Semiconductor Based Positive Marx Modulator EPULSUS-PM1-10

EPULSUS is a registered trademark from EnergyPulse Sytems for high performance pulse generators proposed for industrial applications where the efficiently use of energy, in the shape of precise repetitive energy pulses, is the pathway to accomplish the best results.
The EPULSUS-PM1-10 is a semiconductor based positive Marx Modulator design with state-off-the art semiconductor technology projected for operation with resistive and capacitive type loads, with almost square wave voltage repetitive pulses.

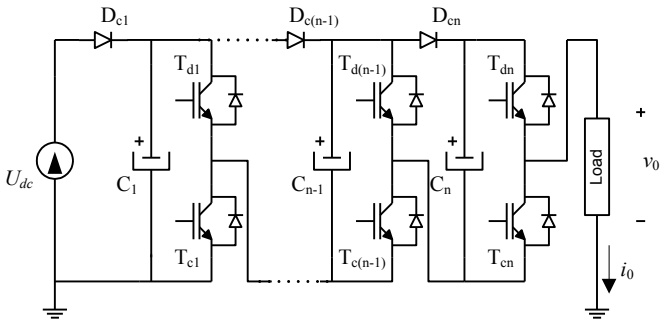
Overall characteristics

- Almost square wave pulse modulator for resistive and capacitive type loads
- Flexible pulse width and repetition rate operation
- Positive pulse voltage range up to 10 kV
- Peak current range up to 240 A
- Voltage pulse rise time 250 ns
- 3.5 kW (PM1.1) or 7 kW (PM1.2)
- Short-circuit protection
- CE Marked

The EPULSUS-PM1-10 comes within a normalized grounded metallic enclosure with forced air ventilation and IP54 index protection. A multi protection system, with interlocks and physical protections, keeps the operator from any accidental contact with high voltage. The modulator is controlled with an industrial PLC, which guarantees a high level of performance and safety, such that any failure will not cause an unsafe condition. In addition, the use of a PLC allows for an easier integration in an industrial environment. Finally, a local touch screen display for programming and diagnostic gives more flexible and user-friendly interface to the operator.

Technical data

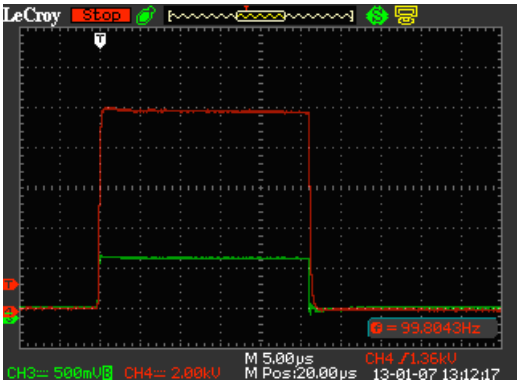
In the EPULSUS-PM1-10 simplified conceptual modular solid-state Marx topology shown right, each cell comprises an energy storing capacitor, a pulse IGBT and a charging IGBT and diode. Capacitors C_i are charged by power supply U_{dc} in parallel by diodes D_{ci} and T_{ci} IGBTs, during this period load capacitances are discharged to zero. Pulse is applied to load by connecting in series the C_i capacitors with the T_{di} IGBTs.



The modular topology used enables the use of relatively low voltage components, 1 kV, and the scaling up for others voltage, simplifying the maintenance.

Operation examples

On top a typical 10 kV / 60 A pulse waveform on a 100 Ω resistor, 26 µs width pulse and 100 Hz repetition rate, and on bottom an arc situation, during a 10 kV pulse, where the current rises to 500 A during 1.3 µs, after which the circuit turns off.
Red line: voltage 2kV/div
Top green line current 50 A/div and 5 µs/div
Bottom green line 100 A/div and 500 ns/div



Operations notes

The frequency is limited to 200 Hz by software (higher value can be set on request as well as burst mode operation). The duty cycle can be select freely, limited by power constraints for charging the capacitors.

Outer characteristics

- Standard galvanized steel enclosure with 800x600x400 mm and 80 kg
- Mains input 220-240 V_{ac} cable supplied
- Output cable 3m URM67 supplied with external
- Touch screen for programming output voltage, frequency and pulse width, and for monitoring capacitors voltage, output voltage and current pulse, output power and internal temperature
- Other input signals for integration in an industrial process are possible

Safety and protections

- Safety interlocks and reset condition after power on
- Slow output overcurrent protection above 240 A
- Fast output short-circuit protection above 300 A
- Series 1 Ω resistance for increasing overall output stability and short-circuit protection

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