BROADCAST tools INC

# Installation and Operation Manual

## BOR-4
## *Box O'Relays 4*

Firmware version 1.15 and above

Manual Update: 2/10/2004

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# Table of Contents





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## INTRODUCTION

Thank you for your purchase of a Broadcast Tools® BOR-4, Box O' Relays (referred to as the BOR-4 throughout this manual). We're confident that 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® BOR-4, Box O' Relays.

## SAFETY INFORMATION

Only qualified personnel should install Broadcast Tools® products. Incorrect or inappropriate use and/or installation could result in a hazardous condition.

## 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:

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***BROADCAST TOOLS® BRAND PRODUCTS!***

Broadcast Tools is a Veteran Owned Business

Designed, Assembled and Supported in WA State, USA

### CAUTION!

**Broadcast Tools®** Products, as with any electronic device, can fail without warning. Do not use this product in applications where a life threatening condition could result due to failure.

### NOTE:

This manual should be read thoroughly before installation and operation.

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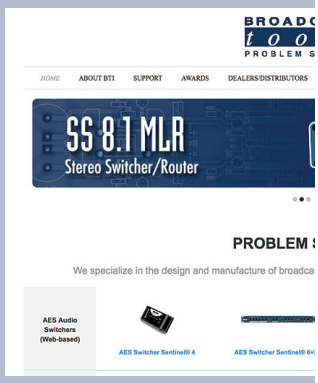

## PRODUCT DESCRIPTION

The BOR-4 provides four independent 2PDT relay interfaces with two optically isolated or 5-volt TTL/CMOS compatible inputs. Other unique features of the BOR-4 are the Programmable logic and pulse stretching (delays) from 500 ms (1/2 second) to 108 minutes. The BOR-4 is equipped with a single small profile aluminum chassis.

### Features:

- Each 2PDT relay maybe configured with two independent 5 to 28 vdc optically isolated or 5 volt TTL/CMOS compatible inputs
- Logic functions include, sustained, toggle, set-reset (flip-flop), dual alternate action or failing/rising edge pulse
- Telephone line ring detection on relay 1
- The pulse stretcher or time delay may be user programmed from 500 ms (1/2 second) to 108 minutes
- All user programming is done with selection jumpers

### 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

### REAR PANEL DESCRIPTION

The rear panel contains screw terminals for all connections. Power LED and relay status LED's.

### Power:

Connect the 2.1mm barrel type power connector into the unit and the 9vac, 500 ma wall transformer into a 120 Vac 50-60 Hz power source. The rear panel green power LED indicates when power is applied to the unit. (220 Vac 50-60 Hz wall transformer OPTIONAL)

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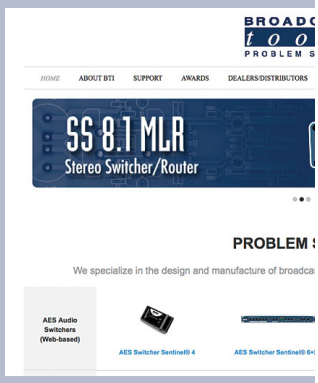




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## Component Options:

We provide pads for a NO momentary switch (SW2). This optional switch is connected to input one of K1.

Pads are provided to install an optional sonolert (S1). The sonolert is connected to K1 via the enable jumper JP13. 5 volts DC is provided for this option.

## MODE TERMINOLOGY

**Mode 0:** Toggle – A low going pulse on input 1 latches the relay, while a second low going pulse on input 1 releases the relay.

***Note: Input 2 must be kept high in order for this operation to work.***

**Mode 0:** Sustained – A sustained low on input 2 will keep the relay closed, releasing the input, releases the relay.

***Note: Input 1 must be kept high in order for this operation to work.***

**Mode 1:** Alternate Action 1 – A sustained low on input 1 causes **NO** relay operation. By releasing input 1, the relay will pulse for the duration configured in the timing description.

***Note: Input 2 must be kept high in order for this operation to work.***

Alternate Action 2 – A sustained low on input 2 will, pulse the relay as on the falling edge configured in the timing description. By releasing input 2, the relay will once again be pulsed for the same timing duration.

***Note: Input 1 must be kept high in order for this operation to work.***

**Mode 2:** Pulse 1 – A **falling** edge pulse on input 1 generates a relay pulse as configured in the timing description.

***Note: Input 2 must be kept high in order for this operation to work.***

Pulse 2 – A rising edge pulse on input 2 generates a pulse as configured in the timing description.

***Note: Input 1 must be kept high in order for this operation to work.***

**Mode 3:** Set/Reset (Flip/Flop) – A low going pulse on input 1 (set) latches the relay. A low going pulse on input 2 (reset) unlatches the relay.

***Note: The state is stored in non-volatile memory during power failures in mode 3 only.***

***Note: All inputs must be equal to or greater than 100ms in duration.***

***Note: The 5-vdc TTL/CMOS compatible inputs are configured as a divider. A low input must be between 0 and + .6vdc, while a high must be between + 4.00 and + 5.00 vdc. This should help in noisy (RF, etc) environments.***

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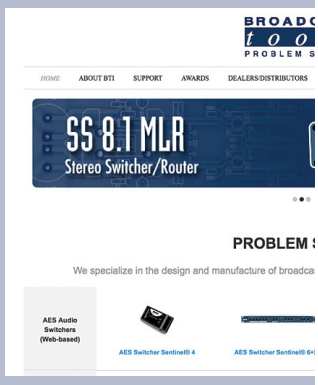

## RELAY 1 CONFIGURATION

| Function | TB-1 | TB-1 | J1 | J1 | J2 | JP1 |
|---|---|---|---|---|---|---|
| Optically Isolated **Dry Contacts** | Pin 1, Cathode of Opto-Isolator | Pin 2, Ground | 1 & 2 | 3 & 4 | 2 & 3 | ON |
| Optically Isolated **Wet Contacts** | Pin 1, Cathode of the Opto-Isolator | Pin 2, Anode of the Opto-Isolator | 2 & 3 | N/C | 2 & 3 | ON |
| TTL/CMOS compatible 5 volt logic | Pin 1, Logic input with pull-up | Pin 2, Ground | 1 & 2 | 3 & 4 | 1 & 2 | ON |
| **Function** | **TB-1** | **TB-1** | **J3** | **J3** | **J4** | **JP1** |
| Optically Isolated **Dry Contacts** | Pin 3, Cathode of Opto-Isolator | Pin 4, Ground | 1 & 2 | 3 & 4 | 2 & 3 | ON |
| Optically Isolated **Wet Contacts** | Pin 3, Cathode of the Opto-Isolator | Pin 4, Anode of the Opto-Isolator | 2 & 3 | N/C | 2 & 3 | ON |
| TTL/CMOS compatible 5 volt logic | Pin 3, Logic input with pull-up | Pin 4, Ground | 1 & 2 | 3 & 4 | 1 & 2 | ON |
| Telephone line Ring detector | Pin 3, TIP Sustained, Mode 0, only | Pin 4, RING Sustained, Mode 0, only | 2 & 3 | N/C | 2 & 3 | **OFF** |

| Function Description | Mode | Input Terminal Numbers | SW1A-1 | SW1A-2 |
|---|---|---|---|---|
| Toggle | 0 | TB-1 / 1 & 2 Only | ON | ON |
| *Sustained* | *0 – (TELCO)* | *TB-1 / 3 & 4 Only* | *ON* | *ON* |
| Alternate Action 1 | 1 | TB-1 / 1 & 2 Only | ON | OFF |
| *Alternate Action 2* | *1* | *TB-1 / 3 & 4 Only* | *ON* | *OFF* |
| Pulse 1 | 2 | TB-1 / 1 & 2 Only | OFF | ON |
| *Pulse 2* | *2* | *TB-1 / 3 & 4 Only* | *OFF* | *ON* |
| Set (flip-flop) | 3 | TB-1 / 1 & 2 Only | OFF | OFF |
| *Reset (flip-flop)* | *3* | *TB-1 / 3 & 4 Only* | *OFF* | *OFF* |

**K1 Timing Description:**

The "PGM" header JP-3 is used to configure the timing duration. To reset the factory default pulse timing duration of 500ms, short the "PGM" jumper for less than 1 second.

User defined timing may be programmed by shorting the "PGM" jumper for the duration of the desired pulse length. The "K 1" LED will blink ON to denote you are in the Programming mode and turn off when you are finished.

The minimum timing duration is 500 ms (1/2 second) with a maximum timing duration of 108 minutes.

## RELAY 2 CONFIGURATION

| Function | TB-2 | TB-2 | J5 | J5 | J6 |
|---|---|---|---|---|---|
| Optically isolated **Dry Contacts** | Pin 1, Cathode of Opto-Isolator | Pin 2, Ground | 1 & 2 | 3 & 4 | 2 & 3 |
| Optically isolated **Wet Contacts** | Pin 1, Cathode of the Opto-Isolator | Pin 2, Anode of the Opto-Isolator | 2 & 3 | N/C | 2 & 3 |
| TTL/CMOS compatible 5 volt logic | Pin 1, Logic input with pull-up | Pin 2, Ground | 1 & 2 | 3 & 4 | 1 & 2 |
| **Function** | **TB-2** | **TB-2** | **J7** | **J7** | **J8** |
| Optically isolated **Dry Contacts** | Pin 3, Cathode of Opto-Isolator | Pin 4, Ground | 1 & 2 | 3 & 4 | 2 & 3 |
| Optically isolated **Wet Contacts** | Pin 3, Cathode of the Opto-Isolator | Pin 4, Anode of the Opto-Isolator | 2 & 3 | N/C | 2 & 3 |
| TTL/CMOS compatible 5 volt logic | Pin 3, Logic input with pull-up | Pin 4, Ground | 1 & 2 | 3 & 4 | 1 & 2 |

| Function Description | Mode | Input Terminal Numbers | SW3A-1 | SW3A-2 |
|---|---|---|---|---|
| Toggle | 0 | TB-2 / 1 & 2 Only | ON | ON |
| *Sustained* | *0* | *TB-2 / 3 & 4 Only* | *ON* | *ON* |
| Alternate Action 1 | 1 | TB-2 / 1 & 2 Only | ON | OFF |
| *Alternate Action 2* | *1* | *TB-2 / 3 & 4 Only* | *ON* | *OFF* |
| Pulse 1 | 2 | TB-2 / 1 & 2 Only | OFF | ON |
| *Pulse 2* | *2* | *TB-2 / 3 & 4 Only* | *OFF* | *ON* |
| Set (flip-flop) | 3 | TB-2 / 1 & 2 Only | OFF | OFF |
| *Reset (flip-flop)* | *3* | *TB-2 / 3 & 4 Only* | *OFF* | *OFF* |

### K2 Timing Description:

The "PGM" header JP-6 is used to configure the timing duration. To reset the factory default pulse timing duration of 500ms, short the "PGM" jumper for less than 1 second.

User defined timing may be programmed by shorting the "PGM" jumper for the duration of the desired pulse length. The "K 2" LED will blink ON to denote you are in the Programming mode and turn off when you are finished.

The minimum timing duration is 500 ms (1/2 second) with a maximum timing duration of 108 minutes.

## RELAY 3 CONFIGURATION

| Function | TB-3 | TB-3 | J9 | J9 | J10 |
|---|---|---|---|---|---|
| Optically isolated **Dry Contacts** | Pin 1, Cathode of Opto-Isolator | Pin 2, Ground | 1 & 2 | 3 & 4 | 2 & 3 |
| Optically isolated **Wet Contacts** | Pin 1, Cathode of the Opto-Isolator | Pin 2, Anode of the Opto-Isolator | 2 & 3 | N/C | 2 & 3 |
| TTL/CMOS compatible 5 volt logic | Pin 1, Logic input with pull-up | Pin 2, Ground | 1 & 2 | 3 & 4 | 1 & 2 |
| **Function** | **TB-3** | **TB-3** | **J11** | **J11** | **J12** |
| Optically isolated **Dry Contacts** | Pin 3, Cathode of Opto-Isolator | Pin 4, Ground | 1 & 2 | 3 & 4 | 2 & 3 |
| Optically isolated **Wet Contacts** | Pin 3, Cathode of the Opto-Isolator | Pin 4, Anode of the Opto-Isolator | 2 & 3 | N/C | 2 & 3 |
| TTL/CMOS compatible 5 volt logic | Pin 3, Logic input with pull-up | Pin 4, Ground | 1 & 2 | 3 & 4 | 1 & 2 |

| Function Description | Mode | Input Terminal Numbers | SW4A-1 | SW4A-2 |
|---|---|---|---|---|
| Toggle | 0 | TB-3 / 1 & 2 Only | ON | ON |
| *Sustained* | *0* | *TB-3 / 3 & 4 Only* | *ON* | *ON* |
| Alternate Action 1 | 1 | TB-3 / 1 & 2 Only | ON | OFF |
| *Alternate Action 2* | *1* | *TB-3 / 3 & 4 Only* | *ON* | *OFF* |
| Pulse 1 | 2 | TB-3 / 1 & 2 Only | OFF | ON |
| *Pulse 2* | *2* | *TB-3 / 3 & 4 Only* | *OFF* | *ON* |
| Set (flip-flop) | 3 | TB-3 / 1 & 2 Only | OFF | OFF |
| *Reset (flip-flop)* | *3* | *TB-3 / 3 & 4 Only* | *OFF* | *OFF* |

### K3 Timing Description:

The "PGM" header JP-9 is used to configure the timing duration. To reset the factory default pulse timing duration of 500ms, short the "PGM" jumper for less than 1 second.

User defined timing may be programmed by shorting the "PGM" jumper for the duration of the desired pulse length. The "K 3" LED will blink ON to denote you are in the Programming mode and turn off when you are finished.

The minimum timing duration is 500 ms (1/2 second) with a maximum timing duration of 108 minutes.

## RELAY 4 CONFIGURATION

| Function | TB-4 | TB-4 | J13 | J13 | J14 |
|---|---|---|---|---|---|
| Optically isolated **Dry Contacts** | Pin 1, Cathode of Opto-Isolator | Pin 2, Ground | 1 & 2 | 3 & 4 | 2 & 3 |
| Optically isolated **Wet Contacts** | Pin 1, Cathode of the Opto-Isolator | Pin 2, Anode of the Opto-Isolator | 2 & 3 | N/C | 2 & 3 |
| TTL/CMOS compatible 5 volt logic | Pin 1, Logic input with pull-up | Pin 2, Ground | 1 & 2 | 3 & 4 | 1 & 2 |
| **Function** | **TB-4** | **TB-4** | **J15** | **J15** | **J16** |
| Optically isolated **Dry Contacts** | Pin 3, Cathode of Opto-Isolator | Pin 4, Ground | 1 & 2 | 3 & 4 | 2 & 3 |
| Optically isolated **Wet Contacts** | Pin 3, Cathode of the Opto-Isolator | Pin 4, Anode of the Opto-Isolator | 2 & 3 | N/C | 2 & 3 |
| TTL/CMOS compatible 5 volt logic | Pin 3, Logic input with pull-up | Pin 4, Ground | 1 & 2 | 3 & 4 | 1 & 2 |

| Function Description | Mode | Input Terminal Numbers | SW5A-1 | SW5A-2 |
|---|---|---|---|---|
| Toggle | 0 | TB-4 / 1 & 2 Only | ON | ON |
| *Sustained* | *0* | *TB-4 / 3 & 4 Only* | *ON* | *ON* |
| Alternate Action 1 | 1 | TB-4 / 1 & 2 Only | ON | OFF |
| *Alternate Action 2* | *1* | *TB-4 / 3 & 4 Only* | *ON* | *OFF* |
| Pulse 1 | 2 | TB-4 / 1 & 2 Only | OFF | ON |
| *Pulse 2* | *2* | *TB-4 / 3 & 4 Only* | *OFF* | *ON* |
| Set (flip-flop) | 3 | TB-4 / 1 & 2 Only | OFF | OFF |
| *Reset (flip-flop)* | *3* | *TB-4 / 3 & 4 Only* | *OFF* | *OFF* |

### K4 Timing Description:

The "PGM" header JP-12 is used to configure the timing duration. To reset the factory default pulse timing duration of 500ms, short the "PGM" jumper for less than 1 second.

User defined timing may be programmed by shorting the "PGM" jumper for the duration of the desired pulse length. The "K 4" LED will blink ON to denote you are in the Programming mode and turn off when you are finished.

The minimum timing duration is 500 ms (1/2 second) with a maximum timing duration of 108 minutes.

## INSTALLATION GUIDELINES

Installation of the BOR-4 in high RF environments should be performed with care. Shielded cable is suggested for all connections. All shields should be tied to the EGND terminals. The station ground should be connected to the chassis ground screw located on the far right side of the BOR-4 as viewed from the rear. It is recommended that all cables connected to the BOR-4 be looped through ferrite cores to suppress RF. Surge protection with RF filtering is also suggested for the wall transformer. The purchase of an inexpensive UPS will provide back up in case of power outages.

The BOR - 4 is very simple to install. All connections are via screw terminals.

Installation of the BOR - 4 consists of five steps:

1. Inspection
2. Jumper selection, if applicable
3. Bench test
4. Mount the unit on a rack shelf, rack panel (RM-3 or 2) or MSO-8 if needed.
5. Connect your equipment to the unit

### STEP 1: INSPECTION

Please examine your BOR - 4 carefully for any damage that may have been sustained during shipping. If any is noted, please notify the shipper immediately and retain the packaging for inspection by the shipper. The package should contain the BOR- 4, 9vac, 500 ma wall power transformer and this manual.

### STEP 2: JUMPERS

See pages 5 to 8

### STEP 3: BENCH TEST

Place each unit on a workspace and connect power to the unit. Check to see if the green power LED is lit. Perform the desired operation.

### STEP 4: MOUNTING

• OPTIONS: Mount the unit on a rack shelf, such as the Broadcast Tools RM-3, the Broadcast Tools RM-2 rack panel or in the MSO-8, allowing adequate airflow for cooling.

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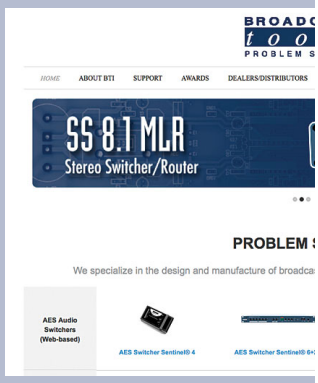




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## INSTALLATION GUIDELINES

### STEP 5: CONNECT YOUR EQUIPMENT

The BOR-4 interfaces to your equipment through rear panel screw terminals. Follow the silk-screened legends on the PCB for the desired connections. Use a small screwdriver to loosen each screw terminal, insert the stripped wire (18 to 26 gauge wire) and tighten the screw. Each section is provided with a 10 position screw terminal. The first four input terminals are described on pages 5 through 8. The remaining six terminals support the 2PDT relay, which are labeled as "A" and "B". NO refers to the normally open contacts, NC refers to the normally closed contacts and COM is the wiper.

**CAUTION!**

*Be cautious when connecting a telephone line to the BOR-4.* **Only connect the phone line to terminals 3 & 4 of TB-1**, *and only after the BOR-4 has been configured with the information on page 5 of this manual. If no ring detection is noted after properly configuring the BOR-4 with information presented on page 5, try reversing the TIP and RING wires on terminals 3 & 4 of TB-1.*

**NOTE:**

*JP14 is provided to facilitate connecting the front panel switches and LED's of the MSO-8 to the BOR-4. Install the 10-position connector supplied with the MSO-8 into JP14. Verify that pin 1 (Black wire) of the MSO-8 connector is matched with pin 1 on JP14 (The pin below the "J" in JP14). NOTE: Toggle is the only useful mode when used with the MSO-8.*

## BROADCAST TOOLS® BOR-4 SPECIFICATIONS

| | |
|---|---|
| **Logic:** | *uProcessor w/non-volatile memory* |
| **Inputs:** | *Momentary or sustained, optically isolated (5 to 28vdc) or 5 volt CMOS/TTL compatible inputs, open collector or contact closures to ground. Ring voltages from 80 to 130 volts.* |
| **Relays:** | *2PDT, 500 ma @ 24Vdc. Sealed relays utilizing 2 - form - C Bifurcated-Crossbar silver alloy with gold overlay contacts.* |
| **Connectors:** | *Screw terminals* |
| **Power Requirements:** | *9 to 24 volts AC/DC, 200 ma. 9 Vac @ 500 ma wall transformer supplied* |
| **Physical Dimensions:** | *7.75" x 4" x 1.25" (WDH)* |
| **Weight:** | *2.0 lb.* |
| **Shipping Weight:** | *3.0 lb.* |
| **Mounting Options:** | *RM-2 Rack Panel.3-RU*<br>*RM-3 Rack shelf. 1-RU*<br>*MSO-8 Chassis. 1-RU* |

**NOTE:**

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

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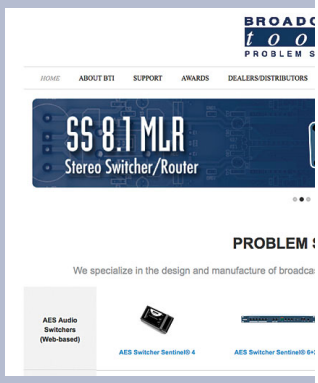




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