

DESCRIPTION

LogicHub Dock Rev.1 is a programmable logic gate experimentation board designed to be used with the METE HOCA Akana R1. The LogicHub Dock is versatile and has been designed as an ideal tool for educational institutions, helping students better understand logic gates and digital electronics.

The LogicHub Dock is engineered to work seamlessly with the Akana R1 board. Featuring a user-friendly interface, the Dock is easy to attach and detach from the Akana R1.

The board includes a total of 9 logic gates, with 7 of them being easily programmable via the Akana R1's display and buttons. This allows users to switch between AND, OR, NAND, NOR, XOR, XNOR, NOT, and BUFFER gates.

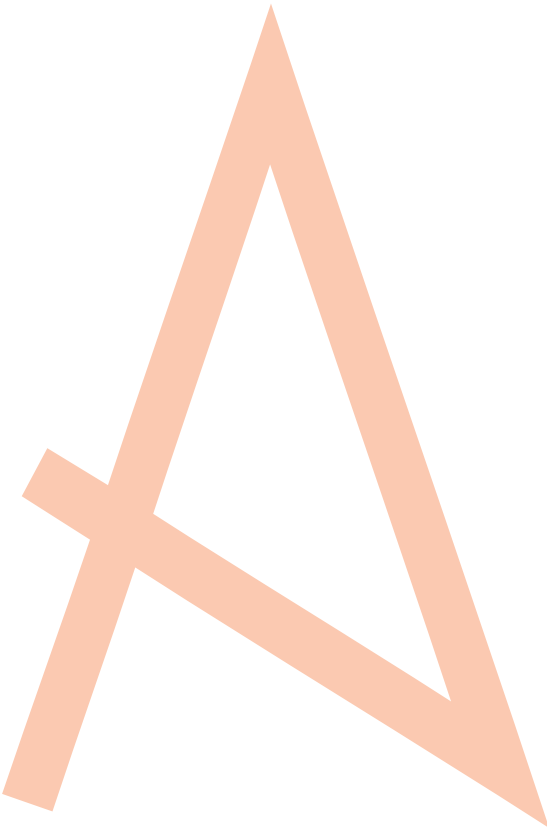
In addition, the board is equipped with a switch for selecting 0-1 inputs, fixed 0 and 1 inputs, and three LEDs to display the project outputs. The LogicHub Dock also features an RC circuit (OSC) that, when combined with NOT gates, can be used to create a simple oscillator circuit. This oscillator circuit allows for the exploration of different applications of logic gates.

All components on the LogicHub Dock are designed to be protected against incorrect connections or short circuits.

With the LogicHub Dock, you can unleash your creativity and push the boundaries in your digital electronics projects!

FEATURES

1. STEM-Optimized PCB Design
 - a. White color scheme suitable for educational use
 - b. Practical component layout
 - c. Labels under each section and pin for easy identification
2. 7 Programmable Logic Gates
 - a. Basic design with 2 inputs and 1 output per gate
 - b. Each gate connected to a separate GPIO pin
 - c. Single input and triple output pin header connections
 - d. Protection resistors against incorrect connections
3. 2 NOT Gates
 - a. Commonly used fixed gate option
 - b. Single input and 3 outputs
4. 3 Output LEDs
 - a. Designed to be used as circuit output indicators
 - b. Current limiting resistors chosen to prevent glare
5. Selector Switch
 - a. Designed to quickly change the input to 0 or 1
 - b. Protection resistor against incorrect connections
 - c. Triple pin header output
6. Fixed Input Headers
 - a. Designed for 0 and 1 input selections
 - b. Each with a triple pin header structure
 - c. Protection resistors against incorrect connections
7. RC Oscillator Project Preparation
 - a. Designed to demonstrate the creation of oscillators using logic gates
 - b. RC circuit capable of producing visually perceptible frequencies
 - c. Planned for use with programmable NOT gates



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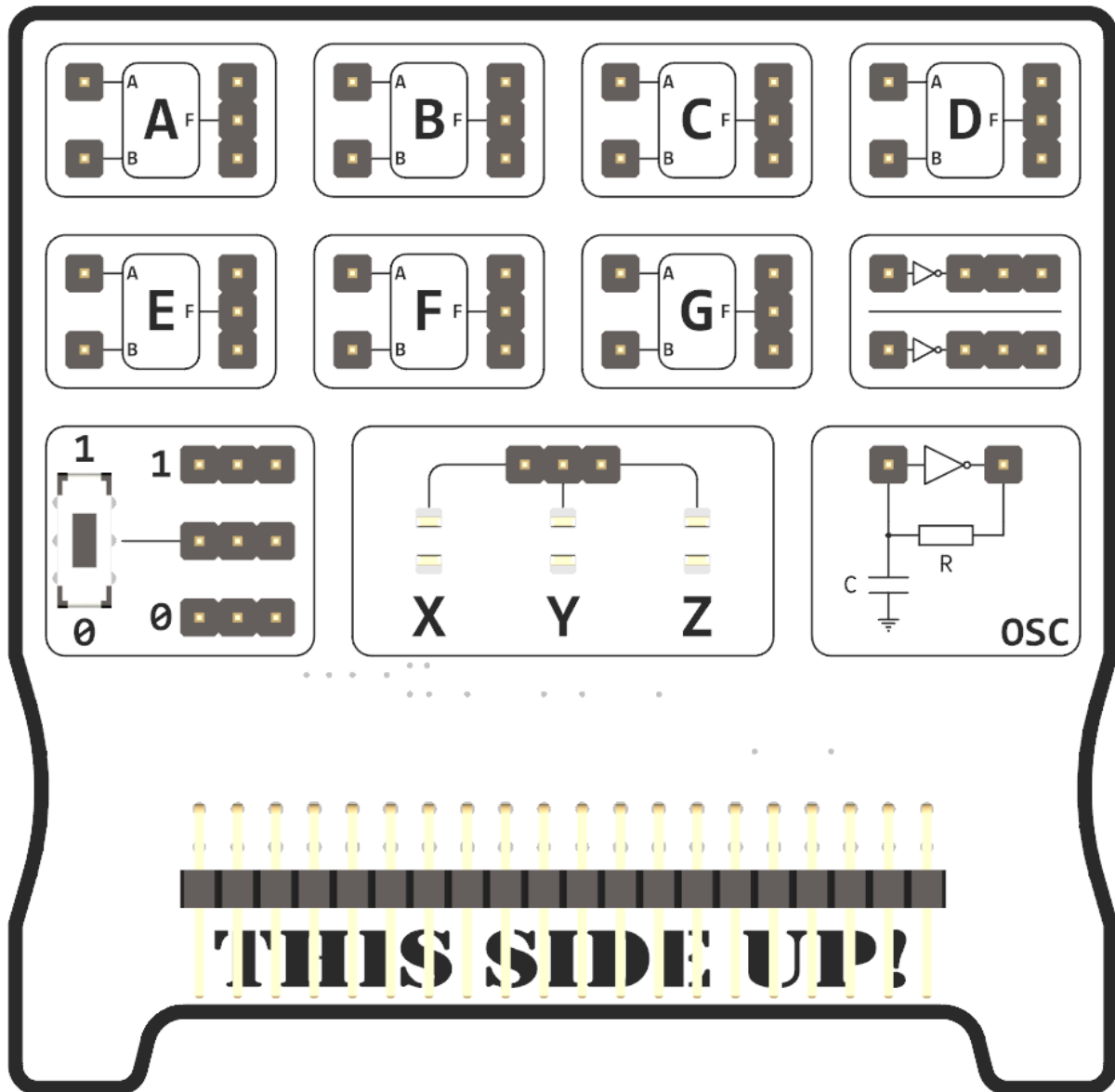
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USAGE GUIDELINES

LogicHub Dock Rev.1, like any electronic device, is sensitive to short circuits and can be damaged if placed on a conductive surface, if conductive objects fall onto it, or if it comes into contact with liquids while in operation.

As with all electronic boards, LogicHub Dock Rev.1 should never be used on metal surfaces, and no conductive objects should come into contact with it.

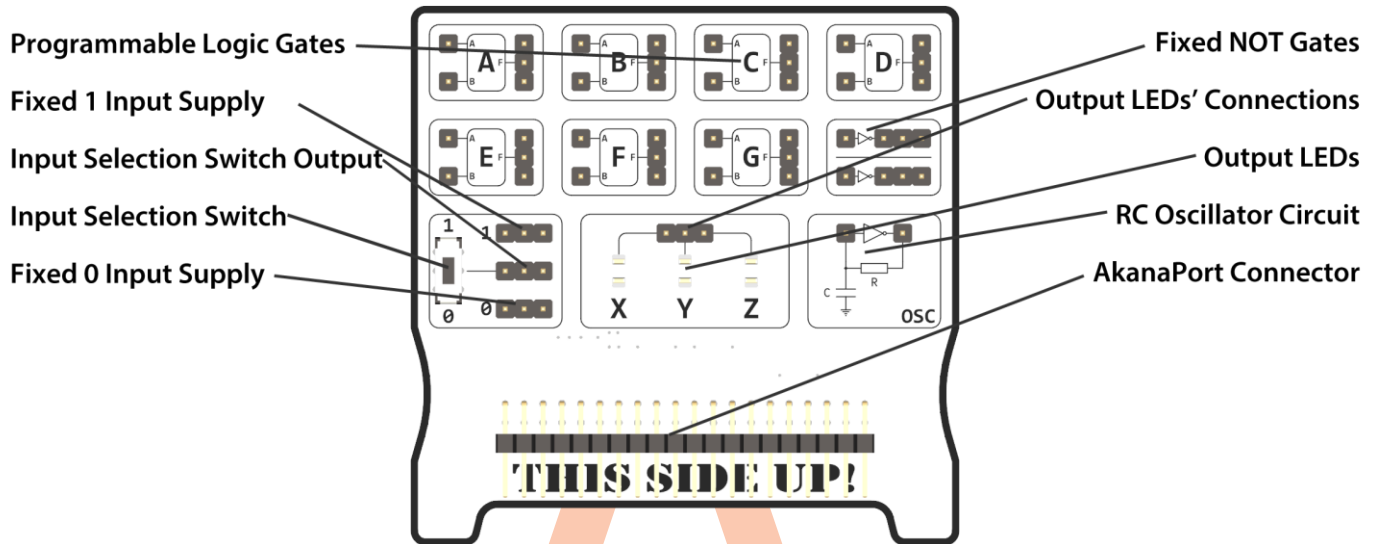


When not in use, the Dock should be removed from the Akana R1 and stored in its packaging to prevent damage.

Leaving cables connected to the header pins on the Dock may cause the cables to loosen over time, leading to poor connections.

GETTING TO KNOW LOGIC HUB DOCK REV.1

Below is the front view of the LogicHub Dock Rev.1. The board, which connects to the AkanaPort expansion slot on the Akana R1, is built on the principle of creating programmable logic gates using GPIO pins. LogicHub Dock is the best way to experience logic gates, one of the foundational concepts in understanding coding logic.



On the board, there are 7 programmable logic gate bases labeled A, B, C, D, E, F, and G. Each logic gate has 2 inputs and 1 output. The inputs are marked with the letters A and B, following the traditional logic gate input labeling. The output section is labeled with the letter F.

Each logic gate base has one input and three outputs. The triple output connection allows the logic gate output to be connected as an input to multiple gates. Using the 10 female-to-female Dupont cables included in the LogicHub package, you can create the desired logic circuit configuration.

Each programmable gate can be selected as an AND, OR, NAND, NOR, XOR, XNOR, NOT, or BUFFER gate through the LogicHub code that will be loaded onto the Akana R1. When NOT and BUF gates are selected, the A pin is used as the input.

In addition to the programmable gates, there are 2 fixed NOT gates placed on the board. These gates are included because they are frequently used in complex logic gate circuits.

To provide input signals to the logic gate circuit you create, there is an input section located in the lower-left corner of the board. This section consists of three parts with three pins each, where you can find a fixed 1, a fixed 0, and an area that can be selected via a switch.

To observe the outputs of the logic gate circuit you create, there are 3 LEDs named X, Y, and Z located in the lower middle section. The triple connection above the LEDs is positioned as the input for each LED.

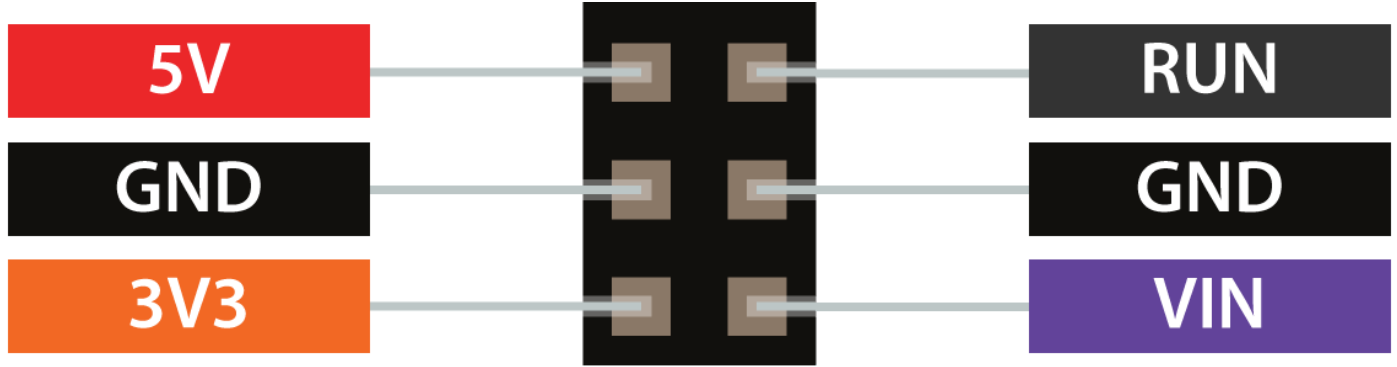
In the lower right corner of the LogicHub, there is an RC circuit designed to allow users to experience creating a frequency generator (oscillator) with logic gates. While this circuit is primarily intended to be connected to a NOT gate, it can also be connected to the inputs and outputs of other gates to observe their responses.

It is recommended to use the RC oscillator circuit with programmable gates rather than the fixed NOT gates on the board. Setting gate G as a NOT gate and connecting the circuit to this gate is a good choice.

ELECTRICAL CHARACTERISTICS AND LIMITS

LogicHub Dock Rev.1 shares the same electrical limitations as the Akana R1, with which it is used.

The RP2040 microcontroller on the Akana R1 operates at a 3.3 Volt logic level. Therefore, any sensors, modules, or other electronic circuits used with the Akana R1 should be selected to operate at 3.3 Volts.



The entire design of the Akana R1 is based on a **3.3 Volt** foundation, and every component on the board operates at this voltage. The **3.3 Volt regulator** (AP2112K-3.3TRG1) on the board uses the voltage supplied through the 5 Volt regulator connected to the USB or VIN input to power all components that operate at 3.3 Volts, primarily the RP2040 microcontroller and the OLED screen.

To enable the use of components that require 5 Volts, such as **WS2812** series addressable LEDs or **micro servo** motors, the Akana R1 also features a 5 Volt output. This 5 Volt output is provided by the **5 Volt regulator** (AMS1117-5.0) connected either through the USB line or the VIN input on the AkanaPort.

The electrical values of the power components and the power pins on the AkanaPort are as follows:

- **RP2040 GPIO voltage:** Maximum 3.5 Volts
- **Onboard OLED display:** Maximum 3.5 Volts
- **AkanaPort 5V supply:** Maximum 5.5 Volts
- **AkanaPort 3.3V supply:** Maximum 3.5 Volts
- **AkanaPort VIN supply:** Maximum 14 Volts

To power the Akana R1 with a single-cell Li-Ion or Li-Po battery, the **5V** supply input should be used. These types of batteries provide a voltage between 3.7 and 4.2 volts when fully charged, which is sufficient for the onboard 3.3V regulator to produce the required voltage. For operating the Akana R1 with a two or more cell battery, the **VIN** (Voltage In) pin should be used.

The VIN input on AkanaPort is protected against reverse polarity with a **Schottky diode**. However, there is no such protection on the 5V and 3.3V lines, so it is crucial to be very careful when powering the board through these lines.



VERSIONS

METE HOCA LogicHub Dock Rev.1 Versions

Date	Changes
31 July 2024	Initial version; Rev.1

Document Versions

Date	Changes
31 July 2024	Initial release

