ACTAtek Wiegand Configuration

Revision History

Revision	Date	Description	Author
1	03/07/2008	Initial Release	Santos
2	29/07/2008		Santos
3	19/08/2008		Santos
4	13/10/2011	Wiegand out example	suhnin
5	04/09/2012	24-bit data output change	Jeff
6	13/09/2012	Manuf. FC Changes for HID cards for 24-bit output	Jeff
7	20/09/2012	Added FP/PWD Wiegand Changes	Jeff
8	02/10/2012	Added Wiegand Output on Access Denied	Jeff

Introduction

The basic requirement for the use of smartcard on ACTAtek UNIT is to follow up the 26-bit wiegand format. In the following section, the 26-bit wiegand format (H10301) has been explained.

Wiegand Data Signals

Figure displays the timing pattern for data bits sent by the reader to the access control panel. This timing pattern falls within the Wiegand guidelines as proscribed by the SIA's Access Control Standard Protocol for the 26-Bit Wiegand Reader Interface (a Pulse Width time between 20 uS and 100 uS, and a Pulse Interval time between 200 uS and 20 mS).

The Data 1 and Data 0 signals are held at logic high level (above the Voh level) until the reader is ready to send a data stream. The reader places data as asynchronous low-going pulses (below the Vol level) on the Data 1 or Data 0 lines to transmit the data stream to the access control panel (the "saw-teeth" in Figure 1).

The Data 1 and Data 0 pulses will not overlap or occur simultaneously.

Table 1 provides the minimum and maximum allowable pulse width times (the duration of a pulse) and pulse interval times (the time between pulses).

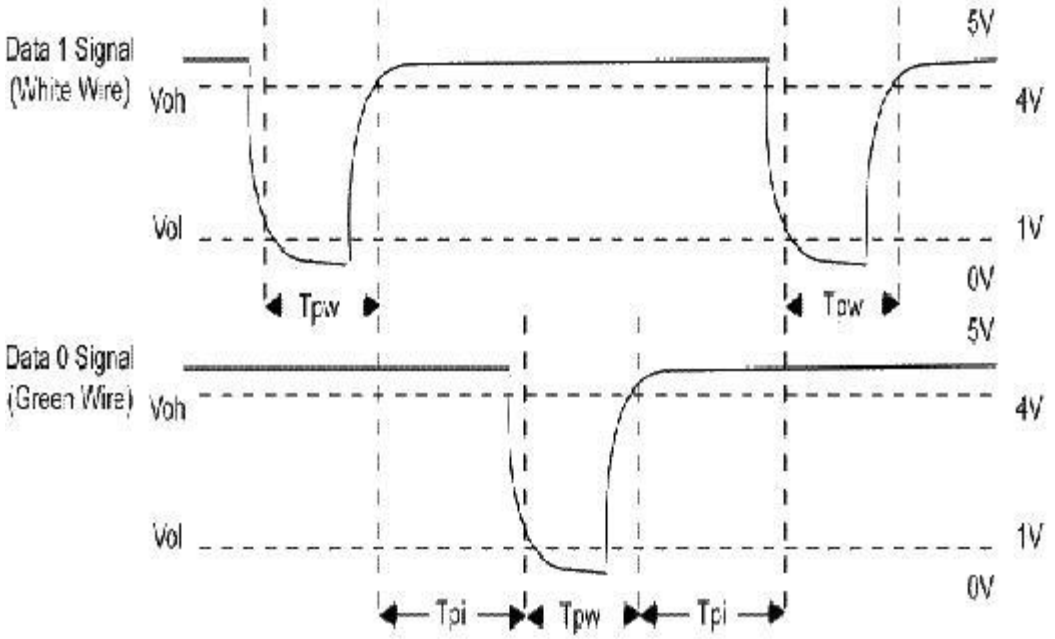


Table 1: Pulse Times

Symbol	Description	Typical Time
Tpw	Pulse Width Time	52 µs
Tpi	Pulse Interval Time	2.2 ms

26-Bit Wiegand Format

The composition of the open de facto industry standard 26 Bit Wiegand format contains 8 bits for the facility code field and 16 bits for the ID number field. Mathematically these 8 facility code bits allow for a total of just 256 (0 to 255) facility codes, while the 16 ID number bits allow for a total of only 65,536 (0 to 65,535) individual ID's within each facility code. Due to the mathematical limitations of the 26-bit Wiegand format, code duplication might occur. Table 2 provides a summary the 26-bit Wiegand format.

Table 2: 26-bit Wiegand Format

Bit Number	Purpose
Bit 1	Even parity (EP) over bits 2 to 13
Bits 2 to 9	Facility code (FC) (0 to 255); Bit 2 is MSB
Bits 10 to 25	UserID OR CardID (0 to 65,535); Bit 10 is MSB
Bit 26	Odd parity (OP) over bits 14 to 25

- The maximum Facility Code is 256 because if all eight Facility Code bits are set to ones, they equal 256 decimal.
- The maximum Card Number is 65,536 because when all sixteen Card Number field bits are ones, it equals decimal 65,536.

A NOTE ON PARITY: A parity bit is used as a very simple quality check for the accuracy of the transmitted binary data. The designer of the format program will decide if each parity bit should be even or odd. A selected group of data bits will be united with one parity bit, and the total number of bits should result in either an even or odd number.

A **facility code** is a location within the production (delivery) processing physical system.

A Facility Code only applies when PIN-codes are used. It is reported as part of the Wiegand code and can be used to link a set of Wiegand Readers to a particular Site.

Wiegand Format for different Smartcards

There are different combination has been considered in place of facility code (FC), UserID and CardID. The facility code can be user defined or manufacturer encoded with the CardID. There is a option displayed at the ACTAtek cgi (web page shown in the picture) to choose either UserID or CardID.

It has been studied that, every smartcard has different data format and some of them are in wiegand format. Based on the data format, different card has different wiegand format. Following are some of the smartcards to be discussed for the above issues.

- HID iClass
- HID Proximity
- Mifare

Wiegand Format for HID iClass

The HID iClass card default data is in 26-bit wiegand format, which includes the facility code, card number and parity bits. For this case customer can choose only the CardID for the wiegand output. Also the UserID and user defined facility code can be chosen instead of CardID for their own convenient.

Sample Example:

Card data: 06 2C 00 25

Below show the output example for 26 bit card ID format.

10 0010 1100 0000 0000 0010 0101 (26 bit) is read as follow,

1 bit Even Parity + 8 bit Facility Code + 16 bit Card ID + 1 bit Odd Parity

Therefore,

Facility Code = 00010110 (bin) = 22 (dec)

Card ID = 0000000000010010 (bin) = 18 (dec)

Wiegand Format for HID Proximity

The HID proximity card data is in 26-bit wiegand format, which includes the facility code, card number and parity bits. For this case customer can choose only the CardID for the wiegand output. Also the UserID and user defined facility code can be chosen instead of CardID for their own convenient.

Sample Example:

Card data: 0602 000E 16

Below show the output example for 26 bit card ID format.

Start, Even Parity, 8-bit F/C (=0x01), 16-bit C# (=0x0007), Odd Parity, Checksum (=0x16)

1 1 0000 0001 0000 0000 0000 0111 0 0001 0110

The checksum is calculated by ADDING all data byte excluding the checksum but including start bit and parity bits. (00 + 00 + 06 + 02 + 00 + 0E = 16).

The wiegand output doesn't include the checksum.

Wiegand Format for Mifare

The Mifare card manufacturer serial number is four bytes of length. Out of four bytes, the first two bytes (16 lower bits, according to HID Mifare Reader Format) has been considered for 26-bit wiegand format along with one bytes of user defined facility code, one bit of even parity and one bit of odd parity bit.

Following is the 32 bit Mifare CSN format:

Bytes	LSB							MSB
CSN Output	Card Type	CSN Byte 0	CSN Byte 1	CSN Byte 2	CSN Byte 3	CSN CHK	Padding	Padding
Example Data	0x03	0x42	0x80	0xFC	0xC9	0xF7	0x00	0x00

The lower 16 bits data: CSN Byte 0 + CSN Byte 1

The real data reading from the serial port : 03 54 2E F2 EE 66 00 00

The CSN (Card Serial Number): 54 2E F2 EE

Sample Example:

Card serial number : 54 2E F2 EE (Hexadecimal)

First two bytes: 54 2E

Wiegand output : EP (Even parity, one bit)+ FC (User defined Facility code, 8 bits) + First four bytes (16 bits) + OP (odd parity, one bit)

=> 0 0000 0001 0101 0100 0010 1110 0

Wiegand Format for FELICA

The Felica card manufacturer serial number is eight bytes of length. The last four bytes are manufacturer serial number and out of which the first two bytes (16 lower bits, according to HID Mifare Reader Format) has been considered for 26-bit wiegand format along with one bytes of user defined facility code, one bit of even parity and one bit of odd parity bit.

Following is the 12 byte CSN format:

START BYTE (02)	LEN (09)	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE 6	BYTE7	BYTE8	BCC	END BYTE (03)

LEN: length of data

BCC: Checksum

Wiegand format: The lower 16 bits (2 bytes) data from last four bytes is CSN Byte 5 + CSN Byte 6

The real data reading from the serial port : 02 09 01 01 01 12 96 07 BA 05 3D 03

The CSN (Card Serial Number): 01 01 01 12 96 07 BA 05

The lower 16 bits (2 bytes) data from last four bytes: 96 07

Wiegand output : EP (Even parity, one bit)+ FC (User defined Facility code, 8 bits) + The lower 16 bits (2 bytes) data from last four bytes (Example: 96 07) + OP (odd parity, one bit)

Wiegand Format for LEGIC

The Legic card manufacturer serial number is four bytes of length (byte 1, byte 2, byte 3 and byte 4). The sixteen lower bits (byte 2 and byte 3) are considered for 26-bit wiegand format

along with one bytes of user defined facility code, one bit of even parity and one bit of odd parity bit.

CSN format (4 bytes):

MCD	MSN_Low	MSN_Mid	MSN_High

MCD: Manufacturer code

MSN: Manufacturer serial number

The real data reading from the serial port : 57 B3 84 55

Wiegand output : EP (Even parity, one bit)+ FC (User defined Facility code, 8 bits) + The second byte and third bytes (Example: B3 84) + OP (odd parity, one bit)

Wiegand Format for EM

The EM card manufacturer serial number is five bytes of length. The last three bytes are considered for 26-bit wiegand format along with one bit of even parity and one bit of odd parity bit.

CSN format :

START BYTE (02)	10ASCII Data Characters (5 bytes)	CHECKSUM	END BYTE (03)

The checksum is the result of the 'exclusive or' of the 5 binary Data bytes i.e., 0ASCII Data Characters (5 bytes).

Example: Card number 62E3086CED, the output data are 086CED and th output form: 10000100001101100111011011

Wiegand Configuration

The wiegand configuration will be done using the Actatek web interface (cgi) under ***Terminal Setup*** as mentioned in the following figures.

There are three basic steps for the above as follows:

1. Wiegand Type

2. Access Method
3. Wiegand Output Format
4. User Facility Code (FC)

Wiegand Type

- The Wiegand output can be enabled or disabled using the two options ***Disable*** and ***26-bit.***
- ***Disable*** option disables the wiegand output. This is needed, whenever the customer doesn't require the wiegand output
- ***26-bit*** option is needed to activate the wiegand output.

Access Method

- Accessing method to the Actatek unit of is of two types. It can be either through **Smart Card** or through **User Input** (**Finger Print** and **Password**).

  1) Smart Card
  - There are various options, which has been described under **Wiegand Output Format** category.

  2) User Input
  - The user input is normally **Finger Print** and **Password**, through which the Actatek unit can be accessed.

Wiegand Output Format

The wiegand output format displays at the CGI based on the type of Actatek unit (iClass, Proximity, Mifare, Invengo_x500 etc.).

Options for the **Smart Card** Access Method

1) UserID + Facility Code (EP + 8-bit FC (User) + 16-bit UID + OP)
2) CardID + Facility Code (EP + 8-bit FC (User Facility code) + 16-bit CID + OP)
3) CardID Only (EP + 8-bit FC (Manufacturer Facility code) + 16-bit CID + OP)

Options for the **User Input** (**Finger Print** and **Password**) Access Method

By default, the options for **Wiegand Output Format** will be disabled,but the output wiegand format is **EP + 8-bit FC + 16-bit UID + OP.**

- ***UserID + Facility Code***
  - Opting ***UserID + Facility Code*** means, the user has to defined the facility code.
  - The wiegand output format (26 bits) is EP (Even parity) + FC (User defined facility code, 8 bits) + UID (UserID, 16 bits) + OP (Odd parity).
  - The ***UserID*** is the last five integers (after removal of characters) in hexadecimal format. If the customer enrolls a smart card with user id “123A5B7C8”, then the UserID for the Wiegand output will be 5C1A (23578 decimal number).
  - The derived ***UserID*** is of 16 bits (2 bytes).
  - **Note**: The removal of characters and taking of last 5 integers from the actual User ID is to fit it in 26-bit wiegand format.
- ***CardID + Facility Code***
  - User has to define the facility code for the smartcard.
  - Some of the smartcards are without 26 bits wiegand format such as **Mifare card**. For those cards, there should be a user defined facility code.
  - The wiegand output format (26 bits) is EP (Even parity) + FC (User defined facility code, 8 bits) + CID (CardID,16 bits) + OP (Odd parity).
- ***CardID Only***
  - The facility code for ***CardID*** depends on smartcrad type.
  - If the smartcard is HID iCLASS and HID Proximity, then the ***CardID*** includes the manufacturer encoded facility code. For this case there is no need to defined the

Facility code.

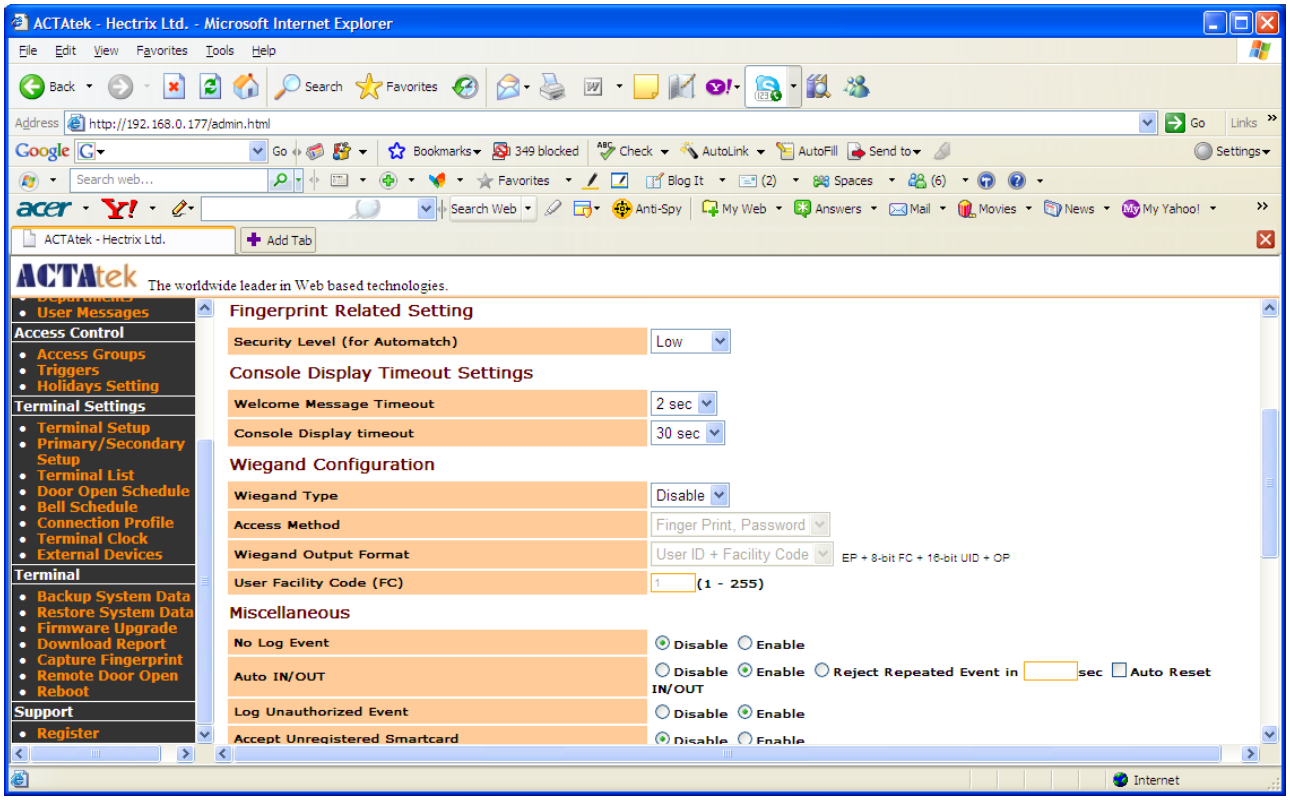
- The wiegand format output (26 bits) is EP (Even parity) + MFC (Manufacturer defined facility code, 8 bits) + CID (CardID, 16 bits) + OP (Odd parity).

User Facility Code (FC)

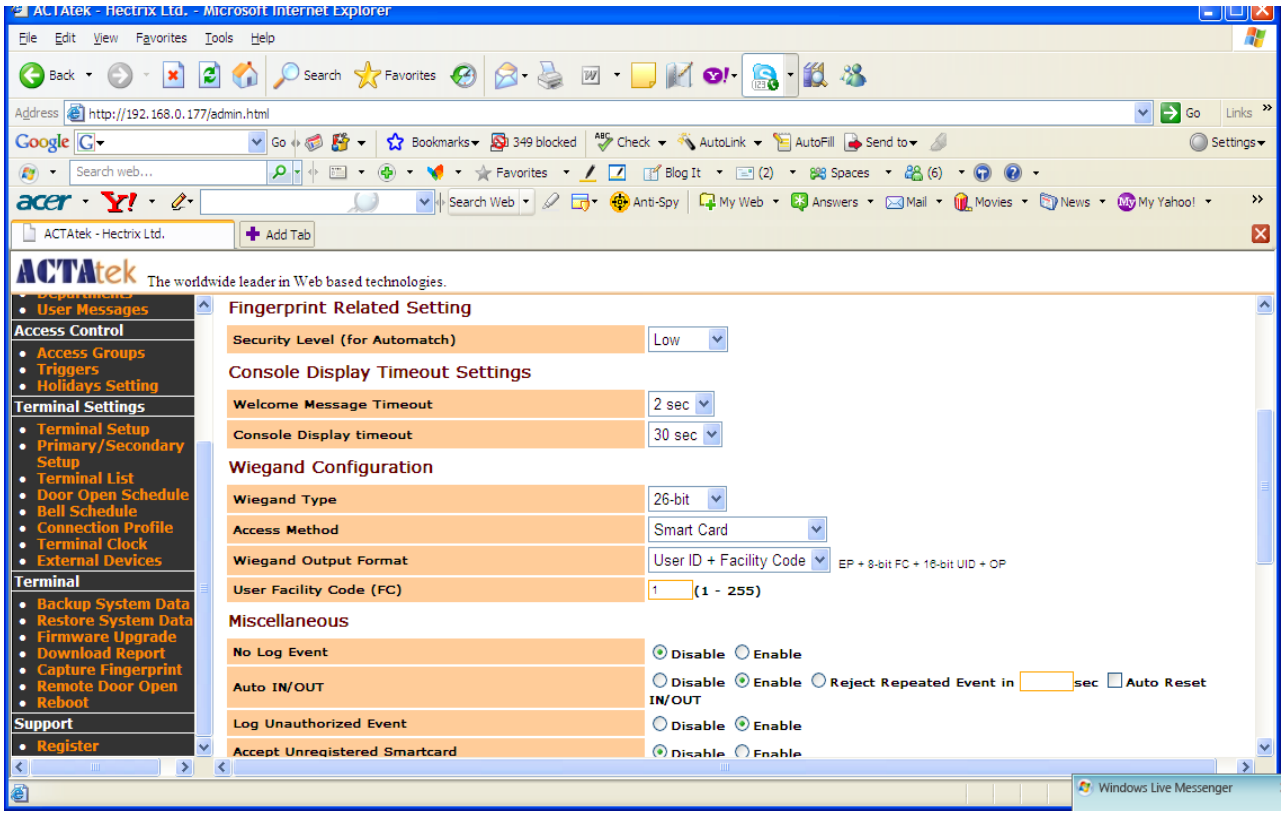
- The default facility code is zero and the user can define the facility code in between 1 to 255.

CGI for Terminal Setup

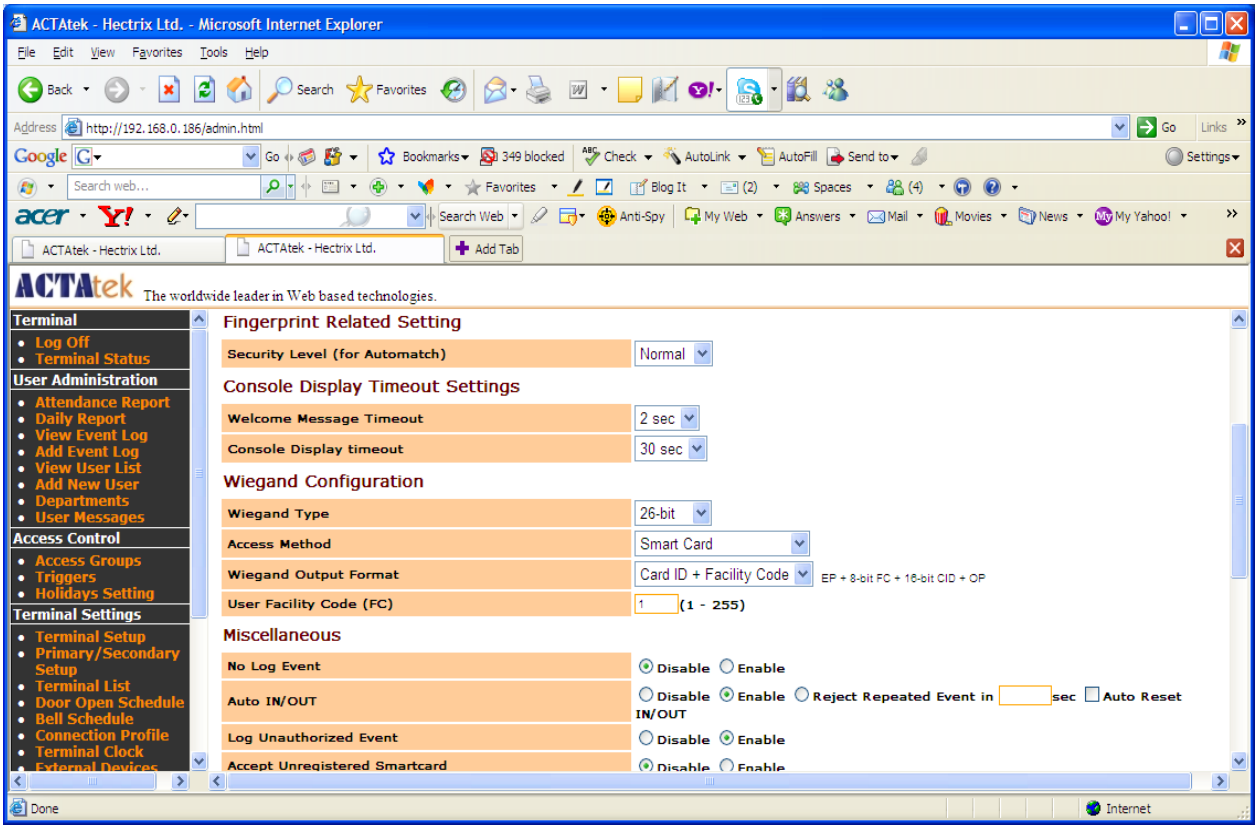
1. **Wiegand Type: Disable**



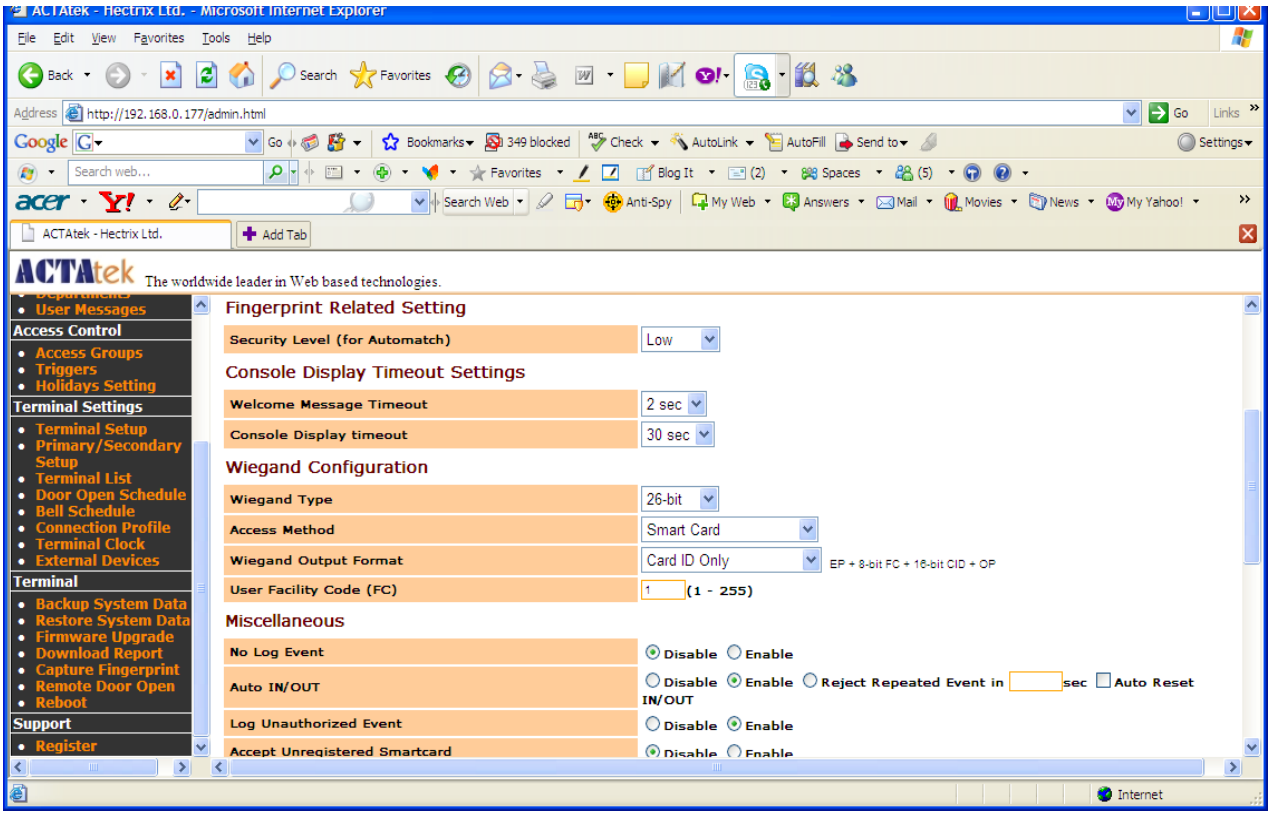
2. **Wiegand Type: 26-bit**
   a) **Smart Card**
      i. **UserID + Facility code**



ii. CardID + Facility Code

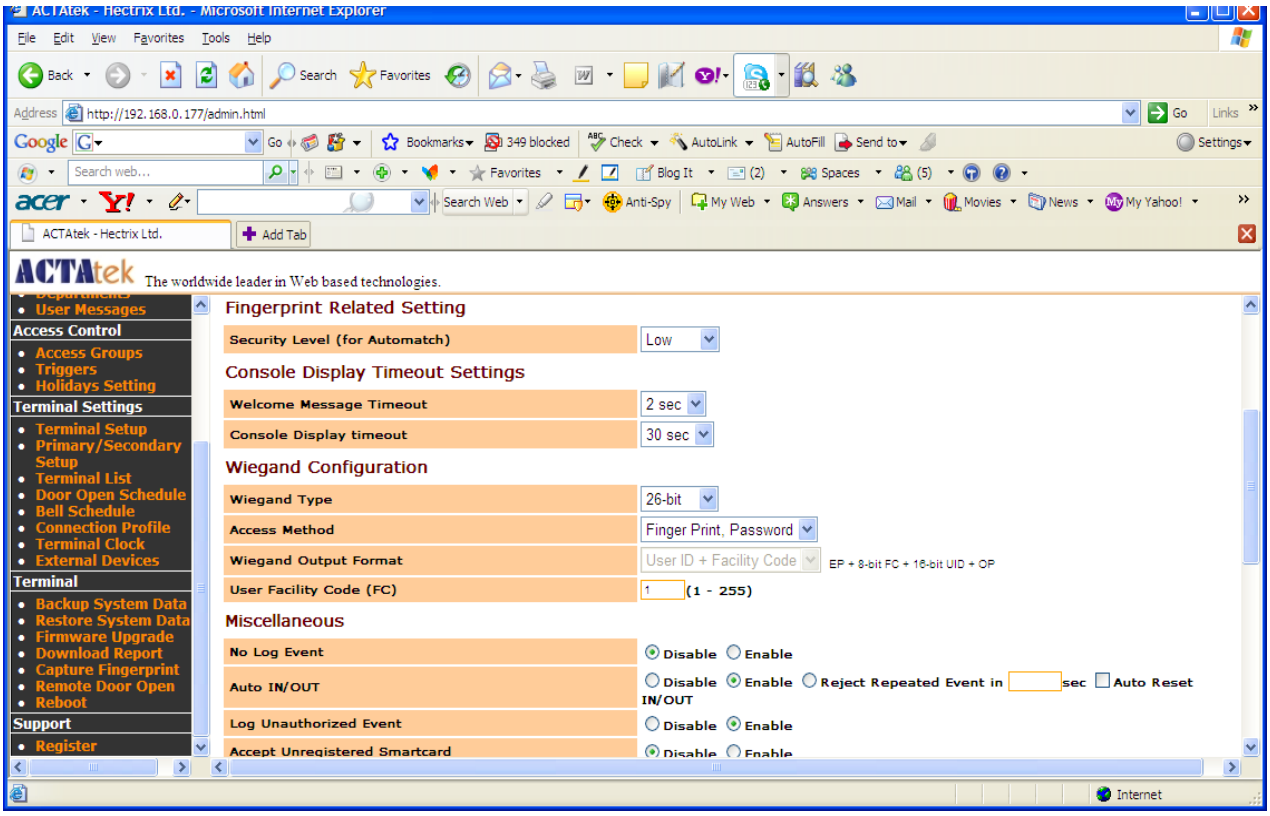


iii. CardID only



b) User Input (Finger Print and **Password)**

i. Default is UserID + Facility Code (User)



Wiegand Configuration Table

Smartcard Type	Manufacturer defined Facility code	Wiegand Output With UserID and User defined Facility code	Wiegand Output With UserID and Manufacturer defined Facility code	Wiegand Output With CardID/Card Serial number and User defined Facility code	Wiegand Output With CardID/ Card Serial number and Manufacturer defined Facility code	
HID iClass	Yes	Yes	No	No	Yes	
HID Proximity	Yes	Yes	No	No	Yes	
Mifare	No	Yes	No	Yes	No	
Felica	No	Yes	No	Yes	No	
Ligic	No	Yes	No	Yes	No	
EM	Yes	Yes	No	No	Yes	

Wiegand output Data Format

FC: User defined Facility code

MFC: Manufacturer defined Facility code

UID: UserID

CID: CardID

EP: Even Parity

OP: Odd Parity

26-bit wiegand format:

EP (Even parity, 1 bit)	FC/MFC (8 bits)	UID/CID (16 bits)	OP (Odd parity, 1 bit)

	HID iClass	HID Proximity	Mifare	Felica	Legic	EM
FC + UID	EP + FC + UID + OP	EP + FC + UID + OP	EP + FC + UID + OP	EP + FC + UID + OP	EP + FC + UID + OP	EP + FC + UID + OP
FC + CID	No format	No format	EP + FC + CID + OP	EP + FC + CID + OP	EP + FC + CID + OP	No format
MFC + UID	No format	No format	No format	No format	No format	No format
MFC + CID	EP + MFC + CID + OP	EP + MFC + CID + OP	No format	No format	No format	EP + MFC + CID + OP

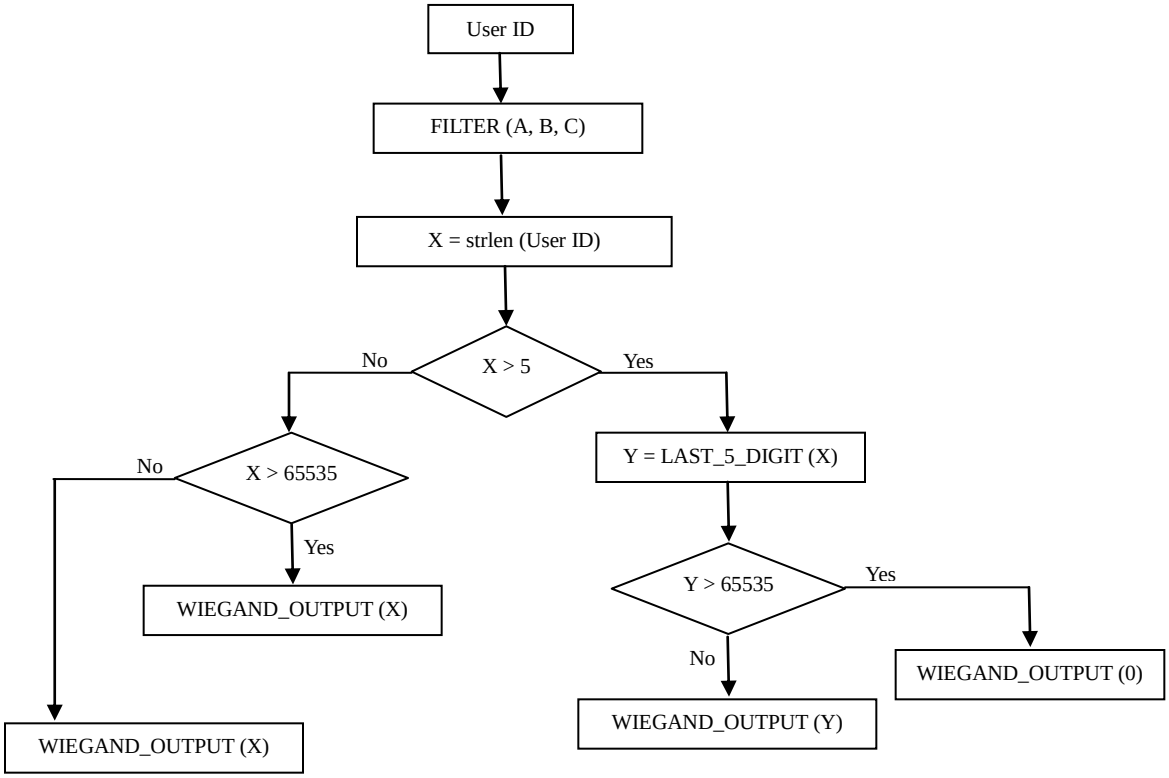
Wiegand output based on User ID

1. The user ID contains the characters and integers.
2. All characters are removed and if the length of user ID id > 5, wiegand output will be only the last 5 integers.
3. If user ID contains only characters, wiegand output will be zero (0).
4. User ID should not exceed 65535. If user ID > 65535, wiegand output of the user ID will be zero (0).
5. The wiegand output of the facility code is converted to hexadecimal value.

Example

User ID	Last 5 integers	Wiegand Output	Remarks
CCC	No	6E:00000	6E is hexadecimal value of FC (110) and 00000 is user ID (removed all characters).
65555	No	6E:00000	User ID > 65535, so wiegand output of user ID is 00000.
65535	65535	6E:65535	6E is hexadecimal value of FC (110) and 65535 is user ID.
ABC12375C	12375	6E:12375	6E is hexadecimal value of FC (110) and 12375 is user ID (removed all characters).
12345AB	12345	6E:12345	6E is hexadecimal value of FC (110) and 12345 is user ID (removed all characters)

Flowchart


User ID
FILTER (A, B, C)
X = strlen (User ID)
X > 5
No
Yes
X > 65535
No
Yes
WIEGAND_OUTPUT (X)
WIEGAND_OUTPUT (X)
Y = LAST_5_DIGIT (X)
Y > 65535
Yes
No
WIEGAND_OUTPUT (0)
WIEGAND_OUTPUT (Y)

24-bit Data output

As of Firmware 3_06.1197 onward, due to Customer requests, ACTAtek Unit will now allow 24-bit Card ID or 24-bit User ID Wiegand output for all card types.

Previously Mifare, Felica and EM cards were only allowed the option to include Facility Code in the output and the other cards were only given the option to display Card ID only without Facility Code.

Now the 4 options given to users are:

FC + Card ID (EP + 8 bit FC + 16 bit Card ID + OP)

FC + User ID (EP + 8 bit FC + 16 bit User ID + OP)

Card ID Only (EP+ 24 bit Card ID + OP)

User ID Only (EP+ 24 bit User ID + OP)

For HID cards (iClass and Proximity), the options are instead:

FC + Card ID (EP + 8 bit FC + 16 bit Card ID + OP)

FC + User ID (EP + 8 bit FC + 16 bit User ID + OP)

Manufacturer FC + Card ID (EP+ 8 bit MFC + 16 bit Card ID + OP)

User ID Only (EP+ 24 bit User ID + OP)

Because HID cards contain an internal Manufacturer defined Facility code.

Where EP stands for Even Parity bit and OP stands for Odd Parity, FC is the User Defined Facility Code. Where there is a specific Manufacturer Defined Facility Code in the card, the Manufacturer Defined Facility Code overrides the User Defined Facility Code.

26-bit wiegand format:

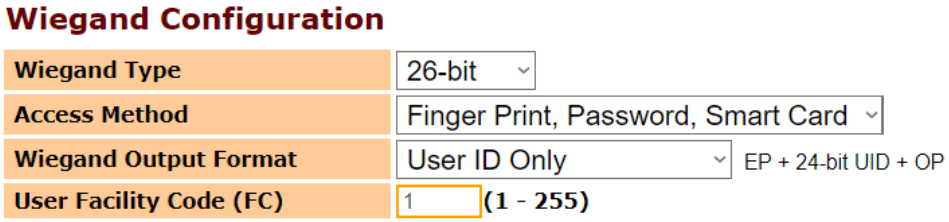
EP (Even parity, 1 bit)	FC/MFC (8 bits)	UID/CID (16 bits)	OP (Odd parity, 1 bit)

OR

EP (Even parity, 1 bit)	UID/CID (24 bits)	OP (Odd parity, 1 bit)

	HID iClass	HID Proximity	Mifare	Felica	Legic	EM
FC + UID	EP + FC + UID + OP	EP + FC + UID + OP	EP + FC + UID + OP	EP + FC + UID + OP	EP + FC + UID + OP	EP + FC + UID + OP
FC + CID	EP + FC + CID + OP	EP + FC + CID + OP	EP + FC + CID + OP	EP + FC + CID + OP	EP + FC + CID + OP	EP + FC + CID + OP
UID Only	EP + UID + OP	EP + UID + OP	EP + UID + OP	EP + UID + OP	EP + UID + OP	EP + UID + OP
CID Only	EP + MFC + CID + OP	EP + MFC + CID + OP	EP + CID + OP	EP + CID + OP	EP + CID + OP	EP + CID + OP

Wiegand output based on User ID



1. The user ID output contains only the integer portion of the assigned User ID.
2. All characters are thus removed from the user id for the output string and if the user ID (UID) is not able to be represented as a 24-bit integer, the number is suitably truncated.
3. If user ID contains only characters, the wiegand output will be zero (0).
4. The wiegand output of the facility code is sent out in hexadecimal.

Examples

Example 1 (Card ID or User ID only):

User ID/Card SN ID: 16716340 (Hex: FF1234)

Display 00FF1234

Example 2 (FC + Card ID/User ID):

User ID/Card SN: FF2345, Facility Code : 255

Display : 00FFFF23

(Display of Card SN or User ID is limited to 4 Bytes due to the fact that the FC data needs to be displayed. Thus only the first 4 bytes of the Card SN or User ID will be display, along with the FC value in front)

Card ID definition

The Card ID output are different for the various models, based on the information that is available on the card and is as follows:

Card Type	Output Value for Card ID
Mifare	CSN
EM	CSN
HID iClass	CID
HID Proximity	CID
CEPAS	CSN
Felica	CID

Fingerprint and Password Wiegand output.

The above changes are also implemented for the fingerprint and password entry methods. There will now be 2 options given to users for the Fingerprint or Password entry selection on the terminal Setup Page Wiegand output section, which are:

FC + User ID (EP + 8 bit FC + 16 bit User ID + OP)

User ID Only (EP+ 24 bit User ID + OP)

The output will be as shown above; EP + 8 bit FC + 16 bit User ID + OP and EP+ 24 bit User ID + OP

Wiegand Ouptut on failed access

There has been a customer request for wiegand output from the device after a rejected authentication following the similar rules to a successful authentication. This is to facilitate use of the ACTAtek device as a dumb reader terminal.

This means that the Card ID or the User ID, depending on settings, will be output even when access is denied.

The following table will show the expected output:

Method	Wiegand output on FP/PWD	Wiegand output on SC - CardID	Wiegand output on SC – User ID
Failed Password entry	User ID	Nothing	Nothing
Failed ID+FP entry	User ID	Nothing	Nothing
Failed Grp ID + FP entry	Grp ID	Nothing	Nothing
Failed SC entry	Nothing	Card ID (if readable)	Value of 0
Failed SC+FP entry OR Failed SC+PWD entry	Nothing	Card ID	User ID
Failed FP Automatch Entry	Value of 0	Nothing	Nothing