PRO-MAX/51-A
Single Board Computer
Technical Manual

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WARRANTY:

BiPOM Electronics warrants PRO-MAX/51 for a period of 1 year . If the board becomes defective during this period, BiPOM Electronics will at its option, replace or repair the board. This warranty is voided if the product is subjected to physical abuse or operated outside stated electrical limits. BiPOM Electronics will not be responsible for damage to any external devices connected to PRO-MAX/51. BiPOM Electronics disclaims all warranties express or implied warranties of merchantability and fitness for a particular purpose. In no event shall BiPOM Electronics be liable for any indirect, special, incidental or consequential damages in connection with or arising from the use of this product. BiPOM's liability is limited to the purchase price of this product.

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1. Overview

PRO-MAX/51-A is a general purpose micro-controller system. It is based on the 8051 and compatible single-chip micro-controllers. This family of micro-controllers provides all the essential elements of a computer system such as microprocessor, memory, serial port, parallel ports, timers, counters and interrupt handlers on a single chip.

PRO-MAX/51-A board complements these features by providing

- 512-byte EEPROM (optional 64-Kilobyte EEPROM)
- RS232 Serial Port
- In-circuit Programming of the micro-controller through the serial port
- Keypad connector
- LCD connector (with programmable contrast adjustment for LCD)
- Expansion bus interfaces to low-cost peripheral boards such as
    - Instrumentation amplifiers
    - Pressure inputs
    - Strain-gage inputs
    - 12 and 16-bit Analog-to-Digital Converters
    - Digital Input/Output cards
    - LED and LCD displays
- System bus interfaces to external ROM and RAM
- Various power supplies.

All these features allow build a complete Single Board Computer (SBC) system in very easy manner.

2. Specifications

Dimensions are 5.25 X 5.00 inches (133.3 X 127 millimeters).

Mounting holes of 0.125 inches (3.175 millimeters) are on four corners.

0° - 70° C operating, -40° - +85° C storage temperature range.

3. Functional Blocks

Figure 1 shows the block diagram of the PRO-MAX/51-A board.

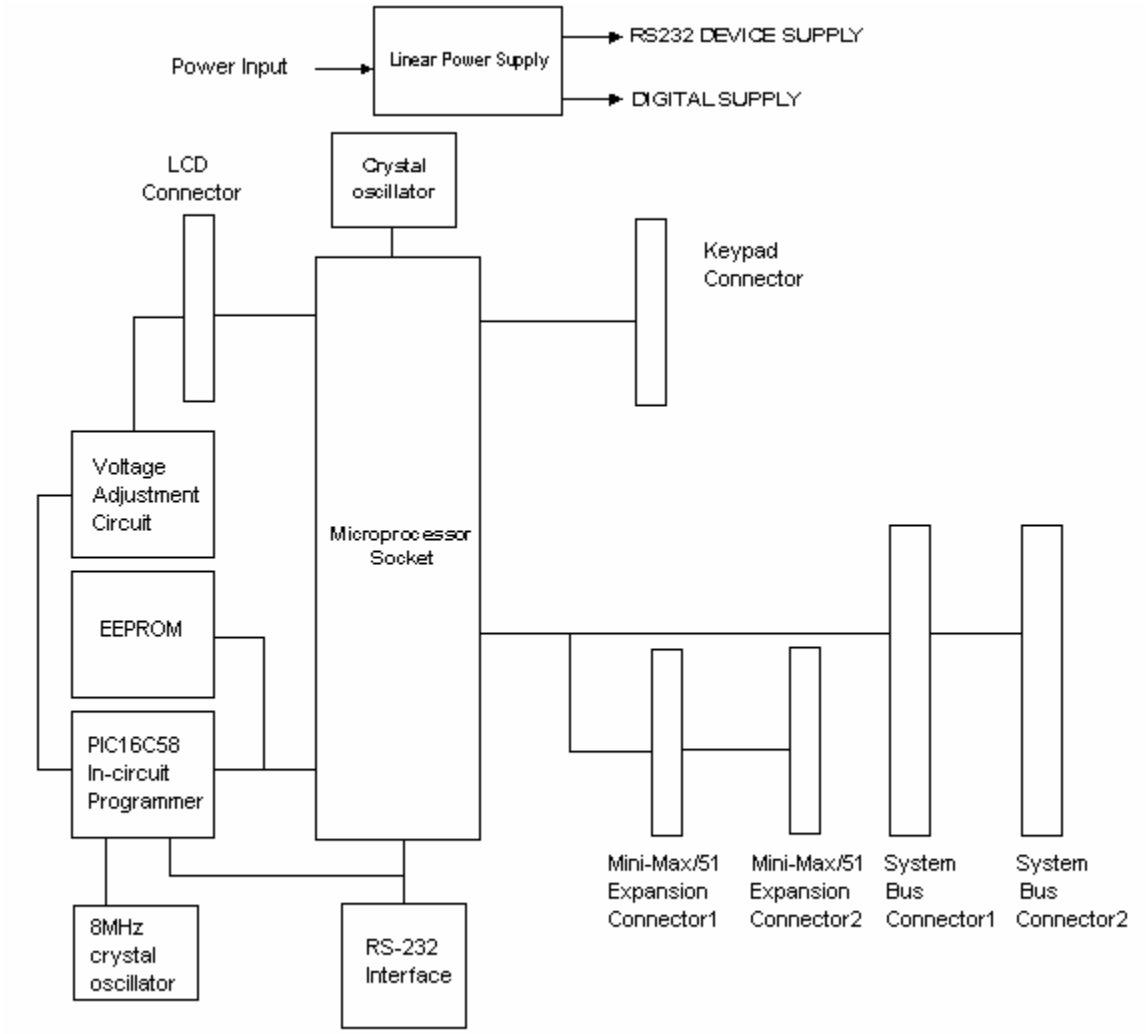


Figure 1

Micro-controller

PRO-MAX/51-A accepts a wide variety of single-chip micro-controllers in the 87C51 (internal memory version of 8051) family. PRO-MAX/51-A provides a socket for the user to install and use the microcontroller that he prefers or is familiar with. All micro-controller ports, system signals and power lines are provided on a 40-pin system bus connectors (J1, J4) for interfacing to peripherals and other external circuits. This way PRO-MAX/51-A can also support microcontrollers that running the program code from external memory. Section 6 shows a list of several popular microcontrollers those PRO-MAX/51-A supports. To minimize current consumption and heat dissipation in the digital power supply (U5), a CMOS type micro-controller is recommended.

As shipped, PRO-MAX/51-A has the 11.0592 MHz crystal oscillator. The 11.0592 MHz crystal oscillator also acts as a baud-rate generator for the RS232/RS485 port. Replacing the oscillator can change clock frequency. Crystal oscillator has been placed on a socket and can be easily replaced. All baud rates may not be available for the hardware serial port at other clock frequencies. Contact BiPOM Electronics about crystal oscillators for other clock frequencies.

Micro-controller ports and power lines have been provided on a 20-pin expansion bus connectors (J2, J3) for interfacing to external circuitry and existing MINI-MAX/51 peripheral boards.

As shipped, PRO-MAX/51-A has ATMEL AT89S53 micro-controller (U1). Micro-controller ports and power lines are provided on 20-pin expansion bus connectors and on 40-pin system bus connectors. AT89S53 has all the ports that are available on the 8051 family of micro-controllers: Port 1 (P1), Port 2 (P2), Port 3 (P3) and Port 4 (P4). P0 has open collector outputs that are available also on the LCD connector. P1 and P2 are general-purpose bi-directional input/output ports. Port 2 is available on the keypad connector. P1 and P3 are available on the expansion connectors. P3 pins can either be used as general-purpose input/output pins or have special purposes such as asynchronous serial port, interrupt inputs, timer inputs and strobe signals of writing/reading to/from external memory.

More information on the AT89S53 microcontroller can be obtained from ATMEL web site at www.atmel.com.

EEPROM

PRO-MAX/51-A has a 24C04 (U4) 4 Kilobit (512 bytes X 8) Electrically Erasable Programmable Read-Only-Memory (EEPROM). Depending on the application, the EEPROM can be used for storing calibration values for sensors, customer identification, serial number or other parameters that need to be retained when the power to PRO-MAX/51-A is off.

If more non-volatile memory is needed for an application, U4 can be replaced with optional 64 Kilobit EEPROM (OPT-EE64).

Expansion

Most of the micro-controller pins, power supplies and the crystal oscillator output are available on the 40-pin System Bus connectors (J1, J4) for interfacing to external circuitry, prototyping boards and peripheral boards. Some of the pins on J1, J4 are also available on the 20-pin MINI-MAX/51 Expansion connectors (J2,J3) for interfacing to existing MINI-MAX/51 peripheral boards. MINI-MAX/51 peripheral boards can be connected either as a piggyback daughter-board on PRO-MAX/51-A using standoffs or can be placed up away from PRO-MAX/51-A using a 20-wire ribbon cable. Section 4 lists the available expansion boards. Table 1 shows the pin assignments for System Bus and MINI-MAX/51 Expansion connectors.

System Bus Expansion (J1,J4)

Signal	Pin	Pin	Signal
P0.0	40	39	P0.1
P0.2	38	37	P0.3
P0.4	36	35	P0.5
P0.6	34	33	P0.7
ALE	32	31	P3.0
P3.1	30	29	P3.2
P3.3	28	27	P3.4
P3.5	26	25	P3.6
P3.7	24	23	GND
P1.0	22	21	P1.1
P1.2	20	19	P1.3
P1.4	18	17	P1.5
P1.6	16	15	P1.7
PSEN	14	13	P2.7
P2.6	12	11	P2.5
P2.4	10	9	P2.3
P2.2	8	7	P2.1
P2.0	6	5	VCC
RESET	4	3	VCC
GND	2	1	CLK

MINI-MAX/51 Expansion (J2,J3)

Signal	Pin	Pin	Signal
P3.0	20	19	P3.1
P3.2	18	17	P3.3
P3.4	16	15	P3.5
P3.6	14	13	P3.7
P1.0	12	11	P1.1
P1.2	10	9	P1.3
P1.4	8	7	P1.5
P1.6	6	5	P1.7
VCC	4	3	GND
VCC	2	1	GND

Table 1

RS232 port

RS232 port has a 10-pin connector (J7) that can be converted to a standard 9-pin D connector by using the serial adapter cable (Part #: CSA-9M-1). Hand-held terminals, calibration pads, computers, modems and other serial devices can be connected to the RS232 port.

U3 converts micro-controller's RXD and TXD pins to/from RS232 levels. U3 has built-in voltage doubler and inverter that generates +/- 10 Volts for RS232 logic levels.

CTS/RTS modem handshaking control lines are also provided on the RS232 port. Table 2 shows the pin assignments of J7. CTS can be used by external host, such as a PC, to put PRO-MAX/51 in program or run modes. Therefore, user applications must not use CTS if the PIC16C58 is installed on the board.

RS232 Serial Port (J7)

Signal	Pin	Pin	Signal
Not Connected	10	9	GND
Not Connected	8	7	Not Connected
CTS	6	5	TXD
RTS	4	3	RXD
Not Connected	2	1	Not Connected

Table 2

LCD Connector

8 pins of Port 0 are connected to the LCD connector. Many different LCD displays can be connected directly to the LCD connector. 5 Volt and Ground power lines are also available on the LCD connector. Contrast adjustment circuit generates programmable voltage (Vee) that also is available on pin 3 of LCD connector. User application can set amplitude of this voltage using I2C bus (P1.7 and P1.6 port pins) as an interface to the PIC16C58. The 16 levels of programmable voltage are available on Vee pin. More information on the programmable voltage can be obtained from **I²C Bus** chapter of this manual. This connector can also be used as a general-purpose port. LCD connector is not available on revisions 1.02 and 1.03 of the board. Table 3 shows the pin assignments for LCD connector.

LCD connector (J6)

Signal	Pin	Pin	Signal
Ground	1	2	Vcc
Vee	3	4	P0.0
P0.1	5	6	P0.2
P0.3	7	8	Ground
Ground	9	10	Ground
P0.4	11	12	P0.5
P0.6	13	14	P0.7

Table 3

Keypad Connector

8 pins of Port 2 are connected to the Keypad connector. Many different keypads (for example, 3 by 5 or 4 by 4) can be connected directly to the keypad connector. 5 Volt and Ground power lines are also available on the Keypad connector. This connector can also be used as a general-purpose port. Table 4 shows the pin assignments for Keypad connector.

Keypad connector (J5)

Signal	Pin
P2.0	1
P2.1	2
P2.2	3
P2.3	4
P2.4	5
P2.5	6
P2.6	7
P2.7	8
Ground	9
Vcc	10

Table 4

I²C Bus

PRO-MAX/51-A takes advantage of Inter-Integrated-Circuit (I2C) bus to access the EEPROM and other peripheral boards. I2C has been developed by Philips to simplify communications between peripheral devices and micro-controllers using only two physical lines. Each device on the I2C bus is accessed using a unique address for that device.

On the PRO-MAX/51-A board, micro-controller port pins P1.6 and P1.7 provide the I2C DATA and CLOCK signals to I2C peripherals. I2C communications is implemented in software. DIAGS.C example program on PRO-MAX/51 diskette has sample I2C routines for use with C or Assembly Language Programs. Some micro-controllers (for example, Philips 87C654) also have hardware support for I2C.

External devices that are I2C compatible can be easily added to PRO-MAX/51-A using the MINI-MAX/51-A Connectors (J2, J3), CPU System Bus Connectors (J1, J4) or the prototyping area on PRO-MAX/51-A.

X-10 connector

Standard X-10 module can be plugged into this connector (X3). X10 module communicates between transmitters and receivers by sending and receiving signals over the power line wiring. These signals involve short RF bursts that represent digital information. BiPOM Electronics provides all necessary hardware and software components for the communications through the AC power line. More information on X10 Technology Transmission Theory can be obtained from www.X10.com.

Power Supply Unit

PRO-MAX/51-A series boards come with the 6 Volts unregulated DC power supply. Power supply can be connected to power jack X1 or to terminal X2. Other power supplies can also be used although this invalidates the warranty. External power supply should be able to supply 6 to 12 Volts DC at minimum 100mA current. PRO-MAX/51-A has an on-board 5 Volt regulator (U5). Regulated 5 Volt DC supply can be also provided externally. SJ-1 jumper should be disconnected in this case. Table 5 shows the state of SJ-1 jumper on the board for different power supplies.

Power supply	SJ1
Unregulated DC	Connected
Regulated 5 Volt DC	Disconnected

Table 5

WARNING: Correct polarity should be observed when applying external DC supply to Power terminal; otherwise PRO-MAX/51-A will be permanently damaged.

CAUTION: Depending on the current requirements of the any external circuitry such as peripheral boards that are attached to PRO-MAX/51-A and the level of input voltage applied, the power regulator U5 may dissipate enough heat to cause skin injury upon touch. Contact with this regulator should be avoided at all times, even after the power to circuit has been switched off.

Figure 2 shows the external power supply connection to PRO-MAX/51-A.

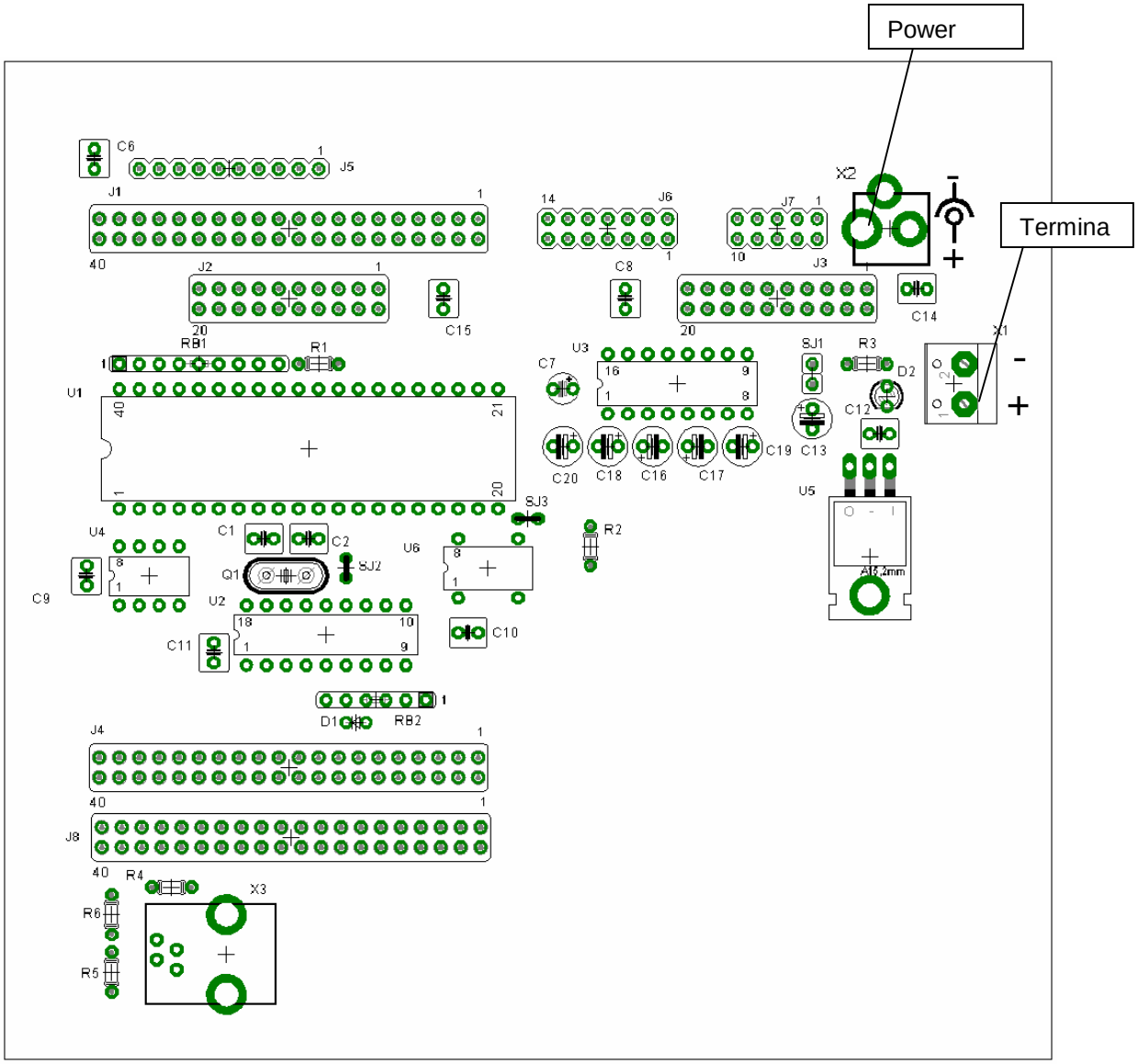


Figure 2

4. Peripherals

Figure 3 shows how various peripherals can be connected to the PRO-MAX/51 system to enhance its features:

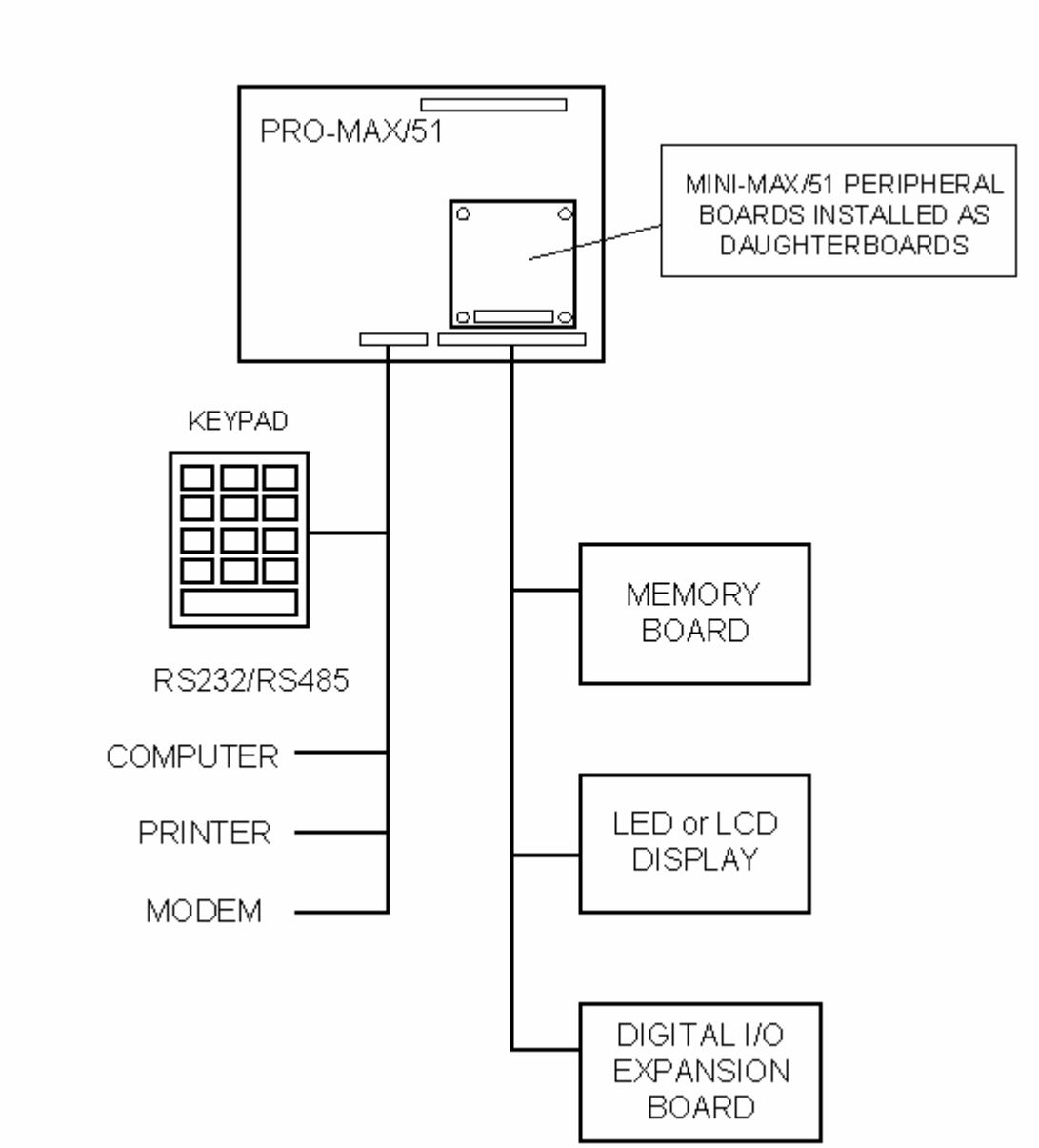


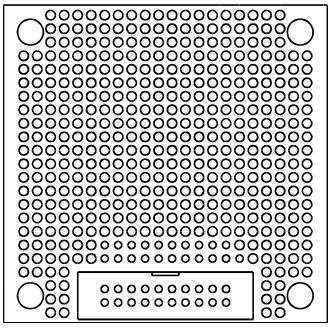
Figure 3

Calibration Pad

Various keypads and terminals may be connected to the RS232 port of PRO-MAX/51 through connector J7.

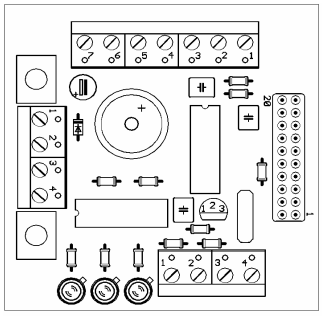
MINI-MAX/51 PROTO-1 Board

Originally designed for MINI-MAX/51, PROTO-1 can also be used with PRO-MAX/51 for additional prototyping space. PROTO-1 can either be mounted on PRO-MAX/51 as a daughter-board using stand-offs or connected to PRO-MAX/51 as a separate board using ribbon cable (EXPCABLE-6 or EXPCABLE-18). The latter method is useful for mounting behind the panel of an instrument enclosure, for example, as a detachable display board.



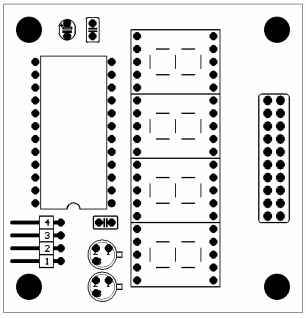
TB-1 Training Board

TB-1 Training Board allows performing various experiments with the MINI-MAX/51-C or other 8051 compatible boards. TB-1 has programmable traffic lights, 4-channel, 8-bit analog inputs, buzzer, switch inputs, and counter/timer inputs to test the interrupts.



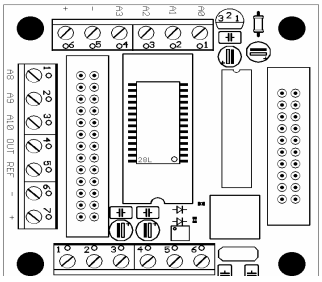
LED Board

LED board has four 7-segment LED displays with decimal point. The displays have been placed on sockets and can be easily replaced. 4-digit LED-driver with I2C-Bus interface is installed on this board. The segment outputs of LED-driver are controllable current-sink sources. Segment outputs are switched on by the corresponding data bits and their current is adjusted by control bits. LED-driver on the board is controlled via an I2C-compatible serial bus.



ADC Board

ADC board has a TLC2543, 11-channel, 12-bit Analog-To-Digital Converter from Texas Instruments. All the channels are available on terminal blocks. The board has also an AD5321, 1-channel, 12-bit Digital-To-Analog Converter from Analog Devices. All the peripherals on the board are controlled via an I2C-compatible serial bus and SPI-compatible serial bus.



Host PC

PRO-MAX/51 can be connected to a host PC through the RS232 port. Some 8051-compatible micro-controllers, such as DS5000T/AT89SXX/P89C51RX2, allow in-system reprogramming of the micro-controller. This can be accomplished through the host PC connected to PRO-MAX/51's RS232 port. Refer to the section titled "In-System Programming" for information on in-system programming of PRO-MAX/51 using the different types of processors.

PRO-MAX/51 can also be used as a remote data acquisition unit serving a host PC in a client-server configuration through the serial port.

PRO-MAX/51's 10-pin RS232 port connector (J7) is converted to a 9-pin male D connector using a serial cable adapter (Part #: CSA-9M-1). Connection to a host PC is done by attaching one end of a NULL modem cable to this 9-pin D connector and the other end to one of the serial ports on the host PC.

NULL modem cable can be obtained from BiPOM Electronics (Part#: CNM1-9F9F-6) or it can be prepared according to the wiring diagram below:

PRO-MAX/51 9-pin Female			Host PC 9-pin Female
RECEIVE DATA (RXD)	2	3	TRANSMIT DATA (TXD)
TRANSMIT DATA (TXD)	3	2	RECEIVE DATA (RXD)
GROUND	5	5	GROUND
RTS	7	8	CTS
CTS	8	7	RTS

PRO-MAX/51 9-pin Female			Host PC 25-pin Female
RECEIVE DATA (RXD)	2	2	TRANSMIT DATA (TXD)
TRANSMIT DATA (TXD)	3	3	RECEIVE DATA (RXD)
GROUND	5	7	GROUND
RTS	7	5	CTS
CTS	8	4	RTS

Unless hardware handshaking is to be used between PRO-MAX/51 and the host PC, it is not necessary to connect RTS and CTS lines. . CTS is used by external host such as a PC to put MINI-MAX/51-C in program or run modes. Therefore, user applications must not use CTS if the PIC16C58 is installed on the board.

5. Board Layout

Dimensions of PRO-MAX/51 board are 5.25 X 5.00 inches (13.34 X 12.70 centimeters).

Figure 4 shows positions of major components, connectors and jumpers on the PRO-MAX/51 board.

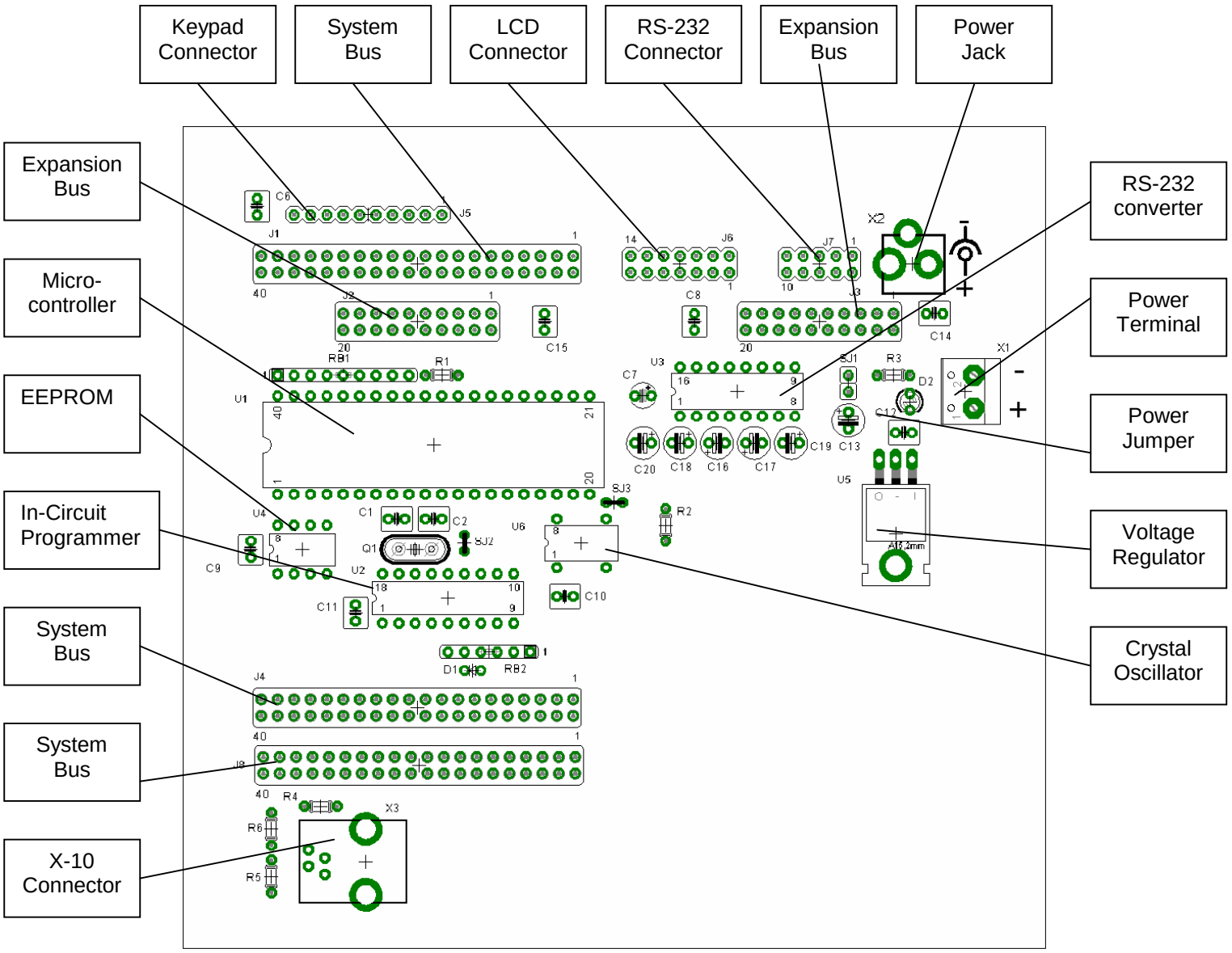


Figure 4

6. Jumper Settings

Jumper	Connected	Disconnected
SJ1	Connects output of built-in voltage regulator to Vcc	Disconnects output of built-in voltage regulator from Vcc
SJ2	--	--
SJ3	Connects CLK signal (output of crystal oscillator) to System Bus Expansion Connectors	Disconnects CLK signal (output of crystal oscillator) from System Bus Expansion Connectors
SJ4	Enables the PIC16C58 control EA line of 89C420 for monitor mode entering	Disables the PIC16C58 control EA line.

7. Supported Microcontrollers

PRO-MAX/51 accepts all 8051 family micro-controllers with 40-pin Dual-Inline-Package (DIP).

PRO-MAX/51 supports the following micro-controllers:

Micro-controller	Manufacturer
87C51	Philips Components - Signetics
87C52	Philips Components - Signetics
87C652	Philips Components - Signetics
87C654	Philips Components - Signetics
87C51	Intel
87C52	Intel
DS5000	Dallas Semiconductor
DS5000T	Dallas Semiconductor
DS5000TK (Programming Kit)	Dallas Semiconductor
DS87C520	Dallas Semiconductor
DS87C530	Dallas Semiconductor
DS89C420	Dallas Semiconductor
89LV52	ATMEL
89C51	ATMEL
89C52	ATMEL
89C55	ATMEL
89S53	ATMEL
89S8252	ATMEL
P89C51RB2/RC2/RD2	Philips Components - Signetics

8. In-System Programming

PRO-MAX/51-A supports in-system programming of several popular micro-controllers:

- AT89S8252, AT89S53
- P89C51RB2, P89C51RC2, P89C51RD2
- DS5000,DS89C420.

Micro-IDE Integrated Development Environment from BiPOM Electronics fully supports In-System Programming and debugging on the PRO-MAX/51-A using the serial port. There is also stand alone loader from BiPOM Electronics (WinLoad) that supports In-System Programming.

AT89S53,AT89S8252.

AT89S53 micro-controller can be re-programmed remotely over the RS-232 interface using a second micro-controller on the board (PIC16C58). The in-circuit programming feature simplifies program development on the board since downloading programs from a host PC takes only few seconds. User programs can also be debugged over the serial port. The on-chip Downloadable Flash of AT89Sxx allows the program memory to be reprogrammed in-system through an SPI serial interface. PIC16C58 is a bridge between RS232, I2C and SPI interfaces. PC sends the necessary request (write, read or erase chip) through RS232 interface, PIC decodes this request and sends the necessary SPI request to AT89Sxx or I2C request to AT24Cxx EEPROM.

The board can work in the two modes:

- run mode;

- program mode.

Run mode is a standard mode when AT89Sxx is running its own program.

Program mode is a special mode when the reset pin of AT89Sxx is pull down. Holding RESET active forces the SPI bus into a slave input mode and allows the program memory to be written-from or read-to.

For In-System Programming, first the PC should switch the board to Program mode. For this operation PC should make the RTS line of communication port as logical "0" (+12V should appear on the RTS pin of COM port). PIC16C58 is checking the state of this signal all the time. When RTS is low the PIC will turn on Program mode for Atmel chip. When RTS is high the PIC will turn off Program mode and A89Sxx will start a running of the program. The user can use this opportunity for resetting of the board. Then the PC should send the Set Type Request. After the PIC has received this request, it sends the Programming Enable Instruction to AT89Sxx via SPI. This instruction enables the SPI programming of flash memory. After this operation the PC can send any request (write, read, erase) to the board.

Set Type Request.

This request enables the SPI programming of flash memory. PC is sending this request to the board at the first time.

< SET_TYPE_COMMAND = 1> <Type = 1><CHECK_SUM = 2>

Set Type Reply.

The board is sending this reply to the PC after the Set Type Request is received and enabling of SPI programming of AT89Sxx is successful.

< SET_TYPE_COMMAND = 1> <STATUS = 0 ><CHECK_SUM = 1>

Note. If STATUS has no zero value it means the board error.

Write Request.

This request allows write the buffer of data bytes to the memory. The maximum length of data buffer is 32 bytes.

< WRITE_BUFFER_COMMAND> <TYPE_MEMORY><LENGTH_BUFFER> <ADDRESS&0x00FF>< (ADDRESS >>8) &0x1F ><… DATA BYTES …><CHECK_SUM>

WRITE_BUFFER_COMMAND (e.g. 2) is the command to write the data buffer to the board.

TYPE_MEMORY defines the type memory on the board.
TYPE_MEMORY = 1 for flash memory of AT89S53 (ADDRESS = 0..0x1FFF).
TYPE_MEMORY = 5 for flash memory of AT89S53 (ADDRESS = 0X2000…0x3000).
TYPE_MEMORY = 5 for EEPROM data of AT89S8252.
TYPE_MEMORY = 3 for EEPROM of AT24Cxx chip on the board.

LENGTH_BUFFER defines a length buffer for writing to the memory.

Write Reply.

The board is sending this reply to the PC after the Write Request is received and writing of memory is successful.

< WRITE_BUFFER_COMMAND = 2> <STATUS = 0 ><CHECK_SUM = 2>

Note. If STATUS has no zero value it means the board error.

Read Request.

This request allows read the buffer with data bytes from the memory. The maximum length of data buffer is 32 bytes.

< READ_BUFFER_COMMAND> <TYPE_MEMORY><LENGTH_BUFFER> <ADDRESS&0x00FF>< (ADDRESS >>8) &0x1F ><CHECK_SUM>

READ_BUFFER_COMMAND (e.g. 3) is the command to read the data buffer from the board.

TYPE_MEMORY defines the type memory on the board.
TYPE_MEMORY = 1 for flash memory of AT89S53 (ADDRESS = 0..0x1FFF).
TYPE_MEMORY = 5 for flash memory of AT89S53 (ADDRESS = 0X2000…0x3000)
TYPE_MEMORY = 5 for EEPROM data of AT89S8252.
TYPE_MEMORY = 3 for EEPROM of AT24Cxx chip on the board.
LENGTH_BUFFER defines a length buffer for reading from the memory.

Read Reply.

The board is sending this reply to the PC after the Read Request is received and reading of memory is successful.

<READ_BUFFER_COMMAND = 3><STATUS = 0 ><…DATA BYTES …><CHECK_SUM >

Note. If STATUS has no zero value it means the board error.

Erase Chip Request.

This request erases all the flash memory of AT89Sxx.

< ERASE_CHIP_COMMAND = 4> <CHECK_SUM = 4>

Erase Chip Reply.

The board is sending this reply to the PC after the Erase Chip Request is received and erasing of AT89Sxx is successful.

< ERASE_CHIP_COMMAND = 4> <STATUS = 0 ><CHECK_SUM = 4>

Note. If STATUS has no zero value it means the board error.

DS5000, DS89C420.

When used with the DS5000 micro-controller from Dallas Semiconductor (BiPOM Electronics Part#: DS5000-32-12 or DS5000T-32-12), PRO-MAX/51-A can be programmed without removing the micro-controller (U1) from its socket. Programs can be developed on a host PC, downloaded to PRO-MAX/51 board through the serial port and executed. DS5000-32-12 has 32 Kilobytes of battery-backed RAM that can be used as program memory, data memory or both. DS5000T-32-12 is the same as DS5000-32-12 with the addition of battery- backed real time clock. Microcontrollers from Dallas Semiconductor have serial bootstrap loader. If this type of a micro-controller is installed on the board the PIC16C58 can enter this chip into special mode when the boot loader is running. The following steps should be taken to execute the boot loader for program downloading and running of user program on the target board:

- Setting Program mode
- Sending Set Type Request to the board
- Receiving an answer about the status of monitor mode entering
- Downloading program using ROM boot loader
- Sending 'H' character to the board
- Setting RUN mode

Set Type Request for DS5000.

This request enters DS5000 to special monitor mode when serial bootstrap loader is running. PC is sending this request to the board.

< SET_TYPE_COMMAND = 1> <Type = 3><CHECK_SUM = 4>

Set Type Request for DS89C420.

This request enters DS89C420 to special monitor mode when serial bootstrap loader is running. PC is sending this request to the board.

< SET_TYPE_COMMAND = 1> <Type = 4><CHECK_SUM = 5>

Set Type Reply.

The board is sending this reply to the PC after the Set Type Request is received and entering into monitor mode is successful.

< SET_TYPE_COMMAND = 1> <STATUS = 0 ><CHECK_SUM = 1>

Note. If STATUS has no zero value it means the board error.
Note. The reply is the same for both micro-controllers.

P89C51RB2, P89C51RC2, P89C51RD2.

P89C51Rx2 micro-controller has factory ROM boot loader. If this micro-controller is installed on the board the PIC16C58 can enter P89C51Rx2 into special mode when the boot loader is running. The following steps should be taken to execute the boot loader for program downloading and running of user program on the target board:

- Setting Program mode
- Sending Set Type Request to the board
- Receiving an answer about the status of monitor mode entering
- Downloading program using ROM boot loader
- Sending 'R' character to the board
- Setting RUN mode

Set Type Request.

This request enters P89C51Rx2 to special monitor mode. PC is sending this request to the board at the first time.

< SET_TYPE_COMMAND = 1> <Type = 2><CHECK_SUM = 3>

Set Type Reply.

The board is sending this reply to the PC after the Set Type Request is received and entering into monitor mode is successful.

< SET_TYPE_COMMAND = 1> <STATUS = 0 ><CHECK_SUM = 1>

Note. If STATUS has no zero value it means the board error.

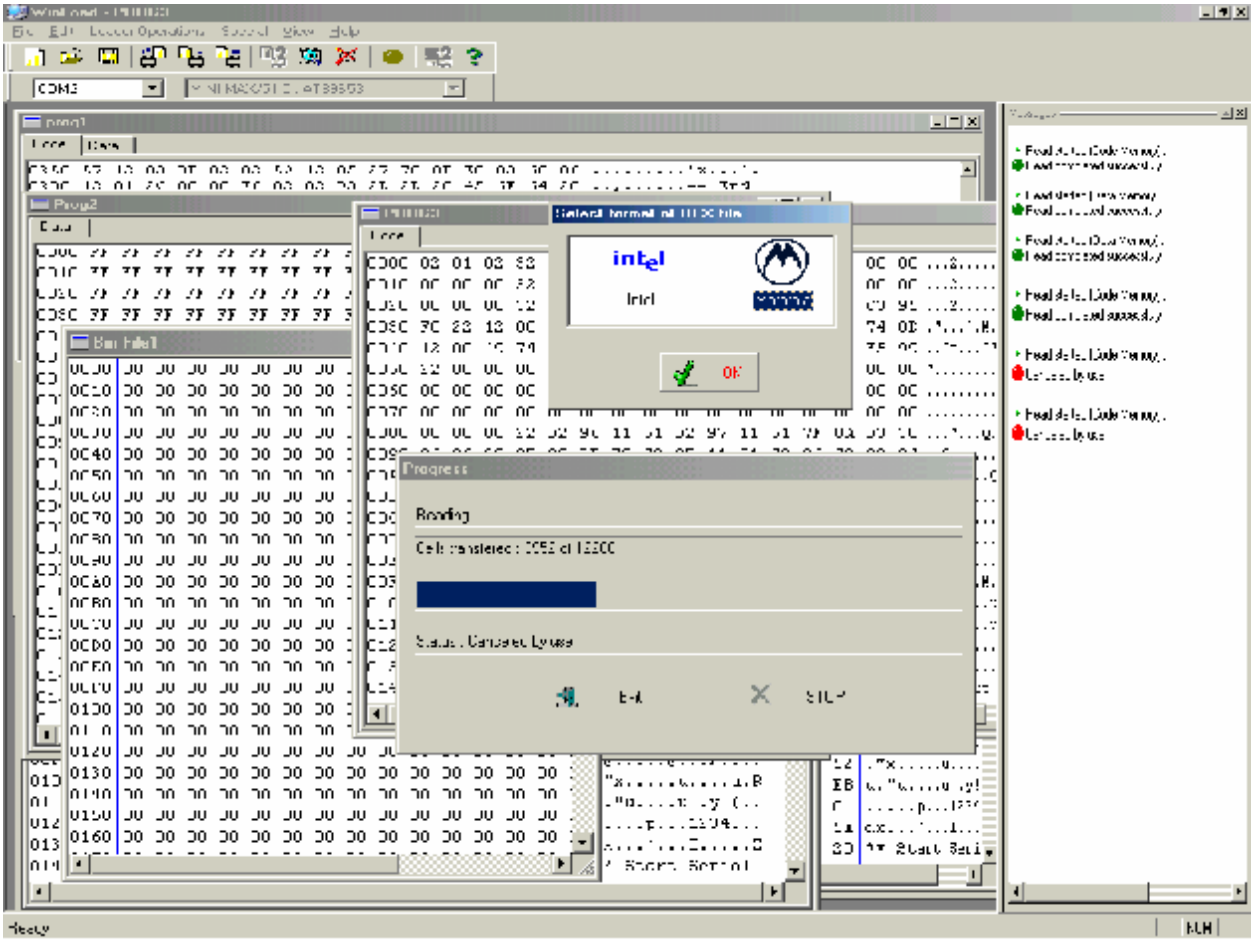
9. Software

PRO-MAX/51-A comes with sample 8051 programs to access on-board peripherals and perform self-diagnostics. PRO-MAX/51-A loader is under **loader** directory and sample 8051 programs are under **examples** directory.

Loader

Windows-based program **WinLoad** with graphical user interface is provided to download programs to the PRO-MAX/51-A, to erase and reset the microcontroller and to read the micro-controller's memory.

- Minimum requirements: Windows 95/98/ME/NT/2000/XP, available serial port (COM1-COM4).
- Support for ATMEL (AT89SXX), PHILIPS (P89C51Rx2), MOTOROLA (MC68HC908GP32 only for Mini-Max/908-C board) microcontrollers and AT24C65 EEPROM
- Program, Read, Verify and Erase operations.
- Hex Editor with Locate and Fill features.
- BIN and HEX (MOTOROLA and INTEL) file format support.



The following programs are available under the “Examples” folder on PRO-MAX/51 diskette:

I2C.ASM: Contains subroutines to transmit and receive on the I2C bus.

24CXX.ASM: Contains subroutines to read from and write to 24CXX series serial EEPROM's. This module calls serial communication routines from I2C.ASM.

PCF8574.ASM: Contains subroutines to read from and write to on-board PCF8574 I/O Expander’s I/O Port.

PROMAX.ASM: Demonstrates how to access PRO-MAX/51 on-board peripherals by performing various tests and diagnostics.

PROMAX.HEX: Binary file for PROMAX.ASM in INTEL Hex format.

DIAGS.C: Demonstrates how to access PRO-MAX/51 on-board peripherals by performing various tests and diagnostics. Written in Micro-C Compiler, it can be easily adapted to other C compilers for the 8051.

DIAGS.HEX: Binary file for DIAGS.C in INTEL Hex format.

LCD.C: Demonstrates how to control LDC display that connected to LCD connector and how to program Vee voltage of LCD connector using the PIC16C58 on the board.

LCD.HEX: Binary file for LCD.C in INTEL Hex format.

LED.C: Demonstrates how to control LED display on the LED board.

LED.HEX: Binary file for LED.C in INTEL Hex format.

10. Schematics.