KEITHLEY

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Model 1483 Low Thermal Connection Kit

Thermoelectric voltages are generated when junctions of dissimilar metals are at different temperatures. They can occur unintentionally, such as when solder is applied to a connection. The potential generated is a function of the metals, their impurities and the temperature difference between junctions. In general, it is not practical to construct an entire circuit of only one material. The thermal EMF or ordinary solder against copper is 3μV/°C. Low thermal cadmium-tin solder, will reduce this thermal EMF by nearly ten times (see Table 1.) Connections made by crimping copper sleeves and lugs, such as that supplied in this kit, are even better. When properly constructed, the resulting junction is cold-welded copper to copper and will generate very little thermal EMF.

Once the number of dissimilar metal junctions has been reduced as much as possible, circuit performance can be further improved by reducing the temperature gradients within the circuit. This can be done by placing the remaining junctions near one another, and by providing good thermal contact with a common heat sink. Do not place the test equipment or connections in direct sunlight, air currents from heating system vents, fan exhausts, etc. Most good electrical insulators are good thermal insulators as well, that is why they have very low thermal conductivity.

The following procedures provide instruction on how to replace the gold pins of a low thermal connector, twin lead shield preparation and preparation of a triax cable to reduce thermal EMFs in connectors.

Table 1. Materials and Their Thermal EMF Potential

Materials	Potential
Cu—Cu (copper to copper junction)	<<0.2μV/°C
Cu—Ag (copper to silver junction)	0.3μV/°C
Cu—Au (copper to gold junction)	0.3μV/°C
Cu—Cd/Sn (copper to cadmium/tin junction)	0.3μV/°C
Cu—Pb/Sn (copper to lead/tin junction)	1-3μV/°C
Cu—Kovar (copper to kovar junction)	40μV/°C
Cu—Si (copper to silicon junction)	400μV/°C
Cu—CuO (copper to copper oxide junction)	1000μV/°C

1. Replacement of gold pins (refer to Figure 1 and 2).

NOTE

When disassembling any low thermal connector always wear gloves so as not to contaminate any part of the connector with body oil, grease, etc.

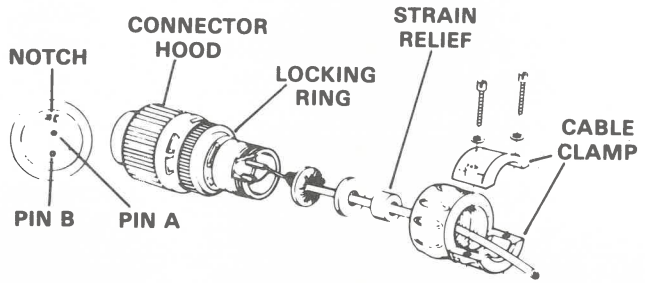
A. Remove the connector from the cable.
B. Remove the cable clamp from the connector.
C. Remove the locking ring from the rest of the connector.

D. Remove the connector hood from the connector body.
E. Remove the retaining ring from the connector body. The retaining ring secures the insulators (front and rear) and the gold pins in the connector body. Use a small flatblade screwdriver to remove the retaining ring.
F. Remove the insulators from the connector body.
G. Separate and remove the gold pins from the rear insulator. Clean and remove the excess thermal compound from the insulators.
H. Install the new gold pins into the rear insulator. Make sure the pins and the insulator are clean and free of contaminants.

NOTE

Just prior to installing new gold pins, drill out the wire hole of each gold pin to remove any trace of contamination. Use a virgin #57 (.067) diameter drill bit.

I. Fill the insulator cup with new thermal compound and install the front insulator in place. Make sure the notch in both insulators line up. Remove any excess thermal compound from the insulators.
J. Install the insulator/pin assembly into the connector body. Make sure the notch in the insulators line up with the notch in the connector body.
K. Reinstall the retaining ring in the connector body.
L. Reinstall the connector hood.
M. Reinstall the locking ring.



PIN "A" CRIMPS TO THE CENTER CONDUCTOR OF THE TRIAX CABLE.
PIN "B" CRIMPS TO THE INNER COPPER SHIELD OF THE TRIAX CABLE.
THE CASE CONNECTS TO THE OUTER SHIELD OF THE TRIAX CABLE.

Figure 1. Low Thermal Connector Exploded View

2. Twin Lead Shielded Cable Preparation
   A. Carefully cut through the outer insulation ¾ inch from the end of the cable without cutting the shield braid. Remove the cut insulation.
   B. Comb out the shield braid.
   C. Carefully cut through the inner insulation ½ inch from the end of the cable without cutting the two wires. Remove the cut insulation.
   D. Carefully cut through the red insulation and the green insulation 3/8 inch from the end of the cable without cutting the wires. Remove the cut insulation.
   E. Using the supplied cleaning pads, clean approximately one inch of the No. 18 gauge untinned solid copper wire (bare only). Cut the wire in ½ inch pieces and insert them into each gold pin. Double crimp each pin. Refer to Figure 3.
   F. Slide the two washers to the combed out shield braid and place the braid between the washers.

NOTE

Make sure that the braid does not protrude out of the slot or make contact with the body of the connector.

   G. Make sure the strain relief is properly seated in the cable clamp and install cable clamp onto the rest of the connector. See Figure 1.
   H. Using a clean cotton swab, clean the gold pins and the area surrounding the pins with methyl alcohol.

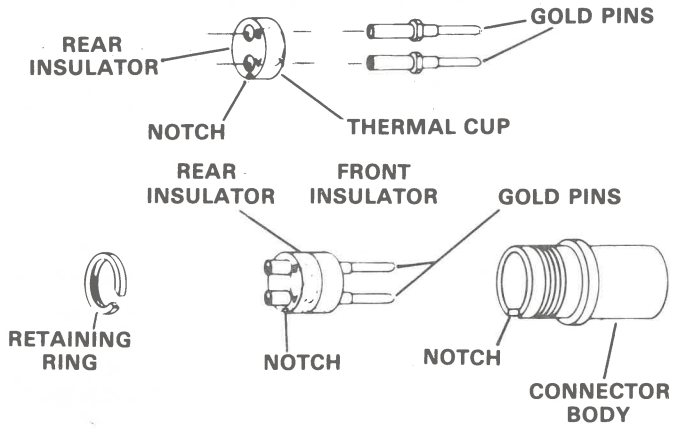


Figure 2. Placement of Gold Pins

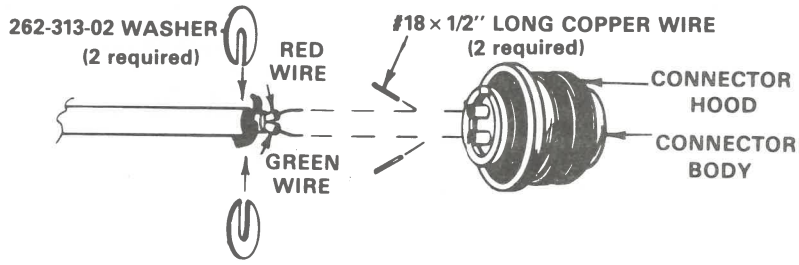


Figure 3. Crimping Cable to Connector

3. Triax Cable Preparation
   A. Carefully cut through the outer insulation ¾ inch from each end of the triax cable without cutting the outer shield braid. Remove the cut insulation .
   B. Comb out the outer shield braid.
   C. Carefully cut through the inner insulation ½ inch from each end of the triax cable without cutting the inner shield braid. Remove the cut insulation.
   D. Comb out the inner shield braid.
   E. Carefully cut through the center conductor insulation 3/8 inch from each end of the triax cable without cutting the center conductor. Remove the cut insulation.

F. Using the supplied cleaning pads, clean approximately one inch of the No. 18 gauge untinned solid copper wire (bare only). Cut the wire in half and insert one half into each gold pin of the low thermal connector (see Figure 3). Crimp the center conductor to pin A of the low thermal connector. Crimp the inner shield to pin B of the low thermal connector.

G. Slide the two washers to the outer shield braid and place the braid between the washers.

NOTE

Make sure that the braid does not protrude from the slot or make contact with the body of the connector.

H. Make sure the strain relief is properly seated in the cable clamp and install the cable clamp onto the rest of the connector (see Figure 1).

I. Using a clean cotton swab, clean the gold pins and the area surrounding the pins with methyl alcohol.

J. Prepare a coax cable in the same manner as the triax cable. Do the following:
   1. Strip the outer insulation of a coax cable ¾ inch from the end without cutting the shield braid.
   2. Comb out the shield braid.
   3. Strip the inner insulation ½ inch from the end of the cable without cutting the center conductor.

K. At the outer end of the triax cable, twist the center conductor of the triax cable together with the center conductor of the coax cable. Crimp the junction together using copper splice tubes.

L. Insulate the junction with electrical tape, glass braid tubing or preferably with shrink sleeving.

M. Twist the inner shield of the triax cable together with the shield of the coax cable and the copper jump lead (for alligator clips). Crimp the junction together using copper splice tubes.

N. Insulate the junction with electrical tape, glass braid tubing or preferably with shrink sleeving.

O. Trim the outer shield of the triax cable as near to the outer insulation as possible. Then wrap the exposed outer shield with electrical tape or preferably use shrink sleeving to insulate and secure the outer shield.

Table 2. Model 1483 Low Thermal Connection Kit Parts List

Item	Contents	Qty	Instructions
1	Crimping Tool	1	Use No. 18-22 die with all lugs.
2	Nylon Hex Nuts	50	For No. 8 nylon screws (item 3), use 5/16 inch
3	Nylon Screws	50	Use as connection posts for lugs.
4	Copper Lugs	100	For easy connection to and removal from post.
5	Copper Splice Tubes	100	For making low thermal splices.
6	Copper Spade Lugs	100	For easy connection to and removal from post.
7	Copper Spade Lugs	100	For easy connection to and removal from post.
8	Copper Alligator Clips	10	To connect to lead, double or triple wire in clip barrel. Use No. 14 or 16 or 10-12 die on crimping tool.
9	Non-Metallic Abrasive	3 pads	Always use this abrasive to clean wires and lugs before making a connection. Do not use on tinned wire.
10	Jumper Wire	3 ft.	No. 18 AWG stranded copper wire for use as jumper wire.
11	Twin Lead Shielded Cable	10 ft.	Use as hook-up wire when circuit cannot be shielded as a whole and to connect circuit to the instrument input.
12	Triax Cable	10 ft.	Use as hook up wire to shield signal HI with signal LO and shield HI and LO with earth ground. Used to connect circuit to the instrument input.
13	Coax Cable	3 ft.	Use as hook up wire to shield signal HI with signal LO to connect circuit to the instrument input.
14	No. 20 AWG Insulated Solid Copper Wire	100 ft.	For circuit interconnections and hook ups when circuit is shielded.

Table 2. Model 1483 Low Thermal Connection Kit Parts List (Cont.)

Item	Contents	Qty	Instructions
15	Thermal Compound	¼ oz.	Used to minimize thermal EMF between pins on connectors.
16	Male Pins	2	For low thermal connector as described in procedures 1 and 2. For replacement purposes.
17	Copper Rivets	3	For low thermal copper contacts (as in Model 148, 262, etc.).
18	Female Pins	2	For low thermal connectors as described in procedures 1 and 2. For replacement purposes.
19	Clips	2	Used in conjunction with the female pins.