80144501-001

AC100
User Manual

Rev. A
06/03/2016

FCC Regulatory Compliance

Notices Class B Equipment

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. This device complies with part 15 of the FCC rules. Operation is subject to two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to the ID TECH AC100 not expressly approved by ID TECH could void the user's authority to operate the AC100.

IC Compliance Warning

Operation is subject to two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Cautions and Warnings

⚠️	**Caution:** The ID TECH AC100 should be mounted 1-2 feet away from other AC100 units. Can be adjusted based on lane setup.
⚠️	**Caution:** Danger of Explosion if battery is incorrectly replaced. Replace only with same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.
⚡	**Warning:** Avoid close proximity to radio transmitters which may reduce the ability of the device to transmit/receive data.

Table of Content

1. Introduction

This document outlines the mechanical, electrical, and connectivity features of the ID TECH AC100 controller, a Linux-based application deployment platform and connectivity solution for users of ID TECH payment peripherals. The AC100 is designed to allow deployment of a wide range of secure payment apps while easing EMV L3 certification requirements.

2. Product Configurations

IDCL-51	AC100; Desktop

3. Features

- Linux Operating System (3.14.38)
- Full development tool chain to allow customers to edit, compile, and debug signed, secure payment apps
- 256MB of Flash memory
- 256MB RAM
- Micro SD Card storage
- Multicolor status LED
- Support for Wi-Fi and Ethernet
- Supports Real Time Clock
- USB type A (three ports) and Micro USB (one port)
- RS232 interface
- Reset button

4. MECHANICAL DESIGN SPECIFICATION

4.1 Physical Size & Look

- Exterior:
  - Unit comes in a plastic enclosure, white on the top and Pantone 2766U blue on the bottom.
  - Rubberized feet prevent movement when unit is placed on a counter
  - Removable plastic cover (held by captive screw) for SD-card access.
  - Mounting: two Nut3.0 attach points on the bottom for customer use.

- Size and Weight
  - Size: 140mm(L) x 86.0mm(W) x 30.0mm(H)
  - Weight: 150g

- Top view:

Logo (IDTECH)
Surface: High Polish

LED-pipe
Color: Transparent
Surface: Polish

Top Housing
Color: White
Surface: MT11006

R

USB port (1 of 3)

MicroUSB port

SD storage access

Power connection

4.2 Body Description   Reset button

- Housing
    - Material: Polycarbonate/ABS resin.
    - Wall thickness: 2.5mm.
- Label
    - Material: Lbl;Z-Ultimate;3000 White; 38mmx21mm;5570-R.
    - Contents:
        - Model Number: IDCL-51
        - Serial Number: To comply WI 7.5.1-8.
        - Assembled in XXX (country of origin)
        - Revision
        - Bar Code: Code 128
        - MAC (12 hex digit)
        - FCC ID
        - CE mark

- Circuit board
    - Material: FR-4
    - Dimension: 128.00mm(L)*61.00mm(W)*1.60mm(T)

4.3 Connectors
- RS232
    - Connector type: ENG_CD_1734354_A1
    - Dimensions: 30.8mm(L)*12.5mm(W)*18.4mm(T)

- USB-A (3 ports)
  - Connector type: USA2-04F1-XNRX-11
  - Dimensions: 14.30mm(L)*6.90mm(W)*14.00mm(T)

- Micro USB
  - Connector type: 5P F SMT Shell DIP 2.0MM;RoHS (CON188R)
  - Dimensions: 8.0mm(L)*5.55mm(W)*3.0mm(T)

- RJ45 (Ethernet)
  - Connector type: KRJ-14006-108XX-GY-A
  - Dimensions: 15.9mm(L)*13.6mm(W)*21.3mm(T)

- SD Card
  - Connector type: 96-90025-085 T-FLASH CARD1
  - Dimensions: 14.75mm(L)*14.5mm(W)*2.00mm(T)

- LED (3 colors)
  - Model type: 19-217/R6C-AL1M2VY/3T
  - Model type: 19-217/GHC-YN2Q1QY/3T
  - Model type: 19-217/Y5C-AM1N1VY/3T
  - Size: 1.6mm x 0.8mm x 0.4mm
  -
- DC power jack
  - Connector type: 2K16A0120-6 5X2 0
  - Dimension: 11.0mm(L)*9.0mm(W)*14.2mm(T)
  -
- Power Button (Reset Switch)
  - Switch type: TS-02PV-130(2)
  - Dimension: 7.4mm(L)*7.3mm(W)*7.85mm(T)

4.4 Electronics
- Microcontroller – Freescale iMX6UL
- Operating System
  - Linux 3.14.38
- Memory
  - 256MB of memory (RAM)
  - 256MB Flash
- Debug port
  - UART1
- Programming interface
  - The same as debug port
- LED

- Three Single-Color LEDs (green, yellow, red) under firmware control.
- Supports Wi-Fi
- Supports micro SD Card
- Interfaces
  - The controller has one RS232 and 4 USB ports
    - One USB port to be a USB Micro B connector (Device)
    - Three USB A connectors （Host）
    - RS232 DB9 Female
    - Ethernet RJ45
    - Ports are spaced adequately to prevent interference when multiple devices are connected.
    - Bluetooth is supported.
  - USB connector pin out
    - Standard USB_A

PIN1	PIN2	PIN3	PIN4
VBUS	D-	D+	GND

    - Standard USB_Micro

PIN1	PIN2	PIN3	PIN4	PIN5
VBUS	D-	D+	NA	GND

  - RS232 DB9 connector pin out
    - Standard DB9 Female

PIN2	RXD（PC）	TXD（iMX）
PIN3	TXD（PC）	RXD（iMX）
PIN5	GND	GND
PIN7	RTS（PC）	CTS（iMX）
PIN8	CTS（PC）	RTS（iMX）

  - All connectors are board-mount.

- Input Power
  - 5VDC.
  - 5V, 500mA available to each USB connector.
  - Total current consumption < 2A including USB connectors.
  - External power supplied via a friction barrel connector.
  - Power Switch (reset button) on the side.
- RTC
  - Separate from MCU to save battery power

- Battery for RTC
  - Battery Type~CR1632
  - 5 years

4.5 Environmental

- Electro-Static Discharges (ESD)
    - The electronics are designed to survive ESD of 8kV contact, and 8 kV air discharge, without permanent damage

- Environmental Temperature range:
    - Operating   0° C to 40° C
    - Storage   -40º C to 80º C
    - Relative humidity: 10% to 95% non-condensing

4.6 Agency Approvals
- FCC ID
- CE
- ROHS 2 and REACH

5. FIRMWARE DESIGN SPECIFICATION

The device uses a generic Linux system, version 3.14.38. ARM tool chain is supplied to compile and debug customer/user applications.
A preinstalled Core/Base Application is launched by OS at startup.

5.1 Secure boot

Below is the Boot process of the system:
- Power On
- The boot process begins at Power On Reset (POR) where the hardware reset logic forces the ARM core to begin execution starting from the on-chip boot ROM.
- Boot ROM process
- Boot ROM will authenticate the u-boot, and pass control to u-boot.
- U-boot process
- U-boot verifies the OS image, and pass control to OS.
- OS process
- OS starts the Core/Base daemon, and user applications.

5.2 Keys

Several security keys are used in the device, as follows. (The keys are generated by PKI tree. All certificates are X509 format.)
- CA key: This is the topmost key and is only used for signing SRK certificates.
- SRK key: Super Root Key is a component of the PKI tree. SRK is an RSA key pair which forms the start of the boot-time authentication chain. The hash of the SRK public key is embedded in the processor using OTP hardware. SRK private key is held by the CA.

- CSF key: This key is a subordinate key of the SRK key, and is used to verify the CSF data. CSF (Command Sequence File) is a binary data structure interpreted by the HAB to guide authentication operations.
- IMG key: This key is a subordinate key of the SRK key, and is used to verify the u-boot image.
- OSK key: This key is a subordinate key of the SRK key, and used to verify the OS image and the monitor daemon.
- APK key: This key is a subordinate key of the SRK key, and used to verify applications.

5.3 Core/Base Application

Core/Base application is used to update the OS and/or add/update/remove application(s) through Ethernet.

Interface: Ethernet, port 14000.

Command & response format

Command format:

```
02 + length (little endian, 4 bytes. Includes ALL from 02 to 03) +
command (1 byte) + data + CRC (2 bytes) + 03
```

Note: The maximum length of a command should be less than 1200 bytes.

Response format:

```
02 + length (little endian, 4 bytes. Includes ALL from 02 to 03) +
Error-status (1 byte) + [data] + CRC (2 bytes) + 03
```

Error status codes:
0xE0: No error
0xE1: The command is invalid
0xE2: The command is error formatted.
0xE3: The file cannot be deleted.
0xE4: The file's mode cannot be obtained.
0xE5: The file's mode cannot be changed.
0xE6: The file cannot be created.
0xE7: The file cannot be written.
0xE8: The authentication failed.
0xE9: The command's sequence is error.
0xEA : The file is too large.
0xEB : The directory cannot be created.
0xEC : The directory exists already.
0xED : The file exists already.

Commands

Get version of this application
Command: 02 09 00 00 00 01 34 bf 03
   Response: Error status [NULL-terminated version string]

Add/Update application
Command: 02 length 02 sequence (little endian, 4 bytes) path mode data CRC 03
<length>: The length must be less than 1200 bytes.
<sequence>: The range is 0x000000 -0x00100000.
 The first package's sequence must be 0x00000000, the next package's sequence is the current package's sequence plus 1. The last package's sequence must be large than 0x00100000.
<path>: A NULL-terminated string which defines the absolutely path of the file. The length of the path must be less than 200 bytes.
<mode>: Defines the mode of the file.
Bit0: 1 means can be executed, 0 means not.
Bit1: 1 means can be written, 0 means not.
Bit2: 1 means can be read, 0 means not.
Response: Error status
Note:
This command will overwrite the existed file.
To update OS, use the path "OS".

Remove application
Command: 02 length 03 path CRC 03
<length>: The length must be less than 200 bytes.
<path>: A NULL-terminated string which defines the absolutely path of the file. The length of the path must be less than 200 bytes.
Response: Error status

Get application mode
Command: 02 length 05 path CRC 03
<length>: The length must be less than 200 bytes.
<path>: A NULL-terminated string which defines the absolutely path of the file. The length of the path must be less than 200 bytes.
Response: Error-status {mode}.

Set application mode
Command: 02 length 06 path mode CRC 03
   <length>: The length must be less than 200 bytes.
<path>: A NULL-terminated string which defines the absolutely path of the file. The length of the path must be less than 200 bytes.
<mode>: Defines the mode of the file.
   Bit0: 1 means can be executed, 0 means not.
Bit1: 1 means can be written, 0 means not.
   Bit2: 1 means can be read, 0 means not.
Response: Error status

Add directory
Command: 02 length 07 path mode CRC 03
   <length>: The length must be less than 200 bytes.
 <path>: A NULL-terminated string which defines the absolutely path of the directory.
The length of the path must be less than 200 bytes.
 <mode>: Defines the mode of the directory.
 Bit0: 1 means can be executed, 0 means not.
Bit1: 1 means can be written, 0 means not.
Bit2: 1 means can be read, 0 means not.
Response: Error status

Reboot
Command: 02 09 00 00 00 0A e7 01 03
  Response: Error status

Get system version
Command: 02 09 00 00 00 31 B7 8E 03
  Response: Error status [NULL-terminated version string]

Get serial number
Command: 02 09 00 00 00 32 2C BC 03
  Response: Error status [NULL-terminated serial number string]

5.4 Test Application

This application is used for manufacturing, and if present, maybe deleted by user. It is used for basic diagnostic testing.

This embedded application uses the RS232 port to communicate with the host. The parameters are: 115200, 8, N, 1.

This embedded application listens for commands from the host (or external device) and sends back the corresponding responses. The commands and responses are all in ID TECH NGA format, which is

```
STX (02) + LengthLSB + LengthMSB + Command + LRC (XOR of command bytes)
+ Sum (8-bit sum of command bytes) + ETX (03)
```

5.5 Command set (RS232 Test App)

Ping
It's used to verify the accessibility of the device.
Command: 18
Response: 06

Get Version
Get the test application's version.
Command: 01
Response: NULL-terminated string.

Set Serial Number
Set device's serial number.
Command: 02 <Serial Number>
<Serial Number>: NULL-terminated S/N
Response: 06 if succeeded, or E1 if failed.

Get Serial Number
Get device's serial number.
Command: 03
Response: Device's serial number if succeeded, or E1 if failed.

LED test
Control the ON or OFF of three LEDs.
Command: 92 <LED mask> <On/Off>
<LED mask>: Specify which LED to control.
Bit 0: RED. Value 1 means controlled by <On/Off>, 0 no influence.
Bit 1: GREEN. Value 1 means controlled by <On/Off>, 0 no influence.
Bit 2: YELLOW. Value 1 means controlled by <On/Off>, 0 no influence.

<On/Off>: This is effective only corresponding bit in <LED> is set.
Bit 0: 1 RED On, 0 RED Off.
Bit 1: 1 GREEN On, 0 GREEN Off.
Bit 2: 1 YELLOW On, 0 YELLOW Off.
Response: 06

SD port test
Get a specified file's content from the SD card's root directory.
Command: 93
Response: The file's content if succeeded, or E1 if failed.
Note: This command will take about 2 seconds.

Network port test
Test if the gateway is accessibility through Ethernet.
Command: 94 <Gateway's address>
                          <Gateway's address>: 4 bytes IP4 address.
Response: 06 if succeeded, or E1 if failed.
Note: This command will take about 3 seconds.

USB host ports test
Get a specified file's content from the USB card's root directory.

Command: 95
Response: The file's content if succeeded, or E1 if failed.
Note: This command will take about 2 seconds.

Wi-Fi test
Test if the gateway is accessibility through Wi-Fi.
Command: 96 <Gateway's address> <AP name> <AP password>
  <Gateway's address>: 4 bytes IP4 address.
<AP name>: NULL-terminated AP's name.
<AP password>: NULL-terminated AP's password.
Response: 06 if succeeded, or E1 if failed.
Note: This command will take about 20 seconds.

Blue-Tooth test
Test if the blue-tooth is accessible.
Command: 97
Response: The Bluetooth devices' names nearby if succeeded, or E1 if failed.
Note: This command will take about 40 seconds.

Set RTC
Set the RTC.
Command: 98 +<DateTime>
<DateTime> : <year> <month>-<date> <hour>:<minute>:<second>
<year> : 4 bytes
<month> : 2 bytes
<date> : 2 bytes
<hour> : 2 bytes
<minute> : 2 bytes
<second> : 2 bytes
For example, if the date is "2016-7-27 11:06:04", the command body should be
"98 32 30 31 36 2D 30 37 2D 32 37 20 31   31 3A 30 36 3A 30 34"
Response: 06 if succeeded, or E1 if failed

Get RTC
Get the RTC.
Command: 99
Response: <DateTime> if succeeded, or E1 if failed

Reset Key test
Test the reset key. After receiving this command, the system will monitor the
key in 10 seconds, and then response the result.
Command: 9A
Response: 06 if the key is pressed, or E1 otherwise

Set MAC
 This command will set the ethernet's MAC address.

Command: 9B <MAC Address>
<MAC Address>: the length is 17 bytes. The format is xx:xx:xx:xx:xx:xx. eg.
31 31 3A 32 32 3A 33 33 3A 34 34 3A 35 35 3A 36 36 means 11:22:33:44:55:66.
Response: 06 if the MAC address is valid, or E1 otherwise

Get MAC
 This command will get the ethernet's MAC address.
 Command: 9C
 Response: 06 <MAC Address> if the MAC address is exist, or E1 otherwise.

Revision History

Revision	Description and Reason for Change	Date
50	First draft.	01/05/16
A	Edits for style and content. Formatting. Deletion of inapplicable content.	6/3/2016 (KT)

Caution

CE1177

1. Adapter shall be installed near the equipment and shall be easily accessible.
2. Avoid exposing your mobile phone to extreme hot or cold temperatures. The temperature range for using the phone is 0°C~40°C.

3. This equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.