Hardware Development Manual

Sherlock

Fingerprint Scanner (SAP45)

Version 1.1

Revision History

Revision No.	Issue Date	Comments
1.0	2013.7	1.0 Version Preliminary
1.1	2014.3	Reformatted

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1. Introduction

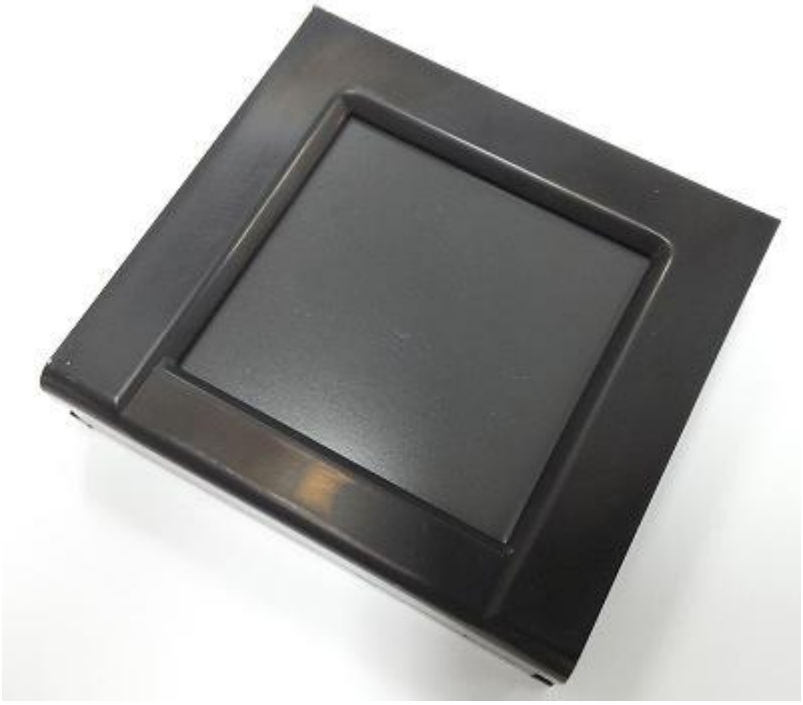

Figure 1: Sherlock

Sherlock utilizes Integrated Biometrics patented LES film with a thin film transistor (TFT) providing the highest forensic-quality roll image in the smallest and lightest form factor available on the market today. Sherlock provides a significant reduction in SWAP (size, weight, & power) when compared to optical scanners.

Sherlock is provided with a full-featured SDK to enable effective integration into applications requiring certified quality images. This product meets the needs for both enrollment and verification applications common in international standards based programs. Sherlock is particularly suited to the many mobile applications where minimal size and weight have significant value. It can also cost-effectively perform all requirements common in Ten Print enrollment applications.

2. Features

- **Lightweight:** designed to have minimal impact on the overall weight or structure of biometric devices
- **Compact:** designed to easily integrate into multiple applications, allowing biometric devices to be smaller and more mobile
- **Durable:** impact-resistant and able to withstand the toughest conditions with minimal maintenance or damage due to scratching or breakdown from contaminants
- **Accurate:** provides accurate high-resolution fingerprint scans in virtually any environment: indirect or direct sunlight, a factory, with dirty or clean fingers
- **Secure:** live finger detection
- **Efficient:** LES fingerprint sensor is not easily confused by foreign matter and contaminants, allowing the sensor surface and the **biometric access control** solution to be essentially maintenance-free. Requires no cleaning for latent prints.

2.1. Hardware Features

- **It can get a fingerprint image with high speed thanks to internal FPGA**
- **The verification of competiablity and interoperability using USB I/F certification**
  - It can get and transfer a fingerprint image most effectively using USB 2.0 interface.
  - It supports USB 2.0 Plug and play.

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2.2. Software Features

- **It can capture single flat fingerprint, single rolled fingerprint, and two flat fingerprints.**
- **High security level**
  - It can distinguish between real and fake fingerprint.
  - U.S patented Contact Light Emitting Sensor
- **High image quality**
  - We get the FBI Appendix F Mobile ID IQS SAP45 certification.
- **Automatic fingerprint capturing**
- **Provide SDK**
  - We provide a SDK for developing Windows & Linux program (Visual Basic, Visual C++, .Net).

3. Applications

- Immigration system
- Electronic ID
- Electronic passport

4. Operational Modes for Sherlock

Sherlock can operate in two modes namely Embedded and Desktop mode. Figure 2 and 3 elaborates the components in each of the modes. At a superficial level Sherlock consists of 5 parts under each mode of operation namely

4.1. Embedded mode

Figure 2: Hardware setup for embedded mode operation

(1) LE Sensor : **L**ight **E**mitting **Sensor**
(2) Sherlock Case
(3) Sherlock USB Connector
(4) Sherlock USB Cable
(5) Sherlock boots

4.2. General (Desktop windows / Linux) mode

Figure 3: Hardware setup for general mode operation

5. Hardware connection setup and Operational Instructions

This section explains the hardware setup and operational instructions for each of the modes.

5.1. Embedded mode

The Sherlock USB connector marked in red, as shown in Figure 4 is used to operate the scanner in the embedded mode. The sequence of the USB connector pins as listed in Table 1 is determined using the color coded wires through each pin.

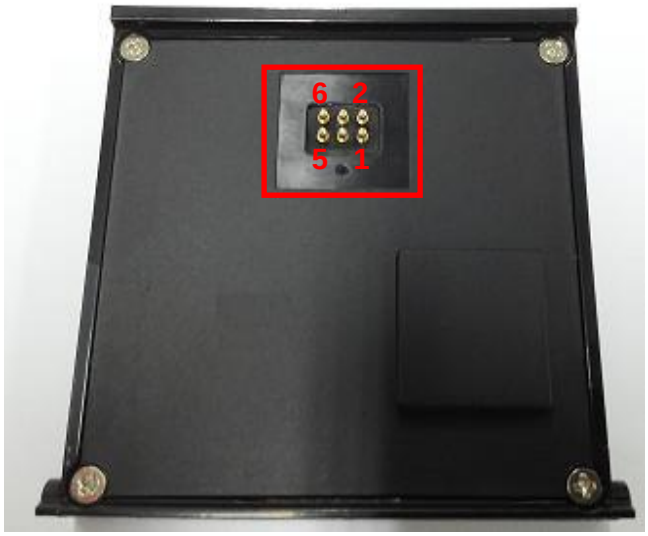


Figure 4: Embedded mode of operation

Table 1: Sherlock embedded pin description

Pin No.	Type	Description
1	G	GND
2	I/O	Wake-UP
3	V_BUS	+5Vdc
4	USB	D-
5	I/O	Shield GND
6	USB	D+

5.1.1 Steps to operate in embedded mode

1. Connect the Sherlock cable to the target board connector
2. Apply wake-up signal to USB connector's pin 5 as shown in Figure 5

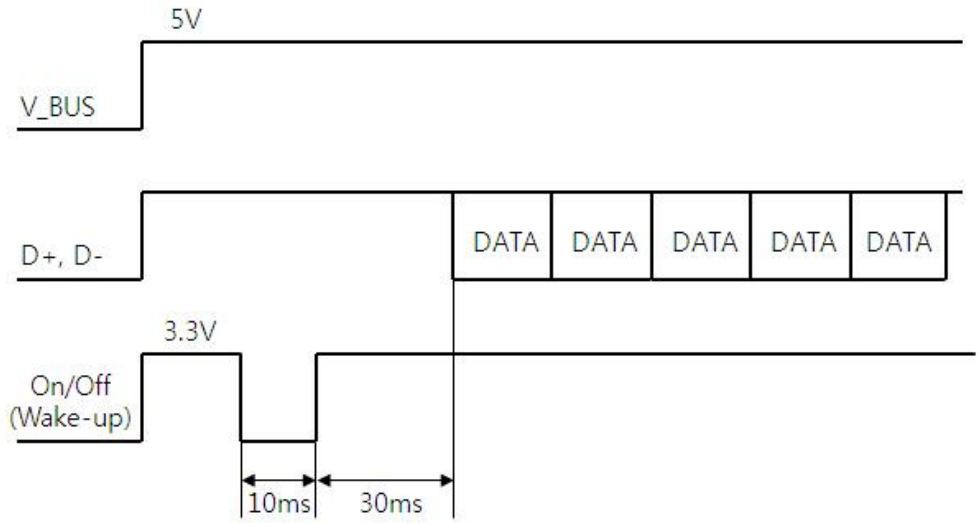


Figure 5: Input/Output to/from USB connector pins

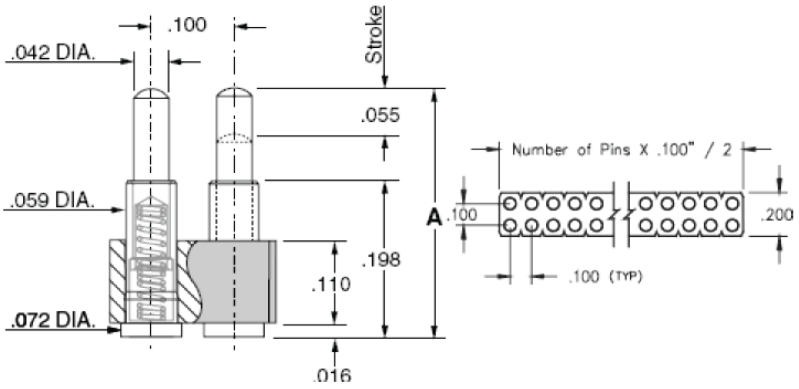
When the "Wake up" signal is set low more than 10ms, the unit is released from "Suspend mode" and after 30ms, Data will be available from D+, and D-.

3. The scanner is now ready to be used with SDK in the embedded mode.

5.1.2 Interconnect Header Specification

The part number and manufacturers information for the pogo pin connector contained within Sherlock is outlined below.

Product Number: 814-22-006-30-000101



Description:
Interconnect Header
Spring-Loaded Header
Double Row
Surface Mount
Plating Code:
22
Shell Plating:
20 µ" Gold over 100 µ" Nickel
Packaging:
Packaged in Tubes

# Of Pins	A	Mill-Max Part Number	RoHS Compliant
6	0.255	814-22-006-30-000101	RoHS 2002/95/EC

Figure 6: Interconnect Header Specification

More information can be found at the following link:

http://www.mill-max.com/

Direct Link to manufacturers datasheet:

814-XX-XXX-30-000101 Datasheet

5.2. General (Desktop windows / Linux) mode

Figure 7: Sherlock with USB cable for general mode

Table 2: Sherlock cable general pin description

Pin No.	Type	Description
1	V_BUS	+5Vdc
2	USB	D+
3	USB	D-
4	G	GND
5	-	NC
6	G	Shield GND

5.2.1 Steps to operate in Desktop mode

1. Install Sherlock SDK if it has not been installed yet.
2. Connect Sherlock to the Desktop using the USB cable
3. Sherlock scanner is ready to be used with the SDK program

6. USB Specification

6.1. Supported OS Driver

Section	Spec.	Remarks
Windows	XP	
	VISTA	
	7	
Linux	Kernel 2.6	

6.2. Recommended specification for PC

Section	Spec.	Remarks
CPU	Pentium4 - 2.0GHz or higher	
Memory	512 RAM or higher	
USB	USB 2.0	

6.3. Minimum specification for PC

Section	Spec.	Remarks
CPU	Pentium4 - 1.0GHz or higher	
Memory	256RAM or higher	
USB	USB 2.0	

7. Specification

7.1. Hardware Specification

Section		Spec.	Remarks
IBNS110	Interface	USB 2.0 High speed Plug & Play	
	Sensor Type	LE Polymer Film	
	Camera	TFT	
	Frames	>10 FPS across 1.5” x 1.6” platen	
	Resolution	500DPI ± 1%	
	Capture area	40mm(W) x 38mm(H), 1.6”(W) x 1.5”(H)	
	Image Size	800(W) x 750(H) pixels	
	Power	USB Level 4.40V ~ 5.25V	
	Static Discharge	IEC61000-4-2 Air Discharge : ±8kV Contact Discharge : ±4kV	
	Sunlight	Has no effect on fingerprint image	
Mechanical	Scanner Package	61.6mm x 65.4mm x 14.3mm (±1mm)	
	Color	Black – Conductive Plastic	
	Product Weight	<55 grams	

7.2. Software Specification

Section	Spec.	Remarks
FBI Certifications	Appendix F Mobile ID IQS SAP45	
API Interface	Capture Two finger	
	Capture roll image	
	BIOAPI 2.0	
Supported Operating System	Windows XP, Windows 7, Vista, Linux	

7.3. Environmental

Section	Spec.	Remarks
Operating Temperature	-10℃ ~ 55℃	
Humidity	20 ~ 95 %RH < 40℃, Non-condensing	
Hazardous Material	RoHS 2002/95/EC Compliant	
Storage Temperature	-30℃ ~ 80℃	

7.4. Electrical DC Characteristics (VDD = 5Vdc, Top = 25℃)

Section		Min.	Typ.	Max.	Unit
Power Supply Voltage (VBUS)		4.5		5.5	V
Full Scanning		-	-	300	mA
Scanner in Sleep Mode		-	-	2	mA
USB only (Driver connection)				70	mA
Wake-Up Line	On/Off V_{IH} (LVTTL)	2		3.6	V
	On/Off V_{IL} (LVTTL)		0.8		V
Grounding		Bezel <5Ω to USB cable shield			
D+ and D-		USB			

8. Mechanical Design Specification

8.1. Embedded mode

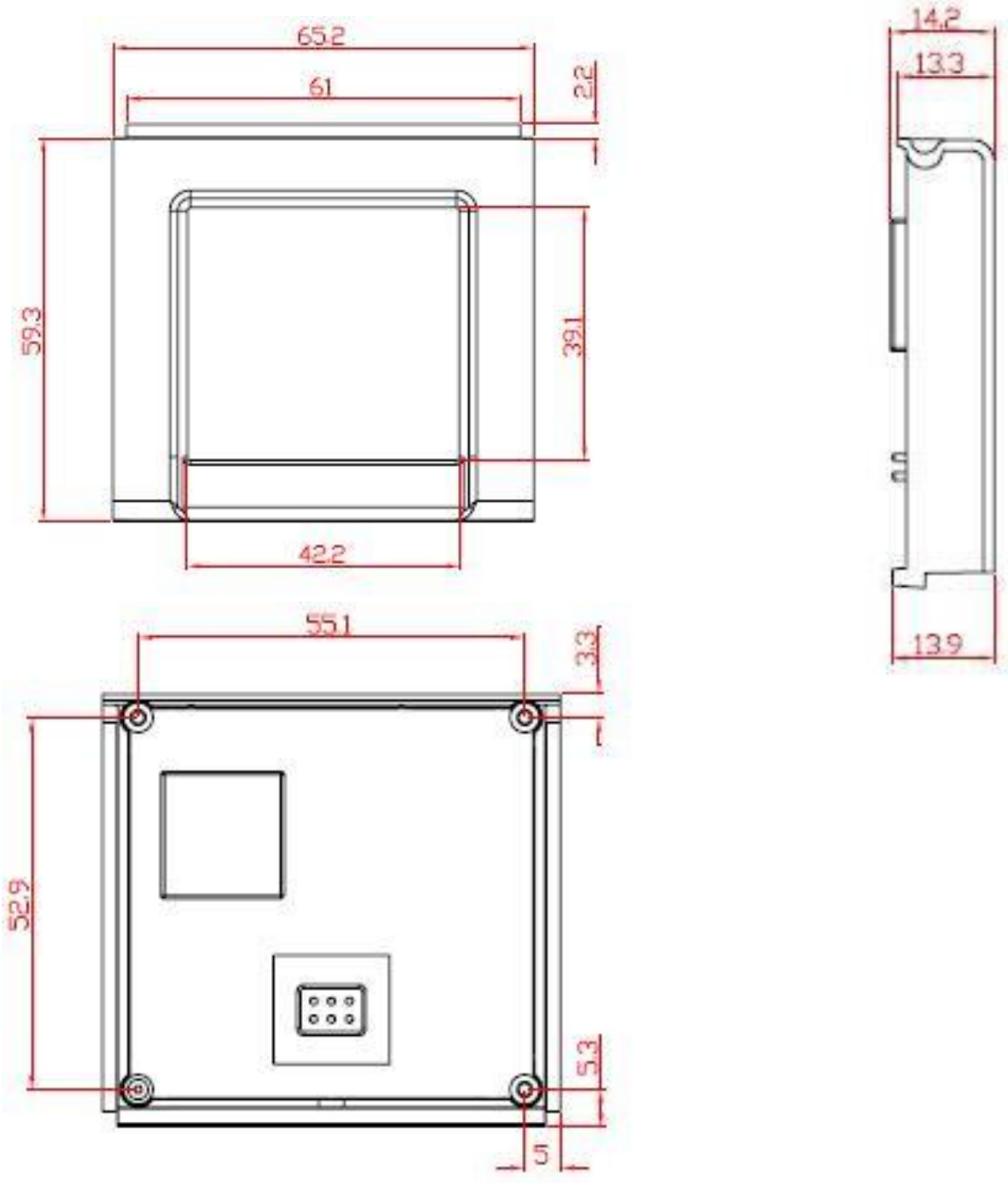


Figure 8: (From top to bottom and left to right) Illustrating Top view, Lateral view, and Frontal view, in sequence for Sherlock scanner

- All dimensions are in mm.
- Drawing is not to scale.

8.2. General (Desktop windows / Linux) mode

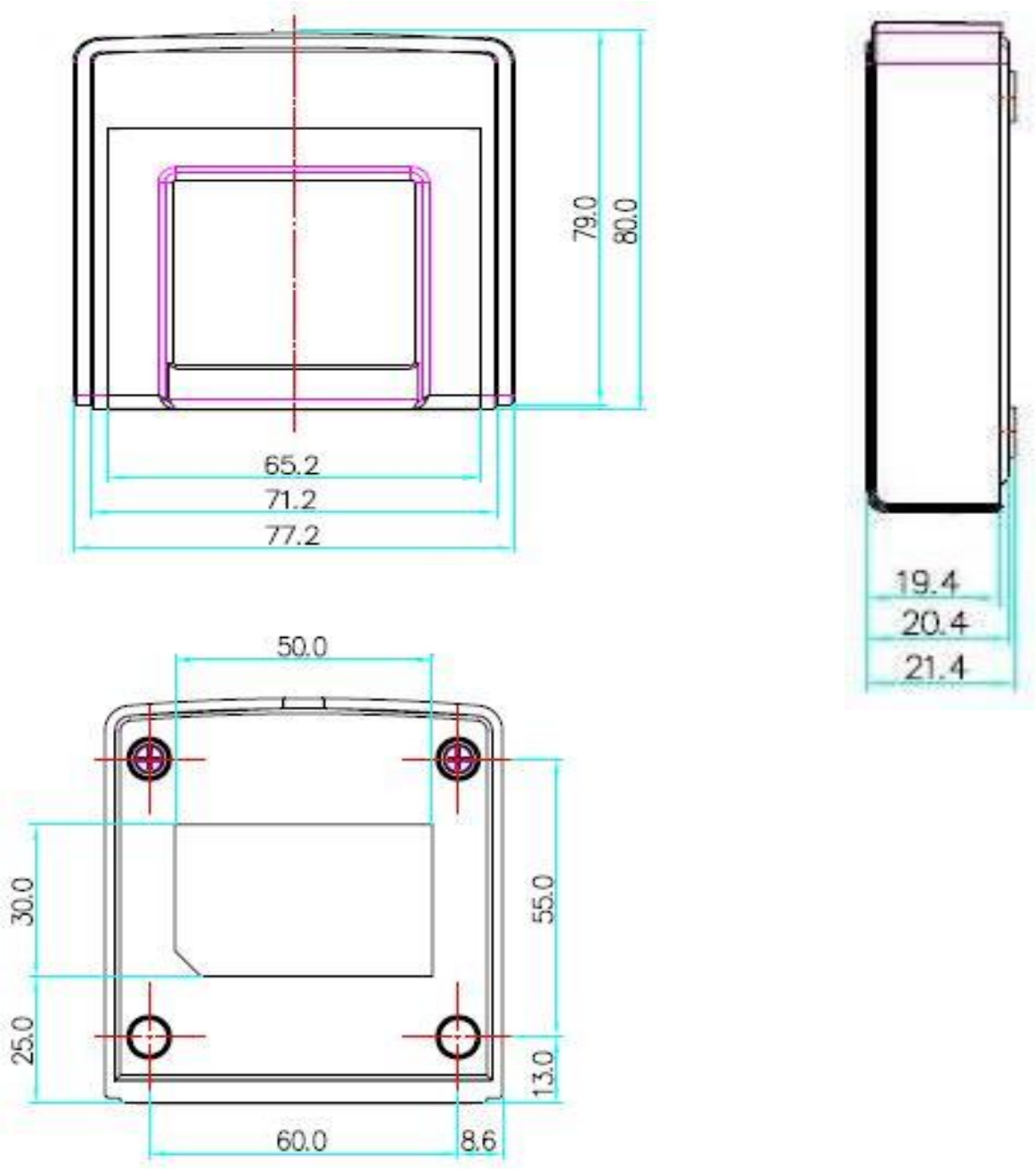


Figure 9: Illustrating Top view for Sherlock scanner in general mode

- All dimensions are in mm.
- Drawing is not to scale.
- Only general mode

9. Block diagram

Furthermore, Figure 10 and 11 show the block diagram of Sherlock scanner under each of the modes of operation. The USB controller is connected either to the target board or the desktop, for each of the modes of operation

9.1. Embedded mode

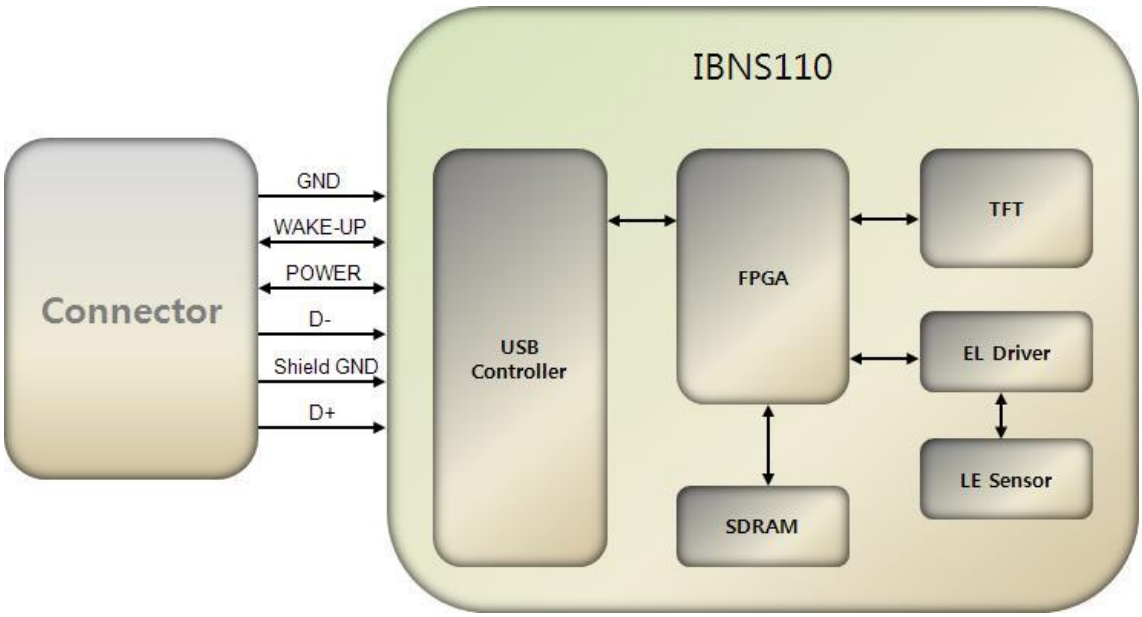


Figure 10: Block Diagram for Embedded mode of operation

9.2. General (Desktop windows / Linux) mode

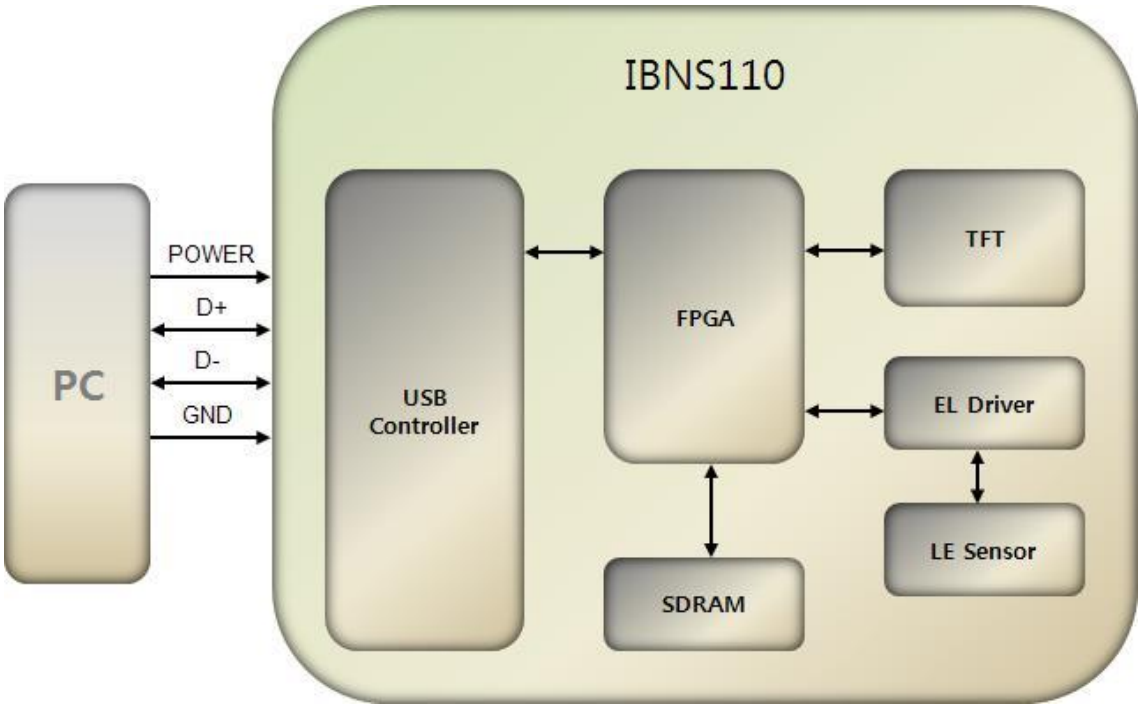


Figure 11: Block Diagram for general mode of operation

10. Frequently Asked Questions

▪ **Product is not working at all**

- Install driver again and connect the USB Scanner to PC and Check ‘Device Manager’, if the driver has installed correctly
- If the driver is not listed under ‘Device Manager’ even though you installed the driver, then connect the USB Scanner to other USB port and check for the driver in ‘Device Manager’. If you still don’t see the driver listed under ‘Device Manager’, please contact our customer service

▪ **Driver has been installed and listed in ‘Device Manager’ but, the fingerprint image is not seen during capture**

- Check for the image after placing the finger correctly on the sensor and the metal frame. The finger must be in contact with both the sensor capture area and the metal frame as shown in Figure 12. Please refer to Table 4 for correct finger positioning on the sensor
- Please contact our customer service, if you cannot see the fingerprint image even though the finger is placed correctly

▪ **Correct fingerprint placement**

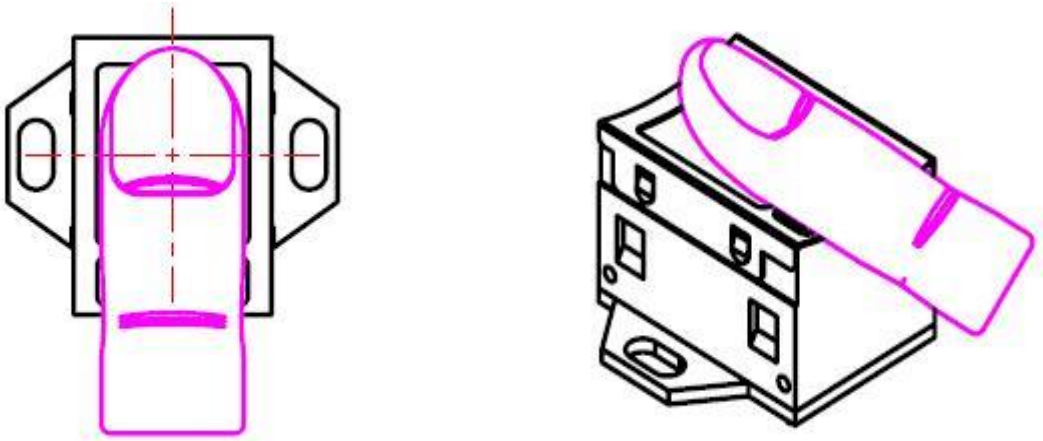
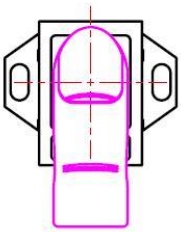
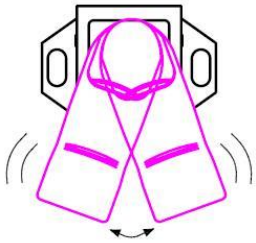
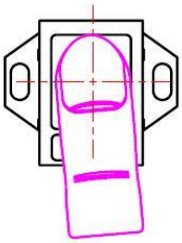
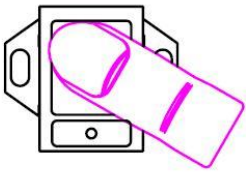
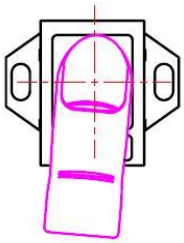
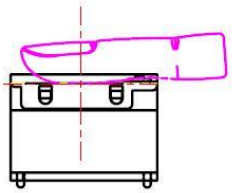
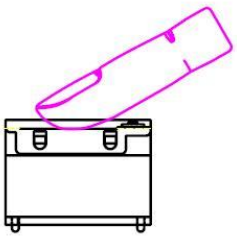
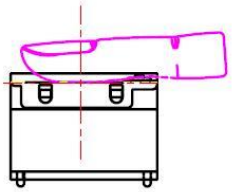
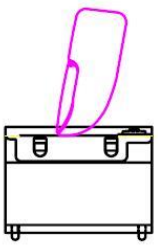


Figure 12: Illustration for correct placement of the finger on the scanner

- Place the finger on the sensor as shown in Figure 12
- Place the finger softly on the sensor and do not apply too much pressure

Table 3: Illustration of Finger positioning on the scanner

Section	Correct	Incorrect
Raked finger		
Rotated finger (±30°)		
		
Finger contact		
		

- **Can wet and greasy finger be identified?**

- Wet and greasy fingers can distort fingerprint patterns a little bit but, IBK algorithm can recover this distortion
- However, if a finger is too wet or too dirty, it interferes with finger capture so please wipe the sweat and oil using dry cloth

- **Which operating systems are supported?**

- Windows XP/Vista/7 and Linux are supported

- **Can USB cable extender be used in the Desktop mode?**

- Yes, but the entire lenght of the USB cable after extension shall not be longer than 5m

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