

## BACKGROUND

We are often asked what is the output voltage of Emfit sensors when there is a force impact on the sensor and what is the effect of the impact area. The following is written for easier understanding of the behaviour of Emfit sensors.

### CALCULATING THE OUTPUT VOLTAGE OF EMFIT SENSORS FOR A FORCE IMPULSE

When there is a force impact ( $\Delta F$ ) on an Emfit sensor, we can calculate the output voltage change ( $\Delta V$ ) from the equation

$$\Delta V = (1/C) \times S_q \times \Delta F \quad (1)$$

where  $C$  [pF] is the total capacitance and  $S_q$  [pC/N] is the sensitivity of the Emfit sensor.

The equation is valid only when we are operating in the linear region of the sensor (see "Linearity of Emfit sensors"). The RC time constant of the measuring circuit must also be much higher than the duration time of the force impact (see "Preamplifiers for Emfit sensors").

As long as we are operating in the linear region, equation (1) gives the output voltage change and the impact area of the force has no effect.

If we want to know the voltage output for a pressure impact  $\Delta P$  [N/cm<sup>2</sup>] ( $\Delta P = \Delta F/A$  where  $A$  is the impact area), we can write equation (1) as

$$\Delta V = (A/C) \times S_q \times \Delta P \quad (2)$$

Now, if the impact area ( $A$ ) is the total area of the Emfit sensor, we get

$$\Delta V = (1/C_0) \times S_q \times \Delta P \quad (3)$$

where  $C_0$  [pF/cm<sup>2</sup>] is the specific capacitance of the Emfit sensor.

In most cases the impact area is smaller than the total area of the sensor, and cables also increase the value of the total capacitance. So equation (3) can be used only in special cases. Generally, we need to know the total capacitance and the sensitivity of the sensor (also the impact area if we are working with pressure) in order to calculate the output voltage.

## ADDITIONAL INFORMATION

For additional information or assistance, please contact:

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