Current Sensor Information Page

Hall-Effect Current Sensor Features:

- Measure: DC, AC, and Pulsed waveforms
- Galvanic Isolation
- Zero Insertion Loss
- Fast Response
- Cost Effective

Current Transformer Features:

- Measures AC only
- No Power Supply
- Electrical Isolation
- Lower Cost

The Basic Principle

Open Loop Operating Principle

In a hall effect-based current sensor, the magnetic flux, proportional to the primary current, is concentrated in gapped magnetic core containing the hall effect device (Fig. 1). The primary current is measured without electrical contact with the primary circuit providing galvanic isolation.

From Figure 1, the magnetic flux, concentrated in the gap of the magnetic core, induces a potential difference, Vh, the Hall voltage, given by the Vh=k*Ic*B. The output signal of the Hall device, Vh, is then further amplified by additional internal signal conditioning circuitry to provide an output voltage proportional to the primary current.

Closed Loop Operating Principle

In a closed loop current sensor the same principles apply with the addition of a secondary coil and feedback circuitry. The closed loop or 'zero-flux' hall effect sensor feeds back an opposing current into a secondary coil wound on the magnetic core to zero the flux produced in the magnetic core by the primary current. The output current of a closed loop current sensor is an exact representation of the primary current scaled by the number of turns in the secondary coil. As with the open loop design the closed loop design provides galvanic isolation.

The output of a closed loop current sensor can be scaled with the addition of a burden resistor, Rm[1] , to produce a voltage level output proportional to the primary current.

[1] Within limits - Consult Tamura Engineering

Figure 1

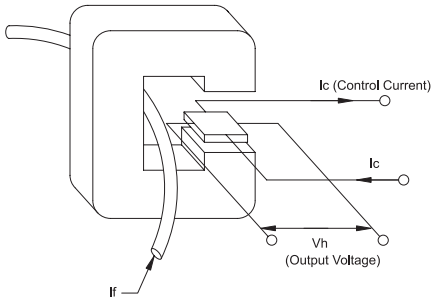
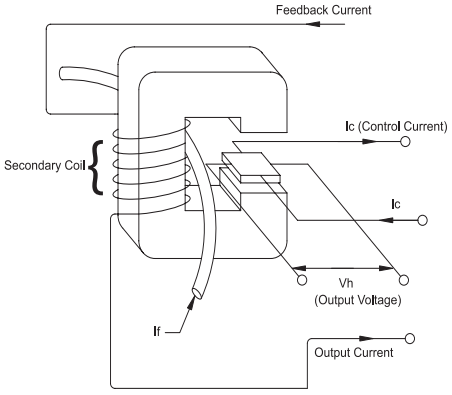


Figure 2



Application notes & tips:

1. Insure power supply polarity is respected to prevent damage to internal circuity.
2. Non-linearity due to magnetic core saturation can occur at primary currents in excess of 2X the nominal rated current.
3. Hall effect based current sensors are affected by static and dynamic electric and magnetic field; use twisted and/or shielded cables to mitigate these affects.
4. Frequency bandwidth in open loop current sensors is limited at high frequency due to magnetic core losses and eddy current induced temperature rise.
5. The Primary conductor should pass straight through the aperture or, in the case of multiple primary turns, wound around the body of the current sensor.
6. Care in placement and orientation of the current sensors in presence of high electromagnetic fields can lessen EMF effect on the current sensor.

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