

## Introduction

210

### RC GENERATORS

|          |            |                                 |               |  |     |
|----------|------------|---------------------------------|---------------|--|-----|
| PM 5110  | <b>NEW</b> | Low distortion<br>RC oscillator | 10Hz...100kHz | 6V <sub>p-p</sub> output<br>Very low distortion  | 213 |
| PM 5109  |            | Low distortion<br>RC oscillator | 10Hz...100kHz | Monitored 10V <sub>p-p</sub> symmetrical<br>and 30V <sub>p-p</sub> asymmetrical output | 214 |
| PM 5109S |            | Low distortion<br>RC oscillator | 10Hz...100kHz | Monitored 30V <sub>p-p</sub> asymmetrical<br>output                                    | 214 |




### FUNCTION GENERATORS

|          |  |                    |                            |  |     |
|----------|--|--------------------|----------------------------|--|-----|
| PM 5131  |  | Function generator | 0.1Hz...2MHz (logarithmic) | Sine/square/triangle with 30V <sub>p-p</sub> output                              | 216 |
| PM 5132  |  | Function generator | 0.1Hz...2MHz (linear)      | Sine/square/triangle/pos. pulse/<br>neg. pulse/DC with 30V <sub>p-p</sub> output | 218 |
| PM 5133  |  | Function generator | 0.01Hz...2MHz (log/linear) | Digital display for frequency and voltage  | 220 |
| PM 5133S |  | Function generator | 0.01Hz...2MHz (log/linear) | As PM 5133 plus special sweep<br>according to DIN standards                      | 222 |
| PM 5134  |  | Function generator | 0.001Hz...20MHz            | Sine/square/triangle/pulses/DC,<br>Digital display, X-tal mode                   | 223 |

### LF SYNTHESIZERS

|          |   |                                     |                    |  |     |
|----------|---|-------------------------------------|--------------------|--|-----|
| PM 5190  |  | LF synthesizer with $\mu$ P control | 0.001Hz...2.147MHz | Feather-touch keyboard frequency<br>selection with LED display | 226 |
| PM 5190X |  | LF synthesizer with $\mu$ P control | 0.001Hz...2.147MHz | As PM 5190 plus enter facility                                 | 226 |

### SYNTHESIZERS/FUNCTION GENERATORS

|         |   |   |                  |  |     |
|---------|---|---|------------------|--|-----|
| PM 5191 | <b>NEW</b>  | Programmable synthesizer/<br> function generator | 0.0001Hz...2MHz  | Sine/triangle/square/pos. sawtooth/<br>neg. sawtooth               | 229 |
| PM 5192 | <b>NEW</b>  | Programmable synthesizer/<br> function generator | 0.0001Hz...20MHz | Sine/triangle/square/pos. sawtooth/<br>neg. sawtooth               | 232 |
| PM 5193 |  | Programmable synthesizer/<br>function generator   | 0.0001Hz...50MHz | Sine/haversine/triangle/square/pos-/neg<br>sawtooth/pos-neg pulses | 237 |

Philips T&M has supplied industry and the consumer with generators of every type for almost 50 years. Such length of service means unprecedented experience and understanding of market requirements, as proved by the present range of equipment. Thirteen instruments cover the whole LF/MF range, which means that the correct model exists for every application, be it in education, R&D or service.

This section is divided into four subsections according to type of instrument: RC generators, function generators, LF synthesizers and synthesizers/function generators. Philips T&M also supplies video and RF generators. Details of these can be found in the "Video and Audio Test Equipment" section.

#### RC generators

Low frequency RC generators are virtually indispensable for testing analog equipment such as that used for speech and audio. Whilst sophisticated test gear could be used for simulation and measurement, routine service tasks may be adequately carried out using an LF RC generator. When choosing the right generator for your application, one of the key factors to consider is its distortion figure. Philips T&M offers three RC generators in the LF range: the PM 5109, the PM 5109S and the PM 5110. They supply both sine and square wave outputs in the range 10 Hz to 100 kHz and all feature extremely low distortion figures.



PM 5109 is an ideal instrument for measuring the characteristics of physically long lines

#### PM 5109 and PM 5109S

These two professional instruments are similar but are tailored for different applications. The PM 5109 is specially designed for telecommunications applications while the economical PM 5109S is ideal for education and audio/hi-fi testing. They provide pure sine and square wave signals across the 10Hz to 100kHz range.

Distortion is only 0.02% at 1kHz (in the low distortion mode) and output attenuation is switchable or continuously adjustable. As an alternative to the low distortion mode, the fast settling mode can be selected by means of a switch on the front panel. This is useful for fast, routine work. Output is monitored on a front-panel voltmeter.

The difference between these two generators is that the PM 5109 features both asymmetrical and floating symmetrical outputs (switchable), while the PM 5109S has only an asymmetrical output, which is sufficient for certain applications.

#### PM 5110



























































































The new PM 5110 is a compact, versatile and low-cost LF generator which features very low distortion figures (typically 0.03% in the low distortion mode). The sine wave output is of exceptionally high quality, making it an ideal source for laboratory and service use in the hi-fi audio field. A square wave output is also available, further increasing the range of applications.

The PM 5110 is easy to operate; simply select the frequency and output attenuation required, using the clearly-marked front-panel controls. Again, either low-distortion or fast-settling modes may be selected, via a switch on the rear panel. Two separate outputs are available - 6Vpp or TTL.



The compact PM 5110

#### LF & MF generator survey

| Classification         | Type number                    | Frequency range            |     | Output Vp-p      | DC | Waveforms   |  |   |   |   | Variable duty cycle | DC-offset   | Output characteristics  |   |   | Sweep   |        |   |   | Burst | Single | Gating | Int/Ext |     | IEEE/IEC |    |     |     |
|------------------------|--------------------------------|----------------------------|-----|------------------|----|---|--|---|---|---|---------------------|---|---|---|---|---|--------|---|---|-------|--------|--------|---------|-----|----------|----|-----|-----|
|                        |                                | Hz                         | MHz |                  |    |  |  |  |  |  |                     |   |  | 600Ω  | 50Ω   | TTL   | linear |   | log   |       |        |        | Int     | Ext | AM       | FM | IEE |     |
|                        |                                |                            |     |                  |    |   |  |   |   |   |                     |   |   |   |   |   | Int    | Ext   | Int   |       |        |        |         |     |          |    |     | Ext |
| R-C oscillators        | PM 5110<br>PM 5109<br>PM 5109S | 10-0.1<br>10-0.1<br>10-0.1 |     | 6<br>30/10<br>30 |    |  |  |   |   |   |                     |   |  |  |  |   |        |   |   |       |        |        |         |     |          |    |     |     |
| Function generators    | PM 5131                        | 0.1-2                      |     | 30               |    |  |  |  |  |   |                     |   |  |  |  |   |        |  |  |       |        |        |         |     |          |    |     |     |
|                        | PM 5132                        | 0.1-2                      |     | 30               |    |  |  |  |  |   |                     |   |  |  |  |   |        |  |  |       |        |        |         |     |          |    |     |     |
|                        | PM 5133                        | 0.01-2                     |     | 20               |    |  |  |  |  |   |                     |   |  |  |  |   |        |  |  |       |        |        |         |     |          |    |     |     |
|                        | PM 5133S                       | 0.01-2                     |     | 20               |    |  |  |  |  |   |                     |   |  |  |  |   |        |  |  |       |        |        |         |     |          |    |     |     |
|                        | PM 5134*                       | 0.001-20                   |     | 20               |    |  |  |  |  |   |                     |   |  |  |  |   |        |  |  |       |        |        |         |     |          |    |     |     |
| LF and MF synthesizers | PM 5190**                      | 0.001-2                    |     | 20               |    |  |  |  |   |   |                     |  |  |  |   |   |        |   |   |       |        |        |         |     |          |    |     |     |
|                        | PM 5190X**                     | 0.001-2                    |     | 20               |    |  |  |  |   |   |                     |  |  |  |   |   |        |   |   |       |        |        |         |     |          |    |     |     |
|                        | PM 5191                        | 0.0001-2                   |     | 30               |    |  |  |  |  |   |                     |   |  |  |  |   |        |   |   |       |        |        |         |     |          |    |     |     |
|                        | PM 5192                        | 0.0001-20                  |     | 20               |    |  |  |  |  |   |                     |   |  |  |  |   |        |   |   |       |        |        |         |     |          |    |     |     |
|                        | PM 5193***                     | 0.0001-50                  |     | 20               |    |  |  |  |  |  |                     |   |   |  |  |  |        |   |   |       |        |        |         |     |          |    |     |     |

\* PM 5134 also provides X-tal mode and X-tal AM mode

\*\* PM 5190 ext. AM

\*\*\* PM 5193 incl. real pulse generator of 3ns

1) pos. and neg.

2) pos. and neg.

## Applications

Such instruments supply both sine and square wave outputs which can be used for a wide variety of tests. These vary from the frequency characteristics of balanced pairs to alignment of line amplifiers and filters, where fast checks can be simplified using a square wave. The low distortion of the RC oscillator makes it ideal for checking such amplifiers and filters.

The PM 5109, PM 5109S and PM 5110 also offer TTL output, which is particularly useful for triggering etc. Application areas include audio service, quality control, education, training, development and telecommunications. The PM 5109, with its monitored output giving a choice of 50 or 600 ohm impedance, symmetrical or asymmetrical, is particularly suitable for telecoms testing.

## Function generators

Function generators are much more versatile than RC generators. They can produce a number of different waveforms, with different modulation modes, at frequencies ranging from below 1Hz up to 20MHz. Their main feature is that they can sweep; either linearly or logarithmically. Thus an automatic change in frequency is obtained, covering for example, the complete audio spectrum. Philips T&M function generators include models ranging from popular, low-cost instruments, for education and service, up to highly-advanced instruments suitable for industrial and R&D applications.

There are five function generators in the range. All offer an attractive price/performance ratio with sine, triangular, and square wave outputs, while the frequency range covered is as high as 20MHz for the top-of-the-range model. Internally or externally controllable sweep facilities, AM/FM modulation and bursting are also features of these instruments. The series consists of low-cost function generators PM 5131 and 5132, which are designed mainly for education, mechanical and service applications, and the more sophisticated PM 5133, 5133S and 5134. The PM 5133S is a special version designed specifically for use in the audio field, while the PM 5134, at the top of the range, is suitable for the most advanced applications, for example as required in R&D.

### PM 5131

This function generator is a versatile instrument at a modest price. It can produce sine, square or triangular waveforms with a peak-to-peak output voltage of 30V over a frequency range of 0.1Hz - 2MHz. The sweep obtained from this generator is logarithmic. A particular advantage is a three and a half decade internal sweep range, allowing coverage of the entire 20Hz to 20kHz audio range in one go. Both internal and external sweep facilities are available. Applications



PM 5133 function generator

range from educational to the broad general purpose area.

### PM 5132

The PM 5132 covers 0.1Hz - 2MHz in seven overlapping subranges, and features sine, square and triangular waveforms, with positive or negative pulse, variable DC offset and 30V peak-to-peak output. Output impedance is switchable: 50ohm or 600ohm. The duty cycle is also variable, between 10% and 90%. A linear sweep is produced by the PM 5132. Again, this instrument is ideal for general purpose applications, laboratory use and in education.

### PM 5133

The compact and versatile PM 5133, with its digital read-out of frequency and output voltage, provides output frequencies from 0.01Hz up to 2MHz. Accurate linear and logarithmic sweep facilities cover more than four decades in seven linear and five logarithmic subranges. Start and stop frequencies for sweeping are non-interactive and can be set independently of each other. The sweep may be stopped at any frequency using the hold facility. This instrument is both rugged and short circuit proof and is ideal for research, industrial and educational applications, and specialized audio applications.

### PM 5133S

The PM 5133S is a special version of the PM 5133 designed for testing hi-fi equipment to DIN standards. It includes all the features of the PM 5133 plus a single sweep of 50s duration. To cover the complete audio spectrum, the start frequency should be set to 20Hz and the stop frequency to 20KHz. Frequency characteristics may be plotted when the PM 5133S is used in conjunction

with an X-Y recorder. Wide ranging applications include R&D and quality control, as well as specific audio applications.

### PM 5134

The PM 5134 is the top of the range function generator; it is easy to use yet extremely sophisticated. Features include: sine, square and triangular waveforms from 1mHz up to 20MHz as well as positive or negative pulses and DC offset, and a duty cycle which is variable between 10% and 90%. Frequency is selected by a 10 position rotary switch with over-riding coarse/fine adjustment. Start, stop and run frequencies are indicated by separate LEDs in combination with the digital display. Output is extremely stable with accuracy as high as  $\pm 5 \times 10^{-6}$ , thanks to the crystal-locking capability. Furthermore, AM/FM, sweep, burst or single modes may be selected. This model is suitable for all sectors of industry and a wide range of applications.

## LF synthesizers

Synthesizers are generators in which the frequency is directly derived from a reference frequency; in this case a quartz (crystal-controlled) oscillator. This results in very high accuracy (typically up to  $\pm 1 \times 10^{-6}$ , high stability and furthermore repeatability.

Direct digital synthesis is the preferred method as this allows fine frequency resolution and short switching times.

Direct digital synthesis has now become more cost effective due to microprocessor control. The microprocessor offers many advantages, such as ease of operation and system compatibility. The microprocessor-based synthesizers featured here are fitted with the IEEE/IEC bus interface as standard, simplifying connection to a host controller, via the bus.

### PM 5190

The PM 5190 is an accurate, microprocessor-controlled LF synthesizer at a competitive price. It covers the frequency range 1 mHz to 2 MHz and is accurate up to  $\pm 1 \times 10^{-6}$ . Square and triangular waveforms are offered in addition to sine wave output, all with DC offset when required. Operation is simple: the parameters are keyed in directly to the unit and all settings can be seen at a glance. Separate LEDs are provided for each parameter. A separate TTL output is available on the front panel in addition to the standard 50 ohm BNC output. Remote control of the PM 5190 is possible via the IEEE/IEC bus, allowing use of this unit in automatic test systems.

### PM 5190X

This instrument is an alternative to the PM 5190; the difference is that an 'ENTER' button is fitted in place of the 'ERASE' button (used for entry correction on the 5190). The ENTER button enables the user to set up a new test frequency before applying it at the output. This feature is useful for applications such as checking servo loops. Other application areas include telecommunications.

### Synthesizers/function generators

Synthesizers/function generators meet the demand for more flexible automatic test systems, which need increased programmability. They combine the features and benefits of both types of instrument and offer: programmability, ease of use, accuracy, stability, reproducibility, etc.

Philips T&M has recently introduced the very successful PM 5192 and PM 5193 synthesizers/function generators. To complete the family, the 2MHz version – the PM 5191 is being introduced early in 1987. This line of instruments is based on the popular 19" rack-mount, for which mounting facilities are supplied as standard. All are IEEE bus controllable.

### PM 5191

The PM 5191, with a 30Vpp output, covers the frequency range 0.1mHz to 2MHz. It is basically a direct synthesizer offering a very pure signal, with a typical distortion figure of only 0.35% (between 1Hz and 200kHz) and a phase noise figure of -80dB. The PM 5191 offers sine, square and triangular waveforms plus up/down ramp. Resolution is a full 8 digits, while internal and external modulation are possible.

The auto-store facility means that the previous setting is always remembered at power-down; switch on a year after use and the last-used setting is still available.

This instrument is fully IEEE bus compatible.



The PM 5190 LF synthesizer provides very stable signals between 1mHz and 2MHz. It is supplied fitted with an IEEE/IEC bus interface, as standard.

### PM 5192

The PM 5192, with a 20Vpp output, covers the frequency range 0.1mHz to 20MHz. The PM 5192 offers sine, square and triangular waveforms plus up/down ramp. Resolution is a full 8 digits, while internal and external AM, FM, gate as well as sweep modulation are possible. This instrument has non-volatile memory for 10 different settings; these can be entered via the front-panel and recalled whenever required. The PM 5192 is also fully IEEE bus compatible.

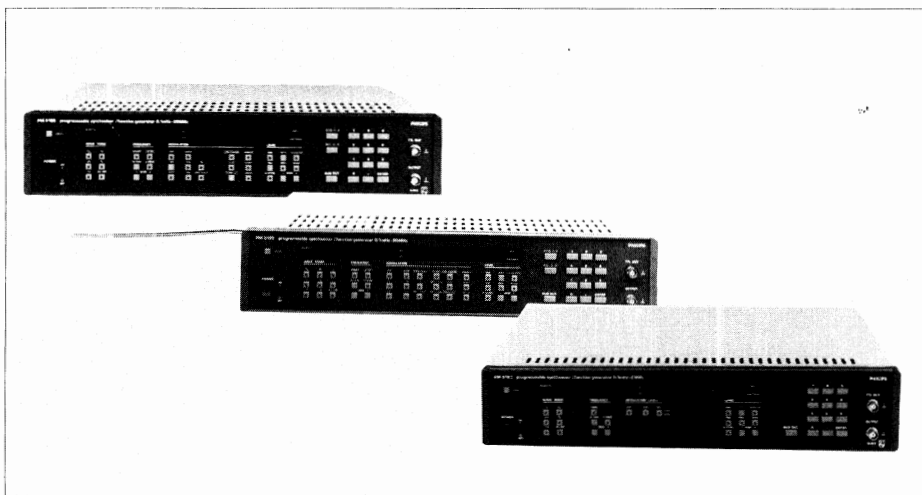
### PM 5193

The frequency range of the PM 5193 covers eleven and a half decades, from 0.1mHz up to 50MHz. Eight standard waveforms are available: sine, pulse (positive and negative), square, haversine, triangle and sawtooth (positive and negative), all directly selectable via push-buttons. Modulation modes (AM, FM, sweep, burst and gating) are also button selectable. Other parameters, for example DC offset, are easily programmable. Up to 10 programs entered via

the front panel may be stored in non-volatile memory. In addition to the high accuracy and frequency resolution (a full 8 digits), this instrument offers excellent long-term stability. Of course, the PM 5193 is completely IEEE/IEC bus compatible so that all functions are remotely selectable and setting information may be transmitted to a remote controller. IEEE address setting is via keyboard entry, rather than dip switches, allowing you to change the address whenever required.

### Application areas

Applications for these instruments include quality control and in-line testing in industry, R&D (where stability and accuracy are needed) and military and defence applications. Thus, the total range of Philips generators, RC function generators, synthesizers and synthesizers/function generators covers virtually every application liable to be encountered in education, servicing, research and electronic and mechanical industry.



PM 5191, PM 5192 and PM 5193 synthesizer/function generators provide a range of waveform outputs with extensive internal and external modulation facilities, plus IEEE/IEC compatibility

NEW

- Frequency range 10Hz..100kHz**
- Very low distortion 0.02%**
- Sine and square wave signals**
- Compact dimensions and low weight**
- Separate TTL output**
- Switchable 20dB and continuous attenuation**
- Low cost**

The PM 5110 has been designed for both educational applications and service workshops. It provides square and sine wave signals, the latter having a special 'low distortion' position for use on HiFi development as well as alignment and maintenance. Another useful service feature is the switchable 20dB attenuation.

The generator is 1kg light and has very compact dimensions. The layout of the front panel is attractive and functional, a feature which is of particular value for educational applications.

## TECHNICAL SPECIFICATION

### FREQUENCY AND CHARACTERISTICS

#### Nominal range

10Hz...100kHz  
(4 subranges, selectable by push-buttons)

#### Indication

Dial (1...10) LED marker

#### Setting error

<4%  $\pm$  1Hz

#### Temperature coefficient

<0.05%/K (1000Hz)

#### Long-term drift (<7h)

<1.5 x 10<sup>-3</sup> (1000Hz)

#### Duty cycle

50% fixed

### WAVEFORMS

Sine wave  
Square wave

### OUTPUT

Attenuation  
20dB calibrated step plus 40dB continuously adjustable

#### Impedance

600 $\Omega$

#### Short-circuit proof

Yes

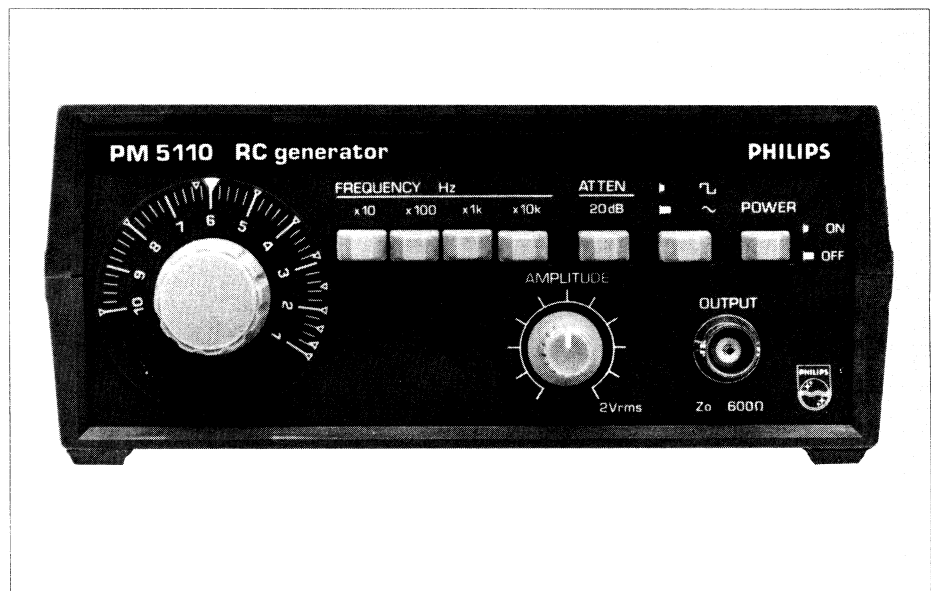
### SINE WAVE

#### Low distortion mode

Total harmonic distortion  
0.02% at 1kHz  
0.03% (300Hz...20kHz)

#### Fast settling mode

Total harmonic distortion  
0.5% (300Hz...20kHz)



#### Max. open circuit voltage

2V<sub>RMS</sub>

#### Frequency response of amplitude

<2% (1000Hz)

### SQUARE WAVE

#### Max. open circuit voltage

4Vp-p

#### Rise and fall time

<0.5 $\mu$ s

#### Sag

<1% (50Hz)

#### Duty cycle

50%

### TTL

#### Amplitude high level

4.5V  $\pm$  0.7V

#### Amplitude low level

<0.3V

#### Sag

<1%

#### Frequency response

3% (1000Hz)

#### Rise time

<30ns

#### Fall time

<15ns

#### Fan out

20

### POWER REQUIREMENTS

#### Voltage

115, 230V  $\pm$  15%

#### Power consumption

4W

#### Frequency

50...100Hz  $\pm$  5%

#### Dimensions and weight

(wxhxd) 155 x 65 x 180mm  
(9 x 4.3 x 8.3-in)  
1kg

#### Accessories supplied

Instruction manual  
Mains cable

## ORDERING INFORMATION

PM 5110 Oscillator low distortion

#### OPTIONAL ACCESSORIES

PM 9075 Cable BNC-BNC

**10Hz...100kHz frequency range****Symmetrical floating output****Low distortion 0.02%****Output voltage: 30V<sub>p-p</sub> (asymmetrical), 10V<sub>p-p</sub> (symmetrical)****Output level indication****Separate TTL and DIN loudspeaker output****Selectable output impedances: variable and stepped attenuation**

PM 5109 is an RC oscillator offering a low distortion (0.02% at 1kHz) yet high, 30V<sub>p-p</sub> (open circuit) output voltage in the asymmetrical mode. It can also be used in a fast settling mode, useful for fast routine work. These features, plus the facility to select asymmetrical or dual floating symmetrical outputs, makes it ideal for telecommunication applications as well as for education, R & D, manufacturing and audio equipment servicing. Both output voltages can be attenuated by a continuous control; the asymmetrical output can also be attenuated in steps of 10dB down to 60dB. Both pure sine waves or square wave signals are available at frequencies from 10Hz to 100kHz; output impedance is switchable for either 600Ω or 50Ω in the asymmetrical mode and 600Ω or LOW Z in the symmetrical mode (see specification).

A DIN loudspeaker connection is provided, which has an impedance similar to the symmetrical low impedance output. This allows direct testing of loudspeakers, regardless of their impedance. A special TTL output for direct connection to TTL circuitry or for synchronization purposes, is also provided.

The open circuit output is monitored by a meter on the front panel and the output range in use is indicated by the appropriate LED, from the seven provided.

For applications where the symmetrical output is not required, a special, economical, version, PM 5109S is available.



### TECHNICAL SPECIFICATION

#### PM 5109

#### FREQUENCY AND CHARACTERISTICS

##### Nominal range

10Hz...100kHz  
(4 subranges, selectable by push-buttons)

##### Indication

dial (1...10)

##### Setting error

<±5% ±1Hz

##### Temperature coefficient

<0.05/K

##### Long term drift (<7h)

<1.5 × 10<sup>-3</sup>

##### Short term drift (<15 min)

<0.5 × 10<sup>-3</sup>

##### Duty cycle

50% fixed

#### WAVEFORMS

Sine wave

Square wave (output B only)

#### OUTPUT

Separate outputs selectable with push-buttons

#### A. Symmetrical output (4 x 4mm connector on front panel)

- a. 2 x 300Ω
  - b. 300Ω + 300Ω
  - c. 2 x low Z
  - d. low Z + low Z
- } not earthed

#### B. Asymmetrical output (BNC connector at front panel)

- a. 600Ω
- b. 50Ω

#### Loudspeaker output (DIN connector at rear panel)

Only active when output Ad is selected

#### TTL Output (BNC connector at rear panel)

#### Open circuit output voltage (RMS)

0.03...3.16V (output A)  
0.1...10V (output B)

#### Indication

Meter (7 ranges indicated by LED)

#### Attenuation

10, 20, 30dB calibrated steps selectable in any combination (output B only) plus 30dB continuously adjustable

#### SINE WAVE

#### Total harmonic distortion

(for output Aa, Ab, and B)



– low distortion mode  
 $<0.7\%$  (10Hz...100kHz)  
 $<0.03\%$  (300Hz...20kHz)

– fast settling mode  
 $<1.5\%$  (10Hz...100kHz)  
 $<0.5\%$  (100Hz...100kHz)

**Total harmonic distortion**  
 (for output Ac and Ad)

– low distortion mode  
 $<0.7\%$  (open circuit 20Hz...100kHz)  
 $<0.03\%$  (open circuit 300Hz...20kHz)  
 $<0.15\%$  (4 $\Omega$  load, 20Hz...100kHz)

– fast settling mode  
 $0.5\%$  (0...4 $\Omega$  load, 100Hz...100kHz)

**Frequency response of amplitude**

$\pm 0.2\text{dB}$  (1 000Hz, outputs A & B, open circuit)  
 $\pm 0.5\text{dB}$  (10Hz...10kHz, outputs Ac & Ad, 4 $\Omega$  load)  
 – 6dB (70kHz, outputs Ac & Ad, 4 $\Omega$  load)

**SQUARE WAVE**

**Rise and fall time**  
 $<0.5\mu\text{s}$

**Overshoot and ringing**  
 $<2\%$  ( $>20\text{Hz}$ )  
 $<1\%$  ( $>50\text{Hz}$ )

**TTL**

**Duty cycle**  
 50%

**Fan out**  
 20

**POWER REQUIREMENTS**

**Line voltages**  
 110, 128, 220, 238V  $\pm 10\%$ .

**Frequency**  
 50...100Hz

**Power consumption**  
 17 W

**Dimensions and weight**  
 (wxhxd) 310 x 140 x 330mm  
 (12.2 x 5.5 x 13-in)  
 PM 5109 6.5kg (14.3lb)  
 PM 5109S 5kg (11lb)

**ACCESSORIES SUPPLIED**

Instruction manual



The specification for PM 5109S is as for PM 5109, without the symmetrical output facility.



PM 5109 being used to check the bandwidth characteristic of a long coaxial cable.

**ORDERING INFORMATION**

PM 5109 RC generator + output monitor  
 PM 5109S RC generator 10Hz – 100kHz

**OPTIONAL ACCESSORIES**

PM 9075 Coax. Cable BNC-BNC  
 PM 9560 19-in Rackmount adapter

**0.1 Hz...2 MHz frequency range: vernier frequency adjustment**

**Logarithmical sub-ranges**

**Sine, square, triangular waveforms, plus DC**

**Stepped & variable output attenuation over 80dB range**

**Variable DC offset**

**Internal & external sweep facility**

**TTL output**

The PM 5131 function generator is an instrument designed for applications extending from educational to the broad general purpose area. Its many features make it an extremely versatile instrument for a modest price. Among these features are the high, 30V<sub>p-p</sub> output voltage and the facilities for both internal and external sweep. This latter feature covers the audio frequency range in a single shot. The frequency is adjustable in three logarithmical sub-ranges from 0.1 Hz to 2 MHz. The frequency vernier allows the frequency setting to be varied from -20% to +20%. The maximum output voltage is 30V<sub>p-p</sub> (open circuit) on the main outlet having a 50Ω impedance. The attenuation can be set over a wide range, either in calibrated steps of 10dB to a maximum of 60dB or in combination with the 20dB continuous attenuator.

A sine, triangle or square wave signal is selected by simply pressing the appropriate push-button. DC voltage can be selected separately without any waveform or whenever used as DC offset can be varied between -10V and +10V.

PM 5131 also provides a 3 1/3 decade internal sweeping facility with adjustable sweep range and a variable sweep period from 10 to 150 seconds.

This is especially useful when sweeping in the audio range to cover the frequency range of 20Hz...20kHz in a single sweep. Added to the versatility of this instrument are an external sweep facility and a TTL output. Good ergonomic design makes operation simple while the instrument occupies minimal bench space.



## TECHNICAL SPECIFICATION

### FREQUENCY AND CHARACTERISTICS

**Nominal range**  
0.1 Hz...2 MHz

**Indication**  
Logarithmic dial

**Setting error**  
± 10%

**Vernier frequency adjustment**  
-20...+20% of frequency setting

**Temperature coefficient**  
<0.5%/K

**Short term drift** (<15 min)  
<0.5%

**Long term drift** (<7h)  
<0.7%

### WAVEFORMS

Sine wave  
Square wave  
Triangular wave } with or without DC offset

DC voltage without AC

### OUTPUT

#### AC VOLTAGE

**Max. open circuit voltage**  
30V<sub>p-p</sub>

#### Attenuation

10, 20, 30dB calibrated steps selectable in any combination plus 20dB continuously adjustable

**Impedance**  
50Ω

**Short-circuit proof**  
Yes

#### DC VOLTAGE

**Offset voltage**  
-10...+10V (open circuit)

#### SINE WAVE

**Total harmonic distortion**  
<0.5% (0.1 Hz...20kHz)  
<3.0% (0.1 Hz...2 MHz)

**Frequency response of amplitude**  
<0.1dB (0.1 Hz...20kHz)  
<0.3dB (0.1 Hz...1 MHz)  
<1.0dB (0.1 Hz...2 MHz)

#### TRIANGLE WAVE

**Linearity**  
>99%

#### SQUARE WAVE

**Rise and fall time**  
<75ns

**Overshoot and ringing**  
<2%



TTL

**Duty cycle**  
50%

**Fan out**  
>20

**INTERNAL SWEEP**

**Characteristics**  
Logarithmic

**Max. sweep range**  
 $3^{1/3}$  decade

**Mode**  
Single

**Period time**  
<10...150s  
Continuously adjustable

**Frequency analog voltage**  
1 V/frequency decade

**EXTERNAL SWEEP**

**Input**  
SWP voltage

**Characteristic**  
Logarithmic

**Max. sweep range**  
 $3^{1/3}$  decade

**Input resistance**  
1 k $\Omega$

**Max. sweep frequency**  
approx. 5 kHz

**Sensitivity**  
1 V/frequency decade

**POWER REQUIREMENTS**

**Voltage**  
115, 230V  $\pm$  15%

**Power consumption**  
21 W

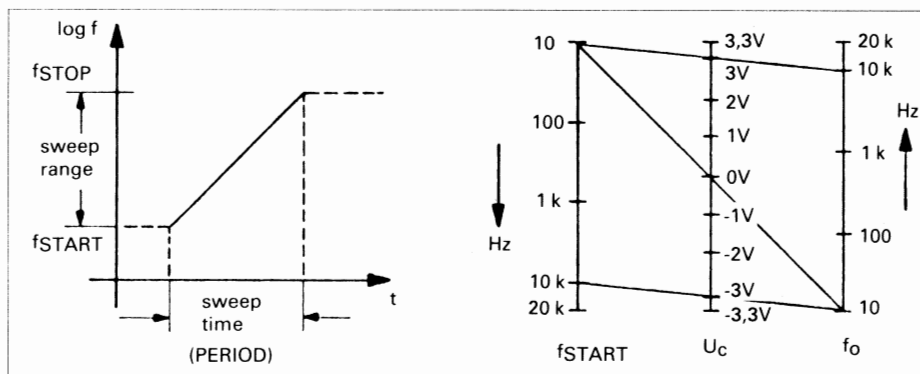
**Frequency**  
50...100 Hz

**Dimensions and weight**  
(wxhxd) 310 x 140 x 330 mm  
(12.6 x 5.5 x 13-in)  
4.5 kg (10 lb)

**Accessories supplied**  
Instruction manual



A typical educational application with PM 5131 being used in conjunction with oscilloscope PM 3215.



### Example of internal single sweep

Internal single sweep from the start- to the stop frequency is started by pressing the button SGLE SWEEP. The characteristic is exponential following the relation

$$f_0 = f_{START} 10^{U_c/C}$$

where

- $f_0$  = instantaneous signal frequency at the output
- $f_{START}$  = frequency at the beginning of the sweep represented by the frequency setting
- $U_c$  = voltage at the socket SWP VOLTAGE IN/OUT

Thus a control voltage difference of 1 V results in a frequency ratio of 10:1.

At the end of the sweep the output remains at the stop frequency which can be set by the SWP STOP/START control. Resetting the SGLE SWEEP button effects the frequency to fly back to the start frequency. The sweep time is adjusted with the SWP PERIOD potentiometer. Pre-adjustment of the stop frequency may be performed at the end of the sweep with minimum period, prior to setting the final sweep operation.

The example shown is for the x10k frequency range; the other two ranges should be regarded similarly, with  $U_c$  scale reading unchanged.

## ORDERING INFORMATION

PM 5131 Function generator

### Optional accessories

- PM 9075 Cable BNC-BNC
- PM 9560 19-in rackmount adapter
- PM 9551 50...600 $\Omega$  impedance transformer

**0.1Hz...2MHz in 7 overlapping sub-ranges**

**Sine, square, triangular waveforms, positive- and negative-going pulses plus DC**

**Output: 30V<sub>p-p</sub> (sine, triangle, square); (15V<sub>p-p</sub> for pulses)**

**Stepped and variable attenuation over 80dB range**

**Variable DC-offset**

**Internal and external sweep facility**

**Variable duty cycle**

The PM 5132 function generator is a general-purpose instrument that will be very attractive for educational applications as well as for laboratory use. It is an extremely versatile generator which produces sine, triangle and square waveforms plus positive and negative pulses, plus DC. It exhibits a high, 30V<sub>p-p</sub> output for all waveforms and 15V<sub>p-p</sub> for pulses. Output impedance is switchable with a choice of 50Ω or 600Ω.

The duty cycle for all waveforms is variable between 10% and 90% and DC-offset can be selected independently for any waveform. This is adjustable from -10V to +10V.

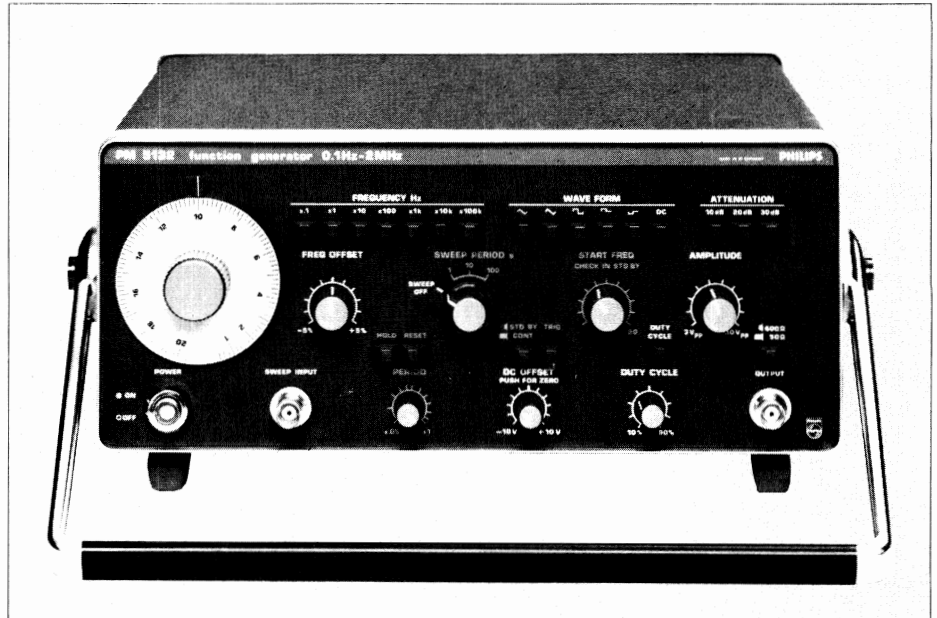
The frequency range of 0.1Hz to 2MHz is adjustable through 7 overlapping subranges and the vernier control allows dial settings of ± 2% of the maximum subrange frequency setting.

Sweep facilities are varied and include:

- choice of linear single or continuous sweep
- adjustable start frequency in the selected sub-range which is independent of stop frequency
- maximum linear sweep range of 2½ decades
- sweep period setting between 50ms and 100s
- control functions with HOLD or RESET by push-button
- electronic triggering

A pen-lift output is provided and the instrument is short-circuit proof.

Good ergonomic design makes the operation simple while the instrument occupies minimal bench space.



## TECHNICAL SPECIFICATION

### FREQUENCY AND CHARACTERISTICS

**Nominal range**  
0.1Hz...2MHz

**Indication**  
Linear dial

**Setting error**  
± 2% ... ± 0.2% of max subrange frequencies

**Vernier frequency adjustment**  
-5% ... +5% of frequency setting.

**Temperature coefficient**  
<0.15%/K

**Short term drift** (<15 min)  
0.10% (Warm-up time 30 min)

**Long term drift** (<7h)  
<0.25%

**Duty cycle**  
5.0% fixed  
<10% ... >90% continuously adjustable

### WAVEFORMS

Sine wave  
Square wave  
Triangular wave  
Positive pulse  
Negative pulse  
DC voltage without AC

} with or without DC-offset

### OUTPUT

#### AC VOLTAGE

**Max. open circuit voltage**  
30V<sub>p-p</sub> (15V<sub>p-p</sub> for pulse)

**Attenuation**  
10, 20, 30dB calibrated steps selectable in any combination plus 20dB continuously adjustable.

**Impedance**  
50Ω or 600Ω selectable

**Short-circuit proof**  
Yes

#### DC VOLTAGE

**Offset voltage**  
-10 ... +10V (open circuit)

#### SINE WAVE

**Total harmonic distortion**  
<0.5% (0.1Hz...20kHz)  
<1.0% (20kHz...200kHz)  
<3.0% (200kHz...2MHz)

**Frequency response of amplitude**  
<0.1dB (0.1Hz...20kHz)  
<0.3dB (0.1Hz...1MHz)  
<1.0dB (0.1Hz...2MHz)

**Linearity**  
>99% (0.1 Hz...100 kHz)

#### SQUARE WAVE

**Rise and fall time**  
<75 ns

**Overshoot and ringing**  
<2%

**TTL**

**Duty cycle**  
as main output

**Fan out**  
>20

**PEN LIFT**

#### SWEEP OUTPUT

#### INTERNAL SWEEP

**Characteristics**  
Linear

**Max. sweep range**  
2½ decades

**Mode**  
Single or continuous

**Period time**  
50 ms...100 s  
Continuously adjustable in 3 subranges

**Control functions**  
HOLD, RESET, TRIG (manually and electronically)

**Frequency control voltage**  
0...5 V (depending on start- and stop-frequency)

#### EXTERNAL SWEEP

##### Input

SWEEP TRIG

**Characteristic**  
Linear

**Max. sweep range**  
2½ decades

**Input resistance**  
47 kΩ

**Max. sweep frequency**  
15 kHz approx.

**Sensitivity**  
5 V for maximum range

#### POWER REQUIREMENTS

**Voltage**  
110, 128, 220, 238 V ±10%

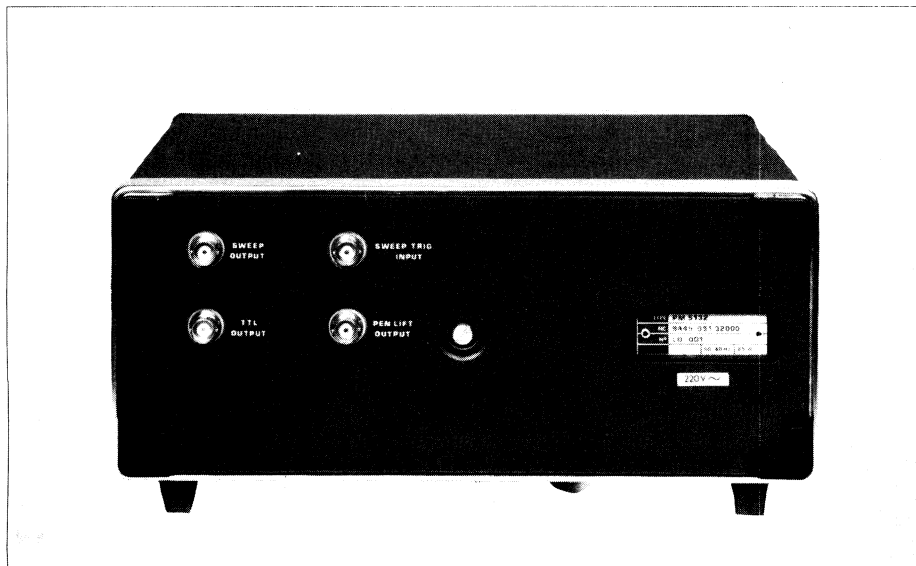
**Power consumption**  
25 W

**Frequency**  
50...100 Hz

**Dimensions and weight**  
(wxhxd) 310 x 140 x 330 mm  
(12.6 x 5.5 x 13-in)  
5 kg (11 lb)

**Accessories supplied**  
Instruction manual

Rear view of PM 5132 showing location of sweep, TTL and pen lift outputs and the sweep trigger input



#### ORDERING INFORMATION

PM 5132 Function generator

#### OPTIONAL ACCESSORIES

PM 9075 cable BNC-BNC  
PM 9560 19-in rackmount adapter

**0.01 Hz...2 MHz frequency range with 20 V<sub>p-p</sub> output**

**Frequency and open circuit output voltage indicated on 3½-digit LED display**

**Selectable 50 Ω or 600 Ω impedance**

**Sine, square, and triangular waveforms, pos./neg. pulses, DC**

**Single and burst with variable start phase**

**Logarithmic or linear sweep with manual and electronic sweep trigger**

**Internal or external sweep facility**

The versatile function generator PM 5133 offers both linear and logarithmic sweep facilities in addition to a wide range of other features. Outputs include sine, triangle and square waveforms as well as positive or negative pulses, and DC. The duty cycle is variable between 10% and 90%.

The wide frequency range of 10 mHz to 2 MHz is selected by means of a 7-position rotary switch with an overriding coarse/fine adjustment. A high-precision, electronic system, using a 3½-digit LED provides very accurate, clearly readable setting conditions and eliminates those human errors (e.g. parallax) likely to occur with more conventional mechanical dials. The display is also used to monitor the open-circuit output voltage, sweep limit values and incompatible setting-up conditions.

The output voltage (20 V<sub>p-p</sub> max., except for pulses at 10 V<sub>p-p</sub> max.) is available at the front-panel mounted socket; there is a push-button choice of 50 Ω or 600 Ω output impedance. Output attenuation of more than 80 dB is selectable in any combination of calibrated steps of 3-10-20-30 dB with an overriding 20 dB continuous control. The output voltage level can be checked by simply depressing a push-button, and appears on the LED panel.

#### Linear or logarithmic sub-ranges

Sweep facilities include single-shot and continuous operation, with the choice of linear or logarithmic mode. Frequency ranges are divided into either seven **linear** or five **logarithmic** sub-ranges with continuous coarse and fine adjustment. The logarithmic sweep ranges cover more than four decades, making the instrument extremely useful for sweeping within the audio range.

The single sweep can be triggered either manually, or electronically, from an external source. The sweep period is continuously adjustable between 5 ms and 100 s. The START and STOP frequencies are non-interactive and can be set independently of each other. Also, a HOLD facility allows a sweep to be stopped at any desired frequency – useful for checking phenomena which may appear during a sweep – by means of a push-button.



An interrupted sweep is re-started by simply releasing the HOLD button. Again, if required, a sweep can be reset back to the start frequency using the RESET button. When used in the sweep mode, the start, stop and run frequencies are all indicated clearly on separate LEDs.

Moreover, as previously mentioned, an error warning lamp automatically flashes in the event of any incompatible setting being made by the operator.

The generator also offers an internally or externally controlled burst, or single waveform signal, having a continuously adjustable start/stop phase, between  $-90^\circ$  and  $+90^\circ$ .

Other input/output facilities available at the rear panel include a TTL output and pen-lift control, internal modulation voltage and frequency control voltage.

The PM 5133 is designed for maximum electrical and mechanical protection. Careful attention has been given to ergonomic considerations, making the instrument easy to use. Its overall versatility makes it suitable for use within a wide range of applications, such as research, design, education and manufacturing. It occupies minimal bench space and is short-circuit proof.

#### TECHNICAL SPECIFICATION

##### FREQUENCY AND CHARACTERISTICS

###### Nominal range

10 mHz ... 2 MHz

###### Display

3½ digits  
7-segment LED  
4 dimension LEDs mHz, Hz, kHz, MHz.

###### Setting error

$\pm 2\% \pm 1$  digit (10 mHz ... 200 kHz)  
 $\pm 3\% \pm 1$  digit (200 kHz ... 2 MHz)

###### Temperature coefficient

$< 1.0 \times 10^{-3}/K$  (linear mode)  
 $< 2.5 \times 10^{-3}/K$  (log mode)

###### Short term drift (< 15 min)

$< 1 \times 10^{-3}$  (10 mHz ... 20 kHz)  
 $< 3 \times 10^{-3}$  (20 kHz ... 2 MHz)

###### Long term drift (< 7 h)

$< 3 \times 10^{-4}$

###### Duty cycle

50% fixed  
 $< 10\% \dots > 90\%$  continuously variable

## WAVEFORMS

Sine wave  
Square wave  
Triangular wave  
Positive pulse  
Negative pulse  
DC voltage without AC

} with or without DC offset

## OUTPUT

## AC VOLTAGE

### Max. open circuit voltage

20V<sub>p-p</sub> (10V<sub>p-p</sub> for pulse)

### Indication (EMF)

Alt. mode frequency display

### Attenuation

3, 10, 20, 30dB calibrated steps selectable in any combination plus 20dB continuously adjustable

### Impedance

50Ω or 600Ω selectable

### Short-circuit proof

Yes

## DC VOLTAGE

### Offset voltage

0...±5V (open circuit)

## SINE WAVE

### Total harmonic distortion

<0.5% (10mHz...200kHz)

<2% (200kHz...2MHz)

### Frequency response of amplitude

<0.1dB (10mHz...20kHz)

<0.3dB (20kHz...1 MHz)

<1.0dB (1 MHz...2MHz) (Max. amplitude)

## TRIANGLE WAVE

### Linearity

>99% (10mHz...100kHz)

## SQUARE WAVE

### Rise and fall time

<60ns

### Overshoot and ringing

<2% (max. amplitude into 50Ω)

## POSITIVE/NEGATIVE PULSES

See SQUARE WAVE

## TTL

### Duty cycle

as main output

### Fan out

>20

## PEN LIFT

## INTERNAL MODULATION

## FREQUENCY CONTROL VOLTAGE

## SWEEP FACILITIES

## INTERNAL SWEEP

### Characteristics

Linear or logarithmic

### Max. sweep range

2<sup>1</sup>/<sub>2</sub> decades (linear mode)

4 decades (log mode)

### Mode

Single or continuous

## Indication

3<sup>1</sup>/<sub>2</sub> digits

7-segment LED

3 LEDS STOP, RUN and START

## Period time

5ms...100s

Continuously adjustable in 4 sub-ranges

## Control functions

HOLD, RESET, TRIG (manually and electronically)

## Internal modulation output

0V start frequency

5V stop frequency

## Frequency control voltage output

0...5V (depending on start- and stop frequency)

## EXTERNAL SWEEP/FM

### Input

SWEEP/FM

### Characteristic

Linear or logarithmic

### Linear Characteristic

1 V/0.2 max. freq.

### Logarithmic characteristic

1 V/freq. decade

### Max. sweep range

>2<sup>1</sup>/<sub>2</sub> decades (linear mode)

>4 decades (log mode)

### Input resistance

5kΩ

### Max. sweep rate

>4kHz (1<sup>1</sup>/<sub>2</sub> decade range)

### Sweep voltage

Sawtooth, duty cycle 90%

## BURST FACILITIES

## INTERNAL BURST

## CONTINUOUS OPERATION

### On/Off-ratio

approx. 1:1 (last cycle ends at START-PHASE level)

### Repetition time

5ms...100s

continuously adjustable in 4 sub-ranges

## SINGLE OPERATION

### Repetition time

See INTERNAL BURST

### Triggering

manually or electronically via TRIG & BURST input

### Start phase

−90°...+90° (− $\pi/2$ ...+ $\pi/2$ ), continuously adjustable

## EXTERNAL BURST

### Input

TRIG & BURST

### Control voltage

TTL-level

### Start

Low/high-transition

### Stop

High/low-transition,  
(when output signal reaches start phase)

### Max. control frequency

2MHz

### Start phase

−90°...+90° (− $\pi/2$ ...+ $\pi/2$ ), continuously adjustable

## SINGLE FACILITIES

## INTERNAL SINGLE

### Repetitive mode

Same as INTERNAL BURST

### Single triggering

Same as INTERNAL BURST

### Start phase

−90°...+90° (− $\pi/2$ ...+ $\pi/2$ ), continuously adjustable

## EXTERNAL SINGLE

### Input

TRIG & BURST

## ERROR INDICATION

## POWER REQUIREMENTS

### Voltage

110, 128, 220, 238V ± 10%

### Power consumption

55W

### Frequency

50/60Hz

### Dimensions and weight

(wxhxd) 310 x 140 x 390mm

(12.2 x 5.5 x 15.4-in)

6.5kg (14.3lb)

### Accessories supplied

Instruction manual

## ORDERING INFORMATION

PM 5133      Function generator

## OPTIONAL ACCESSORIES

PM 9075      Coax. cable BNC

PM 9581      50Ω/3W Termination

PM 9051      Adapter BNC/4mm

PM 9560      19-in rackmount adapter

**Specially adapted for Hi-Fi testing according to DIN standard 45 541**  
**Fixed 50s sweep, 20Hz...20kHz selectable**  
**Sweep started manually or by 1kHz burst signal**  
**26dB attenuation facility included**

The PM 5133S is a special version of the PM 5133, with extra features specifically included to permit the testing of Hi-Fi equipment to DIN standards.

Used in conjunction with an X-Y recorder, it permits the frequency characteristics of e.g. record players, cassette and tape recorders to be plotted. This instrument has wide-ranging applications in R&D and quality control. It is also ideal for use by audio service workshops – permitting them to show customers whether their equipment is performing according to specification.

The PM 5133S includes all the facilities of the standard PM 5133, plus a single sweep with fixed 50s duration. Start and stop frequencies should be set at respectively 20Hz and 20kHz.

The sweep is preceded by a 1kHz burst lasting 6 seconds when manually triggered. A similar signal fed in via the TRIG and BURST input will automatically start the generator sweep (without burst), as an alternative to manual start.

With this feature it is possible to start a sweep on a record, cassette or tape (provided this is preceded by the burst) synchronously with the sweep of the generator.

The special sweep is selected by means of the MOD SWEEP PERIOD switch (position 100s) and the PERIOD adjustment (fixed position) with the generator in the logarithmic sweep mode.



## TECHNICAL SPECIFICATION

(additional to technical specification of PM 5133 or typical for the special sweep)

### OUTPUT

#### Attenuation – fixed

0, 6, 10, 20, 30dB, selectable in any combination

#### Sweep, internal

50s sweep

#### Mode

- single sweep with fixed period and 1kHz burst, started by push-button TRIG
- single sweep with fixed period, electronically started by an external 1kHz burst applied at input TRIG & BURST.

#### Characteristic

logarithmic

#### Start frequency

20Hz set by means of potentiometer START FREQUENCY

#### Stop frequency

20kHz set by means of potentiometer STOP FREQUENCY

#### Burst frequency

1kHz (depending on the setting of the start frequency)

#### Burst period

6s

#### Sweep period

- 50s  $\pm$  0.2s when
- SWEEP PERIOD in pos. 100 (S)
- PERIOD in fixed pos. "S"

### Trigger signal

1kHz  $\pm$  100Hz

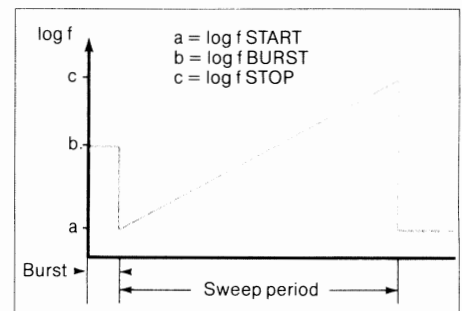
### Trigger sensitivity

0.5V<sub>RMS</sub>

### Reset trigger

By a 1kHz burst possible after 40s sweep period.

- a = log f START
- b = log f BURST
- c = log f STOP



## ORDERING INFORMATION

PM 5133S Function generator 0.01 Hz - 2MHz



## 20MHz Function generator

**1mHz...20MHz frequency range with output 20V<sub>p-p</sub>**  
**Frequency and open circuit voltage indicated on 3½-digit LED display**  
**Indications for dimensions, sweep situations and incompatible settings**  
**Normal or high accuracy X-tal controlled operation**  
**Internal or external sweep and AM/FM modulation facilities**  
**Burst and single with variable start phase**  
**Stepped and variable attenuation over 60dB range**

The PM 5134 is an easy-to-use yet extremely sophisticated function generator embodying an unusually wide range of facilities in a single instrument.

It will produce sine, square and triangle waveforms as well as positive and negative pulses and DC. The duty cycle is variable between 10% and 90%.

The wide, 1mHz to 20MHz frequency range is divided into 10 sub-ranges, which are selected by means of a rotary switch with an overriding coarse/fine adjustment. This fine adjustment, combined with the 3½-digit LED display, gives an immediate, highly accurate readout of the selected frequency. Setting-up procedures are thus very much simplified compared with the traditional dial setting and any human errors (e.g. parallax) are eliminated.

In addition, the 3½-digit display can be used to monitor the open-circuit output voltage by depressing a push-button. Also, when used in the sweep mode, the start, stop and run frequencies are indicated by separate LEDs. Moreover, an error warning lamp automatically indicates any incompatible setting-up conditions.

The high, nominal accuracy (see technical specification) of  $\pm 2\% \pm 1$  digit, can be further improved to  $\pm 5 \times 10^{-6}$  by operating the instrument in the crystal-control mode. This facility is useful, for example, for identical repetitive measurements requiring high accuracy, or for narrow band filter tests. The X-TAL AM mode offers a stable carrier wave with defined frequency. One particular application is when using a 10.7MHz carrier frequency to check that the discriminator section of a radio receiver is suppressing the AM waveform.

The continuously variable 20V<sub>p-p</sub> max. output (10V<sub>p-p</sub> pulses) is available at the front-panel mounted socket; there is a push-button choice of 600Ω or 50Ω output impedance. Output attenuation is selectable in any combination of 3-6-10-20dB push-buttons with an overriding continuous 20dB control. Sweep facilities include single and continuous operation. The single sweep can be triggered either manually, or electronically from an external source. The sweep period is continuously adjustable between 5ms

and 100s. The START and STOP frequencies are non-interactive and can be set independently of each other. A HOLD facility allows a sweep to be stopped at any desired frequency – useful for checking phenomena occurring during a sweep – by means of a push-button. An interrupted sweep is continued by simply releasing the HOLD button. If required a sweep can be reset to the start frequency using the RESET push-button.

The generator offers an internally or externally controlled burst or single-cycle signal. The start/stop phase is continuously adjustable between  $-90^\circ$  and  $+90^\circ$ .

The internal AM is adjustable between 0 and 100% modulation depth. The modulation frequency can be set over a wide range from 10mHz to 20kHz. The AM facility can be used with crystal control, if desired. Exter-

nal AM inputs in the range from DC to 20kHz can be applied via a rear-mounted BNC-socket.

The internal FM can be adjusted, continuously, between zero and  $\pm 10\%$  frequency deviation.

Other input/output facilities available on the rear panel include a TTL output and pen-lift control.

The well-considered design of the PM 5134 has resulted in a clean, simple front panel layout which allows the operator to become familiar with all control functions very quickly. Its overall versatility makes it suitable for a very wide range of applications within research design or educational organizations. The instrument occupies minimal bench space and is short-circuit proof.



## TECHNICAL SPECIFICATION

### FREQUENCY AND CHARACTERISTICS

Nominal range  
1mHz...20MHz

**Display**  
3 1/2 digits  
7-segment LED  
4-dimension LEDs mHz, Hz, kHz, MHz

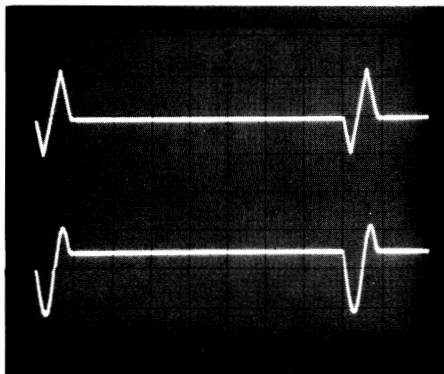
**Setting error**  
±2% ±1 digit (1mHz...2MHz)  
±5% ±1 digit (2MHz...20MHz)

**Temperature coefficient**  
<1.0 x 10<sup>-3</sup>/K (20MHz range excluded)

**Short term drift** (<15 min)  
<1 x 10<sup>-3</sup> (1mHz...2MHz)  
<2 x 10<sup>-3</sup> (2MHz...20MHz)

**Long term drift** (<7h)  
<3 x 10<sup>-4</sup>

**Duty cycle**  
50% fixed  
<10%...>90% continuously variable (20MHz range excluded)



Repetitive single sine wave signal

#### WAVEFORMS

Sine wave  
Square wave  
Triangular wave  
Positive pulse  
Negative pulse  
DC voltage without AC

} with or without  
DC offset

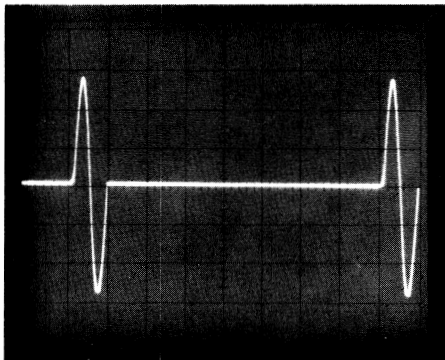
#### OUTPUT

##### AC VOLTAGE

**Max. open circuit voltage**  
20V<sub>p-p</sub> (10V<sub>p-p</sub> for pulse)

**Indication open circuit output voltage**  
Alt. mode frequency display

**Attenuation**  
3, 6, 20, 30dB calibrated steps selectable in any combination plus 20dB continuously adjustable



Repetitive single sine wave and triangle shown with different start phase

**Impedance**  
50Ω or 600Ω selectable

**Short-circuit proof**  
Yes

#### DC VOLTAGE

**Offset voltage**  
-5V...+5V (open circuit)

#### SINE WAVE

**Total harmonic distortion**  
<0.5% (1Hz...200kHz)  
<3% (1mHz...2MHz)  
All harmonics more than 26dB below fundamental (1mHz...20MHz)

Frequency response of amplitude  
<0.1dB (0.1Hz...200kHz)  
<0.5dB (1mHz...2MHz)  
<1.5dB (1mHz...20MHz, for max. amplitude)

#### TRIANGLE WAVE

**Linearity**  
≥99% (>100kHz)

#### SQUARE WAVE

**Rise and fall time**  
<13ns

**Overshoot and ringing**  
<3%

#### POSITIVE/NEGATIVE PULSES

See SQUARE WAVE

#### TTL

**Duty cycle**  
as main output

**Fan out**  
>5

#### PEN LIFT

#### INTERNAL MODULATION

### SWEEP FACILITIES

#### INTERNAL SWEEP

**Characteristics**  
Linear

**Max. sweep range**  
2 decades

**Mode**  
Single or continuously

**Indication**  
3 1/2 digits  
7-segment LED  
3 LEDs STOP, RUN and START

**Period time**  
5ms...100s  
Continuously adjustable in 4 sub-ranges

**Control functions**  
HOLD, RESET, TRIG (manually) and electronic triggering

**Frequency control voltage at modulation output**  
0...5V (depending on start and stop frequency setting)

#### EXTERNAL SWEEP/FM

**Input**  
SWEEP/FM

**Characteristics**  
Linear

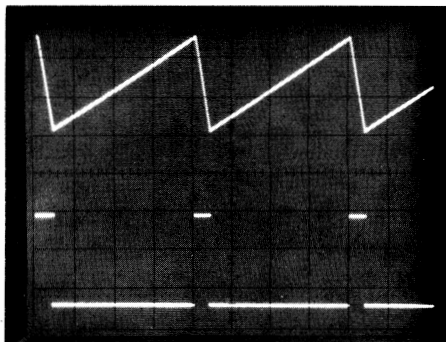
**Voltage/frequency characteristic**  
1V/0.2 max. frequency

**Max. sweep range**  
>2 1/2 decades for sub-ranges above 2Hz

**Input resistance**  
5kΩ

**Max. sweep rate**  
>200Hz (1 1/2 decades range)

**Sweep voltage**  
Sawtooth, duty cycle 90%



Variable duty cycle shown in triangular and square wave signals

## BURST FACILITIES

## INTERNAL BURST

## CONTINUOUS OPERATION

## On/off ratio

approx. 1:1 (last cycle ends at START-PHASE level)

## Repetition time

0.05ms...100s

Continuously adjustable in 6 sub-ranges

## SINGLE OPERATION

## Duration

See CONTINUOUS OPERATION, Repetition time

## Triggering

Manually or electronically via TRIG & BURST input

## Start phase

$-90^\circ \dots +90^\circ$  ( $-\pi/2 \dots +\pi/2$ ), continuously adjustable

## EXTERNAL BURST

## Input

TRIG & BURST

## Control voltage

TTL-level

## Start

Low/High-transition

## Stop

High/Low-transition.  
(when output signal reaches START-PHASE)

## Max. control frequency

2MHz

## Start phase

$-90^\circ \dots +90^\circ$  ( $-\pi/2 \dots +\pi/2$ ), continuously adjustable

## SINGLE FACILITIES

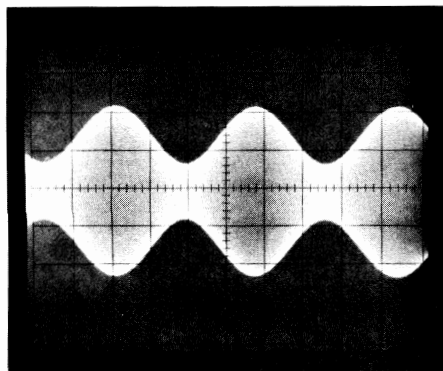
## INTERNAL SINGLE

## CONTINUOUS OPERATION

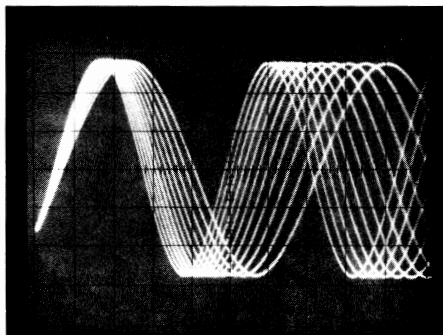
## Repetition time

0.05ms...100s

continuously adjustable



Carrier wave with AM modulation



Frequency sweep or frequency modulation

## SINGLE OPERATION

## Triggering

Manually or electronically via TRIG & BURST input

## Start phase

$-90^\circ \dots +90^\circ$  ( $-\pi/2 \dots +\pi/2$ ), continuously adjustable

## EXTERNAL SINGLE

## Input

TRIG & BURST

## MODULATION

## INTERNAL FM

## Modulation waveform

Sine wave

## Deviation

Approx.  $-10\% \dots +10\%$   
continuously adjustable

## Modulation frequency

0.01 Hz...20kHz  
continuously adjustable in 6 sub-ranges

## Modulation voltage

Available at modulation output

## EXTERNAL FM

## Input

SWEEP/FM

## INTERNAL AM

## Modulation waveform

Sine wave

## Modulation depth

0...>100%  
continuously adjustable

## Modulation frequency

See internal FM

## Modulation voltage

See internal FM

## EXTERNAL AM

## Input

AM

## Modulation waveform

Arbitrary with spectral components up to 20kHz

## Modulation depth

0...>100%

continuously adjustable

## X-TAL MODE

## Frequency lock

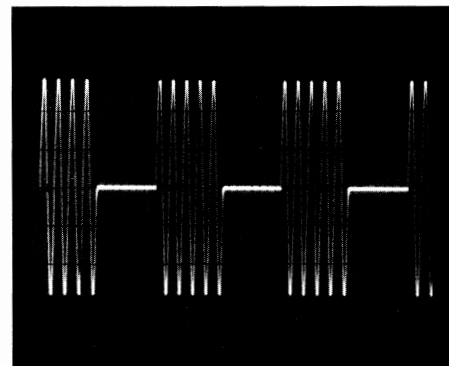
Freezes the momentary frequency display  
(frequency setting inhibited)

## Accuracy

$\pm 5 \times 10^{-6}$

## X-TAL AM MODE

See X-tal mode with additional facilities of internal and external AM



Burst signal

## POWER REQUIREMENTS

## Voltage

110, 128, 220, 238V  $\pm 10\%$

## Power consumption

55W

## Frequency

50/60Hz

## Dimensions and weight

(wxhxd) 310 x 140 x 390mm  
(12.2 x 5.15 x 15.4-in)  
6.5kg (14.3lb)

## Accessories supplied

Instruction manual

## ORDERING INFORMATION

PM 5134 Function generator

## OPTIONAL ACCESSORIES

PM 9075 Coax. cable BNC  
PM 9581 50 $\Omega$ /3W termination  
PM 9051 adapter BNC/4mm  
PM 9560 19-in rackmount adapter



**0.001 Hz...2.147 MHz frequency range**

**Microprocessor-controlled with LED indication**

**Extremely accurate frequency setting to within  $\pm 1 \times 10^{-6}$**

**Very high short- and long-term stability**

**Fast "feather-touch" parameter selection**

**Sine, triangle, square waveforms plus TTL output**

**External AM facility**

This microprocessor-based LF synthesizer includes many unique features that lift it into a special class of medium-priced signal sources for most professional applications, including instrument calibration. Typical design criteria include  $\pm 1 \times 10^{-6}$  frequency setting error and an ageing characteristic of  $< 1.5 \times 10^{-6}$ /year, which clearly underwrites the inherently high accuracy and stability of this instrument.

It will thus be of interest to design or research laboratories seeking such a highly accurate, stable signal source in the range 0.001 Hz to 2.147 MHz for both routine bench use and inclusion in automatic test systems. Its high-grade, virtually zero-error performance, plus simplicity and speed of operation make it equally attractive for use in advanced educational programmes.

The output frequency of the crystal controlled oscillator is shown on a bright 6-digit LED display together with the AC ( $2\frac{1}{2}$  digits) and DC (2 digits) outputs. DC polarity is also displayed.

In addition, the preselected waveforms and external amplitude modulation characteristics are indicated on this panel.

The user has a choice of sine, square and triangle waveform outputs which are available from a 50  $\Omega$  front panel socket (BNC connector).

In addition, there is an adjacent TTL socket. External amplitude modulation signals, from 0...>90% modulation depth can be connected via a rear input socket.

A very clear, simply designed front panel makes operation extremely easy. Fast selection of the desired parameters is assured by 'feather-touch' input push buttons. An 'erase' facility allows equally fast correction of any input errors.

Maximum AC output, for all waveforms is 19.9 Vpp. A DC offset voltage of up to 9.9 V max., is available for setting this output to the desired DC level, up to 19.9 V total amplitude. Voltage levels can be set in minimum increments of 1 mV.



All functions are fully remotely controllable via the built-in IEC-bus interface, enabling the unit to be used within an automatic testing system, if desired, (no modifications or extra accessories are needed). This facility is further enhanced by the generally high switching speeds resulting from a direct digital signal synthesis technique. All these comprehensive facilities are contained in a very compact, portable package.

Typical applications in an automated system include, for example:

- \* accurate testing of audio filters when checking bandpass curves.
- \* as a standard, when checking servo motor speed control systems or for audio/video tape stress testing, etc.

Also, when employed as a signal source for calibrating instruments (e.g. frequency meters) its highly accurate and stable output signal may itself be used as a modulation source.

An alternative version, PM 5190X, features an ENTER, instead of ERS (erase) button. This enables the user to set up the next test frequency, before actually applying it at the output. This is useful for e.g. checking servo-loops and phase-locked loops.

## TECHNICAL SPECIFICATION

### FREQUENCY AND CHARACTERISTICS

**Nominal range**  
1 mHz...2.147 MHz

**Measuring range**  
1 mHz...2.147 MHz for sine and square wave  
1 mHz...<100 kHz for triangular wave

**Setting**  
local: via front panel keyboard  
remote: via IEC bus interface

**Display**  
6-digit 7-segment LED display;  
6 decimal points;  
2 LEDs for dimension Hz, kHz

**Setting error**  
 $\pm 1 \times 10^{-6}$  at 23°C