

USER'S MANUAL

**Getting Started with
ALEXAN ATMEL
AT89C2051 / AT89C4051
Training Module - 2**

Version 1.2
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About This Guide

In this User's Manual, it is assumed that the user is familiar with microcontrollers on the following aspects:

1. How to program using an MCU programmer
2. MCU pin-outs and I/O port functions
3. How to use, program and control Alphanumeric LCD display (16x2), Dot Matrix (8x8), Matrix Keypad (3x4), serial EEPROM, and serial port communication
4. How to read and interpret a schematic diagram
5. Knowledge on some electronic terms and devices

It is also assumed that the user is familiar in microcontroller programming either in C or assembly language. The user must have knowledge on compiling/debugging source codes. Moreover, it is also assumed that the user is knowledgeable on the standards and safety precautions in operating electronic hardware including the correct handling of microcontrollers.

Alexan ATMEL AT89C2051/AT89C4051 Training Module-2 and Alexan 89CX051 TM-2 refers to the same module and will be used alternately.

I. Overview

This user's manual will guide you on how to use the ALEXAN 89CX051 Training Module-2 (TM-2). While the first training module, TM-1, covered topics on LED lamps, 7-segments, buzzer, relay and serial communication, this 2nd level training module has the following applications:

1. Alphanumeric LCD Display (16x2)
2. LED Dot Matrix (8x8)
3. Matrix Keypad (3x4)
4. Serial EEPROM
5. RS232 Serial Communication

The TM-2 is a helping tool in which you can explore the many features of a microcontroller. Like TM-1, this module still uses ATMEL AT89C2051 and AT89C4051 microcontroller (MCU).

You must first be familiar with and understand the schematic diagram of the training module to facilitate your programming.

II. Getting Started

What you need to get started

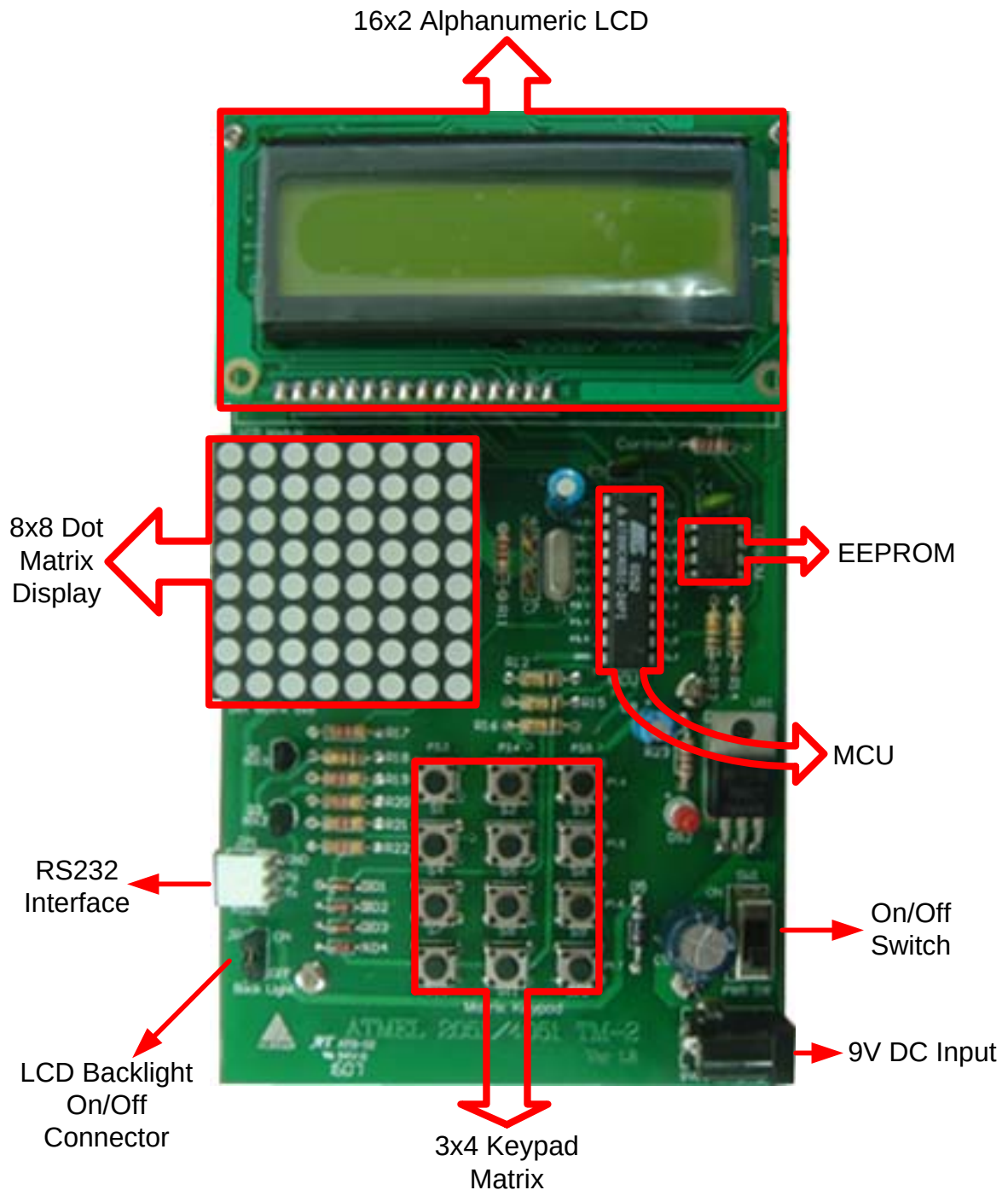
1. ALEXAN 89CX051 Training Module-2
2. 9V DC Power Adapter
3. ATMEL AT89C2051/AT89C4051 Microcontroller
4. 3-Pin Connector to Serial Connector for RS232
5. ATMEL Programmer
6. Debugger/Compiler for your source code

After writing your hex code into the microcontroller by means of an IC programmer, insert your microcontroller into the 20-pin IC socket of your training module.

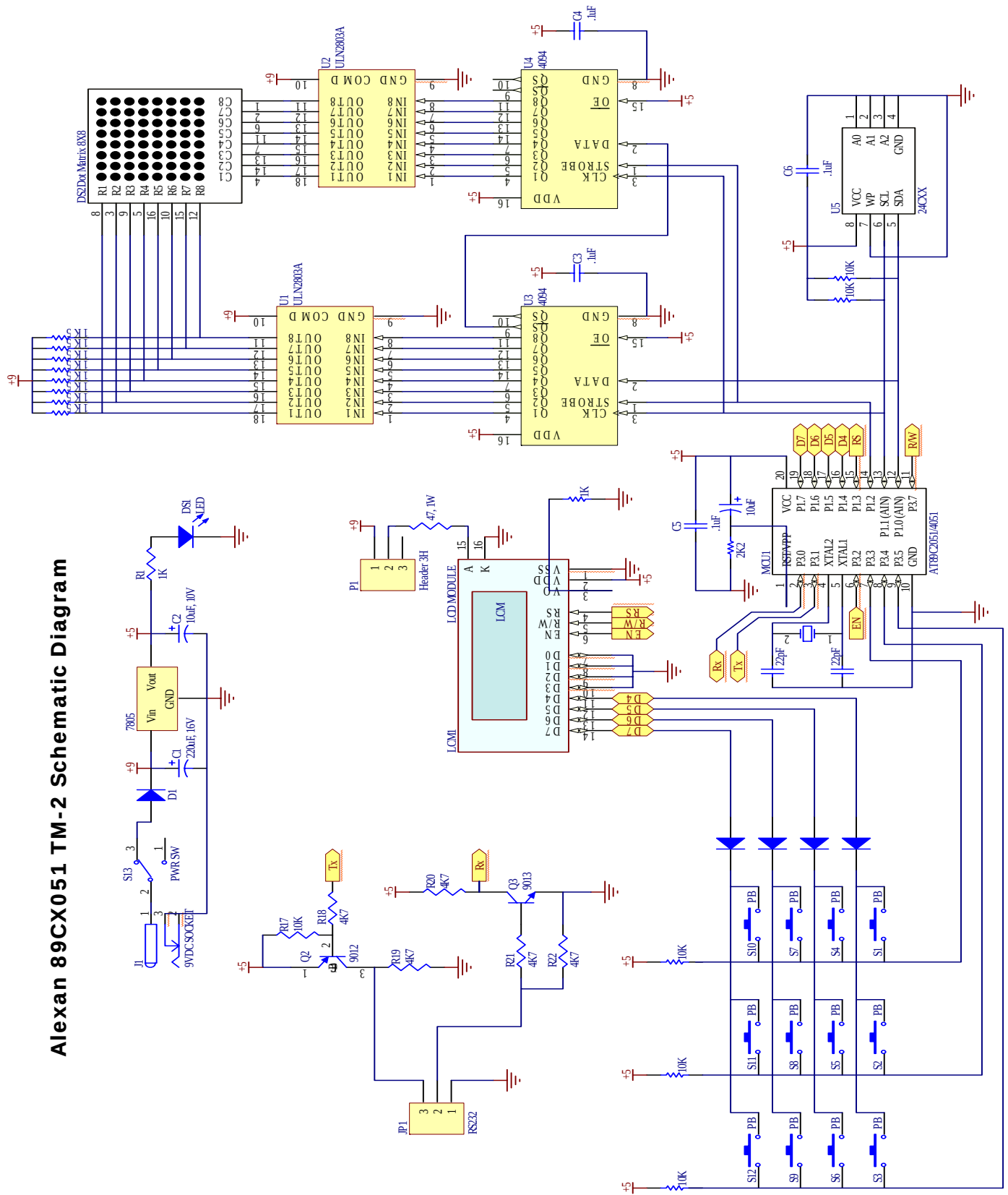
Note: The notch of the IC socket must correspond to the notch of your MCU. Incorrect placement might damage your MCU.

You may use the LCD display, dot matrix and matrix keypad at the same time. However, the dot matrix and serial EEPROM may not be used at the same time as the pins controlling the dot matrix and serial EEPROM (P1.0 and P1.1) are shared by both components.

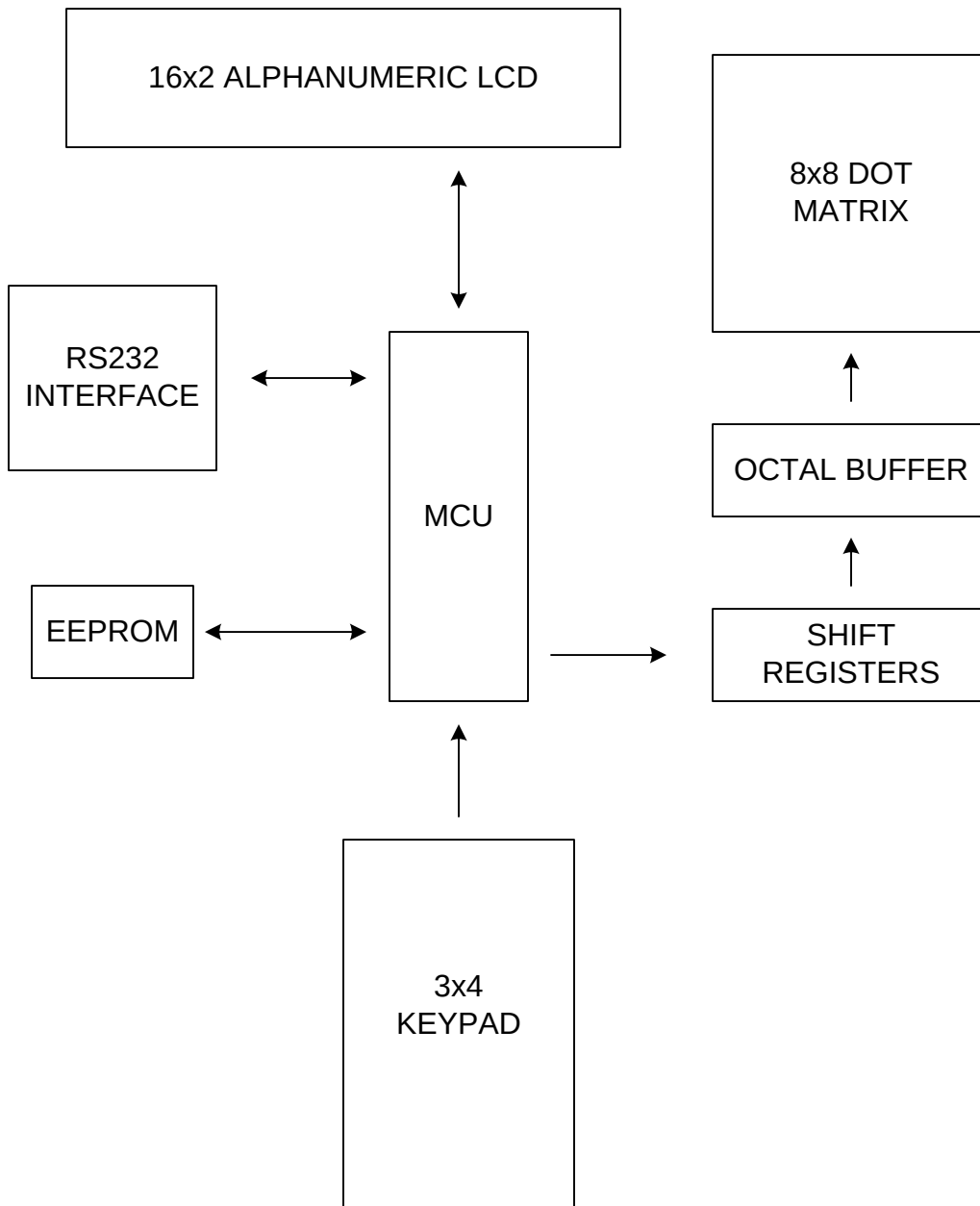
III. Training Module PCB and Schematic Diagram



Alexan 89CX051 TM-2 Schematic Diagram



IV. Alexan 89CX051 TM-2 Block Diagram



V. Alexan TM-2 Pinouts

LCD	MCU PINOUTS	DESCRIPTION
D0	NOT CONNECTED	DATA PIN
D1	NOT CONNECTED	DATA PIN
D2	NOT CONNECTED	DATA PIN
D3	NOT CONNECTED	DATA PIN
D4	PORT 1.4	DATA PIN
D5	PORT 1.5	DATA PIN
D6	PORT 1.6	DATA PIN
D7	PORT 1.7	DATA PIN
R/W	PORT 3.7	READ/WRITE
RS	PORT 1.3	COMMAND/DATA
ENABLE	PORT 3.2	ENABLE PIN
SHIFT REGISTER		
CLOCK	PORT 1.1	INPUT CLOCK
STROBE	PORT 1.2	ENABLE PIN
DATA	PORT 1.0	DATA PIN
EEPROM		
CLOCK	PORT 1.1	INPUT CLOCK
DATA	PORT 1.0	DATA PIN
RS232 INTERFACE		
TRANSMIT	PORT 3.1	TRANSMIT PIN
RECEIVE	PORT 3.0	RECEIVE PIN
KEYPAD		
COLUMN 1	PORT 3.3	MATRIX COLUMN 1
COLUMN 2	PORT 3.4	MATRIX COLUMN 2
COLUMN 3	PORT 3.5	MATRIX COLUMN 3
ROW 1	PORT 1.4	MATRIX ROW1
ROW 2	PORT 1.5	MATRIX ROW2
ROW 3	PORT 1.6	MATRIX ROW3
ROW 4	PORT 1.7	MATRIX ROW 4

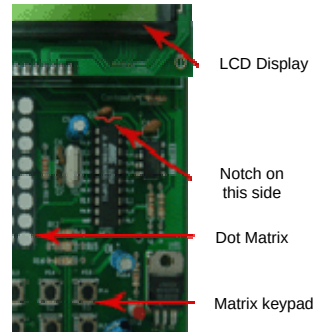
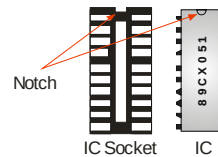
VI. Operating Procedures for Demo Program

1. Demo Program 1 – DOT MATRIX

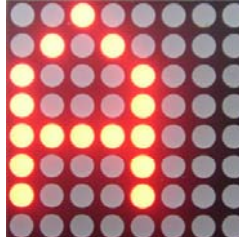
A. Burn the HEX file named “DEMO CODE – DOT MATRIX.HEX” into the AT89C2051/AT89C4051 IC using the Alexan ATMEL Programmer.



B. Transfer the programmed IC to the TM-2. Be sure to *Power Off* the module first. Make sure the IC is in the correct position. The notch of the IC must match the notch of the IC socket as shown in the picture.



C. The letter “A” is displayed on the dot matrix. (Notice that the first line of the LCD display will contain blocks, this shows that the LCD display has not been initialized.)

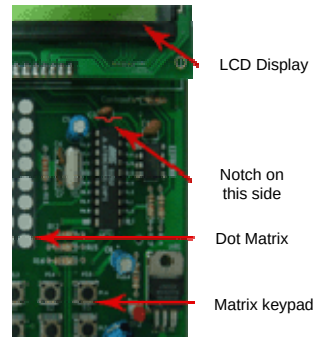
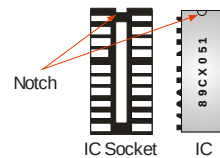


2. Demo Program 2 – LCD Display

A. Burn the HEX file named “DEMO CODE – LCD DISPLAY.HEX” into the AT89C2051/AT89C4051 IC using the Alexan ATMEL Programmer.



B. Transfer the programmed IC to the TM-2. Be sure to *Power Off* the module first. Make sure the IC is in the correct position. The notch of the IC must match the notch of the IC socket as shown in the picture.



C. The message “WOW, IT’S A BLINKING MESSAGE” displays blinking on the LCD.

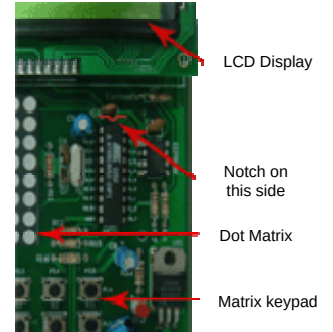
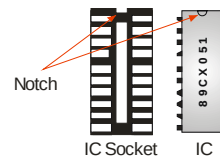


3. Demo Program 3 – Matrix Keypad

A. Burn the HEX file named “DEMO CODE – KEYPAD.HEX” into the AT89C2051/AT89C4051 IC using the Alexan ATMEL Programmer.



B. Transfer the programmed IC to the TM-2. Be sure to *Power Off* the module first. Make sure the IC is in the correct position. The notch of the IC must match the notch of the IC socket as shown in the picture.



C. Click a button on the matrix keypad and the corresponding digit for the button displays on the LCD. For the sample below, the button S7 was clicked.

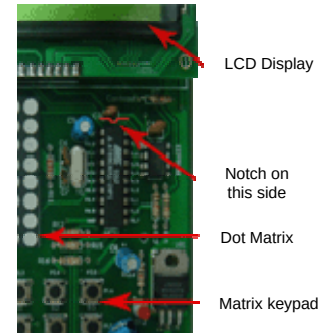
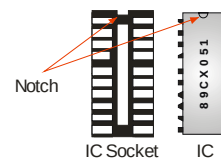


4. Demo Program 4 – RS232

A. Burn the HEX file named “DEMO CODE – RS232.HEX” into the AT89C2051/AT89C4051 IC using the Alexan ATMEL Programmer.



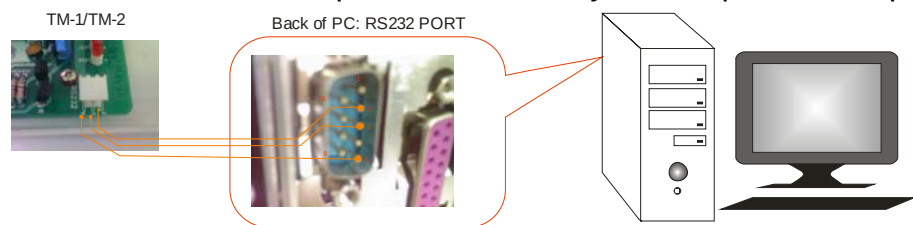
B. Transfer the programmed IC to the TM-2. Be sure to *Power Off* the module first. Make sure the IC is in the correct position. The notch of the IC must match the notch of the IC socket as shown in the picture.



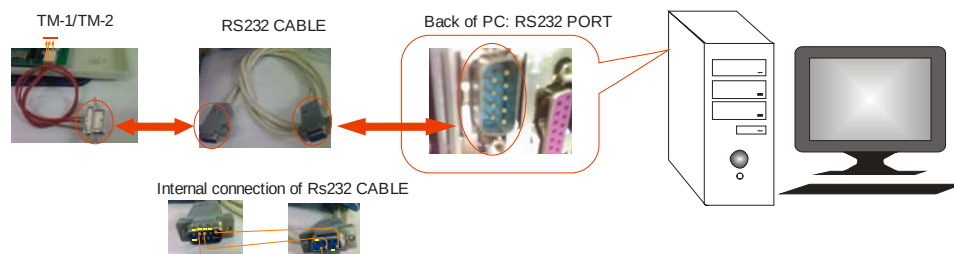
C. Connect the serial port of your PC as shown below. (Steps C-F will also be used for the EEPROM demo code.)

1. Direct Connection.

If your Personal Computer supports Serial Port, connect the TM-2 as shown below. The 3-pin connector of TM-2 (labeled RS232) where each pin is labeled 2, 3 and 5 must be connected to the pins 2, 3 and 5 of your computer serial port respectively.

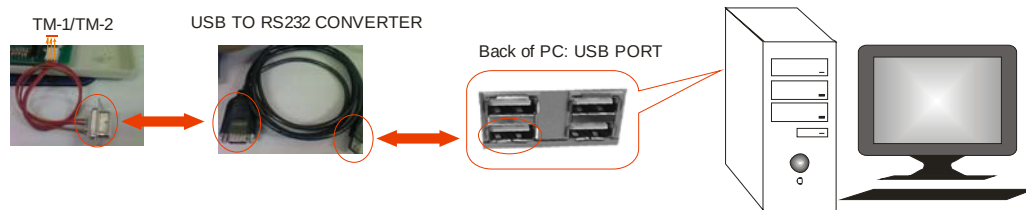


You can use a 3-pin connector (Female), RS232 9-pin connector (Female), and a MALE/FEMALE RS232 Cable to simplify the above connection.



Note: You can leave pins 1, 4, 6, 7, 8 and 9 unconnected, they are not useful in our application or you can also connect them, as long as they are connected 1-to-1(Pin 1 Male to Pin 1 Female, Pin 4 Male to Pin 4 Female, and so on).

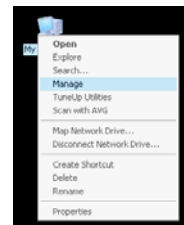
2. Using a USB to RS232 Converter.



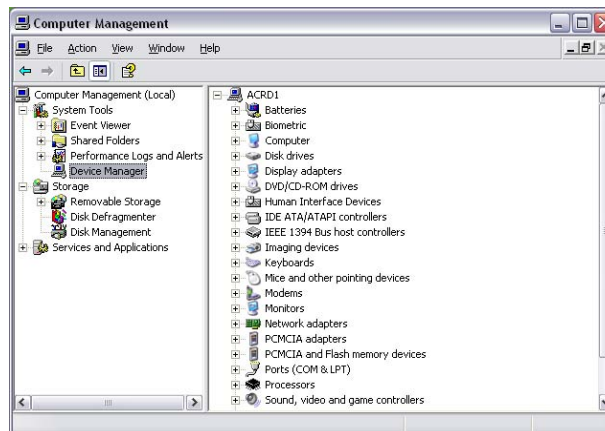
Note: You can use any working USB to RS232 Converter, but you must first install the driver and locate its COM port number. The COM port number of your serial port must be known for this application.

D. Locate the COM port number of your serial port.

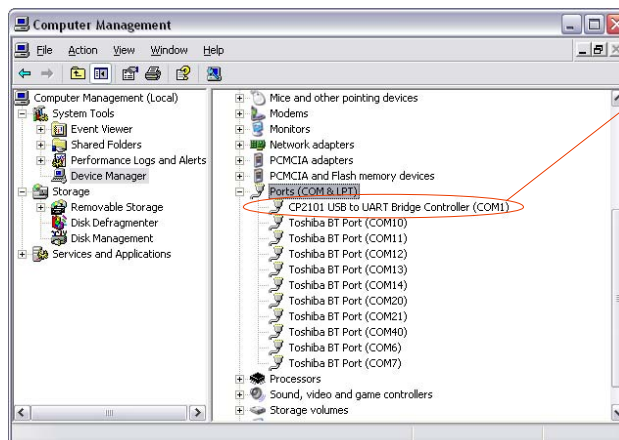
1. Right-click on “My Computer” and click “Manage”.



2. Click “Device Manager”.



3. Double-click the “Ports (COM & LPT)” to view the list of connected devices.

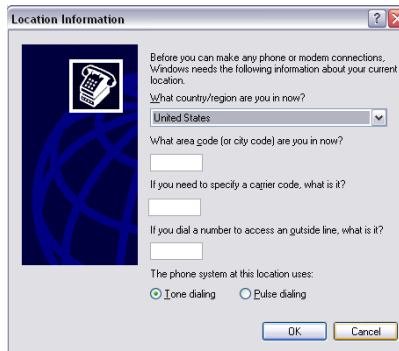


Sample COM port number for USB to serial converter. In this example, the converter is located on COM port 1. Take note that the driver of your USB to serial converter automatically assigns the COM port number, so you must identify the one you are using.

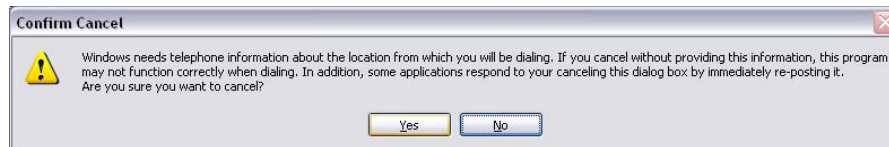
Note: Majority of the built-in serial port is designated as COM1.

F. To run the RS232 and EEPROM demo codes, the HyperTerminal program will be used. HyperTerminal is included in the Windows Operating System.

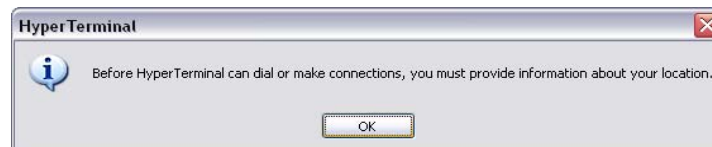
1. Open HyperTerminal.
To open the HyperTerminal, click “Start > All Programs > Accessories > Communications > HyperTerminal”
2. If prompted with the Location Information, click “Cancel”.



3. Click “Yes” to confirm.



4. Click “OK”.



5. In the Name box, type a name that describes your connection as shown in the example below, then click “OK”.

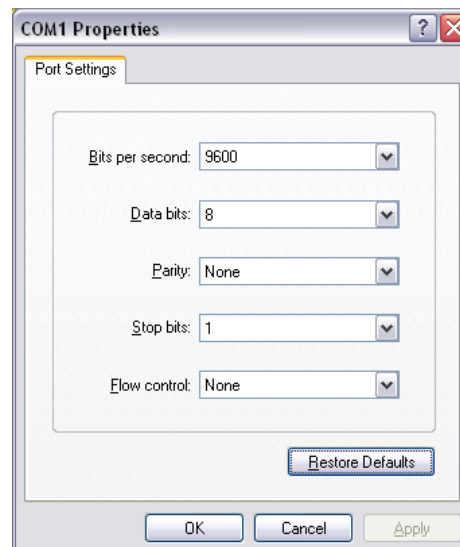


6. In the Connect To dialog box, choose the port number of your Serial Port or USB to Serial converter using the drop down box to connect to TM-2.

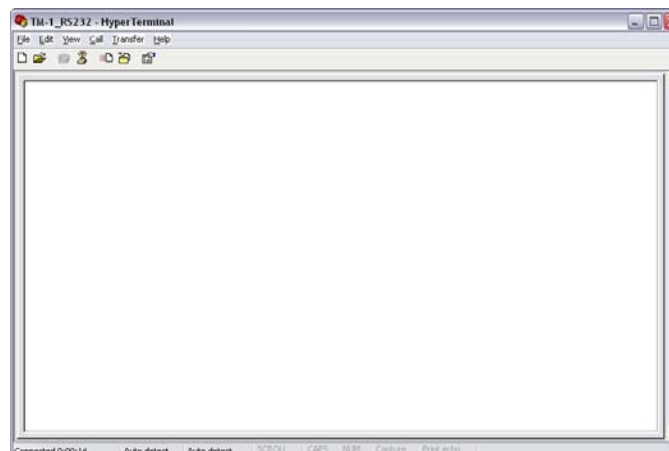


7. In the COM Port Properties, set the following values listed below to set your Port Settings and click "OK".

Bits per second: 9600
Data bits: 8
Parity: None
Stop bits: 1
Flow Control: None



You have successfully loaded and configured the HyperTerminal!

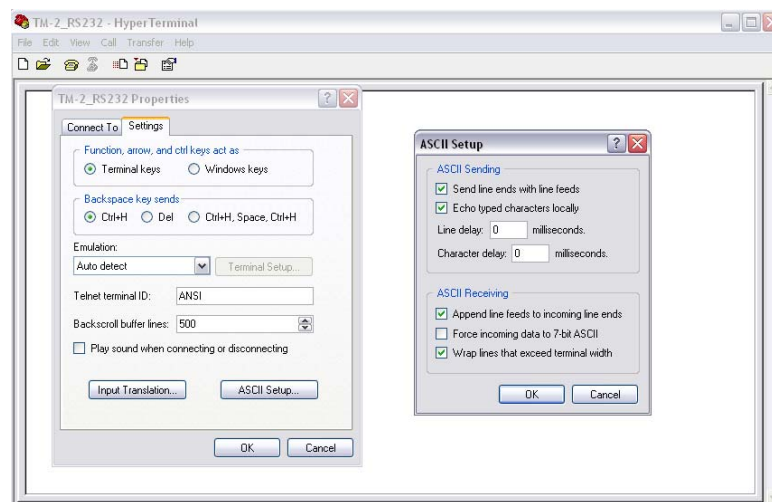


8. Configure the Hyper Terminal Properties. Under the File Tab, choose Properties.

A Properties dialog box appears, choose the Settings tab, then click the ASCII Setup button at the lower right portion of the box.

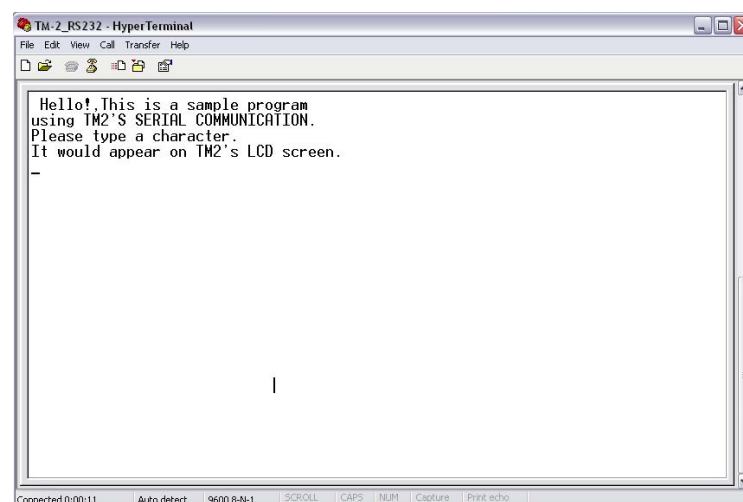
The ASCII Setup dialog box appears. Mark the following check boxes:

1. Send line ends with line feeds
2. Echo typed characters locally
3. Append line feeds to incoming line ends
4. Wrap lines that exceed terminal width



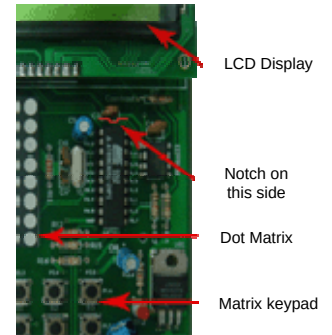
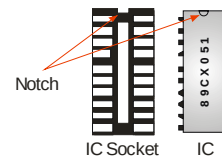
9. You may choose to save your new connection for easier access in the future. From the File menu, choose Save. Enter your desired connection name.

- G. Turn on the TM-2. A welcome message appears on your HyperTerminal. Whenever you type a character from your keyboard, it would appear on TM-2's LCD screen.

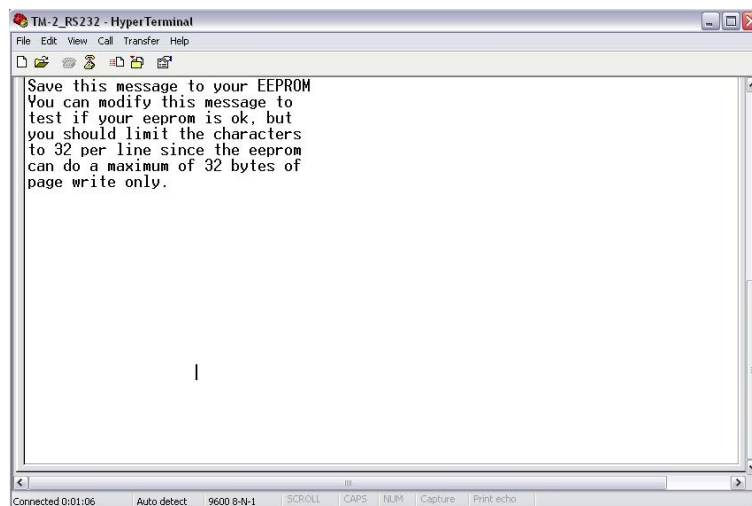


5. Demo Program 5 – EEPROM

- A. Burn the HEX file named “DEMO CODE – EEPROM.HEX” into the AT89C2051/AT89C4051 IC using the Alexan ATMEL Programmer.
- B. Transfer the programmed IC to the TM-2. Be sure to *Power Off* the module first. Make sure the IC is in the correct position. The notch of the IC must match the notch of the IC socket as shown in the picture.



- C. Do steps C-F of Demo Program 4 – RS232.
- D. Turn on the TM-2. Click S1 to see the message stored in the EEPROM on your HyperTerminal.

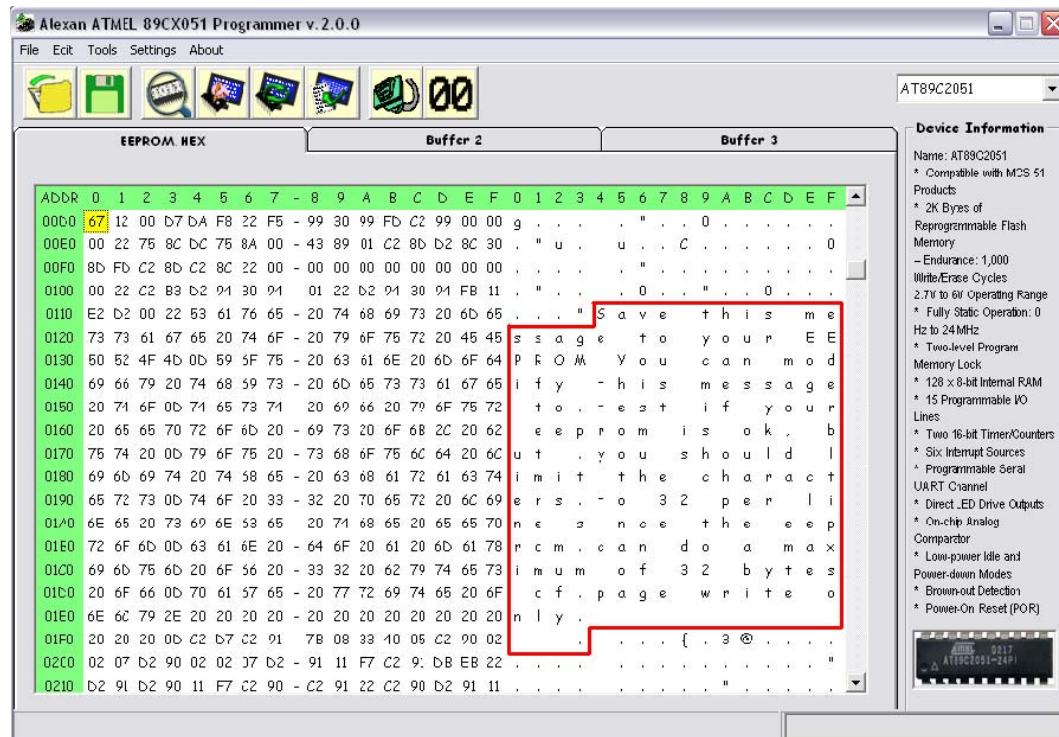


Note : Some dots on the dot matrix may also light up. This is because the pins (P1.0 and P1.1) controlling the EEPROM and dot matrix are the same.

E. To change the saved message on the EEPROM, follow these steps:

1. Open the Alexan ATMEL 89C051 Programmer.
2. Load the file EEPROM.HEX.
3. Modify the message code starting at 0114h to 01F3h.

WARNING: You can only modify those codes at code memory 0114h to 01F3h.

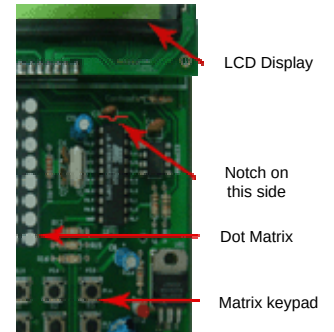
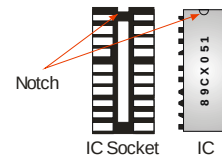


6. Demo Program 6 – Dot Matrix, LCD Display, Matrix Keypad and EEPROM

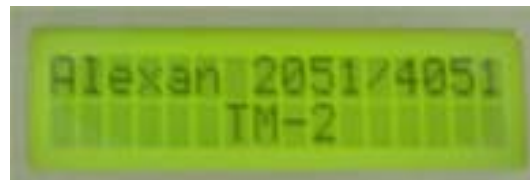
A. Burn the HEX file named “DEMO CODE – TM2.HEX” into the AT89C2051/AT89C4051 IC using the Alexan ATMEL Programmer.



B. Transfer the programmed IC to the TM-2. Be sure to *Power Off* the module first. Make sure the IC is in the correct position. The notch of the IC must match the notch of the IC socket as shown in the picture.



C. After turning on the TM-2, wait for two seconds. A welcome message will appear on the LCD.



D. The main menu will appear shortly after the welcome message.

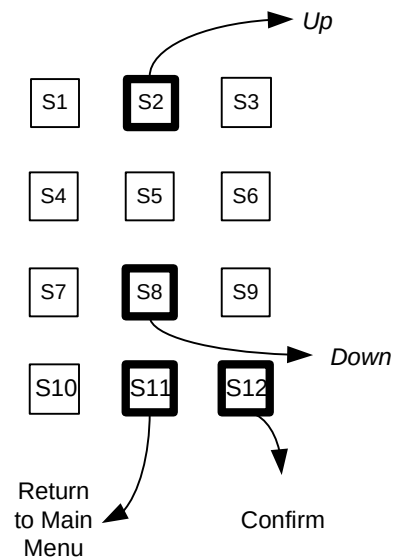
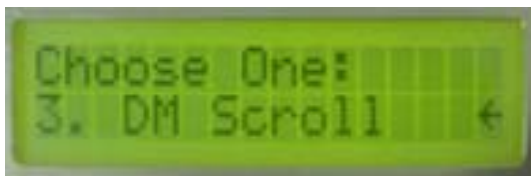
There are three (3) options, namely :

1. ReadEE
2. WriteEE
3. DM Scroll

S2 and S8 serves as the navigation keys. Press S2 to scroll up the menu.

Press S8 to scroll down the menu. Press S12 to confirm your selection

Note: The LCD that came with Alexan TM-2 does not have backlight functionality. You may change the LCD to one that has backlight to make use of the backlight function of the TM-2.



Matrix Keypad Navigation Set-up

- E. ReadEE – The last saved message on the EEPROM can be viewed on the LCD. Press S2 to scroll up the message or press S8 to scroll down the message. Hold S11 to return to the main menu.



NOTE: Due to the shared pins controlling the dot matrix and serial EEPROM, some dots on the dot matrix may light up during serial EEPROM reading and writing.

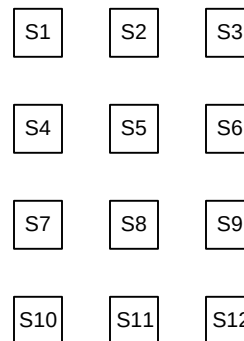


- F. WriteEE – Encode a message of up to 384 characters using the 3x4 matrix keypad and store it in the serial EEPROM. The 3x4 matrix keypad functions like a mobile phone keypad (refer to the character table). A cursor on the LCD screen appears. Hold S12 to store the message into the serial EEPROM. Hold S11 to return to the main menu.



Character Table

S1: . , - ? ! = + % 1
 S2: A B C 2
 S3: D E F 3
 S4: G H I 4
 S5: J K L 5
 S6: M N O 6
 S7: P Q R S 7
 S8: T U V 8
 S9: W X Y Z 9
 S10: backspace
 S11: 0 space
 S12: toggles character case



3x4 Matrix Keypad

- G. DM Scroll – The message saved on the serial EEPROM will “scroll” on the dot matrix display. To scroll the message again, press S12. To return to main menu, hold S11.

NOTE: The program scrolls any message saved in the serial EEPROM. Be sure to write a message in the serial EEPROM before selecting the DM Scroll option. If no message is stored in the EEPROM, then nothing will be displayed on the dot matrix.



*The message on the lcd
scrolls (from right to left)
on the dot matrix*