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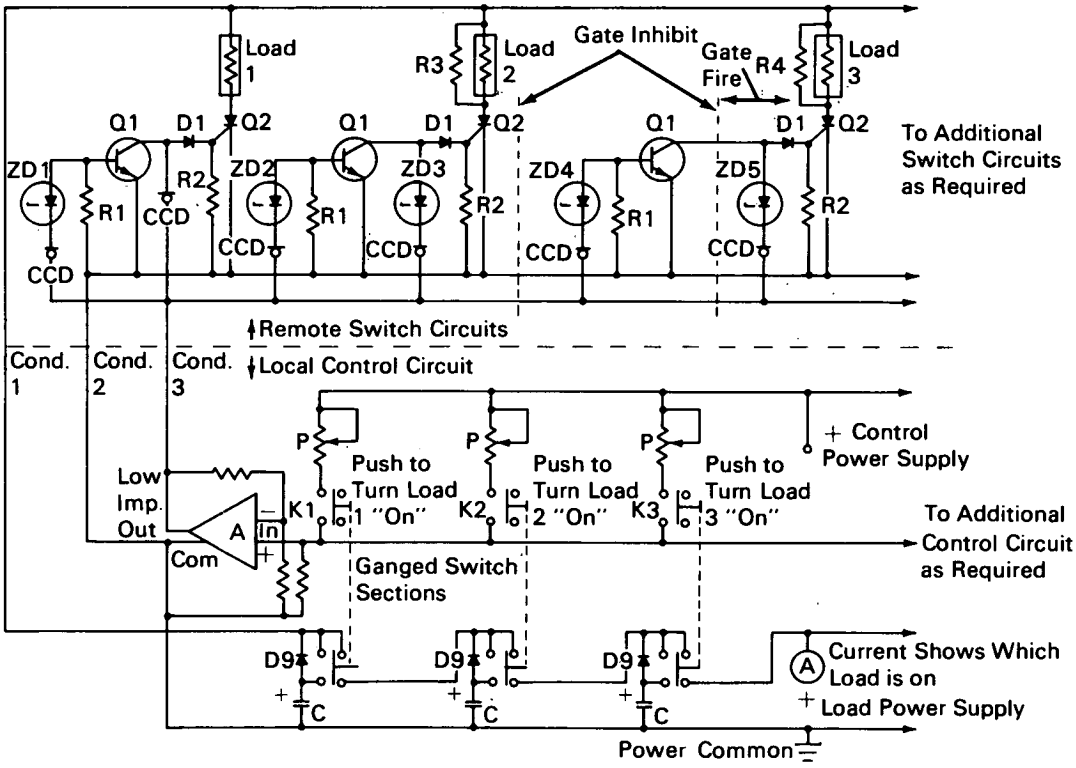
NASA TECH BRIEF

Solid State Remote Circuit Selector Switch



A solid-state remote switching circuit has been developed that differs from existing circuits in that voltage logic is used to switch on a desired circuit. Mechanical relays, frequency responsive circuits, or capacitors in the remote load switching circuit are not required. The switch circuit was orginally designed to control rotating multi-range pressure transducers in jet engine testing. In addition to the above, the circuit meets the following requirements: a three-conductor wire connection between the central control circuit and the remote switch circuits; a continuous central control circuit indication of the remote switch circuit that is activated; and a capability of activating any remote circuit switch in any order of desired sequence.

The schematic illustration shows how the system functions. The remote switching action is produced by a silicon controlled rectifier (SCR) Q2 conducting current through loads 1, 2, 3, etc. The SCR's are latched to the on state by the application of current

(continued overleaf)

to the gate terminal and are cut off by the momentary interruption of current through the anode and cathode conduction path.

Q2 load current is routed via line 1 as a series connection through one section of each of the central control circuit spring return control switches K1, K2, K3, etc., and returns to circuit ground via line 2. A second section of the control switches applies a potential to the input of amplifier (A), as determined by the setting of rheostat P, when any of the control switches are depressed. The output of amplifier (A) is routed through line 3 to the SCR gate "inhibit" or "fire" circuits.

The SCR gate "inhibit" or "fire" action is determined by the voltage conduction values of the zener diodes ZD1, ZD2, ZD3, ZD4, ZD5. In switch circuit (1), when K1 is depressed, the dc output voltage from amplifier (A) is slightly below the conduction value of ZD1; current will flow through CCD and D1, to the gate of Q2 and turn on the current through load 1. If the output voltage of amplifier (A) is above the conduction value of ZD1, a potential will appear at the base of transistor Q1, causing the transistor to conduct and inhibit the gate current path through ZD1 and CCD. If K1 is momentarily depressed under these conditions, the current through line 1 will be interrupted for the period of time it takes the wiper of the switch section to leave the N.C. contact and the load 1 current will cease. Switch circuit (1) can be turned on only when the voltage on line 3 is below the conduction value of ZD1. Diode D9 and capacitor C provide hold-in current for Q2 during the short interval when the switch K1 returns to the up position as it is released from the depressed condition.

The Q1 gate control circuit for switch circuits 2, 3, etc., is the same as circuit (1) except for the voltage conduction values of the two zener diodes. In circuit (2), the voltage conduction value of ZD3 is selected to be more than that of ZD1. The voltage conduction value of ZD2 is higher than ZD3. When K2 is depressed, and the voltage level from P1, in its circuit, is set so that amplifier (A) output voltage is above the conduction values of ZD3 but below that of ZD2, switch circuit (2) will turn on and switch circuit (1) will turn off if it was in the on state.

The zener diodes in each switch circuit set a voltage band that will operate the circuit. An easily set voltage band will fire the gate of one stage, inhibit the gates of preceding stages, but will not be high enough to fire the gates of succeeding stages. Potentiometer P1 is set up once to produce a voltage that falls within the desired band for the switch circuit selected.

In the case where loads 1, 2, 3, etc., draw identical current, shunt resistors R3, R4, etc., can be selected to produce increasing line (1) currents for switch circuit identification as indicated by meter (M). The constant current diodes (CCD) limit circuit current drain to prevent component damage and excessive power supply drain.

Notes:

1. The multirange pressure transducer range switching requirement was a 10-circuit switching capacity. Larger switching capacity is possible and limited only by the closeness of the voltage bands and the voltage breakdown limitations of the constant current diodes. The circuit can also be used in a coded remote circuit activator where a predetermined sequence of remote switching has to occur in a defined length of time to prevent false or undesired circuit activation.
2. Requests for further information may be directed to:
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   Lewis Research Center
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   Reference: B70-10579

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

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