

APELC also offers a wide variety of high power RF solutions, such as ultra wide band systems, mesoband systems, and high power microwave systems.



APELC is the world leader in the development of compact Marx generators (our basis technology). We offer a very wide spectrum of Marx generators, from mJ, kV handheld models, and multi-kJ, MV bench-top systems.

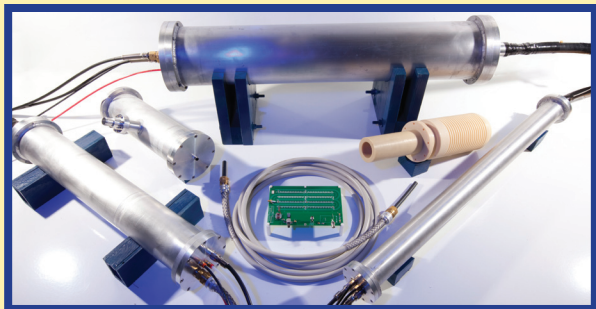
Our generators are unmatched in their performance and compactness.

In support of our Marx generators, we offer a wide variety of electronics and diagnostics, including:

- integrated power supplies
- high rep rate trigger generators
- integrated low rep rate trigger generators
- custom loads
- integrated high speed diagnostic probes

APELC also offers complete pulsed power systems including:

- 33 J/600 kV Marx generator system with a repetition rate of more than 250 Hz.
- 100 J/600 kV Marx generator system, with an integrated 10 kJ/s high voltage capacitor charger. This system has been demonstrated to operate with a repetition rate of 100 Hz.



APELC

APPLIED PHYSICAL ELECTRONICS, L.C.

Applied Physical Electronics, L.C. (APELC) is a small business located in the Hill Country of Central Texas, 20 miles west of Austin. APELC was formed in 1998, and has since grown to a multi-million dollar R&D company, specializing in pulse power related applications, including high power RF solutions designed for defeating electronic-based systems.

With 5 PhD's, 1 M.S.E.E., and 1 M.E. on the engineering team, as well as 12 highly experienced technicians and machinists, APELC brings more than 90 years of combined experience in pulse power related applications.

APELC has moved into a new, wholly-owned facility, offering 7,500 sq. ft. of lab and fabrication space; equipped with a high precision CNC machine shop, and high speed measurement systems, including 6 and 8 GHz real-time oscilloscopes, a 50 GHz sampling oscilloscope (w/TDR head) and an 18 GHz Vector Network Analyzer.

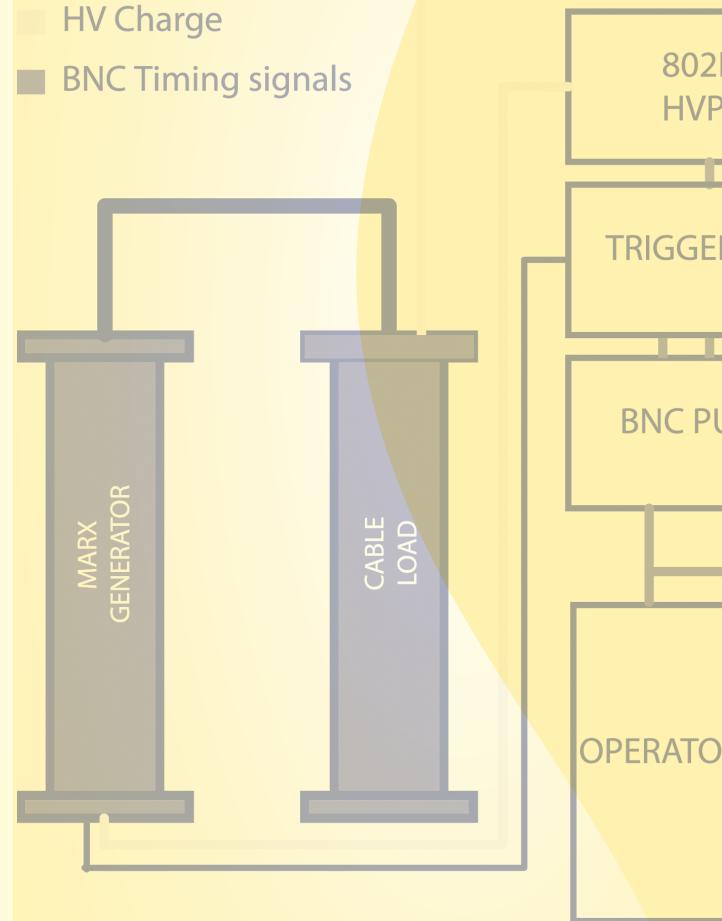


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APPLIED PHYSICAL ELECTRONICS, L.C.

- Trigger/Load Cable
- HV Charge
- BNC Timing signals



HIGH PRF MARX GENERATOR SYSTEM

SYSTEM ARCHITECTURE

The component overview for the high-PRF system is shown in Figure 1 and the block diagram is shown in Figure 2. The basis technology is APELC's SM3C wave-erection Marx generator. The Marx is charged by an 802L High Voltage Power Supply (HVPS) made by TDK-Lambda [1]. A delay generator from Berkeley Nucleonics Corp. (BNC) is used to adjust the PRF and the inter-charge-cycle timing of the trigger generator and the Marx [2].

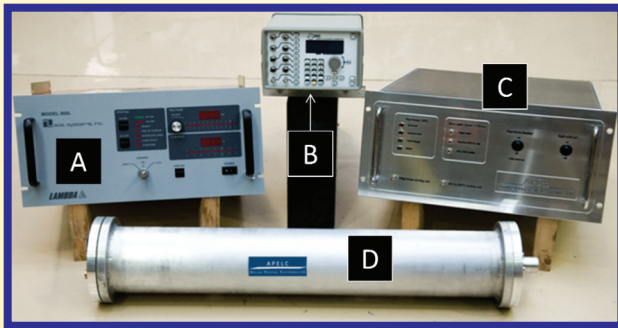


Figure 1. Main components of the high-PRF Marx Generator system: (A) Lambda-TDK 802L power supply, (B) BNC Delay Generator, (C) APELC trigger generator, and (D) APELC SM3C Marx generator.

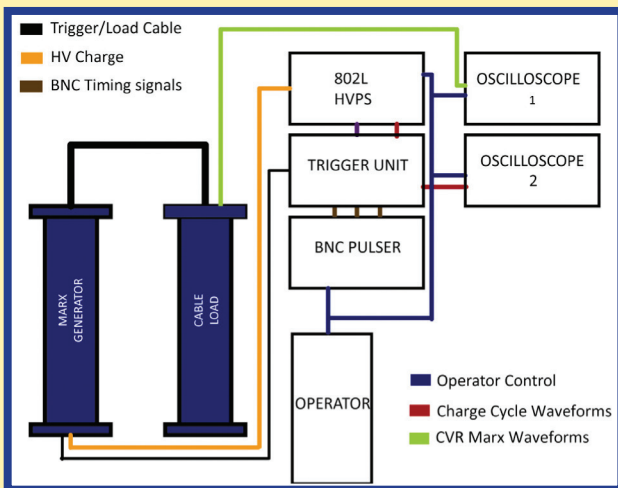
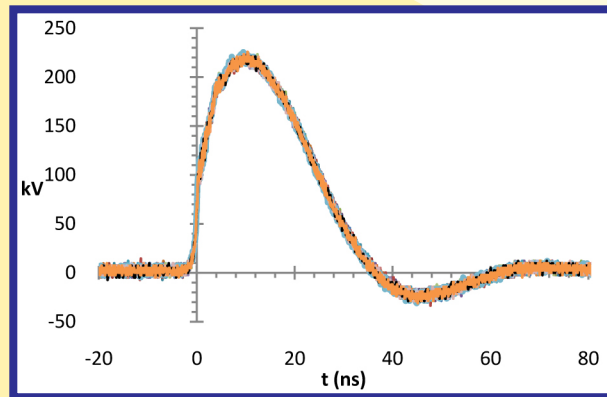


Figure 2. Block diagram for the High-PRF, GW-class SM3C Marx system.

General specification for the SM3C Marx generator

SYMBOL	PARAMETER	VALUE	UNITS
N	Number of Marx generator stages	15	-
Epulse	Maximum Marx energy per pulse	33.0	J
Pmax	Peak power to a matched load	1.7	GW
Vch	Marx maximum charge voltage	40	kV
VE	Peak Erected voltage	600	kV
Cstage	Capacitance per Marx stage	2.8	nF
CE	Erected capacitance	188	pF
Le	Series Inductance	510	nH
Zm	Marx Impedance	52	Ohm
L	Marx Generator Length	31	In.
D	Marx Generator Diameter	5	In.
PRFmax	Maximum Burst-Mode PRF	200	Hz



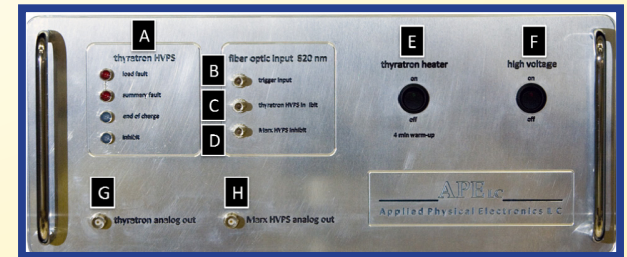
Load-voltage waveform overlay of 20 waveforms out of a 4,000-shot burst, at 100-Hz PRF. One waveform was sampled every 200 shots. The Marx charge voltage was 30 kV and the vessel pressure was 70 PSI.

TRIGGER GENERATOR UNIT

The APELC TGU was designed to deliver repetitive, high-voltage trigger pulses to the Marx generator, facilitate synchronous charge/trigger cycles, and provide diagnostic signals to the operator. The trigger pulse circuit includes a 150-mJ, thyatron-based pulser circuit which is energized by a 500 J/s TDK-Lambda HVPS.

Front-panel diagnostics include summary fault, load fault, inhibit, and HV-enable LED indicators for the thyatron-circuit HVPS.

- | | |
|-----------------------------------|---|
| A Thyatron HVPS LED indicators | E Thyatron Heater power switch |
| B Trigger fiber-optic input | F Thyatron HVPS high voltage power switch |
| C Thyatron HVPS fiber-optic input | G Thyatron analog output |
| D Marx HVPS fiber-optic input | H Marx HVPS analog output |



APELC high-PRF trigger generator unit front panel.

SUMMARY

The system architecture, and experimental results of the 200-Hz, GW-class, pulsed power system have been presented. The integrated system demonstrated successfully erected Marx pulses for a 40-kV charge voltage at PRFs up to 200 Hz.

Charge cycle waveforms of the trigger circuit and Marx power supply allowed the user to diagnose common Marx problems. This ease of diagnosis allows simple adjustments to properly tune the Marx operation. The Marx output waveform displays good stability and repeatability even at PRFs up to 200 Hz.

The work described here has resulted in a compact, rack-mounted, pulsed-power system capable of delivering 1.7 GW at a PRF of 200 Hz. Ongoing efforts are focused on identifying modes of failure after extended operation.