



Document

R116KEY-01-03 (OICA) Concept of Digital Keys
(TF R116KEY#1, Agenda Item 4)

Regulation n°116

Discussions on Digital Keys, Task Force February 18th, 2020

Presentation of Digital Key (Virtual Key) Concept

Background:

- Discussions at GRSG-117 revealed different understandings about proposed functionalities.
- The presentation is intended to clarify the technical concept of digital key/virtual keys working with smart devices.



Concept of Digital Key (Virtual Key)

Regulation status

- UN-R116 aims to ensure safety by preventing unauthorized use of a motor vehicle:
 - ❑ Locking the steering or transmission or gearshift control or brakes systems
 - ❑ Locking the vehicle power
 - ❑ Indicating intrusion into or interference with the vehicle
- UN-R116 key is a device designed and constructed to provide a method of operating the above locks or the alarm system. The UN-R116 locks or alarm system are designed and constructed to be operated only by the intended UN-R116 key for the specific lock or alarm system
- Without that key, the steering or transmission or gearshift control or brakes systems or the vehicle power system or the alarm system can not be unlocked
- UN-R116 does not have requirements on door locking/unlocking
- UN-R116 does not restrict the use of a vehicle to a specific driver
- UN-R116 does not define how the vehicle power is switched on



Car KeyFob Technology

Background

- A car KeyFob containing a digital key is paired with a specific vehicle by the manufacturer.
- A car KeyFob containing a digital key connects a specific keyfob/device to the inactivation/activation of the device to prevent unauthorized use, alarm, immobilizer and start system of a specific vehicle.
- The KeyFob can prove that it holds the correct paired digital car key by using the key to sign commands that are sent from and to the vehicle.
- A car KeyFob containing a digital key can enable detection of the device in close proximity to the vehicle using short range radio communication, RF.
- Unsetting of the device to prevent unauthorized use / immobilizer is only allowed:
 - From inside the vehicle (e.g. by pressing the vehicle start button) if the car KeyFob containing a digital key is detected inside the vehicle, or
 - From outside the vehicle (e.g. at Automatic Park Out) if the car KeyFob containing a digital key is detected in the proximity of the vehicle.
- Setting/Unsetting the Alarm System is allowed from outside of the vehicle if the car KeyFob containing a digital key is detected outside of the vehicle.



* Remark:

A digital key in a car KeyFob is called “Electronic code” under UN Regulation No. 116.

Car KeyFob technology principle is also used in other technologies as Smart Cards, the digital key is handed on a vehicle manufacturer hardware device to the customer.



Digital Car Key (“Code only”)

- A digital car key in a mobile phone also has to be securely paired with a specific vehicle.
- A digital car key connects a specific device to the inactivation/activation of the device to prevent unauthorized use, alarm, immobilizer and start system of a specific vehicle.
- The device can prove that it holds the correct paired digital car key by using the key to sign commands that are sent from and to the vehicle.
- A device containing a digital car key can enable detection of the device in close proximity to the vehicle using short range radio communication, RF
- Unsetting of the device to prevent unauthorized use / immobilizer is only allowed*:
 - From inside the vehicle (e.g. by pressing the vehicle start button) if a digital car key is detected inside the vehicle, or
 - From outside the vehicle (e.g. at Automatic Park Out) if a digital car key is detected outside of the vehicle (e.g. within driver’s eye contact when driver is in charge)
- Setting/Unsetting the Alarm System is allowed from outside of the vehicle if the digital car key is detected outside of the vehicle.

* Remarks:

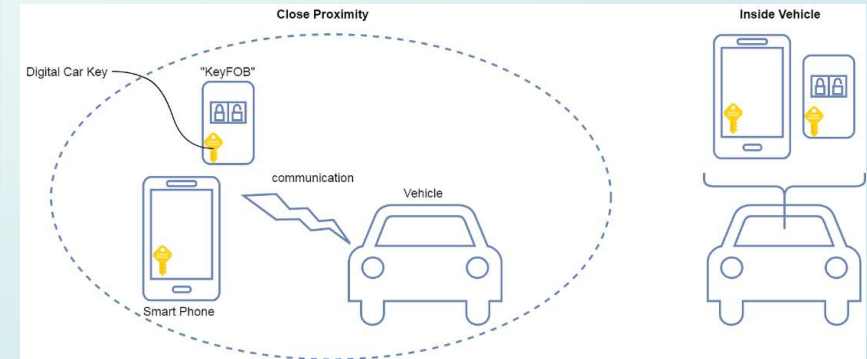
- 1) A second authentication inside the vehicle is needed before control is released to the driver if the vehicle was started from outside.
- 2) The device shall only be able to allow for unlocking the device to prevent unauthorized use. The actual unlocking and locking command needs to come from user input.
- 3) Restrictions could be defined in terms of Speed, Time, Allowed distance, etc.
- 4) Demands by market for digital services, e.g. Amazon Key Service requires alarm system unset, therefore the vehicle owner must give Amazon a key for the alarm system (US experience)
- 5) Detection inside the vehicle can be by vehicle scanning for key or driver authenticating through other means like NFC, UWB, rolling QR, PIN code, etc..

🔗 Digital Car Key in Mobile Phone vs KeyFob

Authorized Vehicle Access

Access for both solutions is **proximity based**, i.e. the device has to be placed close to or inside the vehicle

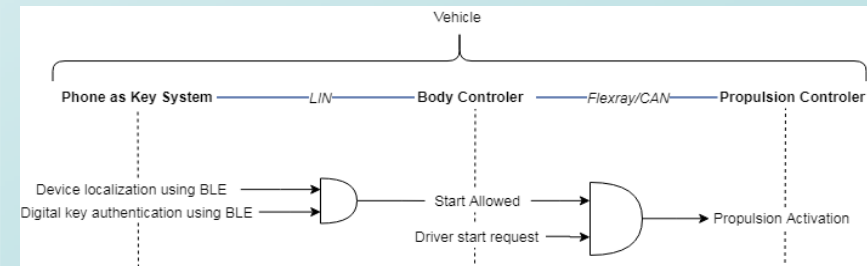
- When the device is in close proximity of the vehicle, it is possible to:
 - Press a button on the key or phone to lock or unlock the vehicle and its alarm system
 - Unlock the device to prevent unauthorized use/immobilizer (e.g. at Automatic Park Out) if a digital car key is detected just outside (e.g. within driver's eye contact when driver is in charge) of the vehicle. Restrictions could be defined.
- When the device is inside the vehicle, it is possible to:
 - Activate start to unlock the device to prevent unauthorized use/immobilizer and enable the propulsion system



Propulsion Activation

Both can only **allow start**, not request start or shut down vehicle

- Propulsion activation requires:
 - Device to be detected - vehicle scans for key or drivers authenticates through other means like NFC, UWB, rolling QR, PIN code, etc..
 - Digital key authentication – vehicle identifies and authorizes the key
 - A start request from the driver – vehicle sets ignition on and the device to prevent unauthorized use is unset
- An attacker has to manipulate both the device detection system and the driver input system in order to start the vehicle, which is the same for a system using digital key in a mobile phone as one using a traditional car KeyFob containing a digital key.





Thank you for your attention