Advanced Card Systems Ltd.
Card & Reader Technologies

ACR89U-A2
Handheld
Smart Card Reader

Technical Specifications V1.02

Table of Contents

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. The ACR89U-A2 Handheld Smart Card Reader with NFC tag support is primarily designed for multi-application that can access any contact and contactless smart cards following the ISO 7816 and ISO 14443 standards.

ACR89U-A2 is a versatile dual interface smart card reader with PIN-pad which can be used to access ISO 7816 MCU cards, ISO 14443 Type A and B contactless cards, MIFARE®, FeliCa and ISO 18092 or NFC tags. It can operate in both office and field-based environments by using it on PC-linked and standalone modes, respectively. It comes with a built-in keypad, LCD, rechargeable battery and large programmable memory features. It is a reliable reader that can support the rigorous performance requirements of highly demanding smart card applications, though operates under low energy consumption.

ACR89U-A2 also supports Secure PIN Entry (SPE) which allows users to securely input data such as PIN, through the device's PIN-pad. This security measure prevents PINs from getting exposed to a vulnerable PC or workstation, and successfully eliminates the possibility of Virus/Trojan or USB Sniffer getting hold of them.

Furthermore, ACR89U-A2 has User Firmware Upgradeability that can be done through its USB Interface. This capability makes ACR89U-A2 very accessible and ideal for many applications.

2.0. Features

- 32-bit RISC Processor running on Embedded FreeRTOS

- USB Firmware Upgradability

- Handheld size and weight

- Two Full-sized Contact Card Slots

- Three SIM-sized SAM Card Slots

- Dual Operation Modes:
  - PC-linked
  - Standalone

- PC-linked Operation:
  - USB 2.0 Full Speed Interface
  - Through detachable USB Cable
  - CCID Compliance
  - Supports PC/SC

- Standalone Operation:
  - 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)

- 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^{TM} 3.1 and above

- Compliant with the following standards:

ISO 7816	CE
ISO 14443	FCC
PC/SC	RoHs
CCID	EMVCo Level 1
USB Full Speed	Microsoft® WHQL

3.0. Supported Card Types

3.1. MCU Cards

The ACR89U-A2 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-A2 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.

3.3. Contactless Cards

The ACR89U-A2 supports the following contactless cards:

- ISO 14443 Compliant, Type A and B Standard, Parts 1 to 4
- T=CL protocol
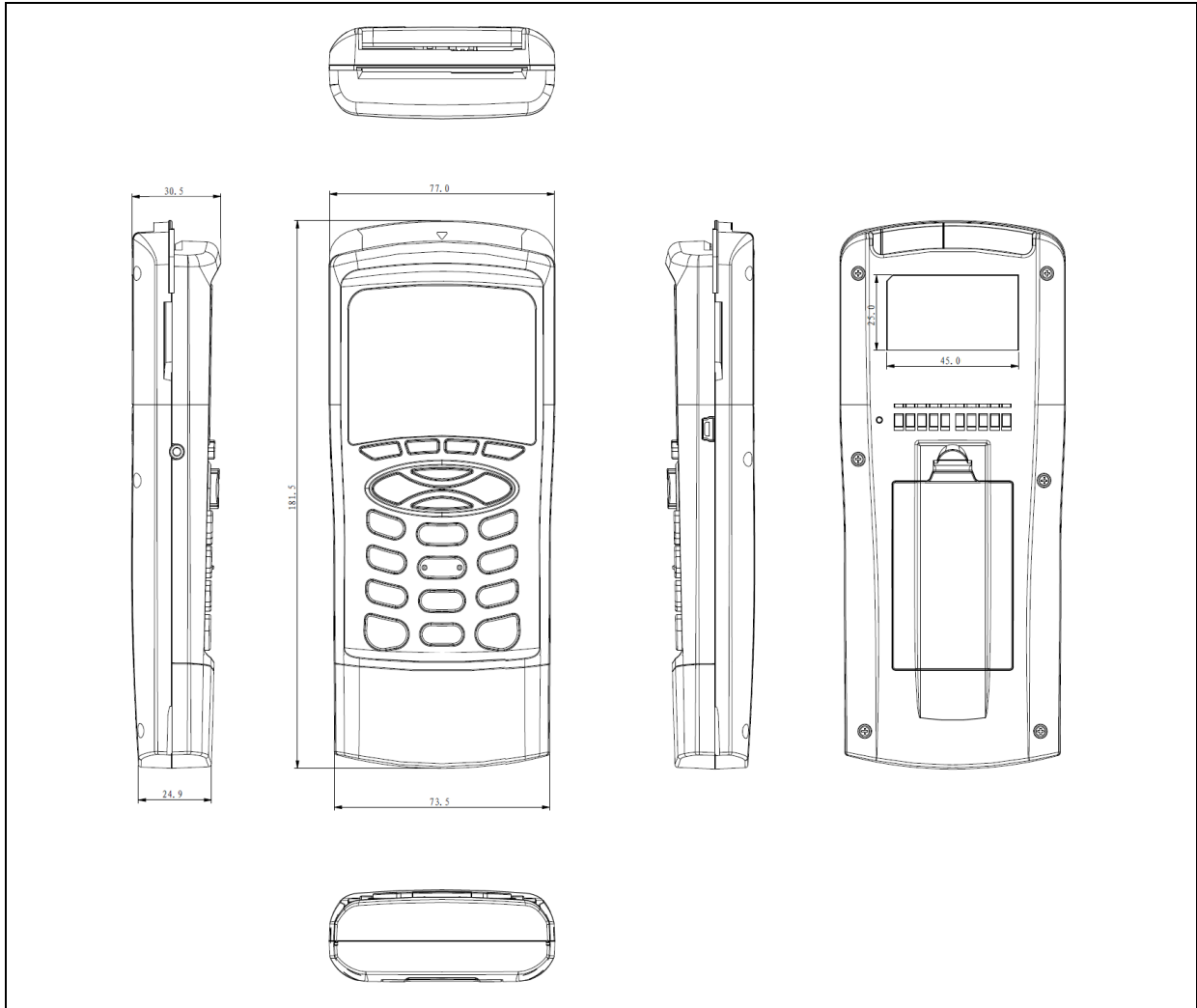- MIFARE Classic Cards
- FeliCa Cards

4.0. Typical Applications

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

5.0. Technical Specifications

Processor	
32-bit RISC Processor	

Operating System	
Embedded FreeRTOS	

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)

Power	
Operating Voltage	3.7 V
Operation Mode	PC-linked and Standalone
PC-linked Mode	USB Powered (via detachable USB cable)
Standalone Mode	Battery-powered Rechargeable Li-ion Battery (charging through USB)
Operation Time	8-10 hrs (varies upon usage and application)
Power Consumption	Less than 60 mA (excluding card and backlight power)
Battery	Lithium Ion, 3.7 V, 900 mAh
Backup Battery	Independent rechargeable backup battery for RTC

Connectivity	
USB	USB Full Speed 2.0 (Type A; via detachable USB cable)

Contact Smart Card Interface

Standard .... ISO 7816 Class A, B, C (5 V, 3 V, 1.8 V), T=0 and T=1
Supply Current .... Max. 60 mA
Smart Card Read/Write Speed....... 12,903 BPS -206,451 BPS (primary/secondary slot)
Clock Frequency .... 4.8 MHz
Card Connector Type..................... ICC Slot 0: Landing; ICC Slot 1: Contact
Card Insertion Cycles..................... Min. 300,000/100,000 (primary/secondary slot)
Short Circuit Protection .... +5 V/GND on all pins

Contactless Smart Card Interface

Standard .... ISO 14443 A and B Parts 1-4, ISO/IEC 18092 (NFC), FeliCa
Protocol.. MIFARE Classic Card Protocol, T=CL
Smart Card Read/Write Speed....... 106 Kbps, 212 Kbps, 424 Kbps
Operating Distance .... 30 mm
Operating Frequency .... 13.56 MHz

SAM Card Interface

Number of SAM Card Slots............ 3
Card Connector Type..................... Contact
Smart Card Read/Write Speed....... 12,903 BPS – 206,451 BPS

Built-in Peripherals

Keypad... 20 keys
LCD Display .... 128 pixels x 64 pixels Black and White Graphic LCD with Backlight
Number of characters: 8 line x 21 characters
Window Size: 49 mm x 29 mm; Active Area Size: 46 mm x 28 mm
Buzzer.. Monotone
LED Status Indicators .... 4 user-controllable LEDs
LED Color .... Red, Green and Yellow
Detachable Printer Cradle.............. PTR89 (optional)

Physical Specifications

Dimensions .... Device: 181.5 mm (L) x 77.0 mm (W) x 30.5 mm (H)
Case Color .... Black
Weight.. Device: 235 g

Operating Conditions

Temperature .... 0 °C – 50 °C
Humidity .... 10% – 90%, non-condensing

Application Programming Interface

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

Other Features

Real-time Clock
Tamper Switch (internal anti-intrusion detections and protection)
USB Firmware Upgradability

Certifications/Compliance

CE, FCC, RoHS, ISO 7816, ISO 14443, PC/SC, CCID, EMVCo Level 1
Microsoft® WHQL for Windows® 2000, Windows® XP, Windows Vista®, Windows® 7, Windows® 8,
Windows® 8.1, Windows® Server 2003, Windows® Server 2008, Windows® Server 2008 R2,
Windows® Server 2012, Windows® Server 2012 R2

Device Driver Operating System Support

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