K149

USB
PICmicro®
Programmer

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Board Construction

The board is quite easy to construct and it is advisable to read through these notes before starting. The USB chip is quite tiny and should be mounted on the underside of the PCB ready for use.

WARNING

Be aware that the premounted USB chip is sensitive to static electricity discharge and could be damaged by mishandling of the PCB. Be careful with the board and avoid touching any of the tracks or pads while assembling it. Try to handle it only by the edges.

Other chips in this kit are also sensitive to static discharge. These are the PIC16F628 and ICL232 chips. Do not touch the pins and only handle them by their ends. It is advisable to use sockets for these two chips.

Starting

The first thing to do is inspect the PCB for shorted or open tracks or other damage. Be aware of the static warning when doing this check. When you are satisfied that all is well, then you can proceed.

Start with the flattest parts first, which are the resistors. Hold each resistor body by the thumb and forefinger and use your other hand to loosely bend both of the leads over at right angles at the same time. Try not to make the bends too sharp, and you will find that they slide straight into the mounting holes on the board.

Leave the pigtails on each of the components until after soldering as the extra lead length serves as a heat sink for the component. Try not to leave the soldering iron on the components too long or you risk damaging them. The usual method is to hold the iron tip so that it touches the component lead and the PCB pad at the same time, and then apply a small dab of solder. This operation should only take about a second or two. If you are unsure of your soldering ability, find some spare components and practice on these before building the programmer board.

Check that each solder joint is bright and shiny and doesn't look like a big dull blob which could mean a dry solder joint. The solder should flow freely onto the component lead and solder pad if it is to be a good joint.

After the resistors are soldered in, recheck your work and then mount the diodes D1, D2 and D3
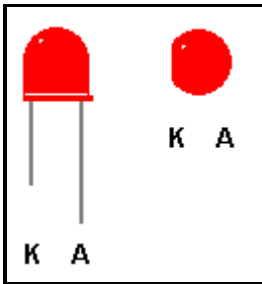
There are 4 LEDs that can be mounted next. Make sure they are oriented correctly. The Anode is marked on the PCB and is the longer of the two leads on the component. The Cathode has a flat surface on the LED body and is also marked on the board.

Next, if supplied, mount the IC socket for the PIC16F628 chip.

Now you can mount the box poly (MKT) capacitors. Most of these look the same, so check the values and make sure they are inserted into the correct positions. Then solder the four 22p ceramic capacitors.

Next, mount all the electrolytic capacitors. These are polarity sensitive components so make sure they are mounted properly. The positive lead is longer than the negative lead, and the negative lead is also marked on the side of the capacitor. On the PCB overlay, there are holes marked [+] as the positive lead for each of these components.

There are five transistors supplied. Four of them are PNP type BC558, and one is an NPN BC547. Do not mix them up and mount them as shown on the PCB overlay.

Now solder the 9 pin RS232 socket, the USB socket and the power jack on to the board followed by the 7805 and 78L08 regulators, again carefully checking orientation.

The next parts to mount are the 2 crystals. One is a 4MHz type and the other is a 6MHz so don't get them mixed up.

You can now mount the DPDT switch and the ZIF socket.

There is 1 wire link that needs to be fitted to the board. DO NOT insert it at this stage.

The last things to fit to the board are the rubber feet. These stick to the underside of the PCB, one in each corner.

Now you should go over all of your work and inspect for dry or unsoldered joints and check all components for correct orientation and placement.

If you are satisfied that all is well, then you will need an 18VDC power supply to test the board. Positive should be on the inner connection of the power jack as shown on the PCB overlay.

Connect the power and observe that the power LED (L4) lights. If not, turn off the power immediately and check the orientation of diode D2 nd the power wiring. Re-check the PCB for any other mistakes.

Turn the power back off if the LED did light up. Make sure you have a multimeter ready for use and set it to measure 5 volts DC. Turn the PCB back on and measure the voltage between a test pads marked on the PCB (+5V) and (Gnd) near the RS232 socket.
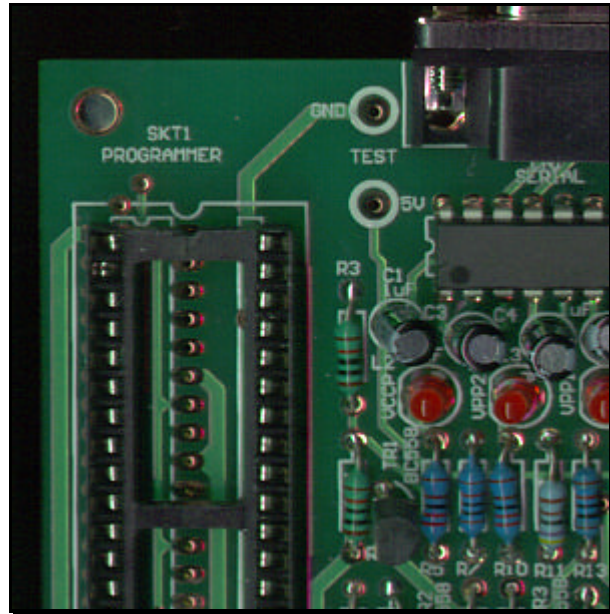
The meter should read close to 5 volts. If not, turn off the power immediately and check that the regulators are inserted properly.

Go over the PCB again and check thoroughly for incorrectly placed components, shorts or open circuit joints.

If all is well, turn off the power again.

Next, mount the 7406 hex open collector inverter, U4, and the ICL232 chip, U3, taking care of chip orientation as it is very hard to remove these chips once soldered. Remember about chip handling and static.

Now comes the time to insert the wire link LK1 near the power jack. This can be a discarded pigtail from a resistor or capacitor. This link completes the power connection to the USB chip and its circuitry.
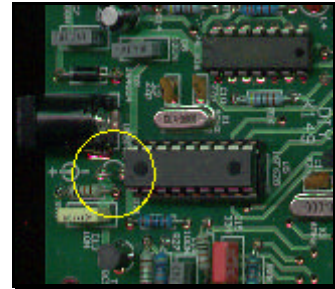
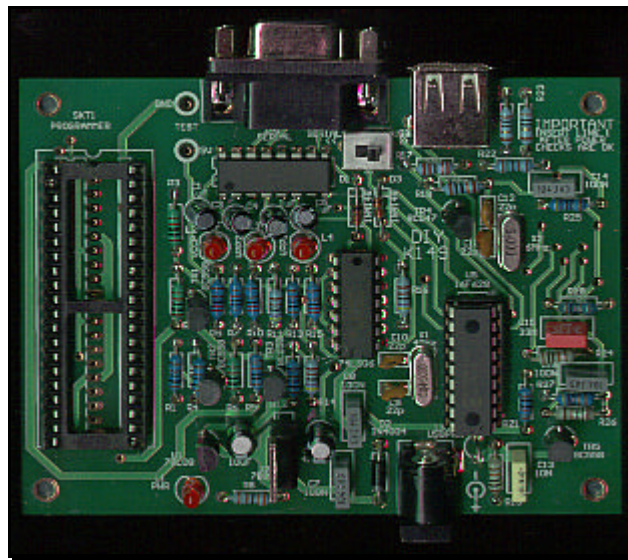Now insert the PIC16F628 into its socket. Pin 1 is towards the power jack.

Image of the finished PCB.

Connect a serial cable between the board and your PC. This cable is a straight through type, NOT a null modem cable. In other words, pin 1 at one end connects to pin 1 at the other end, pin 2 to pin 2 etc.

Make sure the switch is operated towards the [SERIAL] side.

Run the programmer software for the kit. MicroPro.exe

Click [File] -> Port or double click the COM x label on screen to bring up the COM port window. Select the COM port that you will use for serial communications, then [OK].

Re-check the power and PC connections and turn on the programmer board.

You should see Board connected appear on screen. If not, check your cable, the PC port setting and also that the switch is set properly.

If all is well, then as a simple system test, select 16F84 from the chip select menu and click on Read. You should see some LEDs light and the programmer will read from a non existant chip. The screen will most likely fill with0000's.

Now you can turn off the PCB and prepare it for the USB test.

First off, disconnect the serial cable and move all of the switch to the [USB] side.

To enable USB capability for your PC and this project you will need to install a special driver. This is a piece of software that handles the communications between the PC and the special USB chip on the programmer PCB.

Create a USB driver sub directory into the directory where your programmer software was installed. C:\diyk149 was the default. Therefore you would have a new directory called C:\diyk149\usb.

The drivers come in 2 flavours, plug and play support and no plug and play support. As this programmer does not have plug and play support, that narrows it down to 1 choice.

You will need to visit this web page and download this driver.

VCP drivers for Win 98/2000/ME/XP (without PNP support)

http://www.ftdichip.com/FTDriver.htm

Download and unzip the file into the newly created USB directory.

Now visit this other web page and download the PDF application note that describes how to install the driver for your particular system.

http://www.ftdichip.com/FTApp.htm

For example you would download...

AN232-03 for Win 98

AN232-05 for Win2000

Download the PDF file into the USB driver directory listed above.

Open and follow the simple directions given in the PDF file. This should only take a few minutes to do.

When the driver installation is completed, connect a USB cable from the PC to the programmer board.

Make sure MicroPro.exe is _not_ running on the PC.

Turn the board on. Nothing will appear to happen at this stage although you may get a message from Windows saying that it has found new hardware..

Now run MicroPro.exe.

Click `[File] -> Port` or double click the `COM x` label on screen to bring up the COM port window. Select the COM port that you selected for use for USB communications while installing the driver, then `OK`.

The PC may take a short while to establish communications with the USB port. When it has done so, the COM port number will appear on screen and the programmer is ready for use on the USB port.

If all is well, then again as a simple system test, select `16F84` from the chip select menu and click on `Read`. You should see some LEDs light and the programmer will read from a non existant chip. The screen will most likely fill with `0000`'s.

Your new programmer is now ready for use.

When using the USB interface, always turn the programmer on before starting MicroPro.exe.

When finished with the programmer, close MicroPro.exe then turn off the board.

Failure to use this power up sequence may result in a stalled PC because of the non responding USB port.

IMPORTANT INFORMATION

Please do not insert any chip into the programming socket unless the board is connected to the PC either via the serial port or the USB port and the MicroPro software is running.

The controller PIC on the board is held in a reset state until MicroPro gains control of it. In this reset condition, there will be stray voltages present in the programming socket.

There is a modification that keeps these voltages turned off unless needed by the programmer. Please see "resmod.pdf" in your installation directory. It requires the addition of 3 resistors.

The PCB in this project has no protective covering. Please make sure that the underside does not come into contact with any conductive surface or tools or damage may result. The same may happen if something is dropped onto the top of the PCB.

It is possible to damage components if accidental short circuits are placed in the programming socket.

It is possible to damage components and PICmicro® chips if they are placed in the programming socket incorrectly.

18VDC is sufficient to run this programmer. Try to avoid higher voltages or the regulators may overheat.

Do not power this project with AC voltages. Only use DC.
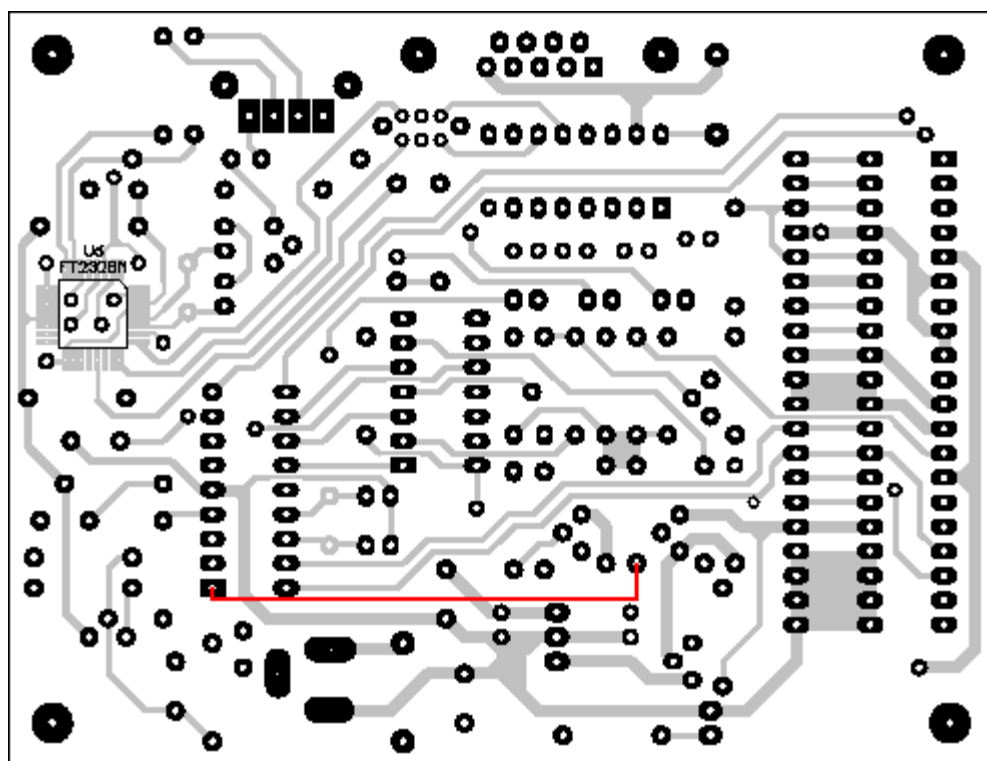
PLEASE INSERT THIS LINK AS SHOWN TO ENABLE THE
AUTO PROGRAM MODE

In Circuit Serial Programming

This programmer is capable of doing In Circuit Serial Programming (ICSP).

ICSP allows you to program a PICmicro® that is already plugged into it' s target circuit. That is, the chip does not need to be in the programmer socket to program it.

The circuits on the following page give some ICSP connection examples.

ICSP programming needs to have control of two PIC pins which are used for Clock and Data. These are usually PORTB pins RB6 and RB7. It also needs to control the MCLR pin and the VCC pin(s). A common ground connection must also be made.

In some cases the ICSP programmer cannot reliably control the programming pins on the PIC because of any connections to these pins that form part of your circuit. Voltage rise times can be critical for programming and if your circuit draws too much current, or has a high capacitive load then ICSP may not work.

If your target circuit draws more than around 60mA, or your circuit is not suitable for an external 5 volt supply. then your circuit will need to supply the 5 volt power. In this case leave the VccP wire disconnected. Some PIC chips need to have the 5 volt rail specifically controlled, and will not be able to be programmed with the VccP wire disconnected. The 16F675 is one example.

Not all circuits will accept ICSP programming, so if you cannot get the chip to program properly using this mode, then the only options are to totally isolate the PIC on the target board, or just use the programming socket.

Be aware that incorrect connections between your circuit and the ICSP connector may cause damage to both your circuit and the programmer.

Please note that LVP programming is not supported.

18 PIN

5V GREEN

10K

IN4148

VCC MCLR

14

4 MCLR
RED

6 RB0   OSC1 16
7 RB1   OSC2 15
8 RB2
9 RB3   RA0 17
10 RB4   RA1 18
11 RB5   RA2 1
CLK YELLOW 12 RB6   RA3 2
DAT BLACK 13 RB7   RA4 3

Gnd

5

GND
WHITE

40 PIN

5V
GREEN

10K

IN4148

V+

MCLR

1 MCLR
RED

2 RA0
3 RA1
4 RA2
5 RA3
6 RA4   OSC1 13
7 RA5   OSC2 14

33 RB0   RD0 19
34 RB1   RD1 20
35 RB2   RD2 21
36 RB3   RD3 22
37 RB4   RD4 27
CLK YELLOW 38 RB5   RD5 28
39 RB6   RD6 29
DAT BLACK 40 RB7   RD7 30

15 RC0
16 RC1
17 RC2
18 RC3   RE0 8
23 RC4   RE1 9
24 RC5   RE2 10
25 RC6
26 RC7

Gnd Gnd

12 31

GND
WHITE

ICSP PROGRAMMING EXAMPLES

PARTS LIST

Used	Part Type	Designators	Description

SEMICONDUCTORS

Used	Part Type	Designators	Description
1	74LS06	U4	OC Hex Inverter
1	ICL232	U3	RS232 transiever
1	PIC16F628	U5	PIC Processor
1	FT232BM	U6	USB
1	78L08	U1	Regulator
1	7805	U2	Regulator
1	6MHz	X1	Crystal
1	6MHz	X2	Crystal
4	BC558	TR1 TR2 TR3 TR5	PNP Transistor
1	BC547	TR4	NPN Transistor
1	IN4004	D2	Diode
2	IN4148	D1 D3	Diode
1	PWR	L1	3mm LED
1	VPP1	L4	3mm LED
1	VPP2	L3	3mm LED
1	VCCP	L2	3mm LED

RESISTORS all 1/4W 5%

Used	Part Type	Designators	Description
2	10R	R20, R23	
1	470R	R25	
5	1K	R1, R4, R12, R13	
1	1K5	R22	
3	2K2	R5, R10, R15	
1	3K3	R8	
3	4K7	R11, R14 R16	
8	10K	R2, R3, R6, R7, R9 R21 R28, R29	
1	22K	R17	
4	100K	R18, R19, R24, R26	
1	470K	R27	

CAPACITORS

Used	Part Type	Designators	Description
4	22p	C9, C10, C11, C12	Ceramic
1	10N	C13	MKT
1	33N	C15	MKT
4	100N	C7, C8, C14, C16	MKT
4	1uF	C1 C3 C4 C5	Electrolytic 16V
1	10uF	C2	Electrolytic 16V
1	47uF	C6	Electrolytic 16V

MISCELLANEOUS

Used	Part Type	Designators	Description
1	BLANK PCB		PCB1
1	IC SOCKET		18 pin
1	SERIAL	CN1	Female RA DB9
1	USB	CN2	UT-5676
4	FEET		Rubber Feet
1	JACK	JK1	3 Pin Power Jack
1	SWITCH	SW1	DPDT
1	HEATSINK		
1	SCREW & NUT		

SKT1
PROGRAMMER

GND
TEST

5V

CN1
SERIAL
SERIAL
<<
USB
USB
>>

CN2
USB

R20
R23

10R
10R

IMPORTANT
INSERT LINK 1
AFTER POWER
CHECKS ARE OK

R3
C1
1uF

R17
22K
R22
1K5

R18
100K

C14
100N

U3
ICL232

D1
S1
D3

TR4
BC547

C12
22p

470R
R25

10K
L2

C3
1uF
C4
L3
C5
1uF

1N4148
1N4148

X2
6MHz

VCPP

VPP2
VPP1

L4

C11
22p

DIY
K149

U5
16F628

R28
10K

TR1
BC558

10K
R2

2K2
R5
10K
R7
2K2
R10
4K7
R11
1K
R13
2K2
R15

4K7
R16

C15
33N

C10
22p
X1
6MHz

100K
R24

1K
R1
1K
R4
TR2
BC558
10K
R6
10K
R9
TR3
BC558
1K
R12
4K7
R14

U4
74LS06

C8
100N

C9
22p

C16
100N
R27
470K
10K
R21

100K

100K
R26

D2
1N4004

LK1
USBPWR

TR5
BC558

C2
10uF
C6
47uF

L1
PWR

U1
78L08
U2
7805
R8
3K3
C7
100N

JK1
18VDC

100K
C13
10N

R29

R19