



**Advanced Card Systems Ltd.**  
Card & Reader Technologies

# ACR89U-A1 Handheld Smart Card Reader



Technical Specifications V1.26



## Table of Contents

<b>1.0.</b>	<b>Introduction .....</b>	<b>3</b>
<b>2.0.</b>	<b>Features .....</b>	<b>4</b>
<b>3.0.</b>	<b>Supported Card Types .....</b>	<b>5</b>
3.1.	MCU Cards .....	5
3.2.	Memory-based Smart Cards (Synchronous Interface) .....	5
<b>4.0.</b>	<b>Typical Applications.....</b>	<b>6</b>
<b>5.0.</b>	<b>Technical Specifications.....</b>	<b>7</b>



## 1.0. Introduction



As smart card technology becomes more widely accepted in the market, developers find an opportunity to offer better usage experience and security by adding more features to smart card reading devices. In this light, the new ACR89U-A1 is a contact smart card reader that features a keypad and an optional thermal printer to bring optimal security and convenience in many types of smart card application.

ACR89U-A1 is an electronic device designed primarily to operate in both office and field-based environments using PC-linked and standalone modes, respectively. It comes with a built-in keypad, LCD, rechargeable battery, and large programmable memory features. ACR89U-A1 is a reliable

reader that can support the rigorous performance requirements of highly demanding smart card applications, even though it operates under low energy consumption.

ACR89U-A1 also supports Secure PIN Entry (SPE) which lets users securely input data such as PIN through the device's PIN-pad. This security measure prevents PINs from getting exposed to a vulnerable computer or workstation, and successfully eliminates the possibility of a virus (Trojan) or USB sniffer getting hold of them.

Furthermore, ACR89U-A1 has User Firmware Upgradeability that can be done through its USB Interface. This capability makes ACR89U-A1 very accessible and ideal for many applications.



## 2.0. Features

- 32-bit RISC Processor running on Embedded FreeRTOS
- Handheld size and weight
- Contact Interface:
  - Two Full-sized Contact Card Slots
- SAM Interface:
  - Three SAM Card Slots
- Dual Operation Modes:
  - PC-linked Mode:
    - USB Full Speed Interface
    - Through detachable USB cable
    - CCID-compliant
    - Supports PC/SC
  - Standalone Mode:
    - Rechargeable Li-ion Battery (charging through USB)
    - Supports third party application programming via FreeRTOS
    - User-programmable in C language
- Built-in Peripherals:
  - Easy-to-Read, High Resolution Backlit LCD
  - Highly Durable Chemical Resistant Keypad
  - Four LED Status Indicators
  - Monotone Buzzer
  - Real-time Clock (RTC) with independent backup battery
  - Optional Detachable Thermal Printer (PTR89)
- USB Firmware Upgradability
- Tamper Detection Switch to protect against unauthorized intrusion
- Supports Secure PIN Entry (SPE)
- Supports PPS (Protocol and Parameters Selection) with 115,200 bps – 206,451 bps in reading and writing smart cards
- Supports Android™ 3.1 and later<sup>1</sup>
- Compliant with the following standards:
  - ISO 7816
  - USB Full Speed
  - PC/SC
  - PC/SC 2.0 Part 10 - Secure PIN Entry
  - CCID
  - CE
  - FCC
  - RoHS 2
  - Microsoft® WHQL

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<sup>1</sup> Uses an ACS-defined Android Library



## 3.0. Supported Card Types

### 3.1. MCU Cards

The ACR89U-A1 operates with MCU cards that follow:

- T=0 or T=1 Protocol
- ISO 7816-compliant Class A, B, C (5 V, 3 V, 1.8 V)

### 3.2. Memory-based Smart Cards (Synchronous Interface)

The ACR89U-A1 supports the following memory cards:

- Cards following the I2C bus protocol (free memory cards) such as:
  - Atmel®: AT24C01/02/04/08/16
- SLE4432/5542 intelligent 256 bytes EEPROM with write-protect function:
  - SLE4432, SLE5542
- SLE4418/5528 intelligent 1 KB EEPROM with write-protect function:
  - SLE4418, SLE5528

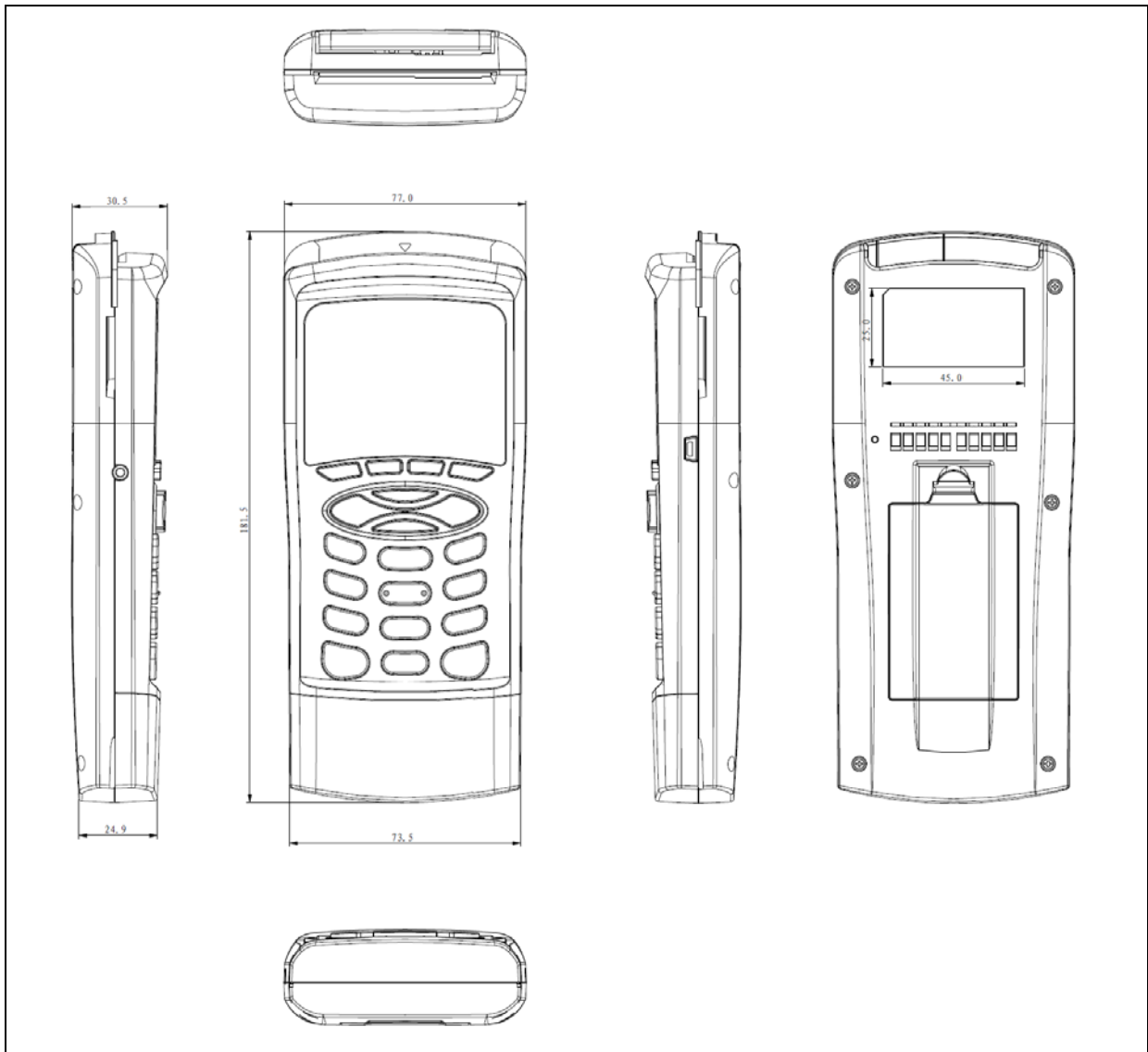
**Note:** Memory card supports ICC0 slot (front slot) only.



## 4.0. Typical Applications

- e-Healthcare
- e-Government
- e-Banking and e-Payment
- Transportation
- Loyalty Program
- Time and Attendance Checking

## 5.0. Technical Specifications



### Physical Characteristics

Dimensions ..... 181.5 mm (L) × 77.0 mm (W) × 30.5 mm (H)  
 Weight ..... 235 g  
 Color ..... Black

### Processor

32-bit RISC Processor

### Standalone Mode

Operating System ..... Embedded FreeRTOS  
 Power Source ..... Lithium-ion battery, 3.7 V, 900 mAh  
 ..... Charging via ACR89 connecting USB cable  
 Operation Time ..... 10 hours (varies upon usage and application)

### Device and User-programmable Memory

Programmable Language ..... C  
 Compiler Provided ..... Yes  
 RAM ..... 20 KB  
 Third-party Applications ..... NOR Flash: 512 KB (default)/1 MB (upon request)  
 Data Storage ..... Serial Flash: 384 KB (multi-lingual storage)  
 ..... EEPROM: 64 KB  
 Tamper-protected Memory ..... 238 bytes (for sensitive data storage with API provided)



**USB Host Interface**

Protocol..... USB CCID  
 Connector Type..... Standard Type A  
 Power Source..... From USB Port (PC-linked Mode)  
 Speed..... USB Full Speed (12 Mbps)  
 Supply Voltage..... 5 V  
 Cable Length..... 1.0 m, Detachable

**Contact Smart Card Interface**

Number of Slots ..... 2 Full-sized Card Slots  
 Standard ..... ISO 7816 Parts 1-3 Class A, B, C (5 V, 3 V, 1.8 V)  
 Protocol..... T=0 and T=1; Memory Card Support (ICC Slot 0 only)  
 Supply Current ..... Max. 60 mA  
 Smart Card Read/Write Speed..... 12.9 Kbps – 206.4 Kbps  
 Short Circuit Protection ..... +5 V/GND on all pins  
 Clock Frequency ..... 4.80 MHz  
 Card Connector Type..... ICC Slot 0: Landing  
 ..... ICC Slot 1: Contact  
 Card Insertion Cycles..... ICC Slot 0: Min. 300,000  
 ..... ICC Slot 1: Min. 100,000

**SAM Card Interface**

Number of Slots ..... 3 Standard SIM-sized  
 Standard ..... ISO 7816 Parts 1-3, Class A, B, C (5 V, 3 V, 1.8 V)  
 Protocol..... T=0, T=1  
 Supply Current ..... Max. 60 mA  
 Smart Card Read/Write Speed..... 12.9 Kbps – 206.4 Kbps  
 Card Connector Type..... SAM Slot 0: Contact  
 ..... SAM Slot 1: Contact  
 ..... SAM Slot 2: Contact

**Built-in Peripherals**

LCD..... Graphic LCD with Backlight  
 ..... Resolution: 128 pixels x 64 pixels  
 ..... Number of characters: 21 characters x 8 lines  
 ..... Window size: 49 mm x 29 mm; Active area size: 46 mm x 28 mm  
 LED ..... 4 tri-color: Red, Green and Yellow  
 Buzzer..... Monotone  
 Keypad..... 20 keys

**Other Features**

Security..... Tamper Switch (internal anti-intrusion detections and protection)  
 Firmware Upgrade ..... Supported (thru USB)  
 Real-time Clock..... Supported

**Printer (Optional)**

Printer Type ..... Thermal, External (PTR-89)  
 Number of Dots/Lines ..... 384  
 Resolution ..... 203 DPI  
 Print Width ..... 48 mm  
 Speed..... Max. 50 mm/s  
 Parts Interface..... 6-pin serial port  
 Communication Interface ..... UART  
 Input Buffer Size..... 512 bytes

**Application Programming Interface**

PC-linked Mode..... PC/SC  
 Standalone Mode..... FreeRTOS

**Operating Conditions**

Temperature..... 0 °C – 50 °C  
 Humidity ..... Max. 90%, non-condensing  
 MTBF ..... 135,000 hrs

**Certifications/Compliance**

ISO 7816, USB Full Speed, PC/SC, PC/SC 2.0 Part 10 - Secure PIN Entry, CCID, CE, FCC, RoHS 2, Microsoft® WHQL





**Device Driver Operating System Support**

Windows® 2000, Windows® XP, Windows Vista®, Windows® 7, Windows® 8, Windows® 8.1, Windows® 10, Windows® Server 2003, Windows® Server 2008, Windows® Server 2008 R2, Windows® Server 2012, Windows® Server 2012 R2  
Linux®, Mac OS®, Solaris, Android™ 3.1 and later



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