

**PICOSECOND
PULSE GENERATOR MODULE
PPM0531**

USER MANUAL

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CONTENTS

Safety manual	2
Package content	3
General view of picosecond pulse generator	3
Description of the generator operation	4
Technical specification	6
Top, front and rear panels view	7
Putting the generator into operation	8
Triggering of the generator	10
Warranty	11

SAFETY MANUAL

Electrical safety

- PPM0531 pulse generator module is a high voltage equipment. Please be very careful and operate by qualified personnel only.
- There is a risk of electric shock, strong electromagnetic interference, damage of the generator or other electronic equipment in case of improper use.
- It is strongly prohibited to switch on the generator without output coaxial cable. We recommend using at least 50 centimeters length coaxial cable connected between the generator and the load (antenna or first attenuator) to prevent permanent damage of the generator. There is a risk of electrical arcing on the open HV coaxial connector and damage of the output circuit of the generator.
- When adding or removing generator to or from the system, ensure that the power supply is unplugged (in OFF state). Please apply power supply only after connecting output and input coaxial cables.
- Please provide sufficient free space and allow free airflow around the generator for the good cooling in case of long time operation at high repetition rate.

Operation safety

- Please read this manual before installing and using of the generator.
- Before using the product, make sure that all the cables are applicable and not damaged. High voltage connector should be clean and dry, free from dust, dirt and any obstacles.
- To avoid short circuit, keep metal parts like clips, screws and staples away from the generator.
- The generator is designed for the operation in normal laboratory conditions. Avoid dust, humidity and temperature extremes. Do not place the generator in any place where it may become wet.
- Place the generator on a stable surface.
- If you encounter any technical problem with the generator, please contact with Megaimpulse Ltd. Do not try to repair the generator by yourself.

PACKAGE CONTENT

Please check the package for the following items:

- ✓ PPM0531 picosecond pulse generator module (hereinafter "generator")
- ✓ Dual voltage AC/DC switching power converter:
AC 85V..264V, 47Hz..63Hz / DC +24V, 0.6A; DC +160V, 0.3A;
- ✓ Semirigid coaxial cable assembly N connector/SM141 cable/open for the output signal feeding and free connection to the load;
- ✓ Coaxial cable assembly SMA connector/RG316 cable/SMA connector for the input triggering signal feeding;
- ✓ User manual (printed or electronic version).



Fig.1. General view of PPM0531 picosecond pulse generator module.

DESCRIPTION OF THE GENERATOR OPERATION

PPM0531 generates picosecond rise time unipolar high voltage pulses with up to 5kV amplitude and 25kHz max repetition rate. It is made as a compact pulse generator module (head) with external power supply and external triggering.

The generator requires external dual voltage DC power supply, including DC +24V (low voltage) and DC +160V (high voltage). Four wires DC power supply cable is included into the standard package.

- ➔ **The ground wires of the power supply cable are marked by black color. Low voltage and high voltage supply wires are marked by the labels.**

The contact pins of the power supply connector are the following:

- Pin 1 – GND (ground return DC +24V)
- Pin 2 – DC +24V low voltage supply
- Pin 3 – GND (ground return DC +160V)
- Pin 4 – DC +160V high voltage supply

Typical output pulse waveform is shown in Fig.2. Normally the generator should operate with 50 Ohm matched load, i.e. 50 Ohm load or matched impedance antenna connected by 50 Ohm impedance coaxial cable.

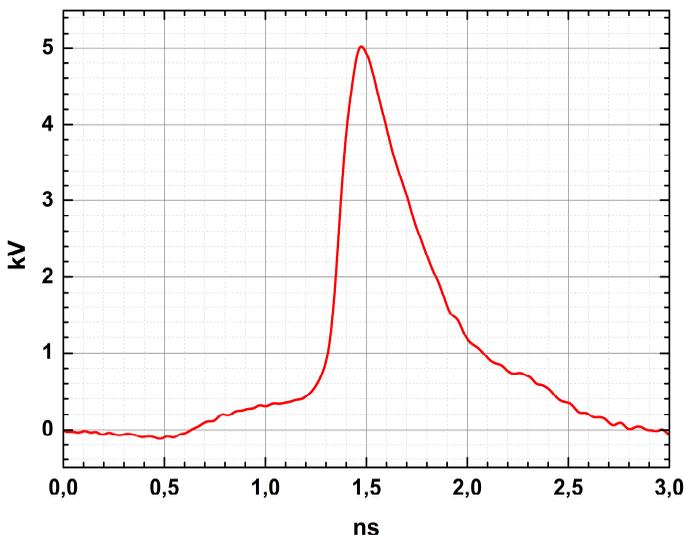


Fig.2. PPM0531 typical output pulse waveform on 50 Ohm matched load.

- ➔ **It is strongly prohibited to switch on the generator without the load (with open connector). We recommend using of 50 centimeters length coaxial cable between the generator and the load (antenna or first attenuator) to prevent damage of the generator in case of load breakdown.**

Operation on unmatched load inevitably results in reflection from the load; part of the pulse energy returns back to the generator and may overheat it. PPM0531 has overheating protection. If the temperature exceeds 55 °C, then red LED "OVERHEAT" lights on and the triggering is blocked. Please cool down the generator and reduce repetition rate if required.

- ➔ **Please provide free airflow around the generator in case of long time operation at high frequency, especially in case of unmatched load.**

The generator is triggered by the leading edge of the external triggering pulse. There is no internal triggering mode. Acceptable triggering pulse amplitude is +3.5V ... +5V at 50 Ohm; low triggering pulse amplitude leads to unstable triggering and higher output pulse jitter. Recommended triggering pulse duration is 10 ns ... 200 ns. Pulse rise time should be no more than 1 ns. Longer rise time may result in increasing of the output pulse jitter. Orange LED "SYNC IN" lights on in case of successful triggering.

The generator has internal over frequency protection. If the triggering pulses frequency is more than 25 kHz then the generator blocks the triggering and red LED "OVERLOAD" lights on. The same occurs in case of very long triggering pulse. Please reduce the triggering pulses frequency and/or triggering pulse width.

Two fans are used for the cooling of the generator. If the temperature is low, then the fans are stopped. The rotation speed of the fans increases with increasing of the temperature. Therefore, the cooling system stabilize the temperature of the generator; this improves the stability of the output pulse waveform and reduce temperature drift.

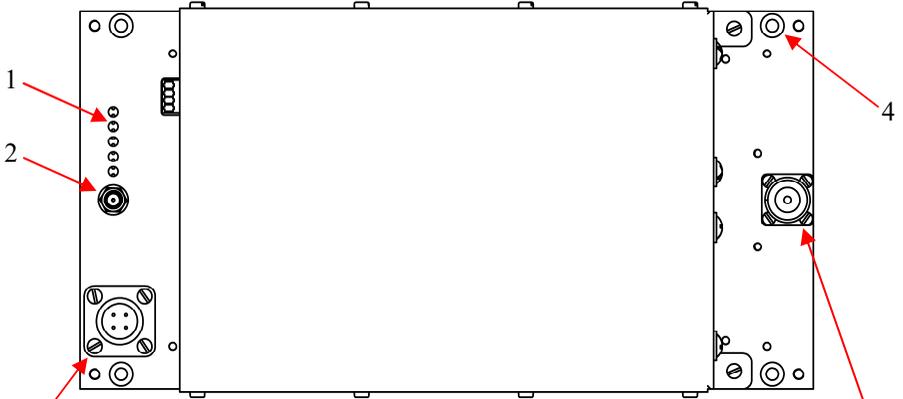
TECHNICAL SPECIFICATION OF PPM0531 PICOSECOND PULSE GENERATOR MODULE ¹⁾

Output pulse amplitude ²⁾	4.5 ... 5.5 kV
Pulse polarity and waveform	Positive, fast rise, short peak, exponential decay
Output connector and load impedance	50 Ohm
Pulse rise time (fast part)	< 200 ps
Pulse width (FWHM)	< 500 ps
Max repetition rate	25 kHz
Jitter (RMS)	< 20 ps
Jitter (peak-to-peak)	< 100 ps
Internal delay (from leading edge of triggering pulse to output pulse)	~ 170 ns
Triggering	External only
Input triggering pulse connector	SMA
Triggering pulse parameters	+5V amplitude at 50 Ohm, 10 ns ... 200 ns width, 1ns rise time
Power supply	+24V, 0.3A; +160V, 0.3A
Size	250 x 130 x 80 mm ³
Operation temperature	0 °C.. +50°C

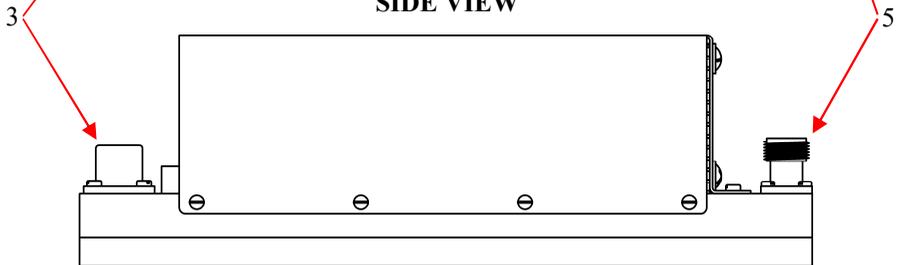
¹⁾ All the parameters are measured after operation of the generator within 10 minutes at maximum repetition rate.

²⁾ Output pulse amplitude increases with increasing of the repetition rate and may change within $\pm 10\%$ depending on the temperature and operation regime.

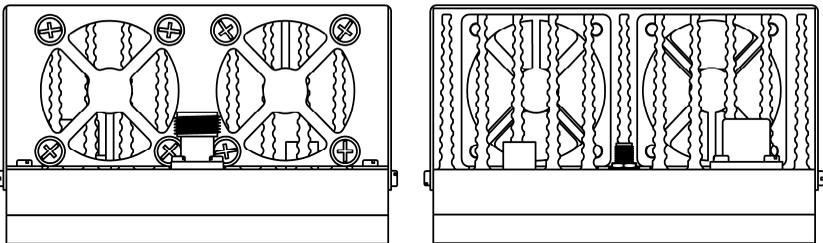
TOP VIEW



SIDE VIEW



LEFT AND RIGHT VIEW



- 1 – control LED (from top to bottom)
 - +24V DC (green) – low voltage +24V DC power supply is applied
 - +HV DC (green) – high voltage +160V DC power supply is applied
 - SYNC IN (orange) – triggering of the generator
 - OVERHEAT (red) – too high temperature
 - OVERLOAD (red) – too high repetition rate
- 2 – Input triggering SMA connector
- 3 – Power supply connector
- 4 – 4x mounting holes 4mm dia, 222x118mm footprint
- 5 – Output HV N-type connector

PUTTING THE GENERATOR INTO OPERATION

- ➔ **Please follow strictly the described steps. It helps to prevent damage of the generator and other equipment.**

Step 1.

Unpack the generator and check the presence into the package of the following items:

- PPM0531 pulse generator;
- Dual voltage AC/DC switching power supply converter with the cables;
- Semirigid coaxial cable assembly N_connector/SM141_cable/open for the output pulses feeding;
- Coaxial cable assembly SMA/RG316_cable/SMA for the input triggering pulses feeding.

Step 2.

- ⇒ In case of using standard AC/DC switching power supply converter:
Check the levels of the low voltage and the high voltage power supplies before connecting to the generator. If required, adjust the voltage levels by the corresponding potentiometer(s).
- ⇒ In case of using alternative power supply:
Please set the external power supplies according to the recommended low voltage and high voltage levels before connecting to the generator.

Step 3.

Connect the output semirigid coaxial cable and the load to the generator.
Connect the triggering pulse generator by input coaxial cable.
Attach four wires DC power supply cable. The ground wires are marked by black color. Low voltage and high voltage supply wires are marked by the labels.

Step 4.

Switch on (plug) power supply. Both green LED “+24V DC” and “+HV DC” should light on. Set the external triggering pulses frequency to 1 kHz, pulse amplitude set to +5V, pulse width set within 10ns ... 200ns. Apply triggering pulses, orange LED “SYNC IN” should light on.

High voltage output pulses should be generated. Please check them. Set the external triggering pulses frequency as required, but below or equal to the maximum repetition rate.

- **Please pay attention that most of standard GHz range coaxial attenuators are not suitable for direct registration of output pulses because of extremely high peak power. Even 100W and more power attenuators will be broken inevitably. We recommend using of 142 series Barth Electronics attenuator (for the frequencies below 5 kHz) as the first attenuator connected just to the generator output or use high voltage directional coupler.**

The generator is designed for the long time operation at max repetition rate. But it can be overheated in case of unmatched load and high ambient temperature. Please provide free airflow around the generator for the good cooling. The temperature of the generator should be below 55 °C. Reduce the repetition rate and/or improve the airflow in case of overheating.

If the triggering pulses frequency is too high, then red LED “OVERLOAD” lights on and generator stops the operation. Please reduce the triggering pulses frequency, LED “OVERLOAD” lights off and generator continue the operation automatically.

TRIGGERING OF THE GENERATOR

The recommended triggering pulse waveform is shown in Fig. 3. Nominal triggering pulse amplitude is +5V at 50 Ohm, pulse duration should be within 10 ns ... 200 ns, rise time should be 1 ns or less. Longer rise time may result in increasing of the output pulse jitter.

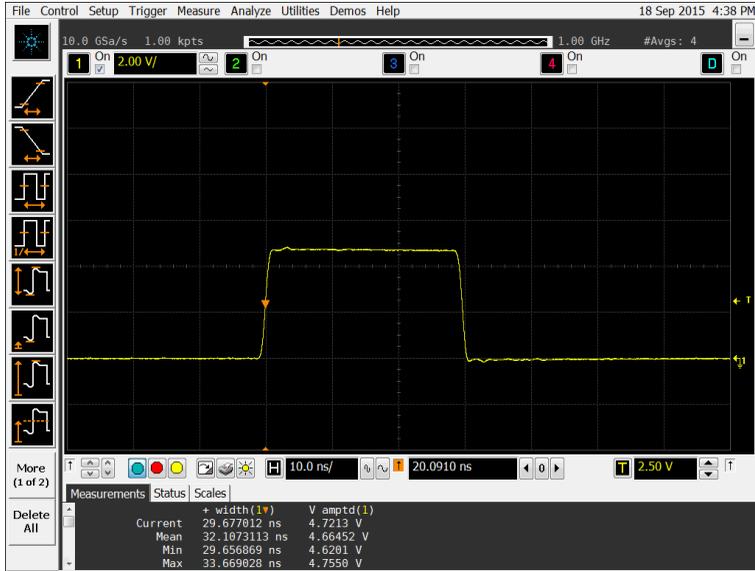


Fig. 3. Recommended triggering pulse waveform.

WARRANTY

Please see your sales agreement to determine the warranty period and warranty terms. The generator has warranty seals.

- ➔ **Removing of the warranty seals terminates the warranty.**