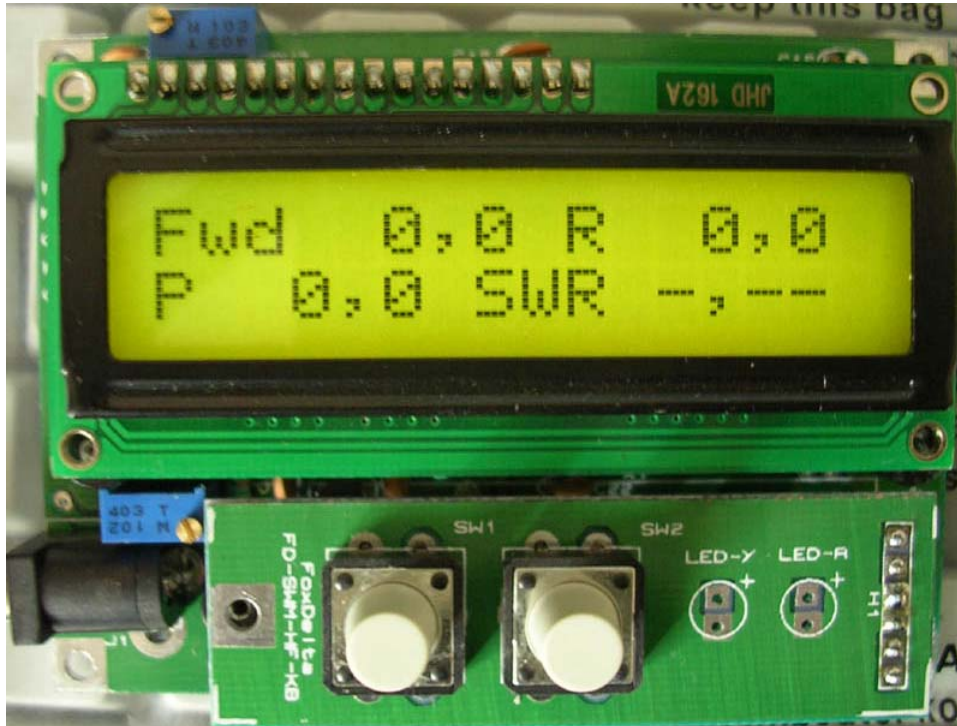




Picture of the completed HF 100W LCD SWR/POWER Meter:



Introduction:

Measuring SWR at HF from 0 to around 60MHZ was always an interest to radio amateurs. Till date, thousands of radio amateurs run their station without an SWR Meter to know how well is matching between Tx and Ant.

SWR Meters of Analog variety are ample, although, not very economical. LCD meters are more expensive, crossing a range of over \$140.

LCD SWR Meter presented here meet many SWR measuring tasks, using a PIC16F877A micro controller. Purpose to make this project is to encourage radio amateurs to build their own SWR Meter at low cost & understand usefulness of PIC Micro-controllers.

Further this also is an attempt to remove a mental hype that everything with "Micro Controller" & "LCD" as to be "Expensive", "Factory built" and a domain of professionals!!

Following task achieved thru this design:

- 1. Simple single micro controller with built-in A/D converter.**
- 2. Simple single toroid HF Bridge**
- 3. Back light control**
- 4. SWR, FWD, POWER and Actual Power to antenna calculations.**
- 5. Bar graph mode for SWR & Forward Power**
- 6. Compact Design**
- 7. May be powered from DC9V battery or 12V DC**

PIC projects are very dear to radio amateurs and enthusiasts because of their easy programming needs and ample of source of codes already available to experiment with.

Project Bases:

Project is developed on two double-sided PTH boards. The concept being that the display electronic may be fitted on your project front panel, and the bridge board may be suitably located at the RF level points.

The CPU board has LCD, Regulator and Back Light Controllers. This board receives pure DC levels from sensor board for calculation & display.

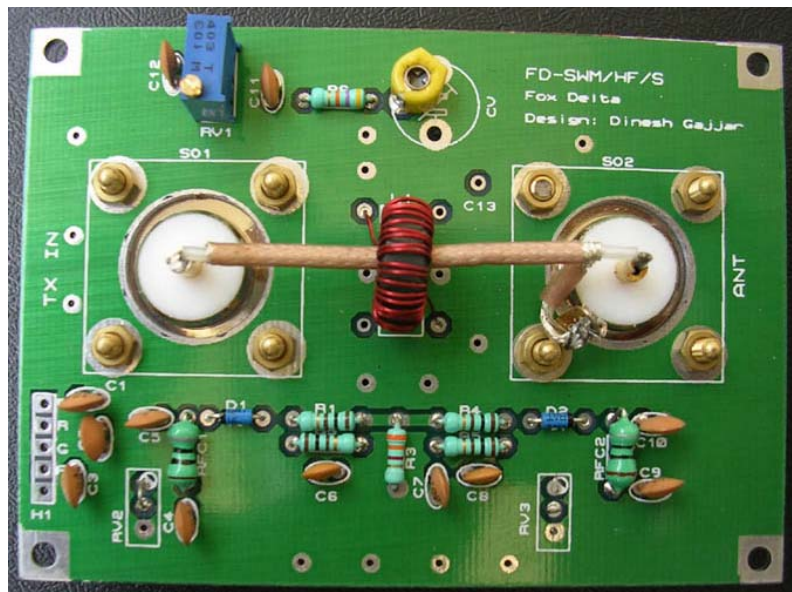
The second board, "RF Sensor Bridge": RF Power from your transceiver comes in and goes out to antenna, thru this board. It is a simple HF Toroidal Bridge design using 1N5719 or BAT85 diodes.

Although SO239 types of connectors are used, there is no reason why N type connectors may not be used. They will fit nicely on four mounting holes available for SO239 sockets.

In actual completed SWR Meter configuration, Two boards, CPU & SWR Bridge, will be housed in metal boxes connected by a 5 wire cable (Shielded) used for interconnection. I held up supply of kits because I intended to provide suitable metal cases for this particular project kits but Lousy fabricators are stealing my time and interested amateurs are firing emails.

As of this writing, I am going ahead to supply kits without cases. Later, when metal box fabricators are reliable in time slot, I will try to supply fully assembled SWR Meters or kits with metal cases.

100W HF Directional Sensor/Bridge:



Variable Capacitor (CV) is used to align the Bridge.

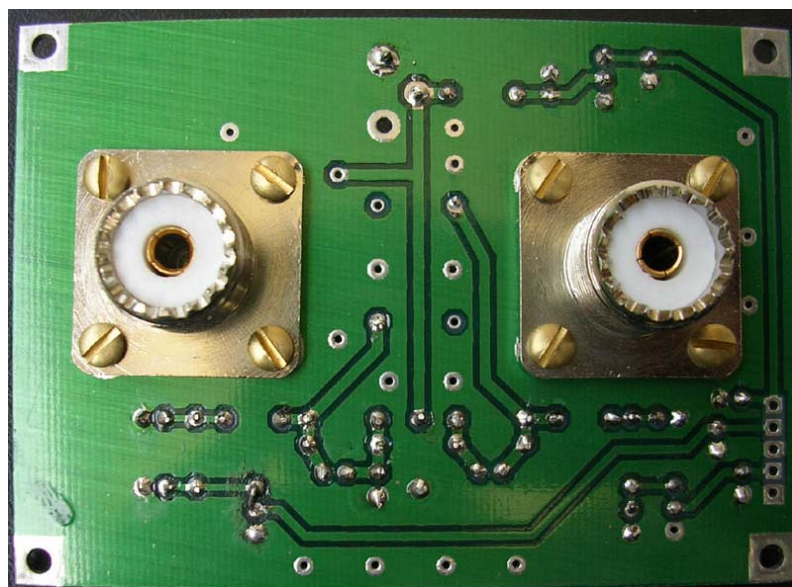
C13 is not installed in this prototype board picture on the left but it is an essential part of the bridge. It connects between "Ant" terminal of SO239/N socket and pad marked as "C13"

Toroidal core is FT-50-43. Diodes are BAT52, BAT85 or 1N5719.

Toroid is wound with #26 wire with about 35 turns.

SO239 connectors are installed on the other side of the Bridgeboard. You will have an option to order type "N" sockets if you like.

Backside of HF Bridge with SO239:



Above is the PCB for HF sensor bridge terminal with 50 ohms constant load. Although, board has possibility to have correction presets (RV2/3) they may or may not be required.

Bridge Alignment:

You will require a dummy load like FD-DL-10/50, which is a 10W 50 ohms dummy load. With such termination, it will be a simple task to adjust above bridge for accurate readings.

Power:

DC12V 2.1mm Connector is provided where either DC12V from wall adaptor or 9V Battery may be connected.

It should be noted that MOSFET (IRFR110 or Equiv) used to control back light may requires a heat sink if prolonged operation at higher display back light is used. Ensure that if you always “Love” full backlight, apply a suitable Heat Sink on the MOSFET. (Q1)

Front Panel menu buttons allow display backlight to be totally off or reduced to a suitable level.

LCD Display:

As detailed above, 2x16 character LCD with Back Light is used & will be supplied with the kits.

Micro Controller Board:



A PIC16F877A is used for measurement of SWR & FWD power by using two of its A/D channels.

Using either NCV1009 or a Zener diode (Z1) creates a Reference supply of 2.5V.

A Contrast preset is provided.

A Dual Op.Amp. (U2) is used for controlling MOSFET(Q1) for LCD Back light

Function Menu Board:

This is a small double-sided PTH PCB housing 2 push buttons and two warning LEDs.

PCB mounts on main board by way of a 6pin SIL header and a Plastic Spacer at the other end of the board.

Kit Assembly:

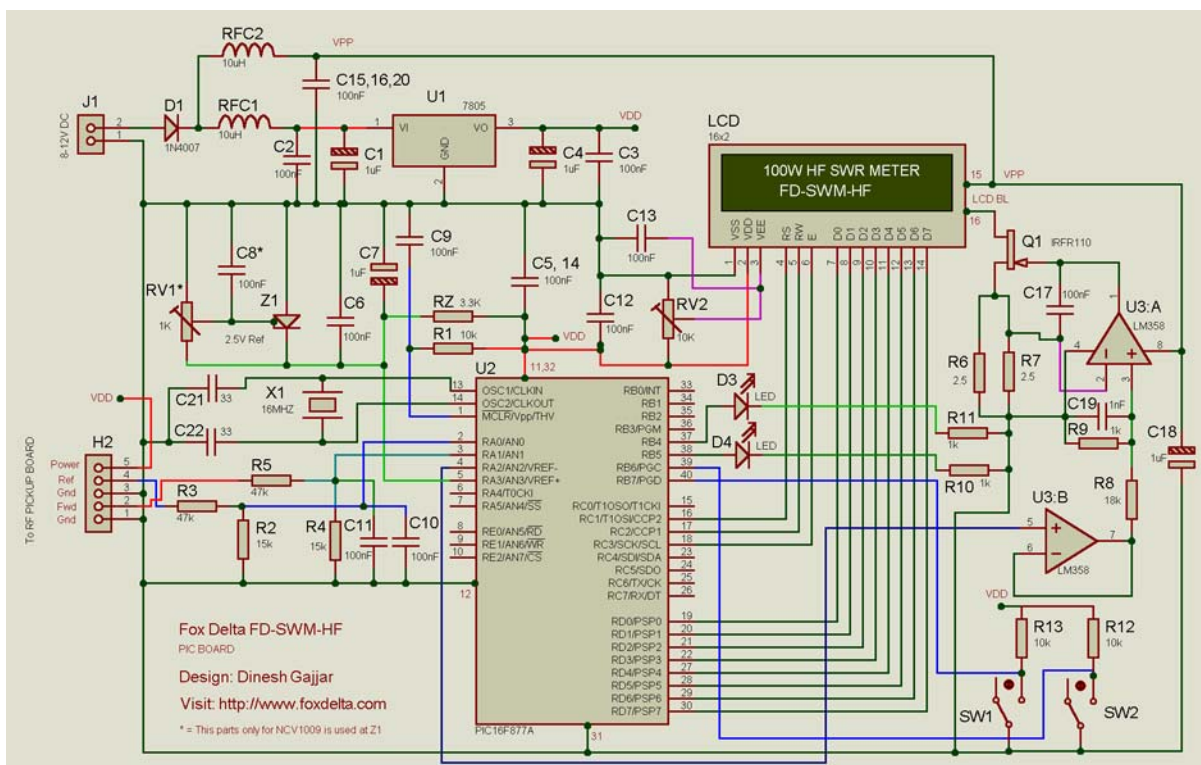
Kits are specially designed for radio amateurs with necessary expertise in understanding SWR, RF power measurement etc. You will also require proper shielding of CPU & Bridge boards. A dummy load and a Variable RF power source (Trx) will complete the alignment requirements.

Do not buy this kit if you do not know what is an RF Bridge or do not fully understand what "SWR" means!! With about 70-100 emails a day, I certainly won't reply such questions.

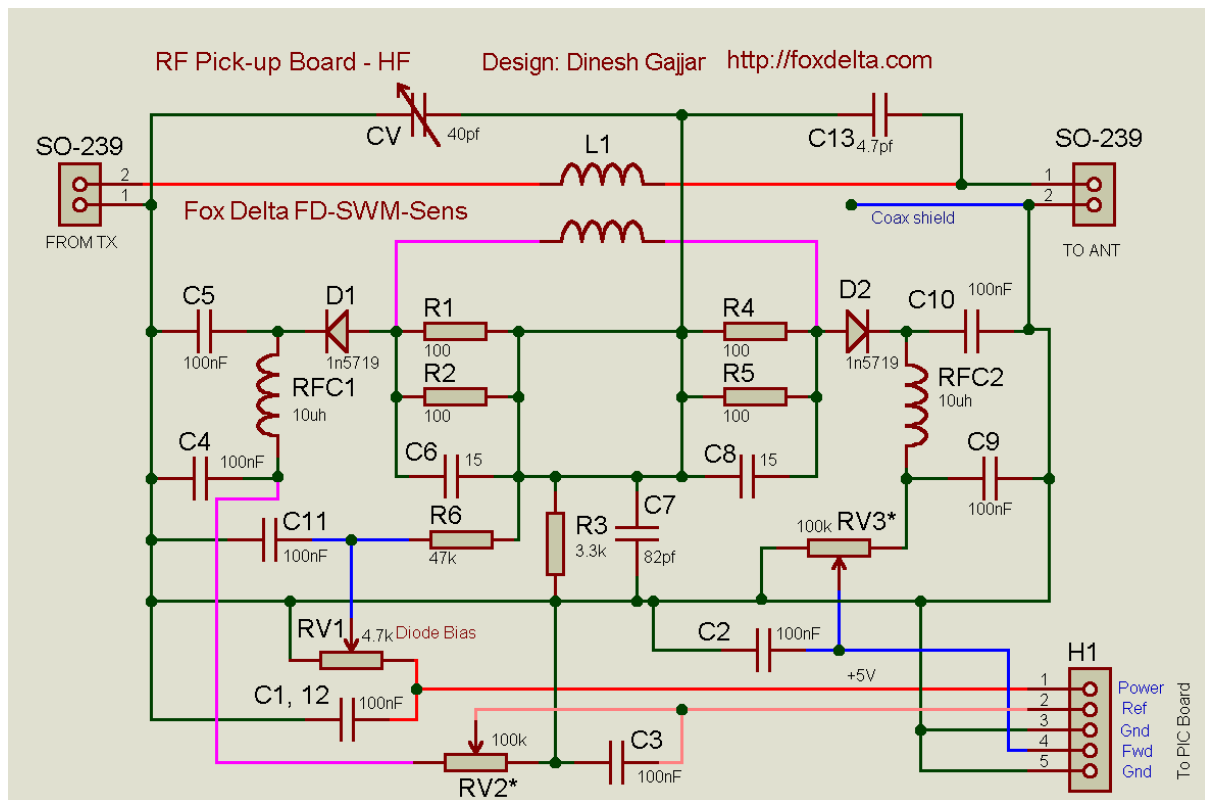
For those who do not have time to build kits, I will be offering ready made (Assembled) SWR Meters housed in a metal, powder coated cases. Please wait for a while.

I am sure this project will receive quite good response from radio amateurs interested in having a good quality LCD SWR meter for their station.

Schematic of the SWR-HF CPU Board:



HF RF Bridge:



Interconnections:

Bridge & CPU requires to be connected by using a shielded 4 or 5 Core cable. (Not included with kit).

If you decide to use 4 Core cable, skip one of the “GND” terminal since two of them are provided.

5 Pin Connections between CPU Board & Bridge Board has Silk Marking error. Please inter-connections boards as detailed below:

Micro-board	RF-board
P -----	P
R -----	F
G -----	G
F -----	R

My special thanks to Jeroen/PE1RGE and Doug/W5DUG for testing prototypes and giving me valuable feedback to complete this project.

Dinesh Gajjar
8th June 2008

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