CK1611 - 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.

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 Kit 152 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.

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?

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Components	
1K R3 brown black red	1
4K7 R7 yellow violet red	1
27K R5 R6 red violet orange	2
100K R4 brown black yellow	1
390K R1 orange white yellow	1
470K R2 yellow violet yellow	1
100K 104 Koa trimpot	1
Capacitors:	
1uF E. cap C1 C3	2
470uF/16V E. cap C5	1
10nF 103 monoblok C2	1
100nF 104 monoblok C4	1
NE/LM555 nmos IC	1
8 pin IC socket	1
14020 IC	1
16 pin IC socket	1
BC547 Q1 Q2	2
3mm LED	1
1N4004 diode D1 D2 D3	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 152 PCB	1