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Flexible 50KV 18-Stage Solid-State Marx Modulator for Driving Capacitive Loads

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Many cathode-driven beam injection systems require a low average power highly stable and flexible modulator to generate an electron beam. The stability of the initial lower-power beam is vital to overall system efficiency. Stangenes Industries has developed a modulator system that is comprised of an 18-stage Marx modulator driving the primary of a pulse transformer within the confines of a 19"5U rack with a 20" depth. The system operates with single-phase 115/230VAC input with <15A of input current. The modulator is a 50KW peak power 150W average load power 18-stage solid-state Marx modulator with pulse-to-pulse output variability of 3-40KV with <100V of output resolution. The pulse width is adjustable up to 5us and rep-rate is 500pps+ for driving loads up to 300pF with an isolated filament via a bifilar winding in the transformer. The system operates over the entire voltage range with a fixed charge voltage.

The system controls are FPGA and MPU based and are Ethernet compatible with live diagnostic monitoring and control. Low-latency hardwired optical isolated and differential signaling receives off-system interlocks and an N-bit signal to choose between several operational states with preset output voltage, rep-rate and delay. These operation states can be adjusted inter-pulse at rep-rates up to 500pps. The trigger is also received via differential signaling with a propagation delay between signal reception and 10% pulse rise of <1us. The system incorporates a pulse transformer with a bifilar winding to provide 40W of DC filament power. All connections are made in the back of the unit with no water-cooling requirements.

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