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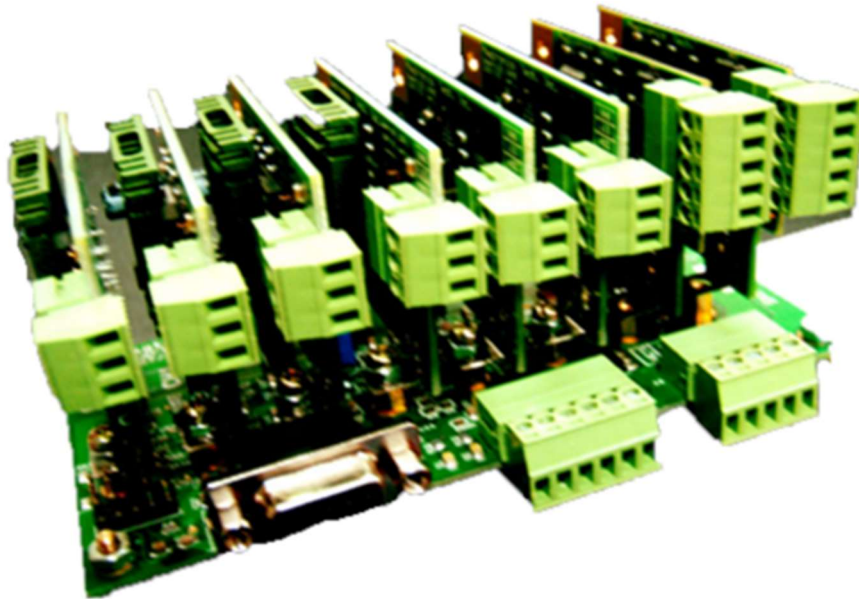
SmartLED controller 2.0 For AOI

Model: SmartLED-MB2.0-V3

High-Speed Strobe version

User's Manual

Version: 2.0 2022-12-01



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1. Features

- **Low-cost high-speed strobe version**

The driver has 8 registers to store 8 brightness combination of 8 channels. The host can activate the specific combination before camera capturing through 4 digital outputs. This scheme eliminates the expensive DAC card or the 64-channel digital I/O card. In addition, this driver also provides a digital output with programmable delay to trigger the camera capturing.

- **Modularized compact design, 8 channels available :**

The design of this driver uses one mother board to control 8 daughter boards. According to the application, you could select any number of daughter boards with different voltage and current ratings to be inserted to the mother board. The driver with 8 channels installed can be realized within the size of 130 x 70 x 70 mm³.

- **Three models of daughter boards :**

There are three models of daughter board for different LED light source 0005: 5V, 700mA, 1224: 12/24V, 650mA, 2416: 12/24V, 1600 mA. The daughter board can be furthermore programmed by DIP switch to select adequate maximal current level so that the resolution of the brightness can be increased.

- **8 registers per channel and 8 combinations per capturing :**

There are 8 registers of 8-bit for each channel which can be programed through RS232 or RS485 interface. In addition, there are also 8 combination registers which used for storing the combination of 8 channel active index.

- **Fast response, no blinking at extra low brightness :**

This driver employes special current control loop such that there is no blinking at extremely low brightness. The current ripple is **0.01%FS**. The response time for channel 0、1 : 25 us, channel 2~7 : 500 us.

- **Two serial interface implemented :**

RS232 or RS422 interface can be used to pre-program the value of the registers and the combination active index of 8 channels.



2. Description

SmartLED-MB2.0-V2 is a LED driver designed for high performance AOI application. It realizes the simultaneously change of 8-channel brightness.

The driver has 8 registers to store 8 brightness combination of 8 channels. The host can activate the specific combination before camera capturing through 4 digital outputs. In addition, this driver also provides a digital output with programmable delay to trigger the camera capturing.

This driver employs novel current control scheme so that the current ripple is very small (only 0.01% of full scale) as compared to conventional PWM current loop (1% of full scale). Hence, there is no blinking at very low brightness which is an easy way to check how stable the brightness is.

There is total 64 registers with 8-bit resolution for brightness control in which each mother board has 8 channels and each channel has 8 registers. Those registers can be pre-programed through RS232, and only one register of each channel can be activated to set the brightness of the specific channel.



3. Electrical Specification and dimension

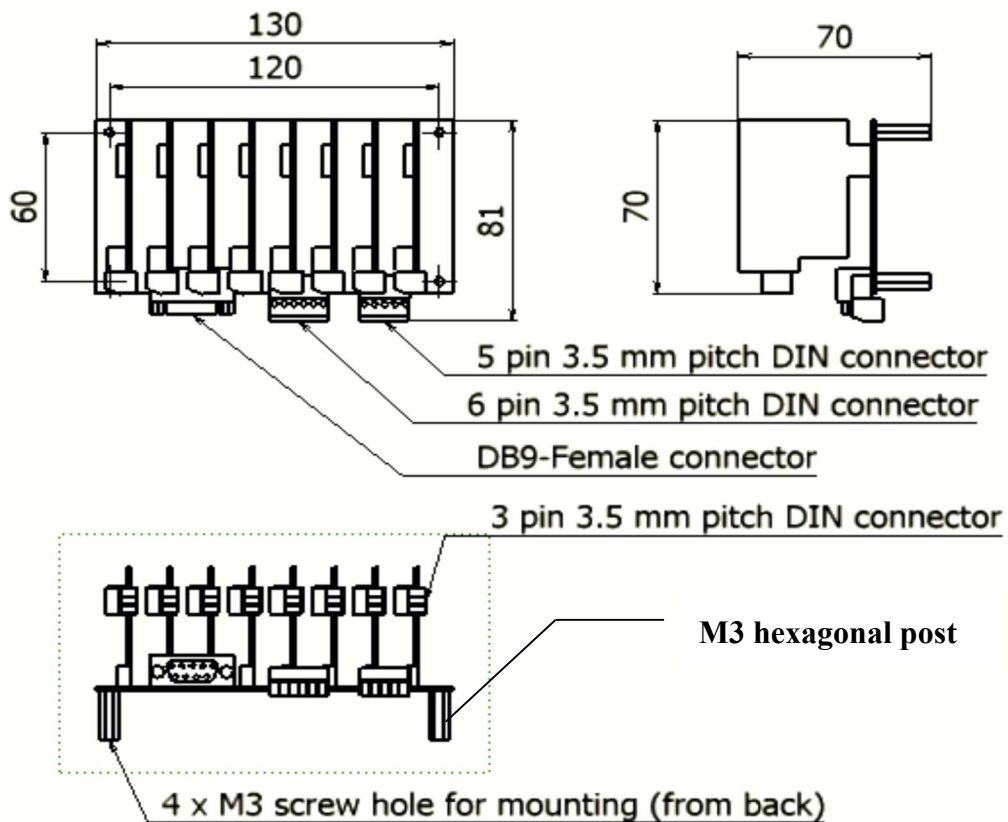
3.1 Electrical specification

| Item | Value | Unit |
|-------------------------------|------------------------|-----------------|
| Control supply voltage | 8~24 | V |
| RS232 interface | 57600 baud rate, N-8-1 | Echo ON. |
| RS422 interface | 57600 baud rate, N-8-1 | Echo OFF. |
| Digital input high voltage※ | >3.5 | V |
| Digital input low voltage※ | <1.5 | V |
| Digital output sink current※※ | 20 | mA |
| Operation condition | 0~70 °C | 20~90% Humidity |

※ All digital inputs are pull high to 5V through a 10K resistor. We recommend driving those inputs by open collector or dry contact outputs. (Not 5V TTL compatible)

※※ All digital outputs are open collector, the maximal pull high voltage is 24V.

3.2 Dimensions





4. Pin definition

J10 : Power connector

| Pin No. | Name | Function |
|---------|------|--|
| 1 | VCTL | Positive input of mother board (8~24V, 50mA) |
| 2 | GND | Common Ground |
| 3 | V5 | 5 V voltage positive input (power for 5V daughter board) |
| 4 | V12 | 12V voltage positive input (power for 12V daughter board) |
| 5 | V24 | 24 V voltage positive input (power for 24V daughter board) |

J9 : Digital I/O

| Pin No. | Name | IO type | Function |
|---------|------|---------|---|
| 1 | MSB | Input | Combination command bit2 (Low為0、High為1) |
| 2 | DSB | Input | Combination command bit1 (Low為0、High為1) |
| 3 | LSB | Input | Combination command bit0 (Low為0、High為1) |
| 4 | INT | Input | Combination command trigger |
| 5 | UPD | Output | Signal output when command finished (open <High> , close <Low>) |
| 6 | GND | Power | Digital common ground, internal connected to GND |

P1: RS-232/422 (DSUB 9-pin, female)

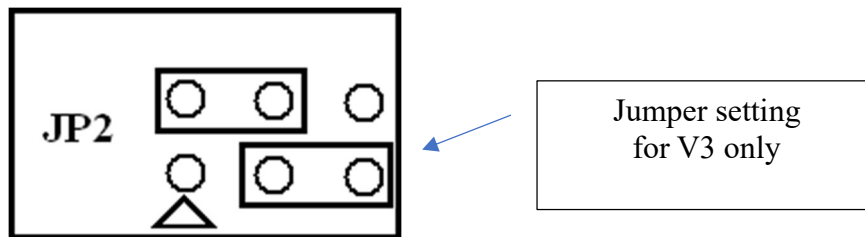
| Pin No. | Name | Function |
|-----------------|------|--|
| RS - 232 | | |
| 2 | TX | RS232 transmit (connected to HOST RX) ◦ |
| 3 | RX | RS232 receive (connected to HOST TX) ◦ |
| 5 | GND | Digital common ground, internal connected to GND |
| RS - 422 | | |
| 6 | T+ | RS422 transmit positive |
| 7 | T- | RS422 transmit negative |
| 8 | R+ | RS422 receive positive |
| 9 | R- | RS422 receive negative |



SW1: mode switch

| Pin No. | Name | Function |
|---------|------|--|
| 1 | TST | Test mode (should be OFF when normal operation) ° |
| 2 | MOD | RS-232/RS-422 selection(ON: RS-232 , OFF: RS-422) ° |
| 3 | TER | RS-422 terminal resistor (ON : connected , OFF : disconnected) ° |

JP2: I/O JUMPER



※ Do not plug or remove daughter board, I/O pin and jumpers when power is on, otherwise, the board may be damaged permanently.



5.Command list

All commands are ASCII code. Each field is separated by [Space] and CR(ASCII-13) should be at the end of command.

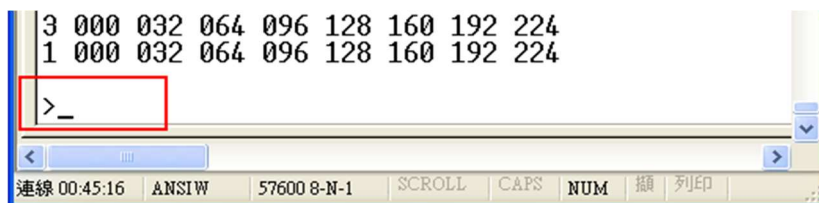
| Command | Opt1 | Opt2 | Value | Function |
|---------|---------|------|-------|--|
| RD | 0~7 | 0~7 | ※X | Read the value of (channel, register) |
| WT | 0~7 | 0~7 | 0~255 | Write the value of (channel, register) |
| WC | 0~7 | 0~7 | 0~7 | Write the value of (combination index, channel) |
| RC | 0~7 | 0~7 | X | Read the value of (combination index, channel) |
| PR | 0、1 | X | | Print all the register values to screen (0: channel register list, 1: combination register list) |
| SV | X | | | Save all the register values to EEPROM for next power up |
| AC | 0~7 | X | | Activate the specific combination command |
| DL | 0~65535 | X | | Setting the delay time of capturing |
| ST | 0~15 | X | | Set listening station under RS422 mode. |
| SS | 0~15 | X | | Set the station number of this board. Only can be changed when TST is ON and MOD is ON. |
| VN | X | | | Read the version number |

※ X represents no value needed.

5.1 Command prompt :

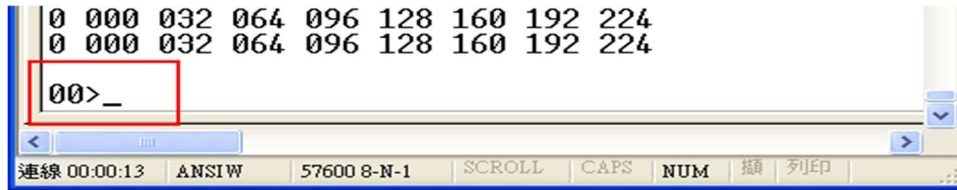
5.1.1 RS-232 mode :

After pressing [Enter] to send the command, the MB will return “>” (ASCII=0x3e) back to the terminal.

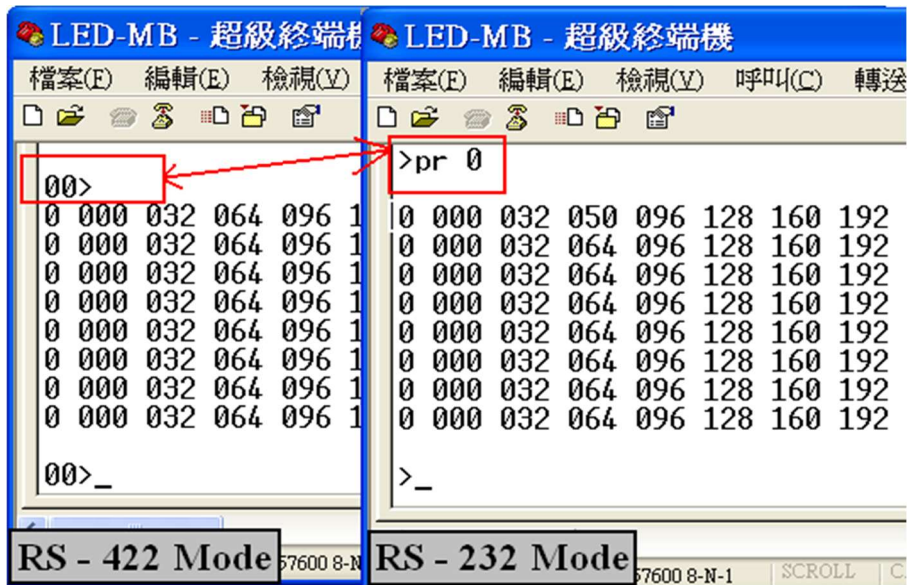


5.1.2 RS-422 mode :

After pressing [Enter] to send the command, the MB will send “Station no.” and “>” (ASCII=0x3e) back to the terminal. Ex. “00>” represents the station 0 now is the listener.



Note : There is no echo when using RS-422 mode as shown in the following figure.





6. Examples of command operation (use Windows Hyper-terminal)

6.1 Modify the value of number 2 register of channel 0 to be 50 :

Key in “WT 0 2 50” then press [enter] after the prompt “>”.



The controller responds “:” + CR + LF + “>”

Key in “PR 0” then press [enter] to check whether the value is modified.

PR 0 is to print the register table.

You can see the value in row 1 and column 4 is changed to 50.





6.2 Modify the combination register (set value 5 to the capture 0 of channel 0)

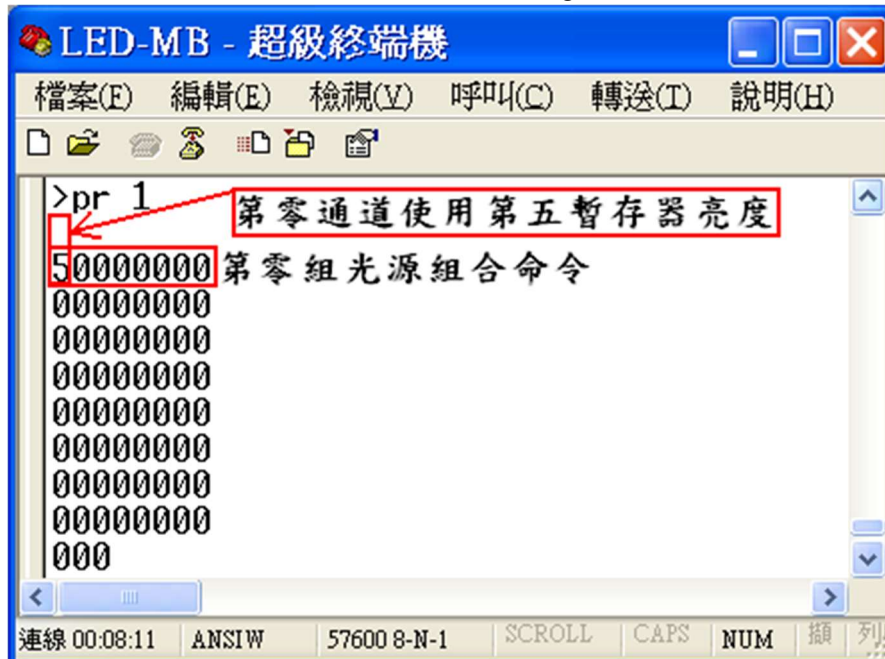
Key in “WC 0 0 5” then press [enter] after the prompt “>”.

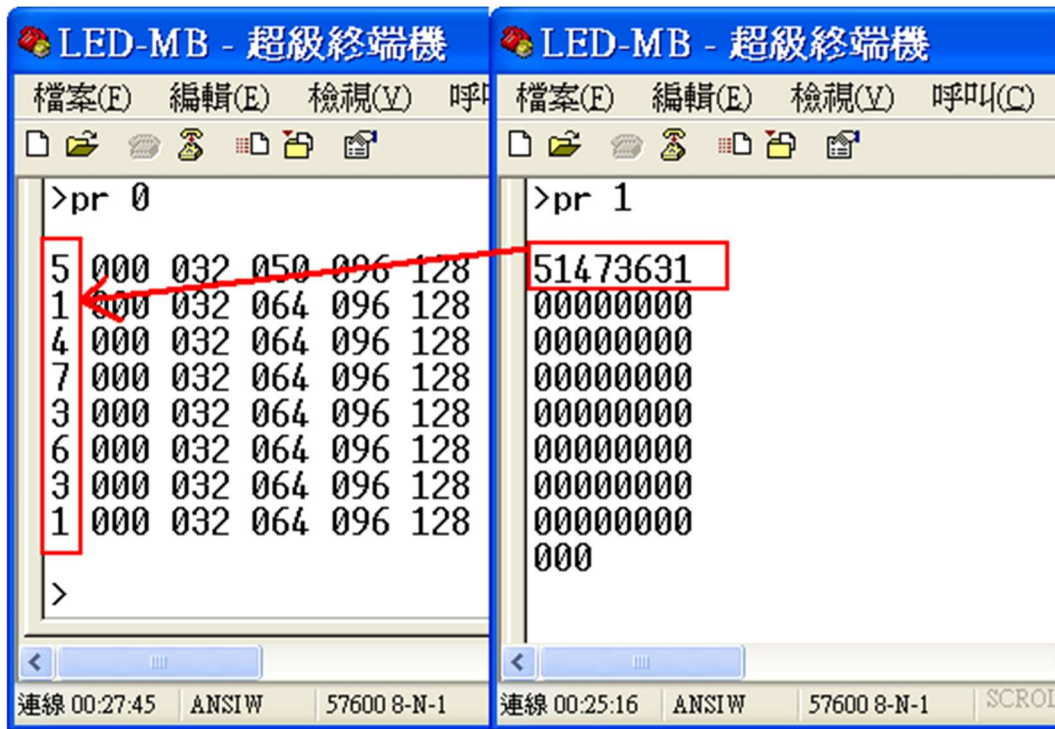


Key in “PR 1” then press [enter] to check whether the value is modified.

PR 1 is to print combination table.

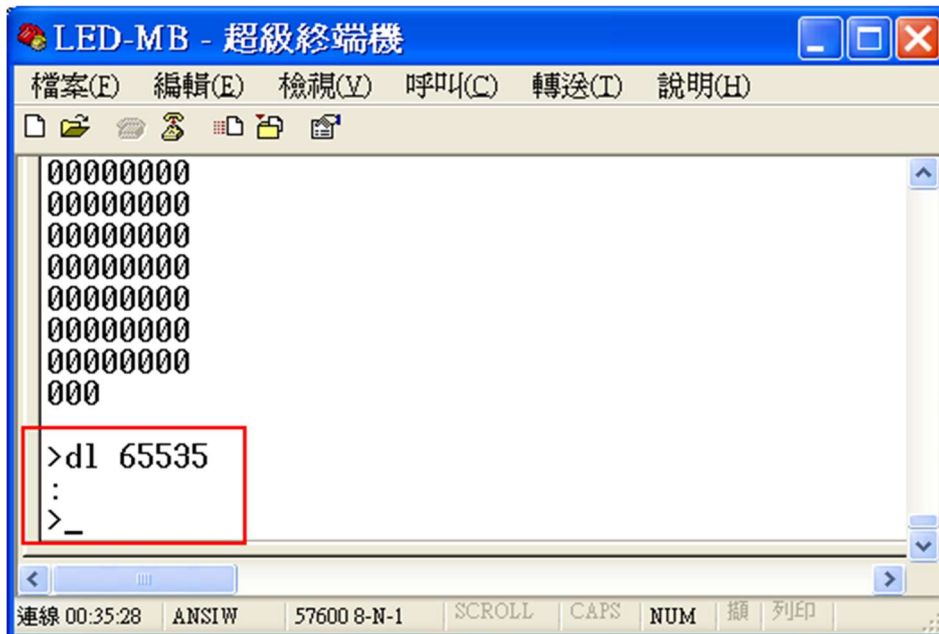
You can see the value in row 1 and column 1 is changed to 5.





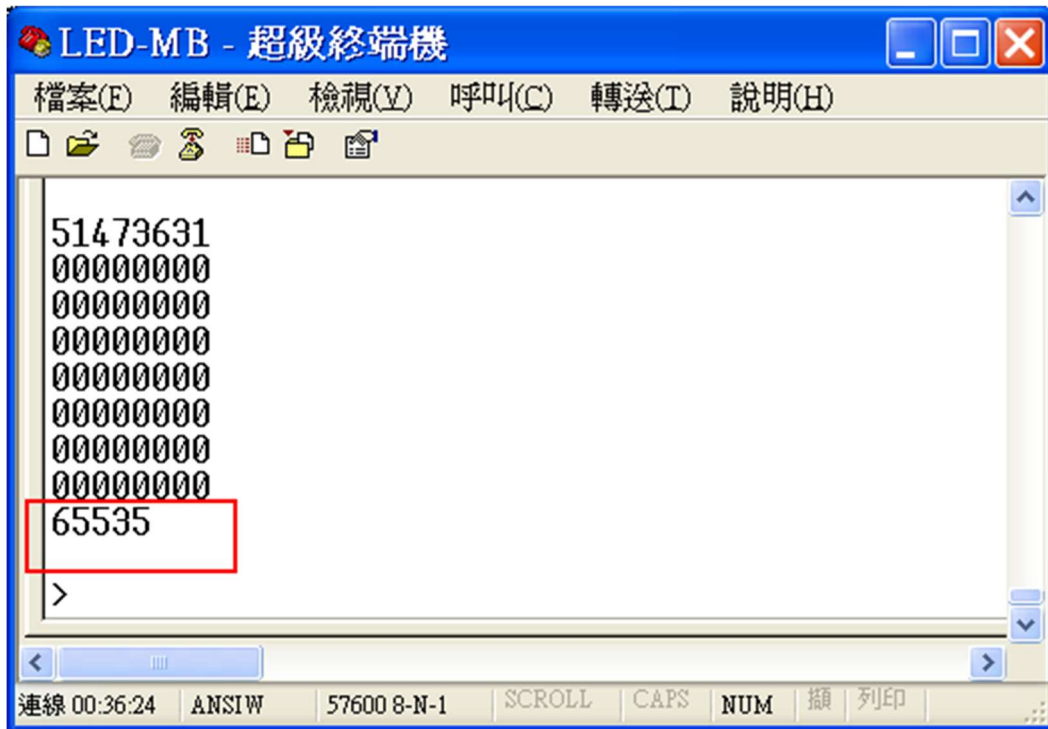
6.4 Modify the delay time before sending UPD to camera

Key in "DL 65535" then press [enter] after the prompt ">".





Key in “PR 1” then press [enter] to check whether the value is modified. PR 1 is to print combination table.



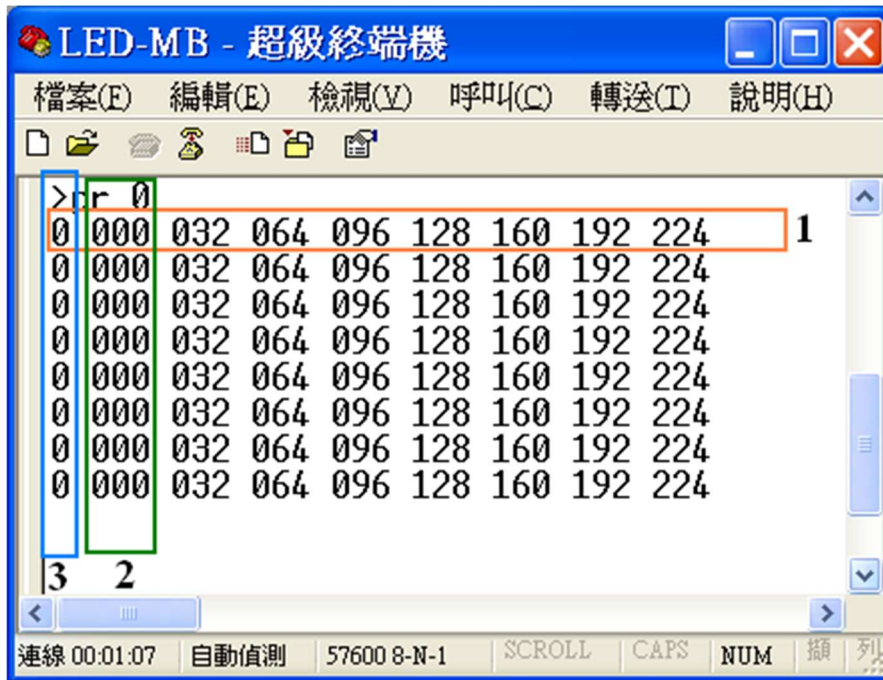
Note :

- 1. You must key in “SV” [enter] to save the modification after changing values. Hence, these values would be valid on next power up.**
- 2. If the command is invalid, the controller will respond “ER” +<CR>+<LF>.**

7. Format of register matrix

The format of the registers is explained below.

7.1 Brightness register table (PR 0)



Description :

| Item | Name | Function |
|------|--------------------------|---|
| 1 | Channel(row) | The orange box encloses the 8 registers plus 1 active register index of the Channel 0. Hence, row index is channel index. There are 8 rows in the list representing 8 channels. The channel index is from 0 to 7. |
| 2 | Register(column) | The green box encloses the first register (register no. 0) of each 8 channel. Hence, column index is the register index and range from 0 to 7. |
| 3 | Index of active register | The blue box encloses the index of active register of each channel. The above picture shows every channel uses register 0 as the active register. |

7.2 Combination register table (PR 1) :

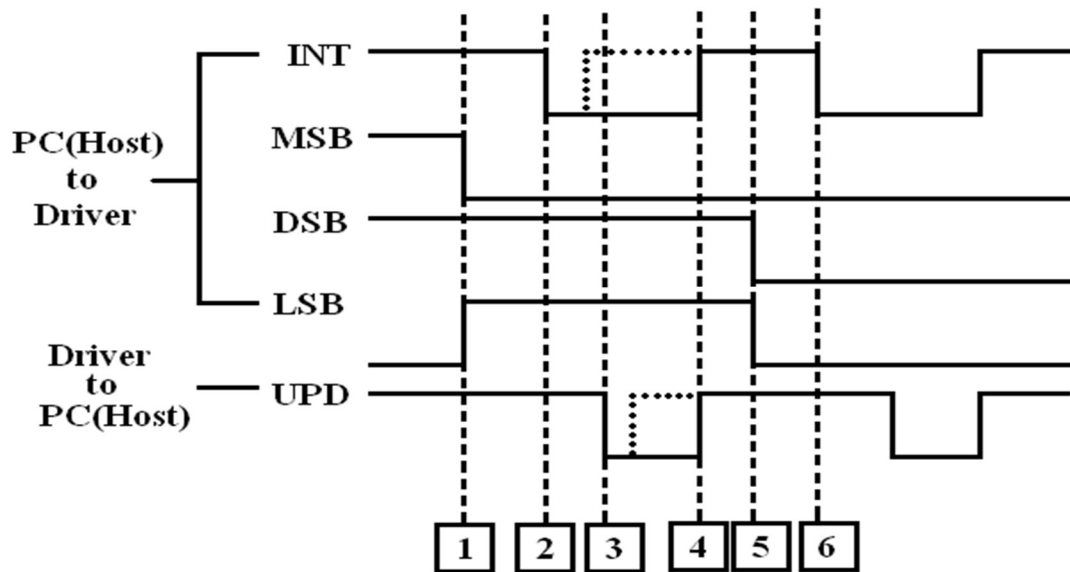


Description :

| Item | Name | Function |
|------|-------------------|--|
| 1 | Combination (row) | Each row is the active index combination of 8 channels of a capture. |
| 2 | Channel (column) | Each column contains the 8-capture active index of the specific channel. |
| 3 | Delay time | Delay time before sending UPD to camera for capturing. 65535 can delay 6553.5 mS ° |



8. Timing diagram of digital input/output for handshake



說明：

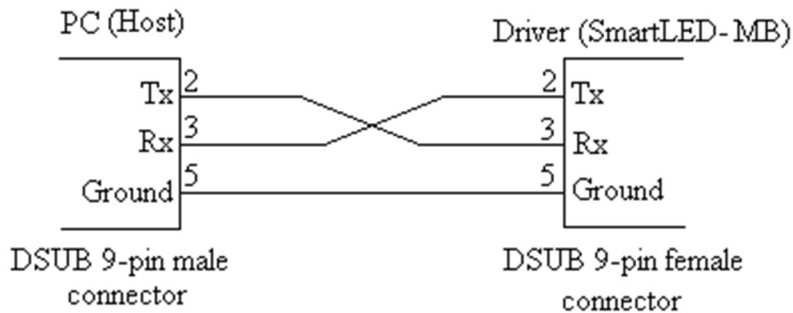
1. The host sets MSB, DSB, and LSB to select the specific combination command. This example selects 3rd combination command (MSB, DSB, LSB = Low, High, High = 011 = 3).
2. The host pulls low INT signal so that the above 3rd combination command is sampled by the driver. The driver then prepares the 8-channel brightness according to this command.
3. When the driver finishes the preparation, it will pull low the UPD signal. This signal can be connected the host or camera depending on the capture scheme. Note that if the LED current is too heavy, the DELAY value can be set to postpone the issue of UPD.
4. When the host pull high the INT signal, the driver will pull high the UPD signal simultaneously. However, if the host pull high the INT signal before the UPD pull low, the driver will pull high the UPD on the next firmware cycle of the UPD falling edge.
5. The host then prepares the next combination command and repeat the above procedure again.



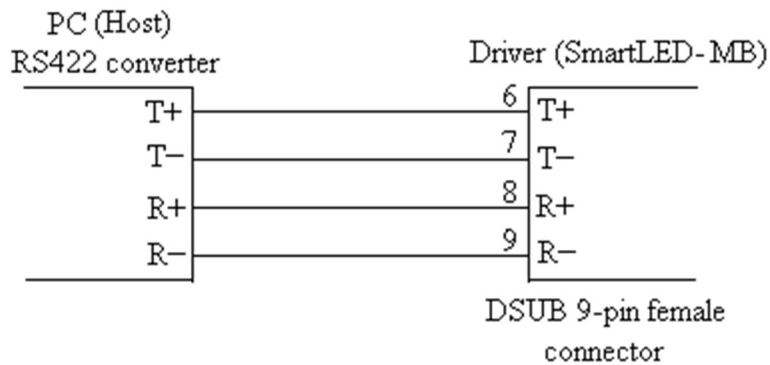
9. RS232/RS422 wire connection

9.1 RS232

The connection of PC to MB uses cable with pin2 pin3 swap version as shown below.



9.2 RS 422





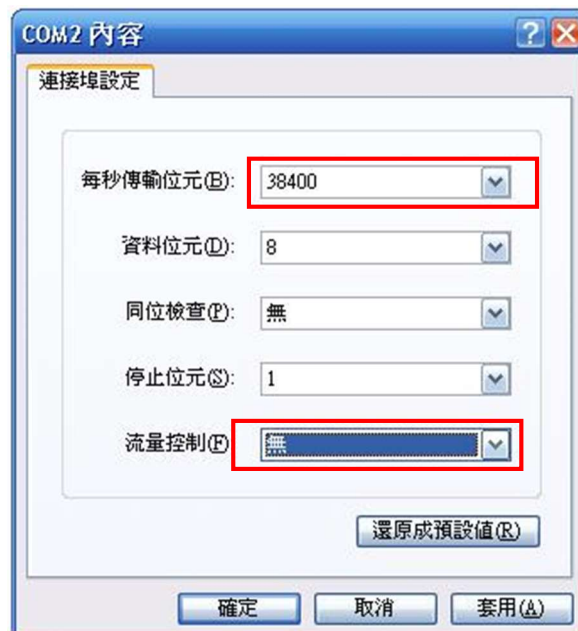
Appendix A. How to setup Hyper-terminal for communication

The setting of Hyper-terminal is explained in this page so that the communication between Host PC and SmartLED-MB can be built.

- Step1. Double click “Hypertrm.exe
- Step2. Select COM port, then press [OK]



- Step3. Set the baud rate to 38400 and flow control to “NONE” then press [OK].

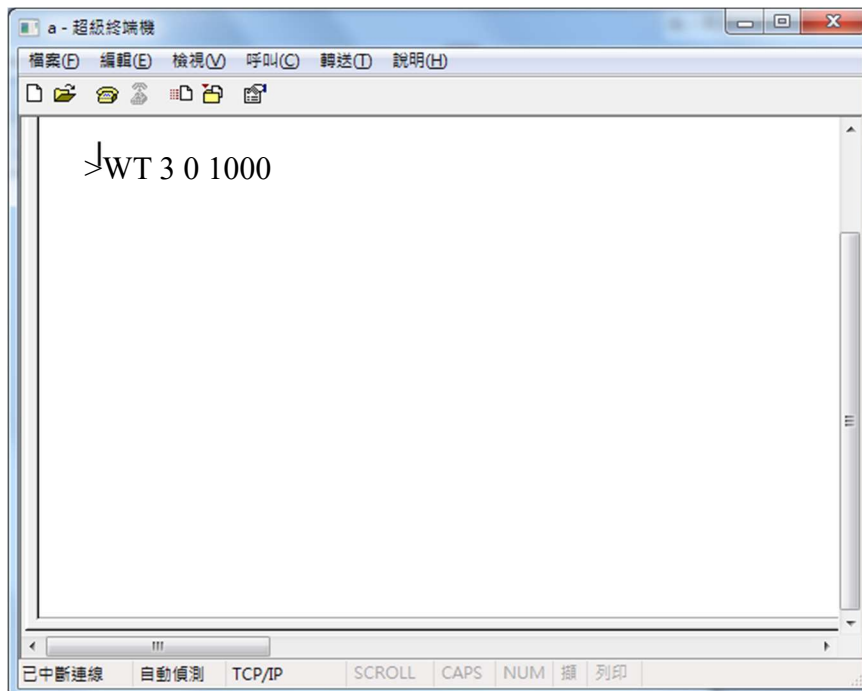




Step4. Check the settings as shown in the following diagram



Step5. Now you can enter command into the popup window





Appendix B. Example Code in VB

The following code uses VB as the IDE.

- 1.COM port number is COM1 ◦
- 2.Modify the register 0 of channel 0 to be 50.

B.1 Port setting

```
MSComm1.CommPort = 1 // Set port no. to 1

MSComm1.Settings = "38400,N,8,1" // Set parameters of port1

MSComm1.PortOpen = True // Open the port
```

B.2 Sending command

```
Dim LED_MB_Command As String // Declare a string variable

LED_MB_Command = "WT 0 0 50" // Put the command text into the string variable

MSComm1.Output = LED_MB_Command & Chr(13) // Send the string variable to output
// and CR(ASCII 13) as the end character
```