

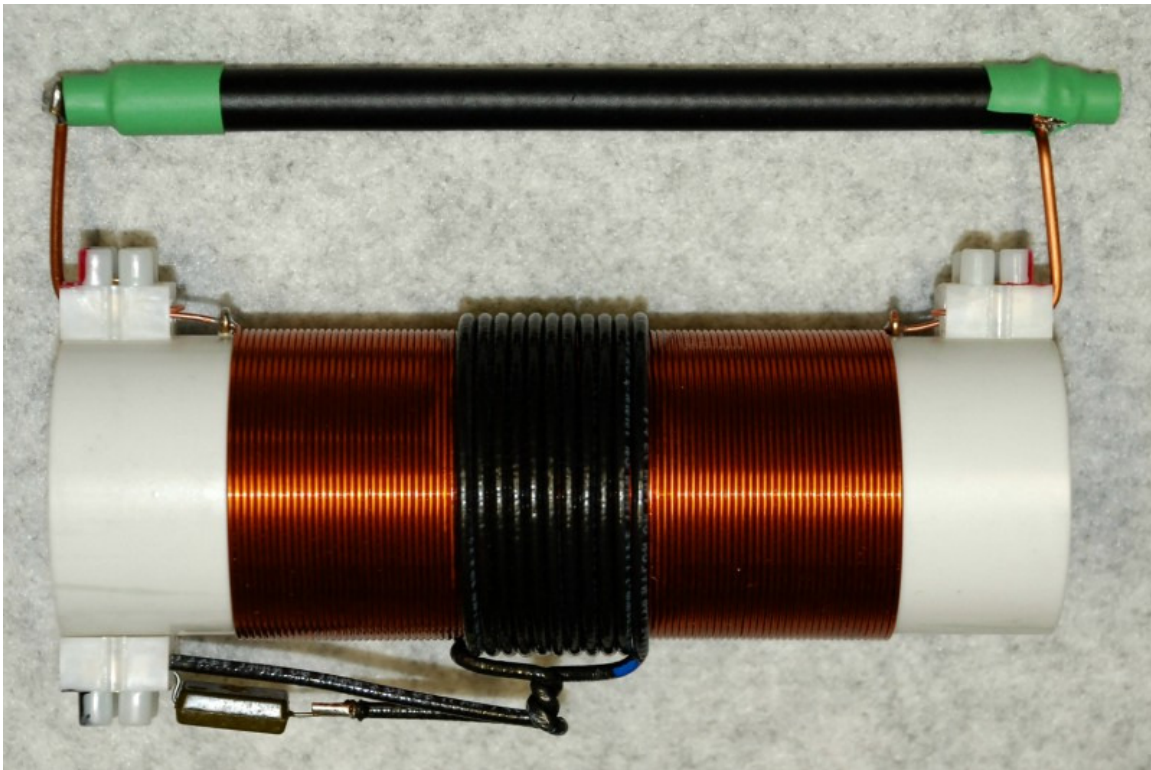
Instruction Manual

for the

LC31S1

3.1 MHz Link Coupler for Plasma Tube Systems

v1.00



Manual v1.00 – 17 November 2012

© 2012 by Ralph Hartwell
Spectrotek Services
All rights reserved

*** LEGAL AND MEDICAL DISCLAIMER ***

Spectrotek Services and Ralph M. Hartwell ARE NOT RESPONSIBLE for any damage or injuries of any sort or form that may be sustained by any person or persons, any animal, or to any equipment or any other thing or things while anyone is using, modifying, testing, or experimenting with the LC31S1 in any manner whatsoever. This device has not been inspected or approved by any governmental or medical agency or inspection service. No medical claims are made for, nor implied by, the sale or use of this device. Using the LC31S1 is done solely at your own risk.

You are advised to always consult with your physician or other health care professional at any time should you have or think you might have a health problem. Please check with your physician or other health care professional before starting any diet, exercise, taking over-the-counter (OTC) medications or supplements and especially before taking any prescribed medication. Never stop taking any prescribed medications without first consulting your physician.

RADIO FREQUENCY WARNING NOTICE

- If the LC31S1 is installed incorrectly or used improperly, it is capable of causing severe radio frequency interference. To prevent this from occurring please observed the following warnings:
- The LC31S1 is to be used as a research device only or as part of a complete system to drive a plasma tube.
- The LC31S1 is not intended to be used for any form of radio transmission in any manner whatsoever.
- The LC31S1 is not intended to be connected to an antenna or to any radiating element or to be used for any form of radio communications purposes in any manner whatsoever.
- All electrical connections to the input terminals of the LC31S1 are to be made by the use of properly shielded 50-ohm coaxial cable capable of handling at least 500 watts at 3.1 MHz.
- All connections are to be made in such a manner as to minimize any RF radiation from the connecting wires to the LC31S1, particularly from the wires connecting to the plasma tube.
- The LC31S1 has been specifically designed to be accept the signal from the SSQ-2F v3.10 or the PA1.
- The operating frequency range of the LC31S1 should be restricted to a one MHz portion of the spectrum centered at 3.1 MHz.
- Avoid physical contact with the LC31S1 during operation. Very high RF voltages are developed on the secondary coil during operation. Painful RF burns may result from accidental contact with exposed wires.

Index and Table of Contents

Legal and Medical Disclaimer	2
Radio Frequency Warning Notice	3
General Information	5
Connections to the LC31S1	6
Mounting the LC31S1	8
Interference Prevention	8
Specifications	9
Special Note about the Coaxial Cable between the LC31S1 Coupler and the RF Source	10
Coaxial Cable Length, Series Link Tuning Capacitor and TCS/TCP Coaxial Capacitor Data for the 3.1 MHz Link Coil Coupler	11
Warranty and Contact Information	12
Schematic Diagram of the LC31S1	13

What does the LC31S1 do?

The LC31S1 is designed to provide an effective means of transferring RF energy from the SSQ-2F v3.10 or the PA1 amplifier to a Cheb SSQ-PT plasma tube. Due to the design of the LC31S1 the fast rise and fall times of the square wave modulated RF signal are sent to the plasma tube. Commercial antenna tuners will often distort the envelope of the RF signal. The LC31S1 avoids this distortion.

May I use a different plasma tube with my LC31S1?

Yes, but some adjustment of the tuning capacitors on the LC31S1 may be required when using the LC31S1 with a different plasma tube.

What type of RF source may be used with the LC31S1?

The SSQ-2F v3.10 with or without the PA1 amplifier may be used with the Cheb SSQ-PT plasma tube.

It is possible to use the LC31S1 with other types of RF power amplifiers, both solid-state and vacuum tube. The LC31S1 is designed to accept RF power from an amplifier with an output impedance of approximately 50 ohms. Some adjustment of the values of the tuning capacitors on the LC31S1 may be required when using the LC31S1 with a different amplifier.

What makes up a typical Rife Plasma system?

This block diagram shows the setup of a typical Rife-type system.

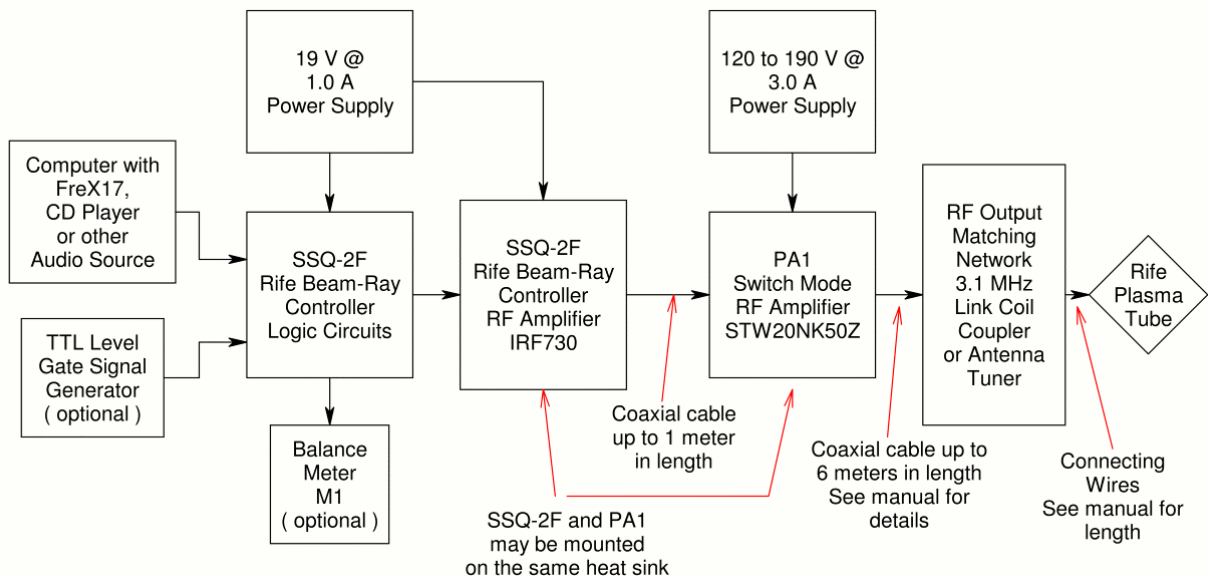


Figure 1

Block diagram of a typical Rife plasma system using the SSQ-2F v3.10, the PA1, and the LC31S1.

CONNECTIONS to the LC31S1:

All connections to the LC31S1 are made by using the six screw terminals that are located in the three plastic terminal blocks that are mounted on the ends of the LC31S1 coil assembly. These terminals will accept either solid or stranded conductor wire. Stranded wire is preferred for its flexibility when making connections between the LC31S1 and the plasma tube.

A two-position terminal block is used for the RF input. Two other two-position terminal blocks are used for connecting the RF output from the LC31S1 to the plasma tube and the TC coaxial tuning capacitor.

When tightening the clamping screws in the terminal blocks, do not over tighten the screws to avoid damaging the connector. To connect the wires, strip approximately 3/8 inch / 9 mm of insulation off of the end of each wire and insert it the bare wire into the hole in the terminal block. Gently, but firmly, tighten the clamping screw to fasten the wire in place.

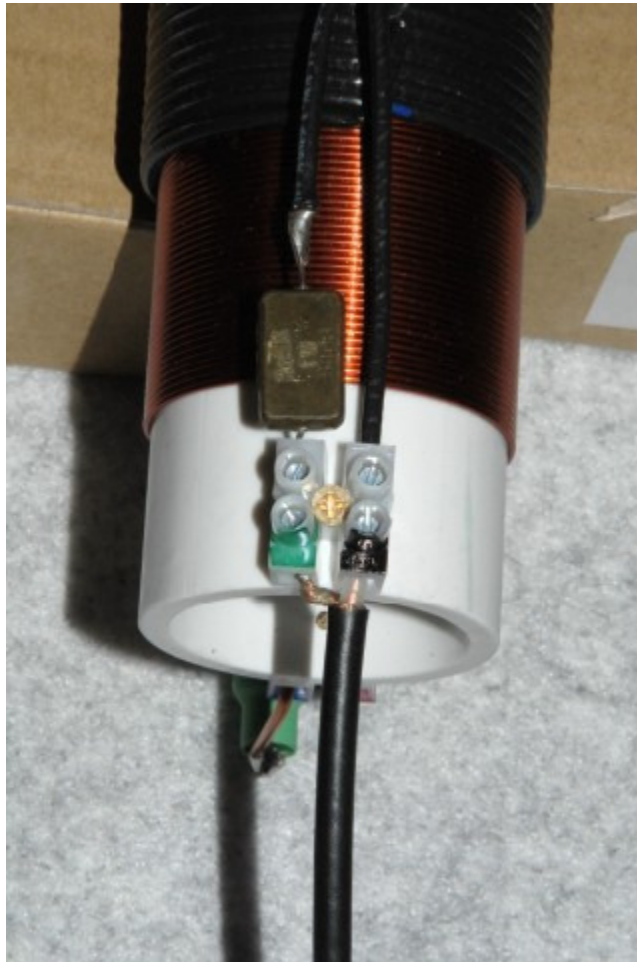


Figure 2

LC31S1 RF Input Terminal Block

To make the connection between the SSQ-2F v3.10 or the PA1, you will need a 50 ohm coaxial cable with a length of 19 to 25 feet / 5.8 to 7.65 meters. One end of this cable will be connected to the RF output terminals of the SSQ-2F v3.10 or the PA1. The other end of this cable will be connected to the input of the LC31S1 coupler system.

Suitable types of coaxial cable are solid dielectric insulation RG-58/U, RG-8/X, and RG-213. Coaxial cables with an impedance of 75 ohms should not be used.

When connecting the coaxial cable to the LC31S1, the center wire of the coaxial cable should be connected to the BLACK terminal block. The shield braid of the coaxial cable should be connected to the GREEN terminal block.

Please refer to the section entitled: **“Coaxial cable length, series link tuning capacitor and TCS/TCP coaxial capacitor data for the 3.1 MHz link coil coupler”** on page 11 in this manual for more information on when this connection option is to be used.

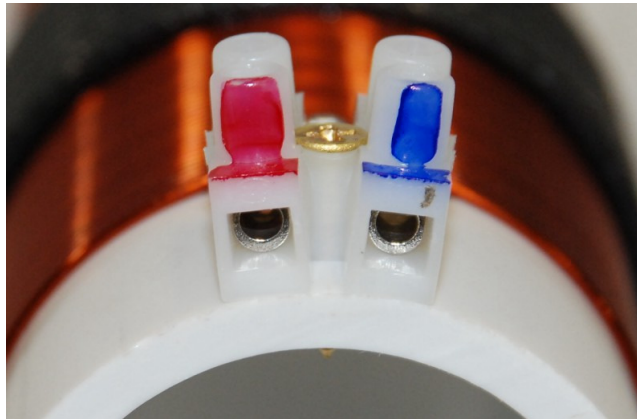


Figure 3.

LC31S1 RF Output Terminal Block

There are two 2-position terminal blocks mounted on the ends of the LC31S1 coil assembly. These terminal blocks are used for connecting the TCS coaxial capacitor and the plasma tube to the LC31S1 coil assembly.

The Type TCS (GREEN) coaxial capacitor should be connected to the BLUE terminal blocks of the LC31S1 coil assembly.

A pair of well-insulated, flexible wires should be connected between the two RED terminal blocks and the electrodes of the plasma tube. These wires should be 8 inches / 20.5 cm in length for the SSQ-PT tube. See page 11 for further information. Use of wires of shorter or longer lengths may result in significant detuning of the LC31S1. This detuning will result in reduced power transfer to the plasma tube.

Mounting the LC31S1

If possible, the LC31S1 should be mounted in a horizontal position. This mounting position allows for the maximum amount of cooling air to flow around the coil of the LC31S1. The LC31S1 will become quite warm during operation. This is normal. The temperature rise will depend upon the level of RF power the LC31S1 must process.

The LC31S1 should be kept at least 2 inches / 5 cm away from metal objects and wires. Wires or cables that are close to the LC31S1 can easily pick up a powerful RF signal from the magnetic field surrounding the LC31S1. This induced signal may cause RF interference to other devices.

Mounting the LC31S1 to a wooden support will not cause tuning problems for the LC31S1, but the LC31S1 assembly should not be placed directly against a wooden support to avoid blocking the flow of cooling air over the coils of the LC31S1.

When mounting the LC31S1 assembly it is acceptable to drill one or more holes for mounting hardware in the exposed ends of the PVC coil form of the LC31S1. These holes should be located at least 3/4 inch / 38 mm away from the ends of the 18 gauge coil winding. Although ordinary iron or stainless steel hardware may be used to mount the LC31S1, the use of brass hardware for mounting the LC31S1 will result in less RF loss due to induction heating of the mounting hardware.

Preventing Interference to Other Devices

The most likely cause of electrical interference to other devices will be from stray RF radiation from the plasma tube and the wires connecting the plasma tube to the LC31S1 coupler system. To minimize radiation from the coupler and the connecting wires, the wires should be equal in length, and spaced as close together as reasonably possible. Placing the wires close together helps to cancel unwanted RF radiation from the wires.

In most jurisdictions, it is the responsibility of the operator of any radio frequency producing equipment to prevent the equipment for producing interference to other users of the radio frequency spectrum or other electronic equipment. Please be aware of local regulations before operating this equipment.

SPECIFICATIONS:

Input Impedance:

50 ohms nominal impedance. Adjustable by changing the value of the input series link tuning capacitors.

Output Load:

Plasma tube, internal or external electrode style. Designed specifically for the Cheb SSQ-PT 1" x 14" or 1" x 16" external electrode plasma tube when the tube is fitted with external electrodes between 1.25 inches / 30 mm and 2.25 inches / 45 mm in length, with a spacing of 9.25 inches / 235 mm between the electrodes.

Power Handling:

Up to 300 Watts average RF power with modulation duty cycles from 0 to 100%.

Up to 500 Watts peak RF power with modulation duty cycles from 0 to 60%.

The power handling ability of the LC31S1 is limited by the amount of heat it can dissipate during operation. Operation at very high power levels for extended periods of time may cause the PVC coil form to overheat, resulting in deformation or melting of the coil form. Please note that such damage is not covered under warranty.

SPECIAL NOTE ABOUT THE COAXIAL CABLE BETWEEN THE LC31S1 COUPLER AND THE RF SOURCE

This coupling system has been designed and optimized for use with a 20 foot / 6.1 meter length of 50-Ohm, solid dielectric insulation coaxial cable such as RG-213 or RG-58. Satisfactory performance will be obtained with cable lengths between 18 to 25 feet / 5.5 to 7.65 meters.

The coaxial cable is to be connected between the RF source (normally the SSQ-2F v3.10 or the PA1 amplifier) and the input terminals of the LC31S1 RF coupler.

Because the cable is an active part of the matching system, changing either the type of cable or the length of the cable may serious problems or damage to the RF amplifier system.

Cable lengths of between 18 to 25 feet / 5.5 to 7.65 meters may be used with no circuit changes. Should it be desired to use a shorter cable length, it will be necessary to change the value of the 2200 Pf link series tuning capacitor. In general, the shorter the cable length, the greater will be the required tuning capacitance. In some cases there may be no series tuning capacitor required.

Technically, what happens is that as the value of the tuning capacitance is reduced, the link coil approaches the condition of series resonance. This causes the load resistance as seen by the RF source to decrease.

Because the SSQ-2F v3.10 and the PA1 amplifier (and most solid-state RF amplifiers) behave as voltage sources, as the load on the RF amplifier is decreased as the link coil approaches resonance, the output MOSFET transistor in the RF amplifier stage will try to supply the power demanded by the load. This will cause the output transistor to draw excessive current and fail. For this reason, when changing cable lengths it will be necessary to carefully monitor the DC power supply current drawn by the amplifier and adjust the DC supply voltage to the amplifier to provide sufficient output while not allowing the output transistor to draw enough current to fail.

In normal operation, the LC31S1 coupler system is operated with the series link tuning capacitor adjusted to a value such that that the circuit is tuned below resonance. This is the most favorable condition for the output amplifier in the SSQ-2F v3.10 or the PA1. Operating the system slightly below resonance allows the output transistor to operate at a higher voltage point but with a lower current. This results in reduced losses in the output transistor and decreases the heat the output transistor has to dissipate.

Coaxial cable length, series link tuning capacitor and TCS/TCP coaxial capacitor data for the 3.1 MHz link coil coupler:

When using a Cheb SSQ-PT - 1" x 14" or 1" x 16" SSQ-PT plasma tube, use external copper collar electrodes that have a length of 1.25 inches / 30 mm or electrodes that have a length of 2.25 inches / 45 mm in length:

- * The spacing between the inner edges of the electrodes should be approximately 9.25 inches / 235 mm.
- * Connect a 6-inch active length coaxial capacitor (Type TCS, **GREEN**) to the **BLUE** terminals of the LC31S1.
- * The connecting wires between the LC31S1 and the plasma tube electrodes should be 8 inch / 20.5 cm in length

When using the PA1 at low power or the SSQ-2F v3.10 - For coaxial cable lengths of 4.6 feet (56 inches) to 10 feet / 1.43 meters to 3 meters. Install a shorting jumper in place of the Mica capacitor on the LC31S1 RF input terminal block.

When using either the PA1 at low power or the SSQ-2F v3.10 - For coaxial cable lengths of 19 feet to 24 feet / 5.8 meters to 7.3 meters, use one series Mica capacitor with a value of 2200 pF. **THIS IS THE WAY THE LC31S1 IS SHIPPED.**

ALL LINK TUNING CAPACITORS SHOULD BE MICA CAPACITORS WITH A VOLTAGE RATING OF 500 VOLTS DC.

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 warranty against component failure. Breakage or overheating damage from soldering of components during assembly is not covered under warranty.

For all warranty claims or equipment service, 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

Ralph Hartwell

Spectrotek Services

641 Sisson Road
Natchitoches, LA
71457-6743
USA

318-527-6766

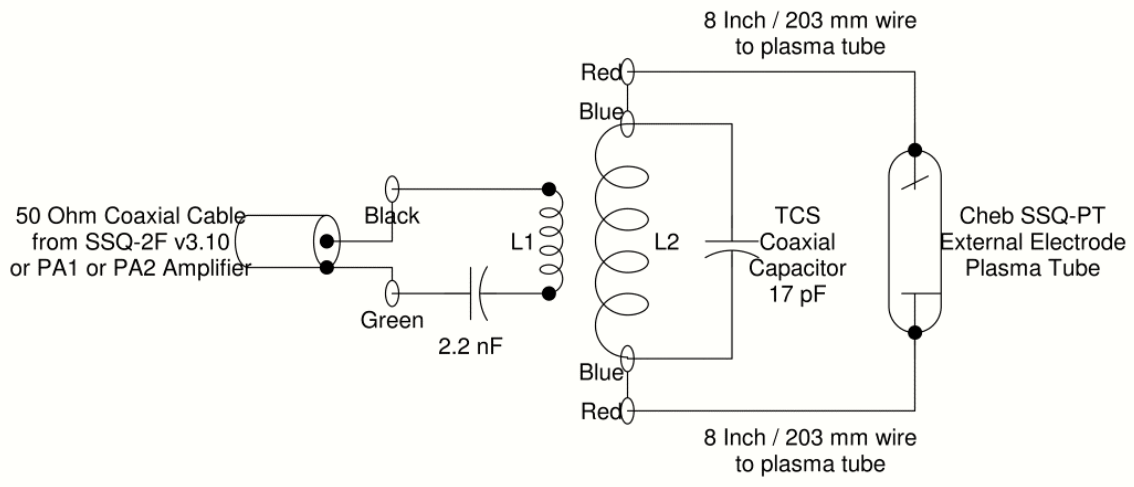
ralph@spectrotek.com

<http://rife-beam-ray.com>

<http://rifebeamray.com>

<http://w5jgv.com/rife>

RF Amplifier to Rife Tube Matching Network Type LC31S1
 Copyright (c) 2012 by Ralph M. Hartwell II
 V1.00 17 November 2012



NOTES:

The values specified here are for use with a 50 Ohm coaxial cable with a length of 24 feet / 7.35 meters between the RF source and the matching network. Using a different length of coaxial cable will require adjustment to the value of Coaxial Capacitor.

- L1 - 11 turns #14 THHN copper wire close wound over the center of L2.
- L2 - 94 turns # 18 enameled copper wire close wound on a 6" long x 2" diameter length of PVC pipe.

Figure 5

Schematic Diagram of the LC31S1 v1.00.



Edited by Cat