SUBNANOSECOND RISE TIME
HIGH VOLTAGE
PULSE GENERATOR MODULE

PPG-1/500

USER MANUAL

v 1.0

Megaimpulse Ltd. contact information

Address: 28 Polytechnicheskaya str., St. Petersburg, 194064 Russia
www: http://www.megaimpulse.com
e-mail: mp@power.ioffe.rssi.ru
fax: +7-812-297-3145

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SAFETY MANUAL

Electrical safety

- PPG-1/500 generator module is high voltage equipment. Please be careful and operate by qualified personnel only.
- There is a risk of electric shock, strong electromagnetic interference, damage of generator or other electronic equipment in case of improper use.
- It is strongly prohibited to switch on the generator without output coaxial cable and/or matched load, because there is a risk of electrical arcing on the unmated output coaxial connector and damage of the generator output circuit. We recommend always use 25 centimeters (10 inches) or more length coaxial cable between the generator and the load (first attenuator). It prevents permanent damage of the generator in case of load breaks or disconnection.
- When you add or remove the generator to or from the system, please ensure that the power supply is unplugged (in OFF state). Apply power supply only after connecting output and input cables.
- PPG-1/500 generator module is power equipment. Please allow free air flow around the generator for good cooling. Enforced air flow is required in case of long time operation at high repetition rates.

Operation safety

- Please read this manual before installing and using of the generator.
- Before using the product, make sure that all cables are applicable and undamaged. High voltage connectors should be clean and dry, free from dust, dirt and any obstacles.
- The generator module is designed to work in normal laboratory conditions. Avoid dust, humidity and temperature extremes. Do not place the generator in any place where it may become wet.
- If you encounter any technical problem with the generator module, please contact with Megaimpulse Ltd. Do not try to repair it by yourself.

PACKAGE CONTENT

Please check the package for the following items:

- ✓ PPG-1/500 pulse generator module (hereinafter "generator");
- ✓ DC power supply cable;
- ✓ AC/DC switching power supply (88V..264VAC, 47Hz..63Hz / +24VDC);
- ✓ User manual (printed or electronic version).

Optional items:

- ✓ Semirigid coaxial cable assembly: N connector / SM141 cable / N connector for the output pulses feeding and load connection;
- ✓ Flexible coaxial cable assembly:
  SMA connector / RG316 cable / SMA connector
  or
  SMA connector / RG316 cable / BNC connector
  for the input triggering signal feeding and/or output pulse monitoring;
- ✓ 20dB (1:10) coaxial attenuator; it is used to attenuate the signal from the internal divider (1:40) to 2.5V level and feeding to oscilloscope 50 Ohm impedance input.

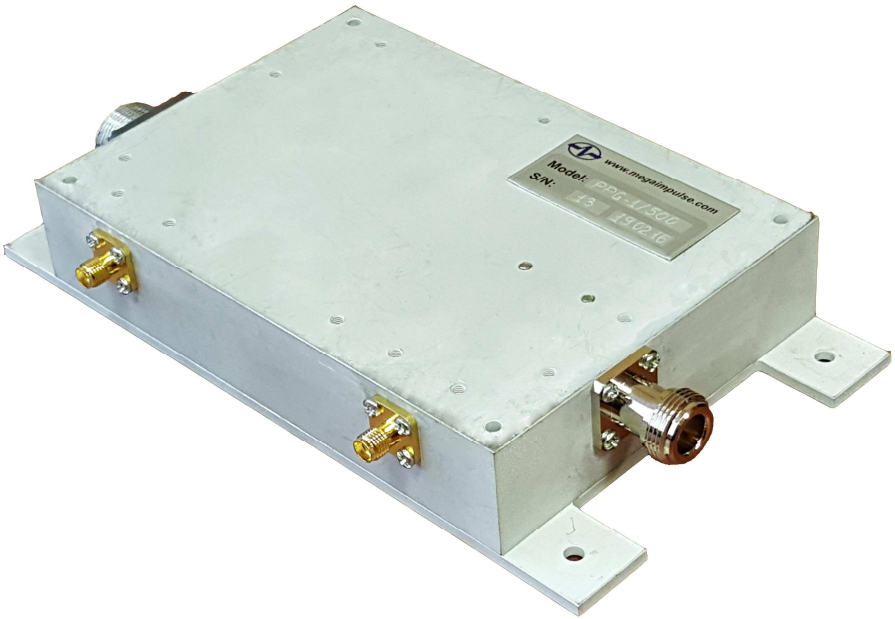

Fig.1. General view of PPG-1/500 pulse generator module.

DESCRIPTION OF THE GENERATOR

PPG-1/500 generates subnanosecond rise time unipolar bell like 1 kV pulses with up to 500 kHz repetition rate. Output pulse waveform is shown in Fig.2. The generator is designed to operate with 50 Ohm matched load only, for example matched impedance antenna connected by 50 Ohm impedance coaxial cable. Operation on unmatched load inevitably results in reflection of part of the energy back to generator and possible generator overheating while it operates at high repetition rate.

➔ It is strongly prohibited to switch on the generator without the load, i.e. with unmated HV output connector. We recommend using of coaxial cable with 25 centimeters (10 inches) length or more between the generator and the load (antenna or first attenuator) to prevent damage of the generator in case of load breakdown or disconnection.

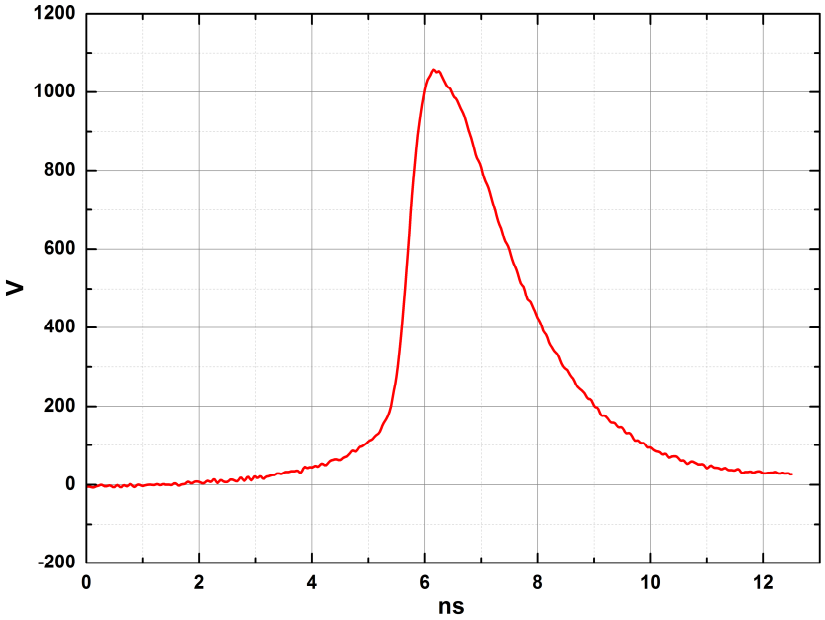

Fig.2. PPG-1/500 output pulse waveform.

PPG-1/500 should be triggered by external sync pulse. There is no internal triggering mode. Standard triggering pulse parameters are: amplitude +5V@50Ohm, polarity positive, pulse width 30 ns, rise time 1 ns. Longer rise time may result in increasing of the output pulse jitter. External sync pulse should be applied to SMA connector closest to power supply connector.

The generator has internal 1:40 divider for the output pulse waveform monitoring on the oscilloscope. The divided signal can be taken from SMA connector closest to the output N-type connector and fed through 50 Ohm impedance cable and additional 20dB (1:10) attenuator to the oscilloscope input set to 50 Ohm input impedance. 20dB attenuator is required to divide the output pulse down to 2.5V level suitable for the oscilloscope input.

The generator is supplied by external +24V DC. The two wires DC power supply cable is included. The ground wire is black color. The power supply wire is marked by “24” label.

The contact pins on power supply connector are the following:

Pin 1 –+24V DC supply voltage
Pin 2 – ground return
Pin 3 – NC
Pin 4 – NC

TECHNICAL SPECIFICATION OF PPG-1/500
PULSE GENERATOR MODULE

Output pulse amplitude	**1 kV**
Pulse polarity and waveform	**Positive unipolar bell like pulse**
Output impedance	**50 Ohm**
Output connector	**N-type**
Pulse rise time (20% - 80% levels)	**600 ps**[1)]
Pulse width (FWHM)	**2 ns**
Max repetition rate	**500 kHz**
Mean output power	**20 W**
Spectrum range (-6dB)	**200 MHz**
Jitter (RMS)	**10 ps**[2)]
Jitter (peak-to-peak)	**100 ps**[2)]
Internal delay (from leading edge of triggering pulse to output pulse)	**< 150 ns**
Temperature drift of internal delay	**<6 ns**
Triggering	**external**
Input triggering pulse connector	**SMA**
Triggering pulse	**+3..+5V@50Ohm, 10..50 ns width, < 3ns rise time**
Internal divider for the output pulse waveform monitoring	**1:40, SMA**
Power supply	**External, +24VDC ± 10%, 2A**
Size	**184 x 110 x 30 mm^3**
Weight	**585 g**

[1)] typical
[2)] typical, depends on the triggering pulse rise time and jitter

OUTLINE DIMENSIONS AND CONNECTORS

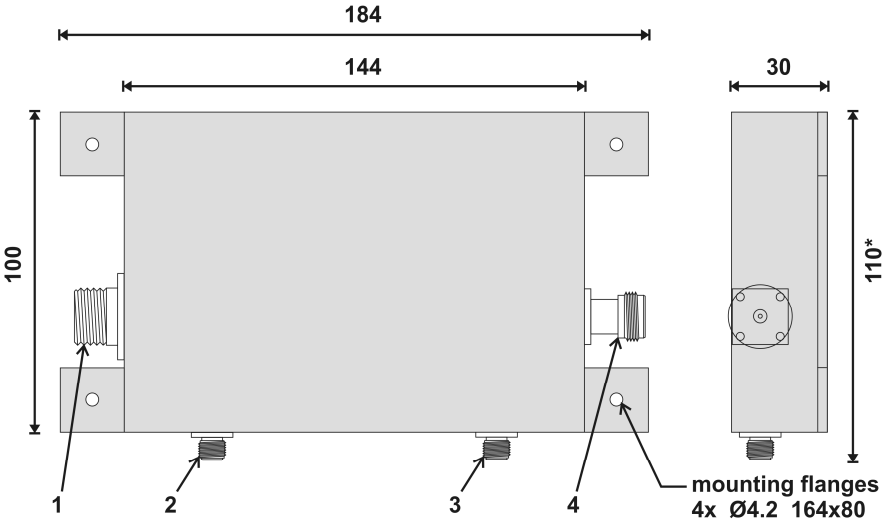

Fig.3. PPG-1/500 outline dimensions and input/output connectors.

1. Power supply connector
2. Input triggering SMA connector
3. Output pulse monitoring SMA connector, signal from internal 1:100 divider
4. 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:

- PPG-1/500 pulse generator;
- power supply cable;
- AC/DC switching power supply (88V..264VAC, 47Hz..63Hz / +24VDC);

optional items:

- Semirigid N-to-N coaxial cable assembly;
- Flexible coaxial cable assembly(assemblies) SMA-to-SMA and/or SMA-to-BNC
- 20dB (1:10) coaxial attenuator with SMA connectors.

Step 2.

Before connecting to the generator please check the DC supply voltage. It should be +24V ± 10%. The supply current is up to 2A and depends on the repetition rate.

Step 3.

Connect the output coaxial cable and the load to the generator.
Connect triggering pulse generator.
Connect output pulse monitoring SMA connector to the oscilloscope through 20dB attenuator. The recommended bandwidth of the oscilloscope is 1GHz, input impedance of the channel should be set to 50 Ohm, external attenuation ratio 400, triggering from the used channel, triggering level 500V, time scale 1 ns/div.
Connect DC power supply cable. The ground wire is black. Power supply wire is marked by “24” label.

Step 4.

Switch on (plug) AC/DC switching power supply.
Set external triggering pulses frequency to 1 kHz. Check the output pulse waveform on the oscilloscope. Adjust the external triggering pulses frequency within 0 .. 500 kHz.

➔ It is possible to use standard coaxial attenuators with N-type connectors for the direct measurement of the output pulses. Please pay attention to the maximum allowable input power and 1 GHz or more bandwidth of the attenuators. The recommended attenuators are 18N10W by Aeroflex/Inmet

(up to 250 kHz), 18N5W by Aeroflex/Inmet (up to 100 kHz), R415.7XX.000 by Radiall (up to 250 kHz).

The generator is designed for long time operation. But to prevent overheating please use enforced airflow at high repetition rates.
The maximum repetition rate is limited to 500kHz. In case of higher frequency of the triggering pulses they will be blocked to prevent damage of the generator. Please reduce the triggering pulses frequency.
It is recommended to place 20dB attenuator just on the oscilloscope input, which help to improve signal-to-noise ratio of the registered waveform (please see Fig.4).

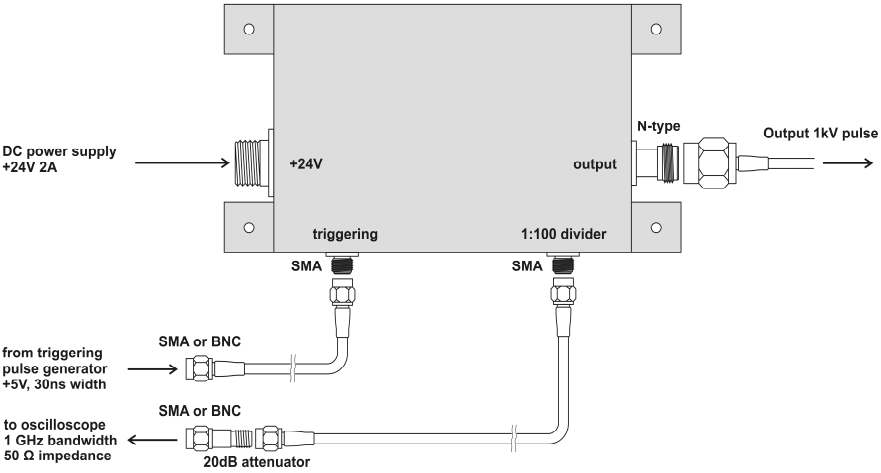

Fig.4. Connection of PPG-1/500 pulse generator module.

TRIGGERING OF THE GENERATOR

The recommended triggering pulse waveform is shown in Fig. 5. Nominal triggering pulse amplitude is +5V at 50 Ohm, pulse duration is 30 ns, rise time is 1 ns. Longer rise time may result in increasing of the output pulse jitter.

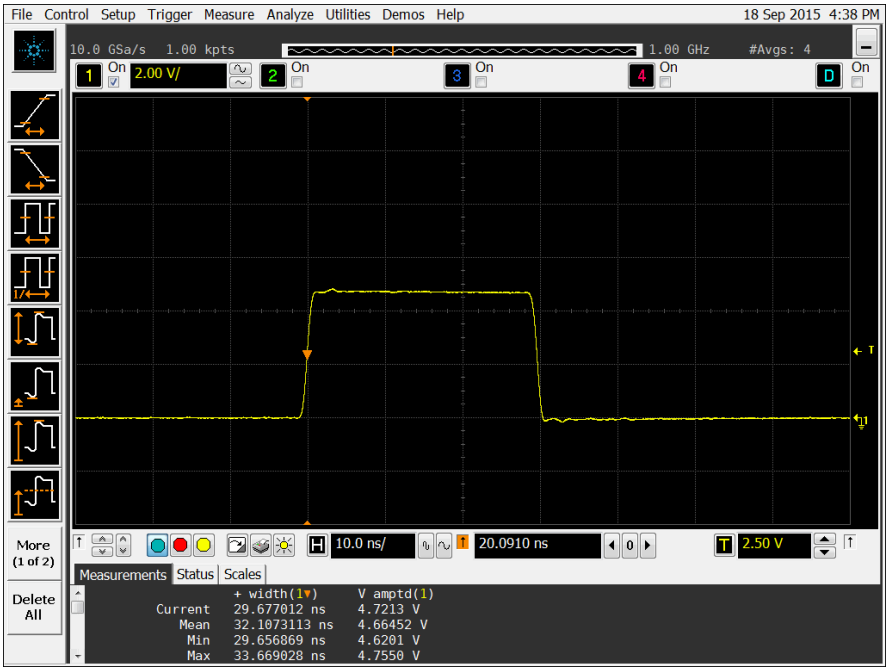

Fig. 5. Recommended triggering pulse waveform.

WARRANTY

Please see your sales agreement to determine the warranty period and warranty condition. The generator has warranty seals. Warranty covers any component or manufacturing defect, but not covers damage of the generator due to improper or inaccurate use, including but not limited to:

- mechanical damage of the input/output connectors;
- damage of the output circuit due to operation without output cable/load;
- applying of two high DC supply voltage;

➔ Removing of the warranty seals terminates the warranty.