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Application Note: 156

Board Command Information

INTRODUCTION

This document explains in more detail the board command structure. The commands shown in this document may not be available in all the board versions, or in older board releases. Some boards may have additional commands that are not listed in this document.

ASCII COMMAND STRUCTURE

All the relay board versions recognize standard 7 Bit ASCII characters that are transmitted from the host computer. The commands must be concatenated and a carriage return must be transmitted to complete the string. Note: when sending back to back commands there must be at least 1 ms delay between these commands, or the boards will not properly recognize the commands. The different board commands are explained below. The commands are transmitted in the following format in one string front left to right:

Command Structure: "AH1<cr>" (without the quotes) as shown below
"<Board Identification><Board Command><Relay Number or Data><Carriage return>"

Board Identification (address)	Board Commands	Relay Number or Data
On 8 channel boards this is the setting of the dip switch as shown in table #1. On 1 & 2 channel versions this address is set to "A" in firmware and may not be altered.	H = Relay HIGH (ON) L = Relay LOW (OFF) R = Read relay status W = Write data (multiple relays) M = Momentary activation T = Toggle relay I or a = read port 1 input O or A = write port 1 output b = read port 2 input B = write port 2 output c = read port 3 input C = write port 3 output d = read port 4 input D = write port 4 output ! = Test command	(H or L) = Relay number 1-8 or 0 to turn ON all relays on the selected board (R) = receive a number 0 (W) = write a number 0 – 255 (M) = Relay number 1-8 or 0 for all relays (T) = Relay number 1-8 or 0 for all relays Input / outputs see information below

Note: All commands are case sensitive. With the new additional commands, the use of upper and lower case commands became a necessity. In previous versions of our boards all commands were in uppercase.

If you are using the Windows operating system, all the board commands and values explained below may be tested using the relay test program software available for download from our website.

Board identification:

The board address is the first part of the command sent to the relay board(s) it ranges from A to P as shown in table 1. If your only using one board, or the 1 & 2 channel versions connected to the PC this command will always stay the same (factory default = A). If your using multiple boards, this part of the command will change depending on which board you want to address. The board address must be sent with any command.

Each 8 channel board connected in the daisy chain configuration, must have a different address to communicate properly with each board.

Example: Dip switch setting = ON-OFF-ON-ON or (1011 in binary) = board address "L", you would replace the 'A' with a 'L' to address this board.

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Board Commands:

The board command is the second part of the serial data sent to the relay board(s) . These commands work in conjunction with the third part of the serial data that will be explained in the following section. All the commands are upper/ lowercase letters or characters, no numbers are used.

H = Relay High (ON) – Sending an "H" will direct the board to turn ON the relay (thus making a connection between the NO & COM contacts on the board). Note: when power is initially applied to the board and no relays were activated, there will be a connection between the NC & COM terminals.

L = Relay Low (OFF) – Sending an "L" will direct the board to turn OFF the relay (breaking the connection between the NO & COM contacts on the board).

Dip Switch Setting				Board
1	2	3	4	Address
OFF	OFF	OFF	OFF	A
OFF	OFF	OFF	ON	B
OFF	OFF	ON	OFF	C
OFF	OFF	ON	ON	D
OFF	ON	OFF	OFF	E
OFF	ON	OFF	ON	F
OFF	ON	ON	OFF	G
OFF	ON	ON	ON	H
ON	OFF	OFF	OFF	I
ON	OFF	OFF	ON	J
ON	OFF	ON	OFF	K
ON	OFF	ON	ON	L
ON	ON	OFF	OFF	M
ON	ON	OFF	ON	N
ON	ON	ON	OFF	O
ON	ON	ON	ON	P

Table 1

W = Write data latch – Sending an "W" will write directly to the port latch. This latch is 8 bits wide and corresponds to the number of relays on the board. This command allows you to turn multiple relays ON or OFF on the same board at the same time.

R = Read relay status – This code is a bit different than the three commands above. When this command is sent to the board – the board will respond back to the PC with a number which corresponds to the status of the relays on the board. This will be explained in more detail below:

M = Momentary Command. This command will briefly activate or deactivate a single relay or all relays. The initial state of the relay will determine whether the relay toggles ON – OFF – ON or OFF – ON – OFF. The momentary delay default is 30 milliseconds, but may be changed from 10-50 milliseconds in the setup.

T = Toggle command The toggle command will reverse the relay from it's current position. The initial state of the relay will determine whether the relay toggles ON or OFF. If the relay is currently ON (connection between NO & COM pins on the terminal block) it will turn the relay OFF (connection between NC & COM pins on the terminal block)

I or a = Input commands for port number 1 on the board. Either command may be used as they are interchangeable.

O or A = Output commands for port number 1 on the board. Either command may be used as they are interchangeable. This command is not used for the opto-isolated input versions.

b = Input commands for port number 2 on the board.

B = Output command for port number 2 on the board. This command is not used for the opto-isolated versions.

c = Input command for port number 3 on the board.

C = Output command for port number 3 on the board. This command is not used for the opto-isolated versions.

d = Input command for port number 4 on the board.

D = Output command for port number 4 on the board. This command is not used for the opto-isolated versions.

! = Test command. Send this command and the board will respond with a known value of 170 decimal (10101010 binary equivalent) used for testing purposes.

Relay Number or Data:

The relay number or data command is the third part of the serial data sent to the relay board(s) this data is numerical. The data that is sent or received will relate directly to the board commands that were explained in the previous section.

If the board command is **"H" or "L"**:
Send a number from 1 to 8 which represents the relay number available on the board and will turn ON or OFF the individual relay specified. You may also send a zero which will turn ON or OFF **ALL** relays on this board.

If the board command is **"W"**: (example for the 8 channel board) See table #2
Send a number from 0 to 255. When this number is converted into binary it represents the relay numbers on the board. This command allows you to turn multiple relays ON or OFF at the same time with one command. Binary data is one's and zero's which represents ON and OFF on the relay board (ON = 1 & OFF = 0). See the example below.

Example:

If you wish to turn ON relay 2, 5 & 7 and leave all the others OFF you would send decimal number 82. This will turn ON the proper relays and turn all the rest OFF. Conversion from binary to decimal can easily be accomplished

Relay numbers on board								Decimal Equivalent	Relays Active
8	7	6	5	4	3	2	1		
0	1	0	1	0	0	1	0	82	(relays 2,5,7 ON)
1	0	1	0	1	0	1	0	170	(relays 2,4,6,8 ON)
0	0	0	0	0	0	0	0	0	(All relays OFF)
1	1	1	1	1	1	1	1	255	(All relays ON)

Table 2

using the scientific calculator built into windows. Select the 'bin' check box in the calculator program and enter the binary number from left to right. Click the 'Dec' check box and the number will be converted to binary.

If the board command is "**R**":

Send any number from 0 to 255 (it doesn't matter it will be ignored). The relay board will immediately respond with decimal number from 0 to 255 representing which relays are active in the same method as explained above.

Note: If you are using the 1 or 2 channel relay boards these units will only respond with a number representing the maximum number of relays available on the board.

- 1 channel relay board maximum valid number returned is 1
- 2 channel relay board maximum valid number returned is 3

If the board command is "**M**":

Send a number from 1 to 8 which represents the relay number available on the board, and it will momentarily active (or deactivate) the individual relay specified. You may also send a zero which will momentarily active (or deactivate) **ALL** relays on this board. The initial state of the relay will determine whether it is turned ON or OFF.

If the board command is "**T**":

Send a number from 1 to 8 which represents the relay number available on the board, and it will reverse the relay from it's current position on the individual relay specified. You may also send a zero which will toggle **ALL** relays on this board.

Input Commands:

The following commands are input commands. These commands are available on some boards, and some models may also have more than one input port. Some ports do not have 8 channels, and these board will only respond to the number of channels available on the board. Some ports may also be setup as a combination of inputs and outputs on the same port. If your board has opto-isolated inputs, these are inputs only and do not have any outputs. All boards are set to inputs when programmed at the factory.

Data values are what is transmitted to the board.

Return value is the information transmitted back to the PC from the board.

If the board command is "**I**" or "**a**":

For boards that only have one input port, the board will respond only to the above commands. To read the port, transmit a zero as the data part of the string, and the unit will read all the channels and reply with a return value. Valid data values to send are 0 to 255 decimal, values greater than zero is a mask function and is explained below. See table #3

If the board command is "**b**":

For boards that only have more than one input port, use the above command to access the second port.

If the board command is "**c**":

For boards that only have more than two input ports, use the above command to access the third port.

Channel numbers on board								Decimal Equivalent	Pins Active
8	7	6	5	4	3	2	1		
0	1	0	1	0	0	1	0	82	(inputs 2,5,7 ON)
1	0	1	0	1	0	1	0	170	(inputs 2,4,6,8 ON)
0	0	0	0	0	0	0	0	0	(All inputs OFF)
1	1	1	1	1	1	1	1	255	(All inputs ON)

Table 3

If the board command is "**d**":

For boards that only have more than three input ports, use the above command to access the fourth port.

When sending any of the input commands above to the board, the unit will read the data latch and reply with the decimal return value representing the state of the inputs connected to the board. Convert the decimal value to binary to determine which pin or pins are active. The valid return values are 0 to 255 on boards with 8 channels. Sending a zero, the units will read the state of both the inputs and the output latch if these are setup as a combination of both, use the mask function below to isolate individual or multiple pins.

Note: for (binary to decimal) or (decimal to binary) conversion see the information in the relay section above.

Input Mask:

To read only one or multiple pins you may send a value between 1 & 255, this is a mask that will restrict which of the port pins you wish to read. Example: to read channel 1 you would send a mask of 1 (00000001 in binary) to read this pin only. If this pin is active it will reply with a 1, if this pin is a zero it will respond with a zero. If you want to read channel 8 send a value of 128 (10000000 in binary).   If this pin is active it will reply with a 128, if this pin is a zero it will respond with a zero.

If you want to read both channels 7 & 8 you will send a mask of 192 (11000000 in binary). If both pins are zero it will return a zero if pin 8 is active and pin 7 is zero it will return a 128 (10000000 in binary). If pin 7 is one and pin 8 is zero it will return a 64 (01000000 in binary) If both pins are active it will return a 192 (11000000 in binary) showing both pins are active. See table #4

Binary Port Value								Decimal	Binary Mask Data								Decimal	Result		
8	7	6	5	4	3	2	1	Number	8	7	6	5	4	3	2	1	Number	Dec	Binary	Notes
1	0	1	1	1	0	0	1	185	0	0	0	0	0	0	0	1	1	1	00000001	Pin 1 is ON
1	1	0	0	0	1	1	0	198	0	0	0	0	0	0	0	1	1	0	00000000	Pin 1 is OFF
1	0	1	0	0	0	0	1	161	1	0	0	0	0	0	0	0	128	128	10000000	Pin 8 is ON
0	0	1	1	1	0	0	0	56	1	0	0	0	0	0	0	0	128	0	00000000	Pin 8 is OFF
1	0	0	1	1	1	1	1	159	1	1	0	0	0	0	0	0	192	128	10000000	Pin 8 ON, 7 OFF
0	1	1	0	0	0	0	1	97	1	1	0	0	0	0	0	0	192	64	01000000	Pin 8 OFF, 7 ON
1	1	0	0	1	1	0	0	204	1	1	0	0	0	0	0	0	192	192	11000000	Pin 8 & 7 are ON

Table 4

Note in the table #4 , the board will only read the pins where there a is 1 in the mask position, it will ignore any other data that is on the other pins.   If your board has less than 8 channels, the mask will only work on the number of channels that are available.

Output Commands:

The following commands are output commands. These commands are used on boards that have an I/O port, also some models may have more than one I/O port.   Also some ports do not have 8 channels, and these boards will only respond to the number of channels available on the board. The ports may be setup as a combination of inputs and outputs on the same port on different pins.

The valid data value is 0 to 255 decimal, and will represent the outputs in binary. A zero will turn all outputs OFF and a 255 will turn all outputs ON. Assuming all 8 channels are set to outputs, sending a 240 decimal will turn channels 8, 7, 6, 5 ON and 4,3,2,1 outputs OFF. Pins set to inputs in the setup program will be unaffected by this command, and no action will result. See table #5 for example.

Notes:
- If your board only has opto-isolated inputs, these ports are inputs only and do not have any outputs.
- I/O ports are set to inputs at the factory and must be changed in the setup program to use as output ports.

Channel numbers on board								Decimal	Output Pins Active
8	7	6	5	4	3	2	1	Number	
1	1	1	1	0	0	0	0	240	8,7,6,5 = ON 4,3,2,1 = OFF
1	0	1	0	1	0	1	0	170	8,6,4,2 = ON 7,5,3,1 = OFF
0	0	0	0	0	0	0	0	0	All Outputs OFF
1	1	1	1	1	1	1	1	255	All Output ON

Table 5

If the board command is **"O" or "A"**:
For boards that only have one I/O port, the board will respond only to the above commands.

If the board command is **"B"**:
For boards that only have more than one I/O port, use the above command to access the second port.

If the board command is **"C"**:
For boards that only have more than two I/O ports, use the above command to access the third port.

If the board command is **"D"**:
For boards that only have more than three I/O ports, use the above command to access the fourth port.

Reading the output port status:

To read the status of the output port, follow the procedure for reading the inputs above using the lower case command that matches your output port. The mask may be used to isolate only the status of the output pins you want to read.

If you need any additional information, email support on the contact page of our website at www.pencomdesign.com.