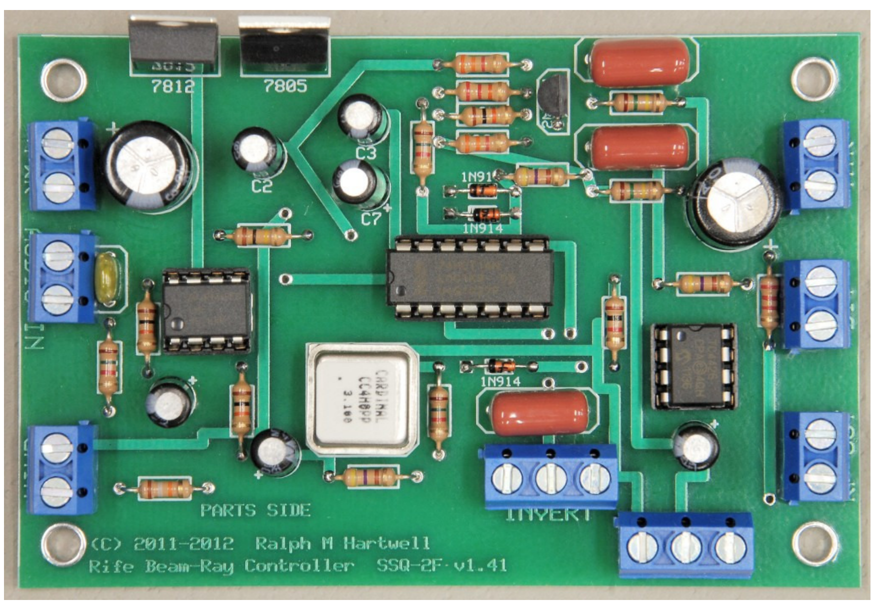
Instruction Manual

For the

SSQ-2F Controller Board

v1.41

For Rife Plasma Tube Systems



Manual v1.00

Spectrotek Services

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About the SSQ-2F

The SSQ-2F 3.1 MHz Rife Controller Board is a compact unit which is designed to generate a square wave modulated RF carrier wave suitable for use in various types of Rife instruments. In particular, it has been designed to implement the 3.1 or 3.3 MHz Rife Sweep protocol as outlined in the document posted at:

http://rifevideos.com/dr_rife_and_philip_hoylands_3.3mhz_sweep.html

This sweep protocol calls for the use of a 3.1 or 3.3 MHz carrier that is 100% modulated by a square wave that slowly sweeps between 500 and 25,000 Hz. Specific "spot" frequencies may also be used.

The SSQ-2F is able to operate over the RF carrier range of 0.5 to 15.0 MHz simply by replacing the plug-in oscillator module with one of the correct frequency.

Why is the SSQ-2F needed?

Most common computer sound cards are unable to reproduce sharp-edged square waves above a few hundred Hz, or even sine wave audio signals above 22,000 Hz, thus making computer sound cards virtually unusable when square wave modulated Rife systems are used.

Because most people will use computer sound cards to generate the required audio frequencies, all references to computer sound cards in this document also refer to audio waveforms that are recorded on MP3 players, CD, or DVD players and the like. It should be noted that MP3 players and CD and DVD players also suffer from the same inability to properly handle square waves.

The inability to generate sharp-edged square waves is a serious problem, because in order to generate the higher frequency harmonic energy required for a Rife system to work properly, the leading and trailing edges of the square wave must be "sharp," that is, it must have a very fast rise and fall time.

What does the SSQ-2F do?

To solve this problem, The SSQ-2F has been designed to accept sine wave audio frequencies within the frequency range that the computer sound card can generate. The SSQ-2F then doubles those frequencies and converts them to clean square waves before modulating the 3.1 MHz carrier wave.

By doubling the input frequency, modulation frequencies of up to 44,000 Hz may be obtained using a standard computer sound card as the signal source. This allows the 3.1 MHz carrier to be modulated across the entire 500 to 25,000 Hz frequency range required for the 3.1 MHz Rife sweep. Because of the frequency doubling action of the SSQ-2F, the computer sound card need only generate sine wave signals within the frequency range of 250 to 12,500 Hz, which is within the range of any computer sound card.

What types of audio signals does the SSQ-2F accept?

The SSQ-2F will accept sine, triangle, or square wave signals as an input and convert them to square waves before using them to modulate the 3.1 MHz or 3.3 MHz RF carrier wave.

What range of frequencies does the SSQ-2F accept?

Although the SSQ-2F will accept modulation signals within the frequency range of 4 to 600,000 Hz, the Controller has been designed for optimum operation within the frequency range of 40 to 60,000 Hz, thus making it practical to use computer sound cards, MP3 players, as well as CD and DVD players to generate the audio modulation signal. Of course, a standard frequency or function generator may be used as an audio signal source for the SSQ-2F.

I am uncomfortable soldering wires to circuit boards. What do I do?

All connections to the SSQ-2F are made using screw terminals, so there is no soldering required

How can I power the SSQ-2F?

The SSQ-2F may be powered from an AC adapter or from batteries, if desired.

Is the SSQ-2F a complete Rife system?

The short answer is no.

The SSQ-2F is designed to produce the correctly modulated RF signal for a Rife Plasma system, but at a low level only. To properly drive a Plasma tube, the output from the SSQ-2F must be amplified to a high power level, somewhere between 100 and 300 watts.

By itself, the SSQ-2F is only capable of driving an intermediate gain RF MOSFET amplifier when the output level of the SSQ-2F is set for 5 Volts, or as a contact device driver when the SSQ-2F output level set to 12 Volts.

The diagrams shown on the next page show how the SSQ-2F is interconnected in typical Rife-type systems.

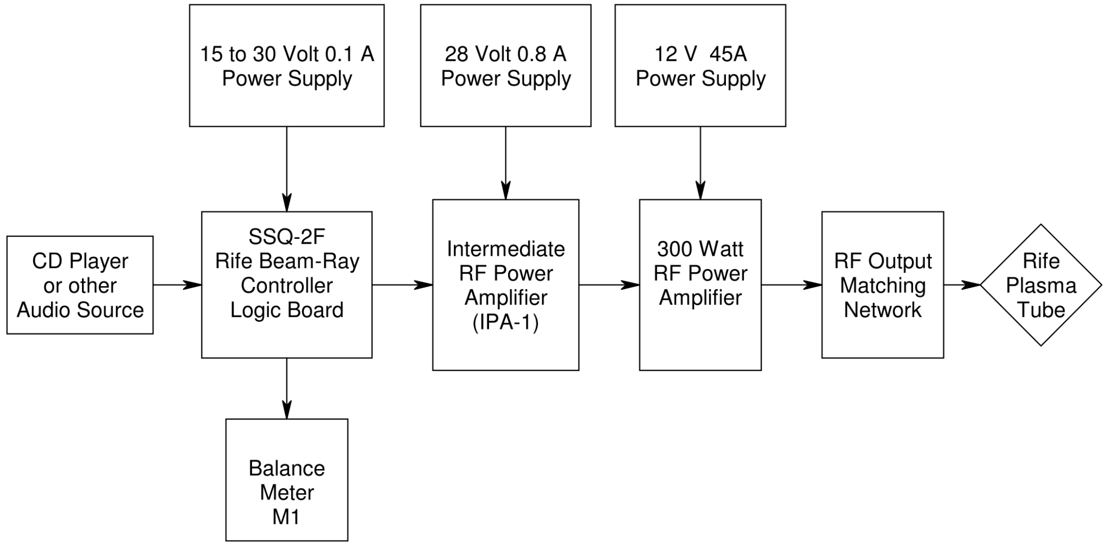

Figure 1 – Block diagram of a typical Rife Plasma System.

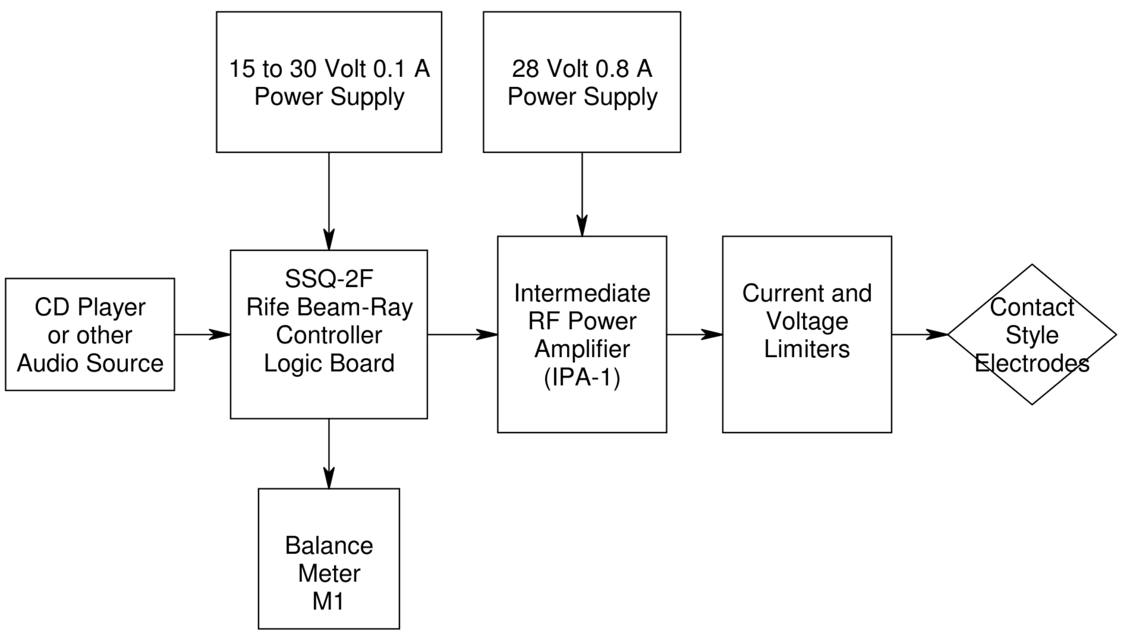

Figure 2 – Block diagram of a typical Rife Contact System.

CONNECTIONS:

All connections to the SSQ-2F are made by using screw terminals in the blue plastic blocks. These will accept either solid or stranded conductor wire. When tightening the screws, do not over tighten the screws to avoid damaging the connector. Just strip about ¼" of insulation off the end of each wire and insert it into the hole in the terminal block, then gently tighten the screw to clamp the wire in place.

This diagram shows the relative position of the various connectors on the SSQ-2F color coded for ease of identification.

Please note that the actual connectors on the board are blue, and not colored as shown here.

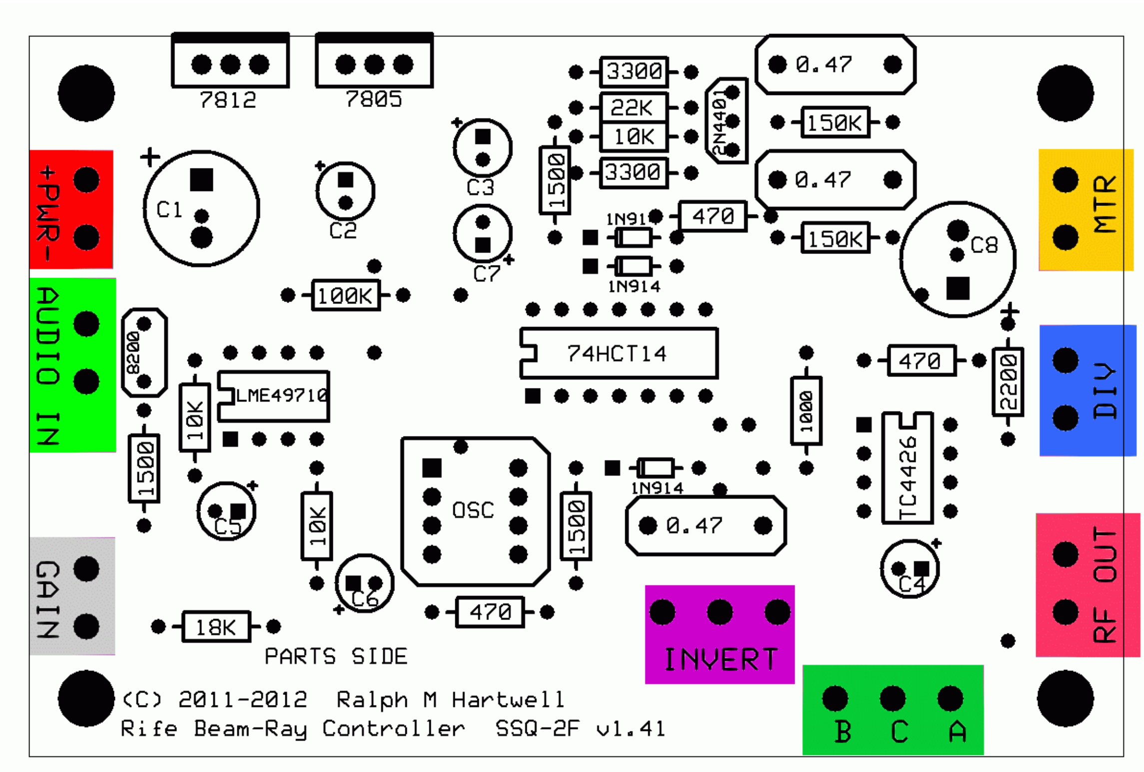

Figure 3 – SSQ-2F Connector Identification

Please refer to Figure 3 for the location of the following connections.

(+ PWR –)

This terminal block is used to connect DC power for the SSQ-2F. Any voltage between +15 to +30 volts may be used. Current required is 100 ma, filtered.

(AUDIO IN)

For connecting a shielded audio cable from the audio signal source to this connector.

Connect the cable shield to the connection closest to the PWR connector – this is the audio ground connection.

Connect the center wire of the shielded audio cable to the connection closest to the GAIN connector – this is the audio input connection.

(GAIN)

Leave these connections open to obtain the maximum audio gain from the SSQ-2F.

Short these connections together to obtain the lowest audio gain from the SSQ-2F.

Using a 100 K Ohm linear taper potentiometer, connect the center (wiper) terminal of the potentiometer to either connection of this terminal block. Connect one of the remaining two connections of the potentiometer to the other connection of this terminal block.

Using the potentiometer, the audio gain of the SSQ-2F may be adjusted from minimum to maximum, as needed.

(INVERT)

Connect a single pole, double throw (SPDT) switch to this connector block.

The center arm of the switch goes to the center connection of the terminal block.

The two outer connections of the switch go to the two outer connections of the terminal block.

When the left and center connections are closed, the SSQ-2F will operate in the 0 to 50% duty cycle mode.

When the right and center connections are closed, the SSQ-2F will operate in the 50% to 100% duty cycle mode.

(A C B)

Connect the right and center connections together to obtain a +5 volt RF output signal from the RF OUT connector.

Connect the left and center connections together to obtain a +12 volt RF output signal from the RF OUT connector.

(RF OUT)

Requires either a shielded RF coaxial cable or a twisted pair of wires to send the modulated RF signal from the SSQ-2F to an external RF amplifier.

Connect the shield of the coaxial cable or one of the wires of the twisted pair to the connection closest to the lower right hand mounting hole of the board – this is the RF ground connection.

Connect the center wire of the coaxial cable or the other wire in the twisted pair to the connection that is closest to the DIV connector – this is the RF output connection.

(DIV)

Connect a single pole, single throw (SPST) switch to this connector block.

This switch allows operation in either the 2 X mode, (switch open,) or the 1X mode, (switch closed.)

(MTR)

Connect the negative (-) terminal of the duty cycle monitoring meter to the connection that is closest to the mounting hole in the upper right corner of the circuit board.

Connect the positive (+) terminal of the duty cycle monitoring meter to the connection that is closest to the DIV connector.

If you are using a meter that is different from the type M-1 meter you may need to insert a resistor in series with the meter to adjust the full scale reading to the correct value.

Mounting the SSQ-2F

The SSQ-2F may be mounted in a metal or plastic enclosure with appropriately sized machine screws and nuts. Four mounting holes located in the corners of the SSQ-2F are provided for mounting the board. If the SSQ-2F is mounted next to a metal surface, then the use of ¼" standoffs is suggested to prevent short circuits between the underside of the SSQ-2F and the metal mounting surface. Either metal or plastic spacers may be used. Clearance has been provided between the outer edges of the mounting holes and the SSQ-2F circuit traces to allow the use of metal standoffs of up to 3/8" in diameter.

Heat Sink

Although it is recommended that the heat sink be used at all times, if absolutely necessary, it may be removed to save space when mounting the SSQ-2F in a small enclosure. If this is done, the DC power supply voltage must be limited to no more than 18 volts to prevent overheating of the 7812 +12 volt regulator.

If the DC power supply voltage is above 18 volts, the heat sink MUST be attached to the 7812 +12 volt regulator to prevent overheating and possible failure of the regulator.

The preferred mounting position of the heat sink is such that cooling air will flow across the ling dimension of the heat sink. If necessary, the heat sink may be rotated to either the horizontal or the vertical position, depending on how the SSQ-2F is mounted. Because the 7805 +5 volt regulator does not require a heat sink, it does not matter whether or not the heat sink on the 7812 +12 volt regulator is in contact with it or not.

The heat sink attached to the 7812 +12 volt regulator is connected to electrical ground.

RF Shielding Considerations

Provided that the RF output of the SSQ-2F is taken through a properly installed and terminated coaxial cable or twisted pair of wires, the incidental RF leakage from the SSQ-2F is minimal, and no interference to radios or television receivers should occur due to radiation from the SSQ-2F itself.

However, it is very important to prevent outside RF energy, such as from an operating plasma tube, from entering the SSQ-2F. Unwanted RF ingress will cause erratic operation and incorrect modulation of the RF carrier.

The most common point of entry for unwanted RF energy is via the audio input cable. Using a shielded audio cable is a must. Make sure the cable is routed well away from the high-power RF components of the system. Use the shortest length of audio cable possible.

In severe cases of interference, looping the audio cable a half-dozen times through a ferrite toroid will usually eliminate the problem. Place the toroid as close to the input connections of the SSQ-2F as possible. Use a toroid core with materiel type 31 for best results.

A second cause of RF ingress is direct pickup by the circuit board traces of the SSQ-2F. Normally, this will only occur in cases where the ambient RF field is extremely high due to incorrect equipment placement.
To prevent this problem, it is suggested that a metal case be used to house the SSQ-2F. If this is not possible, mounting the SSQ-2F on a metal panel at least 8 inches square is recommend.

Another option when using a plastic case is to install a metal plate inside the case to which the SSQ-2F is mounted. The metal plate should be connected with a short lead to the ground terminal of the PWR connector on the SSQ-2F.

If a metal plate is not available, a layer of aluminum foil may be glued to the inside of the plastic case to act as shielding. Make sure the foil is well glued so it cannot come loose at a later time and cause a short circuit against the traces on the underside of the SSQ-2F. As with the metal plate, the foil should be connected to the SSQ-2F power connector ground connector.

Metering the Square Wave Duty Cycle

If you have purchased Meter M1, simply connect terminals or meter M1 to the terminal block on the SSQ-2F marked MTR. Connect the (+) terminal of the meter to the (+) connection of the MTR terminal block. Connect the unmarked terminal of the meter to the unmarked connection of the MTR terminal block.

The meter readings will tell you the approximate duty cycle of the modulated RF square wave output. Please be aware that the meter reading is not an absolute value, but is reasonably close, within five percent or so.

There are unavoidable differences in individual meter movements, circuit component tolerances, etc., which will cause the meter reading to be slightly different from the true reading. If you need an exact duty cycle value, you will need to use an oscilloscope to obtain a truly accurate measurement. However, for most uses, the M1 meter will provide a fast and easy way to set the duty cycle consistently.

Should you choose to use your own meter, it will be necessary to calibrate the meter to read correctly on your SSQ-2F. The metering circuitry of the SSQ-2F has been designed to operate correctly with the M1 meter, which has a 2 mA full-scale movement.

If your meter movement has a full scale reading of less than 1 mA, it will be necessary to install a resistor in series you're your meter to limit the full scale reading to the proper value. It will also be necessary to replace capacitor C8 (470 uF, 16 V) with a capacitor with a value of 47 uF, 16 V. Changing the value of C8 is necessary because the 470 uF capacitor will cause sluggish meter response when using meter with full scale values below 1 mA.

To properly calibrate your meter, you will need to monitor the square wave modulated RF output of the SSQ-2F with an oscilloscope. Adjust the audio input level to the SSQ-2F until the modulated RF signal just shows a 100% carrier, that is, there are no off-time breaks in the waveform on the oscilloscope.

Adjust the value of the series resistor until your meter reads full scale. It is suggested that you use a variable resistor, such as a rheostat or a potentiometer for initially finding the correct resistance value. After you have adjusted the resistance to obtain a full-scale reading, disconnect the variable resistor and, using an ohmmeter, read the resistance you inserted into the meter circuit. Now you can use a fixed value resistor to replace the variable resistor.

Now you should use the oscilloscope to watch the RF waveform while you adjust the modulation of by adjusting the audio input to the SSQ-2F. Determine the meter readings for various modulation percentages from 0 to 100%. You may either rescale the meter appropriately, or you may simply make a look-up chart for meter readings vs. modulation percentages.

General Operation of the SSQ-2F

Initial Setup

Power Supply

To use the SSQ-2F, you will need to connect a power supply of between +15 to +30 Volts DC to the unit. The current required by the SSQ-2F is 0.1 Amperes maximum.

Output Voltage Select

The modulated RF output of the SSQ-2F is a zero-referenced, positive-going signal. The output level may be set to either +5 volts or to +12 volts by using the (A B C) terminal block.

If you are using the accessory IPA-1 amplifier, the output MUST be set to +5 volts, or damage to both the SSQ-2F and the IPA-1 may result.

The +12 volt setting is reserved for special applications, such as setting up contact devices.

Audio Input Signal

Please do not exceed the maximum allowable input audio level voltage of + or - 6 Volts peak to prevent damage to audio input amplifier U1. The audio signal may be offset by an maximum level of +6 or –6 volts DC without damaging input amplifier U1.

The SSQ-2F will ignore any DC offsets, as long as they are constant. A varying DC offset voltage will be interpreted by the SSQ-2F as a change in the audio input level, and will result in a change in the modulation duty cycle.

You will need an audio signal source somewhere between 40 to 175 millivolts peak to peak. The audio signal must not change in amplitude as the frequency of the audio signal changes. Most computer sound cards will meet this requirement. Some CD and DVD players will not, but this can usually be remedied by placing a load resistor across the audio output of the CD or DVD player. The required resistance value will usually be within the range of 10 to 100 Ohms.

To adjust the duty cycle of the modulated RF Square wave output, it is necessary to be able to adjust the amplitude of the audio signal being sent to the SSQ-2F, either by adjusting the level at the source, or by using a 100 K Ohm potentiometer (R2) connected to the terminal block on the SSQ-2F marked GAIN.

If you have a convenient way to adjust the audio level external to the SSQ-2F, you may install a jumper wire between the connections if terminal block GAIN. This will reduce the audio gain of the SSQ-2F to the lowest value. If more gain is required, installing a fixed resistor in place of the jumper will increase the gain. A value of somewhere between zero and 100K Ohms is required, with higher resistance values providing more audio gain. The resistor value will need to be determined by trial and error.

Note that the lower the gain, the flatter will be the audio bandwidth of the SSQ-2F. Using a 100K-Ohm potentiometer connected to the GAIN terminal block is by far the easiest and most convenient method of adjusting the audio gain of the SSQ-2F.

Turn On Caution When Using an External RF Power Amplifier:

When applying power to the SSQ-2F, the SSQ-2F will momentarily output a 100% carrier signal for about two seconds, even with no audio signal applied to the SSQ-2F. You will see the duty cycle meter M1 jump up from zero and then return to zero at power-on time. This is normal, and is due to the capacitors in the SSQ-2F initially charging up to their normal voltage level. As soon as the capacitors are charged, the output of the SQ-2F returns to normal.

If the external RF power amplifier has power applied to it before the SSQ-2F is powered on, the initial burst of carrier may cause the power amplifier to fault or its power supply to shut down.

For this reason, always turn the SSQ-2F on before you turn the RF amplifier on.

Modes of Operation

The following table shows the various operating modes of the SSQ-2F.

Type of Input Audio Signals	Sine, Triangle, Square*	Sine, Triangle
RF Carrier Output	Modulation Rate Equals Audio Frequency (1X Mode)	Modulation Rate Twice Audio Frequency (2X Mode)
0-50% Duty Cycle	**Mode 1**	**Mode 2**
50-100% Duty Cycle	**Mode 3**	**Mode 4**

** When using square wave input, only 50% duty cycle is available*

Selection between the operating modes is made by using jumper wires between the appropriate connections on the INVERT or DIV terminal blocks. For convenience, switches may be connected to the terminal blocks to allow for instant mode selection as needed.

OPERATION WITH SQUARE WAVE AUDIO SIGNALS

When operating in Modes 1 or 3, with square wave audio signals, increasing the audio signal level excessively or turning gain control R2 too high will result in erratic square wave output.

The SSQ-2F determines when to turn the RF carrier on and off by sensing the rate of amplitude change of the input audio signal. While sine and triangle waves have smooth rise and fall times, square waves are very abrupt, and the SSQ-2F cannot do anything except sense the rising and falling edges of square waves. This means that using square waves as an audio input will cause the modulation signal from the SSQ-2F to follow the rising and falling edges of the square wave, but with much faster rise and fall times.

Because of this, the frequency-doubling mode of the SSQ-2F will not work with square wave audio input signals. The output will always be in the 1X Mode (Modes 1 & 3.) Further, the duty cycle of the modulated RF output of the SSQ-2F will always follow the duty cycle of the input square wave signal.

If a square wave audio signal with other than a 50% duty cycle is sent to the input of the SSQ-2F, the polarity (and hence the duty cycle ratio) of the modulated RF output may be inverted by reversing the connections to the INVERT terminal block.

For instance, if a square wave audio signal with a duty cycle of 80% is connected to the input of the SSQ-2F, the modulated RF output of the SSQ-2F will be ON for 80% of the modulation cycle, and OFF for the remaining 20%. Reversing the connections to the INVERT terminal block will result in the RF carrier being ON for 20% of the modulation cycle and OFF for the remaining 80%.

SPECIFICATIONS:

Power:

- Power Requirements: +15 to +30 Volts DC @ 100 mA, filtered, unregulated.

Input Audio Signal Waveform:

- Sine, triangular, symmetrical, or asymmetrical square wave.

Modulation Modes:

- 1X Mode - The modulation frequency equals the input audio frequency using sine, triangle, or square waves.
- 2 X Mode - The modulation frequency equals TWICE the input audio frequency using sine or triangle waves only.

Carrier Frequency:

- 3.1 (standard) or 3.3 MHz. Frequency to be specified at time of order.
- Customer requested frequencies are available on special order.
- The user may easily change the plug-in carrier oscillator module.
- With the appropriate oscillator module inserted in the Controller Board, carrier frequencies from 0.5 MHz to 15 MHz may be obtained.

Modulation Frequency Ranges - 2 X Mode:

Input Audio Frequency Range in 2 X Mode @ 40 - 175 mv p/p input level with a Sine or Triangle Wave input signal:

- Low - 40 Hz
- High - 30,000 Hz at maximum audio gain, or 60,000 Hz at minimum audio gain.
- This will square wave modulate the carrier over the range of 80 to 60,000 Hz or 80 to 120,000 Hz.

NOTE: In the 2 X mode, using a sine or triangle wave audio input, the output of the Controller Board will maintain a 50% duty cycle ratio to within 10% or less across the input frequency range of 40 to 30,000 Hz at maximum audio gain, or 40 to 60,000 Hz at minimum audio gain. This allows unattended operation of the equipment without the need for constant audio gain adjustments when using an audio sweep signal generated by a computer sound card. It is necessary to maintain a low source impedance and a constant voltage as the audio frequency changes during the sweep.

Modulation Frequency Ranges - 1X Mode:

Input Audio Frequency Range in 1X Mode, @ 50 - 140 mv p/p input level with a Sine or Triangle Wave input signal:

- Low - 4 Hz
- High - 200,000 Hz at any audio gain setting.
- This will square wave modulate the carrier over the range of 4 to 200,000 Hz

- Usable frequency range from 4 to 400,000 Hz with increased audio input level.
- This will square wave modulate the carrier over the range of 4 to 400,000 Hz.

Modulation Frequency with a Square Wave input signal of 50 - 75 mv p/p and minimum audio gain:

Note: Square wave audio is usable in 1X Mode only, and a 50% duty cycle is output by the Controller Board.

- Low - 75 Hz
- High - 200,000 Hz
- This will square wave modulate the carrier over the range of 75 to 200,000 Hz.

- Usable frequency range from 50 to 600,000 Hz with increased audio input level.
- This will square wave modulate the carrier over the range of 50 to 600,000 Hz.

Warranty

All our products carry a one (1) year warranty against manufacturing defects. Mechanical damage is not covered; i.e., you dropped it on the floor and then accidentally stepped on it. For warranty claims, you pay shipping to us; we pay shipping back to you.

Kits assembled by the purchaser are also have a one (1) year against component failure. Breakage or overheating damage from soldering of components during assembly is not covered under warranty.

For all warranty claims, please contact us by email or telephone before returning equipment for service.

Out-of-Warranty repair service is at the rate of $20/hour, with a maximum charge of $50 per item, unless otherwise specified. Please contact us for additional pricing on custom repair services.

Contact us

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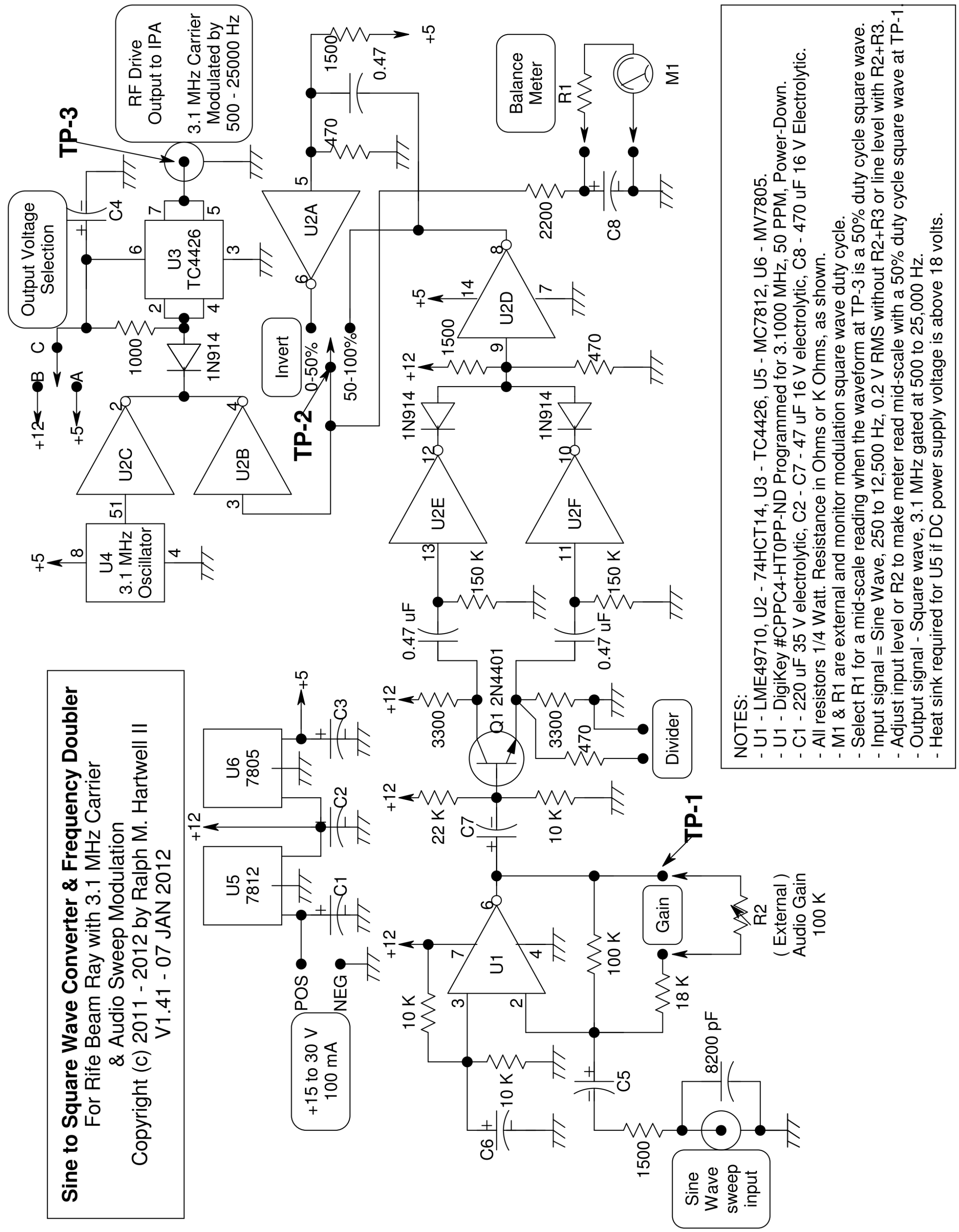
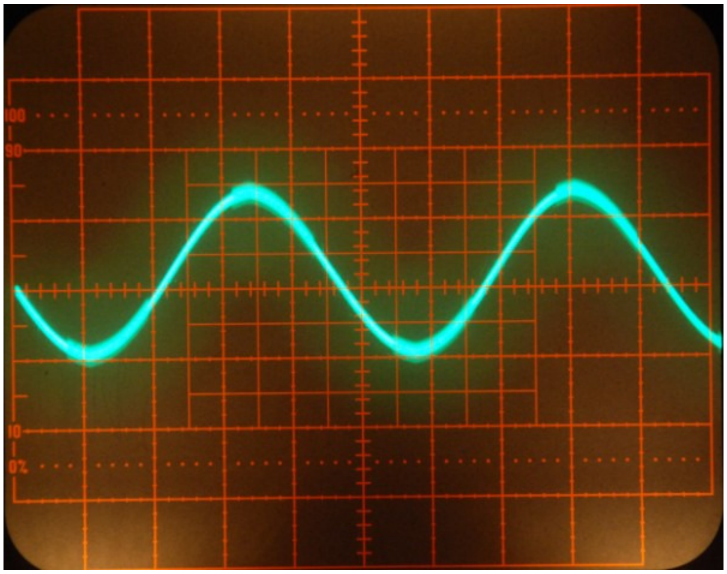


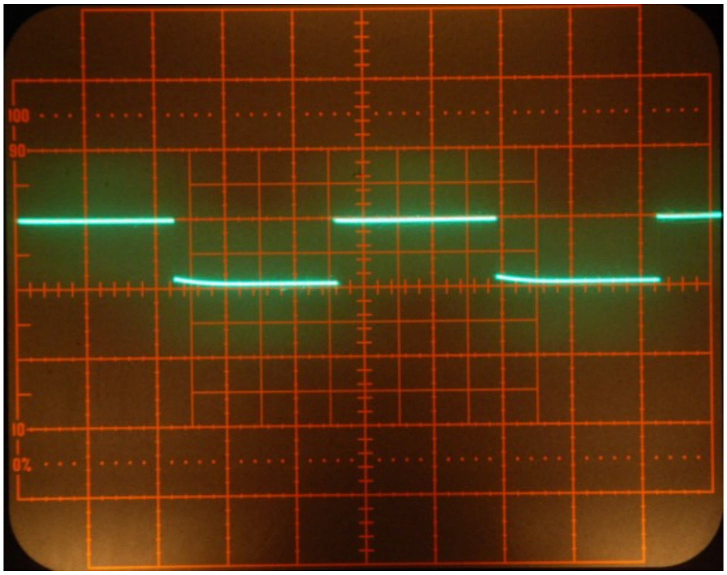
Schematic Diagram of the SSQ-2F.

WAVEFORMS

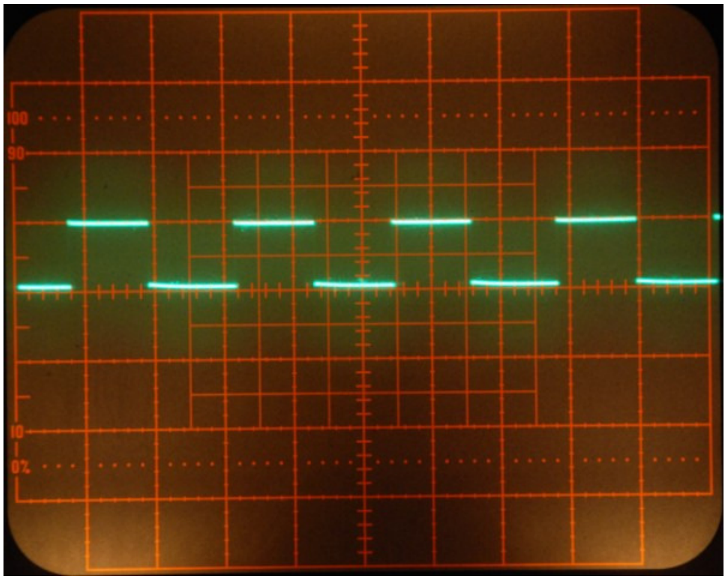
The following waveform photographs were taken with a Tektronix oscilloscope set to a 20 MHz bandwidth. The amplitude of the digital signals shown here is +5 volts peak, ground referenced. The test points mentioned here are found on the schematic diagram. All waveforms are taken with a 6 KHz audio input signal to the SSQ-2F.



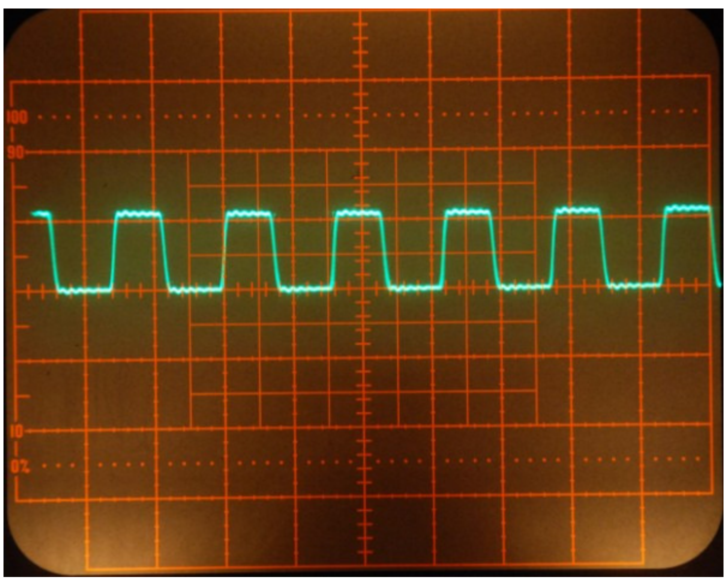
Waveform 1
6 KHz audio signal at TP-1.



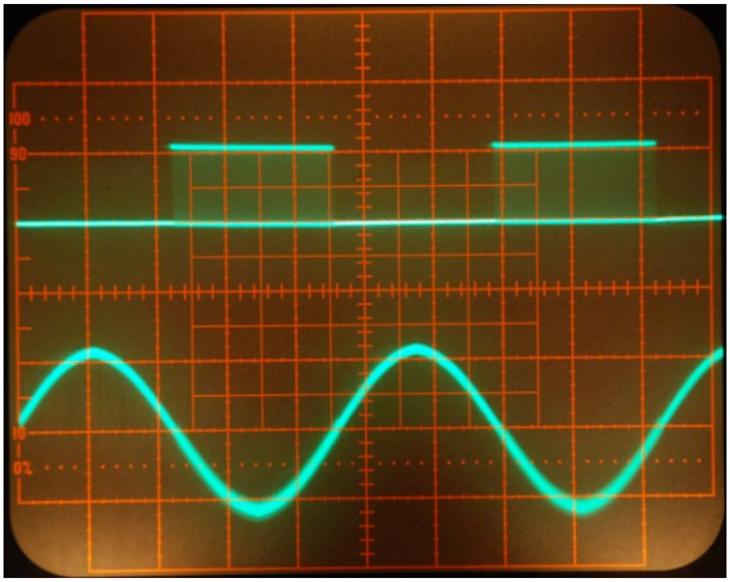
Waveform 2
6 KHz 50% duty cycle square wave at TP-2. This is in the 1X mode.



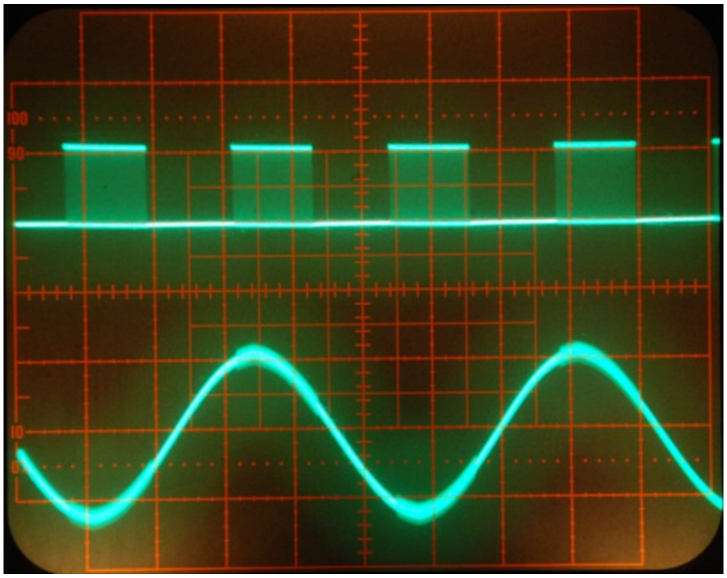
Waveform 3
12 KHz 50% duty cycle square wave at TP2. This is in the 2 X mode.



Waveform 4
3.1 MHz carrier waveform at TP-3



Waveform 5
Bottom trace – TP-1 showing 6 KHz audio.
Top trace – TP-3 showing 3.1 MHz carrier modulated at a 6 KHz rate by a 50% duty cycle square wave. This is in the 1X mode.



Waveform 6
Bottom trace – TP-1 showing 6 KHz audio.
Top trace – TP-3 showing 3.1 MHz carrier modulated at a 12 KHz rate by a 50% duty cycle square wave. This is in the 2 X mode.

-EOT-