

MACE MM (QR)

installation guide

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1 INTRODUCTION

1.1 MACE

MACE is an acronym for Mobile Access Control Enabler. MACE is a platform consisting of readers, apps and a cloud based server that enables the use of smartphones to identify people.

MACE supports Bluetooth, NFC and QR-codes to identify people using virtual credentials are stored in a MACE app that is available for iPhone and Android.

MACE can be used in combination with any access control system or any other system that requires the swift identification of people, like parking management systems or registration systems.

Please remember to fill out the 'How to Order Guide' to prepare your MACE installation and order virtual MACE credentials that will be read by the MACE readers you plan to install.

1.2 FIRMWARE VERSIONS

The MACE reader supports different firmware versions. Below an overview of the available firmware versions and their key features.

STANDARD firmware:

- RS485 communication using CR/LF protocol.
- Wiegand communication output.
- Magstripe (clock & data) communication output.
- LED and buzzer control automatic or remote through digital inputs.

OSDP firmware:

- RS485 communication according to the SIA OSDP v2.1.6 standard.
- Secure Channel Protocol supported.
- LED and buzzer control through OSDP commands.
- General purpose inputs (3x) and outputs (2x).

Default the STANDARD firmware is installed.

Perform a firmware update using the MaceConfigTool software. See chapter 4.6.1.

The firmware update also allows to change from STANDARD to OSDP (or vice versa).

2 INSTALLATION

2.1 SAFETY INSTRUCTION

The following safety precautions should be observed during normal use, service and repair:

- The MACE may only be installed and serviced by qualified service personnel.
- Disconnect the power supply before (dis)connecting any wires, MACE is NOT hot-swappable, so when making or changing connections, power must be switched OFF.
- The cable shield shall be connected with safety ground and the metal case of the external device(s).
- To be sure of safety, do not modify or add anything to the MACE other than mentioned in this installation guide or indicated by NEDAP N.V.

2.2 MOUNTING INSTRUCTIONS

The MACE can be mounted to any surface, including directly to metal. See the picture below for details about the dimensions.

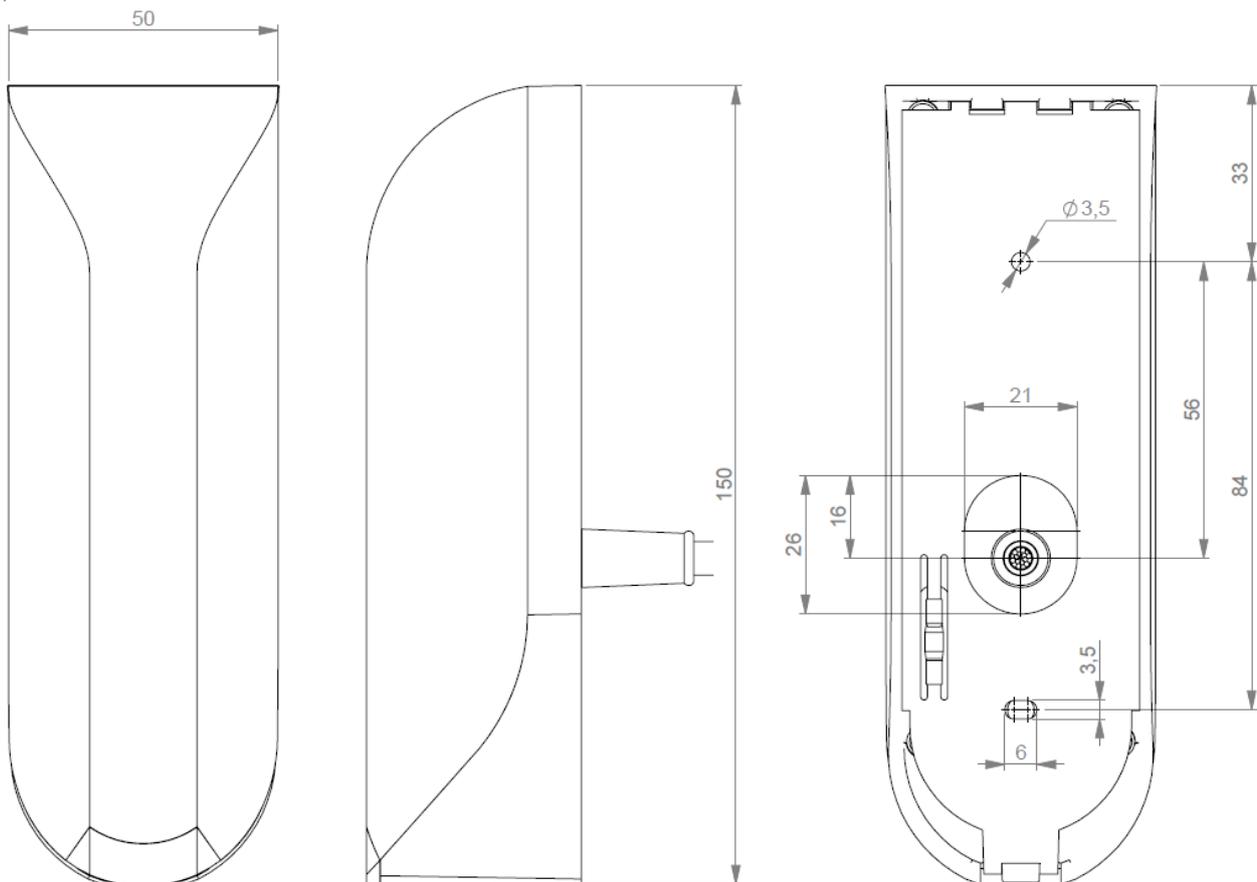


Figure 1: MACE dimensions (mm)

MACE | INSTALLATION GUIDE

Installation

Mount the base-plate on the required location.

Ensure that it is placed correctly covering the cable entry hole. Properly fix the base-plate into its position using the 2 screws. When mounting on a stone or concrete wall drill 5mm holes for the plugs. When mounting on wood, drill with 2.5mm.

Install the MACE reader onto the base-plate:

- 1 Feed the cable through the cable entry hole. Important note: minimum bending radius 30mm.
- 2 Attach the top of the MACE onto the base-plate.
- 3 Fix the assembly using the screw on the bottom.

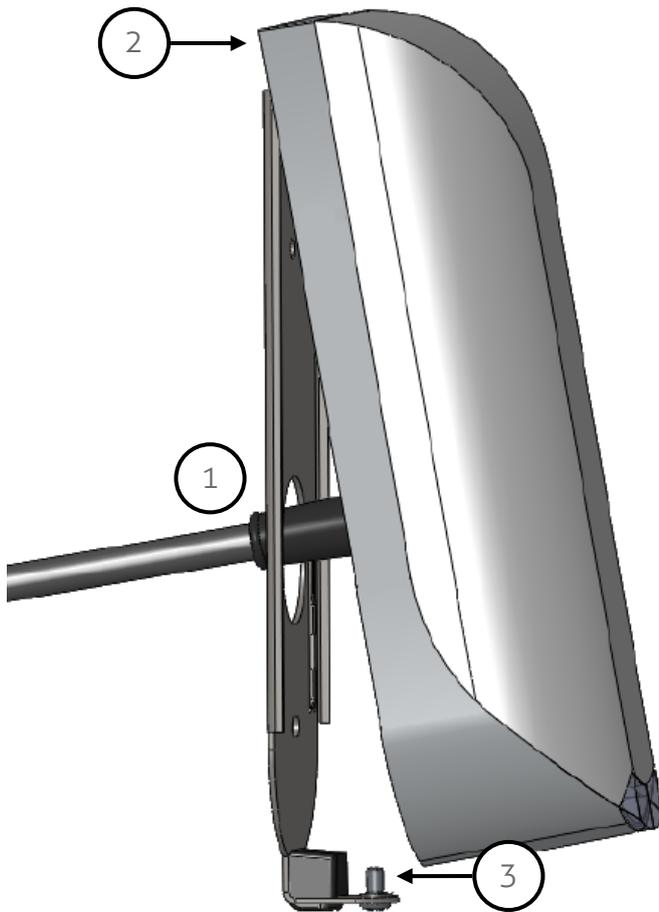


Figure 2: MACE installation

3 CONNECTIONS

The MACE is supplied with a 5 meter (15 feet) shielded cable pigtail with 12 colored wires.

RED	Power supply 12 - 24VDC
BLACK	Power supply 0VDC, DC-Ground
BROWN	RS485 A (-)
GREEN	RS485 B (+)
GRAY	Data-0 / Clock
PINK	Data-1 / Data
YELLOW	Tamper switch (normally closed)
GRY/PNK	Tamper switch (common)
RED/BLU	Led_UL_IN
WHITE	Led_NA_IN
PURPLE	Nedap antenna interface. Connect to ANT
BLUE	Beeper_IN
SHIELD	Shield

3.1 POWER SUPPLY

The MACE requires DC power supply in the range from 12 – 24V. Maximum current consumption is 0.4A @ 12VDC, 0.2A @ 24VDC.

Connections:

RED	Power supply 12 - 24VDC
BLACK	Power supply 0V / DC-ground
SHIELD	Shield connected to DC-ground

3.2 COMMUNICATION

3.2.1 RS485

The MACE reader has a RS485 interface for communication with a host system or to configure the reader settings. RS485 is a 2-wire half-duplex serial communication interface using balanced lines. STANDARD and OSDP protocol are available.

Connections:

BROWN	RS485 A (-)	Balanced RX/TX
GREEN	RS485 B (+)	Balanced RX/TR
SHIELD	Shield connected to DC-ground	

For details about reader configuration see chapter 4.

Standard firmware:

Default RS485 communication baud rate is 115200. See chapter 4.2.4.

The RS485 output message format is described in chapter 4.5.1

OSDP firmware:

The OSDP protocol is implemented according to the SIA OSDP v2.1.6 standard including the Secure Channel Protocol. Default RS485 communication baud rate is 9600. This may be changed using the OSDP_COMSET command.

Note

Cable shield shall be connected to the metal case of the external device(s). Cable extensions shall only be made by means of shielded cable(s). All shields of the shielded cable extensions shall be connected together and to the metal case of the external device(s).

Note:

Extending this connection beyond the 5 meter pig tail length shall ONLY be allowed using shielded cable.

The minimum voltage at the end of the fixed shielded pigtail cable shall be greater than 12VDC -10% The shield shall be connected to the metal case of the external device.

Note:

The RS485 interface is disabled while the USB interface is in use!

Extending this connection beyond the 5 meter pig tail length shall ONLY be allowed using shielded twisted pair cable (2 x 2 x 0.25 mm²) as long as the total length is shorter than 1200 meters, 6000 feet, cable capacity < 100 pF/meter.

The second twisted pair shall be used for the DC power supply.

The shield shall be connected to the metal case of the external device.

3.2.2 USB

The MACE reader features an USB interface for service, installation and firmware upgrade purposes. The Mini-USB connector is located on the bottom of the device and can only be reached when the bottom screw is opened and the MACE is lifted away from the base-plate. This ensures that unauthorized modifications to the reader settings can be detected using the tamper switch.

The USB interface can be used to configure the reader using the MaceConfigTool software. See chapter 4.

USB Driver installation

Make sure your computer is connected to the internet. The driver should install automatically via Windows update when the MACE reader is connected to your PC via the USB cable. Follow the driver installation wizard. If you do not see the Windows update pop-up, you can manually install the driver. To manually install, you need to go to FTDI's website at www.ftdichip.com/Drivers/VCP.htm and download the VCP (Virtual Com Port) drivers for your operating system. Drivers for MacOS and Linux are available as well.

Note

While the shielded USB cable is connected, the RS485 interface is disabled! The maximum shielded cable length shall be < 2 meter.

3.2.3 WIEGAND

The Wiegand and Magstripe ISO7811/2 (clock & data) interface share the same connections. This means that only Wiegand or Magstripe can be used and not both simultaneously.

Wiegand connections:

GRAY	D0
PINK	D1
BLACK	Ground (0V)
SHIELD	Shield connected to DC-ground

Message format:

The Wiegand output format is determined by the programming format of the credential. MACE Wiegand credentials will automatically generate a Wiegand message. If the credential is not programmed in Wiegand format, you may configure the message output format as described in chapter 4.5.2.

Make sure to order the correct credential programming format if you want to use the Wiegand or Magstripe interface. See also the MACE how to order guide (HTOG) for more information.

Wiegand Timing

In the figure below the Wiegand protocol timing is specified.

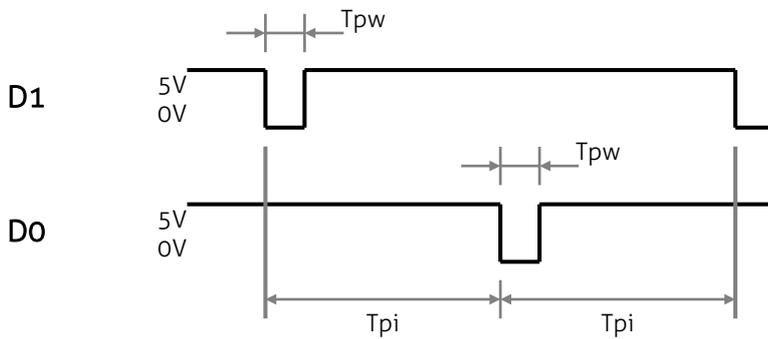


Figure 3: Wiegand protocol timing

Timing constants:

Tpi	Pulse interval time	1msec
Tpw	Pulse width time	50µsec

OSDP firmware:

The OSDP firmware does not support the Wiegand interface!!!

Note

Extending these connections beyond the 5 meter pig tail length shall ONLY be allowed using shielded cable (4 x 0.25 mm²) as long as the total length is shorter than 150 meters (500 feet). The shield shall be connected to the metal case of the external device.

3.2.4 MAGSTRIPE ISO7811/2

The Magstripe ISO78122/2 (clock & data) and Wiegand interface share the same connections. This means that only Wiegand or Magstripe can be used and not both simultaneously.

Magstripe connections:

GRAY	CLK
PINK	DAT
BLACK	Ground (0V)
SHIELD	Shield connected to DC-ground

Message format:

The Magstripe output format is determined by the programming format of the credential. MACE Magstripe credentials will automatically generate a Magstripe message. If the credential is not programmed in Magstripe format, you may configure the message output format as described in chapter 4.5.2.

Make sure to order the correct credential programming format if you want to use the Wiegand or Magstripe interface. See also the MACE how to order guide (HTOG) for more information.

Magstripe Timing

The figure below shows the timing for one Magstripe character. Each bit consists out of one period low (220µsec) and two periods high (440µsec). The Data-signal is valid and stable on the falling edge of the Clock-signal.

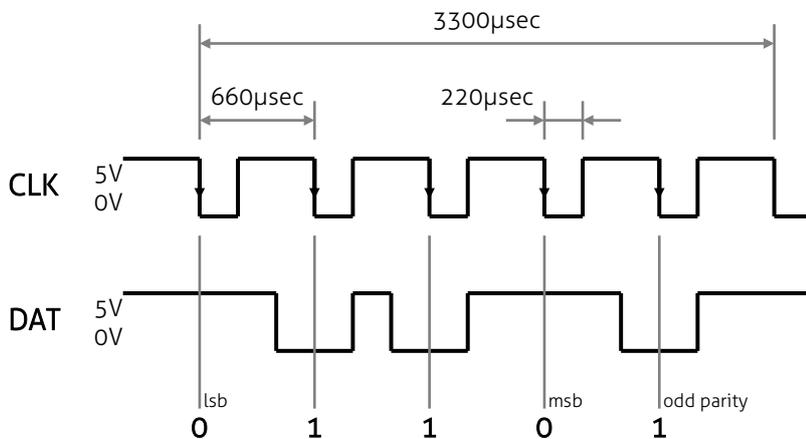


Figure 4: Magstripe protocol timing one character

Timing constants:

Clock period	660µsec
Clock high	440µsec
Clock low	220µsec
Data pre-amble	16 clock periods
Data post-amble	16 clock periods

OSDP firmware:

The OSDP firmware does not support the Magstripe ISO7811/2 interface!!!

Note

Extending these connections beyond the 5 meter pig tail length shall ONLY be allowed using shielded cable (4 x 0.25 mm²) as long as the total length is shorter than 150 meters (500 feet). The shield shall be connected to the metal case of the external device.

3.3 LED CONTROL

The built-in high intensity LED provides visual feedback that the tag has been read or authorized. The LED and buzzer can be controlled by the access control system.

Automatic mode:

Default the MACE reader will automatically control the LED.

During stand-by the LED will be BLUE and upon identification it will be GREEN.

These colors can be changed!

Remote control:

The LED and buzzer can be controlled remotely by a connected access control system by activating digital inputs (active low). See chapter 3.4 for connection details. Use MaceConfigTool software to setup the LED/buzzer control mode and configure the corresponding LED colors.

Color UL LED color when input Led_UL_IN active.

Color NA LED color when input Led_NA_IN active.

Color UL+NA LED color when both inputs Led_UL_IN and Led_NA_IN active.

Color idle LED color when both inputs not active.

Direct (serial cmd):

The LED and buzzer can only be controlled by serial commands.

OSDP firmware:

Use the OSDP_LED command to control the LED.

Automatic mode and Remote control are not supported.

3.4 INPUTS

The MACE reader has 3 digital inputs (active low).

Connect to ground to active the input. Leave unconnected otherwise.

Connections

RED/BLU	Input 0 - Led_UL_IN (active-low)
WHITE	Input 1 - Led_NA_IN (active-low)
BLUE	Input 2 - Beeper_IN (active-low)
BLACK	Ground
SHIELD	Shield connected to DC-ground

STANDARD firmware:

The digital inputs can be used to control the LED and buzzer. See chapter 3.3.

OSDP firmware:

The digital inputs are general purpose inputs.

Upon status change the reader will send input status report message OSDP_ISTATR.

The current input status can be requested by sending the input status report request message OSDP_ISTAT.

Note

Extending these connections beyond the 5 meter pig tail length shall ONLY be allowed using shielded cable (4 x 0.25 mm²) as long as the total length is shorter than 150 meters (500 feet).

The shield shall be connected to the metal case of the external device.

3.5 OUTPUTS

The MACE reader has 2 digital outputs. The function of the digital outputs is dependent upon the installed firmware version. See below.

STANDARD firmware:

The outputs are used for Wiegand or Magstripe communication. See respectively chapters 3.2.3 and 3.2.4

OSDP firmware:

The outputs are general purpose outputs. The outputs are open-collector and can be used to activate an external relay. Mind flyback diode.

Use the OSDP_OUT command to control the output state. The outputs allow for direct activation and deactivation plus timed operation (OSDP output control compliance level 3). The permanent command is volatile (does not transcend power cycles).

When the status of an output changes the reader will send an output status change report message OSDP_OSTATR.

Connections:

GRAY	Output 0 (D0/CLK)
PINK	Output 1 (D1/DAT)
BLACK	Ground (0V)
SHIELD	Shield connected to DC-ground

Output ratings:

Type	open collector (internal weak 5V pull-up resistor)
Max. voltage	+24 VDC
Max. current	200 mA

3.6 TAMPER SWITCH

An internal magnet provides tamper indication when the reader is dismounted. This contact may be connected to an external alarm system. The contacts are normally closed when the reader is in place.

Tamper switches of multiple readers can be connected in series.

Connections:

YELLOW	Tamper switch (normally closed)
GRY/PNK	Tamper switch (common)
SHIELD	Shield connected to DC-ground

Contact ratings:

Max. current	50 mA (0.5 Volt voltage drop)
Max. switching voltage	+24 VDC

The tamper switch status is reported through OSDP_LSTATR event messages.

3.7 NEDAP ANTENNA INTERFACE

The Nedap antenna interface is used to connect the MACE reader to a TCC270 or PCC485 or to NEDAP AEOS access control hardware (e.g. AP1001).

Connections:

PURPLE	Nedap antenna interface. Connect to ANT
BLACK	Nedap antenna interface. Ground, shield. Connect to ANT GND
SHIELD	Shield connected to DC-ground

When using this connection the credentials must have the Nedap XS format!!!

OSDP firmware:

The OSDP firmware does not support the NEDAP antenna interface!!!

Note

Extending this connection beyond the 5 meter pig tail length shall ONLY be allowed using shielded cable (2 x 0.25 mm²) as long as the total length is shorter than 150 meters (500 feet).

The shield shall be connected to the metal case of the external device.

Note

Extending this connection beyond the 5 meter pig tail length shall ONLY be allowed using coaxial cable, RG58U, as long as the total length is shorter than 100 meters (350 feet).

The shield shall be connected to the metal case of the external device.

4 READER CONFIGURATION

The MACE reader can be configured easily using the MaceConfigTool software. This software tool can be downloaded from our partner portal <https://portal.nedapidentification.com>.

Configuration allows to change:

- General settings.
- Reader settings; what to read and how.
- Communication output settings.

Some settings require expert knowledge. Leave settings unchanged, when their specific meaning is unclear.

It's always a good practice to save the configuration into a file for future reference or when requesting technical assistance from Nedap or its business partners.

4.1 CONFIG SOFTWARE

The MaceConfigTool software allows to configure all settings for the MACE reader. The software can interface with the reader using the USB or RS485 interface.

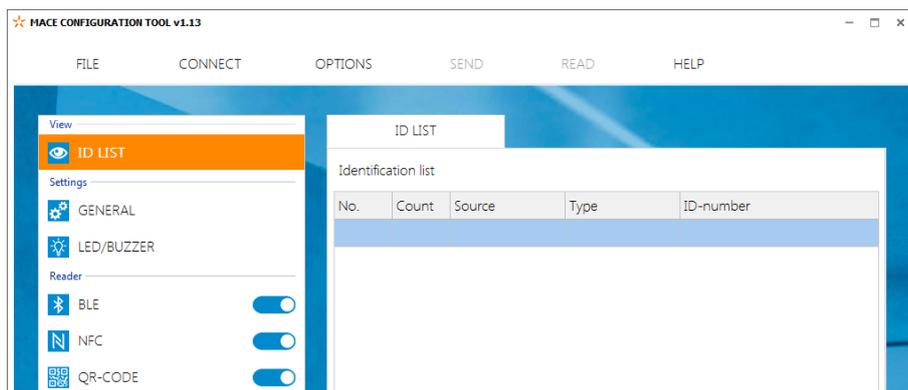


Figure 5: MaceConfigTool software

Start the MaceConfigTool software and click CONNECT.

Select the following communication parameters and click OK.

- COM-port
- Baud rate
- Communication protocol (STANDARD or OSDP)
- Device address (only for OSDP)

When the connection is established, the software checks the MACE firmware version.

Check the ID List to see what is identified.

Check the Console to see the communication details. For details about the communication protocol refer to the firmware manual.

4.2 OPTIONS

The options menu gives access to various MACE reader configuration options.

4.2.1 USER MODE

Select user mode Simple or Advanced to adjust the user interface. User mode Nedap is intended to be used only when recommended by Nedap. Password is **mace**.

4.2.2 SEND CONFIG

Send configuration to reader.

This option will send all configuration settings to the reader and saves them into non-volatile memory of the reader. A message indicates that the configuration was sent successfully.

4.2.3 READ CONFIG

Read configuration from reader.

This option will read all* configuration settings from the reader. A message indicates that the configuration was read successfully.

* Security keys and passwords cannot be read from the reader.

4.2.4 SETUP BAUDRATE

Select the serial communication baud rate.

Possible selections are:

- 1200
- 2400
- 9600 (default OSDP)
- 19200
- 38400
- 57600
- 115200 (default STANDARD)

Click OK after changing the baud rate. Upon success the software will show a message and the baud rate in the software and reader have been changed. The new baud rate setting in the reader is saved to non-volatile memory.

Note that when using a separate interface converter, it may be required to update the baud rate setting in there as well.

4.2.5 SETUP OSDP DEVICE ADDRESS

Select the OSDP device address in range from 0 to 126. Default device address is 0.

4.2.6 RESET CONFIG

Reset configuration to factory defaults.

All settings will be reset to factory defaults. The reader will restart automatically afterwards.

4.3 SETTINGS

4.3.1 GENERAL

Hold time / repeat time

Set tag hold time. Default 1 sec. Max. 25 sec.

Enable 'repeat using hold-time interval' to repeat the communication output while the tag remains within read range.

Configuration password

Enter a configuration password to lock the configuration settings in the reader.

Without the password you cannot change any configuration settings. Please remember this password very carefully. By default the MACE reader has no configuration password.

*** Advanced user mode settings;

Nedap customer codes

The MACE reader is programmed with a customer code. Nedap tags or credentials may also have a customer code. Enable 'Read only if customer code is correct' to make the reader ignore tags that have an invalid customer code.

You may change the customer code(s) in the reader. You can configure up to 20 customer-codes in the MACE reader.

Identifiers without customer code

Other tags or credentials may not have a customer code. For example MIFARE DESFire cards or the MACE UID64. Enable or disable 'Allow reading ID-numbers without customer code'.

Heater

The MACE reader has a heater unit to prevent condensation on the QR-code scanner at low temperatures. By default the heater unit is off.

ID-source values

The MACE reader indicates on which source there was an identification. These ID-source identifier values are configurable by clicking on the link.

*** Nedap user mode settings;

Antenna modulation

This setting is only used for the Nedap antenna interface. See chapter 3.7. The setting defines how often the ID-number is sent on the antenna interface. Default settings is 30 cycles, which corresponds to ± 1 sec.

4.3.2 LED/BUZZER

LED and buzzer mode *

Automatic

MACE reader will automatically set the LED color and optionally beep upon identification. The LED color upon identification and during idle can be configured.

Remote (follow digital inputs)

The connected access control panel may control the LED and buzzer using the digital inputs. The corresponding LED colors can be configured. See chapter 3.3.

Direct (using serial commands)

The connected access control panel may control the LED and buzzer using commands on the serial interface. Details are described in the firmware manual.

LED brightness

Set LED brightness in range from 0 to 100%. Default 50%.

- * Using OSDP the LED and buzzer are controlled using the OSDP_LED and OSDP_BUZ commands. The Automatic mode and Remote control (follow digital inputs) settings are not supported.

4.4 READER SETTINGS

4.4.1 BLE

The MACE Bluetooth Low Energy (BLE) reader is a single mode Bluetooth Smart reader that complies with the Bluetooth Core specification 4.1. The Bluetooth reader implements the peripheral role, which means that it broadcasts its device name like a beacon. Enabling BLE in the MACE App triggers the smartphone to scan the surrounding in order to find and respond to the BLE signal of the MACE reader.

Enable

Enable the MACE BLE module. This automatically starts the Bluetooth advertising.

Default Bluetooth device name

Enable to have the default Bluetooth device name (something like "m085C7"). This is recommended because it is used by the MACE App for ranging purposes.

Please be aware that iOS stores the reader's device name in the cache memory of the phone. After changing the read range, and thus changing the device name, it may take some time before the MACE app recognizes the update. iPhones only refresh this Bluetooth name after the phone has been connected to the reader for a couple of times. When the name is not refreshed automatically, the NRF connect app might help to refresh the Bluetooth name in the cache memory of the phone.

The NRF connect app (downloadable for both iOS and Android devices) is found to be a very useful tool during configuration of Bluetooth devices such as the MACE reader. Amongst others, the app gives an overview of all Bluetooth device names in the surrounding and allows to manually connect and disconnect with a certain Bluetooth device (in order to refresh its cache name).

Ranging profile

The first step in setting the BLE read range is choosing one of the four default ranging profiles:

- P Proximity range (max ± 25 centimeter)
- S Short range (max ± 2 meter)
- M Medium range (max. ± 5 meter)
- L Long range (max ± 15 meter)

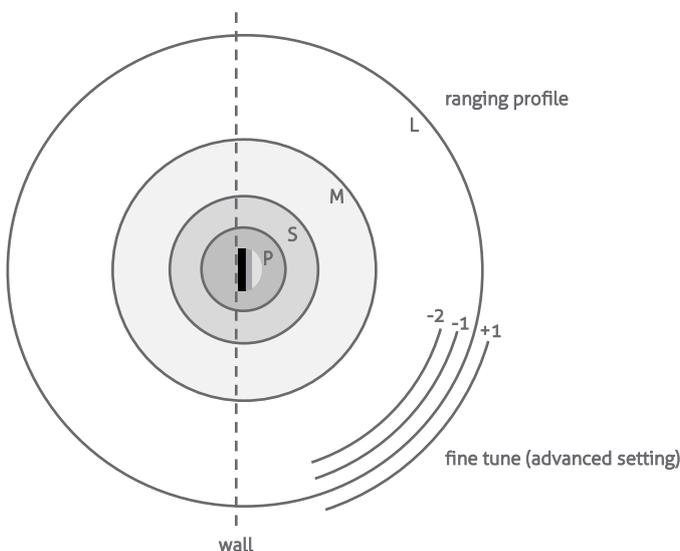


Figure 6: Top view MACE reader with ranging profiles (without the effect of surrounding objects)

In theory, Bluetooth is omnidirectional, which means that the signal strength is the same in all directions (see figure 6). However, the signal can also be influenced by surrounding objects like a concrete wall behind the reader or a metal object or fluid nearby. As a result, the signal strength and therefore the read range might not be the same at all positions around the reader. In that case, the ranging profiles as drawn in figure 6 won't be circular, but more capricious of shape.

*** Advanced user mode settings;

Ranging fine tune

The ranging fine tune option can be used for readers that are mounted on a location that affects the gain of the Bluetooth antenna.

Set the ranging fine tune slider to a positive value when the received signal is lower than expected. In other words; increasing the ranging fine tune value will result in a longer read range, while decreasing the ranging fine tune value will result in a shorter read range. Only 1, 2 or 3 points less or extra read range might be enough to correct the location dependency.

Be careful with setting the read range too short by choosing the 'proximity' ranging profile in combination with decreasing the read range even more via the ranging fine tune option. It might be possible to create a situation in which the set ranging limit is too short for some phones to be able to get in range. Therefore, when in doubt, always choose for the option in which the read range is a bit longer.

There is a lot of variation in performance of Bluetooth communication across the wide range of phones that are available today. Please take this into account when planning the commissioning and configuration of your application.

Reader function

Select the reader function. This function is reserved for future use. It might trigger the MACE app to require user confirmation or pin verification.

Default M - MACE general purpose.

Reader sequence number

Used for MACE reader identification.

*** Nedap user mode settings;

Advertising interval

Default advertising interval is 100 msec.

TX power

Set TX power in dBm (default 8 dBm). Not each TX power setting is possible. The value will be rounded to the nearest possible TX power setting.

It is recommended to keep the highest possible TX power setting. This makes range checking more reliable.

Authentication

Bluetooth authentication should always remain enabled. The key will be diversified to ensure a unique security key per identifier.

4.4.2 NFC

Near Field Communication (NFC) is a wireless communication technique operating on 13 MHz. Read range is only few centimeters. NFC is currently not supported on Apple iOS. On Android at least version 4.4 (KitKat) is required.

Enable

Enable the MACE NFC reading.

*** Nedap user mode settings;

Application ID, file number, data length and offset

For MACE the following settings are required:

Application ID: A0000007151001

File number: 0

Data length: 0

Data offset: 0

Authentication

NFC authentication should always remain enabled. The key will be diversified to ensure a unique security key per identifier.

4.4.3 QR-CODE

The barcode scanner can be used to read MACE QR-codes or a custom barcode.

Default settings are good when using MACE QR-codes. See advanced settings for details about using custom barcodes.

Enable

Enable or disable the barcode scanner.

Aiming beam / illuminator

Enable the optical aiming beam. This may be useful when reading paper barcodes.

Enable the illuminator. Useful when reading paper barcodes during darkness.

*** Advanced user mode settings;

Check prefix/suffix

The prefix and/or suffix may be used to only read tag that contain specific leading or trailing text characters. These characters will be trimmed.

The MACE prefix "MACE: " is automatically stripped, but not required, unless specifically enabled.

The prefix/suffix do not have to be at the start or end of the barcode.

Example customer barcode "<name=Hans><id=123><country=NL>".

Set the prefix to "<id=" and the suffix to ">".

This will result in the barcode ID-number 123.

String format

Default string format is "hex-string".

Select "decimal string" when using barcodes that contain decimal numbers only. This will convert the number from decimal to hex. This might be especially useful when sending this number on the Wiegand output.

Select "Text string" when the barcode contains a text string with alphanumeric characters. Warning: these string can only be sent on the serial output (not on Wiegand or Magstripe).

*** Nedap user mode settings;

Check authentication code

Enable the option 'check authentication code' to prevent copying the QR-code and to prevent uncontrolled generation of fake QR-codes. The MACE App will show a QR-code containing the MACE ID-number. Besides that the QR-code also contains the current date and time and an authentication code calculated using a secure encryption algorithm (AES-CMAC).

If enabled the MACE reader automatically checks the authentication code.

The access control system should check the date and time.

Note: this option is not yet implemented in the MACE App!!!

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Reader configuration

4.4.4 DESFIRE

The MACE Reader features also a universal smartcard reader. It also supports reading MIFARE DESFire (EV1) cards.

*** Advanced user mode settings;

Enable

Enable to read custom MIFARE DESFire cards.

Data to read

Select to read the CSN (7-bytes) or DESFire file data.

Byte order

Select byte order normal or reversed.

For example CSN normal is = 04 6C 5E A2 BD 24 80

For example CSN reversed is = 80 24 BD A2 5E 6C 04

Application ID

Application ID. 6-digit hex. For example F12345.

File number

File number within range from 0 to 255.

Communication mode

Select Plain, MACed or Enciphered.

Data length and offset

Select the data length and offset in nibbles. Set data length and offset both to 0 (zero) to read the whole file. Nibbles are half bytes or digits.

For example file data is 0123456789ABCDEF.

Set data length to 3 and offset to 7.

This will result in the ID-number 789.

Encryption

Select the authentication/encryption method.

- None (skip authentication)

- Native DES/3DES

- ISO DES/3DES

- 3Key 3DES

- AES

Select the key number in range from 0 to 13.

Enter the read key. The length of the key depends upon the chosen encryption method.

Data conversion

Optionally select a data conversion option, for example BCD to HEX or HEX to BCD.

4.4.6 OTHER ID TYPES

The MACE Reader also support reading different RFID card types based upon 13 MHz and 120/125 kHz. Enable the individual RFID card types as mentioned below.

*** Advanced user mode settings;

Nedap XS

Enable reading Nedap XS cards (default enabled).

These tags are programmed with a CF, DF or GF customer code. Optionally enable the customer code check. See chapter 4.3.1.

Nedap RW80

Enable reading Nedap RW80 cards.

EM4200 (and compatible)

Enable reading EM4200 (and compatible) RFID cards. E.g. Sokymat Unique.

HID-PROX *

Enable reading HID-PROX cards. HID-PROX cards contain a Wiegand formatted number. Also HID long format cards are supported (up to max 80 bits).

AWID Proximity/LF *

Enable reading AWID Proximity/LF cards. AWID cards contain a Wiegand formatted number.

* The MaceConfigTool software will show a warning when reading HID-PROX/AWID cards is not supported by the connected reader.

MACE Card

Enable reading MACE Card.

HID iCLASS (UID only)

Enable reading HID iCLASS UID.

The HID iCLASS UID is the read-only 8-byte unique ID.

ISO15693

Enable reading ISO15693.

Different RFID cards comply with this standard, for example NXP ICODE SLI(X) and LEGIC Advant MP cards.

Reading the UID and/or multiple data blocks is supported.

The ISO15693 UID is the read-only 8-byte unique ID.

Read multiple blocks is supported for example by NXP ICODE SLI(X) cards.

Configure first block and number of blocks to read. Each block is 4 bytes.

4.5 COMMUNICATION OUTPUT

4.5.1 SERIAL

The serial communication output defines the format of the message that is transmitted upon identification. This serial output message format is used on the USB and RS485 interface. See for interface connection details chapter 3.2.

STANDARD message format:

```
<prefix><id-source><id-type><id-number><suffix><cr><lf>
```

OSDP_RAW message format:

```
byte 0    Reader number (fixed value 0 = first reader)
byte 1    Format code (fixed value 0 = raw bit array)
byte 2/3  Bit count data length
byte 4/N  <id-source><id-type><id-number>
```

Prefix

Default prefix is '4005!'. Can be any string of max. 10 characters.

Add ID-source

If enabled, the ID-source will be sent as a 2 digit code that identifies how the ID-number was read. The ID-source values can be changed. See chapter 4.3.1.

```
'00' PROX-LF (120/125 kHz)
'01' BLE
'02' NFC
'03' Barcode
'04' Smartcard (13 MHz)
'05' MIFARE
'06' DESFIRE
'07' ISO15693
'08' HID iCLASS
'09' MACE Card
```

Add ID-type

If enabled, the ID-type will be sent as a 2 digit code that identifies the programming format.

```
'00' RAW
'08' MACE UID64
'10' MACE UUID128
'45' EM4200
'4E' Nedap XS
'4F' Nedap RW80
'57' Wiegand
```

ID-number

Select to output the ID-number complete, left aligned or right aligned.

When left or right aligned specify the ID-length and offset in bits.

Optionally convert the ID-number from hex to decimal.

Suffix

Default no prefix is used. Can be any string of max. 10 characters.

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Example:

MACE UID64 on BLE: '40050108B03BF925E6F04D34'<CR><LF>
'4005' = prefix
'01' = id-source BLE
'08' = id-type UID64
'B03BF925E6F04D34' = id-number

OSDP example:

MACE UID64 on BLE: 01, 08, B0, 3B, F9, 25, E6, F0, 4D, 34
01 = id-source BLE
08 = id-type UID64
B0, 3B, F9, 25, E6, F0, 4D, 34 = id-number

Prefix and suffix are not used.

4.5.2 WIEGAND/MAGSTRIPE

The Wiegand/Magstripe communication output defines the format of the Wiegand/Magstripe message that is transmitted upon identification.

Note that if the credential is already programmed in the Wiegand or Magstripe format these settings are not used. The Wiegand/Magstripe output settings are only used for ID-numbers that are not programmed in the Wiegand or Magstripe format.

The OSDP firmware does not output any Wiegand or Magstripe messages !!!

Unconfigured

Select unconfigured if the ID-numbers are already programmed in the Wiegand or Magstripe format or if the Wiegand/Magstripe interface is not used.

Wiegand

Select Wiegand to manually configure the Wiegand message output format.

Wiegand output message format:

```
<P1><prefix><id-src><facility-code><id-number><suffix><P2>
```

Parity

Enable add parity bits to add a leading and trailing parity bit to the Wiegand message. The leading parity bit (P1) is even calculated on the first half of the data bits. The trailing parity bit (P2) is odd calculated on the second half of the data bits. If the number of data bits used in the parity calculation is odd, then the center bit is used in both parity bit calculations.

Prefix

Constant prefix value. Max. 65,535 (16 bits).

ID-source

If enabled, the ID-source will be sent as an 8 bit code that identifies how the ID-number was read. The ID-source values can be changed. See chapter 4.3.1.

0	00000000	PROX-LF (120/125 kHz)
1	00000001	BLE
2	00000010	NFC
3	00000011	Barcode
4	00000100	Smartcard (13 MHz)
5	00000101	MIFARE
6	00000110	DESFIRE
7	00000111	ISO15693
8	00001000	HID iCLASS
9	00001001	MACE Card

Facility-code

Constant facility-code (or site-code) value. Max. 65,535 (16 bits).

ID-number

Select to output the ID-number complete, left aligned or right aligned.

When left or right aligned specify the ID-length and offset in bits.

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Convert BCD to binary

Enable to convert the BCD (decimal) ID-number to a binary value.

For example ID-number 987 = hex 3DB = b'11 1101 1011'.

Note that the conversion may reduce the amount of ID-number bits.

Conversion is only possible if ID-number before conversion is max 80 bits.

When the ID-number is not in decimal, the result may be unexpected.

Suffix

Constant suffix value. Max. 65,535 (16 bits).

Wiegand configuration example:

The configuration shown below will generate a Wiegand 26-bit message with facility-code 10. The ID-number uses the 16 least significant bits (right aligned).

MACE UID64 B03BF925E6F04D34 → ID-number 0x4D34 = 19764.

Protocol

Unconfigured (default)

Wiegand

Magstripe

ID number (N)

Right aligned

Length in bits

16

Offset in bits

0

Convert BCD to binary

Add leading and trailing parity bits (P)

Add prefix (A)

Add ID source 8 bits (B)

Add facility-code (F)

Facility-code

10

Length in bits (max 16 bits)

8

Add suffix (Z)

Wiegand 26-bit

P FFFFFFFF NNNNNNNNNNNNNNNN P

Figure 7: Example Wiegand 26-bit configuration

Magstripe

Select Magstripe to configure the Magstripe message output format.

Magstripe output message format:

```
<0xB><prefix><id-number><suffix><0xF><LRC>
```

Add start, stop-sentinel and LRC

According to the Magstripe ISO7811/2 standard the messages should begin with a start-sentinel (0xB) and finish with an stop-sentinel (0xF) and LRC checksum.

Add preamble and postamble clocks

If enabled the Magstripe output will generate 16 preamble clock cycles before the message and 16 postamble clock cycles afterwards.

Prefix

Constant prefix value transmitted before the ID-number. Max. 16 digits.

ID-number

Select to output the ID-number complete, left aligned or right aligned.

When left or right aligned specify the ID-length and offset in bits.

Convert to decimal

Enable to convert the ID-number to a decimal value. Default enabled because hexadecimal characters should be avoided within the ID-number. Hexadecimal characters are according to the ISO7811/2 standard reserved for message control.

Suffix

Constant suffix value transmitted after the ID-number. Max. 16 digits.

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Magstripe configuration example:

The configuration shown below will generate a Magstripe message. The ID-number uses the 6 least significant hex digits (right aligned) and they are converted to 8 decimal digits.

MACE UID64 B03BF925E6F04D34 → ID-number 0xF04D34 = 15.748.404.

After adding the start, stop-sentinel and LRC this results in message:

B15748404FB

Protocol

Unconfigured (default)

Wiegand

Magstripe

ID number

Right aligned

Length in digits

6

Offset in digits

0

Convert to decimal

Add start, stop-sentinel and LRC

Add preamble and postamble clocks

Prefix (max 16 digits)

Suffix (max 4 digits)

Figure 8: Example Magstripe configuration

4.6 MISCELLANEOUS

4.6.1 FIRMWARE UPDATE

When the MaceConfigTool software is connected to a reader, it automatically checks the firmware version of the MACE reader. If necessary the software recommends to perform a firmware update. A recent firmware version has been installed on your computer together with the software.

The firmware update can also be used to change from STANDARD to OSDP firmware (or vice versa).

Firmware update procedure;

- Start MaceConfigTool software.
- Connect with MACE reader.
- Go to FIRMWARE UPDATE.
- Select the firmware file (e.g. Mace_v140.nis or MaceOSDP_v101.nis).
- Click Update and wait until completed.

When the firmware update is completed, the software will reconnect. Upon reconnect, make sure to select the correct protocol and baud rate setting. This might have been changed due to different firmware.

4.6.2 KEY UPDATE

The key update function updates the masterkey in the MACE reader.

The MACE authentication keys (for BLE, NFC and QR) are diversified to ensure a unique security key per credential. The diversification is done using a shared masterkey. The key update function updates the masterkey in the MACE reader.

Important notice;

After the key update the MACE reader will only read updated credentials. Make sure to synchronize the update for readers and credentials (step 2 and 3).

Step 1. Start key update;

- Login to the MACE Admin Portal and start update masterkey.
- Download the encrypted masterkey update file (.nkey file).

Step 2. Key update procedure;

- Start MaceConfigTool software.
- Connect with MACE reader.
- Go to KEY UPDATE.
- Select the key update file (e.g. default.nkey).
- Click Update and wait until completed.

Step 3. Finish key update;

- Login to the MACE Admin Portal and finish update masterkey. This will update the credentials.

A TECHNICAL SPECIFICATIONS

Technical information	Mace reader MM (QR)
Operating frequency	Bluetooth Low Energy 2.402 – 2.480 GHz NFC & smartcards: 13.56 MHz Proximity cards: 120 kHz
Dimensions	150 x 50 x 40 mm [5.9 x 2 x 1.6 inch]
Weight	0.5 kg [1.1 lbs]
Housing	Aluminum (Zamak5) chassis with polycarbonate cover
Color	RAL9006 cover and RAL7016 chassis
Protection	IP65 [approx.NEMA4x]
Detection range	Bluetooth Low Energy: configurable up to 25 cm (proximity), 2m (short), 5m (medium) or 15m (long). NFC, smartcards and proximity cards: up to 5cm.
Supported RFID cards	ISO14443-3A, Mifare DESFire (EV1), Mifare Classic, Mifare Ultralight, Mifare Plus (SL3) ISO15693, HID iCLASS (UID only), MACE Card Nedap XS, Nedap RW80, EM4200 (and compatible) HID Prox, AWID Proximity/LF
Barcode scanner	QR-code (QR1, QR2, QR micro), as well as most mainstream 1D and 2D barcodes.
Operating temperature	-30 ... +60°C [-22 ... +140°F]
Power	12 ... 24 VDC (from power-limited UL294 or UL603 Listed power source)
Current consumption	0.4A@12VDC, 0.2A@24VDC
Input	2 TTL digital inputs for LED control (RED/GREEN) 1 TTL digital input for beeper control
Tamper indication	Yes, magnetic tamper switch
Cable	Fixed cable length of 5 meters [16.4 ft.] included (pigtail)
Cable length	Wiegand 150 m [500 ft.] 22AWG RS485 1200 m [3950 ft.] when installed properly
Interfaces	RS485 and USB service interface, additional interfacing options exist. Please consult your representative.
Output	Wiegand, Magstripe (clock & data)
Compliance	Europe R&TTE Directive 1999/5/EC USA: FCC Title 47 Part 15B and 15C Canada: ISED ICES-003 and RSS210.
Certifications	Safety: EN60950-1 EMC: EN301489 Telecom: EN330 330 and EN300 328 Human Exposure assessment: ICNIRP Guidelines, EN62369 and EN50364 UL294
UL	UL294 6th ed. Note: QR-code reader has a temperature restriction of max. 49 degrees Celcius ACCESS CONTROL LEVELS: Destructive attack Level I; Endurance Level IV; Line Security Level I; Power Standby Level I "Wiring methods shall be in accordance with the National Electrical Code, ANSI/NFPA70"

B PART NUMBERS

Readers	Part number	Description
	9565523	MACE MM
	9565531	MACE MM QR

C FCC AND ISED DECLARATIONS

FCC ID: CGDMACER1 and IC: 1444A-MACER1

FCC (15.19) and ISED Compliance statement

This device complies with part 15 of the FCC Rules and to RSS210 of Industry Canada. Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

Warning (15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Cet appareil se conforme aux normes RSS 210 exemptés de license du Industry Canada. L'opération est soumis aux deux conditions suivantes:

- (1) cet appareil ne doit causer aucune interférence, et
- (2) cet appareil doit accepter n'importe quelle interférence, y inclus interférence qui peut causer une opération non pas voulu de cet appareil.

Les changements ou modifications n'ayant pas été expressément approuvés par la partie responsable de la conformité peuvent faire perdre à l'utilisateur l'autorisation de faire fonctionner le matériel.

FCC and ISED Radiation Exposure Statement

This equipment complies with FCC (OET Bulletin 65) and Canadian radiation exposure limits set forth in RSS-102 for a uncontrolled environment. This equipment should be installed and operated with a minimum distance of 3 mm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme a RSS-102 limites énoncées pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 3 mm entre le radiateur et votre corps.

ISED EMC Declaration

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de Classe B est conforme à la norme Canadienne ICES-003.

FCC Information to the user (15.106(b))

Note: This equipment has been tested and found to comply with the limits for a class B digital devices, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequent energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does not cause harmful interference to radio or television reception, which can be determine by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver.
- Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- To ensure compliance with FCC regulations, use only the shielded interface cables provided with the product, or additional specified components or accessories that can be used with the installation of the product.

D DISCLAIMER

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E DOCUMENT REVISION

Version	Date	Comment
1.21	2018-07-11	Included extra BLE background information
1.20	2018-05-08	Updated tamper switch info
1.19	2018-04-17	TX Correction Value translated to understandable Ranging fine tune option
1.18	2017-12-15	Added support for reading HID-PROX and AWID Proximity/LF
1.17	2017-11-06	Corrected small typo errors
1.16	2017-10-02	Added ISO15693 read multiple blocks
1.15	2017-08-23	Additional description inputs and outputs
1.14	2017-08-15	Added OSDP
1.13	2017-07-03	Technical specifications updated
1.12	2017-01-24	Correctly spelling mistakes
1.11	2017-01-15	Added Key update procedure and configurable ID-source values
1.10	2016-12-05	Updated Wiegand configuration settings (chapter 4.5.1)
1.9	2016-11-24	Updated for UL certification
1.8	2016-10-31	Added Nedap user mode
1.7	2016-09-21	Added barcode scanner specifications
1.6	2016-09-07	Added MACE card config option
1.5	2016-08-18	Power supply specifications updated
1.4	2016-08-18	Added FCC and ISED declarations
1.3	2016-08-08	BLE note added when changing ranging profile
1.2	2016-07-15	Added simple and advanced user mode settings
1.1	2016-07-07	Added reader configuration chapter
1.0	2016-06-21	First preliminary release