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Development of a 120 kV, 600 A Marx-type power modulator for fast step-wise arbitrary output waveforms

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When driving dynamic loads such as the pulsed electron beam device (GESA), an adjustable output waveform of the driving pulsed power source is desirable. To meet the demand of a maximum output voltage of 120kV at pulse currents of up to 600A for pulse length of up to 100µs, a new Marx-type power modulator is currently under development at IHM. The modular design combined with a gate-boosting circuit enables the use of cost-efficient off-the-shelf IGBT devices as switching elements. Together with a low inductance layout of the capacitor leads and the arrangement of stages, a fast voltage rise time below 100ns across the load is ensured. By implementing an optical bus, the control signal distribution is simplified. Fault detection and clearance as well as EMI robustness is achieved by implementing a control unit on every stage. Individual switching sequences for each stage allow for step-wise arbitrary output waveforms. This contribution presents selected aspects of the design process and their validation in a generator arrangement driving dynamic loads.

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