Philips PM 5175

Function Generator 0.1 Hz - 100 kHz

Service Manual

1. Introduction

The Philips PM 5175 is a compact function generator designed for general laboratory use. It produces sine, square and triangle waveforms over the frequency range of 0.1 Hz to 100 kHz in six decade ranges. The instrument features adjustable output level, DC offset, and symmetry (duty cycle) control, plus a separate TTL output for digital applications.

2. Technical Specifications

Frequency Range: 0.1 Hz - 100 kHz (6 decades)
Waveforms: Sine, square, triangle
Output Voltage: 0-10 Vpp open circuit, 0-5 Vpp into 600 ohms
Output Impedance: 600 ohms +/- 2%
DC Offset: Adjustable +/- 5 V
Symmetry: 10-90% adjustable for square/triangle
Sine Distortion: < 1% at 1 kHz
Frequency Accuracy: +/- 5% of scale
TTL Output: 0-5 V square wave
Power: 110/220 V AC, 50-60 Hz, 10 VA
Dimensions: 260 x 160 x 80 mm, Weight: 2.5 kg

3. Controls

Front panel controls:

- Frequency range switch: 6-position rotary switch (0.1-1-10-100-1k-10k-100k Hz)
- Frequency fine adjust: Continuous potentiometer with calibrated dial
- Waveform selector: Sine/Square/Triangle
- Amplitude control: Continuous, 0-10 Vpp
- DC Offset control: +/- 5 V
- Symmetry control: 10-90%
- Output BNC (600 ohm)
- TTL output BNC (0-5 V)
- Ground terminal

4. Circuit Description

The PM 5175 consists of the following functional blocks:

1. Power Supply: Transformer-based linear supply providing +15V, -15V and +5V.

2. Oscillator Section: A Schmitt trigger generates a square wave. The frequency is determined by an RC network selected by the range switch. The fine frequency control varies the threshold voltages of the Schmitt trigger.

3. Triangle Generator: The square wave is integrated to produce a triangle wave.

4. Sine Shaper: A diode shaping network converts the triangle wave to a sine wave by progressively clipping the amplitude at different levels, approximating a sine curve.

5. Output Amplifier: A buffer amplifier with adjustable gain provides the output signal. A DC offset voltage can be added to shift the signal.

6. TTL Output: A separate comparator provides a 0-5V square wave for digital circuits.

5. Calibration

Equipment needed: Oscilloscope, frequency counter, multimeter.

Frequency calibration:
1. Set range to 1 kHz, adjust fine control to mid-range.
2. Connect frequency counter to TTL output.
3. Adjust trimmer C22 for exactly 1 kHz.

Output level calibration:
1. Set to sine, 1 kHz, output to maximum.
2. Connect 600 ohm load to output.
3. Trim R45 for exactly 5 Vpp on oscilloscope.

Sine distortion calibration:
1. Set to sine, 1 kHz, 1 Vpp output.
2. Monitor with distortion analyzer.
3. Adjust diode bias trimmer for minimum distortion (< 1%).

6. Troubleshooting

No output: Check power supply voltages (+15V, -15V, +5V). Check fuse F1.
Distorted sine: Diodes D1-D4 in shaping network may be faulty. Adjust bias.
No square wave: Check Schmitt trigger IC (741 or discrete).
Frequency drift: Check RC timing components. Clean range switch contacts.
No TTL output: Check comparator IC.
Hum on output: Check power supply filter capacitors C1-C4 (replace if old).

7. Parts List

Main ICs:
IC1: uA741 or LM301 opamp (Schmitt trigger)
IC2: uA741 opamp (integrator/triangle)
IC3: uA741 opamp (output buffer)
IC4: 741 or discrete comparator (TTL output)

Diodes: D1-D6: 1N914/1N4148 (sine shaper)
Transistors: BC107/BC108 or similar

Full parts list and PCB layout available in the complete service manual.