QUASAR PROJECT # 3152 - COUNT-DOWN TIMER WITH RELAY

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.

QUASAR PROJECT KIT # 3152 - COUNT-DOWN TIMER WITH RELAY

Timer kits are an ever popular item with the hobbyist. One of the main methods used is the ever-popular 555 timer IC. In this circuit we use a 555, a counter IC and a transistor switch to activate a relay either on-to-off or off-to-on (mode selected by a jumper) as soon as the counting period is over. Let us look at the kit in more detail. The circuit consists of 3 parts: an oscillator, a ripple counter and two switching transistors.

Oscillator: The 555 is configured in the standard astable oscillator circuit designed to give a square wave cycle at a period of around 1 cycle/sec. A potentiometer is included in the design so the period can be set to exactly 1 second by timing the LED flashesc. A jumper connection is provided so the LED can be turned off. As soon as power is applied to the circuit counting begins. We have not reviewed the operation of the 555 IC here. Most electronic magazines review it in detail once every few years. And it is a standard feature in most intoductory electronic text books. The output pulse from pin 3 of the 555 is fed to a the clock input pin 10 of the 14-stage binary ripple counter, the 4020 (or sometimes 14020.) You can see from the schematic that the LED input is taken directly from this connection.

Ripple Counter: The counter output wanted is set by a jumper. Eleven counter outputs are available: 8 counts, 16 32 64 128 256 512 1024 4096 and 8192 counts. If the 555 is set to oscillate at exactly 1.0Hz by the on-board trimpot then the maximum timer interval which can be set is 8192 seconds (just over 2 hours.) At the end of the counting period a pulse is output on the pin with the jumper on it.

The 14020 ripple counter advances its count on each negative transistion of the clock pulse from the 555. So for each output cycle of low-high-low-high the count is advanced by two. It can be set to an zero state (all outputs low) by a logic high applied to pin 11. In this circuit C3, R4 and D1 are arranged as a power-on reset. When power is applied to the circuit C3 is in a discharged state so pin 11 will be pulled high. C3 will quickly charge via R4 and the level at pin 11 falls thus enabling the counter. The 14020 then counts clock pulses until the selected counter output goes high. D1 provides a discharge path for C3 when the power is disconnected.

Transistor Switch: The output from the 4020 goes to a transistor switch arrangement. We have wired two BC547 so that either switching option for the relay is available. A jumper sets the option.

- the relay can turn ON when power and counting start then turn OFF after the count period, or

- it can do the opposite. The relay will turn ON after the end of the count period and stay on so long as power is supplied to the circuit.

Note that the reset pin of the 555 is connected to the collector of Q1. This enables the 555 during the counting period but as soon as Q1 is turned on the 555 is disabled as the collector of Q1 is pulled low.
These kits are constructed on a single-sided, routed, FR4 fibre glass printed circuit board (PCB) with a printed overlay and bottom solder mask. Protel Autotrax and Schematic were used to produce them.

ASSEMBLY INSTRUCTIONS
Check off the components against the Component listing. It is generally easiest to solder the lowest height components first - the resistors, diodes and IC sockets. There is one link to add to the PCB. Use some wire from a passive component for it. Make sure you get the diodes and electrolytic capacitors around the correct way according to the overlay.

Relay Output. The relay output in this kit must **not** be used to switch the mains power directly (even though the relay itself is rated to do so the board is not). The output is rated to switch 2A @ 45Vac/28Vdc max. For mains switching use with the CT0004 opto-isolated single channel relay board. This accepts a 3-24Vdc input and has a mains rated output relay.

Longer Duration Timers: There are two ways you can easily get the timer to time longer than 8192 seconds.

1. You can change the components values of R1 and C1 to set the 555 count frequency to more than 1.0 Hz. If you change the count to 10 seconds then a maximum timer delay of 81920 seconds, or 22.7 hours, can be obtained. Note that for long duration timers you should use a battery pack power supply and not rely on batteries.

2. Just connect two K3152's together! This would give you 8192*8192 seconds or just over 2 years. And if you set the oscillation to 1 pulse every 10 seconds by changing component values this would be just over 20 years. Long enough for anyone I think. Of course, connecting two units together needs some modification to the hardware. Download **dual_3152.pdf** from the software download page of our website to see exactly how to do it We may do a kit of this arrangement.

What to do if they do not work. Poor soldering is the most likely reason that any of the kits do not work. Check all solder joints carefully under a good light. Next check that all components are in their correct position on the PCB especially the diodes. Are the IC's in the correct way around. Did you put the link in the PCB?

For our full range of kits see

http://www.quasarelectronics.com

GENERAL RELAY INFORMATION

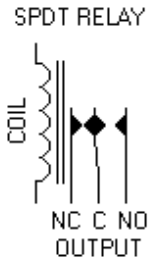
Warning! Risk of Electric Shock!
Some kits and modules have 110-240Vac mains rated relay outputs (as specified in the Product Documentation). Controlling mains equipment using these relay outputs must be treated with extreme caution. Electric shocks can cause severe and permanent injury or even death. 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 local safety requirements.
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 simply an electrically operated on/off switch. It is important that you observe the relay voltage and current limitations specified in the Product Documentation (**not all products are rated to switch mains power even though the relays supplied may state higher voltage and current limits!)**

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.

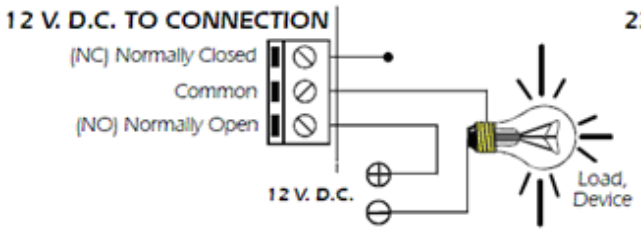


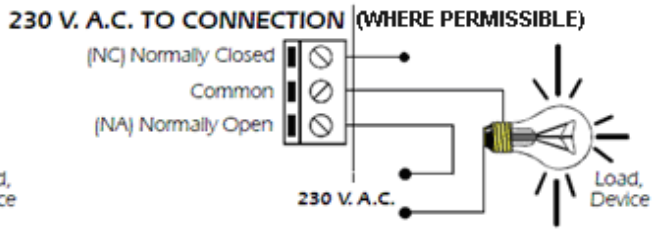
Connecting the Device you want to Control

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.

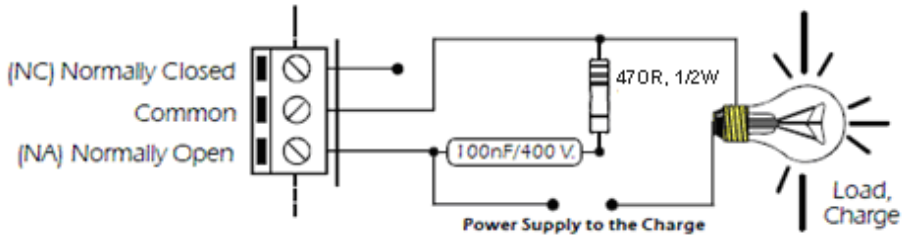
Typical SPDT Relay Connection Diagrams





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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Components

R3 1K brown black red	1
R7 4K7 yellow violet red	1
R5, R6 27K red violet orange	2
R4 100K brown black yellow	1
R1 390K orange white yellow	1
R2 470K yellow violet yellow	1
100K 104 Koa trimpot	1
Capacitors:	
C1 C3 1uF E. cap	2
C5 470uF/16V E. cap	1
C2 10nF 103 monoblok	1
C4 100nF 104 monoblok	1
IC NE/LM555 nmos	1
8 pin IC socket	1
14020 IC	1
16 pin IC socket	1
BC547 Q1 Q2	2
3mm LED	1
D1 D2 D3 1N4004 diode	3
2 pin SIL header strip	1
3 pin SIL header strip	1
4 pin dual header strip - 4 position	1
7 pin dual header strip - 7 position	1
Jumper	3
3 pole terminal block	1
2 pole terminal block	1
Relay RWH-SH-112D	1
SPDT switch	1
Kit 3152 PCB	1