

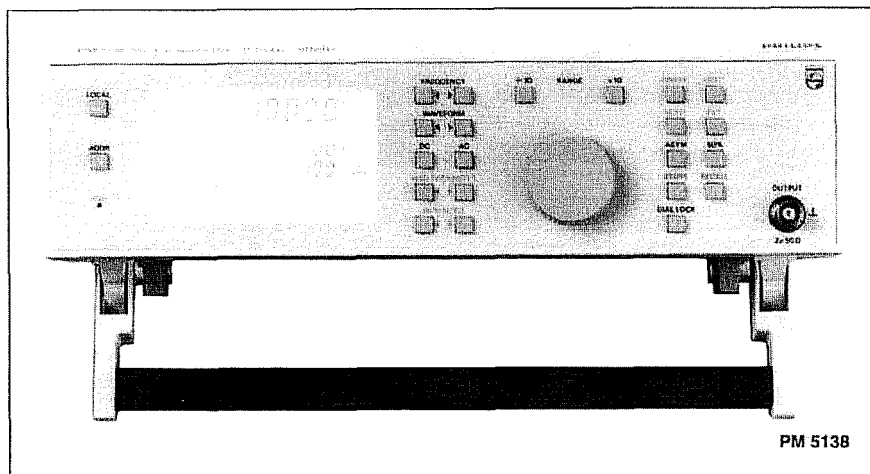
With compliments

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# Function Generators

## PM 5138 & PM 5139



PM 5138

### PM 5138/39 10 MHz/20 MHz Function Generators

- Large backlit LCD display and menu controlled operation
- Frequency range from 0.1 mHz to 20 MHz (PM 5139) or 10 MHz (PM 5138)
- 10 standard waveforms (PM 5139) or 7 standard waveforms (PM 5138)
- Arbitrary waveforms on instruments with GPIB/IEEE-488.2 interface
- Non-volatile memory stores up to 6 user-defined waveforms (PM 5139)
- Programmable internal trigger/modulation source 1 mHz to 100 KHz (PM 5139)
- Selectable Low  $Z_o$  or 50 $\Omega$  output impedance (PM 5139)
- Internal/external modulation modes include AM, FM, PSK, Sweep, BURST, and GATE

Fluke makes precision function generation easier than ever with the PM 5138 and PM 5139. These high-performance instruments bring a new concept to waveform generation and frequency synthesis: full menu-driven operation. Just a few push buttons let you select the function you want. While a single, large control knob allows precise setting of all numeric values.

#### Fast, Simple and Precise

With these precision instruments, setting-up your test signal is faster, simpler and more precise than ever before. At all times, you get a clear indication of the selected signal on the large backlit LCD display. With an instant, at-a-glance readout of vital parameters such as frequency, waveform, amplitude, offset and modulation. So you're always fully informed about instrument status, selections and other essential test parameters.

#### Step-Through Menu Lines

To change a setting, all that's necessary is to select one of the five menu lines and press the corresponding buttons. In each case, the 'active' parameter is clearly indicated on-screen by an arrow. Then, you can step through the available

options, which are highlighted one-by-one on the display. These five menu lines let you make all instrument settings instantly and precisely.

All numeric values such as frequency, offset and modulation depth are set with high precision by the control knob.

#### Precision Performance

The PM 5138 and PM 5139 give you a degree of precision that you wouldn't expect from economically priced general purpose function generators.

Frequency accuracy – among the most important parameters for a function generator – is better than 2 ppm.

#### Special Function Selection

Specific function keys are conveniently located in a separate field at the right of the front panel. These keys allow fast selection of function such as single or continuous burst/sweep; hold and external trigger/modulation; asymmetrical waveform with duty cycles variable from 1 to 99%; a 50% key for instant return to symmetrical waveforms, store and recall keys for up to 9 complete front-panel settings; the dial lock key to disable the control knob for numeric settings; and the Low  $Z_o$  key on the PM 5139.

#### Selectable Output Impedance (PM 5139)

The 50 ohm output impedance is standard. The PM 5139 also has a low-impedance output mode selectable by a front panel button. The low output impedance makes the generator output voltage virtually insensitive to variations in the connected load impedance. With low impedance, the PM 5139 has the capability to deliver a full 20V p-p into a 50 $\Omega$  load in lower frequency applications where back-matching is not critical.

#### Fast, Accurate Carrier Setting

A 4 $\frac{1}{2}$  digit frequency display with digit select and automatic range switching allows fast, accurate setting of the carrier frequency. Out-of-range settings, for example a 5 MHz ramp, are indicated by flashing of the related waveform and frequency display. Access to 10 Hz frequency resolution above 200 kHz is possible via the optional GPIB/IEEE-488.2\* interface.

#### Wide Choice of Standard Waveforms

The PM 5138 is equipped with a broad library of 7 standard waveforms plus one user-defined arbitrary waveform. The PM 5139 has an extended waveform library offering 10 standard waveforms and 6 stored arbitrary waveforms. Selecting one of the 6 arbitrary waveforms takes less than 80 ms, and is done via the front panel control knob or remotely via the GPIB/IEEE-488.2 interface. This fast selection saves time in automated testing routines.

#### Setting AC Voltage and DC Offset

The ac voltage of both instruments can be set between 1 mV and 20V p-p. DC offset can be set independently of the ac level within a  $\pm 10V$  window. A dc offset indication is given in the bottom right corner of the display. This warning is important when the generator has a setting such as dc offset = 8V, ac = 10 mV p-p.

DC offsets may also be applied to arbitrary waveforms.

#### Wide Choice of Modulation Modes

Extensive modulation capabilities are a strong point of these generators. Modulation modes include AM, FM, PSK, burst, gating and linear or logarithmic frequency sweep. Full modulation capabilities are available for all types of waveforms, including arbitrary waveforms. The modulation source may be internal or external.

Both instruments have an internal modulation source; in the case of the PM 5139 this is programmable over the range 10 Hz to 100 kHz, which means that for many applications there is no longer any need for an external modulation source. On the PM 5138 the internal modulation frequency is fixed at 1 kHz, and external modulation sources from dc to 200 kHz can be used.

\*The terms GPIB and IEEE-488 may be used interchangeably throughout this catalog.

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# Function Generators

## PM 5138 & PM 5139

### Versatile Burst and Sweep Modes

The burst mode allows a selectable number of cycles to be created at burst trigger frequencies over a 1 mHz to 100 kHz range (1 kHz only for the PM 5138). The lower trigger frequencies are particularly valuable for mechanical test applications, where intervals as long as 1,000 seconds can be achieved between test cycles. All waveforms, including arbitrary, can be sent as a burst. Frequency sweep mode covers a wide  $9\frac{1}{2}$  decade frequency range, with both linear and logarithmic sweeps and variable sweep times from 10 ms to 999 seconds. Three different modes (sweep and flyback, sweep and hold, and sweep up and down) are provided. All waveforms, including arbitrary, may be swept.

### Arbitrary Waveforms

Both the PM 5138 and PM 5139 offer a versatile 'arbitrary' waveform capability, which is a powerful aid to the generation of custom test signal in GPIB/IEEE-488 system environments. Arbitrary or user-defined waveforms can be created on a PC, and then downloaded to the PM 5138 or PM 5139 via the optional GPIB/IEEE-488.2 interface.

A waveform captured by a Digital Storage Oscilloscope can be transferred to a PC and modified using the PM 2273 AnyWave software package. This package is a powerful tool for creating, capturing and modifying the desired signals, and transferring them quickly and easily to the function generator.

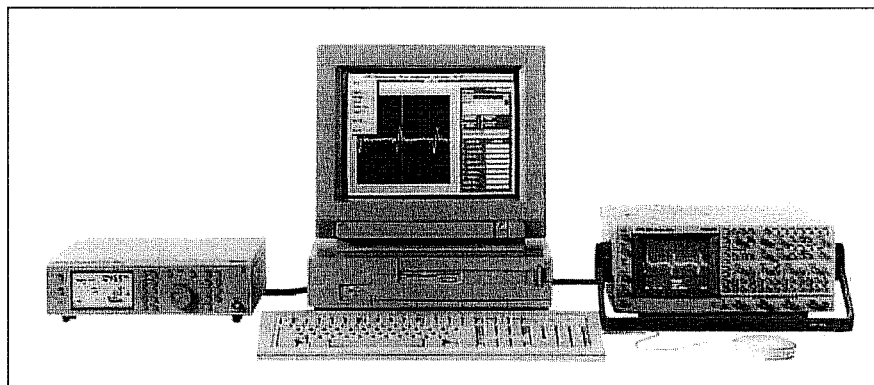
Alternatively, any desired waveform can be captured from a test system using a Fluke Digital Storage Oscilloscope, and then transferred to the PM 5138 or PM 5139 without the need for a PC. The amplitude and frequency of the captured waveform can be varied using the control knob of the function generator, and even modulation modes like AM, FM, gate, sweep and burst can be added to the captured waveform. This makes it very easy to generate a single shot in the arbitrary mode, or to sweep an arbitrary waveform.

There is no need to enter complex parameters; just select the modulation mode and parameters you want, or add a dc offset to the arbitrary waveform by selecting the dc offset function.

### Optional GPIB/IEEE-488.2 Programmability

The PM 5138 and PM 5139 are optionally available with a factory-fitted GPIB/IEEE-488.2 interface that provides true system performance.

Carrier frequencies may be programmed over the bus with resolution of 10 Hz (in the upper two frequency ranges) providing the resolution required for systems applications. The built-in non-volatile memory for 9 complete front-panel settings can also be activated under remote control, which can speed and simplify the programming of frequency used test routines.



The IEEE and arbitrary versions of the PM 5138/39 are able to receive captured waveforms from a DSO directly, or from a PC running PM 2273 AnyWave software.

## Specifications

### Technical Specifications

#### Quick Selection Guide

	PM 5138	PM 5139
Maximum Frequency	10 MHz	20 MHz
Standard Waveforms	7	10
Arbitrary Waveforms	1	6
Output Impedance	50Ω	50Ω low Z <sub>0</sub>
Max. Output Level into 50Ω	10V p-p	20V p-p (low Z <sub>0</sub> )
Internal Modulation/Frequency	1 kHz	10 Hz 100 kHz
Burst Trigger Frequency Internal	1 kHz	1 mHz 100 kHz
Burst START STOP PHASE	0°	-180° to +180°

#### Frequency Characteristics

	PM 5138	PM 5139
f <sub>min</sub>	0.1 mHz	0.1 mHz
f <sub>max</sub>	0.10 MHz	20 MHz

#### Nominal Range

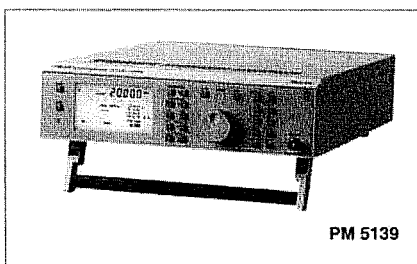
PM 5138: 0.1 mHz to 10 MHz

PM 5139: 0.1 mHz to 20 MHz

#### Maximum Frequency

	PM 5138	PM 5139
Sine	10 MHz	20 MHz
Square	10 MHz	20 MHz
Pos/neg pulse	10 MHz	20 MHz
Triangle	500 kHz	500 kHz
Pos/neg saw	50 kHz	50 kHz
Sine pulse	-	50 kHz
Triangle pulse	-	50 kHz
Haversine	-	50 kHz
Arb (1000 points)	20 kHz	20 kHz

Resolution: 4<sup>1</sup>/<sub>2</sub> digits, max. 0.1 mHz (10 Hz res, f<sub>c</sub> < 200.00 kHz via GPIB)



PM 5139 display with all segments on

**Display:** 4 1/2 digits LCD

**Setting Error:**  $\pm 2 \times 10^{-6}$  ( $\pm 2$  ppm)

**Residual FM**

**PM 5138:** <10 ppm, 1 ppm typical ( $f_c$  <5 MHz);

<100 Hz, 13 Hz typical ( $f_c$  >5 MHz)

**PM 5139:** <10 ppm, 1 ppm typical ( $f_c$  <10 MHz);

<100 Hz, 13 Hz typical ( $f_c$  >10 MHz)

**Temperature Coefficient:** <0.2 ppm/ $^{\circ}$ C

**Aging:** <1 ppm/year

**Drift:** <0.3 ppm in 7 hours

**Synchronization:** By 10 MHz (or 10 MHz sub-harmonic) external clock

### Output Characteristics

**Main Output Connector:** BNC socket on front panel

**Output Impedance**

**PM 5138:** 50 $\Omega$

**PM 5139:** 50 $\Omega$  or low  $Z_0$

**Low  $Z_0$  Mode (PM 5139 only)**

**Output Level:**  $\geq 2V$  p-p

**Impedance:**  $0.36 + 32 \times (f_c/20 \text{ MHz})$

**Maximum Current:** 250 mA peak

**Frequency Range:** As operational range, except for pos/neg pulse, <10 MHz

**Load Capability:** Short circuit proof

**Output Amplitude (open circuit):** 0.000 to 0.2000V p-p, resolution 1 mV; 0.20V p-p to 2.00V p-p, resolution 10 mV; 2.0V p-p to 20.0V p-p, resolution 100 mV

**Basic Setting Error:**  $\pm 2.5\%$ ,  $f_c$  <5 MHz

**Amplitude Flatness 10 mV to 20V p-p**

**0.1 MHz to 200 kHz:**  $\pm 0.03$  dB typical

**200 kHz to 5 MHz:**  $\pm 0.07$  dB typical

**5 MHz to 10 MHz:**  $\pm 0.1$  dB typical

**10 MHz to 20 MHz (PM 5139 only):**  $\pm 0.4$  dB typical

**DC Voltage:** Independent of ac setting within  $\pm 10V$  window

**Range:** -10 to +10V

**Resolution:** 0.1V

**Error:**  $\pm 2\%$

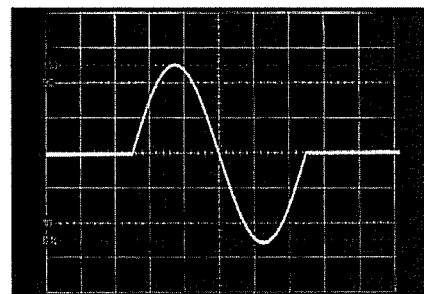
**Offset Error:**  $\pm 50$  mV (at 50 $\Omega$  load)

**TTL Output (rear panel)**

**Fan-out:** <10 TTL inputs ( $Z_0 = 50\Omega$ )

**Level:** 0/5V

### Waveforms



Symmetry (1% resolution)

### Symmetry (duty cycle)

**Range:** 1% to 99%,  $f_c$  <20 kHz

**Resolution:** 1%

**Waveforms:** Sine, square, triangle and pos/neg rectangular pulses

**Range:** 20% to 80%,  $f_c$  <5 MHz

**Resolution:** 1%

**Waveforms:** Square and pos/neg rectangular pulses

### Sine Wave

**Frequency Range**

**PM 5138:** 0.1 MHz to 10 MHz

**PM 5139:** 0.1 MHz to 20 MHz

**Output Range:** 0 to 20V p-p

**Total Harmonic Distortion\*2:** <0.4%, 0.1% typical ( $f_c$  <500 kHz)

	PM 5138	PM 5139
<b>Harmonics</b>		
$f_c$ <500 kHz	<-48 dBc	<-48 dBc
$f_c$ <5 MHz	<-40 dBc	<-40 dBc
$f_c$ <10 MHz	<-36 dBc	<-36 dBc
$f_c$ <20 MHz	—	<-34 dBc
<b>Subharmonics</b>		
$f_c$ <5 MHz	<-60 dBc	<-60 dBc
$f_c$ <10 MHz	<-36 dBc	<-60 dBc
$f_c$ <20 MHz	—	<-38 dBc
<b>Nonharmonics</b>		
$f_c$ <5 MHz	<-37 dBc	<-37 dBc
$f_c$ <10 MHz	<-37 dBc	<-37 dBc
$f_c$ <20 MHz	—	<-37 dBc
<b>Phase Noise (1 kHz dist.)</b>		
$f_c$ <5 MHz	<-80 dBc	<-80 dBc
$f_c$ <10 MHz	<-80 dBc	<-80 dBc
$f_c$ <20 MHz	—	<-80 dBc

### Square Wave

**Frequency Range**

**PM 5138:** 0.1 MHz to 10 MHz

**PM 5139:** 0.1 MHz to 20 MHz

**Output Range:** 0 to 20V p-p

**Transition Times**

	PM 5138	PM 5139
$f_c \leq 500$ kHz	$\leq 30$ ns	$\leq 30$ ns
$f_c > 500$ kHz	$\leq 20$ ns	$\leq 20$ ns

**Symmetry:** 1% to 99%, resolution 1%,  $f_c$  <20 kHz;

20% to 80%, resolution 1%,  $f_c$  <5 MHz

**Aberration:** <2%

### Triangle Wave

**Frequency Range:** 0.1 MHz to 500 kHz

**Output Range:** 0 to 20V p-p

**Linearity Error:** <0.2% ( $f_c$  <20 kHz)

**Symmetry:** 1% to 99%, resolution 1%,  $f_c$  <20 kHz

**Sawtooth (positive/negative ramps)**

**Frequency Range:** 0.1 MHz to 50 kHz

**Output Range:** 0 to 10V p-p

**Linearity:** <0.2% ( $f_c$  <20 kHz)

**Rectangular Pulses**

**Frequency Range**

**PM 5138:** 0.1 MHz to 10 MHz

**PM 5139:** 0.1 MHz to 20 MHz

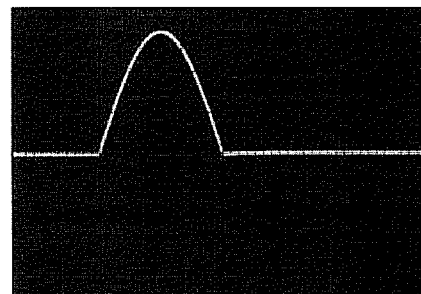
**Output Range:** 0 to 10V p-p

**Transition Time:** "See Square Wave"

**Symmetry:** 1% to 99%, resolution 1%,  $f_c$  <20 kHz;

20% to 80%, resolution 1%,  $f_c$  <5 MHz

**Aberration:** <2% (AC p-p >100 mV)

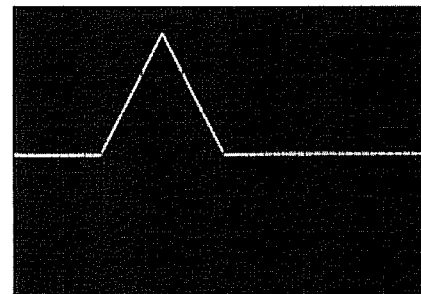


Sine Pulse (PM 5139 only)

**Sine Pulse (PM 5139 only)**

**Frequency Range:** 0.1 MHz to 50 kHz

**Output Range:** 0 to 10V p-p



Triangle Pulse (PM 5139 only)

**Triangle Pulse (PM 5139 only)**

**Frequency Range:** 0.1 MHz to 50 kHz

**Output Range:** 0 to 10V p-p

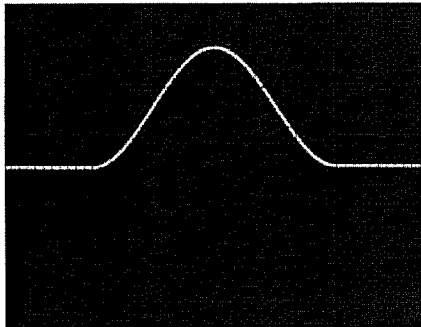
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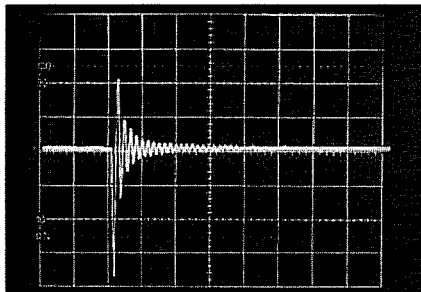
# Function Generators

## PM 5138 & PM 5139



Haversine (PM 5139 only)

**Haversine (PM 5139 only)**  
**Frequency Range:** 0.1 mHz to 50 kHz  
**Output Range:** 0 to 10V p-p



Arbitrary Waveform (user defined)

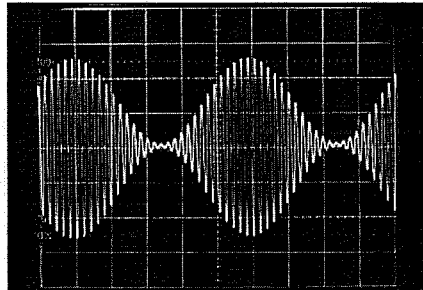
**Arbitrary\*1**  
**Frequency Range (for a waveform of 1024 samples):** 0.1 mHz to 20 kHz  
**Maximum Sample Frequency:** 20.48 MHz  
**Sample Addresses (x):** 1024 (10 bits) fixed  
**Sample Levels (y):** 1024 (10 bits)  
**Programmable:** Via IEEE-488.2 with a PC or direct with a DSO without a PC

### Modulation

**Modes:** AM int/ext, FM int/ext, PSK int/ext, gate int/ext, sweep int/ext, burst int/ext

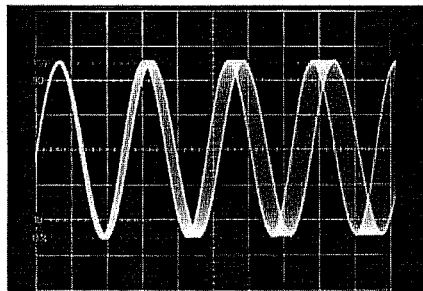
### Internal Modulation Source

<b>PM 5138:</b>	1 kHz fixed	(±0.01%)
<b>PM 5139:</b>	10 Hz to 100 kHz	(±0.01%)
	0.001 to 0.100 Hz;	res. 1 mHz
	0.10 to 1.00 Hz;	res. 10 mHz
	1.0 to 10.0 Hz;	res. 100 mHz
	10 to 100 Hz;	res. 1 Hz
	0.10 to 1.00 kHz;	res. 10 Hz
	1.0 to 100.0 kHz;	res. 100 Hz



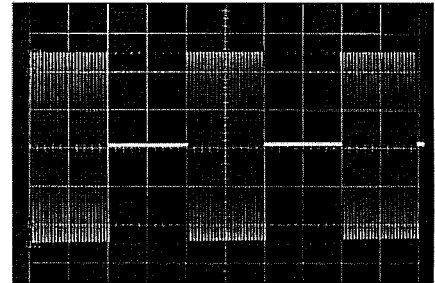
AM

**Internal AM**  
**Carrier Frequency**  
**PM 5138:** 0.1 mHz to 10 MHz  
**PM 5139:** 0.1 mHz to 20 MHz  
**Carrier Waveforms:** All including arbitrary\*1  
**Modulation Frequency**  
**PM 5138:** 1 kHz  
**PM 5139:** 10 Hz to 100 kHz  
**Modulation Depth:** 0 to 100%, resolution 1%  
**External AM**  
**Modulation Frequency:** 0 to 200 kHz  
**Modulation Depth:** 0 to 100%



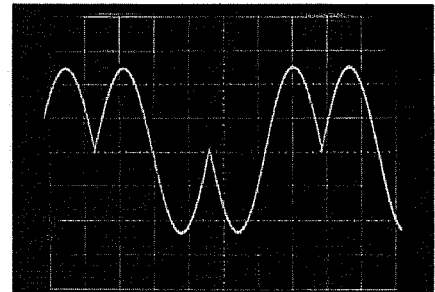
FM or sweep

**Internal FM**  
**Carrier Frequency**  
**PM 5138:** 0.1 mHz to 10 MHz  
**PM 5139:** 0.1 mHz to 20 MHz  
**Carrier Waveforms:** All including arbitrary\*1  
**Modulation Frequency**  
**PM 5138:** 1 kHz  
**PM 5139:** 10 Hz to 100 kHz  
**Deviation:** 0 to 2%, resolution 0.01%  
**External FM**  
**Carrier Frequency**  
**PM 5138:** 0.1 mHz to 10 MHz  
**PM 5139:** 0.1 mHz to 20 MHz  
**Modulation Frequency:** 10 Hz to 200 kHz  
**Deviation:** 0 to 2%



GATE: non-phase coherent signal keying

**Internal Gate**  
**Non-phase coherent signal keying**  
**Carrier Frequency**  
**PM 5138:** 0.1 mHz to 10 MHz  
**PM 5139:** 0.1 mHz to 20 MHz  
**Carrier Waveforms:** All including arbitrary\*1  
**Modulation Frequency**  
**PM 5138:** 1 kHz  
**PM 5139:** 10 Hz to 100 kHz  
**Duty Cycle:** 50%  
**External Gate**  
**Modulation Frequency:** 0 to 200 kHz (TTL signal)



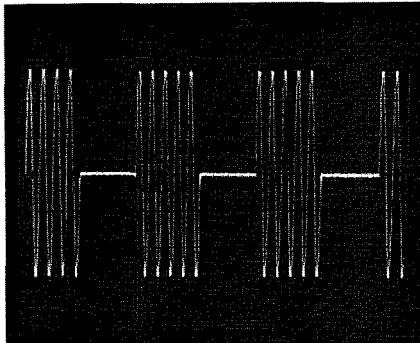
PSK phase shift keying

**Internal PSK**  
**Phase shift keying (0/π)**  
**Carrier Frequency**  
**PM 5138:** 0.1 mHz to 10 MHz  
**PM 5139:** 0.1 mHz to 20 MHz  
**Carrier Waveforms:** Sine, square, and triangle  
**Modulation Frequency**  
**PM 5138:** 1 kHz  
**PM 5139:** 10 Hz to 100 kHz  
**Duty Cycle:** 50%  
**External PSK**  
**Modulation Frequency:** 0 to 200 kHz (TTL signal)

\*1 Instruments with IEEE

# Function Generators

## PM 5138 & PM 5139



Burst with start/stop phase

### Internal Burst

Phase coherent signal keying

Carrier Frequency: 0.1 MHz to 2 MHz

Carrier Waveforms: All including arbitrary\*1

On Cycles: 1 to 2000

Start Phase (PM 5139): -180° to +180° for sine and triangle,  $f_c < 20$  kHz; 0° for other waveforms

Trigger Frequency

PM 5138: 1 kHz

PM 5139: 1 MHz to 100 kHz

Burst Function: Single shot with "SINGLE" key or continuous via internal trigger source

### External Burst

Trigger Frequency: 0 to 200 kHz

### Sweep

Carrier Waveform: All including arbitrary\*1

Sweep Functions: Linear or logarithmic/single or continuous

Sweep Range

	PM 5138	PM 5139
Range I	1 MHz to 5 MHz	1 MHz to 10 MHz
Range II	50 kHz to 10 MHz	50 kHz to 20 MHz

Sweep Modes: I: sweep and fly-back; II: sweep and hold; III: sweep and reverse sweep

Sweep Time: 0.01s to 1000s in 3 ranges, max resolution 10 ms

Triggering: Via front panel key "SINGLE" or "CONTINUOUS", or via modulation/trigger input at rear side, or via IEEE bus

### IEEE-488 Bus Remote Control

Control Capability: All functions and characteristics

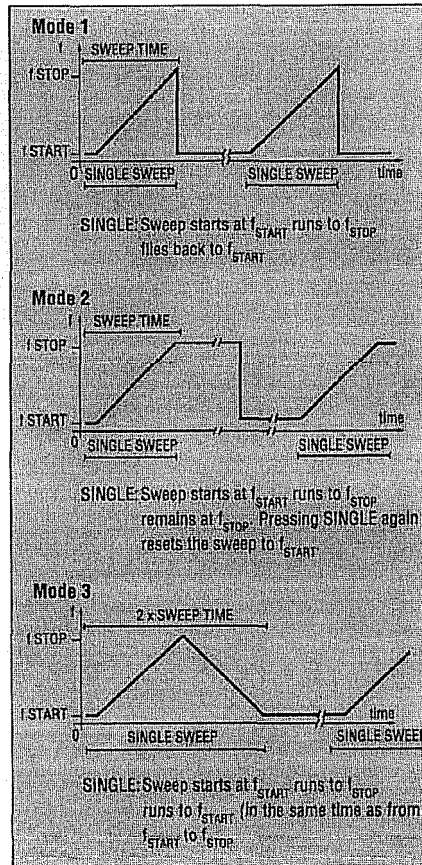
Interface Functions: AH1, L3, SH1, T6, SR1, RL1

Address: Programmable with rotary knob on front panel

Address Range: 0 to 30 and listen only mode

Remote Lock-out: Go to local via front panel key "LOCAL"

Special Functions: Device identification mode/learn mode



## General Specifications

Non-Volatile Memory

Instrument Settings: 10

Arbitrary Waveforms\*1

PM 5138: 1

PM 5139: 6

Rear Connectors: Modulation/triggering input/reference input/TTL output/modulation output/penlift output/sweep output/10 MHz reference output/IEEE bus connector\*1/power connector

### Operating Conditions

Reference Temperature: 23°C ±1°C

Operating Temperature: +5°C to +40°C

Storage Temperature: -40°C to +80°C

EMI: Meets requirement of VDE 0871 Class B

Safety: Meets requirement of IEC 348 Class 1

Voltage: 100V, 120V, 220V, 240V

Line Frequency: 50 Hz to 60 Hz ±5%

### Power Consumption

PM 5138: 42W

PM 5139: 58W

### Mechanical Data

Size: 105 mm H x 315 mm W x 405 mm D (4.1 in H x 12.4 in W x 15.9 in D)

Weight: 6.7 kg (15.4 lb)

## Ordering Information

### Models

PM 5138/00n 10 MHz Function Generator

PM 5138/02n 10 MHz Function Generator with GPIB

PM 5139/00n 20 MHz Function Generator

PM 5139/02n 20 MHz Function Generator with GPIB

### Power Options

The last digit of the type number is the indication for the local line voltage and local line cord. Following line voltage settings plus line cord are available.

n=1 Universal European 220V

n=3 Standard North American 120V

n=4 United Kingdom 240V

n=5 Switzerland 220V

n=8 Australia 240V

### Included with Instrument

One-year product warranty, line cord, Operator's manual and Certificate of Calibration Practices.

### Accessories

PM 2255 Instrument Drivers

PM 9051 BNC to 4 mm Banana Adapter

PM 9563 19" Rack Mount

PM 9581/01 50Ω Feedthrough, 3W

PM 9585/01 50Ω Feedthrough, 1W

### Manuals

PM 5138 Operator\*

PM 5138 Service

PM 5139 Operator\*

PM 5139 Service

PM 5139 Programming Card

\*No charge with purchase of unit

## Customer Support Services

Also see Section 20.

### Factory Warranty

One-year product warranty.

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