BRS
BIO RECOGNITION SYSTEMS

TECHNICAL TIPS

PRODUCT: **BioLock network and BioLock+ Standalone**

Subject: **Cabling standards**

Date: **4th November 2007**
Revision: **5**

BioLocks are supplied with two pre-packaged cables between the BioLock unit and the Secure Input/Output Board (SIOB) – a 30cm and a 5m cable.

BioLocks have been tested with these cables. The shorter cable is most useful for SIOBs located in a wall cavity near the BioLock, or mounted on the inside of the wall behind the BioLock. The 5m cable is suitable for attic or basement mounting of the SIOB, and is generally long enough to locate the SIOB in the attic of many 2-story buildings.

It is possible however to extend the distance between the BioLock and SIOB. However please note that these comments do not imply any sort of guarantee by BRS that such arrangements will be successful. Cabling in such situations depends on many factors, including the skill and planning of the cabling technician, which are beyond the control of BRS. We urge customers to seek expert cabling advice rather than relying solely on these instructions.

For external mounting, and also many internal applications, the waterproof device rating should be maintained. This requires that the rubber grommet in the backplate be present, and that a sufficient length of cable (say from the BRS-supplied 5m cable) be present inserted in the grommet, and cable far enough away that moisture ingress into a cable splice is not a danger. The cable can then be cut and spliced.

For strength and reliability, robust splices should be made. They should be mechanically strong, the electrical contact should not have any chance of being intermittent, and it should be mechanically protected against short-circuits and mechanical damage (especially if it needs to be pulled through a wiring passage). Twisting the conductors together, soldering the join, applying individual heat-

Author	Andy Saunders
Record ID	TT002071104005.as

shrink tubing over the join, and a larger heatshrink over the join in the wiring bundle, or a thick layer of insulating tape should be the minimum splice method.

The BioLock cable has four functions, and each needs careful consideration in turn.

1. Power for the BioLock (5VDC for the Standalone version from the Vout terminal after being down-regulated on the SIOB, 12VDC direct from the plugpack for the Network BioLock version) is carried on the black and red wires in the BioLock cable. If extending the length over which power is transmitted, it is important to avoid excessive voltage drops (the Standalone version is more susceptible to voltage drops as it operates on a lower supply voltage). Up to around 20m distance, wire with copper conductors of a minimum cross-sectional area of 1.5mm^2 should be adequate, up to 100m distance, a cross-sectional area of 2.5mm^2 should be adequate. In any case, the voltage measured at the BioLock end should not be less than 4.8VDC (Standalone) or 11.5VDC (Network).
2. Auxiliary inputs (blue and white wires, often used for an external tamper switch or Wiegand inputs). These are signal wires, and no special additional treatment is generally necessary. Often they are used close to the door and do not need to be extended for a significant distance.
3. Ethernet LAN signals are carried on four conductors (transmit pair is orange and orange/white, receive pair is green and green/white). The Ethernet standard specifies a maximum segment length of 100 meters using Cat5 cable. Extension of the Ethernet cable up to this distance should be relatively straightforward. An extension up to 200m can be achieved by adding a device such as an Ethernet switch or bridge in between two segments of up to 100 meters each. Beware that such extensions cannot be continued indefinitely – the Ethernet standard specifies a maximum of 4 segments. See websites such as http://en.wikipedia.org/wiki/10BASE-T for more details. The properly terminated female RJ45 connector on the BRS-supplied cables must be used, rather than cutting the cables and manually splicing or crimping wires. Manual cable splices void the BRS warranty. Ethernet is a high-speed digital transmission system, and the conductors should be maintained as individually twisted pairs in correct Cat5 cabling standards. Any untwisting of the Cat5 pairs should be limited to less than ½" or 1.3cm. Proper (RJ-45) terminations made with the correct tools and test equipment should always be utilised.
4. The data communication between the BioLock and the SIOB is carried over an encrypted RS-485 link using two conductors (green and yellow) plus ground through the black 0VDC wire. RS-485 is also a high-speed data transmission system, and its cabling needs special attention. Despite

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standard (10Mb/s) Ethernet transmission over Cat5 only requiring 4 of the 8 available conductors in a Cat5 cable, you should NOT attempt to use those "spare" conductors for the RS-485 transmission system. RS-485 is rated to work to large distances (in excess of 1000 meters), but only over properly shielded and terminated transmission paths. Over long distances (say greater than 20 meters), shielded, twisted-pair data cable should be used. The shield should be connected as indicated in the included wiring diagram to the "shield" screw terminal on the SIOB (new-version SIOBs) or via a 100-ohm resistor to the ground/0V screw terminal on old SIOBs.

Over shorter lengths, an unshielded twisted-pair cable may be adequate. Proper termination becomes even more critical in this case (see next paragraph for details). If any conductors in the cable carrying the RS-485 link are unused, they should NOT be left unconnected or floating (they will act as antennae and cause distortion to the RS-485 signal). ALL unused conductors should be connected together and connected to the "shield" screw connector at the SIOB end. Only one end of the shield should be grounded, so as to avoid ground-loop currents.

RS-485 systems should be correctly terminated. This website http://www.maxim-ic.com/appnotes.cfm?appnote_number=763&CMP=WP-1 provides an excellent reference source (including graphics showing the effects of improper termination). Basically RS-485 links should be terminated with a 120-ohm resistor at each end. There is a 120-ohm resistor already on the BioLock end. For short links such as the 30cm or 5m BRS-supplied cables that is adequate, however for longer links a 120-ohm resistor should be added between the RS-485- and RS-485+ screw connector terminals at the SIOB end.

In general, if the distance between the BioLock and SIOB is increased, the doorstrike power cable will also need to be extended. Up to around 20m distance using the standard BRS-supplied doorstrike, wire with copper conductors of a minimum cross-sectional area of 1.5mm^2 (15 AWG) should be adequate, up to 100m distance, a cross-sectional area of 2.5mm^2 (13 AWG) should be adequate. Other doorstrikes or other locking devices may require different specification wire.

In short, then, extending the distance between a BioLock and its SIOB up to perhaps 20m could be achieved by cabling dual Cat5 cables (one for Ethernet, one for RS-485), and two power cables (1.5mm^2, one for BioLock power, one for the doorstrike). Longer extensions require one Cat5 cable (for Ethernet), one

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shielded twisted-pair data cable (for RS-485) and two larger (2.5mm^2) power cables for BioLock and doorstrike.
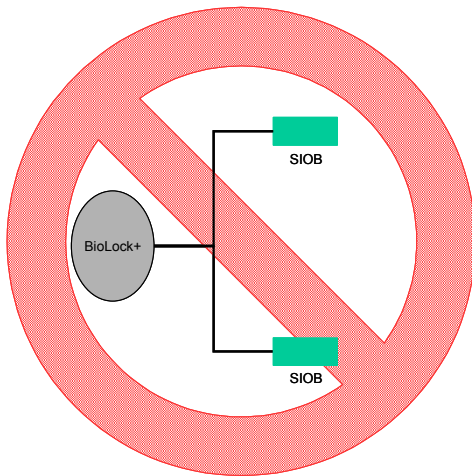
In the event that multiple SIOBs are driven from a single BioLock+, the RS-485 cabling should be daisy-chained between the SIOBs (new SIOBs only), and a 120 ohm resistor added at the most remote SIOB only (no terminating resistor at the intermediate SIOBs). SIOBs should not be cabled as stubs (long dead-end branches off the RS-485 cable). Stub branches cause reflections that distort the hgh-speed signals. See the two diagrams nearby. See also the Multiple SIOB Technical Tip and the SIOBs Technical Tip.

Some installations require use of the BioLock's Wiegand output (from the SIOB connectors), typically to an access control or alarm system. Wiegand connections require three wires, W0, W1 and WG (Wiegand ground) – all must be connected for reliable operation, with the Wiegand ground connected to the ground (zero-volts) terminal of the access control or alarm panel. Wiegand connections are data at TTL levels with potentially fast rise-times and should be run over separate cabling to other data signals. The Security Industry Association has published a standard for Wiegand wiring that specifies a guideline conductor size of 22GA (7/30) at cable lengths of up to 61m (200ft).
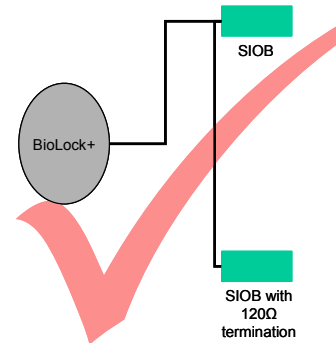
FURTHER INFORMATION:

support@brsgrp.com
Bio Recognition Systems
+61 (0)2 9882 8600

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