Bondable Resistors for Transducers

B PATTERN

The B Pattern bondable resistor is adjusted (decrease in resistance) by shorting out the parallel conducting lines at a desired point along their length. Depending on required stability, shorting can be accomplished through use of a suitable solder or a conductive silver compound.

RECOMMENDED ADJUSTMENT MATERIALS

Solders

63-36.65-0.35 tin-lead-antimony (MM Part No. 361A-20R). Maximum service temperature is +300°F (+150°C).

Conductive Silver (Air-Drying)

#FH-1629 (Acheson Colloids Company)
#8030 (DuPont Electrochemicals Department)

C, D, AND E PATTERNS

Patterns C, D, and E resistors are adjusted (increase in resistance) by cutting various foil bars.

Using an appropriate degree of magnification (preferably under a stereoscopic zoom microscope), locate the cutting points on the resistor pattern. Cuts may be made with the tip of a scalpel blade, or with a tool made by slightly flattening the end of a dental probe (MM Part No. DPR-1). Lightly cut through each end of the shorting bar and lift out the center section, leaving a path clear of foil. Care must be taken to avoid cutting through the backing to the specimen.

The approximate cuts to produce a desired overall pattern resistance can be estimated from the following information for the appropriate pattern; however, many variations may be employed and experimentation may be required to determine the optimum cutting sequence. For example: If steps are cut progressively downward starting from the top of any ladder (for all above patterns), very small changes in resistance are produced. Cuts made in this manner will represent larger changes as the step nearest the large solder tabs is approached.

Note that the actual resistance increase caused by cutting any given step can vary up to 20% of the nominal value. Therefore, it is desirable to plan a series of cuts that will allow the final resistance value to be approached slowly enough to avoid overadjustment. Fine adjustment can also be achieved by gently polishing active portions of the network with 325-mesh alumina powder. This procedure is not recommended when maximum stability is required, however.

C Pattern

The resistance changes produced by cutting the various adjustment steps are specified in terms of R_{MIN}, the uncut pattern resistance. The tabulated data are typical, and were obtained by cutting progressively upward starting with the step nearest the soldering tabs in each respective ladder.

NOTE: Although there are several variations of the C Pattern, the same respective 28 adjusting steps are available in each.

LADDER	APPROX. ΔR AS % R_{MIN}
A	1
B	1
C	10
D	20

D AND E PATTERNS

The resistance values listed for these patterns are the maximum obtainable - after cutting all the ladder steps except the top rung of each row. For the E Pattern, the resistance is measured between terminals 1 and 2, or 2 and 3, with the corresponding shunt (G) cut.

Referring to the pattern diagram for the D resistor, when cutting progressively upward on the center ladder, each step will correspond roughly to an increment of 5.6% of R_{MAX}. The outside ladders provide finer adjustment with each upward step, about 3.4% R_{MAX}.

The shunt (G) in each network of the E Pattern reduces uncut resistance approximately 25%, and reduces adjustment increments of ladders A, B, E and F about 50% to increase resolution. With the shunts uncut, the resistance changes produced by cutting each upward step of ladders A through F as a percentage of R_{MAX} are approximately 2.8%, 1.7%, 3.4%, 3.4%, 1.7% and 2.8%, respectively. R_{MIN} for these patterns is about 0.08 R_{MAX}.

With the shunts (G) cut, the E Pattern is essentially two D resistors with a common solder tab.

H21 AND H22 PATTERNS

H21

The H21 resistor is designed to be wired into a corner of the Wheatstone bridge like the Constantan E01 pattern shown in Figure 1 in Bondable Resistors for Transducers. Resistance adjustment for zero balance is accomplished by rubbing the appropriate loop of the H21 with a soft pencil eraser. An electric eraser can be used to speed the process.

H22

The H22 resistor is similar in application and adjustment to the H21 except its use is for zero-shift-versus-temperature compensation. Setting the H22 resistance value is readily accomplished by calculating its adjustment influence on bridge zero balance after conducting zero-versus-temperature testing of the completed transducer.

Resistance calculation formulas are available upon request.