Frequently Asked Questions

Which is better suited for my application, open or closed loop current sensors?

Open loop sensors are preferred in battery powered applications, such as electric cars. They take considerably less power to operate and above 100A, they are considerably lighter. They also have a higher ability to withstand sustained overloads than closed loop sensors. If cost is a major consideration, the open loop sensors should be the first choice. Closed loop sensors offer fast response and excellent linearity. The closed loop sensor's current output is less susceptible to electrical noise. They are often preferred in high frequency circuits, such as switching power supplies, when quick response and noise immunity to high di/dt's is critical.

How does the position of the conductor inside the aperture effect the reading?

For best accuracy, keep the conductor in the center of the aperture. The effect of positioning is more noticeable when the size of the conductor is significantly smaller than the sensor aperture.

Can I use the Hall effect sensor to measure true power (P = V x I x COS)?

Models PI, NA-25 and NAP-25 can provide a DC output which is accurately proportional to Real Power. This is possible because of the multiplying ability of the Hall sensor used in the current sensor. The load current is sensed by passing the load current carrying conductor through the aperture of the sensor, eliminating the need for a current transformer (CT). The Hall sensor excitation current is derived from a step down potential transformer and resistor. The output of the sensor is an instantaneous multiple of the excitation current and aperture current. The output wave form is an AC ripple on top of a DC component. This DC component is proportionate to Real Power.

Why is there a specification for a minimum and maximum sense resistor on a closed loop sensor?

Closed loop current sensors require a resistor to be connected between the output of the sensor and ground to complete the circuit. This resistor is in series with a compensation coil and one of the drive transistors (depending on the polarity of the aperture current), which is connected to one leg of the bipolar power supply. Each component exhibits a voltage drop, which is both current and temperature dependent. As the current being measured increases, more current is required to drive the coil which nulls the field. This results in a larger voltage drop across the coil and sense resistor. The total of these voltage drops can not exceed the supply voltage minus the voltage drop across the collector/emitter leads of the transistor. Therefore it is the maximum sensed current that determines the maximum value of the sense resistor. For DC analysis, the voltage drop across the sense resistor, compensation coil and drive transistor must total the supply voltage. If less voltage is dropped across the sense resistor, more voltage must be dropped across the drive transistor, since the coil can be treated as a fixed value resistor. The maximum power dissipation of the drive transistor determines the minimum value of the sense resistor.

What determines the frequency range of an open loop current sensor?

In most applications, it is the eddy current heating of the core that sets the upper limit of the frequency. This limit is specified as ampere-kilohertz, which is the product of the frequency and current.

Can I operate multiple sensors from a common power supply?

All F.W. Bell current sensors that operate from a bipolar power supply can have several sensors connected in parallel to the supply. Connections to the power supply ground and output ground should be make separately. Also, the sensor output grounds should be tied to a common ground connection in order to prevent ground loops and possible noise problems.

What happens when an in-rush current far exceeding the sensor's rating is applied? An open loop sensor will not be damaged.

There may be a slightly larger offset due to the magnetization of the core. This additional offset is temporary and will be removed if a current is applied in the opposite direction. A closed loop sensor may be damaged depending on the duration, duty cycle and amplitude of the over current. Consult F.W. Bell with exact requirements.

Why do most sensors require a bipolar plus and minus 15 Vdc? Will they operate on ±12 Vdc?

F.W.Bell current sensors measure current in both the positive and negative direction. A positive current flow as defined in the specification sheet will result in a positive output and a negative current will result in a negative output. With the exception of zero offset, the sensor will have zero output at zero current. This allows the sensor to provide the most accurate representation of dc, AC and AC superimposed on top of DC current wave forms. Most F. W. Bell sensors will operate on ±12Vdc.In some cases there may be some additional zero current offset. The measuring range and sense resistor values may be effected on the closed loop sensors.

I want to measure currents below 2 amperes. How can I do this when the lowest rated sensor you manufacturer is 25 amperes?

By winding turns through the aperture of the sensor, the current is magnetically multiplied by the number of turns. For example, a sensor with 10 turns through the aperture will see 10 A when 1 A is flowing through the conductor. Besides greater sensitivity, ampere turns also decrease the effect of zero offset and offset temperature drift proportionately to the number of turns. For example, at 1 A the Model BB-25 has an output of 40 mV with a typical offset of 5 mV and a typical offset temperature drift of 0.30 mV/ºC. Assuming the worst case, over a 10ºC change the output could vary form 32 mV to 48 mV, a 20% error. With 10 turns, the sensor sees 10A and has an output of 400 mV. Assuming the same conditions as above, the output could vary from 392mv to 408 mV, a 2% error. The 10 turns results in a reduction in error of 10 times!