Hardware Development Manual

Watson Mini

Fingerprint Scanner (SAP45)

Version 1.2



Revision History

Revision No.	Issue Date	Comments
1.0	2012.6	1.0 Version Preliminary
1.1	2013.1	Change specifications
1.2	2014.3	Reformatted

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1. Introduction



Figure 1: Watson Mini

Watson Mini is a USB fingerprint scanner based on the patented LES technology. It can capture single finger flat/roll print, and 2 finger flat prints. The scanner is designed to be durable to vibration impacts and water damage, and can capture images from both wet and dry fingers. It is FBI certified based on the (IAFIS IQS Appendix F) specification. Watson Mini can be used in password based security systems to improve the security level. The scanner is accompanied with the SDK, allowing reliable and high speed fingerprint registration and identification, based on the high performance image processing algorithms to capture and process fingerprint images for identification.

2. Operational Modes for Watson Mini

Watson Mini 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 Watson Mini consists of 4 parts under each mode of operation namely,

(1) LE Sensor : **L**ight **E**mitting **S**ensor
(2) Watson Mini Case
(3) Watson Mini USB Cable
(4) Watson Mini USB Connector

2.1. Embedded mode

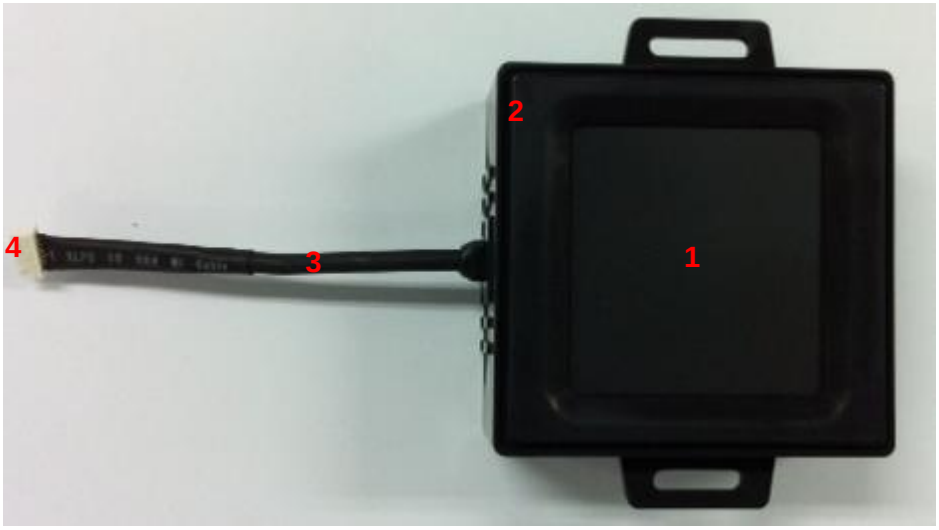


Figure 2: Hardware setup for Embedded mode operation

2.2. Desktop mode (Windows / Linux)



Figure 3: Hardware setup for desktop mode operation

3. Block diagram

Furthermore, Figure 4 and 5 show the block diagram of Watson Mini 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.

3.1. Embedded mode

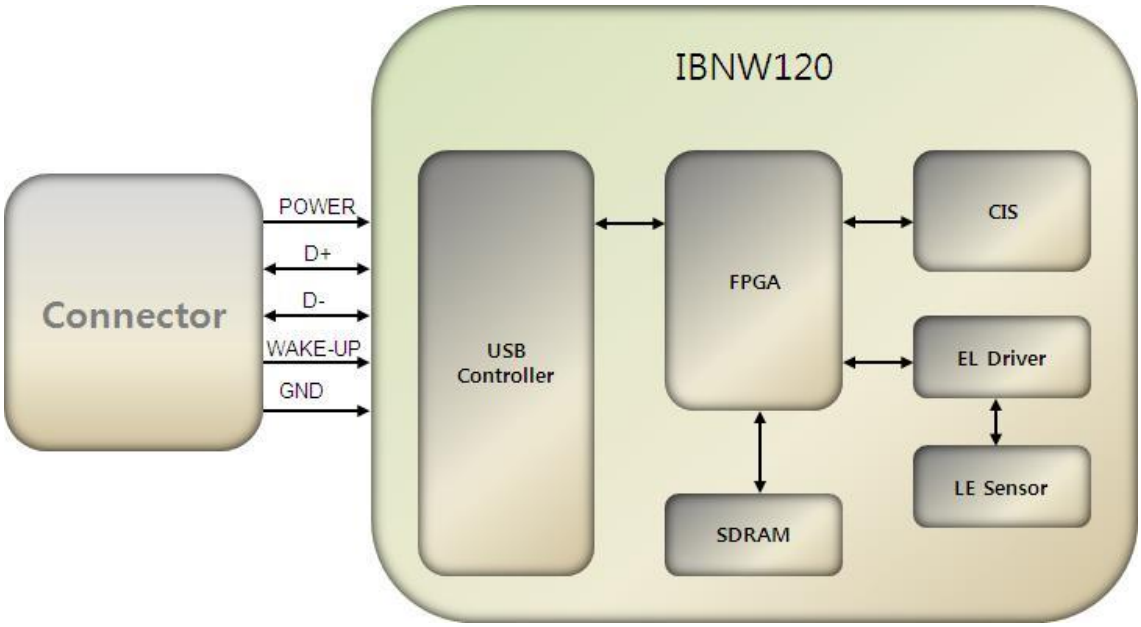


Figure 4: Block Diagram for Embedded mode of operation

3.2. Desktop mode (windows / Linux)

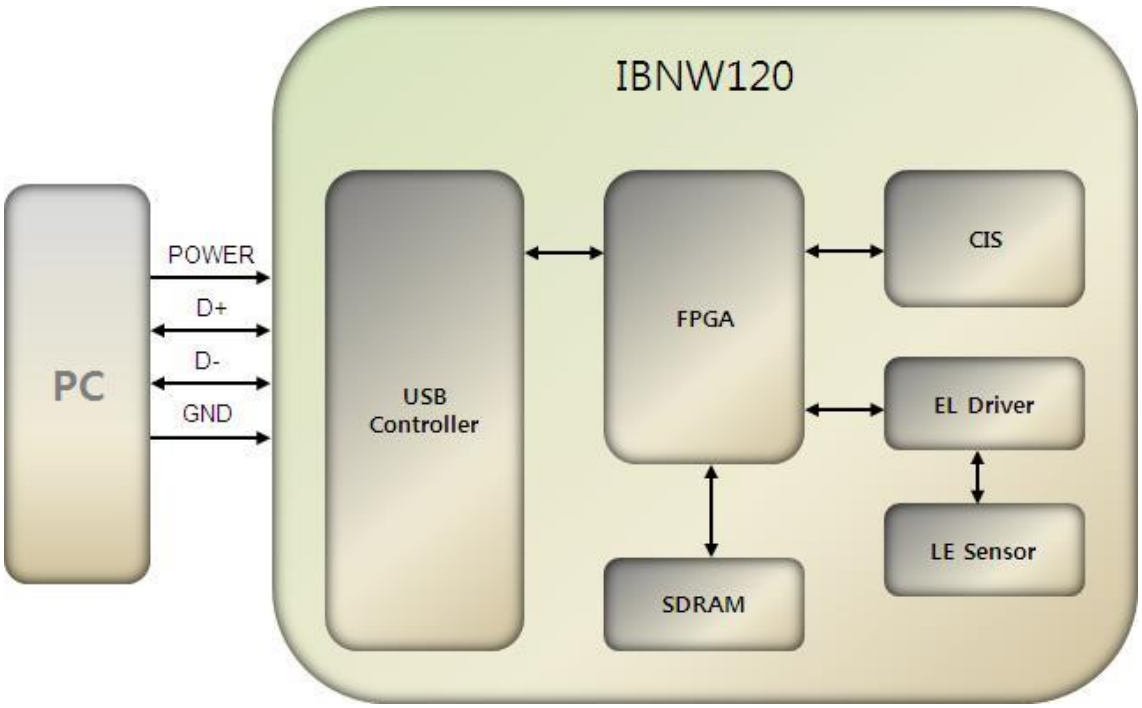


Figure 5: Block Diagram for Desktop mode of operation

4. Hardware connection setup and Operational Instructions

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

4.1. Embedded mode

The Watson Mini 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.

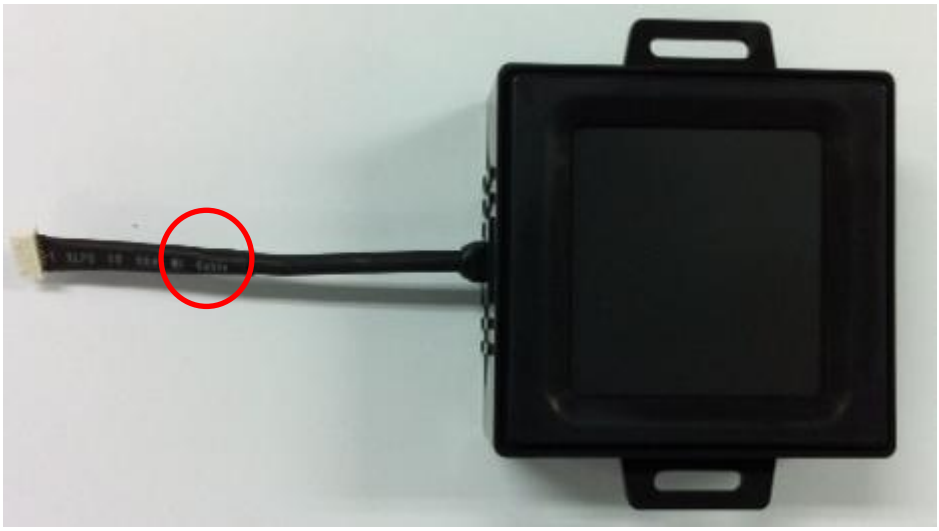


Figure 6: Embedded mode of operation

Table 1: Watson Mini cable Pin Description

Pin No.	Type	Description
1 (Red)	V_BUS	+5Vdc
2 (Green)	USB	D+
3 (White)	USB	D-
4 (Black)	G	GND
5 (Yellow)	I/O	Wake-UP
6 (Black)	G	Shield GND

4.1.1. Example Connection Setup and operational instruction for Watson Mini and Target Board

Figure 7 illustrates the connection setup for Watson Mini and an example target board. J1, J2 are the USB interface connectors and Table 2 lists the pin descriptions followed by the

instructions to operate in the embedded mode Section 4.1.2.

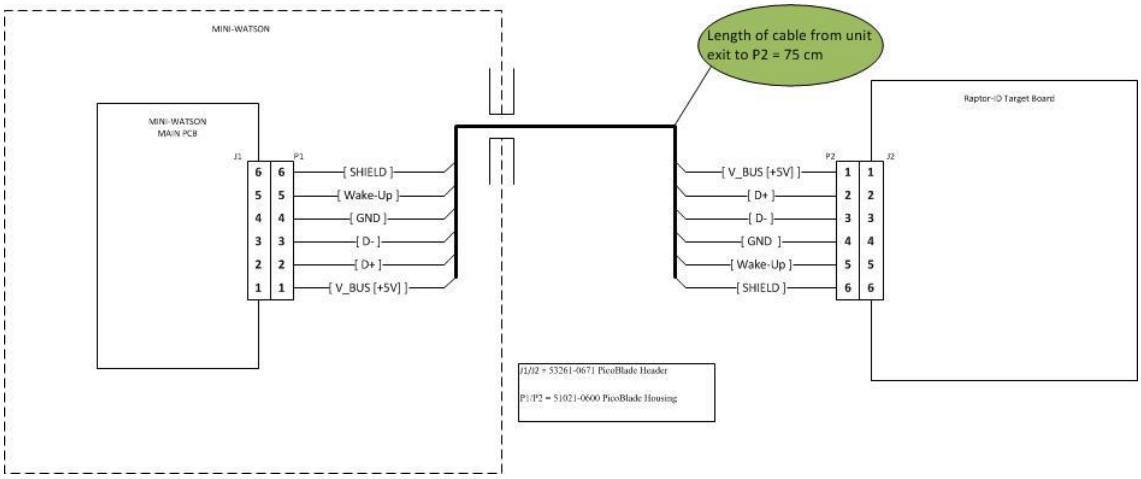


Figure 7: Watson Mini and Target board connection setup

Table 2: J1/J2 Pin description

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

4.1.2. Steps to operate in embedded mode

1. Connect the Watson Mini cable to the target board connector
2. Apply wake-up signal to USB connector's pin 5 as shown in Figure 8

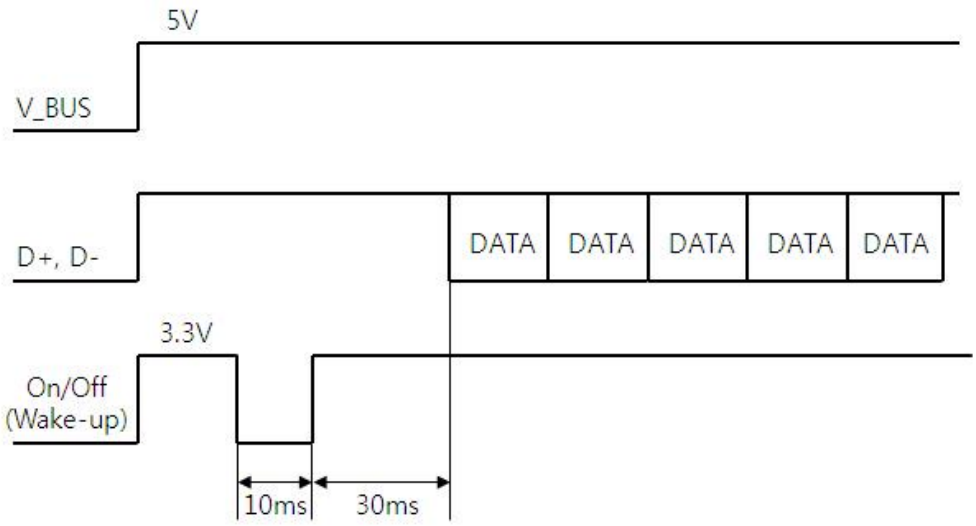


Figure 8: Input/Output to/from USB connector pins

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

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

4.2. Desktop mode (Windows/Linux)



Figure 9: Watson Mini with USB cable for Desktop mode

Table 3: Watson Mini cable 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

4.2.1. Steps to operate in Desktop mode

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

5. USB Scanner Requirements

5.1. Supported OS driver

Operating System	Version	Remarks
Windows	XP	
	VISTA	
	7	
Linux	Kernel 2.6	

5.2. Recommended specification for PC

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

5.3. Minimum specification for PC

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

6. Specifications

6.1. Hardware Specification

Section		Spec.	Remarks
IBNW120	Interface	USB 2.0	
	Frames	15 FPS	
	Power	USB Level 4.40V ~ 5.25V	
	Static Discharge	IEC61000-4-2 Air Discharge : ±15kV Contact Discharge : ±8kV	
	Sensor Type	Light Emitting Sensor (LES)	
	Resolution	500PPI	
	Capture area	1.6” x 1.5”	
	Image Size	800 x 750 pixels	
Product Weight		Less than 200 grams	

6.2. Software Specification

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

6.3. Operating Weather Conditions

Section	Spec.	Remarks
Operating Temperature	-20℃ ~ 60℃	
Humidity	30 ~ 85 %RH < 40℃ Non-condensing	
Hazardous Material	RoHS Compliant	
Storage Temperature	-30℃ ~ 80℃	

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

Section	Min.	Typ.	Max.	Units
Power Supply Voltage (VBUS)	4.5		5.5	V
Full Scanning	-	-	300	㎃
Scanner in Sleep Mode	-	-	2	㎃
USB only (Driver connection)			40	㎃
On/Off VIH (LVTTL)	2			V
On/Off VIL (LVTTL)		0.8		V
On/Off MAX (LVTTL)			3.6	V
D+ and D-	USB			

7. Features

7.1. Hardware Features

- **Watson Mini uses high speed internal FPGA**
- **The verification of compatiablity and interoperability based on USB I/F certification**
  - It captures and transfers a fingerprint image most effectively using USB 2.0 interface
  - It supports USB 2.0 Plug and play

7.2. Software Features

- **It captures single flat, single rolled, and two flat fingerprints**
- **High security level**
  - It distinguishes between real and fake fingerprint
  - U.S patented Contact Light Emitting Sensor
- **High image quality**
  - FBI Appendix F Mobile ID IQS SAP45 certification
- **Automatic fingerprint capture**
- **SDK**
  - Aiding Windows & Linux application development
  - Languages supported: Visual Basic, Visual C++, .Net

8. Applications

- Immigration system
- Electronic ID
- Electronic passport

9. Mechanical Design Specifications

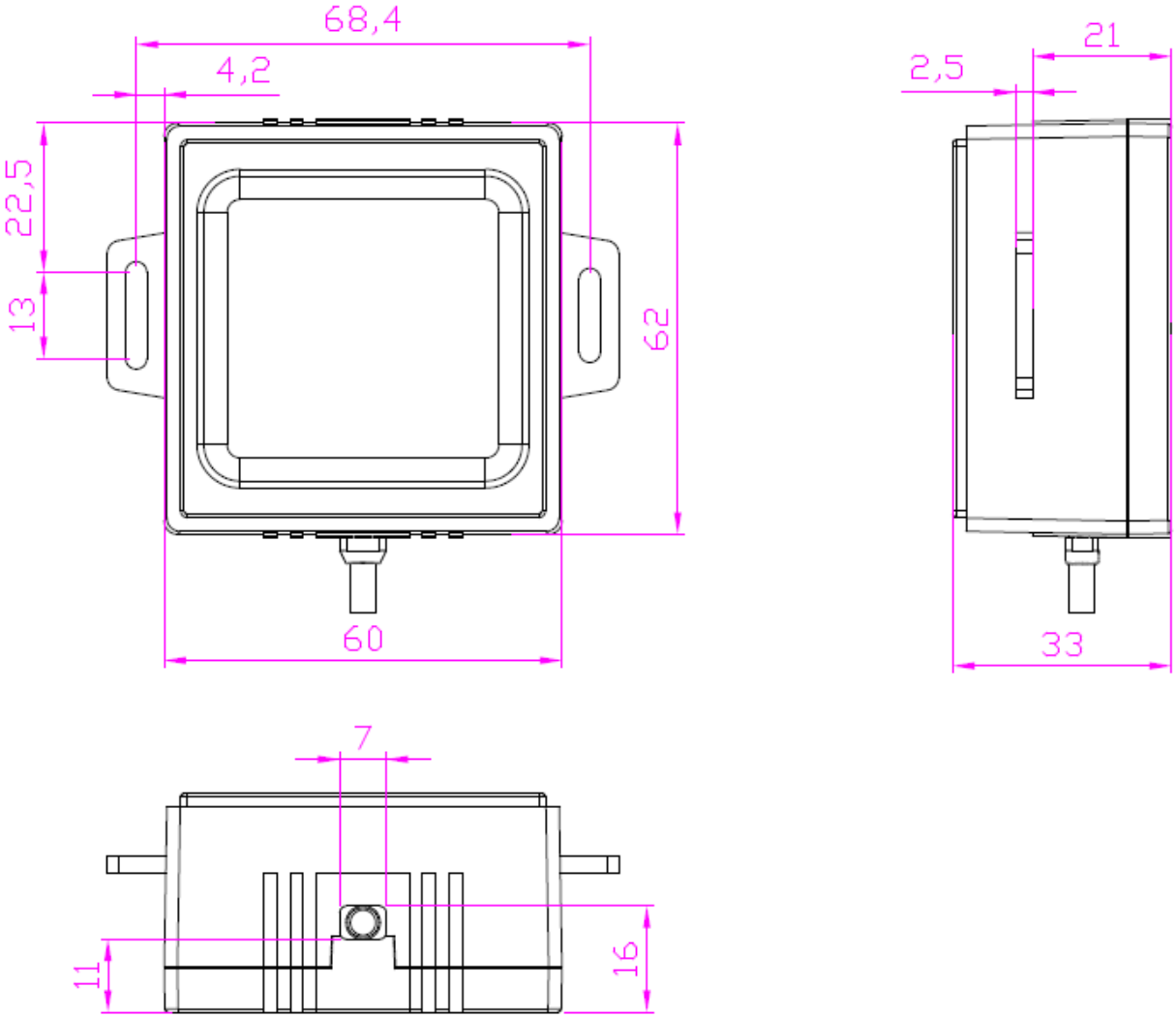


Figure 10: (From top to bottom and left to right) Illustrating Top view, Lateral view, and Frontal view, in sequence for Watson Mini scanner

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

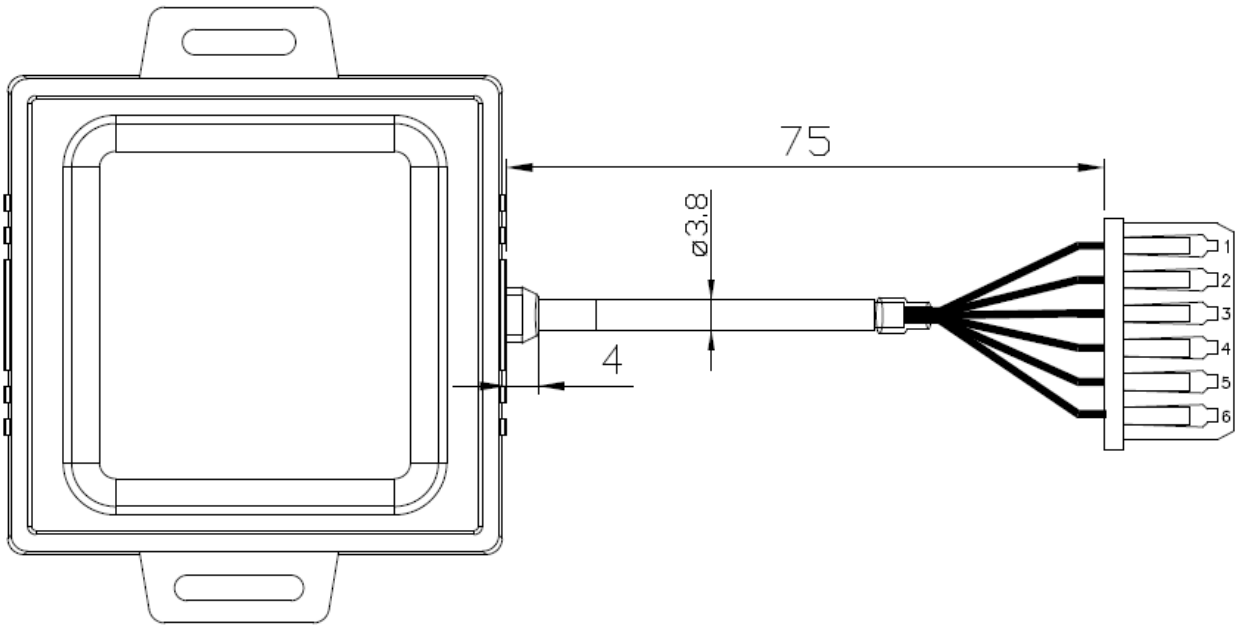


Figure 11: Illustrating Top view for Watson Mini scanner in embedded mode

- All dimensions are in mm.
- Drawing is not to scale.
- Tolerance for cable length is ±5mm

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

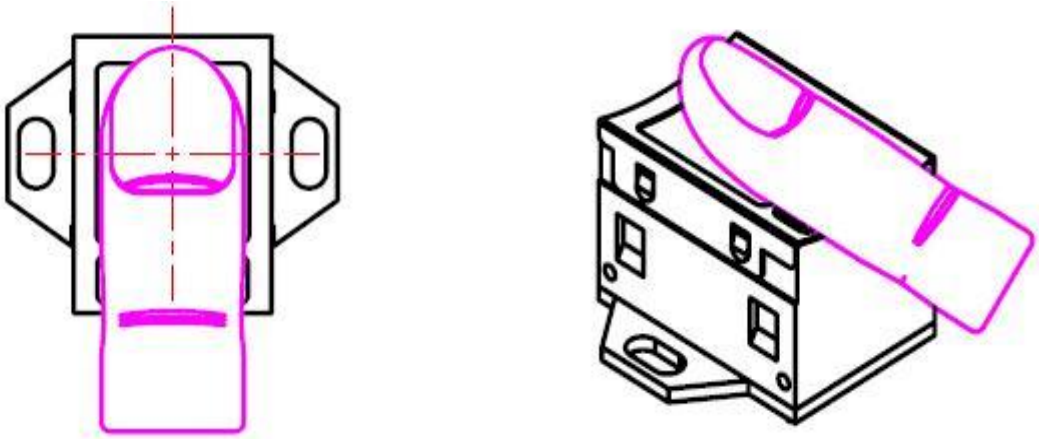
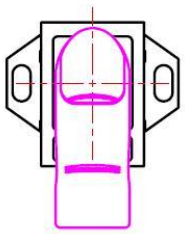
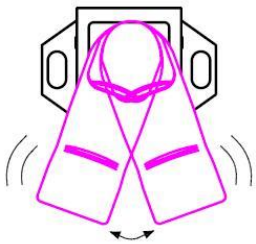
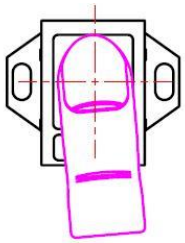
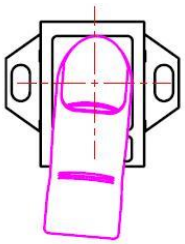
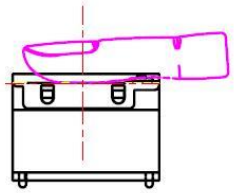
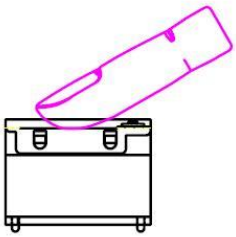
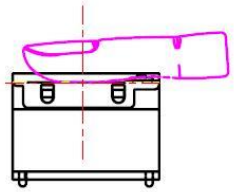
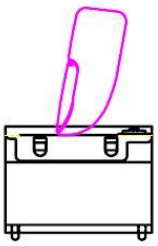


Figure 12: Illustration for correct placement of the finger on the scanner

- 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 4: 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 and higher, Linux, and Android 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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