The Electronic Tap Switching Voltage Regulator and The Power Processor

General

What is an electronic tap switching voltage regulator? An electronic tap switching voltage regulator is a device that regulates voltage by electronically changing winding-taps on a transformer. Most tap switching regulators use a microprocessor based system that detects the input voltage to a system, then based on its value, switches to a tap that compensates for the under or over voltage, bringing it back to nominal.

Taps

Tap switching voltage regulators, for the most part, are available in 3 to 6 tap designs. The greater the number of taps the tighter the regulation. 3-tap designs are mainly for conditions where extreme high and low line conditions occur. The regulation on these units is very poor, + or -10% or more. Most electronic equipment will not function within this regulation range. Six-tap voltage regulators are designed more for electronic equipment, but they have drawbacks also. Being that the regulator has only six taps, its regulation range is only + or - 5%. This is fine for loads that will tolerate this output voltage window, but what if you need tighter than 5%? This is where the Power Processor comes in. *The Power Processor* has 7 taps that can keep the voltage regulated on the output to + or - 3% with smoother transition between tap changes. This ensures that the voltage is within tolerances for most sensitive electronic equipment.

Correction

In the electronics realm, correction is defined *as the process by which an abnormal condition is brought back to normal.* When it comes to voltage regulators, correction is crucial in maintaing a steady output voltage and preventing load damage. Most tap switching voltage regulators correct using a error signal feedback method (ESFM). ESFM voltage regulators work on the principle of a feedback loop. If the input voltage is above or below a preset value, an error signal will indicate to the regulator to move to another tap. The problem with this design is that it is time dependent. Once the unit changes taps, it has to wait for the next cycle to change to another tap. This causes staircasing. If the input voltage is 15% above nominal, it may take up to 1 cycle to begin to correct and another 3-4 cycles to stabilize. During this time the load could already be affected. The Power Procesor uses an alternative design technology called Digital Referencing. Digital Referencing is a method in which a microprocesor decides which tap to select based on the input voltage. In other words, if the input voltage is 15% above nominal, the Power Processor will select the proper tap and will correct the surge within 1/2 to 1 cycle. The correction on the output is almost instantaneous, there is no gradual decreasing with a staircase like waveform; it is fast and it is accurate!

Voltage Sensing and Notching

Accurate voltage sensing is one of the most crucial but overlooked elements of a good voltage regulator. Voltage can be sensed many ways, the most common being a standard digital or analog detection system. Most tap switching voltage regulators use a digital or analog detection circuit to obtain the voltage value instantaneously, and correct based on that instantaneous value. This method is fine if you have a smooth sinewave and only the total voltage changes. But what if you have a notch? In a standard detection system, as soon as the sensing circuits detect a notch, they will most likely change to an incorrect tap resulting in a continuous surge, causing the loads not to function properly or become damaged. So instead of correcting the problem, it made it worse! Does the Power Processor use this technology? The answer is no. *The Power Processor* uses a method called Digital Averaging. Digital Averaging is a process by which the Power Processor takes samples of the incoming waveform and averages its value. From this value, the microprocessor determines whether or not to switch taps. This averaging method is a more accurate way of determining the level of the input voltage. As far as notches are concerned, (since they only represent a small portion of the waveform), the Power Processor ignores the notch and sustains the correct output voltage.

Summary

An electronic tap switching voltage regulator is a device that regulates voltage by electronically changing winding-taps on a transformer. Most tap switching voltage regulators utilize a 3-6 tap design. These designs are not practical for most applications dealing with sensitive electronic equipment. The Power Processor utilizes a 7-tap design that regulates the output voltage to + or - 3% of nominal, a perfect match for today's sensitive electronic equipment. Most voltage regulators incorporate an ESFM method for correcting output voltage. This method is time dependent and the correction is not as fast as it needs to be; typically it takes around 5 cycles. The Power Processor utilizes Digital Referencing Technology, which can precisely correct the voltage fluctuation within 1/2 cycle without over or under shoot. Many voltage regulator manufacturers use a standard analog or digital detecting system to monitor the input voltage. If this type of system is used, then an incorrect error signal, generated from a notch or another high frequency transient, may cause a considerable increase in the output voltage, causing damage to the load. The Power Processor uses a method called Digital Averaging. Digital Averaging is a process by which the Power Processor takes the average value of the waveform and determines whether or not a tap should be switched. This method ignores notches without increasing the output voltage. Controlled Power Company's Power Processor has over 18 years of field application performance. A necessary assurance for long life and trouble free operation.