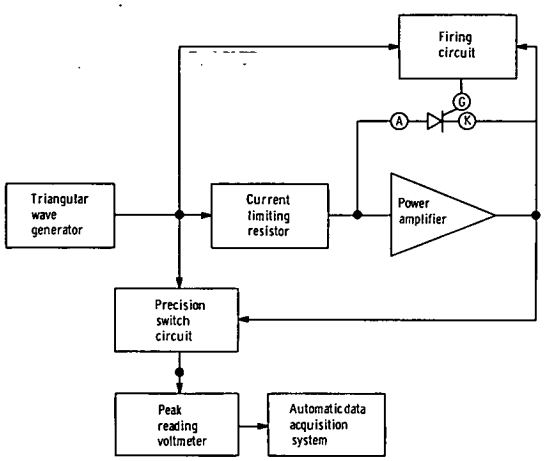
December 1972

B72-10752

NASA TECH BRIEF

Lewis Research Center

AUTOMATIC METHOD OF MEASURING SILICON-CONTROLLED-RECTIFIER HOLDING CURRENT



SCR holding current measuring system.

The Problem:

Silicon controlled rectifiers (SCR's) require a certain minimum anode current to maintain them in their conducting state, which is designated as the "holding current." Nearly all methods of turning off or commutating SCR's involve the reduction of the anode current to some value less than the holding current.

The measurement of holding current was one of the more difficult measurements to obtain in order to determine the effects of reactor radiation on SCR's. The measuring system requirements included: (1) reliability, (2) repeatability, (3) response to change due to radiation effects, and (4) automatic data acquisition, which requirements could not be met by any known commercial unit available.

The Solution:

An automated SCR holding current measuring system that precisely reproduces measurement conditions and averages a large number of output values to an accuracy that exceeds that possible by laboratory bench measurements.

How It's Done:

The essential components of the SCR holding-current measurement system are shown in the figure. The triangular wave generator provides the input voltage to the system. This voltage is applied to the current limiting resistors in series with the test SCR. The SCR test circuit eliminates the effect of the forward voltage drop of the SCR on the measurement of the anode current. This is accomplished by connecting the test SCR in the feedback path of a power amplifier. The firing circuit provides a continuously increasing current to the gate of the test SCR. This current goes to zero when the SCR turns on.

The precision switch circuit is a critical unit in the holding-current measurement system. This circuit senses the precise time when the SCR turns off, that is, when the anode current of the SCR drops below the holding current. When the precision switch circuit senses this point, it connects the triangular-wave voltage to the peak reading voltmeter. The result is a train of negative pulses, the peak of which corresponds to the holding current.

(continued overleaf)

The pulse train produced at the output of the precision switch circuit must be conditioned to display and record on punch tape the holding current as required. The peak reading voltmeter produces an output equal to the most negative peak appearing at the input.

The automatic data acquisition system consisted of the following components: (1) crossbar scanner, (2) digital voltmeter, (3) digital clock, (4) digital recorder, (5) output control, and (6) paper tape punch.

The crossbar scanner operates relays in a special relay unit. This increases the power handling capabilities of the scanner. The relay unit, controlled by the scanner, selects the SCR to be tested. The scanner operation is initiated by the digital clock. Results are recorded, via the voltmeter, by the digital recorder and the paper tape punch. Once the system is set, all subsequent data are taken automatically at predetermined intervals (from 2 to 16 hours) and the requirements of reliability and repeatability are achieved by the design of the automated circuitry.

Notes:

1. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)

   Reference: NASA TM-X-2463 (N72-13207), Design and Analysis of an Automatic Method of Measuring Silicon-Controlled-Rectifier Holding Current
2. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B72-10752

Patent Status:

NASA has decided not to apply for a patent.

Source: Edward A. Maslowski
Lewis Research Center
(LEW-11898)