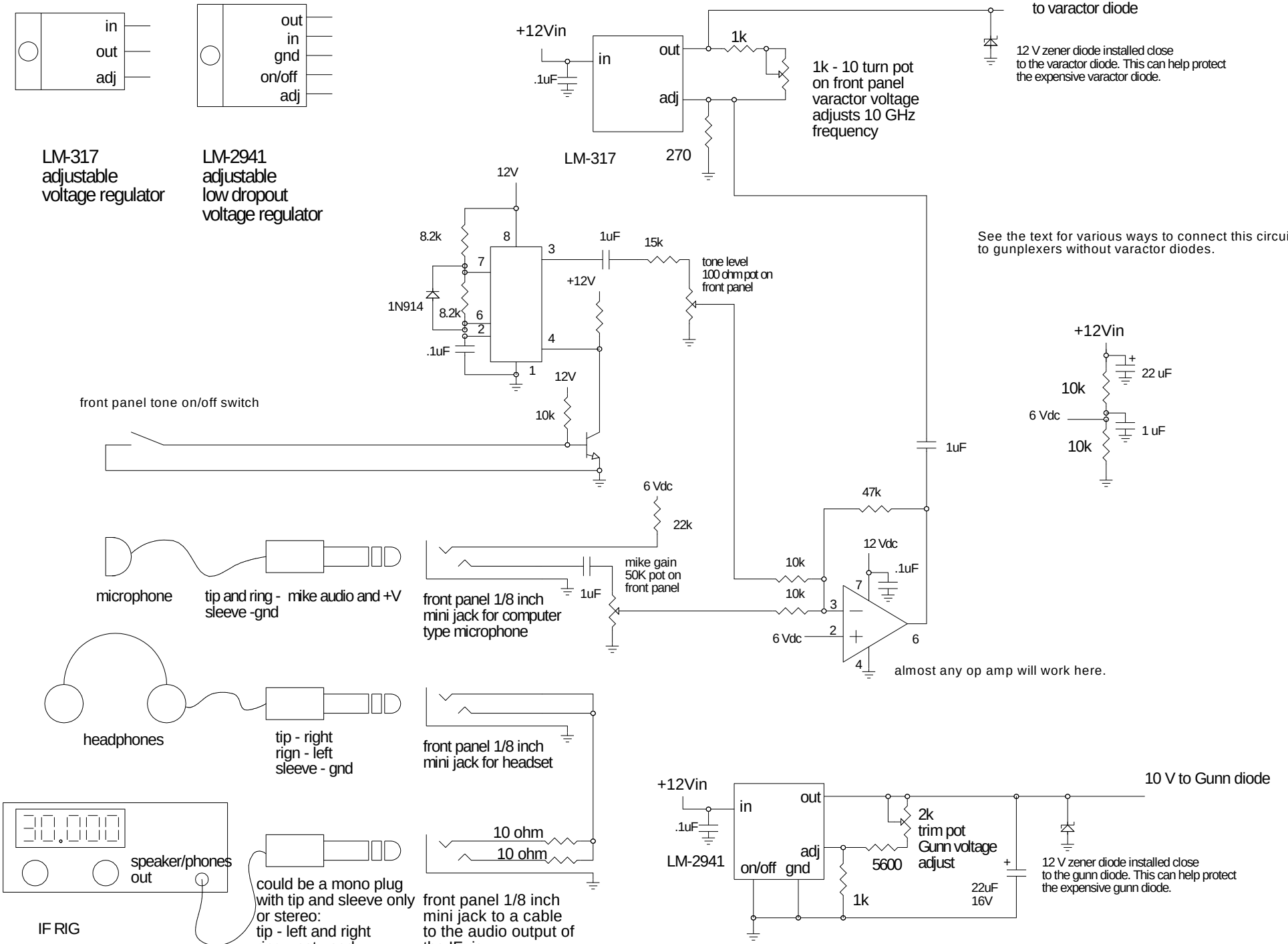
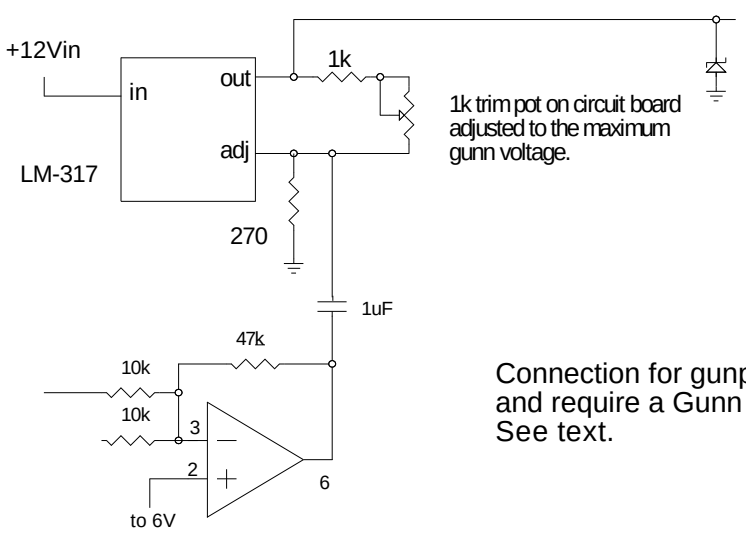
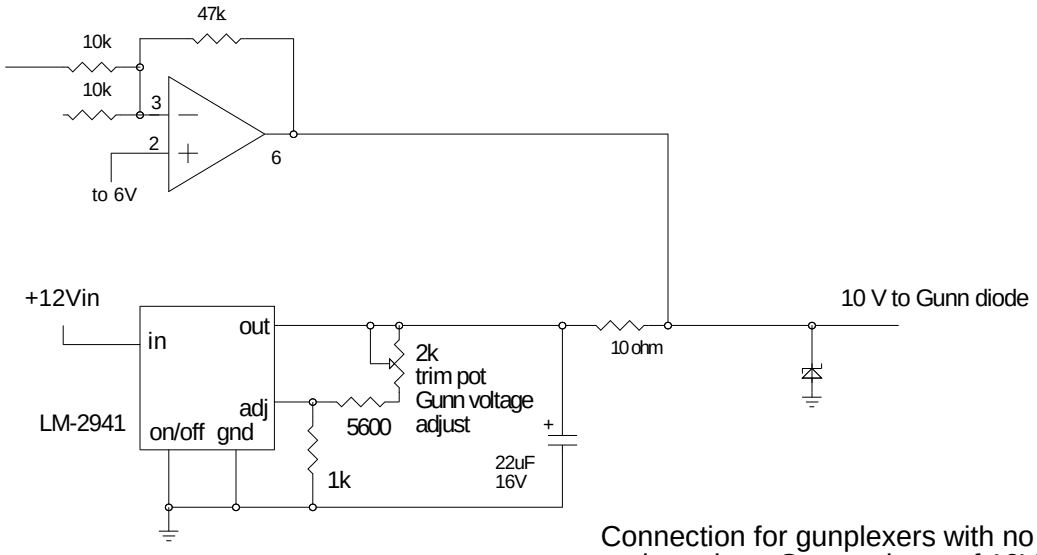


A very basic 10/24 GHz gunplexer control circuit.

Ron Jones K7RJ Dec 2005



Connection for gunplexers with no varactor and require a Gunn voltage of less than 10V
See text.



Connection for gunplexers with no varactor and require a Gunn voltage of 10V.
See text.

This is a list of the components shown on the schematic and the DigiKey part number and the approximate price. Getting everything from DigiKey is easy, but not necessarily the cheapest. (It is almost $50) Almost everything is available elsewhere for a slightly better price, especially the "mechanical" things, like pots and jacks, and you should be able to scrounge and substitute enough to get the cost reasonable.
If you simply order these part numbers and from Digi, you will have almost everything you need. You will need to figure out the chassis, hardware, cables, etc. and you will of course have to build the circuit itself, but that is where the fun is.
* these parts are more or less critical and care should be used in substituting.

*LM-317 voltage regulator Varactor voltage	LM317TFS-ND	.65
*LM-2941 low drop out voltage regulator Gunn voltage	LMZ2941CT-ND	1.90
*7555 timer/oscillator (CMOS 555) Tone oscillator	ICM7555IPAZ-ND	.85
11V zener diode (2 each) Gunn/varactor protection	1N4741ADICT-ND	.80 for 2
1N914 diode (any ole diode will do) Part of tone oscillator	1N914BCT-ND	.09
100 ohm panel mount pot Tone volume	CT2234-ND	2.75
50K panel mount pot Mike volume	CT2240-ND	2.75
*1K 10 turn panel mount pot Varactor (frequency) adj	GU1021S26-ND	18.00
2N2222 transistor Turns tone on/off	MPS2222OS-ND	.30
2K trim pot Gunn voltage adj	490-2918-ND	.87
8.2K resistor Need 3, have to buy 5	8.2KQBK-ND	.30 for 5
10K resistor Need 4	10KQBK-ND	.30 for 5

5.6K resistor Need 1	5.6KQBK-ND	.30 for 5
47K resistor Need 2	47KQBK-ND	.30 for 5
1K resistor Need 2	1KQBK-ND	.30 for 5
270 ohm resistor Need 1	270QBK-ND	.30 for 5
2.2K resistor Need 1	2,2KQBK-ND	.30 for 5
8 pin dip socket Get only machined pin sockets	ED3308-ND	.45
22uF cap Need 2	P814-ND	.16
1 uF cap Need 3	P4675-ND	4.00 for 10
.1 uF cap Need 5	P4625-ND	1.10 for 10
1/8 inch panel mount jack Mike, phones, jumper to IF audio	CP43502PM-ND	3.75
Switch tone on/off/momentary	360-1061-ND	5.75

Here is yet another basic circuit for Gunplexers. This circuit holds no special features other than it is pretty basic with no frills and as such should be fairly easy to build. There is a list of DigiKey part numbers and price for all of the components. I won't build this for you, but here are some suggestions. If you need help, I will be glad to help, but only if you read through this document.

The following is a list of things related to the circuit, suggestion, etc. The list is in no particular order. Please read through it before you call me for help!

First here are some considerations on building your system:

1) No, I don't have a PC board laid out for this. It is a small enough circuit that it shouldn't be very difficult to build on a small piece of vector board using point to point wiring.
2) The finished circuit board you wire should be mounted in a small metal project box. I suggest that you put the gunplexer RF head in a separate box and have 4 foot cable going between the control box and the RF head. It isn't necessary, you can mount everything in one box, but I have found that in operation, the best place for the RF head is usually not the best place for you when you are operating it.
3) Mount the RF head in a box to keep the air currents to a minimum and have it so you can easily attach it to a camera tripod. I have my RF head in a mini-box. I then glued an aluminum plate to the bottom with a ¼ x 24 tapped hole to mount it on a light weight camera tripod. I expect a ¼ X 24 nut epoxied to a minibox would work well to allow you to mount you RF head to a tripod. Believe me, after spending many hours in the field with the gunplexers, I have come to appreciate the fact that I can put the RF head on a tripod and my controller is on a separate table a few feet away.
4) I use a computer headset with a boom microphone. The circuit will power a computer microphone. This, like the tripod, is very handy. Having your hands free is very handy and having a headset is also handy because outside there is a great deal of noise from wind, cars, dogs, etc. Computer headsets with microphones are easy to find and cost from nothing up to about $15.
5) Related to the computer headset is the plug arrangement I show on the schematic. Since the computer headset plugs for the mike and speaker are very close together, it is impossible to plug the microphone plug into the controller and the headset plug into your IF receiver. Therefore, a neat trick is to put three plugs on the controller, one for the microphone. The other two are wired together and plug the earphones in one and plug a cable that goes to the speaker output of the IF receiver in the other. This is just a little trick that makes life easier.
6) The box that has the RF head should have 2 plugs, one for the cables that go to the controller. I have a DIN 5 pin connector. I need 3 pins, but DIN connectors are cheap and the extra 2 pins may be handy some day. The other connector is a BNC connector for the 30 MHz IF signal that goes to the IF rig.

7) The underlying theme when you plan your project is to make it easy for yourself when you are in the field. Make things plug together and clamp down in place. You have only 2 hands, you simply can't hold things while you are adjusting voltages and frequency and holding a mike and trying to hear the audio from a radio that is 10 feet away. Make it so your hands are free while you operate.

Now, here are some considerations on the circuit itself:

1) The circuit is very basic and very little in it that couldn't be done better, but at the cost of more components and expense.
2) The circuit will work with any gunplexer, but there are slight differences in how you connect things for the different types of gunplexers. There are basically two types of gunplexers, ones with varactor tuning and those without varactor tuning.
3) If yours has varactor tuning, the circuit as drawn is what you need.
4) If yours has no varactor, you can not adjust the frequency to any extent with voltage, therefore, you simply set the gunn voltage to its rated value and leave it. You need to know what that voltage is. It may be 5V or as much as 10V. It is up to you to figure that one out.
    a. If you need less than 10 V on the gunn diode, connect the Gunn diode to the output of the LM-317. Make the 1K voltage adjust pot a trim pot on the circuit board so you won't accidentally turn the voltage up too much with a front panel adjustment.
    b. If you need 10 V on the gunn diode, you need to do a couple of changes to the circuit.
        i. You will have to use the LM-2941 low drop out voltage regulator because the LM-317 can not deliver a good regulated 10V with only 12V on its input.
        ii. You will need to modulate that voltage. Connecting the output of the op-amp to the adj pin of the LM-2941 won't work because the output of the LM-2941 requires a rather large capacitor (22uF) which will essentially kill any modulation. One way around this is to put a small value resistor in series between the LM-2941 and the Gunn diode and connect the output of the op-amp through a capacitor to the gunn diode.

5) I have shown these two options on a separate drawing.
6) The tone oscillator is a 555 but it is a special one that can run on 12V. If you use a regular LM-555 it will fry it. It must be a CMOS 7555 that can run on 12 V.
7) There is nothing special about the tone circuit, it just has to make an audible tone. The circuit show oscillates at about 800 Hz more or less. The little diode in the circuit is a trick to make it have a square wave output so it will sound better.
8) A neat trick is put a button in parallel with the switch so you can use the button to send code. The DigiKey part I have listed is a switch that is center

off, up for on and down is spring loaded so it can act like a telegraph key. You don't need to do that, the switch is fairly expensive, but it is the sort of thing that you can scrounge and make up as you go.

9) You could also put a plug in the circuit to plug in a real telegraph key. In all the time I have been playing with my gunplexer, I have found no need for a telegraph key, but I do use my switch as a telegraph key frequently.
10) The op-amp is a no big deal op-amp. Any 741 type op-amp should work. Some of the new high speed jobs may require a little more bypassing. The op-amp does not have to be a single rail op-amp. It can be one that is intended to operate with + and – voltage. The trick is to put the + input to ½ of the supply voltage. That is what the +6V business is all about.
11) The computer type microphones require power but they cleverly put the output of the mike on the power line. In order to pull it off, a resistor connects that line to + voltage and the line is capacity coupled to the amplifier. The voltage required for the mike should be about 5 or so volts. The circuit connects a 2.2k resistor to the 6V bus.
12) Put small heat sinks on the 2 regulators.
13) Not shown is a power switch, but you may want to add one.
14) Another thing that makes life much better is to bring out an easy way to attach a volt meter to the following places:
    a. +12 V input
    b. Gunn voltage (10V)
    c. Varactor voltage (indicates your frequency)
15) I mean easy, make it so the volt meter leads attach and you can measure the voltage with out using your hands at all. If you want to get fancy, you can put a little digital panel meter inside the box and a selector switch to set it to monitor the various voltage points. I did that on my second version of my controller and find it invaluable.