QUADBOOL

Operation Manual & User Guide

v1.0.3

Contents

Overview

QUADBOOL is a quad logic module for Eurorack modular synthesizers. Each of its four sections takes two inputs and performs a logic operation on them to determine the state of its output (on or off). In addition to gates and triggers, the inputs can accept any Eurorack signals, including audio rate and control voltages. While QUADBOOL will function without additional configuration, some alternate modes and optional features are described below.

Definitions

HIGH and LOW – A `HIGH` state on any of the inputs or outputs indicates the presence of a voltage around 5V. In the `LOW` state, there is no voltage (or *close to* no voltage).

Logic Operation – A Boolean logic operation that combines the state of the two inputs to produce either a HIGH or LOW signal at the output. See the logic tables in the Appendices.

Quad – One of the four identical sections on the module's front panel, each consisting of A and B input jacks, an output jack, and an illuminated push button.

Mode – By default, QUADBOOL operates in "Normal" mode. Alternate modes provide alternate paths for the input and output jacks (also called "normalization") and are activated by holding down one of the buttons while powering on the module. See Selecting an Alternate Mode.

Long Button Press – A long button press is defined as a button press with a minimum duration of 3 seconds. This is longer than you'd expect for a long press. Long presses are used to activate the features described in Saving Settings and Locking the Buttons.

Technical Specifications

QUADBOOL is designed to be used in a Eurorack-compatible case.

- Width: 5hp
- Depth: 35mm (+9mm for the power cable)
- Current Draw on +12V Rail: 69.26mA Maximum (with all LEDs and outputs on)

Included with QUADBOOL are:

1. 20cm IDC power cable
2. M3 x .5mm x 6mm mounting screws
3. Quick reference sticker

Solder, printed circuit boards, and all attached electronic components are certified RoHS compliant. Packaging for everything we sell is made of 100% recycled and reclaimed materials. All of our design and assembly work is done using 100% solar power.

Installing the Module

Carefully remove the module from its protective static shielding bag. Make every effort to reduce the possibility of static discharge by holding the module without touching the circuit boards and not opening the bag while standing on a carpet, etc.

Connect the included IDC power cable from the module to your Eurorack power supply. The module does *not* require a power supply that provides 5V.

Pay careful attention to the orientation of the red stripe on the IDC cable. While the keyed box header is meant to ensure that the cable is plugged in correctly, power cables have been known to be built incorrectly. You are safe if you use the power cable included with the module. If you use a cable from another source, however, *be sure that the red stripe's location matches the screen-printed markings* on the QUADBOOL circuit board. If you have to remove the cable, hold the circuit board by its edges. Otherwise, the two boards can separate from each other. If this happens, reconnect the two boards and continue.

ϟ Connecting the cable in the wrong orientation will result in physical damage to the module ϟ

When the module is powered on, it will briefly illuminate each LED from top to bottom, indicating that saved settings have been loaded and the module is ready to be used.

Using the Module

Each of the four quads of QUADBOOL performs a single function: it applies one of 6 logic operations to the A and B inputs, producing an output signal that is either `HIGH` or `LOW` according to the logic tables found in the Appendices. By default, the logic operations are set to `AND`, `OR`, `XOR`, `NAND`, from top to bottom.

Change which logic operation will be applied to a quad's inputs by pressing its button repeatedly. Each time the button is released, a different operation is selected according to the table below. Pressing the button when the last operation is selected will loop back to the top of the list.

Presses	Operation
1	AND
2	OR
3	XOR
4	**NAND**
5	**NOR**
6	**XNOR**

Operations 4, 5, and 6 (shown in bold above) are the inverse of operations 1, 2, and 3, respectively. See Appendices for more information.

Each time a button is pressed and released, the module's four LEDs briefly indicate which operation is currently selected. You do not need to wait for the LED indication to complete before pressing the button again.

The module's four LEDs indicate the six possible logic operations. This is accomplished by using the top three LEDs to indicate the `AND`, `OR`, or `XOR` operations. The fourth LED shows that the output is inverted (i.e., the operation is either `NAND`, `NOR`, or `XNOR`). See the diagram below for a visual explanation.

AND	OR	XOR	NAND	NOR	XNOR
●	○	○	●	○	○
○	●	○	○	●	○
○	○	●	○	○	●
○	○	○	●	●	●

When the LEDs are not indicating which operation is selected, they illuminate to reflect the output of their corresponding quad. In other words, if a given quad's output is `HIGH`, that quad's LED will be illuminated.

Selecting an Alternate Mode

Alternate modes of operation are accessible by holding down a specific button when the module is being powered on. Each of the modes affords a kind of normalization between different inputs and outputs. Using these alternate modes is optional, but they afford the ability to make complex, exciting patterns.

If an alternate mode is selected, it will only be enabled until the power is cycled. To remain in the selected alternate mode after the power is cycled, the module's settings must be explicitly saved as described in Saving Settings.

Drop A Mode

Hold down the *second button from the top* while booting to activate this mode. When the button is released, its LED will flash quickly to acknowledge the mode change.

The top A input signal will be duplicated on all other A inputs. If you connect a cable to any of the bottom three A input jacks, its signal will be combined with the top A input signal, using an XOR operation.

A^2+B^2 Mode

Hold down the *third button from the top* while booting to activate this mode. When the button is released, its LED will flash quickly to acknowledge the mode change.

The top A and B input signals will be duplicated on all of the other A and B inputs. If you connect a cable to any of the bottom three A or B input jacks, that jack's signal will be combined with the top A/B signal, using an XOR operation.

Daisy Chain Mode

Hold down the *fourth button from the top* while booting to activate this mode. When the button is released, its LED will flash quickly to acknowledge the mode change.

The output signal for each quad will be duplicated on the A input of the quad below. This normalization occurs for each output, regardless of whether that output jack has a cable plugged into it. If you connect a cable to any of the bottom three A input jacks, its signal will be combined with the output signal from the quad above, using an XOR operation.

Locking the Buttons

The four buttons can be “locked” to avoid accidentally changing their logic operations. When the buttons are locked, pressing any button will indicate the selected logic operation for that quad. You will not, however, be able to change to a different logic operation.

Lock the buttons by long-pressing the *bottom button*. All four LEDs illuminate briefly to indicate success.

Unlock the buttons by long-pressing the bottom button again. The top two LEDs illuminate briefly.

The buttons will be unlocked when the module’s power is cycled, unless you Save Settings.

Saving Settings

Long-press the second button from the top to save your current module settings. The module settings consist of the following:

1. The logic operations selected for each quad
2. The module’s mode (either “Normal” or one of the Alternate Modes)
3. Whether the buttons are locked (see Locking Buttons)

When the settings have been saved, the LEDs flash quickly from bottom to top.

Resetting the Module

Hold the top button while booting to reset the module to its default settings. In addition to restoring the default logic operations, the buttons will be unlocked and the “Normal” mode will be restored (as opposed to an Alternate Mode).

Limited Warranty

From the date of manufacture, this device is guaranteed for a period of 1 year against any manufacturing or material defects. Any such defects will be repaired or replaced at the discretion of XOXO Modular. This does not apply to damage caused by misuse or physical mistreatment.

No responsibility or liability is implied or accepted for harm to person or apparatus caused through operation of this product or for any errors or inaccuracies that may appear in this document.

By using this product, you agree to these terms.

Appendices

Appendix A: Logic Tables for Basic (Non-Inverted) Logic Operations

AND

A	B	OUT
○	○	○
○	●	○
●	○	○
●	●	●

OR

A	B	OUT
○	○	○
○	●	●
●	○	●
●	●	●

XOR (exclusive OR)

A	B	OUT
○	○	○
○	●	●
●	○	●
●	●	○

Appendix B: Logic Tables for Inverted Operations

NAND (inverted AND)

A	B	OUT
○	○	●
○	●	●
●	○	●
●	●	○

NOR (inverted OR)

A	B	OUT
○	○	●
○	●	○
●	○	○
●	●	○

XNOR (inverted XOR)

A	B	OUT
○	○	●
○	●	○
●	○	○
●	●	●

Appendix C: Diagram of Logic Operations

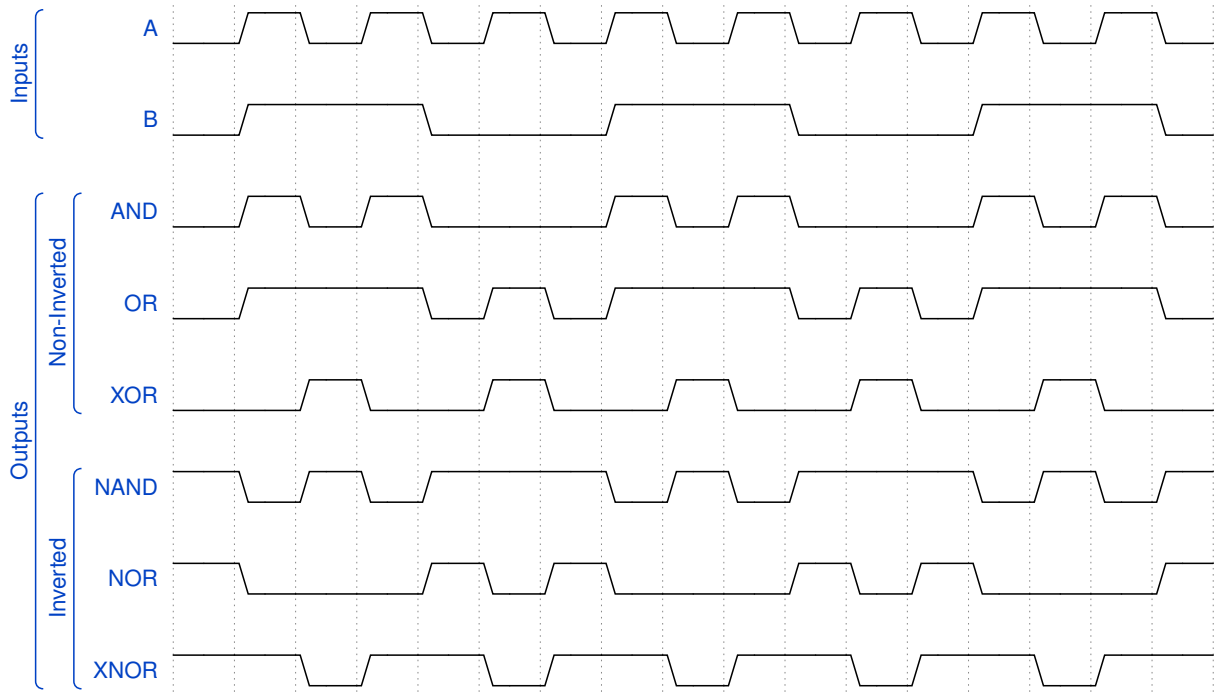

Figure 1: All Logic Operations

Appendix D: Complex Example

This example shows how complex and wild the outputs can become, given only a few input signals (and a bit of brain-melting). The diagram illustrates the following setup:

1. The “Drop A” alternate mode is selected.
2. Cables are connected to the A and B inputs of the top quad. The signals are labeled **A1** and **B1**.
3. The AND operation is selected for the top quad. The result of this operation is shown as **Output 1**.
4. A cable is connected to the A input of the second quad. This signal is labeled **A2**.
5. The OR operation is selected for the second quad.

As described in Drop A Mode, **A1** and **A2** are combined with an XOR operation. The result is shown as **A1 XOR A2** in the diagram.

Finally, the output of the second quad is the result of combining **A1 XOR A2** and **B2** with the OR operation selected for that quad.

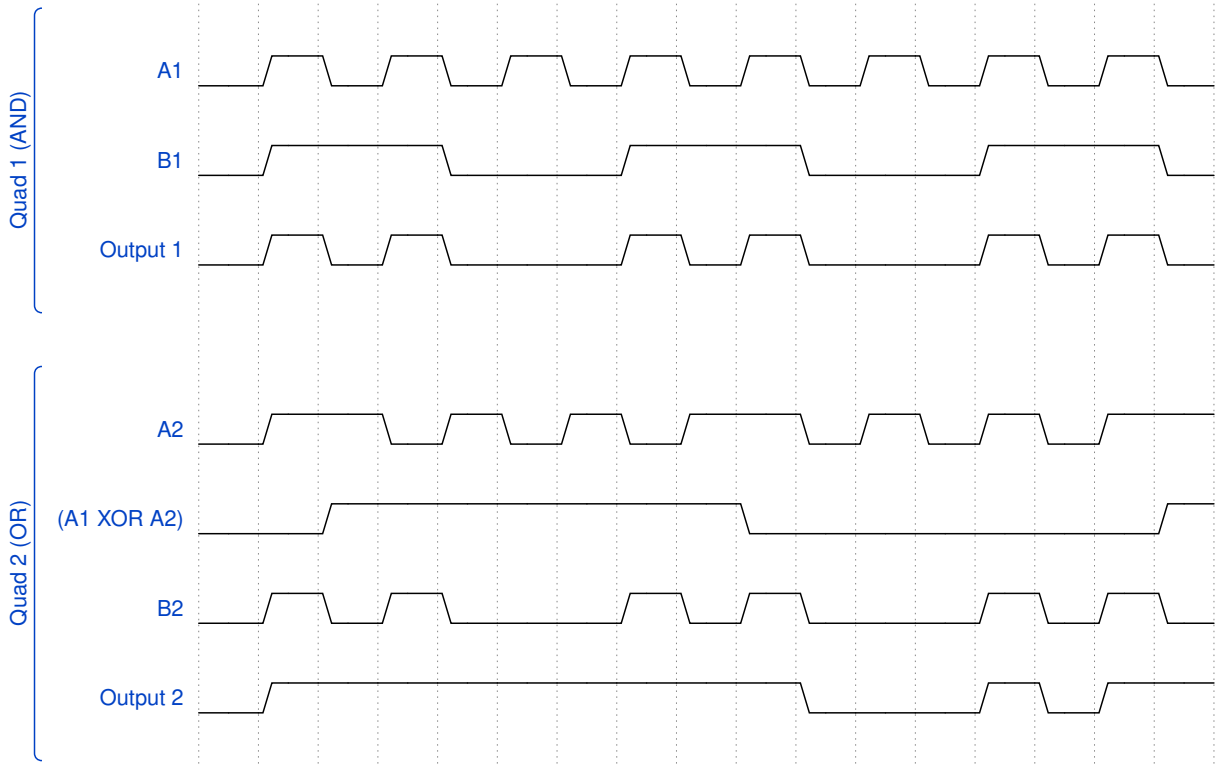

Figure 2: Complex Example with Drop A