

Nedap Readers Convexs & Invexs

Installation Guide and User Manual



11 April 2011 Version 9

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**Convexs MN80(F)X, Convexs MND80(F)X (X is G or C) with FCC ID: CGDCONVEXS
Convexs MND80G with IC ID: 1444A-CONVEXS**

This device complies with part 15 of the FCC Rules and to RSS210 of Industry Canada. Operating 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. Changes or modifications not expressly approved by party responsible for compliance could void the user's authority to operate the equipment.

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1. Nedap Readers General Information

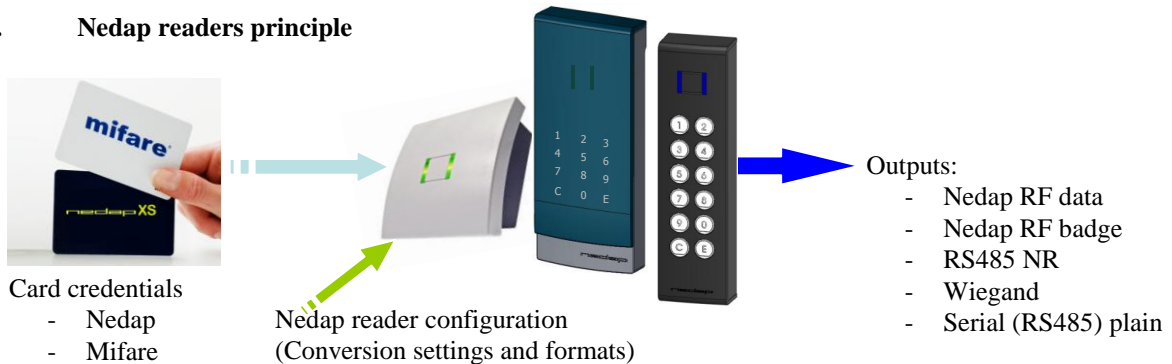
The Nedap readers (e.g. Convexs or Invexs readers) enables smooth migration to Mifare card technology in both existing Nedap XS and Nedap AEOS Enterprise systems. It is capable of reading both Nedap and Mifare cards. The cards that are read are converted (and optionally filtered) to the selected output format.

The readers output (the data the Convexs or Invexs reader sends) can be set to either Wiegand, XS RF modulation or RS485 protocol (encrypted for connection to AEOS or plain output).

Installation aspects and technical data of the Nedap readers can be found in their corresponding Installation sheets (e.g. *Convexs_InstallSheet_E*)

With Mifare also the Mifare Ultralight card is included, DESFire included EV1 card (check firmware version).

1.1. Nedap readers principle



1.2. Availability Convexs 80 readers:

	Surface mounted		Flush mounted		Credentials
	G	C	FG	FC	
Convexs M80xx	9856250	9895400	9856420	9895540	Mifare
Convexs MD80xx	9856900	9895680	9857060	9895710	Mifare - DESFire
Convexs MN80xx	9856110	9895850	9856390	9895990	Mifare - Nedap
Convexs MND80xx	9896210	9896040	9896350	9896180	Mifare - Nedap – DESFire
	Gray	Charcoal	Flush, Gray	Flush, Charcoal	Gray=Light, Charcoal=Dark

For both Surface mounting and flush mounting rugged *Protectors* are available, making the Convexs more vandal resistant.



1.3. Availability Invexs 170 readers:

The Invexs can read Mifare, DESFire and Nedap cards, and is equipped with keypad and / or a display.

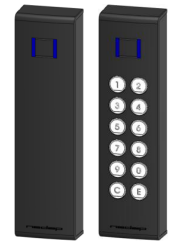
Following Invexs 170 readers are available (with white or black back plane, Screen / display only on request)

	Colour	Reader		Keypad		Screen / Display	
		Reader		Keypad		Screen / Display	
M170 Mifare	Black	M170B	9833900	MK170B	9834230	MKS170B	9939822
	White	M170W	9832750	MK170W	9832920	MKS170W	9833390
MD170 Mifare DESFire	Black	MD170B	9834400	MDK170B	9834680	MDKS170B	9939849
	White	MD170W	9834370	MDK170W	9834540	MDKS170W	9891820
MN170 Mifare Nedap	Black	MN170B	9834060	MNK170B	9833730	MNKS170B	9833870
	White	MN170W	9832890	MNK170W	9833080	MNKS170W	9833420
MND170 Mifare DESFire Nedap	Black	MND170B	9899570	MNDK170B	9938761	MNDKS170B	9938796
	White	MND170W	9899430	MNDK170W	9938753	MNDKS170W	9938788

1.4. Availability Invexs 190 readers:

The Invexs 190 is designed to be used on door pillars (mullion) and suitable for outside and inside use. A model with keypad is also available.

Invexs 190 Reader		Invexs 190 Reader + Keypad		Credentials
Invexs M190	9945512	Invexs MK190	9948422	Mifare
Invexs MD190	9948406	Invexs MDK190	9948457	Mifare + DESFire
Invexs MN190	9948392	Invexs MNK190	9948449	Mifare + Nedap
Invexs MND190	9948414	Invexs MNDK190	9948465	Mifare + Nedap + DESFire



1.5. Functionality

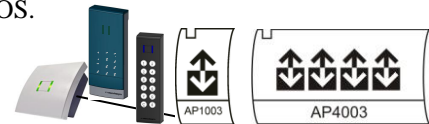
Functionality and output format of the Convexs or Invexs reader is determined by the configuration of the Convexs reader. This configuration is defined using the program *AEreco*, and deployed by the *Convexs configuration card* or via *AEMON* (the configuration file is then uploaded to the Convexs as connected to the APx003).

Depending of the used configuration the cards read by the Convexs (XS and/or Mifare) can be sent to the output using different communication principles:

- **RS485NR**, all data read by the Convexs is transparently sent to AEOS.

To be connected to

- AEOS reader interface AEPacks (e.g. AP1003, AP4003), use firmware: *APx003rs485NR2*
Data read from card is transferred (encrypted) directly to AEPack.



LED's and Beeper are controlled by the communication over RS485. (No separate cables for the LED's are used.). Beeper also can be controlled by hardware or configuration.

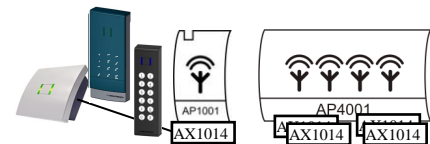
Power must be supplied additionally to the Convexs/Invexs.

Not all Nedap AEPacks have RS485 on board. Check the used AEPacks. Use the AX1012 to convert RS232 to RS485.

- **RF output**

To be connected to

- AEOS Nedap reader AEPacks (e.g. AP1001, AP4001) using AX1014.
All data (*Nedap RF data*) or the (converted) badge (*Nedap RF badge*) is sent over the existing RF cable.



Check firmware in AEPack:

- New updated firmware (\pm 03-2008) transfers all data read from the card transparently to AEPack ('no' limitations to card number)
- Not advisable using the older firmware: the Mifare cards must be converted to XS code, max label number 999.999

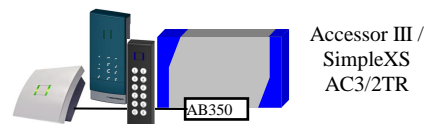
- Nedap XS readers (AB350 on Accessor, SimpleXS, AC3/2TR), to be connected to AP1003 and AX1011 for integration with AEOS.

All data (*Nedap RF data*) or the (converted) badge (*Nedap RF badge*) is sent over the existing RF cable.



- New updated firmware (\pm 03-2008) transfers all data read from the card transparently to AEPack ('no' limitations to card number)
- Not advisable using the older firmware: the Mifare cards must be converted to XS code, max label number 999.999

- Nedap XS readers (AB350 on Accessor, SimpleXS, AC3/2TR), to be connected to WinXS systems.
The (converted) badge (*Nedap RF badge*) is sent over the existing RF cable.



Mifare cards must be converted to XS code, max label number 220.000 depending of amount or RAM memory in XS reader.

Attention: At the XS readers only one customer code for each type can be used!

LED's controlled by separate connections between Convexs/Invexs and AX1014/AB350 (use existing cabling).

Beeper controlled by hardware or configuration.

Power at Convexs/Invexs is retrieved from RF line (no additional power cables needed, existing cabling is used).

Convexs/Invexs readers **cannot be connected parallel** to a RF reader. (Despite using antennas, where in some situations it was possible to connected the antennas parallel, e.g. for In/Out usage at a single door).

- **Wiegand**

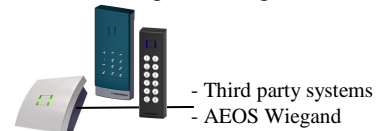
To be used for connection to third party systems, using different Wiegand protocols.

The card data can be transferred using different Wiegand protocols.

LED's are controlled by the two separate connections between Convexs/Invexs and the third party system.

Beeper controlled by hardware or configuration.

Power must be supplied additionally to the Convexs/Invexs.



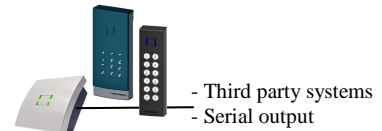
- **Serial RS485 (RS485 Ascii)**

To be used for connection to third party systems, using a serial connection. Requires special configuration in Convexs/Invexs: *NR9002.cfg*

LED's can be controlled by the two separate connections between Convexs/Invexs and the third party system.

Beeper controlled by hardware or configuration.

Power must be supplied additionally to the Convexs/Invexs.

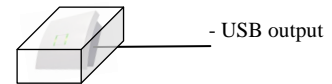


- **USB Desktop reader**

Inside the USB Desktop reader the Convexs is used, with special configuration *NR9004.cfg* in Convexs:

Check the installation manual of the USB Desktop reader for more details

Power can be supplied by USB (check power requirements).



Remark: Depending of the used output the cable distances differ! (See for cabling details the corresponding installation sheets.)

2. Cards read by Convexs/Invexs

The Convexs/Invexs is capable of reading different card credentials simultaneously. The letter stands for the card credentials:

- *M* : Mifare *MD* : Mifare and DESFire
- *MN* : Mifare and Nedap *MND* : Mifare and Nedap and DESFire

Depending of the configuration of the Convexs/Invexs the user itself can determine how the cards that are read must be sent to the output.

The Convexs/Invexs *MN* and Convexs/Invexs *M* can be made suitable for reading DESFire cards at the customer using a special card (*DEScount* card); contact Nedap for more details. (Or order the Convexs/Invexs *MD* at Nedap.)

2.1. Nedap cards

All Nedap cards can be read:

- CF, DF and GF codes, C, D and G codes, A and B codes

At the 'Direct transmission mode' (all data read is sent unchanged to the output, defined with Aereco as *Nedap RF data* or *RS485NR*), no additional configurations have to be made.

If needed a check at the customer code is possible. If this is configured, only cards with one of the defined customer codes are read and sent to the output.

If the data read is been translated to another code (e.g. Wiegand) you can state for each Nedap customer code a specific Wiegand customer code (or another Wiegand code). (Keep in mind if this makes any sense!)

2.2. Mifare cards

For Mifare the common used types can be read (Mifare, Mifare Ultralight and DESFire, including EV1):

- Card Serial Number (CSN, 7 bytes or 4 bytes)
- Data direct from one of the sectors / files
- Data from one of the sectors, using MAD (Mifare Application Directory)

All necessary settings (MAD or sector number, used security keys, location of data, interpretation of the data, etc) have to be made using Aereco. If desired this can be done by the customer itself so the customer keeps the control over the Mifare security keys.

At the 'Direct transmission mode' (all data read is sent unchanged to the output, defined with Aereco as *Nedap RF data* or *RS485NR*), no additional configurations have to be made. The interpretation of the card data is now done at AEOS, not at the Convexs/Invexs.

The Mifare cards can also be transferred to the output as Nedap cards (pay attention of the maximum card number and the chosen customer code, this is depending of the Nedap device that is connected to the Convexs/Invexs).

Remark: This last option can only at special request be programmed at Nedap, so not with the standard Aereco program.

At the Mifare part it is possible to determine a part of the Mifare data as customer code. This customer code of the Mifare part can be used to expand the data read to different codes to the output.

Attention: For programming the correct settings at Aereco for the reading and handling the Mifare cards, knowledge of Mifare cards must be available. E.g. for retrieving the data from the Mifare card it must be know where the data is located, which principle is used, what the keys are, etc, etc.

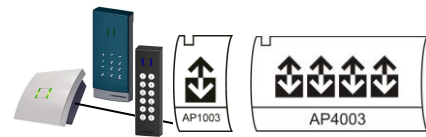
3. Convexs/Invexs Protocols

Depending of how the Convexs/Invexs is configured several output protocols are available.

3.1. RS485NR (including RS485NR2)

RS485 enables the possibility to have bi-directional encrypted communication. If possible use this protocol.

The RS485 is used for connecting the Convexs/Invexs to the Nedap AEOS AEpacks APx003. These AEpacks must have the correct firmware (*APx003rs485NR/APx003rs485NR2*) for handling the Convexs/Invexs. The *APx003rs485NR2* is the successor of the *APx003rs485NR*, having more features and less limitations (see chapter 10, Available reader firmware).



Using RS485 enables the option that the *Nedap reader configuration file* and *firmware* can be downloaded using AEmon. The Convexs/Invexs configuration file still is generated by AEreco.

With RS485 the data from the cards read at the Convexs/Invexs is transmitted transparently ('Direct transmission mode') and encrypted to the AEpack.

If both Nedap and Mifare cards must be read use at the Access Point the *Primarily-* and *Secondarily Identifier* type can be defined. (Check if your AEOS version is capable of handling this.)

- Cabling distance: Max 1000 meters
- LED control: LED's are controlled over the RS485 communication line (by software)
- Beeper control: By hardware connection or software (configuration depending)
- PIN code: For corresponding Invexs readers PIN code can be used over RS485 communication.

At AEreco the output format must be configured as: *RS485NR*.

3.2. RF output

Using Convexs converters (AX1014 / AB350) enables re-use of existing cabling (both for antenna and LED's). The RF output is to be used if the Convexs/Invexs have to be connected to the former Nedap XS readers (Accessor/SimpleXS) or the Nedap AEpacks.

Depending of the possibilities and firmware of the used Nedap readers following options are available:

- Cabling distance: Max 50 meters
- LED control: LED's are controlled by existing cabling (hardware connection)
- Beeper control: By hardware connection or software (configuration depending)
- PIN code: Not possible

For RF output following options are available

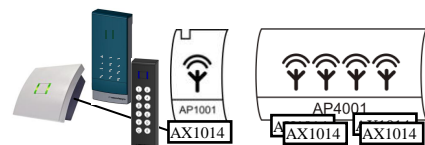
- *Nedap RF data* All data read is transparently sent the the AEpack ('Direct transmission mode') Most preferable, but can not be used in combination with a WinXS system
- *Nedap RF badge* Mifare badges: data read is converted towards another customer code
XS badges: sent directly or converted towards another customer code.

Use this only in case the Convexs/Invexs is used towards a WinXS system.

3.2.1. RF output to AX1014 on AEpacks

Can be used if e.g. the existing Nedap RF antenna connected to an AEpack is replaced with the Convexs/Invexs, thus enabling that both Nedap and Mifare cards or Mifare cards replacing Nedap cards can be read.

For each AEpack (or AEpack reader channel) one AX1014 (Convexs adapter) must be placed on the AEpack, on which the Convexs/Invexs is connected. If e.g. a AP4001 with 4 Nedap antennas is converted to Convexs/Invexs readers 4 AX1014 are needed.



Depending on the type of firmware in the AEpack following options are possible:

- With new updated firmware at the AEpacks:

The data from the cards read at the Convexs/Invexs is transparently sent ('Direct transmission mode') to the AEPack. If both Nedap and Mifare cards must be read, use at the Access Point the Primarily and Secondary Identifier type (check your AEOS version if this is available).
At AEReco the output format must be configured as: *Nedap RF data*.

- Not advisable, but with older firmware at the AEPack the Mifare cards must be converted to XS code, The maximum label number 999.999 (in combination with a GF code). At the Access Point in AEOS the XS Identifier is chosen. So now both Mifare (GF) and the Nedap XS cards can be identified. XS cards will be transparently transmitted.
The chosen XS code may not be used already with existing XS cards.
At AEReco the output format must be configured as: *Nedap RF badge*.
Remark: This option can at special request only be programmed at Nedap, so not with the standard AEReco programm.

3.2.2. RF output to Nedap XS readers for AEOS integration

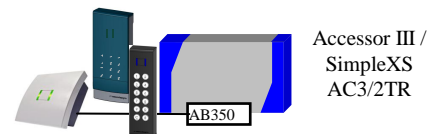
Same as 3.2.1, but now for Nedap XS readers (AB350 on Accessor, SimpleXS). Connected using the MD300 to an AX1001 on the AP1003 for integration with AEOS.



This option can be used if e.g. the existing Nedap RF antenna on the XS reader is replaced with the Convexs/Invexs, thus enabling that both Nedap and Mifare cards or Mifare cards replacing Nedap cards can be read. For each XS reader one AB350 (Convexs adapter) must be placed on the XS reader antenna connector, on which the Convexs/Invexs is connected.
Possibilities and settings are identical as at 3.2.1. Preferable is to use the *Nedap RF data* output.

3.2.3. RF output to Nedap XS readers at a WinXS system

Same as 3.2.1, but now for Nedap XS readers (AB350 on Accessor, SimpleXS), to be connected to the WinXS system (using e.g. LanBoXS or InterVisor, or directly to the WinXS PC).



This option can be used if e.g. the existing Nedap RF antenna on the XS reader is replaced with the Convexs/Invexs, thus enabling that both Nedap and Mifare cards or Mifare cards replacing Nedap cards can be read. For each XS reader one AB350 (Convexs adapter) must be placed on the XS reader antenna connector, on which the Convexs/Invexs is connected.

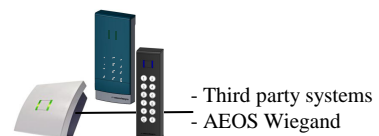
The Mifare cards must be converted to an XS code:

- The maximum label number is 220.000 (in combination with a GF code) and depending on the amount of memory in the XS reader.
If beside the Mifare still the Nedap XS cards are used, the Eprom at the XS readers must be capable of reading both factory codes. The chosen XS code may not be used already with existing XS cards.
At AEReco the output format must be configured as: *Nedap RF badge*.
Remark: This option can only be programmed at Nedap, so not with the standard AEReco programm.

3.3. Wiegand

Maximum cable distance is 150 meters, the LED's on Convexs/Invexs are controlled by hardware signals on the Convexs/Invexs connector.

Beeper control: By hardware connection or software (configuration depending)
PIN code: 8 bits message 4 bits PIN + 4 bits complement, (Dorado format)



For the possible Wiegand protocols, see the section below. Depending of the data read (Card type and Customer code) a different Wiegand code can be transmitted. Also if the selected Wiegand protocol is capable of using facility codes for each code read a different Wiegand facility code can be transmitted

Attention: The card number and customer code that is read must fit in the chosen Wiegand protocol.
If no *bin Wiegand is used, the data format must be specified (AEReco in the *Block decoder* part).

The Wiegand output can be used to connect to Third party systems or to the AEOS APx003 readers with the appropriate Wiegand protocol.

At Aereco the output format must be configured as: *Wiegand* and the correct type of Wiegand protocol.

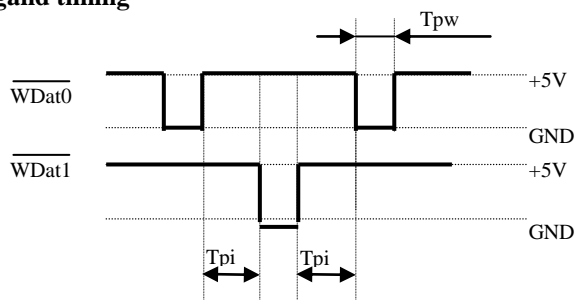
3.3.1. Wiegand formats

Several Wiegand formats can be used:

- Wiegand 26
- Wiegand 32
- Wiegand 32bin
- Wiegand 37
- Wiegand 64bin
- Wiegand 128bin

Wiegand data is been sent at D0 and D1, signals are active low.

3.3.2. Wiegand timing



Timing:

Tpw Pulse Width Time : 60usec
 Tpi Pulse Interval Time : 60 usec

3.3.3. Wiegand 26

Format: Facility code: 8 bits: range: 0..255
 Label number: 16 bits: range: 1..65535
 Parity: 2 bits

3.3.3.1. Wiegand 26 data definition

The Wiegand 26-bit format consists of a parity bit, followed by eight facility code bits, followed by 16 label number code bits and a final parity bit. The first parity bit shall create even parity when combined with the next twelve bits. The last parity bit shall create odd parity when combined with the remaining 12 bits.

The data is represented in bits. (unsigned binary coded)

The complete message consists of the following:

Bit position : 1 23456789 0123456789012345 6
 Bit contents : P FFFFFFFF NNNNNNNNNNNNNNNN P

Parity (even) : P FFFFFFFF NN
 (odd) : NNNNNNNNNNNNNNNN P

Legend : F : Facility code (8 bits: range: 0..255)
 N : Label number (16 bits: range: 1..65535)
 P : Even parity over the first 12 bits
 Odd parity over the next 12 bits

3.3.4. Wiegand 32

Format: Facility code: 16 bits: range: 0..65535
 Label number: 16 bits: range: 1..65535

3.3.4.1. Wiegand 32 data definition

The Wiegand 32-bit format consists 16 facility code bits, followed by 16 label number code bits. There are no parity bits. The data is sent in bits. (unsigned binary coded)

The complete message consists of the following:

```
Bit position : 1234567890123456 7890123456789012
Bit contents : FFFFFFFFFFFFFFFF NNNNNNNNNNNNNNNNN
```

Legend : F : Facility code (16 bits: range: 0-65535)
 N : Label number (16 bits: range: 1..65535)

3.3.5. Wiegand 32bin

Format: Label number: 32 bits: range: 1..FF FF FF FF
 Data is represented in hex, first bit first.

3.3.6. Wiegand 37

Format: Label number: 35 bits: range: 1..34359738368

3.3.6.1. Wiegand 37 data definition

The Wiegand 37-bit format consists of one number, no facility code. There are 2 parity bits. The data is sent in bits. (unsigned binary coded)

The complete message consists of the following:

```
Bit position : 1 23456789 0123456789 0123456789 0123456 7
Bit contents : P NNNNNNNNN NNNNNNNNNNN NNNNNNNNNNN NNNNNNNN P
Parity (even) : P 12345678 9012345678
(odd) : 1 2345678901 2345678 P
```

Legend : N : Label number (35 bits)
 P : Even parity over the first 18 bits
 Odd parity over the next 18 bits (starts from bit 18)

3.3.7. Wiegand 64bin

Format: Label number: 64 bits: range: 1.. FF FF FF FF FF FF FF FF
 Data is represented in hex, first bit first.

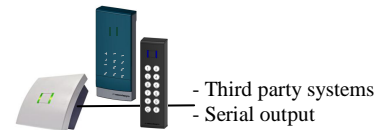
3.3.8. Wiegand 128bin

Format: Label number: 128 bits: range: 1.. FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
 Data is represented in hex, first bit first.

3.4. Serial RS485 (RS485 Ascii)

Maximum cable distance is 1000 meters, the LED's on Convexs/Invexs are controlled by hardware signals on the Convexs/Invexs connector.

Beeper control: By hardware connection or software (configuration depending)



Requires configuration *NR9002.cfg* or *NR9003.cfg*. This configuration can be changed using Aereco.

3.4.1. Default settings

- Nedap cards: Card number
No customer code is sent (default), no check on customer code
- Mifare cards: CSN number (CSN reversed: *NR9003.cfg*)
(Only Mifare, no DESFire at default file)

For other settings the *NR9002.cfg* or *NR9003.cfg* file must be changed by using Aereco.

3.4.2. Data format

Format: 9600 Baud, No parity, 8 bits, 1 stop bit

Data: X 12AB56789 <CR> <LF>

X	Identifier type:	N Nedap
		M Mifare
		D Mifare DESfire
		U Mifare ultralight
12AB56789	Identifier data (depending of type of identifier and configuration file !)	
<CR>	OD hex	
<LF>	OA hex	

Remark: If Mifare block data is used, the block decoder must be used to interpret the data.

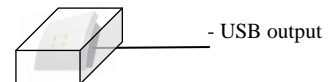
Using Aereco (from version 2.00) user specific header/trailer can be determined. (Check *Aereco user manual*)

3.5. USB Desktop reader

Uses USB to communicate to other systems. Inside the USB Desktop reader a Convexs reader is used with special configuration *NR9004.cfg* or *NR9005.cfg*

Two colour LED on the USB Desktop reader cannot be changed

Configuration *NR9004.cfg* or *NR9005.cfg* can be changed using Aereco.



3.5.1. Default settings

- Nedap cards: Card number
No customer code is sent (default), no check on customer code
- Mifare cards: CSN number (CSN reversed: *NR9005.cfg*)

For other settings the *NR9004.cfg* file must be changed by using Aereco.

3.5.2. Data format

Format: USB 2.0

Data: 12AB56789

12AB56789	Identifier data (depending of type of identifier and configuration file !)
-----------	--

Remark: If Mifare block data is used, the block decoder must be used to interpret the data.

4. Convexs/Invexs connections

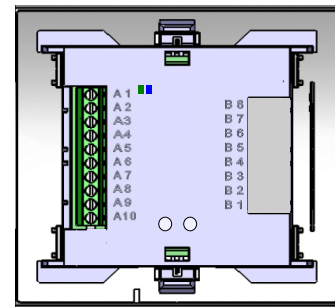
The Convexs/Invexs is **not** hot-swappable, so when making or changing connections be sure power is **Off**.
General:

- Check corresponding documentation of used AEpacks, Convexs converters and third party systems.
- Use correct shielded cables, cable shield must be connected to Power GND of Convexs (A2) Invexs (2) and GND of external device (or metal case)
- Beeper can also optional be controlled by configuration settings (see chapter 5).
- Check for Invexs 190 cabling colours

4.1. Convexs Connections

Convexs		Function
A1	Power / XSMOD	Power in (10-30VDC) / XS modulator (120kHz)
A2	POWER GND/shield	Power Ground
A3	A (-)	RS485
A4	B (+)	RS485
A5	D0	Wiegand Data 0
A6	D1	Wiegand Data 1
A7	BEEP	Beep input
A8	UL*	UL led input
A9	GND	Led/Beep Common Ground
A10	NA*	NA led input

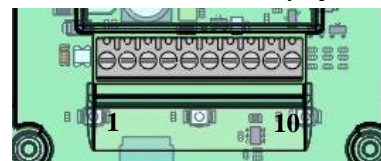
Convexs Rear view



4.2. Invexs 170 Connections

Invexs		Function
1	Power / XSMOD	Power in (10-30VDC) / XS modulator (120kHz)
2	POWER GND/Shield	Power Ground
3	A (-)	RS485
4	B (+)	RS485
5	D0	Wiegand Data 0
6	D1	Wiegand Data 1
7	BEEP	Beep input
8	UL*	UL led input
9	GND	Led/Beep Common Ground
10	NA*	NA led input

Invexs without display



Invexs with display



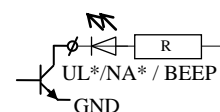
4.3. Invexs 190 Connections

Wire	Colour	Function
w1	Red	Power in (10-30VDC) / XS modulator (120kHz)
w2	Black	Power Ground / RF Ground
w3	Grey	RS485 A (-)
w4	Violet	RS485 B (+)
w5	Green	Wiegand Data 0 (D0)
w6	White	Wiegand Data 1 (D1)
w7	Yellow	Beep input (BEEP)
w8	Pink	UL led input (UL*)
w9	Blue	MD led input (MD*)
w10	Brown	NA led input (NA*)
w11	Shield / Metal	EM shield (connected to power ground)

Cable shield (wire 11) **must** be connected to the metal case of the external device

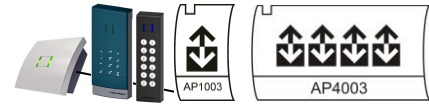
Remark:

- UL*,NA*, MD* and BEEP are *Open Collector to GND*.
If Convexs adapters (AX1014 or AB350) are used, the original UL and NA signals of the reader are converted to be used with UL* and NA* of the Convexs/Invexs.
- Invexs 190 to AX1014 or AB350 needs additional connection between GND (for UL and NA) and Antenna GND **on** the AX1014 / AB350 (Invexs 190 has no separate cable for this connection)



4.4. Connections using RS485

Convexs/Invexs connected to Nedap AEPacks using RS485: For those AEPacks not having RS485 on board use the additional AX1012 (RS485 to RS232 converter)



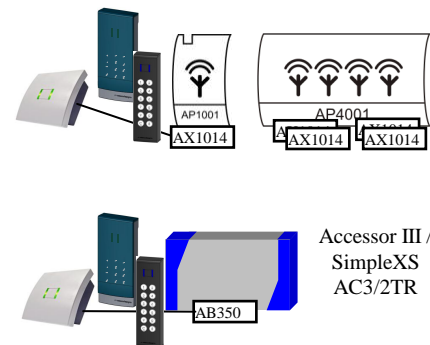
Convexs / Invexs			AP6003	AP4x03x	AP1003 ¹⁾	AP1003+AX1012 ²⁾		
A1	1	Power / XSMOD	Lower 1 ³⁾	1 ³⁾	Upper	1 ³⁾	Upper	1 ³⁾
A2	2	POWER GND/shield	14	14	Lower	1	Lower	1
A3	3	A (-)	8	8	Upper	13	AX1012	Rx+
A4	4	B (+)	10	10	Upper	16	AX1012	Rx-
A5	5	D0		--	--		--	
A6	6	D1		--	--		--	
A7	7	BEEP	16 ⁴⁾	--	--		--	
A8	8	UL*		--	--		--	
A9	9	GND		--	--		--	
A10	10	NA*		--	--		--	

Remarks:

- 1 On AP1003 the RS485 is available on Upper Row connector points 13 - 16, only from PMS D or higher
- 2 For AP1003 with PMS below D use the additional AX1012 to convert RS232 from AP1003 to RS485 for Convexs
- 3 Power for Convexs can be supplied by
 - External Power Supply
 - AEPack, check correct voltage and current at given AEPack output
- 4 Beeper on Convexs can be optional controlled
 - on AP6003 this can be done by pin 16
 - on other AEPacks use Relais output
- 5 LED control is supplied over the RS485 communication, so no additional wiring is needed
- 6 Cable shield must be connected to Power GND of Convexs (A2) and GND of external device or metal case of the external device (at housing of AP6003, AP4x03x, AEbox)
- 7 If Convexs replaces e.g. DC130 antenna the existing cabling of the DC130 antenna (4 x 0,25qmm) can be reused for RS485 and Power only if cable length not exceeds 50 meters and cable shield is correct connected.
- 8 PIN code for the Invexs reader is transmitted using the RS485 communication.

4.5. Connections using RF output

Convexs / Invexs			AX1014	AB350
A1	1	Power / XSMOD	11 – ANT	ANT
A2	2	POWER GND/shield	12 – GND	GND
A3	3	A (-)		
A4	4	B (+)		
A5	5	D0		--
A6	6	D1		--
A7	7	BEEP	relay	relay--
A8	8	UL*	13 – UL*	UL*
A9	9	GND _s	14 – GND	GND
A10	10	NA*	15 – NA*	NA*

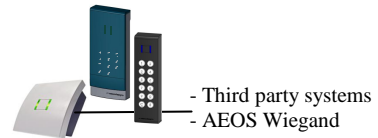


Remarks:

- 1 For Nedap reader AEPacks the AX1014 must be applied to each AEPack
- 2 For the Accessor III / SimpleXS / AC3/2TR the AB350 must be applied
- 3 Existing cabling can be re-used when the Nedap antenna is replaced by the Convexs
- 4 Power is supplied to the Convexs by the RF signals on A1 and A2, no additional Power Supply is needed.
- 5 Beeper can be controlled optional by making the correct configuration settings or hardware connection.
- 6 Cable shield must be connected to Power GND of Convexs (A2) and GND of external device or metal case of the external device (at housing of Accessor, AP4x01, AEbox)
- 7 PIN code for Invexs readers is NOT possible
- 8 Invexs 190 to AX1014 or AB350 needs additional connection between GND (for UL and NA) and Antenna GND on the AX1014 / AB350 (Invexs 190 has no separate cable for this connection)

4.6. Wiegand

If the Convex is connected to a Third party system using Wiegand the Power must be supplied external or from the Third party system.



Convexs / Invexs				Third party system
A1	1	w1	Power / XSMOD	Power +
A2	2	w2	POWER GND/shield	Power GND
A3	3	w3	A (-)	--
A4	4	w4	B (+)	--
A5	5	w5	D0	Data 0
A6	6	w6	D1	Data 1
A7	7	w7	BEEP	? ¹⁾
A8	8	w8	UL*	? ¹⁾
A9	9		GND	? ¹⁾
A10	10	w10	NA*	? ¹⁾
		w9	MD*	? ¹⁾
		w11	Cable shield	Metal case

Remarks:

1 Beeper and LED control is depending of the third party system and optional from the used configuration.

2 Cable shield must be connected to Power GND of Convex (A2) and GND of external device or metal case of the external device.

3 PIN code is possible over Wiegand

5. Convexs/Invexs LED and Beeper control

The Convexs/Invexs has three LED's (red, green and blue) and a buzzer to give additional information to the user. At the backside of the Convexs/Invexs, a status LED (blue) and ID led (green) are available.

5.1. User LED's

- UL LED (green), controlled by a hardware signal to connector A8
Or if rs485NR protocol is used, UL LED is controlled over the RS485 communication line.
- NA LED (red), controlled by a hardware signal to connector A10
Or if rs485NR protocol is used, NA LED is controlled over the RS485 communication line.
- Status LED (blue):
The blue LED is used as status indication to the user.
Up from certain AEOS and firmware versions the blue LED can also be controlled over the RS485NR protocol. Otherwise it must be activated at the Configuration (AEreco). If activated the blue LED will be active if both other LED's or OFF. So if both UL and NA are OFF)NA LED must be OFF ± 1 sec), the blue LED automatically will be ON.

5.2. Beeper

The Beeper can be controlled by:

- Hardware signal to connector A7
Or if rs485NR2 protocol is used, Beeper is controlled over the RS485 communication line.
- Software if card is detected (at AEreco: *NA/UL beep*):
 - If UL LED is activated (valid card) beeper is shortly activated
 - IF NA LED is activated (invalid card) beeper is 3 times shortly activated

The volume of the beeper can also be controlled by AEreco (valid for both hardware and software setting).

The beeper is also used for indicating the status of loading the configuration at the Convexs/Invexs.

5.3. Status LED's

The blue LED at the front side is used to indicate if a configuration is loaded at the Convexs/Invexs.

The blue status LED at the backside is used to indicate the status of the Convexs/Invexs reader, the green ID LED to indicate the detection of a card.

See *Installation sheet* for detailed information.

6. Invexs PIN modes

On the Invexs different modes for using the PIN code are available. These are depending off the used communication protocol.

6.1. RS485NR

The activation of the PIN is controlled over the RS485NR communication, by the used AEbcs. The AEbcs determine if the PIN code is activated or not (and if also the PIN code LED's are activated then).

6.2. Wiegand

The PIN code (if the LED's behind the ciphers are activated) acts different, depending on the version of the Invexs firmware:

- Invexs versions before 2.06
If card is detected by the Invexs, the PIN code LED's are turned on.
At Wiegand the PIN code LED's are turned off by: change at NA or UL LED, or after time-out
- Invexs versions after 2.06
Up from 2.06 it is possible to make a setting on AEreco (version > 2.1.0) to set the PIN code always on.
Default setting as with version before 2.06, if via AEreco the new option is activated, the PIN code is always on (independent of a badge detection)
This option requires also modified firmware at the used AEpack (check AEpack version file for this).

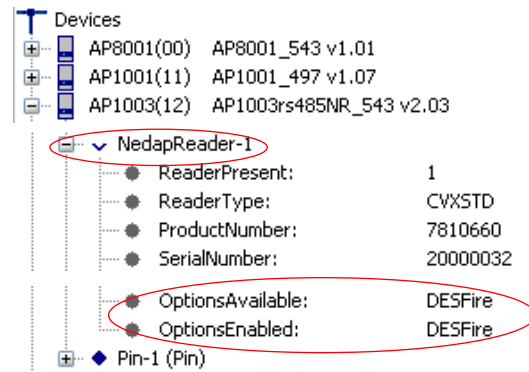
7. Configuring the Convexs/Invexs

Functionality and output protocol of the Convexs/Invexs reader is determined by the *configuration* that is loaded in the reader. This configuration is defined using the program *AEreco*, and deployed by the *configuration card* or via *AEmon* (the specific configuration file is uploaded to the Convexs/Invexs, identical as *AEpack* firmware). With *AEreco* a *Configuration file* or *Configuration card* can be generated. These contain all settings for the Convexs/Invexs:

- Configuration file:
 - The configuration card contains the configuration for a Convexs/Invexs and can be handled as follows:
 - With *AEmon* this file can be loaded into the (or all) Convexs/Invexs
 - Can be used to generate a configuration card
 - With *AEreco* this file can be loaded directly into the connected Convexs/Invexs
- Configuration card
 - By presenting this card to a Convexs/Invexs the configuration in this card is transferred to the Convexs/Invexs.
- DEScount card
 - For situations where existing Convexs/Invexs MN or Convexs/Invexs M must be made suitable to read DESFire cards this special DEScount card is used. On this card the amount of Convexs/Invexs readers that must be made suitable to read DESFire is programmed. For each converted Convexs/Invexs to DESFire the amount on the DEScount card is decreased.

DESFire available / enabled:

If DESFire is enabled (and this reader is suitable using DESFire) can be checked with *AEmon* at the *View Hardware*: (only with the *rs485NR* protocols): Select the Nedap reader and check with options are available (*OptionsAvailable*) and which are enabled (*OptionsEnabled*):



A configuration of a Convexs/Invexs **can not** be read back from the Convexs/Invexs, so when making changes to a configuration you always need to use *AEreco* with the (original) configuration settings for this specific customer.

After loading the configuration the beeper is used to indicate if the loaded configuration is correct or not:

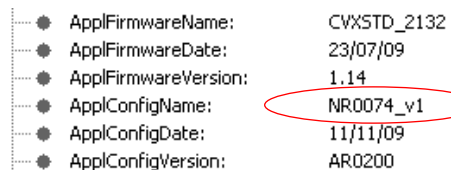
- High sound: Configuration is loaded, a second High sound indicates that this configuration can be used at this reader.
- Low sound: Configuration is not loaded, error has occurred.

7.1. Nedap reader Configuration file

The Configuration file can be uploading to the Nedap reader by:

- Using *AEmon*, the Convexs/Invexs is connected to the *AEOS* reader *AEpack* (APx003rs485NR, the Convexs/Invexs must have the *RS485NR* output protocol)
At *AEmon* in the *Hardware view* the connected Convexs/Invexs reader(s) are available. Selecting now these Convexs/Invexs reader(s) gives the opportunity to load a new configuration file.
Using *AEmon* all connected Convexs/Invexs readers can easily be updated to a new configuration file.

At the *Hardware view* the correct Configuration file can be checked (beside other important settings of the Nedap reader, e.g. Options, Firmware, Kernel versions, etc)



- Connect the Convexs/Invexs directly to *AEreco* and load the configuration file direct to this Convexs/Invexs

Remark: If the Configuration file is uploaded as above to the Convexs/Invexs, no checks are made if this configuration file is suitable for this Convexs/Invexs. This is in contradiction with the use of the Configuration card (then only specific cards with specific keys can be used to program these Convexs/Invexs).

7.2. Configuration card

The configuration made with AEreco can be stored on a configuration card. By presenting this configuration card to a new Convexs/Invexs (default, factory settings) the settings on the configuration card are programmed into the Convexs/Invexs reader. Up from now only these specific unique configuration cards can be used to program the configuration in the corresponding Convexs/Invexs readers.

During the configuration process the beeper will sound, to indicate the configuration is loading (and the card should **not** be taken away from the Convexs/Invexs). This process takes about 5 seconds.

The uniqueness of the combination of Configuration card and Convexs/Invexs is made with the *Reader read key* that is determined at AEreco (*General – Configuration card*). This Reader read key is also stored in the Convexs/Invexs and every following time a Configuration card is offered, this Reader read key is compared against this key of the Configuration card. This principle results that only Configuration cards with the same *Reader read key* can change the configuration of a Convexs/Invexs. This key is independent of the Mifare keys.

8. Updating firmware of the Convexs/Invexs

If new firmware must be loading into the Convexs/Invexs reader this can be done by:

- Using AEmon, the Convexs/Invexs is connected to the AEOS reader AEPack (APx003rs485NR or APx003rs485NR2, the Convexs/Invexs must have the *RS485NR* output protocol).
At AEmon in the *Hardware view* the connected Convexs/Invexs reader(s) are available. Selecting now these Convexs/Invexs reader(s) gives the opportunity to load a new firmware
Using AEmon all connected Convexs/Invexs readers can easily be updated with new firmware.
- Connect the Convexs/Invexs directly to AEreco (RS485) and load the new firmware direct to this Convexs.

Remark: After updating the firmware the configuration must be reloaded. Updating the firmware will automatically remove the configuration.

9. Default settings of the Convexs/Invexs

Default settings (factory settings, *NR9000.cfg*) of the Convexs/Invexs are:

- Mifare reader enabled, Mode: CSN (CSN reversed: *NR9001.cfg*)
- Conversion table

Input Type	Output Type
Nedap XS	RS485NR
Nedap XS	Nedap RF badge
Mifare CSN	RS485NR
Mifare CSN	Nedap RF data

- Beeper: No NA / UL beep
- Led Mode: Red / Green
- Preferred Card Type: Nedap XS Card
- Configuration card enable
- Reader read key: FC9011EE5339

With this default configuration (file *NR9000.cfg* and *NR9001.cfg*) the Convexs/Invexs acting for XS cards as a normal antenna, and can be connected to AEPacks (on RS485NR) or Nedap reader AEPacks (with AX1014) or XS readers (with AB350).

10. Available reader firmware

Pay attention that not for all output protocols suitable firmware is available at the applied readers.

The *Nedap RF badge* can always be used on Nedap readers. *Wiegand formats* can always be used on APx003 series with corresponding firmware.

For the *Nedap RF data* and *RS485NR* not for all readers the suitable firmware is available. Please check always for the correct firmware version.

	Nedap RF data	RS485NR	Remarks
AP1001	AP1001_548v210	X	
AP1002	AP1002_548v211	X	
AP1009	AP1009_548v211	X	
AP4001	AP4001_543v204	X	
AP4001X	AP4001_543v305	X	
AP1003	X	AP1003rs485NR2_543v200 AP1003rs485NR_543v200	
AP4003	X	AP4003rs485NR2_543v210	
AP4003X	X	AP4003rs485NR2_543v210 AP4003rs485NR_543v31x	See remark AP4x03 below
AP6003	X	AP6003rs485NR2_2368v100 AP6003rs485NR_2368v100	
Accessor III on AEOS	A3PNU_AEOS_v2.01	X	
SimpleXS on AEOS	A0PNU_AEOS_v2.01	X	
AC3/2TR on AEOS	H7A3U_AEOS_v2.02	X	

Remarks:

- X in above table means **NOT** possible.
- Two RS485 protocols are available:
 - *rs485NR2* (up from 8-2009) able to show the Convexs/Invexs as an AEpack in AEmon, offering full implementation for AP4x03 and AP4x03X (PIN, tamper switch) and additional features such as Beeper control over RS485.
Can be used for all most corresponding AEpacks (including AP4x03).
Highly preferable to use always this protocol!
 - *rs485NR*: Convexs/Invexs is not visible in AEmon, only AEpack to it is connected is shown.
First implementation of rs485NR protocol.
Not available for AP4x03. The AP4x03 (RS485NR) is only available for the X version up from version v3.1x, and must have **at least** Kernel version 3.10.
Tamper switch and PIN not available at the AP4x03X, only at the AP1003 with RS485.
- AP4003X (*rs485NR*) / AP4003 (*rs485NR2*) connected to
 - AP8001X: needs AP8001X_543v302 or higher
 - AP8001: needs AP8001_543v102 or higher (and kernel for AP8001 version 1.04 or higher)
 - AP4801X, AP4803X, AP4807X: needs kernel 3.11 or higher
 - AP4801, AP4803, AP4807: needs kernel 2.11 or higher
- For XS readers connected to WinXS *Nedap RF data* is not possible (use always RF badge).
- When using RS485 check if the applied AEpack is equipped with RS485 interface. Otherwise the AX1012 (RS232 to RS485 converter) must be placed at the AEpack).

10.1. AEOS versions

The Convexs/Invexs can be connected to AEOS for (almost) all versions; in-dependending of the communication method between the AEpack and Convexs/Invexs (the AEpacks must have the correct firmware, see above).

If the Convexs/Invexs is not supported by an older AEOS version, the data from the card will still be read by AEOS and normal handled, It is not possible to see these Convexs/Invexs in AEmon or to load (using AEmon) a new configuration in the Convexs/Invexs (in case RS485 is used):

- Up from 2.2.0 Convexs/Invexs supported
- Up from 2.1.7 / 2.2.0: Primary and secondary identifier type at Access Points

So if using the Convexs/Invexs with e.g. RS485 it can be connected to AEOS version before 2.2.0 or 2.1.7. If the configuration of the Convexs/Invexs differs from default this configuration must be loaded using a configuration card (using firmware APx003rs485NR)

Remark: Check always the AEOS release notes for detailed information and the Know Problems in chapter 11.

11. Known problems

11.1. Convexs/Invexs to AP1002

In case the Convexs/Invexs reader is connected to an AP1002 (both Nedap RF data and Nedap RF badge) the potentiometer for the transmitter level must be set to minimum. Otherwise detection can be intermittend.

11.2. Convexs/Invexs to Nedap readers with AM badges

In case the Convexs/Invexs reader is connected to Nedap readers (e.g. AP4001 or AP1001) with output *Nedap RF badge* the AM badges (A, B, C, D, G codes) will not be read on the Nedap reader. In this cases use as output the *Nedap RF data*.

11.3. Convexs/Invexs to AP4003 using RS485

Using *rs485NR* firmware: Connecting the Convexs/Invexs to the 4000 series using rs485NR can **only** to the AP4003X (and AP4803X), so **not** to AP4003 (or AP4803). The AP4x03X requires at least kernel 3.10 and corresponding firmware. For the AP4x03 (with kernel version 2) connecting the Convexs/Invexs with RS485 using the rs485NR firmware is **NOT** possible.

This is solved with the *rs485NR2* firmware. This firmware is suitable for both AP4x03 and APx03X (and AP1003, AP6003)

Check always the version of firmware for the AEpu (see *Remarks* at chapter 10).

11.4. Convexs/Invexs to AP4003 using RS485 Tamperwith / PIN

If *rs485NR* is used, the Tamperwith and PIN at the Convexs/Invexs is only available at the AP1003 with RS485, not at the AP4000 series.

Advisable is to use the *rs485NR2* protocol, supporting these features on AP4003 series.

11.5. Convexs/Invexs to AP4x03X series before production code W2 using RS485

The first series of AP4803X and AP4003X (Production codes before W2) will put this AEpack out of order after uploading the Convexs/Invexs configurations and/or firmware to the Convexs/Invexs (or Nedap Readers), when using the RS485NR protocol.

Solution for this is to replace this AEpacks. (These AEpacks can be used for other protocols without problems.)

AP4x03X produced before June 2009 could sometimes have communication problems on the RS485 line. Due to this the Convexs/Invexs can malfunction.

11.6. Invexs with display / screen

Invexs MNKS with display is only available on request, depending on the application to be used (what information must be shown on the screen).

12. Aereco cards enquiry information

For this part check the document *Aereco cards enquiry Information* (available on www.nedap.net). This document described the necessary data (regarding to Mifare cards) for making a configuration file with Aereco.

13. Document History

Date	#	Who	Changes
11-04-2011	9	REW	Invexs 190 to AB350/AX1014 needs additional GND, FCC changed
17-01-2011	8	REW	Invexs 190, FCC certifications and UID 7 bytes added
12-10-2010	7	REW	Invexs with screen / display only available on requses.
18-05-2010	6	REW	Blue led always available (so not only with RS485 communication !), PIN code modes for Invexs added, Enquiry information removed to separate doc.
25-01-2010	5	REW	Blue led only with RS485 communication available added
23-11-2009	5	REW	MND added, check DESFire in AEmon added
08-09-2009	4	REW	Known problems extended with Nedap readers instead of AP4001 (AM badge)
16-07-2009	4	REW	rs485NR2 added (available also for AP4x03), LED/Beeper control changed
28-05-2009	3	REW	Invexs added
12-03-2009		REW	Known problem added about first AP4803X
09-03-2009		REW	EV1 added in Enquiry part DES EV1 and Native settings
26-11-2008		REW	Tamper switch not available on AP4000 added
20-11-2008		REW	Configuration files naming changed to NRxxxx
28-10-2008		REW	Serial output + USB reader added, DESfire enquiry changed Restrictions AP480x series added (in chapter 10)
09-09-2008		REW	Conversion MN/M to DESFire added (DEScount). Using Convexs with older AEOS versions added
15-08-2008		REW	Mifare DESFire added