# PICS in Am Radio

Andy Talbot    G4JNT

# SO what is this magic device ?

- The PIC processor is a Single Chip with Input and Output lines that can be programmed to do (within reason)anything you want

- Low power (2 – 5V < 10mA)

- Cheap (~ 50p to a few £s each)

# How are they used ?

- With a few programming tools
  - Use code written by others for specific jobs
  - Programme your own from first principles
  - Mixture of both

- Wide Range of device families
  - Basic Digital / analogue signal handling
  - TO
  - Advanced Digital Signal Processing

# The Hardware

- All depends on the chip type
- I/O lines (Pins)
  - Digital 5V,   source / sink 20mA
  - Some Schmitt trigger inputs
  - Analogue Inputs
- Peripherals  (use some dedicated pins)
  - A/D Converter
  - Comparator
  - Timer / Counter

# Contd………

- UART  (serial Comms)
- Pulse Width Modulation

➢ A few specialist ones

- USB Core
- I2C Bus
- CAN Bus

# How the code works

- A sequence of instructions are stored in Programme Memory that work on *Data stored in user memory*
- User memory *includes all the peripherals and I/O lines*
- The data is swappd about, moved, manipulated - *and conditionally tested*
- The programme sequence can be interrupted and flow changed depending on the outcome of those tests

# --- and that is all they do ----

- 35 Basic instructions in the baseline 16F family
  - (and of those, about half are used most of the time)
- The peripherals are the complicated bits, and need the data sheets.
- but for now.....
- A bit of code....

# A few ground rules

- All PICs need some setup instructions
  - Peripherals need initialising (some even if not used - a very sore point indeed! RTFM with an unfamiliar device)
  - I/O lines defined –
    - direction, type – or just for for best PCB layout
  - Peripherals have dedicated pins allocated – and may default!
  - Clock Oscillator (int / ext, speed, type)
  - All these depend on the processor
  - Copy from other previous working code – *for that device type*
    - *Some early 1996 vintage initialisation code by G0IAY, when he introduced me to PICs can still be seen in some of the latest stuff on the website.*

# Sample prog (with many setup bits missing)

```
    #define    LED       PORTB, 3      ;Bit 3 of PORTB
    #define   Button PORTB, 4        ; Assume if pressed = 0V, high normally
    BCF        TRISA , B             ;      Set LED pin as an output
    BSF        TRISA , B             ;      Set Button as an input

MainLoop
    BTFSS      Button          ;Test the button, skip next command if high (not pressed)
    GOTO       Pressed         ;If pressd, jump out of loop
    BCF        LED             ;Make sure LED is off,  set its connection to 0
    GOTO       MainLoop        ;Cycle continuously when button is up
;................
Pressed                        ;Turn the LED on when button is pressed
    BSF        LED             ;Set the LED pin high
    GOTO       MainLoop
;.................
    END
```

# Practicalities

- Write the Source code –
  - use any text editor like Wordpad, Notepad,
  - or a custom one - part of programing suite
  - Generate .ASM file
- Assemble it
  - I Use MPASM (from Microchip)
  - Any errors are flagged with line number
    - (so make sure the text editor shows line numbers!!)
- If all is (eventually) correct – no assembly errors – a .HEX file will be generated
  - This will look meaningless

# Blowing the Chip

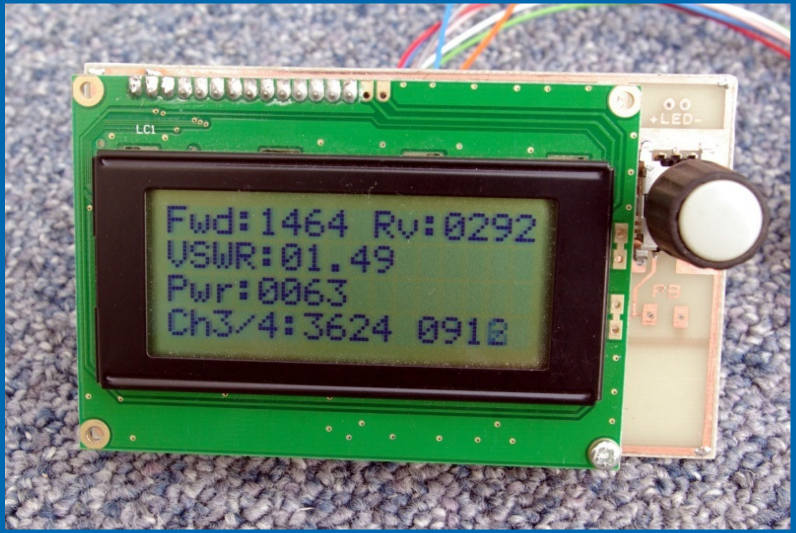
- PIC programmers are rife.  There are dozens of different ones
  - Many homebrew, simple, PC software based ones.     They probably mostly work..... BUT
- Get a proper one
  - Microchip PicKit 2
    - (or PicKit 3, nothing extra for basic jobs)
  - Will do every (modern) device they make
  - And often comes bundled with freebies
  - There are others (Asix Presto) – I need for legacy devices

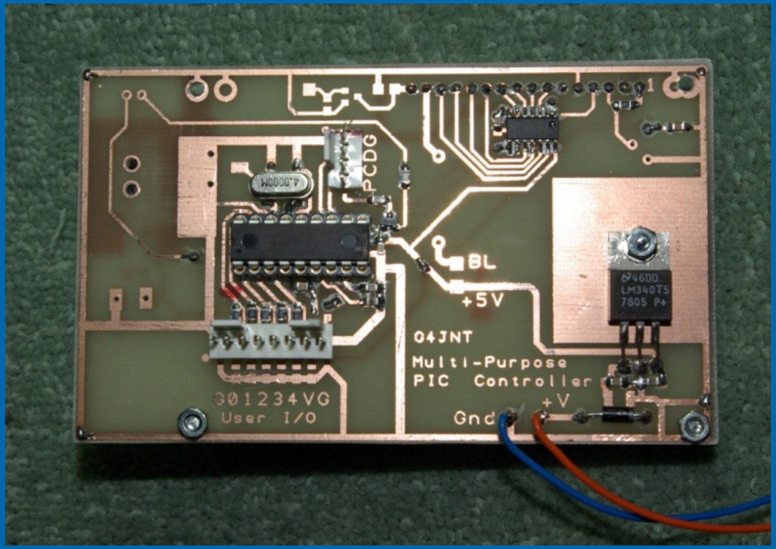
- (Install the programmer Software)
- Connect programmer to PC
  - For the PicKit – connect a blank device first
  - Use chip adapter,
    - or connect the 5 programming wires
  - PicKit reads the device type automatically
    - Other programmers have to be set
- Load in the .HEX file generated earlier
- Click / Press / Hit the programme button
  - Remove chip, solder into circuit

# In Circuit Programming

- Two I/O lines dedicated to programming, along with PGM pin (also device reset)
  - Bring out to connection header on the PCB,
  - Allows chip programmer to re-prog chip on the final board
  - The header may conveniently allow an external user interface to be connected, so pins aren’t wasted – like RS232
    - As in the Beacon Keyer module
    - No spare I/O pins there with its 8 pin PIC

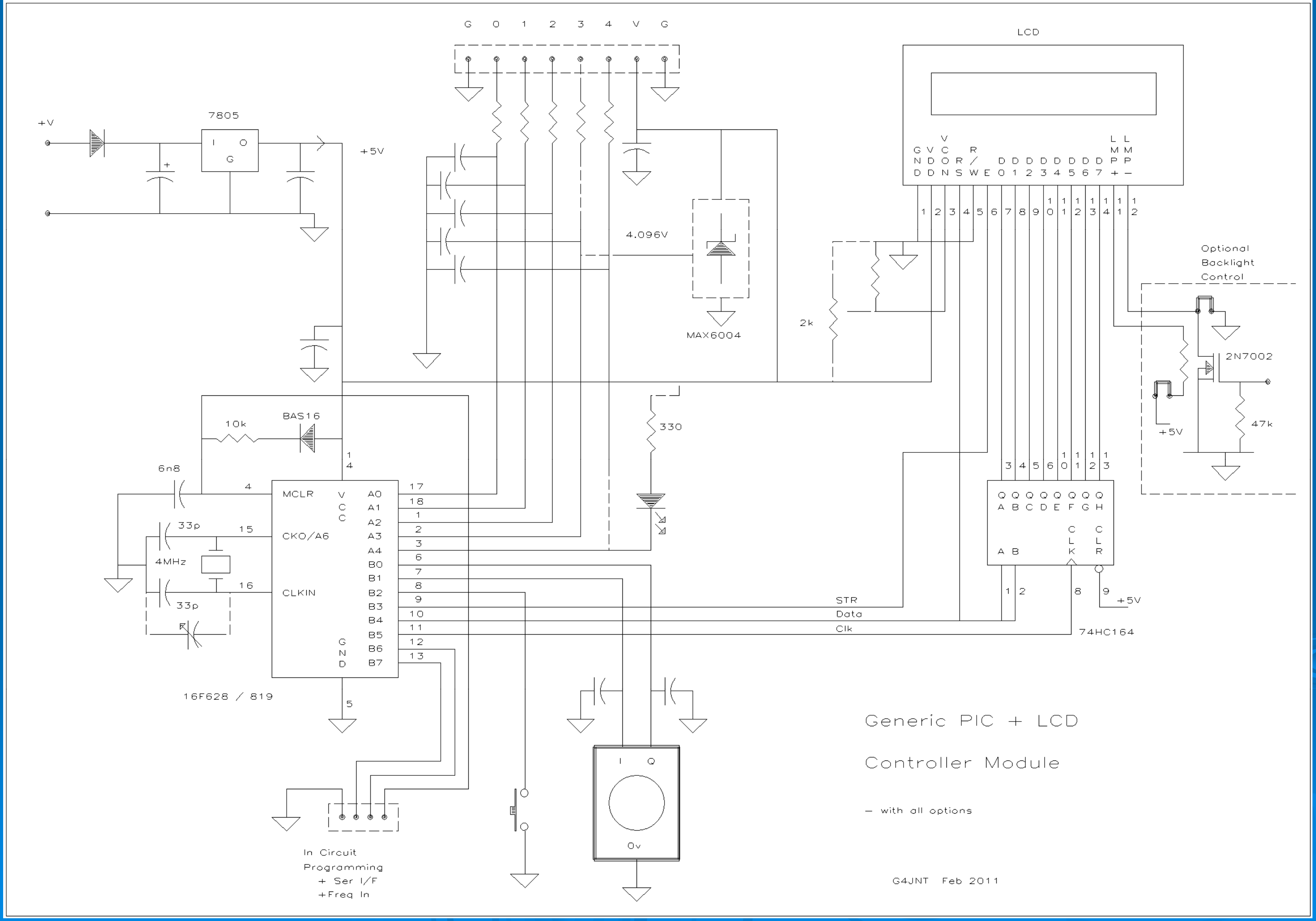
# The ‘JNT Board





Specifically designed as a user I/O interface for analogue and digital tasks

# Circuit Diagram



Generic PIC + LCD

Controller Module

– with all options

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# Details

- 16F628 or 16F819 Processor
  - Socket & In-Circuit Programming
- LCD Module
- Rotary Encoder with built in pushbutton
- Up to 5 User I/O lines (analogue or digital)
- Precision voltage reference
- Expandable, development module

# Uses

- Analogue
  - Monitor several channels and display voltages - accurately
  - Calculate VSWR and Power from ext head
  - ?????????????????
- Digital
  - Control serial synthesizer chips
  - Frequency Counter
  - ?????????????????

# Ready-To-Go Solutions

- 4 Channel Voltmeter
  - 4 voltages on LCD, use rotary control to set and store decimal point position
- VSWR Indicator
  - Feed in FWD and RTN voltages from SWR head, calculate VSWR independent of power
  - Feed in a calibration voltage, use to allow accurate power display
- Frequency Counter
  - Up to ~ 50MHz
  - Rotary control to set and store IF offsets

# ....   Contd......

- Synth Controller
  - Control a pair of MFG modules, or similar synth chips, over dual I2C interface
  - Requires PIC programmer if frequencies / IFs need to be changed

- ------------------------------------

- The module will form the basis of future microwave synthesizer controllers
- Designs based around the LMX family are rising up the do-list ........