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# Remote Access Controller Assembly Instructions

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## Introduction

This document describes the functions of the RAC/UTB and how to assemble it.

## Revision History

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# 1 OVERVIEW

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The Remote Access Controller/Universal Transformer Board (RAC/UTB) fills the need to couple the dispatcher's train line to another line for remote access or couple a telephone line to an audio amplifier. The RAC/UTB offers a choice of transformers, DC blocking capacitors, switch and relay pads and optional RJ25 style connectors to support almost any telephone to audio configuration.

Options:

- Transformer for terminating a phone line or "dry" (no DC) audio connection
- DC Blocking capacitor on line 1 or 2 as needed
- Connection by manual switch, relay or always in circuit
- Screw terminals and/or RJ25 (one connector per line or both lines on one connector)

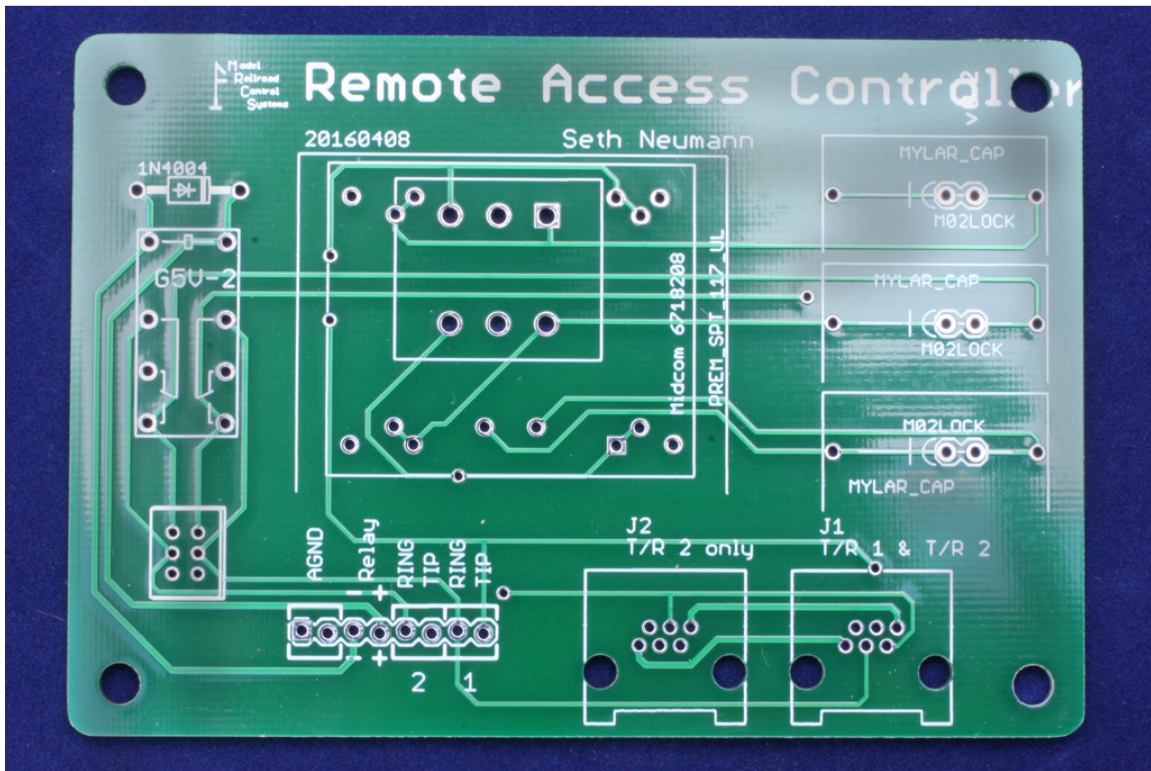
We offer the RAC/UTB as a bare board and in two assembled and tested configurations:

- Bare board
- Equipped with a Triad TY-145p (no DC) transformer, blocking capacitor and 8 position screw terminal block. Use this configuration for coupling to an external amplifier
- Equipped with a Midcom 671-8208 (DC terminating) transformer, blocking capacitor on line 2, 24 Volt Relay for remote control of connection, and 8 position screw terminal block. Use this configuration for coupling a Dispatcher's Train Line to another line

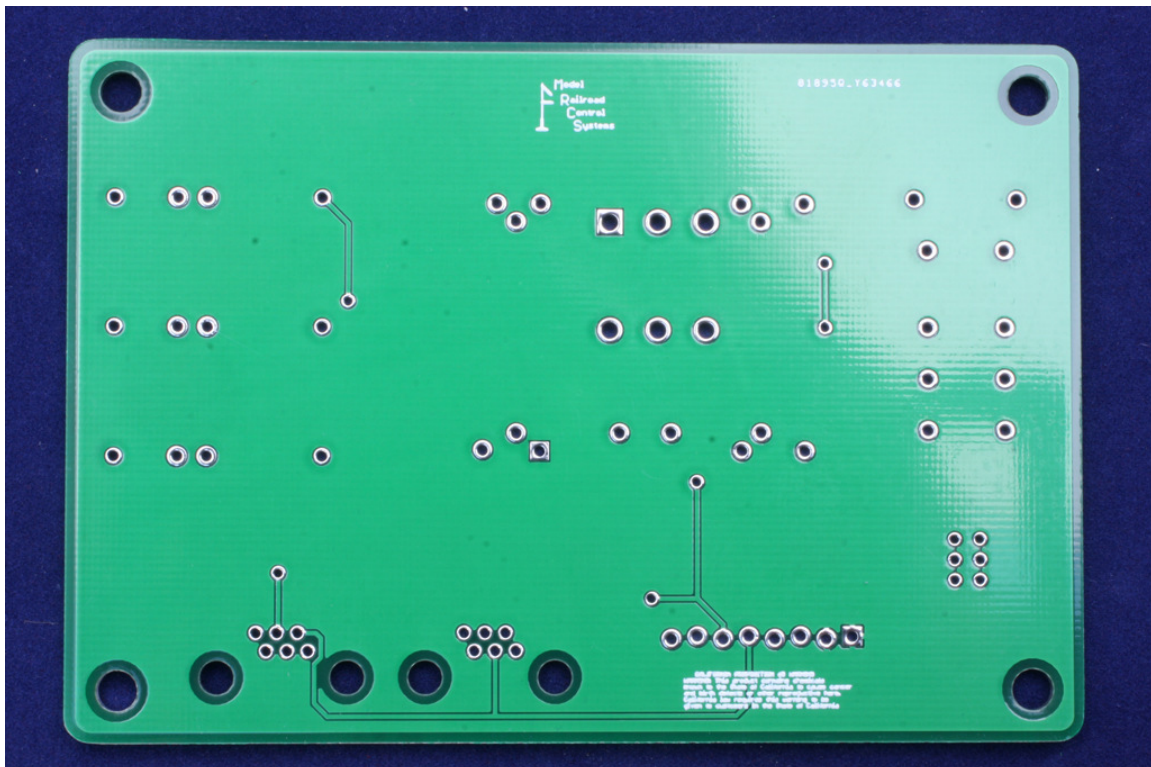
All components are through-hole for ease of assembly and repair.

Pads for I/O connections are standardized on .100" centers. This provides a wide range of interconnect options and components. Port connection options include screw terminal blocks, header pin connectors (male and female), soldered right angle headers, and direct soldered wires. Auxiliary connectors are provided on RJ11 (for tip, ring and second pair).

You can assemble one of the standard configurations or populate the RAC/UTB to meet your own requirements. Please contact us at [seth@modelrailroadcontrolsystems.com](mailto:seth@modelrailroadcontrolsystems.com) for a quote on a custom configuration if you don't want to assemble it yourself.



**Figure 1 - RAC/UTB Top View**



**Figure 2 - RAC/UTB Bottom View**

## 2 HOW TO CONFIGURE YOUR RAC/UTB

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We've laid the RAC/UTB out to accept two kinds of transformers (there are pads for a third, but that is for a future application), an audio transformer that is not intended to have direct current (DC) applied to it (this configuration is sometimes referred to as "dry" or "non-terminating") and a telephone style transformer that can handle direct current and can terminate a telephone line. The transformers are:

Audio only (non-terminating)	Triad TY-145P
Telephone line (terminating)	Midcom 671-8208

**Table 1 - Transformer Options**

We recommend the terminating option where the intent is to couple one or more telephone lines such as a dispatcher's train line fed by our EBF31A and line derived from an analog terminal adapter (cable box, internet phone line) or behind some approved device such as a home or small office PBX. **NOTE THE RAC/UTB DOES NOT HAVE FCC PART 68 CERTIFICATION AND SHOULD NOT BE CONNECTED DIRECTLY TO A LAND LINE.** The RAC/UTB should be set up to terminate the line towards the public network, and optionally can terminate the dispatcher's train line. See "Connections" below for information.

If you want to transformer couple from a phone line or across the receiver leads of a phone, (the R and GN terminals on a 425 speech network), then a non-terminating transformer will do. If you are coupling to a telephone line, be sure to use a blocking capacitor to keep DC out of the transformer. (The telephone network gives you a dry connection if you are connecting across R and GN).

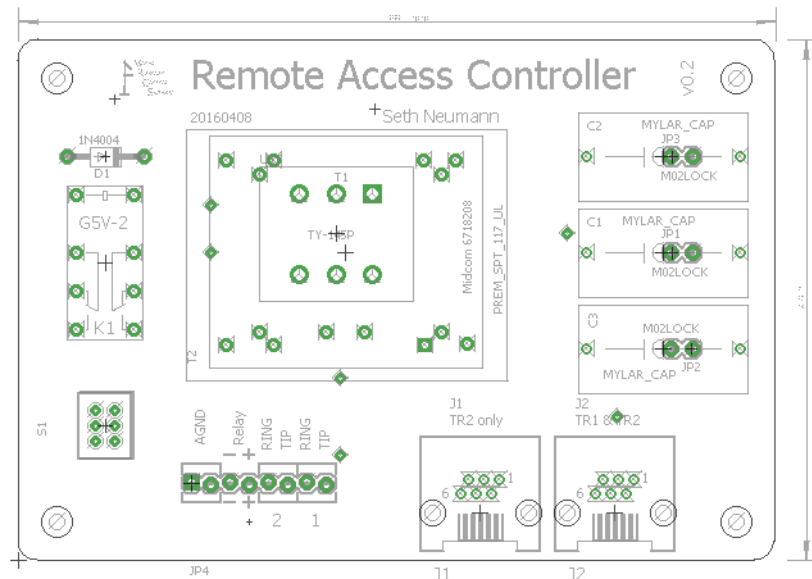
If you want a permanent connection, you can use wire across the switch or relay pads. If you want to be able switch the transformer in or out (to make or release the connection to the cable box) you'll want to use either switch 1 or the relay.

All connections (line 1, line 2 and the relay coil) are brought out to the 8 position screw terminal. Optional RJ25 connectors can be installed to bring two lines in either each on their own connector (J1 & J2) or as pairs 1 and 2 on the RJ25 (J1 only).

Non-terminating	Terminating	DC-Blocking on T1/R1	DC-Blocking on T2/R2	Switched	Non-Switched
T1 – Triad TY-145		C2 (if not blocked jumper JP3)	C1 (if not blocked jumper JP1)	S1 or Relay+D1	S1 jump center to top on both sides
	T3 – Midcom 671-8208	C2 (if not blocked jumper JP3)	C1 (if not blocked jumper JP1)	S1 or Relay+D1	S1 jump center to top on both sides

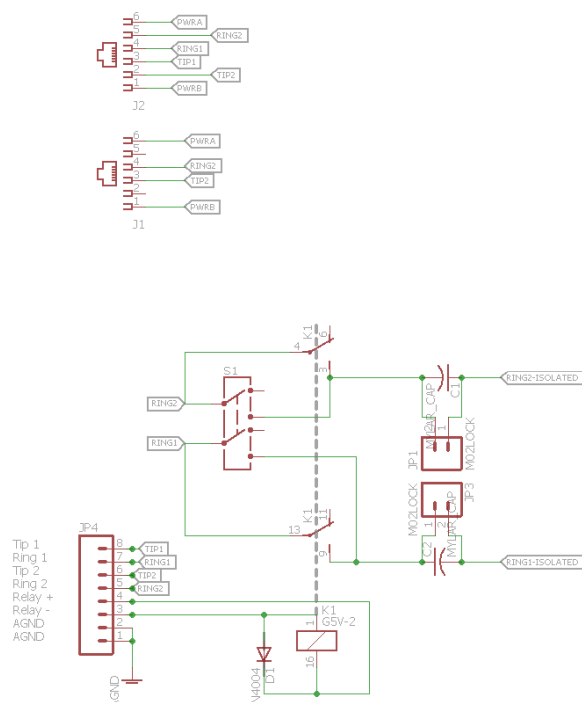
Component	T1	T3	C1	C2	JP1	JP3	K1/D1	S1	non-switched
Audio	X		DC blocking on line 2	DC Blocking on Line 1	Dry on line 2	Dry on line 1	Relay See note on table 4	Manual switch	S1 jump center to top on both sides
Phone		X	DC blocking on line 2	DC Blocking on Line 1	DC or Dry on line 2	DC or dry on line 1	Relay See note on table 4	Manual switch	S1 jump center to top on both sides

**Table 2 - Component Stuffing Chart**

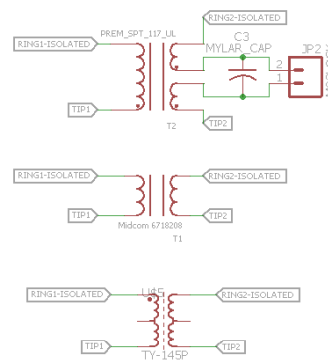


**Figure 3 - Component Layout**

Board size is 7 x 10 CM or 2 ¾ x 3 15/16<sup>th</sup> inches, and fits in our standard DINRail track <http://www.modelrailroadcontrolsystems.com/din-rail-12-inch/> along side the EBF31A.



It is assumed that K1 is 24VDC, but this Omron package is available in many voltages and may substituted per application requirements.



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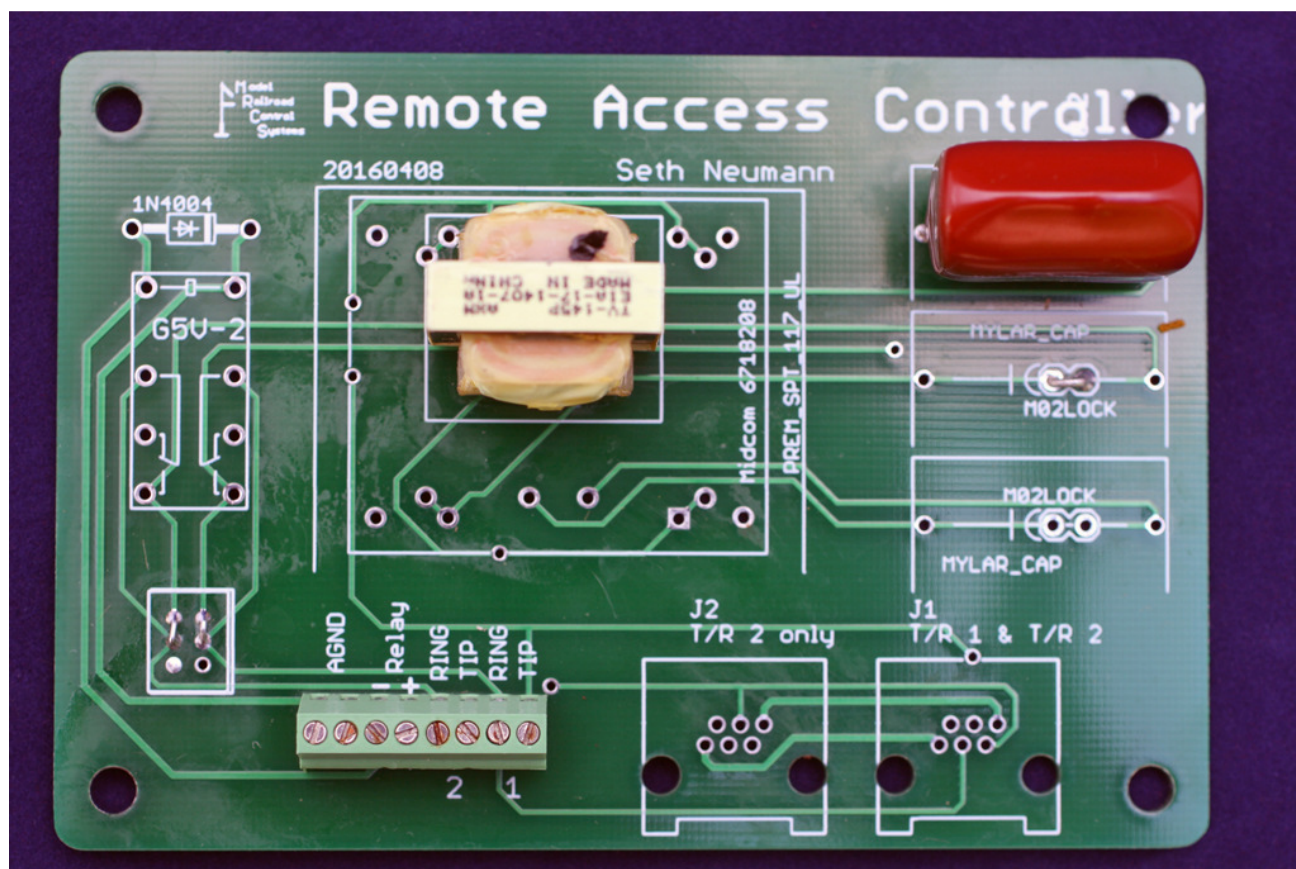
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Figure 4 - RAC/UTB Schematic



Part	Quan	Description	Vendor p/n	
JP4	1	M08LOCK	Electronics salon (eBay)	8 position 0.100 connector
T3	1	Audio Transformer	Jameco 630459	Triad TY145p
	1	Circuit board	MRCs -RACUTB	Circuit board
Options				
J1	1	RJ25-43860-2-MOLEX	Newark molex 43860-0002	RJ25
J2	1	RJ25-43860-2-MOLEX	Newark molex 43860-0002	RJ25

**Table 3- Audio Configuration Bill of Materials**

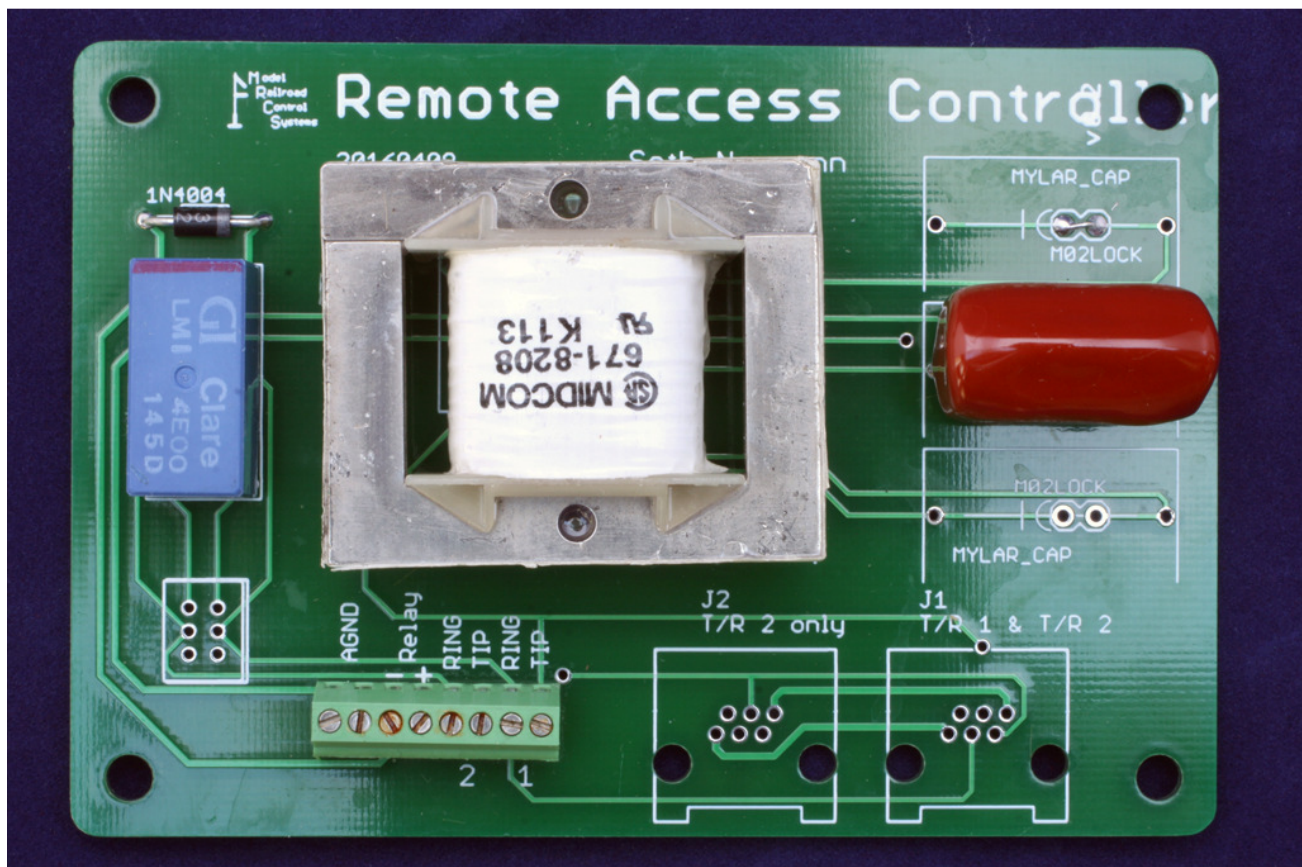


**Figure 5 - RAC/UTB Audio Coupler**

Part	Quan	Description	Vendor p/n	
JP4	1		Electronics salon	8 position 0.100 connector
T1	1	Transformer	MIDCOM	Midcom 6718208
	1	Circuit board	MRCs -RACUTB	RACUTB
<b>Options</b>				
C1	1	MYLAR_CAP	Jameco 93999	
D1	1	1N4004	Jameco 76961	
K1	1	Omron style relay	Futurelec HFD31-24	
J1	1	RJ25-43860-2-MOL	Newark molex 43860-0002	RJ25
J2	1	RJ25-43860-2-MOL	Newark molex 43860-0002	RJ25

**Table 4 - Telephone Coupler Configuration Bill of Materials**

Note that if you're assembling the RAC/UTF, K1 is an OMRON style relay and they are available in a wide range of coil voltages so you can use 5 or 12 volt relays if that is better for your application.



**Figure 6 - RAC/UTB Telephone Coupler**



### 3 ASSEMBLY

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This assembly sequence is suggested but can be modified to fit your requirements:

1. Determine which parts are needed
2. Install the transformer, on my samples the text on the transformer should be upside down with respect to the board label "Remote Access Controller." If using the TY-145P the black dot should align with the square solder pad. If using the Midcom 671-8208, note the pins are not spaced the same on both sides, so check for fit. Make sure you have made good solder joints.
3. Install the 8 position screw terminal with the wire ports facing away from the board (if you like header pins, or some other connector you can substitute any 0.100 device)
4. If using blocking capacitor(s), install per table 2, if not solder across JP 1 and/or 3 as indicated in table 2. I recommend a piece of 22 Ga wire or a piece of component lead. Try to leave about 1/8" if lead below the capacitor to it doesn't break if the capacitor is bent.  
If using a relay, install the relay (K1) and associated diode (D1) - Note that if you're assembling the RAC/UTF, K1 is an OMRON style relay and they are available in a wide range of coil voltages so you can use 5 or 12 volt relays if that is better for your application.
5. If using a switch (the switch the board was originally laid out for is no longer available from the vendor, we'll try to qualify a new one) try using any DPDT switch and running a pig tail on a piece of 3 pair or greater wire (CAT 5 will do fine) and soldering into the holes.
6. If not switching (transformer always in place) just solder across from the center holes of S1 to the top.
7. If using the optional RJ25 connectors J1 and J2, install them now
8. Do not stuff JP2 or C3
9. Visually inspect your solder joints and trim any component leads that are standing below the board.

## 4 TIP AND RING

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### 4.1 CONNECTIONS FOR TELEPHONE LINE

The two sides of the transformer are considered to be tip1/ring1(line 1) and tip2/ring2 (line 2). Generally you will connect the phone line or input side of the transformer to line 1. Make this connection on the 8 position screw terminal or on the optional RJ25 (J1). Generally you will use line 2 for the second phone line or for audio.

In the audio case you will have inserted a blocking capacitor in series with the phone line on T1/R1 and directly connected the output (T2/R2) to your audio device, which should be “dry” (no voltage).

In the Phone line case you generally want to terminate (hold the phone line busy) by passing DC through the transformer. In the example line 2 has a blocking capacitor. In this case, a remote dispatcher calls the phone number of the line on the cable box and it is answered by operating the switch or relay. The phone line is terminated by the line 1 side of the transformer. The other side of the transformer is connected to the dispatcher’s train line (an EBF31A for example) with the local stations across it. We don’t want to draw unnecessary current from the EBF31A so we use the blocking capacitor on the line 2 side by using C2 and JP1. If we wanted to terminate on both sides, we’d omit C2 and use JP1 and JP3

### 4.2 CONNECTIONS FOR RELAY

The relay is connected across positions 3 and 4 of the 8 position screw terminal. We supply relays with a 24V coil. Connect +24 (you can daisy chain from the EBF31A) to the + side and use an external switch at some convenient place to apply a ground to operate the relay and terminate the phone line. Note that if you’re assembling the RAC/UTF these OMRON style relays are available in a wide range of coil voltages so you can use 5 or 12 volt relays if that is better for your application.

### 4.3 24V PASS THROUGH

Model Railroad Control Systems is moving to a standard of chaining 24V on the third pair of 6P6C (6 wire phone cables) in order to make interconnecting the EBF31A, DSOP and other phone boards easier to set up. 24V is passed through J1 and J2 but it is not available on the board.

## 5 TESTING

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Testing your RAC/UTB is quick and simple:

1. Mount the board securely on standoffs or in a piece of 2.75" DINRail
2. Go off hook on a phone on line 1 side and have someone listen on the line 2 side. Be sure to turn the switch or relay on if so equipped.
3. You should be able to hear each other
4. In the case of phone line to dry audio the party on line 2 won't be able to talk but should be able to hear the party across the phone line on line 1