



## ACCESS CONTROL

Pico HF RFID reader series

Access Control reader ID-HF1A-AC1A

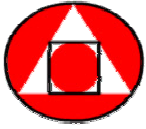
**Reference manual**



2<sup>nd</sup> Edition November 2006

**For more information, please contact [www.pico-mega.com](http://www.pico-mega.com)**

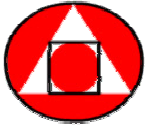
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## **Second edition - November 2006**

This is the first edition of the manual, it describes about  
Pico High Frequency Access Control Reader ID-HF1A-AC1A  
Firmware version 2.4.1

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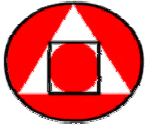
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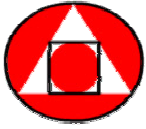
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## 1. Introduction

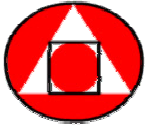
### 1.1. Document description

This document describes about hardware, operational features, command and response data formats of Pico HF RFID Access Control Reader ID-HF1A-C1A. This first edition is meant for the firmware version v2.4.1.

- ❖ All data format in the command frame should be given in hexadecimal format only.
- ❖ The hexadecimal value in brackets “[ ]” indicates a control byte (command).
- ❖ During the reading of a transponder, it must be ensured that the transponder is located within the detection range of the Access Control Reader during the process.
- ❖ Access Control Reader is also referred as Reader in the entire document.

### 1.2 Abbreviations

ASK	Amplitude Shift Keying
bps	Bits per second
FSK	Frequency Shift Keying
ID	Identification
LRC	Longitudinal Redundancy Check
MHZ	Megahertz
Min	Minutes
ms	Milliseconds
MSB	Most Significant Byte
Mbit	Megabit
RF	Radio Frequency
RTC	Real Time Clock
Sec	Seconds
UID	Unique Identifier (read only serial number)



## 2. Hardware Description

### 2.1. General Description – Access Control Reader

Pico RFID line of 13.56 MHz Access control readers brings the efficiency in Access Control applications, office time and attendance management., etc.,

The Pico Access control reader is based on Texas Instruments RFID technology and operates at 13.56 MHz frequency, which is compliance with the ISO/IEC 15693 vicinity card standards. The Access control reader has more features comparing with the other manufacturer readers of its category. Its features include an external antenna, a Real Time Clock (RTC), 2 Mbit memory and a relay. With these features the Access control reader can work as a slave to a host PC or work as a stand-alone device in the absence of the host.

The reader is provided with a RS232 communication port for interfacing the PC at a configurable baud rate. A four line 20 character LCD and two LEDs are used for visual indication and a buzzer for audio communication.

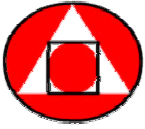
### 2.2. System Overview

HF Access Control Reader works on the 'Readers-talks-first' method. As soon as the Reader gets powered ON, generates an electromagnetic field around the antenna and starts sending commands through the electromagnetic field searching for a valid ISO15693 transponder. The transponder, which enters the RF field, converts the electromagnetic field energy to an operating energy and demodulates the command and sends the response to the Reader accordingly.

### 2.3. Interfacing PC – Reader

The Reader is connected to the PC through RS232 serial port cable. The serial communication occurs at RS232 level using 1 start bit, 8 data bits and 1 stop bit, no parity, no hard ware flow control at a selective baud rate between 9600 bps to 57600bps, except 38400 bps. The PC – Reader communication is carried out in data packets.

The communication from the PC to reader is a request and from the reader to PC is a response.



## 2.4. Functional specifications

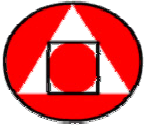
Part Number	ID-HF1A-AC1A
Operating frequency	13.56 MHz
Transmitter power level	200 mW (pulsed)
Antenna connection	External antenna
Antenna impedance	50 ohms @ 13.56 MHz
Communication interface	RS232
Baud rate	Configurable from 300 bps to 57600 bps*.
Visual / Audio Interface	Two LEDs, a Buzzer and a LCD
Additional features	Inbuilt Real Time Clock (RTC) Inbuilt Memory of 2 Mbits A relay
Operating temperature	-20°C to 65°C
Storage temperature	-40°C to 85°C

\*The reader does not support the baud rate 38400 bps.

## 2.5. Mechanical specifications

The Access Control Reader has a simple mechanical construction where all the components are mounted on the Printed Circuit Board. The PCB also carries the connectors of power supply and a serial cable. The outer dimension and weight of the board is given below.

Dimensions	110(L) x 80(W) x 35(H) all in mm
Weight	225 grams



## 2.6. Power Supply

The input supply voltage ranging from +6.5V to 12 V dc can be given to the Access Control Reader. Here with the reader a +12 V dc adapter is given as a power supply. The current consumed by the Access Control Reader while reading UID s is 350 mA.

Input Supply voltage	+6.5 V to +12 V dc power supply
Current consumption	350 mA

## 2.6. Output RF power

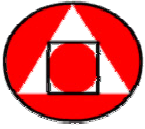
RF output power / antenna	200 mW
---------------------------	--------

## 2.7. Physical layer

Reader to transponder	10% - 30%(nominally 20%) ASK
Transponder to reader	FSK / High speed data rate

## 2.8. Antenna parameters

Impedance	50 ohms @ 13.56 MHz
Loaded Q	$10 < Q < 30$



### 3. Connection Procedure

#### 3.1. Power Supply Connection procedure



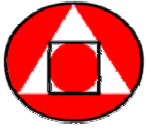
**12 volts DC adapter**

The reader has a power supply connector to be powered up. A 12 V DC adapter with the required specification is connected to get power supply to the reader.

#### 3.2. RS232 serial port interfacing procedure

A RS232 serial cable which has a RS232 DB9 female connector at one end and a male connector at the other end is used for serial communication. The DB9 female connector is connected to a COM port of host and RS232 male connector to the reader.





To the Reader

To the PC

Data transmission through the serial port is carried out using only 3 pins of the DB9 as shown below.

Pin Number	Signal
DB2	TX
DB3	RX
DB5	GND
DB1,DB4,DB6,DB7,DB8,DB9	NC

The serial port communication setup is given below

Baudrate : 19200 bps  
 Start bit : 1 bit  
 Data bits : 8 bits  
 Stop bit : 1 bit  
 Flow control : None

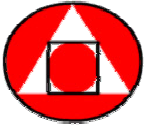
## 4. Command and Response format

### 4.1 Protocol Frame

The protocol frame is same for the Host to Reader as well as the Reader to Host. All the bytes transfer with the most significant byte (MSB) first.

1	2	3	4	5	6 ... n-3	n-2	n-1	N
Start Byte (0x01)	Device Address	Antenna ID	Data Length	Command Byte	Protocol Data	LRC	Separator Byte (0x03)	Stop Byte (0x04)

Data Format



### Start Byte

The start byte of any command is 0x01 (ASCII character 0x01).

### Device Address

The reader can be addressed using the user defined reader identification number of one byte length. The default address of the reader is '0x00'. The reader id '0x00' is a universal id for all readers; it is used particularly for configuring the readers in the distributed network. The reader which has ID '0x01' or '0x00' only will respond to such commands.

### Antenna ID

The antenna ID byte denotes antenna number allocated for the antenna. The antenna ID for this reader is fixed as 0x01. The antenna ID will be considered and present only in the 'response format' of a record.

*A record means, in working mode when the reader detects the presence of a valid card, it will transmit the UID along with the reader ID and timing details, which we call as a 'RECORD'. The format of a single record is given here.*

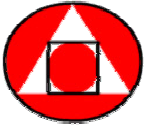
*Reader → Host*

1	2	3	4	5	6..13	14...20	21	22
0x01	DEVICE_ID	0x01	0x16	0xFA	UID	T0..T6	LRC	0x04

### Data Length

The data length byte refers the length of single protocol data frame i.e., the number of bytes in a single command or response.

Note: In the transponders response to the 'Read multiple tags' command, the data length does not include the stop byte.



### Command Byte

Command byte performs the function related to the byte. A brief description of the command byte used in various commands is listed below.

Function	Command byte	Function	Command byte
Soft Reset	0xCB	Append UID list	0xE2
Get Reader ID	0xC4	Configuration Mode	0XE8
Check Reader Status	0xC0	Delete UID list	0xE3
Get UID list	0xE1	Set Lock Interval	0xC9
Set Reader ID	0xC3	Set baud rate	0xCD
Get Firmware Version	0xCF	Set Lock Mode (Normal / Locked / Opened)	0xCA
Set Clock time	0xC5	Raise/Stop Alarm	0xCC
Get Clock time	0xC6	Download Records	0xEA
Get Tag UID to add in List	0xE0	Delete records	0xEB

### Protocol Data

This refers to the Data of the command byte.

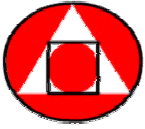
### Separator Byte

The separator byte of any command is 0x03. This byte is used to separate one data from another.

Note: Protocol data and separator byte are pairs. Its an optional segment of the protocol frame. Depends on the command byte protocol data and separator byte may exists zero or many times

### LRC Calculation

The Longitudinal Redundancy Check (LRC) is a one-byte data. LRC is calculated by adding the successive bytes in the command and discarding the carries and then two's complementing the result.



### Stop Byte

The stop byte of any command is 0x04 (ASCII character 0x04).

### UID representation

The transponder has a UID of 16 characters i.e., 8 byte length (64 bit). Each byte contains two character of the UID. The UID of all the transponder begins with the byte 'E0'. Here is an example for a UID 'E000768C0000A54B'.

### Timing Condition

Before sending the protocol start byte, there must be a minimum of 5 ms delay. When the reader is in 'Configuration mode' it will respond to the commands within 5 mS. When the reader is in 'Working mode' the reader's response time will vary from 1mS to 500 mS as the reader will be busy in scanning for the transponder.

## 4.2 Commands and Responses

### 4.2.a. Common mode Commands

#### 4.2.1. Soft Reset

The soft reset command returns the reader to the normal working mode irrespective of its present mode.

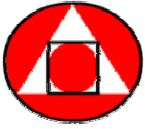
*Host → Reader*

1	2	3	4	5	6
0x01	DEVICE_ID	0X06	[0xCB]	LRC	0x04

*Reader → Host*

1	2	3	4	5	6
0x01	DEVICE_ID	0X06	[0xCB]	LRC	0x04

Note: Soft Reset command can be used in both the modes.



### 4.2.2. Get Reader ID

Only one reader must be connected on the execution of this command. The Get Reader ID command reveals the device address of a single reader.

Host → Reader

1	2	3	4	5	6
0x01	0x00	0x06	[0xC4]	LRC	0x04

**Note: Device ID to this command is 0X00.**

Reader → Host

1	2	3	4	5	6	7
0x01	0x00	0x07	[0xC4]	DEVICE_ID	LRC	0x04

### 4.2.b. Configuration mode commands

#### 4.2.3. Set Reader ID

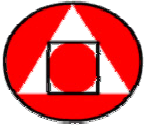
Set reader ID command is used to change the device ID of any reader connected in the network. On the execution of the command the host returns the new ID in the fifth byte. For further commands new DEVICE\_ID is taken into account. The default DEVICE\_ID of a reader is 0XFF.

Host → Reader

1	2	3	4	5	6	7
0x01	DEVICE_ID	0x07	[0xC3]	DEVICE_ID	LRC	0x04

Reader → Host

1	2	3	4	5	6	7
0x01	DEVICE_ID	0x07	[0xC3]	DEVICE_ID	LRC	0x04



#### 4.2.4. Set Clock Time

This command sets the time and date in the reader. This time is used in time based applications.

*Host → Reader*

1	2	3	4	5 ... 11	12	13
0x01	DEVICE_ID	0x0D	[0xC5]	T0...T6	LRC	0x04

*Reader → Host*

1	2	3	4	5...11	12	13
0x01	DEVICE_ID	0x0D	[0xC5]	T0...T6	LRC	0x04

#### TIME:

5	6	7	8	9	10	11
T0_Sec	T1_Min	T2_Hour	T3_Day	T4_Date	T5_Month	T6_Year

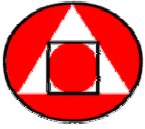
Note: For T3\_day : 0x00-Sun, 0x01-Mon, 0x02-Tue, 0x03-Wed, 0x04-Thu, 0x05-Fri, 0x06-Sat  
The time get set and received in hexadecimal mode only. For example to set 40 sec in T0 ,set the fifth byte as 0x1B (hexadecimal value of 40 is 0x1B).

#### 4.2.5. Get Clock Time

This command get the current time and date of the reader. You can check the time and date set in the reader using this command.

*Host → Reader*

1	2	3	4	5	6
0x01	DEVICE_ID	0x06	[0xC6]	LRC	0x04



*Reader → Host*

1	2	3	4	5...11	12	13
0x01	DEVICE_ID	0x0D	[0xC5]	T0...T6	LRC	0x04

**TIME:**

5	6	7	8	9	10	11
T0_Sec	T1_Min	T2_Hour	T3_Day	T4_Date	T5_Month	T6_Year

Note: For T3\_day : 0x00-Sun, 0x01-Mon, 0x02-Tue, 0x03-Wed, 0x04-Thu, 0x05-Fri, 0x06-Sat.  
The time get set and received in hexadecimal mode only.

**4.2.6. Get tag UID to add in List**

‘Get Tag UID to add in List’ command is used to get the UID from the tag and add that to the UID list. On executing the command the tag has to be kept above the reader for few seconds and the UID data get read by the reader. The UID is then sent to the PC with the following format.

*Host → Reader*

1	2	3	4	5	6
0x01	DEVICE_ID	0x06	[0xE0]	LRC	0x04

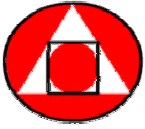
*Reader → Host*

1	2	3	4	5...15	16	17
0x01	DEVICE_ID	0x11	[0xE0]	UID	LRC	0x04

When Tag is not in the field

*Reader → Host*

1	2	3	4	5	6
0x01	DEVICE_ID	0x0D	[0xE0]	LRC	0x04



**4.2.7. Append UID list**

Append UID list command is used to add a list of tag UID to the reader that should be given access incase of access control applications. The separator byte 0x03 should be given to continue with the next UID of the list. To the last UID send the separator byte (25<sup>th</sup> byte) value as 0x00 to represent the end of list.

*Host → Reader*

1	2	3	4	5...24	25	26	27
0x01	DEVICE_ID	0x1B	[0xE2]	UID-TIME	0x03	LRC	0x04

*Reader → Host*

1	2	3	4	5..24	25	26	27
0x01	DEVICE_ID	0x1B	[0xE2]	UID-TIME	0x03	LRC	0x04

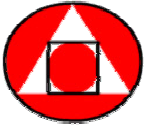
**UID-TIME**

Byte	5...20	21,22	22,24
Data	UID	In Time	Out Time

- UID** : **Transponder UID to get access**
- In Time** : **In Hr/Min format**
- Out Time** : **In Hr/Min format**
- Hr** : **lies between 0 and 23 hours**
- Min** : **lies between 0 to 59 minutes**

For 'any time access' to card holders use 0 hr and 0 min in both 'In Time' and 23 hr and 59 min in 'Out time' bytes.

*Note: Give the data as hexadecimal value only*



### 4.2.8. Get UID list

The Get UID list command used to retrieve the UID list stored in the Reader for access permission. The response data comes with the separator byte 0x03 (25<sup>th</sup> byte) for the entire UID list and the last UID has a 0x00 as separator byte.

*Host → Reader*

1	2	3	4	5	6
0x01	DEVICE_ID	0x06	[0xE1]	LRC	0x04

*Reader → Host*

1	2	3	4	5..24	25	26	27
0x01	DEVICE_ID	0x1B	[0xE1]	UID-TIME	0x03	LRC	0x04

#### UID-TIME

Byte	5...20	21,22	22,24
Data	UID	In Time	Out Time

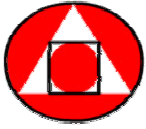
**UID** : **Transponder UID to get access**  
**In Time** : **In Hr/Min format**  
**Out Time** : **In Hr/Min format**  
**Hr** : **lies between 0 and 23 hours**  
**Min** : **lies between 0 to 59 minutes**

### 4.2.9. Delete UID list

Execution of the 'Delete UID list' command permanently deletes the UID list stored in the Reader for access permission. Once deleted the data cannot be retrieved back.

*Host → Reader*

1	2	3	4	5	6
0x01	0x00	0x06	[0xE3]	LRC	0x04



Reader → Host

1	2	3	4	5	6
0x01	0x00	0x06	[0xE3]	LRC	0x04

In the response the first 3 bytes comes at once and as soon as the deleting function ends the other bytes of response follows it. It may take 6 to 7 seconds. While deleting records the LED blinks.

#### 4.2.10. Set Lock interval Time

The Set Lock interval time command is used to set the time interval of door's magnetic latch to be kept opened from the time of showing the card or pressing exit switch.

Host → Reader

1	2	3	4	5	6	7
0x01	0x00	0x07	[0xC9]	Time	LRC	0x04

Reader → Host

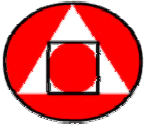
1	2	3	4	5	6	7
0x01	0x00	0x07	[0xC9]	Time	LRC	0x04

**TIME:** In terms of seconds from 0x01 to 0xFF can be given.

### 4.2.c. Commands in Working mode

#### 4.2.11. Get into Configuration mode

This command is used to get into the configuration mode from the working mode. If the reader is already in the configuration mode, on the execution of the command no response is obtained from the reader.



*Host → Reader*

1	2	3	4	5	6
0x01	DEVICE_ID	0X06	[0XE8]	LRC	0x04

*Reader → Host*

1	2	3	4	5	6
0x01	DEVICE_ID	0x06	[0xE8]	LRC	0x04

**Note: At stand alone condition the reader is in working mode.**

#### 4.2.12. Check Reader status

The 'Check reader status' command makes the reader to check whether all the modules are in working condition or not.

*Host → Reader*

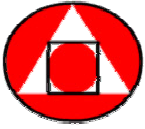
1	2	3	4	5	6
0x01	DEVICE_ID	0X06	[0xC0]	LRC	0x04

*Reader → Host*

1	2	3	4	5	6	7
0x01	DEVICE_ID	0x07	[0xC0]	Error code	LRC	0x04

In response to the above command, one of the following code get displayed.

Code	Message
No response	Communication error
0X00	Reader Status GOOD
0X01	RF Error
0X02	Memory Error
0X03	RTC Error



### 4.2.13. Get Firmware Version

The 'Get Firmware Version' command gives the firmware version of the reader . The byte from B2 to B5 denotes firmware version is in ASCII format. B0 & B1 are used for manufacturer's reference.

*Host → Reader*

1	2	3	4	5	6
0x01	DEVICE_ID	0X06	[0xCF]	LRC	0x04

*Reader → Host*

1	2	3	4	5...10	11	12
0x01	DEVICE_ID	0x0C	[0xCF]	B0...B5	LRC	0x04

### 4.2.14. Set Baud rate

This command is used to set the selectable baud rate from 300 bps to 57600 bps except 38400 bps.

*Host → Reader*

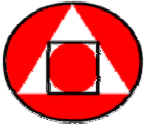
1	2	3	4	5	6	7
0x01	DEVICE_ID	0x07	[0xCD]	Data	LRC	0x04

*Reader → Host*

1	2	3	4	5	6	7
0x01	DEVICE_ID	0x07	[0xCD]	Data	LRC	0x04

Select the suitable baudrate by giving the appropriate data value from the given table.

Data	Baudrate
0x00	57600
0x01	19200
0x02	9600
0x03	4800
0x04	2400
0x05	1200
0x06	600
0x07	300



#### 4.2.15. Set Lock Mode (Normal / Locked / Opened)

This command is used to set the magnetic latch attached to the reader under three different modes.

Upon start or reset, the reader will work in Normal mode.

Under emergency situation like fire etc., Reader can be set in Opened mode. In this mode all the magnetic latches attached to the reader will keep the doors opened permanently.

Locked mode is opposite to opened mode, even valid access also will not open the door.

*Host → Reader*

1	2	3	4	5	6	7
0x01	0x00	0x07	[0xCA]	Lock_Mode	LRC	0x04

*Reader → Host*

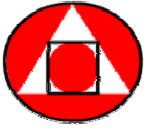
1	2	3	4	5	6	7
0x01	0x00	0x07	[0xCA]	Lock_Mode	LRC	0x04

#### Lock\_Mode:

Door latch	Data
Normal	0x00
Locked	0x01
Opened	0x02

#### 4.2.16. Raise / Stop Alarm

This command is used to raise an alarm from the reader. By this way you can produce different types of alerts as long and short audible beeps which seek attention. The format value can be from 1 to 255. To stop the alarms give the format value as 0x00.



*Host → Reader*

1	2	3	4	5	6	7
0x01	DEVICE_ID	0X07	[0xCC]	FORMAT	LRC	0x04

*Reader → Host*

1	2	3	4	5	6	7
0x01	DEVICE_ID	0X07	[0xCC]	FORMAT	LRC	0x04

**Note:** The binary form of format byte decides the audible length of a beep. The '1' gives a beep and a '0' gives no beep. After the execution of this command either 'Stop Alarm' command or 'Soft Reset' command can get executed. No other commands can get executed.

#### 4.2.17. Download records

This command gives out the read UID list with time, from the memory of the reader.

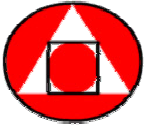
*Host → Reader*

1	2	3	4	5	6
0x01	DEVICE_ID	0X07	[0xEA]	LRC	0x04

*Reader → Host*

1	2	3	4	5	6..21	22...28	29	30	31
0x01	DEVICE_ID	0x01	0x1F	[0xEA]	UID	T0..T6	LRC	0x03	0x04

In Response the Antenna Id is given as third byte. This is helpful in finding whether the cards read at inlet or at outlet of some access control application.



**TIME:**

22	23	24	25	26	27	28
T0_Sec	T1_Min	T2_Hour	T3_Day	T4_Date	T5_Month	T6_Year

**Note:** For T3\_day : 0x00-Sun, 0x01-Mon, 0x02-Tue, 0x03-Wed, 0x04-Thu, 0x05-Fri, 0x06-Sat  
The time get set and received in hexadecimal mode only. For example to set 40 sec in T0 ,set the fifth byte as 0x1B (hexadecimal value of 40 is 0x1B).

**Note:** A separator byte is sent as the 22nd byte in the response to separate the UIDs from one another. The reader will send a stop byte 0x04 after the separator byte with the last UID to indicate the end of the response or it will send the start byte (0x01) at the 23rd byte if another UID get detected.

**4.2.18. Delete records**

On the execution of this command the reader permanently deletes all the UIDs stored in the memory. UIDs once deleted cannot be retrieved back. It may take 1 or 2 sec to delete records.

*Host → Reader*

1	2	3	4	5	6
0x01	DEVICE_ID	0X06	[0xEB]	LRC	0x04

*Reader → Host*

1	2	3	4	5	6
0x01	DEVICE_ID	0X06	[0xEB]	LRC	0x04

**4.2. c. Common response to all the RF commands**

In the RF related commands, when no transponder is found in the field of the reader it gives the response as below.

*Reader → Host*

1	2	4	5	6	7
0x01	DEVICE_ID	0X06	[0xFF]	LRC	0x04