PICOSECOND PULSE GENERATORS

PPG-5/16 AND PPG-7/10

USER MANUAL

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SAFETY MANUAL

Electrical safety

- PPG-5/16 and PPG-7/10 generators are 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 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 coaxial connector and breakdown 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 voltages only after connecting output and input coaxial cables.
- Please provide forced air flow around the generator for the good cooling in case of long time operation at maximum repetition rate.

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 not damaged. High voltage connectors should be clean and dry, free from dust, dirt and any obstacles.
- To avoid short circuits keep metal parts like clips, screws and staples away from the generator.
- The generator 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.
- 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:

- ✓ PPG-5/16 or PPG-7/10 picosecond pulse generator (hereinafter "generator")
- ✓ DC power supply cable
- ✓ User manual

Optional items:

- ✓ Dual voltage AC/DC switching power converter:
  for PPG-5/16:
  AC 85V..264V, 47Hz..63Hz / DC +125V, 0.35A; +24V, 0.65A
  for PPG-7/10:
  AC 85V..264V, 47Hz..63Hz / DC +150V, 0.35A; +24V, 0.65A
- ✓ Semirigid coaxial cable assembly N connector / SM141 cable / N connector for the output signal feeding
- ✓ Flexible coaxial cable assembly SMA connector / RG316 cable / SMA connector for the input triggering signal feeding
- ✓ Flexible coaxial cable assembly SMA connector / RG316 cable / BNC connector for the input triggering signal feeding

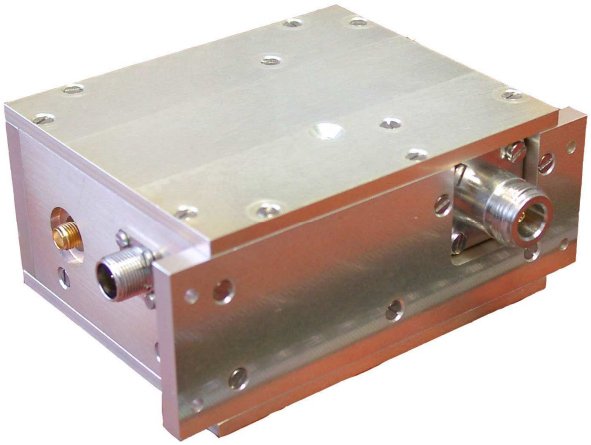


Fig.1. General view of picosecond pulse generator. The control LED are placed on the back side.

DESCRIPTION OF THE GENERATOR

PPG-5/16 and PPG-7/10 generate picosecond rise time unipolar high voltage pulses with up to 5kV/16kHz and 7kV/10kHz amplitude / repetition rate correspondingly. They are made as a compact pulse generator head (module) with external power supply and external triggering. Output pulse waveforms are shown in Fig.2. The generators are designed to operate with 50 Ohm matched load only, i.e. 50 Ohm resistive load or matched impedance antenna connected by 50 Ohm impedance coaxial cable.

➔ **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 part of energy reflection from the load back to generator and possible overheating of the generator.

➔ **Please provide forced air flow around the generator in case of long time operation at maximum repetition rate, especially in case of unmatched load. The temperature of the generator body should not exceed 50 °C. Please reduce repetition rate if required.**

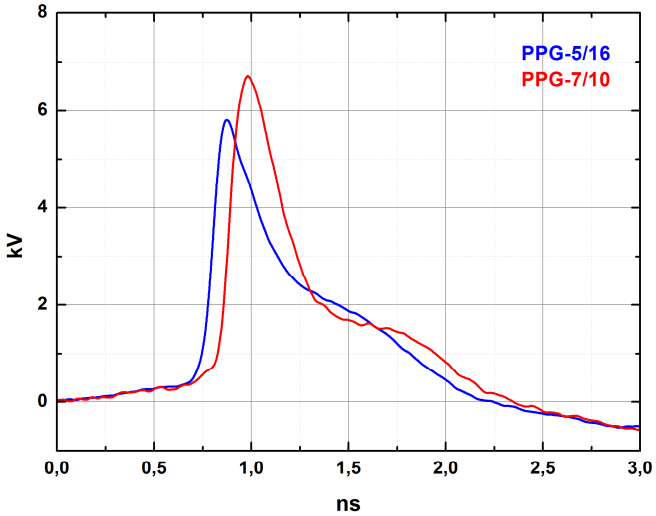


Fig.2. PPG-5/16 and PPG-7/10 typical output pulse waveforms.

The generators should be triggered by external triggering pulse. There is no internal triggering mode. Nominal triggering pulse amplitude is +5V at 50 Ohm. Recommended pulse duration is 10..100 ns, rise/fall times is 1 ns. Longer triggering pulse rise time may results in increasing of the output pulse jitter.

The generator requires external dual voltage DC power supply, including DC +24V (low voltage) and DC +125V or DC +150V (high voltage). Four wires DC power supply cable is included into standard package.

➔ **The ground wires are marked by black color. Low voltage supply wire is marked by "24" label, high voltage supply wire is marked by "125" or "150" label.**

The contact pins on power supply connector are the following:

Pin A – DC +24V low voltage supply
Pin B – ground return (DC +24V)
Pin C – ground return (high voltage)
Pin D – DC +125V or DC +150V high voltage supply
Pin E – not contacted

Output pulse amplitude is proportional to the level of high voltage DC supply.

➔ **It is possible to adjust the output pulse amplitude smoothly by adjusting high voltage DC supply level. Please do not exceed DC +132V for PPG-5/16 and DC +158V for PPG-7/10. There is a risk of damage of the generator.**

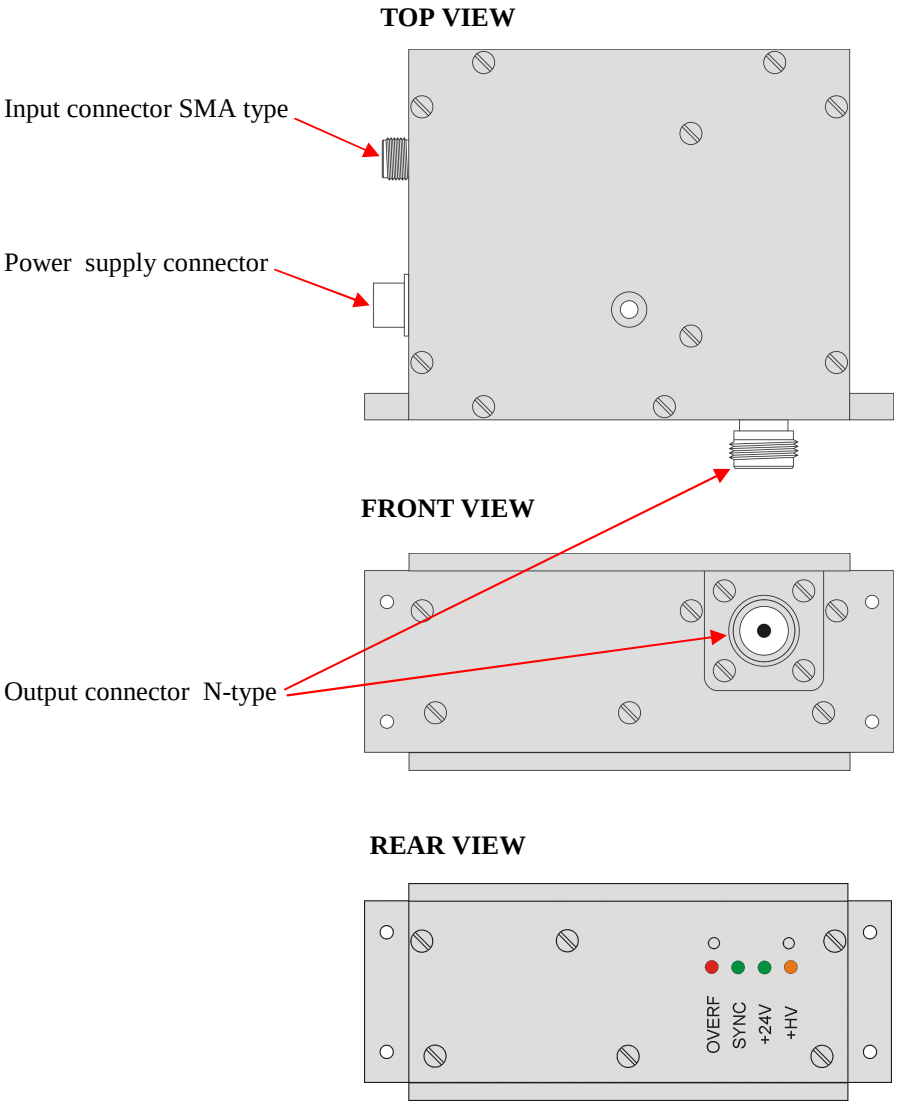
There is internal over frequency protection. If the triggering pulses frequency is more than 16 kHz for PPG-5/16 or 10 kHz for PPG-7/10 then the generator blocks triggering and red LED "OVERF" lights on. Please reduce the triggering pulses frequency.

TECHNICAL SPECIFICATION OF PPG-5/16 AND PPG-7/10 PICOSECOND PULSE GENERATORS [1)]

Output pulse amplitude [2)]	PPG-5/16 PPG-7/10	**4.5 .. 6.0 kV** **6.0 .. 7.0 kV**
Pulse polarity and waveform		**Positive, fast rise, short peak, exponential decay**
Output cable and load impedance		**50 Ohm**
Pulse rise time (fast part)		**100 ps**
Pulse width (FWHM)		**300 .. 400 ps**
Max repetition rate	PPG-5/16 PPG-7/10	**16 kHz** **10kHz**
Jitter (RMS)		**10 ps**
Jitter (peak-to-peak)		**50 ps**
Internal delay (from leading edge of triggering pulse to output pulse)		**220 ns**
Triggering		**external**
Input triggering pulse connector		**SMA**
Triggering pulse requirements		**+5V amplitude at 50 Ohm,** **10 .. 100 ns width, < 1ns rise time**
Power supply	PPG-5/16 PPG-7/10	**+108V..+132V, 0.35A; +24V, 0.65A** **+130V..+158V, 0.35A; +24V, 0.65A**
Size		**120 x 84 x 49 mm^3 (without output connector)**
Operation temperature		**0 °C.. +50°C**

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

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



Control LED from left to right:

OVERF	(red)	– too high frequency, triggering is blocked
SYNC	(green)	– triggering of the generator
+24V	(green)	– low voltage +24V DC power supply is applied
+HV	(orange)	– high voltage power supply is applied

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-5/16 or PPG-7/10 pulse generator
- power supply cable

optional items:

- Dual voltage AC/DC switching power converter:
  for PPG-5/16:
  AC 85V..264V, 47Hz..63Hz / DC +125V, 0.35A; +24V, 0.65A
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Step 2.

⇒ If standard AC/DC switching power converter (optional) is included:
Do not connect initially DC power supply cable from AC/DC switching power connector to the generator. Plug AC/DC switching power supply into AC outlet. Check the low voltage power supply is DC +24V, high voltage power supply is within min/max limits. The exact recommended level of high voltage power supply is written in the generator TESTING PROTOCOL and on the sticker attached to the side panel of AC/DC switching power supply.
Adjust the voltage levels by potentiometers if required. Unplug AC/DC switching power supply from AC outlet

⇒ If standard AC/DC switching power converter is not included:
Please set two external power supplies: low voltage DC +24V, 0.2A and high voltage power supply. The exact recommended level of high voltage power supply is written in the generator TESTING PROTOCOL. Switch off power supply.

Step 3.

Connect the output semirigid coaxial cable and load to the generator.
Connect triggering pulse generator by input coaxial cable.
Connect four wires DC power supply cable. The ground wires are marked by black color. Low voltage supply wire is marked by “24” label, high voltage supply wire is marked by “125” or “150” label.

Step 4.

Switch on (plug) AC/DC switching power supply. Both LED “+24V” and “+HV” should light on.
Set external triggering pulses frequency to 1 kHz, pulse amplitude to +5V, pulse width to 10..100ns. Apply triggering pulses, green LED “SYNC” should light on.
High voltage output pulses should be generated. Please check them. Set external triggering pulses frequency to required range below or equal to 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 as a first attenuator connected just to the generator output or use high voltage directional coupler.**

The generator is designed for long time operation at max repetition rate. But it can be overheated especially in case of unmatched load and energy reflection. Please provide forced air flow around the generator for the good cooling. Check the temperature of the generator and keep it below 50 °C. Please reduce repetition rate if required.

If triggering pulses frequency is above maximum level then red LED “OVERF” lights on and generator stops the operation. Please reduce the triggering pulses frequency, LED “OVERF” lights off and generator continue to work 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 .. 100 ns, rise time should be 1 ns. Longer rise time may results in increasing of the output pulse jitter.

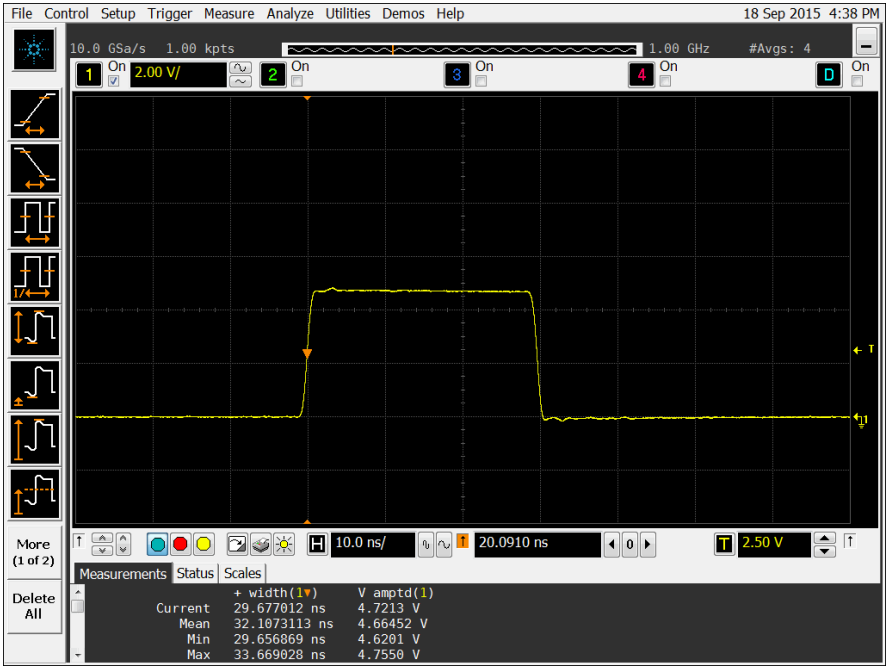

Fig. 3. Recommended triggering pulse waveform.

WARRANTY

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

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