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PROBLEM SOLVED

Installation and Operation Manual

Smart Relay 4 G2 (SR-4 G2)
Four Channel Smart GPIO Converter

Manual update: 8/2/2021
Firmware Version: 1.07 or higher
If you need a firmware upgrade, contact Broadcast Tools®

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NOTE: We recommend the use of Chrome, Firefox or Safari as your browser.

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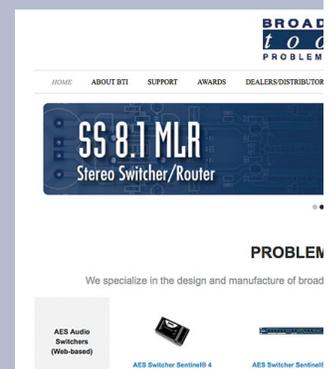
Visit **www.broadcasttools.com** for important product update information.

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INTRODUCTION

Thank you for your purchase of the Smart Relay 4 G2 Four Channel Smart GPIO Converter, which we will refer to throughout the manual as the Smart Relay 4 G2. We are 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® Smart Relay 4 G2.

SAFETY INFORMATION

Only qualified technical personnel should install the Smart Relay 4 G2. Any attempt to install this device by a person who is not technically qualified could result in a hazardous condition to the installer or other personnel or damage to the Smart Relay 4 G2 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 setup of the Smart Relay 4 G2. 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.

WHO TO CONTACT FOR HELP

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:

Broadcast Tools, Inc.
131 State Street
Sedro-Woolley, WA 98284-1503 USA
Voice: 360.854.9559
Fax: 866.783.1742

Internet Home Page: www.broadcasttools.com
E-mail:support@broadcasttools.com

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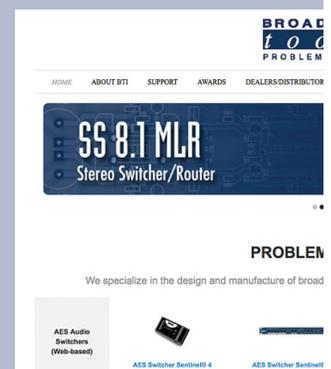
NOTE:

This manual should be read thoroughly before installation and operation.

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INTRODUCTION

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Product Overview

The Smart Relay 4 G2 provides four independent GPIO interfaces in one box, each equipped with two optically isolated inputs (wet or dry) and a 2PDT relay output. The Smart Relay 4 G2 is perfect for converting differing logic levels to contact closures. Additional features include: Independent user programmable Boolean logic and pulse stretching (delays) from 50ms to 99 hours, 59 minutes, 59.99 seconds.

Features/Benefits

- All I/O connections via pluggable screw terminal blocks.
- Each 2PDT relay channel can be configured with two independent optically isolated inputs configurable for dry signals or wet signals (5-24 VDC, or 25-48 VDC via an external resistor.)
- LED status indicators are provided for each relay, input, and power.
- Fifteen logic functions include, sustained, toggle, set-reset (flip-flop), dual alternate action or failing/rising edge, along with additional Boolean logic functions.
- Independent pulse stretcher or time delays may be user programmed from 50ms to 99 hours, 59 minutes, 59.99 seconds.
- Timing and mode configuration from a non-dedicated PC using the USB-serial connection.

Applications

- Convert differing logic levels to 2PDT contact closures.
- Time delay relays
- Pulse stretcher
- Sustained contact to pulse converters
- Rising and/or falling edge pulse converters
- Latching (flip-flop) relays
- Toggle action relays
- Dual alternate action relays
- Additional Boolean logic functions include: XOR, AND, NAND, OR, NOR.

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Inspection

Please examine your Smart Relay 4 G2 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 Smart Relay 4 G2, a power supply, and a USB-A/B cable. Manuals may be downloaded from our web site.

OVERVIEW
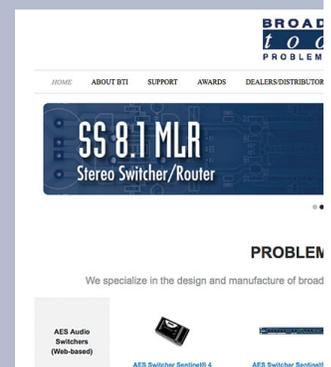
Installation/Operation

Power

Connect the 2.1mm barrel type center positive power connector into the unit and the included 9 to 12 VDC power supply with domestic 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. Check the power jack on the back of the unit to determine which power supply is required.

Surge Protection

The Smart Relay 4 G2 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 Smart Relay 4 G2 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 connect your Smart Relay 4 G2 to a UPS standby power system. A UPS helps minimize the risk to the Smart Relay 4 G2 and provides power during a power outage.

Wire Prep

The Smart Relay 4 G2 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.

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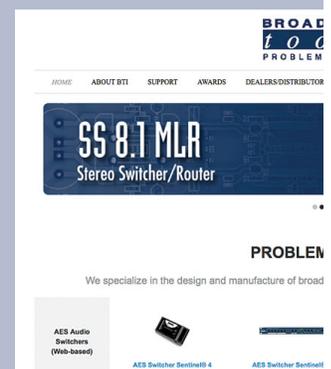
INSTALLATION

Inputs

(Top row, TB1)							(Top row, TB2)					
1A	1B	2A	2B	GND	R1		5A	5B	6A	6B	GND	R3
3A	3B	4A	4B	GND	R2		7A	7B	8A	8B	GND	R4
(Bottom row, TB1)							(Bottom row, TB2)					

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 with 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 5 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 opto-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:

$R = ((Vin-1.2)/0.009)-2200$

Where:

R = External resistor value required
Vin = 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 Smart Relay 4 G2 in "wet" configuration the completed equation for the external resistor value would be:

$R = ((48-1.2)/0.009)-2200 = 3000$ 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 x .009 x 2200 = 0.243 Watts, use a 1/2 Watt rated resistor.

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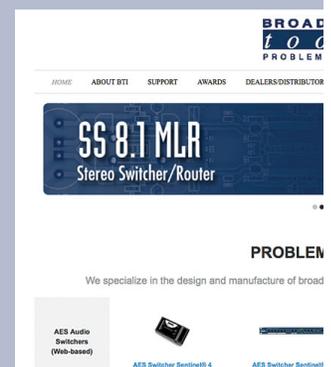
INSTALLATION

Input Jumper Configuration

Each input is equipped with an internal four-position header and two jumpers. The headers are labeled JPx and are numbered IN-1 through IN-8. 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 5 and 24 VDC, or 25-48 VDC with an external resistor), remove both jumpers and place ONE jumper over pins 2 & 3.

Relay Outputs

The Smart Relay 4 G2's relays are 2PDT normally open/dry. Make your connections to the desired relays K1 A/B thru K4 A/B. Front panel LEDs indicate when a relay is active.

(Top row, TB3)					
K1A			K1B		
1CM	1NC	1NO	1CM	1NC	1NO
2CM	2NC	2NO	2CM	2NC	2NO
K2A			K2B		
(Bottom row, TB3)					

(Top row, TB4)					
K3A			K3B		
3CM	3NC	3NO	3CM	3NC	3NO
4CM	4NC	4NO	4CM	4NC	4NO
K4A			K4B		
(Bottom row, TB4)					

CM = Common Relay Contact (Wiper)
NO = Normally Open Relay Contact
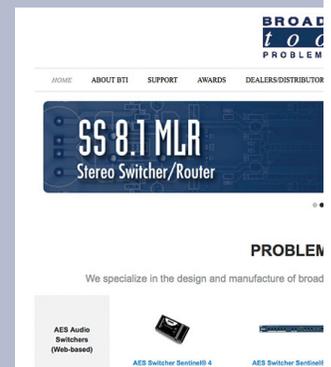NC = Normally Closed Relay Contact

LED Indicators
- "PWR": Power LED (Green).
- "K1"- "K4" Relay LEDs: Lit when the corresponding relay is on. (Green)
- "1-8" Input LEDs: Lit when the corresponding input is on. (Yellow)

USB PGM Port

The front-panel USB type-B port is used to connect the Smart Relay 4 G2 to a computer for configuration via a virtual COM port. See the "Programming" section of this manual for more information on setting modes and timers for each channel.

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INSTALLATION

Operation Overview

Each of the four GPIO channels consist of two optically isolated inputs and one 2PDT relay output. The first input in each channel is referred to as the "odd" input (1, 3, 5, 7) and the second input is referred to as the "even" input (2, 4, 6, 8.)

Each relay's factory default mode setting is Mode 00, where the relay closes when the odd input is active and opens when the odd input is inactive. See the Mode Settings and Programming sections of the manual for more information on configuring the relay section for different logic and timing functions using the USB serial port.

A third non-isolated override input labelled "Rx" is present and allows the user to trigger the channel's relay outputs via a sustained closure to ground, overriding the opto-isolated inputs and the logic functions.

Channel 1 (K1)

Odd Input		Even Input		Override Input	
Input 1A (Ground/Anode)	Input 1B (Cathode)	Input 2A (Ground/Anode)	Input 2B (Cathode)	GND	R1 (K1 Coil)

TB1 Top

K1A Relay Output			K1B Relay Output		
K1A Normally Closed	K1A Common (wiper)	K1A Normally Open	K1B Normally Closed	K1B Common (wiper)	K1B Normally Open

TB3 Top

Channel 2 (K2)

Odd Input		Even Input		Override Input	
Input 3A (Ground/Anode)	Input 3B (Cathode)	Input 4A (Ground/Anode)	Input 4B (Cathode)	GND	R2 (K2 Coil)

TB1 Bottom

K1A Relay Output			K1B Relay Output		
K2A Normally Closed	K2A Common (wiper)	K2A Normally Open	K2B Normally Closed	K2B Common (wiper)	K2B Normally Open

TB3 Bottom

Channel 3 (K3)

Odd Input		Even Input		Override Input	
Input 5A (Ground/Anode)	Input 5B (Cathode)	Input 6A (Ground/Anode)	Input 6B (Cathode)	GND	R3 (K3 Coil)

TB2 Top

K1A Relay Output			K1B Relay Output		
K3A Normally Closed	K3A Common (wiper)	K3A Normally Open	K3B Normally Closed	K3B Common (wiper)	K3B Normally Open

TB4 Top

Channel 4 (K4)

Odd Input		Even Input		Override Input	
Input 7A (Ground/Anode)	Input 7B (Cathode)	Input 8A (Ground/Anode)	Input 8B (Cathode)	GND	R4 (K4 Coil)

TB2 Bottom

K1A Relay Output			K1B Relay Output		
K4A Normally Closed	K4A Common (wiper)	K4A Normally Open	K4B Normally Closed	K4B Common (wiper)	K4B Normally Open

TB4 Bottom
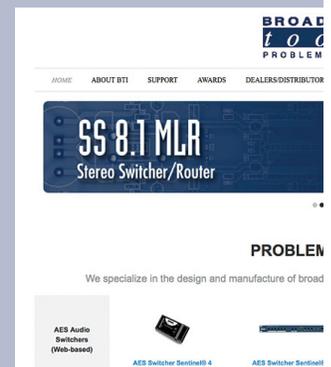
Mode Settings

Mode 00: Relay output closes when the odd input is active and opens when the odd input is inactive. (Factory Default)

Mode 01: Relay output toggles on leading edge of the odd input.

Mode 02: Relay output closes on the leading edge of the odd input. Relay remains closed until the leading edge of the even input is active.

Mode 03: Relay output closes after the odd input has been active for the programmed time period. It opens after the even input is closed for the time period.

Mode 04: Relay closed on the leading edge of the odd input. The relay opens after the trailing edge is closed for the time period.

Mode 05: Relay output closes on leading edge of the odd input for time period.

Mode 06: Relay output closes for the time period on the trailing edge of the odd input.

Mode 07: Relay output closes for the time period on the leading or trailing edge of the
odd input.

Mode 08: Relay output closes on leading edge of the odd input and remains closed for at least the time period. If the odd input stays active for longer than the time period, the relay will open on the trailing edge of the odd input.

Mode 09: Relay output closes on the leading edge of the odd input for no longer than the time period. If a trailing edge is encountered before the time has expired, the relay will open with the edge. Otherwise, the relay opens when the time period expires.

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OPERATION

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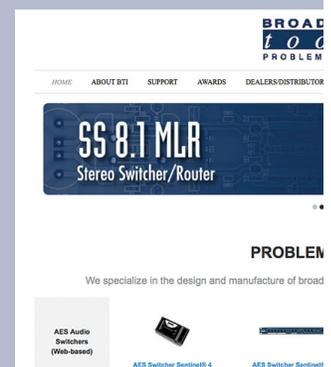
Mode 10: Two input NOT-OR (NOR) (0 = input inactive, 1 = active)

Odd Input	Even Input	Output
0	0	1
0	1	0
1	0	0
1	1	0

Mode 11: Two input OR

Odd Input	Even Input	Output
0	0	0
0	1	1
1	0	1
1	1	1

Mode 12: Two input exclusive OR (XOR)

Odd Input	Even Input	Output
0	0	0
0	1	1
1	0	1
1	1	0

Mode 13: Two input AND

Odd Input	Even Input	Output
0	0	0
0	1	0
1	0	0
1	1	1

Mode 14: Two input NOT-AND (NAND)

Odd Input	Even Input	Output
0	0	1
0	1	1
1	0	1
1	1	0

Mode 15: Reserved (feature creep).

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OPERATION
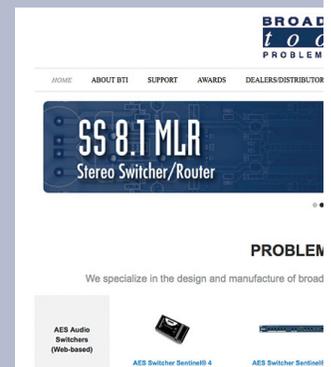
Programming

The Smart Relay 4 G2's modes and timers are programmed via its USB serial PGM port using an interactive text-based setup menu from a serial terminal application.

Connecting via the USB Serial "PGM" port:

1. Connect the supplied USB A/B cable from the "USB PGM" jack on the SR-4 G2 front panel to an available USB port on your PC. When you first plug the SR-4 G2 into your PC, it should automatically install the correct FTDI USB Serial "Virtual COM port" drivers which will allow you to access the SR-4 G2 on a COM port.

   NOTE: If the SR-4 G2's FTDI USB Serial "Virtual COM port" drivers do not automatically install they may be downloaded from the link on our Downloads page: https://broadcasttools.com/downloads/

2. Start a serial terminal application like PuTTY, Tera Term or HyperTerminal configured for the connected COM port set to 9600 baud, 8, N, 1, flow control to NONE, Emulation set to ANSI, and local character echo enabled.

Programming Steps:

1. Type P in the terminal to enter Program Mode and the Program Menu will be displayed in the terminal window:

   > **BTI SR4 G2 Program Menu v1.07**
   > **1 - Set Timers**
   > **2 - Set Modes**
   > **Enter 1 or 2**

2. Type 1 to set timers, type 2 to set relay modes.

Set Timers:

Each of the four channels can be programmed with a timer value from 0 to 99 hours, 59 minutes, 59.99 seconds. The default timing value shown below is 50ms for each channel.

   > **Current Settings HRS:MINS:SECS.NN**
   > **CH1: 00:00:00.05**
   > **CH2: 00:00:00.05**
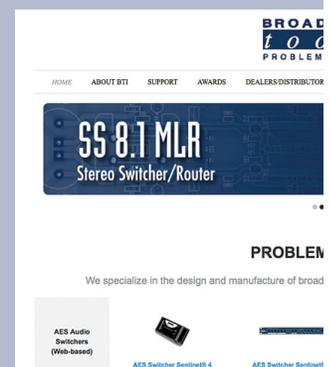   > **CH3: 00:00:00.05**
   > **CH4: 00:00:00.05**
   > **Select1-4**

1. Type the channel number 1, 2, 3 or 4.
2. Type a timer value of as an eight-digit value (00000000-99595999). Do not type the ":" or "." they will be entered automatically. For example, to set a timer to 1 second type: 00000100 and press enter. To return to the Program menu press the ESC key.

PROGRAMMING

Set Modes

Each of the four channels can be programmed with its own independent mode/logic function. See the Mode Settings section of this manual for information on the modes available. The default mode for each channel is: 00.

> **Current Mode Settings:**
> **CH1: 00**
> **CH2: 00**
> **CH3: 00**
> **CH4: 00**
> **Select1-4**

1. Type the channel number 1, 2, 3 or 4.
2. Type a timer value of as a two-digit value (00-15). For example, to set a channel to mode 05 type: 05 and press enter. To return to the Program menu press the ESC key.

To exit Program mode, press the ESC key until "EXIT PGM" is displayed. Program mode will be exited automatically after 60 seconds of keyboard inactivity.

Restoring to factory defaults:

The default program values may be reloaded at any time by removing power from the Smart Relay 4 G2, holding down the front panel Defaults (Def.) button and plugging in the power and then releasing the Defaults button after a few seconds.

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**PROGRAMMING**
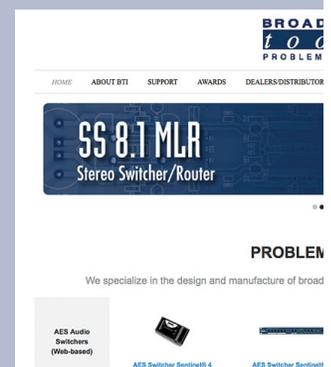
SPECIFICATIONS

Inputs: (8) Optically isolated (5 to 24 VDC, or 25-48 VDC via an external resistor.) wet or dry inputs.
Default = Dry (5 volts internally sourced). With front panel LED indicators.

Relay Outputs: (4) 2PDT, 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.

Logic   Flash Microprocessor with non-volatile memory.

USB Serial: 9600, 8, N ,1 / USB type B female. FTDI Chipset.

Connectors: Inputs and Relay Outputs: (4) 6-position pluggable screw terminal blocks.

Power: 9 to 12 VDC only, greater than 500 mA. 2.1mm ID x 5.5mm OD coaxial connector, center positive, surge protected. Universal switching power supply with domestic connector supplied. International power supply optional.

Dimensions: 6.25" W x 7.75" D x 1.63" H

Weight: 3 lbs.

Options: RA-1 Rack Shelf. 1 RU. Accommodates up to 2 units. Note: Velcro may be used to secure the product to the RA-1 shelf. International power supply.

CAUTION!

For safety, never connect 120 Vac circuits to the inputs or relays!

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SPECIFICATIONS

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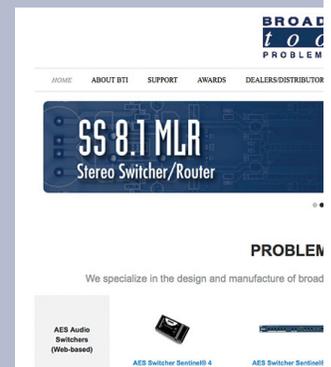
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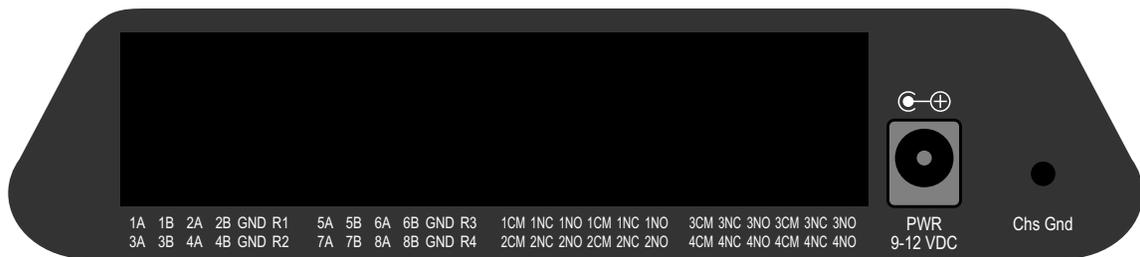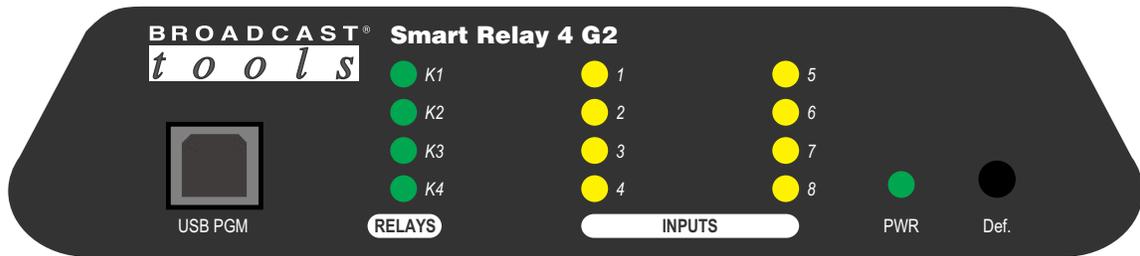
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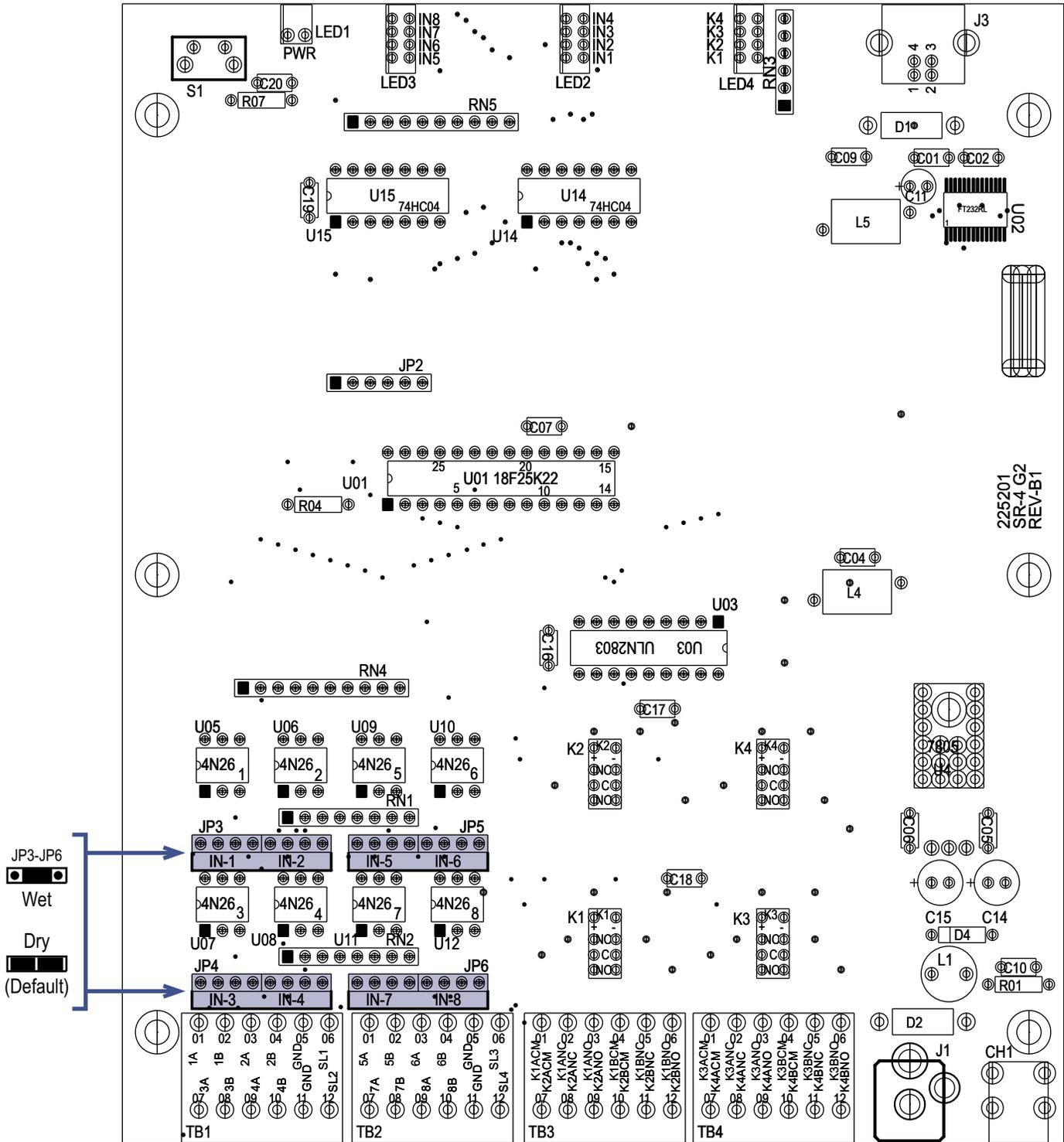131 State Street
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Fractional Schematic