A CRT Display System for a Concept Vehicle

Technical Paper

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Author(s): Douglas J. Brandt Ronn E. Jamieson

Affiliated: Delco Electronics Corp., General Motors Corp. Chevrolet

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Douglas J. Brandt
Advanced Instrumentation Engineering
Delco Electronics Corp.
General Motors Corp.
Ronn E. Jamieson
Advanced Vehicle Engineering
Chevrolet • Pontiac • Canada Group
General Motors Corp.

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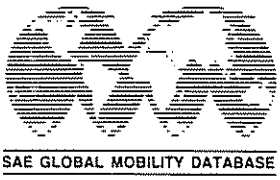

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ABSTRACT

The use of advanced instrumentation in automobiles has increased dramatically over the last several years. The design, development, and build of an advanced concept vehicle recently allowed both vehicle and instrumentation engineers the opportunity to further explore the use of advanced instrumentation for the vehicle display functions. For this vehicle, cathode ray tube (CRT) displays were used for primary information display, secondary information display and functional control, in-vehicle navigation display, and rear vision. Each of these applications of a CRT had unique requirements. This paper will discuss the application and implementation of CRTs for this concept vehicle's display functions.

BACKGROUND

Concept vehicles typically allow engineers the luxury of developing and implementing more advanced and state-of-the-art technology than production intent vehicles. To complement the advanced powertrain, chassis, and aerodynamic features of a recently developed concept vehicle, advanced instrumentation comprised completely of CRTs was developed. CRTs were chosen as the displays for the following reasons:

* CRTs could simultaneously satisfy the brightness, color and reconfigurability requirements
* To further develop previous automotive CRT technology
* Availability of the hardware

The complete system includes six CRTs: a primary display CRT, a secondary display CRT, a dedicated CRT for in-vehicle navigation and three independent CRTs for rear vision (i.e., left side view, rear view, and right side view). The location of each CRT in the vehicle is shown in Figure 1. Because each of these display applications has unique requirements, several different CRT types were developed, evaluated, and implemented.

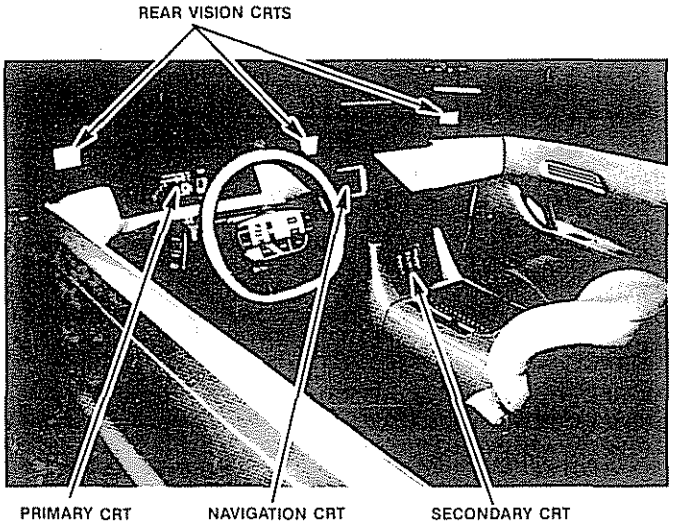

Figure 1. CRT Locations

PRIMARY DISPLAY

The primary display is located directly in front of the driver to display necessary vehicle operational information. The criteria established for the primary display were:

* High brightness
* High resolution (512 x 240 pixels)
* Multi-color
* Single page (required driving information only)
* Direct view (i.e., not head-up or reflective)

* High reliability
* Automotive environment

A high brightness, high resolution, single gun CRT with fixed color phosphor zones was selected. This CRT gives the appearance of a color CRT with the control simplicity of a monochrome CRT. The different color phosphor zones are shown in Figure 2.

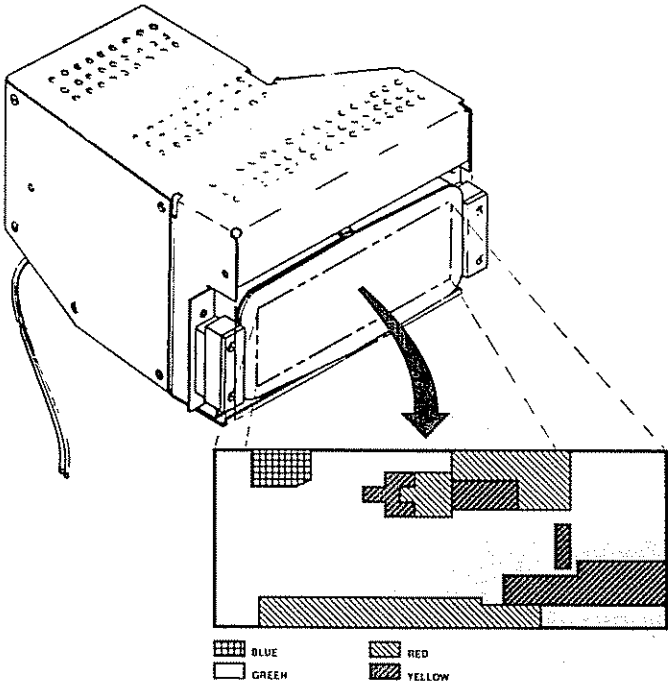

Figure 2. Primary Display Color Phosphor Zones

To achieve the brightness needed in direct sunlight, special burn resistant phosphor was used. Some typical brightness measurements are shown in Figure 3*.

Color	Brightness (fL)
Green	402
Yellow	214
Red	165
Blue	55

Figure 3. Primary Display CRT Brightness Measurements

The primary display electronic controller is the Monochrome Graphics Controller (MGC). The MGC is a microprocessor based video generator that is capable of driving several types of pixel based displays. It has the capability of interfacing with another computer via a serial data link and can also receive information directly from vehicle sensors. The MGC uses a 6802 microprocessor as the central processing unit (CPU). The MGC also contains hardware that provides a total of sixteen analog inputs, sixteen digital input/output lines, a serial communications link, two programmable timer counters, and a 6845 CRT controller.

The graphic information and color specifications defined for the primary display are shown in Figure 4.

Information	Color
Vehicle speed	Green
Engine speed	Green, yellow, and red zones
Odometer	Red
Fuel level	Green and yellow zones
Turn indicators	Green
High beam	Blue
Message center	Red
PRNDL (gear select)	Green
Oil pressure telltale	Red
Coolant temperature telltale	Red
Charging system telltale	Red
Seat belt telltale	Red
Brake telltale	Yellow

Figure 4. Primary Display Graphics Definition

The primary display graphics were developed using a specific dotmap program. This program allowed the designer to view the animated display and quickly make changes. These graphics were then compressed to approximately a 3:1 ratio to reduce memory storage requirements. This graphic information was then translated and programmed into programmable read only memory (PROM) and inserted into the MGC. A decompression algorithm for the graphics is contained in the 6802 microprocessor.

SECONDARY DISPLAY

The secondary display provided a conveniently located, reconfigurable

* All measurements taken with a Pritchard Model 713 Fast Scan Spectroradiometer

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