

## Pattern Generator BPG 12G-TER



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### Key Features

- Wide-band Pattern Generator for Bipolar Return-To-Zero Pulses at Data Rates up to 6 GBaud
- 16 MBit Memory for User Programmable Pattern
- Ternary Output Signal
- Variable Pattern Length
- Complementary Data Outputs
- Amplitude of Positive and Negative Pulses Independently Adjustable for both Data Outputs
- Operation via USB-Port

### Brief Description

The pattern generator BPG 12G-TER is a universal test instrument for electronic components in the picosecond range, fast communication systems and Josephson Junction applications.

The instrument works gap-free at clock rates between 5 MHz and 12 GHz. An external clock signal is needed to provide the time base for operation. The generator is jitter-transparent and follows even abrupt frequency changes. The output data rate equals Clock/2, i.e. the output pulse width after RZ-forming equals one input clock period.

The complementary data outputs provide programmable return-to-zero signals consisting of positive and negative pulses and zeros.

The length of the programmable pattern is variable from 16 digit up to 67108 864 digits and is repeated periodically. Each digit can be set to a positive or negative pulse or to zero.

The pattern memory can be split in 2 or 4 parts to toggle synchronously between different waveforms. Two short user patterns with a length of 16 digit and 32 digit are directly programmable.

Complementary outputs for push-pull applications are provided. Positive and negative pulse amplitudes of the ternary data signal are independently adjustable for both data outputs between 0.5 V and 1 V.

At the front panel a divided clock signal and the pattern-synchronous wordframe trigger signal are available.

The instrument is remotely controlled via its USB-interface. An easy-to-use graphical user interface is included in the supplied software and allows simple operation by mouse-clicking. Additionally self-programmed software may be used to control the instrument.

## Pulse Shaping Principle

At 12 GHz clock frequency the instrument generates two non-return-to-zero (NRZ) data signals with a data rate of 6 Gbps. By logic combination with the clock signal the NRZ signals are converted to RZ signals. For the ternary output channel one of the signals is inverted, then both signals are amplified and added together.

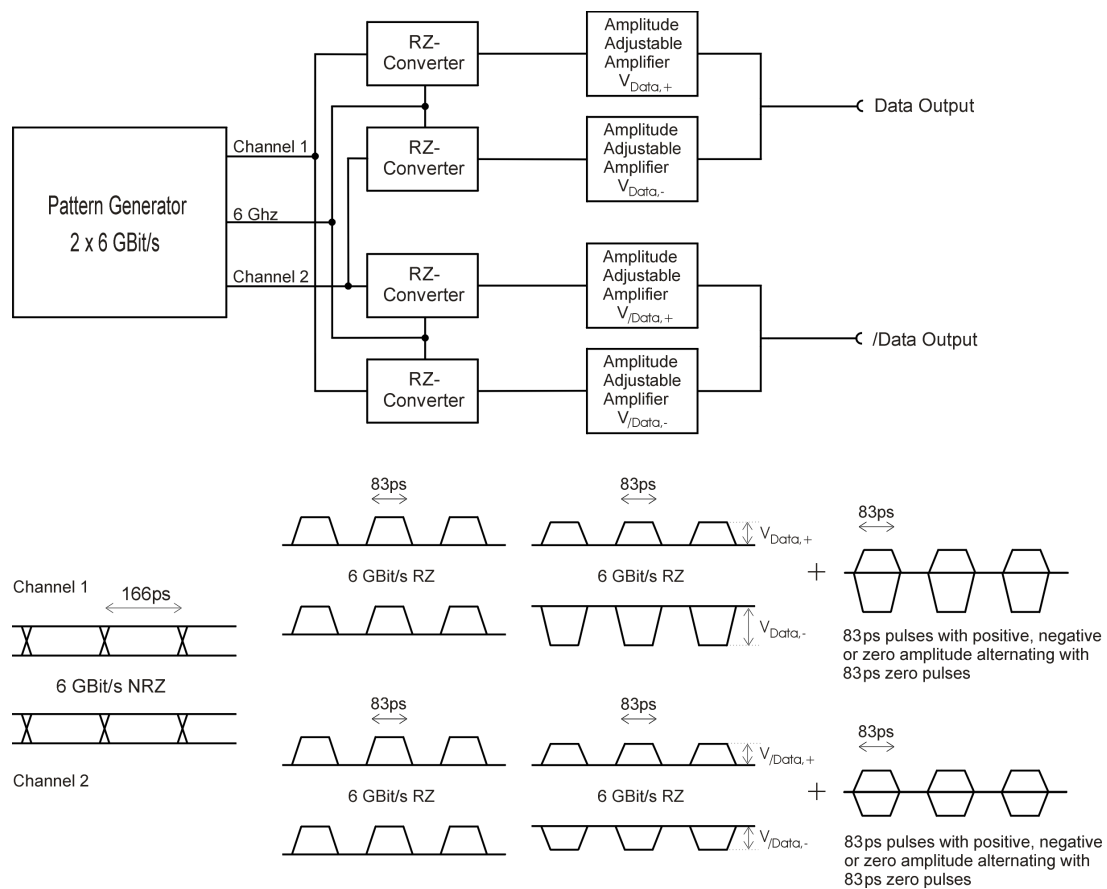


Figure 1: Principle of Generating Ternary Pulses with Adjustable Amplitudes.

Depending on the signals on subchannel 1 and 2, pulses with positive, negative or zero amplitude are formed:

| Channel 1 | Channel 2 | Pulse          |
|-----------|-----------|----------------|
| 1         | 0         | Positive Pulse |
| 0         | 1         | Negative Pulse |
| 0         | 0         | Zero Pulse     |
| 1         | 1         | Not allowed    |

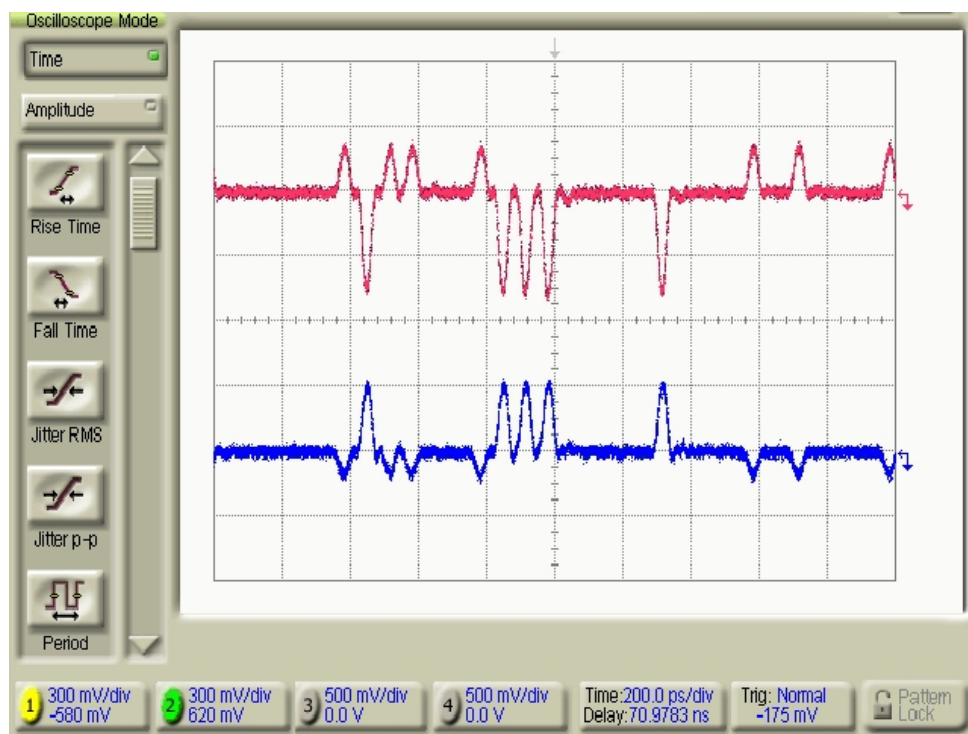
## Output Signals

### Pulse pattern with independent amplitudes:

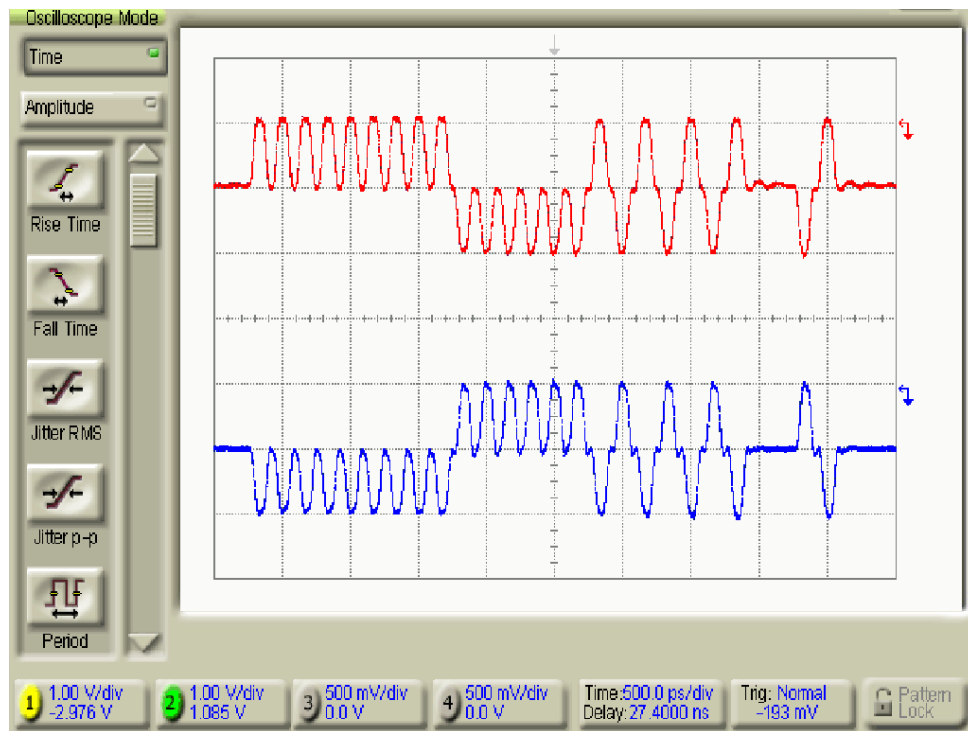
The amplitude of the positive and negative pulses of the ternary signal can be adjusted independently and for both output channels separately. This means four amplitude voltages can be independently set and changed:

- $V_{Data,+}$  and  $V_{Data,-}$  define the amplitude of the positive and negative pulses respectively of the Data output signal
- $V_{/Data,+}$  and  $V_{/Data,-}$  define the amplitude of the positive and negative pulses respectively of the /Data output signal

The adjustment range for all four voltages is 0.5 V to 1 V ( $\pm 10\%$  into 50  $\Omega$ ) with a resolution of 1 mV.

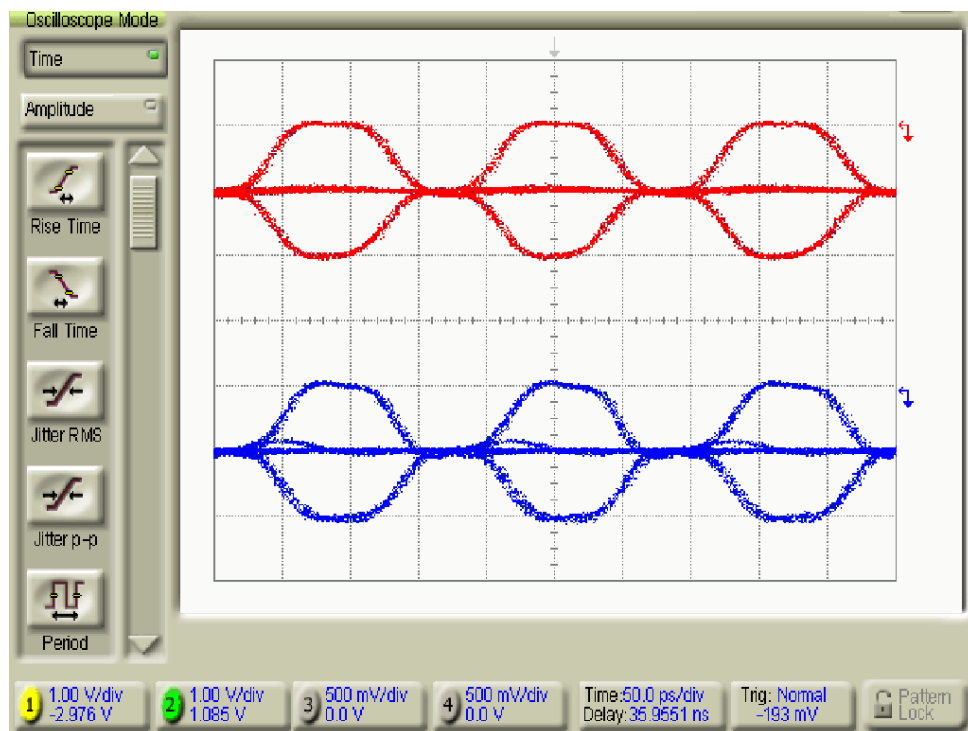


Complementary bipolar pulse pattern at 12 GHz clock rate:



(500 ps/div, 1 V/div)

Complementary bipolar eye diagram at 12 GHz clock rate:



(50 ps/div, 1 V/div)

## Technical Specifications

### BPG 12G-TER

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Frequency Range | 25 MHz ... 12 GHz, fully adjustable<br>(data rate = clock/2, i.e. the data pulse width equals one clock period)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Clock Input     | $U_i = 0.5 \dots 1 V_{pp}$ (-3 ... +3 dBm), $R_i = 50 \Omega$ ,<br>50 $\Omega$ SMA, $ r  < 0,2$<br>6 digit frequency display                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Data Outputs    | 1. Data, SMA connector 50 $\Omega$<br>2. /Data, SMA connector 50 $\Omega$<br><br>Ternary Return-To-Zero Code<br>Data Amplitude: $-U_1 / 0 / +U_2$<br>/Data Amplitude: $-U_3 / 0 / +U_4$<br>$U_i = 0.5 \dots 1.0 V \pm 10\%$ (i=1, 2, 3, 4) into 50 $\Omega$ with a resolution of 1 mV<br>Rise / Fall time < 50 ps (20/80%)<br>Jitter (pp) < 10 ps<br>DC-Offset regulation of the Data and /Data voltage for zero-potential adjustment                                                                                                                                                                                                  |
| Pattern         | 1. 16-digit pulse pattern<br>2. 32-digit pulse pattern<br>3. Pulse pattern of length $32 * m$ digit ( $m = 3, 4, \dots, 2^{21}$ )<br>(=max. 67,108,864 ternary coded digits)<br>4. Pulse pattern consisting of two parts, each of length $32 * m$ digit<br>( $m = 3, 4, \dots, 2^{20}$ ), synchronously selectable<br>5. Pulse pattern consisting of four parts, each of length $32 * m$ digit<br>( $m = 3, 4, \dots, 2^{19}$ ), synchronously selectable<br><br>All patterns are programmable and selectable via the USB-interface. The programmed patterns should have approximately the same number of positive and negative pulses |
| Clock Output    | Clock/2, 0.4 V $\pm$ 0.1 V AC-coupled, 50 $\Omega$ SMA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Trigger Outputs | 1. Clock/8<br>2. Word Frame Trigger<br>0 V/-0.4 V, 50 $\Omega$ SMA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

**BPG 12G-TER**

|              |                                                                |
|--------------|----------------------------------------------------------------|
| Interface    | Operation only via USB-port                                    |
|              | Max. data transmission rate 1 MByte/s                          |
|              | Graphical User Interface for operation and pattern programming |
| Dimensions   | 19" Desktop                                                    |
|              | W x H x D = 448 x 90 x 315 mm                                  |
| Weight       | approx. 6 kg                                                   |
| Power Supply | 110 V – 120 V/60 Hz/36 V A or                                  |
|              | 220 V – 240 V/50 Hz/36 V A                                     |

**Optionally available**
**Option 1: Pattern Memory Extension 128 MDigit**

|                             |                                                   |
|-----------------------------|---------------------------------------------------|
| Pattern Memory              | 268 435 456 Bits                                  |
|                             | max. 134 217 728 ternary coded digits             |
| Programmable Pattern Length | $32 * m$ Digits, ( $m = 1, 2, 3, \dots, 2^{22}$ ) |

**Option 2: Internal Synthesizer**

System clock selectable between internal clock generator and external clock input

|                         |                                 |
|-------------------------|---------------------------------|
| Frequency Range         | 125 MHz ... 12 GHz              |
| Resolution              | 10 Hz                           |
| 10 MHz Reference Input  | $U_i = 1 V_{pp} \dots 3 V_{pp}$ |
|                         | 50 $\Omega$ SMA, AC-coupled     |
| 10 MHz Reference Output | Amplitude $1.5 V_{pp}$          |
|                         | 50 $\Omega$ SMA, AC-coupled     |

**The instrument is produced by SYMPULS in Germany.  
We offer a reliable service and 24 month warranty.**