The FG200 Series function generators feature sweep and modulation capabilities with outstanding ease of operation. The FG300 Series adds arbitrary sweep and simple arbitrary waveform definition capabilities, plus sequencing functions, giving you high performance along with ease of use.

The powerful sweep and modulation capabilities of these instruments make them ideal for applications in mechatronics, and vehicle design and testing.

**FEATURES**

- **Frequencies from 1 µHz to 15 MHz**
  Frequency range: 1 µHz to 15 MHz (Sine, Square)
  1 µHz to 200 kHz (Triangle, Pulse, Arbitrary waveform)
  High resolution: 1 µHz or 9 digits max

- **Easy Setup and Display of Arbitrary Sweep Patterns and Simple Arbitrary Waveforms (FG310/FG320)**
  You define the waveforms by entering points within the scaled ranges for the X (time) and Y (parameter) axes. The waveform can be generated using linear, step, or spline interpolation between the points. Moreover, you can load the data in ASCII format from an MS-DOS floppy disk—so you can set up the data in Excel or the spread-sheet of your choice. You can use arbitrary waveforms thus defined as output waveforms or as sweep patterns.

- **Load and Modify Waveforms on Floppies from Other Instruments (FG310/FG320)**
  You can use the floppy interface to load waveforms created with YOKOGAWA AG Series arbitrary waveform generators, or captured with YOKOGAWA digital oscilloscopes such as the DL4100, or DL5140/DL5180. You can then either output them as is, or, with the FG300 Series, make further modifications before use.

- **Output Terminals**
  You can set all parameters, such as output on/off, waveform type, frequency, amplitude, sweep, and modulation, independently for each of the channels. Maximum output voltage is ±10 V into open, and the wide frequency range extends from 1 µHz to 15 MHz (sine or square wave).

- **Intuitive Touchscreen Based Operation**
  In the past, high-performance function generators were not very easy to operate. With conventional key-based front panels there were just too many keys. Thanks to the large LCD display and touchscreen features of the FG200 & FG300 Series, we’ve solved that problem by putting adequate information on each display, and giving them a much more user-friendly interface.

**FUNCTIONS**

- **Versatile Sweep and Modulation Functions**
  With these instruments you can sweep not only frequency, but also other parameters as well, such as phase, amplitude, offset voltage, or duty cycle, with linear, log, linear step, log step, or arbitrary (FG310/FG320) sweep patterns. You can even sweep frequency and amplitude at the same time.
  Modulation capabilities include not only AM/FM, but also DSB-AM, phase modulation (PM), offset modulation, and PWM. The modulation waveform can be sine or triangle (with variable symmetry), pulse, (with variable duty cycle), or an arbitrary user-defined waveform (FG310/FG320).
**SYNTHESIZED FUNCTION GENERATORS**

**FG200 & FG300**

- **External Control of Sweep by Analog or Digital Signals (/R1 Option)**
  Although these are digital function generators, you can still control the sweep parameters with an external analog signal. You can also control them directly with external digital signals. And you enjoy the high accuracy and repeatability that you can only get with digital technologies.

- **Amplitude and Duty Cycle Continuously Variable**
  With the FG200 & FG300 Series, the output signal is not disrupted even if you continuously vary a parameter such as frequency, phase, amplitude, offset voltage, or duty cycle. Duty cycle setting range is 0% to 100%, with 0.01% resolution.

- **Multichannel Output Via Synchronized Operation**
  By linking multiple units in parallel with the accessory connecting cables, you can obtain three or even more channels of phase-synchronized signals, and even synchronize the sweep.

- **Up to 256 Programmed Sequence Steps (FG310/FG320)**
  The sequencing function lets you define sets of parameters for the frequency, phase, amplitude, offset voltage, and duty cycle and select them sequentially via trigger events. You can also specify sets of parameters directly with external digital control signals (with the /R1 option).

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**OUTSTANDING BASIC PERFORMANCE**

- Spectrum purity
  Sine waveform at 10kHz into 50 load, amplitude setting 20 Vp-p

- Pulse characteristics at rise time 18.6ns (actual value)
  Square waveform at 50kHz into 50 load, amplitude setting 20 Vp-p

---

**FG200 & FG300 SERIES FUNCTION COMPARISON**

<table>
<thead>
<tr>
<th>Function</th>
<th>FG210</th>
<th>FG220</th>
<th>FG310</th>
<th>FG320</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output channels</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Sweep</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Arbitrary sweep</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Modulation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Arbitrary waveform generation</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sequencing</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Built-in 3.5&quot; floppy drive</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>External analog/digital signal-controlled sweep</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

*: Comes with option /R1
**APPLICATION EXAMPLE**

RPM limiter circuit testing using FG200/FG300 Series and data recorder

**OUTPUT WAVEFORM EXAMPLE**

- Damped waveform
- AM
- Trigger burst waveform
- Frequency & amplitude sweep waveform
- PWM (pulse width modulation)
- FSK (frequency shift keying)
- VCF (voltage controlled frequency)
- VCA (voltage controlled amplitude)
- Electrocardiogram waveform
SPECIFICATIONS

**Waveform Output**

Output channels: FG220/FG32: 2 channels
FG210/FG310: 1 channel

Output waveforms: Sine, Square (fixed 50% duty cycle), Triangle (variable symmetry), Pulse (variable duty cycle), or Arbitrary waveform (FG310/FG320).

Output signal:
- Continuous output (CONT): Waveform output continuously
- Triggered output (TRIG): Output preset number (integer) of burst waveforms on trigger sync
- Gated output (GATE): Output integer number of burst waveforms while enabled by gate
- DC output (DC): Output DC voltage

**Frequency**

Frequency range:
- Sine or Square waveform: 1 µHz to 15 MHz
- Triangle or Pulse waveform: 1 µHz to 200 kHz
- Arbitrary waveform (FG310/FG320): 1 µHz to 200 kHz

Resolution:
- 1 µHz or 9 digits max.

Frequency accuracy:
- ±20 ppm

Frequency stability:
- ±20 ppm (at ambient temperature of 5 to 40°C)

Reference clock:
- 40.2107 MHz

**Output Characteristics**

Maximum output voltage:
- FG220/FG320: ±10 V
- FG210/FG310: ±5 V

Amplitude setting range:
- ±20 Vpp (setting resolution 1 mVpp) (negative amplitude represents inverted waveform)

Amplitude accuracy:
- ±(0.8% of setting + 14 µVrms)

Amplitude frequency characteristics:
- Sine waveform:
  - ±100 kHz: ±0.1 dB
  - ±1 MHz: ±0.2 dB
  - ±10 MHz: ±0.5 dB
  - ±15 MHz: ±1 dB
- Square/Pulse waveform (50% duty cycle):
  - ±10 kHz: ±2% (open when output OFF)
  - Triangle waveform (50% symmetry):
  - ±10 kHz: ±3% (open when output OFF)

Offset voltage setting range:
- ±10 V (setting resolution 1 mV)

Output impedance:
- 50 Ω ±1% (open when output OFF)

DC output setting range:
- ±10 V (setting resolution 1 mV)

Output attenuation setting range:
- 1/1, 1/10, 1/100

Output attenuator accuracy:
- 0.2%

Interchannel crosstalk:
- FG220/FG320: -65 dB max.

**Sine Waveform Purity**

Harmonics* (maximum of 2nd to 5th harmonic components):
- 100 kHz: -55 dBc max.
- 1 MHz: -45 dBc max.
- 10 MHz: -35 dBc max.
- 15 MHz: -25 dBc max.

Harmonic distortion* (rms value of 2nd to 5th harmonic components):
- 100 kHz: 0.3% max.

Spurious* (1 kHz to 100 MHz frequency range):
- ±100 kHz: -55 dBc max.

* Measured with amplitude setting 20 Vpp, offset voltage 0V, into 50 Ω load

**Square, Pulse and Triangle Waveform Characteristics**

Rise time*:
- Square waveform: 30 ns max. (10% to 90%)
- Pulse waveform: 100 ns max. (10% to 90%)

Overshoot*:
- ±5% max. of output peak-to-peak value

Duty cycle setting (pulse waveform):
- Setting range: 0% to 100% (setting resolution 0.01% or 25 ns)

Time accuracy:
- ±10 kHz: ±0.2% of (1/frequency setting) per 1 clock period

Symmetry*:
- Triangle waveform:
  - Setting range: 0% to 100% (setting resolution 0.01% or 25 ns)
  - Jitter: 1 clock-period

* Measured with amplitude setting 20 Vpp, offset voltage 0V, into 50 Ω load

**Modulation Characteristics**

Modulation types:
- AM: Modulation setting range
  - 0% to 100% (setting resolution 0.01%)
- FM: Max. deviation setting range
  - 0 Hz to 7.5 MHz (setting resolution 1 µHz or 9 digits)

Offset modulation:
- Max. deviation setting range
  - 0 deg to 360 deg (setting resolution 0.1 deg)

PWM:
- Max. deviation setting range
  - 0 V to 10 V (setting resolution 1 mV)

**Sequence (FG310/FG320)**

Sequence mode:
- Sequential switching of output waveform sets of parameters under trigger control

Affect parameters:
- Can set frequency, phase, amplitude, offset voltage, and duty cycle for each step

Number of steps:
- 1 to 256 (returns to step 1 after last step)

**Arbitrary Waveform (FG310/FG320)**

Output amplitude resolution:
- 12 bits

Memory length:
- 8192 points (not all points will be output if frequency exceeds 4.9 kHz)

Wavenot definition functions:
- Definable waveforms

Trigger source:
- External trigger, Internal trigger, Manual trigger, or GPIB command

Internal trigger frequency setting range:
- 1 MHz to 50 MHz (setting resolution 1 MHz)

Burst cycle setting range:
- 1 to 65536 cycles (1 cycle/step)

Gate source:
- External gate, or Manual gate

**Synchronized Operation**

Number of units:
- Up to eight units can be operated in synchronization

Output delay:
- 70 ns (typ.) for each unit
- [25 ns (typ.) for each unit when triggered]
**SYNTHESIZED FUNCTION GENERATORS**

**FG200 & FG300**

### Other Functions

- **Setup data retention**: 10 sets of parameters can be saved to and recalled from non-volatile memory.
- **Preset TTL**: Sets amplitude 5 V, offset voltage 2.5 V (with high-impedance load).
- **Waveform output ON/OFF**: Output can be switched ON/OFF independently for each channel.
- **Parameter copy**:
  - **(FG220 FG320)**: Copies setup parameters between channels (CH1→CH2/CH2→CH1)
- **Dual setup**:
  - **(FG220 FG320)**: Setup parameters can be changed simultaneously on both channels.

### Built-in Floppy Disk Drive (FG310/FG320)

- **Drive type**: 3.5” floppy disk drive
- **Number of drives**: 1
- **Formats**:
  - MS-DOS: 640 KB, 720 KB, 1.2 MB, and 1.44 MB

### GP-IB Communication Interface

- **Electrical & mechanical specifications**:
  - Conforms to IEEE Std 488-1978
- **Functional specifications**:
  - SH1, AH1, T6, L4, S1R, R1L, PP0, DC1, DT1, C0
- **Protocol**:
  - Conforms to IEEE Std 488.2-1987

### General Specifications

- **Warm-up time**: 30 minutes minimum
- **Operating temperature range**: 5°C to 40°C
- **Operating humidity range**: 20% RH to 80% RH (max. wet bulb temperature 29°C, non-condensing)
- **Storage temperature range**: -20°C to 60°C
- **Rated power voltage range**: 100 V AC to 240 V AC
- **Allowable range of power voltage variation**: 90 V AC to 264 V AC
- **Rated power frequency**: 50 Hz to 60 Hz
- **Allowable range of power frequency variation**: 48 Hz to 63 Hz
- **Power consumption**: 125 VA max.
- **Signal grounding**: Ground sides of all I/O connectors are connected to case ground
- **Dimensions**: Approx. 213(W) × 132(H) × 350(D) mm (not including projections)
- **Weight**: Approx. 5 kg (main unit only)

The above performance is obtained at reference operating conditions after the specified warm-up time has elapsed.

Reference operating conditions: Ambient temperature 23°C±2°C, ambient humidity 50% RH±10% RH, power voltage 100 V±1%.

### Dimensions

![Dimensions Diagram](image)

### AVAILABLE MODELS

<table>
<thead>
<tr>
<th>Model</th>
<th>Suffix Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>706111</td>
<td>FG210: 1-channel model</td>
<td></td>
</tr>
<tr>
<td>706112</td>
<td>FG220: 2-channel model</td>
<td></td>
</tr>
<tr>
<td>706121</td>
<td>FG310: 1-channel model (with arbitrary sweep and simple arbitrary waveform generator functions)</td>
<td></td>
</tr>
<tr>
<td>706122</td>
<td>FG320: 2-channel model (with arbitrary sweep and simple arbitrary waveform generator functions)</td>
<td></td>
</tr>
</tbody>
</table>

### POWER CORD

- **-D**: UL, CSA Standard
- **-F**: VDE Standard
- **-R**: AS Standard
- **-J**: BS Standard

**Option**: /R1 External sweep control

### OPTIONAL ACCESSORIES

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallel connection cable</td>
<td>705926</td>
<td>26-pin (1 m)</td>
</tr>
<tr>
<td>BNC cable</td>
<td>366924</td>
<td>BNC-BNC (1 m)</td>
</tr>
<tr>
<td>BNC cable</td>
<td>366925</td>
<td>BNC-BNC (2 m)</td>
</tr>
<tr>
<td>BNC-alligator cable</td>
<td>366926</td>
<td>BNC-alligator clip (1 m)</td>
</tr>
<tr>
<td>Adapter</td>
<td>366921</td>
<td>BNC plug to banana jack</td>
</tr>
<tr>
<td>Adapter</td>
<td>366927</td>
<td>BNC plug to RCA jack</td>
</tr>
<tr>
<td>Adapter</td>
<td>366928</td>
<td>BNC plug to RCA plug</td>
</tr>
</tbody>
</table>