

COM TERMINAL CHARGING SYSTEMS



BY MARIO CESPEDES

In their quest to optimize fuel economy, reduce weight, satisfy government standards, and attract consumers, auto manufacturers worldwide have turned to using local communication networks to control the vast majority of the moving parts on the vehicle – including the alternator.

The newest charging systems today are controlled by a single-wire which links the alternator to a network. The Engine Control Module, Power-train Control Module or on the latest vehicles, Electronics Control Unit are master nodes in this network. This communication wire, often referred to as a COM terminal on the voltage regulator, is the digital transmission medium. It allows the same alternator-regulator to perform efficiently in different applications under a wide array of conditions. In particular, charge voltage can be fine tuned to fit changing parameters on the fly.

An alternator can now be fully disengaged to remove its mechanical load on the engine when extreme acceleration is needed, like passing another car on a highway. The same alternator may also be used to overcharge a battery momentarily to create a heavy mechanical load on the engine to work in parallel with brakes. This essentially full fields the alternator during braking to save wear on disk and rotor surfaces while generating electrical energy that can be saved by the battery to increase fuel mileage down the road. All of that can be accomplished within fractions of second!

This is possible by using a voltage regulator that communicates with the Control Unit (CU) in much the same way that your desktop computer communicates with a printer or scanner. This type of communication is not really new in the automotive world. General Motors and Ford have both used it in various forms in the past to activate alternators and adjust the charge voltage rate. However, communication in those early systems was basically one-way and very simple when compared with the modern charging systems of today. The COM terminal has truly integrated the alternator and placed it firmly under control of the CU. That presents a challenge for rebuilders, who must be able to test these alternators.

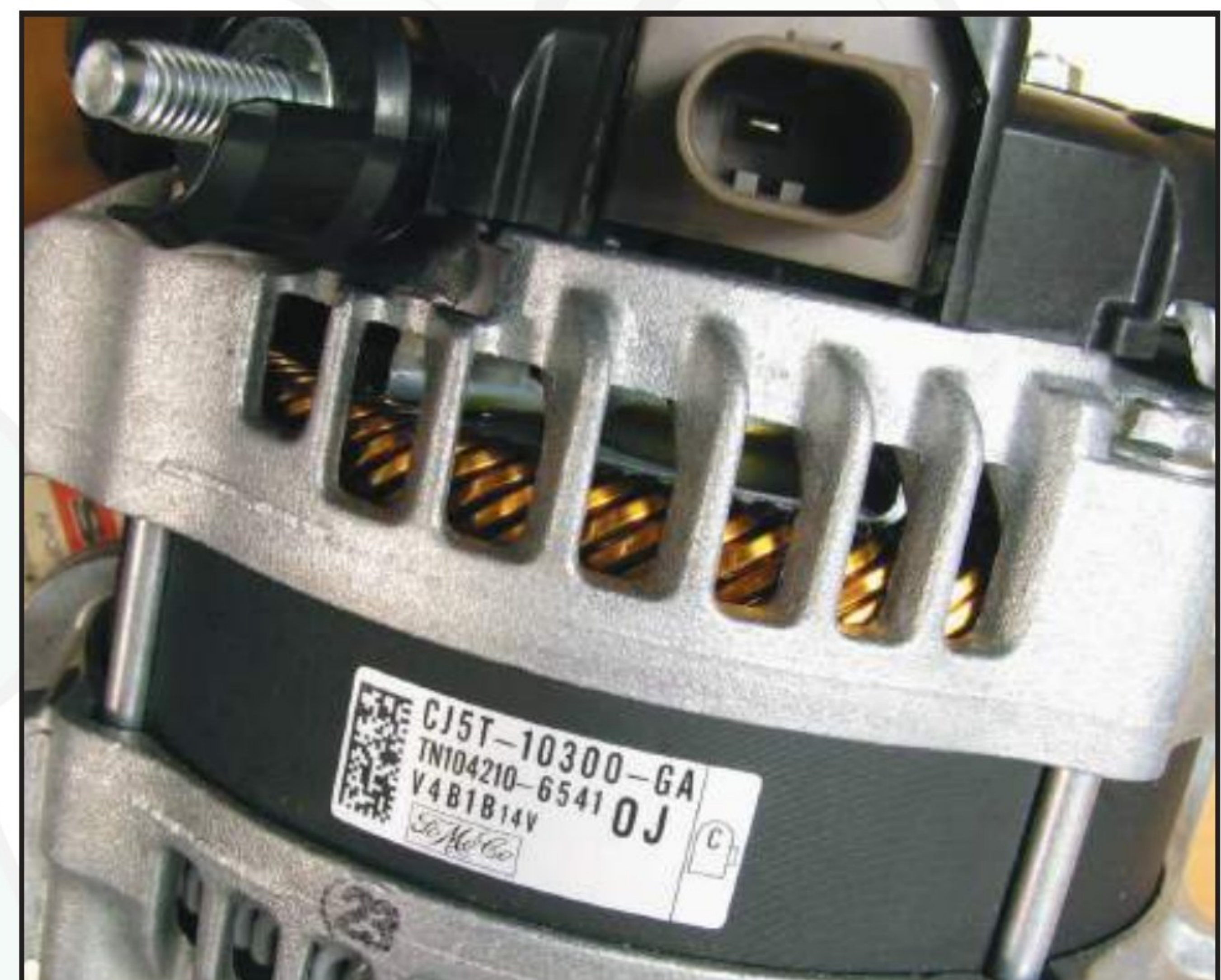
There are many available network protocols in use in vehicles but BSS and LIN are the two most used for charging systems because of their simplicity, low cost and robustness. They are similar in what they do but entirely different in the details. Think of them as different languages. Of the two, LIN has become the dominant choice by vehicle manufacturers because it is easy for them to customize it to suit their needs while making it more difficult to replicate in the aftermarket.

Each LIN network has one master and up to 15 slave nodes, all connected by a single wire. The alternator/regulator is one slave. After every engine start, the CU must initiate communication with a COM regulator before the alternator can do anything. The first contact synchronizes the language speed. After the communication protocol is negotiated, it is called a handshake. Hand-shaking or what I refer to as “secret handshakes,” are key to establishing and maintaining communication with the CU. The COM regulator must recognize the handshake and respond to it correctly. Once communication has been established, the CU controls regulator

activation and voltage set point. In addition, the CU will also request information from the regulator. This type of command must be answered by the regulator as expected.

To communicate with one of these alternator/regulators, you need a test apparatus that speaks the correct language – basically a mini-computer that is bi-lingual. Given that systems are becoming increasingly complex, multilingual is probably more accurate. Different versions of LIN and BSS have already been introduced. CU software updates are becoming more common.

Most COM terminal alternator/regulators will function in default mode in the absence of a handshake or if the signal is lost



This is another view of the Denso/Ford alternator that was shown on the cover. You can clearly see the “C” for COM terminal on the label's plug code and the single wire connection.



This 150 amp Mitsubishi alternator was used on Ford Focus cars and some Transit vans with what looks like a conventional 3-terminal 6G plug. Note that there is no plug code on the alternator's label. Some Ford alternators using COM terminal technology have conventional looking regulator plugs that only use the center terminal. Without the vehicle you have no way of knowing the number of wires in the harness. Attempting to test it without the correct apparatus can damage it.

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altogether during operation. You may get one to operate on your test bench in default by momentarily flashing a stator terminal with DC voltage, assuming that you can access a stator terminal. But there are no guarantees that this trick will work with every COM alternator/regulator. And even if it does charge for you in default mode, there is no guarantee that it will operate on the vehicle for which it is intended, responding as expected by that vehicle's CU. If the control unit senses anything is out of the ordinary – even one bit of data, it will very likely turn on the charge warning lamp – even though the alternator/regulator may be charging at a default rate which will appear to be perfectly normal. In other words – it is risky business to rebuild COM alternators without a test box and an experienced company in the field of automotive digital control that you can depend upon.

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This Denso/Honda alternator has been used on many Civic, CR-V and ILX models since 2012. Note here that the plug code on the label clearly identifies it as being a LIN controlled regulator.



This Denso alternator was used on many different Hyundai and Kia models from 2011 to the current year. Note that the plug code on this label identifies one of the terminals as “COM”. This is not what it looks like. In this case, COM means a PWM (Pulse Width Modulation) signal from the PCM. It is not a network. It is not BSS or LIN communication. BEWARE of misleading designations on plug codes labels! The give-a-way in this case is that there are two other used terminals in this plug, labeled L and FR. All LIN and BSS controlled regulators will have a single wire connection.