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User Manual SmartPIN L100

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1 Introduction

ID TECH's SmartPIN L100 provides a compact, rugged, secure keypad interface for POS systems requiring PIN and/or manual-entry capability. The device's 16-key layout and built-in LCD make it ideal for kiosks and other unattended applications. When paired with ID TECH's Spectrum Pro insert reader, the SmartPIN L100 provides a complete, EMV-ready chip-and-PIN, chip-and-signature, debit/PIN, and MSR solution that meets ADA, ANSI, and ISO standards for PIN Entry Devices.

For development of applications that communicate with the SmartPIN L100, please ask your ID TECH representative about the ID TECH Universal SDK for L100 (Windows), which contains libraries (DLLs), C# source code, a demo app, and documentation for a C# API on Windows. By using the Universal SDK (which also works with other ID TECH products, such as the Spectrum Pro insert reader), you can save time developing host applications that talk to the L100 via USB or RS-232 and take advantage of many convenience methods (including encryption libraries) exposed via the high-level-language API.

Low-level access to L100 via firmware commands can be achieved via USB-HID or RS-232 (serial connection). This manual documents the low-level commands used to control the L100 and provides essential information required for establishing a serial connection to the device.

2 Features

- PCI 4 certified
- x 4 key layout (0-9, *, #, Cancel, Clear, Enter, Blank), plus 64x128-pixel liquid crystal display
- function keys adjacent to the LCD
- One tri-color LED on the back of the L100 to display unit status
- Meets ADA, ANSI, and ISO standards for a PIN Entry Device
- Audio feedback
- Size and mounting compatible with (mechanical drop-in replacement for) Hypercom Artema Compact and the Verifone UX100
- Built-in gasket for watertight mounting
- IP65 rated for dust and water resistance
- IK09 rated for intrusion resistance
- Removal Detection and tamper-resistant
- Secure schemes for authorized activation, installation, and injection of keys
- Low power consumption when PIN pad is in sleep mode
- Support for TDES encryption
- Master/Session & DUKPT key management
- Spectrum Pro (standard version) and L100 (standard version) can work either as two standalone products or be paired together (no special CA certification download required)
- Supports multiple key slots, using the same key storage hardware and firmware design in Spectrum Pro, which can store fifteen (15) DUKPT keys and twelve (12) 2048-bit RSA public keys as X.509 certificates
- Encrypted text and clear text entry
- RoHS and REACH compliant
- One-year manufacturer warranty
- Minimum 2,000,000 keystroke operations
- Meets Interac standard for Canadian Market
- When connected to ID TECH Spectrum Pro, supports full functions required by Spectrum Pro, such as Mutual Authentication with Host through Spectrum Pro, Remote Key Injection through Spectrum Pro, Firmware Download through Spectrum Pro, Key Pairing (for both PIN Debit and Chip & PIN), etc.
- Firmware is easily upgraded in the field via the serial communication interfaces

3 Applicable Documents
- ISO/IEC 7813 – Identification cards, Physical Characteristics
- ISO/IEC 7811 – Identification cards, Recording Techniques, Magnetic Stripe

4 Abbreviations

ANSI	American National Standard Institute
APACS	Association for Payment Clearing Service
API	Application Programming Interface
CPU	Central Processing Unit
DC	Direct Current
DES	Data Encryption Standard
DUKPT	Derived Unique Key Per Transaction, Key management
EMI	Electromagnetic Interference
EMV	Europay, MasterCard, Visa
ESD	Electrostatic Discharge
GND	Signal Ground
Host	A PC or like device with local Application Software for controlling connected SmartPAY terminals
IEC	International Electrical Congress
ISO	International Organization for Standardization
JPOS	Java for Retail Point-of-Sale
KSN	Key Serial Number
LCD	Liquid Crystal Display
mA	MilliAmperes
MAC	Message Authentication Code
MK/SK	Master Key/Secession Key, Key management
MTBF	Mean Time Between Failures
mV	MilliVolts
OPOS	OLE for Retail Point-of-Sale
PC	Personal Computer or similar hardware device
PCB	Printed circuit board
PCI	Payment Card Industry
PED	PIN Entry Device
PIN	Personal Identification Number
TDES	Triple Data Encryption Standard

5 Specifications

5.1 Components

5.1.1 Faceplate Color: Silver gray Finish: Brushed finish

ID TECH logo

LCD window

19 holes for keys
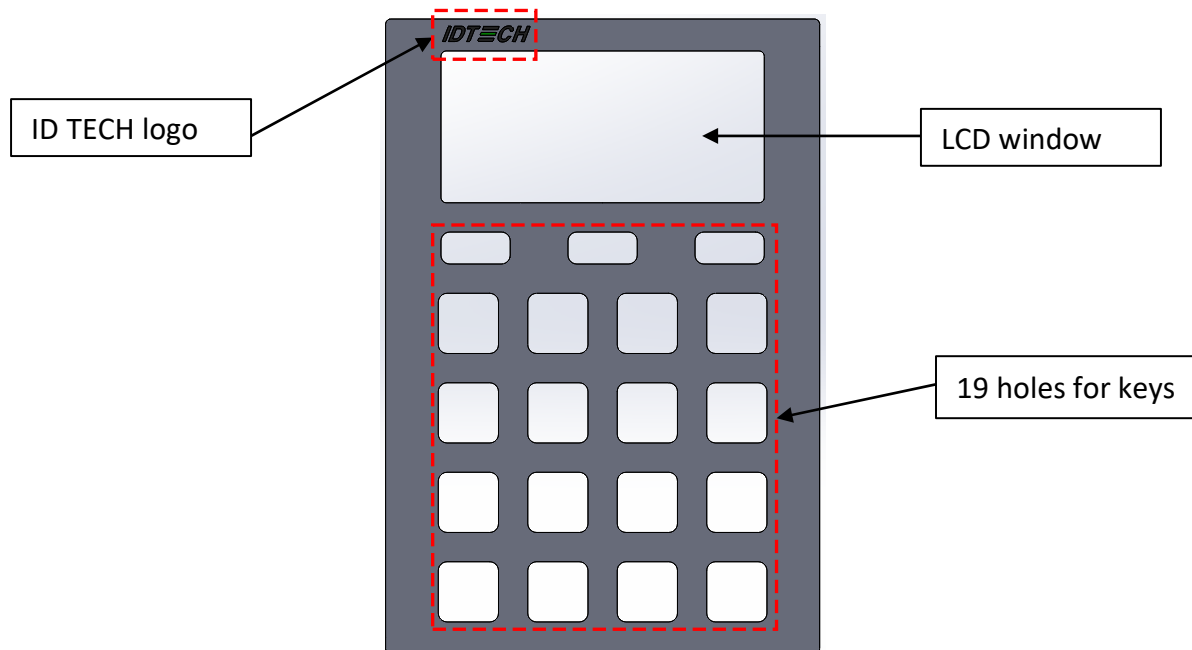
5.1.2 LCD

The L100 has a liquid crystal display with four lines of 20 characters each. With 128 dots to a character, this means there are 4*20*128 (or 10,240) dots in the LCD.

5.1.3 LED

There is one tri-color (red, yellow, green) LED on the back of the L100 to display unit status. Looking at the back of the L100, with the top (LCD end) up, the LED is just to the left of the DB-9 connector opening.

Any given color of LED light can have multiple meanings depending on the context; for details, see the table under LCD & Beeper State from Deactivation State to Activation State below.

5.1.4 Keys

Color: Silver gray Finish: Brushed finish
Layout: Alphabetical characters printed on the keys
Operation keys have engraved, colored bar and symbols: Cancel (red), Clear (yellow), Enter (green).
3 Function Keys are etched or engraved with "F1" "F2" and "F3" respectively Tactile identifier on the numeral key 5.
Meets ADA standard (which requires embossed symbols to be between 0.6 and 0.9 mm in height).
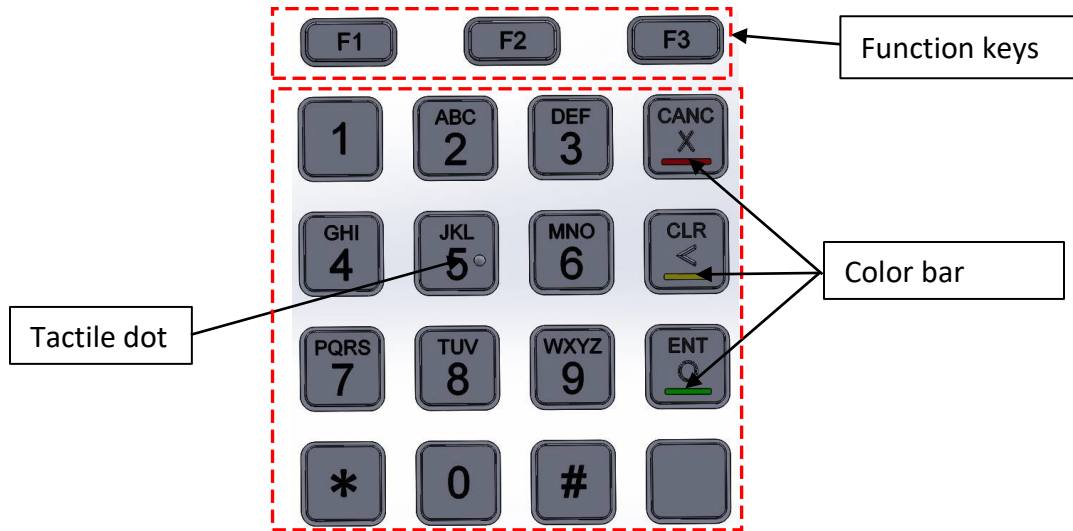
5.2 Size & weight

Size: 107.5 mm *140 mm *29 mm
Weight: 526 g

5.3 Mounting

Use the provided cutouts to mount the device using standard #10 screws or equivalent (shaft diameter 5 mm or 0.19 inch).

Note: The head of the screw should be greater than 11 mm, less than 13 mm. For best results, use a washer (with outside diameter greater than 0.43 in. or 11 mm, less than 0.5 in. or 13 mm) under the screw head.

5.3.1 L100 Dimensions

5.4 Tamper Detection

Use screw with shaft diam. 'd' such that 6 mm >= d >= 5 mm and head diam. 'D' such that 13 mm >= D >= 11 mm
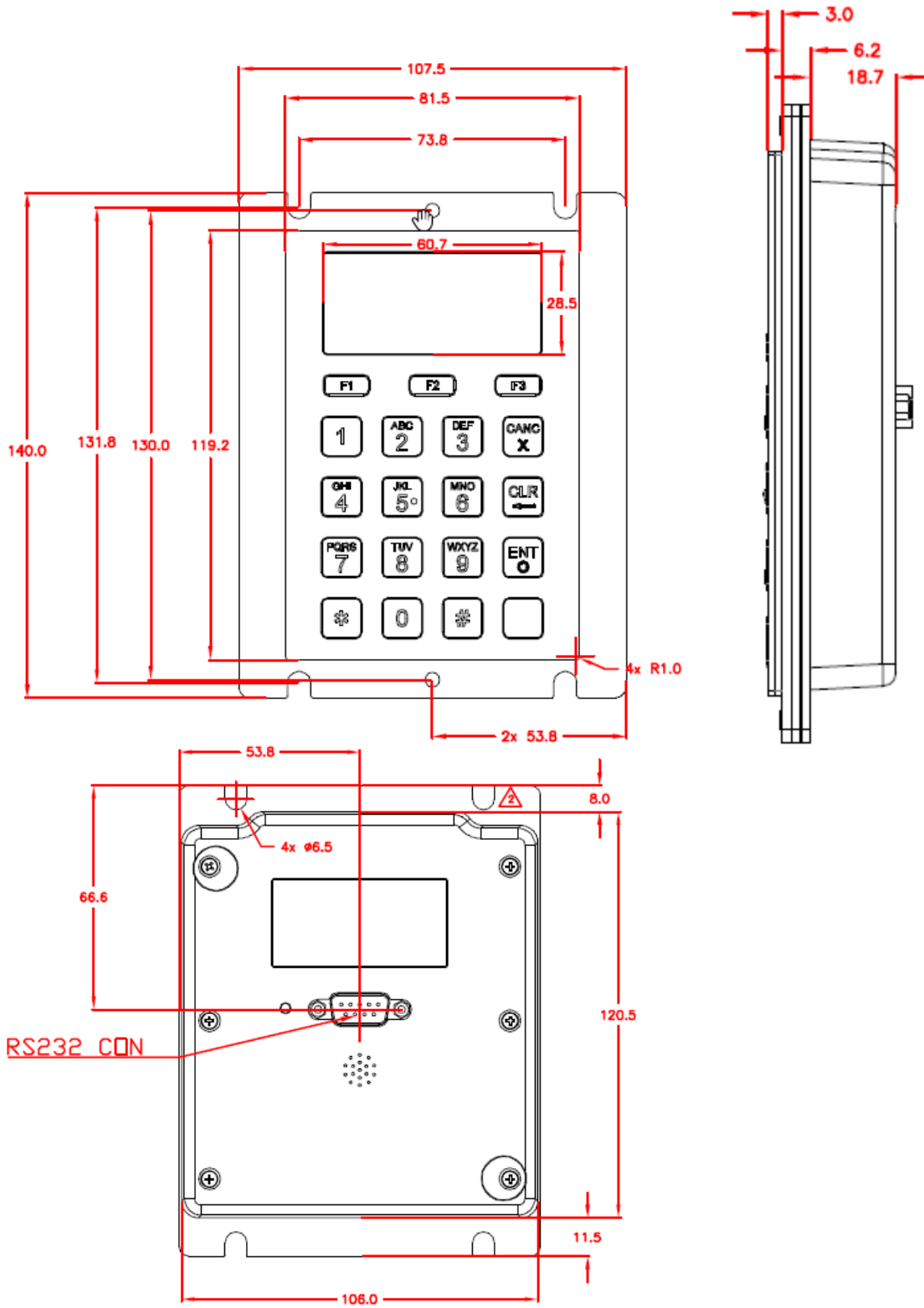
Tamper detect
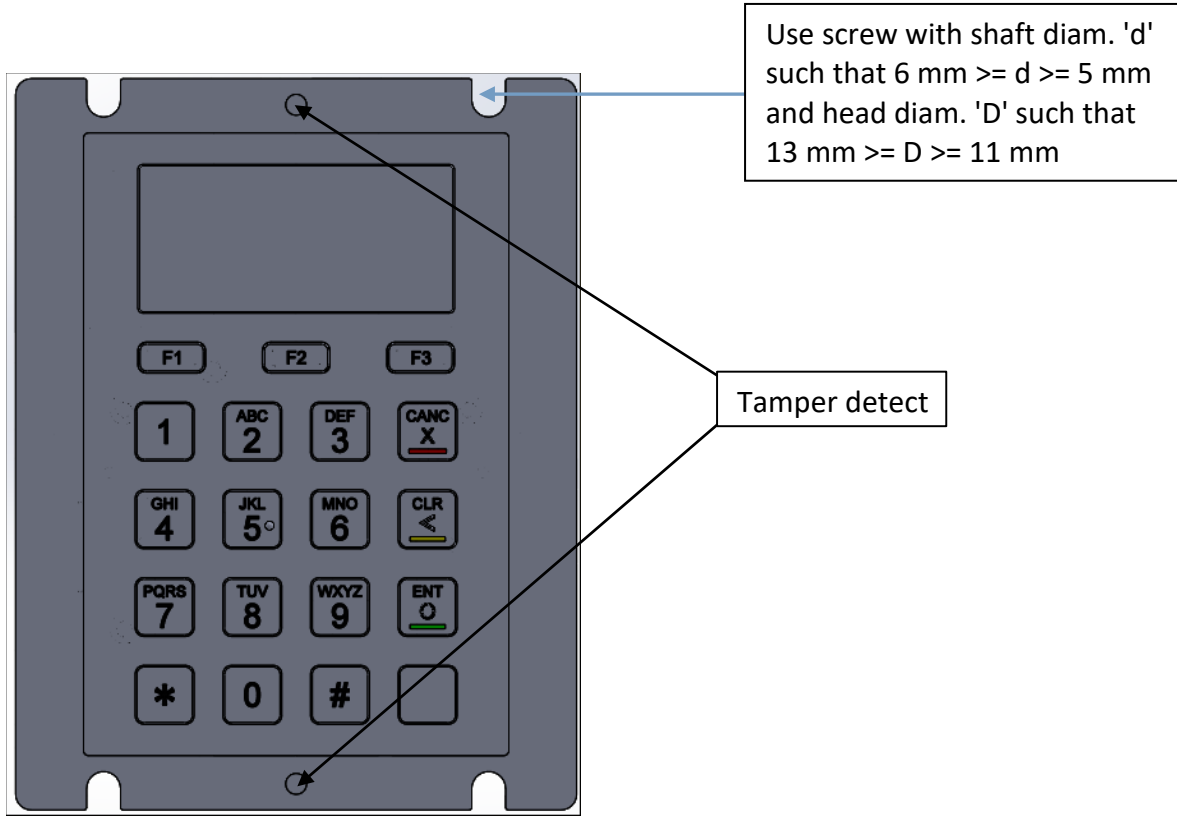
5.1 Engaging the Removal Detection Switch for Testing

The front panel of the SmartPIN L100 incorporates a removal-detection switch behind the bezel's rubber gasket, on the unit's right-edge flange (when viewed head-on, as in the illustration below).

Engaging the removal-detection feature is only necessary when attempting to pair an L100 with a compatible ID TECH reader, such as the VP5300. For bench testing, you may find it desirable to clamp the detection-removal nubs closed using a metal strip held on with two screws (as in the illustration below). **Make sure to do this before powering up the unit.** Conversely, power down the unit before releasing tension on the nubs.
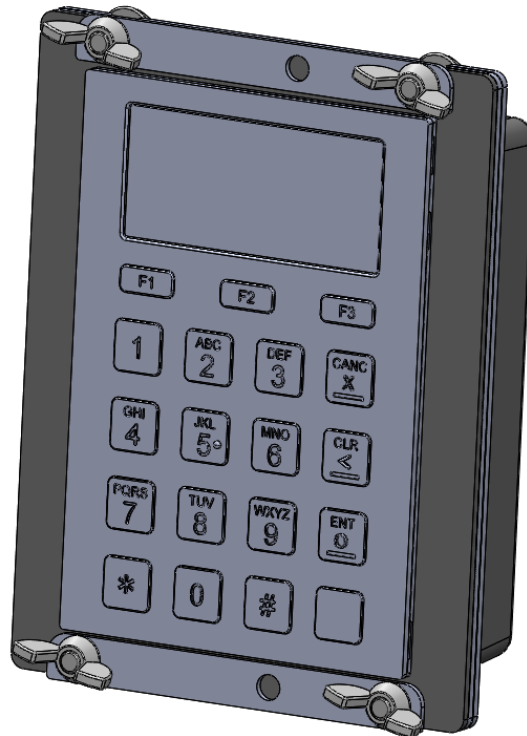
Note: to close the tamper removal switch, 1.63mm of displacement (compression) is required, or 0.056kg of force, but it is recommended that when using a M4-M5 hex nut to mount the unit, a torque between 1.0-1.2 N.m be applied to allow the gasket to prevent water ingress as well.

5.2 Drop Test

The L100 can withstand 4-ft drop to concrete on 6 surfaces and 4 corners (3 cycles) with no damage and still maintain functionality.

5.3 Dust and Water Resistance

All front face components are designed for direct liquid spray, and/or splashed or spilled liquids. The L100 passes IP65 ratings.

5.4 Salt spray test

Faceplate, metal keys, and mounting plate pass the salt spray test.

5.5 IK Test

The front face is impact resistant to meet IK9 rating (10 joules of impact energy, equivalent to dropping a 5kg object from 20 cm height).

5.6 Key Life

The L100 is designed for a minimum of 2,000,000 keystroke operations per key.

6 Electronic Design

6.1 Power Supply

The SmartPIN L100 supports three different modes:
- **RS232** – Requires power supplied by an external A/C power adapter (5VDC).
- **UART** - RJ45 cable connects directly to the Spectrum Pro insert reader; also requires an external A/C power adapter (5VDC).
- **USB** – Connects directly to the host, which provides power through the USB interface.

6.2 USB - Power supplied through USB port Power Management

Power management includes several parts:
1. System voltage supply
   a. An LDO chip is used to convert 5V external voltage to 3.3V, which is the common voltage for all chips and components used in this device.
2. Battery
   a. A battery supplies the power for the SRAM to keep the keys in storage.

6.2.1 Low Power Mode

In low power mode, the voltage of all peripherals is cut off and wakes up by key press and communication from PC.

6.3 Reliability & Environmental

MTBF: 425010 hrs (FR=2352 FITs, BasicR=0.979)

FR is failure rate. FITs is failures per billion hours. MTBF is the Mean Time between Failures in hours.

BasicR (Reliability) is the probability that the circuit, taken as a purely Serial configuration, will operate without failure for the mission time. For example, if the BasicR = 0.837438, then
the circuit has a probability of 0.837438 (or 83.74%) of working without a failure for the mission time duration.

6.3.1 Electro-Static Discharges (ESD)

The L100's electronics can survive electrostatic discharges of 6kV contact and 12kV air discharge with no loss of communications, per ID TECH ESD testing procedures.

6.3.1 Environmental Temperature Range

Operating   -25 to 70° C (-13 to 158° F) [non-condensing]
Storage   -30 to 80° C (-22 to 176° F) [non-condensing]

Relative humidity: Maximum 95% (non-condensing)

6.4 Agency Certifications

FCC CLASS B & CE PCI 4.1

7 Base Functionality

7.1 PIN Pad function
- PIN MK/SK, DUKPT Key Management
- TDES Encryption (keystrokes are not sent in the clear)
- 4 x 4 key layout with 0-9 numerical keys, *, #, Cancel, Clear, Enter, Blank, and 3 additional Function keys adjacent to the bottom of the LCD screen: F1, F2, F3 (function defined by application)
- Supports clear text entry
- PCI-PTS 4.x certified

7.2 Interface function
- USB-HID and RS232 interfaces connect via one DB9 connector on the back of the PIN pad that plugs into the appropriate interface cable.
- The L100 supports both USB-HID and RS232 interfaces for the regular host.

RS232 :
- Baud rates supported: 2400, 4800, 9600, 19200, 38400, 115200 bps
- Data bits: 8
- Parity: Odd, Even, or None
- The COM default settings are initialized to: 38400, 8, 1, & None

USB-HID:
- PID: 0x1050
- VID: 0x0ACD

7.3 Key injection function
- Compatible with FutureX SKI 9000 HSM for PIN Key Injection.
- Can communicate with HSM using the key injection protocol for unattended products.

7.4 Low-Power Modes
7.4.1 Sleep Mode
While using the RS232 interface, Sleep Mode is controlled by a timeout after the L100 is idle for a specified time (default is 120s). While using the USB interface, Sleep Mode is controlled by the USB suspend and resume signals. Sleep Mode is used for battery-operated and solar-powered systems. It reduces power consumption to a much lower level (1 mA USB, 8 mA RS232) than full-power mode (200 mA) but leaves the device able to be woken up by key press or communication from the host.

7.4.2 Stop Mode (20 µA)
Stop Mode is controlled by the application through a specific command. Stop Mode reduces power consumption to the lowest possible level (20 µA). An L100 in Stop Mode can only be woken up by a physical key press.

7.4.3 Bootloader function
The firmware can be upgraded via USB/RS-232 port (Baud rate is 115200).

For detailed information, please refer to document P/N 80000420-001, *Bootloader Firmware Specification (V52).doc*.

8 NGA Commands & Responses format

The L100 uses NGA protocol commands and responses in general communication. The format is:

<STX> <Len_Low><Len_High> <Command Body / Response Body / Notification Body> <CheckLRC> <CheckSUM> <ETX>

Where:
- <STX> is 0x02 and <ETX> is 0x03
- <Len_Low><Len_High> is length of <Command Body / Response Body / Notification Body>
- <CheckLRC> is LRC (8-bit XOR) of all data bytes in <Command Body / Response Body / Notification Body>
- <CheckSUM> is SUM (8-bit SUM) of <Command Body / Response Body / Notification Body>
  - Response Body: <Response Status> + [<Response Data>]
  - <Response Status>: status of the response. 1 byte. NAK: 0x15
  - ACK: 0x06
  - <Response Data>: main response string.
  - If <Response Status> is ACK: More bytes needed.
  - If <Response Status> is NAK: Response data is Error codes (2 bytes).
  - Next section lists <Command Body>, <Response Body>, and <Notification Body> detailed.

8.1 LCD & Beeper State & LED

Note:

Item	Definition
Device is in a Deactivation State	Tamper Switch Or Battery Error
Important Data - No	At least one of Public Key, Firmware Key, Check Value, and/or Numeric Key was not loaded
Important Data - Have	Loaded Public Key, Loaded Firmware Key, Loaded Check Value, and Loaded Numeric Key

8.1.1 LCD & Beeper State from Deactivation State to Activation State

- PK – Public Key (Manufacture Key)
- FK – Firmware Key
- NK – Numeric Key CV – Check Value
- DTV – Date & Timer Value

Device State	Definition	LCD Display Message	Beeper State	LED auxiliary indicator
Deactivation	Device – Removal Security Chip – De-activation No **PK, FK, CV, NK,** and **DTV**	**Line0:** Fatal Error **Other line:** Battery/SDI1/SDI2/Other Other lines are used to describe the cause to de-activation	Always beeping, quick	Steady Red
Load Important Data State	Device – Removal Activation Need to load **PK, FK, CV, NK,** and **DTV**	Load Check Value & Related Key	Always beep (slow)	Steady Red
Activation1	Activation **PK, FK, CV, NK,** and **DTV** loaded successfully No DUKPT Key or Master Key	Ready	Not beeping	If user passwords not set: Blink Yellow If user passwords set or if legally in Removal State: Steady Yellow If legally in Install State: Steady Green
Load Key State	Activation **PK, FK, CV, NK,** and **DTV** loaded successfully Unit prepared to load DUKPT Key or Master Key	Refer to XX DUKPT Key Loading … Master Key Loading…	Refer to Key Loading Note	If user passwords not set: Blink Yellow If user passwords set or if legally in Removal State: Steady Yellow If legally in Install State: Steady Green
Suspend for Get PIN	Activation **PK, FK, CV, NK** and **DTV** loaded successfully GET PIN more than 120 times per hour by MKSK	**Line0:** SUSPEND **Other lines:** Get PIN Other lines are used to describe the cause to suspend	Not beeping	If not set user passwords: Blink Yellow If set user passwords: If legally Removal State: Steady Yellow If legally Install State: Steady Green

Device State	Definition	LCD Display Message	Beeper State	LED auxiliary indicator
Activation2	Activation **PK, FK, SCV, NK,** and **DTV** loaded successfully At least DUKPT Key or MKSK is loaded successfully	Ready	Not beeping	If not set user passwords: Blink Yellow If set user passwords: If legally Removal State: Steady Yellow If legally Install State: Steady Green

8.1.2 Other LCD State for PIN function

State	LCD Display Message	Note
Checking Firmware	Firmware Checking…	
Get Encrypt PIN	Line0:xxxxxxxx Line1:xxxxxxxx Line2:xxxxxxxx Line3:***……	
Get Numeric	Line0:xxxxxxxx Line1:xxxxxxxx Line2:xxxxxxxx Line3: xxxxxxxx…	The Message and Plaintext Numeric Display is defined by Command.
Get Numeric	Line0:xxxxxxxx Line1:xxxxxxxx Line2:xxxxxxxx Line3:***……	The Message and Star Display is defined by Command.
Suspend	Line0: SUSPEND Line1: PWD ERR	Removal Detection Password Error 3 times continuously
Modify default password	Please input one password ******** ⏹ Please input new password ******** ⏹ Please input new password again ******** ⏹ Please input another password ******** ⏹ Please input new password ******** ⏹ Please input new password again ********	Modify two groups' default passwords to user passwords.
Input Removal Detection Enable/Disable user passwords	Please input one new password ******** Please input another new password ********	Enter two groups' user passwords.
Checking Firmware	Firmware Checking…	
Get Encrypt PIN	Line0:xxxxxxxx Line1:xxxxxxxx	

	Line2:xxxxxxxx Line3:***……	
Suspend	Line0: SUSPEND Line1: Get PIN	Get Encrypted PIN under MKSK more than 120 times per hour.

8.1.1 Beeper Tone

Name	Tone Note
Normal Tone	beep tone once
Complete Tone	beep short tone 2 times
invalid Tone	beep short tone 3 times

8.1.2 Keypad Note

F1	F2		F3
1	2	3	Cancel
4	5	6	Backspace
7	8	9	Enter
*	0	#	Blank

8.2 Tamper and Failed Self-Check Indicators

The SmartPIN L100 displays the following indicators when it has been tampered or has any of the other following internal issues, such as an expired certificate, missing key, or similar fault discovered during a self-check.

Indicator	Tampered Status	Other Issue Status
Diagnostic LED	Solid red	Solid red
LCD Display Message	Fatal Error Others	Fatal Error Battery
Buzzer	Quick beep	Quick beep

8.3 Device Operation Process
8.3.1 Activation/Removal of Device

The L100 must be in an activated state before it can exchange encrypted data (and also before it can be key-injected). Putting the device in this state requires:

1. Depressing the removal-detecting buttons at the top and bottom of the frame (and keeping the buttons in the depressed state).
2. Specifying or setting user passwords if user passwords have not yet been specified for the device.
3. Putting the device in the activation state as described in Activate Removal Detection below (this step requires that you *use* the passwords set up in step two).

After the device is activated, it will send PIN data as encrypted data. The device can safely be taken out of the activated (removal-detection-enabled) state at any time using the procedure described below in Deactivate Removal Detection.

Note: do not release the removal detection buttons prematurely.

If the removal detection buttons are released prior to deactivating the device safely (per Deactivate Removal Detection), all keys on the device are erased and the device will be unable to conduct any further data exchanges. As such, it's important to understand how to safely take the device into and out of the activated, removal-detection state. The first step is to set the device's user passwords.

Part 1: Setting User Activation/Deactivation Password

The SmartPIN L100 comes with two default Removal Detection passwords that need to be reset with user-generated passwords before activating the Removal Detection feature. If two user activation passwords have already been set for the L100, it beeps once and enters the "Want Fix / Removal Device" state. If this happens, skip these steps or go to "Part 3: Activate Removal Detection."
To set user passwords:

1. Power up the PIN Pad.
2. After the device beeps its **normal tone** and the LCD screen displays its version message, press **Cancel**, **Clear**, **Enter**, **Blank**, **Clear**, and **Enter** (6 keys) to enter Removal Detection Mode or **Cancel**, **Clear**, **Enter**, **Blank**, **Cancel,** and **Blank** (6 keys) to deactivate Removal Detection Mode. The interval between keys cannot exceed 5 seconds.

Note: if the Fix and Removal log is full, the L100 beeps short tone twice – pause – short tone once and quits the "Want Fix / Removal Device" state.

Part 2: Modifying Activation passwords

New L100s direct from ID TECH come with default passwords:

- Activation Key password A: 12345678
- Activation Key password B: 87654321

Note that all L100 activation key passwords must be numeric.

1. When the LCD screen displays "Please input one/another password", enter default password A

(12345678) and the device will beep to indicate **complete**.
2. When the LCD screen displays "Please input new password", enter new password 1. Note that new passwords cannot be the same as the default loading key passwords. The L100 will beep short tone twice.
3. When the LCD screen displays "Please input new password again", re-enter new password 1. The L100 will beep short tone twice.
4. If the password is modified successfully, the L100 beeps short tone twice and the new password 1 is now a user activation password.
5. The PIN Pad will continue beeping. When the LCD screen displays "Please input another password," enter default password B (87654321).
6. When the LCD screen displays "Please input new password", enter new password 2. Note that new passwords cannot be the same as the default loading key passwords. The L100 will beep short tone twice.
7. When LCD displays "Please input new password again," re-enter new password 2. The device will beep short tone twice.

If the two passwords are modified successfully, the LCD screen displays a prompt to enter section 1 or section 2 according to the key sequence entered in "Setting User Activation/Deactivation Password."

If entry times out, the device quits the "Want Fix / Removal Device" state. Time intervals for entry:
- The interval between passwords 1 and 2 can be no more than 20 seconds.
- The key press interval between two password characters can be no more than 10 seconds.
- Any key will have a short tone to indicate entry.

Part 3: Activate Removal Detection
To activate removal detection:
1. Power-on the L100, and immediately after the device beeps once and the LCD screen displays its version message, press **Cancel**, **Clear, Enter, Blank, Clear,** and **Enter** (6 keys). **Note:** the interval between keys cannot exceed 5 seconds.
2. Enter password 1, which was set in Part 1: Setting User Activation/Deactivation Password. If the password 1 is entered successfully, the L100 beeps twice.
3. Enter password 2, which was set above. If password 2 is entered successfully, the L100 beeps twice.
4. After the two passwords are entered correctly, the LCD screen displays the following menu: *to use "*" and "#", select "Enable PINPAD" or "Enable CR". Press "Enter" to confirm.*
5. Select "Enable PINPAD" to activate removal detection of the L100.
   - If the PINPAD Device is not fixed and **IN Removal State**: PIN Pad will beep short tone twice-pause – short tone 3 times, and will quit the "Want Fix / Removal Device" state.
   - If the PINPAD Device is fixed and **IN Removal State**: the device will beep short tone twice. It means the removal detection of PIN Pad is activated. The PIN Pad saves two records for Active Fixed Device, and will quit the "Want Fix / Removal Device" state.
   - If the PINPAD Device is fixed and **IN Fixed State**: The device will beep short tone three times and quit the "Want Fix / Removal Device" state.
6. Select "Enable CR" to active the removal detection of a Spectrum Pro:
   - If the PINPAD Device is not fixed or **IN Removal State**: The device will beep short tone twice – pause – short tone 3 times, and will quit "Want Fix / Removal Device" state.

If the user enters an incorrect User Activation Password, the device will beep short tone twice – pause-short tone once and then user need to re-enter password.

If the user enters an incorrect User Activation Password three times, the device will beep its Invalid Tone and suspend for three minutes. After the suspension ends, the device quits the "Want Fix / Removal Device" state.

Interval limits:
- The interval between Password 1 and Password 2 cannot be more than 2 Minutes.
- The interval between the two keys of a password cannot be more than 10 Seconds.

Part 4: Deactivate Removal Detection

Power-on the L100 and after the device beeps once and the LCD screen displays its version message, press **Cancel, Clear, Enter, Blank, Cancel,** and **Blank** (the interval between keys cannot exceed 5 seconds). Then:

1. Enter password 1. If password 1 is entered successfully, the L100 beeps twice.
2. Enter password 2. If password 2 is entered successfully, the L100 beeps twice.
3. After the two passwords are entered correctly, the LCD screen displays the menu as follows: *to use "*" and "#", select "Disable PINPAD" or "Disable CR". Press "Enter" to confirm.*
4. Select "Disable PINPAD" to deactivate the L100.
   - If the PINPAD Device is fixed and **IN Fix State**: Device beeps short tone twice. This means PIN Pad removal detection is deactivated successfully; it will save two records for Deactivate Removal Device, and quit "Want Fix / Removal Device State". The PIN Pad can now be removed securely with no data erased.
   - If the PINPAD Device is Fixed and **IN Removal State**: Device beeps **Device is Removal State Tone** and quits "Want Fix / Removal Device State".
5. Select "Disable CR" to deactivate a Spectrum Pro.
   - If PINPAD Device is not fixed or **IN Removal State**: PIN Pad beeps short tone twice- pause- short tone 3 times, and quits "Want Fix / Removal Device" state.

If the user enters an incorrect User Activation Password, the device will beep short tone twice – pause- short tone once and then user need to re-enter password.

If the user enters an incorrect User Activation Password three times, the device will beep short tone twice – pause - short tone once and suspend for three minutes. After the suspension ends, the device quits the "Want Fix / Removal Device" state.

Interval limits:
- The interval between Password 1 and Password 2 cannot be more than 2 minutes.
- The interval between the two keys of a password cannot be more than 10 seconds.

8.4 Testing with the L100

Note that the L100's tamper detection feature requires special handling during testing. See Engaging the Removal Detection Switch for Testing for details.

8.5 Updating L100 Firmware

Users can update the L100's firmware either while the L100 is connected to a VP5300 to a computer or via a direct serial-to-USB connection.

8.5.1 Updating L100 firmware via the VP5300

The steps below describe the process for updating an L100 connected to a VP5300.

Note: Before you begin, contact your ID TECH representative to receive the most recent L100 firmware file and VP5300 firmware; download both ZIP files and extract them to your computer.

1. Navigate to the directory where you extracted the VP5300 firmware files and run **IDTechBootload.EXE**.
2. In the ID TECH Reader Bootload Software app, check the **L100 box** in the upper-left corner.
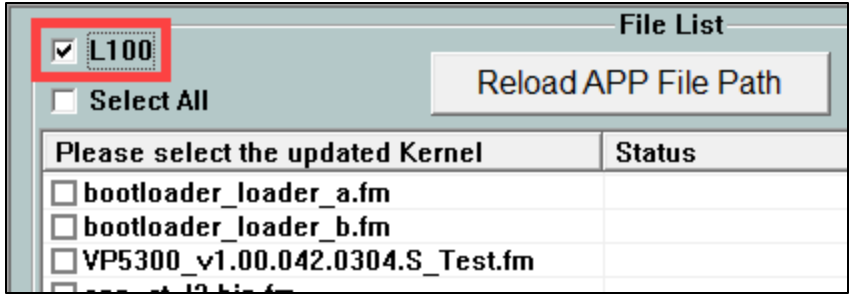
3. Click **Reload APP File Path** to change the directory from with the ID TECH Reader Bootload Software app loads firmware files.
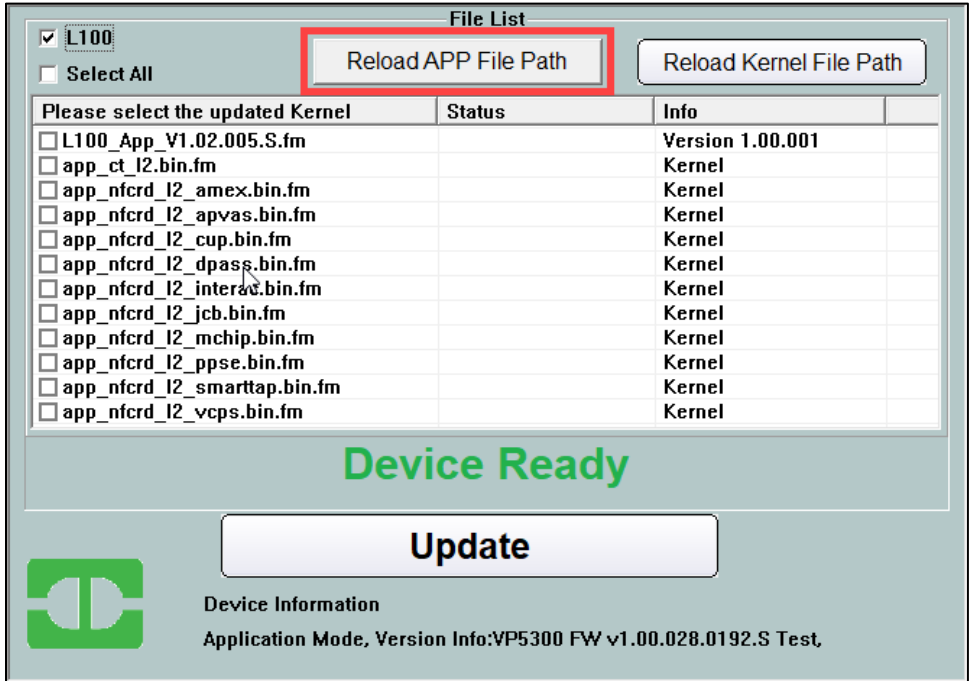
4. Navigate to the directory where you downloaded the L100 firmware and click **OK**.
   Note: If you need to change the directory path for the firmware file, click the **Reload APP File Path** button and select a new directory to update the file list.

5. Select the firmware to load onto the L100.

6. Click the **Update** button. The ID TECH Reader Bootload Software app will update the L100 with the selected firmware.

7. Click **Continue** to verify the desired firmware to update.
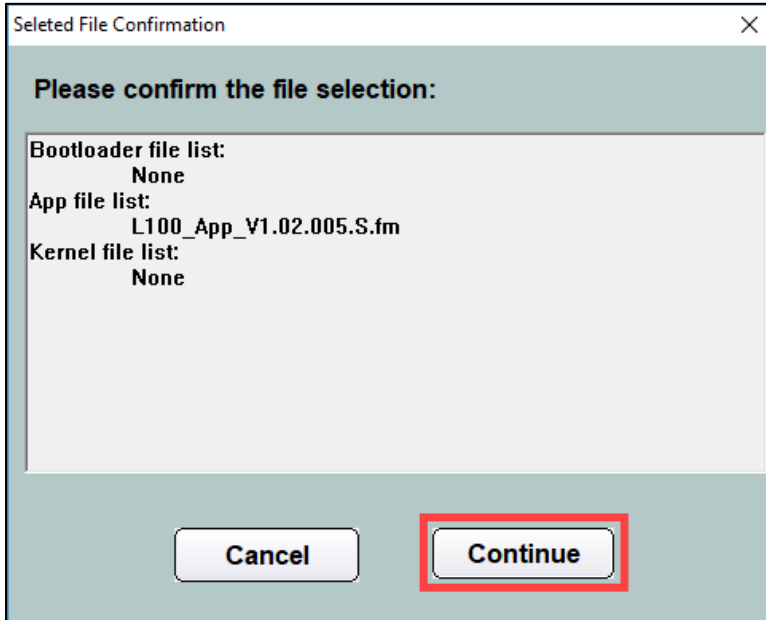
8. The ID TECH Reader Bootload Software app displays a status bar for update progress.
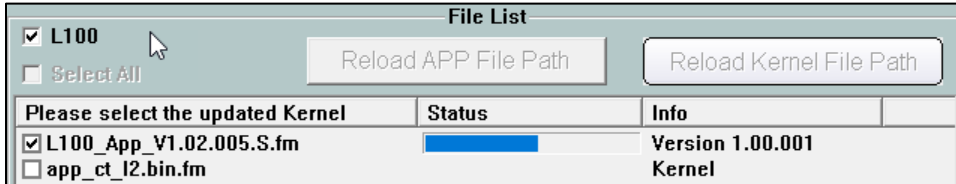
9. When the update completes, the L100 will reboot and the ID TECH Reader Bootload Software app displays a **Completed** status and **Application Update Succeeded**.
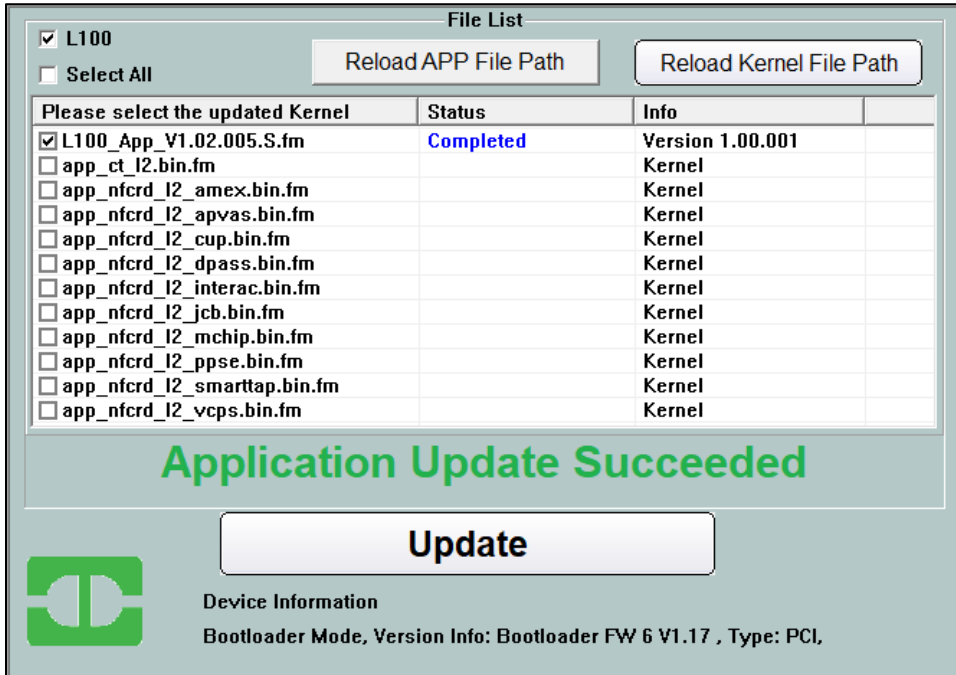
8.5.2 Updating L100 Firmware via Serial-to-USB cable

The steps below describe the process for updating L100 firmware via the Universal SDK Demo.

Note: Before you begin, contact your ID TECH representative to receive the most recent L100 firmware. Download the ZIP file and extract it to your computer.

1. Connect the L100 to your PC via either USB or serial port.
2. Download and install the latest USDK Demo from the ID TECH Knowledge Base (if you cannot access the link, please contact support).
3. Open the USDK demo from the Windows Start menu.
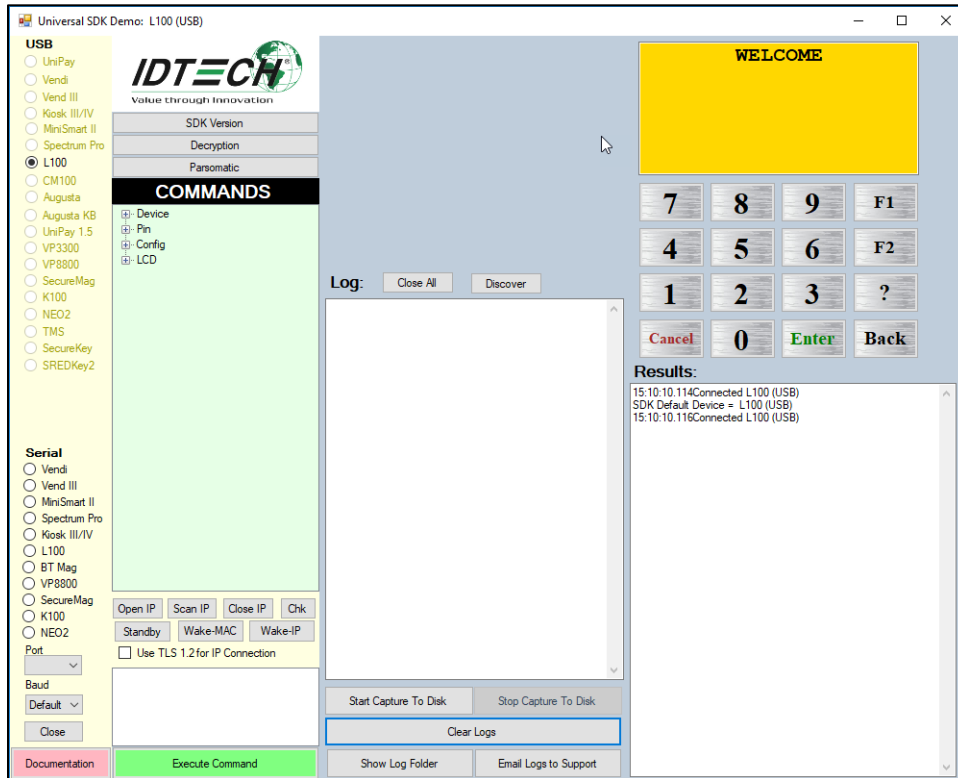
4. Under **Device**, select **Update Device Firmware**, then click **Execute Command**.
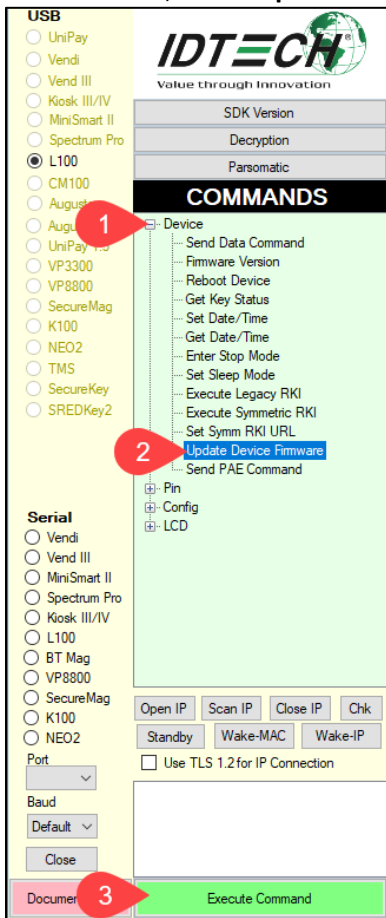
5. Navigate to and select the L100 firmware you downloaded earlier and click **Open**.

6. The L100 will reboot and enter the bootloader, at which point the SDK demo begins updating the device.

7. When the firmware update completes, the L100 will reboot again and the USDK demo will prompt **Firmware Update Successful**.
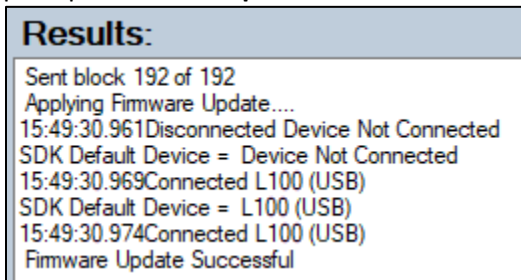
8.6 Bootloader Detailed Process
8.6.1 Detailed Description

When the L100 enters the Bootloader, the device is in the "Waiting State" with "Bootloader…" in Line 0 of the LCD display. In this state, the device can only receive the **Get Version** command. The expected response is the Bootloader version.

The L100 can receive the **Get Version** command and all Data Blocks commands:

- If the L100 successfully receives **Get Version** command, it respond with "Bootloader" characters.
- If the L100 successfully receives a **Data Block** command, it verifies the block data format, version, and signature.
- If verification is OK, the L100 copies the block data into the Application Area and responds **ACK**.
- If verification produces an error, the L100 responds **NAK** with an error code and waits for the block data again. If one data block continuously fails three times, the L100 erases all applications and responds **NAK** with an error code, then waits for the first data block in the Bootloader state.

If the Bootloader times out (30 seconds), and if the application is not modified, the L100 returns to the old application; otherwise the L100 erases all applications and exist in the Bootloader state.

8.6.1 Enter into Bootloader
Command Body: 78 46 7A 49 52 46 57 00 00 00 00 00 00 00 00

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	0F	00	78 46 7A 49 52 46 57 00 00 00 00 00 00 00 00	4E	70	03
Output Hex String: 78 46 7A 49 52 46 57 00 00 00 00 00 00 00 00						

Response Body:
06 – Device has the function, or:
15 – Device does not have the function.

8.7 PIN Pad and MSR Pairing Solution

Step 1: Host sends Pairing MSR KSN from MSR device
Command Body:
75 46 10 00 + [20 bytes ASCII KSN]

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02		00	75 46 10 00 + [20 bytes ASCII KSN]			03
Output Hex String:						

Response Example

STX	Len Low	Len High	Response Body	LRC	CHK SUM	ETX
02	51	00	06 + [80 bytes TR-31 Block Version B Encrypted PAN Encryption Key], or 15 + failure information (see below)			03
Response Body: 06 + [80 bytes TR-31 Block Version B Encrypted PAN Encryption Key] or 15 07 00 – No BDK of Pairing MSR Key, Or 15 07 03 – Pairing Failed, Or 15 07 04 –MSR Pairing Key Other Error						

Note:
- BDK of Pairing MSR Key will generate a Pairing DUKPT Key according to the KSN. PAN Encryption Key is a random number.
- Encrypted PAN Encryption Key Array is encrypted by Pairing DUKPT Key.

Step 2: The host passes the MAC to the PIN Pad

Command Body:
75 46 10 01 + [20 bytes ASCII KSN] +
[6 bytes ASCII MAC]

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02		00	75 46 10 01 + [20 bytes ASCII KSN] + [6 bytes ASCII MAC]			03

Response Body:
06 (Verify OK, PIN pad device save the new PAN Encryption Key) or 15 07 03 – Pairing Failed, Or
15 07 04 –MSR Pairing Key Other Error

8.8 General Group (Task)
8.8.1 Get Firmware Release Version
Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	78 46 01	3F	BF	03
Output Hex String: 0203007846013fbf03						
Command Body: 78 46 01						

Response Example

STX	Len Low	Len High	Response Body	LRC	CHK SUM	ETX
02	25	00	06 <Firmware Version String>	3A	74	03
Return Hex String: 0225000649442054455434820536d61727450490494e204c313030204669726d776172652056631 2 e30303a7403 <STX> <length byte low><length byte high> <ACK>ID TECH SmartPIN L100 Firmware V1.00 <LRC><SUM> <ETX>						

8.8.2 Get Internal Firmware Version

Command Body: 78 31

Response Example

STX		Len Low	Len High	Response Body	LRC	CHK SUM	ETX
02		25	00	06 <Firmware Version Number>			
Return Hex String:							

Response Body: 06 + K21Version Number + 0x0D + MAXQ firmware version

8.8.3 Enter into Bootloader

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	78 46 7A 49 52 46 57 00 00 00 00 00 00 00 00	4E	70	03
Output Hex String:						
Command Body: 78 46 7A 49 52 46 57						

Response Body:

06 – Device has the function, or

15 – Device does not have the function.

8.8.4 Get Serial Number

Command Body: 78 46 02

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	78 46 01	3C	C0	03
Output Hex String: 0203007846023cc003						

Response Body:

06 + 10 bytes ASCII code Serial Number Or 15 62 00 – No Serial Number

Response Example

STX	Len Low	Len High	Response Body	LRC	CHK SUM	ETX
02	0B	00	06 <10-digit serial number>			03
Response Hex String: 020b00063631365435363839343267390 3 <STX><len low><len high><ACK><10-byte serial number><LRC><SUM><STX> The LRC and SUM will obviously depend on the model number.						

8.8.5 Get Model Status

Command Body: 78 46 20

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	78 46 20	1E	DE	03
Output Hex String: 0203007846201ede03						

Response Body: 06 + Model Status

8.8.6 **Response Example**

STX	Len Low	Len High	Response Body	LRC	CHK SUM	ETX
02	0D	00	06 <model status>			03
Response Hex String: 020d0006494450422d3630323430304d79cb03 <STX><len low><len high><ACK><model number><LRC><SUM><STX> In this example, the model number is IDPB-602400M.						

8.8.7 **Reset**

Warm reboot.

Command Body: 78 46 49

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	78 46 49	77	07	03
Output Hex String: 020300784649770703						

Response Body: 06 (and LRC and SUM are 06)

Note:
- Device will Reset (restart; warm reboot) after it responds ACK.
- This is the Highest Priority Command in device except for Key Loading State.

8.8.8 Get Status for Key

Command Body: 78 46 25

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	78 46 25	1B	E3	03
Output Hex String: 0203007846251be303						

Response Body:

06 <2-byte Block Length> <KeyStatusBlock1><[KeyStatusBlock2]> … <[KeyStatusBlockN]>, Or

15 <Error Code>

Response Example

STX	Len Low	Len High	Response Body	LRC	CHK SUM	ETX
02			06 <Block Length Low><Block Length High> <KeyStatusBlock1> <[KeyStatusBlock2]> … <[KeyStatusBlockN]>			03
Response Hex String Example: 0263000618000000000001000000030000000400000006000000070000008000000080001000 080002000800030008000400080005000800060008000700080008000800090008000a000800 0b000a0000000a03e8000c0000000d00000014000001280000000ce2a03 **Where:** <Block Length> - 2 bytes (LenL, LenH) KeyStatusBlock format is <Key Index and Key Name> <key slot> <key status>						

Key Name	Key Index and Key Name
Host-PINPAD Master DUKPT Key	0x00
PIN DUKPT Key	0x01
PIN Pairing DUKPT Key	0x03
Data Pairing DUKPT Key	0x04
CR-PINPAD Master DUKPT Key	0x06
CR-PINPAD MAC DUKPT Key	0x07
PIN Master Key	0x08
Pairing MSR BDK Key	0x0D
LCL-KEK(HSM DUKPT KEY)(HSM DUKPT KEY)	0x14
PIN Session Key	0x28

- <key slot> - 2 bytes. Range is 0 – 9999 (If key has not Slot, the value is 0x00 0x00, if key slot is 1000, the value is 0x03 0xE8)
- <key status> - 1 byte:
  - 0 – NotExist
  - 1 – Exist
- 0xFF – Key Stop (Only Valid for DUKPT Key)`

8.8.9 Get Key Status

Command Body: 78 46 30

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	78 46 30	0E	EE	03
Output Hex String: 0203007846300eee03						

Response Body: 06 + PIN DUKPT Status + PIN Master Key Status + PIN Session Key Status + Account DUKPT Key Status + AccountDUKPT Key Status + RKI-KEK (Admin DUKPT Key)

Where:

Key	Status	Note
PIN Encryption Key	0: None. 1: Exist 0xFF: STOP	
PIN Master Key	0: None 1: At least Exist a Master Key	
PIN Session Key	0: None. 1: Exist	
Account/MSR DUKPT Key	0: None. 1: Exist 0xFF: STOP	Does not support this key. Always 0
Account/ICC DUKPT Key	0: None. 1: Exist 0xFF: STOP	Does not support this key. Always 0
RKI-KEK (Admin DUKPT Key)	0: None. 1: Exist 0xFF: STOP	

If the L100 has not been key-injected, response looks like 0207000600000000000060603

8.8.10 Set Remote Key Injection Timeout

Command Body: 78 53 01 01 02 <Timeout_H> <Timeout_L>

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	07	00	78 53 01 01 02 00 C0	E9	8F	03
Output Hex String: 020700785301010200c0e98f03 In this example, the timing value is 0x00C0 or 192 (decimal) seconds. Timeout_H Timeout_L needs to be in the range 120 seconds ~ 3600 seconds						

Response Body: 06 (Full response string: 02010006060603)

8.8.11 Get Remote Key Injection Timeout
Command Body: 78 52 01 01

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	04	00	78 52 01 01	2A	CC	03
Output Hex String: 020400785201012acc03						

Response Body: 06 78 01 01 02 <Timeout_H> <Timeout_L>

Response Example

STX	Len Low	Len High	Response Body	LRC	CHK SUM	ETX
02	07	00	78 52 01 01 02 00 C0	BC	42	03
Output Hex String: 020700067801010200c0bc4203 In this example, the timing value is 0x00C0 (192 seconds).						

8.8.12 Set Date & Time
Command Body: 78 53 01 50 06 <Date Time>

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	0B	00	78 53 01 50 06	39	F3	03
Output Hex String (example): 020b00785301500616052010305639f303 **Where:** <Data Time> is 6 bytes data – Year, Month, Date, Hour, Minute, Second **Item** **Value Area (BCD Code)** Year 00~99 Month 01~12 Date 01~31 Hour 00~23 Minute 00~59 Second 00~59						

Response Body: 06.
Note:
- If current Date/Time is 2014/08/23 15:24:59, <Date Time> should be 14 08 23 15 24 59 (BCD Code).
- The command always valid in Activation IDLE State.
- 2000/01/01 00:00:00 is the base time; device will reject attempts to set this value.

8.8.13 Get Date & Time
Command Body: 78 52 01 50

16 05 20 10 26 01

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	04	00	78 52 01 50	7B	1B	03
Output Hex String: 020400785201507b1b03						

Response Example

STX	Len Low	Len High	Response Body	LRC	CHK SUM	ETX
02	0B	00	06 78 01 50 06 16 05 10 13 16 19	36	42	03
Output Hex String: 020b0006780150061605101316 19364203						
Which is STX, 2 length bytes, ACK + 78 01 50 06 + <Data Time>						
Where: <Data Time> is 6 bytes data – Year, Month, Date, Hour, Minute, Second						

Note: The command is always valid in Load Important Data State & Activation IDLE State.

8.8.14 Get All Fix/Removal Records
Command Body: 78 52 01 51

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	04	00	78 52 01 51	7A	1C	03
Output Hex String: 020400785201517A1C03						

Response Body: 06 + < Fix/Removal Records Number> (<Record Block>…) < Illegal Removal Records Number> (<Record Block>…)

Where:
- < Fix/Removal Records Number> is Number of Fix/Removal Record Block. If it is 0, there is not <Record Block>
- <Illegal Removal Records Number> is Number of Illegal Removal Record Block. If it is 0, there is not <Record Block>
- <Record Block> has the following format of <UserID> <State> <-> <4 bytes Year> <2 bytes Month> <2 bytes Date> <-> <2 bytes Hour> <2 bytes Minute> </>
  - o **Where:**
  - o <UserID> is 0x31 (User1) or 0x32 (User2) or 0x30 (Illegal Removal)

o <State> is 0x30 (Fix) or 0x31 (Removal) or 0x32 (Illegal Removal) Year, Month, Date, Hour, and Minute need be ASCII code.

Note:
The Max Records is 40. After response this command, all Records are deleted.

8.8.15 Enter Stop Mode
Command Body: 78 46 72 01

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	04	00	78 46 72 01	4D	31	03
Output Hex String: 020400784672014D3103						

Response Body: 06.

Note:
1. Sets device enter to Stop Mode. In this mode, LCD display and backlight are off. Stop Mode reduces power consumption to the lowest possible level. An L100 in Stop Mode can only be woken up by a physical key press.
2. Stop Mode cannot be reached from Bootloader mode, Diagnosis mode, Get PIN, Get Numeric, Get Function Key, Get PIN for Pro, Display and Get Key for Pro and Active PINpad, Activate/Deactivate Passwords, load cert, load key and load important data for PINpad mode.

8.8.16 Set Enter Sleep Mode Time
Enter Sleep Mode timeout period (the period after which the L100, if idle, goes to sleep); default is 120 seconds.

Command Body: 78 46 71 <TimeH> <TimeL>

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	05	00	78 46 71 <TimeH> <TimeL>	62	5C	03
Output Hex String: 020500784671012C625C03 <TimeH><TimeL>: Enter sleep mode time. After TimeH*256+TimeL seconds, device enters Sleep Mode.						

Response Body: 06.

Note:
1. Sleep Mode is controlled by a timeout after the L100 is idle for a specified time.
2. Sleep Mode reduces power consumption to a much lower level, but the device remains capable of being woken up by key press or communication from the host.

3. Bootloader mode, Diagnosis mode, Get PIN, Get Numeric, Get Function Key, Get PIN for Pro, Display and Get Key for Pro and Active PINpad, Activate/Deactivate Passwords, load cert, load key and load important data for PINpad cannot enter sleep mode.

8.9 Other PIN Pad Group (Task)
8.9.1 Get Encrypted PIN
Command Body: 75 46 07 <KeyType><PAN (Account#)><LCD len><LCD Command format>

Where:
- <Key Type>- 1 byte.
- 0x00- MKSK-TDES,   External Plaintext PAN
- 0x01- DUKPT-TDES,   External Plaintext PAN
- 0x10 MKSK-TDES,   External Ciphertext PAN
- 0x11 DUKPT-TDES,   External Ciphertext PAN

[<PAN (Account#)>] - external account, ASCII code for digital (0x30 – 0x39):
- <Key Type> is 0x00 or 0x01, the PAN is Plaintext (Removal detection enable valid), 16 bytes.
- <Key Type> is 0x10 or 0x11, the PAN is Ciphertext: Removal detection enable valid, Ciphertext PAN is encrypted by PAN Encryption Key from pairing, uses PAN Encryption Key as Key, use 8 bytes 0 as IV, TDES and CBC encrypt the Plaintext PAN Format (24 bytes) to get 24 bytes Encrypted PAN.
- <LCD len> - 1 byte. The length of LCD Command format.
- <LCD Command format> - 1~20 bytes ASCII code Display Message.

Response Body:
1. 0x06 if operation is successful, or 0x15 Error Code if it is not successful.
2. Waiting for entering PIN. And:
   - If Get Encrypted PIN with DUKPT Key under Triple DES: 06 + 20 ASCII code KSN + 16 ASCII code Encrypted PIN block
   - If Get Encrypted PIN with MKSK: 06 + 16 ASCII code Encrypted PIN block

Note: If Get Encrypted PIN using Plaintext PAN:
- If the Plaintext PAN is error, response 15 07 02 If Get Encrypted PIN using Encrypted PAN:
- If there is no BDK of Pairing MSR Key, response 15 07 00
- If there is BDK of Pairing MSR Key, but not implement Pairing successfully, response 15 07 01
- If implement Pairing successfully, but the Encrypted PAN is error, response 15 07 02 15 07 00 – No BDK of Pairing MSR Key
- 15 07 01 – Have BDK of Pairing MSR Key, Not Pairing with MSR (No PAN Encryption Key)
- 15 07 02 – PAN is Error
- 15 07 03 – Pairing Failed
- 15 07 04 –MSR Pairing Key Other Error
- If related key was not loaded, response 15 04 00
- If PIN DUKPT Key was STOP, response 15 73 00
- If MKSK algorithm was used more than 120 times in a hours, response 15 72 00 Wait 30 Seconds, The Pin Len default is 4~12

Per 10 Seconds, if the PIN length was not zero, the PIN would be clear.

While you press numeric key, **Device** will increase display "*" on LCD if Total PIN length is smaller than 12. Line 1 display:
- If Enter 2 numeric: **
- If Enter 12 numeric: ************
- While you press Backspace key, **Device** will decrease display "*" on LCD if Total PIN length is not 0.
- While you press Cancel key, **Device** will display cursor on LCD if Total PIN length is not 0, or
- **Device** will quit the work state.
- While Cancel Command was sent, **Device** will quit the work state.

8.9.2 Get Numeric with Display Message

Command Body: 75 46 08 & <256 bytes Encrypted Display Message>

Where:
- <256 bytes Encrypted Display Message> is encrypted Plaintext Display Message by Numeric Key using RSA-2048 algorithm.
- Plaintext Display Message format is: <Len> <Flag> <Display Message String>
- <Len> - 1 bytes, is the length of Display Message String
- <Flag> - 1 byte, is Display Option of Line2

0:
- While you press numeric key, **Device** will increase the display space devoted to this numeric on LCD if Total numeric length is smaller than 16.
- While you press Backspace key, **Device** will decrease the display space devoted to the last numeric on LCD if Total numeric length is not 0.

1:
- While you press numeric key, **Device** will increase display "*" on LCD if Total numeric length is smaller than 16.
- While you press Backspace key, **Device** will decrease display "*" on LCD if Total numeric length is not 0.

<Display Message String> - 1~16 bytes, need be ASCII code.

Note: The Display Message will display in Line1 of LCD.

Response Body:
1. 0x06 if command is successful, or 0x15 Error Code if it is not successful.
2. Waiting for enter Numeric. And 06 + n ASCII code Numeric (n is 1~16).

For Example: enter into 7 numeric keys: 2 5 7 8 9 0 6, response is 06 32 35 37 38 39 30 36.

Note:
- Wait 30 Seconds, The Numeric Len is 1~16
  - Per 10 Seconds, if the Numeric length was not 0, the Numeric will be clear and will display cursor on LCD.
- While you press numeric key, **Device** will increase display numeric on LCD if Total length is

smaller than MaxLen. . Line 1 display:
- o   If Enter 2 numeric (12): 12   or **
- o   If Enter 16 numeric (1234567890123456): 1234567890123456 or ****************
- • While you press Backspace key, **Device** will decrease display numeric on LCD if Total numeric length is not 0.
- • While you press Cancel key, **Device** will display cursor on LCD if Total numeric length is not 0, or **Device** will quit the work state.
- • While Cancel Command was sent, **Device** will quit the work state.

8.9.3 DisplayMessage and Get Numeric Key

Command Body: 75 46 22 & <echo_flag> <max_len> <min_len> <256 bytes Encrypted Display Message>

Where:
- • <echo_flag>:
  - o   0 - display numeric for numeric key on LCD
  - o   1 - display "*" for numeric key on LCD
- • < max_len> - the max length for numeric. Max length cannot be beyond 16
- • < min_len> - the max length for numeric. Max length cannot be less than 1
- • <256 bytes Encrypted Display Message> is encrypted Plain text data by numeric key using RSA-2048 algorithm. The plain text of <256 bytes Encrypted Display Message> format is:
- • <LCD Message len><LCD Message Data>

Response Body:
1. 0x06 if operation is successful, or 0x15 Error Code if it is not successful.
2. Waiting for entering Numeric. And 06 + <len><keys0><keys1>...<keys16>

For example: enter into 7 numeric keys: 2 5 7 8 9 0 6, response is 06 07 25 78 90 6F FF FF FF FF FF FF FF FF FF FF FF FF

Note:
- • Wait 30 Seconds, The Numeric Len is 1~16
- • Per 10 Seconds, if the Numeric length was not 0, the Numeric would be clear and will display cursor on LCD.
- • While you press numeric key, **Device** will increase display numeric on LCD if Total length is smaller than MaxLen. Line 1 display:
  - o   If Enter 2 numeric (12): 12   or **
  - o   If Enter 16 numeric (1234567890123456): 1234567890123456 or ****************
    While you press Backspace key, **Device** will decrease display numeric on LCD if Total numeric length is not 0.
- • While you press Cancel key, **Device** will display cursor on LCD if Total numeric length is not 0, or **Device** will quit the work state.
- • While Cancel Command was sent, **Device** will quit the work state.

8.9.4 DisplayMessage and Get Amount

Command Body: 75 46 23 & <flag> <max_len> <min_len> <256 bytes Encrypted Display Message>

Where:
- • <flag> - 1 byte, Reserved
- • < max_len>- the max length for numeric. Max length cannot be beyond 15

- < min_len>- the max length for numeric. Max length cannot be less than 1
- <256 bytes Encrypted Display Message> is encrypted Plain text data by numeric key using RSA-2048 algorithm. The plain text of <256 bytes Encrypted Display Message> format is:
- <LCD Message len><LCD Message Data>

Response Body:
1. 0x06 if command is successful, or 0x15 Error Code if it is not successful.
2. Waiting for entering Numeric. And 06 + <len><keys0><keys1>...<keys14>

For example: enter into 7 numeric keys: 2 5 7 8 9 0 6, amount is 25789.06, response is 06 07 25 78 90 6F FF FF FF FF FF FF FF FF FF FF FF FF

Note:
- Wait 30 Seconds, The Numeric Len is 1~16
- Per 10 Seconds, if the Numeric length was not 0, the Numeric would be clear and will display cursor on LCD.
- While you press numeric key, **Device** will increase display numeric on LCD if Total length is smaller than MaxLen. Line 1 display:
  - If Enter 2 numeric (12): 0.12
  - If Enter 15 numeric (12345678901245): 1234567890123.45
- While you press Backspace key, **Device** will decrease display numeric on LCD if Total numeric length is not 0.
- While you press Cancel key, **Device** will display cursor on LCD if Total numeric length is not 0, or **Device** will quit the work state.
- While Cancel Command was sent, **Device** will quit the work state.

8.9.5 Get Function Key
Command Body: 75 46 0B

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	75 46 0B	38	C6	03
Output Hex String: 02030075460B38C603						

Response Body: 06 + 1 byte ASCII code Func Key or 2 bytes ASCII code Func Key.

Note:
- Wait 3 minutes.
- While you press Backspace key, **Device** Sends "B" While you press Cancel key, **Device** Sends "C" While you press Enter key, **Device** Sends "E" While you press '*' key, **Device** Sends "*"
- While you press '#' key, **Device** Sends "#" While you press Blank key, **Device** Sends "?" While you press F1 key, **Device** Sends "F""1" While you press F2 key, **Device** Sends "F""2" While you press F3 key, **Device** Sends "F""3

8.9.6 Cancel Command
Command Body: 75 46 09

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	75 46 09	3A	C4	03
Output Hex String: 0203007546093AC403						

Note: Use this command to Cancel "Get Func Key" & "Get Encrypted PIN" & "Get Numeric" & "Get Amount"

Response Body: always 15 18 00

8.9.7 Beeper Control
Open / Close Beeper:
Command Body: 75 46 01 01 <On/Off>

- <On/Off> - 0x00 : Off
- - 0x01 : On

Beep according to Frequency and Duration:

Command Body: 75 46 01 02 <Fre1> <Fre2> <Fre3> <Fre4> <Dur1> <Dur2> <Dur3> <Dur4>

- <Fre1> <Fre2> is the first and second nibble for the first byte of Frequency.
- <Fre3> <Fre4> is the first and second nibble for the second byte of Frequency.

If the Frequency is 1000 (0x03E8), <Fre1> <Fre2> <Fre3> <Fre4> will be 0x45 0x38 0x30 0x33.

According to the datasheet of Beeper of SmartPIN C100:
- Frequency will be more than 1000Hz and less than 20000Hz. 4000Hz tone will generate the First Max Decibels sound.
- 6000Hz tone will generate the Second Max Decibels sound.
- <Dur1> <Dur2> is the first and second nibble for the first byte of Duration.
- <Dur3> <Dur4> is the first and second nibble for the second byte of Duration.
- If the Duration is 200 (0x00C8), <Fre1> <Fre2> <Fre3> <Fre4> will be 0x43 0x38 0x30 0x30. Duration need be more than 16ms and less than 65535 ms.

If Beeper is Off, response 15. If Beeper is On:
- If Frequency is correct, response 06. If Frequency is incorrect, response 15.

8.9.8 Set PIN Len
Command Body: 75 53 01 01 02 MinLen MaxLen

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	07	00	75 53 01 01 02 MinLen MaxLen			03

Output Hex String: 0207007553010102040A2ADA03

MinLen need be 4~12 MaxLen need be 4~12
MinLen need be same or less than MaxLen

Response Body: 06

8.9.9 Get PIN Len
Command Body: 75 52 01 01

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	04	00	75 52 01 01	27	C9	03

Output Hex String: 0204007552010127C903

Response Body: 06 75 01 01 02 MinLen MaxLen

8.9.10 Set Numeric Len
Command Body: 75 53 01 02 02 MinLen MaxLen

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	07	00	75 52 01 02 02< MinLen><MaxLen>	3E	E4	03

Output Hex String: 02070075520102020 8103EE403

MinLen need be 1~16 MaxLen need be 1~16
MinLen need be same or less than MaxLen

Response Body: 06

8.9.11 Get Numeric Len

Command Body: 75 52 01 02

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	04	00	75 53 00	24	CA	03
Output Hex String: 0204007552010224CA03						

Response Body: 06 75 01 02 02 MinLen MaxLen

8.9.12 Default PINpad Group All Setting

Command Body: 75 53 00

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	75 53 00	26	C8	03
Output Hex String: 02030075530026C803						

Response Body: 06

Below Setting should be reset to default value:

Function Name	Default Value
PIN Length	Min is 4, Max is12
Numeric Length	Min is 1, Max is16

8.9.13 Review PINpad Group All Setting

Command Body: 75 52 00

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	75 52 00	27	C7	03
Output Hex String: 02030075520027C703						

Response Body: 06 75 02 01 02 <Min PIN Length> <Max PIN Length> 02 02 <Min Numeric Length> <Max Numeric Length>

8.9.14 Manual PAN Entry Support

Command Body: 75 46 06 <Para>

Where:

Para is 1 byte.

Bit	0	1
Bit0	User does not input CVV data.	User inputs CVV data.
Bit1	User does not input ADR data.	User inputs ADR data.
Bit2	User does not input ZIP data.	User inputs ZIP data.

Response Body:

- If a related key (Data key or MAC key) was not loaded, the response is 15 04 00.
- If a Data DUKPT Key was STOP, the response is 15 73 00.
- Upon command execution, the device first displays "Enter PAN" and waits for the user to enter PAN Data. The format is: (Pre-PAN and Post-PAN is default value), which the LCD displays when the user enters data: (The Pre-PAN and Post-PAN Len default is four). The whole pan data length is between 12~19:
    - 111
    - 1111****
    - 1111********1111
- If the user presses **Enter**, the device displays "Enter Valid Date" and waits for the user to enter date data. All four bytes should be entered, which the LCD displays on entry:
    - MM/YY
    - 11/YY
    - 11/18
- If the user presses **Enter**, due to command parameters the L100 outputs "Enter CVV" and waits for the user to enter CVV data. The data length is three or four and is masked with "*".
- If the user presses **Enter** after entering CVV data, due to command parameters the L100 outputs "Enter Address" and waits for the user to enter ADR data. The data length is 0 or 20 and output in plaintext. The user can also press **Enter** to go on to the next step if no data is entered.
- If the user presses **Enter** after entering ADR data, due to command parameters the L100 outputs "Enter ZIP code" and waits for the user to enter ZIP data. The data length is 0 or 20 and output in plaintext. The user can also press **Enter** to go to the next step if no data is entered.
- The PAN data input process waits three minutes and other data input processes wait one minute.
- Per 20 Seconds, if the PAN length is not zero, the PAN is clear.
- If the user presses **Backspace**, the L100 decrements the digits on the LCD if the total data length is not 0.
- If the user presses **Cancel**, the L100 displays a cursor on LCD if the total PIN length is not 0, or L100 quits the work state.
- When the Cancel command is sent or the user presses **Cancel**, the L100 quits the work state.
- The port outputs key information during the whole operation. During the steps in which the user enters PAN and CVV, the output displays as '*' when numeric keys are pressed; plaintext data is displayed during the other three steps. **Backspace**, **Cancel**, and **Enter** output is displayed as 'B', 'C' and 'E'.

8.9.15 Real Time Key Press Support

This command sets output data content for the **Get PIN**, **Get Numeric Key**, and **Get Amount** commands.

Command Body: 75 46 25 & <1-byte parameter>

Where:

- **Parameter = 0:** when a **Get PIN**, **Get Numeric Key**, or **Get Amount** command is executed, the device outputs "06 57 46 50 47" in hex data when a key is pressed; the device outputs an encrypted pin block or whole numeric key sequence when enter key is pressed.
- **Parameter = 1:** when a **Get PIN**, **Get Numeric Key**, or **Get Amount** command is executed, the device outputs the related ASCII code data when a key is pressed ('0~9','B','C','E'). The device does not output whole numeric key sequence when the enter key is pressed. If executing a **Get PIN** command, the device outputs '*' as numeric, 'B', 'C', 'E' when the related key is pressed, and sends an encrypted pin block when **Enter** is pressed.

Bits	Description
bit 7	0: Device will output "06 57 46 50 47" Hex data when a key is pressed. 1: Device will not output any key event.
bit 6 ~ bit 3	Reserved
bit 2	0: When Get PIN from Host command is executed, the device output will follow the configuration of bit 7. And will output encrypted pin block when enter key is pressed. 1: When Get PIN from Host command is executed, the device will output the related ASCII code data when a key is pressed ('*' for digital key, 'B','C','E'). And send encrypted pin block when enter key is pressed. **Note: Bit 2 can be ignored when the L100 is used with a VP5300 reader.**
bit 1	0: When Get PIN from CR command is executed, the device will not output any key event when key pressed (Special for the requirement of Spectrum Pro/VP5300). And will output encrypted pin block when enter key is pressed. 1: When Get PIN from CR command is executed, the device will output the related ASCII code data when a key is pressed ('*' for digital key, 'B','C','E'). And send encrypted pin block when enter key is pressed.
bit 0	0: When Get numeric/Get amount command is executed, the device output will follow the configuration of bit 7. And will output whole numeric key sequence when enter key is pressed. 1: When Get numeric/Get amount command is executed, the device will output the related ASCII code data when a key is pressed ('0~9','B','C','E'). And won't output whole numeric key sequence when the enter key is pressed.

8.9.16 Get Numeric with Display Message

Command Body: 75 46 08 & <256 bytes Encrypted Display Message>

Where:

- <256 bytes Encrypted Display Message> is the encrypted plaintext display message by numeric

key using RSA-2048 algorithm.
- Plaintext display message format is: <Len> <Flag> <Display Message String>
  - <Len>: 1 byte, the length of Display Message String
  - <Flag>: 1 byte, the Display Option of Line2
  - Bit0 = 0:
    - When the user presses a numeric key, the L100 increments the numbers on the LCD if the total numeric length is smaller than 16
    - When the user presses **Backspace**, the L100 decrements the last number on the LCD if the total numeric length is not 0.
  - Bit0 = 1:
    - When the user presses a numeric key, the L100 increments "*" on the LCD if total numeric length is smaller than 16.
    - When the user presses **Backspace**, the L100 decrements "*" on the LCD if the total numeric length is not 0.
  - Bit1 = 0: Output numbers for numeric keys, 'B' for Backspace, 'C' for Cancel, 'E' for Enter.
  - Bit1 = 1: Output '*' for numeric keys, 'B' for Backspace, 'C' for Cancel, 'E' for Enter.
    - Note: Bit1 setting is valid only after the output mode is set to 1. Please refer the description in <Display Message String> - 1~16 bytes, need be ASCII code.

Note: the display message appears in Line1 of the LCD.

Response Body:
0x06 if successful, or an 0x15 error code if not successful.

Waiting for enter Numeric. And 06 + n ASCII code Numeric (n is 1~16).

For Example: if the user enters seven numeric keys: 2 5 7 8 9 0 6, the response is 06 32 35 37 38 39 30 36.

Use 75 46 25 01 to Set Output data content, as the device will output the related ASCII code data when a key is pressed ('0~9','B','C','E') one by one. When 75 46 25 01 is set, the device will not output the whole numeric key sequence when the user presses **Enter**.

Note:
- The Numeric Len is 1~16
- Per 20 Seconds, if the numeric length is not 0, the numeric display is clear and will displays a cursor on the LCD.
- When the user presses a number key, the L100 increments the numbers on the LCD if the total length is smaller than MaxLen.
- Line 1 display:
- If the user enters two numbers (12): 12 or **
- If the user enters 16 numbers (1234567890123456): 1234567890123456 or ****************
- When the user presses **Backspace**, the L100 decrements the numbers on the LCD if the total numeric length is not 0.
- When the user presses **Cancel**, the L100 displays a cursor on the LCD if the total numeric length is not 0, or the L100 quits the work state.

- When a **Cancel** command is sent, the L100 quits the work state.
- The response body depends on the command (75 46 25). If the related parameter is not 0, the response data is only the ASCII code for the pressed keys.

8.1 LCD Group (Task)
8.1.1 Clear Display
Command Body: 8A 46 01 <Control>

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	0C	00	8A 46 01 <Control>	EA	46	03
Output Hex String: 0204008a4601ff32d003 <Control> 0:First Line 1:Second Line 2:Third Line 3:Fourth Line 0xFF: All Screen						

Response Body: 06

8.1.2 Save Prompt Display
Command Body: 8A 46 24 <Prompt> <Message>

Where:
- <Prompt> - Prompt number 0 – 9
- <Message> - display message 20 char MAX ((ASCII Code – 0x20~0x7F))

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	0C	00	8A 46 24 <Prompt> <Message>	EA	46	03
Output Hex String: 020c008a4624022a2a2a2a2a2a2a2aea4603						
Example shows Prompt 2, Message "********"						

Response Body: 06

8.1.3 Display Prompt
Command Body: 8A 46 25 <Line> <Prompt>

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02		00	8A 46 25 <Line> <Prompt>			03
Output Hex String: 0205008a46250001e8f603						

Response Body: 06

8.1.4 Display Message
Command Body: 8A 46 26 <Line> <1~20 Message>

Where:
- <Line> - Display line number 0 Or 1 or 2 or 3
- <1~20 Message > - Message (ASCII Code – 0x20~0x7F)

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	17	00	8A 46 26 <Line> <1~20 Message>	D2	F6	03

Output Hex String: 0217008a462600536d61727450494e204c313030205265616479d2f603

Where:
- <Line> - Display line number 0 Or 1 or 2 or 3
- <1~20 Message > - Message (ASCII Code – 0x20~0x7F)

The example above sets the message "SmartPIN L100 Ready"

Response Body: 06

8.1.5 Default LCD Group All Setting
Command Body: 8A 53 00

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	8A 53 00	D9	DD	03

Output Hex String: 0203008a5300d9dd03

Response Body: 06

Default values:

Function Name	Default Value
Backlight of LDC On/Off	Off

8.1.6 Review LCD Group All Setting
Command Body: 8A 52 00

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	03	00	8A 52 00	D8	DC	03

Output Hex String: 0203008a5200d8dc03

Response Body: 06 8A 04 01 <Back Light Control>

Response Example

STX	Len Low	Len High	Response Body	LRC	CHK SUM	ETX
02	05	00	06 8A 04 01 <Back Light Control>05 01 <TimerValue>	88	96	03
Output Hex String: 020500068a040101889603						

8.1.7 Set Back light of LCD On/Off

Command Body: 8A 53 01 04 01 <Control>

Where:

<Control>:

- 0: OFF
- 1: ON

Response Body: 06

8.1.8 Get Back light of LCD On/Off

Command Body: 8A 52 01 04

Response Body: 06 8A 01 04 01 <Control>

8.2 RS232 Task Commands

8.2.1 Set BaudRate

Command Body: 70 53 01 41 01 ASCIIChar

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	06	00	70 52 01 41 01 <Speed>	54	3C	03
Output Hex String: 02060070530141013654 3c03						
This example shows Speed as 0x36, the code for 19200 (see table below).						

BaudRate	ASCIIChar
2400	0x32
4800	0x33
9600	0x34
19200	0x36
38400	0x37
115200	0x39

Response Body: 06

8.2.2 Get BaudRate
Command Body: 70 52 01 41

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	04	00	70 52 01 41	62	04	03
Output Hex String: 02040070520141620403						

Response Body: 06 70 41 01 <ASCIIChar>

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	05	00	06 70 41 01 <Speed>	01	EF	03
Output Hex String: 020500067041013701ef03						

BaudRate	ASCIIChar
2400	0x32
4800	0x33
9600	0x34
19200	0x36
38400	0x37
115200	0x39

8.2.3 Set StopBits
Command Body: 70 53 01 45 01 ASCIIChar

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	06	00	70 53 01 45 01 31	57	3B	03
Output Hex String: 020600705301450131573b03						

StopBits	ASCIIChar
1	0x31
2	0x32

Response Body: 06

8.2.4 Get StopBits

Command Body: 70 52 01 45

Command Example

STX	Len Low	Len High	Command Body	LRC	CHK SUM	ETX
02	04	00	70 52 01 45	66	08	03

Output Hex String: 02040070520145660803

Response Body: 06 70 45 01 + <ASCIIChar>

9 Error Codes

Error Code	Definition
0x0100	Log is full
0x0400	Related Key was not loaded
0x0500	Key Same
0x0501	Key is all zero
0x0502	TR-31 format error
0x0700	No BDK of Pairing MSR Key
0x0701	Have BDK of Pairing MSR Key, Not Pairing with MSR (No PAN Encryption Key)
0x0702	PAN is Error
0x0703	Pairing Failed
0x0704	MSR Pairing Key Other Error
0x0705	No Internal MSR PAN (or Internal MSR PAN is erased timeout)
0x0F00	Encryption Or Decryption Failed
0x1800	Response for Cancel (Get PIN, Get Numeric, Get FunKey) command
0x1900	Response for Cancel Key Press in Get PIN / Numeric State
0x3005	Removal detection not active.
0x30FF	Slave Chip is not connected
0x5500	No RKI-KEK (Admin DUKPT Key)
0x5501	RKI-KEK (Admin DUKPT Key) STOP
0x5504	Validate Authentication Code Error
0x5505	Encrypt Or Decrypt data failed
0x5506	Not Support the New Key Type
0x5507	New Key Index is Error
0x5508	Step Error
0x5509	Remote Key Injection Timeout (Latest Command is Timeout)
0x550A	MAC Error
0x550B	Key Usage Error
0x550C	Mode of Use Error
0x550F	Other Error
0x6000	Save or Config Failed / Or Read Config Error
0x6200	No Serial Number
0x6900	Invalid Command – Protocol is right, but task ID is invalid
0x6A00	Unsupported Command – Protocol and task ID are right, but command is invalid
0x6A01	Unsupported Command – Protocol and task ID are right, but command is invalid – In this State
0x6B00	Unknown parameter in command – Protocol task ID and command are right, but parameter is invalid
0x6C00	Unknown parameter in command – Protocol task ID and command are right, but length is out of the requirement.
0x7200	MKSK Suspend or press passwords Error Suspend
0x7300	PIN/MSR/ICC/ RKI-KEK (Admin DUKPT Key) is STOP (21 bit 1)
0x7400	Device is Busy
0x7500	Device is in diagnose mode

0x7600	Device is in Transparent Transmission mode
0x8100	Timeout
0x8200	Wrong operate step

10 LCD Foreign Language Mapping Table

ID	Message ID	English	French	Spanish	Chinese
0	MSG_NULL				
1	MSG_AMOUNT	AMOUNT	MONTANT	CANTIDAD	金额
2	MSG_AMOUNT_OK	AMOUNT OK?	MONTANT OK	MONTO CORRECTO?	确定金额
3	MSG_APPROVED	APPROVED	APPROUVE	APROVADO	通过
4	MSG_CALL_YOUR_BANK	CALL YOUR BANK	APPE VOTRE BANQE	LLAME A SU BANCO	请联系您的银行
5	MSG_CANCEL_OR_ENTER	CANCEL OR ENTER	ANNULE OU ENTRER	CANCEL O ENTRAR	取消或确定
6	MSG_CARD_ERROR	CARD ERROR	ERREUR CARTE	ERROR DE TARJETA	读卡错误
7	MSG_DECLINED	DECLINED	REFUSE	DECLINADO	卡被拒
8	MSG_ENTER_AMOUNT	ENTER AMOUNT	ENTRER MONTANT	INGRESE MONTO	输入金额
9	MSG_ENTER_PIN	ENTER PIN:	ENTRER PIN:	ENTRAR NPI:	请输入密码
10	MSG_INCORRECT_PIN	INCORRECT PIN	NIP INCORRECT	NPI INCORRECT O	密码错误
11	MSG_ICC_MSR1	SWIPE OR INSERT	PASSER OU INSERT	MOVER O INSERT	请刷卡或插卡
12	MSG_ICC_MSR2	CARD	CARTE	TARJETA	卡
13	MSG_INSERT_CARD	INSERT CARD	INSERT CARTE	INSERTAR TARJETA	请插卡
14	MSG_USE_CHIP_READER	USE CHIP READER	UTI LECTEUR CHIP	USO CHIP LECTOR	使用芯片卡
15	MSG_NOT_ACCEPTED	NOT ACCEPTED	PAS ACCEPTE	DENEGADO	无法接受
16	MSG_PIN_OK	PIN OK?	PIN OK	PIN CORRECTO?	确定密码
17	MSG_PLEASE_WAIT	PLEASE WAIT...	ATTENDRE...	POR FAVOR ESPERE	等候中
18	MSG_PROCESSING_ERROR	PROCESSING ERROR	ERREUR DE TRAITE	ERROR PROCESANDO	处理错误
19	MSG_USE_MAGSTRIPE	USE MAGSTRIPE	USAGE MAGSTRIPE	USO DE MAGSTRIPE	使用磁条卡
20	MSG_TRY_AGAIN	TRY AGAIN	REESSAYER	VUELV INTENTARL O	请重试
21	MSG_ONLINE	GO ONLINE	GO LIGNE	GO LINEA	在线

22	MSG_TRANSACTION_ERROR	TRANSACTI ON ERR	ERREUR DE TRANS	ERROR DE TRANSAC	交易错误
23	MSG_TERMINATE	TERMINATE	RESILIER	TERMINAR	终止
24	MSG_ADVICE	ADVICE	CONSEILS	CONSEJOS	建议
25	MSG_TIMEOUT	TIME OUT	TIMEOUT	TIEMPO DE ESPERA	超时
26	MSG_PROCESSING	PROCESSING …	PROCESSUS…	PROCESAND O…	处理中。。。
27	MSG_PIN_TRY_EX	PIN TRY LIMIT EX	PIN TRY DEPASSE	TRY PIN SUPERADA	密码尝试次数过多
28	MSG_ISSUER_AUTH_FAIL	ISSUER AUTH FAIL	EMETTEUR FAIL	EMISOR FALLA	与发卡机构认证
29	MSG_CONTINUE_PROCESS	CONTINUE PROCESS	CONTINUER LA	CONTINUAR PROCES	继续处理
30	MSG_GET_PIN_ERROR	GET PIN ERROR	GET PIN ERROR	OBTENER PIN ERR	密码错误
31	MSG_GET_PIN_FAIL	GET PIN FAIL	GET PIN FAIL	OBTENER PIN FALL	获取密码错误
32	MSG_NOKEY_GET_PIN	NO KEY GET PIN	NO KEY GET PIN	NO CLAVE GET PIN	无法输入密码
33	MSG_CANCELLED	CANCELLED	ANNULE	CANCELADO	取消
34	MSG_LAST_PIN_TRY	LAST_PIN_T RY	LAST PIN TRY	LAST TRY PIN	最后一次密码尝试

11 Appendix A: Spectrum Pro Related Commands

Note: The Length in the message blocks of following commands and responses all has the formatted as 2-byte, little-endian. Card Reader is abbreviated CR.

11.1 CR gets PINPAD UID

Command:

Task ID	'65' or '56'
	'46'
Function ID	'26'
Length	Length of data

Data	• Length of CR Unique identification number (UID),
	• CR Unique identification number (UID);
	• length of Symmetric or Asymmetric flag
	• Symmetric or Asymmetric flag 0 - Symmetric only
	    1. Asymmetric only
	    2. Both Symmetric and Asymmetric

Response:

Result byte	If success, return ACK. If failed, return NAK <Error Code>
Task ID	'56' or '65'
	'46'
Function ID	'26'
Length	Length of data

Data	• Length of PINPAD Unique identification number (UID),
	• PINPAD Unique identification number (UID), 8 bytes
	• length of Symmetric or Asymmetric flag
	• Symmetric or Asymmetric flag 0 - Symmetric only
	    1. Asymmetric only
	    2. Both Symmetric and Asymmetric

11.2 Get Nonce

Command:

Task ID	'65' or '56'
	'46'
Function ID	'27'
Length	Length of data
Data	• Length of NONCE • CR NONCE, 16 bytes

Response:

Result byte	If success, return ACK. If failed, return NAK <Error Code>
Task ID	'56' or '65'
	'46'
Function ID	'27'
Length	Length of data
Data	• Length of NONCE • PINPAD NONCE, 16 bytes

Note:
1. This command must be used just before a command is issues that requires NONCE values.
2. NONCE is active after this command and will be used in checks and calculations. After a NONCE is used (in a check or calculation), it is NOT allowed to use the same NONCE value again. After one side completes a command that uses this NONCE, it will reset the NONCE value to indicate there is no active NONCE value.

11.3 Get DUKPT KSN

Command:

Task ID	'65' or '75' or '78'
	'46'
'Function ID	'3E'
Length	Length of data

Data	• Key Index, 1 byte:
	o 0x0 –Host-PINPAD Master DUKPT Key 0x1 –PIN DUKPT Key
	o 0x3 –PIN Pairing DUKPT Key 0x4 –Data Pairing DUKPT Key
	o 0x6– CR-PINPAD Master DUKPT Key
	o 0x7–CR-PINPAD MAC DUKPT Key
	o 0xA– RKL DUKPT Key
	o 0xC–RKI-KEK (Admin DUKPT Key)
	o 0x14 – HSM Key Encryption Key (Master Key or KEK)
	• Length Key Slot
	• Key Slot

Note: Host to get the LCL-KEK (HSM DUKPT KEY) or Master DUKPT Key KSN or RKL DUKPT Key KSN from PINPAD or Card Reader to get the Master DUKPT Key KSN from PINPAD.

Response:

Result byte	If success, return ACK. If failed, return NAK <Error Code>
Task ID	'56' or '57'
	'46'
Function ID	'3E'
Length	Length of DUKPT KSN
Data	DUKPT KSN

11.4 Activate and Deactivate Removal Sensor

Command:

Task ID	'76' or '56'
	'46'
Function ID	'45'
Length	Length of data
Data	• Length of Operator ID
	• Operator ID
	• Length of Removal Sensor control
	• Removal Sensor control: Reactivate-0, Deactivate-1
	• Length of Removal Sensor control timeout
	• Removal Sensor control timeout, in second
	• Length MAC-PINPAD
	• MAC-PINPAD

Response:

Result byte	If success, return ACK.
	If failed, return NAK <Error Code>
Task ID	'67' or '65'
Function ID	'45'
Length	Length of data
Data	If Card Reader command checks pass, else data not present.
	• Length of MAC -CR
	• MAC -CR

Note:
1. For command between PINPAD-CR and HOST-CR, and when this command is between PINPAD-CR, PINPAD is the master, and CR is the slave.
2. If the removal sensor is activated and removal sensor is not engaged, Reader will see the event as tamper event and erase all the sensitive information like all established / temporal keys, PAN and PIN, and set state to unauthenticated state.
3. If the removal sensor is deactivated and removal sensor is not engaged, the Reader won't erase any sensitive information, but it will disable any PIN related operation. The state of Reader keeps the same. By default, card reader is at the status of deactivate removal sensor.
4. Operator ID is an 8-byte hexadecimal byte array. Because the PIN pad doesn't support account management (no Operator ID supported), it sends all 0 as Operator ID1 to indicate this case and UID/HostID as the Operator ID2.
5. Sensor control timeout: A timeout within which the dual control needs to be finished.

11.5 Handicap Assistant Signal

Output:

Result byte	ACK
Task ID	'57'
	'46'
Function ID	'50'
Length	0
Data	None

Note: This command is used to respond with buzzer beeps for a key pressed, and it just responds when connected with host. This command applies to following commands:
- Get Encrypted PIN
- Get Numeric with Display Message DisplayMessage and Get Numeric Key DisplayMessage and Get Amount
- Get Function Key

11.6 Display and Get Key (command only between CR-PINPAD)

Command:

Task ID	'25'
	'46'
Function ID	'B0'
Length	Length of data
Data	- Display mode 1: Menu Display 2: Normal Display get function key 3: Display without key input ~~4: Normal Display get account number~~ ~~5: Normal Display get numeric key~~ 8: Language Menu Display 16: Clear Screen (Do Not Receive Input Data) - If Normal Display or Menu Display, Length of Total timeout for keypad entry. - If Normal Display or Menu Display, Total timeout for keypad entry, in second, little endian, default is 30 seconds. **Note:** Total timeout will cancel keypad entry and return error. - If Normal Display or Menu Display, Length of minor timeout during each keypad entry - If Normal Display or Menu Display, minor timeout during each keypad entry, in second, little endian, default is 10 seconds. **Note:** Minor timeout will erase all previous keypad entry.

	- Length Display Message Language - Display Message Language, 2 bytes: - EN - English (default) - ES – Spanish - ZH – Chinese - FR - French - Length Display Message Control (0-No Message display) - Display Message Control: repeatable combination of <Line><Message><0x1C> <Line> - Display line number (1-First Line, n-nth Line), Maximum 16 lines. - The lower 7 bits is for line number. The MSB is to indicate following message is a Message String or Message ID. - MSB – 0: Message String. - MSR – 1: Message ID. <Message> - Message String or Message ID. - Message String: character in the range of 0x20 – 0x7f, Maximum 16 characters **Note:** 1: For "Language Menu Display", external display should extend the Message String to full string. For example: - EN – English - ES – Español - ZH – 中文 - FR - Francais 2: For display Message, it is not allowed to have empty display message before max line. Message ID: 1 byte, check <u>LCD Foreign Language Mapping Table</u> <0x1C> - separator - Length Back Light On TimerValue, 2 bytes - Back Light On TimerValue in second, little endian (all 0-Back Light Off, all 0xff-Back Light always On) - Mask the keypad entry with '*': 1 byte 0 - Don't mask 1 - Mask **Note:** The flag works for "Normal Display get account number" and "Normal Display get numeric key".

Response:

Result byte	If success, return ACK. If failed, return NAK <Error Code>
Task ID	'52'
	'46'
Function ID	'B0'
Length	Length of data

Data	• Display mode
	    0: Cancel (user presses cancel key on the keypad for mode 1, 4 and 5)
	    1: Menu Display
	    2: Normal Display get function key
	    3: Display without key input
	    4: ~~Normal Display get account number~~
	    5: ~~Normal Display get numeric key~~
	    8: Language Menu Display
	    16: Clear Screen (Do Not Receive Input Data)
	
	    Note: If Mode byte is "Cancel", there's no need to send the field below, but MAC is required.
	
	• If Normal Display, Length of Key (for function key, length is 1)
	• If Normal Display, Key0...KeyN, ASCII format
	• If Menu Display, Length of Menu value
	• If Menu Display, Menu value, sequence number of selected lines, hex format

Note:
1. This command should be issued after CR and PINPAD have established MAC Key .
2. In response to this command, PINPAD will control its LCD display.
3. When display message has more characters than the LCD screen can support, use F1 key as page up and F2 key as page down.

Function Key Value, ASCII of the 1st character:

Cancel:	0x43
Backspace:	0x42
Enter:	0x45
#:	0x23
*:	0x2A
F1 (pg up):	0x46
F2 (pg dn):	0x47
F3:	0x48

11.7 Get PIN (command only between CR-PINPAD)

Command:

Task ID	'65'
	'46'
Function ID	'AE'

Length	Length of data

Data	• Mode byte:
	     o 0x00 – Cancel (cancel through command)
	     o 0x01 - Online PIN DUKPT (0x81 for NON-PINBYPASS)
	     o 0x02 - Online PIN MKSK (0x82 for NON-PINBYPASS)
	     o 0x03 - Offline PIN (0x83 for NON-PINBYPASS)
	 • If Mode byte is "Cancel", the field below is unnecessary.
	 • If Online PIN, Length of DATA_PAIRING_DUKPT KSN
	 • If Online PIN, DATA_PAIRING_DUKPT KSN
	 • If Online PIN, Length of encrypted Truncated PAN If Online PIN, Encrypted Truncated PAN
	     o If Online PIN, Length of Host ID
	     o If Online PIN, Host ID
	 • Length start PIN input timeout
	 • Start PIN input time out in seconds
	 • Length PIN entry interval
	 • PIN entry interval in seconds
	 • Length Display Message Language
	 • Display Message Language, 2 bytes
	 • EN - English (default) ES - Spanish
	 • ZH - Chinese FR - French
	 Note: the Display Message appears as follows:
	 English – "ENTER PIN:"
	 French – "ENTRER PIN:"
	 Spanish – "ENTRAR NPI:"
	 Chinese – "请输入密码"
	 • Length MAC-CR
	 • MAC-CR
	 • Length of KSN
	 • KSN

Response:

Result byte	If success, return ACK. If failed, return NAK <Error Code>.
Task ID	'56'
Function ID	'AE'
Length	Length of data

Data	• If Mode byte is "Cancel", the field below is uneccessary. If Mode byte is "Online PIN", PIN_KEY is PIN_DUKPT_KEY. If Mode byte is "Offline PIN", PIN_KEY is PIN_PAIRING_DUKPT_KEY.
	 • Mode byte:
	     o 0x00 – Cancel (Can be cancel through command or user presses cancel key on the keypad)
	     o 0x01 - Online PIN DUKPT (0x81 for NON-PINBYPASS)
	     o 0x02 - Online PIN MKSK (0x82 for NON-PINBYPASS)
	     o 0x03 - Offline PIN (0x83 for NON-PINBYPASS)
	 • If Online PIN DUKPT, Length of PIN_DUKPT_KEY KSN; if Offline PIN, Length of PIN_PAIRING_DUKPT_KEY.
	 • If Online PIN DUKPT, PIN_DUKPT_KEY KSN; if Offline PIN, PIN_PAIRING_DUKPT_KEY KSN.

		• Length Enciphered PIN • Enciphered PIN • Length KeyID (If Desjardins Session is loaded) • KeyID (If Desjardins Session is loaded) • Length MAC-PINPAD • MAC- PINPAD

180 seconds is the suggested timeout for starting PIN input. After PIN input starts, 20 seconds the suggested timeout for finishing PIN input.

Note:

11.7.1 Plain text of Truncated Primary Account Number (PAN) pack

Bit

1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	64
0	0	0	0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	

A1 ... A12 = Account number - Content is the 12 right-most digits of the primary account number (PAN) excluding the check digit. A12 is the digit immediately preceding the PAN's check digit. If the PAN excluding the check digit is less than 12 digits, the digits are right justified and padded to the left with zeros. Permissible values are 0000 (zero) to 1001 (9).

11.7.2 Plain text of PIN Block
The plaintext PIN block which will be enciphered shall be formatted as follows 8 bytes:

C	N	P	P	P	P	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F	F	F

Note:

	Name	Value
C	Control field	4 bit binary number with value of 0010 (Hex '2')
N	PIN length	4 bit binary number with permissible values of 0100 to 1100 (Hex '4' to 'C')
P	PIN digit	4 bit binary number with permissible values of 0000 to 1001 (Hex '0' to '9')
P/F	PIN/filler	Determined by PIN length
F	Filler	4 bit binary number with a value of 1111 (Hex 'F')

11.8 Symmetric Key loading

11.8.1 3B – Set Key: Master and Working Key Description
Working key includes PIN/PIN Master /PIN Pairing/ Data Pairing/ MAC Key.

This command should be issued after the Card Reader and PINPAD have established the RKL_DUKPT_KEY.

Note:

Yellow: Optional block-KeyIndex Green: Optional block-KeySlot Red: Optional block-KSN/KeyID

KBH for Master DUKPT Key: B0136B1TX00E0300010800000208000KS18FFFF9876543210E00000

KBH for PIN DUKPT Key: B0136B1TX00E03000108000102080000KS18FFFF0000000000000000

MK/SK PIN Master Key: B0112K0TB00E0200010800080208000

DATA Pairing DUKPT Key: B0136B1TX00E03000108000402080000KS18FFFF0000000000000000

PIN Pairing DUKPT Key: B0136B1TX00E03000108000302080000KS18FFFF0000000000000000

Command:

Task ID	'65' or '75'
Function ID	'3B'
	'46'
Length	Length of data
Data	• Length of Encrypted key ASN.1BLK • Encrypted key ASN.1 BLK, using TR31_B • Length RKL_DUKPT_KEY_KSN • RKL_DUKPT_KEY_KSN

```
Encrypted key ASN.1 structure::= Sequence {
      Encrypted key ASN.1 structure version = 1 (INTEGER) Keys ::= Set {
            keyinfo ::= Sequence {
                  TR31Key = (PRINTABLESTRING)
                  keyType = (INTEGER)
                  ksn = (OCTET STRING) -- If keyType is not DUKPT,
                  00000000000000000000
                  keySlot = (INTEGER)
                  keyName = (PRINTABLESTRING) KCV = (OCTET STRING) -- 2 bytes
            }
      }
}
```

Response 1:

Result byte	If success, return ACK. If failed, return NAK <Error Code>
Task ID	'56' or '57'
	'46'
Function ID	'3B'
Length	Length of data
Data	KCV ASN.1 structure

```
KCV ASN.1 structure::= Sequence {
      KCV ASN.1 structure version = 1 (INTEGER) Keys ::= Set {
            keyinfo ::= Sequence {
                  keyName = (PRINTABLESTRING)
                  errorCode = (INTEGER) --'0' signifies a successful load
```

```
                    errorMessage = (PRINTABLESTRING)
                    KCV = (OCTET STRING) -- 3 bytes, algorithm refer to x9.24
            }

        }
}
```

11.8.2 **3C – Set Working Key**

Working key includes PIN/PIN Master /PIN Pairing/ Data Pairing/ MAC Key.
This command should be issued after the Card Reader and PINPAD have established the
CR_PINPAD_MASTER_DUKPT_KEY.

Note:
Yellow: Optional block-KeyIndex Green: Optional block-KeySlot Red: Optional block-KSN/KeyID

KBH for PIN DUKPT Key: B0136B1TX00E0300010800010208000KS18FFFF0000000000000000

MK/SK PIN Master Key: B0112K0TB00E0200010800080208000

DATA Pairing DUKPT Key: B0136B1TX00E0300010800040208000KS18FFFF0000000000000000

PIN Pairing DUKPT Key: B0136B1TX00E0300010800030208000KS18FFFF0000000000000000

MAC Key: B0136B1TX00E0300010800050208000KS18FFFF0000000000000000

Command:

Task ID	'65' or '75'
Function ID	'3C'
	'46'
Length	Length of data
Data	• Length of Encrypted key ASN.1BLK
	• Encrypted key ASN.1 BLK, using TR31_B
	• Length MASTER_DUKPT_KEY_KSN
	• MASTER_DUKPT_KEY_KSN

```
Encrypted key ASN.1 structure::= Sequence {
      Encrypted key ASN.1 structure version = 1 (INTEGER) Keys ::= Set {
          keyinfo ::= Sequence {
                TR31Key = (PRINTABLESTRING)
                keyType = (INTEGER)
                ksn = (OCTET STRING) -- If keyType is not DUKPT,
                00000000000000000000
                keySlot = (INTEGER)
                keyName = (PRINTABLESTRING) KCV = (OCTET STRING) -- 2 bytes
          }
      }
}
```

Response 1:

Result byte	If success, return ACK. If failed, return NAK <Error Code>
Task ID	'67' or '56' or '57'
	'46'
Function ID	'3C'
Length	Length of data
Data	KCV ASN.1 structure

```
KCV ASN.1 structure::= Sequence {
     KCV ASN.1 structure version = 1 (INTEGER) Keys ::= Set {
     keyinfo ::= Sequence {
                keyName = (PRINTABLESTRING)
                errorCode = (INTEGER) --'0' signifies a successful load
                errorMessage = (PRINTABLESTRING)
                KCV = (OCTET STRING) -- 3 bytes, algorithm refer to x9.24
          }
     }
}
```
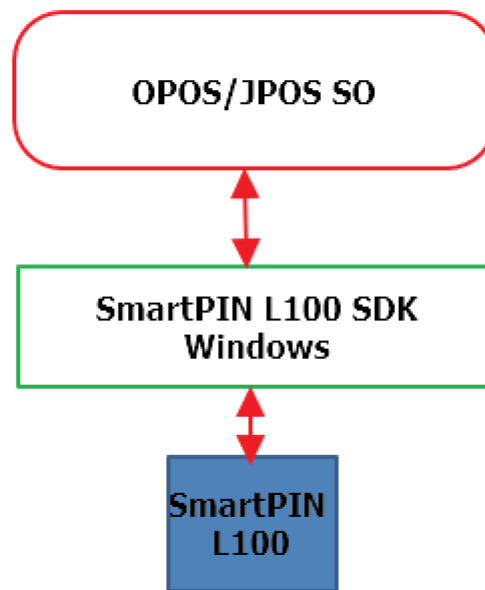
12 Appendix B: OPOS/JPOS

OS: Windows 7 or later, 32 bit and 64 bit
UPOS version: 1.14
JRE : Java 8 or later

Both OPOS and JPOS are supported.

12.1.1 Methods, Properties and Events

AutoDisable	Unsupported
CapCompareFirmwareVersion	Unsupported
CapPowerReporting	Unsupported
CapStatisticsReporting	Unsupported
CapUpdateFirmware	Unsupported
CapUpdateStatistics	Unsupported
CheckHealthText	Full
Claimed	Full
DataCount	Full
DataEventEnabled	Full
DeviceEnabled	Full
FreezeEvents	Full
OutputID	Unsupported
PowerNotify	Unsupported
PowerState	Unsupported
State	Full
DeviceControlDescription	Full
DeviceControlVersion	Full

DeviceServiceDescription	Full
DeviceServiceVersion	Full
PhysicalDeviceDescription	Full
PhysicalDeviceName	Full
CapDisplay	Full
CapKeyboard	Unsupported
CapLanguage	Full
CapMACCalculation	Unsupported
CapTone*	Unsupported
AccountNumber	Full
AdditionalSecurityInformation	Full
Amount	Full
Currency	Full
AvailableLanguagesList	Full
AvailablePromptsList	Full
EncryptedPIN	Full
MaximumPINLength	Full
MerchantID	Full
MinimumPINLength	Full
PINEntryEnabled	Full
Prompt	Full
PromptLanguage	Full
TerminalID	Full
Track1Data	Full
Track2Data	Full
Track3Data	Full
Track4Data	Full
TransactionType	Full
Methods (UML operations)	
open (logicalDeviceName)	Full
close ( )	Full
claim (timeout)	Full
release ( )	Full
checkHealth (level)	Full
clearInput ( )	Full
clearInputProperties ( )	Full
clearOutput ( )	Full
directIO (command, inout data, inout obj object)	Full
compareFirmwareVersion	Unsupported
resetStatistics (statisticsBuffer)	Unsupported
retrieveStatistics (inout statisticsBuffer)	Unsupported
updateFirmware (firmwareFileName)	Unsupported
updateStatistics (statisticsBuffer)	Unsupported
Specific	
beginEFTTransaction (PINPadSystem, transactionHost)	Full
computeMAC (inMsg, outMsg object)	Unsupported

enablePINEntry( )	Full
endEFTTransaction (completionCode)	Full
updateKey (keyNum, key)	Unsupported
verifyMAC (message)	Unsupported
Events (UML interfaces)	
uposeventsDataEvent	Full
uposeventsDirectIOEvent	Unsupported
uposeventsErrorEvent	Full
uposeventsStatusUpdateEvent	Unsupported

*Full: this item is fully supported and functional.
*Unsupported: this item is either not supported or disabled.

13 Appendix C: Clearing the Log

The SmartPIN L100 maintains a log file of administrative events. When this log file becomes full (after approximately 45 logged events), the L100 may fail to enter the Removal Detection mode or may beep twice, then pause, then beep once, when the user attempts to enter a password (indicating that the Log is full).

To clear the Log, send the **78 52 01 51** command to the L100. To do so, follow this procedure:

1. Connect the L100 to the Spectrum Pro using the serial-to-RJ cable.
2. Place the Spectrum Pro in pass-through mode using a **72 46 20 01 00 01** command. A quick way to do this is to launch the [Windows-based U-Demo program (Universal SDK Demo)](#) and select **Device > Send Data Command** from the command tree on the left, as shown below.
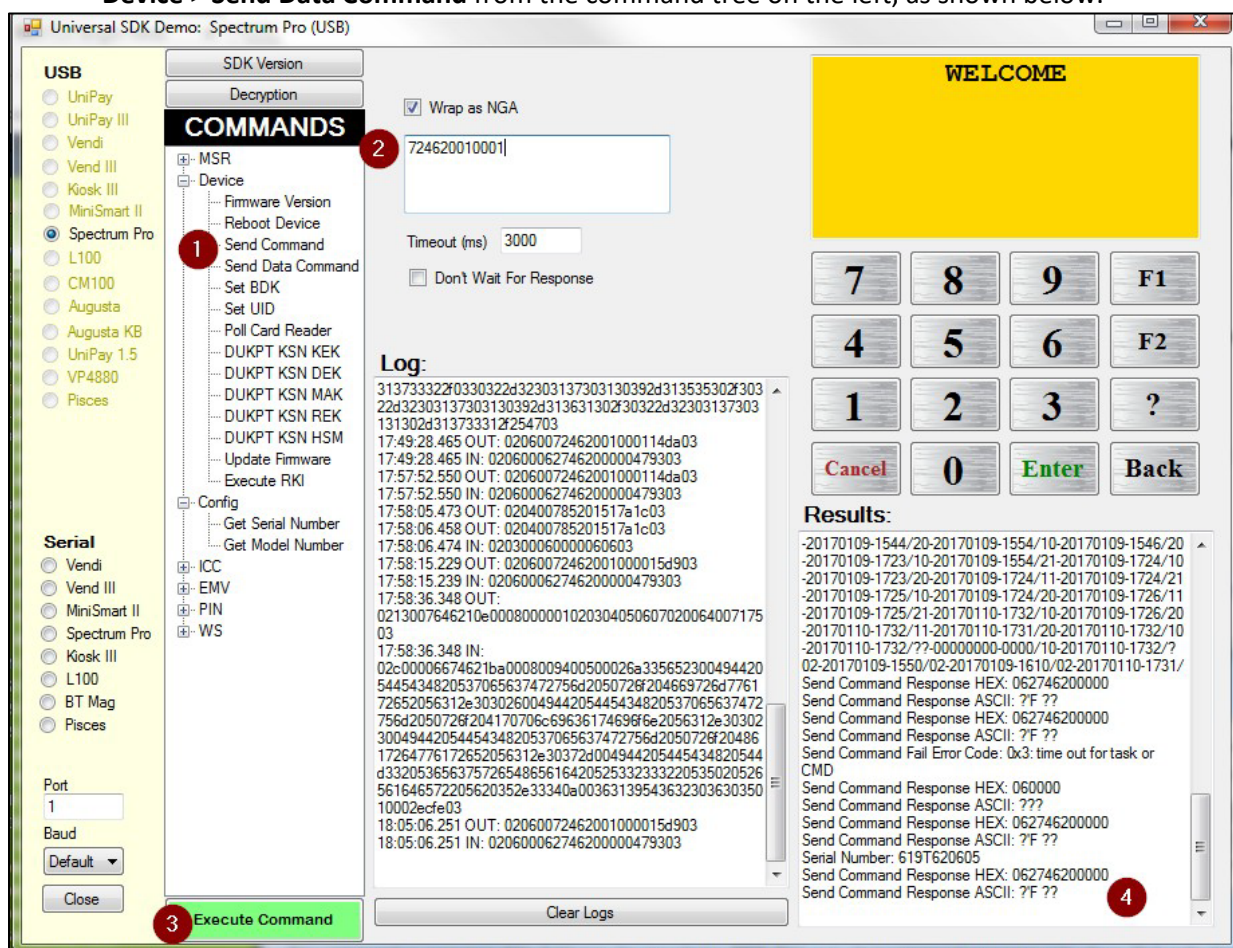
3. Enter the command in the text area (see item 2, above) and select the **Wrap as NGA** checkbox to ensure that the command is properly formatted to send to the device.
4. Click **Execute Command** (item 3) and verify that the command was sent (item 4).
5. After the Spectrum Pro is in pass-through mode, enter the **Clear Logs** command, **78 52 01 51**, in the text area, and click **Execute Command**. See graphic below (items 1, 2, and 3).
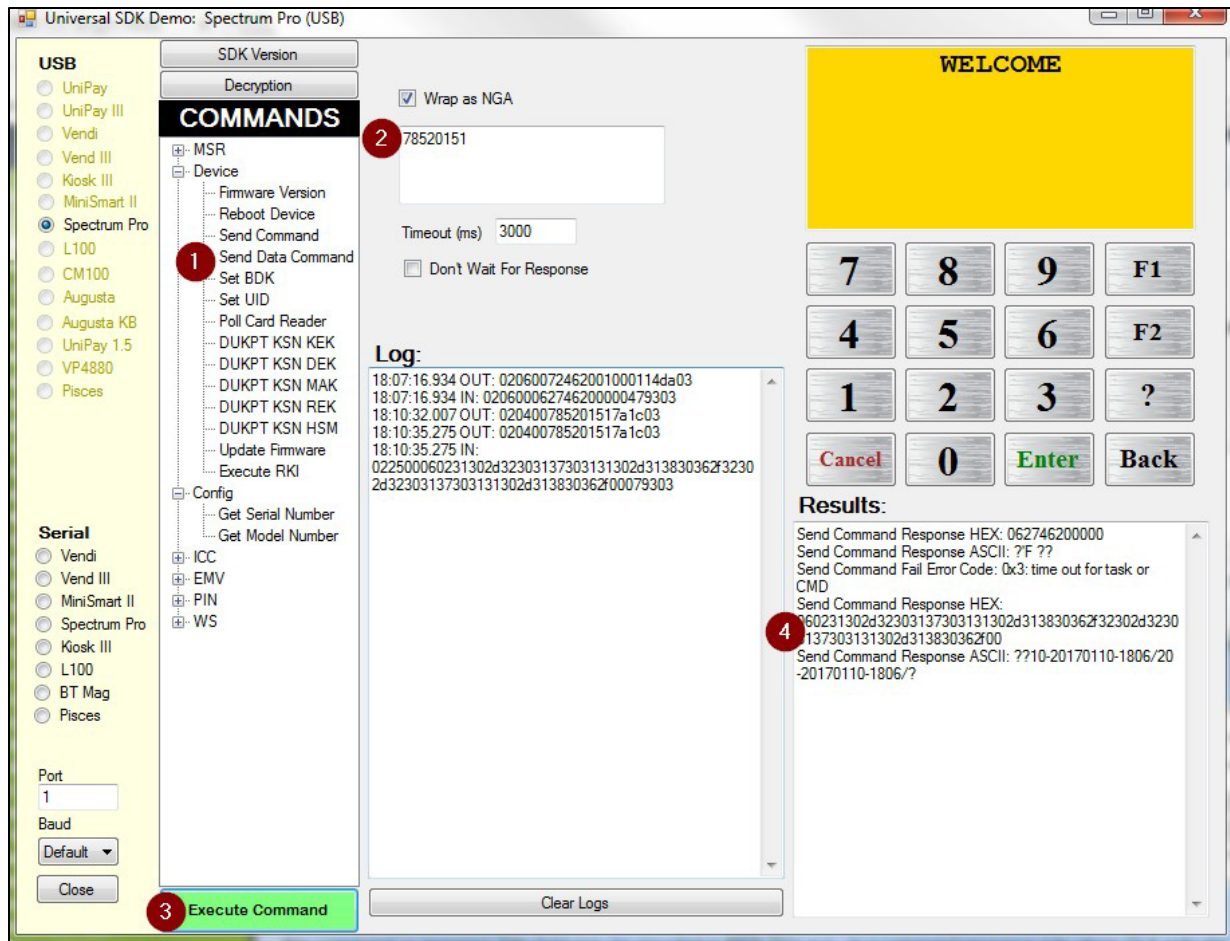
6. Verify that the command was sent (item 4), and that the response includes **ACK (06)**. If you receive a "Send Command Fail Error Code: 0x3: time out for task or CMD" response, make sure your L100 is powered and awake. Repeat the command if necessary.
7. To exit pass-through mode on the Spectrum Pro, enter the command **72 46 20 01 00 00** and click **Execute Command**.