

GENERAL ASSEMBLY INSTRUCTIONS

Arrange for a clean work surface with adequate lighting. You will be working with small parts, and you may need to use a magnifier for close work. Working on a soft surface, such as a short nap towel, prevents parts from rolling off the work area and falling on the floor.

You will be soldering small components in place. If you are not used to soldering such items, it is suggested that you seek assistance from an experienced person before starting assembly.

The circuit board of the SSQ-2F has been designed with ruggedness in mind. Extra-wide and thick copper traces have been used on the SSQ-2F. Because of this, the SSQ-2F will withstand repeated soldering should repairs be necessary, such as if a component has been installed in an incorrect location. Nevertheless, it is strongly recommended that you take care in locating the position of the various components when assembling your SSQ-2F.

You will require the following tools:

- Small needle nose pliers to install the heat sink.
- Small flush cut side cutter pliers to cut off the excess wire ends of components after soldering them in place.
- A #1 Phillips head screwdriver to install the heat sink.
- A soldering iron, with a recommended wattage of between 30-70 watts, and a tip temperature of no more than 700° F. The tip should be a small conical point.
- Solder, 60/40, 63/37, or 62/36/2 grade, no larger in diameter than 0.032". Rosin core flux only. Suitable types are Radio Shack 64-013 and 64-009.

WARNING ! DO NOT use acid core solder!!

Doing so will cause damage to the circuit board and will void any and all warranties. We will NOT warranty any circuit boards that have been assembled using any type of acid core solder.

The circuit layout of the SSQ-2F is such that the leads of all of the capacitors will pass fit through their respective holes on the board without the necessity of bending the leads. The leads on the transistor (Q1 – 2N4401) will need to be spread slightly apart before inserting it into the circuit board. The leads of the 1N914 diodes and all of the resistors will need to be bent at right angles to the body of the component before you insert them into the board.

Bend the component leads using only your fingers, because using pliers may cause the body of the diode or resistor to break or become cracked where the lead exits the body of the component. This can result in outright failure of the SSQ-2F to operate, or even worse, cause intermittent malfunctions during operation. Such problems can be difficult to resolve.

Although you may assemble the components in any order, the following sequence allows you to “build up” from the surface of the board, making it easier to install the rest of the components as you assemble your SSQ-2F.

If you look at the blank circuit board, you will see above the copyright notice, there is a label marked “Parts Side” on the front of the board, and “Solder Side” on the reverse of the board. All of the components are installed on the parts side of the board. All of the soldering is done on the solder side of the board.

Notice that the parts side of the board has outline drawings of all the components, as well as either their part number, (C1, OSC, TC4426) or their value, (1500 [Ohms], 8200 [pF], 0.047 [uF]), making it easy to identify where the various components should be placed. It is suggested that you take the time to inspect the blank circuit board and familiarize yourself with where the various components will be placed. Please refer to the photograph of the complete SSQ-2F in the back of this manual for help in locating the position of the components.

For each assembly step, locate the listed component, and identify where on the circuit board it will be placed. If necessary, bend the leads of the component to fit, and carefully insert the leads through the board. Carefully tug on the free end of the component’s leads to seat the component close to the circuit board. Do not apply excessive force trying to seat the component firmly against the board. If it is positioned slightly above the board that is OK.

After inserting the component, bend the free ends of the component’s leads at a 45° angle to prevent the component from slipping out of the circuit board when the board is turned upside down to solder the component in place.

Solder the component in place, inspect the solder joint, and then cut off the excess lead wires with the flush cutter pliers.

As you install each component, put an “X” or a check mark in the “()” box to the left of each component. Assembling the components in sequence helps to prevent assembly errors.

Installing the Components on the SSQ-2F Circuit Board

NOTE: References to the “top of the circuit board” means that you are looking at the circuit board so that the copyright notice and the board name are viewed right-side-up, and the 7812 and 7805 regulator modules are at the top left of the circuit board.

Install (3) 1N914 diodes

()

()

()

Install (18) Resistors

- () 470 Ohm (Yellow Violet Brown)
- () 470 Ohm (Yellow Violet Brown)
- () 470 Ohm (Yellow Violet Brown)
- () 1000 Ohm (Brown Black Red)
- () 1500 Ohm (Brown Green Red)
- () 1500 Ohm (Brown Green Red)
- () 1500 Ohm (Brown Green Red)
- () 2200 Ohm (Red Red Red)
- () 3300 Ohm (Orange Orange Red)
- () 3300 Ohm (Orange Orange Red)
- () 10 K Ohm (Brown Black Orange)
- () 10 K Ohm (Brown Black Orange)
- () 10 K Ohm (Brown Black Orange)
- () 18 K Ohm (Brown Gray Orange)
- () 22 K Ohm (Red Red Orange)
- () 100 K Ohm (Brown Black Yellow)
- () 150 K Ohm (Brown Green Yellow)
- () 150 K Ohm (Brown Green Yellow)

Install IC sockets at these locations, but do NOT insert the IC's themselves at this time.

When installing the sockets, note that there is a small notch at one end of the socket. Also note that there is a small notch in the printed outline of the socket on the circuit board. When installing the socket, be sure to match the notch on the socket to the notch on the printed outline.

The printed outline for the OSC socket does not have a notch. Install the OSC socket with notch pointing towards the top of the circuit board.

- () LME49710 (8-pin socket)
- () OSC (8-pin socket)
- () TC4426 (8-pin socket)
- () 74HCT14 (14-pin socket)

Install a 2N4401 transistor

The leads of the transistor will have to be spread slightly apart in order for the leads to pass through the holes in the circuit board. The flat side of the transistor faces the two 0.047 capacitors that are to the right of the 2N4401 transistor.

- ()

Install a 8200 pF film capacitor

- ()

Install a 220 uF 35 Volt electrolytic capacitor at location:

NOTE – Observe polarity when installing this capacitor. The negative (-) lead of the capacitor goes to the ROUND mounting pad, and the positive (+) lead of the capacitor goes to the SQUARE mounting pad.

The Positive (+) lead of the capacitor is the longer lead. There is a gray or white stripe on the side of the capacitor that is closest to the Negative (-) lead.

() C1

Install a 470 uF 16 Volt electrolytic capacitor at location:

Observe polarity when installing this capacitor. The negative (-) lead of the capacitor goes to the ROUND mounting pad, and the positive (+) lead of the capacitor goes to the SQUARE mounting pad.

The Positive (+) lead of the capacitor is the longer lead. There is a gray or white stripe on the side of the capacitor that is closest to the Negative (-) lead.

NOTE – If you are using your own meter and external resistor R1 instead of M1, and the full scale reading of the meter is less than 1 Milliampere, then the value of C8 should be changed to 47 uF 16 V or the meter will respond too slowly to duty cycle changes that occur when the audio input level is changed.

() C8

Install a 47 uF 16 Volt electrolytic capacitors at these locations:

Observe polarity when installing these capacitors. The negative (-) lead of the capacitor goes to the ROUND mounting pad, and the positive (+) lead of the capacitor goes to the SQUARE mounting pad.

The Positive (+) lead of the capacitor is the longer lead. There is a gray or white stripe on the side of the capacitor that is closest to the Negative (-) lead.

C2

C3

C4

C5

C6

C7

TERMINAL BLOCK INSTALLATION

When installing the two and three position terminal blocks, be sure to install the terminal blocks so that the wire holes are facing the edge of the circuit board.

The terminal blocks will be a tight press fit into the circuit board; this is normal. Be sure to seat the terminal block completely against the circuit board before soldering.

Install a 2 position terminal strip at these locations:

PWR

AUDIO IN

GAIN

RF OUT

DIV

MTR

Install a 3 position terminal strip at these locations:

INVERT

B C A

Install (3) 0.47 uF capacitors

Install the 7812 voltage regulator at location:

Make sure the metal side of the voltage regulator faces away from the circuit board.

7812

Install the 7805 voltage regulator at location:

Make sure the metal side of the voltage regulator faces away from the circuit board.

7805

Install the Heat Sink on the 7812 voltage regulator.

()

Using one 6-32 x 3/8" machine screw and one 6-32 hex nut, attach the heat sink to the metal side of the 7812 voltage regulator. Do not twist the leads of the voltage regulator when installing the heat sink. The use of thermal compound, a.k.a., "heat sink grease," is optional due to the low power dissipation of the 7812 regulator and the large size of the heat sink.

If the DC supply voltage to the SSQ-2F will never exceed 18 volts, and the SSQ-2F is not in a tightly sealed case, then the heat sink may be omitted if desired. If you are not sure if the heat sink will be needed, then install it to be safe.

FINAL INSPECTION

Using a magnifying glass and a bright light, carefully inspect the top and bottom of the finished circuit board for any unwanted solder splashes between connections, and wire clippings, or anything else that may cause problems during operation of the SSQ-2F.

Should you wish to remove the solder flux residue from the finished circuit board, you may use a commercial flux remover, or 100% Isopropyl alcohol. Rubbing alcohol is NOT suitable for removing the flux residue due to the high water content and the denaturing ingredients contained in rubbing alcohol. Use only 100% Isopropyl alcohol. After cleaning the board, allow it to dry thoroughly before continuing.

This completes the assembly of the SSQ-2F circuit board.

CONTROLLER CIRCUIT BOARD CHECKOUT PROCEDURE

NOTE – When referring to components such as terminal blocks on the Controller Circuit Board, the board is viewed from the component side of the board, turned so that the two voltage regulators are at the upper left corner of the circuit board.

RESISTANCE CHECKS

The following resistance checks are to be made with no external connections made to the circuit board, and without any of the integrated circuits or the oscillator module plugged into the board sockets.

Using an Ohmmeter, measure the resistance between the + and – terminals of the Power connector. The resistance reading should be greater than 100 K Ohms. The resistance reading will be low at first when the Ohmmeter leads are connected, but as the filter capacitors charge from the Ohmmeter voltage, the resistance reading will increase.

After the resistance reading stabilizes, reverse the Ohmmeter leads and make sure the resistance in the reverse direction reads greater than 100 K Ohms.

INSTALLING THE INTEGRATED CIRCUITS AND THE 3.1 MHz OSCILLATOR MODULE

Before installing the integrated circuits (IC's) into their sockets, please make sure all the pins of the IC's are straight and parallel. As supplied from the factory, the leads are slightly angled outwards from the body of the IC. This makes it difficult to plug the IC's into the sockets. Straighten the leads first, and you will reduce the chance of damaging any of the pins on the IC's when you plug them into the sockets.

Plug the integrated circuit chips (IC's) into their respective sockets. Seat them gently, but firmly. The body of the IC's should rest against the top of the socket.

Now it is time to plug in the oscillator module. The pins of the oscillator module are rather thin wire, and are easily bent. When the oscillator is plugged onto the socket, the oscillator will stand above the top of the socket by about 2 mm. Do NOT attempt to seat the oscillator module fully against the socket or you may break off one or more of the pins or damage the socket.

Note that the bottom flange of the oscillator module has one corner that is a right angle – the other three corners are rounded. The pointed corner marks the position of Pin 1. Note that the printed outline on the circuit board has one pointer corner. Plug the oscillator module carefully it into its socket, making sure that the pointed corner of the oscillator module matches the printed outline on the circuit board.

INSERTING THE OSCILLATOR MODULE INCORRECTLY MAY CAUSE DESTRUCTION OF THE OSCILLATOR MODULE WHEN POWER IS APPLIED.

Such damage is NOT covered under warranty.

SETTING THE OUTPUT VOLTAGE

You will need to decide what voltage level you want the controller board to provide. You may choose either +5 volts for driving a MOSFET amplifier module, or +12 volts for driving other devices. Selection of the output voltage level is made by using the terminal block marked "A C B." This terminal block is located at the lower right hand corner of the controller circuit board.

Connect terminals A & C together for +5 volt output.

Connect terminals B & C together for +12 volt output.

POWER ON TESTS

Connect the circuit board to the power supply using the terminal block marker “+PWR-.” It is suggested that you use a current-limited “wall-wart” type of power supply, as there is less chance of catastrophic damage to the controller board should an accident occur.

Should you choose to use a different power supply, the voltage must be within the range of +15 to +30 volts DC, reasonably filtered, although it does not need to be well regulated. The maximum current required by the controller board is 0.1 Ampere, or 100 Milliamperes.

Connect a jumper between the right and center pins of the “INVERT” terminal block. This jumper enables normal operation of the frequency doubler circuitry and sets the SSQ-2F to operate in the 0-50% duty cycle mode.

Connect a jumper between the two terminals of the “GAIN” terminal block. This sets the gain of the input amplifier to minimum.

Connect a 470 Ohm resistor between the terminals of the “RF OUT” terminal block.

Connect the probe of your oscilloscope across the 470 Ohm resistor. The ground clip of the probe connects to the terminal of the “lower” connection of the “RF OUT” terminal block, that is, the connection that is the closest to the lower right of the circuit board. The probe tip connects to the “upper connection.

Connect the Balance Meter to the terminal block marked “MTR.” The negative terminal of the meter connects to the “upper” terminal block connection, and the positive terminal of the meter connects to the “lower” terminal block connection. If you do not have a Balance Meter, you may use a DC voltmeter, set to read +5 volts.

AUDIO INPUT

Connect a variable level audio source to the AUDIO IN terminal block. The “hot” lead goes to the right side connection of the terminal block, and the “return” lead goes to the left side connection of the terminal block.

Set the audio frequency to 6 KHz and the audio signal level to zero.

TESTING

Observe that the square wave duty cycle meter reads zero. The oscilloscope trace should be a flat line.

Slowly increase the level of the audio signal until the meter starts to read upscale. As the audio signal is increased in level, the meter reading will suddenly jump to about 40%. At that point, the frequency doubling function of the SSQ-2F has become active.

Adjust the audio level so that the meter reads 50%.

Observe the oscilloscope screen. You will see a series of square wave pulses that go from zero to +5 or +12 volts, depending on which output voltage level you selected earlier. These square waves will be at a rate of 12 KHz, which is twice the 6 KHz audio input frequency. The duty cycle of the square waves will be 50% on-to-off ratio.

Each positive going half of the square wave is composed of a series of 50% duty cycle square waves which occur at the rate of 3.1 MHz, or whatever frequency your oscillator U4 is set for.

Varying the audio input level will adjust the duty cycle of the 12 KHz modulating signal. It is possible to adjust the duty cycle of the modulating square wave from roughly 40% ON to 100% ON.

Connect a jumper wire between the connections of the DIV terminal block. This takes the SSQ-2F out of the frequency doubling mode.

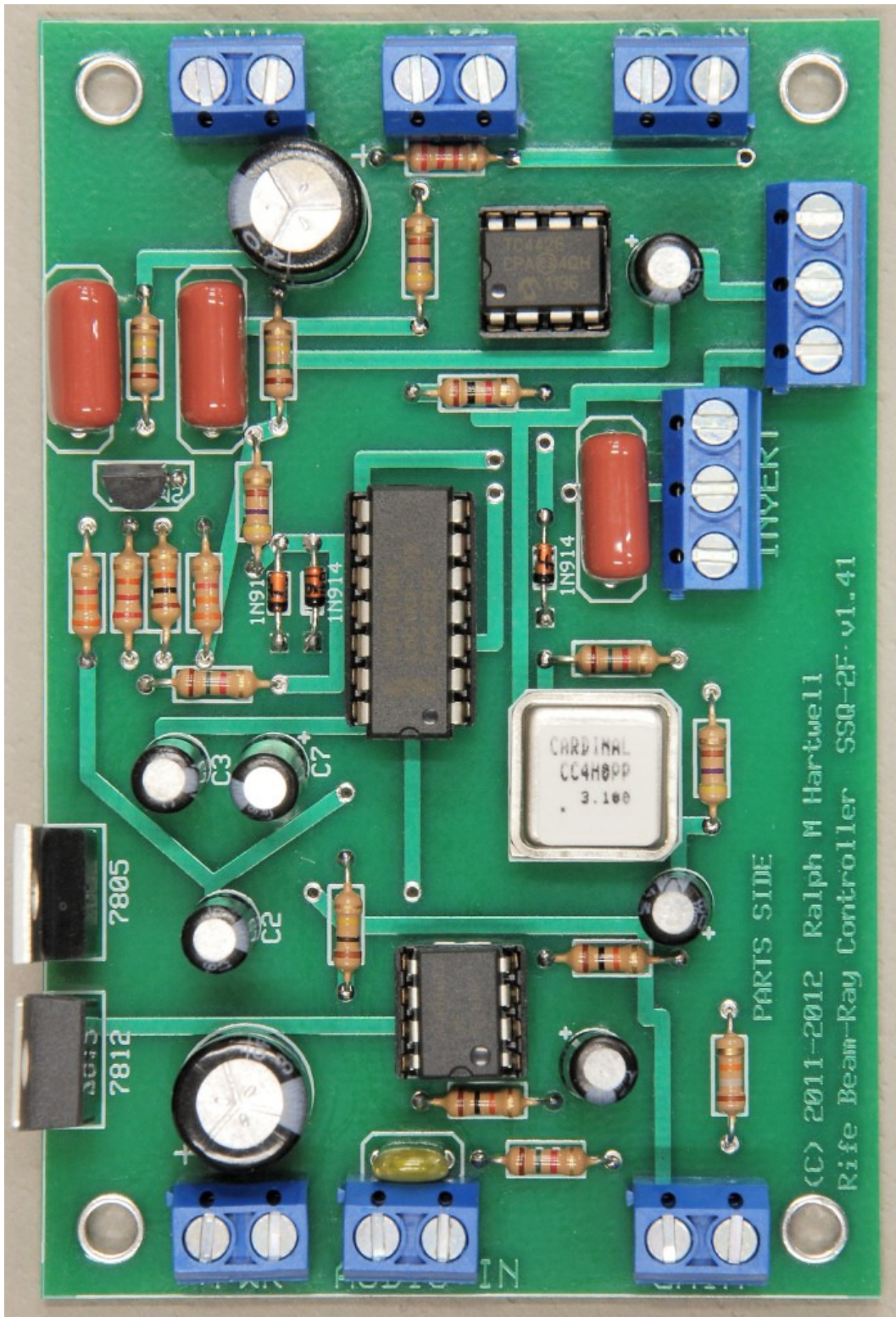
Note that the 12 KHz modulating square wave has now become 6 KHz.

Now, move the jumper to the left and center connections on the INVERT terminal block. This sets the SSQ-2F to operate in the 0-50% duty cycle mode.

Adjusting the audio input level now adjusts the duty cycle of the modulating square wave from roughly 40% ON to 0% ON.

Remove the jumper from the connections of the GAIN terminal block. Note that the audio level required to drive the SSQ-2F has greatly decreased.

This completes the testing of the SSQ-2F. Please consult the Instruction Manual for the SSQ-2F for routine operating instructions.



Assembled SSQ-2F

