### 3.8. Twisted Pair

A twisted pair of wires reduces inductive coupling by canceling induced magnetic field voltages. Figure 3–15 shows magnetic field (**B**) coupling into a circuit. $V_s$ represents an input signal to an electronic device on a vehicle. $R_{in}$ represents the input impedance of the module. The figure shows that the device input voltage, $V_{in}$, is the sum of $V_s$ and the noise voltage $V_n$, which the magnetic field induces.

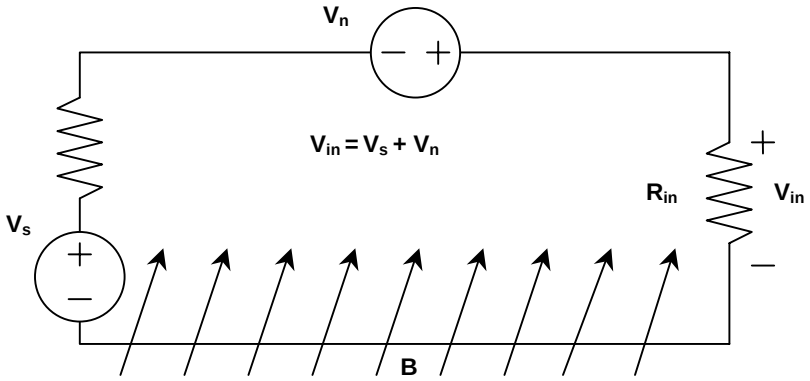


**Figure 3–15. Magnetic Field Coupling into Circuit**

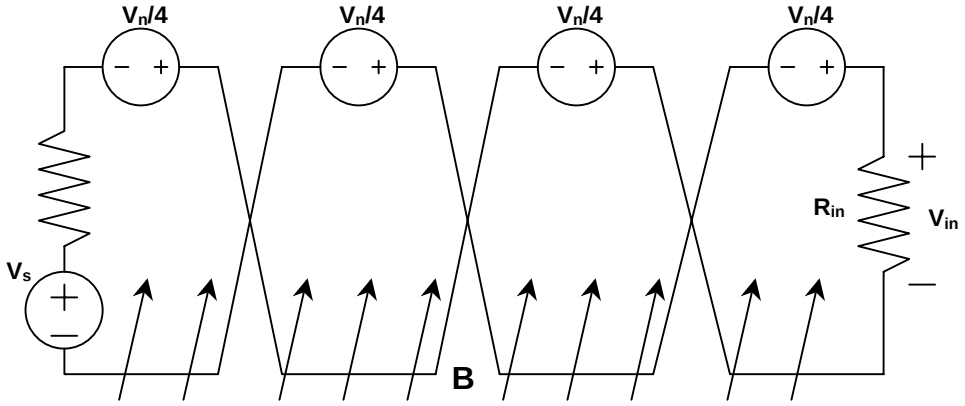


**Figure 3–16. Magnetic Field Coupling into Twisted Wire Pair**

Figure 3–16 shows the circuit in Figure 3–15 that uses a twisted pair. The twisting produces four equal loop areas with equal noise voltages. By summing all the voltages around the circuit the noise voltages cancel due to the twisting. This is why twisted pairs work best to reduce inductive coupling into a receptor circuit.

$$V_{in} = -\frac{V_n}{4} - \frac{V_n}{4} + V_s + \frac{V_n}{4} + \frac{V_n}{4} = V_s$$

**Equation 3–17. Inductive Coupling in twisted-wire pair**