

MACE

firmware guide

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1 INTRODUCTION

1.1 ABOUT THIS MANUAL

This manual is intended for system integrators and software developers that want to interface to the NEDAP MACE reader. This includes the MACE MM and MACE MM QR readers. The manual will describe the serial interface protocol details.

The commands in the manual are also used by the MaceConfigTool software. This software provides a user friendly interface for configuring the MACE readers. The MaceConfigTool can be downloaded from the partner portal:

<https://portal.nedapidentification.com>.

For installation details refer to the NEDAP MACE installation guides.

1.2 ABOUT MACE

MACE is an acronym for Mobile Access Control Entities. 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.

2 COMMUNICATION PROTOCOL

This chapter describes the MACE reader serial communication protocol. This protocol is used on the RS485 and USB interface. Specifically the MaceConfigTool software has implemented this protocol.

2.1 DATA FORMAT

Baud rate: 115200 *
 Data bits: 8
 Parity: none
 Stop bits: 1

* Default baud rate 115200 can be changed. See chapter 5.7.

2.2 MESSAGE FORMAT

The message format is according to the CR/LF protocol. ASCII control characters are reserved for message handling. The characters in the range from 0x32 to 0x127 hex are valid data characters.

Every message is terminated with a CR/LF sequence.

Syntax: LD [OD] <VD> [<OV>] C_R L_F

Where:

| | |
|--------|--------------------------------|
| LD | Literal data |
| [OD] | Optional data |
| <VD> | Variable data |
| [<OV>] | Optional variable data |
| CR | Carriage-return character (13) |
| LF | Linefeed character (10) |

Numeral data is sent in ASCII encoded hex (185 = 'B9') unless stated different.

Command messages start with a 4 digit message identifier in the range '0001' - '0FFF'.

The reader will be respond with a reply message. The first digit of the reply message indicates if the message was successful. The next 3 digits contains the message identifier of the original command.

| First digit | Description |
|-------------|---|
| 4 | OK, message successfully completed. |
| 5 | Error, failed to execute message |
| 6 | Error, unknown message identifier received. |
| 8 | OK, message successfully executed, Reply contains text field. |

When the command is finished (successful or unsuccessful) the reader sends a 'DONE' message.

3 FREE COMMANDS

3.1 GET FIRMWARE VERSION (0101)

Request firmware version information.

Syntax: 0101
 Reply: 4101<MA><MI>
 DONE
 Where: <MA> Version major number
 <MI> Version minor number.
 Example: 41010130 Firmware version 1.30.

3.2 GET FIRMWARE INFORMATION (0102)

Request MACE reader firmware information.

Syntax: 0102
 Reply: 8102<VERSINFO>
 DONE
 Where: <VERSINFO> Version information; e.g. 'NEDAP Mace v130'

3.3 GET HARDWARE INFORMATION (0103)

Request MACE reader hardware information.

Syntax: 0103
 Reply: 4103<HW>
 DONE
 Where: <HW> Hardware information. Bit-coded byte in hex notation.
 Bit-0: Bluetooth reader (1=yes, 0=no)
 Bit-1: 13MHz smartcard reader (1=yes, 0=no)
 Bit-2: 120kHz prox reader (1=yes, 0=no)
 Bit-3: Barcode scanner (1=yes, 0=no)
 Example: 410307 MACE Reader MM
 41030F MACE Reader MM QR

3.4 GET TEMPERATURE (010A)

Request MACE reader internal temperature.

Syntax: 010A
 Reply: 410A<TTTT>
 DONE
 Where: <TTTT> Temperature in degrees Celcius (16-bit signed integer in hex notation).
 0018 = Temperature 24 °C
 FFFB = Temperature -5 °C.

3.5 GET CUSTOMER CODES (010C)

Request Nedap customer codes. The reply is encoded. For example CF10 = 15A0. Specify parameter LS = 01 to get the reply in the new format according to command 020C (page 9).

Syntax: 010C [<LS>]
 Reply: 410C<CCCC><DDDD><GGGG>
 DONE
 Where: <CCCC> CF-code
 <DDDD> DF-code
 <GGGG> GF-code

3.6 BLINK LED (0190)

Blink LED. Only to be used for temporary control. See also command 0201 (page 9)

Syntax: 0190<ID><T-ON><T-OFF><T-TOT>
Where: <ID> LED/Buzzer id
+01=Green
+02=Red
+04=Blue
+08=Buzzer
<T-ON> Blink on-time (0A=100ms)
<T-OFF> Blink off-time (0A=100ms)
<T-TOT> Total time (0A=1s)

3.7 SET TESTMODE (0199)

Enable test mode. Can be used to check the serial, wiegand and magstripe output. While test mode enabled:

- LED blinks in alternating colors
- Serial interface periodically outputs 'TEST'<cr><lf>
- Wiegand/Magstripe output test pattern. Connect these outputs to the beeper input.

Syntax: 0199<TT>
Reply: 4199
DONE
Where: <TT> Testmode time (00=stop testmode, 05=testmode 5 sec)

3.8 RESTART READER (01F0)

Restart the reader.

Syntax: 01F0
Reply: 41F0
DONE

3.9 START BOOTLOADER (01FA)

Start the bootloader. This command should not be used manually!

Syntax: 01FA<DEVICEID>
Reply: 41F0
DONE
Where: <DEVICEID> Start bootloader device-id; MACE

4 CONFIG CONTROL COMMANDS

4.1 GET UNLOCK STATE (01FE)

Request the current configuration unlock state.

Syntax: 01FE
 Reply: 41FE
 DONE
 Where: Unlock status
 00=locked
 01=unlocked (no pwd)
 02=unlocked.

4.2 UNLOCK CONFIG (01FF)

Unlock configuration commands (command numbers 0200 and above). The unlock password can be changed with command 0200. The unlocked state will automatically time-out after 10 seconds. The unlock timeout refreshes upon every received command.

Syntax: 01FF<PWD>
 Reply: 41FF
 DONE
 Where: <PWD> Unlock password. See also command 0200.
 Unlock status
 00=locked
 01=unlocked (no pwd)
 02=unlocked.

4.3 SET UNLOCK PASSWORD (0200)

Set the unlock password for command 0190. Default no unlock password is used and the configuration commands are not protected.

Syntax: 0200<PWD>
 Reply: 4200
 DONE
 Where: <PWD> Unlock password (max. 20 alphanumeric characters).

4.4 SAVE CONFIG (02F1)

Save all configuration settings into non-volatile memory. When configuration settings are not saved, they will be lost when power off.

Syntax: 02F1
 Reply: 42F1
 DONE

4.5 RESET CONFIG (02FC)

Reset all configuration settings back to factory defaults and restart reader.

Syntax: 02FC
 Reply: 42FC
 DONE

5 GENERAL CONFIG COMMANDS

5.1 SET LED CONTROL (0201)

Syntax: 0201 [<MM><GG><RR><BB><ZZ><PG><PR><PB>]

Reply: 4201<MM><GG><RR><BB><ZZ><PG><PR><PB>
DONE

Where: <MM> Mode
00=automatic
01=remote control (follow inputs)
80=command control (all off)
+01=Green
+02=Red
+04=Blue
+08=Buzzer

<GG> Green LED function
Automatic;
+01=LED on upon identification
+80=LED on when idle
Remote control;
+01=LED on when input UL active
+02=LED on when inputs UL+NA both active
+40=LED on when inputs UL+NA both inactive
+80=LED on when input NA active

<RR> Red LED function. See <GG>

<BB> Blue LED function. See <GG>

<ZZ> Buzzer auto function. In remote control mode, the buzzer will follow the BUZZER input.
Automatic;
+01=Beep upon identification

<PG> Dimming percentage green LED in range from 0 to 100 (=0x64)

<PR> Dimming percentage red LED in range from 0 to 100 (=0x64)

<PB> Dimming percentage blue LED in range from 0 to 100 (=0x64)

5.2 SET CUSTOMER-CODE (020C)

Set customer-code(s). Recommended to change the customer-codes only using the mace config tool software.

Syntax: 020C [<NN><CODE01>...<CODEnn>]

Reply: 420C<NN><TT><CODE01>...<CODEnn>
DONE

Where: <NN> Number of customer codes in range from 0 to 20 (hex 14).
<CODExx> Encoded customer code. For example '0415A0' = CF010.

5.3 SET HOLD-TIME (0220)

Set hold-time. Default 0A (=1.0 sec).

Syntax: 0220 [<TT>]

Reply: 4220<TT>
DONE

Where: <TT> Hold time in range from 01 to FF (=0.1 to 25.5 sec)

5.4 SET VARIOUS OPTION FLAGS (0221)

Set various option flags. Default steting is hex FF. This means all options are default enabled.

Syntax: 0221 [<XX>]
 Reply: 4221<XX>
 DONE
 Where: <XX> Various flags. Bit-coded byte in hex notation.
 Bit-0: Refresh hold-time (1=refresh, 0=repeat).
 Bit-1: Not check customer code (1=don't check, 0=check)
 Bit-2: Allow id without customer code (1=yes, 0=no)
 Bit-3: 13MHz always on (1=yes, 0=no, pulsed)

5.5 SET HEATER CONTROL (0229)

Set heater control. Default off.

Syntax: 0229 [<MM><TT>]
 Reply: 4229<MM><TT>
 DONE
 Where: <MM> Heater mode.
 00=off
 01=on
 02=automatic (on when below threshold temperature)
 <TT> Threshold temperature in Celcius. Signed value in hex notation. E.g. 00=0°C, F6=-10°C, 0A=+10°C.

5.6 SET ID-SOURCE VALUES (0230)

Set id-source value. Default 000102030405060708090A0B0C0D0E0F
 These values will be sent with the id-event on both the RS485 interface as Wiegand.

Syntax: 0230 [<S0><S1><S2><S3><S4><S5><S6><S7><S8><S9>...]
 Reply: 4230<S0><S1><S2><S3><S4><S5><S6><S7><S8><S9>...
 DONE
 Where: <S0> ID-source value for PROX-LF (default 00).
 <S1> ID-source value for BLE (default 01).
 <S2> ID-source value for NFC (default 02).
 <S3> ID-source value for Barcode (default 03).
 <S4> ID-source value for Smartcard (default 04).
 <S5> ID-source value for MIFARE (default 05).
 <S6> ID-source value for DESFIRE (default 06).
 <S7> ID-source value for ISO15693 (default 07).
 <S8> ID-source value for HID iCLASS (default 08).
 <S9> ID-source value for MACE Card (default 09).

5.7 SEND KEY UPDATE RECORD (02A0)

Send key update record. Recommended to send only using the mace config tool software.

Syntax: 02A0<NN><XX>...]
 Reply: 42A0
 DONE
 Where: <NN> Record number. Start with 0. Increment with 1. Finish with FF.
 <XX> Enciphered record data.

5.8 SET BAUDRATE (02BA)

Set baudrate. Default 06 (=115200 baud).

Syntax: 02BA[<BI>]

Reply: 42BA

DONE

Where: <BI>

Baudrate index.

00=1200

01=2400

02=9600

03=19200

04=38400

05=57600

06=115200

6 BLE CONFIG COMMANDS

6.1 SET BLUETOOTH OPERATING MODE (0400)

Syntax: 0400 [<MM>]
 Reply: 4400<MM>
 DONE
 Where: <MM> Bluetooth operating mode:
 00=BLE off
 01=BLE peripheral (auto advertise)
 02=BLE central (reserved for future use)

6.2 SET BLUETOOTH DEVICE NAME (0401)

Set or get bluetooth device name.

The bluetooth device name can be any string up to 20 alphanumeric characters (free-text) or will comply with the ranging-format (F CC P NN). Only device names up to 8 characters are sent within the advertising data.

To comply with the ranging format set bit-4 in the bluetooth options (see command 0403). In this case the first character of the device name, as configure here, is also used in the the ranging-format F (Function) - character.

The MACE app requires to enable the ranging-format!

Syntax: 0401 [<BTNAME>]
 Reply: 8401<BTNAME>
 DONE
 Where: <BTNAME> Bluetooth device name (string).

Example 1 - Bluetooth device name ranging-format (FCCPNN = 'i08M01')

```
0401INRIT Function 'I'
040201 Sequence number 01
040311 Enable ranging-format & require authentication
0404M Profile 'M'
040508 Tx power 8 dBm
040600 Tx correction +0 dBm
```

Example 2 - Bluetooth device name ranging-format (FCCPNN = 'u09S02')

```
0401UITRIT Function 'u' (lowercase).
040202 Sequence number 02
040311 Enable ranging-format & authentication required
0404S Profile 'S'
040508 Tx power 8 dBm
040601 Tx correction +1 dBm
```

Example 3 - Bluetooth device name free-text ('PIETJE')

```
0401PIETJE Devicename 'PIETJE'
040200 Not used
040301 Free-text devicename & authentication required
0404M Not used
040508 Tx power 8 dBm
040600 Not used
```

6.3 SET BLUETOOTH SEQUENCE NUMBER (0402)

Set or get the bluetooth ranging-format sequence number (NN).

Syntax: 0402 [<NN>]
Reply: 4402<NN>
DONE
Where: <NN> Sequence number in range from 00 to FF.
Example: 040201

6.4 SET BLUETOOTH OPTIONS (0403)

Set or get bluetooth options.

Enable or disable bluetooth authentication.

Set bluetooth device name free-text mode or comply with ranging-format.

The MACE app requires to enable the ranging-format!

Syntax: 0403 [<OPTS>]
Reply: 4403<OPTS>
DONE
Where: <OPTS> Options. Bit-coded byte in hex notation.
Bit-0: Authentication required (1=yes, 0=no).
Bit-4: Bluetooth device name (1=ranging-format, 0=free-text).
Example: 040311

6.5 SET BLUETOOTH RANGING PROFILE (0404)

Set or get the bluetooth ranging-format profile character (P).

Syntax: 0404 [<P>]
Reply: 8404<P>
DONE
Where: <P> Ranging profile ('S'=short, 'M'=medium, 'L'=long range).
Example: 0404M

6.6 SET BLUETOOTH TX POWER (0405)

Set or get the bluetooth tx power in dBm. Default 8 dBm.

Not all values are possible. The reader will round to the nearest possible tx power setting.

The tx power and tx-correction form the calibrated tx power (CC).

Syntax: 0405 [<POW>]
Reply: 4405<POW>
DONE
Where: <POW> Tx power in dBm. Signed value in hex notation.
08 = 8dBm
06 = 6dBm
02 = 2dBm
FE = -2dBm
F9 = -7dBm
F5 = -11dBm
F1 = -15dBm
ED = -19dBm
Example: 040508

6.7 SET BLUETOOTH TX CORRECTION (0406)

Set or get the bluetooth tx correction in dBm. Default +0 dBm.

Set the tx correction value to calibrate the tx power. The correction value must be set to the difference between measured power and tx power.

The tx power and tx-correction form the calibrated tx power (CC).

Syntax: 0406 [<COR>]

Reply: 4406<COR>

DONE

Where: <COR> Tx power in dBm. Signed value in hex notation.
00=no correction, 01=+1dBm, FF=-1dBm

Example: 040600

6.8 SET BLUETOOTH ADVERTISING INTERVAL (0407)

Set or get the bluetooth advertising interval in milliseconds. Default 100 ms.

Syntax: 0407 [<TIME>]

Reply: 4407<TIME>

DONE

Where: <TIME> Advertising interval in ms in range from 20 to 1000 ms.

Example: 04070064

7 HF CONFIG COMMANDS

7.1 ENABLE HF (0420)

Syntax: 0420 [<XX>]
 Reply: 4420<XX>
 DONE
 Where: <XX> HF enable flags:
 +1=mifare classic
 +2=desfire
 +4=iso15693
 +8=iclass
 +10=nfc
 +20=mace card

7.2 CONFIG DESFIRE (0422)

Syntax: 0422 [<RR><FF><AAAAAA><NN><MM><OO><LL><XX><YY><KKK...>]
 Reply: 4422<RR><FF><AAAAAA><NN><MM><OO><LL><XX><YY>
 DONE
 Where: <RR> Read mode (0=csn, 1=file data)
 <FF> Flags (+70=dconvert, +80=reverse)
 <AAAAAA> AID 3 bytes
 <NN> File number
 <MM> File mode (0=plain, 1=maced, 2=enciphered)
 <OO> Offset in nibbles
 <LL> Length in nibbles (0=while file)
 <XX> Key mode (0=native, 1=ISO, 2=3k3des, 3=AES, FF=none)
 <YY> Key number
 <KKK...> Read key 24 bytes. First 16 bytes used for AES

7.3 CONFIG MIFARE (0421)

Syntax: 0421 [<RR><FF><LL><AA><DD><OO><KKK...><XXX...>]
 Reply: 4421<RR><FF><LL><AA><DD><OO>
 DONE
 Where: <RR> Read mode (0=csn, 1=sector data, 2=ultralight, 3=mfp-sl3)
 <FF> Flags (+1=keyb, +2=MAD, +4=mfp-plain, +70=dconvert, +80=reverse)
 <LL> Length in nibbles
 <AA> Block address (or MAD-AID-hi)
 <DD> MAD-AID-lo
 <OO> Offset in nibbles
 <KKK...> Read key 16 bytes. First 6 bytes used for classic
 <XXX...> MAD key 16 bytes. First 6 bytes used for classic

7.4 CONFIG ISO15693 (0425)

Syntax: 0425 [<RR><FF><OO><LL>]
 Reply: 4425<RR><FF><OO><LL>
 DONE
 Where: <RR> Read mode (0=uid, 1=multiple-blocks, 2=uid + multiple-blocks)
 <FF> Flags (rfu)
 <OO> First block
 <LL> Number of blocks (0=read 1 block = read 4 bytes)

8 LF CONFIG COMMANDS

8.1 ENABLE LF (0440)

Syntax: 0440 [<XX>]

Reply: 4440<XX>

DONE

Where: <XX> LF enable flags (+1=NedapXS, +2=RW80, +4=EM4200)

9 BARCODE CONFIG COMMANDS

9.1 CONFIG BARCODE (0460)

Syntax: 0460 [<XX>]

Reply: 4460<XX>

DONE

Where: <XX> Barcode enable flags (+1=enable, +2=aim, +4=illum, +80=check mac)

9.2 SET BARCODE PREFIX (0461)

Syntax: 0461 [<PL><PPP..>]

Reply: 4461<PL><PPP..>

DONE

Where: <PL> Prefix length (default 0=not checked)

<PPP..> Prefix 8 bytes in hex notation (left aligned)

For example prefix "MACE:" = 4D4143453A000000

9.3 SET BARCODE SUFFIX (0462)

Syntax: 0462 [<SL><SSS..>]

Reply: 4462<SL><SSS..>

DONE

Where: <SL> Suffix length (default 0=not checked)

<SSS..> Suffix 8 bytes in hex notation (left aligned)

For example suffix "!" = 2100000000000000

10 OUTPUT CONFIG COMMANDS

10.1 CONFIG SERIAL OUTPUT (0501)

Syntax: 0501 [<XX><LL><OO><PL><PPP..><SL><SSS..>]

Reply: 4501<XX><LL><OO><PL><PPP..><SL><SSS..>
DONE

Where:

| | |
|---------|--|
| <XX> | Flags (+1=enable, +2=decimal, +4=addsource, +8=addtype, +10=alignleft) |
| <LL> | Length in bits (0=all) |
| <OO> | Offset in bits |
| <PL> | Prefix length in bytes |
| <PPP..> | Prefix 10 bytes (left aligned) |
| <SL> | Suffix length in bytes |
| <SSS..> | Suffix 10 bytes (left aligned) |

10.2 CONFIG WIEGAND OUTPUT (0502)

Syntax: 0502 [<XX><LLLL><OO><PL><PPPP><SL><SSSS><FL><FFFF>]

Reply: 4502<XX><LLLL><OO><PL><PPPP><SL><SSSS><FL><FFFF>
DONE

Where:

| | |
|--------|--|
| <XX> | Flags (+1=enable, +2=addparity, +4=alignleft, +8=addsource, +10=convert bcd2bin) |
| <LLLL> | Length in bits |
| <OO> | Offset in bits |
| <PL> | Prefix length in bits |
| <PPPP> | Prefix 2 bytes (right aligned) |
| <SL> | Suffix length in bits |
| <SSSS> | Suffix 2 bytes (right aligned) |
| <FL> | Facility-code length in bits |
| <FFFF> | Facility-code 2 bytes (right aligned) |

10.3 CONFIG MAGSTRIPE OUTPUT (0503)

Syntax: 0503 [<XX><AA><LLLL><OO><PL><PPP..><SL><SSSS>]

Reply: 4503<XX><AA><LLLL><OO><PL><PPP..><SL><SSSS>
DONE

Where:

| | |
|--------|---|
| <XX> | Flags (+1=enable, +2=addsentinel, +4=convert hex2bcd, +8=alignleft) |
| <AA> | Number of pre-, and postamble ticks |
| <LLLL> | Length in bits |
| <OO> | Offset in bits |
| <PL> | Prefix length in nibbles (max 16) |
| <PPPP> | Prefix 8 bytes (left aligned) |
| <SL> | Suffix length in nibbles (max 4) |
| <SSSS> | Suffix 2 bytes (left aligned) |

10.4 CONFIG ANTENNA MODULATION OUTPUT (0504)

Syntax: 0504 [<LL>]

Reply: 4504<LL>
DONE

Where: <LL> Number of antenna modulation output loops. Default 30.
Each loop takes $64/1875 = 34$ msec.

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B DOCUMENT REVISION

| Version | Date | Comment |
|---------|------------|--|
| 1.5 | 2017-10-02 | Added ISO15693 config command (0425) |
| 1.4 | 2017-01-15 | Added key update command (02A0) Added id-source values command (0230) |
| 1.3 | 2016-12-05 | Removed key setting commands. |
| 1.2 | 2016-10-31 | Added set customer code (020C) |
| 1.1 | 2016-09-07 | Added MACE Card config |
| 1.0 | 2016-06-21 | First preliminary release |