

# TW9906/TW9909 Evaluation Board

## User's Manual (Rev 1.0)

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### **Disclaimer**

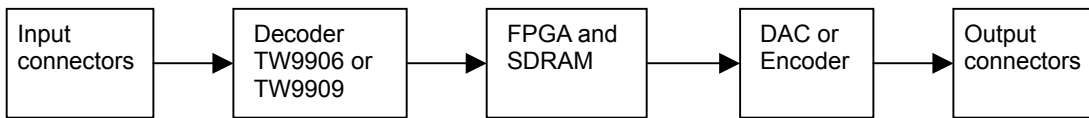
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## 1. Overview

TW9906 and TW9909 are high quality NTSC, PAL, and SECAM multi-standard video decoder plus RGB mixing for multimedia applications. The TW9906/TW9909 evaluation board can demonstrate most of the decoder's features and allows easy evaluation of the TW9906, TW9909 performance. Features such as Scaling and Cropping can be easily examined by modifying a few register setting, switching input and output path can also be changed by a single click of the mouse. The evaluation board is controlled via a RS-232 serial interface cable from a PC, and an application software namely SerCon. User can also use a terminal emulator such as Hyper-terminal, all registers can be manually modified. With TW9909, an OSD menu is also available, together with on-board push buttons, changing register settings and other features without the need of a PC.

In order to truly explore the capability and performance of the TW9906/TW9909, user is strongly recommended to use component output (from DAC, default setting).

The main signal flow of the evaluation board is depicted below.



## 2. TW9906\_9 Evaluation Board Features

### 2.1. Input/output

On the board there are CVBS/S-video/Component/SCART input connectors connected to decoder inputs and CVBS/S-Video/Component output connectors connected to the signals from DAC or the encoder. Use JP3, JP4, JP5 to select the component outputs between DAC and the encoder. Default output is from the DAC. CVBS/S-video output is always from the encoder.

INPUTS:	CONNECTORS
CVBS	CON1
S-VIDEO	CON4
Components (YPbPr)	Y/G:CON1, Pb/B:CON2, Pr/R:CON3
SCART	CON5

OUTPUTS:	CONNECTORS
CVBS	CON13
S-VIDEO	CON12
*Components (YPbPr or RGB)	Y/G: CON9, Pb/B: CON10, Pr/R:CON11
CSYNC	CON8

\*Recommended feature for evaluation

## 2.2. Downscaling

With frame buffer memory turned on, user can see the scaled down image by adjusting register 0x0D, 0x0E and 0x0F. Tips: by only adjusting 0x0E from the default of minimum value of 0x11 to 0x22 or 0x33, the scaling effect can be seen immediately.

## 2.3. VIP (Video Interface Port), and Headers

Header JP1 signals are compatible to VIP standard. User can hook up JP1 to a VGA VIP header with a flat cable (not included).

## 2.4. Closed-Caption

Closed-Caption is supported by Z86129.

## 2.5. LLC (Line-Locked Clock) / Free-run clock mode

In order to avoid output jitter when using Component output thru the DAC, user must turn on the LLC function, and choose Direct Pass mode (turn off the Frame Buffering feature from the board). To turn on LLC mode, Dip switch S1 position 4 must flip to off position (default). Register 0x03 bit 5, LLCMODE set to 1. All above settings are default.

When use composite output thru encoder (CVBS or S-Video), user can Free-Run mode (LLC off). In Free-Run clock mode, frame buffer must be turned on to remove the output jitter.

## 2.6. OSD (On Screen Display)

OSD feature is available only with TW9909. This feature can be activated by pressing the menu buttons, and must set slide switch S12 accordingly to match input source.

## 2.7. Function of the on-board FPGA (U5)

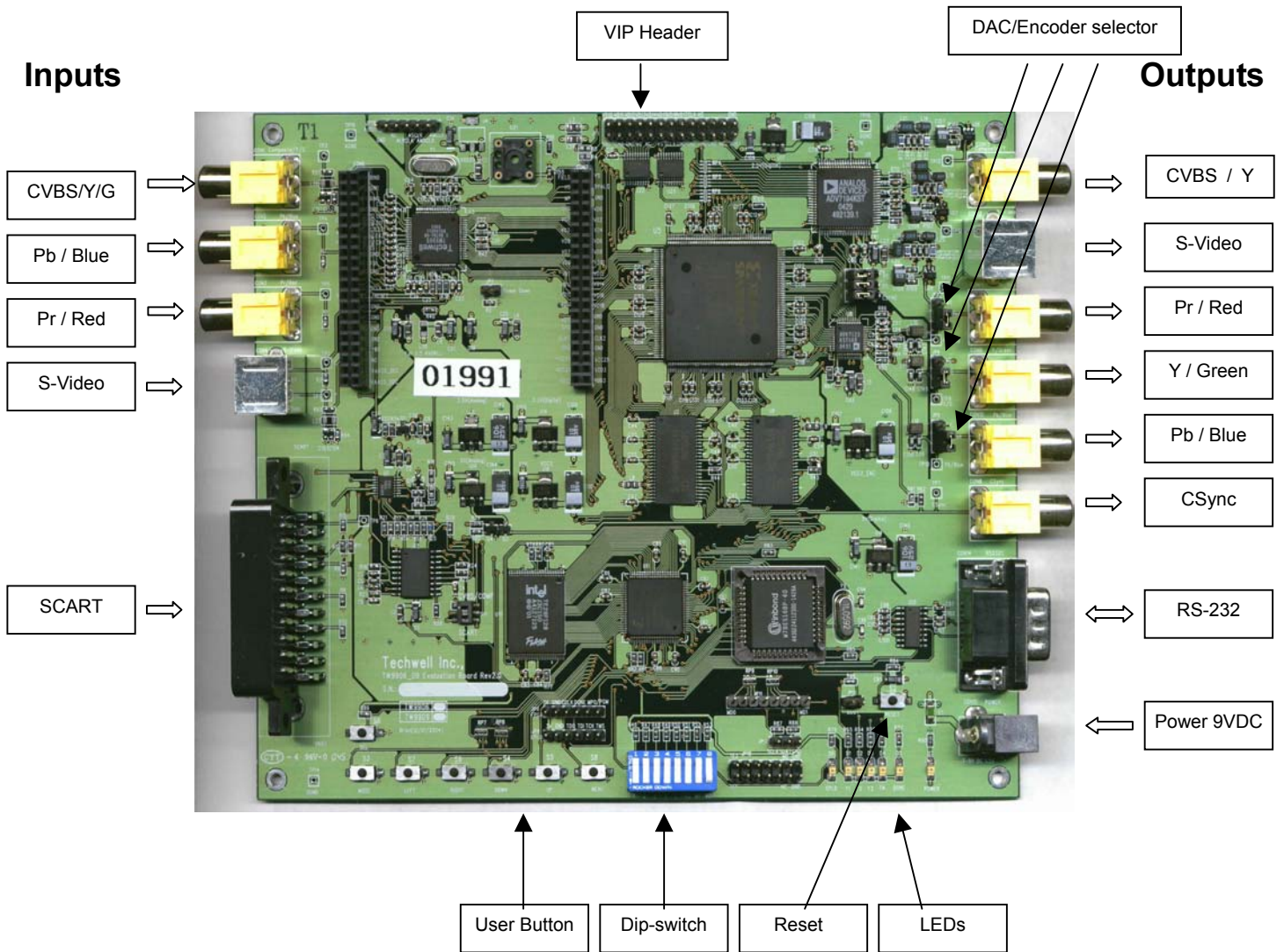
As a SDRAM (frame buffer) controller, is mainly for providing buffering for decoder's scaling function as well as removing jitter when the board is in the Free-run clock mode.

As a format converter, the FPGA de-multiplex 10-bit, 27MHz clocked ITU-R656 4:2:2 data from decoder into component Y,U,V and feed to triple 10-bit video DAC (U10 AD7123), the output from DAC is component Y/Pr/Pb or R/G/B.

The FPGA interfaces to the Encoder in 10-bit mode. In bypass mode, data can feed through the FPGA from decoder directly to encoder. It also generates other synchronous signal in Free-run clock mode for frame buffered signal and to Encoder.

A 2-wire Serial interface is used for communication between Microcontroller and the FPGA. LEDs are also controlled by the FPGA.

### 3. Input/output connectors Location

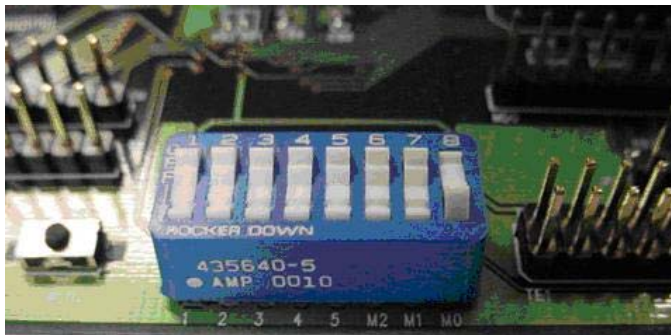


#### 4. Power Adaptor

DC power adaptor is included in the kit, or use any 7~9V/1.5A DC adaptor with center + plug.



#### 5. Dip-switch settings



There are board options user can set by the Dip-switches S1.

Switch	Function description	Default pos
1	Reserved	OFF
2	Reserved	OFF
3	Auto Register Set mode ON (default), some registers are changed automatically by the Microcontroller, such as automatically detect video input (color system, interlace, etc). Manual mode: User controls all board function via RS232 Serial Interface.	OFF ON
4	OFF: LLC(default), ON: Free-run clock, When using component output video signal, must set LLC mode. Refer to LLC/Free-run section for detail.	OFF
5	Reserved	OFF
6	FPGA programming loading M2	OFF or ON
7	FPGA programming loading M1	OFF
8	FPGA programming loading M0	ON

#### 6. Slide Switch

Slide switch S12 is for OSD selection for CVBS/Component and SCART. This switch must set accordingly to match the source of input for OSD to properly function.

### 7. Jumpers and Headers

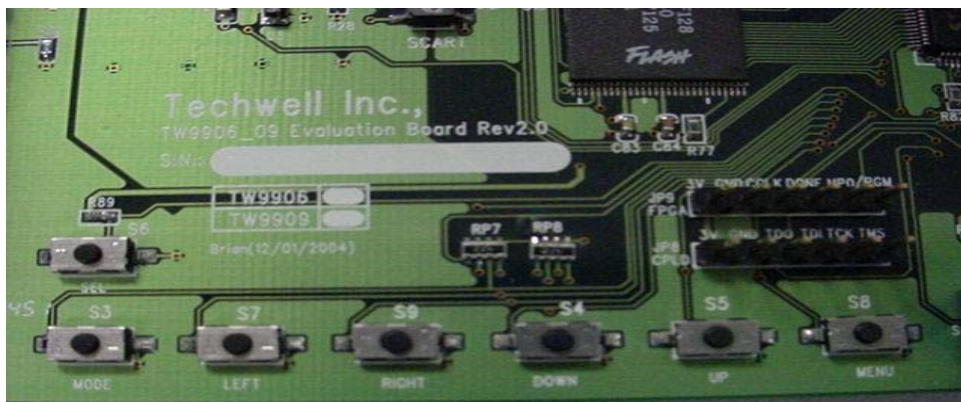
Jumper	Function
JP1	VIP standard compatible output header
JP2	Power down (TW9906/TW9909 )
JP3	Pr Component output select from DAC or Encoder
JP4	Y Component output select from DAC or Encoder
JP5	Pb Component output select from DAC or Encoder
JP6	Select sync from FPGA or Decoder for VS
JP7	Select sync from FPGA or Decoder for HS
JP8	JTAG port for CPLD
JP9	Programming port
JP10	CPLD test header
JP11	Microcontroller test header
JP12	2-wire serial interface signal
JP13	Boot jumper for Microcontroller firmware download when jumped
JP14,15,16	Not applicable
JP17	Select sync from FPGA or Decoder for CSYNC
JP18	Audio Clock Signal

### 8. User Push Button

There are 8 push buttons on the evaluation board.

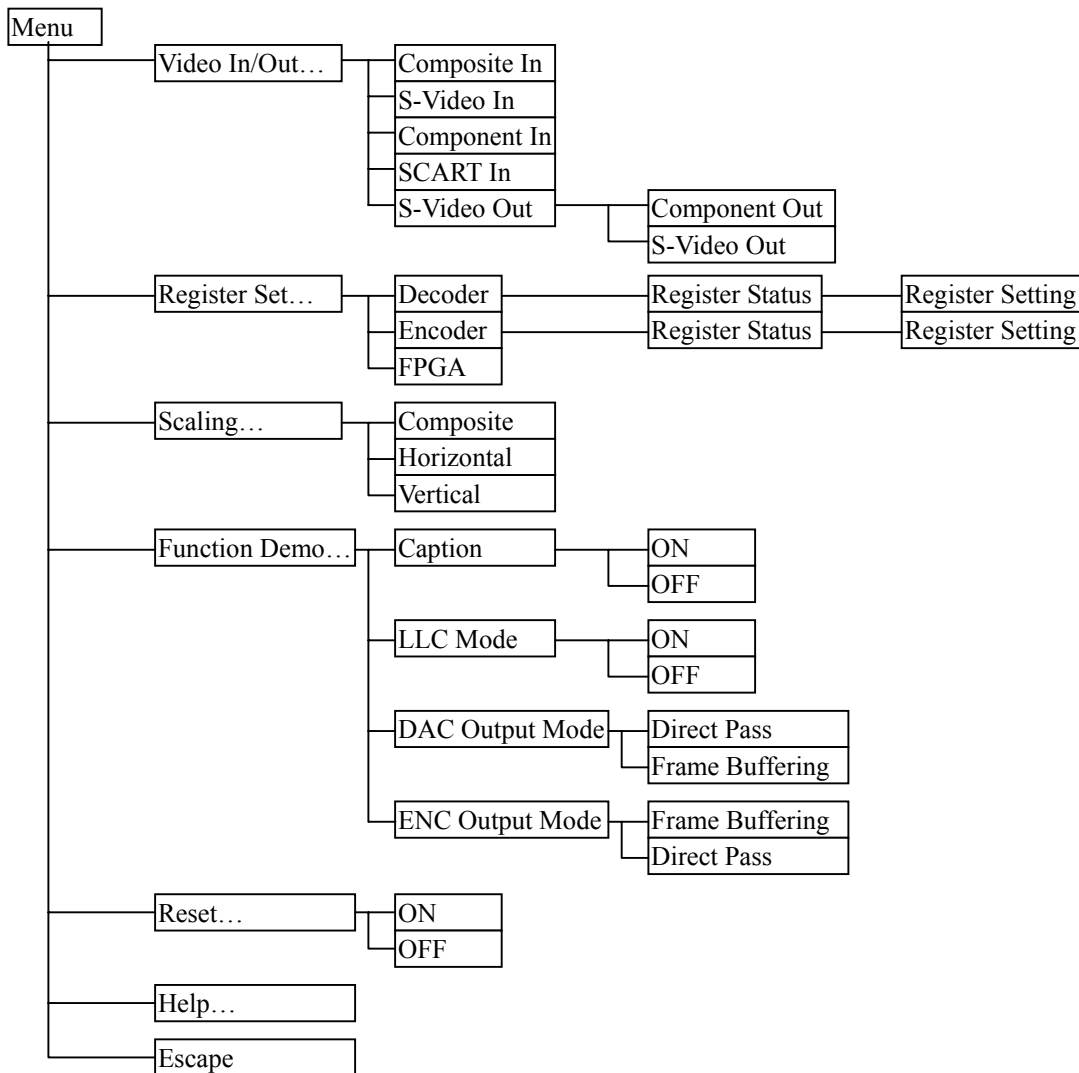
Button	Name	Function
S2	RESET	System reset, reset the on-board 8051 Microcontroller
S3	MODE	Short cut to Function Demo function (LLC, DAC, ENC)
*S4	DOWN	Select or Enter the highlighted menu item in red
*S5	UP	Move to upper menu
S6	SEL	Input select: CVBS(default) -> S-Video -> component -> SCART(TW9909) -> CVBS. If being held down for >2s, LED T2 will be on indicating Caption is on.
*S7	LEFT	Scroll down, decrement index or register address
*S8	MENU	Main Menu
*S9	RIGHT	Scroll up, increment index or register address

\*Function only available in TW9909 with OSD feature for menu accessing.



### 9. Menu Map

The menu system is accessible through the 5 buttons stated in the User Push Button section. The OSD feature for this menu system is only available in TW9909 and not available in TW9906. On top of the 5 push buttons, there are 2 more short cut buttons that can immediately lead to the frequently used functions such as Video inputs (S6) and Demo Functions (S3). All these push buttons are functional on both TW9906 and TW9909, except that with TW9906, user has to shoot in the dark when traversing the menu using these buttons.

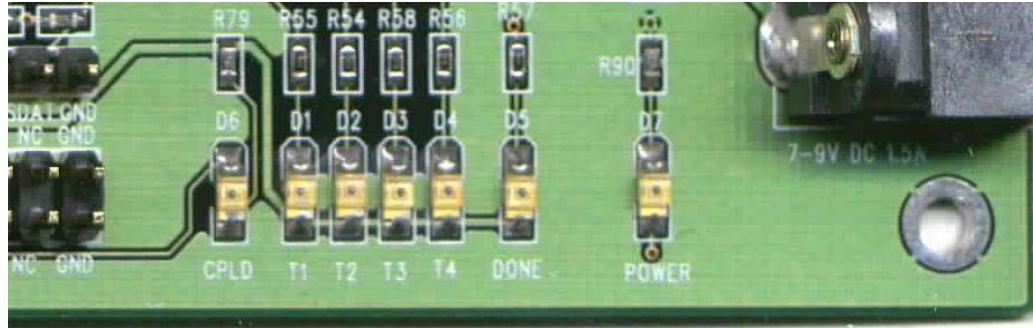


Button	Name	Function
S8	MENU	Main Menu
S5	UP	Move to upper menu
S4	DOWN	Select or Enter the highlighted menu item in red
S9	RIGHT	Scroll up, increment index or register address
S7	LEFT	Scroll down, decrement index or register address



## 10. LEDs

Name	Function indicated when LED on
Power	Power on
Done	FPGA loading fail
CPLD	Reserved
T1	PAL mode on
T2	Caption mode on
T3	Reserved
T4	Reserved



## 11. How to control the TW9906\_9 registers

Note: If the Auto Mode is on (position 3 of Dip Switch S1 is set to off), the on-board Microcontroller continues checking the decoder status and changes registers when weak/bad signals occur such as VCR Playing FF, Fast Rewind, noisy TV, etc. It also automatically detects color system. User may want to turn off this function when manually changing registers. Turn 'ON' the Dip-switch3. This will stop the auto compensation feature.

There are two ways to adjust the register of the TW9906 and TW9909 on the TW9906/TW9909 evaluation board. First method is using the on-board push buttons, second method is using a PC via the RS232 serial port.

### 11.1. Using Push Buttons

When using push buttons, it is best with TW9909 where OSD feature is available. Even though these buttons are functional under TW9906, due to lack of the OSD feature, it is hard for user to control the board functions. Follow the menu map in previous section to traverse the menu item and adjust the register content by using the Left (S7) and Right (S9) button, or use these 2 buttons to scroll up and down among menu items. Use the Down (S4) button to enter lower level menu or select the highlighted item (in red). Use Up (S5) button to move up one level from the current menu.

### 11.2. Using PC Serial port

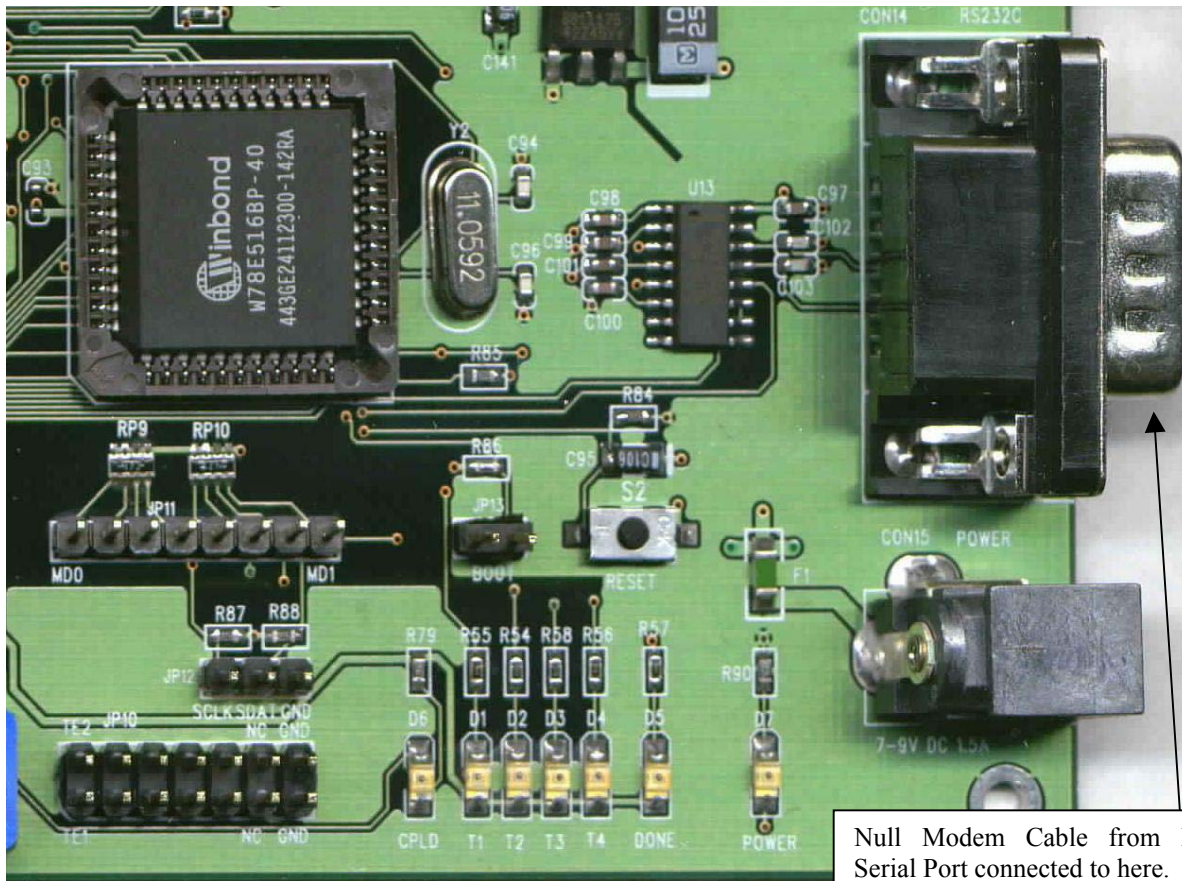
When using a PC to control, there are 2 ways. First, user can use the HyperTerminal command line style to control. Second, use the Serial Controller application which is a user friendly application with Graphical User Interface (supplied by TechWell). Using PC to control requires that a null-modem cable between PC serial port and the board serial port. The null-modem cable is provided with the board.



11.2.1. Null Modem Cable

If a null-modem cable is not available, user can build one with the connections as follows.

9 PIN D-SUB FEMALE	9 PIN D-SUB FEMALE.
Receive Data [2]	[3] Transmit Data
Transmit Data [3]	[2] Receive Data
Data Terminal Ready [4]	[6]+[1] Data Set Ready + Carrier Detect
System Ground [5]	[5] System Ground
Data Set Ready + Carrier Detect [6]+[1]	[4] Data Terminal Ready
Request to Send [7]	[8] Clear to Send
Clear to Send [8]	[7] Request to Send



11.2.2. Set up and Use the Hyper Terminal to Control the Board

Follow these steps to create a Hyper Terminal control short cut

- Select "Hyper Terminal"



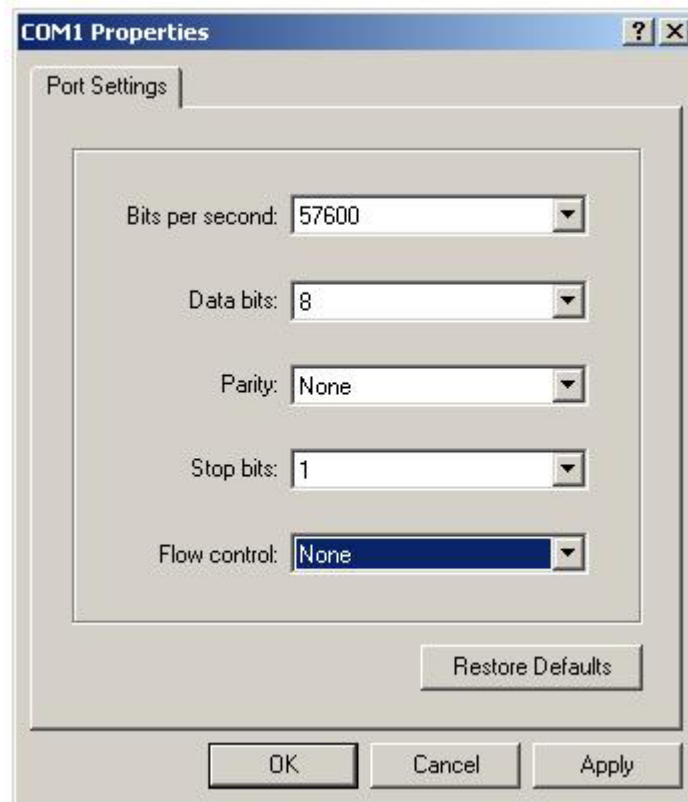
- Connection Description



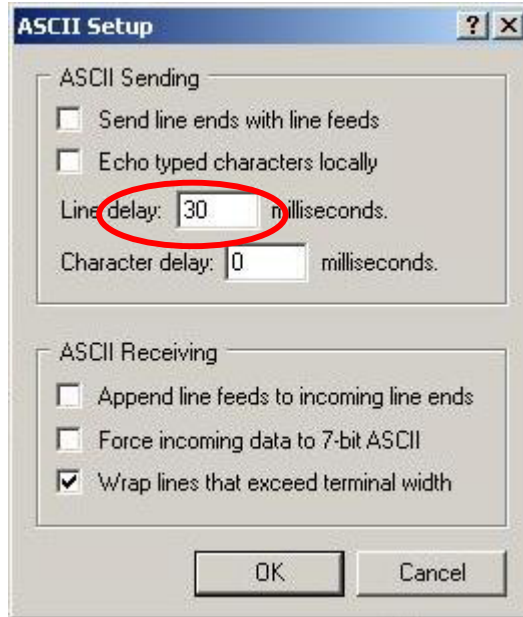
- Choose COM port.



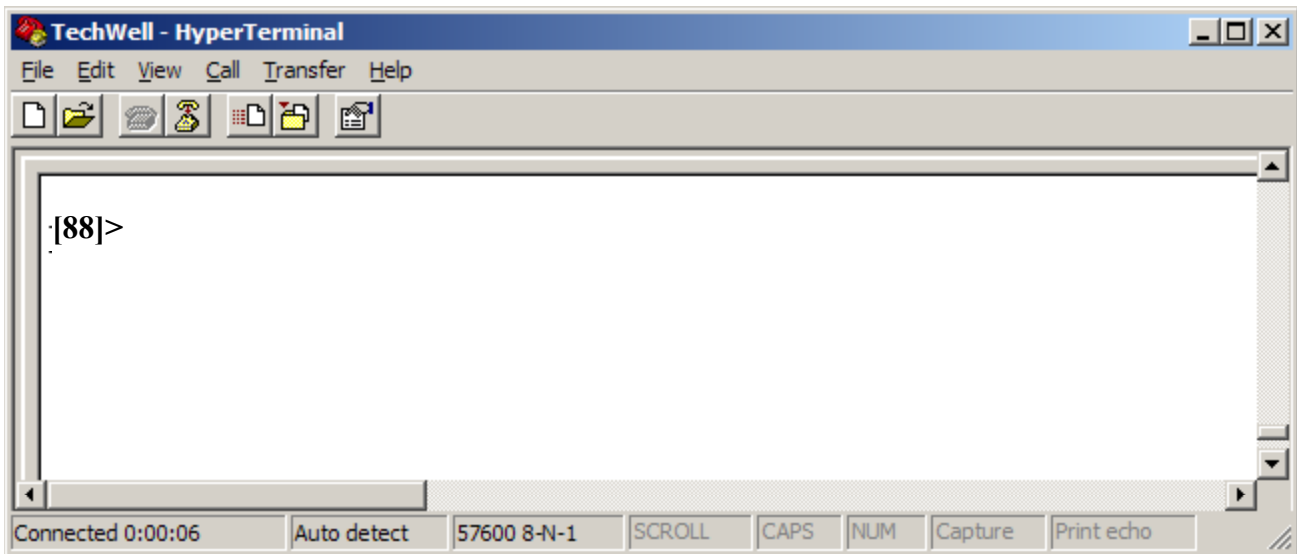
- Set the COM port properties. Those should be 57600bps, 8 data, No parity, 1 stop, No flow control.



- Set line delay :10~30ms,  
Note: if there is check sum error during firmware download, user may need to adjust this value.
- Character delay:0ms. Select [File\Properties\Settings\ASCII Setup..]. It is required when user download new firmware.



- Type [Enter] and see if it works. The command prompt will be displayed.



## 11.2.2.1. Basic Command Set and Control Example via the Hyper Terminal

Type H or ? at the command prompt will display the available command set.

```

+----- TW9909 EV Board(Keil)-Rev1.41 -----+
| W Index Data   Write register                |
| X Index D D,, Write Multiple(<7) bytes      |
| R Index       Read register                 |
| D Index Index Dump registers                |
| J Index D D,, Write Multiple command        |
| C Address      Change I2C Address            |
| I 011|2|3     Change Input C>YC>YUV>SCART  |
| S 011 011     0:CC(F1) 1:CC(F2), 0:TXT 1:HEX |
| < >          Register++,Register--         |
| /            Repeat previous command        |
| H,?          Help                           |
+-----+

```

## Examples.

Change address

```

[88]>C 28
Address : 28
[28]>

```

Dump registers

```

[88]>d 0
Read [Adrs:88h,00h] 50h
Read [Adrs:88h,01h] 93h
Read [Adrs:88h,02h] 41h
Read [Adrs:88h,03h] A2h
Read [Adrs:88h,04h] 00h
Read [Adrs:88h,05h] 81h
Read [Adrs:88h,06h] 00h
Read [Adrs:88h,07h] 12h
[88]>

```

Read register

```

[88]>r 2
Read [Adrs:88h,02h] 68h
[88]>

```

Write register

```

[88]>w 2 41
Write 41h to [Adrs(88h)Index(02h)]
Read [Adrs:88h,02h] 41h
[88]>

```

Changing 2 wire serial bus slave device address.

**TW9906, 09: 0x88** // User can change the address to 0x8A, by swap R39, R40 resistors  
**Z89129 : 0x28**  
**ADV9174 : 0x54**

Example

```
[88]>C 54 // change slave address to ADV9174
[54]> // Now user can access registers in ADV9174
```

How to test the down-scaling.

To evaluate down-scaling performance, just change scaling registers(0x0d, 0x0e, 0x0f).

Example)

```
[88]>W e 22 // 1/4 size
[88]>W e 33 // 1/9 size
[88]>W e 44 // 1/16 size
[88]>W e 11 // full size
```

#### 11.2.2.2. Down Load new Firmware to TW9906/TW9909

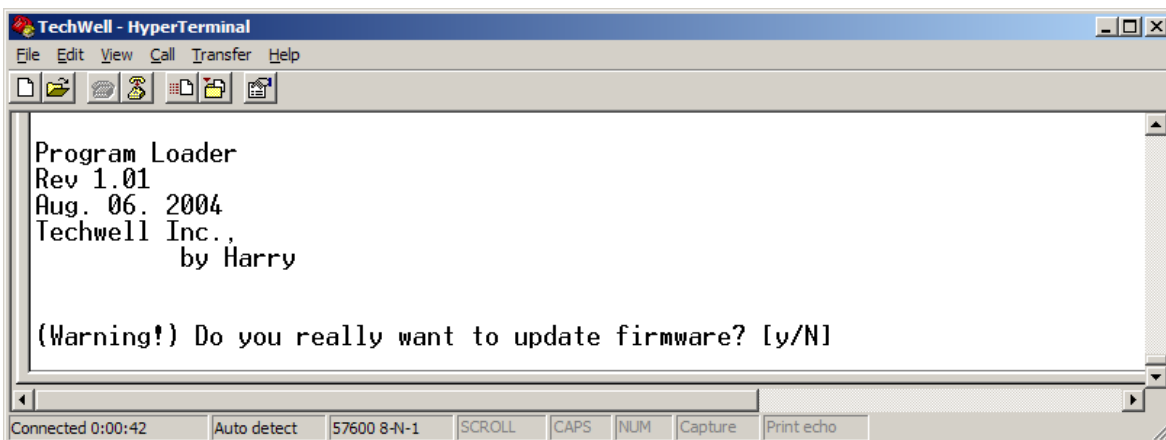
**Warning: This procedure could erase the firmware, if not handle correctly, the board will not work.**

Connect serial cable to host PC, and start Hyper Terminal.

Make sure Hyper Terminal settings are:

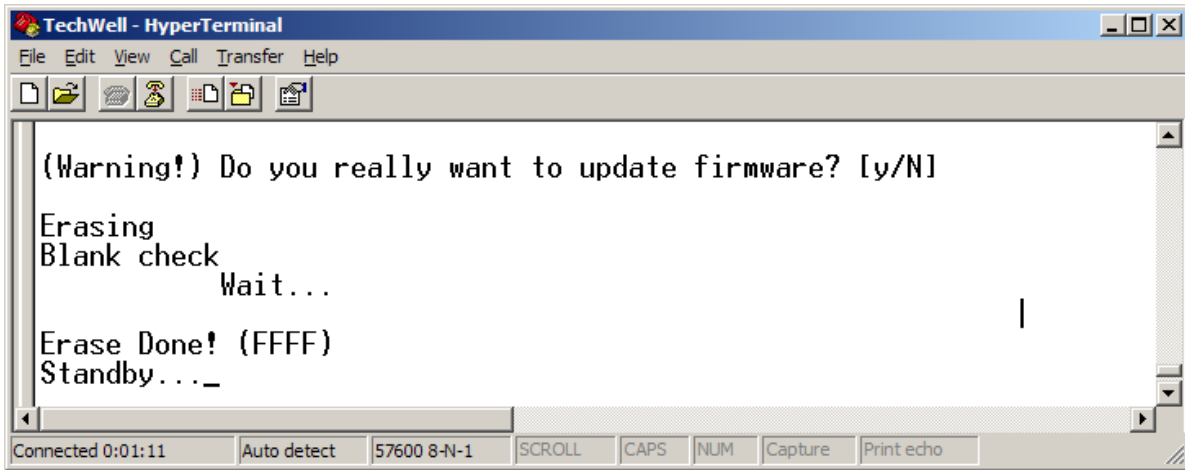
COM port properties: 57600bps, 8 data, No parity, 1 stop, No flow control.  
 Line delay : 30~10ms, Character delay : 0ms

Put a jumper at J13 next to reset push button. Power On or Press {Reset}. The boot loader screen will show up.



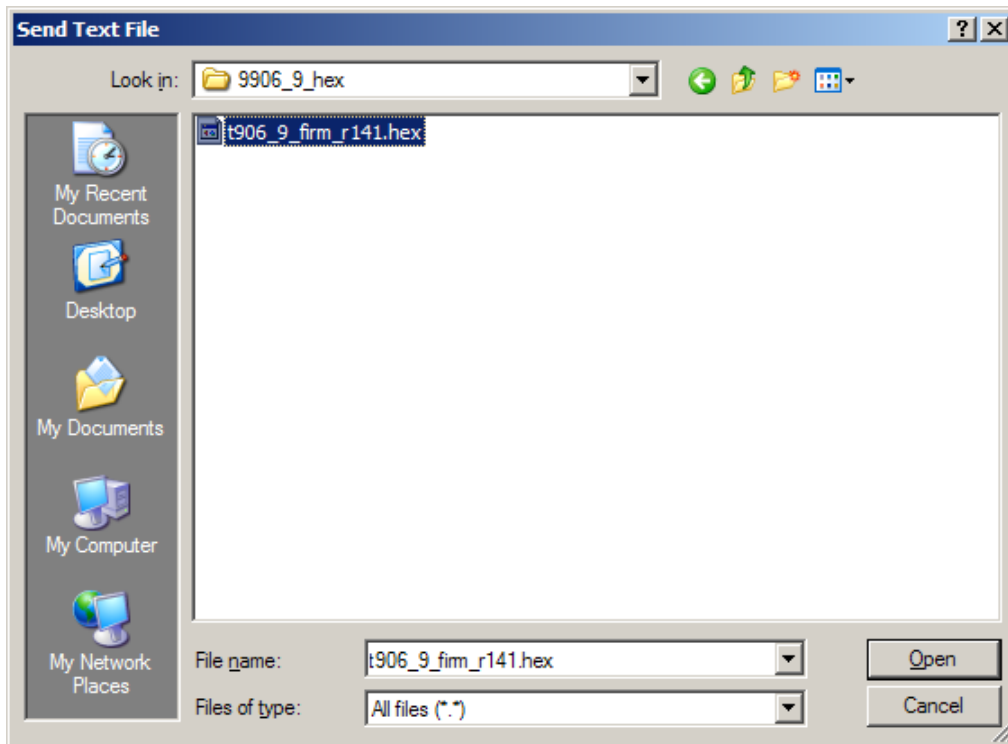
Type 'Y', the following message will be seen,





Click Hyper Terminal menu [Transfer\Send Text File..]

Select the HEX file to be downloaded. Click Open Button and downloading will begin.



Firmware is being downloaded

The screenshot shows a HyperTerminal window titled "TechWell - HyperTerminal". The menu bar includes File, Edit, View, Call, Transfer, and Help. The main text area displays the following output:

```
(Warning!) Do you really want to update firmware? [y/N]
Erasing
Blank check
    Wait...
Erase Done! (FFFF)
Standby...
Programming
155E_
|
```

The status bar at the bottom shows "Connected 0:03:40", "Auto detect", "57600 8-N-1", and buttons for SCROLL, CAPS, NUM, Capture, and Print echo.

Programming completed.

The screenshot shows the same HyperTerminal window. The main text area displays the following output:

```
Erasing
Blank check
    Wait...
Erase Done! (FFFF)
Standby...
Programming
47E6
Complete 47E7h(18407) bytes

Please turn OFF and ON to execute New Firmware !!!

*
```

The status bar at the bottom shows "Connected 0:06:40", "Auto detect", "57600 8-N-1", and buttons for SCROLL, CAPS, NUM, Capture, and Print echo.

Follow the on screen instruction, and recycle the board power, then the board will run with new firmware.

### 11.2.3. Install and Use the Serial Control application

#### 11.2.3.1. Install the Serial Control application

The SerCon application can be downloaded from the Techwell Website. Download the application software in a compressed file SerCon170.zip. Unzip it to a local folder and install it. During the installation, if it asks for the serial number, user can type in 000. After installation is done, the following icon will be found under the program application. User can copy the short cut to the desk top. Following is the icon.



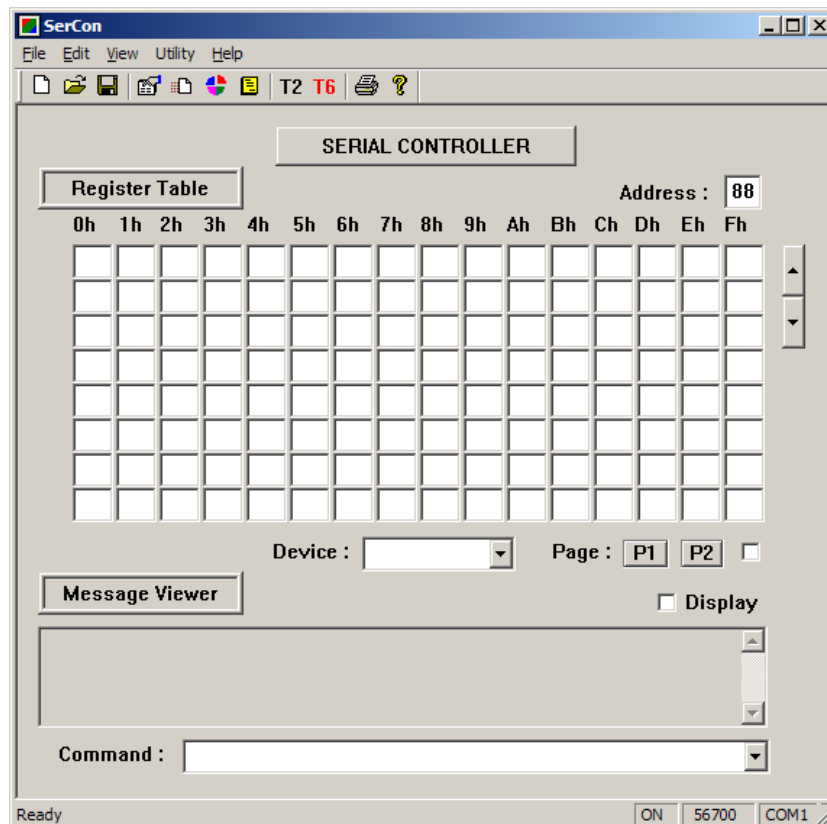
Sercon.Ink

Detail instruction on how to use the SerCon, please refer to document "Instruction of Serial Controller1216.pdf."

The SerCon program also has command line input option for those who prefer using command line input. This can be done by typing in the command in the command box in the bottom of the SerCon GUI.

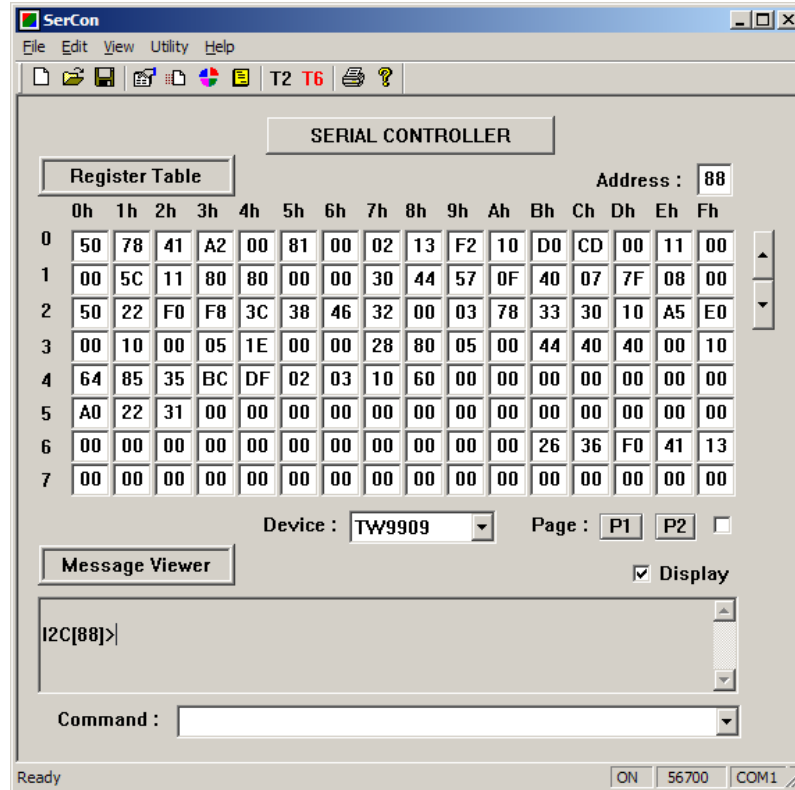
11.2.3.2. Use SerCon to control registers and board features.

Turn on the power of the board, plug in the serial cable, and make sure JP13 is open. Execute the SerCon program, the following will display.



Select device TW9906 or TW9909 from the device box, and check the box before the word Display (right under P2). Click on P1, P2 and P1 again. The following screen will be seen with current register content.

Hit the Reset button, pay attention to the Message Viewer, there are message scroll up quickly.



Now user can change any register content and will see the resulting effect in real time.

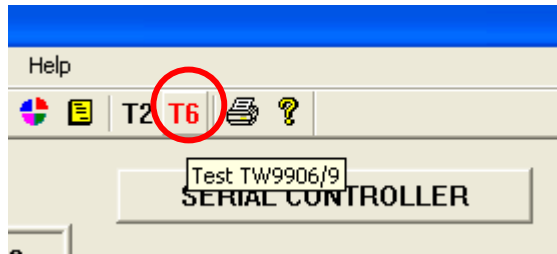
Example 1: Scaling: change the content of Register 0Eh, from 11 to 22, the screen will be scaled downed.

Example 2: Change Brightness. Register 10h, change content to 7F maximum brightness, or 80 to minimum.

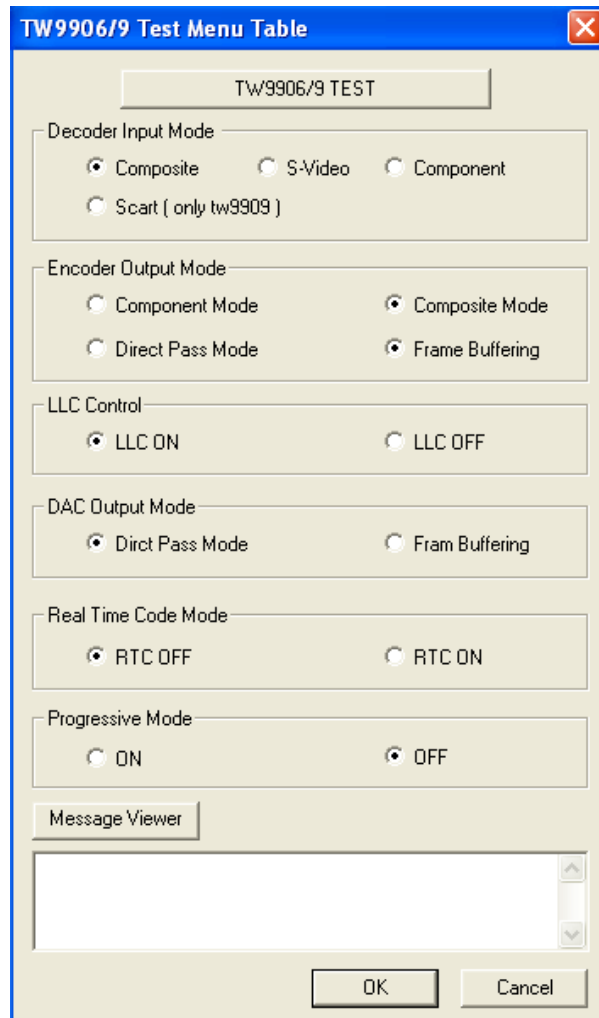
User can explore other register following the datasheet.

Note that when placing the mouse cursor over the register in the SerCon graphical interface, the name of that register will pop up.

Some frequently used features can be changed quickly by using the test menu. Click on T6 from the menu bar (for TW9906 and 09)



The test menu will show up. User can click on the radio button to change the board features such as decoder mode, encoder mode, LLC, DAC output mode, RTC mode, Progressive mode, etc.

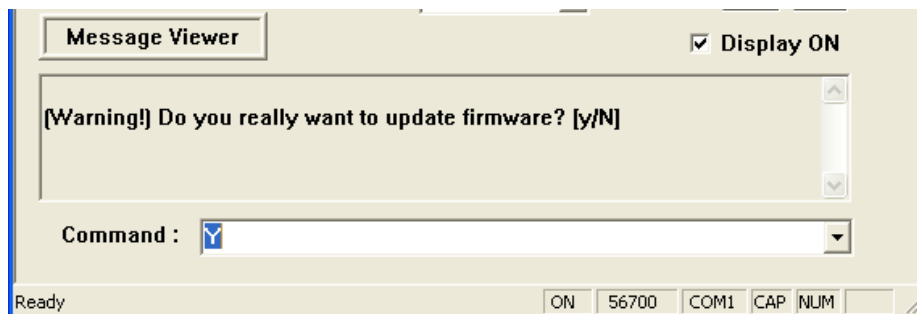


11.2.3.3. Down Load Firmware to on board Microcontroller

Make sure JP13 boot jumper is short,  
and Display ON is checked.  
Push Reset button.



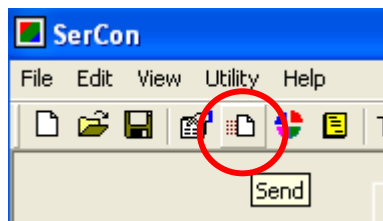
Type 'Y' in the Command box after received message from the message viewer.



When the erase is done the following screen will display.

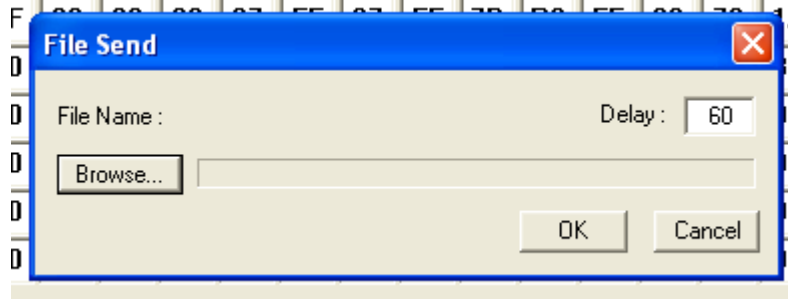


Click on "Send" button from the menu bar

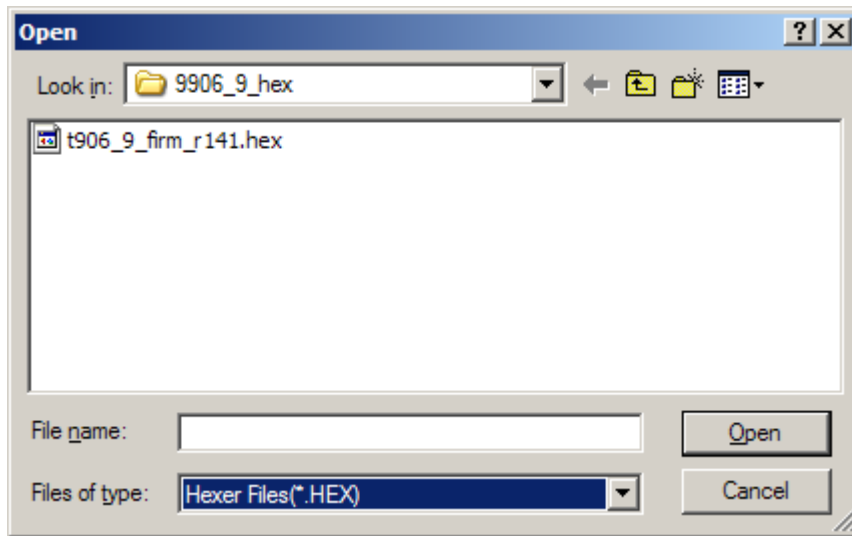




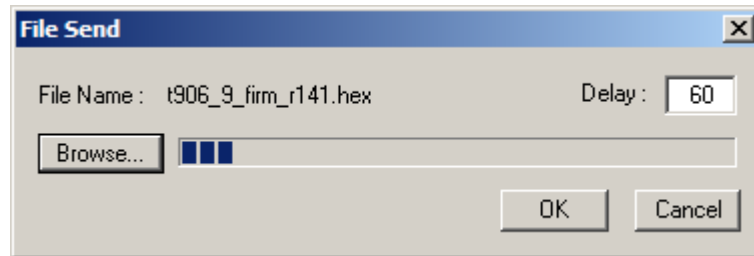
Click on "Browse" and select the hex file to be down loaded.



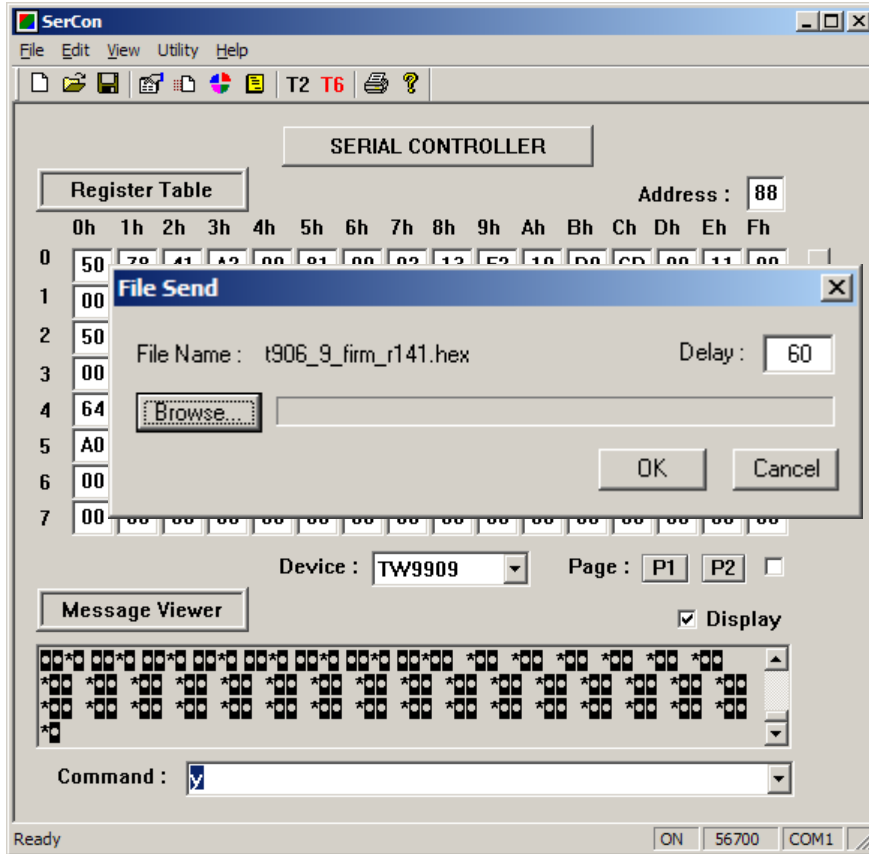
Select the newest hex file, and click open, the download will begin.



Down Load In progress.



Download completed, click OK, remove JP13 jumper, and recycle the power.

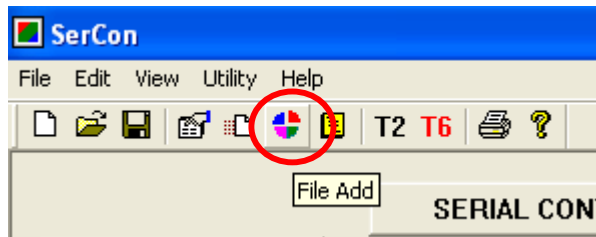


11.2.3.4. Down Load Firmware to on board FPGA

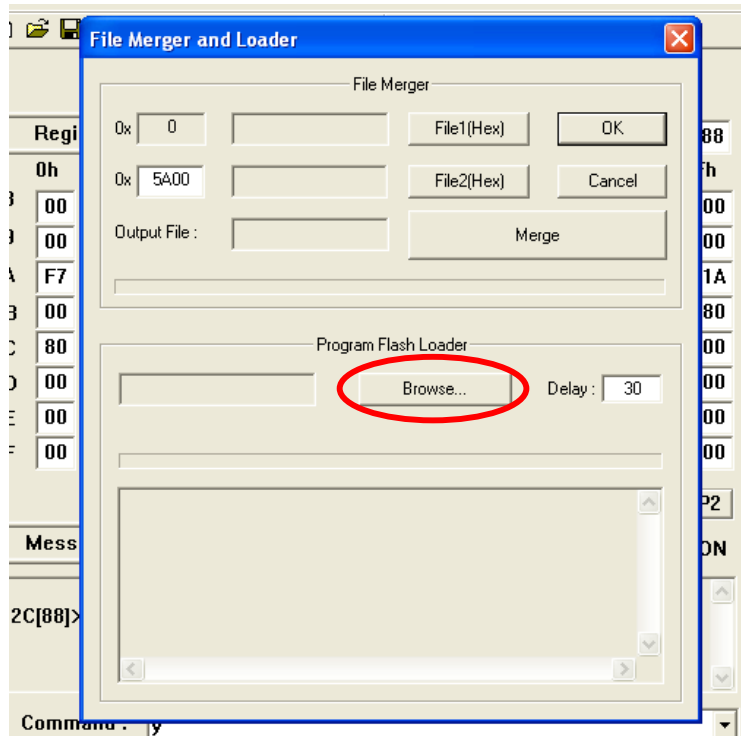
Set dip switch S1 pos 6, 7 and 8 respectively M2, M1, M0 to OFF.

Recycle the power.

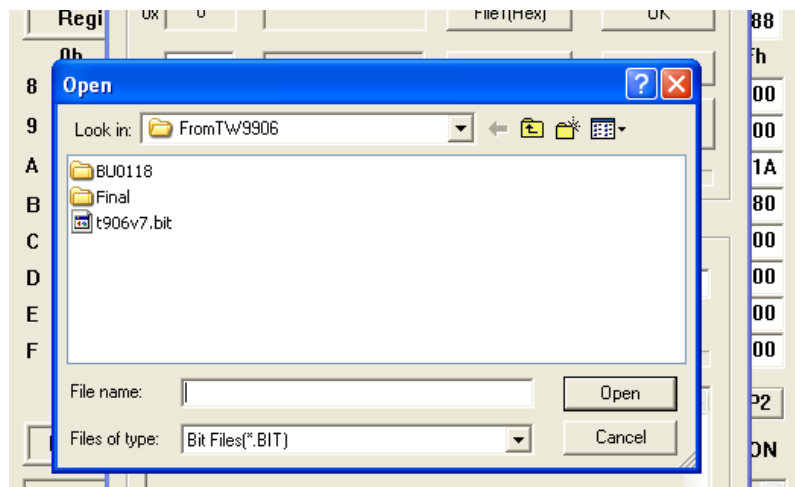
Click "File Add" from menu tool bar.



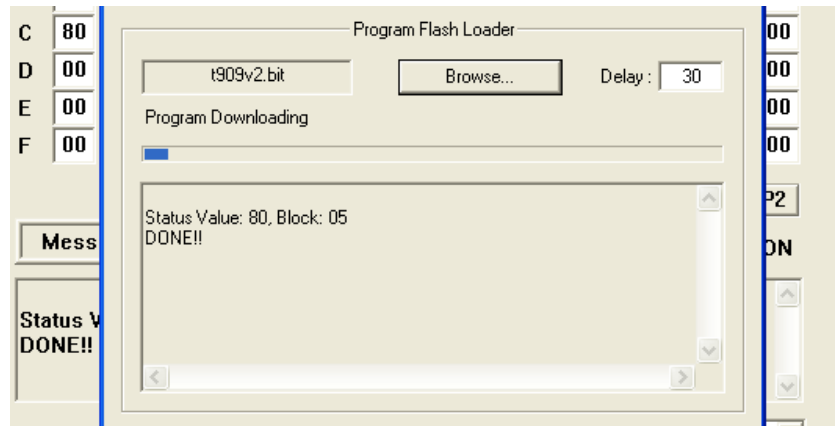
Click on "Browse" from the File Merger and Loader window.



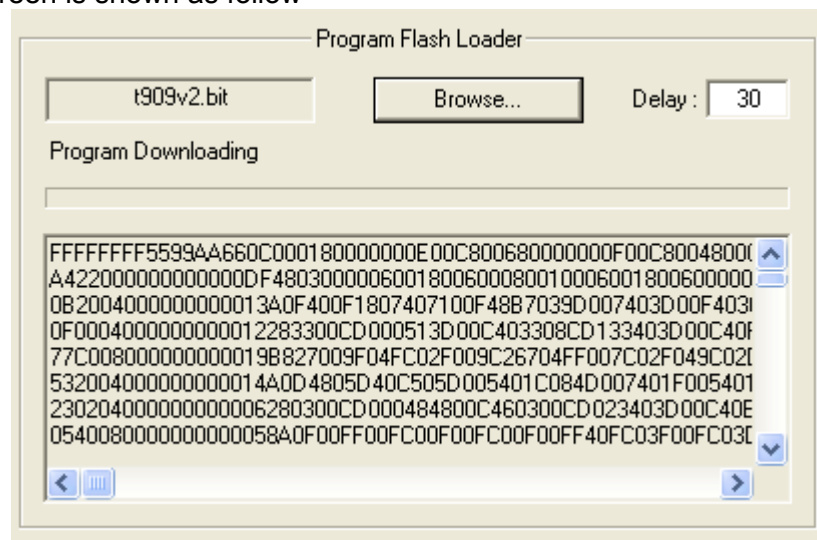
Choose "bit" file from open window.



Downloading in progress



The ending screen is shown as follow



Set dip switch pos 6, 7, 8 back to ON OFF ON or OFF OFF ON respectively. Recycle the power, the board's FPGA firmware is updated.

## 12. Revision History

Version	Date	Revision history	By
0	01/21/2005	Initial release	Brian An
1.0	3/08/2005	Update and add details.	Albert Au