Megaimpulse
MODERN SEMICONDUCTOR TECHNOLOGIES

SUBNANOSECOND PULSE GENERATOR MODULE

PPG-4/100

USER MANUAL

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CONTENTS

SAFETY MANUAL

Electrical safety

- PPG-4/100 pulse 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 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 of 50 centimeters length or more coaxial cable 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 destruction 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.
- PPG-4/100 generator is high power equipment. Please allow free air flow around the generator for the cooling. Please do not place the generator in fan down position on the table surface, because it prevents normal air flow.

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-4/100 subnanosecond pulse generator module (hereinafter "generator");
- ✓ PS3002 dual voltage AC/DC switching power supply AC 85V..264V, 47Hz...63Hz / DC +150V, 1.6A; +24V, 2A
- ✓ AC outlet power supply cable
- ✓ Semirigid coaxial cable assembly "N connector / SM141 cable / N connector" for the output pulses feeding
- ✓ Flexible coaxial cable assembly "SMA connector / RG316 cable / SMA connector" with SMA-to-BNC adapter for the input triggering pulses feeding.

Optional items:

- ✓ Semirigid coaxial cable assembly "N connector / SM141 cable / open" for the output pulses feeding;

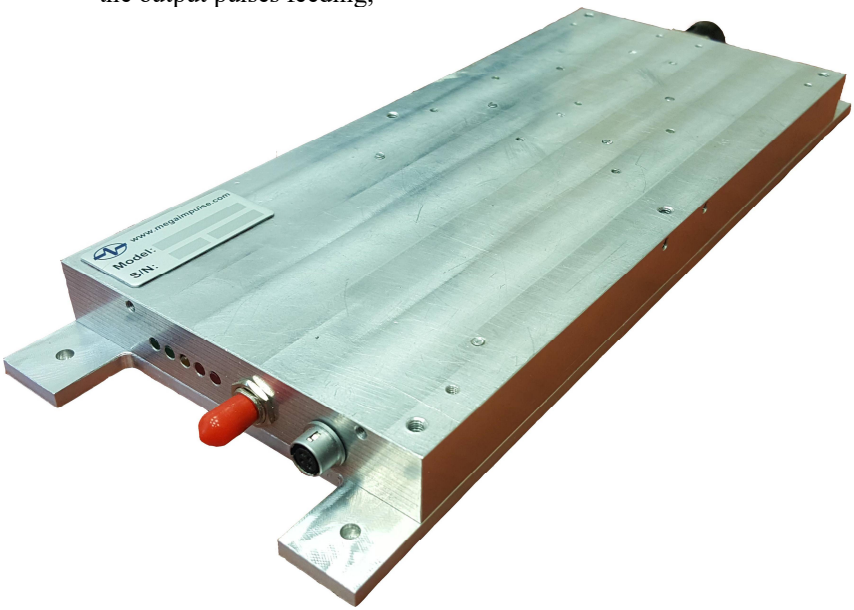


Fig.1. PPG-4/100 subnanosecond pulse generator module. General view from the input connectors and control LED side.

DESCRIPTION OF THE GENERATOR OPERATION

PPG-4/100 generates subnanosecond unipolar bell like 4 kV pulses with up to 100 kHz repetition rate. Output pulse waveform is shown in Fig.2. The generator is 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. Operation with unmatched load inevitably results in partial reflection of the energy from the load back to generator and possible overheating. It is strongly prohibited to switch on the generator without the load (with open N type connector). We recommend using of 50 centimeters length or more coaxial cable between the generator and the load (antenna or first attenuator) which prevent damage of the generator in case of the load breakdown or disconnection.

⇒ **WARNING!** Any standard coaxial attenuator will be broken immediately by extremely high peak power. The special pulse attenuators should be used. We recommend Barth Electronics attenuators.

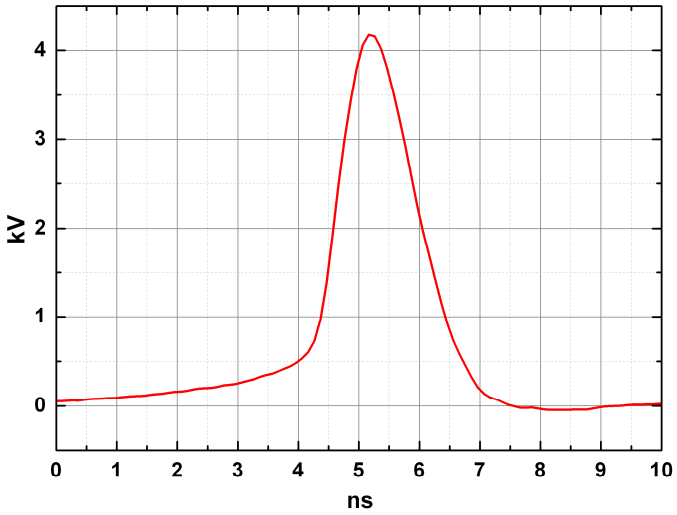


Fig.2. PPG-4/100 output pulse waveform.

PPG-4/100 should be triggered by external triggering pulse. There is no internal triggering mode. Nominal triggering pulse amplitude is +5V at 50 Ohm, nominal pulse duration is 100 ns, rise/fall times is 1 ns. Longer than 3 ns rise time results in increasing of the output pulse jitter.

The generator requires external dual voltage DC power supply, including DC +24V (low voltage) and DC +150V (high voltage). 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 the high voltage DC supply. Do not exceed DC +150V level for the high voltage supply. There is a risk of damage to the generator.

⇒ The generator comes with PS3002 standard DC power supply with fixed DC voltage, and therefore output pulse amplitude is fixed. It is recommended to use external laboratory 0V…+150V /1.2A DC power supply for the smooth amplitude adjustment.

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

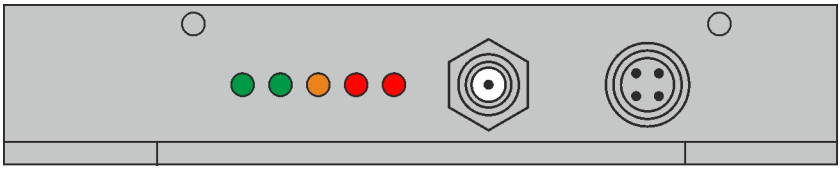
Pin 1 – DC +150V supply voltage
Pin 2 – ground return (DC +150V)
Pin 3 – DC +24V supply voltage
Pin 4 – ground return (DC +24V)

PPG-4/100 is a high power unit. The mean output power at 100 kHz repetition rate is about 100 W. The total power consumption is more than 180 W, therefore tens of watts should be dissipated. There are internal over temperature and over frequency protections. If the temperature of the generator is too high then the generator stops the operation and red LED “OVERHEAT” lights on. In this case please allow idle operation during few minutes. When the temperature decreases the generator returns to normal operation regime automatically. If the triggering pulses frequency is more than 100 kHz then the generator blocks triggering and red LED “OVERLOAD” lights on. Please reduce the triggering pulses frequency below or equal to 100 kHz.

TECHNICAL SPECIFICATION OF PPG-4/100
SUBNANOSECOND PULSE GENERATOR MODULE

Output pulse amplitude	**4 kV**
Pulse polarity and waveform	**Positive unipolar bell like pulse**
Output cable and load impedance	**50 Ohm**
Pulse rise time (20% - 80% levels)	**600 ps**
Pulse width (FWHM)	**1.7 ns**
Max repetition rate	**100 kHz**
Jitter (RMS)	**30 ps**
Jitter (peak-to-peak)	**200 ps**
Internal delay (from leading edge of triggering pulse to output pulse)	**< 100 ns**
Temperature drift of internal delay	**< 1 ns**
Triggering	**external**
Input triggering pulse connector	**SMA**
Triggering pulse requirements	**+5V amplitude at 50 Ohm, 30 ns width, < 3ns rise time**
Power supply	**Dual DC supply: +150V, 1.6A; +24V, 2A**
Size	**290 x 110 x 21 mm^3 (with mounting flanges)**
Weight	**1.2 kg**

INPUT CONNECTORS AND CONTROL LED SIDE VIEW



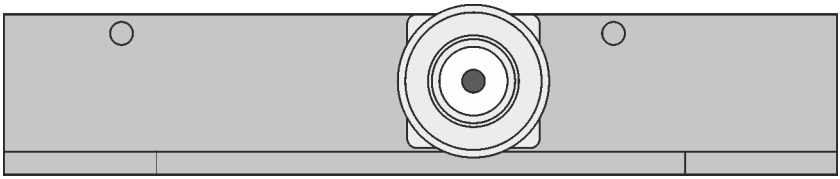
Control LED from left to right:

+24V DC (green)	– low voltage power supply "+24V DC is applied"
+150V DC (green)	– high voltage power supply "+150V DC is applied"
SYNC IN (orange)	– triggering of the generator
OVERHEAT (red)	– operation is stopped due to overheating of the generator
OVERLOAD (red)	– triggering is blocked because frequency of triggering pulses is above 100 kHz

Connectors:

SYNC IN	– SMA type input connector for external triggering signal
POWER SUPLLY	– connector for the external DC power supplies

OUTPUT CONNECTOR SIDE VIEW



Connectors:

OUTPUT	– N type output 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-4/100 pulse generator;
- PS3002 DC power supply: +150V , 1.6A; +24V, 2A;
- Semirigid coaxial cable assembly "N connector / SM141 cable / N connector" for the output pulses feeding;
- Flexible coaxial cable assembly "SMA connector / RG316 cable / SMA connector" with SMA-to-BNC adapter for the input triggering pulses feeding;

optional items:

- Semirigid coaxial cable assembly "N connector / SM141 cable / open" for the output pulses feeding;
- Flexible coaxial cable assembly "SMA connector / RG316 cable / BNC connector" for the input triggering pulses feeding.

Step 2.

Connect PS3002 DC power supply to the generator.

Step 3.

Connect the output coaxial cable and the load to the generator.
Connect triggering pulse generator.

Step 4.

Turn on PS3002 DC power supply. Both green LED “+24V DC” and “+150V DC” on the generator should light on.
Set external triggering pulses frequency to 1 kHz. Apply triggering pulses. Orange LED “SYNC IN” should light on which indicated the proper triggering.
4 kV output pulses should be generated. Check the pulses on the load.
Set external triggering pulses frequency to required range below or equal to 100 kHz.

➔ Please pay attention that standard GHz range coaxial attenuators are not suitable for direct registration of output pulses because of extremely high pulse peak power. Even 100W and more power attenuators will be broken

immediately. We recommend using special high voltage pulse attenuators, high voltage directional coupler or GHz range adjusted resistive divider.

The generator is designed for long time operation at max repetition rate 100 kHz. But it can be overheated in case of limited air flow around the generator or high ambient temperature. Red LED “OVERHEAT” lights on in this case and generator stops the operation. Please allow idle operation during several minutes for the cooling. LED “OVERHEAT” lights off and generator returns to normal operation automatically when the temperature decreases.

The maximum repetition rate is 100 kHz. If triggering pulses frequency is above this level then red LED “OVERLOAD” lights on and generator stops the operation. Please reduce the triggering pulses frequency.

TRIGGERING THE GENERATOR

The recommended triggering pulse waveform is shown in Fig. 4. Nominal triggering pulse amplitude is +5V at 50 Ohm, pulse duration should be from 30 ns to 1 µs, rise/fall times are 1 ns. Longer than 3 ns rise time may results in increasing of the output pulse jitter.

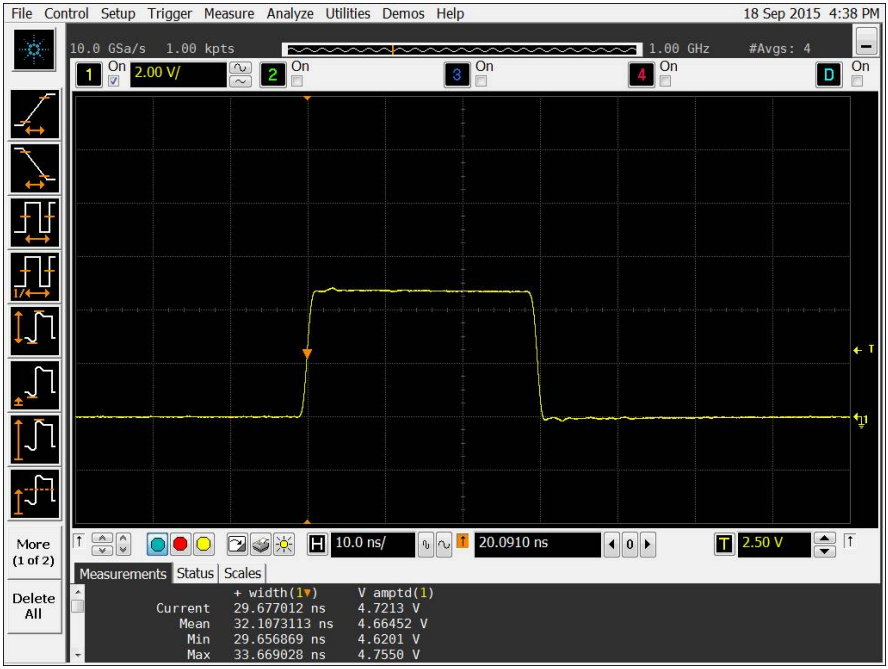


Fig. 4. Recommended triggering pulse waveform.

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.