



# Fox Delta

Amateur Radio Projects & Kits

FD- FoxEcho-K7

Tech Info Doc: Advanced PIC16F84A Echo Link Interfaces with AGC

Revision:0808



## Fox Echo & Foxecho-k7

PIC16F84A Micro Controller **Echo Link** Interface is designed to achieve some of the following points of Interest to Radio Amateurs:

- ◆ Real RS232 signals
- ◆ 100% galvanic isolation of Rig (Audio, PTT & COR)
- ◆ COR (Positive or Negative logic selectable)
- ◆ Plug-in, AGC & Audio amplifier with Tone Controls (Option)
- ◆ Hardware DTMF decoding with MT 8870
- ◆ Muting (automatic) of receiver audio
- ◆ Adjustable receiver and transmitter audio levels
- ◆ Power status, DTMF, PTT and COR LED's
- ◆ Uses a PIC16F84A
- ◆ DIN 5 Front Panel Connector for easy interface to Rig
- ◆ Transceiver connection has "HT" Header for portables

- ◆ No relays. Uses HFE4053 Analog Switches.
- ◆ 16.5cm x 7cm, Double Sided PTH Board.
- ◆ Usable for other digital modes like PSK31
- ◆ Supplied with a Powder Coated Aluminum Box

## Foxecho-k7

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After development of FoxEcho project, Prototype boards were tested by [Frank/k7sfn](#). As suggested by frank, following essential changes to the design were made:

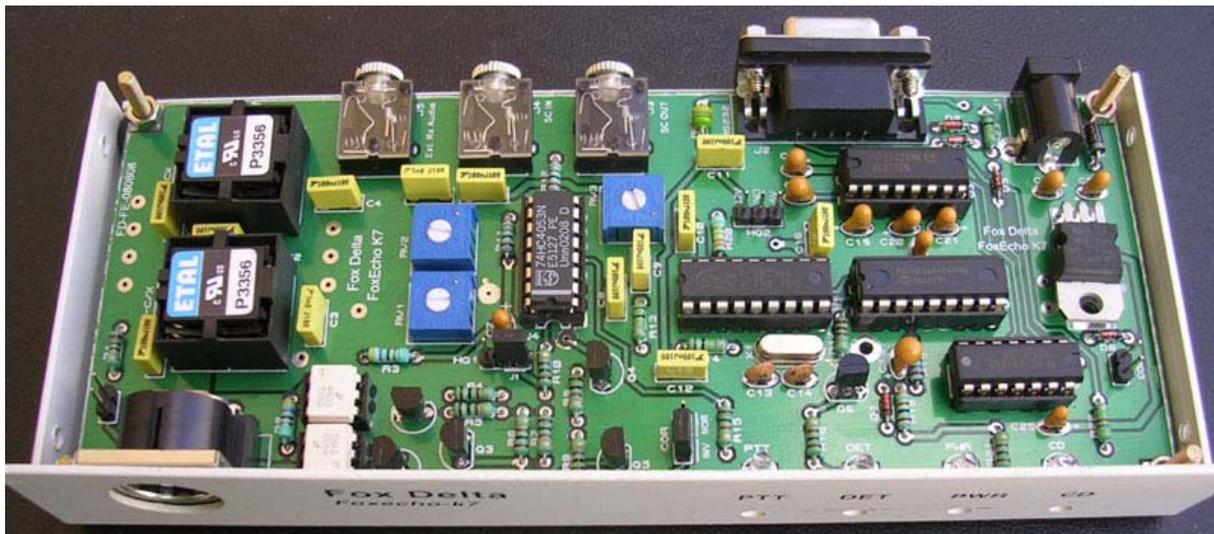
1. Inclusion of isolation transformers for audio paths
2. Opto couplers for COR & PTT
3. Option to regulate receive audio level. (AGC)

New boards were made with inclusion of above points and the interface was named “Foxecho-k7”

Kits and Assembled units are now supplied with a Powder Coated Cases.

## Picture of the completed FoxEcho-K7:

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## Technical Information & Header settings

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In addition to two Sound Card phone jacks, a third phone 1/8" jack, J5 is added at the back panel.

This jack is to supply transceiver receiver audio to this interface. Normally, transceiver receiver audio is to be applied at DIN5 connector along with MIC, PTT and COR connections. This jack was added considering views of many radio amateurs who wanted a separate receiver audio jack at the back panel.

### Com Port Interface:

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For true RS232 signal levels, a MAX232 or equivalent chip is used. This chip converts 5V TTL/CMOS level signals to RS232 standards. It works on 5V DC supply and has built-in Voltage Level generator for positive & negative voltages.

### Supply:

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DC12 adaptor is required for this interface board. Most circuit works on +5V where as +12V is used for COR control. Voltage regulator type 7805 is used for 5V Supply.

### Hardware DTMF Decoder:

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An MT8870 in DIP 18 is used to detect DTMF tones. It requires a 3.57MHZ Crystal. Clock generated from this DTMF chip is also applied to PIC16F84A.

Threshold audio level to the DTMF Receiver, MT8870 may be adjusted by RV3, a potentiometer. When RV3 is properly adjusted, the "DET" LED will only light when DTMF tones are detected. Do not adjust RV3 beyond the point that provides reliable decoding.

### PIC16F84A:

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This micro controller controls the DTMF tones & PTT of the Radio & Echo link. In kits & Assembled units, PIC will be supplied with *foxecho.hex* pre-loaded. No programming by user/kit builder is required.

## Audio Control:

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An HFE4053 is used to control audio to & from the PC soundcard. RV2 adjusts audio level towards the PC soundcard (SC MIC input), and RV1 controls the TX audio level towards the transceiver.

PTT control is applied to analog gate to mute the receiver audio while Transmitting.

## AGC Plug-in Module:

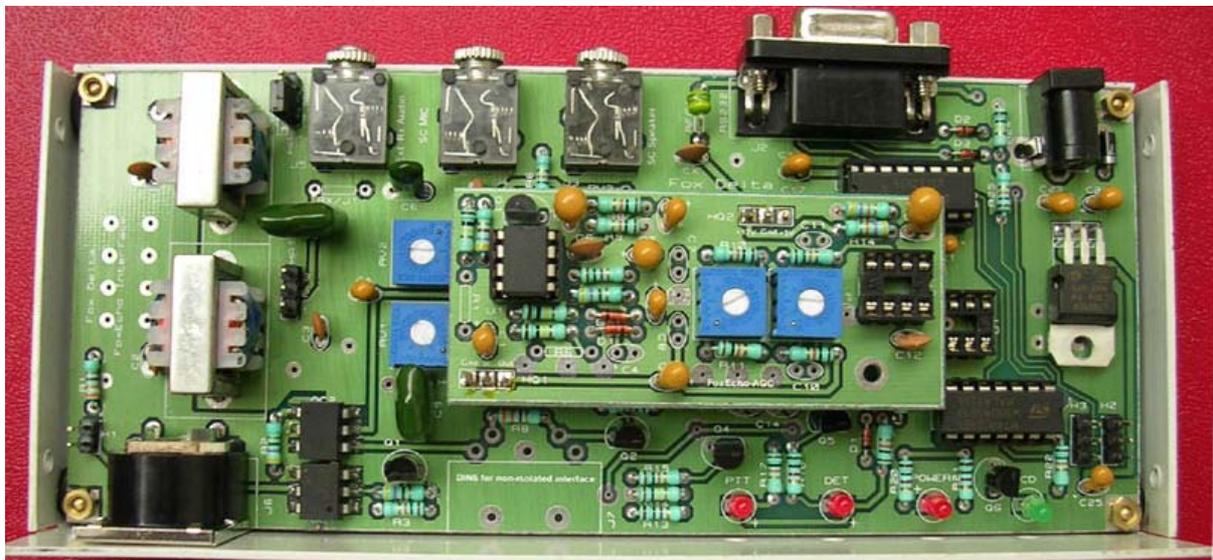
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As discussed earlier, field test indicated that many interfaces suffer from poor audio for some of the following reasons:

1. Variation in received audio level. (From rigs)
2. Need to boost audio due to losses in isolation transformers.
3. Insufficient receiver audio. This is usual when receiver output is picked up at low level.

Received audio coming from transceiver is routed to HQ1 header. Under normal situation (No AGC card installed), header HQ1 is installed by a shorting pin between “No AGC” pins to pass audio to analog switch.

## Picture of the Foxecho-K7 interface with AGC card installed:

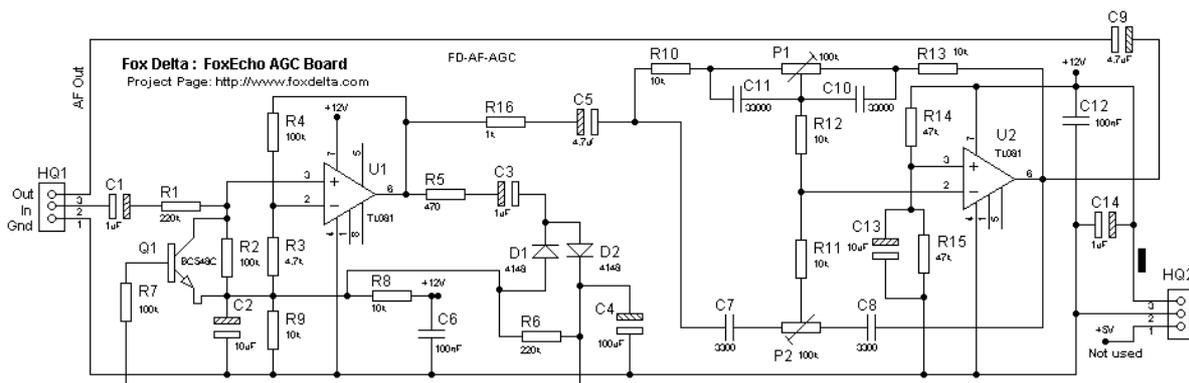


Old version of FoxEcho-K7 is presented above. So far AGC add-on card is concerned, there is no difference between old and the new version of boards.

This card will provide:

1. Some amplification of received audio with effective tone controlling
2. AGC of received audio

## Schematic of the AGC Plug-in card:

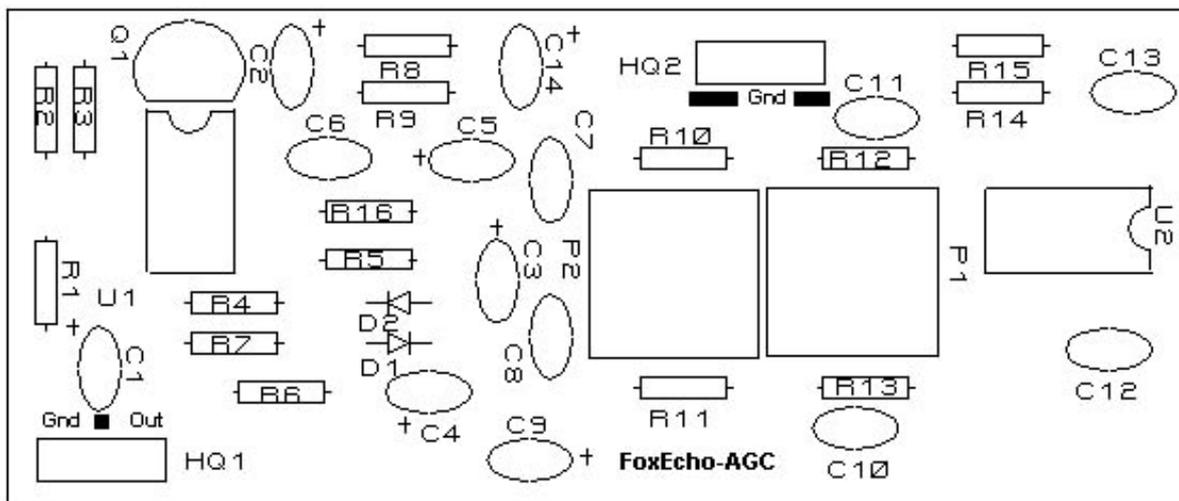


U1 is an AGC amplifier. TL081 is used at U1 (NE5534 is a good option) This stage is followed by U2, which provides added amplification and tone controls. P1 & P2 are tone control presets. U2 is TL081.

Board receives its 12V DC thru HQ2 headers. Main board has an RFC1 and a bypass capacitor to decouple DC voltages before they reach AGC board. Although +5V from main board is available on HQ2 header, its not used on AGC card anywhere.

It is suggested that this board be installed and tested “on-line” only after successful test of basic Foxecho-k7 interface on echolink network.

## Silk Snap of the AGC Board:



## Headers:

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HT: Putting a shorting pin enables PTT for portables.

COM: PTT Control: Selects PTT control from PIC or Echolink (RS232)  
From PIC = Already Connected.  
From RS232 = Shorting pin required at header "COM"

COR: DCD: Carrier Detect may be Normal or Inverted. Select as required.

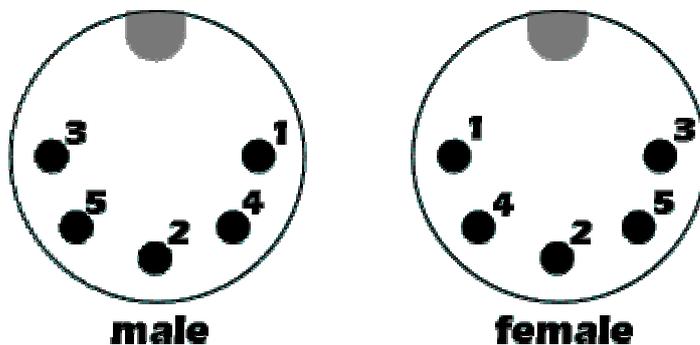
HQ1: A shorting pin between "No AGC" is required if AGC card is not installed.

HQ2: +12V, Ground & +5 are available at this header. [This Female Header](#) is only required when AGC add-on board is to be installed.

## Connection for DIN5:

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### 5 pin DIN



DIN5 Female is mounted on Foxech interface. A male DIN5 is supplied with kits

- |   |   |                                       |
|---|---|---------------------------------------|
| 1 | - | COR                                   |
| 2 | - | Ground                                |
| 3 | - | Transceiver Receiver output (Speaker) |
| 4 | - | Transceiver Microphone                |
| 5 | - | PTT                                   |

## Suggested settings for Foxecho

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Here are step-by-step instructions to provide a simple interface between the Fox Echo board and your PC for Echolink operation.

This arrangement uses the Fox Echo Board to provide audio and serial data control interface between your PC and radio.

DTMF tones are decoded by Echolink. You will need to have Echolink configured in the "Sysop" Mode as either a Link (-L) or Repeater (-R).

### For PC to Radio Direction:

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1. Connect TX Mic Input to TX (J7, Pin 4), and Gnd (J3, Pin 2).
2. Connect Cable between SC Spkr Jack (J3) and PC Soundcard Spkr Line output (Green Jack on PC).
3. Install a shorting pin at "COM" header if you want PTT control by Echolink. If no shorting pin is installed, it will operate as "Interface PTT".
4. Connect RS-232 cable between PC Com Port and Fox Echo Board. J2
5. In Echolink, goto "Tools/Sysop Settings/Tx Ctrl/" and set "PTT activation" to "RTS".
6. Under "tools/Sysop Settings/Tx Ctrl/" Also select the proper Com Port.
7. To confirm operation, Connect to the Echolink "Test Server" and verify red "ptt" led lites on the Fox Echo board, and transmitter keys.
8. NOTE: The "RTS" lead (J1, Pin7) should go "High" in Transmit Mode.

### For Radio to PC Direction:

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1. Connect Radio Speaker Audio Between RX In (J7, Pin 3) and Gnd (J7, Pin 2) (Careful of level) or at jack J5. If connected at J5, follow HA1 & HA2 header settings
2. Connect Cable between SC Mic Jk (J4) and PC soundcard Mic Input (Pink Jack on PC).
3. In Echolink, goto "Tools/Sysop Settings/Rx Ctrl/", and set the "Carrier Detect" to "Serial CD".

4. In Echolink, goto "Tools/Sysop Settings/Rx Ctrl/", and check the "Invert Sense" Box.

4. Goto "Tools/Sysop Settings/DTMF and select "External" in the DTMF Decoder Box.

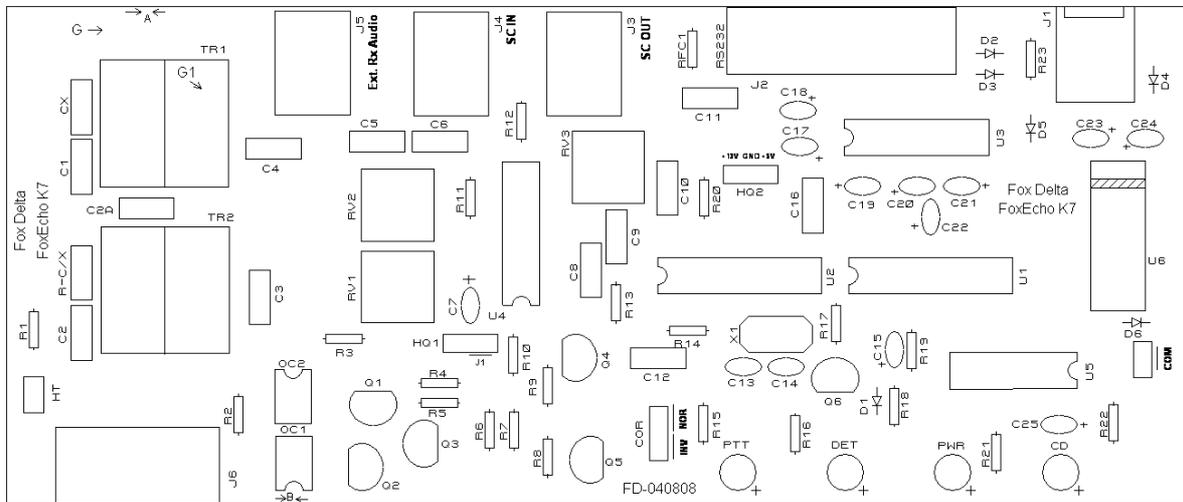
5. Send DTMF tones from a HT or Mobile Radio, and Echolink should display the "Digits" in a small gray box at the lower right-hand side of the screen as they are received by Echolink.

**Adjust Tx and RX Interface Levels in Echolink by going to:**

**"Tools/Adjust Volume/Playback & Recording"**

**Use the Echolink Test Server to verify proper program operation.**

**Silk snap of Foxecho-k7 PCB:**



## Note of Thanks

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I received a lot of feedback from all over the world for this interface project.

The first, non-PIC based interface boards were successfully tested by [Frank/k7sfn](#) and [Fredrik/SM6VTT](#) with good results. The First PIC board using MT8870 was tested by [Frank/K7SFN](#)

After test results & active test support of Frank further modifications were made. Design changes included isolation transformers, Opto Couplers and an add-on AGC board. Modifications improved the interface further and produced noise free, high quality audio on echolink network.

This project is built, tested and now presented to help others build it. I have already put PIC firmware and detailed schematics on web pages. I will be putting Gerber files for those who wish to make their own boards.

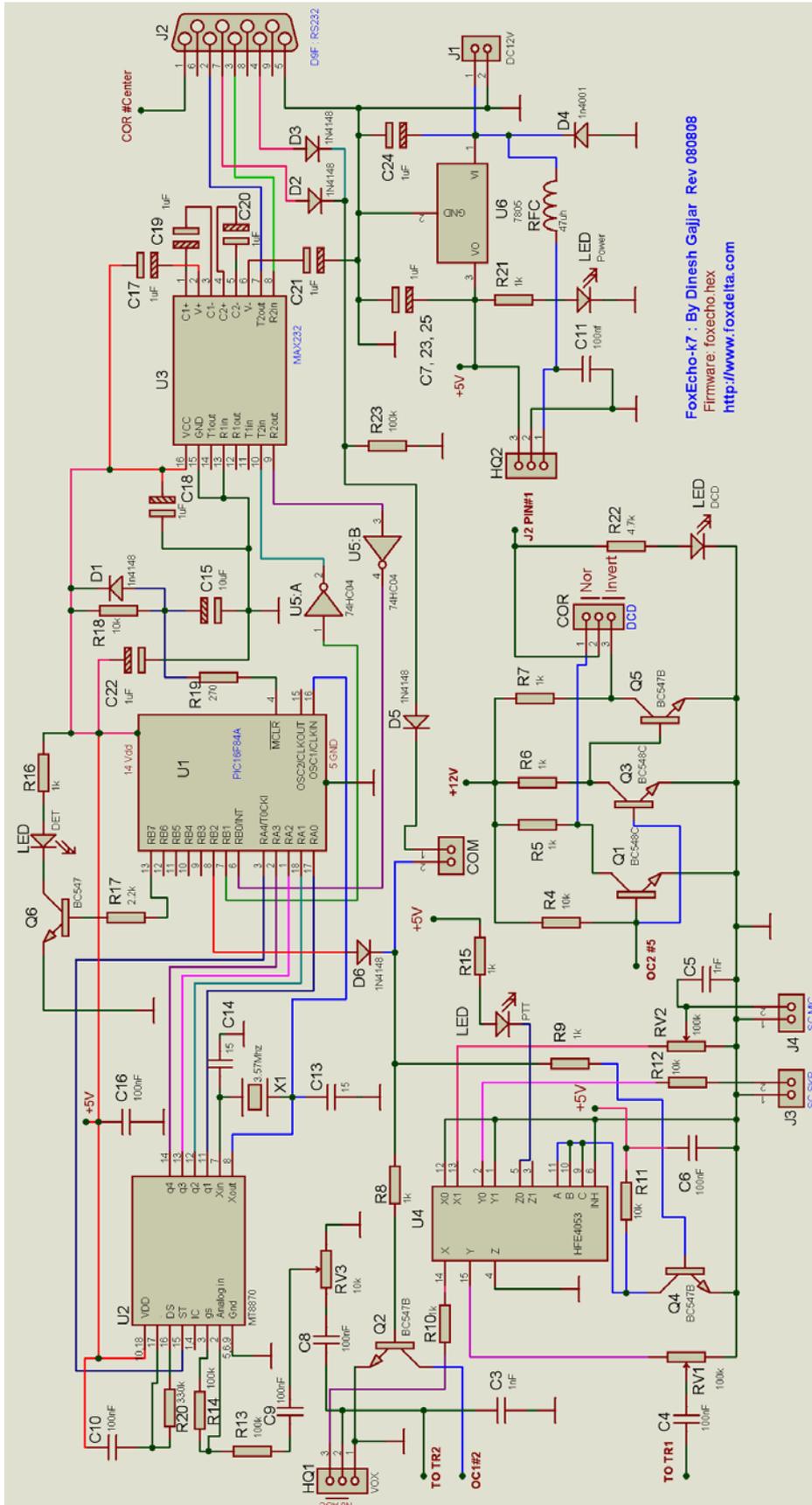
Project was delayed due to extreme delay in making aluminum cases!!  
I think delay is justified!!

AGC card is now fully tested by [Frank/K7SFN](#) with encouraging results. Effective control of incoming audio from rig was observed. Tone Controls have good effect over audio quality.

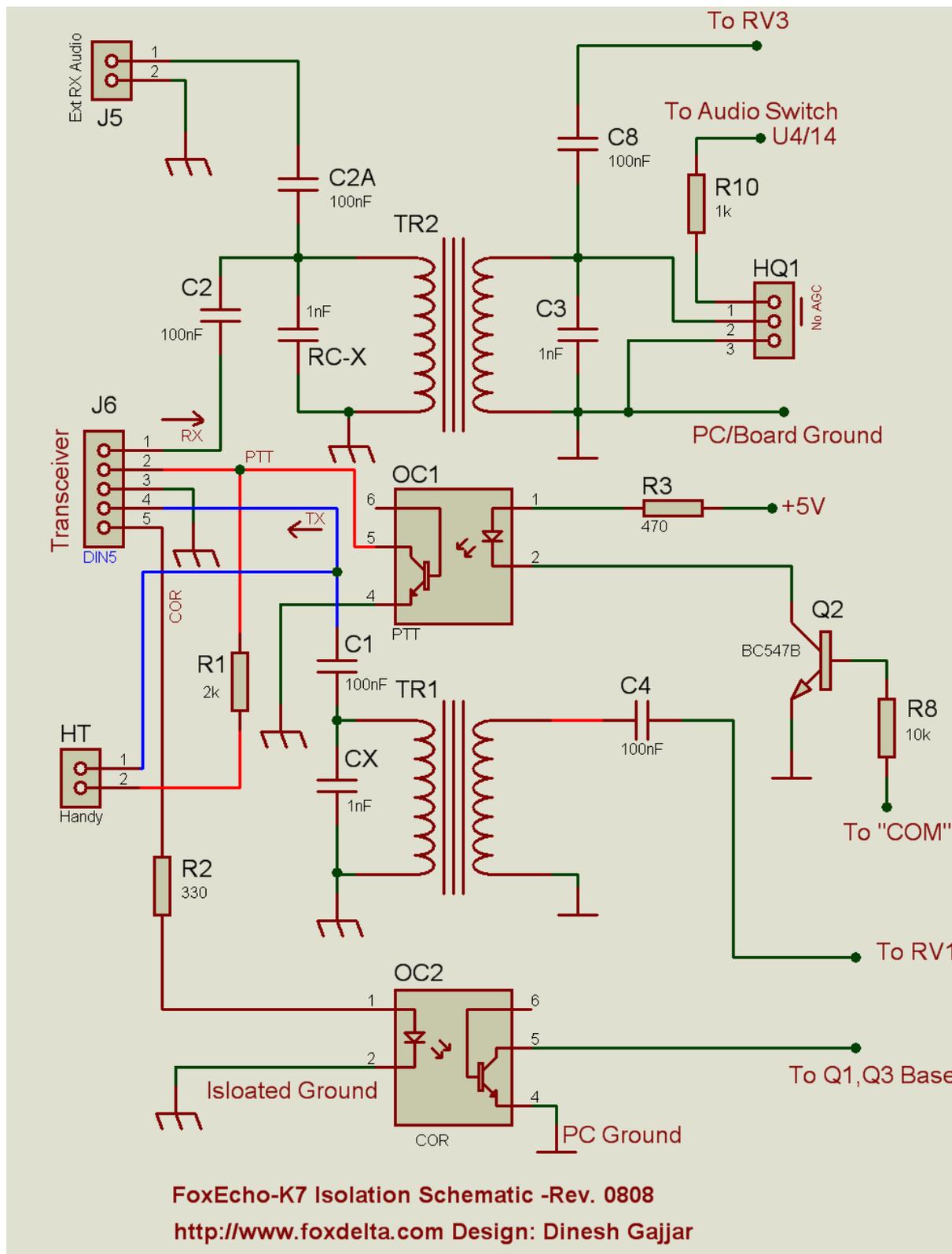
With this option added, you will have one of the finest Interface available for Echolink providing 100% isolation, External DTMF and effective AGC functions, not found on any other designs or available Echolink interfaces.

Project is much delayed due to various reasons but targeted purpose of making exclusive Echolink Interface Design at low cost, is achieved.

# Schematic of the FoxEcho Interface:



**Schematic of Isolation Section:**



73s

Dinesh Gajjar / 17<sup>th</sup> Sept. 08

For more information, please visit project page at: <http://www.foxdelta.com>