![BRS Bio Recognition Systems logo]

TECHNICAL TIPS

PRODUCT: **BioLock+ Standalone**

Subject: **Enrolment**

Date: **7ᵗʰ March 2008**
Revision: **5**

Enrolment (also known as registration) of fingerprints is fundamental to biometric devices installation and commissioning. Good enrolments result in generally trouble free sites; poor enrolments can be the cause of many customer problems such as false rejects (users with valid fingers unable to verify, which can cause frustration), and false acceptances (fingers presented to the unit being matched with the wrong user, which can cause a loss of confidence in the security of the system).

Enrolments are critical – they are the first time that a user experiences the system, and the resulting enrolment can make the user experience either very convenient if done correctly, or very awkward if not.

Enrolments can be improved in three ways under the control of the installer or customer: finger angle, finger placement and finger pressure/dryness.

Finger angle
Fingerprint sensors use the unique patterns of the skin whorls (ridges) to distinguish between individual fingers. The greatest uniqueness of these whorls is found on the face of a finger, rather than the tip. Possibly the most common error experienced in enrolment is enrolling the tips of fingers rather than the face of a finger. In turn, this is often caused by a user "poking" at the device rather than "patting" it with their finger. See the photos below.

Incorrect (tip of finger)   *Correct (flat of finger)*

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The key ways that an installer can assist proper finger angle are:

1. Mount the unit high enough (the higher the mounting, the more natural it is to place the face of a finger rather than the tip) – a minimum of 1.5m/5ft from the floor (or around shoulder height as a rough guide for an average height adult)[1].

2. Use thumbs preferably rather than fingers. Thumbs more naturally present the face rather than the tip. In addition, thumbs are generally better at being placed accurately (see below).

3. Training and explaining to users and (importantly) the administrator.

Finger placement

Users should therefore be encouraged to notice and use the finger ridge guide, and the "channel" to help them place their finger correctly.

Incorrect (too low)   *Correct (covering all of sensor)*

It is important that users do not roll or move their finger (swiping or vibrating) on the sensor, as the image captured will be inferior.

Finger pressure/dryness

Fingers should be placed on the sensor with a firm, but not excessive pressure. The finger should flatten out and cover the square inner area of the sensor. The amount of pressure required is greater than typing on a keyboard, less than for an ATM key. Use pressure a little more than that for a camera shutter button or a button on a remote control.

Dry fingers do cause a lower signal than normal (and may even cause the sensor not to detect the presence of the finger – this will be indicated by there being no LED or buzzer response at all from the device). In this case, press more firmly. If

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[1] Note that some building codes recommend a maximum mounting height for door interaction of 1.2m/4ft (generally to be accessible for disabled persons in wheelchairs). This is too low for proper operation by non-disabled adults, so if this is relevant it is strongly recommended to mount two BioLock units at height suitable for both sets of users.

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even quite a firm press does not cause a fingerprint capture, then wiping the finger with a damp cloth, or using moisturising cream may be required in extreme circumstances.

Similarly wet or excessively sweaty fingers may not read well. Simply wipe moisture off the finger and try again (perhaps with less pressure). Likewise avoid grease or sweat build-up on the sensor (wipe with a clean cloth to remove).

Additional important notes

Fingerprints have swirls of ridges that revolve or are distributed around a small central area, which is called the "core" of the fingerprint. It is usually located directly opposite the bottom of the fingernail (cuticle).

It is important to have the fingerprint core on the sensor image during enrolment, and preferably close to the centre of the sensor image. The reason is that most of the unique ridge information (*minutiae,* such as ridges branching, joining, starting, ending etc.) of a finger is contained around this core. While a non-optimal position can usually be tolerated, central placement of the core gives the best performance (less false rejects, less chance of false acceptances). In particular, enrolling the tip of a finger is likely to lead to false acceptances, as the number of minutiae at the tip is usually very low. Another way of saying this is that most fingertips ridge patterns look very similar. To date, false acceptances have been *invariably* caused by poor enrolments (mostly finger-tip enrolments). The cure is to re-enrol the user – that is, **not** the user that experiences the false acceptance problem, **but** rather the one that they have matched against.

Some users have trouble achieving high quality scores during enrolment. If all the hints above are being followed correctly (good finger angle, placement position, pressure, good contrast on the sensor image) yet a high quality score is still not being achieved, then two techniques can assist.

- The first is simply to select another finger. Thumbs are usually the best – they are shorter with one less knuckle joint, which means more consistent placing (less "wobbly") and more consistent pressure. They also are more naturally correctly presented to the reader (less chance of using the tip of the thumb).

- Secondly, with the second, third and subsequent finger placements during enrolment, adjust the position slightly – a couple of millimetres up, down, left and then right of the initial placement. This will present a greater area (and hence more minutiae) to the sensor and hence achieve a higher quality. In addition, users will experience more tolerance to slight

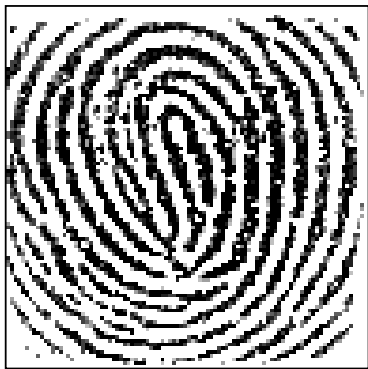| Author	Andy Saunders
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misplacements in actual use, therefore less false rejects. See below for an illustrative example (albeit with exaggerated movement in between finger placements – note that a core should be visible in all your enrolment images, unlike these).
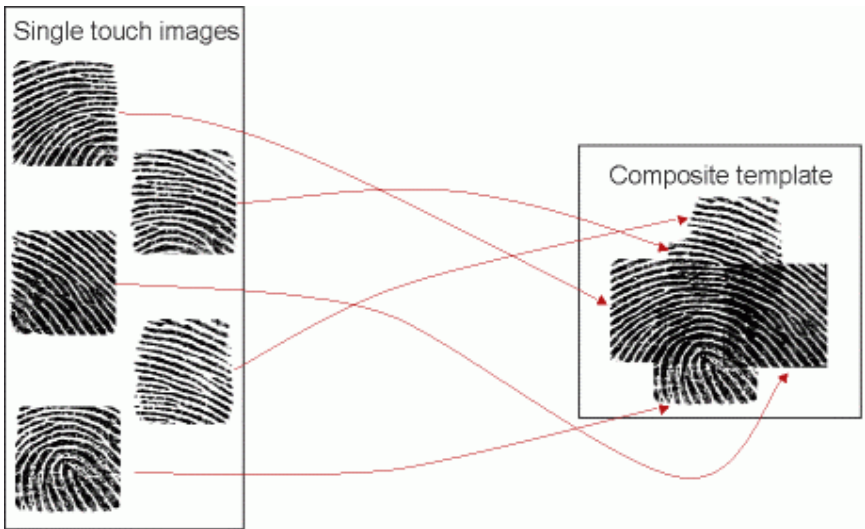
Diagnosis/examples of fingerprint images:

Example 1. Excellent quality finger. Core visible, almost entire area filled with image, good contrast, minutiae clearly visible indicating good pressure.
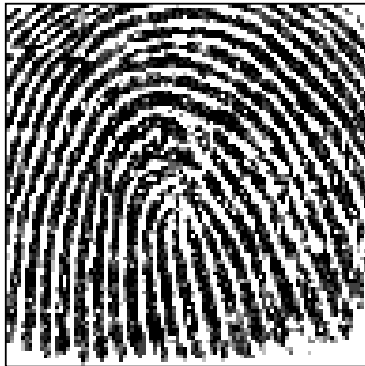

Example 2. Same finger as example 1. Excellent quality, good for a subsequent enrolment capture. Note core/finger slightly higher, same features.

Example 3. Good quality. Note white area at top and ridge distortion caused by a scar.

Example 4. Good finger image from a somewhat sweaty finger. Note generally darker tone but core still in centre and ridges/minutiae clear.


Example 5. Reasonable finger image. Not filling whole sensor image (lower corners) indicating slightly more pressure should be used. Note the naturally-occurring crease across the centre of the image.

Example 6. Reasonable finger image. Not filling whole sensor image (lower corners) indicating slightly more pressure should be used. Note the unusual core shape.

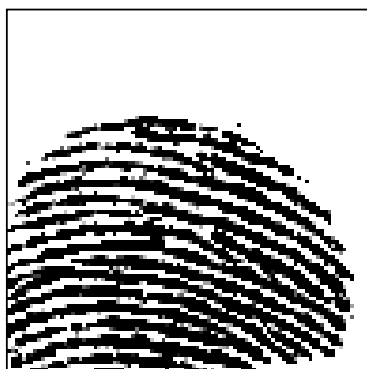| Author	Andy Saunders
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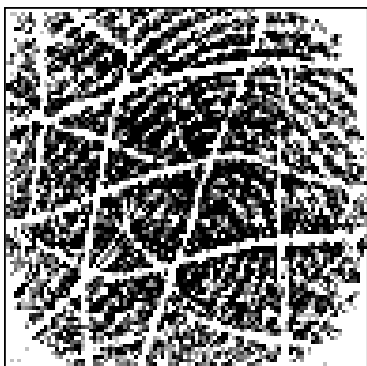
Example 7. Unacceptable. Extremely challenging finger image from elderly (note large numbers of creases) manual labourer (note ridges worn away by abrasion). Try another finger.

Example 8. Small finger placed too low (core off the bottom of the image) and with slightly too low pressure (image not filling up to the corners). Should be rejected and repeated.
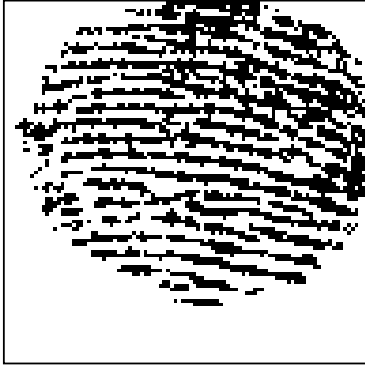

Example 9. Same finger as example 8 but better position and pressure. Marginally acceptable quality (difficult finger – perhaps choose another if possible)

Example 10. Very poor finger placement – tip of finger, not filling sensor area. Should be rejected and/or deleted, and finger placed much higher.
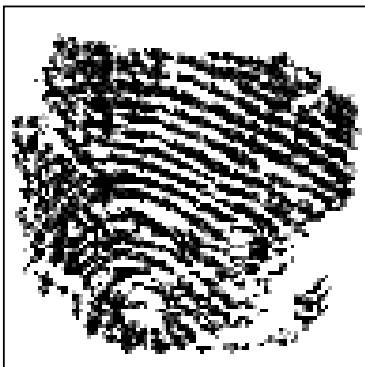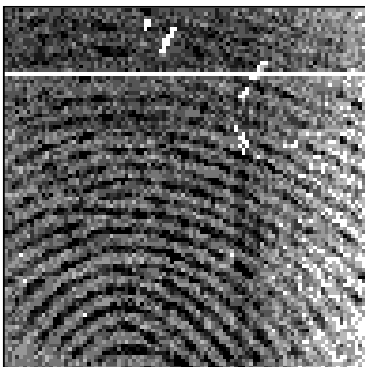
Example 11. Very poor image – finger not placed flat (tip only).

Example 12. Very poor finger placement (too low and to the right). Should be rejected/deleted.

Example 13. Finger moved (not still) when placed. Unacceptable.

Example 14. Scratched sensor, note dead horizontal line (can also be vertical), low overall contrast, dead areas (white in this case, but sometimes black). Sensor must be replaced. Finger also placed too low.

FURTHER INFORMATION:

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Bio Recognition Systems Pty Ltd is a 100% Australian owned and operated hardware and software developer and manufacturer. Located in Lane Cove, Sydney, Bio Recognition Systems Pty Ltd began by offering its customers software and hardware solutions in 1999. Its leading edge BioMetric technology harnesses the power of the newest technology in fingerprint recognition.

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