Card Formats

For Magnetic, Bar codes and Wiegand technologies

1- Wiegand technology

Sensor controllers may read up to 66 bits Wiegand string, via they inputs Data.
Several pre-defined formats are recognized by the controllers and the 66 bits read, according to the format selected,may contain card code, site code and parity bits.
See Table 1.1 below for the formats description.
The format recognized at a reader is programmed from the PC application via Mess 03.
From the GuardPointPro application, it is defined through the 'Controller/Reader/Miscellaneous-Badge format' screen.
In addition, other formats may be programmed by users
Note that each reader may have a different format.

1.1 Pre-defined formats

Table 1.1 shows the pre-defined format recognized by the controllers.
Each Wiegand string may include up to 66 bits represented as follows:
b65……b0 (b being the less significant bit)
For each format, the card code and the possible site code are indicated with their bit position in the Wiegand string.
- When jumpers JP4/6,7,8 (or DS1/6,7,8) are in position on,off,off, the controller checks that the card is read correctly,
i.e. that the number of bits received and the parity bits corresponds to the format defined at the reader. (See table 1.1)
- When jumpers JP4/6,7,8 (or DS1/6,7,8) are in position off,on,off, the controllers doesn't check the card reading. (not recommended)
The pre-defined format is sent to the controller with Mess 03 (see par. 3) where byte 2 is the format number (and bit 7=0)

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Multi-format reading:

From version 01/11/09, when different formats are defined for the readers, each reader supports also the 3 other formats defined at the other readers. It's works as follows:

When a specific format (other than the 'Hexadecimal' one) is defined at a reader, if a card passed at this reader doesn't have the number of bits expected for this format (see table 1.1), the system will check if the number of bits received from the card corresponds to the format defined on one of the 3 other readers. If yes, it will use this format for the card.

If no, the card will not be read excepted if ALL the readers get the same format. In this case, the card read will be in this format.

(For example, if the decimal format 01 must be applied to cards with more than 26 bits, the same format 01 must be defined for all the controller readers.)

This multi-format is active only if the card verification is set (JP4-DS1/6,7,8=on,off,off). If the card is not checked (JP4/7 or DS1/7 on), the controller will read the card only according to the format defined at the reader used.

Example:

- If formats 1,5,15,17 are defined at the readers 1,2,3 and 4, these 4 formats will be recognized at each reader.
- If format 1 and 17 are defined at reader 1 and 2, and format for readers 3 and 4 are 'hexadecimal', format 1 and 17

will be recognized at readers 1 and 2 only.

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Table 1.1: Pre-defined formats recognized by the controllers					
Format number	Format Name	Total Bit length	Card data		
			Card code	Site code	Parity
00	Hexadecimal	Up to 66	$b_{48}.....b_1$	-	b_n,b_0 [1]
01	Decimal	26	$(b_{16}...b_1)_{Dec.}$	$(b_{24}...b_{17})_{Dec.}$	b_n,b_0 [1]
02	Wiegand 44	44*	$b_{43}.....b_4$	-	$b_3..b_0$ [2]
03	Dec. 24 bits	26	$(b_{24}...b_{17})_{Dec}(b_{16}...b_1)_{Dec}$	$(b_{24}...b_{17})_{Dec}$	b_n,b_0 [1]
04	Dec. 6 digits	26	$(b_{24}...b_1)_{Dec}$	-	b_n,b_0 [1]
05	Decimal	Up to 42	$(b_{40}.....b_1)_{Dec}$	-	b_n,b_0 [1]
06	Hexa Wieg. 06	36*	$b_{35}.....b_4$	-	$b_3..b_0$ [3]
07	Hexa Wieg. 07	37*	$b_{36}.....b_1$	-	b_0 [4]
08	Hexa Wieg. 08	48*	$b_{47}.....b_0$	-	-
09	Hexa Wieg. 09	34	$b_{24}...b_1$	-	b_n,b_0 [1]
10	Dec Wieg. 10	37*	$(b_{35}...b_{25}b_8...b_1)_{Dec}$	$(b_{24}...b_9)_{Dec.}$	b_n,b_0 [1]
11	Dec Wieg. 11	32*	$(b_{28}...b_2)_{Dec.}$	-	b_{31}-b_{29},b_1,b_0 [5]
12	Hexa Wieg. 12	64*	$b_{23}...b_0$	-	-
13	Dec Wieg. 13	32*	$(b_{31}...b_0)_{Dec.}$	-	-
14	Hex Wieg. 14	32	$b_7..b_0b_{15}..b_8b_{23}..b_{16}b_{31}..b_{24}$	-	-
15	Hex Wieg. 15	32*	$b_{31}...b_0$	-	-
16	Dec Wieg. 16	48*	$(b_{15}...b_0)_{Dec.}$	$(b_{31}...b_{16})_{Dec.}$	-
17	Dec Wieg. 17	35**	$(b_{20}...b_1)_{Dec}$	$(b_{32}...b_{21})_{Dec.}$	b_{34},b_{33},b_0 [6]
18	Dec Wieg. 18	44*	$(b_{43}...b_4)_{Dec}$	-	-
19	Hex Wieg. 19	34*	$b_8..b_1b_{16}..b_9b_{24}..b_{17}b_{32}..b_{25}$	-	-
20	Hex Wieg. 20	37*	Encrypted code (Specific firmware 16/04/13)		
21 [7]	Hex Wieg. 21	64*	$b_{47}.....b_0$	-	-
22 [8]	Hex Wieg. 22	34	$b_{32}.....b_1$	-	b_n,b_0 [1]
23 [9]	Hex Wieg. 23	37	$b_{32}.....b_1$	-	b_n,b_0 [1]
24 [9]	Wieg. 24	22	$(b_{16}...b_1)_{Dec.}$	-	b_n,b_0 [1]
25 [10]	Wieg. 25	Up to 66	$b_{39}...b_0\ n_7...n_0$	-	-
30,31	Proprietary format (TechTalk/Risco) on specific firmware "TPLFLEX"				
32	Customized format (See par. 1.2)				

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The “Total bit length” column shows how many bits (Data+parity) the Wiegand string may contain.
This information is used for 3 purposes:

- Check the card code integrity:
If jumpers JP4/6,7,8 (or DS1/6,7,8) are in position on,off,off, the controller, in addition to the parity bits verification, checks also
that it has receive the correct number of bits indicated in this column (only for formats for which the total bit length is shown with a ‘*’).
If these switches are in position off,on,off, the controllers accepts any card code length.
If the total bit length is shown with ‘**’, the controller always checks that it received the correct number of bits (independently of the switches position).

- Multi-formats feature (see par. 1.1):
When different formats are used for the 4 readers of a same controller, the controller selects at any reader the format to use according to the number of bits read: the format selected is the one which get the same “Total bit length” than the number of bits read. This feature cannot be used for formats for which the total bit length is indicated as “Up to ”

- Biometric readers with error code:
Some Biometric readers (Fingerprint readers or other) may add a 4 bits error code before the card code if the card code has been recognized but the biometric test has failed (wrong finger for example). This Total bit length is therefore used by the controller to detect that if it receives the expected total bit length + 4 bits, it means that an error code has be added before the card code.

Notes on card verification:
When jumpers JP4/6,7,8 (or DS1/6,7,8) are in position on,off,off, the controller checks that the card has been correctly read either
by checking that the number of bits received corresponds to the number expected (shown on table 1.1) , or by checking the parity
bits (see hereunder the parity bits the calculation) , or both.
If these switches are in position off,on,off, the controllers doesn’t check the card reading. (not recommended)

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1: The parity bits are the first (b0) and the last bit (b) received as follows :
bn is the Even Parity of the half H.S. bits (i.e. bn47 to b if 48 data bits), b0 is the odd parity of the half L.S. bits (i.e. b23 to b024 if 48 data bits)
If odd number of data bits, the middle bit is used for both parity.
Ex.: for 35 bits of data, E is the even Parity of the fir st 18 bits (b to b17), O is the odd parity of the last 18 bits (b17 to b).
For HID cards, it is recommended to use the Sensor format 'D10302.CDF' which is defined as follows :
37 bits as follows : Eb34bbbbbbbbbbbbbbbb170bbbbbbbbbbbbbbbb0O
Bit E : Even parity for bits bb34 to b17, Bit O : Odd parity for bits b Bits b34b33b32 fixed for all the cards to value 101 Bits b31 to b00
to b0
: 8 BCD digits (32 bits) printed out on the card.

2: The 4 parity bits b3b2b1b0
are the XOR of the 10 hexa data digits (40 bit data b)

3: The 4 parity bits b3b2b1b0 are the XOR of the 8 hexa data digits (32 bit data b)

4: The parity bit b0 is the odd parity bit over the 36 bits of data b

5: The 3 bits b31b30b29 = fixed value 101 and the 2 parity bits b136, b as follows:
b1=Even parity of the odd bits (b29,b27,…b1), b0 to b01= Odd parity of the even bits (b)28….b….b28,b26,…b0

6: HID format 'Corporate 1000-35': The data bits and the 3 parity bits b34b33 and b0 are computed as follows:

P	P	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	P
34	33	32										21	20																		1	0
.	E	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.
.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	X	X	.	O
O	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

P are 3 parity bits : 'E' is an even parity, 'O' is an odd parity calculation. 'X' indicates the bit positions used in the parity
calculation.
AA…A is a 12 bits site (converted in decimal) code and BB..B is a 20 bits card code (converted in decimal).
For this format, if dip switches JP4 or DS1/6,7,8 = off,on,off, the system will not check the parity bits but will check that the card
get 35 bits.

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For Magnetic, Bar codes and Wiegand technologies

To program such a format at reader No.1 using Mess 03 with programmable format (see par. 3), with a site code of 1234, the
message to send is: 03 01 81 94 15 8C 00 00 00 00 12 34 00 22 00 00 00 00

7. From version 25/11/13

8. From version 01/01/14

9. From version 03/04/14.
Created to bypass a bug on Suprema fingerprint readers (read only 32 or 16 bits and discard an eventual wrong FC code introduced in the Wiegand string)

10. From version 12/09/14. Format used for technical support to analyze the whole Wiegand string received by the controller: **b39…b0** are the 40 Low Significant Bits received on the Wiegand string and **n7..n** are the total bit length (the total number of bits received).

Format No.	Data string in Hexa	Card code	Site Code
00	CD5180AB689F (48 bits of data)	CD5180AB689F	-
01	AB689F (24 bits of data)	26783 (=689F in dec.)	171 (=AB in dec.)
02	5180AB689F (40 bits of data)	5180AB689F	-
03	AB689F (24 bits of data)	17126783(=AB & 689F in dec.)	171 (=AB in dec.)
04	AB689F (24 bits of data)	11233439 (=AB689F in dec.)	-
05	80AB689F (32 bits of data)	2158717087 (=80AB689F in dec.)	-
05	5180AB689F (40 bits of data)	350051068063 (=5180AB689F in dec.)	-
06	80AB689F (32 bits of data)	80AB689F	-
07	180AB689F (36 bits of data)	180AB689F	-
08	9E5180AB689F (48 bits of data)	9E5180AB689F	-
09			
10	580AB689F (35 bits of data)	360607 (=5809F in dec.)	43880 (=AB68 in dec.)
11	1AB689F (27 bits of data)	28010655 (=1AB689F in dec.)	-
12	12349E5180AB689F (64 bits of data)	AB689F	
13	80AB689F (32 bits of data)	2158717087 (=80AB689F in dec.)	
14	80AB689F (32 bits of data)	9F68AB80	
15	80AB689F (32 bits of data)	80AB689F	
16	9E5180AB689F (48 bits of data)	26783 (=689F in dec.)	32939 (=80AB in dec.)
17	80AB689F (32 bits of data)	747679 (=B689F in dec.)	2058 (=80A in dec.)
18	5180AB689F (40 bits of data)	5180AB689F	
19	80AB689F (32 bits of data)	9F68AB80	
21	12349E5180AB689F (64 bits of data)	9E5180AB689F	
22	80AB689F (32 bits of data)	80AB689F	
23	780AB689F (35 bits of data)	80AB689F	
24	AB689F (24 bits of data)	26783 (=689F in dec.)	
25	7FFEE864F (35 data bits + pe,o=1,0)	1FFFDD0C9E**25**	

Card Formats

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To program such a format at reader No.1 using Mess 03 with programmable format (see par. 3), with a site code of 1234, the
message to send is: 03 01 81 94 15 8C 00 00 00 00 12 34 00 22 00 00 00 00

7. From version 25/11/13
8. From version 01/01/14
9. From version 03/04/14.
Created to bypass a bug on Suprema fingerprint readers (read only 32 or 16 bits and discard an eventual wrong FC code introduced in the Wiegand string)
10. From version 12/09/14. Format used for technical support to analyze the whole Wiegand string received by the controller: **b39…b0** are the 40 Low Significant Bits received on the Wiegand string and **n7..n** are the total bit length (the total number of bits received).

1.2 Format '32': Customized format
Format '32' is dedicated to customized format and depends on the firmware version as follows:
Firmware from 25/11/13:
The card code is the 6 L.S.Digits of the decimal value of bits b
1.3 User defined format (On controllers with firmware version from 2008 only) 31…b0
Mess 03 with bit 7 of byte 2=1 (see Par. 3) allows to define the position of the Card code and the Site code, the size of these codes and if they must be read in hexadecimal or converted in decimal.
If the card verification is set (JP4 or DS1/6,7,8 = on,off,off), the verification is done according to the first and last bits read, which are the parity bits, are described in previous note 1.
Example : to read a card code of 24 bits from position 01 without site code, use Mess 03 with bytes 2,3,4,5=81,18,00,00. A 32 bits data string (i.e. bits b32….b) 80AB689F will give a card code = AB689F.
If the 24 bits card code from position 01 must be converted in decimal (Mess 03, bytes 2,3,4,5=81,98,00,00), the same 32 bits data string will give a card code = 11233439.
1.4 Serial readers
Sensor Controllers can support serial readers via their serial Port2.
They are programmed as follows:
- On firmware's 2012: programming is done via the 'format number' as follows:
  Format No.20: Aperio readers (polling mode); Format No.21: Sensor serial readers (polling mode);
  Format No.22: Sensor serial readers (Event mode).
- On firmware's from 2013, the programming is done via bytes 11,12 of Mess 03 (see par.3 and 4) and any Wiegand format may be used.

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2- Magnetic ISO1 / ISO2 ('Clock and Data') and Bar Codes Technology

Sensor controllers may read ***any*** magnetic card coded into the ISO 1 or 2 standard (track 1 or 2) and ***any*** Bar code cards in standard 39 and 2/5 interleave. Among all the digits encoded in the card, the controller may identify two codes: the

Card Code and the **Customer Code**:

- The ***Card Code*** is a code unique to each card. Its place on the data track is user programmable.
- The ***Customer or Site Code*** is a code common to all cards pertaining to a same organisation.

When defined, controllers will accept only cards with the same Site Code.

This code can have up to 8 digits. Its size, value, and place on the data track are programmable by the user.

These user programmable informations are called the system ***card format*** which defines the five following informations:

the **position of the card code** (between 00 and 37), the **size of the card code** (between 04 and 20), **the position of the customer code** (between 00 and 37), **the size of the customer code** (between 01 and 08), and **the value of the customer code** as shown in the example in figure 1:

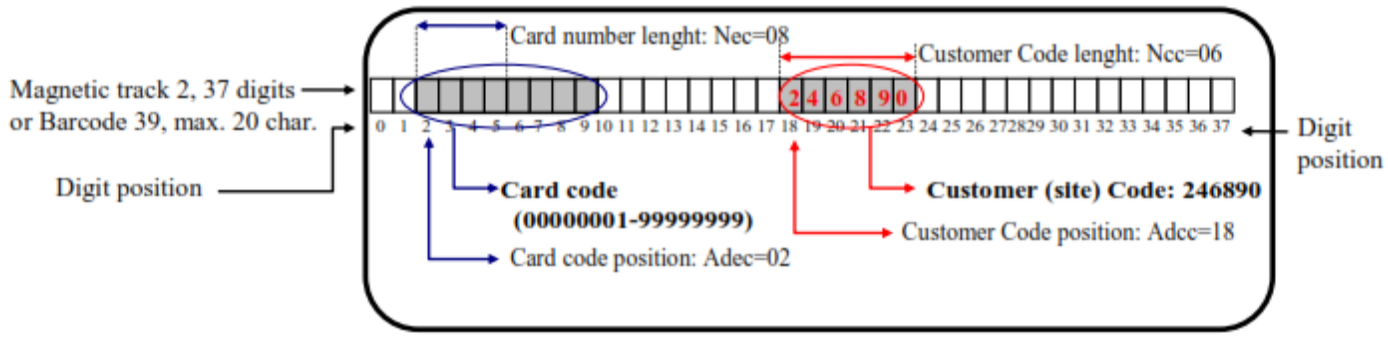

Figure 1: Magnetic track 2 format exemple

Figure 1: Magnetic track 2 format exemple

This format is user programmable. Therefore, users can use already existing cards by programming the controller with the format of the cards they already use.

Notes:

1- The first digit is in position is '0' (and not '1'), the second digit in position '1', etc....

2- If Customer Code length = 00, the Customer code is not checked.

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The Card Format, down-loaded from the PC includes the following information:
- **'Adec'**: Position of the first Card code digit in the tack, from 00 to 27. (the first position in the track is '00')
- **'Nec'**: Card code size, either 8, 10 or 12 digits.
- **'Adcc'**: Position of the first Site code digit in the tack, from 00 to 27. (the first position in the track is '00')
- **'Ncc'**: Site code size.
- **'ss...s'**: Site (Customer) code itself.

Example: In order to programme a IC4000 to read cards with format as described in figure 1, the format must be defined as follows:
Adcc=18, Ncc=06, ss..s=246890, Adec=02 and Nec=08.
Then, the format of the cards recognized by the terminal will be as follows:
Card Code 00000001: xx00000001xxxxxxxx246890, …. Card Code 99999999: xx99999999xxxxxxxx246890
('x'=any digit, not relevant)

3- Programming the Card Format

Mess 03 of Protocol 4 allows to define the card fomat as follows :

		Magnetic, Barcode or Pre-defined Wiegand [1]		Wiegand Programmable Format [2]
Byte	**bits**	**Function**	**bits**	**Function**
1	3-0	Reader No. (1-8)	3-0	Reader No. (1-8)
2	6-0 7	Mag. Card code position ('adec') in digits (00-27, 00=first digit) or Wiegand pre-defined format **=0**	6-0 7	Position of the first Card code bit ('adeb'). (00-40h, 00= L.S. bit) **=1**
3	6-0	Mag. Site code position ('adcc') in digits (0=first digit)	6-0 7	Card Code Length in bits ('neb') (0-40h) 1: Card code in decimal (and the ncb ≤ 20h)
4	3-0 7-4	Site Code Length in digits ('Ncc') (0-8) [5] Card Code Length in digits ('Nec') (8, 10 or 12)	6-0	Position of the first Site code bit ('adcb'). (0=L.S. bit)
5	3-0	High Significant Site code digit ("c_7") [3].	6-0 7	Site Code Length in bits ('ncb') (1-30h) [5] 1: Site code in decimal (and the ncb ≤ 20h)
6	3-0	Site code digit ("c_6").	7-0	H.S. Site Code bits b_{48}….b_{41} [4].
7	3-0	Site code digit ("c_5").	7-0	Site Code bits b_{40}….b_{33}.
8	3-0	Site code digit ("c_4").	7-0	Site Code bits b_{32}….b_{25}.
9	3-0	Site code digit ("c_3").	7-0	Site Code bits b_{24}….b_{17}.
10	3-0	Site code digit ("c_2").	7-0	Site Code bits b_{16}….b_9.
11	3-0 7-0	Site code digit ("c_1"). Card technology, bits $t_7t_6t_5t_4$ See note 6 and par. 4	7-0	L.S. Site Code bits b_8….b_0.
12	3-0 7-0	Site code digit ("c_0"). Card technology, bits $t_3t_2t_1t_0$ See note 6 and par. 4	7-0	TT (Card technology bits t_7..t_0 see par. 4)
13	Bytes not sent		7-0	String length in bits
:			7-0	00 (Not used)
:			:	
17			7-0	00 (Not used)

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The Card Format, down-loaded from the PC includes the following information:
- **'Adec'**: Position of the first Card code digit in the tack, from 00 to 27. (the first position in the track is '00')
- **'Nec'**: Card code size, either 8, 10 or 12 digits.
- **'Adcc'**: Position of the first Site code digit in the tack, from 00 to 27. (the first position in the track is '00')
- **'Ncc'**: Site code size.
- **'ss...s'**: Site (Customer) code itself.

Example: In order to programme a IC4000 to read cards with format as described in figure 1, the format must be defined as follows:
Adcc=18, Ncc=06, ss..s=246890, Adec=02 and Nec=08.
Then, the format of the cards recognized by the terminal will be as follows:
Card Code 00000001: xx00000001xxxxxxxx246890, …. Card Code 99999999: xx99999999xxxxxxxx246890
('x'=any digit, not relevant)

3- Programming the Card Format
Mess 03 of Protocol 4 allows to define the card fomat as follows :

Notes:
1- In this column, the data read from cards are defined in digits, i.e. 4 bits. (decimal if Magnetic or barcode or hexadecimal ifWiegand).
In Wiegand, the first digit sent is the Low Significant digit and is referenced as digit No.00.
The control bits (as per note 1 of table 1.1) are checked if the board dip switches JP4 (or DS1) 6,7,8= on,off,off. If off,on,off, the control bits are not checked.
2- In this column, the data read from the Wiegand string are defined in bits. The first bit sent is the Low Significant bit and is referenced as bit No.00. If the board dip switches JP4 (or DS1) 6,7,8= on,off,off, the control bits are checked as per note 1 of table 1.1 in Chapter 1.
If the dip switches = off,on,off, no control bits are checked.
3- When site code is programmed in 8 digits, c7 to c, if the code has less than 8 digits, non significant zeros must be added after the code to complete to 8 digits. (Ex.: Site code 246 will be sent 24600000)
4- When site code is programmed in 48 bits, b48 to b0, if the code has less than 48 bits, non significant zeros must be added before the H.S.bits. (Ex. Site code AB81 must be sent 00000000AB81)
5- When site code length is 0, the Site code is not checked.
6- On firmware's from 2013, it is possible to connect up to 4 serial readers (No. 1 to 4) to the controller port 2. The type of the serial readers is defined by bytes 11,12 as shown in par.4

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4- Programming the Card reader interface (TTL or Serial) and Technology

Sensor Controllers recognize two kinds of reader interfaces:

- **TTL readers** (Two TTL signals: Clock/Data for Magnetic or Data0/Data1 for Wiegand) which are connected to the 4 controller reader connectors.

The TTL Reader technology (Magnetic, Wiegand, etc.) is given via controller dip switches JP4 or DS1/6,7,8 (See controllers installation manual). However, if these switches are in position 6,7,8=off,off,on, the reader technology may be programmed via Mess 03 bytes 11 and 12 (t7….t=TT) as shown in the hereunder table.

- **Serial readers** (on firmware's from 2013): Up to 4 serial readers may be connected to the controller Port 2. The type of serial reader used is defined via Mess 03 bytes 11 and 12 (t7….t0=TT) as shown in the hereunder table.

TT	TECHNOLOGY	TT	TECHNOLOGY	TT	TECHNOLOGY
TTL Readers selection (If JP4 or DS1/6,7,8= off,off,on):					
80	Magnetic track 2 (ISO2)	88	Barcode 39	81	Wiegand with parity check
87	Magnetic track 1 (ISO1)	8F	Barcode 2/5 Interleave	82	Wiegand without parity check
85	Radio (JCM)				
Serial Readers selection					
40	Aperio readers	42	DDS Serial readers (Polling mode)	43	DDS Serial readers (Event mode)
		46	DDS LCD Serial readers (Polling)	47	DDS LCD Serial readers (Event)