

## The Gentex Full Display Mirror (FDM)

### Background

Gentex is the world's leading supplier of automatic-dimming interior and exterior rearview mirrors. Using a combination of chemistry, digital light sensors and microprocessor-based algorithms, these mirrors automatically detect and eliminate dangerous mirror glare from the headlamps of trailing vehicles. Last year, Gentex shipped over 30 million mirror units, most of which included one or more advanced electronic features.

To Gentex and its OEM customers, the mirror has become a strategic electronic module – a delivery mechanism for advanced electronic features such as microphones, telematics interfaces, rear camera displays, side blind zone alerts, forward lighting optimization systems and more. Indeed, improving the driver's vision is central to just about everything Gentex does.

For over 30 years, the auto industry has theorized that some day displays would replace rearview mirrors. That's why Gentex has strategically and methodically acquired the technologies necessary to support the mirror's evolution. But how should displays for rear vision be introduced into the vehicle? The challenge is to balance factors like safety, driver preference/acceptance, cost and design, among others factors.

### The Problem

For a variety of reasons, the interior mirror's rearward view can be less than ideal. For starters, the interior mirror's rearward view is limited by Federal Motor Vehicle Safety Standards (FMVSS-111) that call for an interior mirror of unit magnification and a field of view measured from the projected eye point of 20 degrees. These regulations themselves somewhat restrict the mirror's rearward view.

Moreover, it's not always easy to see out the rear window because the mirror's view is often obstructed. Current vehicle design trends are yielding vehicles with upward-sloping beltlines and downward-sloping rooflines. The result is a small and sometimes nonexistent rear window. Further complicating the issue of rearward visibility are wider C/D pillars, full-sized headrests, multi-row seating, theater seating, and drop-down entertainment screens – all of which can block the mirror's view.

Several years ago, in the midst of FDM's development, Gentex conducted "clipping path studies" on the mirrors of all the vehicles in every major OEM's lineup. The goal was to quantify the degree to which the mirror's rearward view was blocked, or "clipped," by C/D pillars, headrests and the like. Gentex found that every mirror's view was clipped to some degree, and that most had approximately 15-30% of its rearward view obstructed. In extreme cases, a majority of the mirror's rearward view was blocked.

## **Solution**

That's why Gentex developed its all-new Full Display Mirror (FDM), an intelligent rear vision system that uses a custom, externally mounted camera and mirror-integrated video display to optimize a vehicle's rearward view.

The Gentex system is the world's first hybrid FDM. It provides unique yet critical bi-modal functionality. In mirror mode, the FDM functions as a standard rearview mirror. Additionally, during nighttime driving, digital light sensors talk to one another via a microprocessor to automatically darken the mirror when glare is detected. However, with the flip of a switch, the mirror enters display mode, and a clear, bright, LCD display appears through the mirror's reflective surface, providing a wide, unobstructed rearward view.

This bi-modal functionality is also important because it helps foster consumer acceptance. The driver is able to choose mirror or display mode depending on the driving task and/or the user's preference. It's also the only product of its type that meets current U.S. mirror regulations. The Gentex FDM is first and foremost a standard, FMVSS-111-compliant rearview mirror, but can also function as a supplemental display.

The Gentex FDM is a critical advancement in automotive rear vision that dramatically increases driving safety. It is the first commercially viable embodiment of the long-discussed and theorized prediction that video displays and cameras would one day be used to enhance the driver's rearward vision.