

## Overview

GenPIC is a generic microcontroller utility PCB that can be used for a wide range of projects. The PCB will allow nearly any small appliance to be constructed requiring microcontroller control. The PCB measures 2.9" x 4.75".

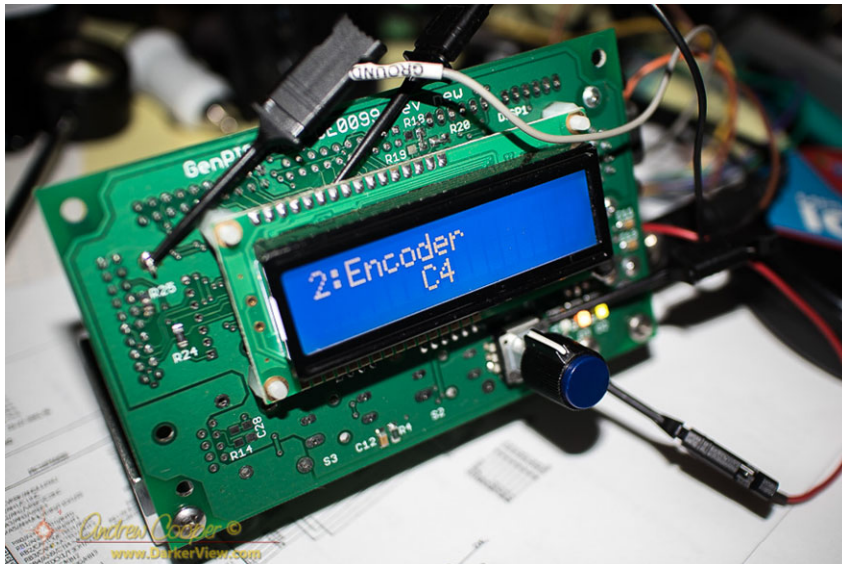
The PCB is designed around the PIC18F66K80-I/PT microcontroller, or any of several other controllers that use the same pinout. This capable controller provides 64kb of ROM, 3.6kb of RAM, EEPROM, 12bit A/D running at up to 64MHz.

The PCB can be housed in an extruded aluminum case and support connections at either end of the case. A Hammond case 1455J1201 (5"x3"x1") will fit the PCB and allow construction of a neat assembly.

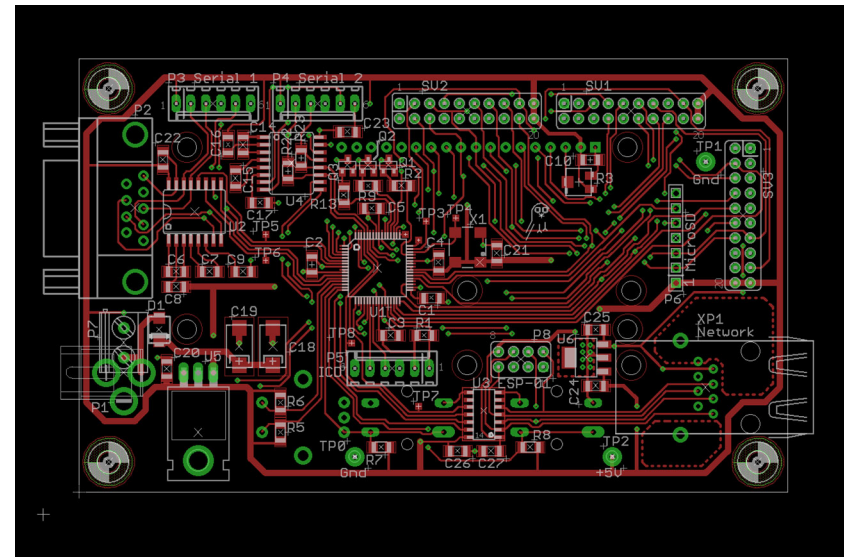
The PCB can also be set up in a front panel user interface configuration with an LCD display and either switches or a rotary encoder for input. A standard 2x16 LCD display such as a Newhaven NHD-0216 will fit directly on the PCB.

Communications is through either a pair of serial ports, one with a Dsub-9 on one end of the PCB. Or through a Lantronix XPort that allow direct to ethernet control of the device.

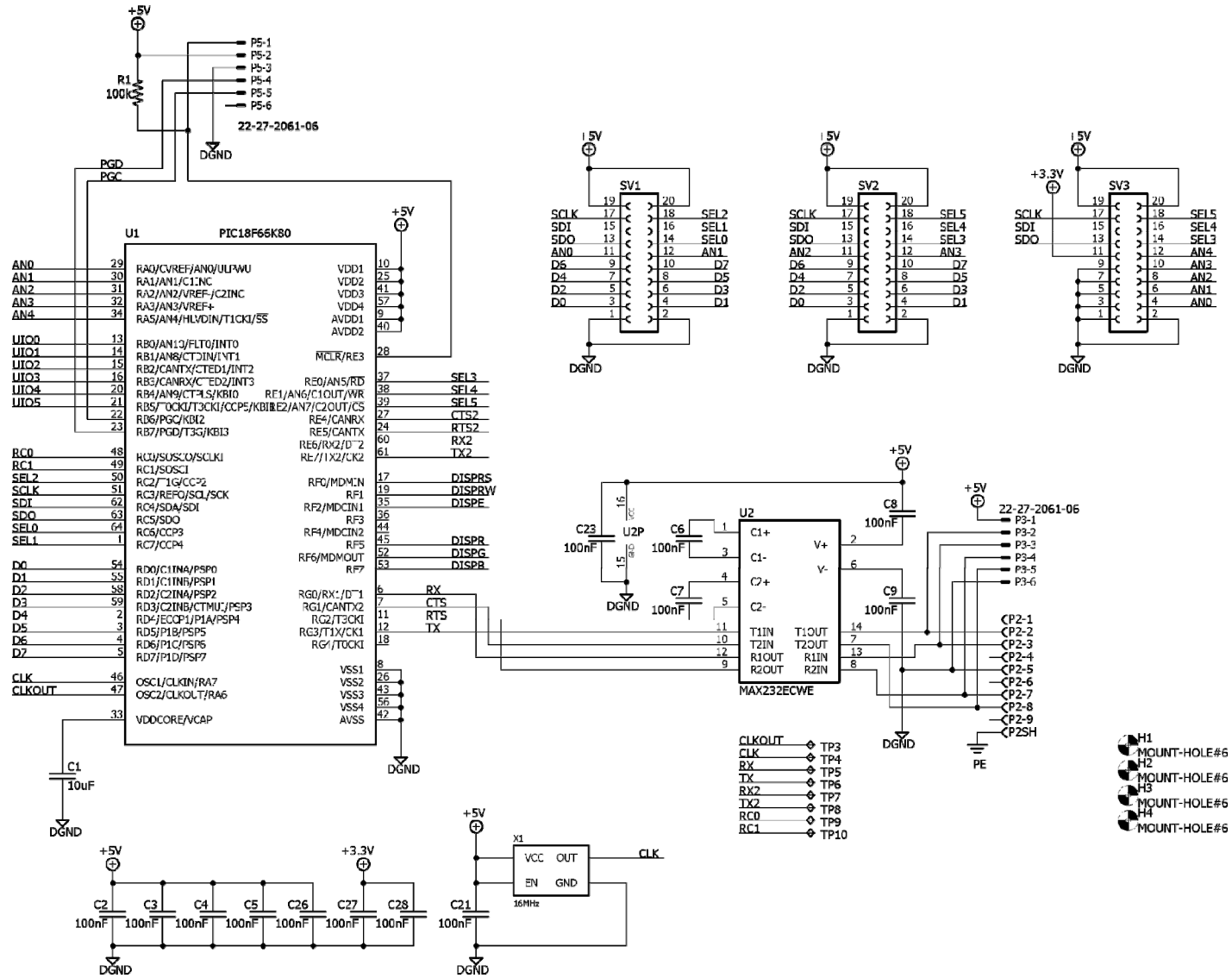
A range of connectors and headers allow expansion of the PCB with a selection of I/O provided.



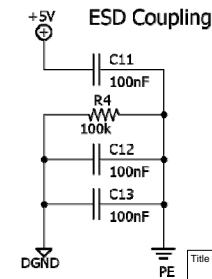
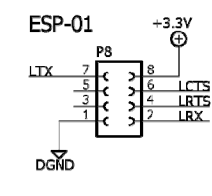
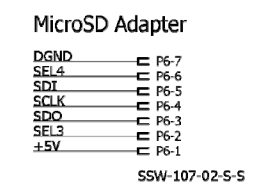
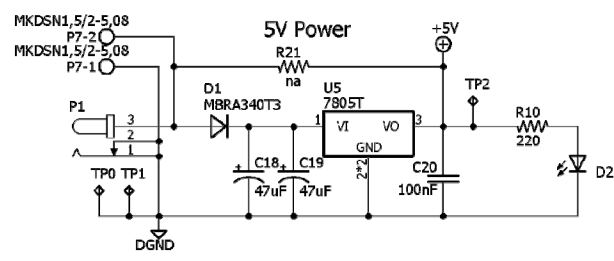
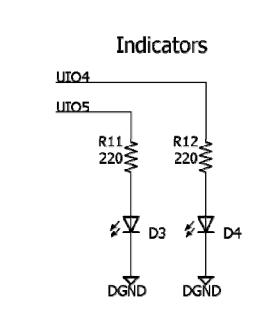
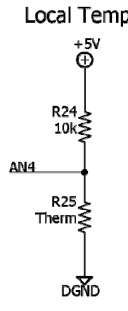
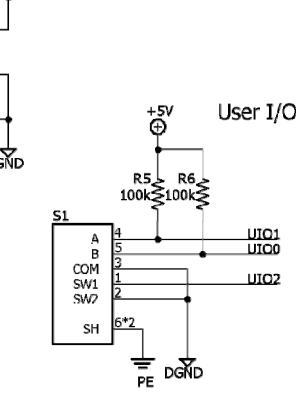
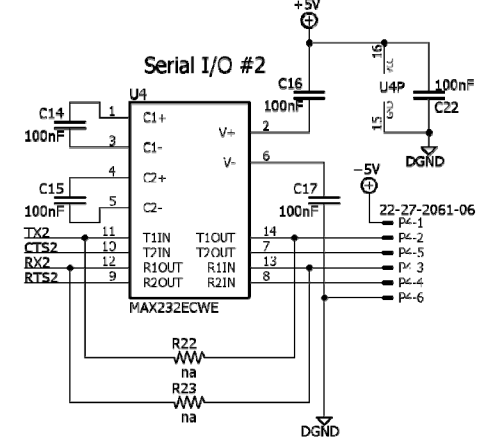
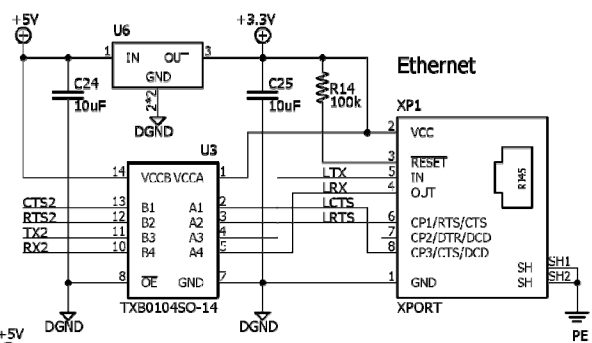
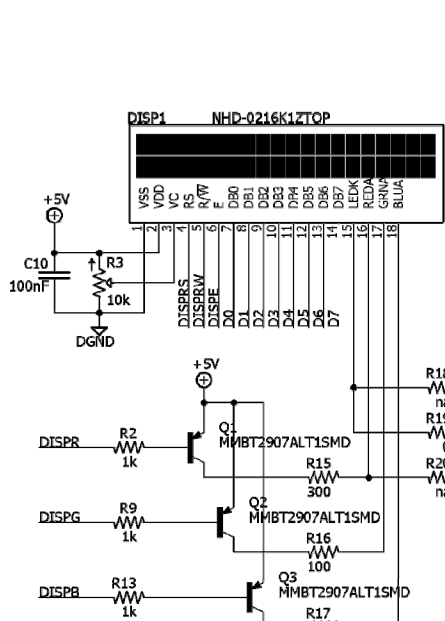
## Appearance



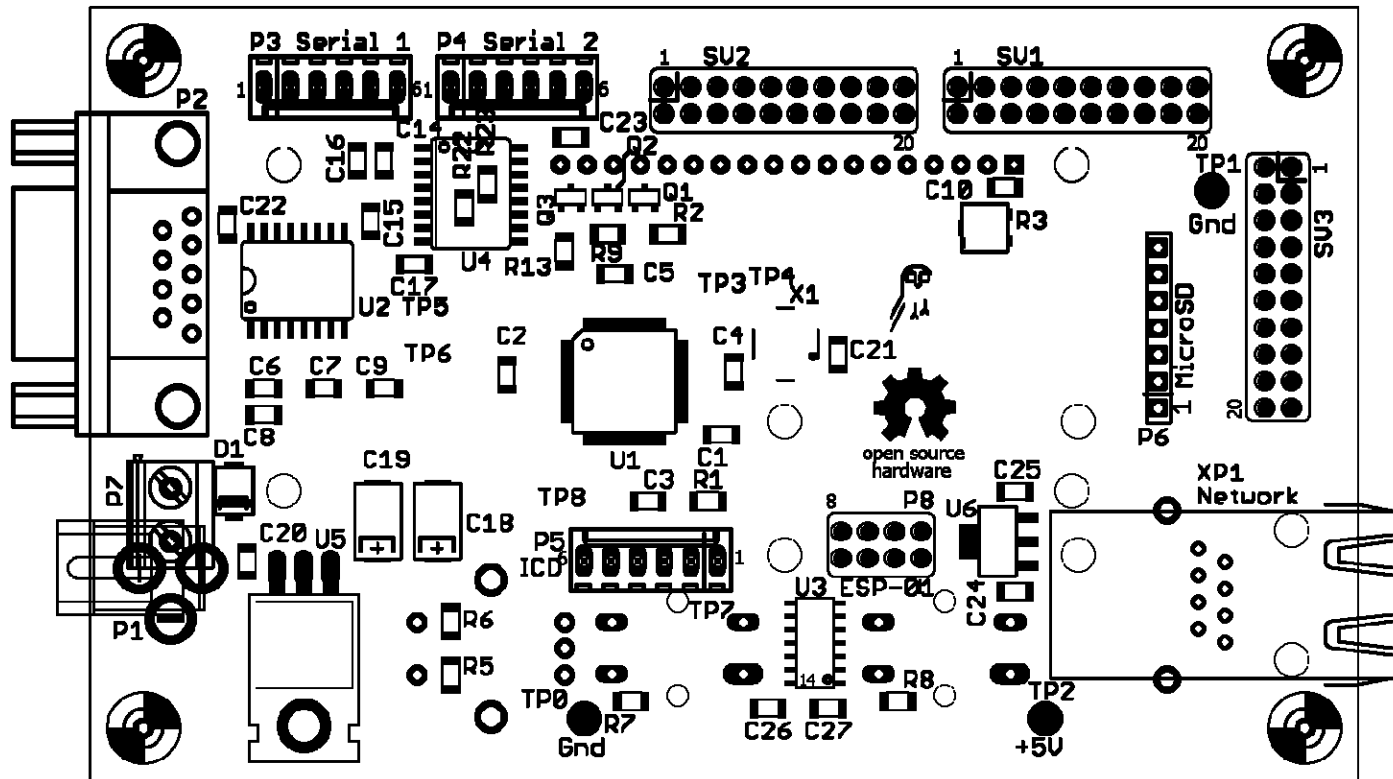
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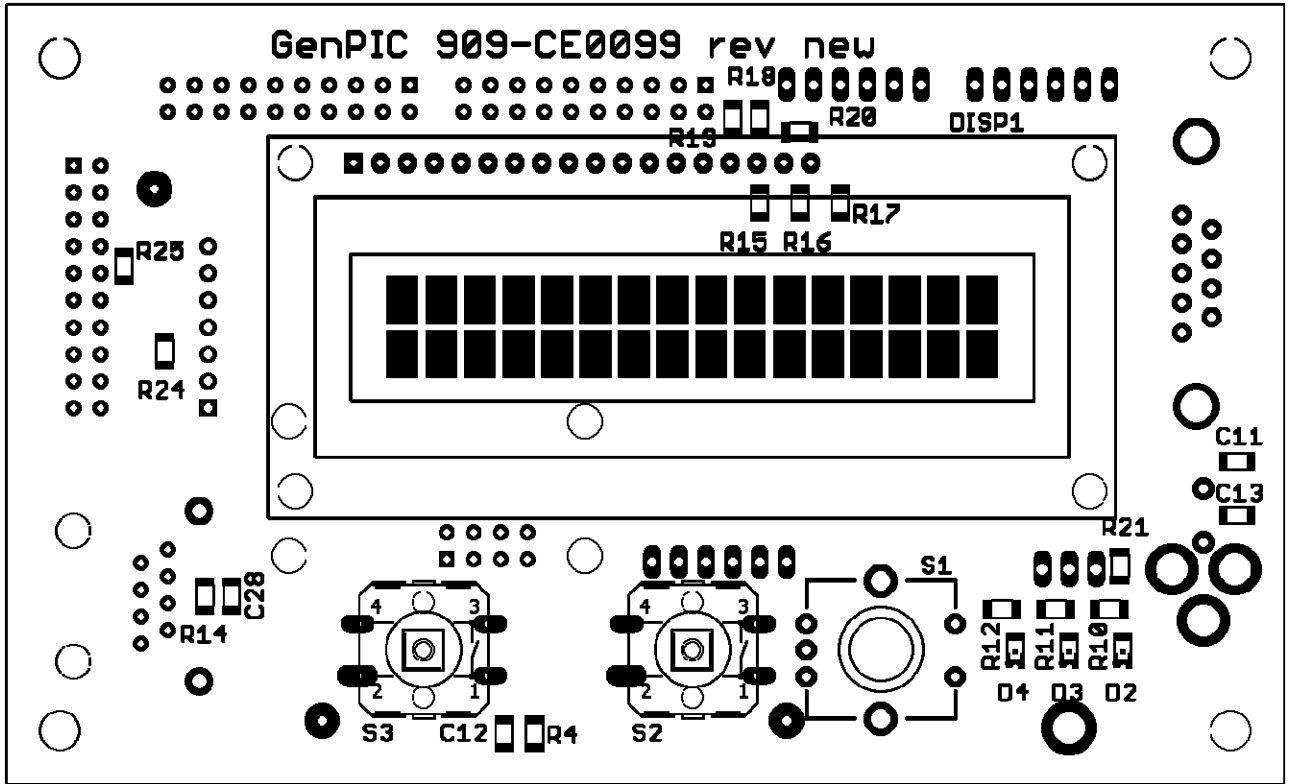
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## General BOM

The BOM below is generic and must be tailored to the application. GenPIC presents any number of options in loading the PCB. There are some components that cannot be loaded if others are used. See the following pages of notes to understand the various options.

Item	Qty	Description	Part# / Mfg
PCB	1	GenPIC PCB	909-CE0098 / Keck
C1	1	10uF 16V ceramic capacitor 1206	CL31A106KOHNNNE / Samsung
C2-C9,C11-C17, C20-C28	25	0.1uF 50V ceramic capacitor 1206	C1206C104K5RAC7867 / Kemet
C18, C19	2	47uF 25V tantalum capacitor 7343	T495D476K025ATE250 / Kemet
D1	1	1A rectifier diode	S1A / Fairchild
D2	1	Green LED 1206	LTST-C150GKT / Lite-On
D3	1	Yellow LED 1206	LTST-C150KSKT / Lite-On
D4	1	Red LED 1206	LTST-C150CKT / Lite-On
DISP1	1	16x2 LCD display	NHD-0216K1Z-NSW-BBW-L / Newhaven
DISP1 (alt)	1	16x2 LCD display	NHD-0216K1Z-NS(RGB)-FBW / Newhaven
P1	1	5.5x2.5mm DC jack	PJ-202B / CUI
P2	1	Dsub 9 conductor female	A-DF 09 A/KG-T2S / Assmann
P3-P5	3	Locking header, 6 conductor 0.1"	0022232061 / Molex
P6	1	Header, 6 conductor 0.1"	PPPC071LFBN-RC / Sullins
P6	1	MicroSD Module	DEV-13743 / SparkFun
P7	1	Terminal block 5.08mm	1729128 / Phoenix
P8	1	2x4 position header, 0.1"	PPPC042LFBN-RC / Sullins
P8	1	WiFi Module	ESP-01 / Espressif
Q1-Q3	3	PNP transistor SOT-23	MMBT2907ALT1G / OnSemi
R1,R4-8,R14,R20	7	100k resistor 1206	RC1206FR-07100KL / Yageo
R2,R9,R13	3	1k resistor 1206	RC1206FR-071KL / Yageo
R3	1	10k potentiometer 3mm	ST32ETB103 / Copal
R10-12	3	220ohm resistor 1206	RC1206FR-07220RL / Yageo
R15	1	300ohm resistor 1206	RC1206FR-07300RL / Yageo
R16-17	2	100ohm resistor 1206	RC1206FR-07100RL / Yageo
R18-20,R21-23	6	0ohm jumper 1206	RC1206JR-070RL / Yageo
R24	6	10k resistor 1206	RC1206FR-0710KL / Yageo
R25	6	10k thermistor B=3500k	NTHS1206N02N1002JE / Vishay

Item	Qty	Description	Part# / Mfg
S1	1	Rotary encoder with switch	EVE-JBBF2020B / Panasonic
S2,S3	2	Pushbutton switch 12mm	B3F-4055 / Omrom
S2,S3	2	Switch cap	B32-1610 / Omrom
SV1-3	3	2x10 position header, 0.1"	SFH11-PBPC-D10-ST-BK / Sullins
U1	1	8bit microcontroller	PIC18F66K80-I/PT / Microchip
U2,U4	1	RS-232 Transceiver, SOIC16W	SP232ECT / Exar
U3	1	Level shift IC, SOIC14	TXB0104DR / TI
U5	1	5V linear regulator, TO-220	LM7805CT / Fairchild
U5 (alt)	1	3.3V linear regulator, TO-220	LM1086IT-3.3 / TI
U6	1	3.3V LDO regulator, SOT-223	AP2114H-3.3TRG1 / Diodes Inc
X1	1	16MHz crystal oscillator	CB3-3I-16M0000 / CTS
XP1	1	XPort terminal server	XP1001000-05R / Lantronix

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## Power and Power Connector

Two power connectors are provided in the P1/P7 location, only one of these connectors can be loaded as they occupy the same space. This allows a screw terminal block or a standard 5.5x2.5mm DC jack to power the board with 7-18Vdc when used with the U5 voltage regulator.

Alternately 5Vdc power could be supplied directly on Pins 1 and 6 of P3 or P4 if one of these serial ports is not used.

P1	1	5.5x2.5mm DC jack	PJ-202B / CUI
P7	1	Terminal block 5.08mm	1729128 / Phoenix

## Regulator

A standard 7805 voltage regulator is provided at U5. This allows use of the assembly with 7 to 18Vdc power. Current usage depends on configuration.

As this is a linear regulator care must be taken to limit power dissipation. Depending on the loading of the GenPIC board and feature selection power consumption will go up. Power dissipation can be limited by reducing the supply voltage to 9Vdc or as low as 7Vdc.

Some heatsinking is provided by means of the copper ground plane. Additionally there should be room for a heatsink to be used with U5.

If direct 5.0Vdc power is to be provided with no regulator then R21 can be loaded with a jumper while U5, D1, C18, and C19 are omitted.

If a 3.3V environment is needed the PIC18F66K80 microcontroller can be run on 3.3V by replacing U5 with a 3.3V regulator. Care must be taken to insure all other components used in the configuration can also run at 3.3Vdc.

R21	1	0ohm jumper 1206	RC1206JR-070RL / Yageo
U5	1	5V linear regulator	LM7805CT / Fairchild
U5 (alt)	1	3.3V linear regulator	LM1086IT-3.3 / TI

## Microcontroller

A capable PIC18F66K80 microcontroller is used for GenPIC. There are quite a few other microcontrollers in the Microchip catalog with pinouts close enough to be used, but few provide the dual serial ports needed for many of the GenPIC configurations.

While this microcontroller is probably complete overkill for most applications GenPIC will be used for, it is only \$4 in single piece quantities.

U1	1	8bit microcontroller	PIC18F66K80-I/PT / Microchip
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## Oscillator

The X1 position allows a standard 5x7mm oscillator for the microcontroller. 16MHz is nominal and can be multiplied up to 4 times to 64MHz by an internal PLL in the microcontroller.

If frequency precision is not needed the PIC18F66K80 has an internal oscillator available, the X1 position can be left empty.

X1	1	16MHz crystal oscillator	CB3-3I-16M0000 / CTS
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## Serial Port #1

A standard RS-232 serial port is provided by serial port #1. This is a full implementation including RTS/CTS flow control if properly implemented in software. Level conversion from logic to RS-232 levels is provided by a standard ST232/MAX232 driver IC.

Two connectors are provided, P2, a female 9 pin DSub with a standard pinout and P3, a 6 pin locking header. Only one of these should be used in the configuration.

P2	1	Dsub 9 conductor female	A-DF 09 A/KG-T2S / Assmann
P3	1	Locking header, 6 conductor 0.1"	0022232061 / Molex
U2	1	RS-232 Transceiver	SP232ECT / Exar

## Serial Port #2

A standard RS-232 serial port is provided by serial port #2. This is a full implementation including RTS/CTS flow control if properly implemented in software. Level conversion from logic to RS-232 levels is provided by a standard ST232/MAX232 driver IC.

A 6 pin locking header is provided for the port.

If logic level serial is required the transceiver IC can be omitted and jumpers loaded into the R22 and R23 positions. This precludes RTS/CTS but provides RX and TX.

Alternately a RS422 or other style of driver could be constructed on a daughterboard plugged into the P4 position via a header. +5V and Gnd are provided on the connector.

P4	1	Locking header, 6 conductor 0.1"	0022232061 / Molex
R22, R23	2	0ohm jumper 1206	RC1206JR-070RL / Yageo
U4	1	RS-232 Transceiver	SP232ECT / Exar

## Micro SD Storage

If large amounts of data needs to be stored a micro SD card can be accommodated using a SparkFun breakout module connected at P6

P6	1	Header, 6 conductor 0.1"	PPPC071LFBN-RC / Sullins
P6	1	MicroSD Module	DEV-13743 / SparkFun

## Ethernet

A direct ethernet connection can be provided by means of a Lantronix XPort terminal server. This uses serial port #2 on the microcontroller and precludes use of serial port #2, U4 must not be loaded.

The XPort is a 3.3V device, thus power is supplied by U6, a 3.3V regulator and U3 a logic level shift IC is used to convert the I/O lines.

U6	1	3.3V LDO regulator	AP2114H-3.3TRG1 / Diodes Inc
U3	1	Level shift IC	TXB0104DR / TI
XP1	1	XPort terminal server	XP1001000-05R / Lantronix

## WiFi

A simple WiFi wireless connection is possible using an ESP-01 module with a ESP8266 WiFi controller. The ESP-01 uses an 8-pin header at P8 as well as serial port #2, the three volt regulator U6, and the logic shift IC U3. Use of the ESP-01 precludes use of the XPort or serial port #2, XP1 and U4 must not be loaded.

U6	1	3.3V LDO regulator	AP2114H-3.3TRG1 / Diodes Inc
U3	1	Level shift IC	TXB0104DR / TI
P8	1	2x4 position header	PPPC042LFBN-RC / Sullins
P8	1	WiFi Module	ESP-01 / Espressif

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## Character Display

A standard 80x36mm 16x2 LCD character display can be loaded into position DISP1. This is a very generic display that uses the standard Hitachi HD44780 control protocol. If a larger display is to be used it can be connected to the same header, even if it will not fit on the PCB. Alternately the display could be connected to one of the service ports SVC1 or SVC2 that provide the needed I/O for a display.

The display is provided a full 8bit parallel bus allowing for easy control. SPI and 4bit displays could be driven from a service port.

The configuration of jumpers R18-20 allow several different backlight configurations to be accommodated. Alternately the Newhaven RGB displays could be controlled with transistors Q1-Q3 and resistors R15 to R20. Normally jumpers are used here for displays with built in backlight limiting resistors, if no onboard resistor is present a current limiting resistor can be installed here.

DISP1	1	16x2 LCD character display	NHD-0216K1Z-NSW-BBW-L / Newhaven
DISP1 (alt)	1	16x2 LCD character display	NHD-0216K1Z-NS(RGB)-FBW / Newhaven
DISP1 (alt)	1	16x2 OLED character display	LOD-H01602DP/A-Y / Lumex

## User Interface

A rotary encoder and two pushbutton switches allow a user interface to be constructed alongside the LCD display.

The rotary encoder S1 incorporates a pushbutton switch, as such it could be used without additional switches to allow a simple user interface that required values to be adjusted by means of a rotary knob. The encoder switch uses the same input line as S2, only one or the other may be installed.

S2 and S3 are located below the display, the two pushbutton switches would allow a user interface to be constructed.

Additionally two LED's, D3 and D4, are located near the switches to provide additional status indications. A third LED in the group, D2, simply indicates power status.

S1	1	Rotary encoder with switch	EVE-JBBF2020B / Panasonic
S2, S3	1	Pushbutton switch 12mm	B3F-4055 / Omron
D2	1	Green LED 1206	LTST-C150GKT / Lite-On
D3	1	Yellow LED 1206	LTST-C150KSKT / Lite-On
D4	1	Red LED 1206	LTST-C150CKT / Lite-On

## Service Ports

The service ports allow for a wide range of additional circuitry to be added.

SV1 and SV2 are identical in pinout, with different select lines for use a strobes and clocks. These provide the full eight bit wide data bus, the SPI bus, two analog inputs, and three select lines. +5V power and ground are also provided. A couple mounting holes are provided in the PCB for a standoff that can be used for securing a daughterboard connected to the service port.

SV3 is focused on analog use with eight lines that can be either analog inputs (AN0-AN7) or digital outputs from the microcontroller. The SPI bus is provided as well as both 5V and 3.3V power.

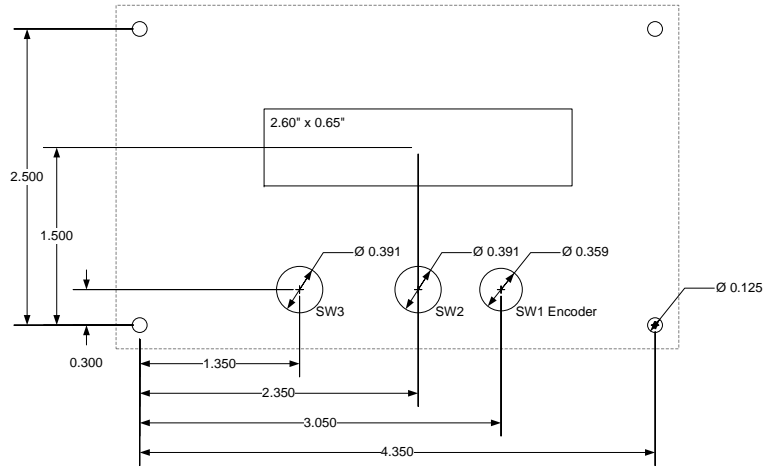
All of the service ports are connected using a 2x10 0.1" header, with the female header mounted to the GenPIC PCB.

SV1-3	3	2x10 position header, 0.1"	SFH11-PBPC-D10-ST-BK / Sullins
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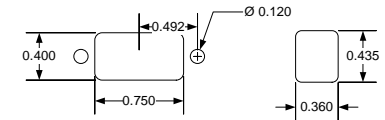
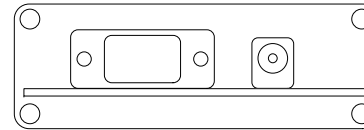
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## Front Panel Layout

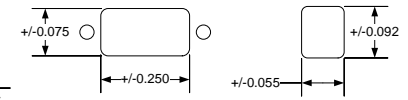
If used in a panel mount situation the GenPIC allows for easy layout. All of the needed drilled holes are on even centers while the display is centered on the same grid with everything else.



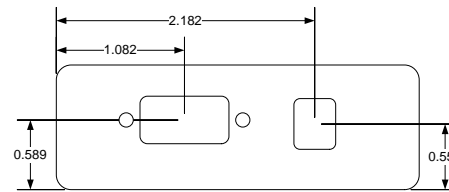
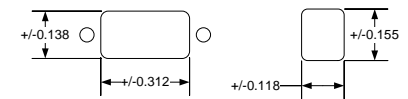
## Case Panel Layouts



Using a 0.25" tool



Using a 0.125" tool



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