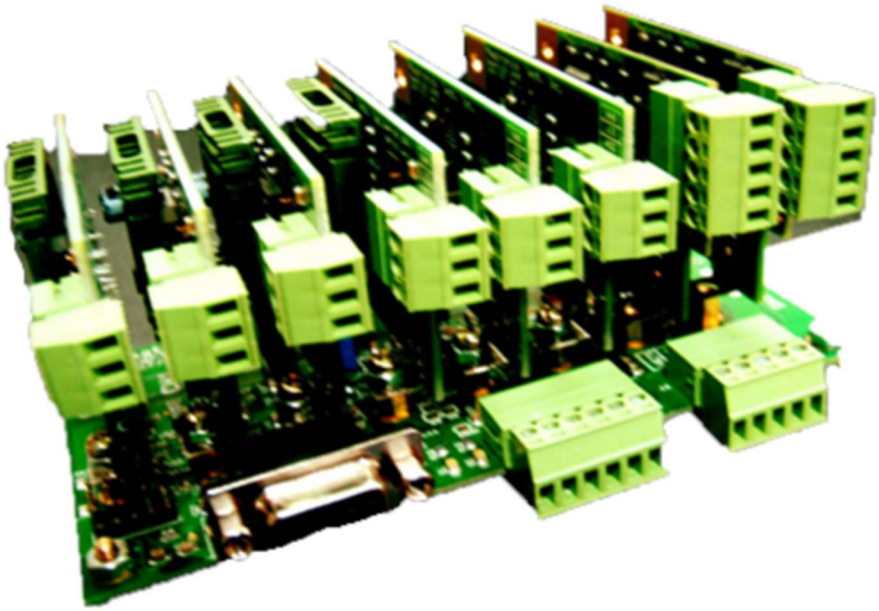
Smart LED controller 2.0 For AOI

Model: SmartLED-MB2.0-V1

Programmable constant light version

User's Manual
Version: 2.0 2022-12-01



Magtronics Technology Inc.
Address: 2F, No.27, Shengli 10th St., Zhubei City, Hsinchu County 30286, Taiwan (R.O.C)
TEL: +886-3-6676096, Fax: +886-3-6676095

www.magtronics.com.tw

Table of contents

1. Features

- **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.

- **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 mm^3.

- **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 for brightness presetting：**

  Each channel has 8 pre-programmable14-bit registers to lower the communication period for brightness change. Only one register can be activated to control the brightness.

- **Two serial interface implemented：**

  RS232 or RS422 interface can be used to pre-program the value of the registers and activate the specific register of each channel.

- **Digital inputs：**

  Four digital inputs can be used to activate the specific register of each channel and then all the channels can be turned ON/OFF with the activated register by GSW input.

- **Dimmer simulator：**

  A software simulating variable resister dimmer is provided for free. Source code in VB can also be provided upon request.

- **Strobe flash is possible：**

  This version of control board can perform strobe flash of 8 channels by using the strobe input on the daughter boards.

2. Description

SmartLED is a LED driver especially designed for the application of the automatic optical inspection (AOI). 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. MB2.0-V1 is a mother board of programmable constant brightness version, which means it is not necessary to flash or high-speed blink during inspection period. A brightness adjustment software is also provided to simulate an old-fashion dimmer with knob.

There is total 64 registers with 14-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. The reason why we have 8 registers for each channel is that we can pre-set these registers then activate one of them by using external digital inputs to increase switching speed without using ASCII commands through RS232. There are 4 digital inputs used to activate the specific register of the specific channel, see page 8. In addition, there is another digital input used to simultaneously switch the 8 channels on or off. Such a scheme makes brightness change very fast and convenient.

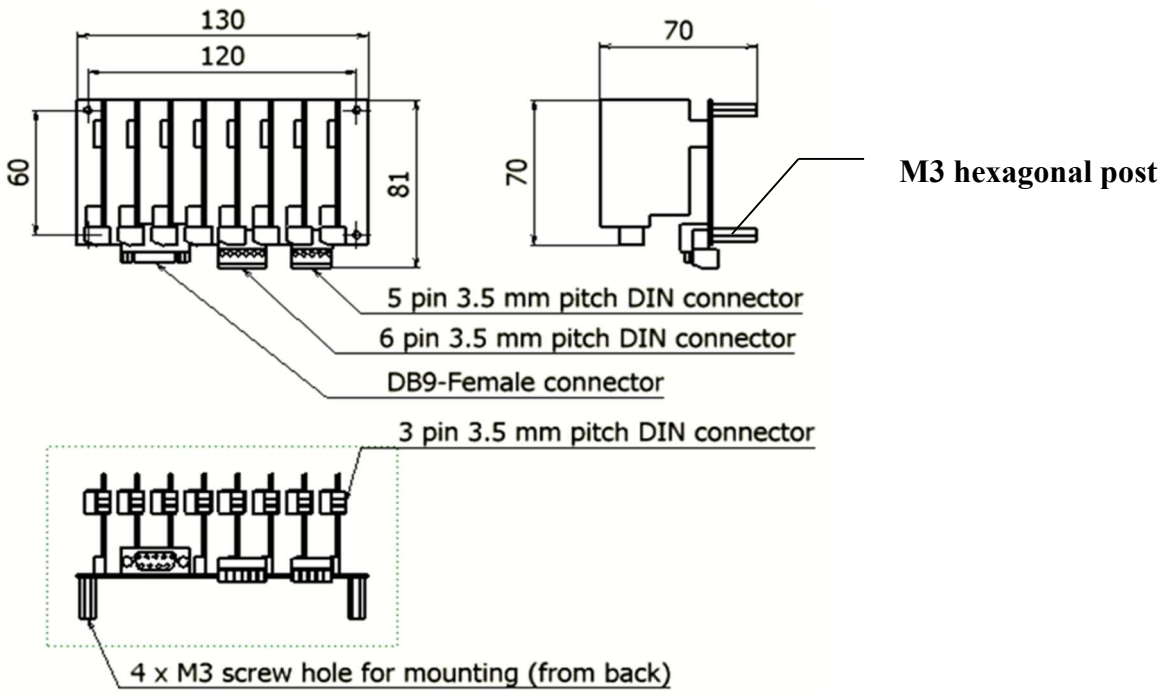
3. Electrical Specification and dimensions

3.1 Electrical specification

Item	Value	Unit
Control supply voltage	8~24	V
RS232 interface	38400 baud rate, N-8-1	Echo ON.
RS422 interface	38400 baud rate, N-8-1	Echo OFF.
Digital input high voltage※	>3.5	V
Digital input low voltage※	<1.5	V
Operation condition	0~70 ℃ 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)

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 Inputs

Pin No.	Name	Function
1	GSW	Global switch (Pull High：turn on all channels, pull Low：turn off all channels)。
2	CTL	Sampling input for MSB, DSB, and LSB.
3	MSB	bit2 (Low:0、High:1)
4	DSB	bit1 (Low:0、High:1)
5	LSB	Bit0 (Low:0、High:1)
6	DGND	Digital common ground, internal connected to GND

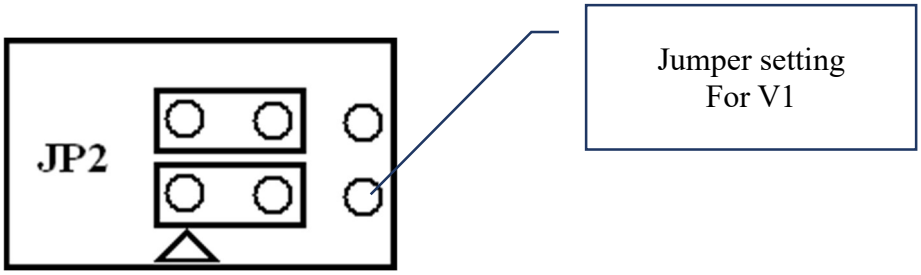
P1: RS-232/422 (DSUB 9-pin, female)

Pin No.	Name	Function
RS - 232		
2	TX	RS232 transmit (connected to HOST RX)。
3	RX	RS232 receive (connected to HOST TX) 。
5	DGND	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 selection 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)。

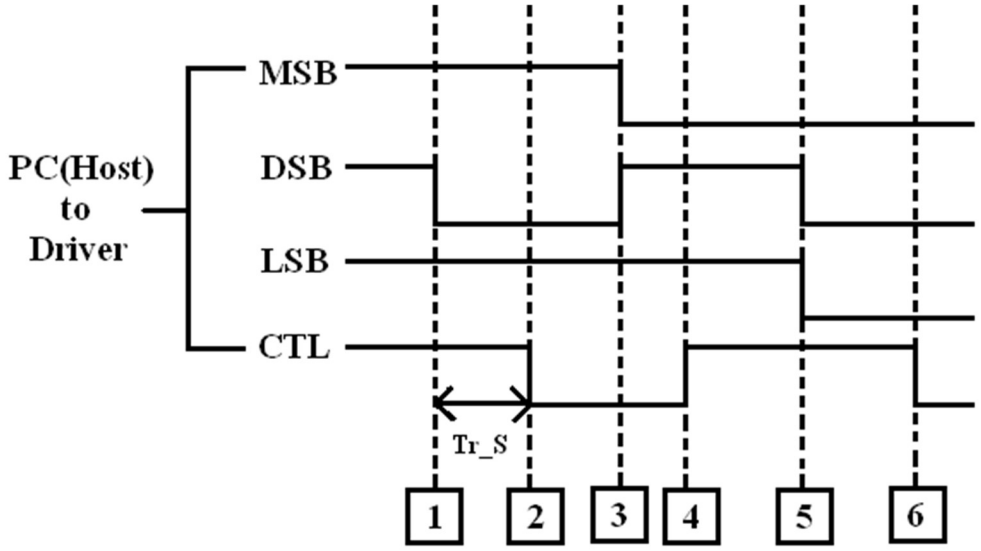
JP2: JUMPER selection



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

5. Timing diagram of digital inputs for register activation

This mother board can use 4 digital inputs to select the specific register of the specific channel to be active. MSB、DSB and LSB were used to select channel number or register number, CTL is used to determine whether channel or register is selected. When CTL goes from H to L, the MSB, DSB, and LSB are sampled to be channel number. When CTL goes from L to H, the MSB, DSB, and LSB are sampled to be register number. CTL should remain high when not working. The follows explain the sequence of selecting channel 5, register 3 to be active.



Step1. Prepare the channel number to be 5. Hence, MSB、DSB and LSB should be (MSB、DSB、LSB = High、Low、High = $101_2 = 5_{10}$).

Step2. CTL goes from High to Low, the channel number 5 is sampled to the controller.

Step3. Prepare the register number to be 3. Hence, MSB、DSB and LSB should be changed to (MSB、DSB、LSB = Low、High、High = $011_2 = 3_{10}$).

Step4. CTL goes from Low to High, the register number 5 is sampled to the controller. At this point, the channel 5 and register 3 has been activated successfully.

You can repeat the same procedure to select another pair of channel and register as shown in Step5, Step6, and so on.

Note：As shown above, the delay (Tr_s) between CTL sampling and the ready of data (MSB,DSB,LSB) should be at least 100us.

6. Command List

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

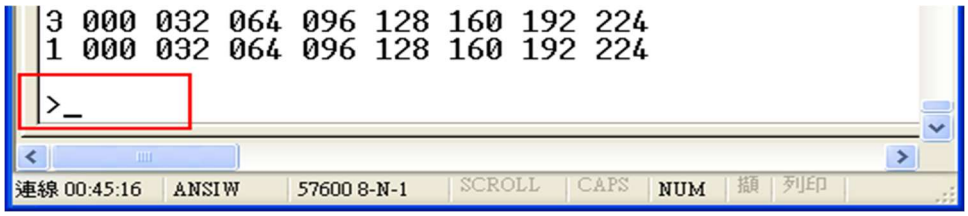
Command	Channel	Register	Value	Function
RD	0~7	0~7	※X	Read the value of (channel, register)
RA	0~7	0~7	X	Read the value of (channel, register) then activate
WT	0~7	0~7	0~16383	Write the value of (channel, register)
WA	0~7	0~7	0~16383	Write the value of (channel, register) then activate
SW	0 or 1	X		Switch all channels ON (1) or Off (0)
SV	X			Save all the register values to EEPROM for next power up.
PR	X			Print all the register values to screen
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.

6.1 Command prompt

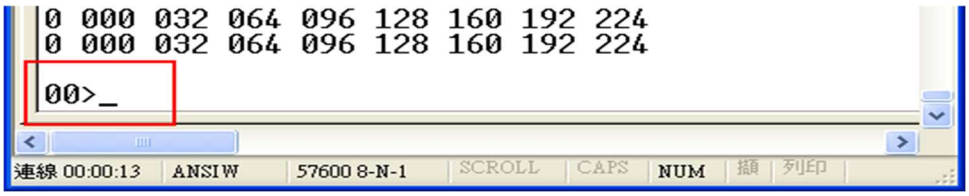
6.1.1 RS-232 mode

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

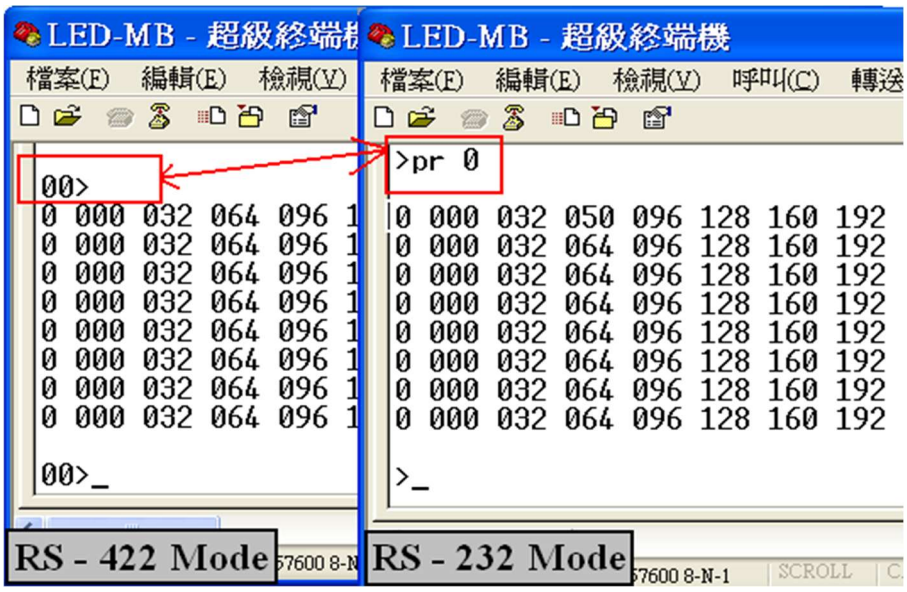


6.1.2 RS-422 mode：

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. ◦



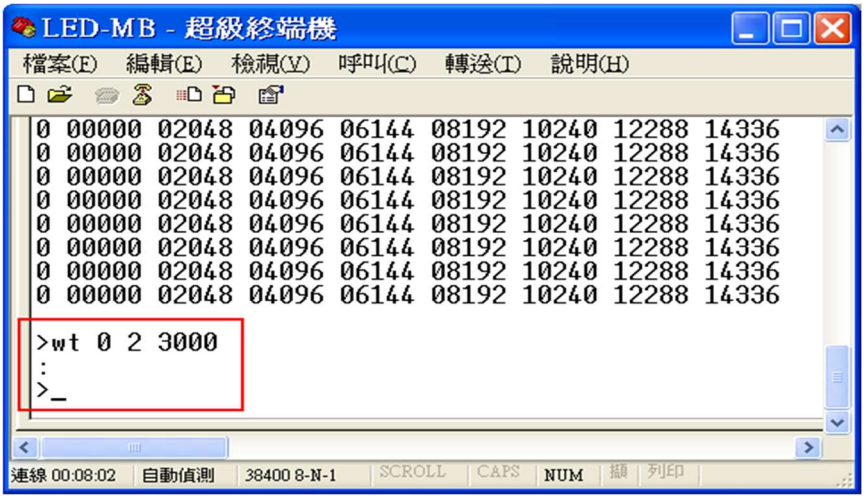
Note：There is no echo when using RS-422 mode as shown in the following figure.



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

7.1 Modify the value of number 2 register of channel 0 to be 3000：

Key in “WT 0 2 3000” then press [enter] after the prompt “>”.



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

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

You can see the value in row 1 and column 4 is changed to 3000

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>.

8. Format of register matrix

The format of the registers is explained below.

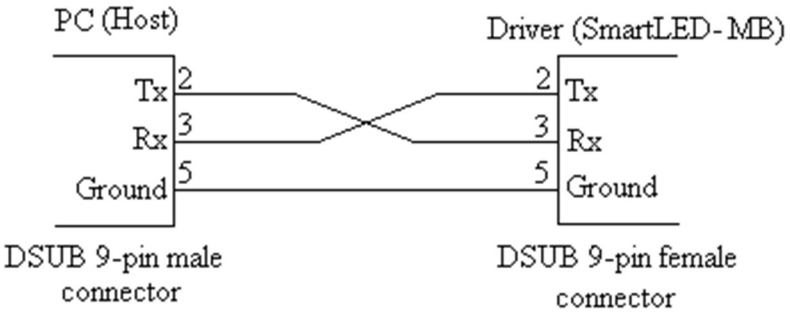
Description：

No.	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.

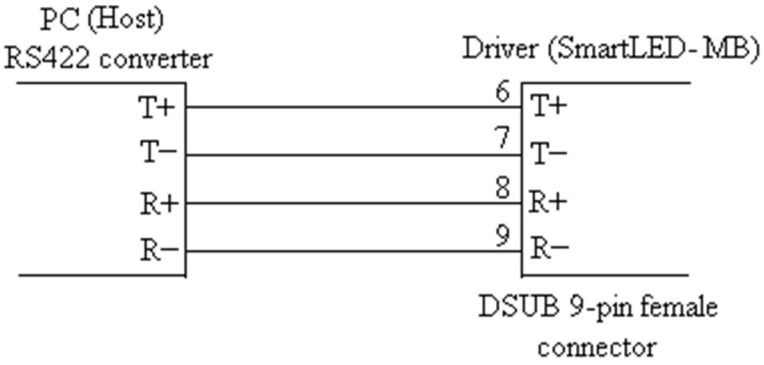
9. RS232/RS422 wire connection

9.1 RS232:

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



9.2 RS422:



Appendix A. How to setup Hyper-terminal for communication

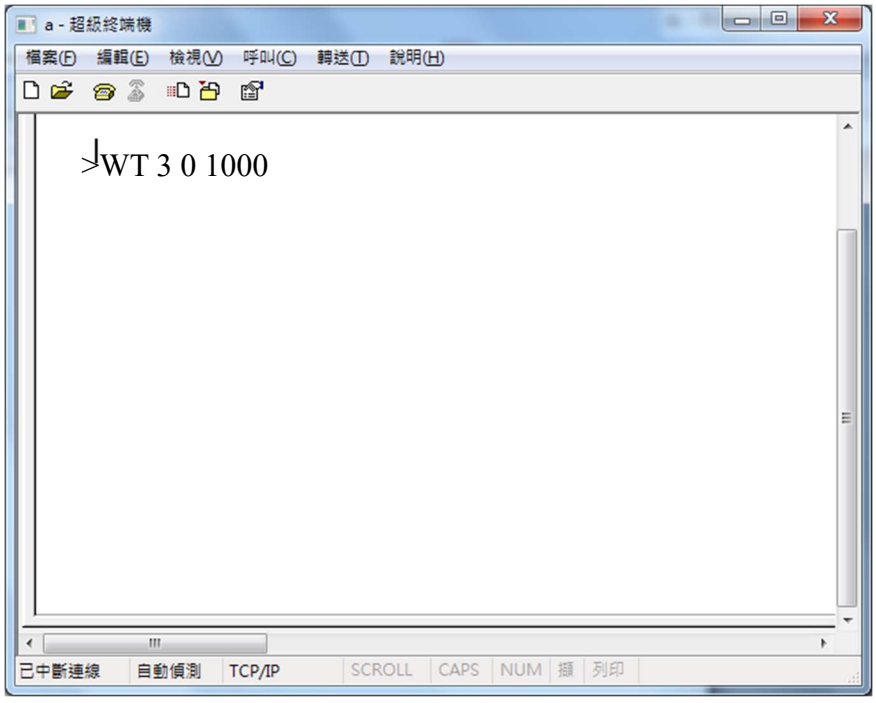
The setting of Hyper-terminal is explained in this page so that the communication between Host PC and SmartLED-MB can be built.

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 傳送指令

```
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(ACSII 13) as the end character
```