

# kiekert

TECHNOLOGY THAT LEADS



## **excellENTRY: SYNERGY FROM ELECTRONICS AND MECHANICS**

More safety and new freedom for design and comfort

Electrified side door locking systems create new possibilities for design, comfort and functional networking. They enable intelligent entry and exit functions and more safety in everyday use. The Kiekert excellENTRY locking system consistently bridges the gap between mechanics and electronics – with a fail-safe mechanical fallback mode in the event of a crash.

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## ELECTRIFICATION BEGINS BEFORE THE JOURNEY



With the electrification of the car, you might first and foremost think of electric power trains, but there is more: we find ourselves in the midst of a shift from mechanical to mechatronic systems, networked communication inside and outside the vehicle, automation of the vehicle and traffic. This is a challenge for product planners and developers, but also opens up completely new possibilities for making automotive technology more attractive, safe and comfortable for consumers.

The result of this development could be cars that act fully autonomously from entering to exiting the vehicle. A scenario in which you approach your vehicle, it automatically opens the door, automatically takes you to your destination and without any intervention also prepares a comfortable exit is only a matter of time. Figuratively speaking: “no autonomous vehicles without autonomous doors”. The key point of such a scenario is the electrically-activated side door latch, which can be locked and unlocked virtually “by bit”.

## DO WE STILL NEED MECHANICS?

When designing an electrically operated locking system, the idea is to discard any mechanical “ballast” and reduce the system to its minimum.

In practice, this means that an electric motor with no detour actuates the pawl, which surrounds or releases the striker mounted in the door frame.

This eliminates the need for a whole series of components that normally require manually-operated locking systems: the entire external chain of external and internal handles can be removed, including all Bowden cables that make the connection between the handles and the latch.

From a purely functional perspective, the excellENTRY locking system does not need this external actuation chain because the actuator responds to an electric impulse that can be triggered in any way. Whether you keep the classic handle design, work with sensory elements such as gesture or voice control or, for example, trigger the impulse via smartphone – the latch itself is always opened in the same way by an electric motor.

**However, a closer look reveals that this “no detour” approach leaves an open question.**

## PATHS TO SAFE CRASH REDUNDANCY

The question is: how to ensure that after a crash the doors can be opened under all circumstances? The dilemma to be solved: in the event of a major accident, a side door locking system should not open during and immediately after an impact, but must unlock after a few seconds so that people on the outside can open the doors.

With conventional locking systems, this requires a complex system of counterweights because the outside door handle can be exposed to enormous centrifugal forces that can lead to an opening. In other words: in an absolutely exceptional situation, you always gain more weight and increased mechanical complexity.

The excellENTRY locking system has a clear advantage in this respect: it does not require mechanical external operating levers that could react to centrifugal forces – thus no counterweights. It is designed to manage without the mechanical external actuation chain, is functionally leaner and more efficient.

But what happens if the power fails after an accident? One way of maintaining the power supply is capacitors in conjunction with decentralized control electronics for each door to contact and open the latch.

However, that is expensive, and little is known about the reliability of this type of redundancy after years of weathering effects, for example.



## WHERE MECHANICS SUCCEEDS

This residual risk, albeit small, can be avoided by a mechanical fallback level, which always works even without electricity. The excellENTRY locking system with mechanical redundancy combines the functional benefits of electric operation with the proven and reliable operability of mechanics. In everyday use, the latch is only electrically operated, and if need be, there is a simplified mechanical fallback level. Why simplified? A conventional door latch, which is mechanically opened thousands of times,

has to do this reliably and permanently – while maintaining the same quality of operating comfort, leverage, acoustics etc. A simplified mechanical fallback level in the event a crash can be optimized for one exceptional situation – with lower wear requirements on the operating chain from the handle to the lock and with an operating concept optimized for this situation. In the event of an accident, the electric operation will usually continue to work; but if not, the *mechanical, temporary crash redundancy* is available.

# ALWAYS LOCKED – ALWAYS SAFE



## **At first it sounds like a contradiction:**

the excellENTRY from Kiekert is always mechanically locked and yet you can open the doors.

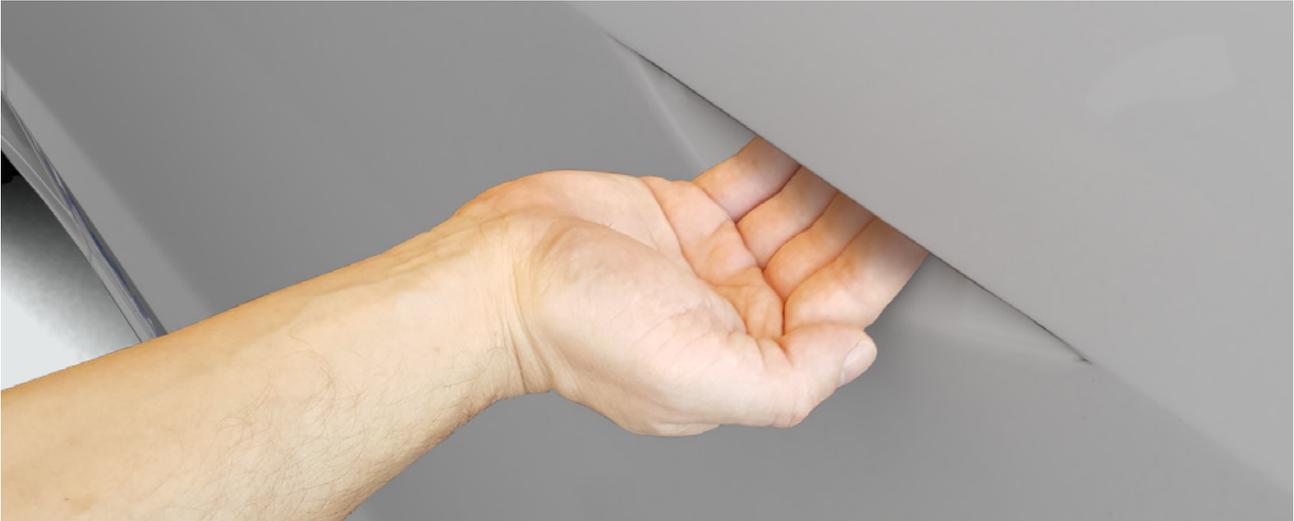
Take a look at the differences in functionality: with a mechanical locking system, the operation is transmitted from the outside or inside door handle to the latch via a Bowden cable. There, an internal mechanical chain actuates the pawl and the catch. This encloses the striker, which is mounted as a counterpart in the door frame.

If the latch is locked, this mechanical chain is interrupted and the pull on the door handle is futile – but if the lock is unlocked, the mechanical chain is closed and you can open the door.

Not with the excellENTRY locking system: here, an electrical impulse triggers an electric motor that directly actuates the pawl without detouring past the simplified mechanical lock, which is still redundant. This mechanical crash redundancy, triggered by the crash sensor, is only activated in the event of an accident: in this case, by reversing the direction of rotation, the electric motor engages the mechanical latch in the transmission chain between the outside door handle and the latch. An external actuation chain is, therefore, available.

If the electronics are still intact, the motor changes its direction of rotation again after a defined period of time and unlocks the door as with normal operation. However, apart from this brief exceptional situation, the excellENTRY *is always mechanically locked*.

## BENEFITS FOR DESIGN, COMFORT AND INTERIOR



Safety is mandatory, design and comfort are free – because they are the decisive criterion for the purchase decision of the consumer. With the excellENTRY locking system, mechanical requirements of the external actuation chain (there are none) do not obstruct the design of the inside and outside handles. Aerodynamics and design, feel and operating forces can be designed in practically any way.

For example, consider the preposterous process of pulling on an inner lever while simultaneously pressing with the elbow to open a door. The excellENTRY locking system does not require this lever.

It allows operating concepts that combine the electrically-operated unlocking and opening of the door in one comfortable ergonomic movement.

Even more obvious are the advantages of the exterior design: while a mechanical exterior door handle must take into consideration criteria such as leverage, durability, etc., the excellENTRY locking system allows a consistent focus on

design, uncompromising comfort and aerodynamics.

In terms of perspective, the question arises of whether a conventional handle is even necessary if the mechanical actuating chain is, in fact, electrically bypassed in everyday life. Consumers are used to a conventional handle, but from a functional perspective one can also imagine completely different operating and design concepts in the longer term. The lack of an external-operating chain also creates room for more interior space. Whether Bowden cables, counterweights or support brackets – the electric locking frees the door of components that take up a lot of space inside the door construction. None of this is required for the excellENTRY locking system; only the small latch itself remains at the transition from door to door frame. This creates space: the space gained within the door makes it possible to lay the glass pane further outwards, thus gaining several centimeters of interior cabin space width.

## WHAT DID FINALLY CONVINCED THE CUSTOMERS OF THE KIEKERT excellENTRY?

„Our locking system combines mechanical components with a variety of optional electric features. The introduction of electronics is optional and it is precisely this modularity that makes our product special and unique.“

**Thorsten Bendel, Director Product Development**



## SIMPLIFICATION REDUCES COSTS

“Electrification” does not make the excellENTRY locking system more complex, but rather the other way round: as already explained, the entire periphery is no longer needed for mechanical external operation. Furthermore, the electric motor means no additional effort, because it would be needed for the central locking anyway.

Moreover, the central locking system is an intrinsic part of the electric locking concept because it is always mechanically locked.

Another example: a child safety lock is usually a mechanical solution that can only be activated at the latch in the fond of the car – by hand.

With the excellENTRY locking system, the basic function of the child safety lock, like that of the anti-theft lock, can be activated electrically without having to leave the vehicle, provided that the mechanical inner operating chain at the rear is omitted.

Door design and testing are also easier: since the behavior of the external actuation chain plays no role in the excellENTRY locking system — it is defined exclusively by the control of the electric motor — it can be applied more or less independently of the door construction, whether in terms of its functional design of the door or the installation.

## WHAT WERE THE CHALLENGES OF DEVELOPING excellENTRY?

„On the way to becoming a Smart Access Company, our challenge is to create a synergy of minimal mechanics and optimum electronics. This is how we create products with maximum comfort that meet the demands of the digital age.“

**Frank Kunst, Director Global Core Engineering**



## SPECIALIZED MECHANICS IS MORE EFFICIENT



Mechanical crash redundancy still requires a rudimentary external activation chain, however, this can be designed much easier — adapted to the exceptional situation of an accident. For example, inside and outside, it suffices to have handles arranged behind trim strips in conjunction with simple, lever-optimized pullers.

In the outer handle, for example, a function can be integrated in which a concealed lever with a long ten-centimeter stroke unlocks the latch. This long stroke allows even more favorable leverage to allow manual door opening in the event of a crash with less effort.

Last but not least, mechanical crash redundancy does not have to be set up for continuous operation, rather simply optimized for the exceptional crash situation.

## NEW FUNCTIONAL SCENARIOS

Already in current vehicles, the excellENTRY locking system can generate additional benefits for the driver in addition to increased safety. A key aspect is that its operation by “bit” enables virtually any operating and functional concepts. The design, ergonomics and operating strategies are virtually unlimited. For example, the opening of the doors can be electrically delayed if the environmental sensors report a passing bicycle. Sound designers were also able to use the absence of the switching of the servo motors to make the sound of locking and unlocking pleasantly high quality.

In view of the growing importance of sensor fusion, networking and digitization, there are also many opportunities to define new functions via software and even to retrofit them if necessary. In the area of vehicle locking systems alone there are synergy effects, but also the opportunity to make the vehicle more attractive and safer as a complete system.

In the longer term, new electronic redundancies are conceivable, but they must be fully comparable with mechanical redundancy in terms of effort and safety. excellENTRY already offers the customer benefits in terms of design, comfort and new operating scenarios up to the “autonomous door”.

### THE ADVANTAGES OF EXCELLENTY AT A GLANCE

- › increased safety with mechanical crash redundancy and permanent locking
- › new design options for the exterior and interior
- › improved ergonomics and feel
- › more width in the cabin
- › theft protection and parental controls without additional hardware
- › new functions through sensor fusion, e.g. exit assistant
- › reduced weight and less space requirement



## KIEKERT AG



Founded in 1857, Kiekert AG is the leader in automotive locking system technology. With 6,500 employees in eleven countries and eight production, seven development and three sales centers, Kiekert develops, produces and sells tailor-made customer solutions around the clock.

In 2018 it recorded sales of 830 million euros.

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