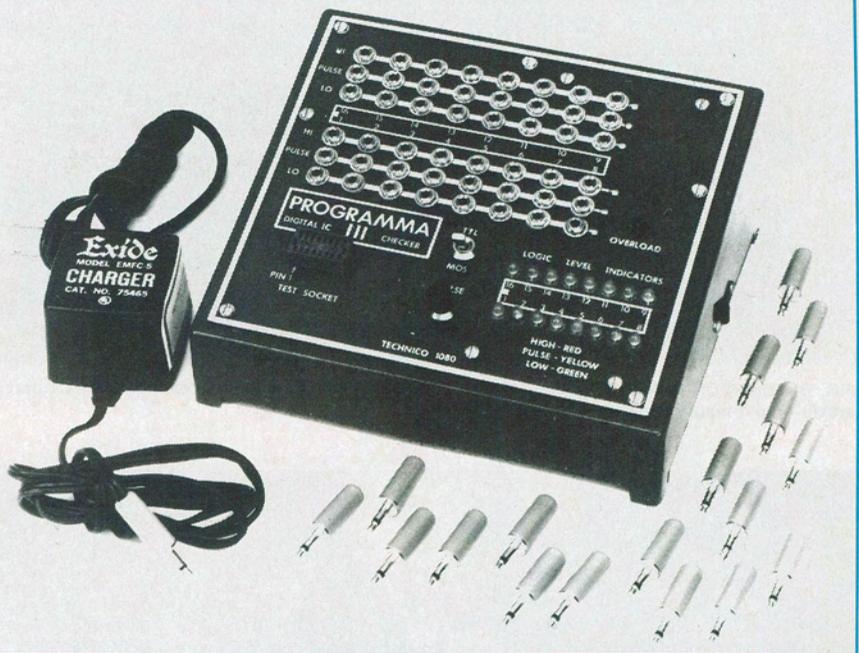


# BUILD THIS

## Digital IC Tester

An IC tester like the Programma III can make work a lot easier for you. Here in Part 2 we'll continue with the construction of the device

GARY McCLELLAN



**Part 2** IN THE FIRST PART OF this article we finished one side of the display-board portion of the IC tester. Let's now start on the other side.

### Display board: other side

Turn the display board over, position it as shown in Fig. 6 and install the 7805 voltage regulator, IC5, at the bottom right corner. Note that the tab faces left. Once it is in place, turn the board over and solder the leads; then clip off any excess. Note that although there are two large pads by the voltage regulator, nothing will be mounted on them.

The next step is to install the resistors. Start with R4 through R19. They're the 100K units around SO1, and you'll need 16 of them. Install the R12-R19 units first, then solder the leads on the other side of the board and clip off the excess. Turn the board back over so the resistors are visible and solder them to the foil in four places at the edge of the board (the pads can be seen in Fig. 5, (see January 1983 issue of **Radio-Electronics**) at the bottom of the board). That step is important because it connects the ground foils on both sides of the board together, so don't forget to do it.

After that, install R4-R11 in the same way. Move to the foil side of the CD4011, and solder two 10K resistors, R1 and R2, across the IC pins. Connect R1 between pin 8 and pin 1, then connect R2 between pin 8 and pin 7. Move to the bottom, and install a 68 ohm, 1-watt resistor at R36. Note that it mounts vertically. Solder the lead closer to the middle of the board, and to both the top and bottom sides of the

board; that gets the power to the IC's. Moving on, install a 1K resistor at R40. Then move left and install an 8.2K resistor at R37. Finish up the resistors by installing a 3.3K unit at R38, and a 2.2K unit at R39. Check your work carefully. If you had any problem installing a resistor, chances are it is in the wrong place! Check to be sure. When you are sure all the resistors are installed properly, you can continue.

Next, SO1 and the jumpers can be installed. Do not omit the socket; it's the connector for the wiring from the panel board. Install SO1 as shown, and turn the board over to solder it in. Turn the board back over and install a jumper between the two points to the left of the socket and resistors. A leftover resistor lead will work fine. After the jumper is soldered in, position it away from the copper foil nearby to prevent shorts.

The capacitors finish up this phase of the wiring. Turn to the voltage regulator, and install 0.1  $\mu$ F ceramic discs above and below it at C6 and C7. Clip off the excess leads and you are done. Figures 7 and 8 show how the completed component- and foil-sides of the display board should appear.

Next, position the display board so that the IC's are facing up and, referring to Fig. 9, install the six jumpers from SO2 to the IC's. Use short lengths of insulated hookup wire.

The next step is to install connector SO1. Refer to Fig. 10 for details. Note that the wires are all inserted from the "foil" side of the board. First, cut eleven pieces of hookup wire, each about four inches long. Prepare one end of each wire, and insert a wire into each of the holes indicated in the illustration. Then route the wires for pins 1, 10, and 11 of

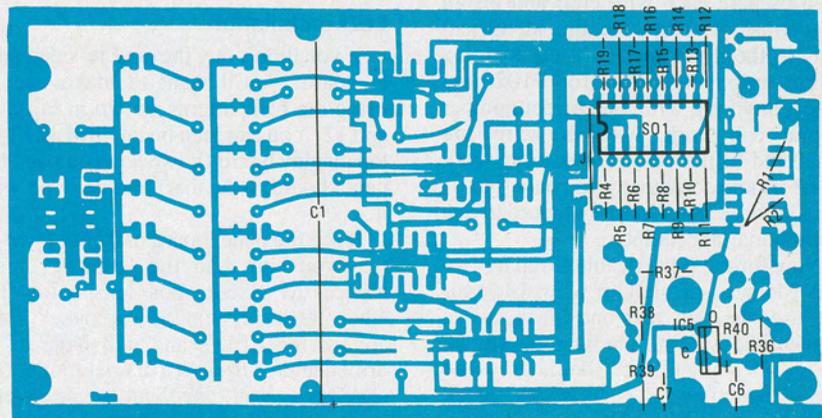


FIG. 6—PARTS PLACEMENT on "foil-side" of display board. Resistor R2 (at right) is soldered to pads on opposite sides of board.

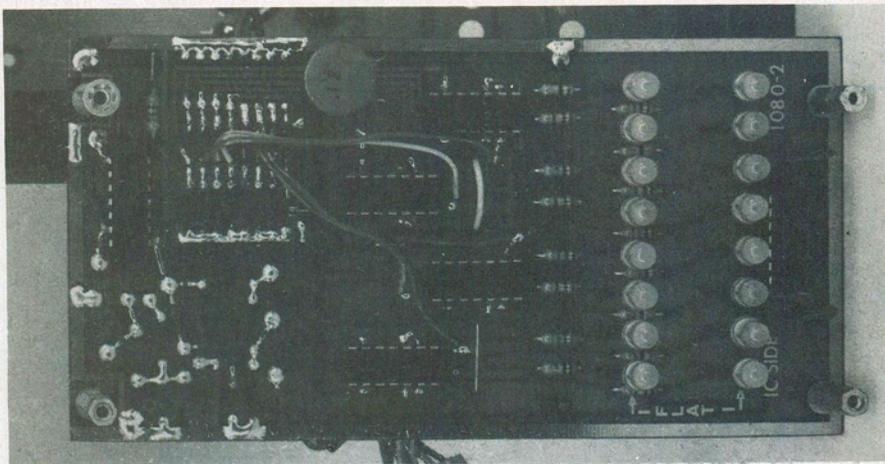


FIG. 7—"COMPONENT-SIDE" of display board. Mounting of LED's will be described in next part of article—don't install them without reading it.

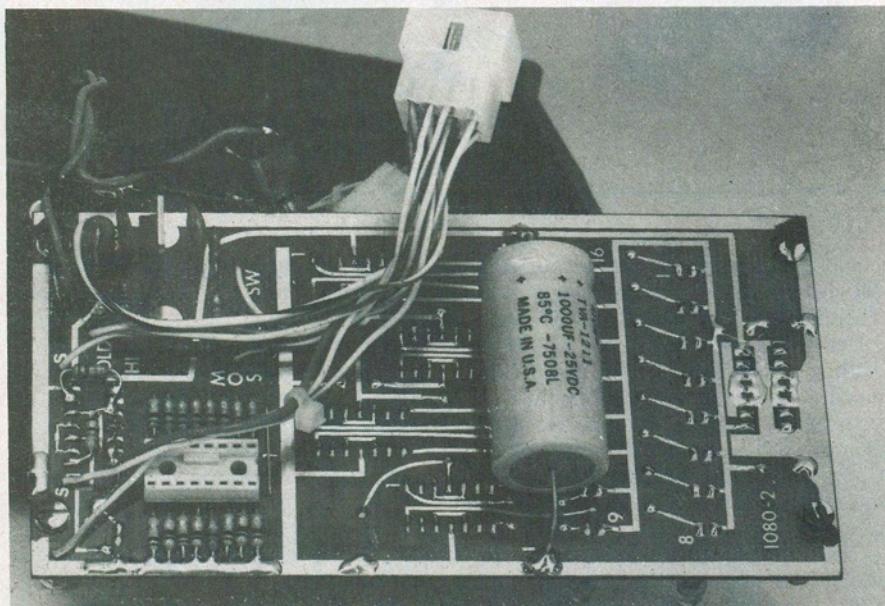


FIG. 8—"FOIL-SIDE" of display board. Multi-wire assembly connects to components on panel board.

the connector over the voltage regulator and group them with the others. That will make a neat cable.

Trim the ends of the wires so that the total cable is about three inches long. Then prepare each wire end, and install the connector. Note the pin identifications in the illustration. I used a Molex 12-pin nylon connector for P102, but almost anything with the correct number of pins will work. After the wires are connected to the pins, check your work for errors and correct any you may find. If you like, lace the wires together to give a professional appearance.

Now for the power cable. Prepare two 1-foot lengths of hookup wire. If possible, use one red, and one black, wire. Connect the wires to the board as shown in Fig. 10. The red wire should go to the hole indicated by a "+," and the black one to the one indicated by a "-." Twist the wires together.

The final step (with the exception of

installing the LED's) is to install capacitor C1. Be sure that it's oriented properly. Push the leads through the foil, and solder. Be sure to solder the negative terminal on *both* sides of the board.

#### LED installation

If you didn't buy the double-sided panel board, you'll want to make one up using the foil patterns shown in Figs. 11 and 12. You can then install the LED's on the display board (however, you need the panel board to do that) and be done with it.

Place the panel board in front of you so that you can read the lettering on it. Notice the sixteen positions below the label "LOGIC LEVEL INDICATORS." They are for the LED's and will have to be drilled and/or filed to a diameter of 0.200 (3/16)-inch. You may want to use several increasingly larger drill-bit sizes to do that. Stop and check the hole size from time to time using one of your LED's until

the fit is snug. Make another hole the same size at the position above the "OVERLOAD" label using the same procedure.

At the edges of the board there are seven large positions marked, and, slightly inboard of them, four smaller ones (those four are for mounting the display board). All eleven should be drilled to 1/8-inch for 4-40 hardware. Then, turn the panel board over and install a 3/4-inch threaded spacer at each of the four "inboard" holes. (If you can't find the spacers, you can make a substitute for them with 4-40 x 1 bolts and nuts. First, install a bolt and secure it to the panel with a nut. Then, add another nut, but screw it down only until the distance between the panel and the side of the nut away from the panel is 3/4 inch.) Now you're ready to install the LED's.

Refer back to Fig. 5 (in Part 1), and note the positioning of the LED's. The flat spot on the package (or the shorter lead) indicates the cathode, and should point to the left. Insert the top row of LED's, LED9-LED16, in the display board, but don't solder the leads. Place the panel board on the top of the spacers on the display board, and temporarily secure it in place with the 4-40 hardware. Push each LED forward so that it seats in the appropriate hole on the panel board. After all the LED's are in place, solder their leads to the foil, and clip off the excess. Separate the display board and the panel board, and install the bottom row of LED's, LED1-LED8. Again, temporarily install the display board on the panel board and push the LED's through the holes. Solder the leads in place and clip off the excess lengths. That completes the LED installation, so remove the display board.

#### Panel board

The rest of the work on the panel board consists mainly of installing jacks and wiring two cables. The schematic in Fig. 13 will help you understand what has to be done. It's routine work, but you'll get the best results if you take your time.

The first thing is to drill more holes. Position the board so you can read the legend "PROGRAMMA III." First, drill all the "HI," "PULSE," and "LO" holes to a diameter of 0.230-inch (a little less than 1/4 inch). A few tips on drilling PC-board material: To avoid tearing the foil, use at least three smaller drill sizes before you get to 0.230-inch. Better yet, start small and use a file or reamer to enlarge the holes. Use one of the jacks that will be installed to check hole size periodically. Carefully enlarge each hole until a jack fits snugly in it. Then deburr the holes, working from both sides of the board; use a sharp knife like an X-ACTO knife.

Next come the holes for the two switches. They, of course, are between the "TTL" and "MOS" legends, and just below the word "PULSE." Using the same

technique as you did for the jack holes, enlarge the switch holes to 0.250-inch.

Now, the small parts can be mounted on the panel board. They include the IC test socket (SO101), the switches, and the OVERLOAD LED. The jacks will be installed later. Install the test socket first, from the front side of the board (the side with the lettering). After that, install a SPDT toggle switch at the TTL/MOS hole. Then install an SPDT pushbutton switch in the PULSE hole. Finish up this phase of construction by installing an LED in the OVERLOAD hole, from the rear of the board. Use quick-setting epoxy on the rear side of the board to secure the LED in place. Allow the epoxy to dry before you continue.

Now for the jacks. Refer to Fig. 14 for details, and note how the lugs on the jack bodies are oriented on the rear side of the board. For easiest installation, start at the top of the board with the "HI" row. Install the jacks, one by one, positioning the bodies as shown and then tightening the hardware. After that row is completed, continue with the "PULSE" row just below it. After that, move down to the "LO" row, and repeat the whole process. When you've finished the three rows, check for loose hardware and tighten things up as required. Then install the other three rows of jacks in the same fashion.

### Panel board wiring

The jack wiring comes next. Note that only one lug of each jack will be used; the ground connections have already been made by attaching the jacks mechanically to the foil on the board. Again, refer to Fig. 14 for the wiring. Start with the pin-16 series of jacks (HI, PULSE, and LO), and tie the three terminals together with a

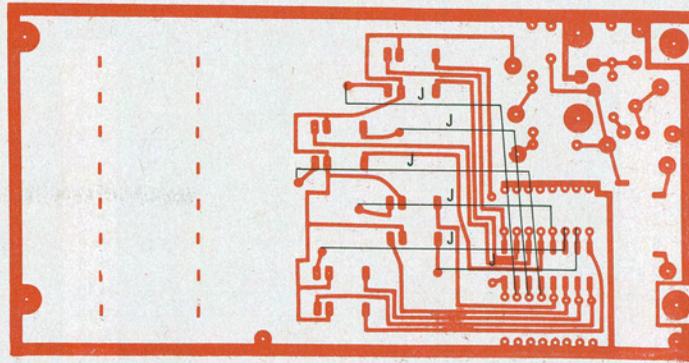


FIG. 9—RUN SIX JUMPERS between the zero-insertion-force test socket and the appropriate pads on the component-side of the board.

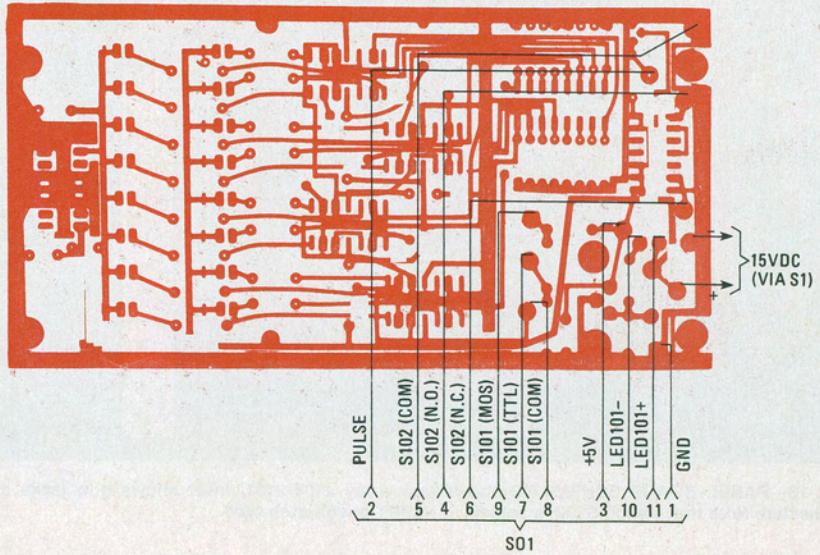


FIG. 10—MAKE UP AN 11-WIRE cable to connect S01 to the circuit board at the points shown.

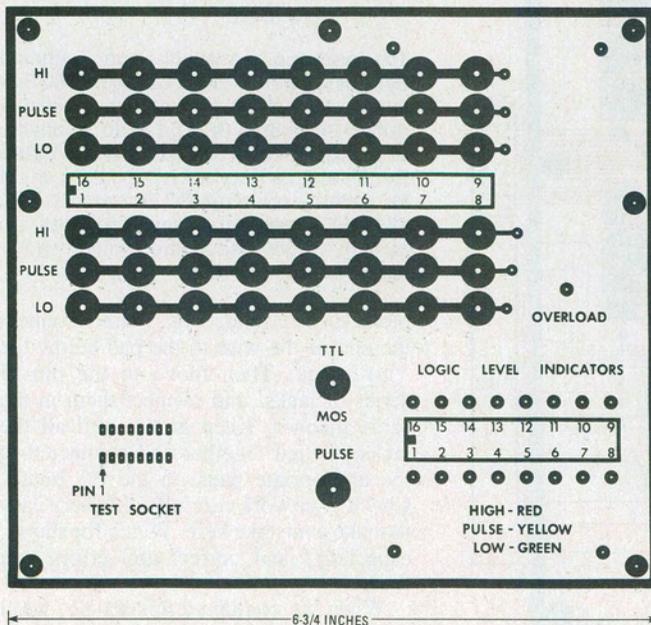


FIG. 11—TOP OF PANEL BOARD. Drill out holes at large foil pads as described in text.

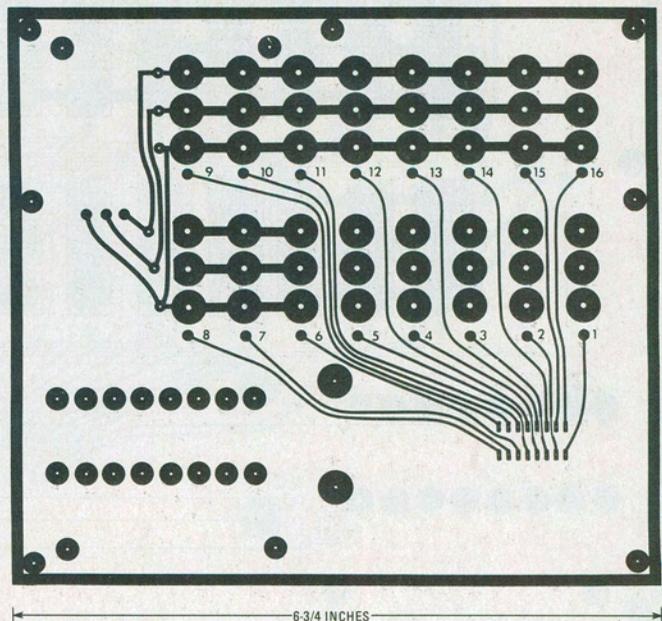


FIG. 12—FOIL SIDE OF panel board. Holes for 16 LED's are at lower left.

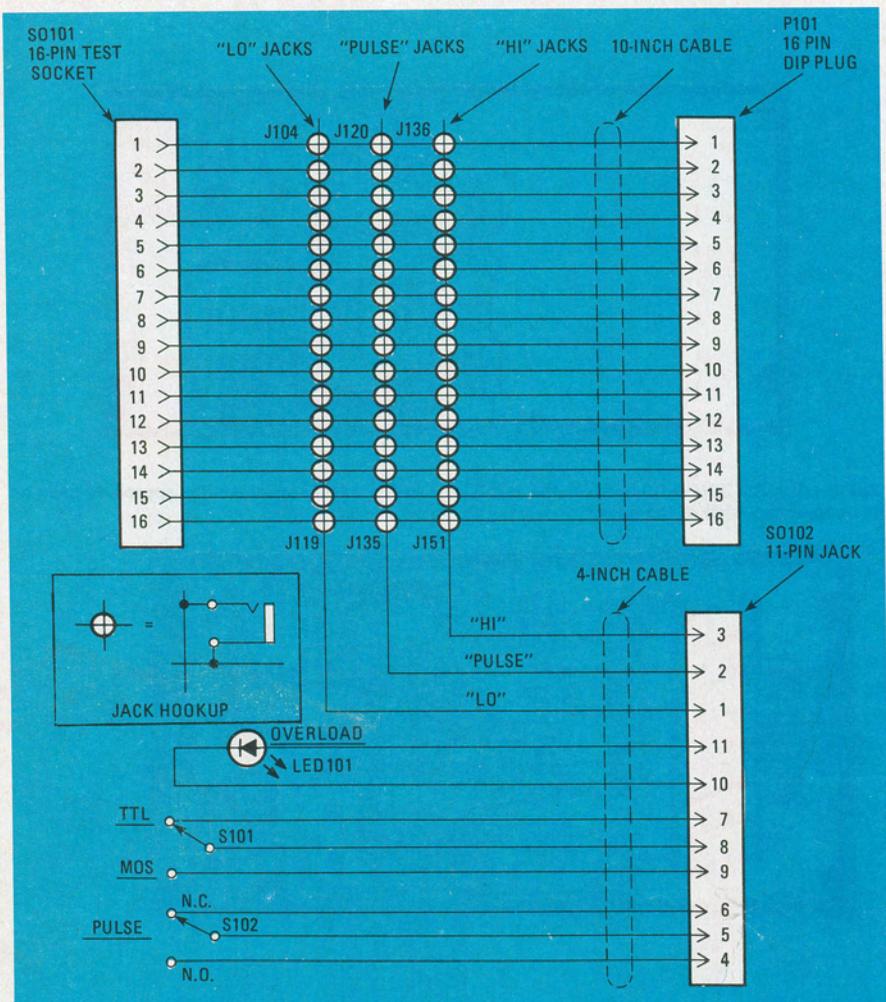


FIG. 13—PANEL BOARD SCHEMATIC shows jack array J104-J151. Inset shows how jacks are connected. Note that switch S102 is actually an SPDT pushbutton type.

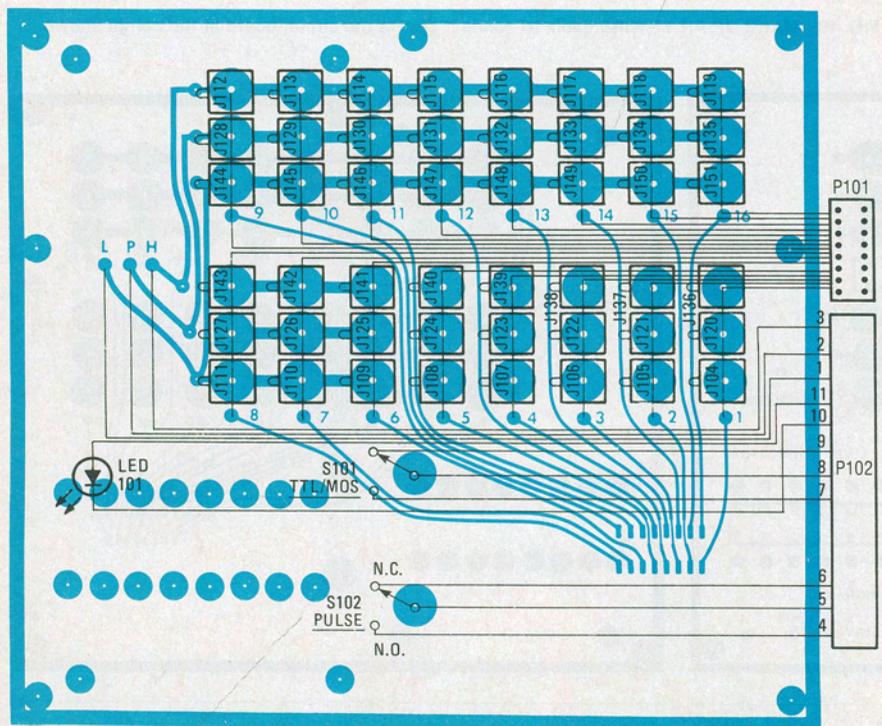
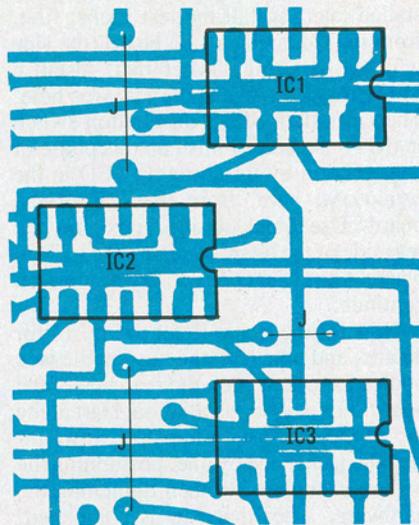


FIG. 14—CENTER PINS of the HI, LO, and PULSE jacks for each IC pin are bused together. No wires are connected to ground lugs.

### OOOOOOOPS

The center jumper in Fig. 5 of Part 1 was shown incorrectly. The correct portion of that parts-placement diagram is shown below.



### PARTS LIST—PANEL BOARD

#### Semiconductors

- LED101—jumbo red LED lamp
- P101—16-pin DIP header with 10-inch (minimum) cable
- P102—12 pin Molex nylon connector
- S0101—16 pin ZIF (Zero Insertion Force) socket (Welcon ZIF—16 or similar)
- S0102—12-pin socket to mate with P102 from display board
- J104-J151—miniature phone jack
- J201—two-conductor polarized jack (a phone jack is OK)
- S101—SPDT mini toggle switch
- S102—SPDT mini pushbutton switch (push-on/push off)
- S201—SPST toggle switch

**Miscellaneous:** cabinet, hookup wire, 4-40 hardware, 3/4-inch threaded spacers, phone plugs, etc.

The following is available from Technico Services, PO Box 20HC, Orangehurst, Fullerton, CA 92633: set of two etched & drilled PC boards (IC-1), \$30.00. Available from ABC Electronics, 2033 W. La Habra Boulevard, La Habra, CA 90631 is a set of all parts, *excluding PC boards (IC-1P)*, \$85.00. CA residents please add sales tax; foreign orders please add \$3.00 for postage & handling.

piece of uninsulated bus wire. Connect the end of the wire to the pad below the "LO" jack. Then move to the pin-15 series of jacks, and connect them in the same manner. Keep going until all the jacks are tied together and connected to the appropriate pads on the PC board. Check your work carefully. It's very easy to make a mistake here. Watch for shorts, especially, and correct any errors you find.

When we continued this article, we'll finish up the panel-board wiring and complete the assembly. Then we'll make sure the tester operates properly. **R-E**