Model CC701
Charge converter operating guide

Single channel charge converter for piezoelectric transducers

1.0 Introduction

The CC701 charge converter is a solid state device which converts the signal of a high output impedance piezoelectric transducer (accelerometer) to a low output impedance voltage signal. The CC701 yields a strong signal, immune to output cable motion noise, compatible with standard signal readout equipment such as data collectors, voltmeters, analyzers, etc. Long output cables can be driven without significant signal loss.

2.0 Description

The CC701 charge converter is a rugged, self-contained, cylindrical stainless steel unit, 2 inches (5.1 cm) long overall, and 5/8 inches (1.5 cm) in diameter. At one end, it has a 10-32 coaxial connector for mating to the accelerometer and, at the other end, a male BNC connector for connection to the power unit/amplifier. The charge converter incorporates an overload-protection circuit and the Wilcoxon low-noise PiezoFET® amplifier.

The CC701 charge converter is powered by the constant current source of a Wilcoxon Sensing Technologies Power Unit/Amplifier (model P702, P703B, P704B, PR710, or PR712) or it can be powered from an external constant current supply of 18 to 30 VDC, capable of delivering from 2mA to 10mA (a 4mA constant current diode recommended).

3.0 Operation

3.1 Inspection

Upon receipt, carefully unpack and inspect the charge converter for any visible signs of damage to connectors or the case. If there is damage, file a claim with the carrier who transported the instrument. Retain the shipping container and packing material for use if reshipment is required.

3.2 Preparation for use

The CC701 charge converter is put into operation by simply inserting it between the high-impedance piezoelectric charge output accelerometer and a P700 Series power unit/amplifier or other source of constant current. The accelerometer is connected to the CC701 using the 10-32 input connector by means of a miniature coaxial cable. The output of the CC701 is obtained from the BNC connector. A coaxial cable is used for the output to reduce possible extraneous electrical pickup.

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The input coaxial cable should be of the low-noise variety and should be kept as short as possible since cable-flexing can contribute erroneous charge signals known as triboelectric effects. The 10-32 coaxial cable connectors and 10-32 terminals on the CC701 should be kept clean and dry to prevent deterioration of frequency response.

Note: As a result of thermal transients, piezoelectric transducers can develop substantial static charges. Although the input of the CC701 is somewhat protected from damage caused by such charges, it is advisable to short the transducer output prior to connecting it to the input of the CC701.

The CC701 has a gain of 1 mV/pC, calibrated at the factory. With a supply voltage of 18 VDC, typical for any of the P700 Series power unit, (and a constant current of 2mA to 10mA), the unit is capable of an output 5 Vrms.

Constant current levels are usually selected by considering the cable length (or capacitance) which the charge amplifier has to drive. A 4mA constant current diode (Motorola IN5312 or Siliconix J5XX, or equivalent) is recommended for most applications fed from an +18 to +30 VDC supply, when a P700 Series power unit is not used.

The case of the CC701 and the outer shell of the BNC output connector are the common return for signal and supply. To avoid interference and the creation of ground loops, the case and connector shell should be kept isolated from contacts with grounded objects.

3.3 Cable drive considerations

As a current output device, any charge amplifier is limited by its ability to supply adequate current to drive (charge) the cable capacitance at high frequencies. Assuming the entire constant current is available to drive the cable, it can be shown, starting with the relation Q=CV (charge equals capacitance times voltage), and differentiating, (for sinusoidal voltages), that:

$$I = C\,\frac{(dV)}{(dt)} = 6.28 \times 10^{-6}\ fCA$$

I = Constant current supplied, mA dt
f = Frequency, kHz
C = Cable capacitance, pF
A = Voltage, V peak

For example: an output of 6 V peak, assuming a constant current supply of 4mA, the maximum cable capacitance which would permit an undistorted output at 10 kHz is 12000pF or roughly 350 feet of the typical 30 pF/ft cable. If the constant current was increased to 10mA, the maximum cable length would then be 880 feet.

The above relation also shows that if one is willing to accept a lower amplitude output signal with the same supply current, the cable capacitance or the upper frequency limit can be increased proportionately. Thus, using the above accelerometer with a 2.5 V peak signal (at 4mA), at 10 kHz a cable about 850 feet long can be used. Alternately, with a 175ft cable and 4mA, and an output of 6 V, the frequency response can be extended to 20 kHz. The accelerometer's resonance frequency may begin to affect the frequency response of the system beyond 15 kHz, however.

Caution must be observed, however, in attempting to increase cable driving capability by increasing the constant current. It should be noted that the CC701 supply must be de-rated at 0.10 mA/ºC above 25º C to keep internal dissipation within ratings.

4.0 Troubleshooting and repair

The Model CC701 charge converter requires no maintenance. Make sure the connectors are kept clean. In case of apparent malfunction, the problem can be isolated by substitution of system components. Consult the factory if such substitution does not solve the problem.

4.1 Technical assistance

For technical assistance, please contact Wilcoxon Sensing Technologies at 301-330-8811 or email info@wilcoxon.com.

4.2 Customer service

For all customer service inquiries, please call 301-330-8811 or email info@wilcoxon.com.