PUT YOUR BEST METER FACE FORWARD

You can make professional-looking scales with little effort and a small investment

By DON LANCASTER

WANT to change the scale of that panel meter sitting in your junk box? Or how about that surplus bargain, an 0-50 d.c. microammeter . . . calibrated as 0-75 MR/HR/FT or something equally mysterious? Help stamp out sloppy meter faces! Get rid of wrong scales! You don’t have to be an artist—all you need is $2.15 and some time. You’ll wind up with a meter face as good as the factory original, and to your exact specifications. And each duplicate face will cost just 15 cents.

What’s the catch? You simply work five times life size. In this king-size world, mistakes are few and far between, and easily corrected. Any misalignment that might creep in gets reduced 5:1 in the final reproduction. You use all prefab letters and numerals—no ink and no mess. A nearby photolithography firm then gives you the required reduction.

Measurements. The first step in making a new meter face is to carefully remove the original, and make all the measurements shown in Fig. 1. Multiply each one by five (except c, the scale angle), and record the results. Dimension a is the distance in inches between the pivot point or center and mounting screw; b the distance between the pivot point and title; c the scale angle in degrees; d the numeral radius in inches; e the lower division radius; f the middle division radius; and g the upper division radius.

Decide what the full-scale reading of the new meter scale will be, and choose a reasonable number of major divisions. Every major division, or every other one,
Fig. 1. Carefully measure dimensions "a" through "g" on original meter face and multiply by five. All measurements are in inches except the angle "c," which is measured in degrees with a protractor.

Fig. 2. Materials you need for making a new face include instant transfer letters, a beam compass, 3/8" printed circuit dots, 1/8" and 1/16"-wide black printed circuit tape, and white illustration board.

Fig. 3. The new meter face is drawn lightly in pencil on a piece of illustration board working five times up. First draw vertical center line, then add a horizontal base line 2" up from bottom of board.

Fig. 4. High-contrast photolith negative (top) is a 5:1 reduction of art work. After negative is made, it is a simple matter to get photographic contact prints (below). Mount new face as described in text.
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Best Meter Face Forward

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top arc. Then lay out each minor division by dividing each major division into a suitable number of parts. Guide lines are drawn through each of these division points, aimed radially toward the meter pivot point. Add the actual scale markings using ½"-wide black printed circuit tape for the major divisions, and ½"-wide tape for the minor ones. Carefully cut the tape squarely across each arc with a razor blade or a sharp knife.

Transfer the scale numerals into place, being very careful about centering. Note that the center of a 20 is exactly between the "2" and "0," while the center of a 10 is just inside the "0." The center of each numeral group should exactly correspond to the axis of that major division. The title baseline is drawn parallel to the original baseline, and the title pressed into place. To center the title, add up all the space required for each letter and space, and then start the lettering half this distance away from the centerline.

**Nonlinear Scales.** Nonlinear scales require more thought. If the scale is clearly defined mathematically, the scale divisions may be determined by suitable algebra or geometry. An ohm meter scale is started with a 0 and ends with infinity at full scale. The exact center of the scale is equal to $R$, the internal resistance of the ohm meter; $2R$ is located one-third of the way up the scale; $3R$ is one-fourth, $4R$ is one-fifth of the way up the scale, etc. For a 1-10 log scale, lightly lay out a linear 0-10 scale. Divisions for each log point are then placed on the log of each desired number. This means the 1 goes at 0, the 2 at 3.01, the 3 at 4.77, etc. Decibel scales work in much the same manner.

**Photolith Negatives.** Most towns have at least one photolithographer who can make a 5:1 reduction of your art work in the form of a photographic negative. The cost of this service is about $1.00. Don't go to an ordinary photographer, as it will cost much more, and the film used will not have nearly the contrast ratio that lithography film has (the negative is either perfectly transparent or else jet black). Take the negative to a photo store and have semigloss contact prints made; the cost of each print should be about 15 cents.

To mount a new meter face, cut the print to size, align it carefully, and cement it with rubber cement to the back of the original meter face. If you ever need the original again, you'll have it handy. ---