Marx Generators

Our 20-plus year legacy of delivering reliable high voltage equipment and extensive experience in practical pulse generator applications traces back to North Star Research Corporation. We combine our expertise in high voltage pulse generator techniques with an understanding of the physics and engineering involved to exceed customer requirements. We tailor and adapt technology for customer needs by starting with a well-understood existing design; then using simulation and analytical analysis, we develop a new design with a proven base. This creates a low risk approach to delivering reliable Marx generators. Comprehensive testing is performed on the Marx generator to ensure the delivered system meets all critical performance requirements to achieve overall customer satisfaction.

For more information about our products and services, please visit our web site at
www.appliedenergetics.com/highvoltage.asp

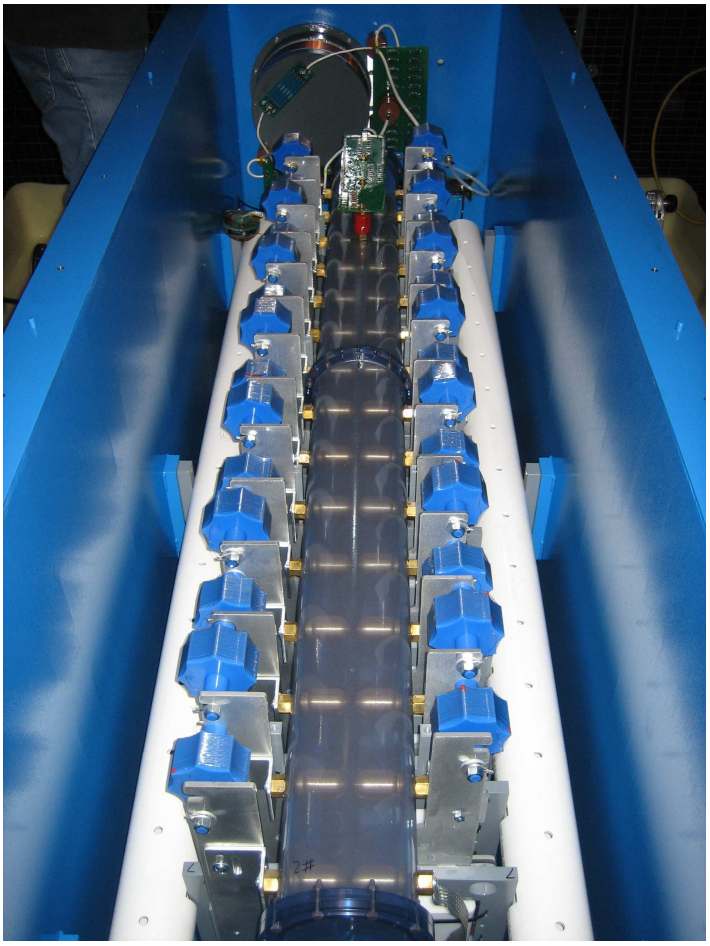
Marx Generators Defined

A Marx generator is made up of a number of capacitors that are charged in parallel to a given voltage, V, and then discharged in series. This produces an output voltage of V multiplied by the number of capacitors stages. Proper performance depends upon capacitor selection and the triggering of the discharge. Insulation of the high voltages produced is often accomplished by immersing the Marx generator in transformer oil or in a pressurized electronegative gas such as sulfur hexafluoride (SF6).

Applied Energetics' Marx bank designs have a number of unique features that distinguish them from other designs. These included the ability to generate square pulse output waveforms at rep rate. Our Marx bank square pulses do not have the fall time decay of traditional designs. We also integrate the power supply into the Marx bank. This improves reliability by eliminating the cables between the capacitor stack and the power supply. Supply protection circuits are designed integral to the supply itself.

Applications

Applied Energetics' Marx generators have been designed to address a wide variety of high voltage and high current pulsed power needs. These include applications in high power microwaves, X-ray sources, lightning simulators, electro-magnetic pulse (EMP) generators, trigger sources and other high energy physics studies.



500kV Marx generator in an oil containment vessel prior to oil fill.

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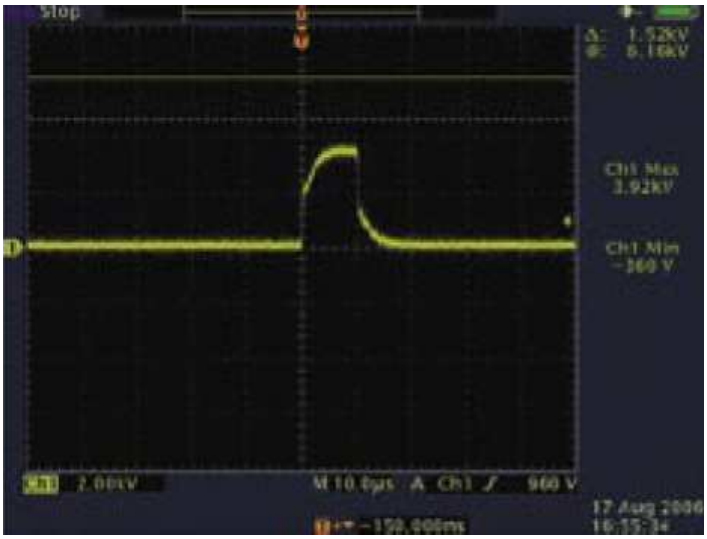
Applied Energetics Marx Generators

Marx generator capacitor chain



Solid-state Marx generator pulse waveform

Pictured above is the Marx capacitor chain for a 400 kV,15 kA system. This capacitor assembly was then inserted into a gas pressure vessel which also housed the integral power supply. The entire system included computer controls.

Advantages

Applied Energetics' Marx generators represent a unique advance in Marx generator design. These easily assembled units can be provided with "flat top" pulses using our unique PFN design, with fast rise-times, or with exponential waveforms. Units built have provided output voltages in the range from 50 kV - 1.5 MV.

A unique feature of the Marx generator shown above is the use of gas as the ambient insulating medium which leads to the elimination of switch housings. The systems offer either computer control, or a simple manual control system. The computer control is capable of a variety of functions. We have combined our Marx generators with compact, rugged power supplies to offer truly integrated devices.

Applied Energetics will quote custom and semi-custom applications tailored to meet your requirements.

Specifications

The Solid-state Marx generator (output shown above) range of system parameters are outlined below. The designs are essentially limited by the size of the switch element used and their respective switching characteristics.

Output Voltage Range	1 V - 20 kV
Output Current Range	10 A - 4 kA
Output Average Power	10 W - 50 kW
Output Pulse Characteristics	Square Wave

A 4 kV 1 kA single pulse solid-state Marx generator was designed with an average output power of 40W and could easily be increased by two orders of magnitude with a modified charging system.

Other gas and oil filled systems have been built with the range of outputs shown in the table below.

Marx Generators Delivered

Voltage kV	Current kA	Duration ns	Risetime ns	Rep Rate Hz
400	8	300	60	20
400	15	250	15	10
500	5	150	40	
500	10	500	100	
500	12	1000	200	5
1500	3	120	25	10

Specifications and performance figures are subject to change without notice.

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