

Evocative Lighting Design for Premium Interiors

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With the RGB-LED light source, which can show various colours, a new generation of ambient lighting has entered the automobile interior. Dräxlmaier developed the innovative Paspol welting light design for premium interiors, and uses illuminated ornamental seams to create a special feeling of space for the passengers inside the vehicle. Now, any number of colours can be created and displayed with a single light source appearing alternately.

COLOURS PROVIDE WELL-BEING AND ATTENTION

Time is valuable, so drivers and passengers want to use it sensibly, even sitting in a traffic jam – listening to their favourite music, relaxing in a seat with an integrated massage function, or connecting with other people or the Internet using modern communications technology. In order to fulfil the wishes of their sophisticated customers, various premium automobile manufacturers have for some time been equipping the interiors of their top models with ambient lighting [1]. Light and colour have a well-known influence on the psyche: They affect our mood and well-being, as studies [2]

show. Based on this, scientists are convinced that light has a positive effect on concentration while driving, too. This is confirmed also by on-going EU-wide studies [3], showing that indirect lighting in a car could contribute to more safety, especially when driving at night.

Previously, interior lighting could only be done in one colour using monochromatic light-emitting diodes (LEDs) in the colours of red, orange, yellow, green, cyan and blue. But different white tones are possible if blue LED chips are combined with phosphor. For two-colour combinations, there were Duo-LEDs. With the new RGB-LEDs, Dräxlmaier can now create and display as many colours as necessary with a single light source

appearing alternately, so that the light displays can be more interesting while costs and installation effort are reduced.

INSERTED OR SEWN CONTOUR ACCENTS

Previously, door panels or centre consoles were lighted by a plastic fibre optic conductor hidden behind the interior, which illuminated downward. **FIGURE 1** shows the indirect lighting of the centre console in a current Mercedes-Benz C-Class. Using this, a floating impression can be created in the interior. With Paspol linear lights, however, the shapes of the vehicle interior can be emphasised in an even more impressive way.

A much more precise and elegant emphasis of the contours in the vehicle interior is made possible by the new Paspol ambient lighting. Here, the flexible light conductor is integrated directly into genuine leather or vinyl surfaces. This uses functional and ornamental seams to the best effect. The thin light conductor made of polymethylmethacrylate (PMMA, better known under its trade name, Plexiglas) is wrapped in a translucent fabric and inserted into a seam with the retaining profile. Alternatively, the light conductor is sewn directly into the genuine or artificial leather surface material and then laminated in the interior, as shown in **FIGURE 2**.

Only in-house manufactured, translucent, dirt and heat resistant fabrics are used for coating; these are characterised by a comfortable look and feel, but are still very robust. In order for the transmission behaviour to remain as large as possible – in other words, for as much light from the light conductor as possible to be visible on the surface of the piping – and for the textile to not affect the colour of the LED, only light or neutral colours are used. When using this in series, be sure that the colour of the textile fits with the overall interior. The colour of the wrapping fabric is visible in daylight, although not in the dark. At night, the new microchip-controlled RGB-LED illuminates the wrapped light conductor in a multitude of colours as a design line.

MORE COLOUR VARIETY IN THE INTERIOR USING RGB-LED

Previously, only a few colours were used in a vehicle interior: for example, the combination of amber, ice blue and white. These are generated using a Duo-LED, which is installed in a housing at the end of the light conductor, along with a circuit board. The two colour chips for amber and ice blue are integrated onto the circuit board, and when activated together, they create the combination colour white.

The design of the RGB-LED functions differently. This new light technology

permits a colour scenario to turn into an large colour spectrum: Users of premium-class vehicles are now able to use the on-board computer to select their own individual colour combinations from theoretically millions of colours. This is possible because every RGB-LED is equipped with three semiconductor chips in the base colours of red, green and blue (= RGB), which are controlled individually using a LIN bus system. In order to not overtax the end customer with this gigantic colour selection, the automobile manufacturers are able to limit the number of colours available by setting preconfigurations. Most likely, there will just be ten colours actually made available to the end customer.

The end customer can be sure that the ambient colours he or she selects from the brochure or online will be precisely the same in real life. A microcontroller on every RGB-LED circuit board assures that the brightness of the light, as well as the colour precision, will be guaranteed for the life of the vehicle – even after extended use. Since development and production come from a single source, production-related tolerances are also prevented so that the calibration is already concluded in the production process [4]. The LED brightness is constant over all displayable colours. The brightness is adjustable and can be dimmed if desired. The intelligent



FIGURE 1 Indirect blue ambient lighting of the centre console in a current Mercedes-Benz C-Class (© Dräxlmaier)

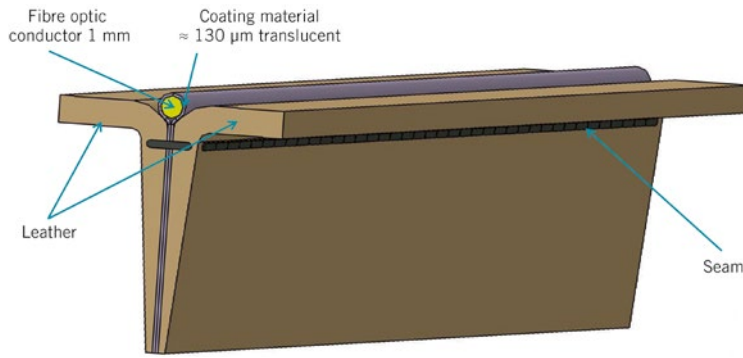


FIGURE 2 Cross-section (left) and actual photo (right) of the laminated pink-coloured Paspol light conductor in a grey leather surface (© Dräxlmaier)

microcontroller compensates for changes in the environmental temperature, which can have an influence on the brightness or the colour mixture of the RGB-LED.

DISCREET LIGHTING – MINIMAL SPACE REQUIREMENTS

In tune with the efforts toward light-weight construction, the RGB-LED and attached plastic light conductor add very little mass to the scale. Depending on the dimensions of the interior that must be illuminated, the entire part weighs only a few grams. The Paspol ambient lighting system is also thrifty with regard to installation space requirements: The housing’s dimensions are $12 \times 17 \times 16 \text{ mm}^3$, the circuit board inside is $11 \times 8 \times 5 \text{ mm}^3$ and the light conductor connection has a diameter of only a few millimetres, **FIGURE 3.**

Thanks to its small dimensions, the module can be used flexibly in the automobile’s interior, depending on the need. In the last step of the production process, the installed RGB-LED is connected to the wiring harness or wiring harness system using the correct connector end on the back side of the interior. The RGB-LED, which is connected using a four-pole wiring harness, is designed for a wiring harness voltage in a range between 7 and 18 V. The board, LED, resistor, microcontroller and board size are designed to meet the current amperage. A rise of brightness by current increase is not possible.

FROM EMOTION TO SAFETY CONSIDERATIONS

Paspol ambient lighting, whose suitability for automotive use has been confirmed, will be used in the future in

series production by major premium automobile manufacturers. This product innovation with the almost unlimited colour selection generates an exclusive, emotional effect in the interior and emphasises the premium character of the automobile. **FIGURE 4** shows the armrest of a centre console that uses two Paspol light conductors.

Automobile manufacturers also offer the Paspol ambient lighting as a means to set themselves apart from the competition. Looking more closely at the developments in past years, it is clear that ambient lighting will become more and more important for differentiation in the premium segment. An individualised lighting design can, for example, be used as a means to emphasise and emotionalise market identity. Whether it is in the centre console, door panels, instrument panel, headliner or seat backs – there are innumerable options for integrating light into the interior to emphasise the vehicle design.

The new ambient lighting technology, however, is able to do more than just look pretty. It completely justifies its existence in safety matters. Scientists at the Technical University in Ilmenau, Germany, for example, have determined that a little interior light at night improves exterior vision [5]. Also, navigation in the dark vehicle interior is much easier with discreet light sources. It would even be conceivable that individual colours change for certain events. For instance, when a call comes in, or when the driver exceeds the speed limit. It could also function as an exit alert. The light in the door panel could blink or turn red if, for example, a bicycle rider is approaching the car.

The new Paspol ambient lighting from Dräxlmaier offers a wide variety of op-

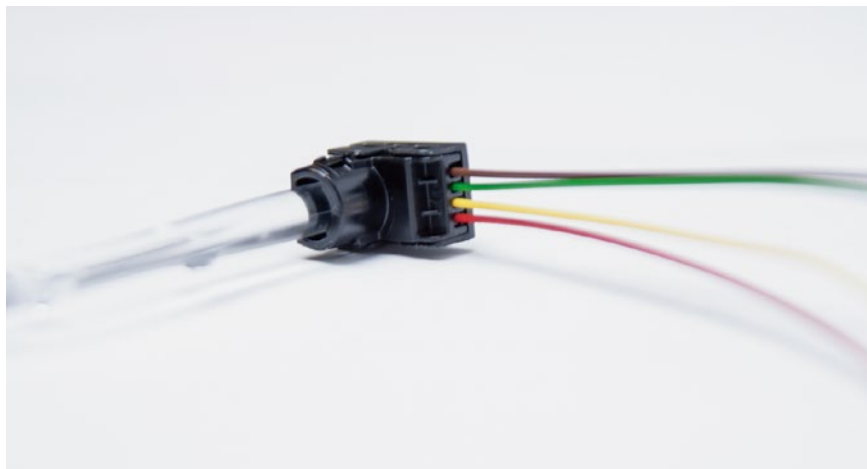


FIGURE 3 The black housing for the Paspol ambient lighting system (right) protects the circuit board, which is designed for a temperature range from -40 to 85 °C; the clear light conductor is on the left (© Dräxlmaier)

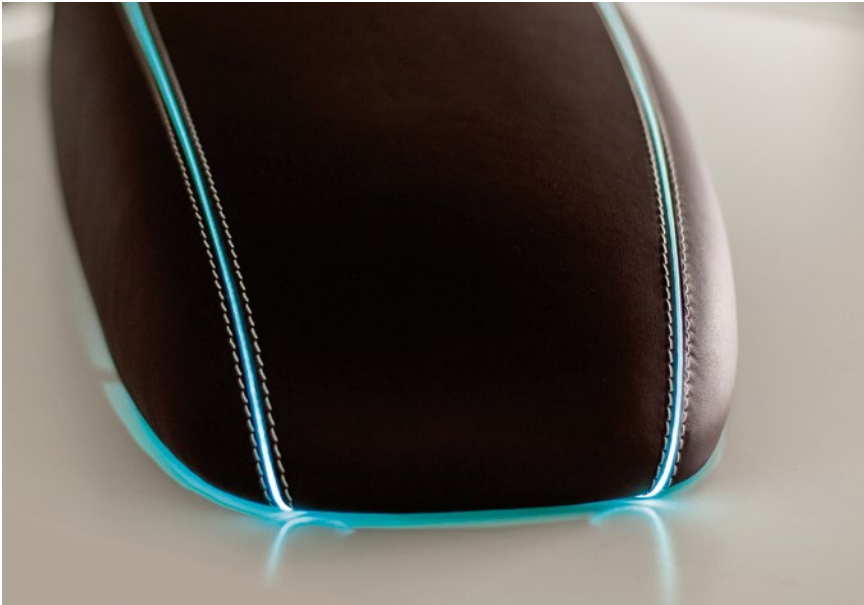


FIGURE 4 Armrest for a concept centre console, with two Paspol light conductors that emphasise the curved shape and the exclusivity of the interior (© Dräxlmaier)

tions for use, even outside the automotive industry. End customers appreciate discreet lighting and colour selection in

places other than a car. For example, it is possible that these innovations could be used in airplane interiors and train com-

partments, in ship cabins or high-quality furniture and hotel bars. In short, anywhere that an exclusive look and atmospheric premium ambiance should be created.

REFERENCES

- [1] Daimler AG: Mercedes-Benz GL-Klasse, Innenraumkomfort – auf alles vorbereitet. In: http://www.mercedes-benz.de/content/germany/mpc/mpc_germany_website/de/home_mpc/passengercars/home/new_cars/models/gl-class/x166/facts_/comfort/interior.html, access date: 13 July 2015
- [2] Fördergemeinschaft Gutes Licht / licht.de: Wirkung des Lichts auf den Menschen. In: licht.wissen, Ausgabe 19 http://www.licht.de/fileadmin/Publikationen_Downloads/1403_lw19_Wirkung_auf_Mensch_web.pdf, access date: 4 August 2015
- [3] Lucerne University of Applied Sciences and Arts, Engineering & Architecture: Trans.Safe – Improving Traffic Safety by Stress Management. In: <http://www.transsafe.eu/>, access date: 4 August 2015
- [4] Reichenbach, M.: Dräxlmaier setzt für neue Ambientebeleuchtung auf RGB-LED. In: <http://www.springerprofessional.de/draexlmaier-setzt-fuer-neue-ambientebeleuchtung-auf-rgb-led/5007886.html;jsessionid=33B4D641865724ED-82BCA4110223CF2F.sprproflltc0101>, access date: 13 July 2015
- [5] Hucko, M.: Ambiente-Beleuchtung: Lichtblick am Autohimmel. In: <http://www.spiegel.de/auto/fahrkultur/ambiente-beleuchtung-autobauer-ruesten-innenraeume-mit-farblight-auf-a-939786.html>, access date: 13 July 2015