

AirBorn Operating, L.P.

PRODUCT TECHNICAL BULLETIN #42

1.0 PURPOSE:

The purpose of this technical bulletin is to provide information regarding the proper procedure for assembling AirBorn's RM4 and RM6 "*straddle surface mount*" connectors to printed wiring boards (PWBs).

2.0 BACKGROUND:

AirBorn's RM4 and RM6 straddle surface mount connectors are often used in applications where high power generation on the daughtercard requires a heat conducting *thermal plane* in the PWB to allow heat to be conducted from the components on the PWB to the thermal plane, and ultimately to some external heat sink, often the metal chassis in which the PWBs are installed. The presence of the solid metal core in the center of the PWB precludes the use of a traditional right angle solder tail connector because of the difficulty of putting plated through holes through the metal core. Unlike traditional right angle solder tail connectors, the RM straddle-mount connectors have two rows of surface mount leads which "straddle" the edge of the PWB and are soldered to *both* sides of the PWB, thus requiring no plated through holes in the connector mounting area. The RM connectors are available in a variety of pin counts in both 4 and 6 row configurations. The 4-row version has SMT leads on .0375" centers, and the 6-row version has SMT leads on .025" centers. By varying the shape of the SMT leads, both the flexibility of the leads, and the "board thickness gap" between the two opposing rows of leads can be adjusted during AirBorn's manufacturing process. This allows the connectors to be easily and inexpensively customized to accommodate a wide range of PWB thickness. AirBorn has been manufacturing these connectors since 1992 and has found that customers would like to better understand how to properly mount these connectors on their PWBs.

Properly attaching these connectors to the PWB requires several things:

1. Understanding the features incorporated into the design of the connector so that the purpose of the feature(s) is not inadvertently defeated during the process of installing the connector.
2. Following the recommendations for the PWB layout.
3. Following the installation procedure.

3.0 CONNECTOR DESIGN FEATURES:

Variable PWB Thickness Accommodation: The SMT leads on the RM4 and RM6 connectors are formed to precise shapes during the connector manufacturing process in order to accommodate a wide range of PWB thicknesses. This forming process puts all the "solder feet" (the flat portion at the end of the SMT lead that is soldered to the pad on the PWB) on one side of the connector in one plane, and all the solder feet on the other side in a second, parallel plane. These two planes are separated by a controlled distance that is slightly less than the minimum PWB thickness. Because of this, there is always a slight interference fit

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between the two rows of SMT leads and the PWB. The result of this slight interference fit is that the connector will not “drop” onto the edge of the PWB. *This is intentional*, and the user should *NEVER* bend the SMT leads in an attempt to widen or narrow this “board thickness gap”. It is important to maintain this slight interference between the connector leads and the PWB because this is what guarantees that the solder feet will always rest on the solder pads on the PWB. If the solder feet do not contact the pads on the PWB, proper soldering will be difficult or even impossible.

Tie Bar: The ends of all the SMT leads in each row are connected together by a plastic “tie bar” or “lead organizer” which serves several purposes. First it makes the leads much less fragile than they would be if they were not tied together, and second it holds each lead in its correct position on .0375” centers on the RM4 connectors, and .025” centers on the RM6 connectors. In addition, it helps keep all the solder feet in the same plane. Unless otherwise specified by the customer, the leads are scored so that the organizer can be easily removed, if desired, *after* the connector is soldered to the PWB. The “tie bar” should *never* be removed before soldering, or the registration between the connector leads and the SMT pads on the PWB will be lost.

Board Mounting Hardware: All 6-row RM connectors, as well as the 4-row 404 position RM connectors, are provided with 4-40 threaded inserts for attaching the connector to the PWB. (All other 4-Row RM connectors have 2-56 inserts.) User supplied screws are screwed into the threaded inserts from the opposite side of the PWB and proper tightening of these screws insures that the connector is rigidly attached to the PWB. The screws align the connector to the PWB and also clamp the connector tightly to the PWB in order to provide strain relief to the surface mount solder joints. If these mounting screws are either omitted, or not tightened properly, the force applied to the PWB during mating and unmating of the connectors will be applied directly to the SMT leads, possibly damaging the solder joints. It is also important to have as tight a fit as possible between the 4-40 screw and the clearance hole in the PWB because if the screws work loose over time and there is a large clearance between the screw and the mounting hole in the PWB, the mating and unmating forces will be applied directly to the solder joints.

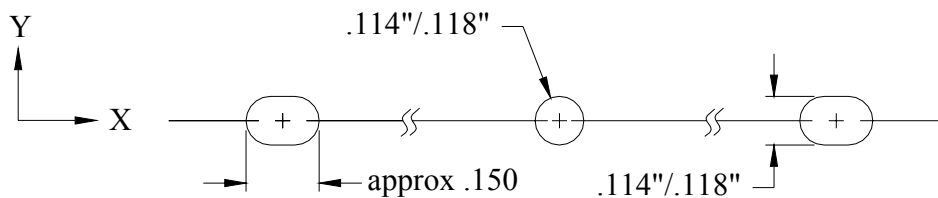
In addition to strain relieving the SMT solder joints, the mounting screws serve to align the solder feet to the solder pads on the edge of the PWB prior to soldering. In order to minimize misalignment, without sacrificing the strain relief function, it is important to properly position and dimension the mounting holes on the PWB. The larger pin count RM connectors have three mounting holes (one in the center and one at each end). Smaller pin count connectors have only two mounting holes (one at each end) and there is a different mounting hole location strategy that should be used for each.

In the case of connectors with a center mounting hole, AirBorn recommends that the center mounting hole be used as the primary alignment feature to center the connector lengthwise (in the "X" direction) relative to the pad pattern on the PWB. The two end holes should be

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used to restrain the movement only in the direction perpendicular to the long axis of the connector (the "Y" direction). To accomplish this AirBorn recommends locating the center mounting hole very accurately in the center of the solder pad pattern and drilling the center hole so that it has minimum clearance with the mounting screw (i.e. about .114" to .118" for a 4-40 screw which has an OD of .112"; or .087" to .091" for a 2-56 screw which has a diameter of .086"). Since the screw in the center mounting hole will locate the connector with very little "float" in the "X" direction, the two holes in the PWB that align with the threaded inserts at the ends of the connector can be made slightly elongated in the "X" direction (by up to half the diameter of the center mounting hole). This will make it easier to align the end mounting screws with the threaded inserts in the connector even if tolerances cause the centers of the end holes in the PWB to align less than perfectly with the holes in the threaded inserts in the connector. The non-elongated dimension of the end mounting holes should be the same as the diameter of the center hole (i.e. .114"/.118" or .087"/.091") in order to tightly restrain the connector in the "Y" direction. Note that because the end holes are no longer circular, they must be routed instead of drilled. The illustration below shows the dimensions suitable for a 4-40 screw.



For connectors without a center mounting hole, AirBorn recommends using a single tight fitting hole mounting hole at one end of the PWB and an elongated hole at the other end. This forces the single tight hole to act as the primary connector location feature in the "X" direction while the elongated hole will handle any small location tolerance between the location of the hole and the location of the threaded insert at the opposite end.

4.0 PWB LAYOUT RECOMMENDATIONS:

4.1 Pad Size (width x length x pitch)

4-Row: .020/.023" x .120/.125" on .0375" centers

6-Row: .012"/.015" x .125"/.130", on .025" centers

4.2 Pad Pattern Location on PWB

Refer to detailed drawings in the catalog

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It is important that the solder feet slide up *onto* the pads during installation. If the feet slide between the pads, the connector cannot simply be pushed sideways by ½ of a pad pitch to correct the misalignment. The pads stand several mils above the surface of the PWB and the solder feet will get “hung up” on the edges of the pads because the feet are preloaded against the surface of the PWB. Also, be sure that the connector is “right side up” relative to the component side of the PWB. The threaded inserts and the SMT leads on the connector are “left to right” symmetric, so it is possible to install the connector upside down on the PWB and still have all the pads and leads aligned properly.

Step 3: Push the connector onto the PWB. With the connector aligned as described in step 2, gently push the connector until the two rows of SMT leads on the connector slide up and over the edge of the PWB. If the edge of the PWB is not beveled as described in paragraph 4.3 above, it will be very difficult to slide the connector onto the edge of the PWB.

As described in paragraph 3.0, the two rows of SMT leads are spaced apart by a controlled distance such that there will always be a slight interference fit even with the thinnest PWB. The connector should slide onto the thinnest PWBs with very little effort, but it will require a greater force to push the connector onto a max thickness PWB. However, even with a max thickness PWB, it should still be possible to push the connector onto the PWB by hand without excessive effort. *Under no circumstances should the assembler attempt to bend the rows of SMT leads in an attempt to reduce the force required to install the connector.* Continue to push the connector onto the PWB until the beveled edge of the PWB bottoms against the connector housing indicating that the connector is fully seated on the PWB.

Step 4: Check for proper SMT tail alignment: Once the connector is fully seated on the PWB, visually check to assure that the solder feet are resting on the pads on the PWB. This will generally require the use of magnification (a ring magnifier, a loupe, or a stereo microscope with a magnification of about 10X is recommended). Also check that the connector is fully seated against the edge of the PWB. If it is not, push it until it is fully seated. At this point the solder feet do not need to be perfectly centered on the pads, but they should be resting *on* the pads, and not in the spaces between pads. If they are in between pads, remove the connector from the PWB and start over from step 2 above.

Step 5: Align the primary alignment hole in the PWB with the hole in the threaded insert in the connector: The primary alignment hole is the *round* hole (in the center of a three-hole pattern, or at one end of a two-hole pattern). Using the same magnification device that was used in Step 4, check to see that the round hole in the PWB is perfectly aligned with the hole in the threaded insert in the connector (inspect from the PWB side, not the connector side). It may be necessary to move the connector slightly back from the edge of the PWB (in the “Y” direction) in order to achieve perfect alignment of the holes in the “Y” direction. This alignment must be very accurate because there is very little clearance between the mounting hole and the OD of the screw. If the two holes are not aligned nearly perfectly, the

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screw will not line up with the threaded hole in the insert, and it will be difficult to thread the screw into the insert. .

As long as the solder feet are on the pads, the connector can be gently pushed sideways while observing the movement of the hole in the threaded insert relative to the hole in the PWB under a magnifier until they appear accurately aligned visually. This can be difficult to do however when the PWB is very thick. In this case, an alternative method is to align the two holes mechanically by gently inserting a pin with a tapered tip through the round hole in the PWB and into the threaded insert. This will cause the connector to slide to one side or the other until the round hole in the PWB is lined up with the hole in the threaded insert. To be effective, the pin must have a constant diameter equal to the OD of the screw thread (0.112” for the 4-40 screw, 0.086” for the 2-56) and this constant diameter portion of the pin must be at least as long as the thickness of the maximum thickness PWB. Below the constant diameter portion, the pin should taper from the full diameter to about half that diameter over a distance of between 0.050” to 0.100”. This alignment procedure using the tapered pin must be performed relatively gently in order to avoid damaging the leading threads in the threaded insert.

Step 6: Install a screw in the primary alignment hole: Once the round hole is accurately aligned with the threaded insert, slide the screw through the round hole in the PWB, thread it into the threaded insert in the connector, and tighten it “finger tight”.

Step 7: Install a screw(s) in the remaining, elongated mounting hole(s): Since these holes are elongated there should be no problem lining up the screw(s) with the corresponding hole(s) in the threaded inserts and threading them in by hand. Again, tighten these screws until they are finger tight.

Step 8: Tighten all screws to the proper torque: Using a torque wrench, tighten all mounting screws to the recommended torque. AirBorn recommends using 2.5-3.5 in-lbs for 2-56 screws and 3.5-4.5 in-lbs. for the 4-40 screws.

Step 9: Visually inspect the solder feet and pads: Using magnification as recommended above, visually check each of the solder feet to assure that all are properly located on the solder pads on the PWB.

Step 10: Solder the connector to the PWB: Soldering the connector to the PWB can be done by a variety of processes, the specifics of which are beyond the scope of this technical bulletin.

Step 11: Remove the “lead organizer” or “tie bar”: Although it is not absolutely required, most customers choose to remove the organizer after the connector is soldered to the PWB. Unless otherwise specified by the customer, the SMT leads are scored on the underside (the side closest to the surface of the PWB, between the end of the solder foot and the organizer) to facilitate removal of the organizer. Occasionally the customer may want to leave the

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organizer attached and will specifically request that AirBorn *not* score the leads, but in most cases the score will be present. Under no circumstances should the organizer be removed prior to soldering, and no attempt should be made to remove the organizer if the leads have not been scored because of the high probability of damaging the solder joints. To remove the organizer, fold it back toward the body of the connector (away from the surface of the PWB) until the organizer breaks away from the leads. It should break away easily on the first bend, but if it does not, bend it back to its original position and repeat.