QUASAR Kit 3156 - DUAL HI/LO SWITCHED RELAY BOARD

General Guidelines for Electronic Kits and Assembled Modules

Thank you for choosing one of our products. Please take some time to carefully read the important information below concerning use of this product. The assembly and operating instructions are on the following pages. Help with component identification can be found on our website at www.quasarelectronics.com/componentid.htm. If you are unsure about any aspect of the assembly or use of this product please contact our Support Team before proceeding.

WEEE Directive (Waste Electrical and Electronic Equipment)
Notice To All European Union Citizens. Important environmental information about this product.
The crossed out wheeled bin symbol on this product, package or documentation indicates that disposal of this product after its lifecycle could harm the environment. Do not dispose of this product (or batteries if used) as unsorted municipal waste. It should be disposed by a specialized company for recycling.
The unit should be returned to your distributor or to a local recycling service. Please respect the local environmental rules. If in doubt contact your local authorities about waste disposal rules.

Safety: General rules concerning safe use of our Kits or Modules.
To ensure your safety, please observe these safety measures. In no way are these complete. As safety requirements vary, please check with your local authorities, in order to comply with local requirements. If in doubt, seek the help of a qualified person.

Battery or wall-adaptor operated devices are safe devices. They do not require special attention unless mains voltage is connected to an output e.g. a relay.

To ensure electrical safety, and also protection from fire or personal injury, make sure your mains operated equipment complies with these safety hints:

- Use a suitable plastic enclosure. If a metal enclosure is used, make sure it is properly earthed.
- Use a power switch if the device consumes more than 10W. Use a double pole switch for mains operated, transformer-less kits.
- Mount a fuse in series with the mains switch. Use a slow blow (T) 50mA fuse for transformers up to 10W and a 100mA fuse for transformers up to 20W.
- Use a mains input connector, or a robust power cord with a clamp.
- Internal wiring carrying mains voltages must have a minimum cross-sectional area of 0.5mm^2.

If supplied, attach the power rating label near the power cord of the device and fill-out the mains voltage, frequency, power consumption and fuse values.

Troubleshooting and Support
90% of non working kits are due to poor soldering.
We operate a Get-You-Going service for non-working kits but there is a charge based on the time and components needed to complete the repair. Quite often it is not economically viable for us to repair and it is cheaper to supply a new ready made product at full cost.

Disclaimer
Quasar Electronics reserves the right to change product specifications or to discontinue products without notice. Quasar Electronics cannot be held responsible for any loss or damage, direct or indirect, which might occur from the use of a product. Quasar Electronics Kits or Modules are intended for educational and demonstration purposes only. They are not intended for use in commercial applications. If they are used in such applications the purchaser assumes all responsibility for ensuring compliance with all local laws. In addition, they are not suitable for use as or as a part of life support systems, or systems that might create a hazardous situation of any kind.

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There are many applications where you need quick availability of a relay for connection to a particular piece of apparatus. We found in developing our kits that we always needed to have a relay mounted on a PCB within arms reach. So we thought if we need it then many others probably do too.

But there are problems. Relay pinouts and packages are not standardized. And then what voltage of relay should we use - 3V, 6V, 9V, 12V or 24V. So we chose a commonly available miniature relay, and we have supplied a 12V version of it here.

We have used two Goodsky RWH-SH-112D (or similar) 12V relays that may be rated to switch up to 240Vac at 10A. However, because of the PCB track size, each relay output is rated to switch resistive loads of up to 240Vac or 28Vdc @ 5Amps maximum current.*
***WARNING: Mains voltages can be lethal!**
Board must be housed in a suitable isolating enclosure.
Construction, installation, testing and commissioning should only be attempted by competent persons and in compliance with all local regulations.
You can download the relay data sheet from
http://www.quasarelectronics.com/ds/rwh_relay.pdf

Board Power Supply: 12Vdc, 100mA minimum

Assembly. Follow the overlay. Solder the resistors first. Make sure to get the diode and the IC around the correct way.

How it Works. The kit is based around the ULN2003A IC, a 7-channel high voltage, high current relay driver. The inputs are TTL compatible, allowing them to be directly connected to logic circuits operating from a supply voltage of 5V.

Each driver is effectively a logic inverter with an open collector output, meaning the 'load' is connected between the output pin and V+.

Looking at the schematic we see that there are two identical circuits, one for each relay. Operation is the same for both so we will refer to the RL1 circuit only in the following explanation.

There are two inputs that can be used to operate the relay, marked LO and HI. As the names suggest a low on the LO input will operate the relay. Similarly a high on the HI input will also operate the relay.

The LO input operates the relay via IC1:A and IC1:B. A low level input will be inverted by IC1:A and its output will be high. Then this high is inverted again by IC1:B to give a low output to operate the relay. Resistor R1 holds the input high when not used.

Now 'hang on' you might say – why invert a low to a high then just invert it low again? Why not connect the LO input direct to the relay and forget about using IC1:A and IC1:B. Good question. The answer is that if you connect the LO direct to the relay you lose all control about what the voltage at the LO inout can be. An input of 3V for example, will trigger the relay closed. This might be quite undesired. By using the two relay drivers to process the signal the LO must be no more than 0.8V. Anything over that will not trip the relay and you have full control.

The relay can also be operated via the single inverter IC1:C. In this case a high level on the HI input is inverted by IC1:C and the resulting low output will operate the relay. Resistor R3 holds the input low when it is not used.

So, the relay will be operated when either the LO input is low (0 – 0.8V) or the HI input is high (2.4V – 12V.).

Note that the outputs of IC1:B and IC1:C are connected together. At first glance it might seem that they would destroy each other if one was high and the other low. This cannot happen because the outputs are 'open collector', meaning that the inverter can drive the output low but it relies on an external device to pull the output high. In this case the external device is the relay.

For a discussion of 'open collector' outputs see
http://www.quasarelectronics.com/ds/opencol.txt

Tying open collector outputs together like this is known as a "wire OR' configuration. It means that the relay is operated when either the IC1:B output **OR** IC1:C output is low.

Diode D1 provides reverse polarity protection in case the power supply to the kit is connected the wrong way around.

You can download the ULN2003A data sheet from
http://www.quasarelectronics.com/ds/uln2003a.pdf

Specifications.

Operating voltage:	12V DC
Input low voltage:	0 – 0.8V
Input high voltage:	2.4 – 12V

COMPONENTS	
10K resistor 5% 1/4W brown black orange	6
1N4004 diode	1
3 pole terminal block	4
ULN2003A IC	1
16 pin IC socket	1
RWH-SH-112D 12V relay	2
3156 PCB	1

See out website at http://www.quasarelectronics.com

GENERAL RELAY INFORMATION

Warning! Risk of Electric Shock!

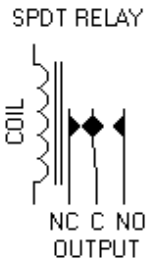
This information concerns kits and modules with relay outputs. TO USE THE RELAY OUTPUTS SAFELY YOU MUST OBSERVE THE MAXIMUM VOLTAGE AND CURRENT LIMITS QUOTED IN THE **PRODUCT DOCUMENTATION** (this is because the board design may not be rated to switch the maximum voltage and current limits printed on the relay itself or specified in the relay manufacturer's data sheet).
Controlling mains equipment with relay outputs must be treated with extreme caution. Electric shocks can cause severe and permanent injury or even death. Construction, installation, testing and commissioning should only be attempted by suitably qualified persons, or under the supervision of a suitably qualified person. These products are not suitable for children. Before connecting mains powered equipment to the relay outputs please check with the relevant authorities in order to ensure compliance with all current safety regulations.
Many areas of the assembly may operate at mains voltage. A suitable isolating enclosure must be used. Exposed screw terminal blocks on some products must be insulated to prevent contact with exposed metallic parts at mains potential. Connected equipment should be suitably fused.

You will find relay outputs on many of the kits and modules that we sell. A relay is an electrically operated on/off switch. The voltage and current limits specified in the product documentation generally relate to resistive or light inductive loads.

Relay Terminals

Most boards have SPDT (Single Pole Double Throw) style relays. These have three outputs:

C = Common
NO = Normally-Open contacts connect the circuit when the relay is activated; the circuit is disconnected when the relay is inactive. It is also called a Form A contact or "make" contact.
NC = Normally-Closed contacts disconnect the circuit when the relay is activated; the circuit is connected when the relay is inactive. It is also called a Form B contact or "break" contact.

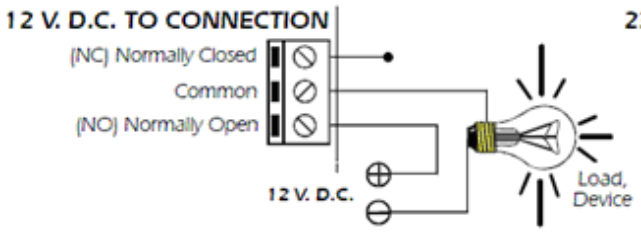


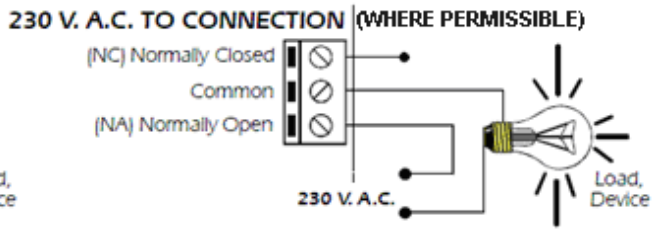
Connecting the Device you want to Control

You must provide an external power source to the device you want to control. No voltage is present at the relay terminals (remember it is just a switch). The relay is normally connected in *series* with the positive (+) power wire of the device you want to control.

In this case, the positive wire from the power source should be connected to Common. Then either the NO or NC terminal (as appropriate for your purpose) is connected to the positive (+) wire going to the device you want to control. The negative (-) wire does not connect to the relay at all. It goes directly from the power source negative output to the device negative (-) terminal.

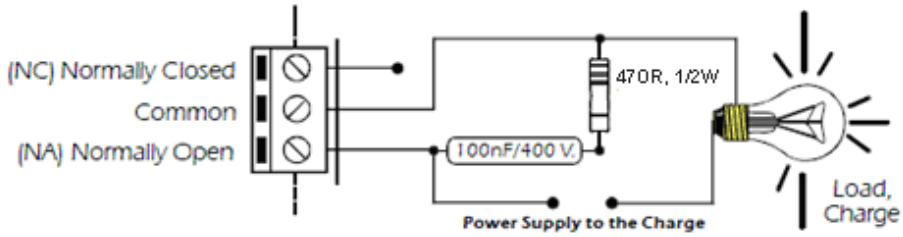
Typical SPDT Relay Connection Diagrams





Anti-Spark SPDT Relay Connection Diagram

Sometimes the connected equipment can cause arcing across the relay contacts. This must be corrected by installing a resistor and capacitor (not supplied) between the two contacts of the relay as shown below. Component values are for 230Vac mains.



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