**PRG\_22-14 IDTRONIC LEUZE RFID SYSTEMS**

**HF IO-LINK COMMUNICATION PROTOCOL AND DEVICE CONFIGURATION**

**RDH 142 00 M30, RDH 242 00**

|  |  |  |  |
| --- | --- | --- | --- |
| Version | Date | Author | Changelist |
| 01 | 16/04/2024 | Fabrizio Picotto | First draft |
| 02 | 06/09/2024 | Fabrizio Picotto | First release |

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# Scope

This document refers to the Leuze RDH 142 00 M30 and RDH 242 00 devices and describes in detail the communication protocol and the configuration parameters.

# Field of Application

This document applies to the Leuze RDH 142 00 M30 and RDH 242 00 devices with firmware version v1.0.0.

# Definitions and Abbreviations

| Term / Abbreviation | Definition |
| --- | --- |
| **TBD** | To Be Determined |
| **RO** | Read Only |
| **RW** | Read Write |
| **UID** | Unique Identifier |
| **WO** | Write Only |

# IO-Link Communication Interface

The IO-Link communication interface is available in accordance with specification 1.1.4 on pin 4. You can easily configure the devices via the IO-Link communication interface. Furthermore, the device transmits the process data via the IO-Link communication interface and makes diagnostic information available through it.

## IO-Link Identification

| VendorID dec/hex | DeviceID dec/hex | Device |
| --- | --- | --- |
| 338/0x152 | 50150660/0x2FD3D04 | RDH 142 00 M30 |
| 338/0x152 | 50150662/0x2FD3D06 | RDH 242 00 |

## IO-Link Process Data

### Device input data (PDOut – 8-bit data length)

| Subindex | Bit Offset | Data Type | Value range | Default value | Name | Description |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 0 | Boolean |  |  | Reader disable | To enable/disable the RF field |

Byte 0

| Bit Offset | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Subindex | x | x | x | x | x | x | x | 1 |

### Device output data (PDIn – 80-bit data length)

| Subindex | Bit Offset | Data Type | Value Range | Default value | Name | Description |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 16 | 64-bit UInteger |  |  | UID | To enable/disable the RF field |
| 2 | 8 | 4-bit UInteger |  |  | Transponder type | Transponder type of the transponder in detection range |
| 3 | 0 | 2-bit UInteger | 0 = no signal, 1 = poor, 2 = good |  | Transponder signal quality | Transponder signal quality of the transponder in detection range |
| 4 | 2 | Boolean |  |  | Auto read or write error | Error with auto read or auto write |
| 5 | 4 | 4-bit UInteger | 0 = no transponder, 1 … 15 |  | Short ID | Short ID teached to the transponder in detection range |

Byte 0

| Bit Offset | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Subindex | 1 | | | | | | | |

Byte 1

| Bit Offset | 71 | 70 | 69 | 68 | 67 | 66 | 65 | 64 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Subindex | 1 | | | | | | | |

Byte 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bit Offset | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 |
| Subindex | 1 | | | | | | | |

Byte 3

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bit Offset | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 |
| Subindex | 1 | | | | | | | |

Byte 4

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bit Offset | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 |
| Subindex | 1 | | | | | | | |

Byte 5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bit Offset | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 |
| Subindex | 1 | | | | | | | |

Byte 6

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bit Offset | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 |
| Subindex | 1 | | | | | | | |

Byte 7

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bit Offset | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
| Subindex | 1 | | | | | | | |

Byte 8

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bit Offset | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
| Subindex | x | x | x | x | 2 | | | |

Byte 9

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bit Offset | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Subindex | 5 | | | | x | 4 | 3 | |

## IO-Link Parameters

Hereinafter the description on the configurable parameters of the device.

| Parameter | Description |
| --- | --- |
| Data Hold Time | The time in ms during which the data of the process data input image can be held constant |
| Enable Transponder Type | The device operation enable for each transponder type. Single bits are dedicated to enable (1, true) or disable (0, false) functions:   | **Bit** | **Description** | | --- | --- | | Bit 0 | NXP ICODE 1 | | Bit 1 | ISO 15693 | | Bit 2 | ISO 14443 A | | Bit 3 | ISO 14443 B | | Bit 4 | Not used | | Bit 5 | Not used | | Bit 6 | Not used | | Bit 7 | Not used | |
| Enable AFI Filter Operation | The device operation enable for the AFI (Application Family Identifier) filter:   * 0, false: Disabled * 1, true: Enabled   This parameter must be used in combination with the AFI (Application Family Identifier) code parameter  The AFI filter is a legitimation for the ISO15693 transponder in this application: if enabled, only if the AFI on the transponder and the data stored in the AFI code are the same, the transponder can be read or written |
| AFI Code | The AFI (Application Family Identifier) code  This parameter must be used in combination with the enable AFI (Application Family Identifier) filter operation parameter.  The AFI filter is a legitimation for the ISO15693 transponder in this application: if enabled, only if the AFI on the transponder and the data stored in the AFI code are the same, the transponder can be read or written |
| Memory Read or Write Specification | The memory read or write operation specification for the “Auto read” or “Auto write” operating modes:   * Address: the address of the first byte to read or write to the transponder * Length: the number of bytes to read or write to the transponder   In the operating modes “Auto read" and "Auto write" the device reads and writes the specified number of data of the transponder automatically  The read operation is performed using the memory read transfer buffers  The write operation is performed using the memory write transfer buffers |
| Memory Auto Read or Write | The device operation enable for the “Auto read” or “Auto write” operating modes:   * 0: Disabled * 1: Auto write * 2: Auto read   In the operating modes “Auto read" and "Auto write" the device reads and writes the specified number of data of the transponder automatically  The read operation is performed using the memory read transfer buffers  The write operation is performed using the memory write transfer buffers |
| Memory Read Buffer | The transponder’s memory area read in the operating mode “Auto read” with the given memory start address and length. This is a fixed 232-bytes length parameter, unnecessary bytes are padded with 0. If address and length does not fit with the block size of the transponder, the area outside is filled with 0 |
| Memory Write Buffer | The transponder’s memory area to write in the operating mode “Auto write” with the given memory start address and length. This is a fixed 232-bytes length parameter, unnecessary bytes are not written. If address and length does not fit with the block size of the transponder, the area outside is filled with 0 |
| Memory Read Buffer 1 | The transponder’s memory area read in the operating mode “Auto read” with the given memory start address and length  This is not included in IODD. Here variable length (up to 232 bytes) can be used by PC applications or PLC. This improves the performance and only needed data must be transferred |
| Memory Write Buffer 1 | The transponder’s memory area to write in the operating mode “Auto write” with the given memory start address and length  This is not included in IODD. Here variable length (up to 232 bytes) can be used by PC applications or PLC. This improves the performance and only needed data must be transferred |
| Short ID 1 Teach Value | If a UID has been taught into the storage space of a Short ID 1, then the Short ID 1 is displayed in the process data when the associated UID has been recognized:   * 0: not set * 1…4294967295: the UID set |
| … | … |
| Short ID 15 Teach Value | If a UID has been taught into the storage space of a Short ID 15, then the Short ID 15 is displayed in the process data when the associated UID has been recognized:   * 0: not set * 1…4294967295: the UID set |

Hereinafter the details on the configurable parameters of the device.

| Parameter | Index | Subindex | Data Type | Access | Range | Default |
| --- | --- | --- | --- | --- | --- | --- |
| Data Hold Time | 64 | 0 | 16-bit UInteger | RW | 1000  …  60000 | 1000 |
| Enable Transponder Type – NXP ICODE 1 | 65 | 1 | Boolean | RW | true  false | true |
| Enable Transponder Type – ISO 15693 | 65 | 2 | Boolean | RW | true  false | true |
| Enable Transponder Type – ISO 14443 A | 65 | 3 | Boolean | RW | true  false | true |
| Enable Transponder Type – ISO 14443 B | 65 | 4 | Boolean | RW | true  false | true |
| Enable AFI Filter Operation | 66 | 0 | Boolean | RW | true  false | false |
| AFI Code | 67 | 0 | 8-bit UInteger | RW | 0  …  255 | 0 |
| Memory Read or Write Specification - Address | 80 | 1 | 16-bit UInteger | RW | 0  …  8191 | 0 |
| Memory Read or Write Specification - Length | 80 | 2 | 8-bit UInteger | RW | 0  …  232 | 0 |
| Memory Auto Read or Write | 81 | 0 | 8-bit UInteger | RW | 0  1  2 | 0 |
| Memory Read Buffer | 82 | 0 | 232-octet OctetString | RO |  |  |
| Memory Write Buffer | 83 | 0 | 232-octet OctetString | WO |  |  |
| Memory Read Buffer 1 | 90 | 0 | - | RO |  |  |
| Memory Write Buffer 1 | 91 | 0 | - | WO |  |  |
| Short ID 1 Teach Value | 100 | 0 | 64-bit UInteger | RW | 0,  1  …  4294967295 | 0 |
| … |  |  |  |  |  |  |
| Short ID 15 Teach Value | 114 | 0 | 64-bit UInteger | RW | 0,  1  …  4294967295 | 0 |

|  |  |
| --- | --- |
|  | More information can be found in the IODD file of the device |

# Operation of the Device

The device supports several operation modes:

* “Read UID”
* “Auto read”
* “Auto write”

## Deactivate Internal Antenna

The RF field of the device can be deactivated at any time. With RF field deactivated:

* the device can still be accessed via IO-Link,
* no RF field is generated by the device,
* the device does not detect tags.

To deactivate the internal antenna set the “Reader disable” bit in the process data output.

## Operating Mode “Read UID”

In the operating mode "Read UID" the UID of a transponder is read. Then the UID is available in the process data input. If no transponder is in the range of the device, the data is filled with the value 0x00.

For UIDs with a data length < 8 bytes the data remaining are filled with the value 0x00.

The data in the process image is updated as soon as a transponder enters the detection range. If the transponder leaves the detection range, the data is held in the process image according to the “Data hold time”. If the “Data hold time” is exceeded and there is no transponder in the detection range, the data is filled with the value 0x00.

|  |  |
| --- | --- |
|  | The default operating mode after the device is started is “Read UID” |

## Operating Mode “Auto Read”

In the operating mode "Auto read" the memory area of a transponder is read. Then the memory area is available in the parameters “Memory Read Buffer” and/or “Memory Read Buffer 1”. The memory area address and length are set by the parameter "Memory Read or Write Specification". If reading was unsuccessful, the error value is shown in the process image.

For memory areas with a data length < 232 bytes the data remaining in the parameter “Memory Read Buffer” is filled with the value 0x00.

To enable the “Auto Read” mode correctly there are a few steps to follow:

1. Define the address of the first byte to read from transponder setting the parameter “Memory Read or Write Specification – Address” (Index = 80, Subindex = 1).
2. Define the number of bytes to read from transponder setting the parameter “Memory Read or Write Specification – Length” (Index = 80, Subindex = 2).
3. Enable “Auto Read” mode setting the parameter “Memory Auto Read or Write” (Index = 81) to 2.

## Operating Mode “Auto Write”

In the operating mode "Auto write" the memory area of a transponder is written. The memory area is set in the parameters “Memory Write Buffer” and/or “Memory Write Buffer 1”. The memory area address and length are set by the parameters "Memory Read or Write Specification". If writing was unsuccessful, the error value is shown in the process image.

For memory areas with a data length < 232 bytes the data remaining in the parameter “Memory Write Buffer” is filled with the value 0x00.

To enable the “Auto Write” mode correctly there are a few steps to follow:

1. Define the address of the first byte to write to transponder setting the parameter “Memory Read or Write Specification – Address” (Index = 80, Subindex = 1).
2. Define the number of bytes to write to transponder setting the parameter “Memory Read or Write Specification – Length” (Index = 80, Subindex = 2).
3. Define the data to write to transponder setting the parameter “Memory Write Buffer” (Index = 83).
4. Enable “Auto Write” mode setting the parameter “Memory Auto Read or Write” (Index = 81) to 1.

# Transponder (Tag) Specific Information

## Memory Organization NXP I-CODE 1

| Block | Byte 0 | Byte 1 | Byte 2 | Byte 3 | Description |
| --- | --- | --- | --- | --- | --- |
| 0 | SNR0 | SNR1 | SNR2 | SNR3 | Serial number (low) |
| 1 | SNR4 | SNR5 | SNR6 | SNR7 | Serial number (high) |
| 2 | F0 | FF | FF | FF | Write access |
| 3 | x | x | x | x | Special functions |
| 4 | x | x | x | x | Filter code / App Id / User data |
| 5 | x | x | x | x | User data |
| 6 | x | x | x | x | User data |
| … | … | … | … | … | … |
| 14 | x | x | x | x | User data |
| 15 | x | x | x | x | User data |

## Memory Organization NXP I-CODE SLI

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 26 | 32 | User data |
| 27 | 32 | User data |

### Unique Identifier (UID) NXP I-CODE SLI

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 04 | | 01 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

To differentiate it from the other I-CODE types of transponder bits 37 and 36 are programmed to ‘00’.

## Memory Organization NXP I-CODE SLI-S

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 38 | 32 | User data |
| 39 | 32 | User data |

### Unique Identifier (UID) NXP I-CODE SLI-S

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 04 | | 02 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

To differentiate it from the other I-CODE types of transponder bits 37 and 36 are programmed to ‘00’.

## Memory Organization NXP I-CODE SLI-L

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 7 | 32 | User data |
| 8 | 32 | User data |

### Unique Identifier (UID) NXP I-CODE SLI-L

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 04 | | 03 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

To differentiate it from the other I-CODE types of transponder bits 37 and 36 are programmed to ‘00’.

## Memory Organization NXP I-CODE SLIX

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 26 | 32 | User data |
| 27 | 32 | User data |

### Unique Identifier (UID) NXP I-CODE SLIX

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 04 | | 01 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

To differentiate it from the other I-CODE types of transponder bits 37 and 36 are programmed to ‘10’.

## Memory Organization NXP I-CODE SLIX-S

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 38 | 32 | User data |
| 39 | 32 | User data |

### Unique Identifier (UID) NXP I-CODE SLIX-S

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 04 | | 02 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

To differentiate it from the other I-CODE types of transponder bits 37 and 36 are programmed to ‘10’.

## Memory Organization NXP I-CODE SLIX-L

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 6 | 32 | User data |
| 7 | 32 | User data |

### Unique Identifier (UID) NXP I-CODE SLIX-L

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 04 | | 03 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

To differentiate it from the other I-CODE types of transponder bits 37 and 36 are programmed to ‘10’.

## Memory Organization NXP I-CODE SLIX2

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 77 | 32 | User Data |
| 78 | 32 | User data |
| 79 | 32 | Counter |

### Unique Identifier (UID) NXP I-CODE SLIX2

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 04 | | 03 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

To differentiate it from the other I-CODE types of transponder bits 37 and 36 are programmed to ‘01’.

## Memory Organization TI Tag-it HF-I Standard

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 6 | 32 | User Data |
| 7 | 32 | User data |

### Unique Identifier (UID) TI Tag-it HF-I Standard

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 07 | | C0 / C1 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

## Memory Organization TI Tag-it HF-I Plus

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 62 | 32 | User Data |
| 63 | 32 | User data |

### Unique Identifier (UID) TI Tag-it HF-I Plus

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 07 | | 00 / 01 /  80 / 81 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

## Memory Organization TI Tag-it HF-I Pro

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 6 | 32 | User Data |
| 7 | 32 | User data |

### Unique Identifier (UID) TI Tag-it HF-I Pro

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 07 | | C4 / C5 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

## Memory Organization STM LRI 512

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 14 | 32 | User Data |
| 15 | 32 | User data |

### Unique Identifier (UID) STM LRI 512

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 |  |  |  |  |  |  |  |  |  |  | 1 |
| E0 | | 02 | | IC manufacturer serial number | | | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

## Memory Organization Infineon my-d (02P)

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 54 | 32 | User Data |
| 55 | 32 | User data |

### Unique Identifier (UID) Infineon my-d (02P)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 05 | | 40 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

## Memory Organization Infineon my-d (10P)

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 32 | User data |
| 1 | 32 | User data |
| … | … | … |
| 246 | 32 | User Data |
| 247 | 32 | User data |

### Unique Identifier (UID) Infineon my-d (10P)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 05 | | 00 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

## Memory Organization EM EM4135

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 13 | 64 | User data |
| 14 | 64 | User data |
| … | … | … |
| 47 | 64 | User Data |
| 48 | 64 | User data |

### Unique Identifier (UID) EM EM4135

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 |  |  |  |  |  |  |  |  |  |  | 1 |
| E0 | | 16 | | IC manufacturer serial number | | | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

## Memory Organization Fujitsu MB89R118C

| Block | Bits | Description |
| --- | --- | --- |
| UID | 64 | Fixed serial number |
| 0 | 64 | User data |
| 1 | 64 | User data |
| … | … | … |
| 248 | 64 | User Data |
| 249 | 64 | User data |

### Unique Identifier (UID) Fujitsu MB89R118C

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 64 | 57 | 56 | 49 | 48 | 41 | 40 |  |  |  |  |  |  |  |  | 1 |
| E0 | | 08 | | 01 | | IC manufacturer serial number | | | | | | | | | |
| UID 7 | | UID 6 | | UID 5 | | UID 4 | | UID 3 | | UID 2 | | UID 1 | | UID 0 | |

## Memory Organization NXP MIFARE Classic 1k

| **Sector** | **Block** | **Bits** | **Description** |
| --- | --- | --- | --- |
| 0 | 0 | 128 | Manufacturer Block |
| 1 | 128 | User Data |
| 2 | 128 | User Data |
| 3 | 128 | Sector Trailer |
| 1 | 0 | 128 | User Data |
| 1 | 128 | User Data |
| 2 | 128 | User Data |
| 3 | 128 | Sector Trailer |
|  | … | … | … |
| 15 | 0 | 128 | User Data |
| 1 | 128 | User Data |
| 2 | 128 | User Data |
| 3 | 128 | Sector Trailer |

## Memory Organization NXP MIFARE Classic 4k

| **Sector** | **Block** | **Bits** | **Description** |
| --- | --- | --- | --- |
| 0 | 0 | 128 | Manufacturer Block |
| 1 | 128 | User Data |
| 2 | 128 | User Data |
| 3 | 128 | Sector Trailer |
| … | … | … | … |
| 31 | 0 | 128 | User Data |
| 1 | 128 | User Data |
| 2 | 128 | User Data |
| 3 | 128 | Sector Trailer |
| 32 | 0 | 128 | User Data |
| 1 | 128 | User Data |
| 2 | 128 | User Data |
| 3 | 128 | User Data |
| … | … | … |
| 13 | 128 | User Data |
| 14 | 128 | User Data |
| 15 | 128 | Sector Trailer |
| … | … | … | … |
| 39 | 0 | 128 | User Data |
| 1 | 128 | User Data |
| 2 | 128 | User Data |
| 3 | 128 | User Data |
| … | … | … |
| 13 | 128 | User Data |
| 14 | 128 | User Data |
| 15 | 128 | Sector Trailer |

### Manufacturer block NXP MIFARE Classic 1k / 4k

| **128 49** | **48 1** |
| --- | --- |
| Manufacturer Data | UID (32 bits if NUID) |

### Sector trailer NXP MIFARE Classic 1k / 4k

| **128 81** | **80 49** | **48 1** |
| --- | --- | --- |
| Key B (optional) | Access Bits | UID (32 bits if NUID) |

## Memory Organization NXP MIFARE Ultralight C

| **Pages** | **Byte** | **Bits** | **Description** |
| --- | --- | --- | --- |
| 0 | 0 – 3 | 32 | Serial Number |
| 1 | 0 – 3 | 32 | Serial Number |
| 2 | 0 | 8 | Serial Number |
| 1 | 8 | Internal |
| 2 – 3 | 16 - 31 | Lock Bytes |
| 3 | 0 – 3 | 32 | One Time Programmable |
| 4 | 0 – 3 | 32 | User Memory |
| … | … | … | … |
| 39 | 0 – 3 | 32 | User Memory |
| 40 | 0 – 1 | 16 | Lock Bytes |
| 2 – 3 | 16 | Reserved |
| 41 | 0 – 1 | 16 | 16-bit Counter |
| 42 | 0 – 4 | 32 | Authentication Configuration |
| 43 | 0 – 4 | 32 | Authentication Configuration |
| 44 | 0 – 4 | 32 | Authentication Key |
| 45 | 0 – 4 | 32 | Authentication Key |
| 46 | 0 – 4 | 32 | Authentication Key |
| 47 | 0 – 4 | 32 | Authentication Key |

### Unique Identifier NXP MIFARE Ultralight C

| **Page** | **Byte 3** | **Byte 2** | **Byte 1** | **Byte 0** |
| --- | --- | --- | --- | --- |
| 0 | Check Byte 0 | Serial Number part 1 | | |
| 1 | Serial Number part 2 | | | |
| 2 | Lock Bytes | | Internal | Check Byte 1 |

## Memory Organization NXP NTAG 210

| **Pages** | **Bytes** | **Bits** | **Description** |
| --- | --- | --- | --- |
| 0 | 0 – 3 | 32 | Serial Number |
| 1 | 0 – 3 | 32 | Serial Number |
| 2 | 0 | 8 | Serial Number |
| 1 | 8 | Internal |
| 2 – 3 | 16 | Lock Bytes |
| 3 | 0 – 3 | 32 | Capability Container |
| 4 | 0 – 3 | 32 | User Memory |
| … |  | … | … |
| 15 | 0 – 3 | 32 | User Memory |
| 16 | 0 – 3 | 32 | Configuration page CFG 0 |
| 17 | 0 – 3 | 32 | Configuration page CFG 1 |
| 18 | 0 – 3 | 32 | Configuration page PWD |
| 19 | 0 – 1 | 16 | Configuration page PACK |
| 2 – 3 | 16 | Configuration page RFUI |

### Unique Identifier NXP NTAG 210

| **Pages** | **Byte 3** | **Byte 2** | **Byte 1** | **Byte 0** |
| --- | --- | --- | --- | --- |
| 0 | Check byte 0 | Serial number part 1 | | |
| 1 | Serial number part 2 | | | |
| 2 | Lock Bytes | | Internal | Check byte 1 |

## Memory Organization NXP NTAG 212

| **Pages** | **Bytes** | **Bits** | **Description** |
| --- | --- | --- | --- |
| 0 | 0 – 3 | 32 | Serial Number |
| 1 | 0 – 3 | 32 | Serial Number |
| 2 | 0 | 8 | Serial Number |
| 1 | 8 | Internal |
| 2 – 3 | 16 | Lock Bytes |
| 3 | 0 – 3 | 32 | Capability Container |
| 4 | 0 – 3 | 32 | User Memory |
| … | … | … | … |
| 35 | 0 – 3 | 32 | User Memory |
| 36 | 0 - 2 | 24 | Dynamic Lock Bytes |
| 3 | 8 | Dynamic Lock Bytes RFUI |
| 37 | 0 – 3 | 32 | Configuration page CFG 0 |
| 38 | 0 – 3 | 32 | Configuration page CFG 1 |
| 39 | 0 – 3 | 32 | Configuration page PWD |
| 40 | 0 – 1 | 16 | Configuration page PACK |
| 2 – 3 | 16 | Configuration page RFUI |

### Unique Identifier NXP NTAG 212

| **Pages** | **Byte 3** | **Byte 2** | **Byte 1** | **Byte 0** |
| --- | --- | --- | --- | --- |
| 0 | Check byte 0 | Serial number part 1 | | |
| 1 | Serial number part 2 | | | |
| 2 | Lock Bytes | | Internal | Check byte 1 |

## Memory Organization NXP NTAG 213

| **Pages** | **Bytes** | **Bits** | **Description** |
| --- | --- | --- | --- |
| 0 | 0 – 3 | 32 | Serial Number |
| 1 | 0 – 3 | 32 | Serial Number |
| 2 | 0 | 8 | Serial Number |
| 1 | 8 | Internal |
| 2 – 3 | 16 | Lock Bytes |
| 3 | 0 – 3 | 32 | Capability Container |
| 4 | 0 – 3 | 32 | User Memory |
| … |  | … | … |
| 39 | 0 – 3 | 32 | User Memory |
| 40 | 0 - 2 | 24 | Dynamic Lock Bytes |
| 3 | 8 | Dynamic Lock Bytes RFUI |
| 41 | 0 – 3 | 32 | Configuration page CFG 0 |
| 42 | 0 – 3 | 32 | Configuration page CFG 1 |
| 43 | 0 – 3 | 32 | Configuration page PWD |
| 44 | 0 – 1 | 16 | Configuration page PACK |
| 2 – 3 | 16 | Configuration page RFUI |

### Unique Identifier NXP NTAG 213

| **Pages** | **Byte 3** | **Byte 2** | **Byte 1** | **Byte 0** |
| --- | --- | --- | --- | --- |
| 0 | Check byte 0 | Serial number part 1 | | |
| 1 | Serial number part 2 | | | |
| 2 | Lock Bytes | | Internal | Check byte 1 |

## Memory Organization NXP NTAG 215

| **Pages** | **Bytes** | **Bits** | **Description** |
| --- | --- | --- | --- |
| 0 | 0 – 3 | 32 | Serial Number |
| 1 | 0 – 3 | 32 | Serial Number |
| 2 | 0 | 8 | Serial Number |
| 1 | 8 | Internal |
| 2 – 3 | 16 | Lock Bytes |
| 3 | 0 – 3 | 32 | Capability Container |
| 4 | 0 – 3 | 32 | User Memory |
| … |  | … | … |
| 129 | 0 – 3 | 32 | User Memory |
| 130 | 0 - 2 | 24 | Dynamic Lock Bytes |
| 3 | 8 | Dynamic Lock Bytes RFUI |
| 131 | 0 – 3 | 32 | Configuration page CFG 0 |
| 132 | 0 – 3 | 32 | Configuration page CFG 1 |
| 133 | 0 – 3 | 32 | Configuration page PWD |
| 134 | 0 – 1 | 16 | Configuration page PACK |
| 2 – 3 | 16 | Configuration page RFUI |

### Unique Identifier NXP NTAG 215

| **Pages** | **Byte 3** | **Byte 2** | **Byte 1** | **Byte 0** |
| --- | --- | --- | --- | --- |
| 0 | Check byte 0 | Serial number part 1 | | |
| 1 | Serial number part 2 | | | |
| 2 | Lock Bytes | | Internal | Check byte 1 |

## Memory Organization NXP NTAG 216

| **Pages** | **Bytes** | **Bits** | **Description** |
| --- | --- | --- | --- |
| 0 | 0 – 3 | 32 | Serial Number |
| 1 | 0 – 3 | 32 | Serial Number |
| 2 | 0 | 8 | Serial Number |
| 1 | 8 | Internal |
| 2 – 3 | 16 | Lock Bytes |
| 3 | 0 – 3 | 32 | Capability Container |
| 4 | 0 – 3 | 32 | User Memory |
| … |  | … | … |
| 225 | 0 – 3 | 32 | User Memory |
| 226 | 0 - 2 | 24 | Dynamic Lock Bytes |
| 3 | 8 | Dynamic Lock Bytes RFUI |
| 227 | 0 – 3 | 32 | Configuration page CFG 0 |
| 228 | 0 – 3 | 32 | Configuration page CFG 1 |
| 229 | 0 – 3 | 32 | Configuration page PWD |
| 230 | 0 – 1 | 16 | Configuration page PACK |
| 2 – 3 | 16 | Configuration page RFUI |

### Unique Identifier NXP NTAG 216

| **Pages** | **Byte 3** | **Byte 2** | **Byte 1** | **Byte 0** |
| --- | --- | --- | --- | --- |
| 0 | Check byte 0 | Serial number part 1 | | |
| 1 | Serial number part 2 | | | |
| 2 | Lock Bytes | | Internal | Check byte 1 |