Rocket Launch Controller

Control your igniter with this sophisticated timer circuit.

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This project is an automatic rocket launch controller. It won't launch a NASA rocket, but it will launch a model rocket purchased through a hobby store.

This unit has all the features you could ask for in a rocket launcher, except perhaps a voice output. It has a ten second countdown and then fires off the rocket by applying power to the igniter for four seconds. The count can be reset at any time or put on hold if any problems occur. It also has a safety switch to make sure no power is sent to the igniter while you are near the rocket.

Once built this controller can be used with any model rocket launch pad.

How It Works

The operation of the launcher is basically a countdown timer. U1 is an astable pulse generator that sets the clock speed of the counter. The counter can be made to go faster or slower by turning the trimmer resistor R1.

The clock pulses are sent to U3 (presettable binary up/down counter) which keeps control of the count in binary form. The counter is loaded with the bi-

nary value of ten when the power is turned on, or when the clear button (S1) is pressed. The display then shows 'c' which means ten, but for the purpose of the launcher it means *cleared* or *reset*. Pin 5 of U3 is the UP/DOWN control. When it is held in the high (1) state, the counter counts down. When it is held in the low (0) state, it counts up.

The display (D1) is a seven-segment common anode display, which is controlled by the BCD to seven-segment decoder (U2). U2's purpose is to convert the binary count of U3 into a readable decimal format displayed by D1.

The purpose of the four NAND gates of U4 is to send an active low pulse (normally high but goes low for one pulse) to U5 when the count of zero is reached or when a count of four is reached in the up direction.

Between the counts of ten to one the counter just counts down. But when the count reaches zero, power to the igniter has to be turned on for four seconds to set off the rocket. This is accomplished in the following manner. Pin 12 of U3 is the Max/Min control. This remains low until

the counter reaches the count of zero/Min (or fifteen/Max). When zero is reached, Pin 12 goes high.

This causes an active low pulse to be sent from Pin 8 of U4c to toggle the output of U5a. When this happens the UP'/DOWN control of U3 is made low. Which makes the counter start to count upwards and the IGNITION Indicator (D3) is turned on. The output of U5a also turns on Q1 sending 5V through the relay (RL1) coil. This switches on power to the igniter.

The counter then counts upward from one to three with power still being sent to the igniter. When the counter reaches a count of four, the power to the igniter has to be turned off. When this is reached, U4a sees that a count of four has been reached in the up direction and then sends an active low pulse from pin 8 (U4) to toggle the output of U5a. Which in turn toggles the output of U5b (U5a has to be toggled twice before U5b is toggled because they are set up as a binary counter). Once this happens the UP'/DOWN control is reset back to the high state and the IGNITION Indicator is turned off. Q1 is turned off removing power from the relay coil. This in turn

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S1 is the CLEAR button.
S2 is the HOLD/GO switch in HOLD position.
S3 is the IGNITOR TEST button.
S4 is the POWER switch.
S5 is the SAFETY switch in UNARMED position.
D1 is the COUNTDOWN display.
D3 is the COUNTDOWN DISPLAY.
D5 is the IGNITOR CONTINUITY indicator (cont. when lit).
D6 is the SAFETY indicator (armed when lit).
D7 is the POWER indicator.

Fig. 1. The schematic of the Rocket Launch Controller.

removes power from the igniter leads.

Once U5b is toggled, it puts a high state on the hold control of U3 (Pin 4) which stops the counter. This pin has to be low in order for the counter to continue counting. When you want to halt the counter by turning on the hold switch (S2), this also holds Pin 4 in a high state.

After the count of four, the counter is stopped and the rocket should be launched (if all goes well).

Construction
First you will need to etch and drill the two

Rocket Launch Controller

Fig. 2. The main PC board foli side.

Fig. 3. The main PC board parts layout.

P.C. boards shown in Figures 2 & 3. Then you can install the parts as shown in the component location guides (Figures 4 & 5). Start by installing the sockets, resistors and diodes. Then install the capacitors, regulator, transistor, display and relay. Next install the nine jumpers.
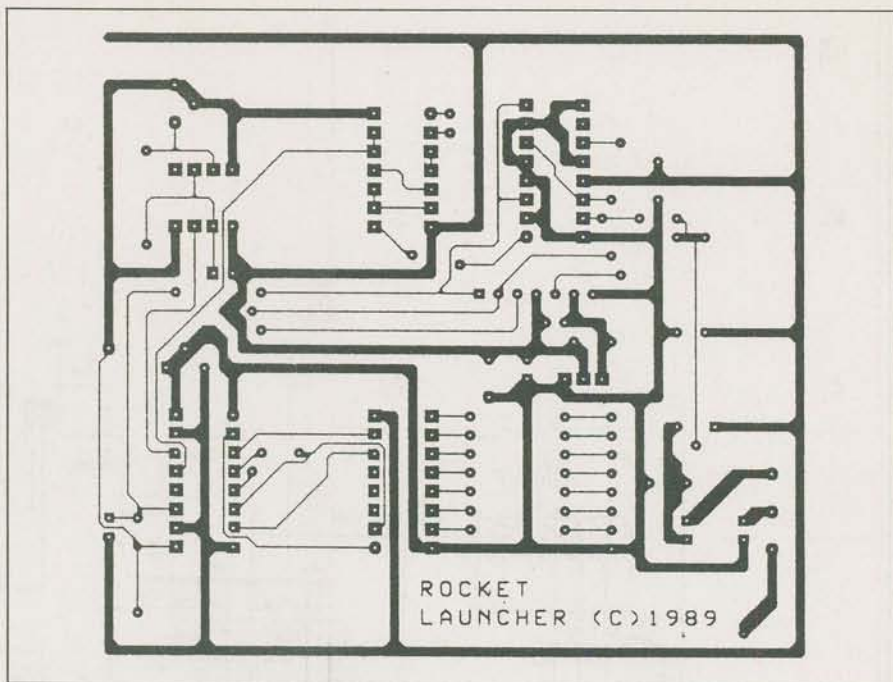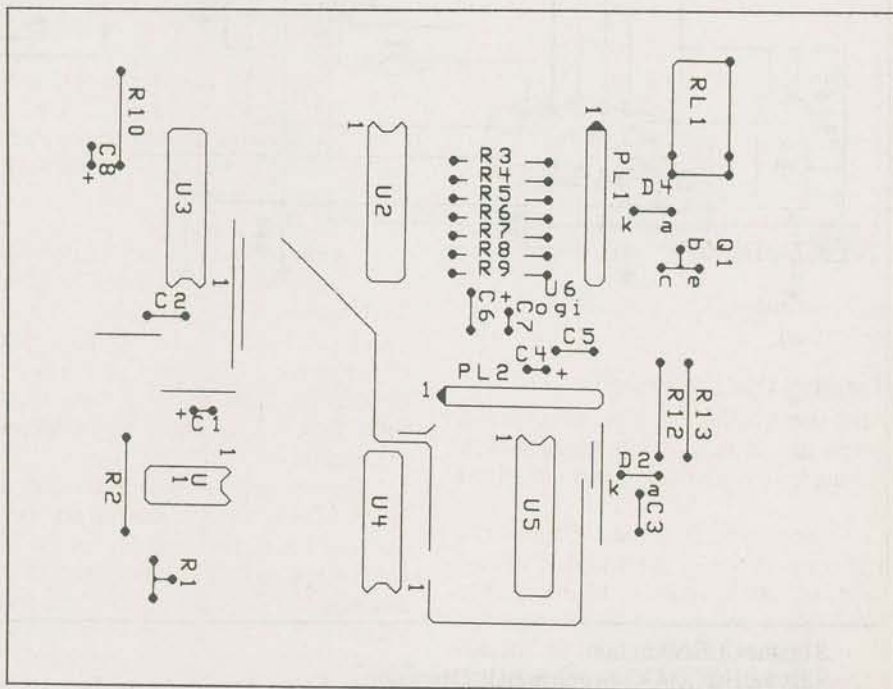
Connect a piece of 8-wire ribbon cable between PL1 and PL3. Make sure to wire Hole 1 of PL1 to Hole 1 of PL3. Do the same with Holes # 2 through 8.

Cut and drill holes in the cabinet for all the switches, indicators and jack. Then install all the switches, indicators (except D1) and jack onto the cabinet.

Connect a piece of 7-wire ribbon cable to PL1. Wire the other end to the switches and indicators using other wire

as necessary. See Figure 6. Next install the IC's. Then fasten the display board, main board and battery holders to the cabinet.

The instructions for construction given here are only a general guide. I leave all the cabinet construction to the builder. Refer to Figure 1 for the main schematic.

You will also need to connect a twenty foot piece of 2-conductor wire to a 1/8" phone plug on one end. At the other end at-
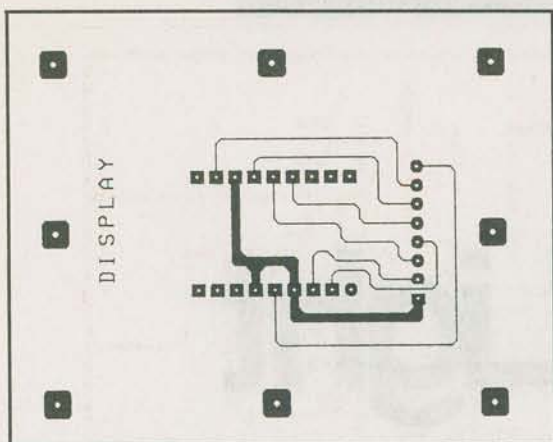
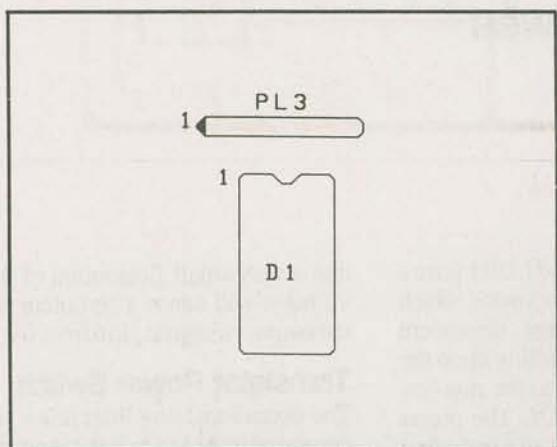*Fig. 4. The display PC board, foil side.*

Fig. 5. The Display PC board parts layout.

Fig. 6. The wiring diagram of the Rocket Lauch Controller.

tach two micro clips. This will be your ignition lead.

Testing the Launcher

After construction you should test the unit before use. If the unit fails any of the following tests you will have to troubleshoot it.

Install the batteries. Connect a voltmeter to the ignition lead. Turn the safety switch on. Set the Hold/Go switch to Hold. Turn the power switch on. The Armed indicator should not be lit. The display should show 'c' and not be changing. The voltmeter should show 0V. Set the Hold/Go switch to Go and the display should start counting down. When the count reaches zero the Ignition indicator should light. The voltmeter should still show 0V because the safety switch is on. When the count reaches four the Ignition indicator should go out and the display should remain at four.

Next turn the safety switch to off and the Armed indicator should light. Press Clear and the display will reset to 'c', and
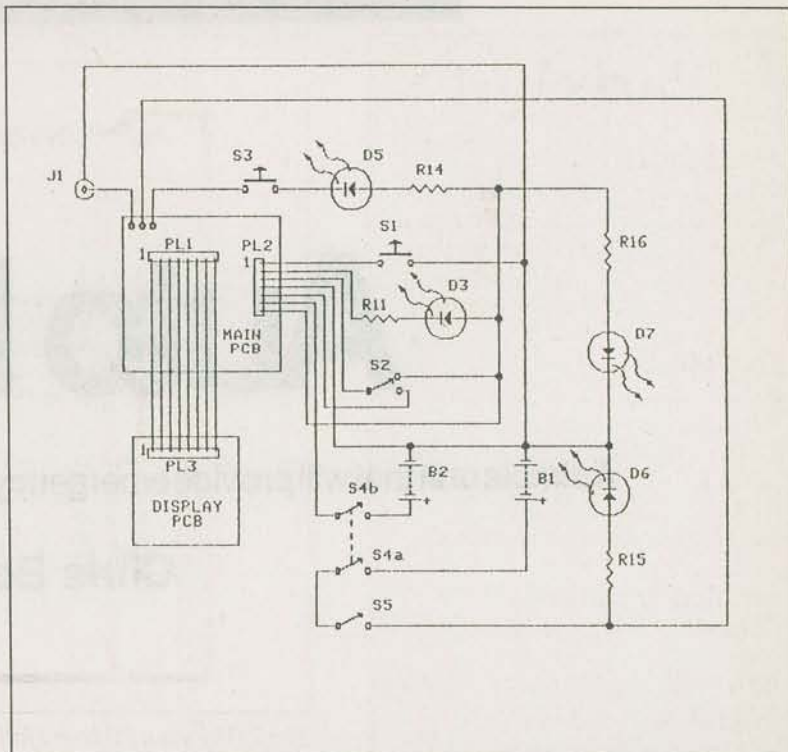
then start counting down. When the count reaches zero the voltmeter should read 6V. When the count goes back up to four the voltmeter will read 0V.

Set the Go/Hold switch to Hold. Press Clear. Remove the voltmeter. Press the Continuity Test button. The Continuity indicator should not light. Short the ignition micro clips together. Press the Continuity Test button. The Continuity indicator should light. Remove the short on the ignition micro clips.

Set the safety switch on and the Go/Hold switch to Go. Let the unit count down and adjust trimmer R1 for the best count down speed. Keep resetting the unit and adjusting R1 until you find the speed you like. You may find you will like it to count faster than one second intervals.

Once passing these tests, you are ready to use the controller on your model rocket.

Safety at the Launch Site

Always keep the power switch off when hooking up the ignition lead to the model rocket igniter. Use the safety switch while you have the unit on and are waiting for the all clear to launch or checking igniter continuity. 10 - 9 - 8 - *Good Luck...* ∎