

High Voltage Pulse Generator

FPG 20-100MC2

Operation Manual



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FPG 20-100MC2 OPERATION MANUAL

OVERVIEW

High voltage pulse generator FPG 20-100MC2 (the Generator) is designed to produce positive and negative voltage pulses with the maximum amplitude of up to ± 10 kV into 200 Ohm, rise time of 2 ns and width of 10 ns at 90% of maximum voltage. Combined output is 20 kV into 500-1000 Ohm. Operation of the FPG 20-100MC2 should be carried out according to this Operation Manual. The operator should study this Operation Manual prior to using of the FPG 20-100MC2.

DISCLAIMER

This Generator contains high voltage power supplies, careless use could result in electric shock. It is assumed that this highly specialized equipment will only be used by qualified personnel. FID GmbH accept no responsibility for any electric shock or injury arising from use or misuse of this equipment, as well as for the consequences of the Generator operation with a user's equipment. It is the responsibility of the user to exercise care and common sense with this highly versatile equipment.

TRANSPORTATION

Transportation of the Generator should be performed with a complete disconnection from all power sources. The Generator should be transferred in a specialized container, protecting it from possible shocks during the transportation.

UNPACKING

Having received the package with the Generator, put it into the horizontal position as labeled on the package. Remove the transportation packing from the package and after that remove the Generator. Make sure that the Generator has no visible mechanical damage. If the packing material was damaged during shipping, please take a photo of the damaged packing and its contents and send it to FID GmbH or its representative immediately upon receiving the package.

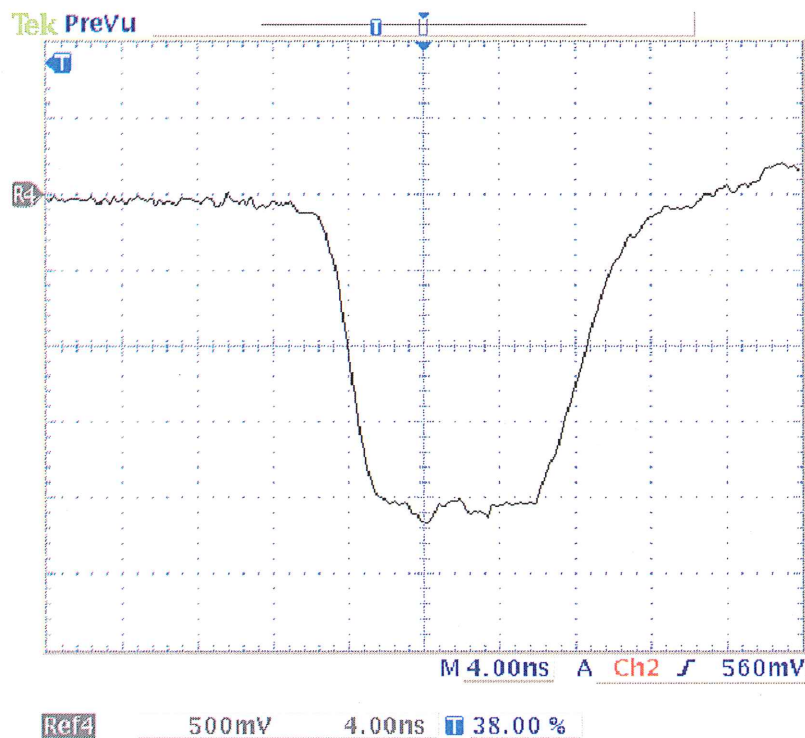
LIMITED EXPRESS PRODUCT WARRANTIES

All Products are warranted to Buyer against defects in materials and workmanship for the period of time of 12 months. FID shall, at its option, repair or replace any Product that proves, in the reasonable opinion of FID, to be defective in materials or workmanship during the warranty period. All Products repaired or replaced under warranty are only warranted for the remaining un-expired period of time in the original warranty for the particular defective Product. FID reserves the right to issue a credit note for any defective Products that have proved effective through normal usage. **THIS WARRANTY EXCLUDES PRODUCTS, PARTS OR EQUIPMENT THAT HAVE BEEN ACCIDENTALLY DAMAGED, DISASSEMBLED, MODIFIED, MISUSED, OR WHICH ARE USED IN APPLICATIONS THAT EXCEED THEIR SPECIFICATIONS OR RATINGS, NEGLECTED, IMPROPERLY INSTALLED OR OTHERWISE ABUSED.** Buyer must claim under the warranty in writing no later than 30 days after the claimed defect is discovered. This warranty does not extend to any third party, including without limitation Buyer's end-users or customers, and does not apply to any parts, equipment or other goods not manufactured by FID. **EXCEPT FOR THE LIMITED WARRANTIES EXPRESSLY SET FORTH ABOVE, FID SPECIFICALLY DISCLAIMS ANY AND ALL OTHER WARRANTIES TO BUYER, INCLUDING WITHOUT LIMITATION, ANY AND ALL IMPLIED WARRANTIES, SUCH AS FREEDOM FROM INFRINGEMENT, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

SPECIFICATIONS

Maximum amplitude into 500-1000 Ohm	20 kV
Number of output channels	2; ± 10 kV into 200 Ohm
Output adjustment range	4-20 kV
Rise time	2 ns
Pulse width at 90%	10 ns
Pulse repetition rate	0-100 kHz in continuous mode
Triggering	Internal and External 5-10 V @50 Ohm; 0,1-0,3 μ s
Input power	Main power – DC 150-250 V, 8 A Auxiliary power – AC 100-240 V, 50/60 Hz

FPG 20-100MC2 PULSE SHAPE



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OPERATION METHODOLOGY

Generator FPG 20-100MC2 is designed to operate with a 500-1000 Ohm load. All technical specifications such as voltage amplitude, rise time, pulse duration are provided at the above mentioned particular load of 500-1000 Ohm.

Practically the real load may differ from 500-1000 Ohm value either way because of capacitance of inductance, non-linear effects and other things connected with a particular load.

The FPG 20-100MC2 is capable of operating in fail-free mode even if the load's impedance differs from the nominal 500-1000 Ohm for $\pm 50\%$.

At higher levels of variation of the impedance of the load a significantly smaller amount of energy is consumed by the load. In this case there appear reflected from the load repetitive voltage pulses and almost all energy of the initial pulse is absorbed inside the FPG 20-100MC2. This induces a significant heating-up of internal structures of the generator and can lead to emergency shutdown of the FPG 20-100MC2.

In any case when the load for the FPG 20-100MC2 is less than 100 Ohm or is more than 2000 Ohm it is necessary to consult regarding the modes of operation of the FPG 20-100MC2 with FID GmbH.

The most important condition of a safe operation of the FPG 20-100MC2 is the tolerance of surrounding electronic equipment to an electro-magnetic interference. Usually a source of such interference is the load. The experience in operation of similar pulse generators shows that customer's triggering generators often do not comply with increased electro-magnetic interference level. Such instability can lead to loss of power supply stabilization and spontaneous triggering of the trigger generators at frequencies higher than 100 kHz. Any of these in its turn could lead to the FPG 20-100MC2 breaking.

INSTALLATION

1. Put the Generator into the horizontal position..
2. Make sure that the Generator has no visible mechanical damage.
3. Connect the load to the output connectors of the Generator using the included cables. The cables should have minimum inductance possible to allow transmission of high-frequency part of spectra into the load thus avoiding reflection to the Generator.

Attention!!!

It is forbidden to turn-on the FPG 20-100MC2 without connected output cables. This may lead to damage of the Generator.

4. Connect the Generator to the AC outlet.
5. Connect a DC power supply to the corresponding connector on the rear panel of the Generator using the included power cord. The red plug of the cord should be connected to the positive terminal of a DC power supply.

Attention!!!

The red connector of the DC power cord should be connected to the positive “+” terminal of the DC power supply. Polarity mismatch would damage the Generator.

6. If required connect the external triggering pulser to the connector labeled ‘TRIGGER IN’ on the rear panel of the Generator.

Attention!!!

The external triggering generator should be capable to withstand high frequency electromagnetic interference. Malfunction of the triggering generator may lead to damage of the FPG 20-100MC2.

OPERATION ORDER

1. Check if the Generator is properly connected (see section INSTALLATION)

The Generator can operate in two triggering modes – using internal triggering circuit and using the user's triggering pulser. For the requirements to the external triggering pulser please see sections SPECIFICATIONS and INSTALLATION.

FID GmbH recommends to perform the initial testing of the FPG 20-100MC2 using internal triggering mode.

2. For operation in the internal triggering mode proceed as follows:

- 2.1. On the rear panel of the Generator put the "TRIGGER MODE" tumbler into the "INT." position.

- 2.2. The pulse repetition rate can be adjusted by the knob on the rear panel of the Generator labeled 'FREQUENCY'

- 2.3. In the internal triggering mode the PRF adjustment range is 6-100 kHz.

3. For operation in the external triggering mode proceed as follows:

- 3.1. On the rear panel of the Generator put the "TRIGGER MODE" tumbler into the "EXT." position.

- 3.2. Check whether the external triggering pulser is connected to the corresponding connector on the rear panel of the Generator.

- 3.3. Turn on the triggering generator and set the desired PRF.

IMPORTANT – Never exceed the maximum PRF of 100 kHz (see notes regarding the triggering pulser in the INSTALLATION section).

4. Turn on the black AC switch located below the AC power cord terminal on the rear panel. The cooling fans inside the Generator should begin to operate.
5. Using the red switches on the rear panel turn on the required number of output channels. It is possible to use any combination of channels. Maximum output voltage is reached when all of the output channels are on.

6. Turn on the external power supply DC 150-250 V.

Attention!!!

The turning order of AC power and the external DC power supply is important. AC power should be turned on first, the DC power supply DC 150-250 V is turned on second. It is forbidden to turn on the DC 150-250 V power supply while AC power is switched off. Failure to obey these instructions will lead to the damage of the FPG 20-100MC2

Output voltage amplitude is adjusted by change of the input DC voltage from 150 V to 250 V.

Attention!!!

When the load impedance is higher than 600 Ohm it is necessary to:

- 1) Smoothly increase the input DC voltage from 150 V to 250 V at maximum PRF for at least 10 seconds

OR

- 2) Smoothly increase PRF from 6 kHz to 100 kHz at maximum input voltage for at least 10 seconds.

Attention!!!

When the input DC voltage exceeds 257 V the Generator is shutting down automatically to avoid damage. The overvoltage indicator on the rear panel is turned on. To turn the Generator on again turn the DC power off and then on again.

7. To turn the Generator off proceed in reverse order. First turn off the DC power supply, and after that turn off the AC power.

APPLICATION NOTES – IMPORTANT INFORMATION

It is permissible to use the Generator with the load values which do not match the output impedance of the Generator.

Maximum efficiency of energy transmission to the load is achieved when the load value is 200 Ohm.

When the value of the load is significantly different from the above value the large amount of energy will be reflected from the load back inside the Generator. **As an exception, in a short circuit (0 Ohm) or open circuit (∞ Ohm) modes all energy is reflected back to the Generator.**

The Generator has an automatic overheating protection. When the maximum permissible temperature of the output devices is reached the Generator is shutting down. The corresponding overheating indicators will lit on the rear panel.

To turn the Generator on after an emergency shutdown it is necessary to do the following:

- 1) Turn off the DC power supply and AC power.
- 2) Wait for 20-40 seconds.
- 3) Turn the AC power on again. The cooling fans will start operating.
- 4) Wait for 1-2 minutes while the internal structures are cooled down.
- 5) After that it is possible to turn on the DC power again.

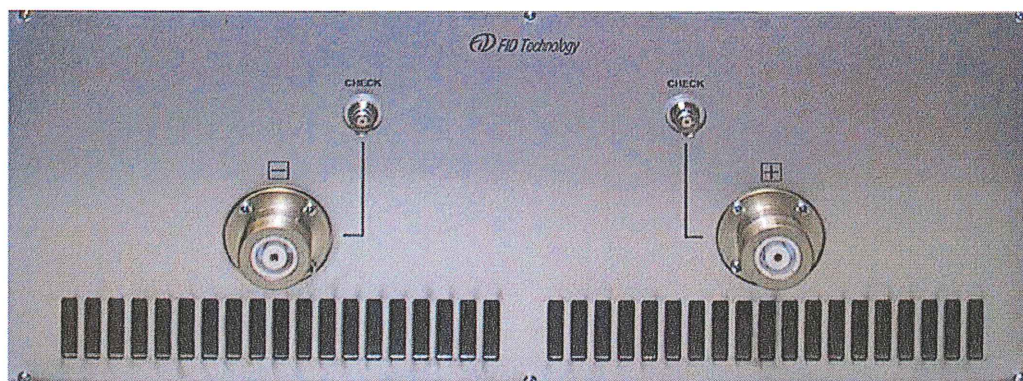
Internal structures of the Generator are heated nonuniformly. **When the load impedance is higher than 600 Ohm it is obligatory to avoid turning on the Generator at full PRF and output voltage at once.**

Proceed as following:

- 1) Smoothly increase the input DC voltage from 150 V to 250 V at maximum PRF for at least 10 seconds
or
- 2) Smoothly increase PRF from 6 kHz to 100 kHz at maximum input voltage for at least 10 seconds.

To roughly estimate the pulse shape and the amplitude of the output pulses it is possible to use the control outputs on the front panel of the Generator marked 'CHECK'. The division ratio is approximately 1:200 at 50 Ohm.

FRONT PANEL



REAR PANEL

