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Driving Comfort: The Perfect World of Driver Information

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The volume of possible and necessary information for the driver is increasing continuously, both in road traffic and in the vehicle itself. The global targets for reducing CO2 emissions and consumption apply more than ever before to all vehicle components, including display systems. The driver information systems in the BMW 7 Series all offer maximum image quality and are optimally tailored to the driver and the occupants.

1. Introduction

The technologies for driver information systems in the consumer sector are developing at a rapid pace. The requirements pertaining to future display systems are increasing accordingly: For example, accessing new display areas in ergonomically favorable sections, variable and situation-related display contents, scalability in terms of size and costs, low weight and energy consumption plus high-quality depiction.

Top priority in integrating the displays into the vehicle was given to meeting the requirements for maximum image quality plus a harmonious effect and appearance in the overall interior.

2.Premium Class Driver Information — the Instrument Cluster

The instrument cluster in the BMW 7 Series sets new standards in terms of its display concept, appearance and functionality. Figure 1 shows the instrument cluster's integration into the vehicle's onboard electrical system.

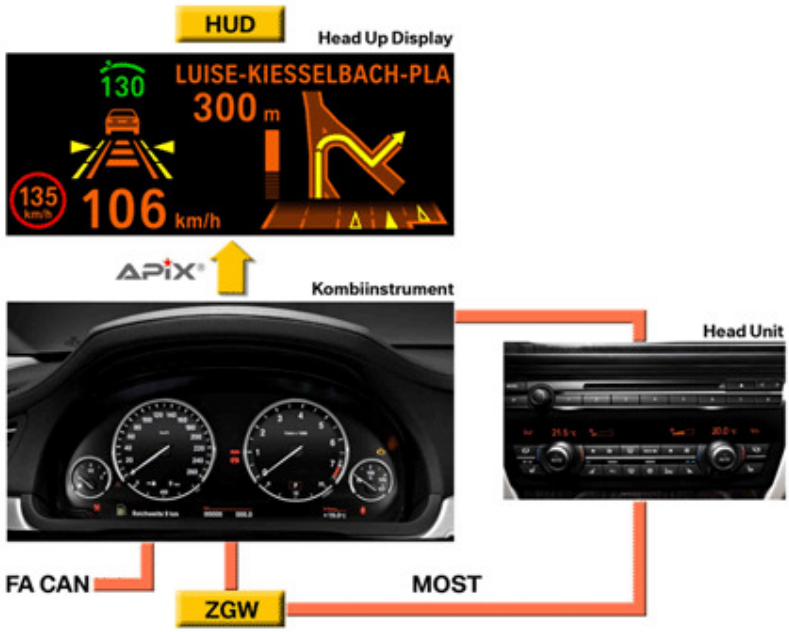

Figure 1: Instrument cluster integration into the vehicle onboard electrical system

All information which is shown in the Head-Up Display is generated in the instrument cluster.

The instrument cluster display to welcome the driver deserves particular attention. Whilst the instrument cluster is asleep, only the trim rings hint at the four tubes. Once the driver's door has been opened, the instrument cluster wakes up. The four tubes are initially illuminated by means of special, white corona lighting. Once the driver has taken his seat, the digits are gradually faded in.

The instrument cluster comprises five pointer instruments for indicating the speed, the tachometer, the fuel tank content, the oil temperature and the set ACC speed. The ACC pointer (orange, green) within the corona serves to depict the set ACC speed.

The integrated 9.2" TFT display with super-high contrast red/white LED backlighting provides the display of dynamic functions such as the momentary consumption and the remaining range, Figure 2.

Figure 2: Integrated 9.2" TFT display with super-high contrast red/white LED backlighting

2.1 Technical Design

The instrument cluster is based on a 2-printed circuit board concept, Figure 3. The instrument cluster PCB uses a 32-bit Fujitsu processor, whilst the graphics PCB employs a high-end graphics processor (Capricorn).

Figure 3: Instrument cluster with 2-printed circuit board concept

The interface between the instrument cluster and the Head-Up Display is APIX (Automotive PIXel Link), a digital pixel link, which reliably transmits image and control data over distances of up to 20 meters with a data rate of up to 1 Gbit/s, Figure 4.

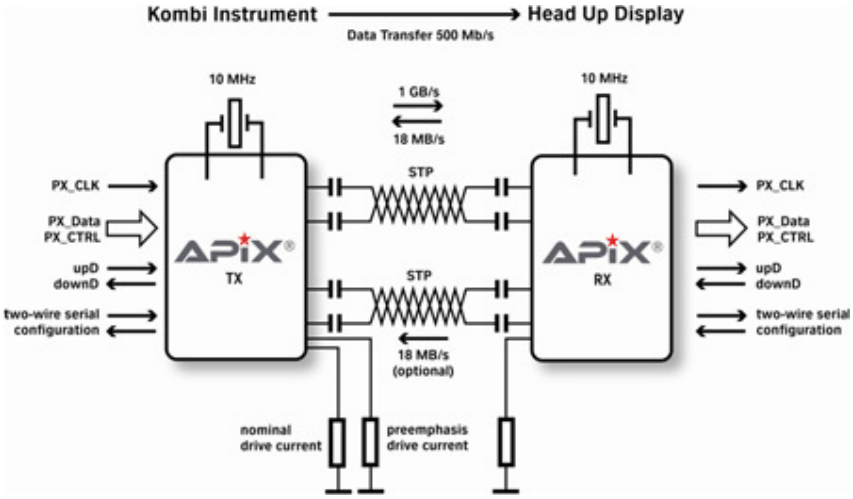

Figure 4: Instrument cluster and Head-Up Display with APIX interface

During the development of APIX, great value was attached to optimal EMC behavior. All of the module's high-frequency stages are designed as Current Mode Logic (CML), which ensures high signal integrity and stable transmission. The output current and pre-emphasis can additionally be infinitely adjusted, with the result that the link can be optimally adapted to the relevant cable for ranges from a few centimeters up to around 20 meters. The image data are additionally coded, so that the serial signal's spectral components are constant and independent of the image content. In addition to the transmission channel for the video data, APIX is also equipped with bi-directional sideband channels, via which digital audio, CAN, IC or UART control data can be transmitted in both directions at 2 x 18 Mbit/s, entirely irrespective of the video signal or the pixel clock. An APIX measuring technology, which will be implemented as of September, is currently being developed to validate the electrical behavior and the signal quality.

2.2 Innovative Technologies

A 3D Black Panel Marnot film offers a seamless transition between the real printed surface and virtual displays, Figure 5. The display is designed in such a way (brightness, contrast) that this effect is put to optimal use.

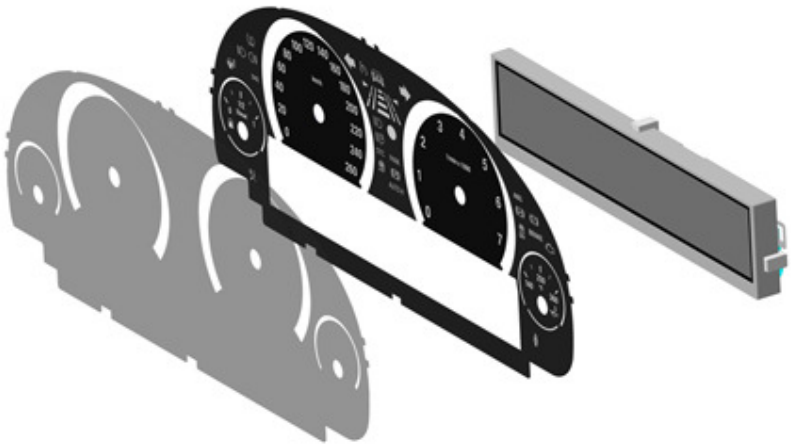

Figure 5: 3D Black Panel Marnot film

The ACC pointer is based on a special projection technology, and is shown in Figure 6.

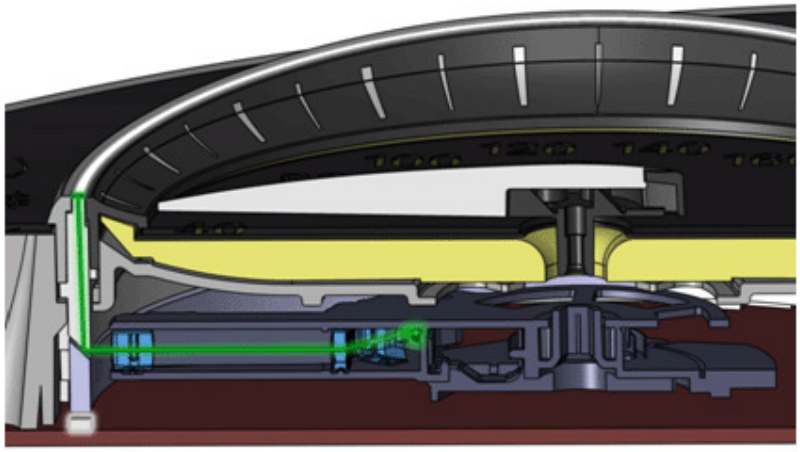

Figure 6: ACC pointer projection technology

The light beam for the display is projected onto the surface of the corona ring (designer element) via special optical elements (aperture slot, lens, diffusor and redirecting prism). A special surface structure guarantees an optimal display.

3. The Head-Up Display

The Head-Up Display first thrills the driver with its exposed display area. This facilitates the absorption of information, reduces distraction and creates scope in subdividing the displays.

The BMW 7 Series is already fitted with the third generation of the BMW HUD system. In addition to integration suitable for mass production, it is particularly outstanding for customers thanks to its increased contrast value and more brilliant, brighter colors. This has been made possible by consistent further development of the LTPS display technology and the innovative multicolor LED backlighting concept.

The driver can adjust the image position himself. The brightness is automatically adapted to the environment and therefore also the eyes, ensuring permanent legibility. The driver can also adjust the basic brightness.

Depending on the situation, navigation instructions, the speed, warning messages, cruise control or proximity control and lane departure warning information, traffic jam warnings and Night Vision information are displayed.

The driver has the option of selecting the display functions himself according to his requirements. Display redundancy has been omitted as far as possible: For example, the navigation display in the instrument cluster switches off as soon as it is displayed in the HUD.

4. Central Information Display and Rear Display Units

The central 10.25-inch screen in the BMW 7 Series literally sets standards, not merely because of its size. The combination of new and tried-and-tested technologies enables first-class image quality: For the first time, high-performance LEDs have replaced the cathode tubes to optimize the backlighting. Display transflectivity has again been employed to achieve better contrast.

"Using the sunlight instead of fighting against it" is the motto which additionally saves energy and therefore actively contributes towards environmental protection in addition to ensuring better legibility in direct sunlight. Passengers can therefore read the information on the display even in intensive sunlight.

4.1 Display Technology in the BMW 7 Series

1280 x 480 pixels in the display unit ensure that the contents are depicted in high-quality form. The new backlighting technology for the displays is an innovation: It is no longer implemented using cold-cathode tubes, but with very bright white LEDs.

Two techniques are used in the case of the transflective monitor: Reflection of the environmental lighting and background illumination (transmission) within a pixel. The combination of both techniques (transflection) leads to the achievement of an almost constant contrast curve and legibility across all environmental lighting up to 100,000 lx. This roughly corresponds to direct sunlight.

The major advantage arising from the use of the transflective technique in combination with the LCF film is the increased freedom available in designing the instrument panel and the front of the vehicle's interior. Transmissive displays have to be integrated deep into the instrument panel in order to shade the display from sunlight or interference emitted from the TFT.

Optional screens for the rear seat entertainment system, which are integrated into the front seat backrests, are also available for the BMW 7 Series. In this case, the display housing is equipped with a movable mounting, enabling passengers to incline the screen as desired according to their seating position.

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