Typical Technical Data Long Pulse High Voltage Power Modulators

Typical Technical Data High Pulse Modulator	
Pulse Power	Up to 24 MW
Efficiency η	≥ 90 %
Pulse voltage UK	< 150 kV
Pulse width TPW	0,1 – 4 ms
Rise/fall time TR,TF	≤ 100 µs
Short circuit energy	< 10 J
Maximum droop	1 % of UK
Maximum voltage ripple	0.1 %

Key Features

- Three different topologies available to optimize the system according to the requirement of the application
- Up to 100 Hz pulse repetition rate, depending on the application
- Continuously adjustable pulse length and amplitude with solid state based topologies
- Easy maintenance due to the modular topologies
- Crowbar less operation
- Short circuit energy at the load (<10 J)
- System efficiency (>90 %); trimmed to minimum rise and fall times
- Adjustable voltage accuracy (0.1 %)
- Standard external control interface available
- EPICS, TINE, Tango, OPC, etc. interfaces available
- Full system integration and turnkey capability

Past Performance

Ampegon Reference List of Long Pulse High Voltage Power Modulators

Customer	Country	Application	Units	Rating	Contract Date
ESS	Sweden	Klystron (Linear Accelerator)	1	115 kV, 50 A	2014
DESY Hamburg	Germany	Modulator for XFEL	2	12 kV, 2 kA	2013
ESS / CERN	Switzerland	Klystron (Linear Accelerator)	1	115 kV, 25 A	2012
DESY Hamburg	Germany	Modulator for XFEL	5	12 kV, 2 kA	2012
DESY Hamburg	Germany	Modulator for XFEL	22	12 kV, 2 kA	2011
LAL Orsay	France	Modulator for XFEL	1	8.2 kV, 1.5 kA	2009

Contact

Ampegon Power Electronics AG
Kreuzweg, 11 | CH-5400 Baden, Switzerland
Tel. +41 58 710 44 00
info@ampegon.com | ampegon.com

Science MedTech Industry Broadcast

AMPEGON

The Heartbeat of High Power

Long Pulse High Voltage Power Modulators

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Long Pulse High Voltage Power Modulators

Ampegon designs and delivers stand-alone, versatile and compact long pulse modulators for a wide range of applications

Ampegon has long experience with RF amplifier systems, high voltage as well as high current power supplies and modulators for world-class medical, industrial and research facilities. Our customers include particle accelerator and fusion research institutes, fundamental and applied physics, materials and life sciences engineering, notable providers of accelerator-based cancer treatment solutions, as well as innovative partners enhancing industrial processes. Offering its innovative and pioneering spirit with expertise of a century, Ampegon products stand for premium quality, reliability and best performance.

Unique Expertise and Innovation
Our expertise includes stand-alone high voltage power supply (HVPS) systems with voltages up to 200 kV and currents up to 2000 A, RF amplifier systems up to 55 MW power at frequencies up to s-band, short and long pulse modulators with voltages over 500 kV and currents up to 400 A, and stand-alone multi-channel digital low level RF control systems. Our technology base extends across the entire field of RF transmission.

In this wide application field, the long pulse modulator, based on solid state technology, complements Ampegon's product range for pulsed high voltage modulator applications, as well as RF amplifier systems. Drawing on this experience and detailed understanding in high power solid state modulator technology, further topologies for long and short pulse applications have been successfully developed over the past 30 years. The modulator technology has been continuously enhanced, improved, integrated into various systems, and adapted for customer specific solutions.

Unlimited Flexibility
Ampegon long pulse modulators are valued for their high flexibility. Thanks to the modular design of the implemented technology, these systems are adaptable to meet practically any customer specification. The design is optimized for best performance, an ideal footprint, long term reliable operation by implementing the latest semiconductor technology.

The integrated fast protection shut down circuit protects the sensitive load and guarantees a safe daily operation. The technical design advantages increase the equipment's lifetime and enables the users to save energy costs while having best output signal performance for their application.

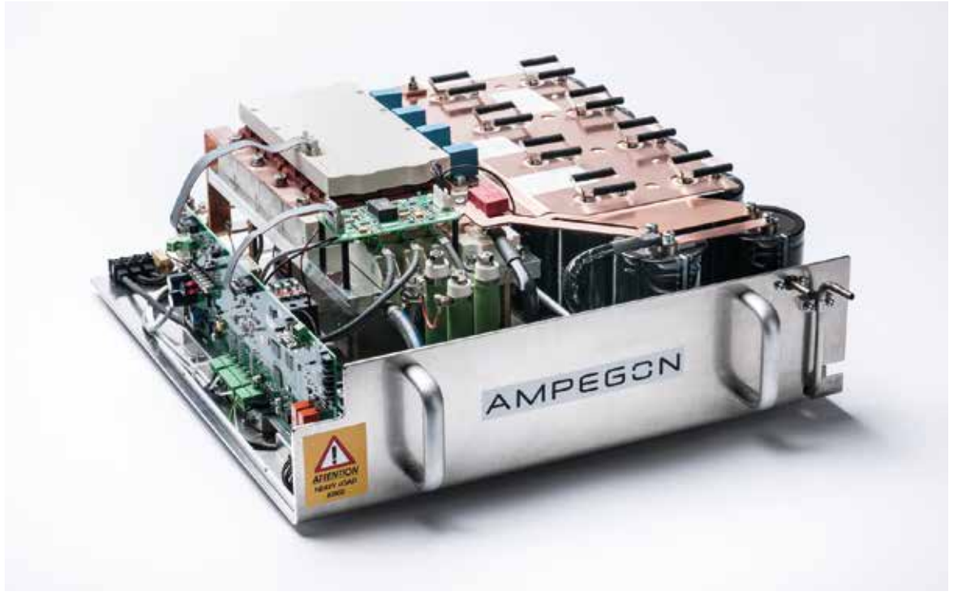
Environmental Compatibility
With very high peak energy levels, accelerator facilities are dependent on a highly stable mains power supply and very low Electromagnetic Interference (EMI) figures. The specified mains input current is regulated to keep the consumption during pulsed operation at a constant level. The excellent harmonic distortion characteristic of the integrated active Power Factor Compensation (PFC) ensures that loading of the mains supply with harmonics is kept to an absolute minimum.

Ampegon's long pulse technology provides a high efficiency rate of better than 90 % and optimized pulse rise and fall time resulting in a considerable reduction of energy consumption and operating costs.

System Features
Unique features of the long pulse modulator include crowbar less operation for sensitive loads as well as typical short circuit energy of less than a few joules, stored in the system and output network. The fast protection device ensures a minimum short circuit switching off time after detection of a short circuit during pulsing.

Depending on the specification, customers have the choice between three different topologies: Bouncer based modulators, pulse step modulators (PSM) or serial parallel resonant converters (SPRC technology).

Considering customer specific requirements, each topology has its own unique advantage and purpose. The selection criteria are dependent on parameters like pulse-shape, rise- and fall time, flattop ripple, power, system and pulse efficiency, but also footprint, redundancy and modularity. In order to evaluate the most advantageous topology, our experts will be pleased to act as consultants to design a system entirely optimised for your individual application.



Power Module for Long Pulse Modulator