

The module described act a general purpose platform for designs using the 16F628 or 16F819 PIC microcontrollers. It has an 18 way DIP socket direct mounting capability for 16 x 4 or 16 x 2 line Liquid Crystal Display modules, provision for a rotary encoder with integral pushbutton, input conditioning resistors / capacitors for when analogue inputs are used, +5V regulator of up to 1 Amp capability, suitable for powering external hardware as well as the module itself (which only takes a few milliamps)

User interfacing is via an 8 way header which carries 5 I/O lines which with the 16F819 device can be analogue or digital, with ground and +5V. There is also another 4 way header which carries two more I/O pins and double sup as the in-circuit programming interface, removing the need to keep taking the PIC out of its socket to reprogramme it.

Circuit Details and optional Components

The circuit diagram is shown in Figure 1, with components cross-referenced to the PCB layout in Figures 2 / 3.

A number of components are optional, these are shown connected by dotted lines in Figure 1. Input resistors R1 – R5 on the 5 I/O lines A0 – A4 can serve as analogue filtering in conjunction with capacitors C1 – C5. Alternatively, C1 – C5 could be replaced with resistors (or both C and R in parallel by piggy-backing) to give a potential divider on some or all analogue inputs. When used for digital I/O, a small resistor here of 100 – 300 ohms is useful to protect the lines against short circuits. An on-board LED shares the A4 connection.

A MAX6004 4.096V precision voltage reference can be installed, in which case it is routed to pin A3 of the PIC to use as the A/D converter reference. If used, R4 can bring the 4.096V to the outside world for additional analogue circuitry.

The LCD with its many parallel inputs is driven via a shift register so it appears to the PIC as being a serially controlled device needing just three I/O lines. The rotary encoder uses two I/O lines, and the pushbutton one more. If the specified encoder is used, this comes with an integral pushbutton – just press the knob. Alternatively pads are available for a dedicated button. On off-board higher resolution rotary encoder can be used; even a stepper motor + line receiver combination.

Two wire links and resistor Rb can be installed if an LCD with backlight is used. Space for a FET and logic drive input pad are available for software control of the backlight; if used do not install Link 2.

The LCD contrast control can either be a single fixed resistor R8, which for the low cost modules is usually uncritical and a value of 2k2 works adequately. Fussier modules, or those needing a variable contrast / viewing angle control may requires a preset resistor, instead, in the VR1 position.

The preset capacitor Vc1 is only required where an accurate clock frequency is needed, such as for frequency counters or real-time clock functionality.

PCB and Assembly

The double sided PCB has plated through holes so wire ended components can be soldered from either side. All components are mounted on the underside apart from the rotary encoder, pushbutton switch if a separate one is used, and the LCD mounting socket. Most of the resistors and capacitors are 0805 SMT style and only those on the main I/O connections are at all closely spaced. Be careful with the chip orientations: Pin 1 of the PIC device is adjacent to the 8 way header. Pin 1 of the 74HC164 device is adjacent to the 16 way LCD connector strip.

Figure 4 shows a photograph of the under, component side of the PCB; the top view showing LCD and rotary encoder installation in Figure 5.

Special Components

The 16 way connector has been positioned so a standard 16x4 line or 16x2 line display can directly installed using either pins/wires connected direct, or with the preferred solution, a 14 or 16 way in-line pin/socket arrangement. These two modules should then sit with their mounting holes directly over the respective holes in the PCB. Other sizes of LCD, or vacuum fluorescent modules can be installed with a 14 or 16 way jumper. Larger modules – as in Figure 6 - will have to have the rotary encoder installed off-board

The specified rotary encoder is the EC11J152, Farnell part Number 165-6447, which is a surface mounted device with integral pushbutton and will fit onto the pads to the right of the LCD.

The PIC code supplied for the ready-to-go projects needs a 4MHz crystal for correct operation. However, the PIC is specified for operation up to 20MHz (and it will go a lot higher in practice) so future uses may swap the crystal for another frequency. For some timing requirements, a more-specialist value may also be substituted. The 16F819 has internal oscillator options, so the crystal and C7/8 can be removed if this route is taken.

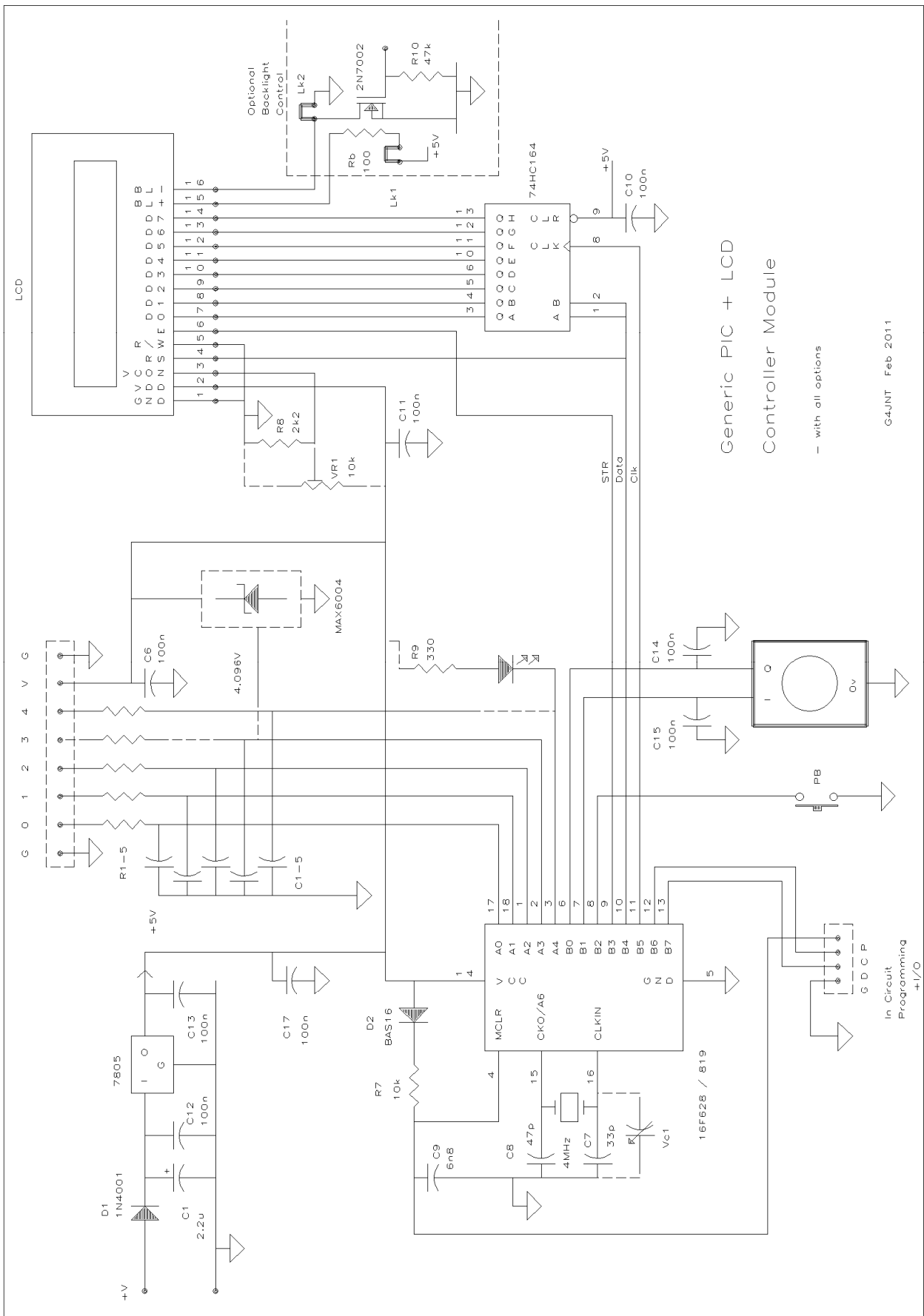


Figure 1 Circuit Diagram

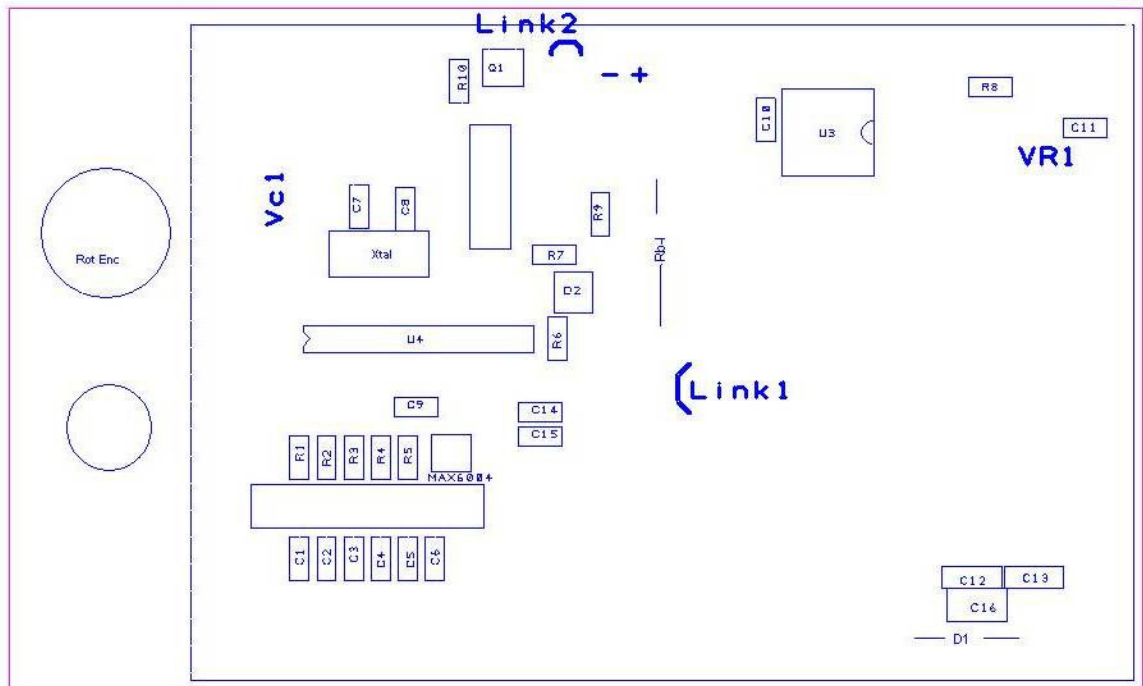


Figure 2 Component Overlay

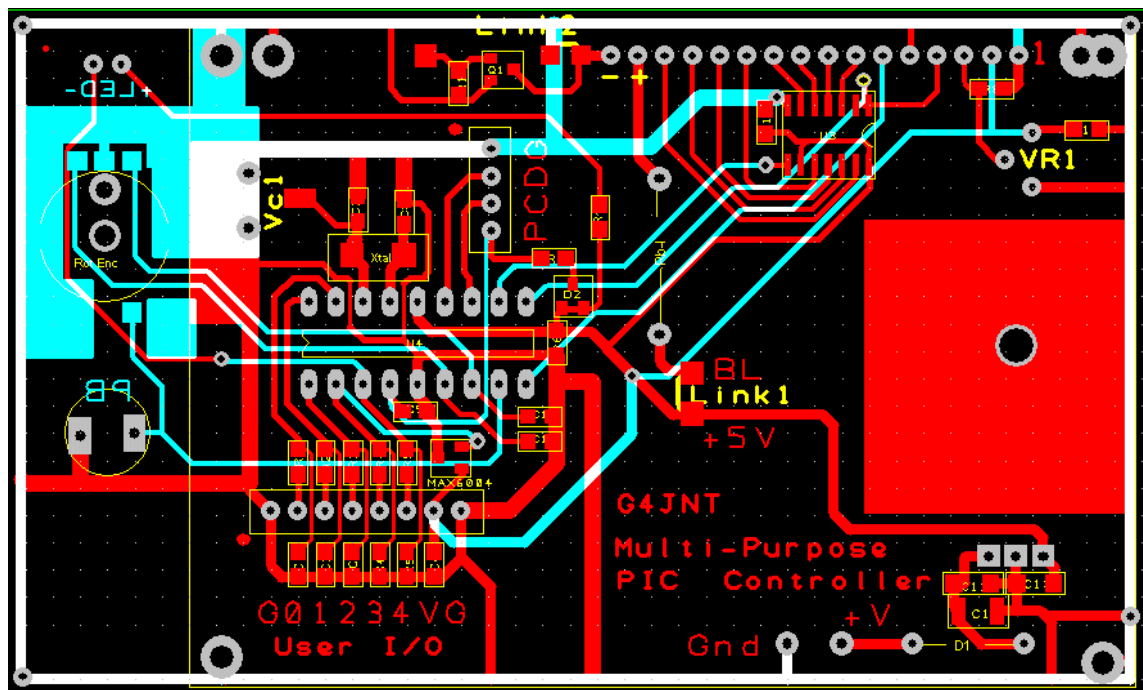


Figure 3 PCB Design

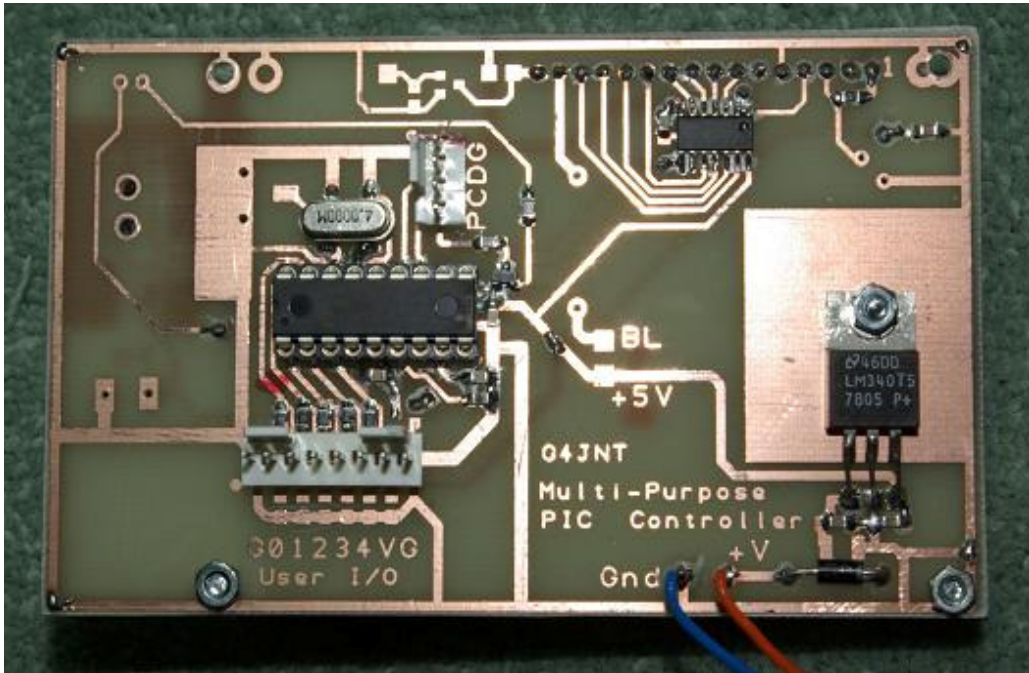


Figure 4 PCB Rear View

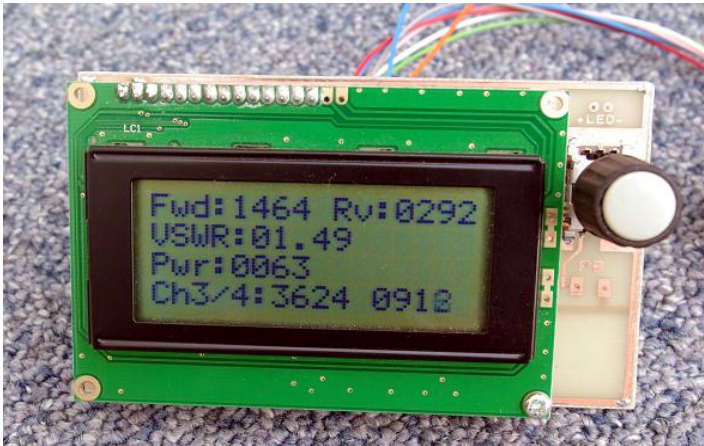


Figure 5 Top View with Standard 4 line LCD

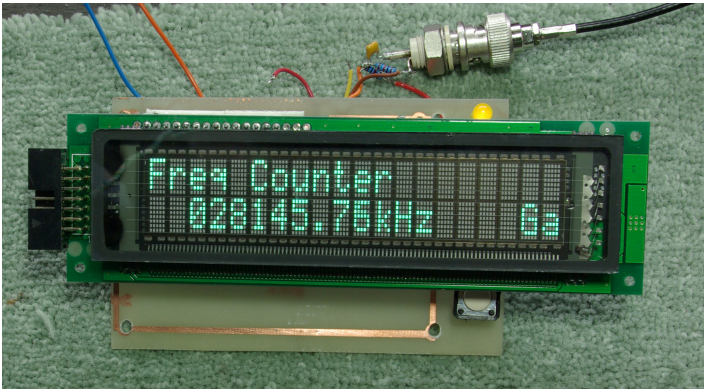


Figure 6 Using an alternative display – in this case a Vacuum Fluorescent type. The rotary control cannot be installed on the PCB, and even the separate pushbutton pads are partially obscured.

Construction Notes and comments so far...

1) On the First batch of PCBs the holes are too small a diameter for the LCD connector and the header pins to pass through. These can be drilled out, but this will damage the plating meaning that pins connected to tracks on both sides will then have to be soldered separately to each.

An alternative would be to just solder the pins surface mount style, and not try to pass them through the holes.

Another alternative I used is a SIL socket so the LCD can be plugged in rather than soldered. The SIL socket strip has thinner pins that can pass through the existing holes.