
Relay Latch Board

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Introduction

This document describes the Relay Latch board and how to assemble and install it.

Revision History

V0.1 – first pass

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1 INTRODUCTION

This board has a relay and supporting components and implements a latch circuit for alerting operators to call the Dispatcher as part of a model railroad telephone system, typical applications include:

- Lighting an indicator (a limiting resistor is provided for LEDs, but a 12V light bulb can be substituted) after a station is initially called (buzzed): the indicator will remain lit until the associated phone is picked up. This allows for an unmanned location to be called or can be used at a manned location where the operator may be busy with another task and might forget to call back.
- Lighting an indicator at the Dispatcher's desk indicating that a call request has been made but not answered

Features:

- 12 VDC operation
- Option of on-board power from a wall wart via 2.1mm plug or screw terminals for use with 12V layout auxiliary power bus.
- Latch is held in series with a normally closed contact from the associated phone or with our "Off-Hook Detector"
- Current limiting resistor (normally 1K ohm) for LED indicator on board
- Jumper to select 12V or ground for LED/Lamp supply
- Extra +12V and GND connections for easy daisy chaining and connections to phones
- Compact (1.2" x 2") footprint allows the relay latch to be placed inside standard phones, close by our Cup Hook Phone or placed at a central location close to the Dispatcher

All components are through-hole technology for ease of assembly and repair.

Input connection pads are on 0.100" centers. This provides a wide range of interconnect options and components. Connection schemes include screw terminal blocks, header pin connectors (male and female), soldered right angle headers, and direct soldered wires.

Schematic, circuit board layouts and CAD files are available on the product page on our website and on my GitHub page.

2 IDENTIFICATION AND INFORMATION

2.1.BOARD LAYOUT

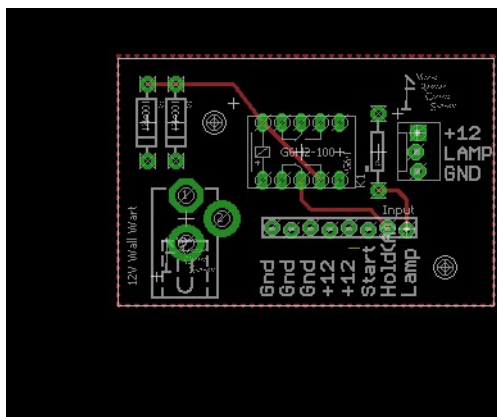


Figure 1 - Rev 1.0 Board

This board is sold as a single unit, assembled and tested (white board) or as panel of 6 (green board) bare boards. If you are interested in alternate connectors, resistor values, large quantities, or custom modifications please contact us. We also offer an OMRON Relay breakout for those applications needing a relay only.

2.2.BILL OF MATERIALS

Qty	Value	Device	Package	Parts	Description
1	12V DC Power Jack	CONNECTOR-DC-POWER-RA	DCJ0202	CON1	DC POWER JACK
1	1K	RPTH04	AXIAL-0.4-RES	R1	Resistor
2	1N4001	DIODEPTH	DIODE-1N4001	D1, D2	Diode
1	CONNECTOR-M03MOLEX-254-LOCK	CONNECTOR-M03MOLEX-254-LOCK	MOLEX-1X3_LOCK	LAMP_POLARITY	3 Position
1	G6H2-100	G6H2-100	G6H2-100	K1	RELAY
1	Input	CONNECTOR-M08FEMALE_LOCK	1X08_FEMALE_LOCK	J1	Header 8
1	0.100 jumper	0.100 jumper	0.100 jumper		0.100 jumper

Table 1- Bill of Materials Rev 1.0

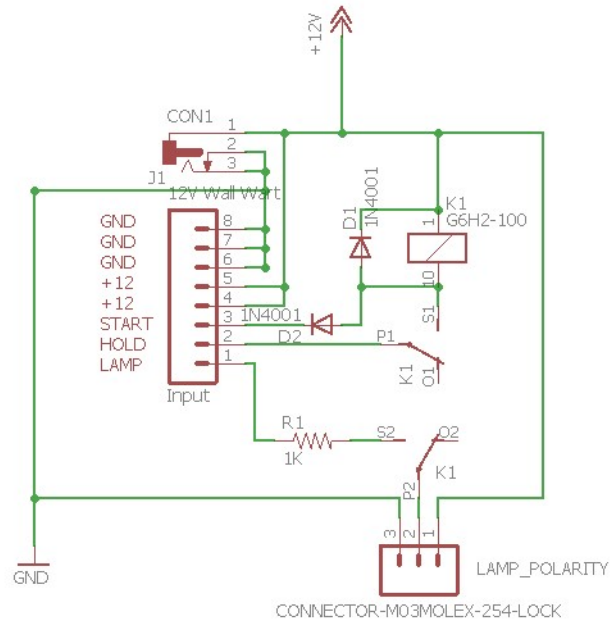


Figure 2 - Rev 1 Schematic

3 OPTIONS

3.1.CONNECTION INFO:

Pin	Designation	Comment
1	Lamp	Connect LED or Lamp here, polarity controlled by Lamp Polarity Jumper. Limiting value is 1000 ohm
2	HOLD	Connect a Normally-Closed (when on hook) contact from the phone, other side of the contact goes to ground
3	START	Connect the Dispatcher's normally open is push button (other side goes to ground)
4	+12	+ 12 VDC Power, both power terminals are connected to each other and to the + of the DC power jack (if you are using a wall wart to provide power)
5	+12	
6	GND	The grounds are connected to each other and to the – of the DC Power Jack. You can use these to daisy chain power to another relay latch or to connect to a phone. You may also use the screw terminals to connect to a 12V aux power bus.
7	GND	
8	GND	

Table 2 – Screw terminal connections

3.2.CONNECTORS

- The input connectors are on 0.100 centers (staggered slightly to hold the connectors in place during assembly). While our standard connector is the 0.100 screw terminal, you may substitute any other 0.100 connector you prefer. If you are ordering an assembled and tested unit from MRCS and you would prefer a different connector, please contact us at sales@modelrailroadcontrolsystems.com and indicate your preference and we'll provide a quotation.
- We provide a 2.1 mm, center positive, barrel jack for power, generally from a 12v wall wart. If you won't using a 2.1mm connector, you can omit the DC power jack

3.3.DETAILED ASSEMBLY

[] All of the components are through-hole technology with wire leads. A useful tool is a lead bender for forming the leads at 90 degrees for easy insertion into the pad holes. The general rule is installing the lowest components first, working towards components that are higher off the board. This enables you to support the low components as you solder them.

[] Resistors, Diodes

[] Install Resistor R1. Install the gold tolerance band towards the bottom (screw terminal side) for easier reading of values. We recommend 1K ohm for 12V operation, yielding ~ 10mA through the LED, but feel free to modify as needed.

[] Install diodes D1, D2. Observe polarity – band towards DC Power Jack.

[] Relay

[] install the relay, K1 Make sure the black band is towards the top of the board (away from the screw terminals).

[] Option Header

[] Install the Lamp_Polarity header.

[] Screw Terminals and Power Jack

[] Install the “Input” screw terminal

[] Install Con1 (2.1 mm barrel jack) unless you will not be using a 2.1mm plug to power your relay latch

3.4.SUBSTITUTIONS

If you ‘d like to work with a different voltage, the G6H2 relay is available in a variety of voltages from 3V to 48V. . If you use a different voltage, you may want to use a different value for R1, we recommend setting the value to provide 10mA to the LED.

4 TESTING

Testing your Relay Latch is quick and simple:

1. Mount the board securely on standoffs or with double stick tape
2. Apply 12VDC power with a 2.1mm center positive plug to Con1 or to the +12V and GND terminals on the screw terminal
3. Connect the HOLD lead to a normally closed switch with the other side connected to any of the GNDs.
4. Connect the START lead to a normally open push button with the other side connected to any of the GNDs.
5. Put the jumper on the Lamp_Polarity header between the LAMP and +12 Pins. Connect an LED with the long lead to the LAMP terminal and short lead to any of the GNDs.
6. Press the push button. The relay will operate with a faint click and LED will come on.
7. Operate the normally closed switch so it opens (simulating the phone going off hook). The relay will release (faint click) and the LED will extinguish.

5 THEORY OF OPERATION

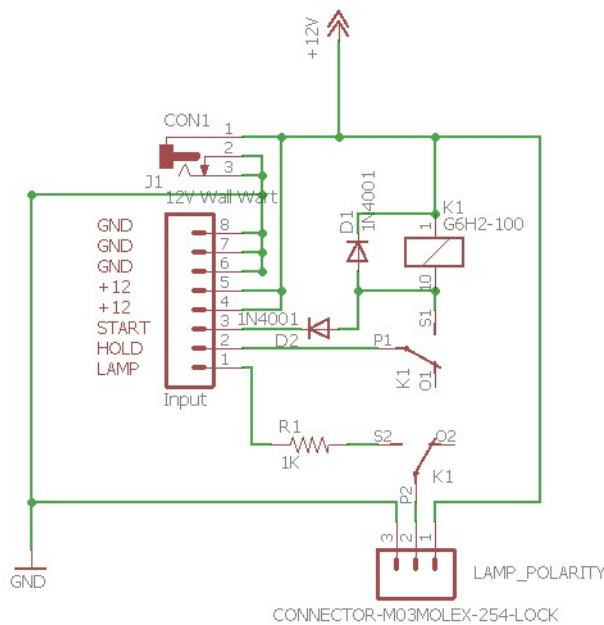


Figure 3 - Schematic, for reference

Latch Theory of Operation:

- In the idle state the relay is off, and the LED is Dark
- When the Dispatcher wants to call the station, he presses a push button at his desk.
 - This applies a ground at the START terminal and the black (- end of the buzzer) and the buzzer (red end is connected to +12 at E2) starts to buzz.
 - The ground is also applied to the relay K1 via diode D1, causing K1 to operate.
 - The LED connected to the LAMP terminal operates via the second contact of K1 and lights as long as the relay is operated. LED current is limited by R1.
- When the Dispatcher releases the push button:
 - The Buzzer will stop buzzing
 - the relay will stay operated under control of the normally closed (when on hook) hook switch contact through the HOLD terminal.
- Station Goes Off-Hook
 - The holding circuit for the relay is in series with a normally closed hook switch contact in the phone, on the HOLD terminal, which is removed when the station goes off hook, causing the relay to release and the LED to go dark
- Snubbing (reverse voltage spike protection) is provided by D2.
- This circuit has the useful property that the DS can “re-ring” a station that has already answered, for example the Yardmaster about the departure of an upcoming

train. The YM goes off to check and gets distracted but has left his phone off-hook. The DS can press his push button and the buzzer will buzz and the LED will light.

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6 INSTALLATION AND CONNECTIONS



Figure 4 – Vellman SvM12N buzzer (12VDC)

<http://www.modelrailroadcontrolsystems.com/dc-buzzer/>

We recommend the Vellman SvM12N buzzer, Red to +12V, Black to ground, draws ~30mA. A 12 Volt buzzer of this style will draw about 25mA from 12V, this is well within the 1A DC rating of the relay, so this will work fine. Available from your favorite electronic supplier, we also offer them so you can have a one-stop shop.

3.5. BUZZERS

Buzzers, are useful at manned stations but just add to the noise during an operating session when buzzing at an unmanned station. Some operators at manned stations may also find constant buzzing annoying if they're busy with other tasks. A solution is to buzz once and then light an LED to alert a passing crew or to remind yard operator to pick up the phone and contact the Dispatcher. The LED is turned off automatically when the phone is taken off-hook.

3.6. CONNECTIONS

Suggested Station Connections for Relay Latch:

Position on Cat 5	Color	Designation	Relay Latch Connection	Purpose
1	Wh/Bl	T	None	Tip of talk circuit on EBF31A or other battery feed
2	Bl/Wh	R	None	Ring of talk circuit on EBF31A or other battery feed
3	Wh/Or	A	none	Switched side of contact aux closure from second cup hook contact (grounded when station is ON hook*) See hook switch wiring figure 8, use Wh/Grn wire.

4	Or/Wh	A1**	Ground	Ground side of aux closure from second cup hook contact, tied back to one of the GND terminals on the Relay Latch
5	Wh/Grn	LG	None	tied back to one of the GND terminals on the Relay Latch
6	Grn/Wh	L	None	Tied to LAMP Terminal
7	Wh/Brn	Buzz Start**	Push button at DS to operate buzzer and latch	Ground (black) side of buzzer**
8	Brn/Wh	LED or buzzer supply	+ side of buzzer supply	Hot (+12) side of buzzer** and tied to one of the + 12 terminals

Figure 5 – Relay Latch Connections

Case – LAMP polarity

Case – Latch central location

Case – latch at or in phone

3.7.POWER CONNECTIONS