MicroTech

MicroBoard Hardware Reference

Version 1.02

www.mcu.hk

Warning:
Incorrect power connection to any electronic and electrical equipment may seriously damage them or even cause a fire hazard or explosion. Users must take care to identify the correct pins and supply an acceptable voltage to operate them safely.

June 29th, 2006

INTRODUCTION

The **MicroBoard** is a palm-size, battery powered single board computer system, ideal for educational robotics and other interface projects. This general purpose embedded controller board can also be used for data logging, smart instruments, and custom control applications. It has a pre-loaded run-time system designed to execute pseudo-code produced by the TinyC compiler and it can store up to 5 user programs on board.

TinyC is a subset of the standard C language with various functions tailored for robotics applications. The primary design of this controller board is for robotics applications, but it can easily be adapted for other control applications as well.

SYSTEM FEATURES

- **MicroTech** Integrated Development Enviroment (IDE) for developing and downloading programs
- Dual regulated and separate 5V and 6V power supplies to improve system stability
- Accepts 7 to 10V DC supply, suitable for battery operation
- 8-digit, 7-segment display
- 20 LED bar display
- 14 buttons for system functions and programmable data input
- An L293D chip capable of driving 2 small DC motors
- A ULN2003 chip with 7 open collector outputs for driving resistive and inductive loads
- 2 x EEPROMs, 24C02 and 95C56 (both 256 bytes) for data storage.
- The MCU is able to store up to 5 programs of 4K bytes each, plus an internal 2K bytes of EEPROM for data storage
- A 3-pin connector for program download and serial RS232 communications, including LEDS indicating data going in and out
- A 38KHz IR receiver module with indicator LED
- Piezo speaker for sound output
- 2 sets of 5V power supply connectors for powering other circuits and ‘gadgets’
- Small board size - 10cm x 8cm
- No expensive hardware programmer needed – programs are downloaded using the standard PC serial port
- Over 30 sample programs to demonstrate various features of the TinyC language

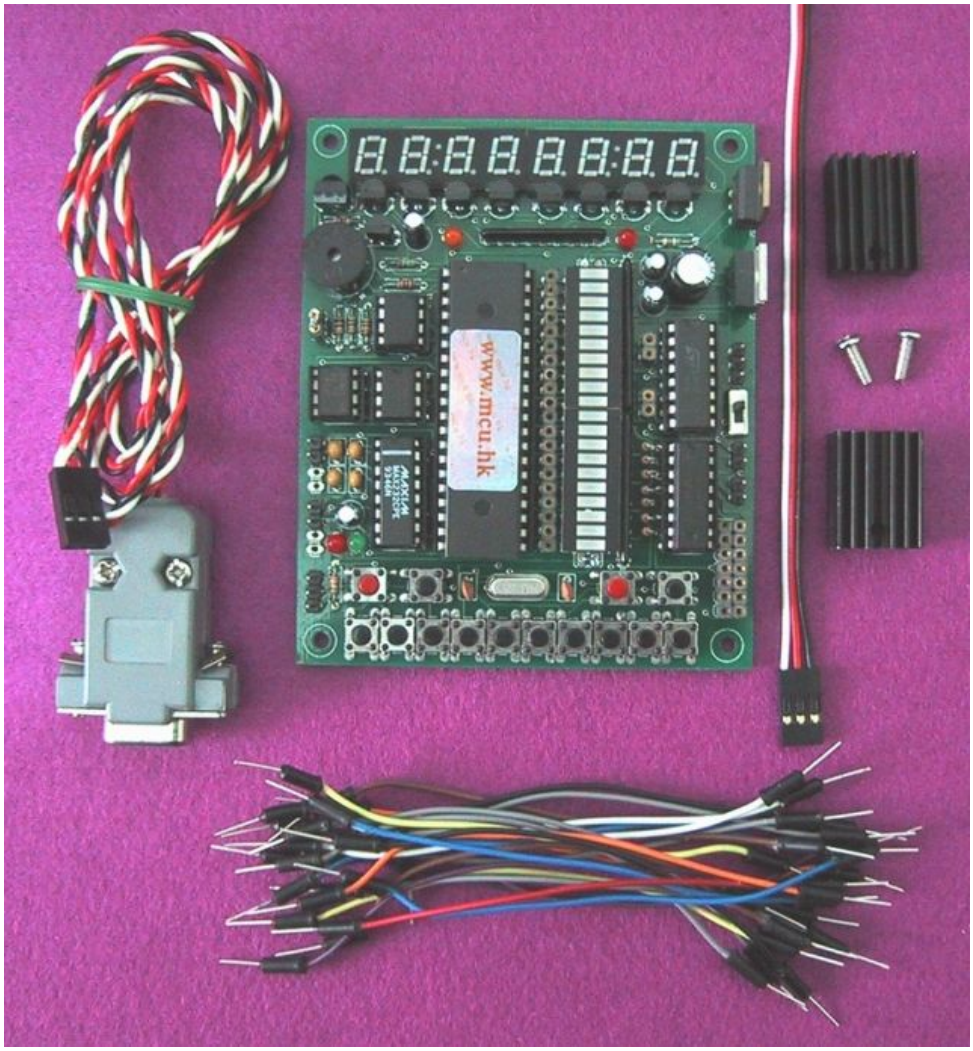
ASSEMBLY INSTRUCTIONS

The Microboard comes completely assembled and includes the following items:

1. MB1 or MB2 board
2. Serial download cable
3. Power cable
4. Set of jumper wires

In some cases the heatsinks may be supplied separately. In this case they will need to be fitted to the voltage regulators **before** applying power to the board. Use the supplied screws to attach a heatsink to each of the voltage regulators. The screw is inserted

through the hole in the regulator's metal tab and into the heatsink (see photo). The heatsink is threaded to take the screw – no nut required.



MicroBoard kit contents

POWER SUPPLY

The MicroBoard requires a minimum DC voltage of **7.6 volts**. This ensures that the 5V regulator is working properly. This is necessary for proper system function.

The 6V regulator is only used to power the L293D motor controller and to provide a convenient power source for the ULN2003 output driver. A 7.2V input means the 6V regulator is not working properly. However this is not a problem because the 6V supply is not critical. It is there to ensure the maximum DC motor voltage voltage rather than the minimum.

It is recommended to use as low a power supply voltage as possible. This minimises the heat dissipation in the regulators, allowing them to run cooler. If using higher voltages then larger heatsinks may be necessary.

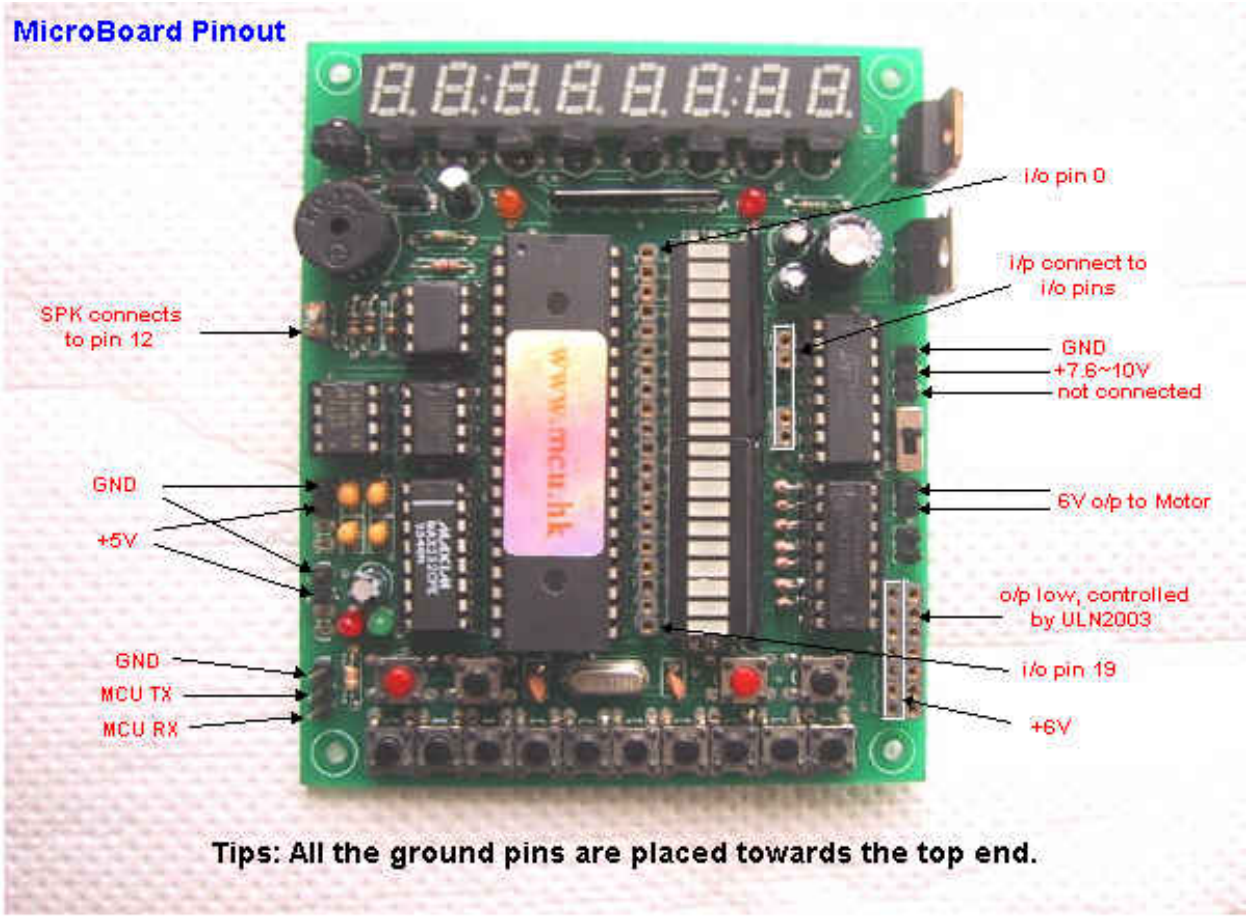
Power to the board is connected using the supplied 3-way cable, with the red wire connected to positive and the black wire to negative or ground. The white wire is not used and should be left unconnected.

The cable connects to the 3-pin header (23) just below the voltage regulators. Plug the cable in so that the black wire is closest to the voltage regulator.

NOTE 1: There is no reverse polarity diode to protect the board against connecting the power supply the wrong way around. This was done deliberately to minimise voltage drops when using batteries. However the arrangement of the 3-pin power connector on the board provides some protection against reverse connection. The third pin (closest to the power switch) is unconnected. If the cable is plugged in reverse the black wire would be connected to this pin, which goes nowhere! Of course this will only work if the cable is wired as described above.

NOTE 2: In ALL cases where a connector has a ground pin it is arranged so that the ground pin is towards the top (display) end of the board (refer to the pinout photo below).

PINOUT



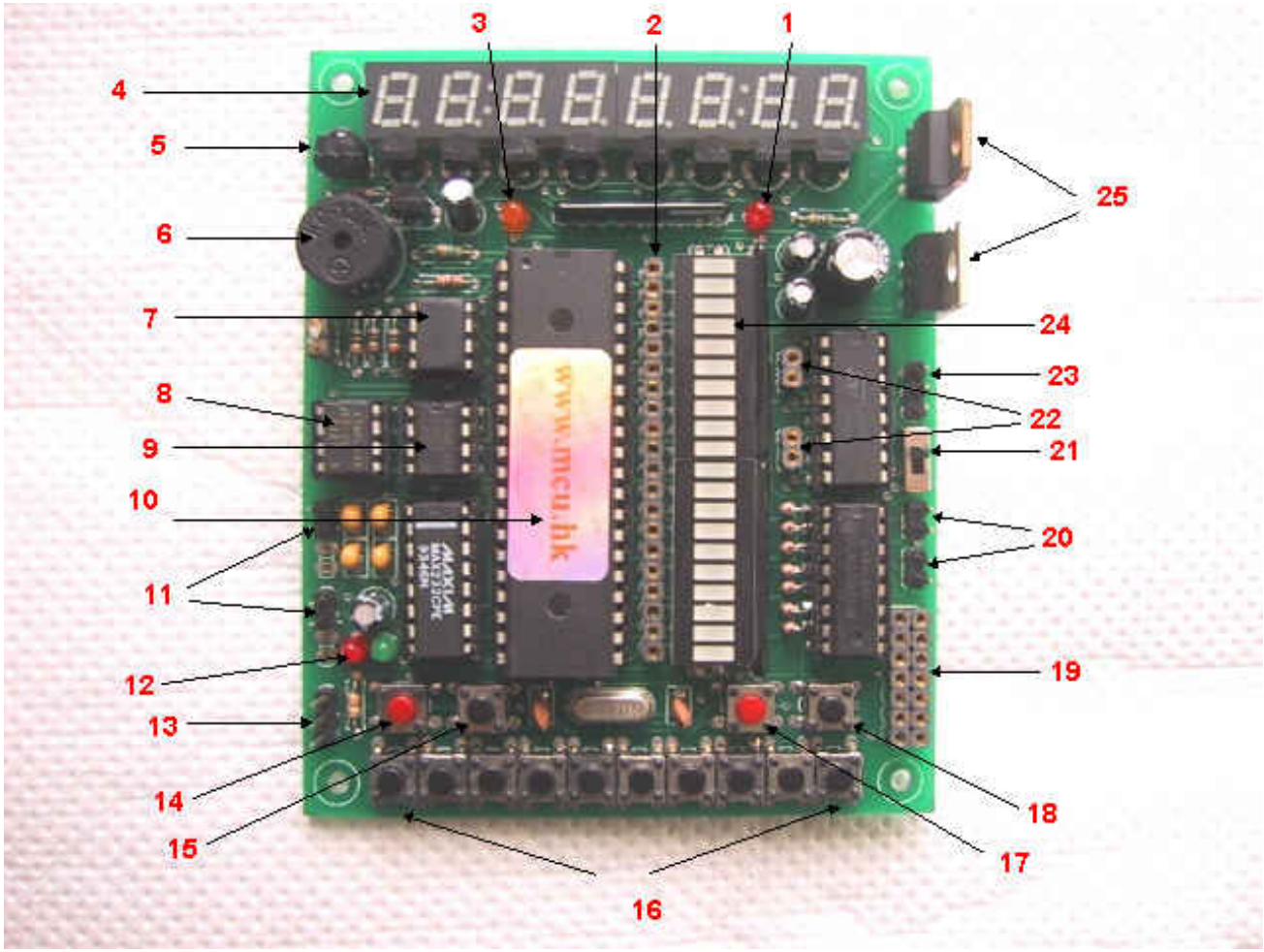
I/O PIN ARRANGEMENT

- I/O pins 0 - 7 are connected to segments A - H respectively of the 7-segment display
- I/O pins 8 – 15 are connected to the inputs (via 15K resistors) of the ULN2003. Therefore all the ULN2003 outputs will turn on after power up or reset
- I/O pins 8 – 19 are connected to buttons 0 – 9, System and User , respectively.
- The speaker is connected to I/O pin 12 but this can be changed. Simply remove the jumper link below the speaker and use a jumper wire to connect to another I/O pin.

ATTENTIONS AND CAUTIONS

- High speed motors will generate a lot of electical noise which can affect system operation. In the worst case this electrical noise can alter the value of data stored inside the chips (a common problem to all circuits, not just the MicroBoard). In extreme cases it can also damage the on-chip run-time system. In this case you will need to send the MicroBoard back to us to reset the whole system. Using gearhead motors is recommended to minimise electrical noise.
- The last 27 bytes of the 24C02 EEPROM are reserved for system housekeeping. Any user data written into these locations will be overwritten each time the system is reset.
- The TinyC functions ‘delay() and ‘sound()’ only provide approximate time accuracy. This must be taken into account when writing time critical applications.
- The TinyC functions ‘writes()’ and ‘writec()’ display formatted representations of characters on the 7-segment display. Please familiarise yourself with these functions before use. You can use the ‘writeb()’ function to display an unformatted byte.

MICROBOARD LAYOUT



See Table 1 for details.

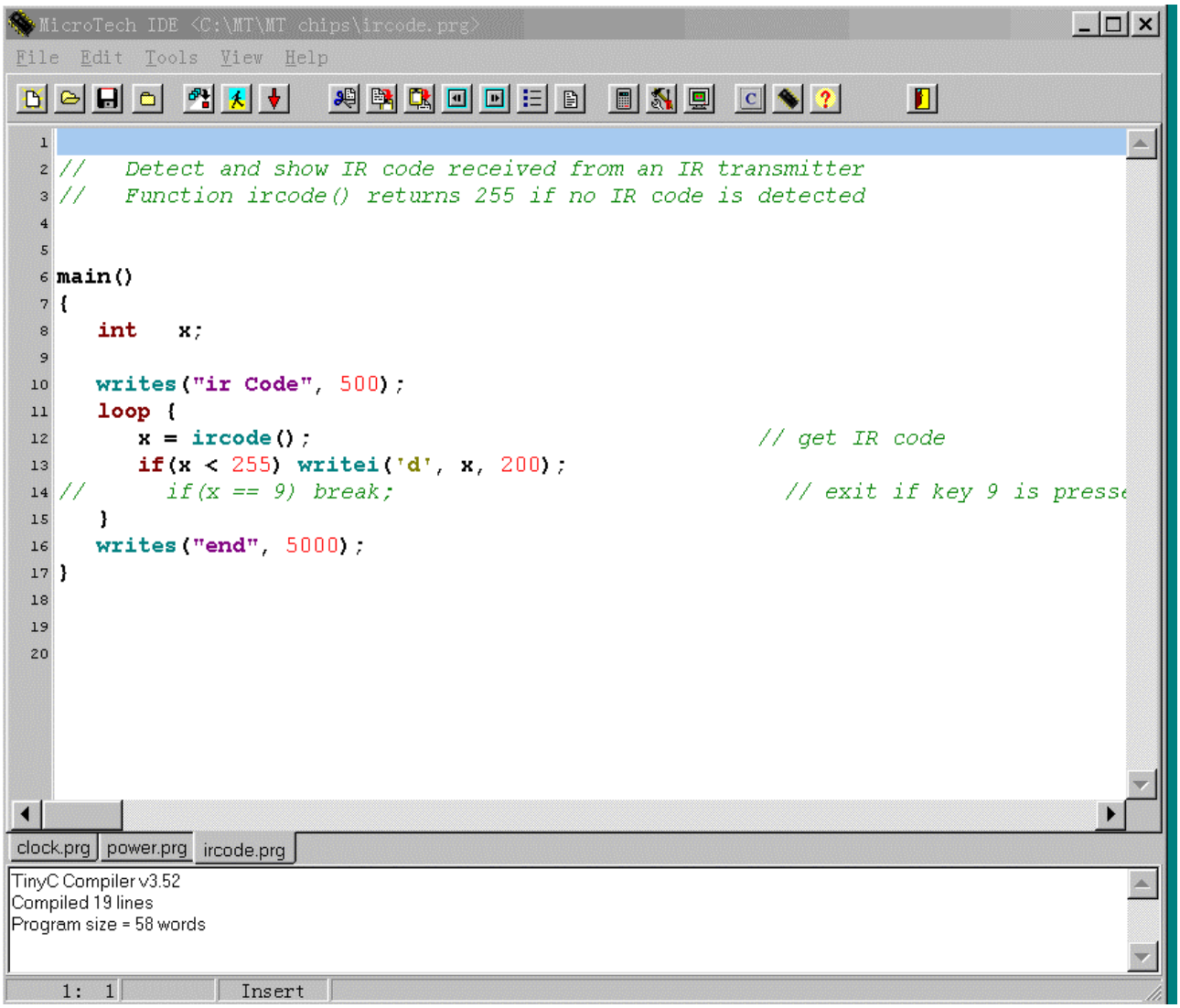
1	Power supply indicator
2	20 digital I/O connectors, numbered 0 to 19 from top to bottom. These are also connected to other parts of the board – see '24' below.
3	IR / Low Voltage indicator. This amber LED flashes when the Microboard is detecting and receiving IR data OR when the supply voltage is low. The Microboard will not detect any IR signal when the power supply is insufficient.
4	8 digit 7-segment display
5	38KHz IR receiver module
6	Piezo speaker. The speaker is connected to pin 12 but can be changed.
7	System control IC
8	EEPROM 93C56 (256 x 8)
9	EEPROM 24C02 (256 x 8)
10	System MCU
11	5V output connector
12	Communications indicators. The red and green LEDs flash when the Microboard is transmitting and receiving serial data.
13	Serial RS232 connector. This 3-pin connector connects the Microboard to the serial COM port of a PC.
14	Reset button – used to reboot the system
15	PC button. This button puts the Microboard into download mode to transfer a program from a PC. Keycode = 255.
16	Numeric buttons. These buttons, numbered 0-9 (from left to right) are user for numeric input. Keycodes = 48–57 (ASCII '0'–'9').
17	System Test button. When pressed after reset the system will perform a check of the board. Keycode = 254.
18	User button – user defined. Keycode = 253.
19	7 pairs of 6V programmable outputs for driving (inductive) loads.
20	Motor control outputs.
21	Main power switch.
22	Motor control inputs.
23	External power supply connector. **BEWARE: Not polarity protected.**
24	20 LED bar display. These are connected to the I/O pins as well as the numeric buttons and the 7-segment display. Therefore they will light as the I/O pins change, buttons are pushed or data written to the 7-segment display. The LEDs can be disabled by cutting the wire links at each end of the bar displays.
25	5V/6V voltage regulators. **Be careful – these can get hot! Must use heatsinks.**

Table 1

DEVELOPING PROGRAMS FOR THE MICROBOARD

- The MicroTech IDE invokes the external program 'CMP.EXE' to compile programs.
- TinyC programs are simply text files – any text editor can be used.
- Right clicking anywhere on the text will invoke a popup command menu.
- Programs are saved automatically before compiled.

The following photo shows a screenshot of the MicroTech IDE.



DOWNLOADING AND STORING PROGRAMS TO THE MICROBOARD

(The following assumes the program is already open in the IDE).

1. Connect the download cable to a PC COM port.
2. Switch on or press the Reset button on the MicroBoard.
3. Press the PC button (15) until the message “PC 0-4” appears on the display. Then press one of the buttons 0-4 to select the program storage area. Wait until the selected digit disappears on the display before starting the download.
4. Click the Download button on the IDE menu bar.
5. The red and green LEDs will flash as data is downloaded.
6. After a successful download the message “Done” appears.
7. Soon after the message “Run 0-4” appears. Press button 0-4 to select the program to run.
8. A number appears indicating the amount of free run-time memory units.
9. Program starts running

RUNNING PROGRAMS ON THE MICROBOARD

1. Switch on or press the Reset button on the MicroBoard
2. Wait until the message “Run 0-4” appears then press button 0-4 to select the program to run.
3. A number appears indicating the amount of free run-time memory units.
4. Program starts running.

NOTE: While downloading the error message “Size Error” will be displayed if the size of the downloaded program is too large for the available program storage area. Note that the size of the object code file has no direct relationship with its run-time memory requirement.

WHERE TO GET THE SOFTWARE

The latest version of the MicroTech editor IDE, compiler and sample programs can be downloaded direct from the manufacturer’s website at www.mcu.hk/download.php.

For just the sample programs then download from www.mcu.hk/experiments.php.

For further information about this and other kits please visit the Ozitronics website at www.ozitronics.com

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