FLUKE®

Technical Data

# Function Generators

## PM 5136: 5 MHz

- **High performance at a budget price**

## PM 5138A: 10 MHz

- **Output voltage of 40 Vpp**

## PM 5139: 20 MHz

- **24 Arbitrary waveform-memories**

*Fluke PM5136, PM5138A, PM5139 Synthesized Function Generators with arbitrary waveform*

**PM 5136**
- High performance at a budget price
- Frequency range from 0.1mHz to 5MHz (20Vpp)
- High accurate signals, low distortion
- In practice proved mechanical and electronic design
- Large backlit display and easy menu controlled operation
- Continuously variable symmetry
- 7 Standard waveforms: sine, triangle, square, pos/neg pulse, pos/neg/ sawtooth
- Internal and external modulation modes: AM, FM, Lin. Sweep, Log. Sweep and Burst
- 9 Setting memories
- GPIB/IEEE 488.2 interface (optional)

**PM5138A** *as PM5136, incl.:*
- Output voltage of 40 Vpp for all waveforms, including arbitrary
- Frequency from 0.1 mHz to 10 MHz
- 24 Arbitrary waveform–memories
- Arbitrary functionality supported via AnyWave™ software package
- AnyWave™ software included
- 9 additional setting memories to store frequently used settings
- Arbitrary–waveforms, Gate and PSK modulation
- Selectable output impedance, 50Ω or 600Ω
- GPIB or RS 232 interface (optional)

**PM5139** *as PM5138A, incl:*
- Frequency from 0.1 mHz to 20 MHz. *(20Vpp)*
- 10 Standard waveforms including sine and trainle pulses, haversine
- Programmable modulation frequencies
- Low output impedance $Z_O$.

**Wide range of applications**
These top–value generators, built on years of experience, combine high precision with easy operation, making it the ideal choice for a wide range of applications like automotive, mechanical, calibration, telecom, audio, component–testing, medical, education and training. Applications that require higher frequencies are perfectly suited for the PM5139, while the PM5138A is extremely usefull when higher output voltages are required. This higher output, 40 Vpp, available for the complete bandwidth up to 20 MHz and also for the 24 arbitrary waveforms, makes this instrument ideal for tranducer simulation up to 14 Vrms for the automotive industry.

**Simple, menu–controlled operation**
To change a setting, all that's needed is to make a selection from the 5–line menu and operate the corresponding buttons. Specific functions can be accessed directly via control buttons which are conveniently located in a separate field. For example: store or recall of instrument–settings. Numeric values are set precisely by a large rotary control (which can be disabled to secure the setting). At all times, you get a clear indication of the instrument setting by the large backlit LCD display.

**Accurate setting of modulation parameters**
Modulation parameters such as modulation depth, deviation, number of cycles and start/stop phase can be set with high accuracy. The modulation/trigger source is programmable with a wide frequency range of 1 mHz to 100 kHz, and an accuracy of 0.1%. The sweep parameters $f_{start}$, $f_{stop}$, time, lin/log and sweep mode are independently programmable.

**Versatile modulation mode selection**
Modulation modes such as AM, FM and sweep are selected from the modulation mode menu. All waveforms can be modulated, even the user–defined arbitrary waveforms. The burst mode can be triggered via the internal modulation/trigger source or via the external modulation input. Bursts may also be manually triggered by a front panel key. The single–shot mode in burst can be used with all waveforms, including arbitrary.

**Arbitrary waveform function via GPIB/IEEE–488 / RS232 link**
Both the PM 5138A and PM 5139 with GPIB/IEEE–488 or RS232 installed, provide the arbitrary waveform capability, a powerful aid to the generation of custom test signals.

**Application example:**
In mechanical vibration analysis, such as shock testing, a DSO can capture the output of an accelerometer and transfer the vibration waveform either to a PC for modification or directly to the PM 5138A or PM 5139 to reproduce it when needed, without having to repeat the actual experiment. The waveform can then be sent continuously, as a burst for a defined number of cycles, or when triggered by an external source.

| Model | PM 5136 | PM 5138A | PM 5139 |
|---|---|---|---|
| ***Frequency characteristics*** | | | |
| Nominal Range | 0.1 mHz – 5 MHz | 0.1 mHz – 10 MHz | 0.1 mHz – 20 MHz |
| Operational Range | | | |
| Sine, pos/neg pulse | 5 MHz | 10 MHz | 20 MHz |
| Square wave | 5 MHz | 10 MHz | 20 MHz |
| Triangle | 500 kHz | 500 kHz | 500 kHz |
| Pos./neg. sawtooth | 20 MHz | 50 kHz | 50 kHz |
| Sine … , triangle pulse | | | 50 kHz |
| Haversine | | | 50 kHz |
| Resolution | 4_ digits, max. 0.1 mHz | | |
| | 10 Hz ($f_C$>200kHz)*3 | | |
| Setting error | ± 2 x $10^{-6}$ (± 2 ppm) | | |
| Residual FM deviation (measuring bandwidth 10Hz–20kHz) | | ($f_C$≥5MHz) <10ppm, 1ppm typical | ($f_C$>10MHz) <10ppm, 1ppm typical |
| | <100Hz, 13Hz typical | ($f_C$≤5MHz) <100Hz, 13Hz typical | ($f_C$≤10MHz) <100Hz, 13Hz typical |
| Phase noise at 1kHz distance from carrier | < –80dBc/Hz | | |
| Temperature coëfficient | <±0.2ppm / K | | |
| Aging | <±1ppm / year | | |
| Drift | <±0.3ppm in 7 hours | | |
| Synchronization by an external reference | $f_{REF}$=10MHz/N, N=1, 2, 3...10 | | |
| ***Output characteristics*** | | | |
| **Main Output** | | | |
| Connector BNC socket | On front | | |
| Impedance | 50Ω | 50Ω or 600Ω | 50Ω or LOW $Z_O$ |
| Load capability | Short circuit proof | | |
| Max. external voltage | ±15V < 3min | 50Ω: ±15V | 50Ω: ±15V < 3min |
| | | 600Ω: ±24V | LOW $Z_O$ : ±12V < 3min |
| **AC voltage** | independent of DC setting within: …. | | |
| Ranges | ± 10V window | ± 20V window | ± 10V window |
| I resolution 1 mV | 0 – 0.200 Vpp | 0 – 0.400 Vpp | 0 – 0.200 Vpp |
| II resolution 10mV | 0.20 – 2.00 Vpp | 0.40 – 4.00 Vpp | 0.20 – 2.00 Vpp |
| III resolution 100 mV | 2.0 – 20.0 Vpp | 4.0 – 40.0 Vpp | 2.0 – 20.0 Vpp |
| Accuracy for AC voltages Basic setting error *2 | > 10mVpp | > 20mVpp | > 10mVpp |
| | ±2.0%, 1Hz < $f_C$ < 200kHz | | |
| Amplitude flatness *2 | | | |
| $f_C$: 1Hz–200kHz | ±0.03dB | ±0.03dB | ±0.03dB |
| $f_C$: 200kHz –5MHz | ±0.07dB | ±0.07dB | ±0.07dB |
| $f_C$: 5MHz –10MHz | | ±0.1dB | ±0.1dB |
| $f_C$: 10MHz –20MHz | | | ±0.2dB |
| **DC voltage** | independent of AC setting within: … | | |
| | ± 10V window | ± 20V window | ± 10V window |
| Range (open circuit) | ±10V resolution 100mV | | |
| Error limits *2 | ±2.0% ±50mV | ±2.0% ±100mV | ±2.0% ±50mV |
| **TTL Output 0/5V, $Z_O$=50Ω** Fan–out | BNC on rear panel > 4 TTL inputs | | |

| Model | PM 5136 | PM 5138A | PM 5139 |
|---|---|---|---|
| ***Waveforms*** | | | |
| Asymmetrie | | | |
| $f_C \leq$ 20kHz | 1% – 99%, resolution 1% | sine, square, triangle, pos./neg. pulses | |
| $f_C$ : 20kHz – 5MHz | 20% – 80%, resolution 1% | square, pos./neg. pulses | |
| **Sinewave** | | | |
| Frequency range | 0.1 mHz – 5 MHz | 0.1 mHz – 10 MHz | 0.1 mHz – 20 MHz |
| Output range open circuit | 0 – 20 Vpp | 0 – 40 Vpp | 0 – 20 Vpp |
| Distortion for output voltages and frequencies | 10–70% of voltage range maximum*2 1Hz – 500kHz | 25–100% of voltage range maximum*2 1Hz – 500kHz | 10–70% of voltage range maximum*2 1Hz – 500kHz |
| Total harm.distortion | < 0.4%, 0.1% typical | < 0.4%, 0.1% typical | < 0.4%, 0.1% typical |
| Harmonics fc:1Hz – 500kHz | <–48dBc | <–42dBc | <–48dBc |
| Harmonics fc:500kHz–5MHz | <–40dBc | <–34dBc | <–40dBc |
| Harmonics fc:5MHz–10MHz | | <–30dBc | <–36dBc |
| Harmonicsfc:10MHz–20MHz | | | <–34dBc |
| Subharmonics fc < 5MHz | <–60dBc | <–60dBc | <–60dBc |
| Subharmonics fc > 5MHz | | <–38dBc | <–38dBc |
| **Square, Positive / Negative Pulses** | | | |
| Frequency range | 0.1 mHz – 5 MHz | 0.1 mHz – 10 MHz | 0.1 mHz – 20 MHz |
| Output range open circuit | 0 – 20Vpp | 0 – 40Vpp | 0 – 20Vpp |
| **Pos/Neg. pulse open circuit** | 0 – 10 Vpp | 0 – 20 Vpp | 0 – 10 Vpp |
| Rise–/Fall time (at 50 % symmetry)*2 | | | |
| $f_C$: 0.1 mHz – 500 kHz | ≤ 30 ns | | |
| $f_C$ > 500 kHz | ≤ 20 ns | | |
| Aberration *2 | < 2% (AC > 200 mVpp) | | |
| Asymmetry | See Waveforms | | |
| **Triangle** | | | |
| Frequency range | 0.1 mHz – 500 kHz | | |
| Output range | 0 – 20 Vpp | 0 – 40 Vpp | 0 – 20 Vpp |
| Linearity error | < 0.2% ($f_C$<20 kHz) | | |
| Asymmetry | See Waveforms | | |
| **Positive / negative sawtooth** | | | |
| Frequency range | 0.1 mHz – 50 kHz | | |
| Output range | 0 – 10 Vpp | 0 – 20 Vpp | 0 – 10 Vpp |
| Linearity error | <0.2% ($f_C$ < 20kHz) | | |
| **Sine pulse, triangle pulse, haversine** | | | |
| Frequency range | | | 0.1 mHz – 50 kHz |
| Output range | | | 0 – 10 Vpp |
| **Arbitrary** (Instruments with interface) | | | |
| Frequency range | | 0.1 mHz – 20 kHz | |
| Sample frequency | | max. 20.48 MS/s | |
| Waveform memories | | 24 (non volatile) | |
| Memory length | | 1024 (10 bits) | |
| Vertical resolution | | 1023 (10 bits) | |
| Programmable | | via interface with a PC or direct with a DSO | |
| Full scale output range | | 0 – 40Vpp open circuit | 0 – 20Vpp open circuit |

| Model | PM 5136 | PM 5138A | PM 5139 |
|---|---|---|---|
| **Modulation** | | | |
| Modes | AM, FM, Burst, Sweep | AM, FM, Burst, Sweep, Gate, PSK | |
| **AM** | | | |
| **Carrier frequency** | 0.1 mHz – 5 MHz | 0.1 mHz – 10 MHz | 0.1 mHz – 20 MHz |
| Carrier waveforms | All | All incl. arbitrary*1, except PSK | |
| **Internal AM** | | | |
| Modulation frequency | 1 kHz ± 0.01% | 10 Hz – 100 kHz, max. resolution 1 Hz ± 0.1% | |
| Modulation waveform | Sine | | |
| **Modulation Depth** | 0–100%, resolution 1% | | |
| Mod. depth: ≤ 90% | <0.5%, <0.15% typical | | <0.7%, |
| ≤ 90% and $f_C$ ≤ 15MHz | | | <0.5%, <0.15% typical |
| ***External AM*** | | | |
| Modulation frequency | 0 to 200 kHz | | |
| **Modulation Depth** | 0–100% | | |
| Mod. depth: ≤ 90% | <0.5%, <0.15% typical | | <0.7%, |
| ≤ 90% and fC ≤ 15MHz | | | <0.5%, <0.15% typical |
| *with (.. Ω) output impedance of modulation signal source | | | |
| **FM** | | | |
| Carrier frequency | 0.1 mHz – 5 MHz | 0.1 mHz – 10 MHz | 0.1 mHz – 20 MHz |
| Carrier waveforms | All | All incl. arbitrary*1, except PSK | |
| **Internal FM** | | | |
| Modulation frequency | 1 kHz ± 0.01% | 10 Hz – 100 kHz, max. resolution 1 Hz ± 0.1% | |
| Modulation waveform | Sine | | |
| Deviation | 0 – 2 % resolution ± 0.01% | | |
| Modulation distortion, | <0.4%, typ. 0.12% | | |
| THD | for 1% deviation | | |
| ***External FM*** | | | |
| Modulation frequency | 10 Hz to 200 kHz | | |
| **Deviation** | 0 – 2 % | | |
| **Phase Shift Keying (PSK)** | Carrier phase keying between 0° and 180°, non-coherent | | |
| Carrier waveforms | | Sine, triangle, square | |
| Carrier frequency range | | Total range | |
| **PSK, internal** keying freq. | | 10Hz – 100kHz, 50% duty cycle | |
| **PSK, external** keying freq. | | 0 – 200kHz, TTL signal | |
| **Burst** | | | |
| Carrier frequency | 0.1 mHz – 2 MHz | | |
| Carrier waveform | All, phase-coherent on/off – switching | | |
| On periods per Burst | 1 – 2000 | | |
| Start/Stop – Phase | 0° | 0°<br>–180° ...+180°, resolution 1° for sine, triangle and $f_C$ ≤ 20kHz | |
| ***Burst trigger modes*** | | | |
| Internal (Manually) | Single & Continuous with 1kHz ± 0.01% rep. freq | Single & Continuous with 1mHz – 100kHz repetition frequency | |
| External via Mod. input | with 0 – 200kHz repetition frequency | | |

| Model | PM 5136 | PM 5138A | PM 5139 |
|---|---|---|---|
| ***Sweep*** | | | |
| Carrier waveform | All | | |
| Sweep functions | Single<br>Continuous<br>Hold/Release<br>Reset to start frequency | | |
| Sweep characteristics | Linear or logarithmic<br>Up or down | | |
| Sweep modes | Sweep and flyback<br>Sweep and hold<br>Sweep from $f_{start}$ to $f_{stop}$ and back to $f_{start}$ | | |
| Sweep ranges max. | 1mHz – 5MHz | 1mHz – 5MHz<br>50kHz – 10MHz | 1mHz – 10MHz<br>50kHz – 20MHz |
| Sweep time | 10ms – 1000s | | |
| Number of frequency steps | Sweep time / 1ms | | |
| **Gate** | Non–coherent signal keying | | |
| Carrier frequencies | | All | |
| Carrier waveforms | | All | |
| **Gate, internal** | | | |
| Keying frequency | | 10Hz – 100kHz | |
| Duty cycle | | 50% | |
| **Gate, external** | | | |
| Keying frequency | | 0 – 200kHz, TTL signal | |
| ***Interface bus remote control*** | | | |
| Isolation | in– and outputs galvanically separated with opto–couplers | | |
| Control capability | all functions and characteristics | | |
| GPIB/IEEE–488.2 | Address range 0 – 30 and listen only mode | | |
| RS232 | | | |
| Baud rate / data ../ stop bits | | 110–19200 / 7 or 8 / 1 / odd, even or no parity | |
| Handshake | | hardware or software (Xon/Xoff) | |
| ***Miscellaneous*** | | | |
| **Instrument settings** | 1 + 9 | | |
| Rear connectors | modulation input / triggering input / reference input / TTL output / modulation output / penlift output / sweep output / 10 MHz reference output / interface bus connector *1 / power connector | | |
| Dimensions (HxWxD) | 105 x 315 x 405 mm | | |
| Weight | 6.7 kg | 6.1 kg | 6.7 kg |
| ***Operating conditions*** | | | |
| Temperature | Reference 23°C ± 1°C, Operating + 5 .. +40°C Storage –40 .. +70°C | | |
| Safety | According to CE regulation 73/23: EN 61010–1, CAT II, Pollution Degree 2 | | |
| EMC | According to CE regulation 89/336:<br>Emission according to EN 55 011 Group 1 Class B, respectively CISPR 11.<br>Immunity according to EN 50 082–1, inclusive IEC 801–2, –3, –4. | | |
| Power / line frequency | 100,120,220,240V / 50 – 60 Hz ± 5% | | |
| Power consumption | 42W | 66W | 58W |

*1 Instruments with GPIB/IEEE 488.2 or RS232 interface

*2 Zo=50Ω, Rl=50Ω, Modulation off

*3 Via GPIB interface

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## *Ordering Information*

PM 5136/00n 5 MHz Programmable Function Generator
PM 5136/02n 5 MHz Programmable Function Generator with GPIB/IEEE 488.2 interface

PM 5138A/10n 10 MHz Programmable Function Generator
PM 5138A/12n inclusive GPIB/IEEE–488.2 interface and Arbitrary
PM 5138A/13n inclusive RS232 interface and Arbitrary

PM 5139/00n 20 MHz Programmable Function Generator
PM 5139/02n inclusive GPIB/IEEE–488.2 interface and Arbitrary
PM 5139/03n inclusive RS232 interface and Arbitrary.

**Power options**
n = 1 Universal European 220 V
n = 3 Standard North American 120V
n = 4 United Kingdom 240 V
n = 5 Switzerland 220 V
n = 8 Australia 240 V

**Accessories**
PM 9051 BNC to 4 mm banana adapter
PM 9551 50 ohm to 600 ohm Adapter
PM 9581/01 50 ohm feed–through termination 3 W
PM 9585/01 50 ohm feed–through termination 1 W
Y8021 Shielded DEEE–488 Cable, 1m
Y8022 Shielded DEEE–488 Cable, 2m
Y8023 Shielded DEEE–488 Cable, 4m
PM 9564 19 inch Rackmount kit for PM5136/38A/39

**Factory Warranty**
One year product warranty

**Manuals**
Operators Manual included with instrument

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