

*mega***AVR**[™]

Starter Kit User Guide

February 1999



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Section 1

Introduction

Welcome to the megaAVR™ Starter Kit.

This system incorporates an applications board and in-system programming hardware key for programming AVR® devices in your application. Be sure to check the README.TXT file included with the software for installation information.

1.1 Device Support

The system software currently has support for the following devices.

- ATmega603
- ATmega603L
- ATmega103
- ATmega103L

Software upgrades for new devices will be available in the AVR section of the Atmel website, which is located at <http://www.atmel.com>.



Section 2

Getting Started

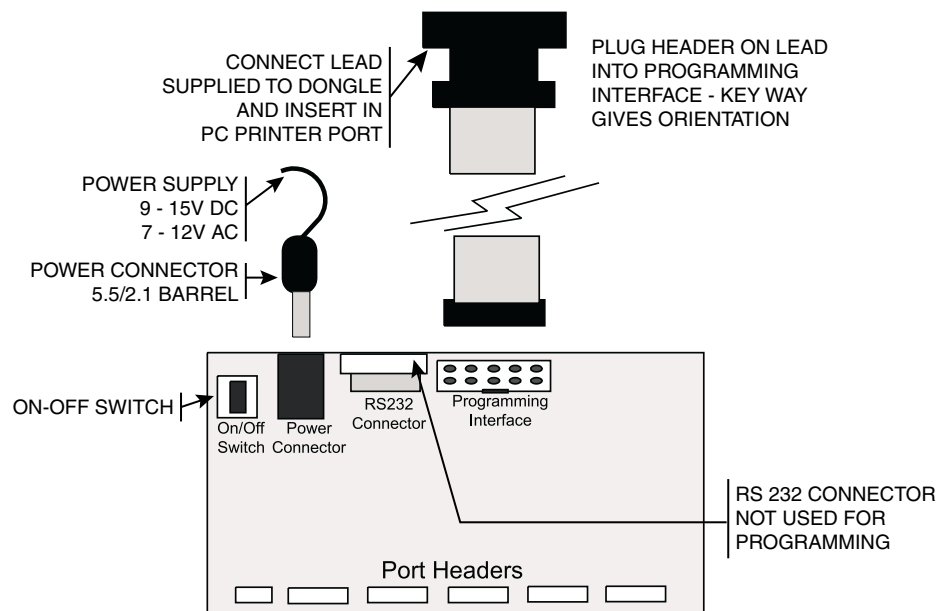
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- 2.1 Unpacking the System**
- Contents of box:
- Evaluation Board
 - Disk set consisting of AVR ISP software and STK300 Application Builder
 - In-System Programming (ISP) Dongle
 - ISP Ribbon Cable

-
- 2.2 System Requirements**
- The minimum hardware and software requirements are:
- 80386 Processor or Above
 - 1MB Ram
 - 1MB Free Hard Disk Space
 - Windows 3.1 or Windows 95



Section 3

Connecting the System



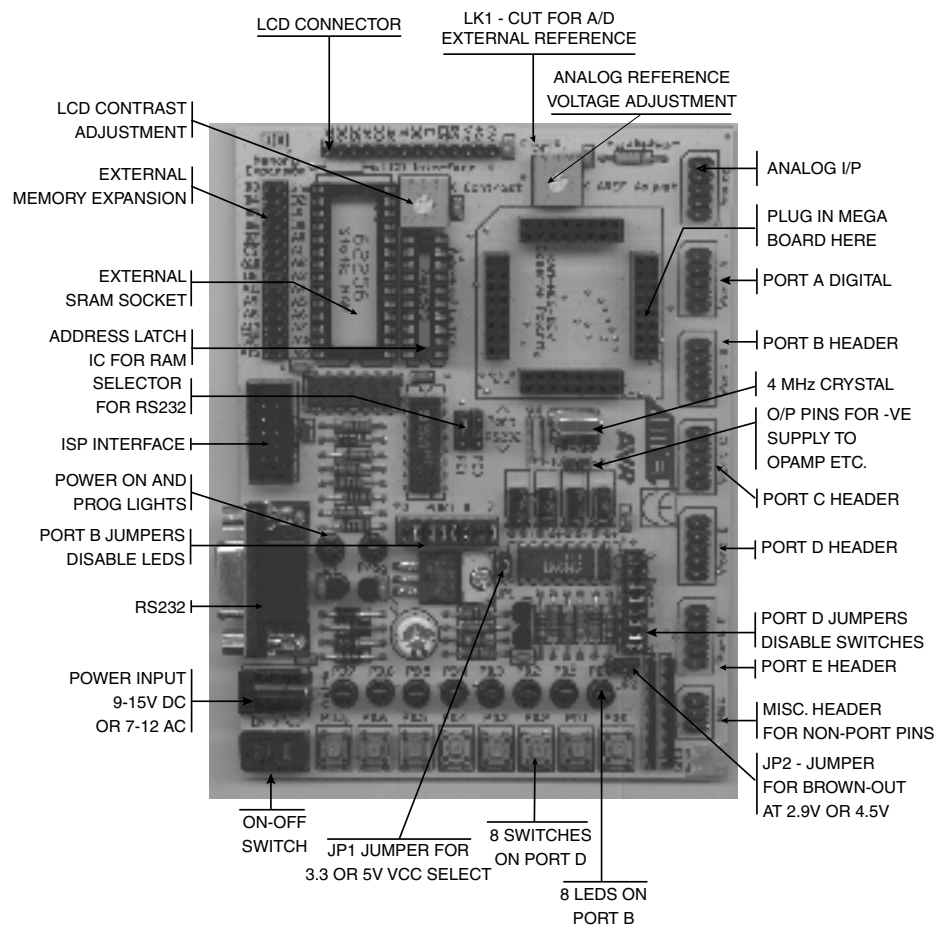
A Power Supply is required with a standard 2.1mm barrel connector. It can be AC 7 - 12V or DC 9 - 15V. The connector is inserted into the power connection socket as shown, above.

The programming lead supplied is fitted into the Dongle case and the other end is inserted into the programming interface on the board as shown.

The Dongle case is connected to one of the printer ports on the PC. If this is not LPT1, then you will need to change the printer port setting in the software—see software section for details.

Hardware Description

The main features of the board are shown in the diagram below.



Note: There are a number of jumpers on the board which are used to select different operations and voltages. The default jumper settings are for programming operations at 5V JP1 Closed, with brown-out also set to 5V JP2 Open. To carry out other operations, some jumpers may have to be removed—refer to the relevant section for details. A full list of the jumpers and links are given in the following table.

4.1 Jumpers, Links and their Functions

Jumper	Function	Open	Closed	Default
JP1	Voltage select	5V	3.3V	Open
JP2	Brown-out select	2.9V	4.5V	Closed
PE0	RS232 RXD	Port E.0	RXD	Port E.0
PE1	RS232 TXD	Port E.1	TXD	Port E.1
Port B	LEDs	LEDs Disabled	LEDs Enabled	Closed
Port D	Switches	Switches Disabled	Switches Enabled	Closed
LK1	Analog Reference	If LK1 cut, then EXTERNAL REF from header	ONBOARD POT	Closed
CUT Under Board	LCD Contrast	If Cut, add extra resistor	Contrast Pot	Closed

4.2 External Connections

All Ports are brought out to edge of board on to headers. Each header has a VCC and Ground pin for power supply to external circuits. Port F is the Analog input port and is on the header marked “Analog”. There is an extra six-pin header for miscellaneous functions—Read, Write, ALE, Reset, Ground and VCC.

See sections “Using External Connections” on page 9-1 and “Using Analog Functions” on page 9-2 for details.



Section 5

Installing the Software

-
- 5.1 Windows 95** To install the software, insert the supplied disk or CD-ROM into your computer and perform the following steps:
1. Click on the "Start" button.
 2. Select "Settings".
 3. Select "Control Panel".
 4. Choose "Add/Remove Programs".
 5. Click the "Install" button.
 6. Follow On-Screen prompts.

The software will then be installed onto your computer and an Icon will be added to your start menu.

-
- 5.2 Windows 3.1** Choose "RUN" from Program Manager, and enter A:\SETUP.EXE as the filename. Press the "OK" button and the software installation program will begin. The software will then be installed onto your computer and an Icon and Program Group will be added to Program Manager.

Note: On some PCs, especially laptops, programming problems may occur if the BIOS Parallel Port settings are set to EPP Version 1.7. If programming problems do happen, ensure that the Parallel Port settings in your BIOS are set to EPP V1.9 not V1.7. This applies to both Windows 95 and Windows 3.1 based PCs.

In the unlikely event that you have any problems installing the software or suspect that you have faulty media, please contact the Atmel Starter Kit hotline:

Telephone Number: **(44) 1970 621 049**

Fax Number: **(44) 1970 621 040**

Email: **stk300_support@atmel.com**



Section 6

How to Use the Software

The software is fully context sensitive. This means that pressing F1 at any time will bring up help information about the current option that you have selected.

Please note that the toolbar icons referred to in the text have ToolTip's, so if you want to know the function of any particular button, hold your mouse pointer over the button in question and its function will be displayed.

- Starting a Project
- In-System Programming (ISP)
- Hardware Requirements
- Projects
- Data Files
- Editing Data

6.1 Projects

If you have used a high-end professional development system, you will be familiar with the project concept. Essentially, this is a collection of details and data which are managed by the program on your behalf. In the AVR, you have both Program Memory and non volatile Data Memory (EEPROM), with various security and device options. The project manager keeps this information together for you so you don't have to remember and reload all the various files every time you use the programmer.

The project manager will allow you to store information like the project name and the project identifier. It also has a small notepad for you to store comments about the project.

Before you can start a programming session, you must either open an existing project or start a new project. You can open a project, or create a new one, by either going to the Project menu and selecting "New" or "Open", or by using the "New Project" or "Open Project" buttons on the toolbar.

6.2 Files

Once a project is open, you can load the files that you need to program into the device. Files may be loaded by either using the "Load" command in the File menu or by using the "Open" icon on the toolbar.

The program will automatically decode your files whether they are in Intel Hex format, Atmel Generic, Binary or Motorola S record. The file you choose will be loaded into the window, then it is displayed on the top of the desktop. Therefore, if you have the EEPROM Data Memory window on top, it will load the data into that window.



Section 7

Programming Using the Board

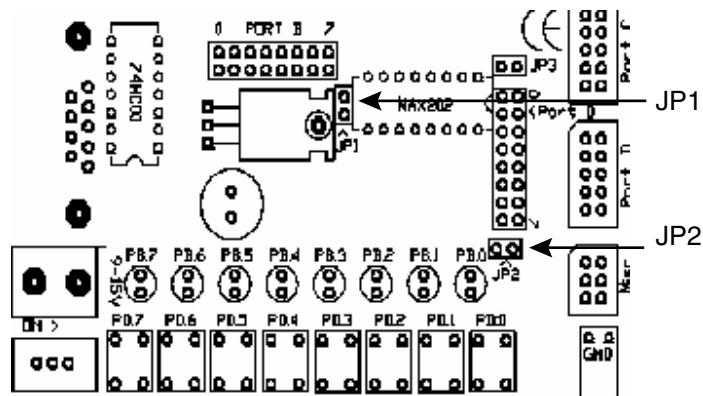
7.1 Device Orientation

Before programming a device using the programming module, the device adapter must be inserted correctly into the programming unit. The adapter itself has a corner cut-off, which locates pin 1 of the device and matches the marking on the main unit. This adapter should be prefitted, but can be replaced if the device programming life is exceeded—refer to your supplier to obtain a new device adapter.

The orientation of the device is vitally important. If you put it in the wrong way then you may damage the device. **DO NOT PLUG A DEVICE ADAPTER IN WITH THE POWER SWITCHED ON** or you may damage it. Similarly, never remove the device adapter with the power on.

7.2 Voltage Selection

Jumper JP1 is used to select either 3.3V or 5V programming.
For $V_{CC} = 5V$, remove jumper JP1 - jumper open
For $V_{CC} = 3.3V$, insert JP1 - jumper closed
Jumper JP2 is used to set Brown-Out detector voltage.
For Brown-Out = 4.5V, insert jumper JP2 - jumper closed
For Brown-Out = 2.9V, remove jumper JP2 - jumper open
This should be set to the same voltage as V_{CC} . If V_{CC} is set to 3.3V and Brown-Out is set to 4.5V, then the device will be held in reset and will NOT program. See “Brown-Out Detector” on page 8-1 for more details.



7.3 Power and Lead Connections

The 10-way programming lead is inserted in the box header—the key-way ensures correct orientation. The computer connections are shown in “Connecting the System” on page 3-1.

The power supply 9-15V DC or 7-12V AC is plugged into the power connector 5.5/2.1 Barrel.

The Power On/Off switch is located next to the power connector. Insert the device adapter before switching the power on. The power on LED should light when the power is correctly applied.

Your hardware is now ready for programming. Refer to “How to Use the Software” on page 6-1 for details of programming operations. A programming LED indicates programming is happening.



Section 8

Brown-Out Detector

The brown-out detector circuit is used to detect voltage drops. If a short glitch occurs in the power, this circuit ensures that the processor resets properly rather than operating randomly.

The brown-out detector must be set to the same voltage as the circuit voltage, V_{CC} —3.3V or 5V. For 3.3V operation, jumper JP2 must be removed (jumper open) and for 5V operation it must be closed.

Voltage	Operating Voltage	Hysteresis
5 Volts	4.5 Volts	200 mV
3.3 Volts	2.9 Volts	200 mV

These values are approximate and may vary with temperature and other factors.



Section 9

Board Applications

9.1 Using Switches and LEDs

The LEDs are connected through a 1K resistor network to Port B.

The switches are connected to Port D.

The switches and LEDs can be disconnected, if required. To use them, ensure that the jumpers labeled “Port B” and “Port D” are closed. The board is also marked with the port pin connection for each switch and LED.

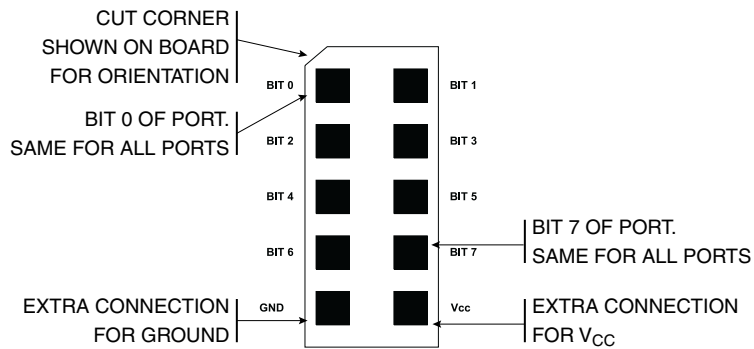
The ports must be correctly set in software as input or output. This is accomplished by setting the direction control registers to 0 for input and 1 for output. Typical set-up code would be:

```
ldi r16,$ff ;move immediate into temporary store register
out DDRB,r16 ;set direction register to ones for output -
                LEDs
out PORTB,r16 ;switch all the LEDs on
ldi r16,$00 ;move immediate into temporary store register
out DDRD,r16 ;set direction register to zeros for input
                Switches
```

9.2 Using External Connections

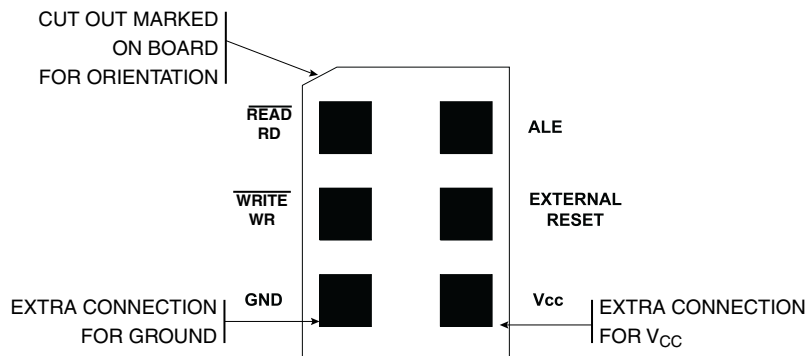
All the ports are brought out to headers on the edge of the board. In addition to the port pins, each header has a connection for ground and V_{CC} to supply external circuits. Note this voltage, V_{CC} , will be either 3.3V or 5V depending on the setting of jumper 1, JP1, and the brown-out detector will operate.

Note: If your circuit is to draw significant current (>150 mA) then a heat sink will be required on the on-board regulator—LM317. This device is rated at 1.5 amps but it does need a heat sink to supply this current. If your circuit will draw more than 1 amp, you may need a separate power supply. The ports on the device are connected to the headers marked Port A, Port B, Port C, Port D, Port E and Analog, Port F. The layout of all the headers is the same and is shown in the following diagram.



9.2.1 Misc. Header

The last header labeled “Misc.” has connections to processor pins other than the port pins.

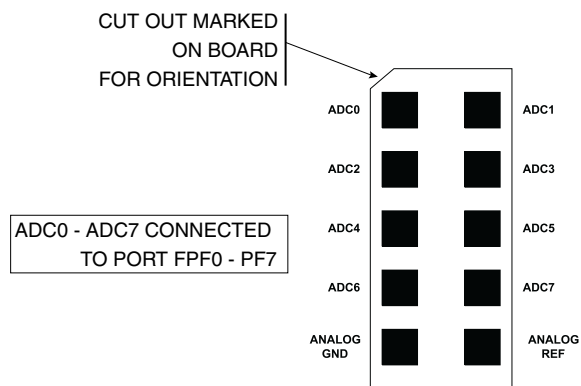


If external operations do not want pull-ups on the port pin, both the switches and the LEDs can be disconnected from the processor. To isolate the LEDs, remove the jumper set labeled “Port B”, and to isolate the switches, remove the jumper set labeled “Port D”.

9.3 Using Analog Functions

The A/D converters use the header labeled “Analog” for the A/D inputs on Port F, which is input only. A +10V to -10V supply is provided on the connector marked “Op-Amp” next to the crystal. A lead from this connector can be used for an external amplifier for the A/D inputs. The layout of the Analog header is shown below.

9.3.1 Analog Port: Marked on Board



The A/D converters can use either the on-board (Internal) Voltage Reference or an external Voltage Reference.

9.3.2 Using Internal Reference

To use the internal, on-board Voltage Reference, the pot marked “AREF” is used to set the voltage level. The voltage level can be measured with a DVM connected to the

header pins labeled “Analog Ref” and “Analog Gnd” in the previous diagram or from the two holes marked Meter + and -.

9.3.3 Using External Reference

To use the A/D converters with an external Voltage Reference, the link marked “LK1” must be cut. The voltage is applied to the pins marked “Analog Ref” and “Analog Gnd” on the Analog header—see previous diagram.

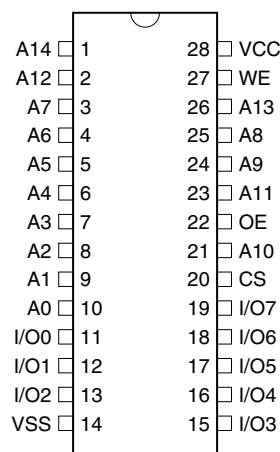
9.4 Using External RAM

The ATmega103 can be used with external SRAM. A socket is provided for a 28-pin RAM chip and for an address latch chip. These are next to the device adapter at the top of the board. There is also a header for further memory expansion, which is connected through the address latch. The pin functions are marked on the board, including chip select (CS).

9.4.1 RAM Recommendations

A low power 62256 SRAM is suggested with an access time of 70 nS. If a very fast RAM is required, the crystal frequency may need to be increased. If a much slower SRAM is used, the SRAM Wait State bit must be enabled in user software—see data book. The layout of the 28-pin RAM socket is shown below, and any RAM with this pin-out could be used.

9.4.2 RAM Socket Pin Layout



9.4.3 Address Latch

The board connections are for a 74HC573 device. This device will operate reliably with the 4 MHz crystal supplied but if a faster crystal is inserted, a faster version of this device may be required—74AHC573 or 74FHC573. Note that this option will alter the EMC characteristics of the board and the CE mark will no longer be valid without retesting.

9.5 Using LCD Connections

The header marked LCD interface is for a standard 2 x 16 LCD. The connections are shown on the board and in the following table.

Connection Name	Function
0V	Ground
+5	V _{CC} - must be 5V
Vo	Contrast
RS	Register Select- A14
Wr	Not Write
E	Enable
D0	Data Bit 0

Connection Name	Function
D1	Data Bit 1
D2	Data Bit 2
D3	Data Bit 3
D4	Data Bit 4
D5	Data Bit 5
D6	Data Bit 6
D7	Data Bit 7

The board is designed for use with a LCD with a Hitachi driver chip built-in, with a contrast pin voltage of 0 to 5 Volts. The pot next to the LCD connector is used for contrast adjustment.

If you use a different LCD driver, it may have a different voltage contrast range. In order to accommodate this, add a resistor to the board (shown on board) and cut track on underside of board—marked cut.

This board is not designed for use with back lit LCD modules, so the extra connections needed are not included and the power supply will not supply the current required.

The LCD must be driven in Memory Mapped Mode as Read and Write are descite pins on the Mega parts—see data sheet. If the crystal has been changed to a faster crystal frequency, memory mapped operations will not work.

9.6 Using RS232

The connection supplied is a 9-way female D-type, so a straight-through lead is required, not a null-modem cable.

The Jumpers in the middle of the board, marked PE0 and PE1 must be set to RS232, not Port or RXD and TXD will be disabled.

As this board has a 4 MHz crystal, the percentage error on the Baud Rate will be between 0.2 and 7.8%. Replacing the crystal with a 3.6846 MHz or 4.608 MHz crystal will reduce this error to zero but may have EMC implications.

A standard (straight-through) lead is required, NOT a null-modem cable.

9.7 Programming In-System

Devices can be programmed in your circuit rather than on the board.

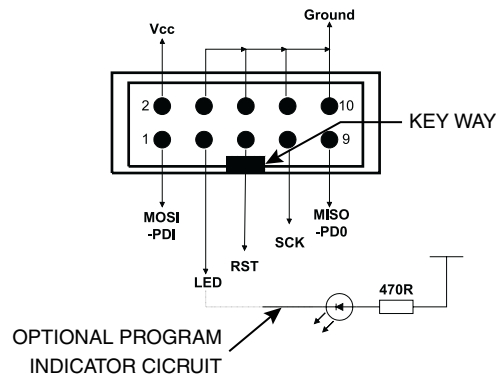
For In-System Programming, ISP, the 10-conductor ribbon cable is connected to a dual row 10-pin 0.1" pitch header on your circuit.

You will need to use either a multiplexer chip, such as a 4053, or wire directly to the pins of the device. Without a multiplexer chip, Serial Communications and SPI port will be unusable.

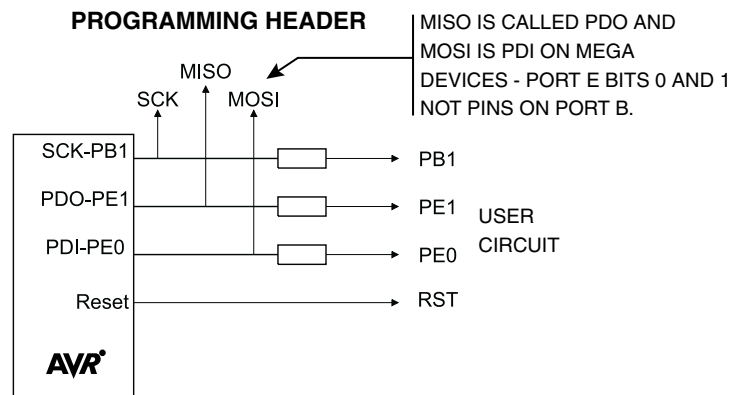
In addition, the system 5 Volts and Ground needs to be connected to the programming lead.

DO NOT EXCEED 5 VOLTS \pm 5% (4.75V TO 5.25V). YOU MAY DAMAGE YOUR COMPUTER. THIS WARNING APPLIES TO ANY ISP SYSTEM.

9.8 ISP Header Layout

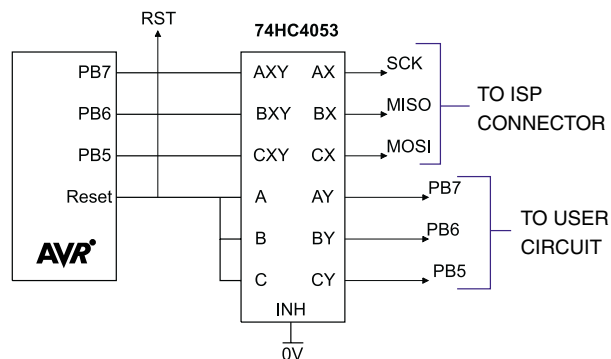


9.9 Interface Using Resistors



Typical resistor values would be 1K. This circuit is fine if ports PB7, PE0 and PE1 are used as inputs in your circuit and no communication is required. If Outputs are needed or RS232 connections, especially higher than a few milliamps, then the multiplexed circuit is preferable.

9.10 Using an Analogue Multiplexer IC

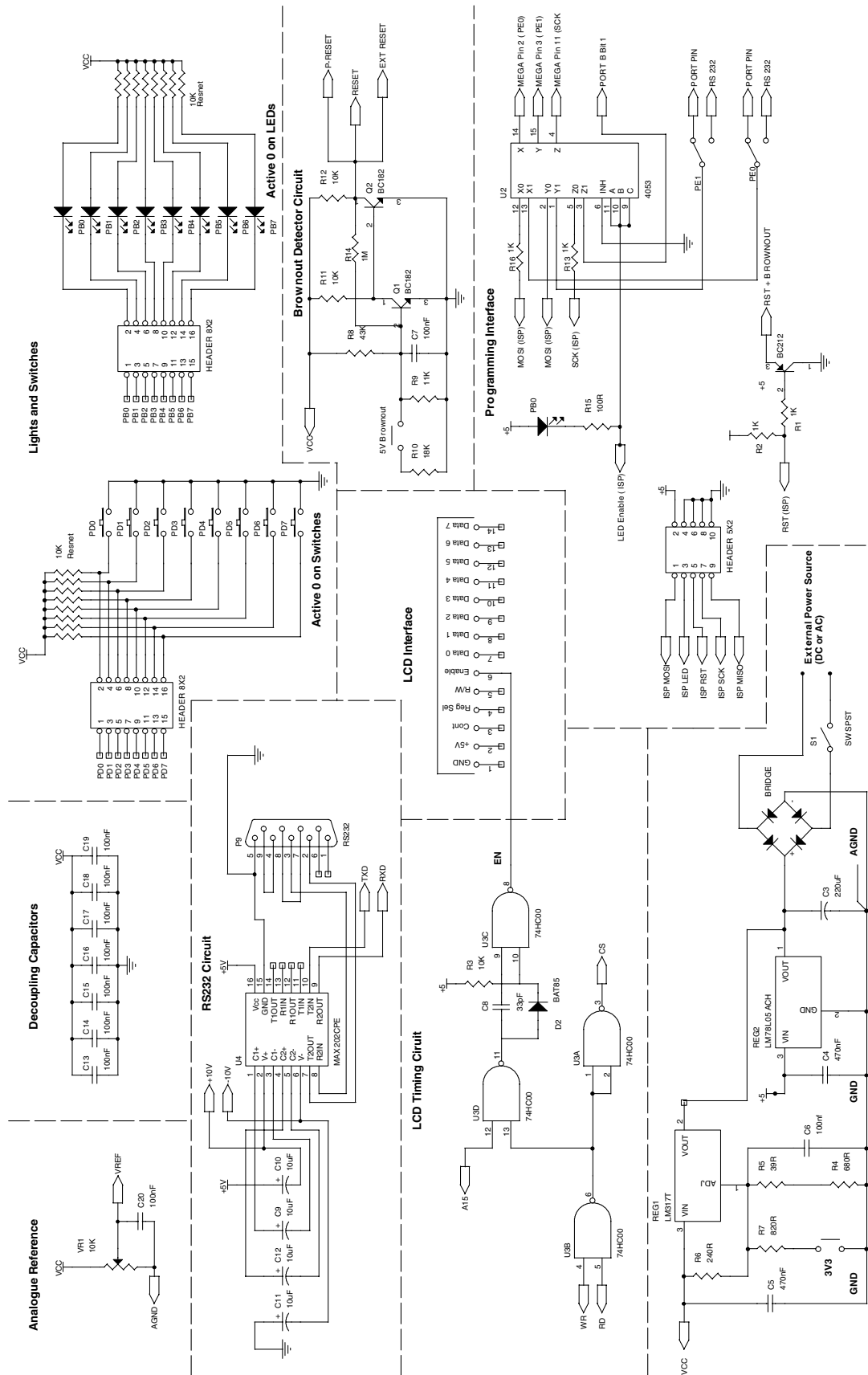


The multiplexer select can be driven from the LED connection on the programming lead, as can a low power LED with its cathode connected to the LED connection via a suitable resistor. 1K Ω is fine. If you use this connection, then the output will be low 0 during programming and a 1 at all other times. Note that it will float if the programmer is not active, i.e., the software is not running, so you may need to use a pull-up resistor.

Note: All the pins except ground will float if the programmer is not active. The device may then be programmed in the normal way.

9.10.1 Using Real Time Clock

A 32.768 kHz crystal is connected to TOSC1 and TOSC2 pins—Pin 18 and Pin 19. This can be used to generate a 1 second pulse—see data book for details.





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