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NASA TECH BRIEF

Circuit Automatically Calibrates Flowmeter Against Liquid-Level Gage Reference

The problem:

To calibrate a turbine-type flowmeter, using the flow of liquid from a tank equipped with reed-type liquid-level switches as a calibration reference or standard. As the liquid level changes, a float carrying a ring magnet rides along the switch gage column and momentarily closes each of 40 reed switches located at known tank levels. The switches are divided into two groups of 20 parallel switches each. In order to allow identification of the switches, each switch is wired internally in series with one of four values of resistance. The resistors are sized according to an identification code which allows the identity of any switch in the tank to be determined by observing a minimum of two successive deflection amplitudes. The precise volume increment between any two switches in the tank is established by a separate calibration. The basic instrumentation problem is that of providing a circuit to generate a reliable and accurate gate signal, allowing the tank-level switches to control the flowmeter pulse count and corresponding time-count interval.

The solution:

The circuit consists of four stages: (1) an input and switch identification stage, (2) a monostable multivibrator, (3) a bistable multivibrator, and (4) a signal inverter and pulse output stage. The first stage conditions the signal from the liquid-level gage for transmission to the subsequent stages and to allow the deflection amplitude to be recorded externally for switch identification. The monostable multivibrator provides a clean (free of effects of multiple closures and bounce of switch contacts) input pulse which corresponds to the closure of a liquid-level switch. This signal is used to initiate the gate signal. The bistable multivibrator provides the two stable states, *open* and *close,* for the gate signal. This signal provides a decreasing voltage step as the gate transfers from *close* to *open*. Since the signal required to turn on the counters and timer is an increasing voltage step, the signal polarity must be inverted.

The initial state of the unit controls is: power *on* and sequence *start*. At the closure of the first level switch, the gate will *open,* allowing counting to start (as indicated by a green light). The gate may be set to close at any predetermined level switch by setting the sequence to *stop* after observing the closure of the preceding switch. The following switch closure will close the gate and terminate the count (as indicated by a red light). After recording the timer and counter readings, the timer and counters are reset to zero, and the entire cycle may be repeated as required. The switches that close at the known level increments are identified by evaluating the pattern of the signals recorded across the switch resistors. Comparison of the gate signal recordings with the identified switches provides a measure of the volumetric flow corresponding to the flowmeter signal count.

Note:

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
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Reference: B67-10376

(continued overleaf)

Patent status:

No patent action is contemplated by NASA.

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