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The Detrimental Effect of a Rubber O-ring on a 10-32/10-32 Cable Connection

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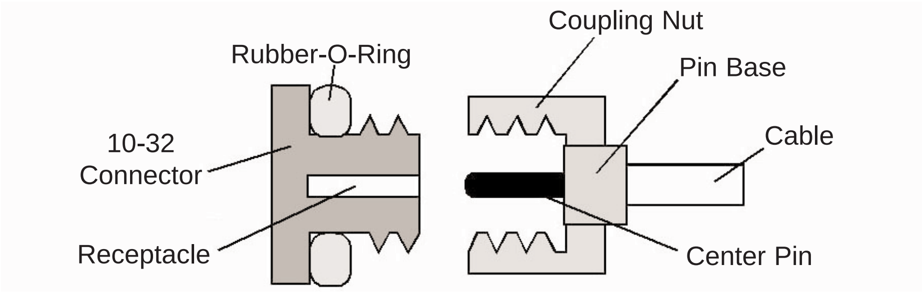

Anatomy of a typical connection between a 10-32 connector and an accelerometer's cable

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Many instrumentation manufacturers offer signal conditioners with 10-32 connectors that incorporate rubber o-rings. Often misunderstood to be environmental seals, the o-rings are intended to be used on the connectors like lock-washers are used with typical nuts and bolts. When a cable's coupling nut is fastened onto an instrument's connector, the o-ring spring-loads the coupling nut's threads against the threads of the connector. This causes more friction between the corresponding threads than there would be if no o-ring was present. The greater friction makes it more difficult for the connection to loosen accidentally.

Endevco recommends that whenever you encounter a 10-32 connector that has an o-ring, get rid of the o-ring.

Although the o-ring can make it more difficult for a connection to accidentally loosen, in the process it can create a different problem. The o-ring can position a mating coupling nut in a manner that permits its associated center pin to rotate, causing intermittent electrical contact and, ultimately, a distorted accelerometer output signal. Because of this, **Endevco recommends that whenever you encounter a 10-32 connector that has an o-ring, get rid of the o-ring**. In fact, if you even hear mention of an o-ring, scream "SACRILEGE!" and run in the opposite direction. O-rings on 10-32 connectors cause problems.

To prevent the chances of an intermittent output signal from a connection, it is absolutely necessary that a cable's pin base be in direct contact with the associated 10-32 connector.

In order to prevent the chances of an intermittent output signal from a connection, it is absolutely necessary that a cable's pin base be in direct contact with the associated 10-32 connector. When they are in direct contact and have been fastened together with the recommended torque (finger-tight at 1.5 in.-lbs.), there is sufficient friction present between the two to prevent their relative rotation. Because the center pin is an integral part of the pin base, it too is prevented from rotating. Because the center pin is not allowed to rotate, there can be no intermittent electrical contact.

In many instances, an o-ring simply prevents the necessary contact between the connector and the pin base. When a coupling nut is fastened onto a connector, an o-ring prohibits the nut from being completely threaded onto the connector. The leading edge of the coupling nut encounters the o-ring before the connector even has a chance of bottoming-out on the pin base. If the pin base never meets the connector, there won't be any friction available between the two to prevent their relative rotation.

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The following illustrations show typical 10-32/10-32 cable connections.

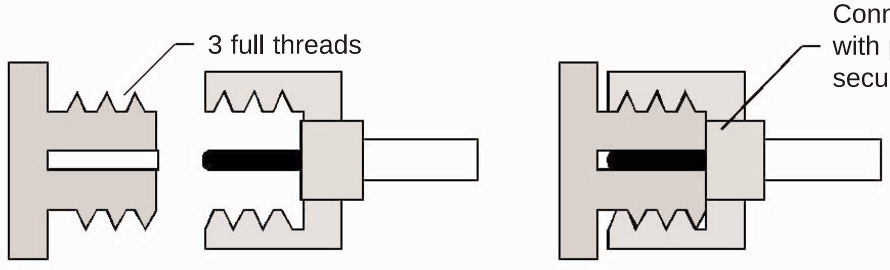

Figure 1

Figure 1 illustrates an ideal accelerometer/cable connection. There exists no rubber o-ring and there are three complete threads engaged. The cable's pin base is in direct contact with the corresponding surface on the 10-32 connector. This coupling design is critical for maintaining good contact during vibration and has been the standard configuration on all Endevco transducers. This ideal type of connection, however, is usually never found at the signal conditioner end.

When a coupling nut is fastened onto a connector, an o-ring prohibits the nut from being completely threaded onto the connector.

Having three complete threads on both a coupling nut and a 10-32 connector helps to reduce the risk of the coupling nut coming loose. The more threads there are engaged on a connector, the better the chances are of a coupling nut staying fastened. When a coupling nut is fastened to a connector with the recommended torque (finger-tight with 1.5 in.-lbs.), the threads exert friction on one another, giving rise to a moment that resists vibrational forces that attempt to loosen the nut. One way to increase the friction between the threads is to simply increase the number of threads. Endevco has three complete threads on all of its transducers. Most of the signal conditioners available from Endevco and its competitors, however, have connectors with only two complete threads. This is due to the fact that vibration is not usually an issue at the conditioner end.

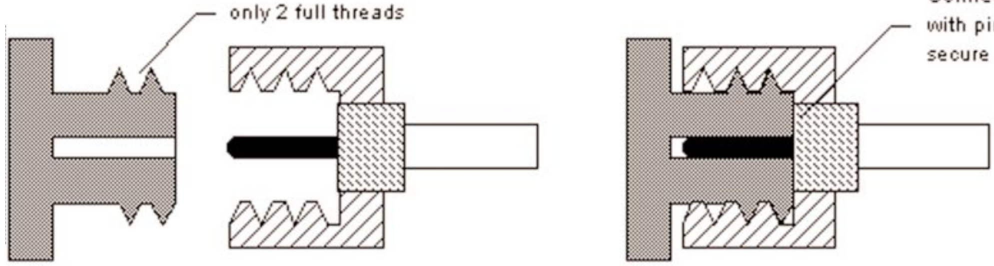

Figure 2

The more threads there are engaged on a connector, the better the chances are of a coupling nut staying fastened.

Figure 2 shows a connection that is acceptable only under low-level vibration. Note that there is no o-ring present. Connectors that incorporate o-rings typically only have two complete threads. The engagement of two complete threads will normally provide enough friction to keep the coupling nut fastened at lower vibration levels.

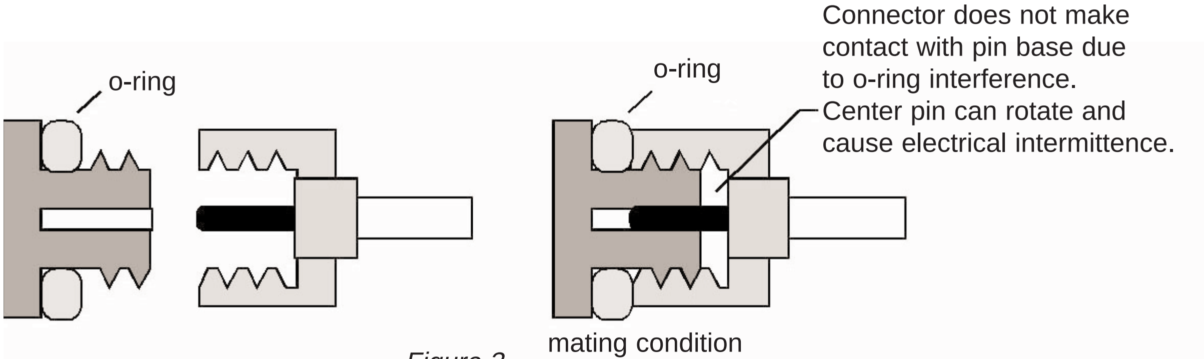

Figure 3

Figure 3 shows the problem that o-rings can cause. With the same connector shown in Figure 2, the o-ring doesn't allow the coupling nut to be completely fastened onto the 10-32 connector. As a result, the pin base isn't allowed to contact the connector. Because of this, the pin base cannot exert the friction necessary on the connector to prevent its integral center pin from rotating. In this type of a situation, intermittent center-pin contact is inevitable, causing electrical noise in the output signal.

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