

Multi-Key v2.4

Multi-Function Amplifier Keying Interface

ASSEMBLY & OPERATION INSTRUCTIONS



INTRODUCTION

The Harbach Electronics, LLC Multi-Key is a multi-function external device designed for the safe interface of modern transceivers and RF amplifiers. For those that prefer an external interface to those that mount inside the amplifier, such as the SK-220 or SK-201 for the Heathkit SB-220 and SB-201 series of amplifiers, this kit fits the bill! You can now interface any amateur transceiver with any amplifier safely and quickly. The Multi-Key features 2 solid state relays capable of switching loads of 200 peak volts DC or AC at 250mA of current. It also has 2 accessory jacks for control of other devices, such as an ON-AIR sign or a Dow-Key relay. The possible uses for the accessory connections are endless! The accessory ground-isolated outputs can safely switch 220VDC or 250VAC at 3A of current.

PRINTED CIRCUIT BOARD ASSEMBLY INSTRUCTIONS

- () **Read, re-read and fully understand these instructions prior to beginning assembly and use of the Multi-Key. Make sure to perform the steps in the order they are listed.**
- () 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.
- () NOTE: All components are installed on the top (silk screened) side of the printed circuit board (PCB) and are soldered on the bottom side of the PCB. There is no right or wrong sequence for soldering the components to the PCB. The sequence below is just a suggested sequence that works well.
- () Install diodes D1-D2 (1N4005) flat to the PCB. The banded end of the diode (cathode) matches banded end of the silk screen on the PCB.
- () Install resistors R1-R6 flat to the PCB. Resistor color codes are listed in the table below.

PCB Designation	Value	Color Code
R1, R2, R6	220 Ω 1/4W	Red-Red-Brown-Gold
R3	2.4K Ω 1/4W	Red-Yellow-Red-Gold
R4	24K Ω 1/4W	Red-Yellow-Orange-Gold
R5	130 Ω 1/4W	Brown-Orange-Brown-Gold

- () Install solid state relays IC1 and IC2 (PLA140). NOTE: Make sure the notch on the body of the IC chip lines up with the notch in the outline on the PCB. **These are static-sensitive devices; make sure to ground yourself before touching and installing them.**
- () Install transistor Q1 (2N3906BU) and voltage regulator U1 (L78S05CV). Note the outline of the components on the silk screen. The middle leg (B) of transistor Q1 is bent slightly away from the other 2 legs when inserting the transistor into the PCB.
- () Install ceramic capacitors C1, C2 and C4-C6. The code is printed in one side of the capacitor.

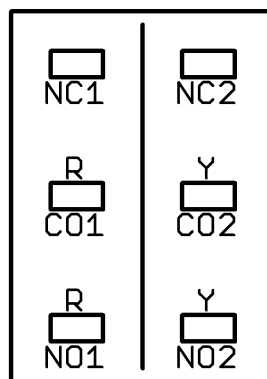
PCB Designation	Value	Capacitor Value Code
C1	0.33 μ F 50VDC	334
C2	0.1 μ F 50VDC	104
C4-C6	0.01 μ F 200VDC	103

- () Install the 2.5mm x 5mm coaxial DC power jack J1 and the 3-position terminal block TB1 (AUXTB). The side with the large square holes faces the rear of the PCB.
- () Install RCA phono jacks J2 (RADIO), J3 (AMP1), J4 (AMP2) J5 (AUXRCA) and DPDT relay K1 and 2-pin jumper JP1.
- () Install electrolytic capacitor C3 (220 μ F 50VDC). **The negative lead of C3 is shorter than the positive lead. There is also a stripe on the side of C3 that denotes the negative lead.**
- () Clean the flux from the rear of the PCB with isopropyl alcohol and Q-tips and then inspect each solder connection using a magnifying glass. Pay particular attention to component ground connections; make sure solder has flowed onto the PCB ground plane and isn't beading up on the pad.
- () Place the 2-pin shunt over the 2 pins on JP1 to enable the isolated relay and terminal block outputs (J5 and TB1). If you wish to disable the isolated relay and terminal block outputs, remove the shunt from JP1.
- () This complete assembly of the PCB. Set the PCB aside.

ENCLOSURE & FRONT PANEL ASSEMBLY INSTRUCTIONS

- () Press LED1-GREEN (POWER), LED2-RED (XMIT) and LED3-GREEN (READY) from left to right through the 0.25" holes in the front panel from the front side of the panel. Note: You may have to use a small razor knife to slightly ream the holes. Spin the razor knife once or twice on the front and back edges of each hole. This will help the LEDs snap into place.
- () Press rocker switch S1 through the square hole in the front panel from the front side of the panel. There is no mounting orientation as the switch will be connected to the PCB later.
- () Strip, tin and solder two (2) 6-1/2" red (R) and two (2) 6-1/2" yellow (Y) #22 wires to the solder lugs on the back of the rocker switch according to the diagram below. Note: The diagram shows the wire connections looking at the back of the rocker switch with the switch in the OFF or down position. NOTE: Connections NC1 & NC2 will not be used.

TOP OF SWITCH



FRONT PANEL WIRING & FINAL ASSEMBLY INSTRUCTIONS

- () Strip, tin and solder the other ends of the red and yellow wires from the rocker switch to the corresponding holes in the PCB (CO1, NO1, CO2 & NO2). The switch connections are located in a square silk screen labeled S1 on the PCB. Trim wire length as necessary as extra wire has been provided.
- () Solder the positive (red) and negative (black) leads of LED1-G, LED2-R and LED3-G to their corresponding pads on the PCB. The positive (red) lead connects to the round pad and the negative (black) lead connects to the square pad. Trim lead length as necessary as the LED leads are very long.
- () Slide the front and rear panels into their respective mounting grooves in the bottom half of the enclosure.
- () Set the PCB on the mounting risers in the bottom half of the enclosure so that the phono connectors on the rear of the PCB protrude slightly through the rear panel. NOTE: The bottom half of the enclosure has two (2) holes on the bottom for attaching the top and bottom halves of the enclosure together.
- () Attached the PCB to the bottom half of the enclosure using four (4) #6-1/4" screws. DO NOT over tighten!
- () Slide the top half of the enclosure over the front and rear panels so that the panels engage in their respective mounting grooves.

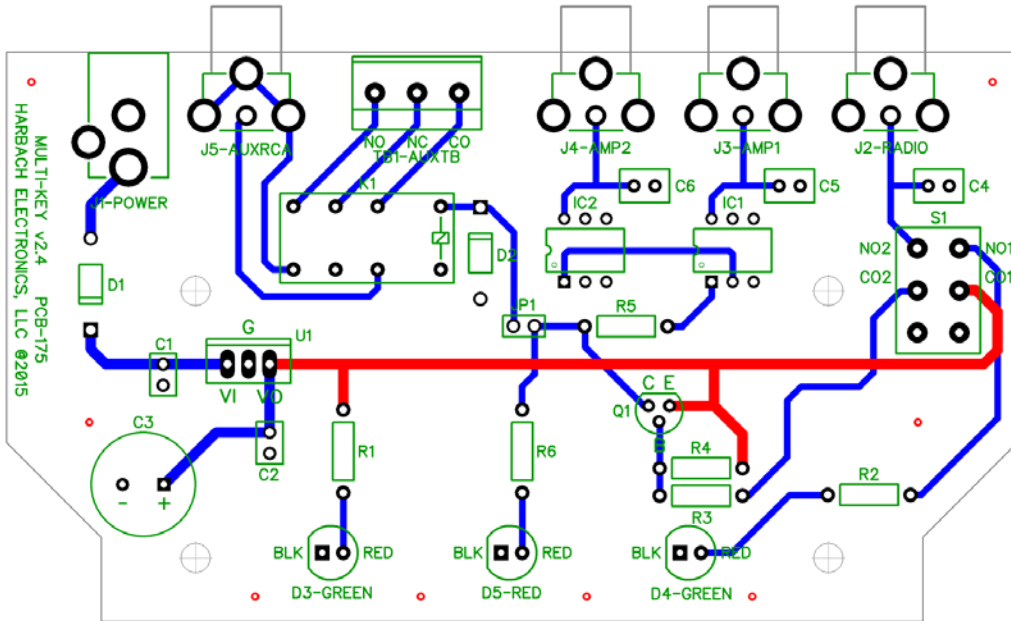
- () Attached the bottom and top halves of the enclosure together using two (2) M3 0.5 x 10mm screws.
- () Attached the four (4) adhesive-backed rubber feet to the bottom of the case at the corners.
- () Connect the 2.5mm x 5mm power plug onto a user-supplied 2-conductor cable to make the power cable. NOTE: The center connection on the power plug is positive (+)!
- () Attach the positive and negative leads of the power cable to a suitable 9-16VDC supply. This could be a DC output wall wart or a station DC power supply.
- () This completes the assembly of the Multi-Key. Make sure the rocker switch is in the down (STDBY) position before applying power to the Multi-Key.

INITIAL SETUP & OPERATION OF THE MULTI-KEY

WARNING: If your amplifier requires more than 250mA of keying current, then **ONLY** the auxiliary relay contacts (J5) should be used. (Note: Dentron amplifiers require approximately 200-250 mA of keying current, depending on the model)

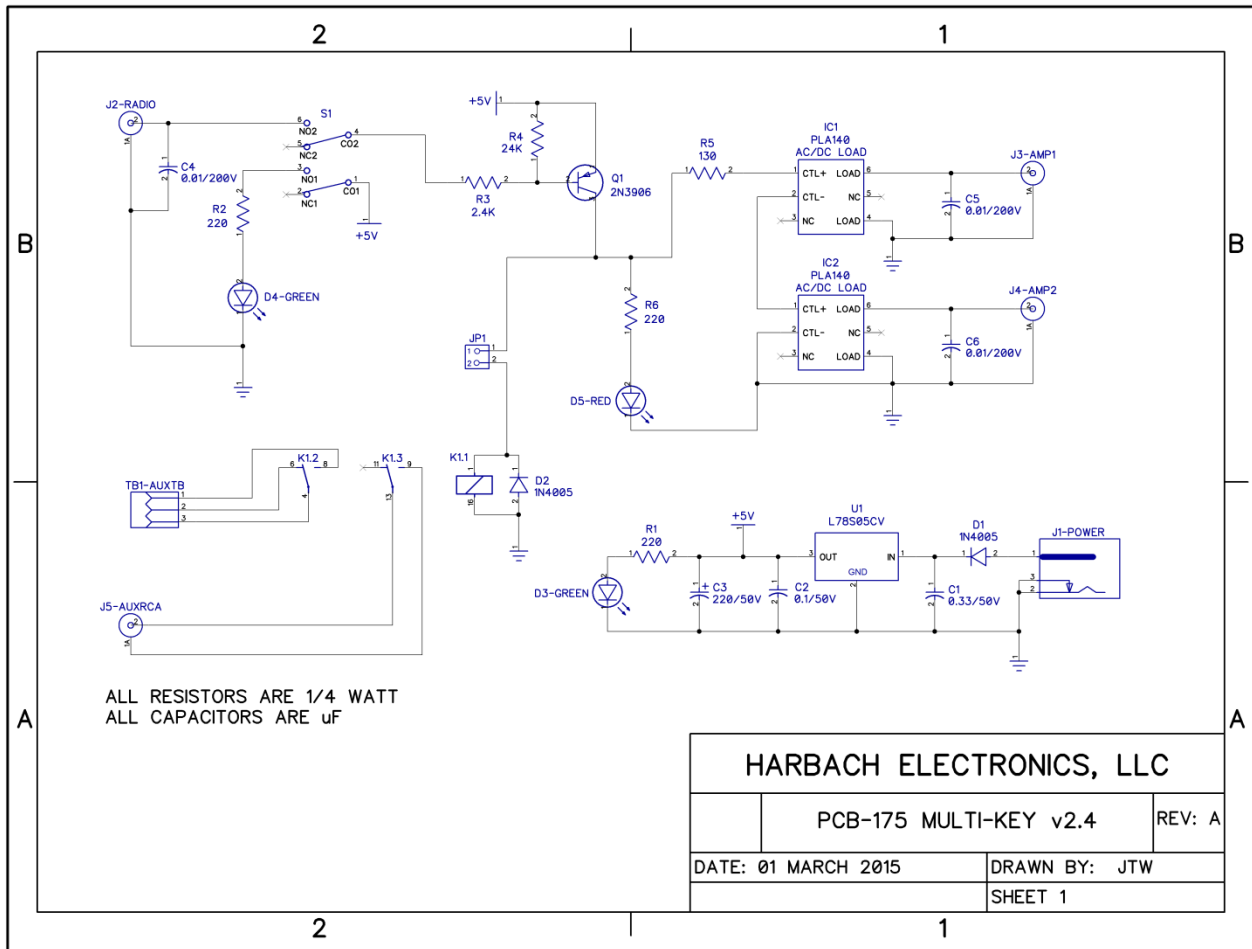
- () Insert the power plug into the power jack at the rear of the Multi-Key. The green POWER LED should illuminate.
- () The rocker switch is used to select either **STANDBY** or **OPERATE** mode. Move the rocker switch to the **OPERATE** position. The green **READY** LED should illuminate. This is especially convenient for amplifiers that do not have a standby switch. Move the rocker switch back to the **STANDBY** position. The green **READY** LED should go off.
- () Connect the RADIO connector on the Multi-Key to the amplifier keying/control jack of the transceiver using a 2-conductor cable with an RCA phono plug on one end of the cable for the connection to the Multi-Key and whatever connector your transceiver requires on the other end of the cable. The center pin of the RADIO RCA phone jack on the Multi-Key should be connected the center pin of the keying/control jack of the transceiver. This is normally called TX-GND or GROUND-ON-TRANSMIT. Consult the operator's manual for the proper connections. The outer ring (ground) of the RADIO RCA phono jack should be connected to the ground connection of the transceiver keying/control jack. **A standard 2-conductor (shielded) RCA patch cable will work well for this application. Leave the RCA plug on one end of the cable and replace the RCA plug on the other end of the cable with the connector for the transceiver.**
- () Connect the AMP1 or AMP2 connector on the Multi-Key to the keying jack on the amplifier using a cable with an RCA phono plug on one end for the connection to the Multi-Key and whatever connector the amplifier requires on the other end of the cable. The center pin of the AMP1 or AMP2 jack on the Multi-Key should be connected the center pin of the amplifier keying jack and the outer ring (ground) of the AMP1 or AMP2 jack should be connected to the ground connection of the amplifier keying jack. **A standard 2-conductor (shielded) RCA patch cable will work well for this application. Leave the RCA plug on one end of the cable and replace the RCA plug on the other end of the cable with the connector for the amplifier, if required. Most amplifiers will have an RCA phono jack for this connection so no modification of the cable will be required.**
- () Move the rocker switch to the **OPERATE** position. When you key your radio to transmit (and the green **READY** LED is illuminated), the amplifier and/or other devices connected to the Multi-Key will operate and the red **XMIT** LED will illuminate. When you unkey transceiver, the red **XMIT** LED will turn off. This LED lets you know the Multi-Key is working properly.
- () If you choose to use either or both of the ground-isolated, relay-controlled accessory outputs (RCA phono jack [**AUXRCA**] or terminal block [**AUXTB**]), these outputs will operate simultaneously with the **AMP1** or **AMP2** outputs.

PRINTED CIRCUIT BOARD LAYOUT (COMPONENT-SIDE VIEW)



RED traces are on the component side of the PCB and **BLUE** traces are on the solder side of the PCB

SCHEMATIC DIAGRAM



BILL OF MATERIALS

Verification	Part Number	Quantity	Description	Designation
[]	C320C334M5U5TA	1	0.33µF 50VDC Multi-Layer Ceramic Capacitor (334)	C1
[]	C322C104K5R5TA	1	0.1µF 50VDC Multi-Layer Ceramic Capacitor (104)	C2
[]	UVZ1H221MPD	1	220µF 50VDC Aluminum Electrolytic Capacitor	C3
[]	C320C103K2R5TA	3	0.01µF 200VDC Multi-Layer Ceramic Capacitor (103)	C4-C6
[]	1N4005	2	600 PIV 1A General Purpose Rectifier	D1, D2
[]	PLA140	2	PCB Mount Solid State SPST Relay 6-Pin DIP	IC1, IC2
[]	KLDX-0202-B	1	2.5mm x 5mm PCB-Mount DC Power Jack	J1
[]	161-0360-E	4	PCB-Mount RCA Phono Jack	J2-J5
[]	5-146278-2	1	2-Pin Jumper	JP1
[]	V23105A5001A201	1	PCB-Mount 5VDC DPDT Relay	K1
[]	SSI-LXH600GD-150	2	5mm Green LED Panel Mount Indicator with 6" Leads	LED1, LED3
[]	SSI-LXH600ID-150	1	5mm RED LED Panel Mount Indicator with 6" Leads	LED2
[]	2N3906BU	1	PNP Transistor General Purpose	Q1
[]	291-220-RC	3	220Ω 1/4W Resistor (Red-Red-Brown-Gold)	R1, R2, R6
[]	291-2.4K-RC	1	2.4KΩ 1/4W Resistor (Red-Yellow-Red-Gold)	R3
[]	291-24K-RC	1	24KΩ 1/4W Resistor (Red-Yellow-Orange-Gold)	R4
[]	291-130-RC	1	130Ω 1/4W Resistor (Brown-Orange-Brown-Gold)	R5
[]	62112421-0-0-N	1	DPDT Rocker Switch	S1
[]	39880-0303	1	3-Circuit Terminal Block	TB1
[]	L78S05CV	1	5 VDC 2A Linear Voltage Regulator	U1
[]	2-382811-1	1	2-Pin Jumper Shunt	NA
[]	171-PA5525-1-E	1	2.5mm x 5mm DC Power Plug	NA
[]	1598BSGY	1	5-1/4" x 5-1/4" ABS Plastic Enclosure	NA
[]	NA	1	Milled & Silk-Screened Plastic Front Panel	NA
[]	NA	1	Milled & Silk-Screened Plastic Rear Panel	NA
[]	NA	2	M3 0.5 x 10mm Slotted Cover Screws	NA
[]	NA	4	#6-1/4" Phillips PC Board Mounting Screws	NA
[]	NA	4	Rubber Feet	NA
[]	NA	2	6-1/2" #22 Red Wire	NA
[]	NA	2	6-1/2" #22 Yellow Wire	NA

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