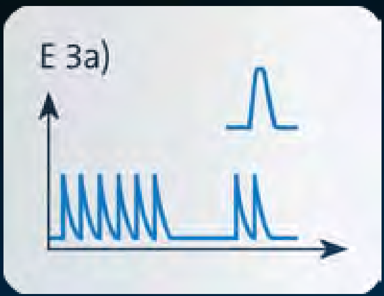
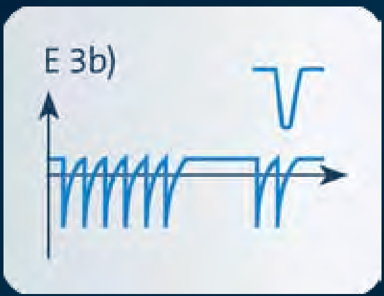
GOSSEN METRAWATT

Safety through Competence





Modern DC Power Supplies Generate Exact Test Signals

Power Supplies

Modern DC Power Supplies Generate Exact Test Signals

BY DENIZ VARTANOGLU

In order to incorporate the highly demanding functions into passenger vehicles and trucks, electrical and electronic components and modules must be subjected to a broad range of tests during the R&D and production phases. These evaluations are important, in order to be able to make well founded decisions regarding quality standards and readiness for series production.

In the automotive industry it must always be assured that the greatest majority of the tests are executed under realistic conditions of use, thus making it possible to guarantee error-free, safe functioning in advance.

The test conditions, such as the environment in which testing takes place, test signal and test procedure must meet the demands of highly variable operating states, in order to simulate the various conditions in the vehicle as perfectly as possible.

In the field of automobile manufacturing, motor and electronically controlled devices include, amongst others, complex airbags, ABS, headlight technology and complete operating units in the center console, as well as electronically controlled components in doors, windows and in the roof. This great multiplicity of functional assemblies must be tested as reliably and safely as possible, and guaranteed for subsequent use in series production. In order to assure that different impedances within the vehicle's electrical system do not cause any problems for subsequent series production, vehicle-specific test signals and modifications of standard test pulses have to be developed.

Standards and Transient Pulses

Test signals are specified in the SAE standards (Society of Automotive Engineers), which cover distinctive functions and conditions of use. In addition to these, test signals are also specified by the manufacturers.

Transient pulses within the automotive electrical system are caused when loads or inductances are switched. They are described in ISO 7637 (pulses) for the purpose of testing interference immunity. Depending upon how the device under test has been wired into the electrical system, it may be impaired by various pulses. The ISO standard differentiates amongst five different types of pulses (E1 through E5), which demonstrate varying amplitudes and durations depending upon how they are caused.

Pulse E1 is generated by an inductance which is parallel connected to the electronics (e.g. seat or window heater) when the battery is disconnected. This inductance is then discharged through the electronic system and generates a negative pulse, namely E1. The pulse has a duration in the microsecond range.

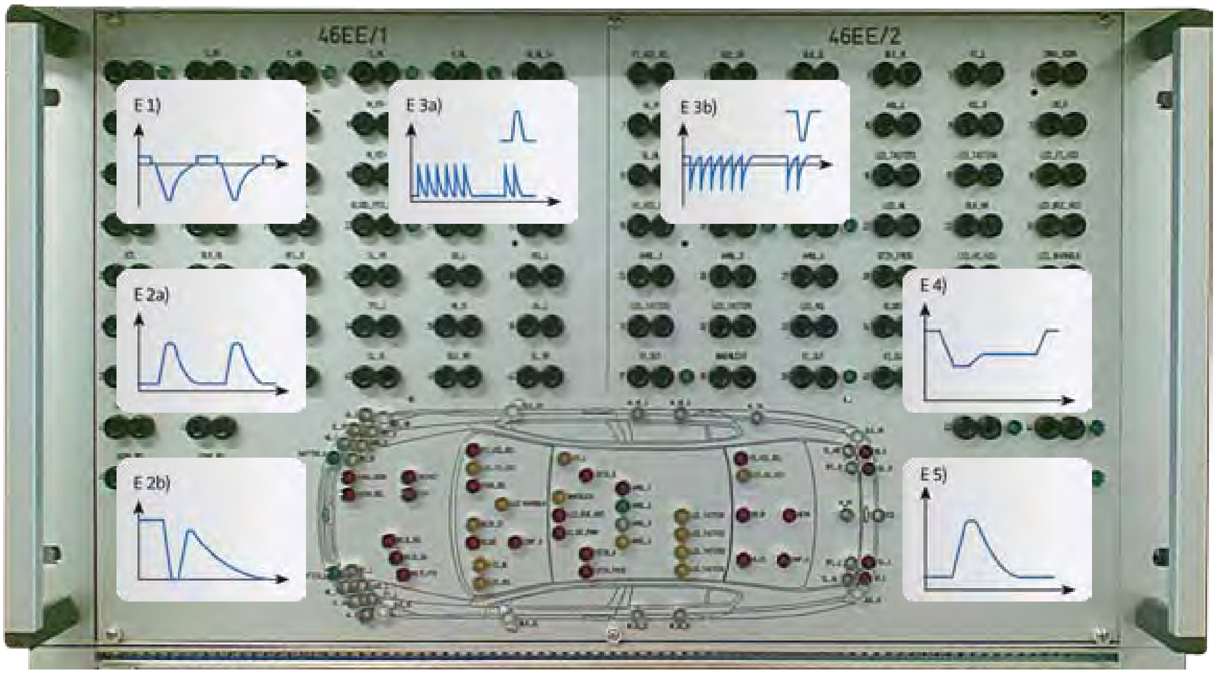
When control electronics are shut down while a DC motor is still turning, for example a windshield wiper motor or an electric window motor, pulse E2 occurs. As long as the motor continues to turn due to its intrinsic gyrating mass, it's transformed into a generator. This pulse also has a duration in the microsecond range, but it's significantly shorter than pulse E1.

The best known pulse is E3. It's generated when small parasitic inductances and capacitances are switched off which occur in the cable harness. Bouncing of the switch contacts then generates rapid transient pulses. These are unipolar pulses which can be negative or positive, but not alternating. Simulated test pulses 3a and 3b (positive or negative) are transient pulses in the nanosecond range, but have only minimal energy in comparison with the other pulses.

Pulse E4 is caused when the car is started (characteristic starter motor curve). The electrical system caves in due to the large amount of energy required by the starter motor. Local conditions also cause this pulse to occur with greatly varying parameter values, for example ambient temperature and the viscosity of the motor oil influence engine starting. Pulse 2b, the engine shutdown pulse, which is caused when the automotive electrical system is switched off while the alternator is still turning, also falls within this range. The alternator once again generates a voltage, although it's not an overvoltage, but rather just a short-term automotive electrical system voltage.

If the battery is switched off or disconnected while the alternator is still generating energy, pulse E5 occurs. Due to the fact that the low impedance of the battery is no longer available, overvoltages occur which are applied directly to the electronics. This type of disconnection may result from battery cable failure due to corrosion, or when the vehicle is jump started. This is a high energy pulse with a duration in the millisecond range.

The calibration center of GMC-I is specialized in ensuring the highest possible measure of precision.



The automotive test system equipment uses special pulses to examine the reliability performance, with the characteristic curve being the determining factor in the process.

Tests for Automotive-Test Setups

Pulses E1 through E5 demonstrate which categories of tests are required in the automotive field, and which can be implemented by means of laboratory power supplies in the testing, R&D and production phases.

Three categories of test setups have been established for metrological ascertainment of various pulses:

- Tests with high frequency test signals with edge rises in the microsecond range
- Tests in the medium dynamic range for which edge rises in the millisecond range are required
- Tests in a semi-static operating state in accordance with battery voltage tolerances.

Fast, high-frequency pulses are measured with the help of a special mechanical switch, a simulated automotive electrical system and an oscilloscope. The test setup is precisely described in ISO 7637, and must be strictly adhered to because results are not otherwise reproducible.

The mean or static pulses are ascertained in a similar fashion with an electronic switch, a simulated automotive electrical system and an oscilloscope. It's precisely in this working range that the new power supply from GMC-I Messtechnik fulfills all requirements specified by the automotive industry with the SYSKON P series KONSTANTERs.

Modern Laboratory Power Supplies

Modern laboratory power supplies are equipped with switching controller technology in order to achieve greater levels of efficiency and to reduce weight and size. However, switching controllers require an appropriate filter with an output capacitor in the output circuit. This capacitor, the rating of which may be several thousand Mikrofarad depending upon its power rating, directly determines dynamic performance. In addition to load current, adequately high charging current must be allowable in order to achieve short response times from lower to higher output voltages. Accordingly, this charging current influences dimensioning of the entire power component right on up to the mains input.

Rapid discharging must be assured for the other direction, namely reducing output voltage. Due to the fact that we cannot always assume that adequately high load current will be available, discharging must be accomplished by the power supply itself. An accelerated discharging function can be achieved by means of an integrated dynamic load or current sink. This concept is used for the SYSKON P series as well.

Another possibility is to rapidly discharge the output capacitor by returning its energy to the intermediate circuit at the primary side via the power transformer. This concept prevents any further power loss within the overall system, and is made use of in all high precision KONSTANTERs under the name of BET technology (bidirectional energy transport).

In either case, influence on the thermal balance of the entire power component must be observed. Beyond this, these additional functions must also be observed and taken into consideration in the layout and dimensioning of the controller. The overall control loop is thus expanded to include an additional function.

The New KONSTANTER Generation

The new programmable KONSTANTERs included in the SYSKON P series fulfill all of the requirements set forth by the ISO standard and the automotive industry for power supplies. Top quality, manually and remote controlled DC power supplies for laboratory and systems applications in the automotive sector are made available by these state-of-the-art instruments. The requirements and suggestions of users representing numerous applications ranges were taken into consideration during the developmental stages.

Deniz Vartanoglu
Dipl.-Ing. (FH)
Product Manager – Power Supply
GMC-I Messtechnik GmbH
Phone +49 911 8602-0
Deniz.Vartanoglu@gossenmetrawatt.com
www.gossenmetrawatt.com

GMC-I Messtechnik GmbH
Südwestpark 15
90449 Nürnberg, Germany
Phone +49 911 8602-111
Fax +49 911 8602-777
E-Mail info@gossenmetrawatt.com
www.gossenmetrawatt.com

Printed in Germany • Subject to change without notice • 1/12.09 • 3-337-248-03