CHANGEABLE-MESSAGE DISPLAYS: SOME DESIGN CONSIDERATIONS

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Changeable-message displays in the past have been used mainly in outdoor advertising applications. Sign company designers, familiar with advertising requirements, have designed those displays to achieve maximum effect for advertising at the lowest possible cost.

Applications of changeable-message displays in public safety present an entirely new set of requirements that can be considerably more complex than those of advertising. Public-safety displays usually require a systems concept. That is, the display operates in a system of information units, sometimes involving electronic computers. In addition, public-safety displays require high performance because life or property may be endangered if there is faulty operation. Requirements for public-safety display systems are usually first drafted by officials who are concerned about performance. That is, they know what it is they wish to achieve. They usually do not have an electronic background, so they look for some yardstick by which to gauge the requirements to ensure that they are realistic.

The purpose of this paper is to set forth some guidelines based on available technology.

Legibility is the most important consideration in the specification of a display. It is also one of the most difficult to define in a specification. Simple block letters are the most legible. Block letters, width 60 percent of their height, can be read by an average viewer 500 ft away for each foot of letter height. This applies to exposed lamps or other bright copy on a dark background. Lamp spacing is also a legibility factor. Correctly spaced lamps, when viewed at the correct reading distance, will produce a continuous, nearly smooth line of light. For medium-base lamps (household type of base), this distance is 250 to 500 ft.

Viewing angle is important where the person reading the display travels through a large angle. A typical example is a highway display where the driver may have to start reading at a distance and finish reading at close range. If the display is mounted over the roadway, the viewing angle may become severe at close distance.

Because of visual effects, colors have different impacts on viewers. The designer must take account of this in the display design. For instance, for the same visual

"impact," 11-W yellow, 15-W orange, 25-W red and green, and 40-W blue would be required. Mixing colors on displays should be avoided if possible.

Because of the extreme daylight brightness, the display should use the maximum contrast possible. The readability is based on contrast, not brightness. The background color of the display should be a dark, flat color that reflects little or no incident sunlight. A flat finish also improves unwanted headlight reflection glare at night. Typical highway displays use lamps in the 15-W and over range to produce the required light intensity. Unwanted sunlight reflections from lamps, particularly the reflector type, are greatly reduced by means of sun screens. Sun screens work like miniature blinds, deflecting sunlight at an angle but allowing light to shine out in a down direction.

The required light output from the display at night is greatly reduced. In many applications the light is reduced to 10 percent of the daytime level. Without reduced light output, the display would be difficult to read because of glare.

Dimming is the reduction of light output to maximize the legibility of the display. Dimming should be continuously variable, automatically. This will ensure that the display is legible at all hours of the day. One of the difficulties of step dimming, which is sometimes used, is that at dusk or dawn the display is either too bright or too dim. Stepless dimming also has an added maintenance factor that is highly desirable. With stepless dimming, lamp life up to 15,000 hours is feasible.

There are many ways to control a display. Controls range from manual to full computer control. In selecting modes, one should be mindful of possible future requirements. In the beginning the requirements may be simple, such as a manual selector switch controlling a fixed library of messages. Control system design parameters should answer the following questions: Will initial messages ever be changed, or will more messages be required in the future? Will messages have to be composed as the situation warrants? Will the system be adaptable to both manual and automatic computer control? What are the telephone or cable requirements to display sites? Is it necessary to verify that the display actually displayed the message commanded? Is it sufficient merely to indicate that the display went to position 6 on some selector switch? Must the display read back to the control point data such as power on, lines to display intact, electronics functioning, and message being displayed? Is a permanent record or hard copy required of all messages? Can manual override be employed when local conditions, such as telephone line failure or floods, require local control or manual control at computer location? Is the system modular?

Figure 1. Figuregram matrix display.

Displays composed of banks of lamps are commonly called matrix displays. Some of these displays are very limited in what they can display, and others are completely universal. Simple displays that are hard wired can display a limited number of words such as OPEN and CLOSED. Displays that can show any number of characters are also matrix displays. The point here is that a matrix display has a wide range of capabilities.

There are also several forms of matrix displays. One form is the solid bank of lamps. Typically this type is 7 lamps high by 80 or so lamps long. Space for each character is 5 lamps wide. Space between characters is usually 1 lamp wide. This form requires 42 lamps per character.

Another form of matrix is the "figuregram" type. This type is not a solid bank but consists of strings of lamps to form

segments. All letters and numbers can be formed with 15 segments. The advantage of the figuregram over the solid bank is that less control equipment is required. Any letter can be formed with only 15 switches, whereas the solid bank requires 7 times 5 plus 7 or 42 lamps to be switched per character. Also the figuregram type requires 31 lamps instead of 42. A slightly stylized alphabet is used with the figuregram type, but that is not objectionable (Fig. 1). The figuregram type is favored over others because of complete interchangeability and lower cost. Equipment costs are lower because there are fewer parts per character, and operating costs are lower because there are fewer lamps to maintain.

Although changeable-message displays have been used for some time, additional considerations in public safety require new specifications. The system concept must be adopted to allow future expansion of the system. Each level should build on the previous level without extensive revisions or downtime. Flexibility is inexpensive to obtain with modern electronics. Careful examination of present and near-future requirements should be included in drawing all specifications.