Burroughs

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Application Notes

BAR GRAPH DISPLAY FOR INSTRUMENTS

INTRODUCTION

The Burroughs SELF-SCAN® bar graph displays are flat panel indicators that provide analog displays with digital accuracy. While bar graphs can be designed and manufactured in almost any configuration, this application note describes two dual linear bar graphs and a circular bar graph. These 3 devices, as well as most custom displays,are basically identical in operation and construction. These displays can have such diverse applications as:

- Process Control
- Automobile Displays
- Panel Meters
- Depth Indicators
- Aircraft Displays
- Level Indicators

The soft neon orange glow characteristic of gas discharge display technology provides a display that is uniformly bright, yet pleasing to the eye, while the display has sufficient contrast to be viewed comfortably under high ambient illumination. Added features of low-cost drive circuitry and low power consumption make this all-electronic display an ideal solution to nearly any problem.The extremely rugged display may be incorporated in equipment subject to severe shock and vibration with ease.

DESCRIPTION

The bar graph panels are manufactured using advanced thick film technology for high reliability. Burroughs' internal addressing technique used in the

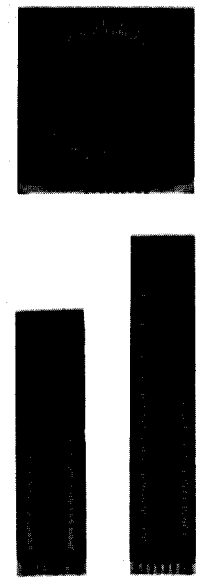

Figure 1. SELF SCAN Bar Graph Displays

SELF-SCAN panels eliminates a majority of the addressing electronics required for a comparable matrixed display. Figure 1 shows the bar graph displays described here. There are two dual linear bar graphs: one with 100 elements in each bar for 1% resolution, the other with 200 elements in each bar for ½% resolution. The circular bar has 120 elements on 3-degree centers with every 5th element elongated.

CONSTRUCTION

The bar graph panels are constructed of a rear substrate, spacer, and glass front plate as shown in Figure 2. The desired segment pattern is screened onto the substrate using a conductive ink. A black dielectric mask is also screened onto the substrate to create a light-absorbent background, enhancing the contrast ratio. The front glass has two transparent anodes and anode contacts applied for the dual linear bar graph displays (one transparent anode and anode contact for the circular bar graph). A spacer is placed between the front and rear surfaces. The entire display is then sealed and filled with a neon gas mixture. All panel connections are made through a connector assembly that slides between the opposing surfaces of the substrate and front glass, and mates with the printed contacts that are on one end of the panel.

THEORY OF OPERATION

The display segments are illuminated by using the glow transfer principle, where the glow is established at the reset cathode and then transferred sequentially to the desired segment of the panel at approximately 70 cycles per second.

Figure 3 is a combined isometric and block diagram designed to demonstrate the circuitry required for a dual linear bar graph. Figure 4 demonstrates the circuitry required for a circular bar graph.

When the panel is energized, the +250V potential between the keep-alive anode and cathode establishes a glow discharge at this area.

The phase generator controls the transferral of the glow along the bar. The phase generator for the linear bar graphs is a three-phase plus reset circuit; for the circular bar graph, it is a five-phase plus reset circuit. To initiate a scan, the reset transistor Q1 is turned on, subsequently grounding the reset cathode. The reset and phase drive anodes are connected to the +250 V source through limiting resistors. When the reset cathode is grounded, ionization of the gas occurs at this one cathode.

The counter advances on the next clock pulse, and phase 1 transistor Q2 is turned on, while the reset cathode is returned to the off condition.

NOTE

The following description is written for a dual linear bar graph. The circular bar operates in a similar fashion, although there are 5 phases instead of 3 and the 5th phase is held on for two clock pulses.

Transistor Q2, coupled to the phase 1 bus, grounds every third cathode, and ionization rapidly transfers on the surface of cathode 1, while at the same time, ionization is no longer supported at the reset cathode. The glow will only occur at the adjacent or nearest grounded cathode because once ionization occurs at this cathode, the anode voltage drops, due to current flow, to a level high enough to support ionization at the desired cathode but too low to cause ionization at any other grounded cathode.

The next clock pulse turns off transistor Q2 and turns on transistor Q3, removing the ground from phase 1 cathodes and simultaneously grounding the phase 2 cathode bus, and transferring the glow to the second cathode. Similarly, the next clock pulse turns off phase 2 and grounds the phase 3 cathode bus.

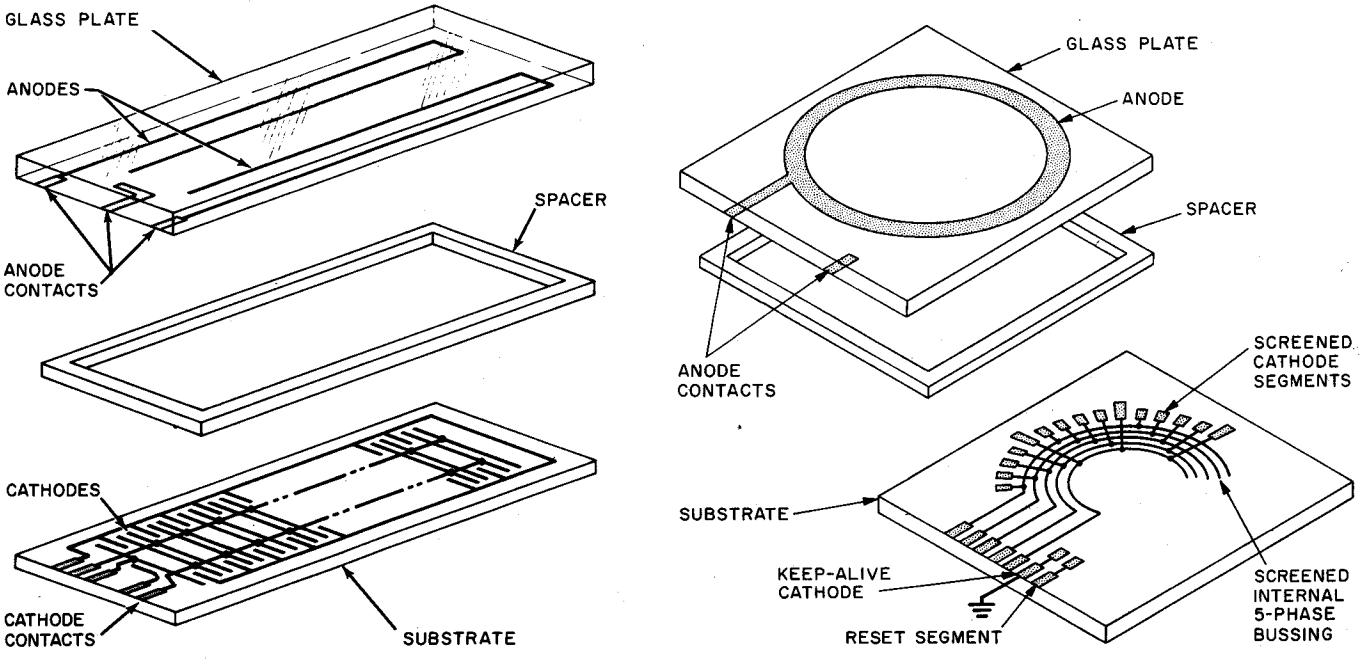

Figure 2
PANEL CONSTRUCTION

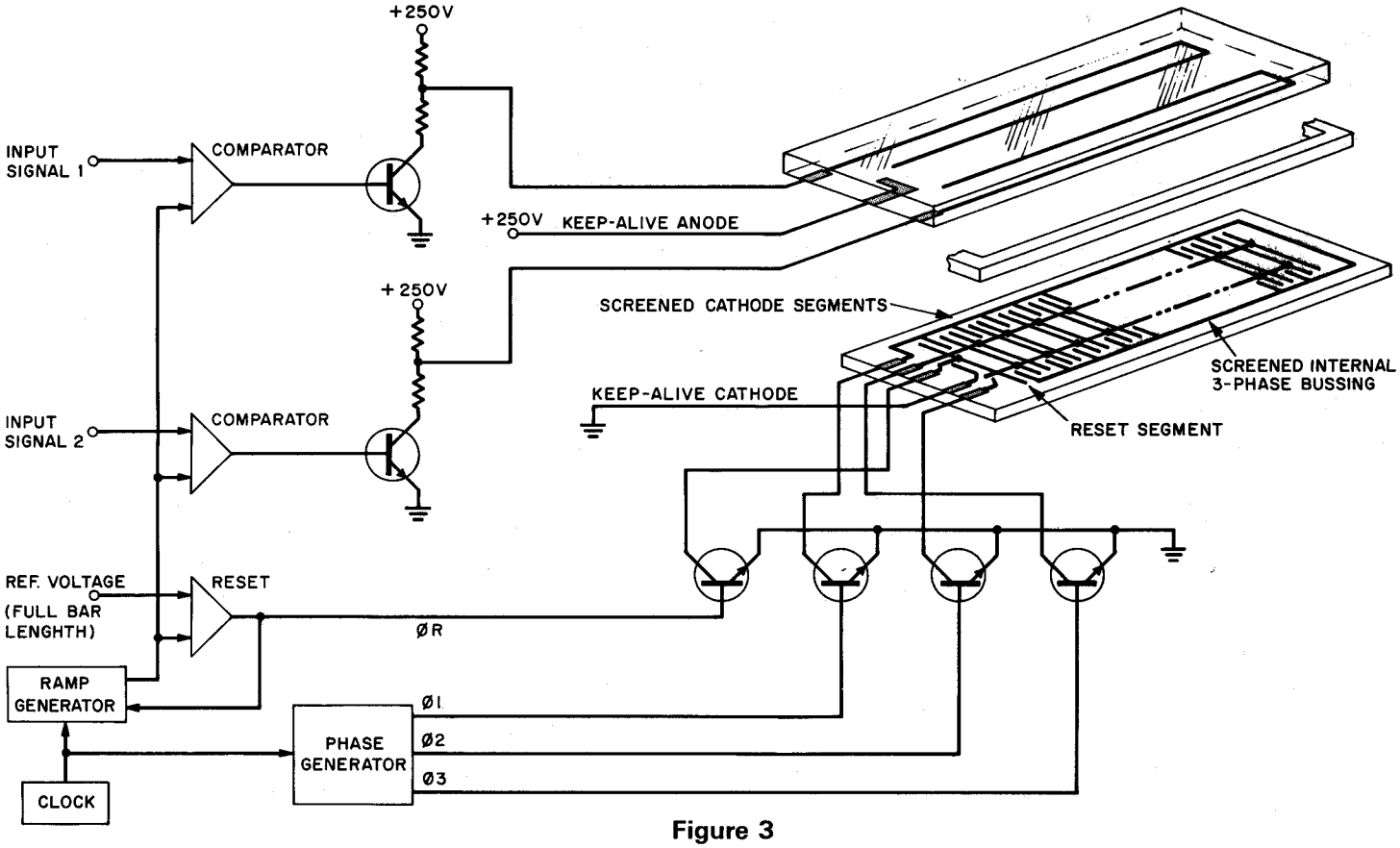

Figure 3
LINEAR BAR GRAPH CIRCUIT

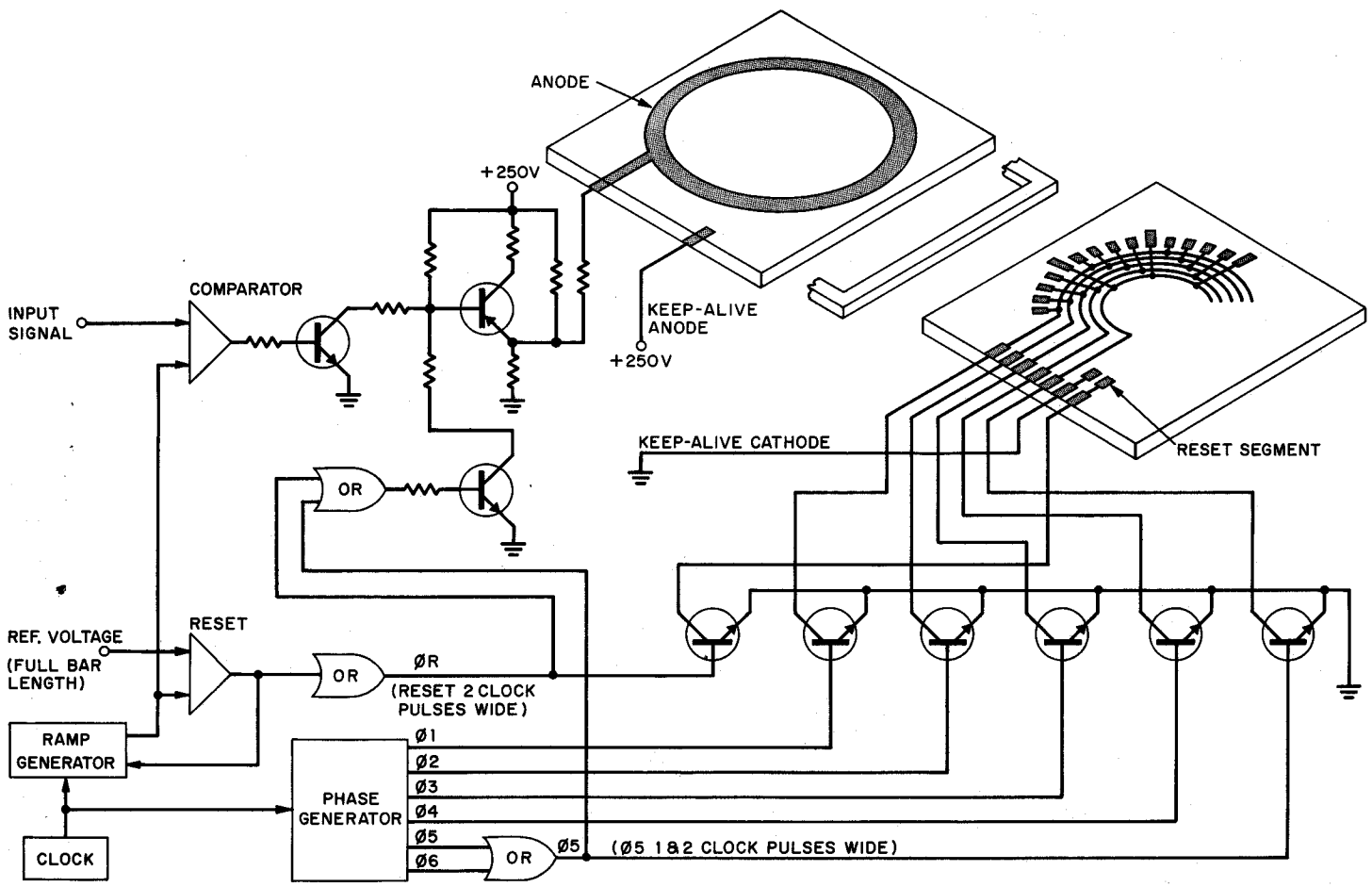

Figure 4
CIRCULAR BAR GRAPH CIRCUIT

As the counter advances, the cathode busses are sequentially grounded, causing the glow to transfer along the panel. When the counter determines that a sufficient number of clock pulses have been generated to scan every cathode element, the reset pulse generator is enabled, grounding the reset transistor Q1, and the scan cycle begins again.

To eliminate perceptible flickering, the scan rate should be approximately 70 cycles per second, or approximately 14.2 mS per scan. Each cathode is then on for the period shown in Table 1.

Table 1. CATHODE "ON" TIMES (70 Hz Scan)

Number of Bars Scanned	Any One Cathode "On" Time
100	142 us
120	119 us
200	71 us

Since the phase 1 bus is connected to cathodes 1,4,7, etc. whenever cathode 1 is grounded, so are cathodes 4 and 7. However, the glow only appears at cathode 1. When cathode 1 is turned off, the glow transfers to cathode 2 and ionization at cathode 1 begins to decay. When cathodes 1 and 4 are again grounded (two clock pulses later), the ionization has had to decay below a point where a glow will again form on cathode 1. Therefore, if a different scan rate is selected, the period that each cathode must remain off before that bus is grounded again is between 100 and 150 us.

BAR LENGTH CONTROL

In the dual linear bar graph panels, like cathode segments for both channels are connected to three common busses. A separate anode serves each column of cathodes. A cathode in either channel will glow whenever voltage greater than the ionization voltage is applied between it and the anode for that channel.

In the circular bar graph panels, the cathode segments are connected to five common phases and a single anode serves all cathodes. A cathode will glow whenever voltage greater than the ionization voltage is applied between it and the anode.

The bar length is determined by terminating the glow after the desired number of clock pulses. This is accomplished by turning the anode driver on at the beginning of the reset period and turning it off at the desired count.

DRIVE CIRCUITS

Figures 3 and 4 illustrate typical drive circuits as provided in the Bar Graph Designer's Kits available from Burroughs. This Kit contains all discrete components and printed circuit board to enable you to rapidly build an evaluation model to adapt the bar graph to your program needs. For further information on the kits, see Bulletin No. 5006.

For further information, write to Burroughs Corporation, Electronic Components Division, P. O. Box 1226, Plainfield, New Jersey 07061; or call our special sales/applications assistance number, (201) 757-3400 in New Jersey, or (714) 835-7335 in California. For overseas inquiries, write Burroughs ECD International, Astronaut House, Feltham, Middlesex, England; or call (01) 890-9441 in England.