Contact tester quantifies open-, short-circuit tendencies

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Many present-day electronic systems, being modular in nature, rely heavily on connector blocks to hook the various functional units together. As such, it is becoming increasingly important to detect any momentary open-circuit or short-circuit tendencies of the system at the connector—especially in high-vibration environments—both in production-line testing and during actual operation. This tester detects both, while indicating if either condition persists beyond a given time preset by the user.

Consider the detection of an open-circuit tendency of contact S_1, as shown in the figure. For the purposes of discussion, the open-circuit condition is arbitrarily chosen to be one in which the resistance across S_1 is greater than 10 ohms for a period equal to or greater than 100 microseconds.

On system reset, the 74192 counters and 7476 flip-flops are brought to logic 0. If S_1 is closed, voltage V_1 will be near zero and the outputs of comparators G_1 and G_2 will be high. Light-emitting diode D_0 then glows, indicating the contact is closed.

If S_1 is momentarily opened or shows any contact deterioration, V_1 rises slightly above ground potential, forcing G_1 low and gating the output of the 1-megahertz clock through to the counters. Thus should the contact deterioration last for 100 μs, 100 clock pulses will be counted and the resulting carry pulse generated from the second 74192 will set flip-flop F_1. And if the ohmic resistance across S_1 goes above 10 Ω, V_1 will rise above 50 millivolts, forcing G_2 low and flip-flop F_2 high.

Thus D_1 will glow if F_1 is set and F_2 is clear. D_2 will glow if F_1 is clear and F_2 is set. D_3 will light if both F_1 and F_2 are set, so that the predetermined open-circuit time and resistance of S_1 may be readily recorded.

Short circuits are readily detected by connecting points A and B across the normally opened contact under test. When the contact is open, V_1 is near zero and the system remains in the reset position, lighting up D_0. If shorted momentarily, S_1 will cause either D_1, D_2 or D_3 to light. For the values shown in the figure, D_1 will glow if the short circuit exceeds 100 μs or more; D_2 indicates if S_1's resistance is less than 1 MΩ; D_3 illuminates if both of the aforementioned conditions exist.

By changing the clock frequency or the counting limit, any time interval can be preset. Similarly, the impedance at which the circuit responds may be selected by adjusting the threshold voltage at G_2. □

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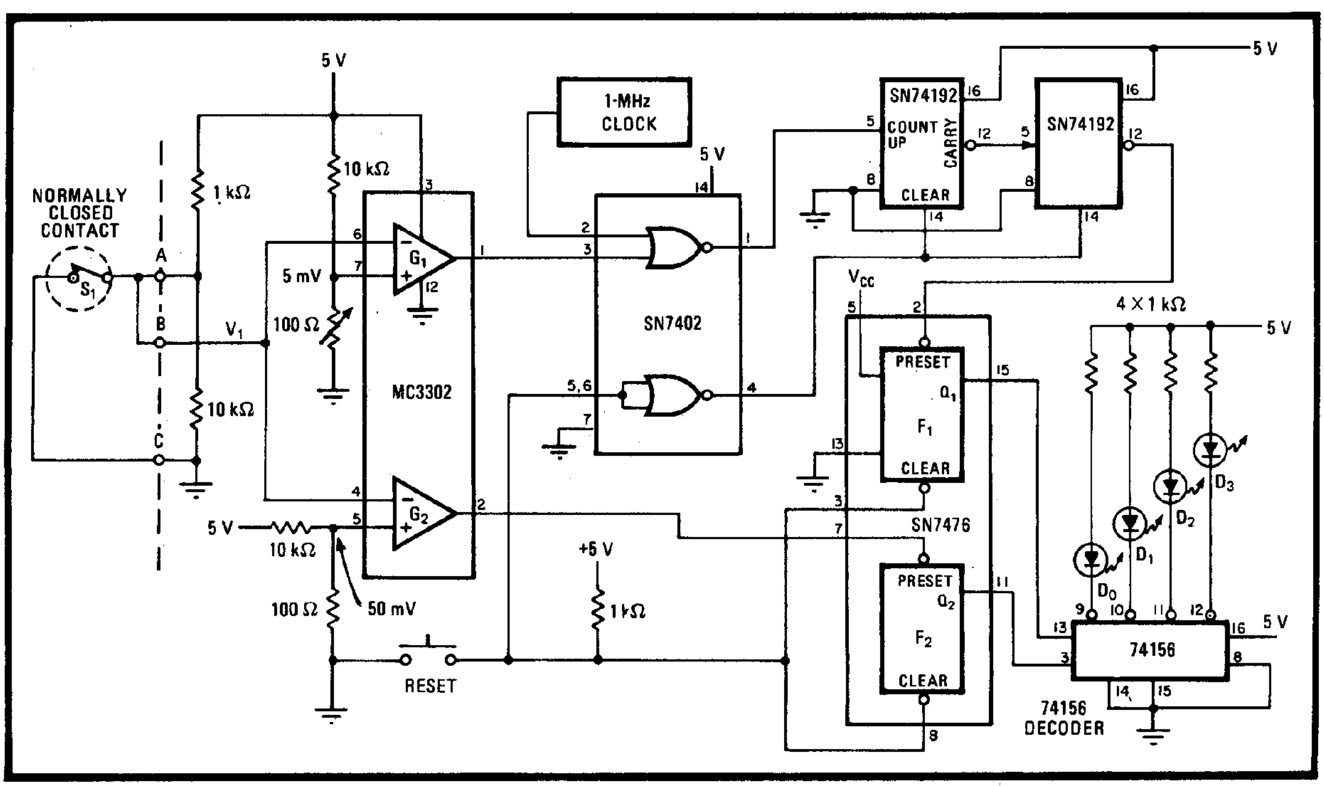
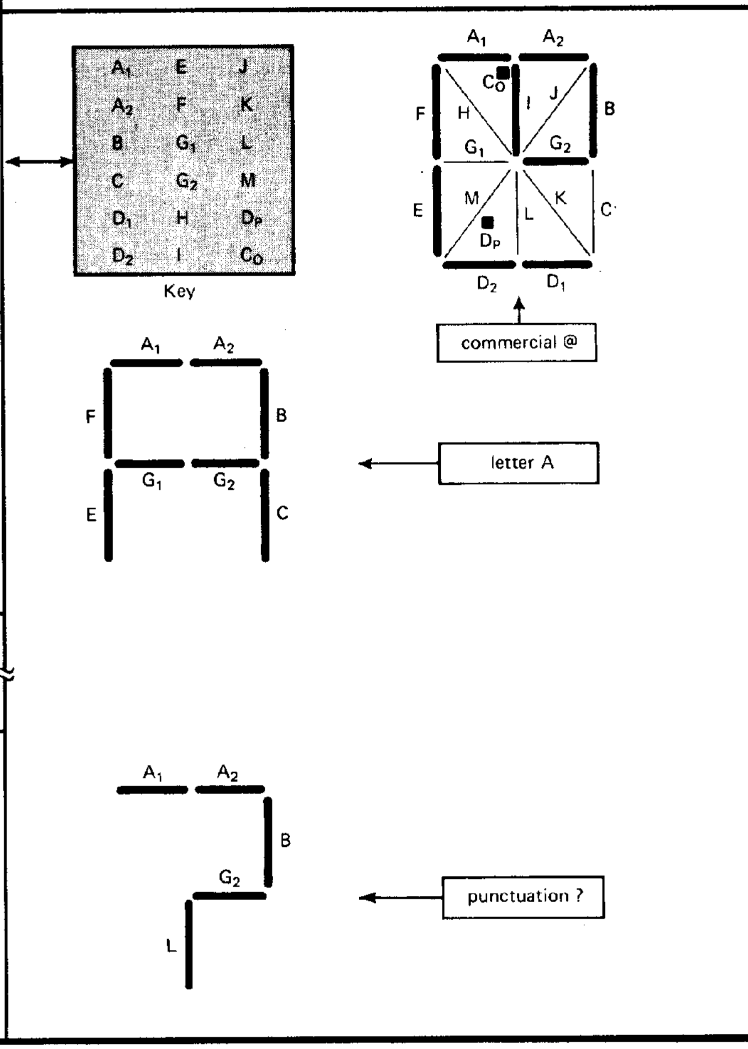


Connection. Tester for block connectors, pc boards, and cable assemblies indicates if duration of open or short circuit in circuit pin or lead exceeds preset time and checks relative magnitude of resistance across switch or broken wire. Four LEDs indicate state of affairs.

READ ONLY MEMORY CHARACTER GENERATOR

Address	Q_6	Q_5	Q_4	Q_3	Q_2	Q_1
000_8	0	0	1	X	X	X
001	0	1	0	1	1	0
002	0	1	1	1	1	0
003	1	0	0	1	1	0
004	1	0	1	0	0	0
005	1	1	0	1	0	0
006	1	1	1	1	0	0
007	1	1	1	X	X	X
010	0	0	1	X	X	X
011	0	1	0	1	1	0
012	0	1	1	1	1	0
013	1	0	0	1	1	0
014	1	0	1	1	1	0
015	1	1	0	0	0	0
016	1	1	1	0	0	0
017	1	1	1	X	X	X
⋮			⋮			
770	0	0	1	X	X	X
771	0	1	0	1	0	0
772	0	1	1	1	0	0
773	1	0	0	1	0	1
774	1	0	1	0	0	0
775	1	1	0	0	0	0
776	1	1	1	0	0	0
777	1	1	1	X	X	X

Symbol



requiring high voltage may be accommodated, also.

In general operation (see figure), the microprocessor coordinates character selection, strobe-timing, and overall control duties with the aid of the NE590 strobe drivers, the NE591 peripheral display drivers, and the 74LS175 quad latch. When suitably addressed, the 82S115 512-word-by-8-bit PROM, which stores all the ASCII characters, delivers a logic-state table corresponding to the character selected via the clocked 74LS175 and the NE591s.

The PROM functions both as a character-request look-up table and as a state machine, with the quad flip-flop holding the current machine state. Bit 7 of the processor initializes the state to zero at the beginning of a character-decode cycle.

Logic signals corresponding to the character desired are then applied to pins A_3–A_8 of the PROM, and the device is clocked through seven states (see table) so that the desired segments are excited. The display is then strobed and the character thus placed in any desired location via command from pins 0 to 6 of the processor via the strobe latches, each latch of which is enabled separately. This process is repeated for up to 64 characters, the maximum that may be placed on the display at any given instant. Thereafter, as in all multiplexed displays, only one character is enabled at any time. All characters will appear to be displayed continuously, however, because of the high scanning rate.

As seen in the table, during each clocked state the PROM generates 3 bits of segment information. Six such states define the character produced. Thus only three display segments switch during each NE591 latching period, substantially reducing load transients and large load-current variations, which tend to cause difficulty in circuits of this kind. Only six of each NE591's eight outputs are used, to reduce power dissipation. Note that each device handles 6 of the total of 18 display segments for each character.

As the circuit is digital, neither layout nor component values are critical. The clock frequency, typically less than 5 MHz, should have a minimum pulse width (t_w) of 100 ns, however, in order to ensure proper display and strobe latching. □