8051 Trainer Board Reference Manual

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Note: This document applies to REV A of the board.

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Overview

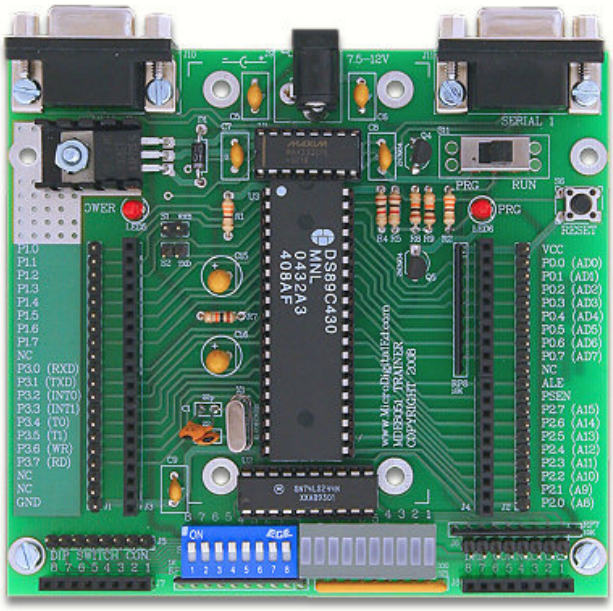
The 8051 board is a useful tool for embedded control and robotics projects for both students and hobbyists.

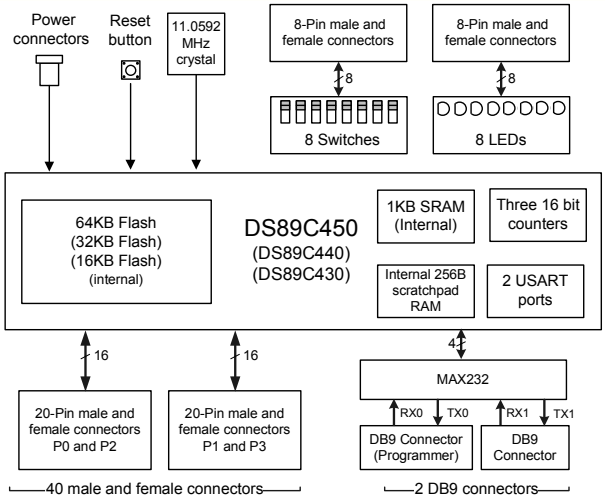
Its versatile design and programmable microcontroller lets you access numerous peripheral devices and program the board for multiple uses. The board has many I/O connectors and supports a number of programming options including 8051 assembly and C

The 8051 trainer board has 8 switches and 8 buffered LEDs for connection to the microcontroller, bread board or peripheral devices. It provides access to pins of the 8051 through sip male and female connectors for wiring to bread board or attaching Digilent Pmod™ peripheral modules. Digilent peripheral modules include H-bridges, analog-to-digital and digital-to-analog converters, speaker amplifier, switches, buttons, LEDs, as well as converters for easy connection to screw terminals, BNC jacks, servo motors, and more.

Features include:

- A Maxim Semiconductor DS89C450 microcontroller (an 8051/52) with 64K bytes of on-chip Flash memory.
- Eight on-board Switches accessible via both male and female connector
- Eight on-board LEDs accessible via both male and female connector
- an on-board voltage regulator (in some versions)
- two 20-pin male and female connectors allowing access to all 8051 ports of P0, P1, P2, and P3 for connection to external devices such as bread board or Digilent peripheral module boards.
- support for the Maxim on-chip serial programmer
- two RS232 compatible Serial ports with DB9 connectors
- An small bread board can be screwed on the board to insert any external IC and connect it to the board





8051 Trainer Circuit Diagram

Features of the DS89C450 include:

- On-chip loader using a serial port
- two USART serial interfaces (COM ports)
- three 16-bit timer counters
- 64KB program flash
- 256B scratchpad RAM
- 1KB on-chip RAM accessible with MOVX instruction.

For more information on the DS89C450 microcontroller, refer to the data sheet available at www.maxim-ic.com.

Functional Description

The 8051 is designed for embedded control and robotic applications as well as microprocessor experimentation.

The 8051 has an on-chip loader/programmer: The loader / programmer is accessed via Serial COM Port #0 DB9 Connector.

The 8051 Trainer features a flexible power supply routing system with VCC and GND pin available on 20 pin male and female connector for powering the ICs on the bread board as well as Digilent Pmod peripheral modules connected to the board.

Digilent Pmod peripheral modules can be connected to the connectors on the 8051 Trainer board via cables. Digilent has a variety of Pmod interconnect cables available.

Power supply

The 8051 Trainer board may be powered via the dedicated power supply connector.
The 8051 Trainer board is designed for operation at 5V. Using a voltage other than 5V can damage the 8051 trainer or the connected devices. ***Note: the earlier rev of the board indicated in the silk screen that the operating voltage range was 7.5V-12V. If this didn't get changed in the current rev, we need to note that the silk screen voltage doesn't apply***
There is a power supply connector on 8051 trainer for board/processor. The barrel connector is useful for desktop development and testing. It is the connector used by the DC supply adapter available from Digilent.

Programming the 8051 Trainer

The 8051 Trainer programming can be accomplished using Serial#0. Programming via Serial#0 requires use of the HyperTerminal program which comes with the Microsoft Windows Operating System. For more information on programming the 8051 trainer and access some sample codes, refer to www.microdigitaled.com

RS232 compatible Serial connectors (DB9)

The DS89C450 microcontroller provides 2 USART serial interfaces. The 8051 trainer board comes with MAX232 to convert TTL voltage level to RS232. So you can connect the 8051 trainer board directly to a PC.

Jumper Settings for second serial port

Jumpers S1 and S2 are provided for connection the second serial port. If no jumper is connected to S1 and S2, then the P1.2 and P1.3 are disconnected from MAX232 and can be used as simple I/O pins.

Crystal Oscillator

The DS89C450 microcontroller supports numerous clock source options for the main processor operating clock. The 8051 Trainer has an 11.0592 MHz oscillator crystal. 11.0592 MHz oscillator crystal makes you enable to connect the 8051 trainer board to PC by COM port and the serial transfer error will be as low as zero.

User I/O Pins

The 8051 Trainer board has two rows of male and female connector for user to access all the ports of the 8051 microcontroller (DS89C450) plus 8 LEDs and 8 switched available via 8 pin male and female sip connectors.

8051 Trainer Headers Connection

Note: All 8051 ports can be used as general purpose I/Os or for the following specific purposes.

Connector	Description	8051 Trainer 20 Pins Header to DS89C450 Ports / Bit		
		Pin	Function	Port / Bit
J2 and J4 **P0** **(Pin 2-9)**	**External memory bus** These pins are accessible for I/O operation. Also they can be connected to the multiplexed Address/Data line of the DS89C450 for external memory bus interface.	1	VCC	
		2	AD0	P0.0
		3	AD1	P0.1
		4	AD2	P0.2
		5	AD3	P0.3
		6	AD4	P0.4
		7	AD5	P0.5
		8	AD6	P0.6
		9	AD7	P0.7
		10		
		11	ALE	
		12	PSEN	
J2 and J4 **P2** **(Pin 13-20)**	**External memory bus** These pins are accessible for I/O operation. They can be connected to the higher order address pins of the external memory bus interface.	13	A8	P2.0
		14	A9	P2.1
		15	A10	P2.2
		16	A11	P2.3
		17	A12	P2.4
		18	A13	P2.5
		19	A14	P2.6
		20	A15	P2.7
J1 and J3 **P1** **(Pin 1-8)**	PORT1 is used for I/O operation. If jumper S1 and S2 are connected P1.2 and P1.3 should not be externally used because P1.2 and P1.3 are connected to Max232. To be able to connect P1.2 and P1.3 to an external device you must disconnect the S1 and S2 jumpers.	1	I/O	P1.0
		2	I/O	P1.1
		3	I/O	P1.2
		4	I/O	P1.3
		5	I/O	P1.4
		6	I/O	P1,5
		7	I/O	P1.6
		8	I/O	P1.7
		9		
J1 and J3 **P1** **(Pin 10-17)**	**Serial port communications and interrupts** Asynchronous serial port, UART0, as well as the 8051 external interrupt sources are part of this port Connection to Serial#0 is used on this port for an RS232 serial interface. This is used for programming (downloading) the hex file to DS89C450 chip. No device can be connected to P3.0 and P3.1 during programming.	10	RxD0	P3.0
		11	TxD0	P3.1
		12	INT0I	P3.2
		13	INT1	P3.3
		14	T0	P3.4
		15	T1	P3.5
		16	WR	P3.6
		17	RD	P3.7
		18		
		19		
		20	GND	

connector	Description	8051 Trainer 8 Pins Headers	
		Pin	Function
J5 and J7	**Dip Switch Connectors** These pins provide access to switches. It provides logical zero or one (0 or 5v) for the chip or any external devices.	1	Switch 1 of dipswitch
		2	Switch 2 of dipswitch
		3	Switch 3 of dipswitch
		4	Switch 4 of dipswitch
		5	Switch 5 of dipswitch
		6	Switch 6 of dipswitch
		7	Switch 7 of dipswitch
		8	Switch 8 of dipswitch
J6 and J8	**LED Connectors** These pins provide access to the LEDs. Each LED input is buffered via 74LS244 and there is no need for external diver.	1	LED 1
		2	LED 2
		3	LED 3
		4	LED 4
		5	LED 5
		6	LED 6
		7	LED 7
		8	LED 8

Jumpers

Jumper Label	Function
S1	**RXD of serial #1** This jumper is used to connect p1.2 to the max232 IC. If jumper S1 is connected P1.2 should not be externally used because P1.2 is connected to Max232 through S1. To be able to connect P1.2 to an external device you must disconnect the S1 jumper on the board.
S2	**TXD of serial #1** This jumper is used to connect p1.3 to the max232 IC. If jumper S2 is connected P1.3 should not be externally used because P1.3 is connected to Max232 through S2. To be able to connect P1.3 to an external device you must disconnect the S2 jumper on the board.