Overview

Looking for a novel puzzle to use in your escape room? Look no further! This specially designed controller allows one or more people to create a human chain across two conductive surfaces or objects to "connect" a circuit electrically and activate up to three output relays which can then be used to create a near infinite number of unique puzzles or challenges. Whether you are illuminating invisible ink with a UV light or unlocking an electromagnetic door or safe, the possibilities are endless.

Background

Eastern Voltage Research was the first in the escape room industry to offer this type of human conductivity switch back in 2010 and as the original creator, we continually strive to improve the functionality, quality, and reliability of our human chain controllers. These new human chain controllers feature improved detection and pre-amplifier circuits and also provide one and two 10A relay outputs as well as a 3A solid state relay to control almost any type of output device. We have tested this human chain controller with up to eight (8) people. (See paragraph on Performance Factors)

Features

- Operating voltage: 12VDC nominal
- Output 1 – Relay, SPDT (NO and NC)
- Output 2 – Relay, SPDT (NO and NC) – (2.0 only)
- Output 3 – Solid state – 12V @ 3A (max)
- Output 4 – Solid state – 12V @ 3A (max)
- Three (3) LED status lights
- High quality removable terminal blocks
- Mounting holes for board mounting

Compatible Output Devices:

- Lights (LEDs, incandescent, halogen)
- Flicker LED controllers such as our Flicker 3.0
- UV Lights (perfect for revealing invisible ink)
- Electromagnetic door locks
- Pneumatic switches and solenoids
- PLCs, external microcontroller circuits / devices
- External audio devices (with input trigger)

Input Power Supply

Nominal input power supply voltage: 12VDC
Nominal input current for controller: 100mA (no loads)

To properly size the 12VDC power adapter, add the total current of the devices connected to the solid state relay output (J5), and relay outputs (J3,J4) to the 100mA load of the controller. In most cases, a 12V, 1A adapter is sufficient.

Note, if you are using separate power supplies to provide power for devices connected to the relay outputs (J3,J4), then do NOT add the current of those devices to the controller input power adapter current.

Safety Ground

For commercial or public use, be sure to use an isolation transformer and also connect the VIN- input to EARTH ground for safety. This ensures the 12V circuit is ground referenced and not floating. See next page for more information on isolation transformers.

Sense Input

The sense inputs are connected to two external conductive surfaces or objects (electrodes). When someone touches both of the electrodes with their hands and completes the electrical circuit, the controller will sense this connection and activate the output relays.

Additionally, more than one person can be used to create a "human chain" across electrodes placed at greater distances across a room. We have tested this controller with up to eight (8) people creating a long human chain. (See paragraph on Performance Factors)

Test Pushbutton

Pressing the test button simulates a human chain connection and is useful for testing your outputs without having a SENS input connected.

LED Indicators

Ready LED – Indicates that the controller is enabled
Connect LED – Indicates a "connection" has been made
Output LED – Indicates the output relays are enabled

High Current Relay Outputs

Output Relay specifications:

Output	Specification
Output Relay J3	0-28VDC, 10A (max) (See safety note below)
Output Relay J4	0-28VDC, 10A (max) (See safety note below)

Relay contact definitions:

COM1/COM2 – Connect to the common voltage that the relay is switching.

NO1/NO2 – Normally open. The connection between NO and COM is open when there is no connection at the sense input.

NC1/NC2 – Normally closed. The connection between NC and COM is short when there is no connection at the sense input.

SAFETY NOTE: We do not recommend the use of line powered (115VAC) equipment due to safety reasons as if isolation breaks down within the relay, there could potentially be 115VAC across the sense inputs.

Solid State Outputs

The solid state outputs do not require an external voltage source. +12V is already tied to the VIN+ input power supply. Make sure that your input power supply or adapter is rated for the current of the load being connected to this output.

The AUX1 output is normally ENABLED meaning it will turn the output OFF when a human connection is made while the AUX2 output is normally DISABLED meaning it will turn the output ON when a human connection is made.

Solid state Relays specification:

Output	Specification
Solid State Relay AUX1 (Normally ENABLED output)	12VDC, 3A max Open collector output
Solid State Relay AUX2 (Normally DISABLED output)	12VDC, 3A max Open collector output

When connecting a load to the solid state relay outputs, the positive connection should connect to +12V and the negative connection should connect to AUX1- or AUX2-.

Performance Factors

The performance of the human chain controller sense input and the ability of the sense inputs to be "connected" through one or more human bodies is dependent on the following factors:

Electrodes

The size, geometry, and total surface area being touched by a human can affect the performance. Generally, the larger the surface area of an electrode, the better performance and conductivity of the circuit.

Electrode Contamination

Electrodes which have contaminants such as oil, dirt, and oxidation, will not conduct as well a clean electrodes and thus reduce overall performance. So it is very important always maintain clean electrodes.

Humidity

Higher humidity can both increase and reduce performance of the circuit. Hands are generally more moist with higher humidity and will provide better conductivity, however, it may also increase leakage current through shoes or clothing which will reduce performance.

Human Hands

One of the biggest factors to affect performance, which unfortunately is the least controlled, is the condition of a customer's hands. Hands that are dirty, dry, or oily, will not conduct as well as clean, oil-free hands. This factor will greatly affect how many people can be together to form a human chain. Experimentation is key when designing and positioning electrodes within an escape room or similar application.

Line Voltage Safety Requirements

If this controller is being used in a commercial or other application in which the general public will be making contact with the electrodes, then an isolation transformer is required between the AC outlet and the power supply / adapter being used to provide 12VDC to the controller. In the rare event that the power supply or power adapter's isolation fails, the isolation transformer will reduce the probability and / or severity of an electrical shock.

This is also the reason you may see orange colored outlets in hospitals or other medical facilities. The orange colored outlets denote that there is an AC isolation transformer installed on that particular circuit for safety.

Using AC Devices with Output Relays

Due to safety reasons, we do not recommend the use of AC line powered devices to be used with the output relays of the controller. Although relays are electrically isolated between the input coil and output contacts, although extremely rare, if that isolation fails, there could potentially be AC line voltage connected to the input sense electrodes.

NOTE: AC line powered devices do not refer to devices that use an AC power adapter where only 12VDC may be connected to the output relay terminals of the controller. AC line powered devices would mean actually having 115VAC connected to the output relay terminals of this controller with that switched 115VAC going directly to an output device. An example would be a standard 115VAC lightbulb for example or an electromagnetic lock powered with 115VAC.

Application Examples (Guide)

Please refer to our Escape Room application guide for detailed hook-up diagrams and examples. This guide can be directly downloaded as a PDF from the Escape Room section of our website.