Electric Tech

Build a Pad-Side Continuity Checker

By Ted Cochran, NAR 69921

Some launch systems provide continuity checking at the console, but not at the pad. The 12-pad system I built years ago for outreach launches is like that, as are the NAR systems used at TARC and NARAM. These systems are simple and reliable, but if you want to confirm continuity, you have to ask the LCO - or provide your own tester. Why bother the LCO for continuity checks when you can easily make a simple, reliable, in-line continuity checker?

I built a simple system with a switch that disconnects the pad from the launch console, and tests continuity with a nine-volt battery at very low amperage. Better still, while you're testing continuity, the circuit to the launch console is disconnected, and the LCO can't accidentally launch your rocket.

I built my tester in a couple hours, using parts I mostly had lying around the house. I got a bit fancy and used a three position, double pole switch. When the switch is in the "off" (middle) position, the leads to the rocket are completely disconnected. When the switch is in the "test" position, the launch console remains disconnected, but the battery puts a tiny current through the igniter, and a piezo buzzer sounds continuously to confirm you have good continuity—you don't have to look away from the clips to check a light. When the switch is in the "armed" position, the leads to the launch console are connected just as they should be, and in addition, an independent second circuit illuminates an LED so you confirm you're ready to go. The LED also functions as a battery tester.

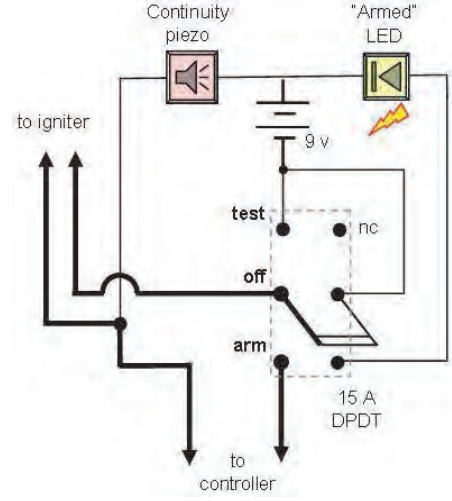
To build one for yourself, you'll need:

- An enclosure. I used a 90-degree elbow for 3/4-inch PVC electrical conduit, but a project box will do fine, too, as will a plastic junction box and cover rated for outdoor use.
- A double-pole, double throw switch, preferably with a center "off" position. The switch contacts should be rated for at least 15 amps. If you don't want to incorporate the battery tester and "armed" (ready-to-launch) indicator, you can get away with a single pole switch. AxMan has 20 amp three-position DPDT switches at a great price. Remember that the center terminal on a double throw toggle switch is typically connected to the terminal opposite the position of the switch lever—if the lever is up, the middle connector is connected to the bottom terminal; if the switch is down, the middle connector is connected to the top terminal.
- A piezo buzzer. I used a part from radio shack; it draws a few milliamps at nine volts and is safe for all commercial igniters, including the Quest Q2G2.
- A nine-volt battery and a snap on connector for it. You could also use a battery holder for AAA batteries; just match the piezo and LED to the available voltage.
- A super-bright LED rated for nine volts. • A connector for the leads to your rocket. I used a two-conductor AC socket, into which I plug a "MASA-standard" red AxMan two-wire extension cord with alligator clips on one end. If there's any chance someone might plug your leads into an electrical socket, you should use something else, like banana jacks or a rated molex connector.
- A connector for the clips on the leads from the launch console to hook onto. I used metal banana jack test terminals, but there are lots of possibilities. Again, use something rated for fifteen amps or more at twelve volts.
- Assorted hookup wire (make sure the leads from the controller connectors to the igniters are 12 gauge or larger).
- Crimp-on connectors and/or solder and heat shrink tubing.

Building is easy. Note that both the piezo and the LED are polarity sensitive—they have a positive and negative terminal that you'll need to pay attention to. You might want to hook everything up with test leads to confirm you have all the polarities correct before you start soldering.

One nice thing about the PVC box is that it's easy to mount it on a length of PVC conduit to use as a stake—that keeps the connections off of the ground. The piezo buzzer was almost exactly the right size to fit in the hole in the side of the conduit box—a little hot glue was all it took. Also, you shouldn't have to worry about battery life—a standard 9-volt battery should last for a years of normal use.

Once you're done building your tester, please ground test it for safety- especially if you use low-current igniters like the Quest Q2G2- before you bring it to the field. The addition of a relay and connectors for use with a pad side battery is left as an exercise for the reader.



Launch Controller, continued from page 10

now arm and fire one pad or both at once. You might be able to fit a little continuity LED for each pad into the box, but I think that the large toggle switches are a good enough indicator of which pad is armed. Label pads 1 and 2 and pads left and right.

This system has been tested at recent launches, with excellent results. Using a 7.2 volt NiCad battery and 25

Alan Estenson

foot cord, it had no problems igniting Estes and Quest igniters. If you'll be launching motors bigger than "E", I recommend using a 50 foot extension cord and a 12 volt battery. If you need lots of power at the pad for lighting clusters or high-current igniters, you'll want to add a padside relay box with a 12 volt battery.

I hope that this article inspires you to build your own multi-pad launch controller. Good luck!

Planet's Plans

Thumper

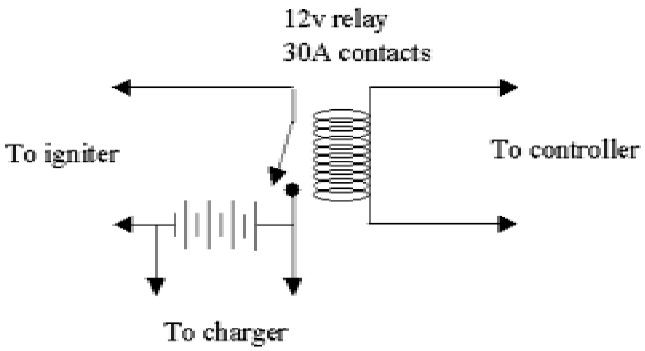
Pad-side ignition augmentation

Ted Cochran, NAR 69921

Thumper was designed to light clusters of black powder or AP motors. It is capable of sourcing over 60 amps, and has lit clusters of up to seven AP motors. It is also good as a pad-side relay box for single motors. It isn't quite so good for single Estes igniters— they sometimes vaporize too quickly for the motor to light!

Parts required:

A. 1 plastic storage box with handle
B. 1 or more 12 v batteries (I use three 4Ah gel cells)
C. 1 12v relay rated 30 amps or better
D. 10 gauge or larger wire
E. Assorted screw terminals and connectors



The relay and the batteries are the key ingredients. I was fortunate to find a 60 Amp contactor from a commercial appliance at a surplus store, but you can also use automotive relays. AxMan sells 30A Bosch relays that would be adequate for most applications.

Interconnections should all be made using very large wire, to reduce resistive losses. You may wish to add a piezo buzzer across the igniter leads to alert you if the relay is stuck closed, and/or a continuity indicator. Finally, be aware that digital devices may need to be protected from relay coil inductance—Ask Steve Robb what Thumper did to his MOSFETs!

Ted Cochran