Output Format Description

Access 7 C 2.0 and Access 7 C 2.0 pin

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1.00	Ara	9.11.2012	First version
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1. Introduction

1.1. Brief Operational Description

Access 7 C 2.0 readers are multi-purpose configurable readers targeted mainly for access control applications. This document is valid for all Access 7 C 2.0 readers.

The reader supports Wiegand, Clock and Data, RS-232, USB and USB HI interfaces **(USB and USB HI interfaces only for non-pin readers)**. As a default, the reader uses Wiegand, Clock and Data and RS-232. RS-232 is always in use. It can be decided whether Wiegand or Clock and Data is used together with RS-232. When USB or USB HI interface is used, other interfaces and input controls are disabled. USB interface uses identical messages to RS-232 formats and it can be used either through a virtual COM port or a DLL driver. USB HI interface acts in a so called keyboard emulation mode, which means that the interface outputs tag information directly in the cursor location.

Certain parameters can be configured accordingly to customer's needs. These are:

- Wiegand bit amount, parity bits and bit timings,
- Led and buzzer functionality
- Re-reading delay
- Keypad backlight functionality (color and backlight time)
- RF field on/off time
- Generic output control and functionality
- Tamper functionality
- Alive message

For additional information on these, please see chapter two.

1.2. Supported 13,56 MHz Technologies

The reader supports following different tag technologies: MIFARE® DESFire: UID, MIFARE® Classic: UID, MIFARE® Ultralight UID, MIFARE® Plus UID, MIFARE® SmartMX (MIFARE® Classic emulation mode) UID, NFC (UID), Mifare Classic 7 Byte UID.

The reader does not support anti-collision as it is not normally needed in access control applications. Low (125-300kHz) and high frequency tags can be in the operating field without any effect, as well as most of unsupported 13,56 MHz tags.

1.2.1. Mifare

32-bit MIFARE Classic or 56-bit MIFARE DESFire/Ultralight anti-collision serial number is read from the tag. Manufacturer guarantees this number to be unique, so it is suitable for access control applications.

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2. Configurable Parameters

The following parameters can be configured with the Access 7 C 2.0 readers. Please note that these parameters are typically configured at Idesco Oy prior to delivery. Also, customer can configure these parameters by using Idesco's Descoder 2.0 tool.

- Output format (Wiegand or Clock and Data, RS-232 always in use)
- Wiegand data length and data structure (parity / no parity)
- Wiegand timings
- Clock and Data selection
- Clock and Data timings
- RS-232 mode
- Buzzer and LED function modes
- PIN-code formats
- Re-reading delay
- USB and USB HI interfaces
- Keypad backlight functionality (color and backlight time)
- RF field on/off time
- Generic output control and functionality
- Tamper functionality
- Alive message
- ID number in reverse order

2.1. Output Format Selection

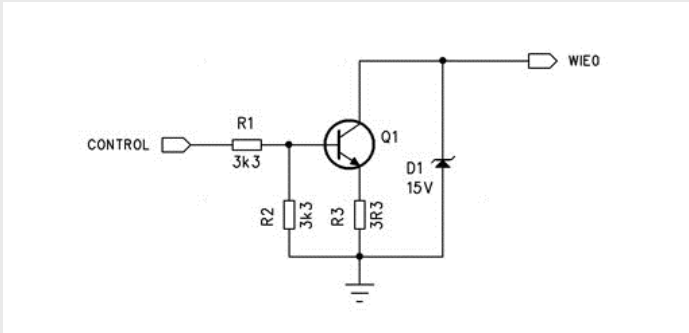
With Wiegand and Clock and Data output, the electrical connection is the same for both outputs.

2.1.1. Pulse Output (Wiegand / Clock and Data)

Pulse output is implemented using open collector outputs. Maximum current drain is 50 mA and maximum voltage is 15 VDC. The connection requires external current source, for example pull-up resistors, to be used.

2.1.2. Internal Output Circuit (Wiegand / Clock and data)

Output circuits inside the reader are shown below.



Picture 1. Internal Output Circuit (Wiegand / Clock and Data

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The output voltage is limited to +15 V and current to 100 mA. Conducting state voltage has maximum level of 0.7 V from ground with 60 mA current.

2.2. Wiegand Data Length

The length can vary between 24 and 66 bits. Notice that bit frames can be either with or without parity bits. For example if data length is defined as 32 bits and parity bits are also included, the data frame is constructed of 30 data bits and two parity bits.

Examples of data lengths:

MIFARE Classic 1k 24-bit data:
UID number 32 bits: B5402BA2 hex
Data shortened to 24 bits: 402BA2 hex

MIFARE Classic 1k 35-bit data:
UID number 32 bits: B5402BA2 hex
Wiegand data length changed to 35 bits: 1011 0101 0100 0000 0010 1011 1010 0010 **000** binary (3 zeroes added)

2.3. Wiegand Data Timings

Customer can define Wiegand bit length and Wiegand bit delay timing parameters. When timings need to be configured, please contact Idesco Oy to get more information. Timing parameters can also be configured with Idesco's Descoder 2.0 tool.

2.4. Wiegand Parity Bits / No Parity Bits

Wiegand data can be sent either with or without parity bits. When parity bits are included in the data string, the parity bits are defined in the following way:

- First bit is even parity
- Last bit is odd parity

Parity bit calculation:

Even data length

- data is split in the middle (for example 12+12 bits)
- the first part of the data is the even parity range, and the last part of the data is included in the odd parity calculation
- even parity is calculated so that the total amount of logical one bits is even
- odd parity is calculated so that the total amount of logical one bits is odd

Odd data length

- the bit in the middle of the data string is used for both parity bits
- for example in the 35-bit Wiegand data string both parity ranges are 18 bits, and the bit in the middle of the data string is used for calculating both parity bits
- first part of the data is the even parity range, last part of the data is included in the odd parity calculation
- even parity is calculated so that the total amount of logical one bits is even
- odd parity is calculated so that the total amount of logical one bits is odd

NOTE 1. The default 66-bit Wiegand format is an exception from this rule. In this format the first bit is odd parity and last bit is even parity. 4+4 bits in the middle are used to calculate both parity bits. I.e. odd parity is calculated from the first 36 bits of a serial number and even parity is calculated from the last 36 bits of a serial number.

NOTE 2. It is possible to use another 37-bit Wiegand format. The format is otherwise the same as the normal 37-bit Wiegand - only additional zeroes are added in the beginning of the data string (after the first parity bit).

Example:
MIFARE UID number B5402BA2:
Reader sends the data in the following binary form:
0 0001 0110 1010 1000 0000 0101 0111 0100 0100

2.5. Clock and Data Selection

Access 7 C 2.0 reader supports only 10 character BCD Clock and Data format. Please see detailed description below.

All data characters are sent in BCD format. Reader adds 10 leading and 10 trailing zeroes to the Clock and Data string.

Output format:

10 leading 0's	SS	DATA	ES	LRC	10 trailing 0's

SS = Start sentinel 'B'
DATA = 10-character BCD-coded data converted from the card's 32-bit hexadecimal UID number.
ES = End sentinel 'F'
LRC = Checksum character. LRC calculation is defined in the ISO 7811-2 standard.

2.6. Clock and Data Timings

Customer can define timing parameters for both the Clock and Data line. If timings need to be configured, please contact Idesco Oy to get more information.

2.7. RS-232/USB Format 1

Output string has a format:

BSSSSSSSSSSSSSSS=PPPPMTC<LF><CR>

, where

Data	Length	Description
B	1 byte	Start character, constant 'B'
S	16 bytes	Serial number
=	1 byte	Separation character, constant '='
P	4 bytes	constant 0000h
M	1 byte	Tag type 1=Mifare
T	1 byte	End character, constant 'T'
C	1 byte	LRC-checksum, explained in chapter 2.7.1. Only 4 information bits are used.

All transmitted characters are ASCII characters.
Mifare Standard has serial number length of 32 bits, remaining 8 characters are always zeroes.

Communication settings: 9600 bauds, no parity, 8 databits, 1 start bit, 1 stop bit.

2.7.1. Checksum calculation

Detailed information on calculation can be requested from Idesco Oy.

2.8. Buzzer and LED Modes

Reader's buzzer and led control can be configured in nine different modes:

Mode	Description
00	Beep on when a tag is read, LED is red when idle, reader flashes green on tag read
01	Beep off when a tag is read, LED is red when idle, reader flashes green on tag read
02	Beep on when a tag is read, LED is off when idle, reader flashes green on tag read
03	Beep off when a tag is read, LED is off when idle, reader flashes green on tag read
04	Beep on when a tag is read, LED is red when idle, host flashes green (cable)
05	Beep off when a tag is read, LED is red when idle, host flashes green (cable)
06	Beep on when a tag is read, LED is off when idle, host flashes green and / or red (cable)
07	Beep off when a tag is read, LED is off when idle, host flashes green and / or red (cable)
08	Beep off when a tag is read, LED is off when idle, reader flashes yellow on tag read

2.9. PIN-code Formats

2.9.1. PIN-codes in Wiegand Format

PIN-codes can be sent in 4-bit, 6-bit, 8-bit, 26-bit or in 32-bit format. The following tables describe the 8-bit and 4-bit PIN-codes.

Other PIN-code options are composed of 8-bit and 4-bit code formats. Please note that all PIN-code formats can be sent out without sounding the buzzer when the pin pad is pressed.

Table 1. 8-bit PIN-codes

Key	Hex	Binary
0	F0	11110000
1	E1	11100001
2	D2	11010010
3	C3	11000011
4	B4	10110100
5	A5	10100101

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6	96	10010110
7	87	10000111
8	78	01111000
9	69	01101001
*	5A	01011010
#	4B	01001011

Table 2. 4-bit PIN-codes

Key	Ascii	Binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
*	A	1010
#	B	1011

4-bit mode: each key press produces a 4-bit code described in Table 2.

6-bit mode: each key press produces a 6-bit code where the first bit is even parity and the last bit is odd parity. First two data bits are included in even parity bit calculation and the last two data bits are calculated to odd parity bit.

8-bit mode: each keypress produces a 8-bit code described in Table 1.

26-bit mode: 1-6 pcs of 4-bit codes. 4-bit codes are described in Table 2. In a 26-bit Wiegand data string the first bit is the even parity bit and the last bit is the odd parity bit. First twelve data bits are included to calculate the even parity bit and the last twelve data bits are used to calculate the odd parity bit. The data is sent out after six keypresses or when '#' is pressed in the pinpad. Note that the reader waits for up to 20 seconds for each keypress. Reader's internal buffer is deleted of keypress records if no keys have not been entered within 20 seconds.

Example:
Pressing 1234 and # produces a record '001234' to be sent out.

32-bit mode: 4 pcs of 8-bit codes are sent in one block. 8-bit codes are described in Table 1. The data is sent after four keypresses or when '#' is pressed on the pinpad. Note that the reader waits for up to 20 seconds for each keypress. Reader's internal buffer is deleted of keypress records if no keys have not been entered within 20 seconds.

Example:
Pressing 12 and # produces a record '0012' to be sent out from the reader.

Please note that when the PIN-input wire is grounded, the reader does not react to key presses. Nevertheless, the tag reading operates normally.

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2.9.2. PIN-codes in Clock and Data Format

10-character BCD format use 10 leading/trailing zeroes when sending PIN-codes. Please see Table 3.

< 10 leading zeroes > BPFC < 10 trailing zeroes >

Data	Length	Description
B	1 byte	Start character, constant '1011'
P	1 byte	PIN-code character
F	1 byte	End character, constant '1111'
C	1 byte	Checksum

Output data:

Table 3. Clock and Data PIN-codes

Key	Hex	Binary Output
0	0	11010 00001 11111 00100
1	1	11010 10000 11111 10101
2	2	11010 01000 11111 01101
3	3	11010 11001 11111 11100
4	4	11010 00100 11111 00001
5	5	11010 10101 11111 10000
6	6	11010 01101 11111 01000
7	7	11010 11100 11111 11001
8	8	11010 00010 11111 00111
9	9	11010 10011 11111 10110
*	A	11010 01011 11111 01110
#	E	11010 01110 11111 01011

2.9.3. PIN-codes in RS-232/USB formats

In RS232 format 1 the PIN-codes are sent out as described in Table 1 in chapter 2.12.1 (hexadecimal characters). In RS-232/USB format 2 pin codes are sent out according to the Table 2 in chapter 2.12.1 (ASCII characters).

Note! Pin code is sent out as a plain character. It doesn't include any frame.

Serial communication parameters are: 9600 bauds, no parity, 8 data bits, 1 start bit, 1 stop bit.

2.10. Data in Reverse Order

ID number can be sent out in reverse order. When this option is used, bits are reversed in the following way:

MIFARE Classic: all bytes are reversed.
MIFARE DESfire, MIFARE Ultralight: all bits are reversed.

Examples:
MIFARE ID number: B5402BA2
ID in reverse order: A22B40B5

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2.11. Re-read Delay

Re-read delay can be set to be any time between 0 to 63 seconds. This is the delay after which a same tag is accepted again.

2.12. Readers Equipped with EL-foil (example Access 7 C 2.0 Pin Illuminatum)

EL-foil is on for 5 seconds after the card is presented to the reader. EL-foil is also switched on on a key press.

2.13. Keypad backlight functionality (color and backlight time)

Pinpad backlight color can be configured to red, green and blue.

Backlight on / off time can be configured from 1 to 62 seconds. Backlights can also be configured continuously on.

2.14. RF field on/off time

RF field on / off time can be configured from 20 ms to 2550 ms.

2.15. Generic output control and functionality

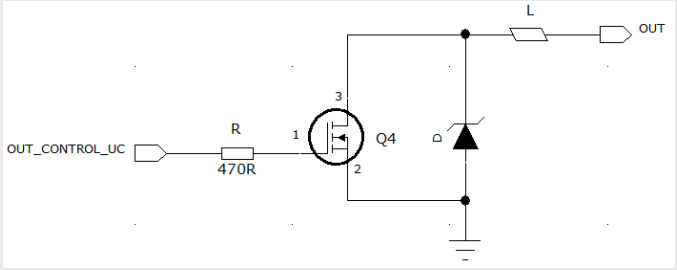
Reader has one generic output, which can be used to trigger some functionality. Output drive source can be one of the following:

- Correct pin code (Pin code is given separately to trigger output control. There can be two different pin codes for this control.)
- Tamper alarm

Also, reader output can be directly driven by the exit button in the door, i.e. when person presses the exit button, reader output opens the lock.

2.15.1. Internal FET output circuit

Reader has two internal FET outputs. Output circuit is described below. Max current load is 500 mA.



FET output circuit

2.16. Tamper functionality

The reader has an optical tamper that can be enabled or disabled. When tamper is set on, reader sends the hex character “C” to the host system when tamper is alarming. Tamper message is sent out in the similar frame that is used in the pinpad reader pin output.

Please note that installation surface has effect to the tamper switch sensitivity. Use Idesco installation plate behind the reader to achieve similar tamper sensitivity level in all installations.

2.17. Alive message

The reader can send an Alive-message to inform the host system its existence. This feature can be configured on / off. The first message is sent 30 seconds after power up and then the message is sent out in a frequency of 1 minute. When the pinpad is pressed or a card is shown, the Alive-message is sent to the host system one minute after this. In another words, pressing the keypad or showing card resets the Alive-message counter inside the reader.

Alive message can use 4-, 6-, 8- and 38 message structures. When 4-, 6-, or 8-bit mode is selected hex character “D”- hex is sent to host system. Alive message in these formats is sent out in the similar frame that is used in the pinpad reader pin output.

38- bit Message structure:

Message length: 38 bits
E = first bit even parity
STATUS1 = “1” when the reader is powered, reset to “0” after first message is sent out.
STATUS2 = ”1” when the reader doesn’t function correctly, “0” when it does function correctly.
MANUFACTURER DATA = 4 bits, Idesco number “5” hex, “0101” in binary.
MANUFACTURER TYPE = 4 bits, Idesco Access 8 CD reader “D” hex, “1101” in binary.
MANUFACTURER STATUS = 4 bits, reader HW status

- 0000 -> status OK, other values -> NOK

READER SERIAL NUMBER = 22 bits
O = last bit odd parity

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