Advanced Card Systems Ltd.
Card & Reader Technologies

ACR880 GPRS Portable Smart Card Terminal

SDK User Manual

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1.0. Introduction

1.1. Overview

Smart card technology provides high level of security and cost-efficient mechanism through a reliable and secure environment to streamline several operations. Aside from its invulnerability against tampering and fraud, smart card technology also provides a digital approach to manage information more easily and effectively.

The new ACR880 is a secure and feature-rich handheld portable smart card terminal that leverages on the characteristics and mechanisms of smart card technology. This innovative device is capable of facilitating secure mutual authentication, detailed multi-layered information from the cards based on the embedded access rights, and transactions through both private and public network infrastructures. It can offer solution to different applications such as: Healthcare, e-Government, and e-Administration.

The ACR880 Secure Smart Card Terminal Software Development Kit (ACR880 SDK) provides an effective way of developing customized applications and systems. It serves as an ideal training and development tool for those who are interested in exploring smart card technologies. The SDK comes with sample codes written in C programming language. These sample codes showcase the different capabilities of the ACR880, as well as provide instructions on how to control ACR880 peripherals and communicate with ISO 7816 and ISO 14443 cards.

1.2. Typical Applications

- Electronic Healthcare:

    - Medical Identification

    - Digital Signatures

    - Digital Prescriptions

    - Patient Data and History

    - Billing Transactions

- Electronic Government

- Secure Electronic Payment

- Customer Loyalty

- Secure Home-banking

- Time and Attendance

2.0. Features

- 32-Bit ARM 9 Processor running Embedded Linux
- 32MB Flash and 32MB SDRAM Memory
- Dual Operation Modes (PC-Linked/Standalone)
- Long Battery Life for All Day Use
- Charging via Docking Cradle
- Dual Interface Reader (Contact and Contactless)
- USB Host & Client Full Speed/Serial/Ethernet Interface
- GPRS/GSM quad band (850, 900, 1800, 1900 MHz)
- 2 Full-Size Contact Card Slots (Landing Connector)
- 2 SAM-Size Card Slots (Contact Connector)
- Firmware Upgradeable
- Hand-held Size and Weight
- Easy-to-Read, High Resolution Backlit LCD
- Highly Durable Chemical Resistant 20-Button Keypad
- 4 LED Status Indicators
- Built-in Speaker
- Tamper Detection Switch to Protect Against Unauthorized Intrusion
- Real-Time Clock (RTC) with Independent Backup Battery
- Supports Secure PIN Entry (SPE)
- Supports PPS (Protocol And Parameters Selection) with 9,600—230,400 Bps In Reading and Writing Smart Cards
- (Optional) Built-in Fingerprint Sensor
- (On Request) Wifi
- (On Request) Color LCD
- (On Request) Internal Microphone
- (On Request) Cigarette Lighter Adapter

3.0. Scope and Limitations

3.1. Purpose of this Manual

This manual aims to provide the user with relevant information on how to setup and configure ACR880 terminal as provided in the Software Development Kit. It also instructs the user on how to execute the SDK demo applications. Further, it provides general information on real-world applications where the ACR880 terminal may be used.

3.2. Applicability

This manual is only applicable to the ACS ACR880 Software Development Kit.

3.3. Embedded Software

The ACR880 terminal is embedded with Linux 2.6 OS to allow stand-alone operations. This also allows the device to be operated by a computer (running on Windows, Mac and Linux OS) within the same network.

3.4. Operating Environment

When used as a stand-alone terminal, the ACR880 device is fully functional with the Pin-Pad for user input and the LCD screen for display output. The device can be accessed or programmed through a computer (running on Windows, Mac and Linux OS) using the TCP/IP protocol.

3.5. How to use this manual

This is a comprehensive manual which includes guides on how to use the kit and the provided demos. Users that are new to the device should read this manual thoroughly. Otherwise, users may directly proceed to the particular section which needs further reviewing.

4.0. Getting Started

4.1. ACR880 Device and its Parts

The ACR880 terminal and some of its essential components are displayed below:

LCD Display with Backlight

LED Status Light

Numeric Keys

Cancel / Delete Key

Menu Key

Backspace Key

Enter / Tick Power ON Key

Charging Cradle

Contactless Card Reader
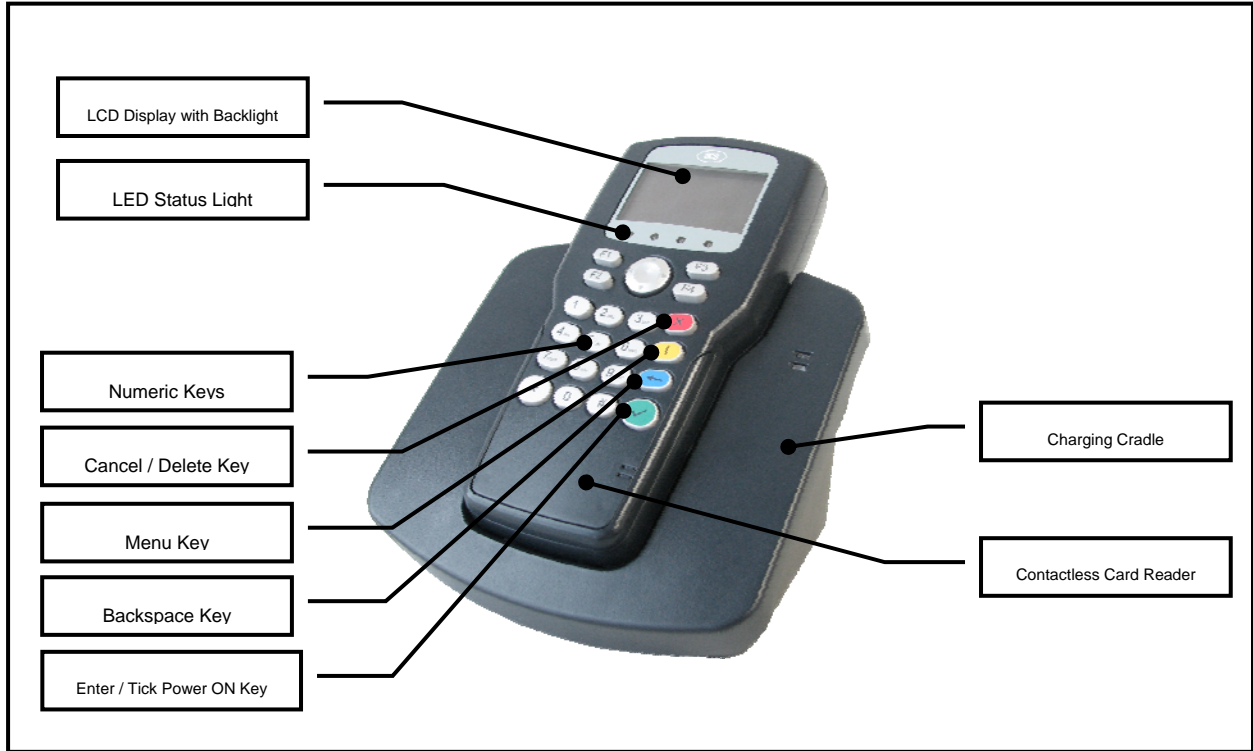
Figure 1: ACR880 Terminal and its Parts

Power Button

Card Slot 2

Card Slot 1

Charging Cradle
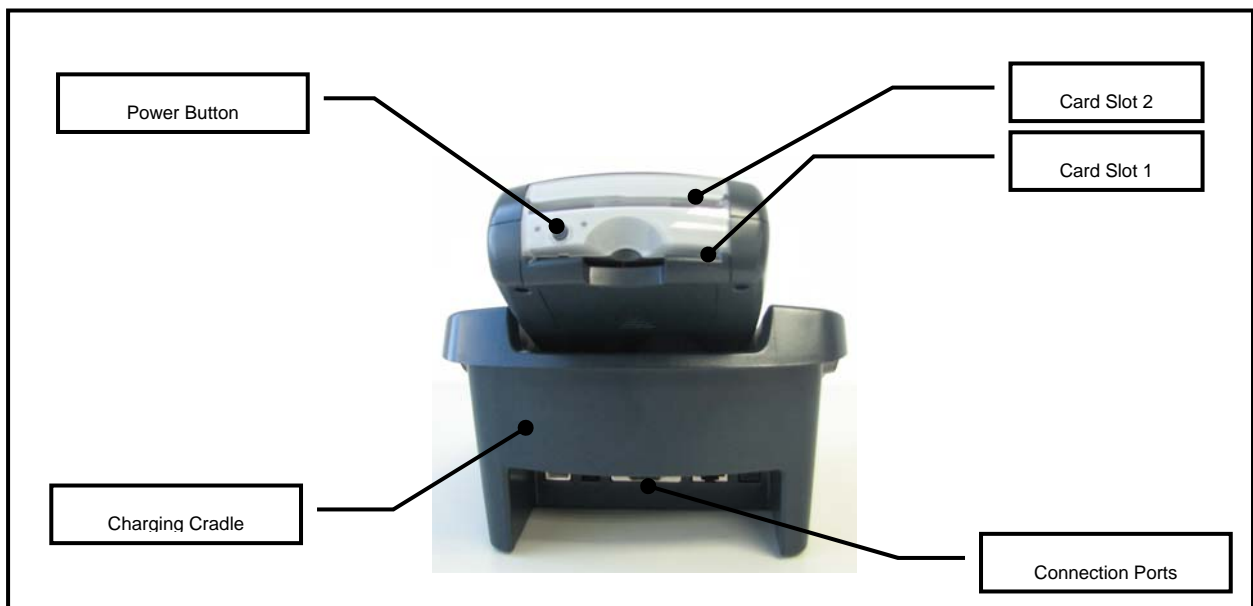
Connection Ports

Figure 2: ACR880 Terminal and its Parts
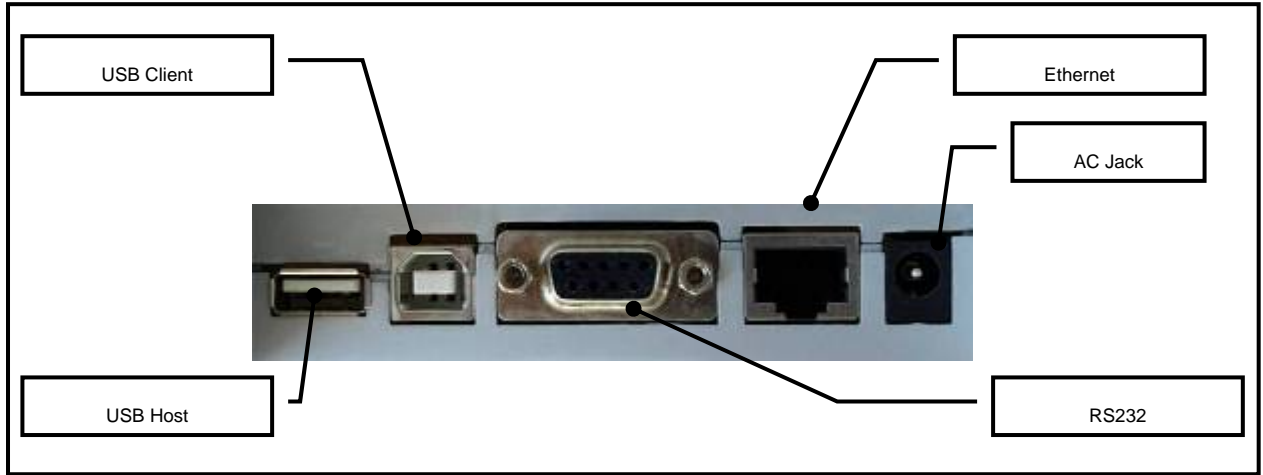
Figure 3: Connection Ports at the back of ACR880 Terminal

Figure 4: SAM Slots and Reset Button at the back of ACR880 Terminal

4.2. Function Keys

The ACR880 terminal is equipped with function keys that serve as shortcuts to special device operations. These function keys are as follows:

- **F1** is reserved for future use

- **F2** is reserved for future use

- **F3** is reserved for future use

- **F4** is used to display the terminal firmware version, demo version, IP address, date and time.

4.3. Connectivity Setup

The ACS ACR880 terminal is a fully-functional device developed for complex applications like Health Care, Time & Attendance, and Identification. Thus, the terminal is designed to use the TCP/IP Protocol to communicate with other external devices within a network.

Shown in the diagram below, is the connectivity setup for ACS ACR880:

Ethernet

Router with

Internet
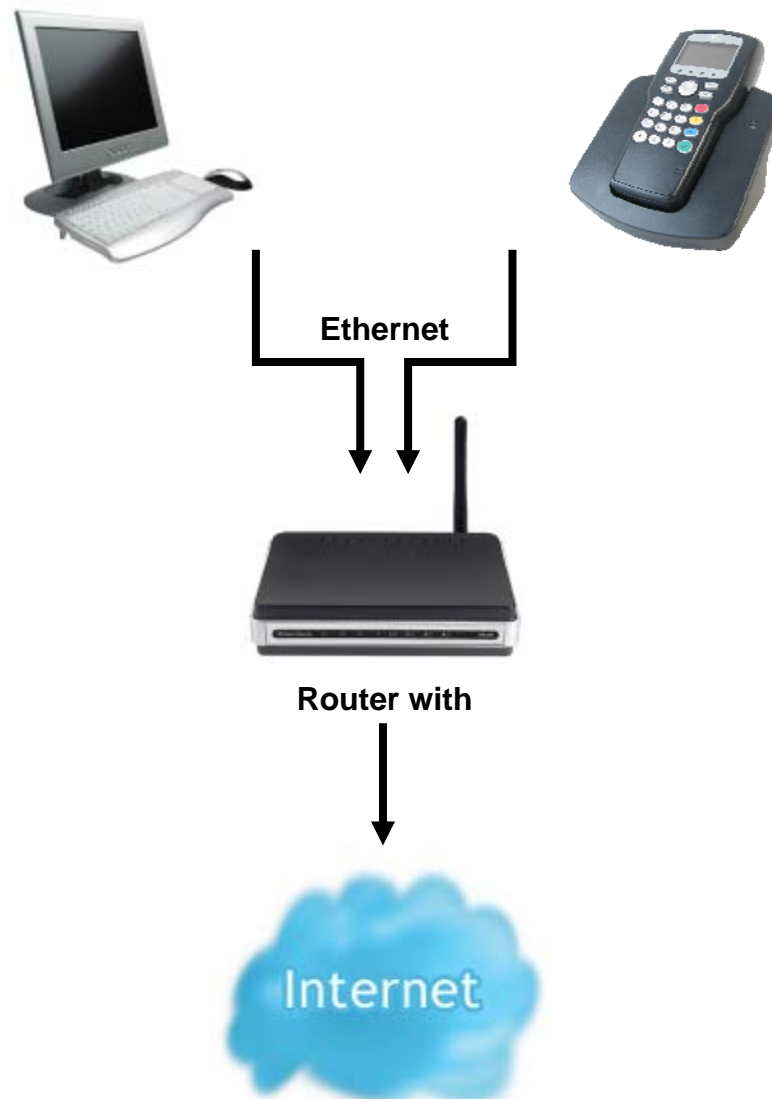
Figure 5: ACR880 Connectivity Setup

Within the same network, a computer may run applications that can do any of the following:

- Use the ACS ACR880 terminal as a smart card reader to read and write data into various Smart Cards like ACOS, SLE5542, MiFARE, etc.,

- Use ACS ACR880 terminal as key input terminal as well as display device for effective user interaction,

- Read and display terminal information and process status, and

- Download new software into the ACS ACR880 terminal such as firmware binaries upgrade.

5.0. Configuring the Device

To configure the settings of the ACR880 terminal, follow the instructions below:

A. Hold **ENTER/TICK (✓)** key until the screen below is shown.

```
1   Ethernet…
2   Date/Time
3   Settings…
4   Exit…
```

Figure 6: Configuration Menu

B. Select the configuration option from the *Configuration Menu*. Use **Cancel/Cross (✗)** key to go back to the previous menu

The Configuration Menu has different configuration options, these options are as follows:

1. Ethernet

On the *Configuration Menu*, press **1** for the Ethernet page, here you can choose to fix the IP of the device or set it to DHCP.

```
1. Fixed IP
2. DHCP
```
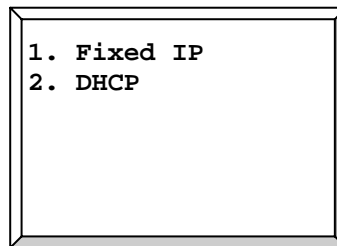
- If the Fixed IP option (**1**) is selected, you will be required to input the desired IP Address of the terminal, e.g., 192.168.61.1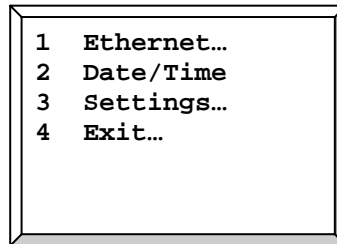23. The user will then be asked to provide the Subnet Mask, Gateway and the DNS Server addresses. If the user does not provide any values to these fields, the terminal will generate the following values:

  - Subnet Mask: 255.255.255.0

  - Gateway: 192.168.61.1 (consistent to the sample IP address above)

  - DNS: Not used

- If the DHCP option (**2**) is selected, the ACR880 terminal will obtain its IP Address from the network. The ACR880 terminal will be accessed or operated from a computer; hence this computer must be similarly set to obtain its own IP address from the same DHCP-enabled network. In this manner, the ACR880 terminal and the computer would belong under the same local area network.

2. Date/Time

On the *Configuration Menu*, press **2** to input the **Date/Time** of the device.

```
New Date/Time:

_ _ _ _- _-_ _   _ _:_ _
```
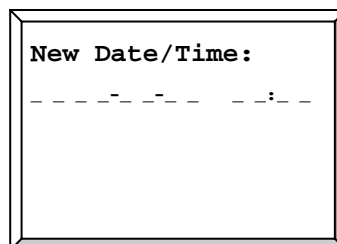
3. Settings

On the C*onfiguration Menu*, press **3** for the **Settings** page, here you can change the terminal password and load the default settings of the ACR880 terminal. Use **Cancel/Cross (✖)** key to go back to the previous menu.

```
1. Load Defaults
2. Change
   Password
```
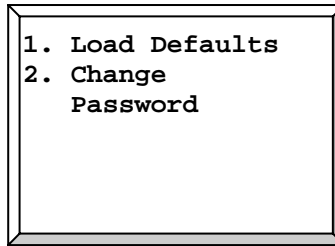
- **Load Defaults** setting**:** Press **1** to reset the ACR880 terminal to its factory default configuration.

  Note: German is the default language after the reset.

- **Change Password** setting: Press **2** to change the terminal password.

  Note: The default password is 1234.

4. Exit

To leave the *Configuration menu*, press **4** key and select Save (**1**), or Without Save (**2**) from the menu below.

```
1. Save & Reboot
2. Exit w/o Save
```
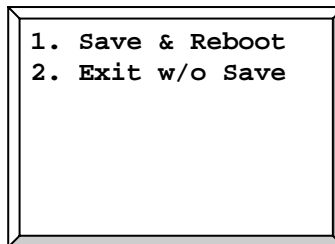
- **Save & Reboot** : Saves the changes made and exits to the remaining booting process
- **Exit w/o Save** : Exits without saving the changes made

6.0. ACR880 Standalone Demo

6.1. Overview

The ACR880 Standalone Demo is a preloaded demo application in the ACR880 that consists of many application programs, demonstrating the multi-slots, contactless, LCD, keypad, buzzer, and other features of the ACR880 terminal.

The ACR880 Standalone Demo includes the following applications:

- POS Demo
- eHealth Demo
- Loyalty Demo

Supported Card Types:

- ACOS3 MCU Card
- MIFARE 1K Card
- SLE5542 Memory Card

Supported Languages:

- English
- German

Note: Make sure that no other processes are running while the demo is going on.

6.2. Turning the Terminal ON

Hold **ENTER/TICK** key **(✓)** for a few seconds. Wait for the *Main Menu* to appear as below:

```
1. POS Demo
2. eHealth Demo
3. Loyalty Demo
4. Toggle Backlight
5. Pwr Off  6. Exit
```

Figure 7: ACR880 Demo Main Menu

6.3. POS Demo

This demo shows how the ACR880 device can be used for POS applications. To try the demo, follow the instructions below:
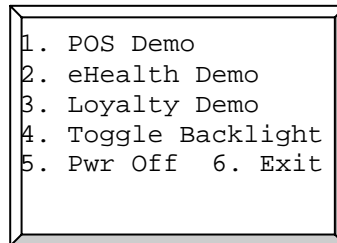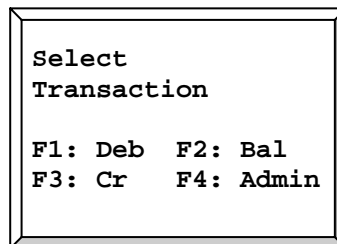
A. On the *Main Menu (Figure 6)*, press **1** to enter the POS Demo.

```
Select
Transaction

F1: Deb  F2: Bal
F3: Cr   F4: Admin
```

B. Select transaction type. Follow the screen instruction and present your MiFARE card.

- Press **F1** to deduct a certain value from the card

```
Debit Amt = 100
Present MiFare


F1: Deb   F2: Bal
F3: Cr    F4: Admin
```

- Press **F2** to check the remaining balance of the card

```
Balance Check
Present MiFare


F1: Deb   F2: Bal
F3: Cr    F4: Admin
```

- Press **F3** to add a certain value to the card

```
Credit Amt = 100
Present MiFare


F1: Deb   F2: Bal
F3: Cr    F4: Admin
```

C. The *Administration Menu* function allows users to backup the transaction records stored in the ACR880 terminal. In this demo, ACOS3 card is used as a data collection card. Records are transferred from the ACR880 terminal to the ACOS3 card.

- Press **F4** to enter the *Administration Menu (Figure 7)*

```
1. Issue ACOS3/2
2. Show Rec POS
3. Show Rec ACOS
4. Xfr Rec-ACOS
5. Leave Admin
0. Exit POS Demo
```

Figure 8: POS Demo – Administration Menu

- Insert an ACOS3 card to card slot 0 or 1. Press **1** to issue a new ACOS3 data collection card.
- Press **2** to show the transaction records stored in the ACR880 terminal, then **Clear/Cross** key **(✖)** to return to the administration menu
- Press **4** and then the **Enter/Tick (✓)** key to transfer all the records from the ACR880 terminal to the ACOS3 card.

For example, four records have been transferred from the terminal to the card as shown in the screen below. And all records in the terminal are cleared.

```
Xfr Record to ACOS
POS Rec:  4➔0
ACOS Rec: 0➔4

<Enter> to Confirm
<Clear> to Cancel
```

- Press **3** to show the transaction records stored in the ACOS3 card. Press **Enter** to proceed to the next record. Press **Clear** to return to the administration page.

```
Rec #4: SN: 60988244
2008-12-12 00:23:44
Deb=8, Bal=76

Clear: Exit
Enter: Next
```

- Press **5** to leave the administration page and return the POS demo. Press **0** to leave the POS demo.

6.4. eHealth Demo

This demo shows how the ACR880 device can be used for eHealth applications. Two pre-initialized SLE 5542 cards are included in the ACR880 SDK package that you can use with this demo application. To try the demo, follow the instructions below:

A. On the *Main Menu (Figure 6),* press **2** to enter the eHealth Demo.

```
Insert Card then
Select Card Slot
1. Card Slot 0
2. Card Slot 1
3. Back
```

B. Insert a Health Insurance Demo Card (a pre-initialized SLE5542 card) to Card Slot 0 or 1. Press **1** or **2** to select the card slot to read the card.

C. Health insurance information (Insurance company, insured no., name and address, etc.) stored in the Health Insurance demo card is shown on the LCD of the ACR880 terminal. Press any key to proceed with the next data.

```
Press any key
HII Name:
ABC Insurance Co.
```

6.5. Loyalty Demo

This demo shows how the ACR880 device can be used Loyalty programs. To try the demo, follow the instructions below:

A. On the *Main Menu (Figure 6)*, press **3** to enter the Loyalty Demo.

```
Insert Card then
Select Card Slot
1. Card Slot 0
2. Card Slot 1
0. Back
```

```
ACOS Card Demo
1. Issue Loyalty card
2. Purchase
0. Exit
```

B. Insert an ACOS3 card to slot 0/1. Press **1** or **2** to select the card slot to read the card.

C. Press **1** to issue a new ACOS3 Loyalty card. Press any key to return to the Loyalty Demo menu.

```
Issue Card#: 21810

Press any key
```

D. Press **2** for purchase and insert your ACOS3 Loyalty card. Input the purchase amount using the key pad (e.g.: **1000**) and press **Enter.**

The purchaser is entitled to an allotment of points which can be used for future purchases. For every purchase amount of 100, one bonus point is given in this demo.

If you don't have any Loyalty Points in your card before your first purchase, please press any key to return to the *Loyalty Demo Menu*.

```
Card#: 21810
Loyalty Pts: 0
Purchase
Amount:1000
Use Loyalty Points
0=Yes    Others=No
```

```
Actual Amt: 1000
Pts. Earned: 10

Press any key
```

E. Press **2** for purchase again. Input the purchase amount using the keypad (e.g.:**1000**) and press **Enter.** Now you can use your loyalty points to do purchase. Press **0** to use loyalty points. Actual amount to be paid is 990 instead of 1000. Press any key to return to the *Loyalty demo Menu*.

```
Card#: 21810
Loyalty Pts: 10
Purchase
Amount:1000
Use Loyalty Points
0=Yes    Others=No
```

```
Actual Amt: 990
Pts. Earned: 9


Press any key
```
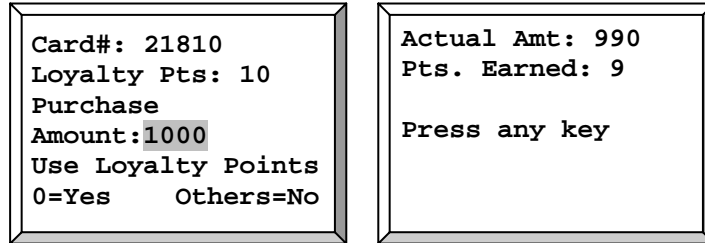
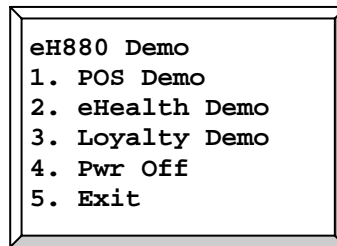F. Press **0** to leave the Loyalty application demo

6.6. Toggle Backlight

Press 3 to turn the backlight of the device ON or OFF.

6.7. Turning the Terminal OFF

Press **4** to turn OFF the terminal on the *Main Menu*.

   Note: *Option (5) Exit is reserved for future use only*

```
eH880 Demo
1. POS Demo
2. eHealth Demo
3. Loyalty Demo
4. Pwr Off
5. Exit
```

7.0. eH880 Web Tool

7.1. Overview

The eH880 web tool is an application utility tool preloaded in the ACR880 that enables you to perform commands to control the device and its peripherals. This tool helps the user identify the basic information, memory information and network information of the device. This tool also allows the user to modify the device's default settings, check the inserted cards in each slot, test the functionality of all peripherals, update firmware easily and upload any file onto the device for device programming.

> *Note: For more details, please refer to the Setup Development Environment Manual.*
>
> *Make sure that no other processes are running when running the web tool.*

7.2. How to Access the eH880 Web Tool

To access the tool, make sure that the device is properly connected to the computer via Local Area Network. Once connected, open your web browser (**Mozilla Firefox, Internet Explorer 7**) and navigate to the following address:

> ***Error! Hyperlink reference not valid.*** *Address of the ACR880 Terminal>*

The IP address may also vary depending on the Network Admin. For more information on how to modify the default IP address, click here.

To login, use the following default Username and Password:

Username: *admin*

Password: *1234*

Figure 9:eH880 Web Tool

> *Note: To identify the IP address of the ACR880 terminal, press and hold the **F4** key of the device.*

7.3. General Tab

This tab displays the essential information about the device. It displays the basic, memory and network information of the device.
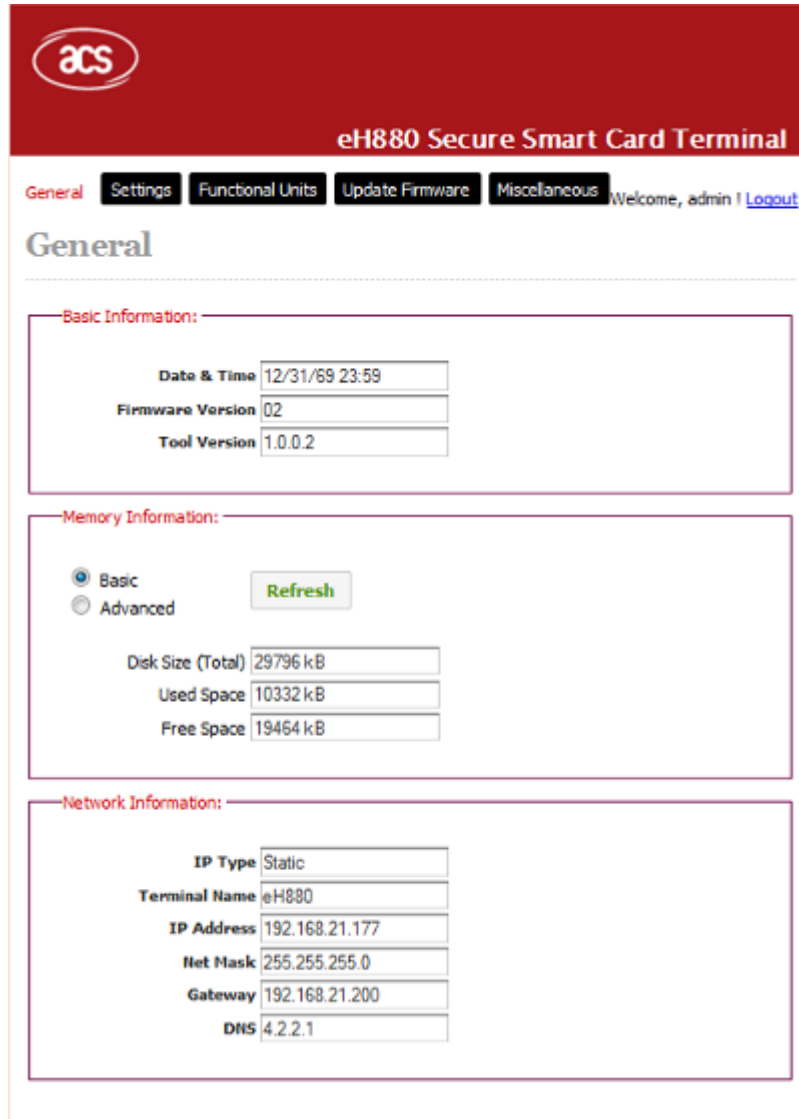

Figure 10: General Tab

7.3.1. Basic Information

This shows the following information about the device: current date & time, current firmware version and current eH880 Tool version.

7.3.2. Memory Information

This shows the current memory information of the device. It can display the device's basic memory or advanced memory. It also allows users to refresh the displayed information. Explained below are the options provided.

- **Basic:** Shows the basic memory information e.g. available, used and total memory space.
- **Advanced:** Shows all memory information e.g. buffers, cache, etc.
- **Refresh Button:** Reloads the current memory information.

7.3.3. Network information

This shows the current network connection information of the device. It shows the device's Terminal Name, IP Address, Net Mask, Gateway and DNS.

7.4. Setting Tab

This tab allows users to configure the device's settings. It allows the users to configure the device's date & time, network settings, and login password.
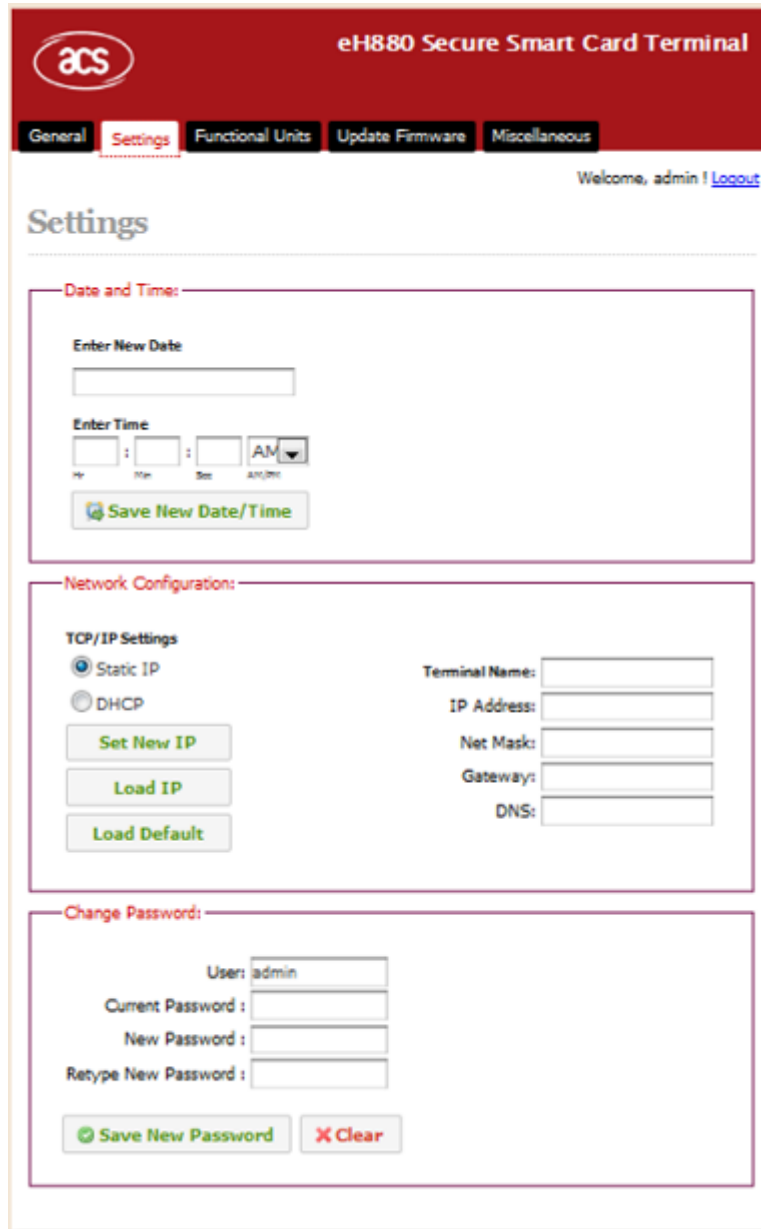

Figure 11: Setting Tab

7.4.1. Date and Time

This function is used to set the date and time of the device.

7.4.2. Network Configuration

This function is used to configure the network connection of the device i.e. Terminal Name, IP Address, Net Mask, Gateway and DNS. It also allows you to load the default network configuration of the device. For the Static IP address, user can manually input the IP address including the Net Mask, Gateway and DNS while the DHCP automatically assigns the IP address for the device.

> *Note: You need to restart the device for the changes to take effect.*

7.4.3. Change Password

This function is used to change the login password.

> *Note: The maximum password length is 8 characters.*

7.5. Functional Units Tab

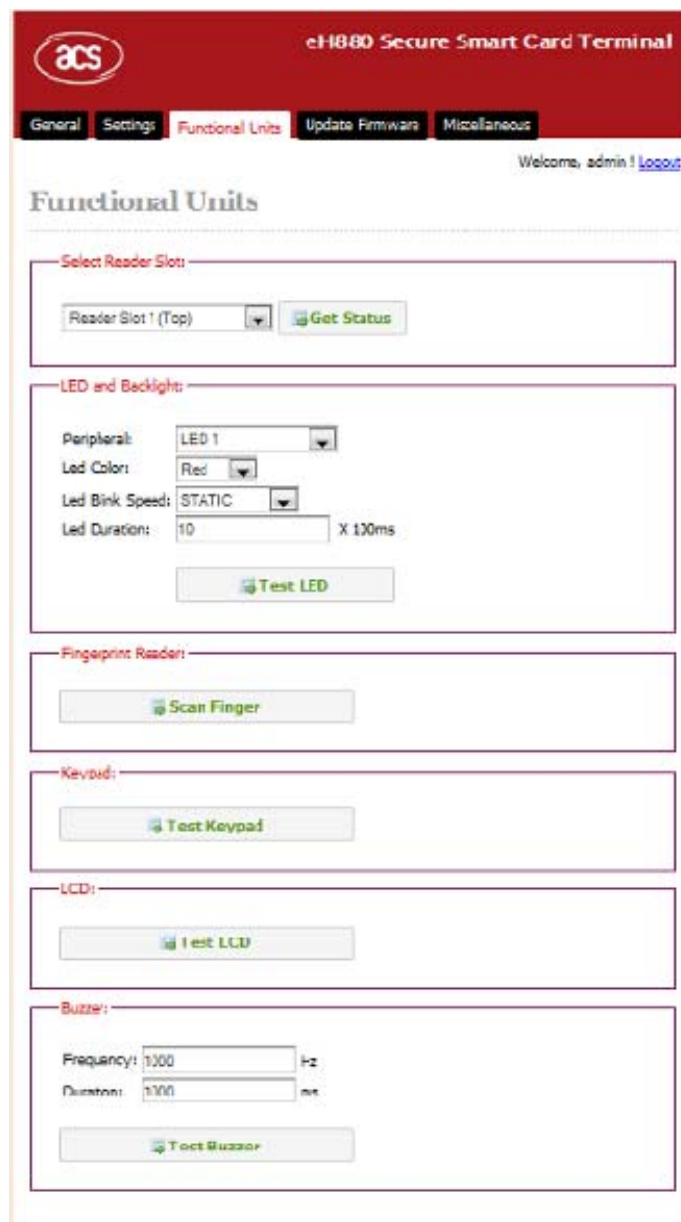This tab allows the users to check the functionality of all the peripherals of the terminal.

Figure 12: Functional Units Tab

7.5.1. Select Reader Slot

This function is used to check if card is properly inserted or placed on each reader slot.

- If ICC card is detected the ATR as well as the status of the reader will be displayed.
- If PICC card is detected the serial number of the card and the reader status will be displayed.

7.5.2. LED and Backlight

This function is used to test the LED, the Backlight of the LCD, and the keypad.

- **Peripheral:** The peripheral option to be tested.
- **LED Color:** The color of the led you want to appear. This is only applicable for LEDs 1 and 2. LEDs 3 and 4 are in default colors red and green consecutively.
- **LED Blink Speed:** The speed of the blink which can be STATIC, FAST, MODERATE or SLOW.
- **LED Duration:** The duration of the flash of the LED.

7.5.3. Keypad

This function is used to test the keypad of the device. If activated, the device will wait for the user's input. The input will then be showed in the LCD of the device.

Note: If the tool does not receive a response from the user for a long time, the device will 'time out'.

7.5.4. LCD

This function is used to test the LCD of the device. If activated, the tool will try to fill the LCD with dots. The LCD will then ask the user to press the appropriate button for acknowledgment.

Note: If the tool does not receive a response from the user for a long time, the device will 'time out'.

7.5.5. Buzzer

This function is used to test the Buzzer/Speaker of the device.

- **Frequency:** The sound frequency you want to hear.
- **Duration:** The duration of the sound.

7.6. Update Firmware Tab

This tab allows the users to update the firmware stored in the terminal.

Figure 13: Update Firmware Tab

7.6.1. Update Firmware

This function allows the users to specify the firmware file for the update.

7.7. Miscellaneous Tab

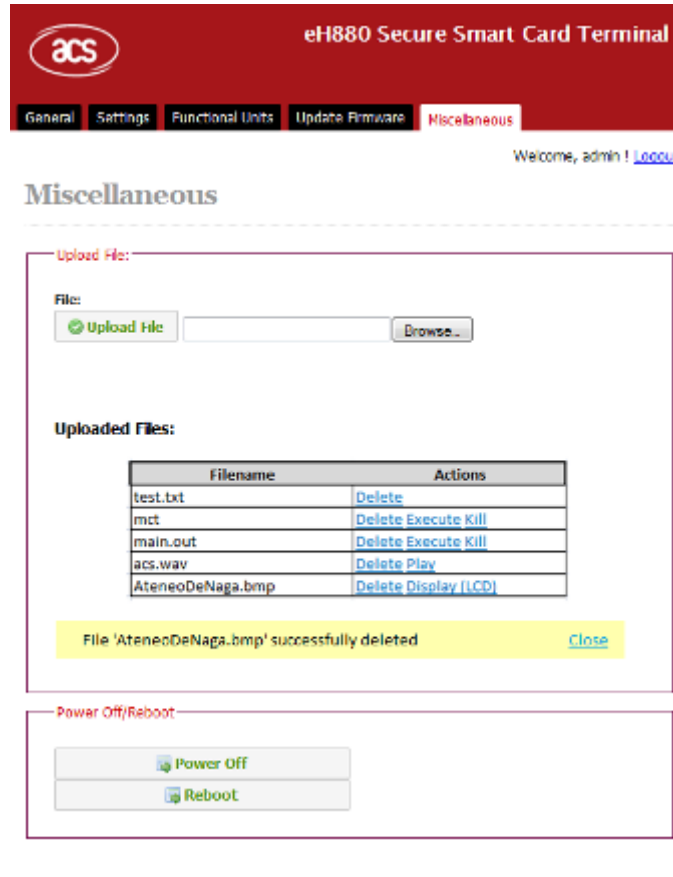This tab allows the users to perform miscellaneous commands.

Figure 14: Miscellaneous Tab

7.7.1. Upload File

This function allows users to upload file(s) and perform some action on it.

Shown in the table below is the list of file format that users can upload and actions that users can perform:

File Format	Actions
BMP – Bitmap files	Delete, Display(LCD)
OUT – Binary files	Delete, Execute, Kill
WAV – Wave files	Delete, Play
File without extension – also consider as Binary files	Delete, Execute, Kill
Others	Delete

Table 1: File Format and Actions

The following commands are used in this function:

- **Delete:** Deletes the file.

- **Display (LCD):** Displays the bitmap image into the LCD.

  Note: Recommended file image dimension & format are 128 x 64, mono color (Black/White).

- **Execute:** Allows you to execute the binary file.

- **Kill:** Stops/Kills the process.

- **Play:** Plays back the wav file.

  Note: Recommended wave file format is: Audio Sample Size: 16 bit; Channels: Stereo;

  Audio Format: PCM; and Audio Sample Rate: 44.1kHz.

7.7.2.   Power Off/Reboot

This function allows users to turn off or reboot the device. The device can be turned ON by pressing the check (✓) button on the terminal.

8.0. ACR880 Manuals and Reference Materials

The ACR880 SDK also contains manuals and reference materials that will help you learn more about the device

- ACR880 Technical Specifications

  - This document contains the technical information of the ACR880 terminal, which includes the device's features, supported smart card types, applications and technical specifications.

- ACR880 Application Programming Interface Manual

  - This manual describes the API (Application Programming Interface) commands developed specifically for the ACR880 GRPS terminal. Application software developers can make use of these APIs to develop their smart-cars related applications.

- ACR880 Manual Firmware Update Instructions

  - This manual provides instructions on how to manually update the ACR880 firmware.

- Application Note

  - This document includes other software programming topics that are not included in the API manual.

- SDE Setup Manual for ACR880

  - This manual provides instructions on how to setup a software development environment to develop application programs for the ACR880 system.