

Applications Bulletin

TELEDYNE PHILBRICK

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NEED A 1 kHz FULL-SCALE V-F?

Philbrick's versatile V-to-F converters, such as Model 4701, also 4703, 4705, 4709, can be applied in several ways to produce a Full-Scale frequency lower than their rated frequency. The 10 kHz 4701, for example, can be connected, as shown below, to provide 1 kHz, (or 1 Hz, or 90 Hz or 90 milli Hz, as required).

1. The easiest way to get a 1 kHz full-scale output from a 4701 is to put a resistor of approximately 200k Ω in series with the input (see Figure 1). The linearity in this configuration will probably not be degraded. The temperature coefficient of full scale, however, will be degraded by the temperature coefficient of the resistor you add. For example, if you add a 200k Ω metal film resistor with a TC of 100 ppm/ $^{\circ}$ C maximum, then the TC of full scale of the 4701 will degrade from 100 ppm/ $^{\circ}$ C to 200 ppm/ $^{\circ}$ C. In addition, the temperature coefficient of zero offset will be degraded because of the high value of the input resistor, i.e., the 200k Ω input resistor will degrade the zero offset drift to 0.4 mV/ $^{\circ}$ C or 40 ppm/ $^{\circ}$ C of full scale. However, in many applications this performance will be quite acceptable.

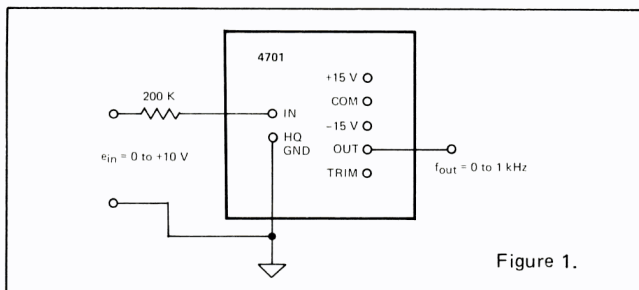


Figure 1.

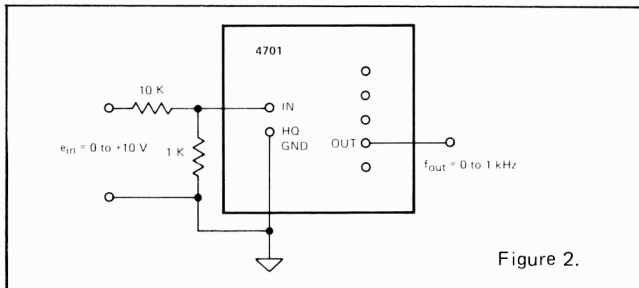


Figure 2.

2. An alternate scheme which might be considered would be to use a 10k Ω /1k Ω attenuator in place of the 200k Ω input resistor at the input (see Figure 2). This will give the 1 kHz full scale output frequency but will also degrade the transfer characteristics. A poorer full scale temperature drift can be expected, the exact degradation depending on the TC's of the two resistors. The zero drift will also probably degrade to 40 ppm/ $^{\circ}$ C due to the input attenuation. In addition, this resistor-divider will degrade linearity to typically

0.08% of the 1 kHz span, and the dynamic range will be only 100:1, from 1 kHz to 10 Hz. Still, this simple circuit may be adequate for some applications.

3. The best way to get a 1 kHz full scale output from a standard 4701 is to put a 5k Ω rheostat in series with the input to get an 8 kHz full scale output and then use a simple 8 to 1 frequency divider on the output (see Figure 3). As with almost any module, attenuation after the 4701 causes less error than attenuation ahead of the 4701. Furthermore, a divide by 8 TTL logic element is low cost and inherently accurate; that is, there will be no TC problems. There is no doubt that this is the most accurate way to do the job. Further, the circuit would give the customer the least trouble to set up and operate. For specific divider elements, we recommend $\frac{3}{4}$'s of the SN7493, or 1 of the SN74193, or $1\frac{1}{2}$ of the SN7474, or any other comparable DTL, COSMOS, OR HNIL digital IC's.

In general, a 25 k Ω cermet rheostat in series with the 4701's input will let you cover a 2 — 1 range of analog attenuation, without significant loss of accuracy. Then, of course, you can add as many (or as few) binary (or decade) stages of Digital Frequency Divider as you need. For example, with 4 Decade stages of SN7490, the 25 k Ω rheostat will let you trim to any Full Scale between 1 Hz and 0.5 Hz.

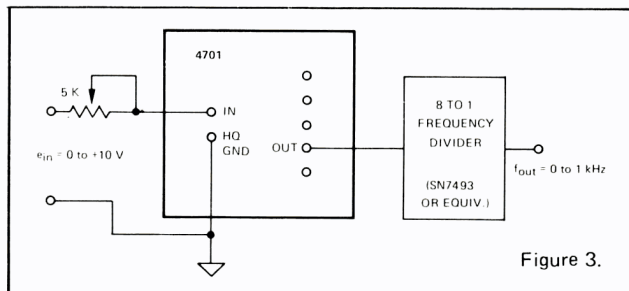


Figure 3.

In general, the approach shown in section 3, is the best way to accomplish any Full-Scale Frequency from 1 MHz to 1 μ Hz. However, for large-volume OEM requirements, Teledyne Philbrick will be pleased to review your specification requirements, and to recommend a Special Application Circuit for one of our large line of Standard V-to-F converters, or to quote on a Special unit which may be the best solution.

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