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# Introduction

## Document Purpose

The Function (Group) Specification (FS) specifies an individual function / a group of functions.

To get more information about the concept of feature, function and component level abstraction refer to the [Ford RE Wiki](http://wiki.ford.com/display/RequirementsEngineering/Requirements+Engineering+for+SW+Enabled+Features).

## Document Audience

The FS is authored by the owners of the individual functions. All Stakeholders, i.e., all people who have a valid interest in the functions and their behavior should read and, if possible, review the FS. It needs to be guaranteed, that all stakeholders have access to the currently valid version of the FS.

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## Document Conventions

### Terminology

When referring to aspects of the system design, this document uses standardized language to avoid ambiguity and confusion. The following terms are of particular relevance to this document:

|  |  |
| --- | --- |
| **Term** | **Definition** |
| Configuration parameter | A property of a system that is stored in nonvolatile memory and not expected to be changed during system operation. Examples include assigned serial numbers that are unique to each module and static. |
| Runtime variable | A property of a system that can be read and modified during normal system operation. The variable might be stored in volatile or nonvolatile memory. Examples include stored/saved records, system states, and measured values. |
| Message | A message defines a data structure whose elements are all transmitted simultaneously. The message might be transmitted within a single system, or across a network between two separate systems.  The term “message” is used here to reduce confusion when discussing automotive system behaviors. As it is used in this document, a “message” is identical to the concept of a “signal” as defined in UML/SysML.  A message may or may not contain *signals* – see below. |
| Signal | A signal is a single data element within a message. A signal cannot be transmitted independently of a message, but a message can be transmitted without any signals.  As it is used in this document, a signal corresponds to the UML/SysML concept of a *property*. |

# Logical Architecture

The NFC Entry and Starting feature is designed assuming the following system structure. The components shown are the logical systems; they may map one-to-one onto a physical module, or one physical module might house multiple logical systems.

## Structure

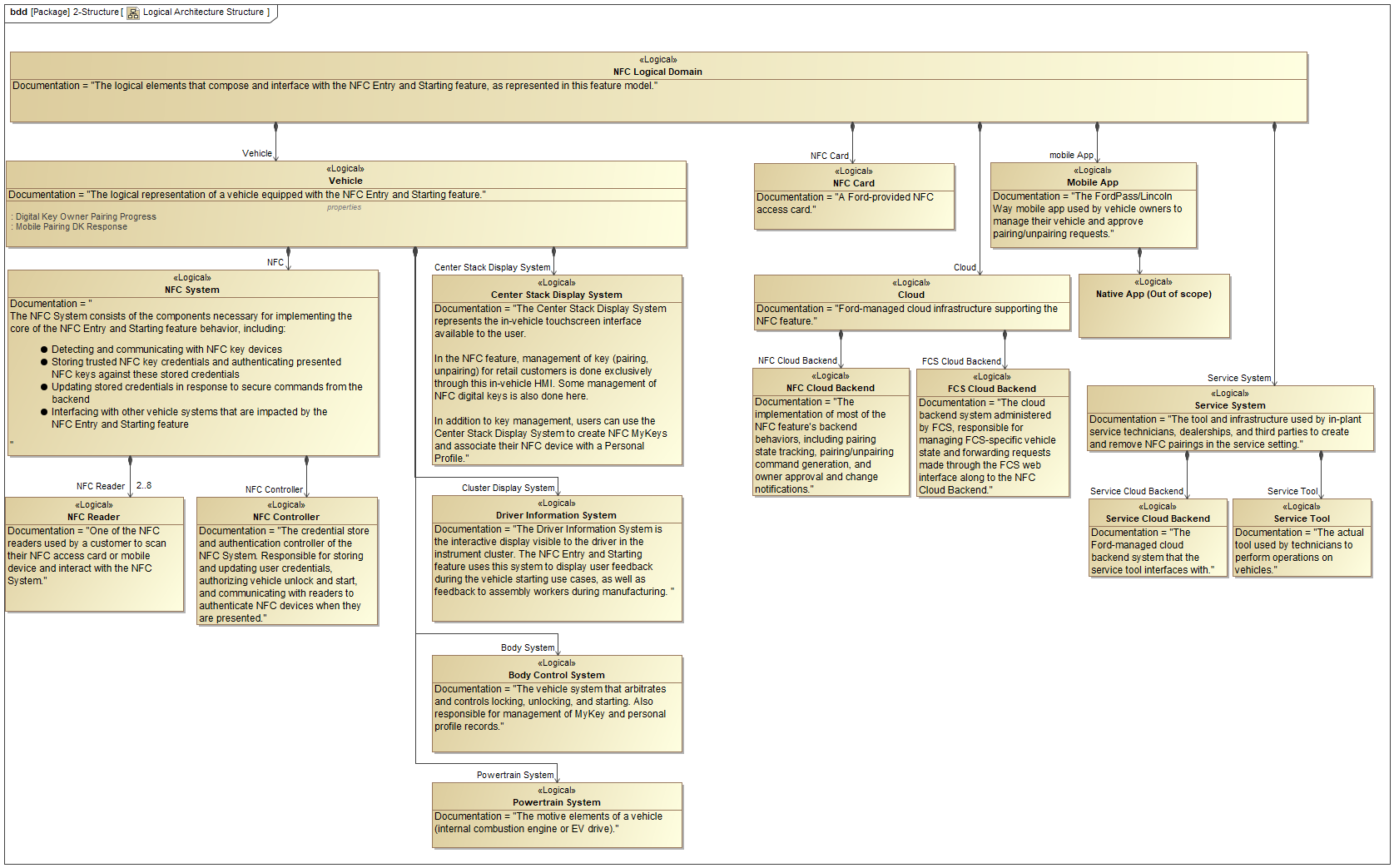


Figure 1: NFC Logical Domain Structure

## Logical Architecture

The Logical Architecture diagram shows the messages that flow between different elements of the NFC Logical Domain. Details on the contents of the messages shown here can be found in the Data Dictionary provided as an appendix.

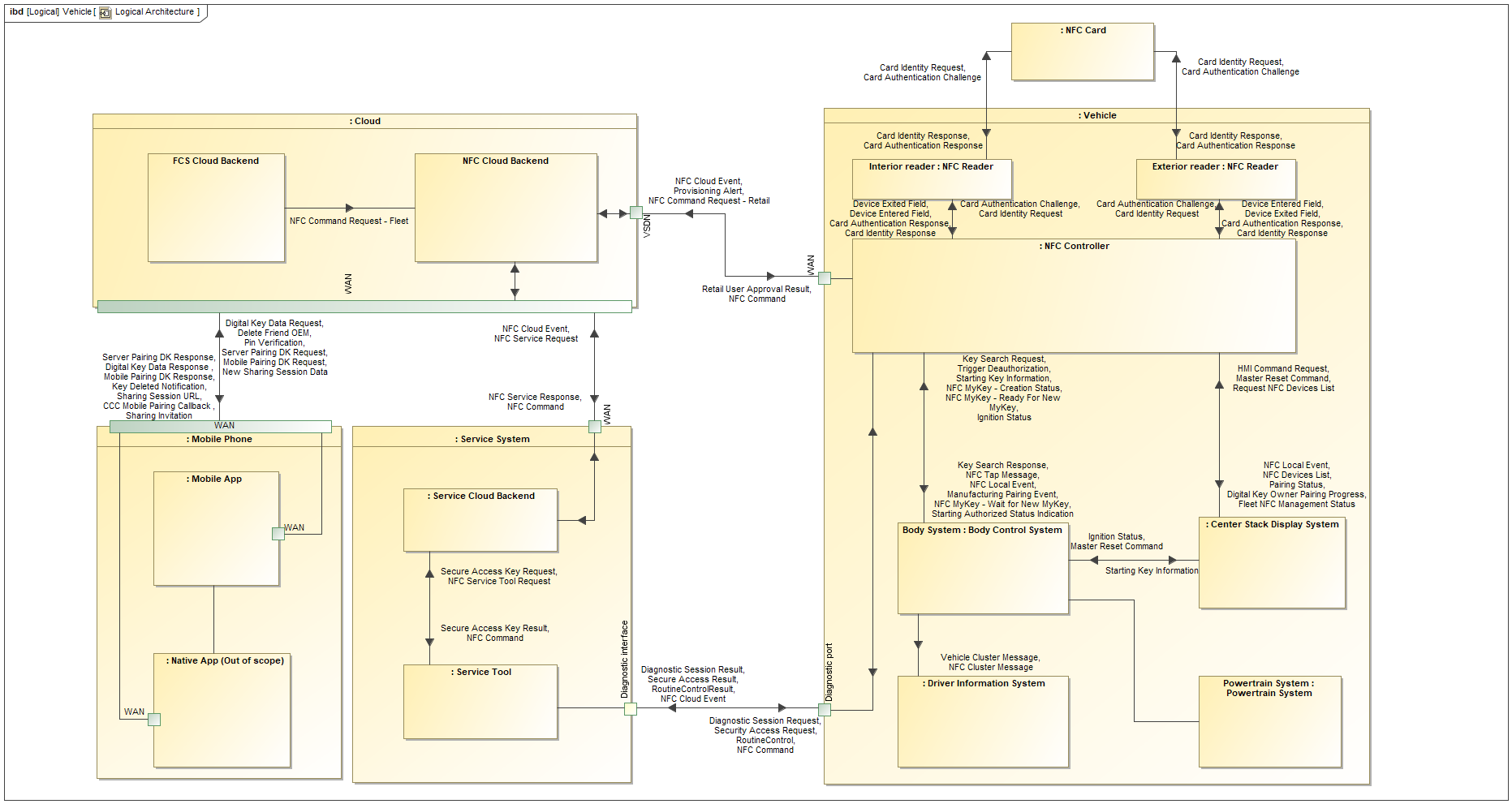


Figure 2: NFC Logical Architecture

# Function Group Description

This specification consists of documentation about the logical system component 870598806.png **Driver Information System**.

The Driver Information System is the interactive display visible to the driver in the instrument cluster. The NFC Entry and Starting feature uses this system to display user feedback during the vehicle starting use cases, as well as feedback to assembly workers during manufacturing.

## Logical System Behavior

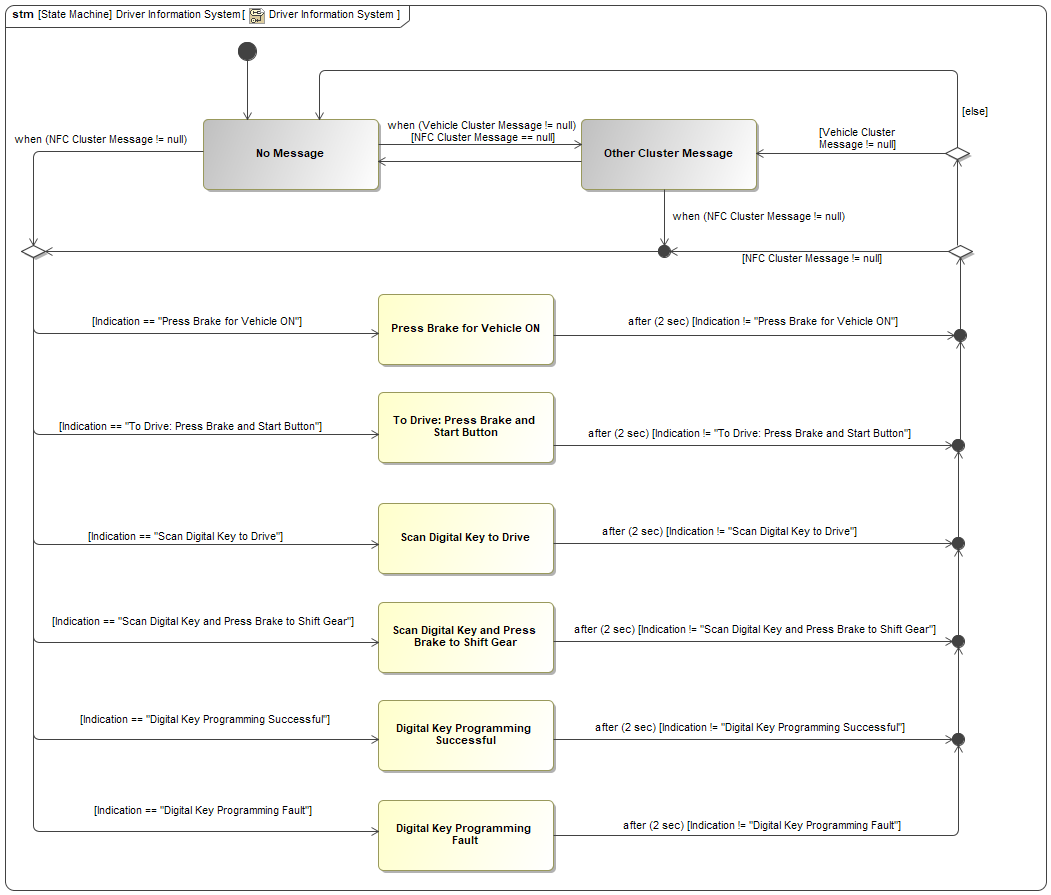


Figure 3: Driver Information System

## Logical System Requirements

REQ-NFC-ES-307 Locking and starting function even without display system

The NFC system shall fulfill the unlocking, locking, and vehicle starting functions without depending on communications with, or the operation of, the in-vehicle display system.

**Acceptance Criteria:** Enter and Start the vehicle with missing or disconnected Sync module

REQ-NFC-ES-311 Driver Information System: message display logic

The Driver Information System shall display warnings based on the "Indication" signal of the "NFC Cluster Message" and "Vehicle Cluster Message" as follows:

|  |  |  |
| --- | --- | --- |
| **NFC Cluster Message** | **Vehicle Cluster Message** | **Display** |
| To Drive Press Brake And Start Button | X (don't care) | To Drive: Press Brake And Start Button |
| Press Brake for Vehicle ON | X (don't care) | Press Brake for Vehicle ON |
| Scan Digital Key To Drive | X (don't care) | Scan Digital Key To Drive |
| Scan Digital Key And Press Brake To Shift Gear | X (don't care) | Scan Digital Key And Press Brake To Shift Gear |
| Digital Key Programming Successful | X (don't care) | Digital Key Programming Successful |
| Digital Key Programming Fault | X (don't care) | Digital Key Programming Fault |
| Null | *Any value* | Message specified in "Vehicle Cluster Message" signal |

REQ-NFC-ES-312 Driver Information System: "Scan Digital Key And Press Brake To Shift Gear" message details

When the Driver Information System displays the message "Scan Digital Key And Press Brake To Shift Gear", it shall have the following characteristics:

|  |  |
| --- | --- |
| **Message color** | Amber |
| **Play chime when message displayed** | No |
| **Show icon with message** | Yes |

REQ-NFC-ES-313 Driver Information System: "Scan Digital Key To Drive" message details

When the Driver Information System displays the message "Scan Digital Key To Drive", it shall have the following characteristics:

|  |  |
| --- | --- |
| **Message color** | Amber |
| **Play chime when message displayed** | No |
| **Show icon with message** | Yes |

REQ-NFC-ES-314 Driver Information System: "To Drive: Press Brake And Start" message details

When the Driver Information System displays the message "To Drive: Press Brake And Start Button" message, it shall have the following characteristics:

|  |  |
| --- | --- |
| **Message color** | Amber |
| **Play chime when message displayed** | No |
| **Show icon with message** | No |

REQ-NFC-ES-315 Driver Information System: "Digital Key Programming Successful" message details

When the Driver Information System displays the message "Digital Key Programming Successful", it shall have the following characteristics:

|  |  |
| --- | --- |
| **Message color** | Amber |
| **Play chime when message displayed** | No |
| **Show icon with message** | No |

REQ-NFC-ES-316 Driver Information System: "Digital Key Programming Fault" message details

When the Driver Information System displays the message "Digital Key Programming Fault", it shall have the following characteristics:

|  |  |
| --- | --- |
| **Message color** | Amber |
| **Play chime when message displayed** | No |
| **Show icon with message** | No |

REQ-NFC-ES-317 Driver Information System: display time for "To Drive: Press Brake and Start Button", "To Drive: Press Brake and Select D/R Gear", and "Scan Digital Key To Drive"

When any of the following messages are triggered on the Driver Information System:

* "To Drive: Press Brake And Start Button"
* "Press Brake for Vehicle ON"
* "Scan Digital Key To Drive"

that message shall continue to be displayed until the input signals that caused it to be displayed are changed. After the input signals change, the Driver Information System shall no longer display the message.

REQ-NFC-ES-318 Driver Information System: display time for "Scan Digital Key And Press Brake to Shift Gear" message

After the "Scan Digital Key And Press Brake to Shift Gear" message is triggered, it shall continue to be displayed on the Driver Information System until one of the following occurs:

* The "OK" button is pressed
* The input signals that caused the message to be displayed change their value

When any of the conditions listed above occurs, the Driver Information System shall stop displaying the message immediately.

REQ-NFC-ES-319 Driver Information System: display time for NFC key programming messages

When any of the following messages are triggered on the Driver Information System:

* "Digital Key Programming Successful"
* "Digital Key Programming Fault"

that message shall continue to be displayed until any of the following occurs:

* + Four seconds elapse from the time the message was triggered
  + The "OK" button is pressed
* When any of the conditions above occur, the Driver Information System shall stop displaying the message.

REQ-NFC-ES-320 Driver Information System: message availability in Limited mode

When the vehicle is in Limited mode (ignition state is not RUN), the following messages shall be displayed if their trigger occurs:

* "To Drive: Press Brake And Start Button"
* "Press Brake for Vehicle ON"
* "Scan Digital Key To Drive"
* "Digital Key Programming Successful"
* "Digital Key Programming Fault"

REQ-NFC-GE2-1 Driver Information System: To Drive: Press Brake And Select D/R Gear message details

When the Driver Information System displays the message "To Drive: Press Brake And Select D/R Gear" message, it shall have the following characteristics:

|  |  |
| --- | --- |
| **Message color** | Amber |
| **Play chime when message displayed** | No |
| **Show icon with message** | No |

# Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| Revision | Date | Description | Responsible |
| 2020-08-24 | 8/24/2020 | Initial Functional Specification release for UPV1 | abonnel1, fehsan2,  ekarpins |
| 2020-11-09 | 11/9/2020 | Update all functional requirements to reflect latest design. Update behavior diagram for Driver Information System. Add “Vehicle Cluster Message”. Rename “Driver information indication” to “NFC Cluster Message”. Update “NFC Cluster Message” encoding type with new warnings. Remove Nisha Patel from stakeholders list. | abonnel1, fehsan2, ekarpins |
| 2020-11-10 | 11/9/2020 | Modified REQ-NFC-ES-319 and REQ-NFC-ES-320 text based on STSS author feedback to align with HMI Global Message List | abonnel1, fehsan2, ekarpins |
| 2021-06-08 | 6/8/21 | Update data dictionary.  Add logical architecture information.  Updated Figure 3  Added Requirements:   * REQ-NFC-ES-312 * REQ-NFC-ES-313 * REQ-NFC-GE2-1   Updated Requirements:   * REQ-NFC-ES-311 * REQ-NFC-ES-317 | abonnel1, adelong2, fehsan2,  ekarpins, jwolf53, rsepulv6 |

# Appendix

## Data Dictionary

### Logical Messages

NFC Cluster Message

|  |  |
| --- | --- |
| **Name** | **NFC Cluster Message** |
| **Description** | Message sent from the Body Control System to the Driver Information System that indicates which NFC-specific driver warning message should be displayed. |
| **Realized by** |  |

**Parameters/Owned Signals**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Description** | **Realized By** |
| 963127440.png Indication | -1102010346.png [NFC Cluster Message](#_328cfb2fa25ca96d48b702a53ed7fb81) | Which message should be displayed on the cluster. |  |

Vehicle Cluster Message

|  |  |
| --- | --- |
| **Name** | **Vehicle Cluster Message** |
| **Description** | Existing message sent from the Body Control System to the Driver Information System that causes specific warning messages to be displayed on the cluster. |
| **Realized by** |  |

**Parameters/Owned Signals**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Description** | **Realized By** |
| 963127440.png Indication |  | Which message should be displayed on the cluster. |  |

### Logical Data Types (encodings)

-1102010346.png NFC Cluster Message

The NFC feature-related messages that can be displayed in the vehicle's cluster.

**Encoding** **values**

|  |  |  |
| --- | --- | --- |
| **Enumeration Value** | **Enumeration Value Description** | |
| Scan Digital Key To Drive | Cluster message prompting the user to scan an authorized NFC device in order to start or drive the vehicle |
| To Drive Press Brake And Start Button | Cluster message prompting the user to start the vehicle after they have scanned their NFC device |
| Null | No NFC feature-related indication requested. |
| Scan Digital Key And Press Brake To Shift Gear | Cluster message prompting the user to scan an NFC device in order to exit Secure Idle or Remote Start |
| Digital Key Programming Successful | Cluster message indicating that an attempt to pair an NFC device while in Factory Pairing Mode was successful |
| Digital Key Programming Fault | Cluster message indicating that an attempt to pair an NFC device while in Factory Pairing Mode has failed |

### Technical Signals

#### GSDB Signals

ImmoMsgTxt\_D\_Rq

|  |  |
| --- | --- |
| **Signal Name** | **ImmoMsgTxt\_D\_Rq** |
| **Description** | Provides a trigger indication to IPC after BCM system performs key search |
| **Encoding** | 230697813.png [immoMsgTxt\_D\_Rq\_ET](#_ee23943e17c0f1205b6b6e8668d19fbe) |
| **Transmitter** | -2042894189.png BCM |
| **Receiver** | -2042894189.png IPC |
| **Logical Signal** | 662243001.png Key Search Request  1569026423.png Vehicle Cluster Message  963127440.png Indication |

NfcDevc\_D\_Dsply

|  |  |
| --- | --- |
| **Signal Name** | **NfcDevc\_D\_Dsply** |
| **Description** | This signal is transmitted by Body Control Module (BCM) as a result of key search to trigger Near Field Communication (NFC) related warnings in cluster. |
| **Encoding** | 230697813.png [NfcDevcDsply\_D\_Rq\_ET](#_71e5de2b54904acb29e6f6c3e2ecf28e) |
| **Transmitter** | -2042894189.png BCM |
| **Receiver** | -2042894189.png IPC |
| **Logical Signal** | 1569026423.png NFC Cluster Message  963127440.png Indication |

Document ends here.