

## **Ford 2009 Smart Charge**

1. Battery Temp Sensor
2. Alternator Charge Set-point
3. Emission Control
4. Torque Converter Lockup

Ford 2009 Smart Charge uses multiple control parameters to improve battery life, decrease emissions, improve fuel economy and actively control alternator set-point. This is done by a two way communication between the PCM and the smart chip in the alternator. See schematic below. This two way communication is vital to keep all of the above characteristics functional.

1. Ford has incorporated a battery monitoring system to prevent battery overcharging. The sensor recognizes battery temp and relays that data to the PCM. PCM then in-turn instructs the alternator to reduce its voltage set-point, reducing charge current. The intent is to prevent batteries that have been depleted below the 11.6 VDC level from overheating. Batteries that have been depleted below 11.6 will be not able to be restored to the proper float voltage and will eventually bubble and explode.
2. PCM has been designed to change set-point voltage the alternator operates at to handle load conditions. Set point determines alternator output current. AGM batteries will work well with this system due to their inherent float voltage of 14.7 VDC. PCM voltage set-point adjustment will also allow increase in charge current to maximum in high demand situations, such as wheel chair lift, and other non-continuous loads. PCM can also slightly increase idle to assist in heavy load apps, in addition to raising voltage set-point.
3. PCM will use alternator load setting feed back to adjust firing angle of each cylinder to optimize and minimize emissions. Alternator must feedback signal to PCM with load and current data.
4. Ford has designed the 2009 chassis to allow the torque converter to run in locked mode as much as possible to improve fuel efficiency. PCM uses the alternator to temper chugging caused by this lock up when changing loads on the engine occur. PCM will modulate the alternator set point to offset engine/transmission vibration and to dampen chassis shaking. The PCMM two communication with the alternator allows instant change in set-point to vary load placed by the alternator on the engine.

## **Legend**

- 17 Transmission final drive
- 21 PCM
- 23 two communication between engine and PCM
- 24 Torque converter lockup signal from PCM
- 27 Two way communication between transmission torque sensor and PCM
- 29 Ignition module control from PCM
- 31 Ignition control module
- 32 Ignition module to engine control
- 33 Engine interface
- 43 Battery temp sensor
- 49 PCM to alternator two way communication
- 61 Battery current sensor

## **Battery Discharge Limit**

Lead Acid batteries are not designed to be discharged below 11.6 VDC. Doing so will permanently damage battery and prevent it from being recharged and possibly cause it to explode. Exploding batteries are not caused by spiking alternators. Alternators do not have enough reserve capacitance to blow up a battery. Exploding batteries are caused by improper maintenance and attempts to recharge fully depleted batteries.

AGM batteries are better able to withstand repeated low discharges below 11.6 VDC. For better performance and longer life it is recommended that AGM batteries be incorporated into 12VDC buss (distribution) designs.

Production procedures to insure that batteries are not depleted during the manufacturing process will greatly decrease battery failure and improve customer satisfaction.

## **PCM communication**

The Ford 2009 PCM system uses a digital com buss which uses a 125 Hz frequency. The digital square wave signal is modulated or pulse width modulated to generate the binary codes (0s or 1s) to allow two way communication. Without this signal path the PCM will not be able to handle its required functions and will trip the yellow wrench light and the yellow engine light on the lower right side of the instrument panel dash.

Attempts have been made to try a dual frequency generator chip in the alternator regulator to fool the PCM into thinking a true com between it and the alternator exists. The problem with this strategy is the pulse width variance sought by the PCM com-buss is not there. These attempts to short the 125 Hz frequency usually end in hard codes.

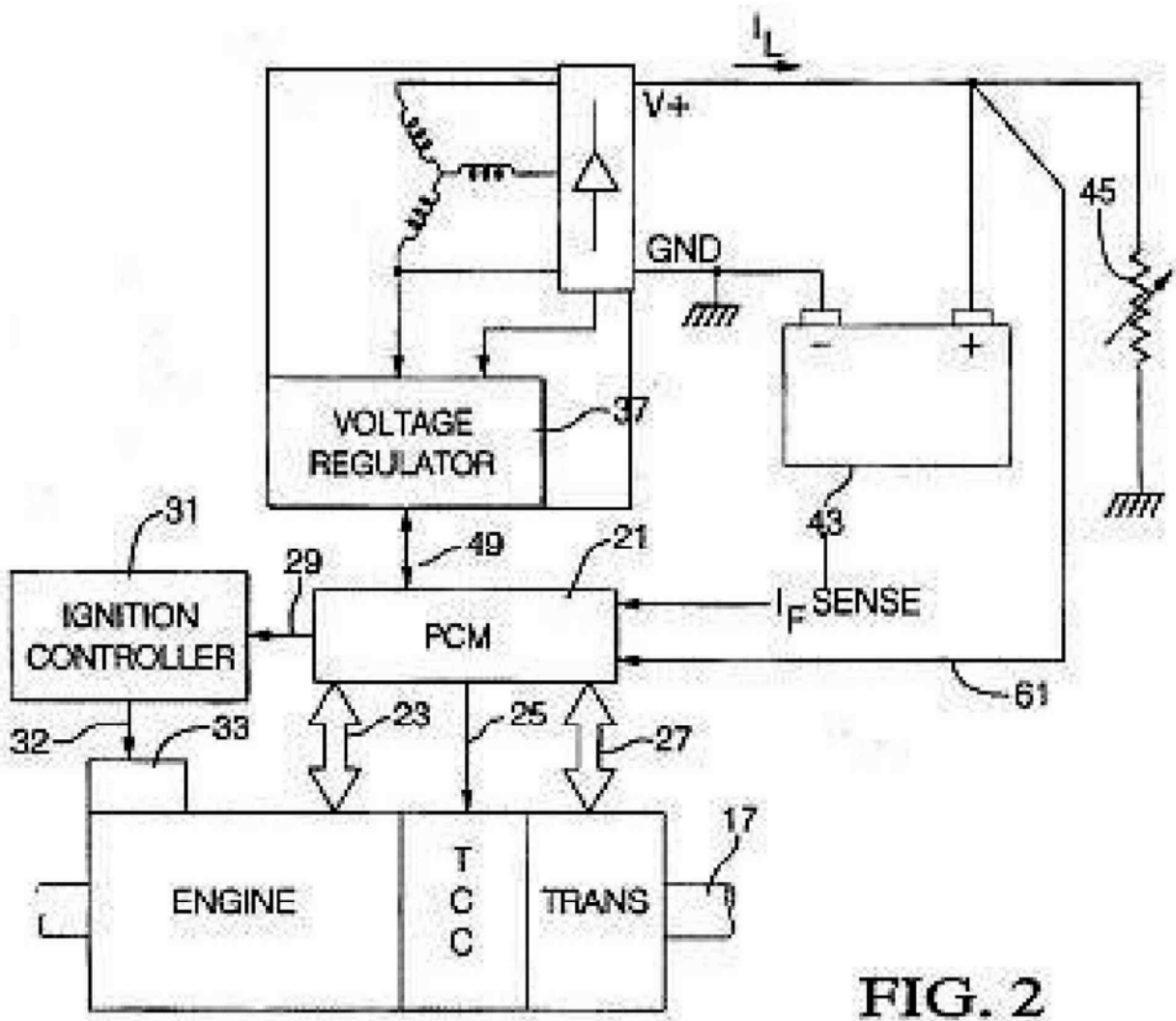


FIG. 2