td>8050</td>
</tr>
<tr>
<td>8060</td>
</tr>
<tr>
<td>8067</td>
</tr>
</tbody>
</table>

For output single-channel, the `BB = 1c, Ac or Bc` where `c` is the selected channel, and the `DD` must be 00 to clear output and 01 to set output.
Response:  Valid Command :  >[CHK](cr)
Invalid Command :  ?[CHK](cr)
Ignored Command :  ![CHK](cr)
Syntax error or communication error may get no response.
>
> delimiter for valid command
?
? delimiter for invalid command
!
! delimiter for ignore the command. The module’s host watchdog timeout status is set, and the output is set to Safe Value.

Example:
Command : #0100FF Receive : >
Assume module is 8041, set address 01 output value FF, return success.
Command : #021001  Receive : >
Assume module is 8067, set address 02 channel 0 on, return success.
Command : #021701  Receive : ?
Set address 02 channel 7 on, return the channel is invalid for 8067 only have 7-channel outputs (0 to 6).
Command : #0300FF  Receive : !
Set address 03 output value FF, return ignore. The module’s host watchdog timeout status is set, and the output is set to Safe Value.

**Related Command**:
*Sec.2.15 @AA(Data), Sec.2.18 ~AA0, Sec.2.19 ~AA1*

**Related Topics**:
*Sec.1.9 Configuration Tables, Sec.3.2 Module Status, Sec.3.3 Dual Watchdog Operation*

**Note**:
The command is useless for 8041/52/53.
2.4 #AAN

Description: Read Digital Input Counter from channel N

Command: #AAN[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.

Command: #025 Receive: ?02
Read address 02 digital input counter value of channel 5, return the channel is not available.

Related Command:
Sec.2.12 $AACN

Note:
The command is useless for 8043/8067
2.5 $AA2

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:

!AATTCFF[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 (Ref Sec.1.9)

FF data format of module (Ref Sec.1.9)

Example:

Command: $012 Receive: !01400600

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

Related Command:

Sec2.1 %AANNTTTCFF

Related Topics:

Sec.1.9 Configuration Tables, Sec3.1 INIT* pin Operation
2.6 $AA4

**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)
  - AA: address of response module (00 to FF)
  - S: status of synchronized data, 1 = first read, 0 = been readed
  - (Data): synchronized DIO value (Ref Sec.1.9)
- **Invalid Command**: ?AA[CHK](cr)
  - Syntax error or communication error may get no response.

- !: delimiter for valid command
- ?: delimiter for invalid command

**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

**Related Command**: Sec2.2 #**

**Related Topics**: Sec.1.9 Configuration Tables
2.7 $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.

**Related Topics**:

Sec3.4 Reset Status
2.8 $AA6

Description: Read Digital I/O Status

Command: $AA6[CHK](cr)

$       delimiter character
AA      address of reading module (00 to FF)
6       command for read digital input/output status

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)  digital input/output value (Ref Sec.1.9)

Example:
Command: $016   Receive: !0F0000

Assume module is 8060, read address 01 DIO status, return 0F00, digital input IN1 to IN4 are open, digital output RL1 to RL4 are off.

Related Command:
Sec.2.14 @AA

Related Topics:
Sec1.9 Configuration Tables
2.9 $AAF

**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.

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

Read address 01 firmware version, return version B1.1.
2.10 $AAM

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 : !017041
Read address 01 module name, return name 8041.
Command : $03M  Receive : !037060D
Read address 03 module name, return name 8060D.

Related Command :
Sec.2.16 ~AAO(Data)
2.11 $AAC

Description: Clear Latched Digital Input

Command: $AAC[CHK](cr)

$ delimiter character
AA address of setting module (00 to FF)
C command for clear latched digital input

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: $01L0 Receive: !01FFFF00
Read address 01 latch-low data, return FFFF.
Command: $01C Receive: !01
Clear address 01 latched data, return success.
Command: $01L0 Receive: !01000000
Read address 01 latch-low data, return 0000.

Related Command:
Sec2.13 $AALS

Note:
The command is useless for 8043/8067.
2.12 $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.

Command : #010     Receive : !0100000  
Read address 01 input channel 0 counter value, return 0.

**Related Command** :

Sec2.4 #AAN

**Note** :
The command is useless for 8043/8067.
2.13 $AALS

**Description**: Read Latched Digital Input

**Command**: $AALS[CHK](cr)

$  delimiter character  
AA  address of reading module (00 to FF)  
L  command for read latched digital input  
S  1 = select latch high status, 0 = select latch low status

**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 status (Ref Sec. 1.9). 1 = the input channel is latched, 0 = the input channel is not latched.

**Example**:

Command : $01L1  
Receive : !012300  
Read address 01 latch-high data, return 0123.

Command : $01C  
Receive : !01  
Clear address 01 latched data, return success.

Command : $01L1  
Receive : !000000  
Read address 01 latch-high data, return 0.

**Related Command**:

Sec2.11 $AAC

**Note**:

The command is useless for 8043/8067.
2.14 @@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 (Ref Sec.1.9)

Example:
Command : @@01 Receive : >0F00
Read address 01 DIO status, return 0F00.

Related Command :
Sec.2.8 $AA6

Related Topics :
Sec.1.9 Configuration Tables
2.15 @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 8060, from 0 to F
(Data) is two characters for output channel less than 8
For 8050, from 00 to FF
For 8067, from 00 to 7F
(Data) is four characters for output channel less than 16
For I-7043/43D, from 0000 to FFFF

**Response** :

Valid Command : >[CHK](cr)
Invalid Command : ?[CHK](cr)
Ignore Command : ![CHK](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: @017  Receive: >
Output address 02 value 7, return success. (The example is suitable for 8060)
Command: @0200  Receive: >
Output address 01 value 00, return success. (The example is suitable for 8050/67)

Command: @030012  Receive: !
Output address 03 value 0012, return the module is in host watchdog timeout mode, the output command is ignored.

Related Command:
Sec.2.3 #AABBDD, Sec.2.18 ~AA0, Sec.2.19 ~AA1

Related Topics:
Sec.1.9 Configuration Tables, Set.3.2 Module Status, Sec.3.3 Dual Watchdog Operation, Sec.3.5 Digital Output

Note:
The command is useless for 8041/52/53.
2.16 ~AAO(Data)

**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
- (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 : ~01O7050 Receive : !01

Set address 01 module name 7050, return success.

Command : $01M Receive : !017050

Read address 01 module name, return name 8050.

**Related Command** :

Sec.2.10 $AAM
2.17 **

**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

**Related Command**:
Sec.2.18 ~AA0, Sec.2.19 ~AA1, Sec.2.20 ~AA2, Sec.2.21 ~AA3EVV, Sec.2.22 ~AA4V, Sec.2.23 ~AA5V

**Related Topic**:
Sec.3.2 Module Status, Sec.3.3 Dual Watchdog Operation
2.18 ~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.

Example:
Refer Sec.2.21 ~AA3EVV example

Related Command:
Sec.2.17 ~**, Sec.2.19 ~AA1, Sec.2.20 ~AA2, Sec.2.21 ~AA3EVV, Sec.2.22 ~AA4V, Sec.2.23 ~AA5V

Related Topic:
Sec.3.2 Module Status, Sec.3.3 Dual Watchdog Operation
## 2.19 ~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)

**Example**: Refer Sec.2.21 ~AA3EVV example

**Related Command**:

- Sec.2.17 ~**, Sec.2.18 ~AA0, Sec.2.20 ~AA2, Sec.2.21 ~AA3EVV, Sec.2.22 ~AA4V, Sec.2.23 ~AA5V

**Related Topic**:

- Sec.3.2 Module Status, Sec.3.3 Dual Watchdog Operation
2.20 ~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

Example:

Refer Sec.2.21 ~AA3EVV example

Related Command:

Sec.2.17 ~**, Sec.2.18 ~AA0, Sec.2.19 ~AA1, Sec.2.21 ~AA3EVV, Sec.2.22 ~AA4V, Sec.2.23 ~AA5V

Related Topic:

Sec.3.2 Module Status, Sec.3.3 Dual Watchdog Operation
2.21 ~AA3EVV

**Description**: Set Host Watchdog Timeout Value

**Command**: ~AA3EVV[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 module 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.

**Related Command**:

Sec.2.17 ~**, Sec.2.18 ~AA0, Sec.2.19 ~AA1, Sec.2.20 ~AA2,
Sec.2.22 ~AA4V, Sec.2.23 ~AA5V

**Related Topic**:

Sec.3.2 Module Status, Sec.3.3 Dual Watchdog Operation
2.22 ～AA4V

**Description**: Read PowerOn/Safe Value.

**Command**: ～AA4V[CHK](cr)

～    delimiter character
AA    address of reading module (00 to FF)
4     command for read PowerOn/Safe value
V     P = read PowerOn 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) PowerOn Value or Safe Value

For 8043 (Data) is VVVV, where VVVV is the PowerOn Value (or Safe Value).
For modules, (Data) is VV00, where VV is the PowerOn Value (or Safe Value).

**Example**:

Command : @010000    Receive : >
Output address 01 value 0000, return success.

Command : ～015S      Receive : !01
Set address 01 Safe Value, return success.

Command : @01FFFF    Receive : >
Output address 01 value FFFF, return success.
Command : ~015P Receive : !01
Set address 01 PowerOn Value, return success.
Command : ~014S Receive : !010000
Read address 01 Safe Value, return 0000.
Command : ~014P Receive : !01FFFF
Read address 01 PowerOn Value, return FFFF.

**Related Command** :
*Sec.2.17 ~**, Sec.2.18 ~AA0, Sec.2.19 ~AA1, Sec.2.20 ~AA2,
Sec.2.21 ~AA3EVV, Sec.2.23 ~AA5V*

**Related Topic** :
*Sec.3.2 Module Status, Sec.3.3 Dual Watchdog Operation*

**Note** :
The command is useless for 8041/52/53.
2.23 ~AA5V

Description : Set PowerOn/Safe Value.

Command : ~AA5V[CHK](cr)

~ delimiter character
AA address of setting module (00 to FF)
5 command for set PowerOn/Safe Value
V P = set current output as PowerOn Value, 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 : @01AA Receive : >
Output address 01 value AA, return success.

Command : ~015P Receive : !01
Set address 01 PowerOn Value, return success.

Command : @0155 Receive : >
Output address 01 value 55, return success.

Command : ~015S Receive : !01
Set address 01 Safe Value, return success.

Command : ~014P Receive : !01AA00
Read address 01 PowerOn Value, return PowerOn Value AA.
Command: ~014S  Receive: !015500
Read address 01 Safe Value, return Safe Value 55.

Related Command:
Sec.2.17 ~**, Sec.2.18 ~AA0, Sec.2.19 ~AA1, Sec.2.20 ~AA2,
Sec.2.21 ~AA3EVV, Sec.2.22 ~AA4V

Related Topic:
Sec.3.2 Module Status, Sec.3.3 Dual Watchdog Operation

Note:
The command is useless for 8041/52/53.
3. Application Note

3.1 INIT* pin Operation

Each 8000 module has a build-in EEPROM to store configuration information such as address, type, baudrate and other information. Sometimes, user may forget the configuration of the module. Therefore, the 8000 have a special mode named “INIT mode”, to help user to resolve the problem. The “INIT mode” is setting as Address=00, baudrate=9600bps, no checksum

To enable INIT mode, please following these steps:

Step1. Power off the module
Step2. Connect the INIT* pin with the GND pin.
Step3. Power on
Step4. Send command $002(cr) in 9600bps to read the configuration stored in the module’s EEPROM.

Refer to “8000 Bus Converter User Manual” Sec.5.1 and “Getting Start” for more information.

3.2 Module Status

PowerOn Reset or Module Watchdog Reset will let all output goto PowerOn 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.
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 be down by the external signal. The circuit may let the module to work continues and never halt.

The Host Watchdog is a software function to monitor the host’s operating status. Its purpose is to prevent the network from communication problem or host halt. When the timeout interval expired, the module will turn all outputs to predefined Safe Value. This can prevent the controlled target from unexpected situation.

The 8000 module with Dual Watchdog may let the control system more reliable and stable.

3.4 Reset Status

The Reset Status is set while the module power on or reset by Module Watchdog, and is cleared while the command read Reset Status ($AA5) applied. This is useful for user to check the module’s working status. When the Reset Status is set means the module is reset and the output may be changed to the PowerOn Value. When the Reset Status is clear means the module is not reseted, and the output is not changed.

3.5 Digital Output

The module’s output have 3 different situation:

1. Safe Value. If the host watchdog timeout status is set, the output is set to Safe Value. While the module receive the out-
put command, like @AA(Data) or #AABBDD, the module will ignore the command and return ‘!’, and will not change the output to the output command value. The host watchdog timeout status is set and store into EEPROM while the host watchdog timeout interval expired, and only can be cleared by command ~AA1. If user want to change the output, he need to clear the host watchdog timeout status firstly, and send output command to change the output into desired value.

<2> PowerOn Value. Only the module reseted, and the host watchdog timeout status is clear, the module’s output is set to predefined PowerOn Value.

<3> Output command value. If the host watchdog timeout status is clear, and user issue a digital output command, like @AA(Data) or #AABBDD, to module for changing the output value. The module will response success (receive >).

3.6 Latch Digital Input

For example, user connect the key switch to digital input channel of a digital input/output module and want to read the key stoke. The key input is a pulse digital input, and user will lost the stroke. While reading by command $AA6 in A and B position, the response is that no key stroke and he will lose the key stroke information. Respectly, the read latch-low digital input command $AAL0 will slove this problem. When issue $AAL0 command in A and B position, the response denote that there is a low pulse between A and B position for a key stokke.
4 DN Module

4.1 DN-SSR4

Output Channel: 4 Solid State Relay Contact

Output Specification:
- Type: Zero-Cross AC Solid-State Relay Output
- Rated Load Voltage: 200 to 240 VAC
- Rated Load Current: 4 Arms
- Surge Current: 50A
- Max. Off-State Leakage Current: 5.0 mA
- Operate Time: 1/2 cycle of voltage sine wave + 1mS

Input Impedance: 1.5K Ohms
Din-Rail mounted
Power Input: +24VDC
4.2 DN-PR4

Output Channel: 4 Relay Contact

Output Specification:

Type: 1 FormC Relay Contact
Nominal Load: 5A@250VAC, 5A@30VDC
Max. Switching Power: 1250 VAC
Max. Switching Voltage: 250VAC, 150VDC
Max. Switching Current: 5A
Mechanical/Electrical Life: Min. 10*10^6/100*10^3 ops.
Operate/Release Time: Max. 10mS/5mS
Dielectric Strength: 2000VAC 1 minute

Nominal Coil Power: 360mW
Din-Rail mounted
Power Input: 24VDC
4.3 RM-104, RM-108, RM-116

Output Channel: 4/8/16 Relay Contact

Output Specification:
- Type: 1 FormC Relay Contact
- Rated Load: 16A @ 250VAC
- Max. Switching Voltage: 400VAC
- Max. Peak Current: 30A
- Standard Contact Material: AgCd0
- Min. Life: 100,000 ops.

Din-Rail mounted

Dimension:
- RM-104: 78mm * 77mm
- RM-108: 135mm * 77mm
- RM-116: 270mm * 77mm

Power Input: 24VDC
4.4 RM-204, RM-208, RM-216

Output Channel: 4/8/16 Relay Contact

Relay Specification:
- Type: 2 FormC
- Rated Load: 5A @ 250VAC
- Max. Switching Voltage: 400VAC
- Max. Peak Current: 10A
- Standard Contact Material: Ag Nt
- Min. Life: 100,000 ops.

Din-Rail mounted

Dimension:
- RM-204: 78mm * 77mm
- RM-208: 135mm * 77mm
- RM-216: 270mm * 77mm

Power Input: 24VDC
4.5 Application

The DN Modules are the IO extension of 8000 modules. These modules may drive more power and heavy load in application. User may use 8000 modules, like 8043 or others, to control the DN modules to drive loads.