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Installation and Operation Manual



Box O' Relays 6 **Six channel optically isolated relay module.**

Manual update: 5/17/2023

If you need a firmware upgrade, contact Broadcast Tools[®]

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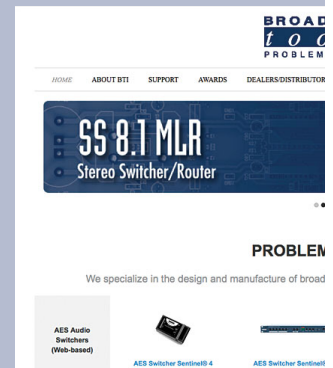
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INTRODUCTION

Thank you for your purchase of the BOX O' RELAYS 6 optically isolated relay interface, which we will refer to throughout the manual as the BOX O' RELAYS 6. We're confident this product will give you many years of dependable service. This manual is intended to give you all the information needed to install and operate the Broadcast Tools® BOX O' RELAYS 6.

SAFETY INFORMATION

Only qualified technical personnel should install the BOX O' RELAYS 6. Any attempt to install this device by a person who is not technically qualified could result in a hazardous condition for the installer or other personnel or damage to the BOX O' RELAYS 6 or other equipment. Please ensure that proper safety precautions have been taken before installing this device. If you are unfamiliar with this type of equipment, please contact a properly qualified engineer to handle the installation and set-up of BOX O' RELAYS 6. Broadcast Tools, Inc., is unable to support NON-Broadcast Tools software, hardware, or NON-Broadcast Tools computer/hardware/software problems. If you experience these problems, please research your hardware/software instruction manuals, or contact the manufacturers technical support department.

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If you have any questions regarding your product or you need assistance, please contact your distributor from whom you purchased this equipment. If you would like more information about BROADCAST TOOLS® products, you may reach us at:

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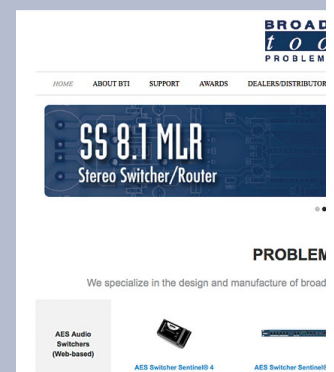


NOTE:

This manual should be read thoroughly before installation and operation.

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INTRODUCTION

Product Overview

The BOX O' RELAYS 6 is a six channel optically isolated relay module, following in the footsteps of the original Box O' Relays 4 from over twelve years ago. The new design of the BOX O' RELAYS 6 is perfect for converting GPO outputs from AoIP systems and other devices to dry contact closures. All six SPDT relay outputs are available via pluggable screw terminal block connectors for ease of installation. The BOX O' RELAYS 6's SPDT relays are rated up to 30V at 1 amp, perfect for controlling on-air lights, LED indicators, and other externally powered devices. All six optically isolated inputs are available via an RJ45 input jack as well as pluggable screw terminal block connectors and can be configured via to interface with dry contact closures, open collector outputs, as well as voltages from 3.3-24 VDC, or 25-48 VDC via an external resistor.

Convert Wheatstone Blade Logic Outputs (GPOs) to Contact Closures

The RJ45 input jack on the BOX O' RELAYS 6 is compatible with the RJ45 logic jacks on Wheatstone Blades. The BOX O' RELAYS 6 allows the user to easily convert six WheatNet Blade logic outputs (GPOs), on one Cat5/6 cable to 6 isolated SPDT dry contact closure outputs on pluggable screw terminal blocks. Because the Logic ports on Blades can be switched between inputs and outputs in software, it's important that the logic port connected to the BOX O' RELAYS 6's Input jack be configured as outputs.

Convert GPIO xNode General Purpose Outputs (GPOs) to Contact Closures

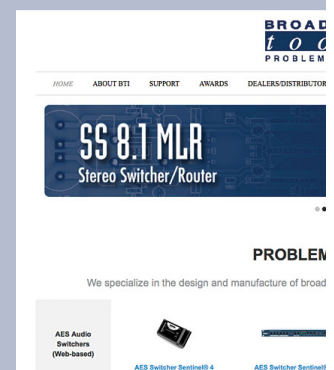
Using the optional Broadcast Tools COA-15/RJ, DB-15 to dual RJ45 adapter you can easily interface an xNode GPIO port with the BOX O' RELAYS 6 via standard Cat5/6 cabling converting the port's 5 GPOs to 5 isolated SPDT dry contact closure outputs on pluggable screw terminal blocks. The COA-15/RJ also breaks out the GPIOs to their own RJ45 jack for ease of installation.

Inspection

Please examine your BOX O' RELAYS 6 carefully for any damage that may have been sustained during shipping. If any damage is present, please notify the shipper immediately and retain the packaging for inspection by the shipper. The package should contain the BOX O' RELAYS 6, and a 9 VDC power supply. Manuals can be downloaded from our web site.

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Installation/Operation

The BOX O' RELAYS 6 provides an easy way to convert GPOs from an AoIP system to isolated SPDT relay contact closures. All six of the GPO relay trigger inputs on the BOX O' RELAYS 6 are designed to be controlled by GPO outputs from an AoIP system but will work equally well with other devices. Each trigger input is opto-isolated and configured to be controlled from a dry contact closure or open collector output.

For example: pulling input 1 low (to ground) and holding it there will activate (close) the K1 relay output and light the K1 indicator LED, they will stay active as-long-as the input 1 is held low. Releasing the trigger input back to its normal high level will de-activate (open) the relay and turn the LED off. The GPO relay trigger inputs are connected in parallel to the RJ45 jack J2 as well as to pins on the TB1-3 pluggable screw terminal block connectors.

The BOX O' RELAYS 6 connects with your equipment through a standard RJ45 Cat5/6 patch cable and/or six removable euro-block screw terminals. Follow the labels in this manual and on the circuit board for all connections.

Mounting the BOX O' RELAYS 6

Mounting options for the BOX O' RELAYS 6 are numerous: The plastic enclosure can be screwed, cable tied or Velcroed to most surfaces. The optional RA-1 Rack Shelf may be used to rack mount up to three units.

Surge Protection

The BOX O' RELAYS 6 has built-in resistance to voltage changes; we recommend that you use a power surge protector or line conditioner on the incoming AC line. Lightning strikes and/or other high voltage surges may damage your BOX O' RELAYS 6 and connected equipment if it is not properly protected. For lightning protection devices, check out www.polyphaser.com and www.itwlinx.com.

UPS Standby Power System

We recommend that you power your BOX O' RELAYS 6 from an uninterruptable power supply (UPS) system. A UPS, like the BE600M1 from APC, helps minimize the risk to the BOX O' RELAYS 6 and provides power during a power outage.

Power

Connect the 2.1mm barrel type power connector into the unit and the 9 VDC universal switching power supply with domestic AC connector into a 120 Vac 50-60 Hz power source.

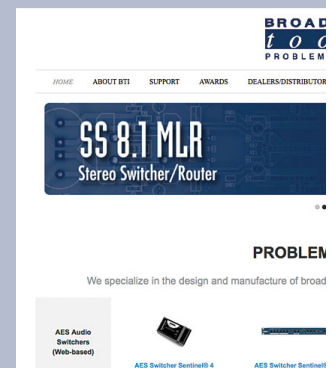


NOTE:

Never use any type of power supply other than the specified/supplied power supply.

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LED Indicators

- “PWR” Power LED: Illuminates when power is applied. (Green)
- “K1-K6” Relay LEDs: Lit when each respective relay output is active. (Yellow, Red, Green, Yellow, Red, Green)

Terminal Block Wiring Instructions:

The BOX O’ RELAYS 6 interfaces to external equipment through removable euro-block screw terminals. The terminals accommodate wire sizes from 16 - 28 AWG solid or stranded wire. Before installing a wire, remove the euro-block screw terminal plug and turn each capture screw fully counterclockwise. Strip each conductor to a length of 0.25” and insert the conductor fully into the terminal. Turn the capture screw fully clockwise to secure the conductor.

Terminal Block Connector Pinouts

Input/Relay 1 (TB1 Bottom)

Optically isolated Input 1

K1 Relay Output

Input 1A (Ground/Anode)	Input 1B (Cathode) (RJ45 pin 2)	K1 Normally Closed	K1 Common (wiper)	K1 Normally Open
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Input/Relay 2 (TB1 Top)

Optically isolated Input 2

K2 Relay Output

Input 2A (Ground/Anode)	Input 2B (Cathode) (RJ45 pin 3)	K2 Normally Closed	K2 Common (wiper)	K2 Normally Open
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Input/Relay 3 (TB2 Bottom)

Optically isolated Input 3

K3 Relay Output

Input 3A (Ground/Anode)	Input 3B (Cathode) (RJ45 pin 4)	K3 Normally Closed	K3 Common (wiper)	K3 Normally Open
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Input/Relay 4 (TB2 Top)

Optically isolated Input 4

K4 Relay Output

Input 4A (Ground/Anode)	Input 4B (Cathode) (RJ45 pin 5)	K4 Normally Closed	K4 Common (wiper)	K4 Normally Open
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Input/Relay 5 (TB3 Bottom)

Optically isolated Input 5

K5 Relay Output

Input 5A (Ground/Anode)	Input 5B (Cathode) (RJ45 pin 6)	K5 Normally Closed	K5 Common (wiper)	K5 Normally Open
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Input/Relay 6 (TB3 Bottom)

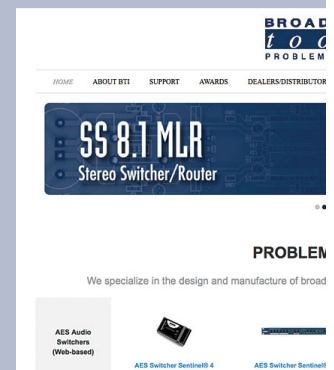
Optically isolated Input 6

K6 Relay Output

Input 6A (Ground/Anode)	Input 6B (Cathode) (RJ45 pin 7)	K6 Normally Closed	K6 Common (wiper)	K6 Normally Open
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RJ45 Jack Pinout (J2):

Function:	Wire Pair:	RJ45 Pins:
Ground	White/Orange	1
Input 1B	Orange/White	2
Input 2B	White/Green	3
Input 3B	Green/White	6
Input 4B	White/Blue	5
Input 5B	Blue/White	4
Input 6B	White/Brown	7
+5V In*	Brown/White	8

* See JP7 Power Jumper Configuration

Optically Isolated Inputs

Each optically isolated input has a terminal labelled “xA” and a terminal labelled “xB”. Inputs can be configured for either wet or dry operation via internal jumpers. The factory default configuration is dry, where the “A” side of the input is ground (GND) and the “B” side of the input is the cathode (-) of the opto-isolator. In this configuration, 5V is applied internally to the anode (+) of the opto-isolator. This configuration is best for interfacing external dry contact relay outputs, switches, and open collector outputs.

In the “wet” configuration an external voltage must be applied to the input to activate the opto-isolator. When configured for wet operation the “A” side of the input is the anode (+) and the “B” side of the input is the cathode (-). This configuration is best where full isolation is preferred or when interfacing with external voltage/logic level outputs.

Each optically isolated input is connected through an internal 2.2k ohm series current-limiting resistor directly to an opto-coupler circuit so no external resistor is necessary if the input voltage is between 3.3 VDC and 24 VDC. Higher DC voltages, from 25 to 48 VDC, can be used but must be reduced with an additional external resistor of the appropriate value and power rating to limit the input current.

Here is how to calculate the value and power rating of an external current limiting resistor for DC voltages up to 48 VDC: Each optically isolated input has an internal 2.2K ohm series resistor. The opto-isolator works well with an input current of 9 mA and has a voltage drop of around 1.2V. With this information we can determine the correct external series current limiting resistor value needed for other voltages using the equation:

$$R = ((V_{in}-1.2)/0.009)-2200$$

Where:

R = External resistor value required

V_{in} = Desired input voltage

1.2 V = Forward voltage drop of the LED in the opto-isolator

0.009 A = Nominal LED current

2200 ohms = Internal resistor

For example:

To connect a 48 VDC signal voltage to an input on the BOX O’ RELAYS 6 in “wet” configuration, the completed equation for the external resistor value would be:

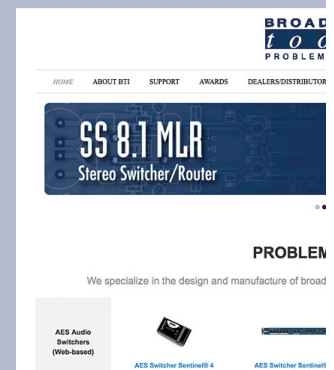
$$R = ((48-1.2)/0.009)-2200 = 3000 \text{ ohms}$$

To calculate the power dissipated by the external resistor, the equation would be:

$P = I \times I \times R$, so the resistor must be at least $.009 \times .009 \times 2200 = 0.243$ Watts, we recommend the use of a 1/2 Watt rated resistor.

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OPERATION

Input Jumper Configuration

Each optically isolated input is equipped with an internal four-position header and two jumpers. The headers are labeled JP1-6. The factory default configuration is for a DRY input (relay contact, switch, open collector) with a jumper over pins 1 & 2 and another jumper over pins 3 & 4. To change the input to WET (user supplied voltage between 3.3-24 VDC, or 25-48 VDC with an external resistor), remove both jumpers and place ONE jumper over pins 2 & 3.

NOTE: When using this product with WheatNet Blade or GPIO xNode GPO's, ALL inputs MUST be configured for DRY operation.

JP7 Power Jumper Configuration

From the factory the BOX O' RELAYS 6 is powered from the supplied external 9 VDC power supply. Alternatively, the internal JP7 header/jumper allows you to power the BOX O' RELAYS 6 from a user supplied external +5 VDC sourced via pin 8 (+5V IN) on the RJ45 jack (J2.) See the component layout drawing for more information.

Connecting to GPOs from a WheatNet Blade:

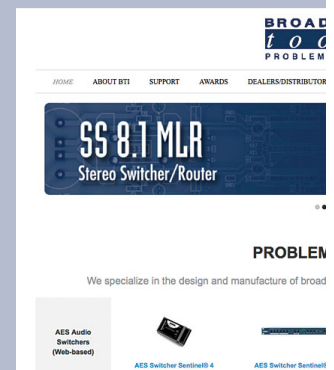
1. Configure one of the Logic ports on your Blade so that all six logic pins on the port are configured as GPOs.
2. Use a standard Cat5 or Cat6 Ethernet patch cable to connect the RJ45 jack on the BOX O' RELAYS 6 (J2) to the Logic port on the Blade.
3. Wire the devices you wish to control (on-air lights, LED indicators, etc.) to the K1-K6 dry contact closure relay outputs on the 5-position terminal blocks on the top and bottom of the headers labelled TB 1-3.
4. Apply power to the BOX O' RELAYS 6 using the supplied 9 VDC power supply and test the GPOs from your WheatNet-IP system.

Connecting to GPOs from a GPIO xNode or Engine:

1. Connect the optional Broadcast Tools COA-15/RJ DB15 the dual RJ45 adapter to the one of the DB15 GPIO ports on the Node/Engine.
2. Use a standard Cat5 or Cat6 Ethernet patch cable to connect the RJ45 jack (Output, J2) on the BOX O' RELAYS 6 to the RJ45 jack on the COA-15/RJ labelled "J2, Output."
3. Wire the devices you wish to control (on-air lights, LED indicators, etc.) to the K1-K5 dry contact closure relay outputs on the 5-position terminal blocks on the top and bottom of the headers labelled TB 1-3.
4. Apply power to the BOX O' RELAYS 6 using the supplied 9 VDC power supply and test the GPOs from your Livewire system.

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Specifications

Optically isolated Inputs: (6) Optically isolated (3.3 -24 VDC, or 25-48 VDC via an external resistor). Wet or Dry inputs. Default = Dry (5 volts internally sourced and current at 2ma).

Relay Outputs: (6) SPDT, 1 amp @ 30 VDC maximum relays. Sealed relays utilizing 2 - form – C, Bifurcated-Crossbar silver alloy with gold overlay contacts, with front panel LED indicators.

CAUTION! For safety, never connect 120 Vac circuits to these relays!

Connectors: Inputs and Relay Outputs: (6) 5-position pluggable screw terminal blocks. (1) RJ45 input jack.

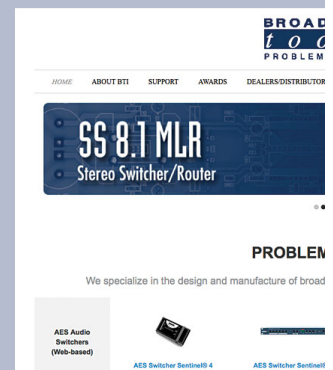
Power: 9 to 12 VDC only, greater than 350 mA. 2.1mm ID x 5.5mm OD coaxial connector, center positive, surge protected. Universal switching power supply with domestic connector supplied. ***This product may be powered by an external 5-volt DC source that can source => 350ma at 5-volts DC via the RJ45 jack.***

Dimensions: 6 x 5.25 x 1.63 in (W x L x H)

Options: **RA-1 Rack Shelf** – 1 RU. Accommodates up to 3 units, filler panels supplied. Note: Velcro is supplied to secure the product to the RA-1 shelf.
COA-15/RJ – DB-15M to RJ45 Breakout Adapter for GPIO xNodes.

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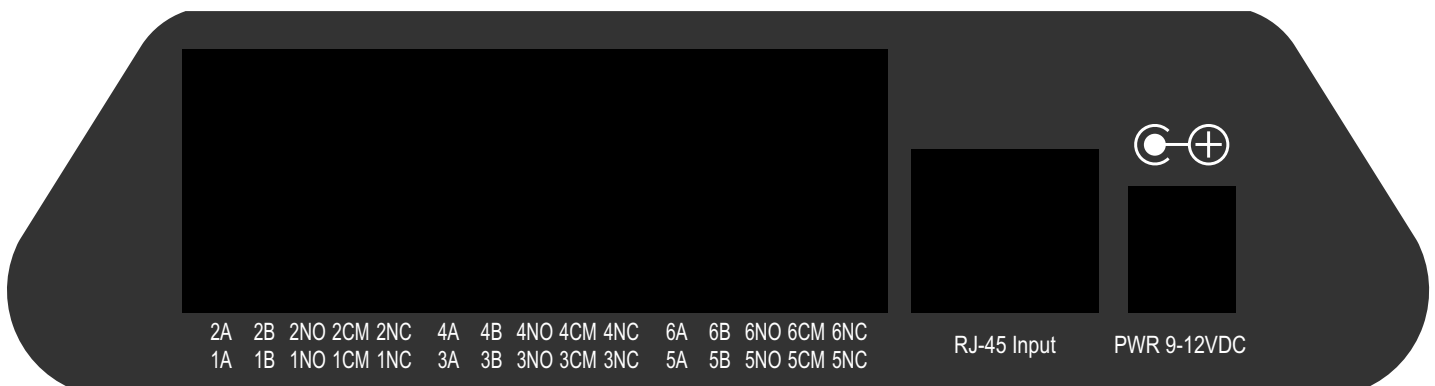
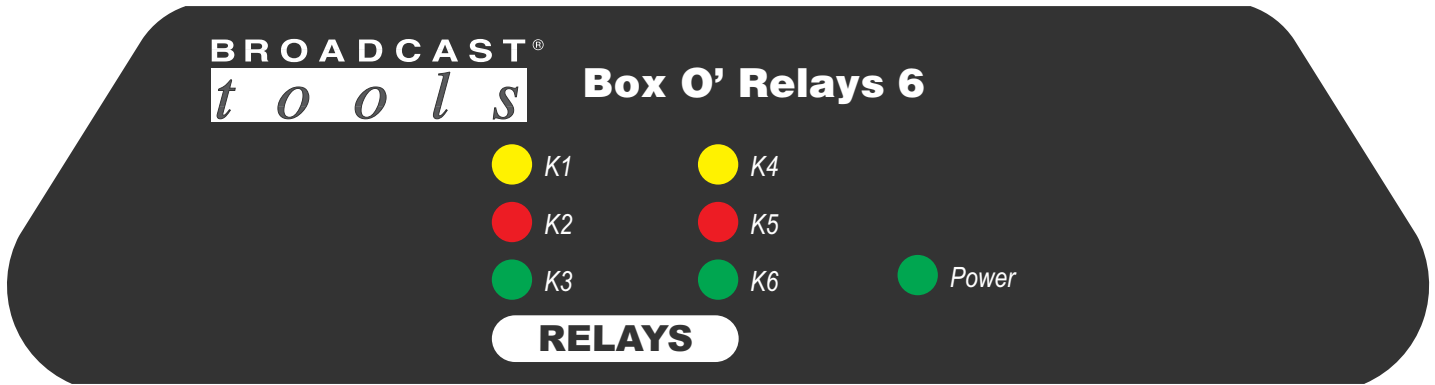
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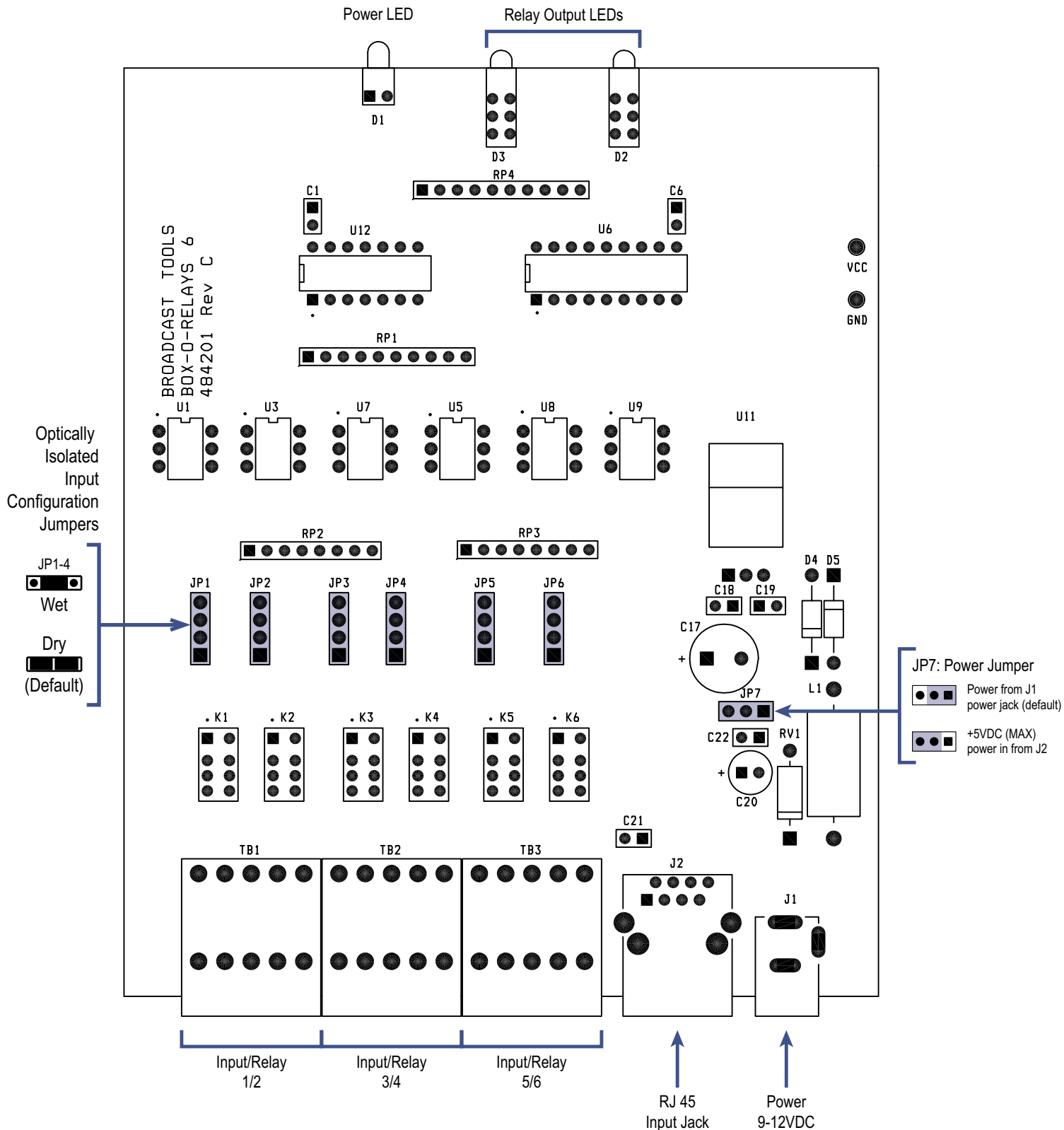
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Component Layout



Fractional Schematic

