

RUP6-25bip_{v6}

Bipolar high voltage pulse generator with variable rise and fall times

- True square wave pulses with active switching off and both polarities
- pulse width and form nearly arbitrarily adjustable
- rise time adjustable in the range 600ns to 60µs
- frequency up to 2.5 kHz
- voltage up to +/-25 kV
- peak pulse current up to 50 A
- short circuit proof

RUP6 is a universal high voltage pulse generator concept, which can be built for voltages from 2kV to 30kV. Prominent features are high pulse current, very high efficiency, scalability of the voltage and ultrafast switch off in case of arcs.

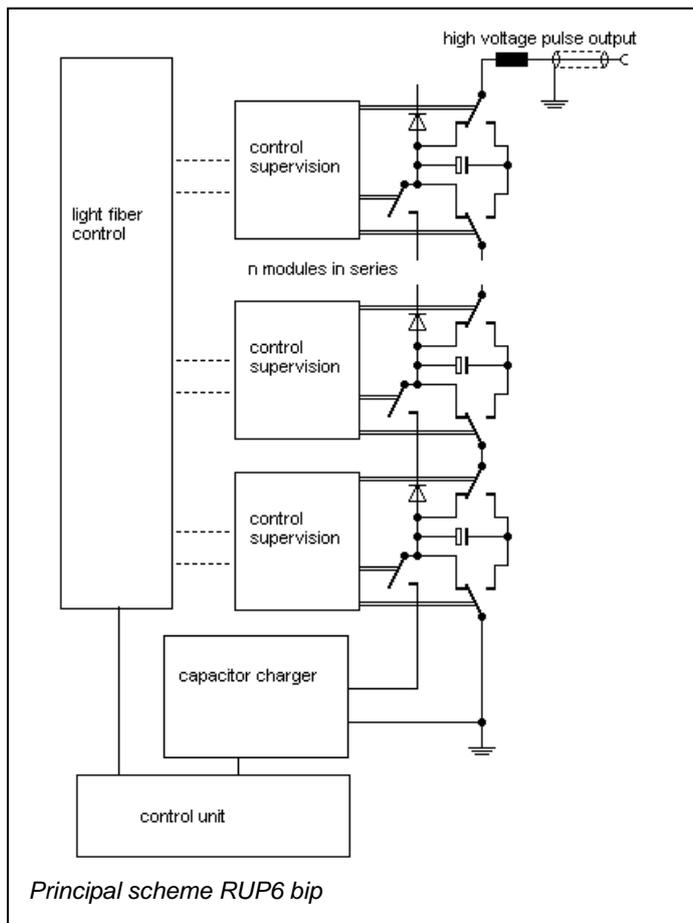
The RUP6 consists of a number of 1kV pulse modules which are charged in parallel and are switched in series during pulse. Power supply and modulator

are integrated within this principle.

The pulse modules of the RUP6bip contain full bridges instead of half bridges

as the standard RUP6 design.

Absolute synchronous switching is not necessary with the RUP6 principle; furthermore, the bipolar version definitely uses sequential switching to achieve variable rise and fall times and even completely arbitrary pulses.



Technical Data

Current and voltage

- Maximum output voltage -25 kV to +25 kV.
- Maximum average output power 2 kW, decreasing with increasing duty cycle.
 $P_{out} = P_{max} * (1 - \text{frequency} * (\text{pulse width} + 150\mu\text{s}))$.
- Average output current up to 80 mA max., corresponding to an internal power supply current of 2A.
- Output impedance (DC) about 15 Ohm, corresponding to 0.6 Ohm per module; in series to this is an output inductor of 50µH, which internally can be adjusted to 100µH, 200µH or 400µH by choosing the corresponding tap.
- Internal pulse capacity around 7.2 µF, corresponding to 180 µF per module.
- peak current up to 50 A.
- Maximum tolerable load capacity depends on voltage and rise time. Capacities up to 200nF can be connected as long as the product of rise rate and capacity $dU/dt * C$ does not exceed 50A.
- Reactive power: The RMS output current must not exceed 5A.

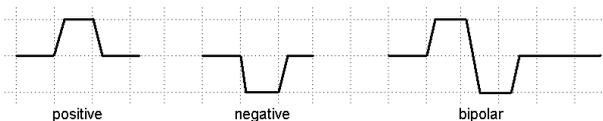
Current surveillance

The pulse generator is proof to short circuit and flashover. Overcurrents will be detected and lead to switch off, and therefore will not damage the device:

- Exceeding a free adjustable level of average current of the internal power supply will switch off high voltage. A LED indicates operation close (90%) to the switch-off level.
- Overcurrent >50A and RMS current >5A will also shut down the pulse generator. Also here, operation at >90% of maximum current will be indicated by a flashing LED.
- Any error on module level (overcurrent, overtemperature,..) will also lead to shutdown.
- Maximum possible peak short circuit currents are limited to around 90A.

Waveform and frequency

- Square wave pulses with variable frequency and pulse width of both polarities.
- Selectable modes of operation are: Unipolar positive, unipolar negative and bipolar.



- Adjustable pulse width 0.5 µs - 100 µs. Basically, the internal pulse capacity should discharge during pulse not more than 10% of the maximum voltage (2.5 kV in this case).

- With an external trinary logic (0V, +5V, -5V) control signal, almost arbitrary pulse waveforms can be generated.
- Ramp times can be adjusted in two ranges of 0.6...7µs and 6µs ... 60µs. Variable rise times are realized by sequentially driving the pulse modules. This results in a staircase-like output signal. The actual waveform depends on the chosen output inductor and may exhibit a certain amount of ringing. However, by fine adjusting the ramp time of the pulse to the ringing frequency, any overshoot can be limited in any case to <8%.
- Duty cycle can be chosen nearly arbitrarily, but average output power will decrease with increasing duty cycle. The reason for this is that during a pulse until 150µs after the pulse the internal power supply is not working.
- Maximum frequency 2.5 kHz.
- Control of voltage, pulse width, frequency an operation mode can by done by switches and potentiometers on the front.

mechanical, included items

- 19" rack, 600 * 600 * 2000 mm
- supply voltage 230-240 V.
- monitor outputs for voltage and current
- meters for module voltage (0-1000V) and average internal power supply current (0-2A).
- resettable operation time counter for "high voltage on".
- documentation including circuit diagrams.

Additional metering and other modifications on request.

safety

- external Interlock
- A fast short circuit detection protects the generator modules to a far extend from arcs and short circuits in the load.
- Short circuit currents a short transients are limited to 90 A.
- The pulse generator is conformal to laws about electromagnetical compatibility.

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