

# RA-160 T-4X/B PLUG-IN RELAY MODIFICATION KIT v2.1

## INSTALLATION INSTRUCTIONS

**WARNING: Voltages inside the radio CAN & WILL KILL YOU! You MUST know how to work around HIGH VOLTAGE safely. If you do not, get assistance from someone who does. You MUST also be able to read your specific radio schematic and understand the design, theory and wiring of your radio to properly perform this upgrade.**

### RA-160 T-4X/B PLUG-IN RELAY MODIFICATION KIT INSTALLATION

- ( ) **Read, re-read and fully understand these instructions prior to beginning this upgrade.** Make sure to perform the steps in the order they are listed. Also, be sure to label wires and/or connections as they are disconnected from various points inside the radio. This will help when the time comes to re-attach the wires and/or connections that will be disconnected during installation of the kit.
- ( ) Go through the Bill of Materials (BOM) and compare that list with the parts in the kit to make sure all parts are present. If you are missing any parts, please contact Harbach Electronics, LLC.
- ( ) Install one (1) #4-40 x 5/8" machine screw through each of the large holes in the new relay PC board (PCB). Attach each screw on the bottom side of the PCB using one (1) #4 lock washer and two (2) #4-40 hex nuts. Secure both screws by tightening both hex nuts.
- ( ) Install the relay socket on the top (silk screened) side of the new relay PC board (PCB) and solder on the bottom of the PCB. **Make sure the mounting screws described in the previous step have been installed prior to soldering the relay socket as the head of one of the mounting screws is directly under the relay socket!**
- ( ) Remove the top and bottom covers of the transmitter from the chassis.
- ( ) Remove the power amplifier (PA) cage. NOTE: PLATE and LOAD shaft couplers are friction-held and some force may be required to disconnect them.
- ( ) Remove two (2) screws holding the power connector and dress the power connector to one side for access to the relay. **USE CAUTION as not to break any leads from the power connector.**
- ( ) Remove four (4) screws attaching the SO-239 connector to the chassis. Carefully pull out the SO-239 connector to allow for unsoldering of the center pin. Unsolder the lead from the center pin and set the SO-239 connector aside.
- ( ) Compare the wiring of the original relay to the schematic diagram at the end of the instructions. If there are any differences, note these differences on the instructions. If a 100Ω resistor is connected between a relay terminal and the RCVR MUTE jack on the transmitter, note that it will not be reinstalled. Unsolder accessible armature and contact leads from the original relay.
- ( ) One of the mounting screws of the relay is under the PLATE control. It may be necessary to remove the rear mounting screw of the PLATE control and move it aside slightly to gain access to the relay mounting screw. Remove the two (2) relay mounting screws and carefully reposition the relay to gain access to the remaining unsoldered leads. Unsolder the ground lead at the ground lug. Unsolder the green/white lead at the relay. Remove the relay.
- ( ) Remove the original relay. **Be sure to save the two (2) brass washers when removing the relay as they will re-used later.**

- ( ) Prepare the new relay PCB by soldering colored #22 wire leads to the following holes:

Y	4" #22 YELLOW
R	4" #22 RED
W	4" #22 WHITE
GY1	4" #22 GRAY
GY2	4" #22 GRAY
BL	4" #22 BLUE
V	4" #22 VIOLET
BK	4" #22 BLACK
G	4" #22 GREEN

Holes marked B1, B2 and B3 will be connected later.

- ( ) Slide a small length of spaghetti tubing (approximately 1") on to the lead coming from the LOAD control. You can use either size spaghetti tubing, whichever works best for your radio. This lead enters the relay area through a grommet in the chassis. Carefully bend this lead so that it will enter the hole labeled B2 on the new relay PCB as it is installed.
- ( ) Install the new relay PCB and align to allow the mounting screws to pass through the old relay mounting grommets. Install two (2) brass washers removed earlier, two (2) #4-40 hex nuts, one on each mounting screw, and tighten.
- ( ) Dress the solid LOAD control lead through the hole labeled B2 and solder. Trim the lead as needed. Make sure the lead does not short to another connection or bind.
- ( ) If the PLATE control was moved in an earlier step, reposition the PLATE control, install the ground lug and secure with mounting screw.
- ( ) Dress the black lead from the hole labeled BK on the new relay PCB along the chassis and solder to the ground lug.
- ( ) Unsolder the bare wire at the RCVR ANT jack and discard. Carefully bend the center conductor contact on the RCVR ANT jack away from the ground terminal and toward the hole labeled B3 on the new relay PCB. Connect a piece of #22 solid wire covered with a piece of #19 spaghetti tubing from the RCVR ANT jack to the hole labeled B3 and solder both ends.
- ( ) Reinstall the SO-239 connector removed earlier. Cut a 2-1/2" piece of #18 solid wire and slide a 2" piece of #16 spaghetti tubing over the wire. This wire will connect between the hole labeled B1 and the SO-239 connector. Before soldering this wire, bend to fit as necessary. Solder both ends.
- ( ) Cut the supplied 8-position terminal strip in half to make two (2) four-position strips. Mount the two (2) terminal strips as shown in the diagram using the supplied #6-32 self-tapping screw. **DO NOT over tighten the screw.** Choose a chassis hole that will mount the terminal strips close to the new relay PCB.
- ( ) Unsolder the bare wire from the RCVR MUTE jack and discard. Connect the gray lead from the hole labeled GY1 on the new relay PCB to the RCVR MUTE jack and solder.
- ( ) Connect the remaining leads from the new relay PCB to the terminal strips as shown in the diagram below in the following order, gray (GY2), blue (BL), white (W), red (R), yellow (Y) and green (G). Clip the bare wire at the power detector board and connect the violet wire from the hole labeled V on the new relay PCB and solder.
- ( ) Reinstall the power connector removed earlier.
- ( ) Install the new plug-in relay into the socket and install the relay retainer clip over the relay body. NOTE: It will be a tight fit and difficult to get the clip in its proper position.

- ( ) Remove the wire from pin 6 of the 6EV7 tube socket.
- ( ) Solder one end of the 1.5 k $\Omega$  2-watt resistor to pin 6 of the 6EV7 socket.
- ( ) Solder the other end of the 1.5 k $\Omega$  2-watt resistor and the wire removed from pin 6 of the 6EV7 socket to pin 9 of the 6EV7 socket.
- ( ) Recheck all solder connections and dress all wire leads as needed.
- ( ) Reinstall the PA cover and top and bottom covers.

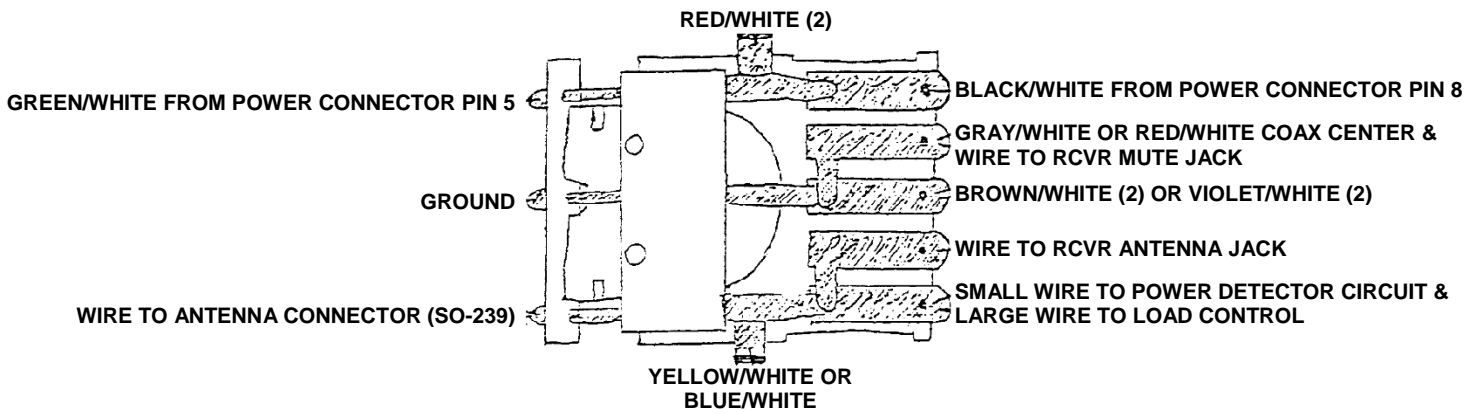
This completes the installation of the RA-T4X/B Plug-In Relay Modification Kit.

<b>RA-160 BILL OF MATERIALS (BOM)</b>				
<b>Verification</b>	<b>Part Number</b>	<b>Quantity</b>	<b>Description</b>	<b>Designation</b>
[ ]	LUG-105	1	8-Position Terminal Strip	N/A
[ ]	NUT-103	6	#4-40 Hex Nut	N/A
[ ]	PCB-160	1	T-4X/B Plug-In Relay PCB v2.0	N/A
[ ]	RES-800	1	1.5K $\Omega$ 2W Resistor	N/A
[ ]	RY-TR4C	1	4PDT Plug-In Relay	K1
[ ]	SCR-160	2	#4-40 x 5/8" Machine Screw	N/A
[ ]	SCR-161	1	#6 x 1/4" Self-Tapping Screw	N/A
[ ]	SKT-150	1	4PDT Relay Socket	N/A
[ ]	SKT-151	1	Relay Retainer Clip	N/A
[ ]	TUB-150	6	#16 Spaghetti Tubing	N/A
[ ]	TUB-160	6	#19 Spaghetti Tubing	N/A
[ ]	WAS-160	2	#4 Lock Washer	N/A
[ ]	WIR-102	4	#22 Stranded Black Wire	N/A
[ ]	WIR-107	4	#22 Stranded Blue Wire	N/A
[ ]	WIR-108	4	#22 Stranded Red Wire	N/A
[ ]	WIR-109	4	#22 Stranded Yellow Wire	N/A
[ ]	WIR-110	4	#22 Stranded Green Wire	N/A
[ ]	WIR-115	6	#18 Solid Bare Wire	N/A
[ ]	WIR-116	6	#22 Solid Bare Wire	N/A
[ ]	WIR-117	4	#22 Stranded Violet Wire	N/A
[ ]	WIR-118	8	#22 Stranded Gray Wire (2 x 4" Pieces)	N/A
[ ]	WIR-119	4	#22 Stranded White Wire	N/A

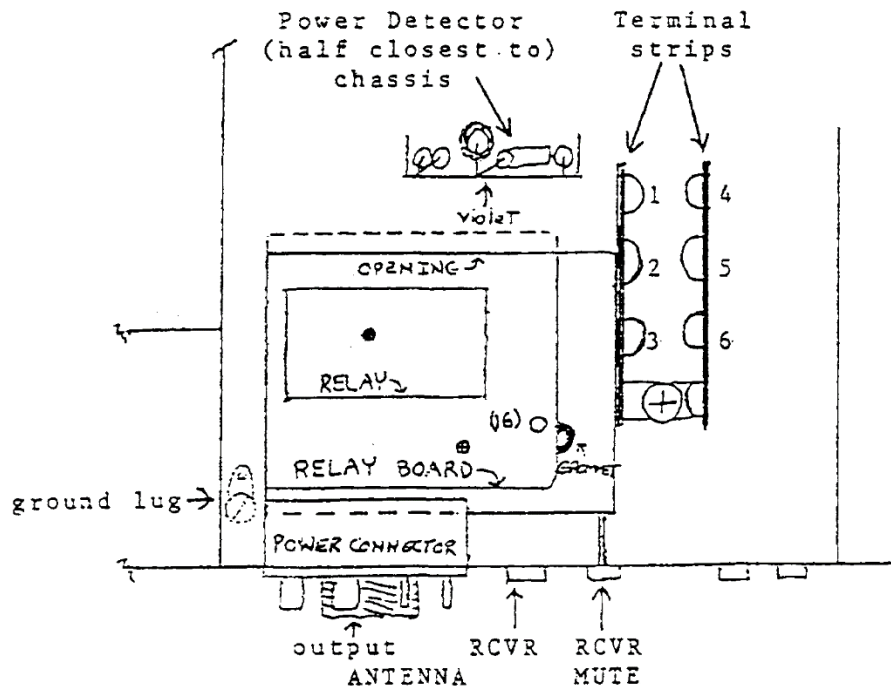
## TERMINAL STRIP/RELAY WIRING CODE

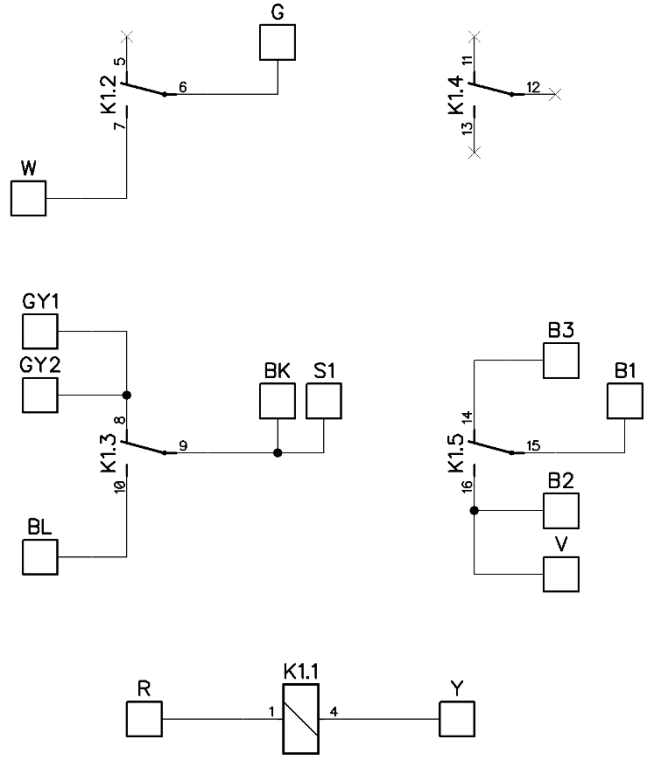
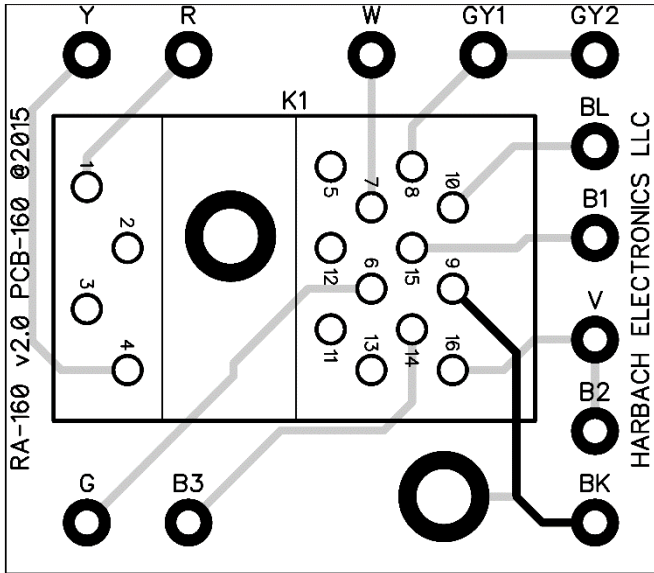
TERMINAL STRIP POSITION	NEW RELAY ADAPTER BOARD	OLD RELAY WIRING
1	WHITE (W)	BLACK/WHITE
2	RED (R)	RED/WHITE (2)
3	YELLOW (Y)	YELLOW/WHITE OR BLUE/WHITE
4	GRAY (GY2)	GRAY/WHITE OR RED/WHITE COAX CENTER
5	BLUE (BL)	BROWN/WHITE (2) OR VIOLET/WHITE (2)
6	GREEN (G)	GREEN/WHITE

## ORIGINAL T-4X & T-4XB RELAY WIRING



## BOTTOM VIEW OF T-4X & T-4XB RELAY AREA





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