Tech Info Document: PIC16F877 based 4x20 LCD APRS Weather Station

WX1

Stand-Alone PIC16F877 APRS Weather Station with Data Logger:

Some of the interesting features of this project:

1. 4x20 LCD. Displays all weather parameters.
2. May be operated without LCD for maximum power saving.
3. On board Temperature, Humidity, RTC (For time Stamp) & Pressure Sensors.
4. RTC has battery back-up
5. DIN5 connector for Transceiver. HT header for portables.
6. No requirement of a TNC.
7. Industry Standard Data Logger output for weather programs.
8. Supports 1Wire Wind instrument from AAG.
9. Runs on a 12V supply.
10. Transmits APRS Weather Data at 1200baud.
11. User data may be entered by simple hyper terminal.
12. Optional rain Unit connections.

Introduction:

Radio Amateurs have long been looking for an economical, high performance weather station for their radio stations. There are many great ideas, like the 1-Wire weather Station detailed elsewhere on this site, but when it comes to having a nice display of your weather data, there just is not much available.

To make my own economical, advanced weather station, I decided to seek permission to use wonderful firmware created by David Andersen.

I decided to have a few extra PCBs made, and assemble a few kits for others, who might not be able to do this project themselves. David was kind enough to grant me permission to make kits available on non-profit basis for other hams. With David's firmware, I developed the enthusiasm to go ahead and put together the hardware to implement, what I think, is a very nice weather display.

Obtaining some of the parts, like the sensors and Maxim chips, was problematic, but with the help of my friend Frank/K7SFN, I was able to obtain these parts and create the WX1 kit.

I hope you will agree this is an indispensable addition to your station.

Project Details:

This is a PIC project. Uses a large, 40pin PIC16F877 chip. Most hard work is done by the processor. Basic functions are:

Interfaces to:
1. Honeywell HIH-3610 humidity sensor
2. Motorola MPXA4115 Pressure sensor
3. Uses DS 1307 RTC with 32.768khz crystal reference
4. DS1621 is a thermo meter
5. 1Wire Wind Instrument from AAG
6. Ready for rain unit

APRS Output:

Weather Station output 1200baud aprs data at an interval of 5-10min.

No TNC is required. Your radio simply connects to this WX station directly at DIN5 Connector.

Data Logger:

Station produces weather data in industry standard formal at D9F socket, which may be interfaced to a PC running a suitable program like: Weather-Display.

Display:

Weather Station was built with a 4x20 character LCD display. Without a wind instrument connected, it looks like this:
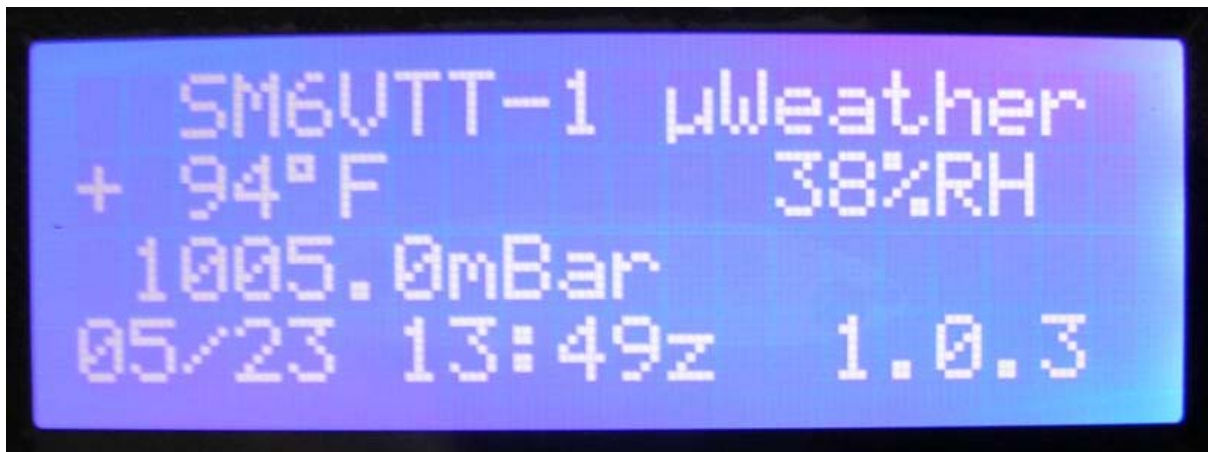

User parameter entry:

Upon completion of assembly, the first thing require to carryout is to enter amateur radio user information. For which following procedure is required:

1. **Remove the LCD**
2. **On SW1, push "on" the switch marked as "Config"**
3. **Connect your PC using a standard serial cable**
4. **Apply power**
5. **Open Windows Hyper Terminal. (2400/8/1/none)**
6. **Strike space bar & a list of menu will appear.**
7. **Select each item & enter user info.**

Please Note:

1. **Unless you enter pressure thru this config process, display will only show 000.00mb. (Get present pressure reading from nearby station)**
2. **Time required is in GMT**
3. **Keep AAG instrument ready & connected to set wind wane direction entry.**
4. **Temp & Humidity do not require any treatment**

Picture of the SW1:
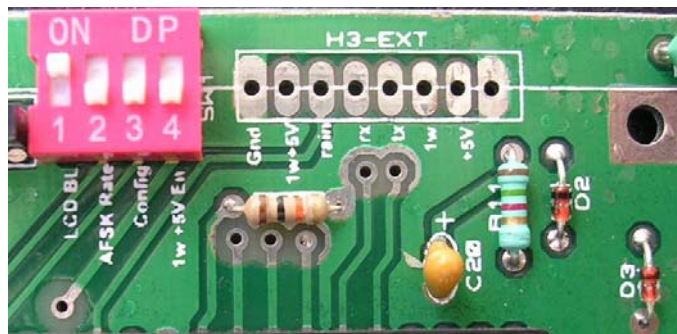
Details of SW1 Switches:

1. **LCD BL:** Switched Back Light of LCD
2. **AFSK Rate:** Change in rate
3. **Config:** While "ON" unit goes into configuration mode. When "Off" unit is in normal mode.
4. **1W +5V En:** Switching on this will make available +5V at H#-EXT socket and also on RJ12 used for 1Wire Wind Instrument.

H3-EXT Socket:

In kits or assembled, an 8 pin socket and an 8 wire ribbon cable is provided. This may be useful for those who wish to run wind instrument using their own thick multi-core cable instead of using RJ12 connector & cable.
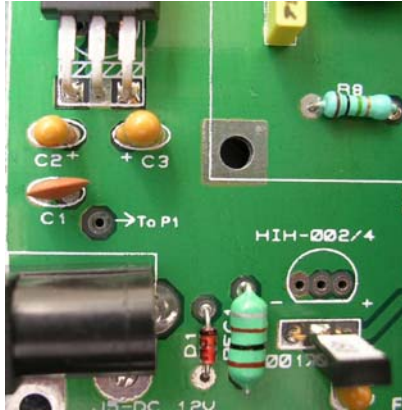
H1 Header for Portable Radios:
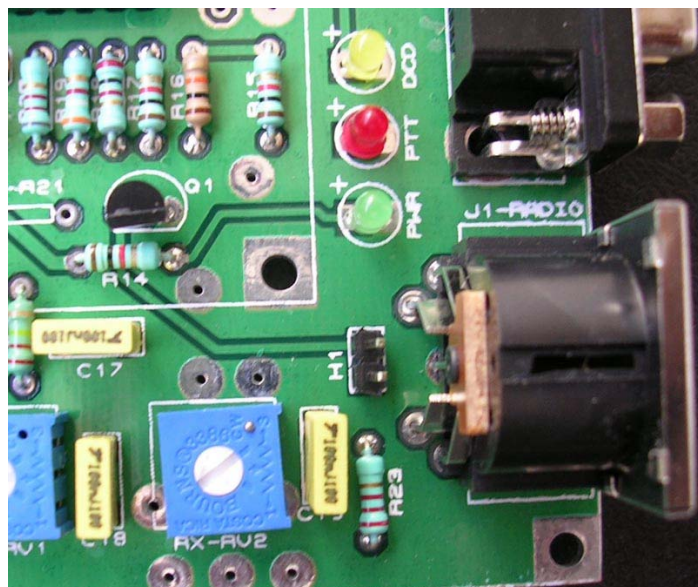
If you are going to use a portable radio, which can trigger PTT thru mike connection, simply install a shorting pin provided in the kit.

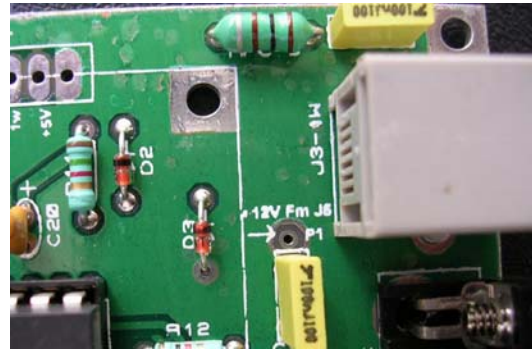**This will place a 2.2K resistor between MIC & PTT.**

Please note that J1-R21 is not used & nothing is to be installed here. However, if you want active pull-up on PTT line, a 2.2K resistor may be placed here.

1Wire 12V:

P1   P2

If you wish to take 12V supply from this weather station to 1W socket, which may be using 6-core wire, you may add a like between P1 & P2.

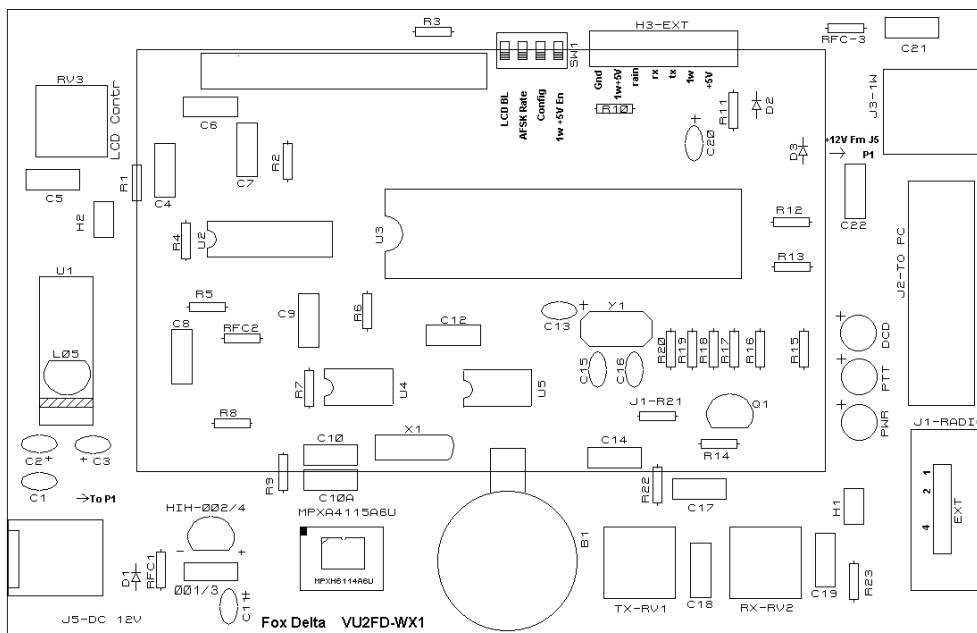Please study PCB foil before wiring link as detailed above.

Preset Details:

RV1: Adjusts Transmitter Audio Output Level
RV2: Adjust this preset at a level that "DCD" LED is off (With radio quiet)
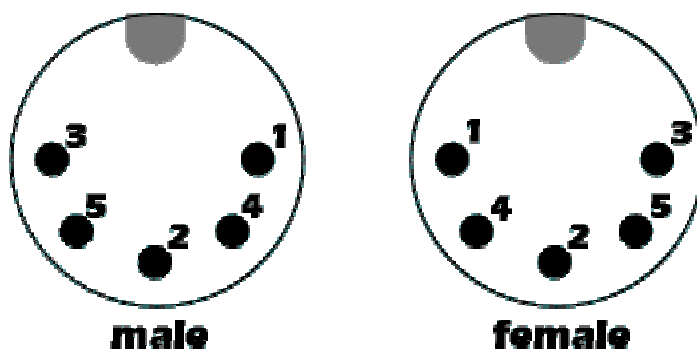RV3: Adjust for LCD Contrast.

Silk Snap of the WX1:

A Completed Weather Station in operation:

DIN5 Connector for Radio:

As visible in above picture, a DIN5 Female PCB mounted connector is used for connecting your radio to this weather station.

A male DIN5 is supplied with kit/assembled for connecting your radio to this weather station.

DIN5 Female PINOUT:

1. NC
2. Ground
3. AF In (Transceiver Receiver Audio)
4. AF Out (To Transceiver MIC)
5. PTT Out. (Not connected if shorting pin installed at H1)

Parts List:

ICs, Sensors, Crystals & Other Hardware:

Quantity	Check	Part Detail
1		PIC16F877 DIP / U3
1		DS1621 / U4
1		DS1307 / U5
1		MCP6024 / U2
1		7805 Regulator (U1)
1		IC Socket 40Pin (PIC16f877A)
1		IC Sockets 14pin (MCP6024)
2		IC Socket 8 pin (DS1621 & 1307)
1		LCD 4x20 (with 16pin male/female SIL headers)
1		Crystal 32.768khz
1		Crystal 20.00mhz
1		Socket D9F R/A
1		Socket RJ12 R/A
1		DC Socket
1		DIN5 Socket
3		10K Presets
3		3mm LED
1		8pin Ext header
1		4way DIP switch
1		BC547B (Q1)
1		RTC Cell Holder
2		BAT85 (D2, 3)
3		10uh RFC
1		1N4148
1 set		LCD Support
1		WX1 Double Sided PTH PCB
Total	34	

Quantity	Check	Part Detail
Sensors:		**Following sensors are only supplied with Full Kits or Fully Assembled Units**
1		MPXA4115A6U
1		HIH-3610
Total	2	

Quantity	Check	Part Detail
Resistors		
3		1M (R1, 5, 8)
6		10K (R4, 6, 7, 10, 13, 16)
1		10 Ohms (R3)
1		15K (R2)
1		1.5K (R11)
4		1K (R12, 14, 15, 17)
1		2K (R18)
1		3.9K (R19)
1		8.2K (R20)
1		220K (R22)
1		2.2k (R23)
1		820 ohms (R9)
Total	22	Note: J1-R21 is not required nor supplied or installed
Capacitors		
16		0.1uf Poly (C1,4,5,6,7,7,9,10,10A,12,14,17,18,19,21,22) C1 is a Ceramic, rest are Ploy.
5		1uf Tantalum (C2,3,11,13,20)
2		22pf Ceramic
Total	23	

Enough? Well, I don't think so!!

We will have more of weather stations coming up in next projects. Attempts would be to make thing simpler and economic with attention on aprs.

I hope, with PCBs, Kits & Assembled WX1 stations now available at non-profit, low price, there should be no excuses for radio amateurs for not having a good weather station at home.

Schematic of this project is here……….

PIC16F877 firmware is here……………….

73s
Dinesh Gajjar
21st May 2008

For more details, please visit Project Page: http://www.foxdelta.com