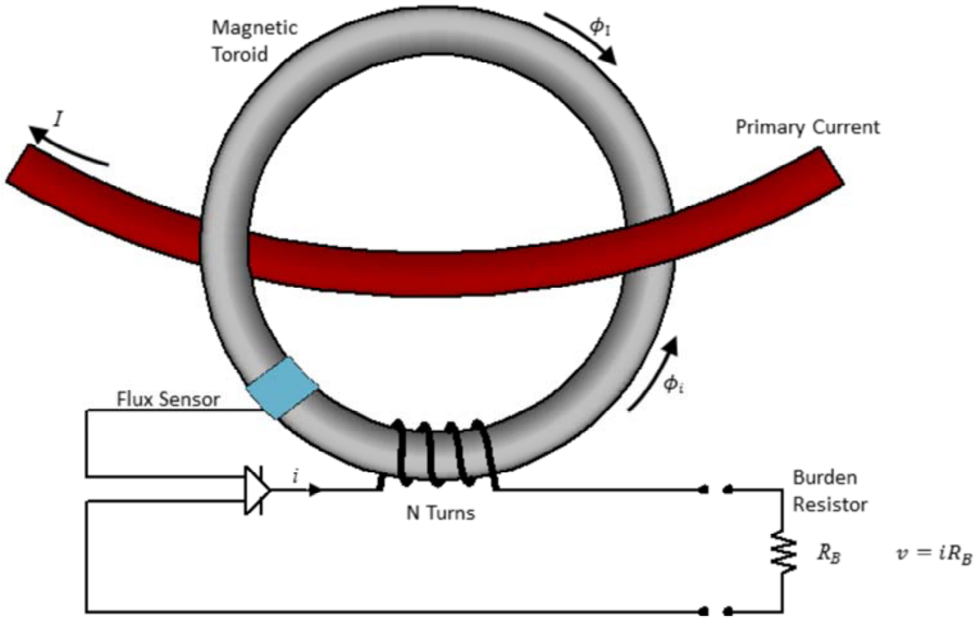
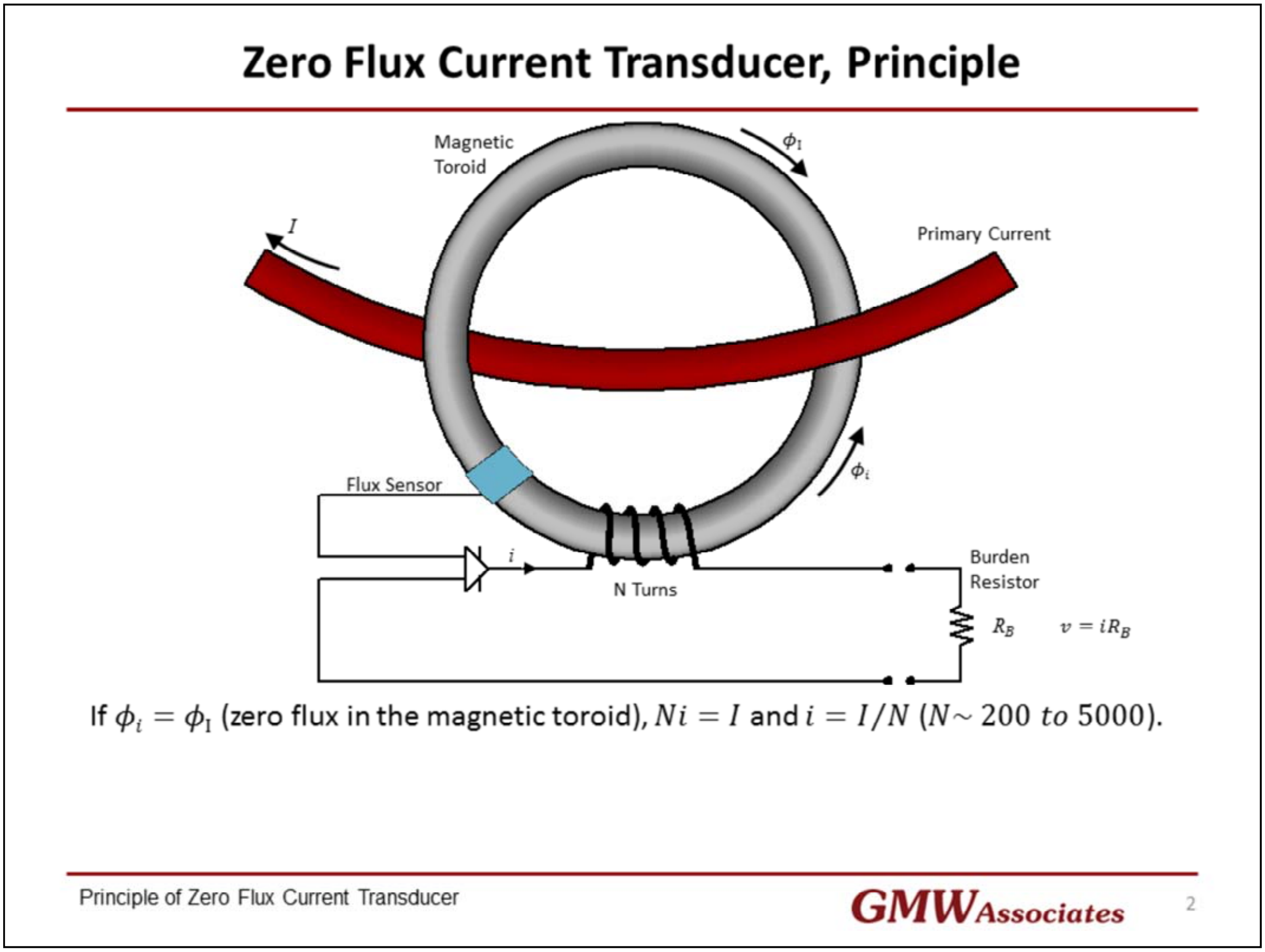
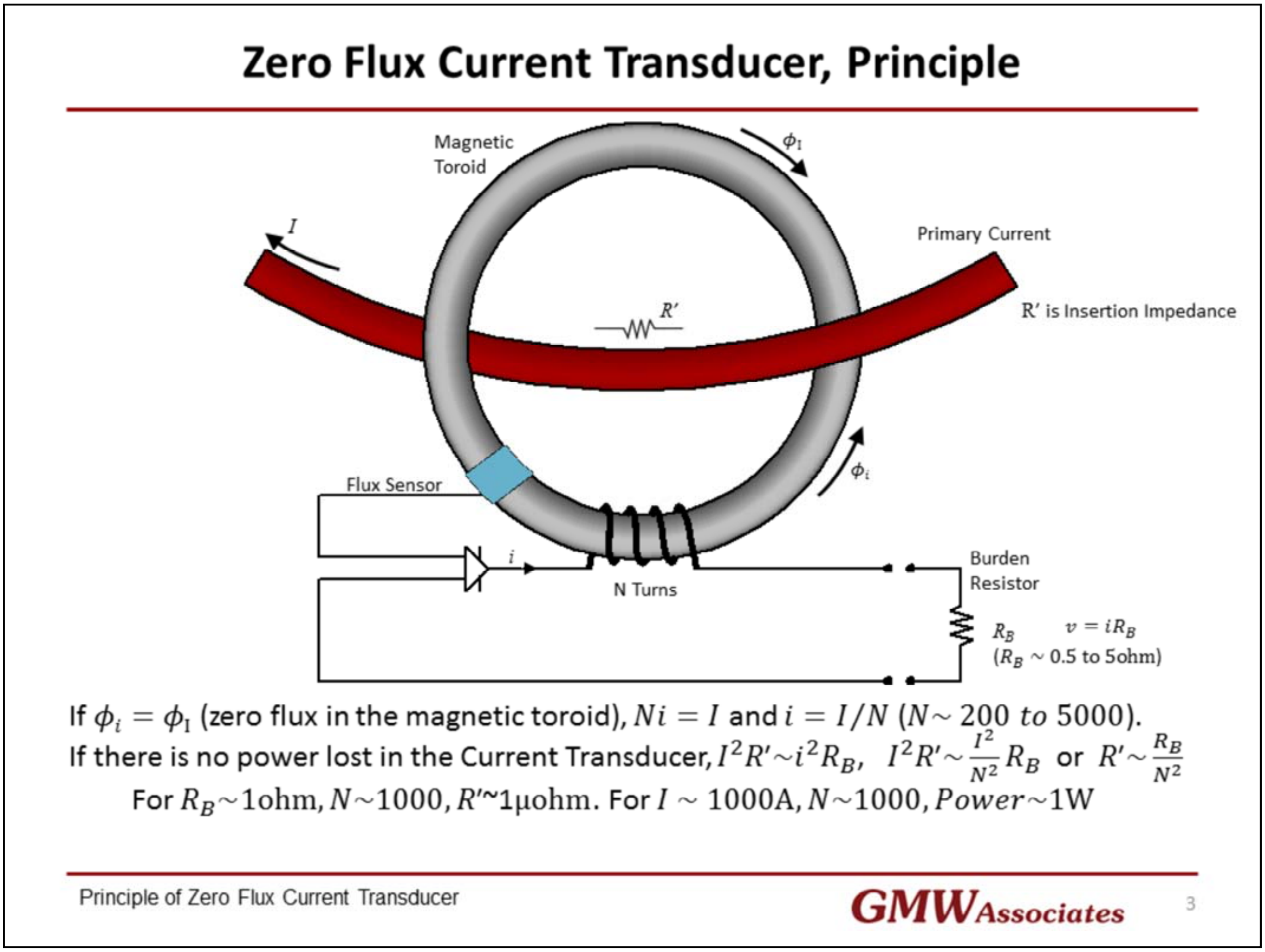
Zero Flux Current Transducer, Principle



The primary current, I, in a conductor through a magnetic core will generate a magnetic flux in the core ϕ_I. If somehow this flux in the core can be sensed by a "core flux sensor" then a compensation current, i, in a winding around the core can be used to generate an opposite flux ϕ_i so that $\phi_i \ = \phi_I$. The compensation current, I, can be measured in a "Burden Resistor" R_B as $v = I \cdot R_B$.



With this arrangement the basic requirements of a Current Transducer have been achieved. The output current, i, is reduced from the primary current, I, to $\frac{I}{N}$ where N is a fixed constant, the number of turns in the compensation winding. Also the output current, i, is electrically isolated from the primary current, I.



If there is no power lost in the toroid and the compensation winding, then the equivalent insertion impedance, R', of the Current Transducer can be estimated by equating the power dissipated in R' with the power dissipated in the Burden Resistor R_B. This shows that the equivalent insertion impedance is the Burden Resistance R_B/N^2 .

Not only does the Current Transducer provide electrical isolation and current division but also a dramatic reduction in the insertion loss compared to using a low resistance shunt to measure the primary current.

The typical insertion impedance can be about 1µohm with a peak series power dissipation in the primary circuit of about 1W at 1000A.