NIXIE®

INDICATOR TUBES

. . . . . INTRODUCTION

NIXIE tubes are all-electronic, gas filled, cold cathode indicators. They consist of a common anode and ten individual metallic cathodes, each of which is formed to the shape of numerals (0-9), alphabetical characters, or special symbols.

Their simplicity of operation makes NIXIE tubes ideal for the conversion of electro-mechanical or electronics signals directly to readable characters. Application of a negative voltage to the selected character with respect to the common anode makes the character the cathode of a simple gas discharge diode. Only the selected character is visible in the common viewing area because the visual glow discharge is considerably larger than its metallic source.

NIXIE tubes are unusually efficient electronic-to-visual converters since all of their electrical energy is converted into a neon glow of relatively narrow optical band width. The eye acts as a natural filter and distinguishes this glow in high ambient light.

Typical features which have established NIXIE tubes as the readout standard of the electronic industry are:

1. All-electronic design provides:
   a. Minimum power requirements
   b. High speed of operation
2. Smallest volume and lightest weight make simple and reliable packaging possible.
3. NIXIE tubes are lowest in cost — both to buy and operate.
4. Human engineered character design eliminates confusing segments or dot matrix patterns.
5. Best readability for characteristic size at any distance — any viewing angle.
6. Temperature, shock, and vibration characteristics qualify the tube for military use.
7. Simple decimal inputs eliminate decoding or segment selection circuitry.
8. NIXIE Tubes offer longest life and greatest reliability of any readout device.

This last feature, the combination of life and reliability, requires further explanation, since it is probably the most important reason for the NIXIE tube's outstanding popularity.

In September 1958, after two years of development and production of "regular" standard NIXIE tube types, a new series of tubes was announced. Called "Ultra Long Life" NIXIE tubes, these devices exhibited greatly increased life expectancy. On the basis of accelerated tests, a life of 20,000 hours per cathode or 200,000 hours for a complete 10 cathode tube was predicted. The 200,000 hour figure was based upon an assumption of uniform use of each of the characters within the tube.

To confirm these estimates, 50 Ultra Long Life Standard NIXIE tubes (Type 8037 (B5031) were placed on life test on September 9, 1958. Ten tubes were operated dynamically (sequential changing of cathodes at a 2 cps rate), while the remaining 40 tubes were subjected to "static" life (continuous display of the same character). This is the most severe life condition possible. (4 tubes displayed the numeral Zero, 4 tubes the numeral One, etc.) On December 8, 1958, a second group of 50 tubes joined the continuing life test and were operated in the same manner.

Progress of the life tests as of January 1, 1962, 29,200 hours later, indicates that of the first 50 tubes, 49 are still operating. One tube developed an intermittent open connection caused by a poor weld after 21,600 hours of continuous "static" operation. Examination of the cathode surface of the numeral which had been lighted showed it to be in excellent condition and capable of many more thousands of hours of use. The second group of 50 tubes have passed the 26,800 hour mark *without a single failure of any type.*

Based upon the results of tests to date, it is apparent that the original life predication of 20,000 hours (static) and 200,000 hours (dynamic) were conservative, since visual examination of the tubes undergoing test indicates that the individual cathode life will be on the order of 35,000 to 50,000 hours. Assuming that "dynamic" life under actual field operating conditions may provide a less than equal distribution of usage among the 10 characters of the tube, a realistic "dynamic" life can be predicated as being between 200,000 and 500,000 hours.

These figures indicate that Ultra Long Life NIXIE tubes can be expected to outlast the equipment in which they will be used.

This life and reliability, combined with the advantages of low cost, low power, best readability, small size and weight, high speed, rugged construction, and simplicity of operation offer the design engineer the ultimate in readout performance in a single device — the NIXIE Indicator Tube.

ANOTHER ELECTRONIC CONTRIBUTION BY
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