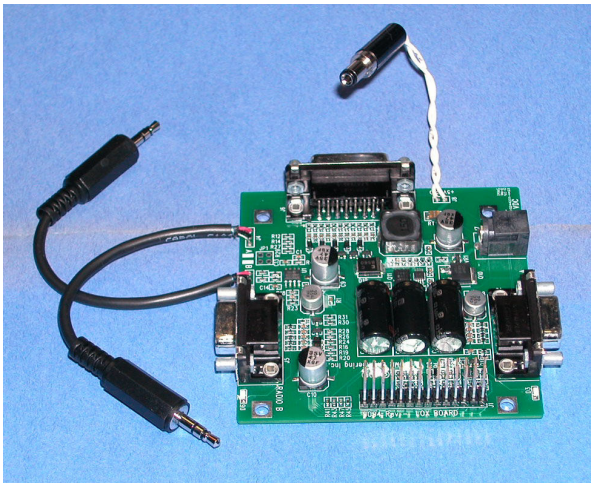
Level One Expansion (LOX) Board

Pico Node

Features

- Plugs directly into expansion connector of BeagleBoard-xM
- Small size – same footprint as Beagle Board
- Controls 2 radios, either simplex or full-duplex
- Two channel audio I/O plus CTCSS and COR inputs, and PTT outputs
- +6dB gain low-noise amplifiers with 4KHz bandwidth for audio outputs
- Jumper selectable 0 or -20 dB attenuation for audio inputs
- Five available GPIOs with open drain outputs and diode isolated inputs
- All I/O filtered for RFI
- 15 Watt high efficiency switching regulator on board
- Low cost



Description

The LOX Board allows one or two standard land or mobile FM radio to be connected to a BeagleBoard-xM single board computer http://www.beagleboard.org . Potential radios include amateur, business, public service & safety, GMRS, citizens band, and many others. The BeagleBoard-xM runs free downloadable software from its on-board flash drive.

See http://www.piconode.org/piconode/ for more software information.

The LOX Board in conjunction with the BeagleBoard-xM may be used for remote radio control or can link two or more radios in repeater mode. Audio can be passed through VOIP/Ethernet.

Many radios provide an interface connector for external access. These signals can be easily connected to the LOX Board's standard DB-9 connectors.

Each DB-9 connector has dedicated input pins for CTCSS and COR, plus an output pin for PTT. There are also five general purpose inputs and 5 outputs that may be controlled by software available on a separate DB-15 connector. Note that internally there are only 5 GPIOs. Each of the 5 I/O lines must be configured through software as either an input or an output. A single channel cannot function as both input and output at the same time.

Each analog audio output channel is fed through a +6dB gain low-noise amplifier with an 8KHz low pass filter. The amplifier outputs are AC coupled through 10µF non-polarized capacitors allowing wide bandwidth into low impedance inputs.

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Description Continued…

Two female DB-9 connectors are provided to interface with two radios. Each connector has an LED adjacent to it which is lit when the corresponding PTT output is active. The pin assignments are shown in Table 1.

Table 1. Radio A/B Connector Pin Assignments (DB9F)

Pin No.	Name	Description
1	GND	DC Return
2	CTCSS	Input, diode isolated continuous tone-coded squelch system detect
3	PTT	Push to talk open collector outputs to radio transmitter. Maximum off state 40V, maximum on state current 0.75 amps
4	AUDIO OUT	AC coupled audio output to radio, 8KHz bandwidth
5	AUDIO IN	AC coupled audio input from radio, jumper selectable for -18dB or -38dB attenuation
6	GND	DC Return
7	COR	Input, diode isolated, receive (carrier operated relay) detect
8	GND	DC Return
9	GND	DC Return

One female DB-15 connector is provided with 5 general purpose inputs and outputs. Plus 5 volts DC is available to power external circuits up to 100mA. The five inputs and outputs are numbered 1 through 5, but there are only 5 GPIO channels available on the BeagleBoard Xm. Through software each channel must be configured as either an input or an output. The unused state, input or output becomes inactive. The pin assignments are shown in Table 2.

Table 2. GPIO Connector Pin Assignments (DB15F)

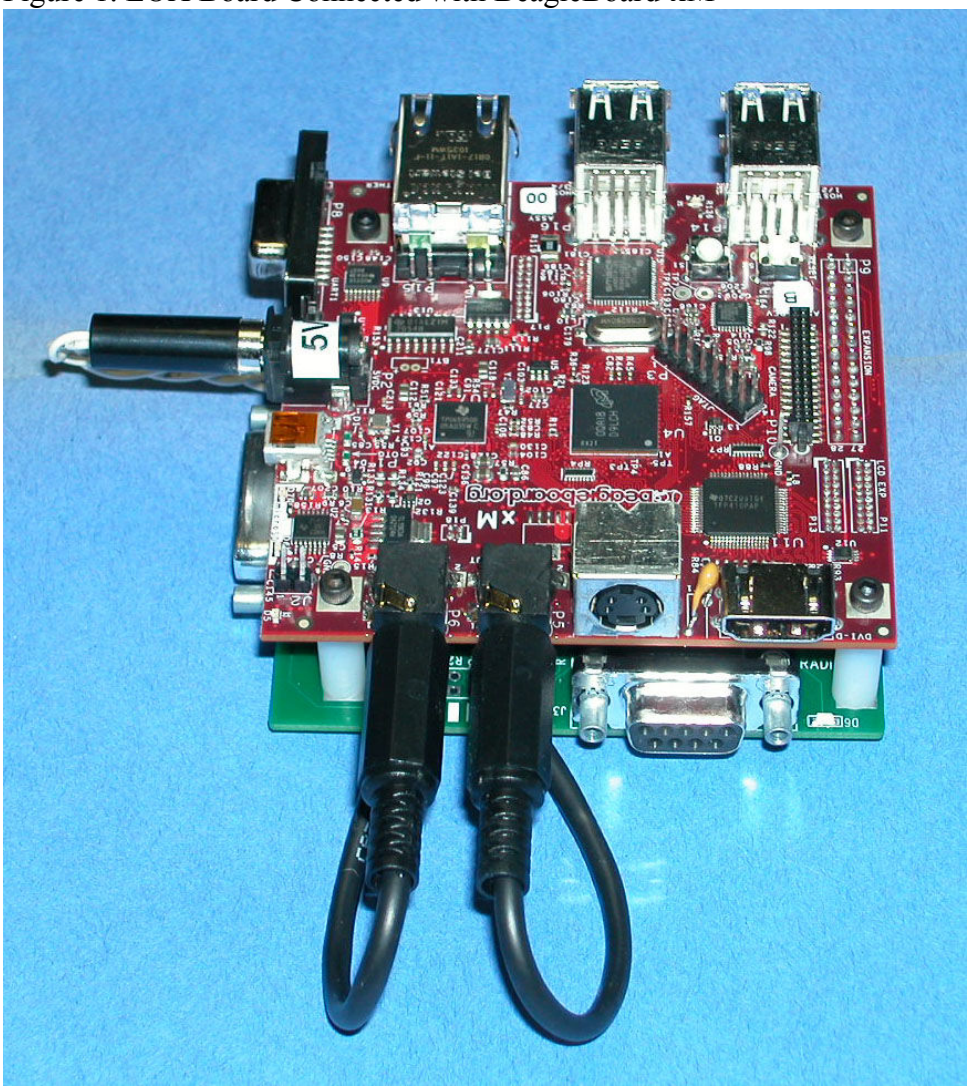
Pin No.	Name	Description
1	IN1	Channel 1 input
2	IN2	Channel 2 input
3	IN3	Channel 3 input
4	IN4	Channel 4 input
5	IN5	Channel 5 input
6	GND	DC Return
7	GND	DC Return
8	GND	DC Return
9	OUT1	Channel 1 output
10	OUT2	Channel 2 output
11	OUT3	Channel 3 output
12	OUT4	Channel 4 output
13	OUT5	Channel 5 output
14	+5V	DC output, 100mA maximum
15	+5V	Common with pin 14

All digital inputs including COR, CTCSS and IN1 through IN5 are diode isolated. No pull-up resistor is required to generate a logic high. Maximum input voltage is 36 volts. When pulled to ground the low state input current will be approximately -0.5mA.

All digital outputs OUT1 through OUT5 are open drain transistor outputs. An external pull-up resistor is required to generate a logic high. Maximum output high (off state) voltage is 18 volts. Maximum output low (on state) current is 0.75 amps.

Since the BeagleBoard Xm analog inputs are designed for microphone levels, standard line level signals must be attenuated. Jumpers on the LOX Board allow for user selectable attenuation. When the jumper is installed the input signal is attenuated by -20dB. Selection is made separately for each channel.

Figure 1. LOX Board Connected with BeagleBoard-xM



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PTT Output

The push-to-talk outputs are open drain MOSFET transistor outputs. There is no internal pullup so these outputs require an external load or pullup resistor. Maximum off-state voltage is 40 volts. Maximum on-state current is 0.75 amps. Voltage and current must be limited to remain within these limits at all times.

DC Power Input

A 2.1mm coaxial power jack is provided for input power. Center contact is positive. Input voltage range is from 6 to 40 volts DC. Current draw will be approximately 0.5 amps at 12 volts when powering just the Beagle Board. With a fully loaded compliment of powered USB devices attached current draw may be as much as 3 amps.