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# Understanding the Endevco Variable Capacitance Accelerometer Electrical Characteristics

Technical Paper 323

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# Understanding the Endevco variable capacitance accelerometer electrical characteristics

The Endevco variable capacitance (VC) accelerometer family features a very versatile signal output arrangement allowing for differential or single-ended operation. They require a regulated excitation voltage (see individual data sheets for details) and produce an output of ±2 volts. In addition to the output signal there can be a bias present, in some instances up to 3.6 volts, which will be detailed later in this paper.

## Excitation voltage

Endevco VC accelerometers are ideally suited for operation with piezoresistive bridge signal conditioners found in many modern data acquisition systems. When using these accelerometers with a bridge signal conditioner, 10 Vdc excitation should be selected.


Figure 1 Model 7290D variable capacitance accelerometer.

Compatible Endevco signal conditioning equipment includes the model 136; three channel signal conditioner/power supply and the multi-channel OASIS system with the 236 signal conditioner cards.

**The 7290 and 7590 accelerometer series features a very versatile signal output arrangement allowing for either differential or single-ended operation.**

Input (excitation voltage) is always applied between the red (+) and black (-) leads (see figures 2 and 3). The power supply ground should always be isolated from the AC line power ground. If the excitation voltage ground and power ground are common, this could result in excessive noise, unwanted ground loops and, in some cases, interaction between the excitation power supply and signal amplifier.

**Endevco VC accelerometers are ideally suited for operation with piezoresistive bridge signal conditioners.**

Unlike a piezoresistive accelerometer, the VC accelerometer uses active electronics and is not a passive resistive bridge.

Piezoresistive accelerometers use a passive resistance bridge as the transduction element. The sensitivity and zero characteristics are approximately ratio-metric to the excitation voltage applied to the device. The VC excitation voltage can be operated within the specified range with very little effect on the unit's sensitivity or zero characteristics (the VC accelerometer's output is not ratiometric to the excitation voltage). It should also be noted that if the excitation voltage drops below the minimum specified voltage, the VC accelerometer will not operate. Exceeding the maximum voltage can cause permanent damage.

## About ZMO

The zero measurand output (ZMO) is the voltage present on the accelerometer's output at 0 gs (see figure 2). When the accelerometer is on its side, ideally the output should read zero volts. VC accelerometers are "DC responding", which means they will sense constant acceleration such as earth's gravity.

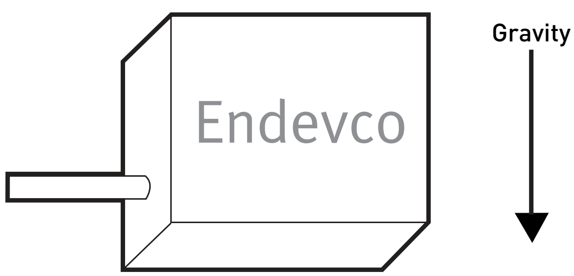


Figure 2 **Showing a typical Endevco VC accelerometer on its side. This is the "zero g" position.**

While most Endevco VC accelerometers have been trimmed with a ZMO goal of zero volts out, there will almost always be some voltage (ZMO) present. The ZMO can generally be corrected using the signal conditioner zero, or balance adjustment.

## Differential operation

While the VC accelerometer can be operated in the single-ended mode (described later), differential operation is the preferred mode. When operating in the differential mode, the user can expect the most stable performance over the specified temperature range due to the reduction of common mode errors.

> **When operating in the differential mode, the accelerometer's (+) and (-) outputs are isolated from ground, thus the bias voltage is not a factor!**

When using a differential output, the red and black wires are connected to the excitation source. The green (+) and white (-) wires are connected to the (+) and (-) inputs, of the signal conditioner, respectively (see figure 3).

Many Endevco data sheets state that the differential output is dc coupled at a dc bias of 2.5V to 3.6V (depending on model), which causes some confusion. It should be noted that when operating in the differential mode, the accelerometer's (+) and (-) outputs are isolated from ground, thus the bias voltage is not a factor! When the accelerometer is on its side, the output will equal zero volts plus the ZMO (described above). Figure 3 illustrates the differential configuration.

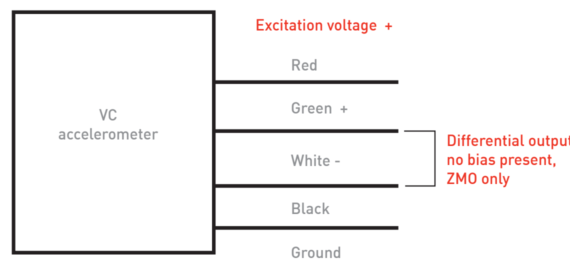


Figure 3 **Showing proper connections for a differential output. The green and white wires connect to a differential amplifier.**

## Single-ended operation

Sometimes, due to instrumentation limitations, it is desirable to operate the accelerometer in the single-ended mode. The versatility of the 7290A does allow for single-ended operation without any modifications.

As previously stated, there are limitations when using the single-ended operational mode. In single ended operation, the ambient temperature should be reasonably stable since the temperature compensation also corrects for changes in the reference voltage.

There will also be a bias present on the signal output (between the green and black lead). The signal conditioning equipment should have sufficient offset to

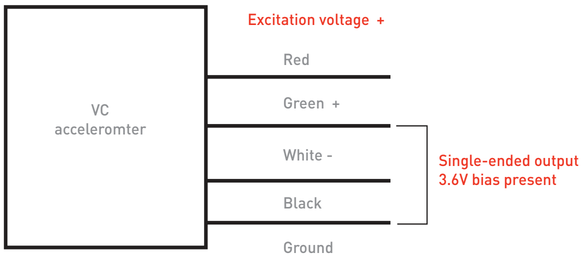


Figure 4 **Showing proper connections for a single-ended output. An amplifier with a single-ended input is connected to the green and black leads.**

adjust for this bias and ZMO. In single-ended operation, the white wire should float.

**Do not ground the white wire.**

## TEDS

The 7290D has a built-in transducer electronic data sheet (TEDS). This feature is independently read via the orange lead, on the 7290D.

## Additional output considerations

The user should observe the minimum load resistance, which is generally 10k Ω. The shunt capacitance should not exceed 0.1 μF. For more details, see the instruction sheet included with the accelerometer.

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