10kHz, 100kHz, 10kHz
General Purpose
Frequency to
Voltage Converters

The 4702, 4704, and 4714 are general purpose frequency to voltage converters specifically designed for applications requiring high performance at a low cost. With $\pm 0.005\%$FS nonlinearity (4704) and $\pm 1\%$FS gain error, these devices provide the user with a 0 to +10V output range that is a linear function of the input frequency regardless of its waveshape or amplitude. Other features include thirty percent overrange as well as low full scale and zero offset drifts.

Applications Information
Output offset voltage is guaranteed to be less than $\pm 10\text{mV}$ (0.1\%FS) when the input frequency is zero. For applications requiring greater precision, this offset can be trimmed with a 10k$\Omega$ to 1M$\Omega$ trim potentiometer (TCR $\pm 100\text{ppm}/^\circ\text{C}$ or less, see Figure 1). By utilizing offset techniques, a $\pm 5\text{V}$ output range can be obtained. Full scale is typically 9.9V $\pm 0.1\text{V}$. A 500$\Omega$ trim potentiometer is recommended for achieving a precise $\pm 10.000\text{V}$ output.

Output Filtering
The outputs of these devices are filtered through a lowpass RC filter consisting of a 24k$\Omega$ resistor in parallel with a 0.001$\mu$F (4704) or 0.01$\mu$F (4702/4714) capacitor (Figure 1). The addition of an external capacitor between the output and the summing junction will further reduce the output ripple at the expense of increasing the circuits’ time constant and slowing its response time (Figures 2 & 3).

Figure 1. Block Diagram

FEATURES
- $\pm 0.008\%$FS Nonlinearity (4702/4714)
- $\pm 50\mu$V/$^\circ\text{C}$ Zero Offset Drift
- Thirty Percent Overrange
- High Noise Immunity

APPLICATIONS
- FM Demodulation
- RPM Measurement from Magnetic and Optical Sensors
- Wide Frequency Range Monitors
- Data Transmission
FREQUENCY INPUT
Full Scale Frequency
4702, 4714
4704
10 Hz to 10 kHz
100 Hz to 100 kHz
Overrange
+10% min., 30% typical
Configuration
Differential, Reflected to the Ref Input Pin
Input Levels
-12 V to +0.9 V = Low
+2.0 V to +12 V = High (±15 V Fault)
Loading
< 1 TTL Load
Input Pulse Width
4702, 4714
20 μsec min. for rated accuracy
4704
2.5 μsec min. for rated accuracy
Input Impedance
1 Ω / 8 kΩ
ANALOG OUTPUT
Full Scale Voltage
0 V to +9.9 V ± 0.1 V
Offset, Eos
±10 mV max. @ f = 0 Hz
Nonlinearity, (1 Hz to 11 kHz) % FS
+0.03% max., +0.008% typical
Model 4702, 20 μsec pulse width
+0.09% max., +0.008% typical
Model 4714, 20 μsec pulse width
+0.05% max., +0.005% typical
Model 4704, 2.5 μsec pulse width
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 = 1 kHz, 25 mV p-p @ f = 1 Hz
Model 4704
70 mV rms @ f = 100 kHz, 50 mV p-p @ f = 10 Hz
Output Current
Model 4702/4704
+20 mA, -5 mA
Model 4704
± 5 mA
Offsetting Scale Factor in μA/V
42 μA/V nom., 48 μA/V max., 37 μA/V min.
RESPONSE
Filter Time Constant
Model 4702/4714
240 μsec (will be increased by external capacitor)
Model 4704
24 μsec
STABILITY
ΔEos vs. Temp. max.
Model 4702/4704
+50 μV/V°C (±5 ppm/V°C)
Model 4714
+100 μV/V°C (±10 ppm/V°C)
ΔEos / ΔVCC max.
Model 4702/4704
+50 μV/V%/ (±5 ppm/V%)
Model 4714
100 μV/V%/ (±10 ppm/V/month)
ΔVr / Δt, Temp., max.
Model 4702
+100 ppm/p°C
Model 4714/4704
+150 ppm/p°C
ΔVr / ΔVCC
±500 ppm/%
ΔVr / Time
10 ppm per day, 30 ppm per month
POWER
Voltage (VCC)
±15 V, ±5% (±14 V to 16 V with derated caps)
Quiescent Current
Model 4702/4714
±18 mA
Model 4704
Recommended Philbrick Supply
2211
ENVIRONMENT
Temperature
Model 4702/4714
-40 to +70°C
Model 4704
-40 to +85°C
Humidity
98% non-condensing
MTBF
> 400,000 hours

1. Hysteresis: 400mV p-p, nominal
2. 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.
3. At 2kΩ Rated Load. Trimmable to +10.000V with an external 500Ω rheostat at rated F.S. input frequency. By offsetting, output voltage can be ±5V.
4. Output short circuit protection: indefinite to ground or to +VCC; 5sec to -VCC.
5. Current into summing point to offset output.

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Figure 2. 4702/4714 Ripple vs. Frequency

Figure 3. 4704 Ripple vs. Frequency