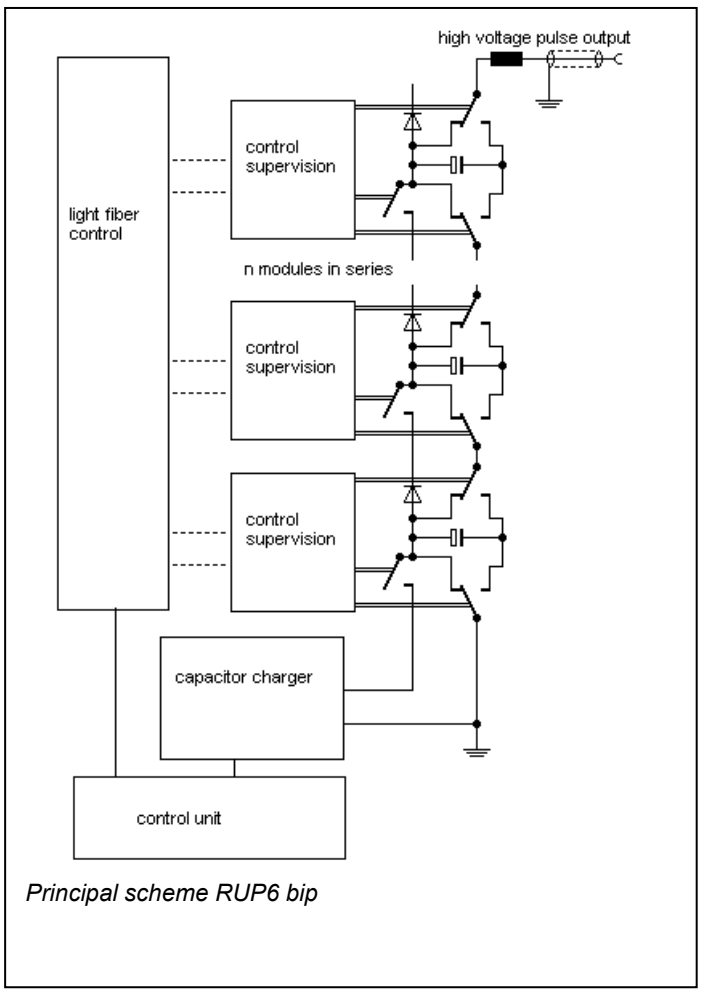
RUP6-8bip$_{v8}$

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 200ns to 40µs
- frequency up to 5 kHz
- voltage up to +/-8 kV
- peak pulse current up to 75 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.



Principal scheme RUP6 bip

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.
The v7/v8 revision works completely with SiC transistors, such allowing a higher frequency at least 5 kHz.

Technical Data

Current and voltage

- Maximum output voltage -8 kV to +8 kV.
- Maximum average output power 2 kW, decreasing with increasing duty cycle. Pout=Pmax *(1 - frequency * (pulse width + 40µs)).
- Output impedance (DC) about 3 Ohm, corresponding to 0.4 Ohm per module; in series to this is an output inductor of 15µH.
- Internal pulse capacity around 18 µF, corresponding to 147 µF per module.
- peak current up to 75 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 6A.

surveillance

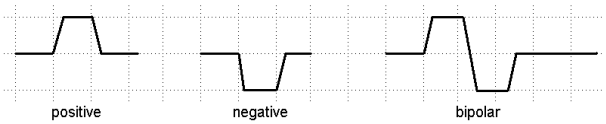
The pulse generator is proof to short circuit and flashover. Overcurrents will be detected and lead to switch off, and therefore will not damage the device:

- 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 >75A and RMS current >6A will also shut down the pulse generator. Also here, operation at >90% of maximum current will be indicated by a flashing LED.
- Overvoltage >13 kV, caused by excessive ringing due to a too short rise time setting, will lead to shut down.
- Any error on module level (overcurrent, overtemperature,..) will also lead to shutdown.

After an error shutdown, the corresponding LED will remain on. The error can be reset adjusting the voltage setting to zero.

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.
- Maximum frequency 5 kHz.
- With an external trinary logic (0V, +5V, -5V) control signal, almost arbitrary pulse waveforms can be generated; and with some restrictions, frequency can be extended to 10-20 kHz.
- Ramp times can be adjusted in two ranges of 0....6µs and 0 ... 40µs. 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 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 40µs after the pulse the internal power supply is not working.
- Control of voltage, pulse width, frequency an operation mode can by done by switches and potentiometers on the front.

mechanical, included items

- 19" rack, 550 * 800 * 1060 mm
- supply voltage 230-240 V.
- output cable 2m.
- 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.

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 as short transients are limited to 160 A.
- The pulse generator is conformal to laws about electromagnetical compatibility.

option

Ross relais in the output, which disconnects the output cable from the pulse generation in case of HV off and connects it to ground.

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