

10 kHz 100 kHz 10kHz
4702/4704/4714

**GENERAL PURPOSE
 FREQUENCY-TO-VOLTAGE
 CONVERTERS**

Model 4702, 4704, and 4714 F/V Converters are designed for general purpose applications. The 1 mV to +10 V output voltage is a direct, linear function of the 1 Hz to 10 kHz input frequency (10 Hz to 100 kHz for 4704). With 4 decades of dynamic range and high linearity the transfer characteristic is:

$$E_o = 10 \text{ V} \times \text{FREQ IN} / 10,000$$

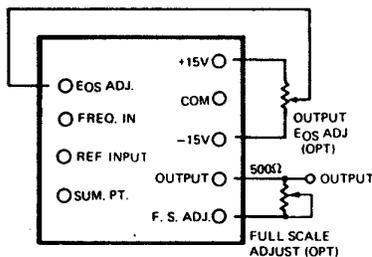
$$E_o = 10 \text{ V} \times \text{FREQ IN} / 100,000 \text{ (4704)}$$

The high linearity of these devices make them an excellent choice for applications such as measuring RPM or flow rates from pulse type transducers. In these applications the accuracy is determined by the transducers, not the V to F.

An inexpensive method of 2-wire data transmission (FM telemetry) uses Philbrick's economy V/F converter as the modulator/transmitter and the 4714 as the demodulator/receiver. Transmission of this data in the presence of high common mode voltages is possible by putting an optical isolator on the output of a 4713 or at the input of the Model 4714.

TRIMMING OFFSET AND FULL SCALE

Output offset is guaranteed to be less than ±10 mV when the input frequency is zero. However, for applications requiring extreme precision, this offset can be trimmed out with a trim potentiometer, connected as shown below. Although a 50,000 Ω trimpot is the normal recommended value, any value from 10 kΩ to 1 MΩ can be used.



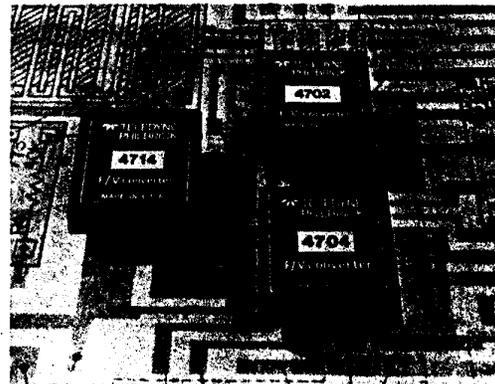
NOTE: FULL SCALE ADJ. PIN MUST BE SHORTED TO OUTPUT PIN IF TRIM-POT IS NOT USED

Figure 1. Zero and Full Scale Frequency

FILTERING THE OUTPUT

The output of the 4702 and 4714 is filtered by a 24 kΩ in parallel with a 0.01 μF RC lowpass filter (see Figure 4). The addition of an external capacitor between the output and the summing point will further reduce the ripple, but will increase the circuit's time constant and slow its response. Curves of ripple voltage versus frequency for the 4702 and 4714 with and without an external 1 μF filter capacitor are in Figure 2.

The output of the 4704 is filtered in a similar manner with a 24 k resistor and a 0.001 μF capacitor. See Figures 3 and 4.



FEATURES

- Low Cost
- Good Linearity
- Input – Logic Pulse to Sine Wave
- Output – ±10 V

APPLICATIONS

- Low Cost FM Demodulation
- RPM Measurement from Magnetic & Optical Pickups
- Wide Range Frequency Monitors

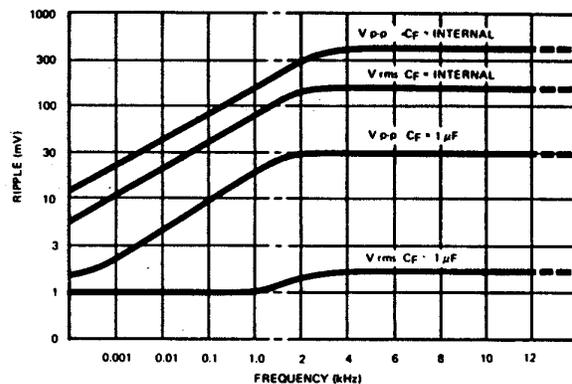


Figure 2. 4702/4714 Ripple vs. Frequency

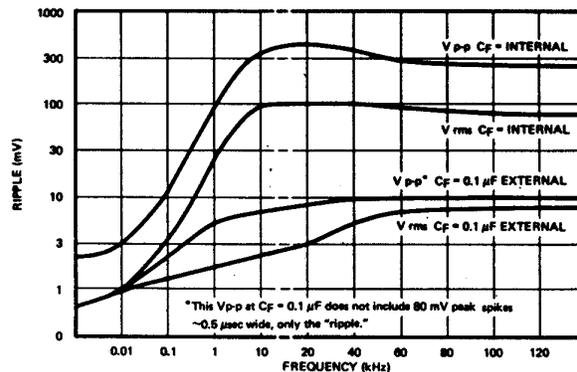


Figure 3. 4704 Ripple vs. Frequency

FREQUENCY INPUT

Full Scale Frequency	10 Hz to 10 kHz
4702, 4714	100 Hz to 100 kHz
4704	+10% min., 30% typical
Overrange Configuration	Differential, Referred to the Ref Input Pin
Input Levels ①	-12 V to +0.8 V = Low (± 15 V Fault ②)
	+2.0 V to +12 V = High
Loading	< 1 TTL Load ③
Input Pulse Width	20 μ sec min. for rated accuracy ④
4702, 4714	2.5 μ sec min. for rated accuracy ④
4704	
Input Impedance	1 M Ω 8 pF

ANALOG OUTPUT

Full Scale Voltage	0 V to +9.9 V ± 0.1 V ⑤
Offset, E_{OS}	± 10 mV max. @ $f = 0$ Hz
Nonlinearity, (1 Hz to 11 kHz) % FS	
Model 4702, 20 μ sec pulse width	$\pm 0.03\%$ max., $\pm 0.008\%$ typical
Model 4714, 20 μ sec pulse width	$\pm 0.09\%$ max., $\pm 0.008\%$ typical
Model 4704, 2.5 μ sec pulse width	$\pm 0.05\%$ max., $\pm 0.005\%$ typical
Output Impedance	
Model 4702	0.05 Ω max., < 0.005 Ω typical
Model 4714/4704	0.2 Ω , < 0.01 Ω typical
Ripple	
Model 4702/4714	170 mV rms @ $f = 10$ kHz, 25 mV p-p @ $f = 1.0$ Hz
Model 4704	70 mV rms @ $f = 100$ kHz, 50 mV p-p @ $f = 10$ Hz
Output Current ⑥	
Model 4702/4704	+20 mA, -5 mA
Model 4714	± 5 mA
Offsetting Scale Factor in μ A/V ⑦	42 μ A/V nom., 48 μ A/V max., 37 μ A/V min.

RESPONSE

Filter Time Constant	
Model 4702/4714	240 μ sec
Model 4704	24 μ sec (will be increased by external capacitor)

STABILITY

ΔE_{OS} vs. Temp. max.	
Model 4702/4704	$\pm 50 \mu$ V/ $^{\circ}$ C (± 5 ppm/ $^{\circ}$ C)
Model 4714	$\pm 100 \mu$ V/ $^{\circ}$ C (± 10 ppm/ $^{\circ}$ C)
$\Delta E_{OS} / \Delta V_{CC}$ max.	
Model 4702/4704	$\pm 50 \mu$ V/% (± 5 ppm/%)
Model 4714	100 μ V/% (± 10 ppm/%)
$\Delta E_{OS} /$ Time	30 μ V/day, 100 μ V/month
ΔV_{fs} vs. Temp., max.	
Model 4702	± 100 ppm/ $^{\circ}$ C
Model 4714/4704	± 150 ppm/ $^{\circ}$ C
$\Delta V_{fs} / \Delta V_{CC}$	± 500 ppm/%
$\Delta V_{fs} /$ Time	10 ppm per day, 30 ppm per month

POWER

Voltage (V_{CC})	± 15 V, $\pm 5\%$ (± 14 V to 16 V with derated specs)
Quiescent Current	
Model 4702/4714	± 18 mA
Model 4704	± 22 mA
Recommended Philbrick Supply	2211

ENVIRONMENT

Temperature	
Model 4702/4714	-40 to +70 $^{\circ}$ C
Model 4704	-40 to +85 $^{\circ}$ C
	-55 to +85 $^{\circ}$ C Storage, absolute max.
Humidity	98% non-condensing
MTBF	> 400,000 hours

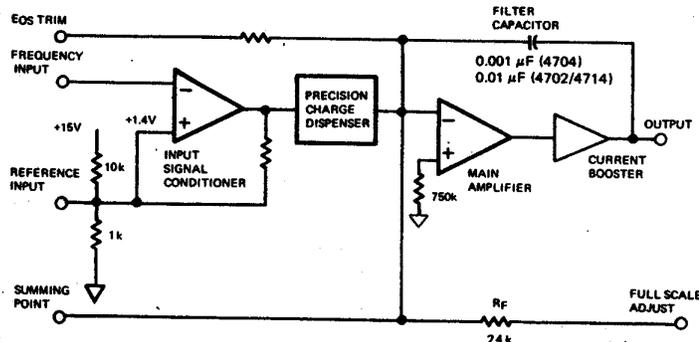
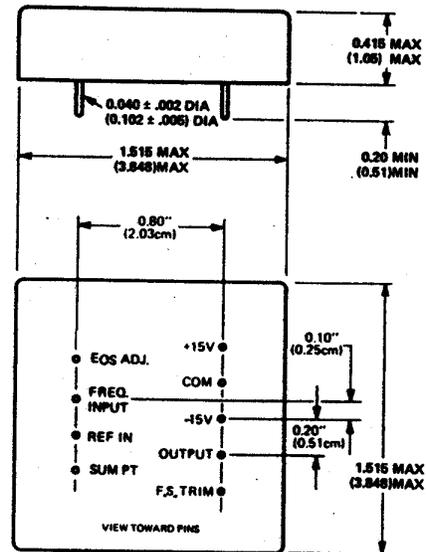


Figure 4. Block Diagram

NOTES:

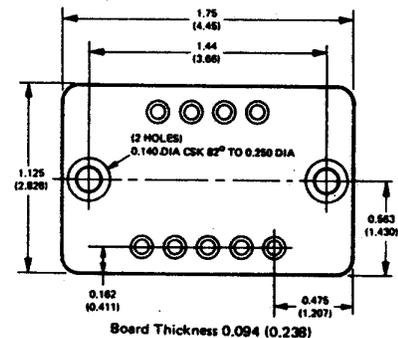
- ① Hysteresis: 400 mV p-p, nominal
- ② Compatible with TTL and DTL Logic. Compatibility with High Noise Immunity Logic (HNIL or CMOS) can be achieved with a noise immunity of 6 V by the addition of an external resistor.
- ③ Applies to both normally high dc levels with negative-going pulse trains, or, to normally low dc levels with positive-going pulses. The rise and fall times are not critical.
- ④ At 2 k Ω Rated Load. Trimmable to +10,000 V with an external 500 Ω rheostat at rated F.S. input frequency. By offsetting, output voltage can be ± 5 V.
- ⑤ Output short circuit protection: indefinite to ground or to + V_{CC} ; 5 sec to - V_{CC} .
- ⑥ Current into summing point to offset output.



± 0.01 Non-cumulative tolerance between pins
 ± 0.02 Tolerance from case edge to center of pins

DIMENSIONS IN PARENTHESES ARE EXPRESSED IN CENTIMETERS

Optional Socket: Model NSK-20



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Allied Drive at Route 128, Dedham, Massachusetts 02026
 Tel: (617)329-1600 TWX: (710)348-6726 Telex: 92-4439