

NVITE

installation guide

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1 Introduction

1.1 NVITE

NVITE is a multiple technology reader that reads contactless smartcards, low frequency proximity cards, 1D and 2D (QR) barcodes and supports Bluetooth Low Energy (BLE) and Near Field Communication (NFC).

NVITE can be used in combination with any parking, access control or logistics management system that requires the swift identification.

Identification is depending on the user-enabled technologies: presenting a card, scanning a barcode or activating a smartphone credential.

Please remember to fill out the ‘How to Order Guide’ to prepare your NVITE reader installation.

1.2 Firmware versions

The NVITE 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 v2.1.7 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.

OSDP (Open Supervised Device Protocol) is an access control communications standard developed by the Security Industry Association (SIA). The OSDP protocol specification can be obtained from the website;
www.securityindustry.org/industry-standards/open-supervised-device-protocol.

2 Installation

2.1 Safety instructions

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

- The NVITE reader may only be installed and serviced by qualified service personnel.
- Disconnect the power supply before (dis)connecting any wires, the reader 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 reader other than mentioned in this installation guide or indicated by Nedap.

2.2 Mounting instructions

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

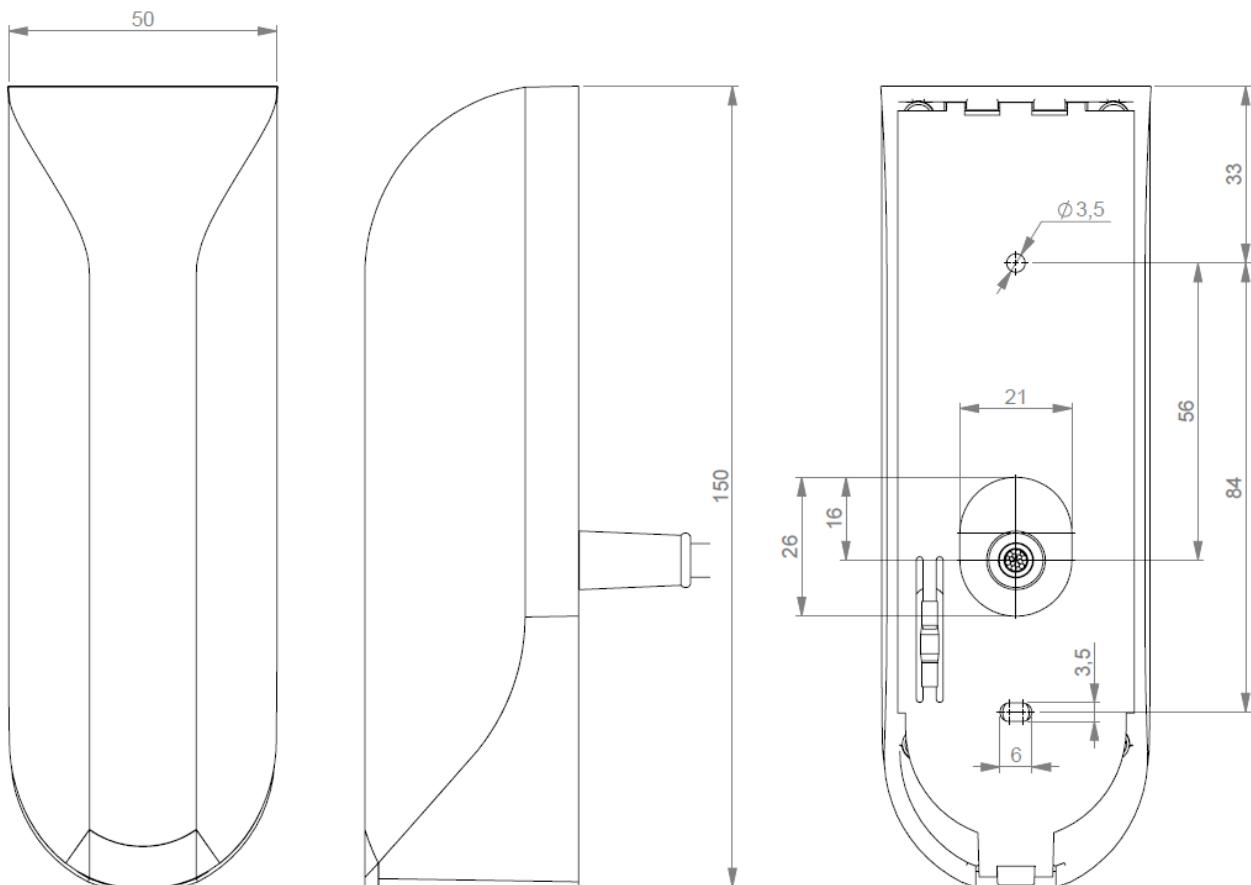


Figure 1: NVITE reader dimensions (mm)

Mount the base-plate on the required location.

Ensure that it is placed correctly covering the cable entry hole.

The cable entry hole must be at least 11mm in diameter.

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.

Screws and plugs are included.

Install the NVITE reader onto the base-plate:

1. Feed the cable through the cable entry hole. Minimum cable bending radius 30mm.
2. Attach the top of the reader onto the base-plate.
3. Fix the assembly using the screw on the bottom.

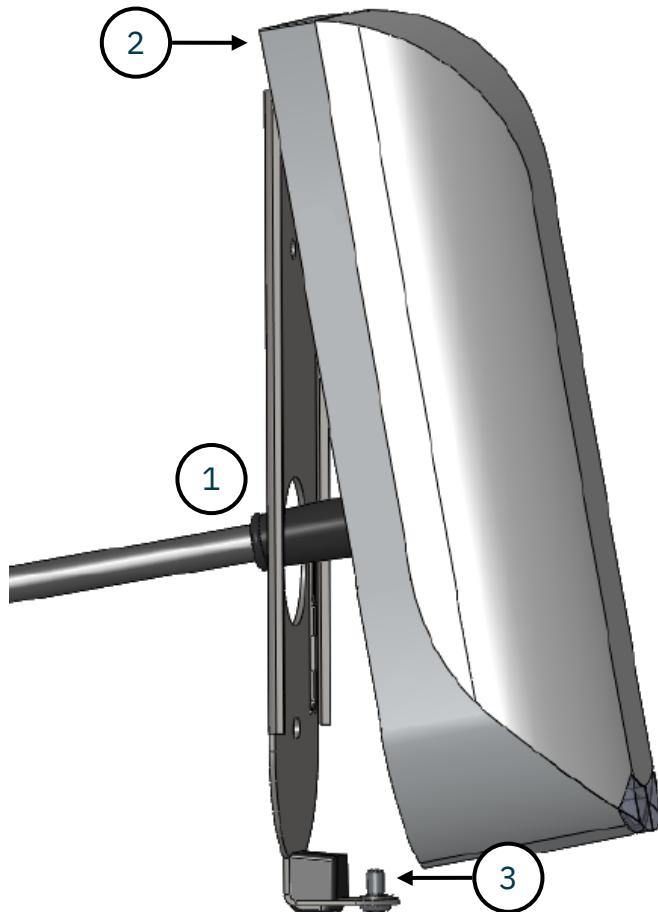


Figure 2: NVITE reader installation

3 Connections

The NVITE reader 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 / CLK |
| PINK | Data-1 / DAT |
| YELLOW | Tamper switch (normally closed) |
| GRAY/PINK | Tamper switch (common) |
| RED/BLUE | LED_UL_IN (UL = unlock) |
| WHITE | LED_NA_IN (NA = not authorized) |
| PURPLE | Nedap antenna interface. Connect to ANT |
| BLUE | BEEP_IN |
| SHIELD | Shield |

Notes

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).

3.1 Power supply

The NVITE reader 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 NVITE 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 | Shield connected to DC-ground |

For details about reader configuration see chapter 4.

STANDARD firmware

This is the default NVITE reader firmware version and implements a simple CR/LF protocol. The RS485 output message format is described in chapter 4.5.1. Default baud rate is 115200. See chapter 4.2.4 for details about baud rate setup.

OSDP firmware

The NVITE reader has implemented the OSDP protocol including the Secure Channel Protocol. Default baud rate is 9600. This may be changed using the OSDP_COMSET command.

Perform a firmware update to change from STANDARD to OSDP (or vice versa).

The firmware update procedure is described in chapter 4.6.1.

RS485 point-to-point communication

Termination resistors (120Ω) are recommended to prevent unwanted signal reflections on long RS485 communication lines. The resistors should be installed at both ends of the communication line.

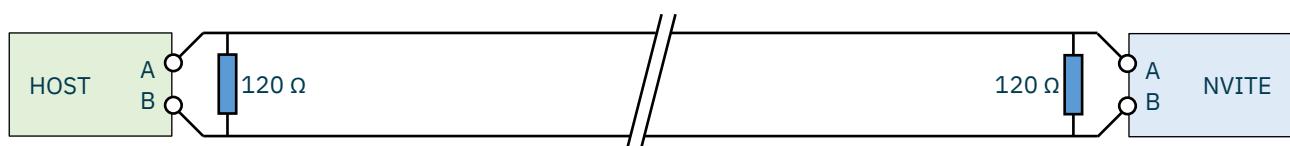


Figure 3: RS485 point-to-point communication

Notes

- Use shielded twisted pair cable when extending the RS485 wiring beyond the standard 5 meter cable.
- Maximum RS485 cable length 1200 meters (4000 feet).
- The RS485 interface is disabled while the USB interface is in use.

RS485 multi-drop communication

Multi-drop communication requires an addressable communication protocol, such as OSDP.

Termination resistors (120Ω) are recommended to prevent unwanted signal reflections on long RS485 communication lines. The resistors should be installed at both ends of the communication line. See Figure 4 below.

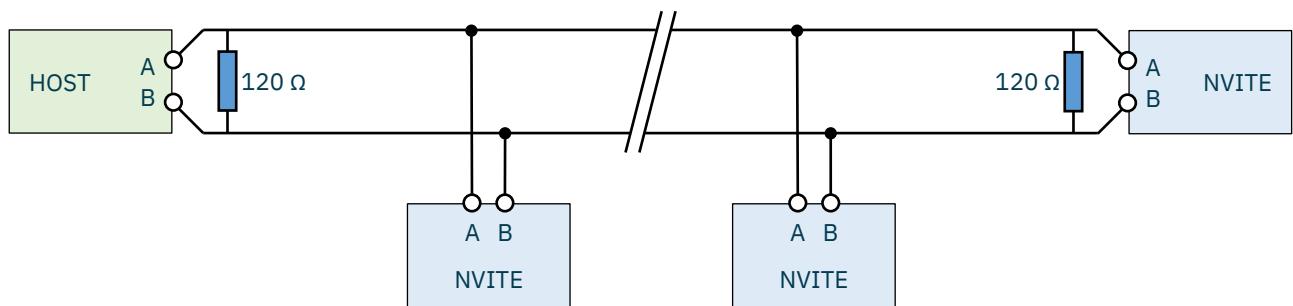


Figure 4: RS485 multi-drop communication

Notes

- Use shielded twisted pair cable when extending the RS485 wiring beyond the standard 5 meter cable.
- Maximum RS485 cable length 1200 meters (4000 feet).
- The RS485 interface is disabled while the USB interface is in use.

3.2.2 USB

The NVITE 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 reader is lifted away from the base-plate. This ensures that unauthorized modifications to the reader settings can be detected using the tamper switch.

USB Driver installation

Make sure your computer is connected with internet. Connect the NVITE reader to your computer via the USB cable. The USB drivers may be installed automatically. In case you need to install the USB drivers manually, please go to the website www.ftdichip.com/Drivers/VCP.htm and download the VCP (Virtual Com Port) drivers. After successful installation of the USB drivers the reader will appear in the Windows device manager in "Ports (COM & LPT)" section.

Notes

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

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 | Data-0 |
| PINK | Data-1 |
| BLACK | Ground (0V) |
| SHIELD | Shield connected to DC-ground |

Message format

The Wiegand output format is determined by the programming format of the credential. Wiegand formatted 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.

Wiegand timing

In the figure below the Wiegand protocol timing is specified.

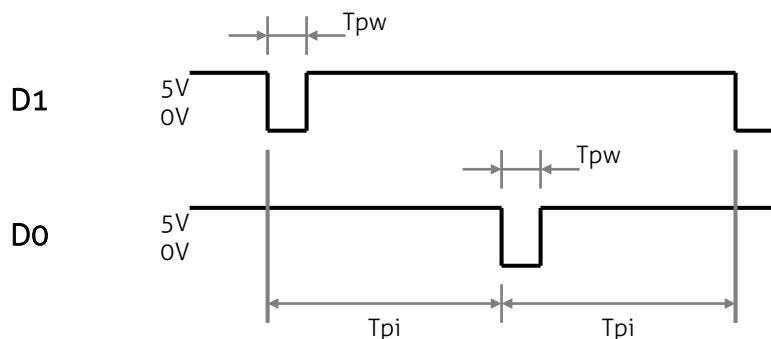


Figure 5: Wiegand protocol timing

Timing constants

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

OSDP firmware

The OSDP firmware does not support the Wiegand interface!

3.2.4 Magstripe ISO7811/2

The Magstripe ISO7811/2 (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. Magstripe formatted 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.

Magstripe timing

The figure below shows the timing for one magstripe numeric character.

Each character contains 5 bits: 4 data bits (lsb first) and 1 parity bit (odd).

See for more details about encoding and character set the ISO7811/2 documentation.

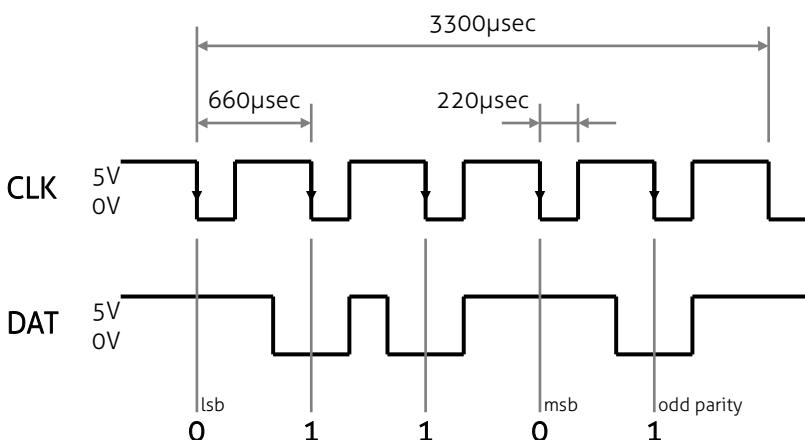


Figure 6: Magstripe (clock and data) character timing

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!

3.3 Inputs

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

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

Connections

| | |
|----------|----------------------------------|
| RED/BLUE | Input 0 - LED_UL_IN (active-low) |
| WHITE | Input 1 - LED_NA_IN (active-low) |
| BLUE | Input 2 - BEEP_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 details about LED/buzzer control in chapter 4.3.2.

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.

3.4 Outputs

The NVITE reader has 2 digital outputs. The function of the digital outputs is dependent upon the installed firmware version. See description 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. Please ensure to install a flyback diode across the relay inductor to avoid voltage spikes.

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 (Data-0 / CLK) |
| PINK | Output 1 (Data-1 / 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 |

3.5 Tamper switch

An internal magnet and reed contact 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) |
| GRAY/PINK | 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

OSDP firmware

The tamper switch status is reported through OSDP_LSTATTR event messages

3.6 Nedap antenna interface

The Nedap antenna interface is used to connect the NVITE reader to a TCC270 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 |

OSDP firmware

The OSDP firmware does not support the Nedap antenna interface!

Notes

- Nedap XS formatted credentials are required to use the Nedap antenna interface!
- Extending this connection, beyond the pig tail length, shall ONLY be allowed using coaxial cable; RG58U.
- Maximum cable length (including extension) shall be < 100 meters (350 feet).

4 Reader configuration

The NVITE reader can be configured easily using the NVITE configuration 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 Configuration software

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

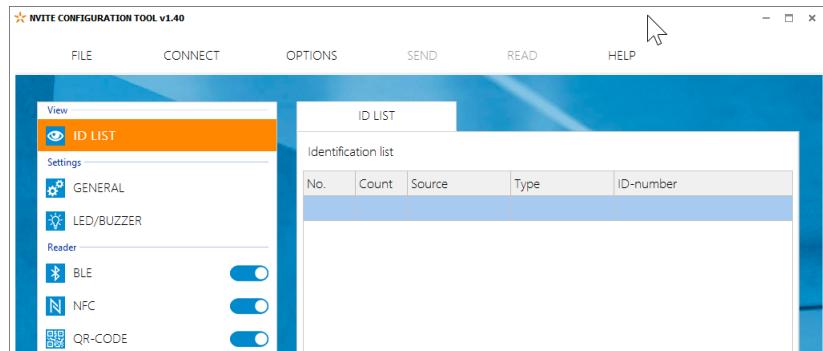


Figure 7: NVITE configuration software

Start the NVITE configuration 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 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 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 **nvite**.

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 baud rate

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.

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 reader 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 reader has no configuration password.

Nedap customer codes

The NVITE 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 a different customer code.

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

Identifiers without customer code

Other tags or credentials may not have a customer code. For example MIFARE DESFIRE cards, custom QR-codes or the Mobile ID Raw ID64 credentials. Enable or disable 'Allow reading ID-numbers without customer code'.

Heater

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

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

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.

LED/buzzer control

Automatic mode

The NVITE reader will automatically set the LED color and optionally beep upon identification.

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

These colors can be changed with the NVITE configuration software.

Remote (inputs)

The LED and buzzer can be controlled remotely by an access control system by activating digital inputs (active low).

Two digital inputs are used (LED_UL_IN and LED_NA_IN) to set the LED color. With the combination of these 2 input, 4 different colors can be selected. For each of the 4 LED input combinations you may choose one of the following colors; GREEN, RED, BLUE, YELLOW, CYAN, PINK, WHITE or OFF.

Use NVITE configuration software to setup the LED/buzzer control mode and configure the corresponding LED colors. See screenshot below.

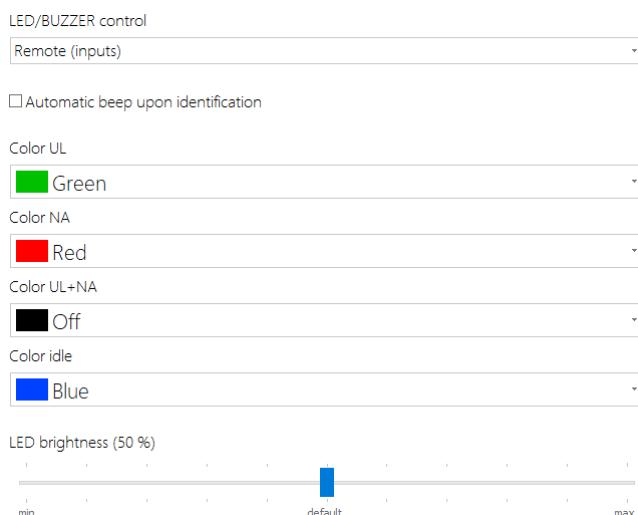


Figure 8: Remote LED/buzzer control settings

See chapter 3.3 for input connection details.

Direct (serial cmd)

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%.

OSDP firmware

Use the OSDP_LED command to control the LED.

Automatic mode and Remote control are not supported.

4.4 Reader settings

4.4.1 BLE

The NVITE Bluetooth Low Energy (BLE) reader complies with the Bluetooth Core specification 4.1. The NVITE reader implements the Bluetooth peripheral role (connectable beacon).

Mobile-apps can scan for nearby readers and can send their ID-number securely to the reader.

The NVITE reader firmware implements the Nedap Mobile ID protocol.

The Mobile ID protocol uses secure authentication based upon AES128-bit encryption with diversified keys.

Separate Mobile ID documentation is available on request.

Enable

Enable BLE. This automatically starts the Bluetooth advertising.

Default Bluetooth device name

Enable to have the default Bluetooth device name compliant with the ranging format (f CC P NN).

This may be required by the mobile-app for ranging purposes.

The default Bluetooth device name will be 6 characters, for example "n08S4E".

f Reader function.

CC TX output power (default 08) - ranging fine tune slider value (default 0).

P Ranging profile; S = short range.

NN Reader identification sequence number.

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 mobile-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 (available for both iOS and Android devices) is found to be a very useful tool during configuration of the NVITE reader. The app gives an overview of all advertising Bluetooth devices nearby and allows to manually connect and disconnect with a certain Bluetooth device (in order to refresh its cache name).

Ranging profile

The NVITE reader can advertise the requested BLE read range in its device name.

BLE ranging must be implemented in the mobile-app!

Choose one of the BLE read range profiles:

- P Proximity range
- S Short range
- M Medium range
- L Long range

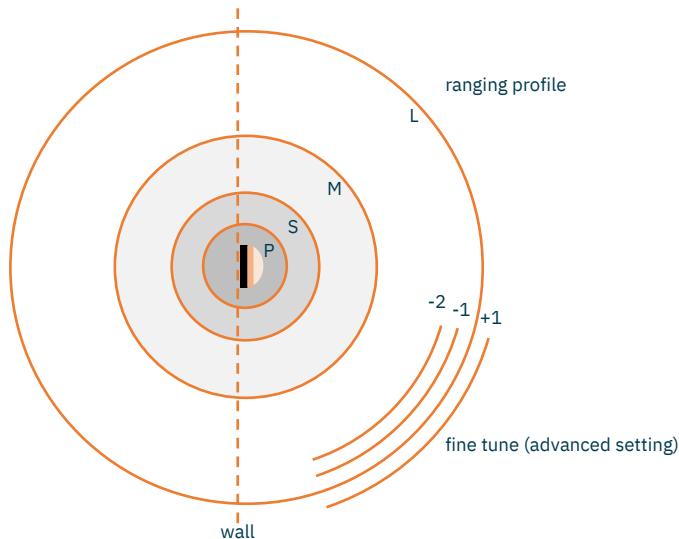


Figure 9: Top view BLE ranging profiles

In theory, Bluetooth is omnidirectional, which means that the signal strength is the same in all directions (see Figure 9). 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 9 won't be circular, but more capricious of shape.

Ranging fine tune

Set the ranging fine tune slider to a positive value to increase the read range.

Decrease the ranging fine tune slider to get a shorter read range.

The ranging fine tune slider value will adjust the tx power value in the advertising message.

Be careful with setting the read range too short. There is a lot of variation in performance of Bluetooth communication across the wide range of available smartphones. Please take this into account when configuring the reader(s).

BLE ranging must be implemented in the mobile-app!

Reader function

Select the reader function. This might indicate to the mobile-app the specific function of the reader.

Reader sequence number

Used for reader identification. The sequence number can be any 2 digit hexadecimal number.

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.

See below the possible TX power settings and the corresponding value (CC) in the Bluetooth device name.

| TX power | Range fine tune setting | Bluetooth device name (f CC P NN) |
|----------|-------------------------|-----------------------------------|
| 8 dBm | 0 | f08PNN |
| 6 dBm | 0 | f06PNN |
| 2 dBm | 0 | f02PNN |
| -2 dBm | 0 | fFE PNN |
| -7 dBm | 0 | fF9PNN |
| -11 dBm | 0 | fF5PNN |
| -15 dBm | 0 | fF1PNN |
| -19 dBm | 0 | fEDPNN |
| 8 dBm | Longer +1 | f07PNN |
| 8 dBm | Shorter -1 | f09PNN |

4.4.2 NFC

Near Field Communication (NFC) is a wireless communication technique operating on 13 MHz.

Read range is only a few centimeters.

The NVITE reader firmware implements the Nedap Mobile ID protocol.

The Mobile ID protocol uses secure authentication based upon AES128-bit encryption with diversified keys.

Separate Mobile ID documentation is available on request.

Notes

- Android version 4.4 (KitKat) or newer is required with host card emulation (HCE) supported.
- NFC is currently not supported on Apple iOS.

Enable

Enable NFC Mobile ID reading.

Application ID, file number, data length and offset

For NFC Mobile ID the following settings are required:

Application ID: A0000007151001

File number: 0

Data length: 0

Data offset: 0

4.4.3 QR-code

The barcode scanner can be used to read QR-codes or barcodes from a smartphone display or printed paper.

Default settings are good when the QR-codes contain text with a hexadecimal number. See advanced settings below for details about using custom text barcodes.

Enable

Enable or disable the barcode scanner.

Aiming beam / illuminator

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

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

Check prefix / suffix

The prefix and/or suffix may be used to only read tag that contain specific leading or trailing text characters or to find the id-number within a longer text string. The prefix/suffix characters will be removed from the output. Also the prefix/suffix do not have to be at the start or end of the barcode.

Example barcode "<name=Hans><id=00123><country=NL>".

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

This will result in the barcode ID-number 00123.

Fixed offset / data length

The offset and data length settings are useful to read only a substring of a longer barcode text.

Offset value 1 means to skip the first character of the barcode string.

Example barcode "123456789".

When fixed offset = 0 and fixed data length = 5 then the output would be 12345.

When fixed offset = 2 and fixed data length = 5 then the output would be 34567.

You can use the Check prefix or the fixed offset, but not both options simultaneously.

You can use the Check suffix or the fixed data length, but not both options simultaneously.

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.

Text strings can only be sent on the serial output (not on Wiegand or Magstripe as these support only numeric values).

4.4.4 DESFIRE

The NVITE reader features a universal smartcard reader. It supports reading MIFARE DESFIRE (EV1/EV2/EV3) cards.

Enable

Enable or disable DESFIRE card reading.

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

DESFIRE 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 (a single digit).

For example file data is 0123456~~789~~ABCDEF.

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.

Example DESFIRE configuration

See below an example DESFIRE configuration.

Enable Desfire

| | |
|-------------------------------------|--------------------------|
| Data to read | File data |
| Byte order | Normal |
| Application ID (AID) | F12345 |
| File number | 2 |
| Communication mode | Enciphered |
| Data length in nibbles (0=complete) | 8 |
| Data offset in nibbles | 0 |
| Authentication | AES |
| Key number | 1 |
| Read key | •••••••••••••••••••••••• |
| Data conversion | No conversion |

Figure 10: Example DESFIRE configuration

4.4.5 MIFARE

The NVITE reader supports reading MIFARE Classic, MIFARE Ultralight (C) and MIFARE Plus cards (SL3) cards.

Enable

Enable or disable MIFARE card reading.

Data to read

Select what to read from the MIFARE card;

- CSN (can be 4-byte or 7-byte)
- MIFARE Classic sector data
- MIFARE Ultralight (C) data
- MIFARE Plus SL3

Byte order

Select byte order normal or reversed.

For example CSN normal is = A2 07 6E 43, CSN reversed is = 43 6E 07 A2

Sector and block number

Select sector using fixed sector number within range from 0 to 39.

Block number to read data from. The block number must be in range from 0 to 3.

For sectors 32 to 39 the block number can range from 0 to 15.

MAD (Mifare Application Directory)

When using MAD the AID and MAD Key must be given.

MAD key for MIFARE Classic is normally A0A1A2A3A4A5.

MAD key for MIFARE Plus SL3 is normally A0A1A2A3A4A5A6A7 A0A1A2A3A4A5A6A7.

Page number

MIFARE Ultralight page number to read data from. Must be in range from 0 to 15.

Authentication

Enter the read key. The key length is dependent upon MIFARE card type;

MIFARE Classic key length is 6 bytes (e.g. A1 23 B4 56 C7 89).

MIFARE Ultralight C key length is 16 bytes.

MIFARE Plus SL3 key length is 16 bytes.

For normal MIFARE Ultralight (C) the 3DES authentication may be enabled or skipped.

For MIFARE Classic specify if KeyA or KeyB must be used for reading (usually KeyA).

Data length and offset

Select the data length and offset in nibbles. Nibbles are half bytes (a single digit).

Each MIFARE Classic data block contains 16 bytes data = 32 nibbles.

For example sector data contains 12345000000000000000000000000000.

Set data length to 5 and offset to 0 -> This will result in the ID-number 12345.

Data conversion

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

Example MIFARE Classic configuration

See below MIFARE Classic example configuration for fixed sector data reading.

| | |
|---|----------------------------|
| <input checked="" type="checkbox"/> Enable Mifare | |
| Data to read | Mifare Classic sector data |
| Sector select | Fixed |
| Sector number | 2 |
| Block number | 1 |
| Key select | Key A |
| Read key | •••••••••••• |
| Data length in nibbles | 8 |
| Data offset in nibbles | 0 |
| Byte order | Normal |
| Data conversion | No conversion |

Figure 11: Example MIFARE Classic configuration

Example MIFARE Ultralight configuration

See below MIFARE Ultralight example configuration for fixed sector data reading.

| | |
|---|------------------------------------|
| <input checked="" type="checkbox"/> Enable Mifare | |
| Data to read | Mifare Ultralight data |
| Page number | 1 |
| Authentication | 3DES authentication (Ultralight C) |
| Read key | •••••••••••••••••••••••• |
| Data length in nibbles | 8 |
| Data offset in nibbles | 0 |
| Byte order | Normal |
| Data conversion | No conversion |

Figure 12: Example MIFARE Ultralight configuration

4.4.6 LEGIC

The NVITE reader features a universal smartcard reader.
It also supports reading LEGIC Advant and LEGIC Prime cards.

Enable

Enable LEGIC Advant – ISO15693

Enable LEGIC Advant – ISO14443A

Enable LEGIC Prime

Search

The reader can search for a specific LEGIC segment. Up to 3 searches can be defined. When search 1 is found, the next are not performed anymore.

Search for data or access segment by segment number or segment stamp.

Data

When a LEGIC segment search was successful, data can be read from that segment.

Specify here what data should be read; UID, stamp or segment data.

Up to 3 data definitions can be allocated to 1 or more specific search definitions.

Example

See below LEGIC configuration for reading Kaba Group Header segment (KGH).

- Enable LEGIC Advant - ISO15693
- Enable LEGIC Advant - ISO14443A
- Enable LEGIC Prime

| SEARCH 1 | SEARCH 2 | SEARCH 3 |
|---------------------------------|---------------------|----------|
| Search enable | With segment search | |
| Segment number | 0 | |
| Segment type | Data segment | |
| Segment stamp search | 02 | |
| Stamp length (LEGIC prime only) | 4 | |

| DATA A | DATA B | DATA C |
|------------------------------|---|--------|
| Allocation of data to search | <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input checked="" type="checkbox"/> 3 | |
| Data type | Segment data | |
| Data address | 0 | |
| Data length (in bytes) | 3 | |

Figure 13: Example LEGIC configuration

4.4.7 Other ID types

The NVITE 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.

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 for more details about Nedap customer codes.

Nedap RW80

Enable reading Nedap RW80 cards.

EM4200

Enable reading EM4200 (and compatible) RFID cards.

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.

NVITE/MACE Card

Enable reading NVITE/MACE Card, which is a specifically by Nedap programmed DESFIRE card.

The MACE Cards may be programmed with a Wiegand or Nedap XS formatted number.

HID iCLASS

Enable reading HID iCLASS.

Read access control ID: The access control ID is the Wiegand formatted ID number programmed in the application area. The reader will automatically perform a secure authentication using the default encryption key.

Read UID: The HID iCLASS UID is a read-only 8-byte unique ID.

ISO15693

Enable reading ISO15693. Reading the UID and/or multiple data blocks is supported. No authentication is performed. Different RFID cards comply with this standard, for example NXP ICODE SLI(X).

Read UID: The ISO15693 UID is a 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.

Sony Felica

Enable reading Sony Felica UID. The Sony Felica UID is a read-only 8-byte unique ID.

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:

```
CMD      OSDP_RAW (fixed value 0x50)
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
- '05' MIFARE
- '06' DESFIRE
- '07' ISO15693
- '08' HID iCLASS
- '09' MACE Card
- '0A' LEGIC
- '0B' Sony Felica

Add ID-type

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

- '00' RAW
- '08' Raw ID64 (8-byte id-number)
- '10' Raw ID128 (16-byte id-number)
- '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.

Example

Mobile ID Raw ID64 on BLE.

STANDARD firmware: '40050108B03BF925E6F04D34'<CR><LF>

'4005' = prefix

'01' = id-source BLE

'08' = id-type Raw ID64

'B03BF925E6F04D34' = id-number

OSDP firmware: 50, 00, 00, 50, 00, 01, 08, B0, 3B, F9, 25, E6, F0, 4D, 34

50 = command (OSDP_RAW)

00 = reader number (fixed value 0 = first reader)

00 = format code (fixed value 0 = raw bit array)

50 = data bit count LSB (hex 50 = 80 bits)

00 = data bit count MSB

01 = id-source BLE

08 = id-type Raw ID64

B0, 3B, F9, 25, E6, F0, 4D, 34 = id-number

Prefix and suffix settings are not used in OSDP firmware.

4.5.2 Wiegand/magstripe

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

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!

4.5.2.1 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.

4.5.2.2 Wiegand

Select Wiegand to manually configure the Wiegand message output format.

In case the card ID-numbers are already programmed in the Wiegand or Magstripe format, then the below settings will not be used.

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 |
| 5 | 00000101 | MIFARE |
| 6 | 00000110 | DESFIRE |
| 7 | 00000111 | ISO15693 |
| 8 | 00001000 | HID iCLASS |
| 9 | 00001001 | MACE Card |
| A | 00001010 | LEGIC |
| B | 00001011 | Sony Felica |

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.

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'.

The conversion will 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).

Example Wiegand configuration

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).

Mobile ID Raw ID64 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 NNNNNNNNNNNNNNNNN P

Figure 14: Example Wiegand 26-bit configuration

4.5.2.3 Magstripe

Select Magstripe to configure the Magstripe message output format.

In case the card ID-numbers are already programmed in the Wiegand or Magstripe format, then the below settings will not be used.

Magstripe output message format:

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

Add start, stop-sentinel and LRC

This should normally remain enabled. According to the Magstripe ISO7811/2 standard the messages should begin with a start-sentinel (0xB) and finish with a 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.

Example Magstripe configuration

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.

Mobile ID Raw ID64 B03BF925E6F04D34 → ID-number 0xF04D34 = 15.748.404.

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

B15748404FB

The screenshot shows a configuration interface for a Magstripe message. It includes sections for Protocol selection, ID number settings, and various checkboxes for message construction.

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): [empty]

Suffix (max 4 digits): [empty]

Figure 15: Example Magstripe configuration

4.6 Miscellaneous

4.6.1 Firmware update

When the NVITE configuration software is connected to a reader, it automatically checks the firmware version of the reader. If necessary the software recommends to perform a firmware update. Recent reader firmware versions are included within the software.

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

Firmware update procedure:

- Start NVITE configuration software.
- Connect with NVITE reader.
- Go to FIRMWARE UPDATE.
- Select the firmware (e.g. NVITE STANDARD firmware v1.55).
- 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 BLE and NFC authentication masterkeys for the Mobile ID protocol in the NVITE reader.

The Mobile ID authentication keys 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 NVITE reader.

Key update procedure:

1. Generate a new masterkey.
2. Update masterkey in NVITE reader(s).
3. Update the mobile credentials with new diversified keys.

See the separate Mobile ID documentation for more details about the masterkey generation procedure.

To update the masterkey in the reader, select the encrypted key update file (*.nkey) and click Send.

Note

Make sure to synchronize the update for readers and credentials (steps 2 and 3).

After the key update the NVITE reader will only read updated mobile credentials.

Authentication will fail upon Mobile ID credentials that have not been updated.

A Technical specifications

| Item | Specification |
|--------------------------|---|
| Part number | 9566945 - NVITE Reader - model NVR2001 |
| Dimensions | 150 x 50 x 40 mm (5.9 x 2 x 1.6 inch) |
| Color | RAL9006 cover and RAL7016 chassis |
| Weight | 0.5 kg (1.1 lbs) |
| Protection class | IP65 (approx. NEMA4x) |
| Material | Aluminum (Zamak5) chassis with polycarbonate cover |
| Operating temperature | -20 to +60 °C (-4 to +140 °F) |
| Storage temperature | -20 to +60 °C (-4 to +140 °F) |
| Relative humidity | 10 to 93 % relative humidity, non-condensing |
| Power supply | 12 to 24 VDC (from power-limited UL294 or UL603 listed power source) |
| Power consumption | 0.4A @ 12 VDC, 0.2A @ 24VDC |
| Read range | Bluetooth low energy: up to 15 meter (may be restricted by mobile-app) NFC, LF proximity cards and smartcards: up to 5 cm |
| Barcode scanner | QR-code (QR1, QR2, QR micro), as well as most mainstream 1D and 2D barcodes |
| Operating frequency | Bluetooth low energy: 2.402 to 2.480 GHz NFC and smartcards: 13.56 MHz Proximity cards: 120 kHz |
| Supported RFID cards | 120 kHz: Nedap + EM4200 + HID-PROX + AWID-LF 13.56 MHz: ISO14443A, MIFARE DESFIRE (EV1/EV2/EV3), MIFARE Classic, MIFARE Ultralight (C), MIFARE Plus (SL3), ISO15693, HID iCLASS, LEGIC Advant, LEGIC Prime and Sony Felica. |
| Communication interfaces | RS485, USB service interface |
| Communication protocols | CR/LF, OSDP |
| Relay output | No relay output |
| Input | 2 TTL digital inputs for LED control, 1 TTL digital input for beeper control |
| Output | 2 open-collector outputs (OSDP) Wiegand, Magstripe ISO7811/2 (clock & data) |
| Max. cable length | Fixed cable length of 5 meter (16.4 ft) included pigtail Wiegand 150 meter (500 ft) 22 AWG RS485 1200 meter (4000 ft) when installed properly |
| Tamper switch | Magnetic switch, normally closed |
| Standards | Europe RE Directive 2014/53/EU Safety: EN62368-1 EMC: EN301 489, EN55032, EN55035, EN61000-6-2, EN61000-6-3 Radio: EN330 330 and EN300 328 Human Exposure assessment: ICNIRP Guidelines, EN62369 and EN50364 USA: FCC Title 47 Part 15B and 15C, 47 CFR § 1.1310 and UL 294. Canada: RSS-Gen, RSS-210, RSS-102, SPR-002 and ICES-003. |

B Disposal of equipment

The products will be disposed of by the end-user and discharge Nedap for any liability or responsibility thereof.



The WEEE symbol in Europe indicates that the relevant electrical product or battery should not be disposed of as general household waste in Europe. To ensure the correct waste treatment of the product and battery, please dispose them in accordance to any applicable local laws of requirement for disposal of electrical equipment or batteries. In so doing, you will help to conserve natural resources and improve standards of environmental protection in treatment and disposal of electrical waste (Waste Electrical and Electronic Equipment Directive WEEE 2012/19/EU).

C CE declaration

Hereby NEDAP N.V. declares that the subject equipment is in compliance with the directives 2014/53/EU (Radio Equipment Directive) and 2011/65/EU (Restriction of the use of certain hazardous substances). The full text of the EU declaration of conformity is available on <https://portal.nedapidentification.com>.

D FCC and ISED statement

FCC ID: CGDNVR2001 and IC: 1444A-NVR2001

FCC and ISED Compliance statement

This device complies with part 15 of the FCC Rules and contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions: (1) this device may not cause interference and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage et (2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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 an 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 à CNR-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

This equipment has been tested and found to comply with the limits for a Class B digital device, 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 frequency 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 cause harmful interference to radio or television reception, which can be determined 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 is connected.
- Consult the dealer or an experienced radio/TV technician for help

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

NOTE: 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.

E Document revision

| Version | Date | Comment |
|---------|------------|--|
| 1.07 | 2022-03-18 | Updated RS485 notes |
| 1.06 | 2022-01-19 | Added Desfire EV3 |
| 1.05 | 2021-08-23 | Added model name NVR2001 |
| 1.04 | 2020-12-02 | Updated FCC compliance statement |
| 1.03 | 2020-07-20 | Updated standards and conformance declarations |
| 1.02 | 2020-04-14 | Added RS485 point-to-point and multi-drop wiring details |
| 1.01 | 2020-02-25 | Updated certification declaration identifiers |
| 1.00 | 2020-02-04 | Created |