Collins S-Line

CW Full Break-In

System

By

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1.0 Scope

This document describes the modified Collins S-line QSK system that was designed by Dave Hallock KØAZJ (now WØSS) and published in Sept, 1970 QST. This paper supplements that article.

2.0 General

This circuit has been running on my S-Line for 25 years and a modified version on a Drake C-line for about as long. The system is fairly free of clicks or thumps in the receiver, but the keying shape control on the 32 S-3 has to be adjusted towards softer keying to accomplish this performance. Using a narrow receive filter will cause some clicks to appear when listening to your transmitted signal due to ringing and differential delay in the filter. If the receiver is fully muted and the keyer sidetone is used for monitoring, no clicks can be identified in the receiver.

2.1 Transmitter Spotting

Spotting using the CW spot button on the 32S-3 front panel is difficult because the QSK system senses that the keyline is active and tells the T/R switch to disconnect the receiver antenna. The CW spot level has to be turned fully advanced in order to hear the spot signal. This emits a fair signal that can be heard at least 10 miles away. To overcome this problem, a spot relay was added that disables the QSK switching process. The spotting level is adjusted by a potentiometer that is temporarily connected to the mixer key line. A push button spot switch can be mounted on your keyer paddles

2.2 Receiver Crystal Oscillator Driving the 32S-3

This warning is per a Collins service information letter. One disadvantage of the QSK system is that the 75S-3(x) crystal oscillator should not be used to drive the 32S-3 when using the receiver to monitor the transmitted signal. When listening to the 32S-3 transmitted signal, a mixing product is generated in the 75S-3(x) that is fed back to the transmitter via the crystal oscillator coax. This causes spurious sidebands to be transmitted. If the operator listens to the sidetone only, then the receiver crystal oscillator maybe used to drive the transmitter.

3.0 Technical

Comparing the modified circuit to the original published in QST, you will see that two transistors have been added to key the diode T/R switch. A small transformer is used to generate the 1KV diode blocking voltage. Rather than build a power supply, the 516F-2 800-volt supply may be tapped, and a voltage doubler rectifier connected to the 6.3 filament voltage can be used to supply several hundred milliamps of +12 VDC required for the switch.

3.1 High Voltage Transistors

Transistors Q6, 7, and 9 are high voltage types. In the last 30 years, technology has advanced to point that these devices are readily available. The component testing done in the article need not be done. Q6 and 7 are HV vertical output transistors NTE 2538 or NTE 396. They are rated at 400 volts.

Transistor Q9 that switches the HV for the TR switch is a horizontal output transistor NTE 238. The NTE 238 device is rated at 1500 volts. The NTE product line can be procured through a local electronic distributors or Mouser Electronics in Dallas.

4.0 TR Switch

The TR switch is connected to the transmitter output jack so when in the receive state both transmitter and receiver are connected to the antenna. It is advisable to connect the switch through a very short piece of coax to prevent signal “suck outs” caused by the transmitter tank circuit. Otherwise a length of coax will have to be found experimentally that does not exhibit this behavior. When the transmitter is keyed, the switch disconnects the receiver from the antenna and then reconnects it 7 milliseconds after transmitter is unkeyed. The switch, when built with proper shielding (see figure 4) will give over 100 dB of attenuation.

4.1 TR switch operation

Figure 3 is the schematic of the diode TR switch. The TR switch uses HV rectifier diodes type 1N4007 to perform the switching. The 1N4007 is a very slow device that turns into a large value resistor at frequencies above two or three kHz. When forward biased, the diodes have a very low resistance and pass RF frequencies with very little attenuation. As the system is keyed, the TR switch toggles between the receive and transmit states that are as described below.

Relay K1 disconnects the RF path from the switch to prevent damage when other radios are being used or the S-line is switched over to normal phone operation.

Approximately 1KV is used to block the diodes in transmit. This value will permit 1KW operation into a 2 to 1 SWR with margin.

4.1.1 Receive State

When Transistor Q9 (see figure 2, sheet two of QSK circuit) is biased on, the 1KV blocking voltage is dropped across R-19 and 20 to zero volts, and a ground is applied to the cathode end of T/R switch diodes D1 and D2. The diodes are forward biased by the 12 volt supply (120 milliamps). With D1 and D2 are forward biased, the receive signals are passed through to the 75S-3(x) receiver.

The voltage at the junction of L1, R5 and R3 will be approximately 2.0 volts which is not enough forward bias Q1, therefore D4 is reverse biased.

4.1.1 Transmit State (key down)

When the transmitter is keyed, transistor Q9 is biased off, which removes the ground from D1 and D2 and apples a 1KV blocking voltage to the diodes, thereby reverse biasing them. This opens the receive path to the 75S-3(x) receiver.

The voltage at the junction of L1, R5 and R3 will rise to approximately 12 volts, as this voltage rises past 3.3 volts, D3 will break down and Q1 will be forward biased when the voltage at this point exceeds approximately 4 volts. Q1 then provides a ground to the cathode of D4 which forward biases that diode. D4 and C7 form a RF short across the receiver antenna jack.

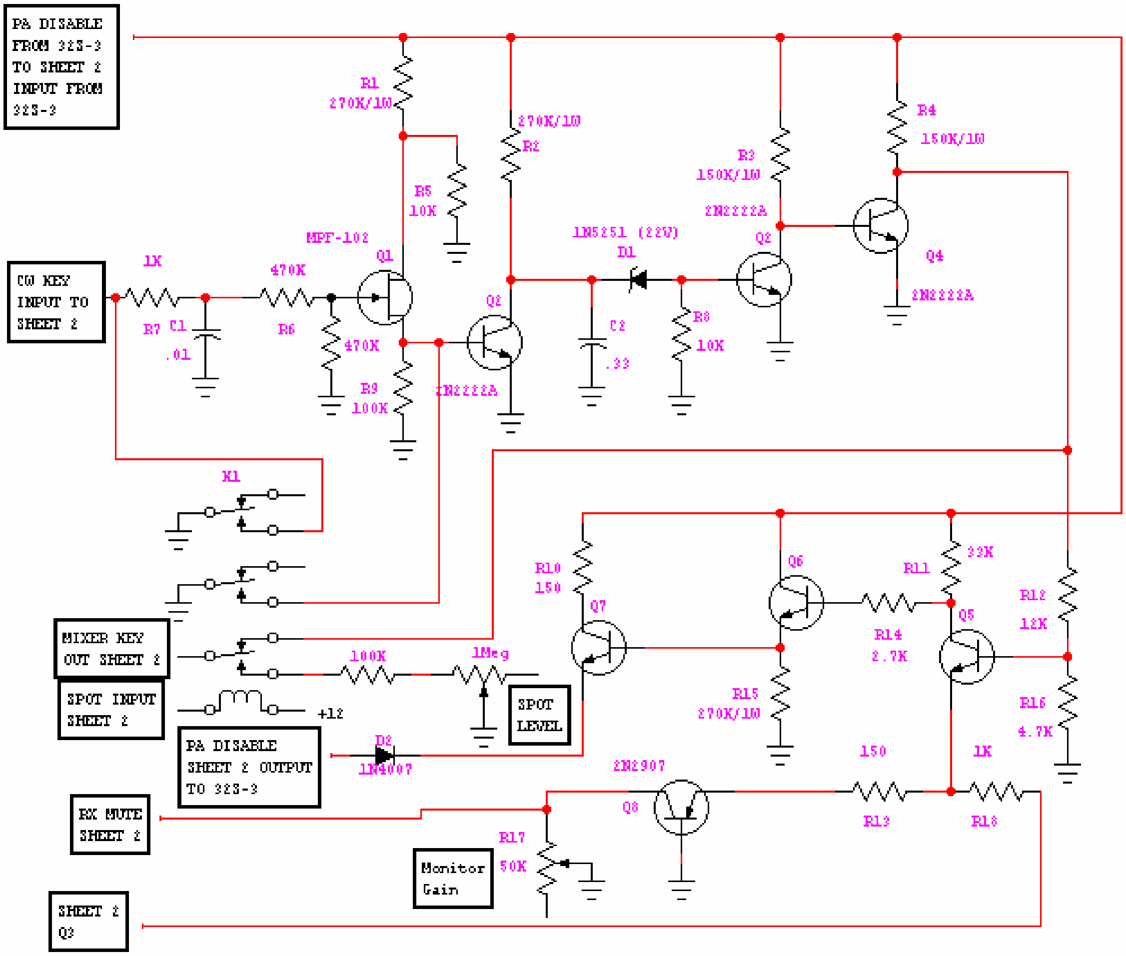

Figure 1
QSK Schematic
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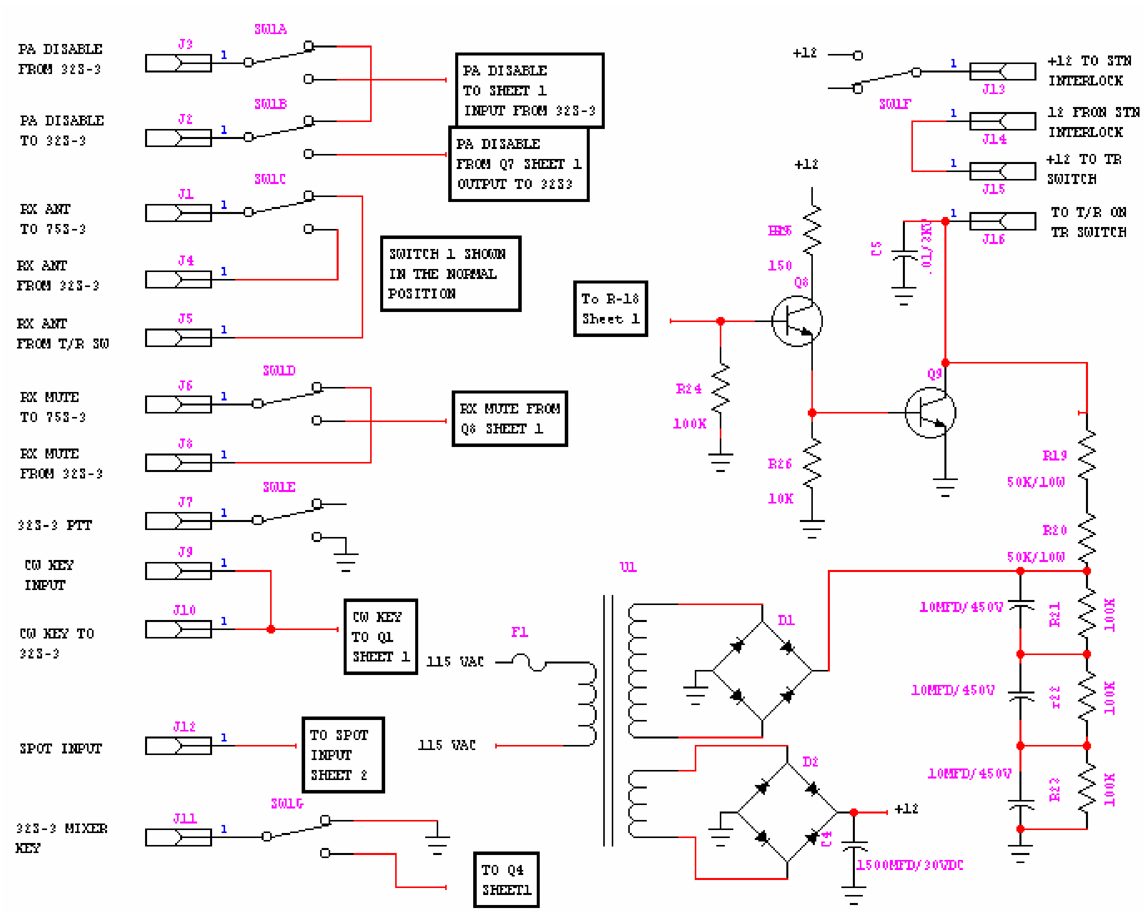

Figure 2
QSK Schematic
Page 2

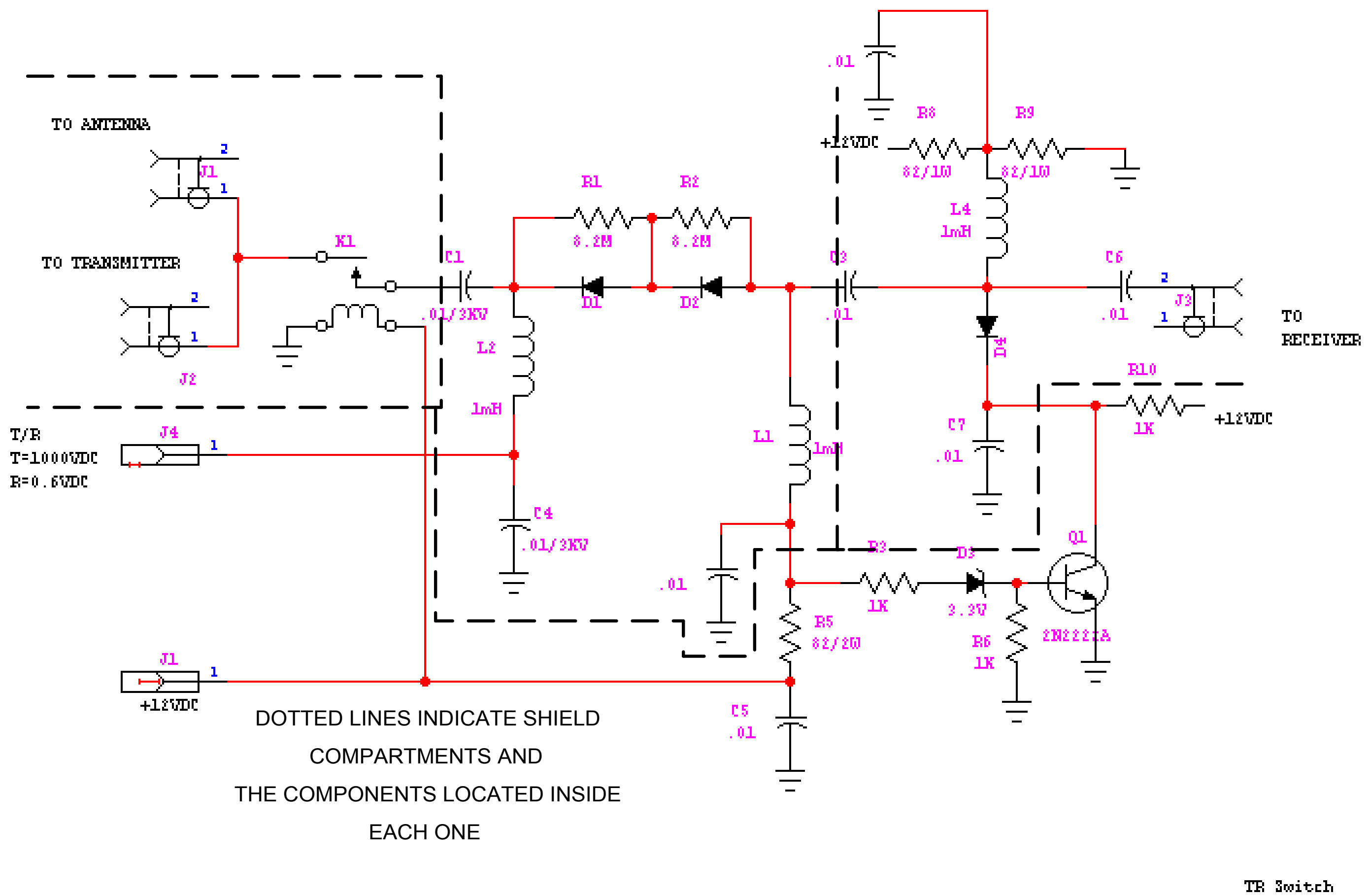

Figure 3
Diode TR Switch Schematic

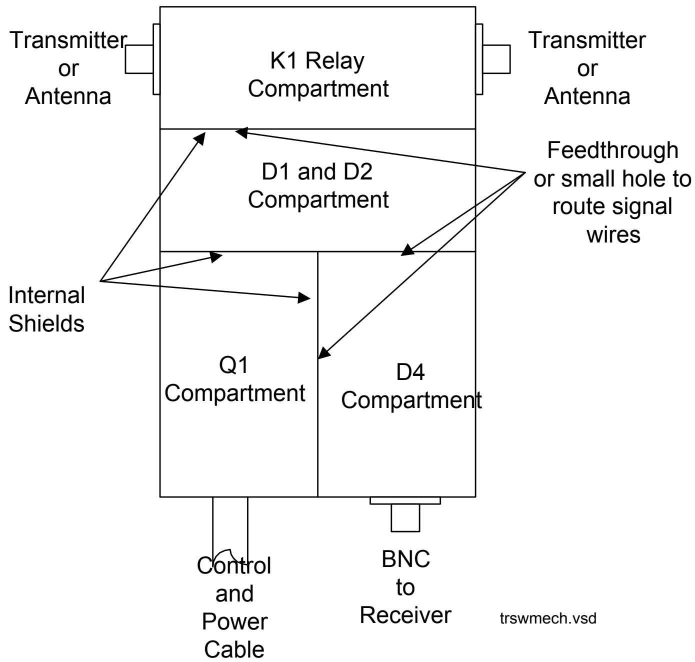

Figure 4
TR Switch layout

5.0 Construction

5.1 QSK Adapter

Construction of the QSK switching and timing circuits is not critical,. From the QST article, one can see the original was built to genuine "Basement Grade" quality practices. My adapter is built in a short S-line style cabinet that I found at the Cedar Rapids Hamfest quite a few years ago.

5.2 TR Switch

The TR switch is built in a cast aluminum box. Figure 4 shows the internal layout of the switch Small holes or feed through insulators are used to route the receive signal through each compartment.

6.0 Interconnect

Figure 5 is an example of the system interconnects wiring.

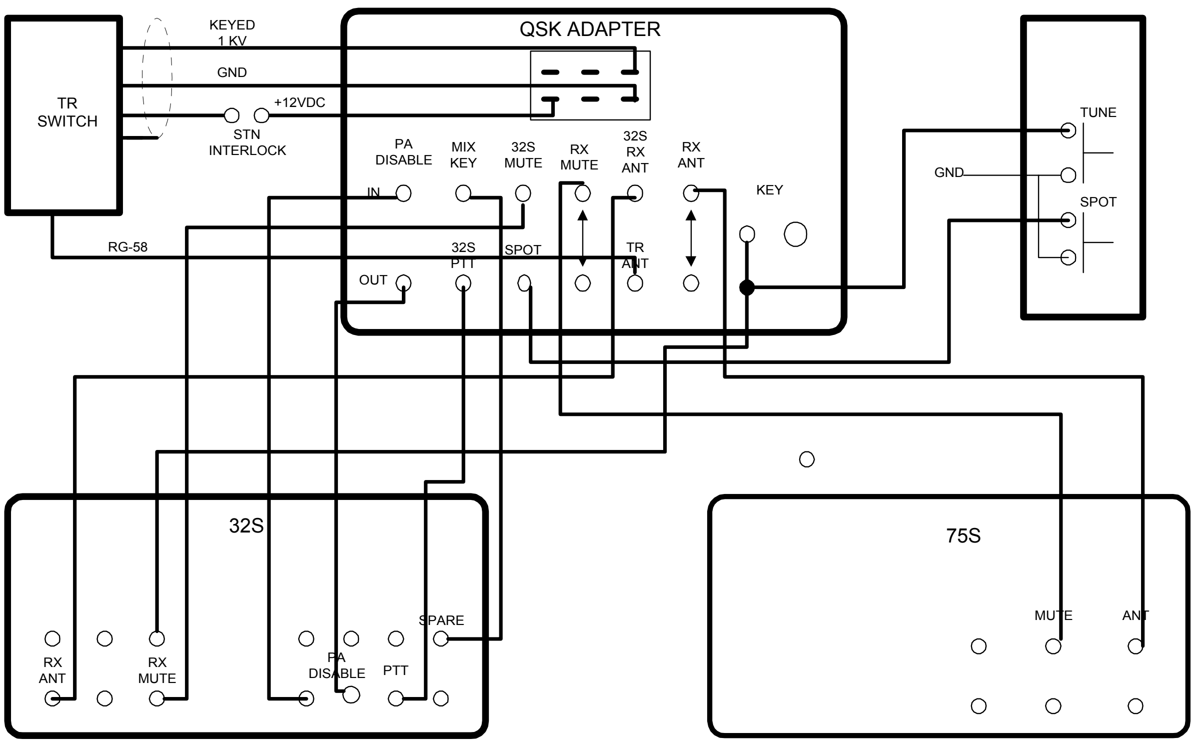

Figure 5
QSK System Interconnect