Sensitivity 1mV (fsd) to 300V
Bandwidth 2 Hz...12 MHz
High accuracy up to 1% fsd ± 1% of reading
140dB CMRR at 50 Hz (1mV range)
DC recorder output or AC output

Wide bandwidth AC millivoltmeter PM 2554

PM 2554 combines good accuracy with an extremely wide bandwidth (12 MHz) and voltage range (100μV-300V). It is therefore ideal for all measurements from audio frequencies to the HF and beyond. All ranges are protected from overloads of up to 300V_{RMS} (400V_{DC}). Mains voltage variations of ± 10% give no more than 0.1% change in accuracy.

TECHNICAL SPECIFICATION

Measuring ranges
0-300V_{RMS} in 12 ranges from 0–1mV to 0–300V dB scale ranging from −80dB to +52dB (0dB = 1mV into 600Ω)

Frequency range
2 Hz–12 MHz

Input
Floating
Input impedance 1 MΩ//33pF
Max. voltage low-ground 500V_{peak}
Impedance low-ground 1GΩ/1.4nF
For reduction of capacitive loading, PM 2554 can be used with PM 8925 Oscilloscope Probe, input impedance 10 MΩ//11pF
Common mode rejection 140dB at 1kHz in 1mV range
120dB at 100kHz in 1mV range.

Accuracy
1% f.s.d. + 1% of reading
Additional error for frequencies outside flat part of bandwidth – see graph.

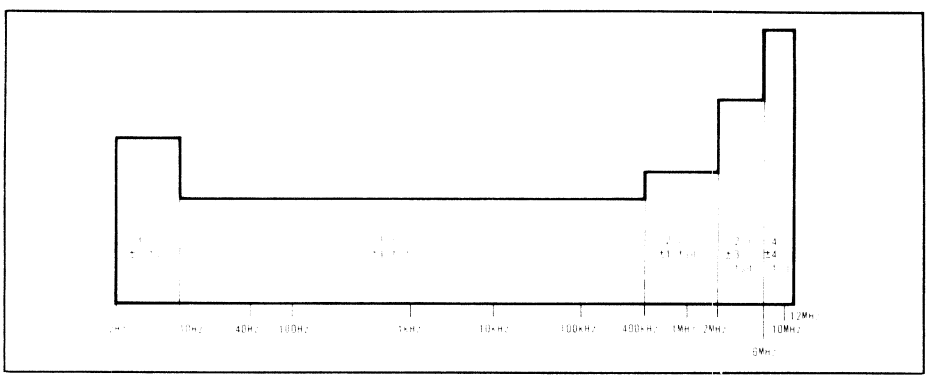
Stability
A line voltage variation of ± 10% will give an additional error of 0.1% max.
Long term stability ± 0.1% over 90 days

Noise
At short-circuited input < 30μV.
Influence of noise on measuring accuracy less than 0.5% at 10% of full scale deflection.

Overload
Protected against overloads up to 300V_{RMS} or 400V_{DC}

Measuring system
Measurement: average value
Reading: RMS value for pure sine wave

Recorder output
DC voltage: 1V at full scale
Output impedance 1kΩ
Accuracy as specified for voltmeter



AC output
Output impedance 600Ω in serial with 47μF
Output voltage 50mV
Short-circuit proof

Supply
Mains: 90V...132V or 180V...265V; 50/60Hz

Temperature range
Reference temp. 23°C ± 5°C
Rated rage of use 0°C...45°C
Temperature coefficient 0.1%/°C

Dimensions and weight
(w x h x d) 236 x 145 x 298 mm
(9.3 x 5.7 x 11.7-in)
3.5kg (7.7lb.)

ACCESSORIES

Supplied with instrument
Mains Connection Cable
Measuring cable
Manual

Optional
PM 9072 Measuring cable Banana, BNC, 135Ω
PM 8925 Passive probe 10:1
PM 9051 Adapter BNC-Banana

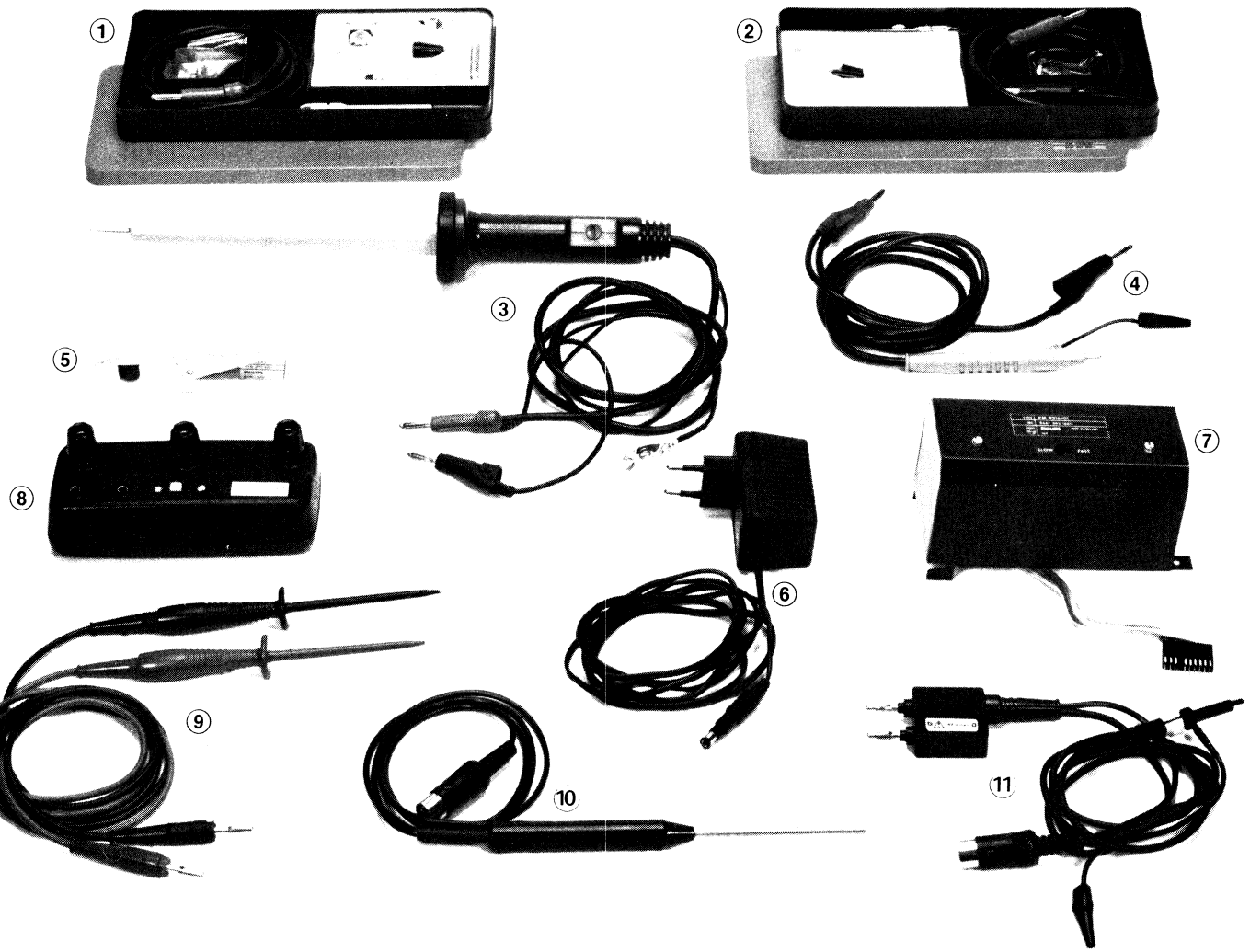
Multimeter Accessories

● Included in delivery 0 optional			PM 2434	PM 2502	PM 2504	PM 2505	PM 2517	PM 2521	PM 2522A	PM 2524	PM 2527	PM 2528	PM 2554	For details see
Measurements cables	PM 9071	Banana–Banana 135Ω	0		0	0	0	0	0	0	0	0		p 62
	PM 9072	Banana–BNC 135Ω	0		0	0	0	0	0	0	0	0	0	p 62
	PM 9074	BNC–BNC 50Ω											0	p 62
	5322 320 14093	BNC–Banana											●	
Adapters	PM 9051	Adapter BNC–Banana											0	p 62
	PM 9053	Adapter Banana–BNC	0		0			0	0	0	0	0	0	p 62
	PM 9061	Adapter BNC–BNC											0	p 62
	PM 9067	T–piece BNC											0	p 62
Test leads	PM 9260	Pair of testleads	●	●	●	●	●	●	●	●	●	●		p 167
	5322 321 20506	4–wire-testleads										●		
	5322 321 24376	measuring cable									●	●		
Probes	PM 8921	1:1 passive probe											0	p 56
	PM 9326	10:1 passive probe											0	p 56
	PM 9263	Hold probe					0	0	0			0		p 168
HF accessories	PM 9258	HF option										0		PM 2528
	PM 9210	HF probe	0		0	0	0	0	0	0				p 167
	PM 9211	HF probe set (linear)									0	0		p 167
	PM 9212	Accessory set for PM 9210	0		0	0	0	0	0	0				p 167
	PM 9213	Low cost HF probe	0		0	0	0	0	0	0				p 167
HT probe	PM 9246	30kV probe	0	0	0	0	0	0	0	0	0	0		p 168
Peak voltage	PM 9259	Peak voltage option										0		PM 2528
Temp. probes	PM 9249	Temp. probe						0				0		p 168
	PM 9248	Temp. probe −60...+200°C					0		0	0	0			p 168
	PM 9257	Temp. option									0			
Current accessories	PM 9244	30A shunt	0	0		0	0	0	0	0	0	0	0	p 168
	PM 9245	100A transformer		0	0	0	0	0	0	0	0	0		p 168
	PM 9101	DC current probe	0	0	0	0	0	0	0	0	0	0		p 168
Supply units	PM 9216	Rechargeable batt. unit							0	0				p 168
Mains supplies	PM 9218	Mains adapter			0		0							p 167
	PM 9111	Mains adapter				0								p 168
Ever-ready cases	PM 9672	Carrying case							0	0				p 168
	PM 9278	Ever-ready case		0		0	0							p 168
Rack mount	PM 9669/01	Rack mount unit							0	0				
	PM 9669/03	Rack mount unit									0	0		
Parallel interfaces	PM 9237	BCD output									0			
	PM 9292	BCD output										0		p 168
	PM 9220	50 pole cable									0	0		p 168
Serial interfaces	PM 9238	Bus-line interface									0			p 168
IEC-625	PM 9280	Bus-line cable									0	0		
	PM 9282	Bus-line cable									0	0		
	PM 9291	Bus-line interface										0		p 168
Analog outputs	PM 9255	Analog output									0			p 168
	PM 9254	Analog output										0		p 168
Mains cables	PM 9011	Mains cable Europe	●					●	●	●	●	●		
	5322 231 14001	Mains cable Europe											●	

Technical specifications for PM 9210, PM 9211, PM 9212 and PM 9213

	PM 9211	PM 9211 + att.	PM 9210	PM 9210 + PM 9212	PM 9213
Frequency range	100kHz-1GHz	100kHz-1GHz	100kHz-1GHz	100kHz-1GHz	10kHz-100 MHz
Straight line within 5%	100kHz-6 MHz	100kHz-6 MHz	100kHz-6 MHz	100kHz-6 MHz	30kHz-30 MHz
Max. deviation	3dB	3.5dB	3dB	3.5dB	3dB
Voltage ranges (f.s.)	2mV-2V	2V-200V	*150mV-15V	15V-200V	10mV-15V
Max. voltage AC	30V	200V	30V	200V	30V
Max. voltage DC	200V	500V	200V	500V	350V
Input capacitance	2pF	2pF	2pF	2pF	40pF
T-piece	Included in delivery		Optional in PM 9212		Not available
Frequency range	100kHz-1.2GHz			100kHz-1.2GHz	
Impedance	50Ω			50Ω	
Standing wave ratio	1.25 at 700 MHz	1.15 at 1GHz		1.25 at 700 MHz With attenuator 1.15 at 1GHz	

* using calibration chart below 150mV



① **HF probe PM 9211.** Provides instruments with an increased frequency range of 100kHz to 700 MHz for measuring voltages between 2mV and 200V.

② **HF probe PM 9210.** Provides instruments with increased frequency range of 100kHz to 700 MHz for measuring voltages between 150mV and 15V.

③ **HT probe PM 9246.** Allows measurement of DC-voltage up to 30kV.

④ **HF probe PM 9213.**

⑤ **Current transformer PM 9245.** Extends the AC current ranges to 100A.

⑥ **Battery eliminator PM 9218.** Provides mains operation for the PM 2504, PM 2517.

⑦ **Rechargeable battery supply PM 9216,** for the PM 2522A and PM 2524. Plugs into a cavity at the rear of the instrument and provides 8h mains-independent operation.

⑧ **Current shunt PM 9244.** Extends the AC/DC current ranges to 31.6A.

⑨ **Test leads and test pins PM 9260.** Highly flexible (512 wires). Silicone rubber insulation for temperatures between −100°C and +300°C. Test voltage 4kV; specified for 1kV.

⑩ **Temperature probe PM 9248** for temperature measurements between −60°C and +200°C.

⑪ **Data hold probe PM 9263.**

Multimeter accessories

PM 9101 DC Current probe
Clip on probe for DC and AC current measurements up to 200A.
- Output voltage 1mV/A
- Recommended load ≥ 3k
- Accuracy 2% up to 100A
  3% 100A...200A
  for DC to 1kHz
- Max. voltage to ground 250 V_{RMS} or 350Vp
- Power requirements 4x "AA" batteries or 9V mains adapter e.g. PM 9218

PM 9111 Mains adapter
Provides mains operation for PM 2505
- Mains voltage 220V ± 10%

PM 9216 Rechargeable battery unit
For mains independent use of multimeters PM 2522A and PM 2524.
The unit plugs into a cavity at the rear of the multimeter.
- Operating time 6h for PM 2522A
  4h for PM 2524
- Recharging time 15 hours via power supply of the multimeters

PM 9218 Mains adapters
Provides mains operation for PM 2517 and PM 2504.
- Mains voltage
  220V ± 10% for A version
  110V ± 10% for Q version
  240V ± 10% for G version

PM 9237 and PM 9292 BCD parallel output
- Output isolated from input up to 250V_{RMS}
- System: Word parallel – bit parallel
- Code: positive BCD
  0'' = 0...+0,4V, "1" =5 or +15V
- Output data:
  measuring result including overload and range indication, parameters and polarity
- "Print command":
  500μs output pulse
- Start command:
  With negative pulse of 15μs...100ms

PM 9238 IEC-625 Busline interface
Interface functions:
- T5: Talker capability with serial poll, talk only and automatic unaddress facility
- L4: Listener capability with automatic unaddress facility
- SR1: Service request capability
- DT1: Device trigger capability

Output data: Parameters measured
Measuring range
Polarity and measuring data
Input data: Start command

PM 9244 DC and AC Current shunt
- Ranges: 10A and 31.6A
- Output voltage: 100mV output or 31.6mV at choice
- Accuracy: for DC and AC up to 1kHz
  1% for 100mV output; 2% for 31.6mV output
- Max. voltage to ground: 400$V_{DC\ or\ AC}$

PM 9245 AC Current transformer
- Range 10A to 150A
- Transfer factor 1000x
- Accuracy at 50 Hz + 0.5% for 40 Hz to 10kHz ± 2%
- Max. voltage to ground: 400$V_{AC\ or\ DC}$

PM 9246 High tension probe
For measurement of DC Voltage up to 30kV. The probe may be used with instruments having 100 MΩ, 10 MΩ or 1.2 MΩ input resistance.
- Max. input voltage 30kV
- Attenuation 1000x
- Input impedance 600 MΩ
- Accuracy 3% at 100 MΩ or 10 MΩ input impedance; 5% at 1.2 MΩ input impedance, both ± 6ppm/V

PM 9248 and PM 9248A Temperature probe
PM 9248 is a contact probe suitable for measurements of surface temperatures.
PM 9248A is an indentical probe for measurements of liquids.
- Temperature range −60 to +200°C
- Resolution 0.1°C
- Accuracy including instrument specification
  − 60...+100°C ± (1% rdng + 2°C)
  +100...+200°C ± (3% rdng + 2°C)
- Max. voltage on probe tip 60V

PM 9249 Temperature probe
For measurement of surface temperatures and of liquids
- Temperature range −60 to +200°C
- Resolution 0.1°C
- Accuracy excluding multimeter specification: (0.5% rdng + 0.5°C)

PM 9254 Analog output
- Output isolated from input up to max. 250V_{RMS}
- Output voltage 1mV/digit over a maximum of 3 digits that can be selected at choice
- Output resistance 200Ω
- Accuracy ± (0.2% rdng + 0.1 rng) excluding voltmeters

PM 9255 Analog output
- Output isolated from input up to max. 250V_{RMS}
- Output voltage 2V at end of range
- Resolution, steps of 1mV
- Output resistance 200Ω
- Accuracy ± (0.2% rdng + 0.1% rng) excluding voltmeters

PM 9263 Data hold probe
For use in combination with multimeters having data hold facilities on the DIN probe input. A switch on the probe is pushed forward to hold the data in the display.
- Max. input voltage 30V_{RMS} (test voltage 500V_{AC})
- Max. input current 200mA
  Several probe tip adapters are supplied with the probe.

PM 9672 Carrying case
For use with the multimeters PM 2522A and PM 2524

PM 9278 Ever-ready case
Sturdy shock resistant case of plastic with paddings on the inside for shock absorption and space for accessories.

PM 9291 IEC-625 Busline interface
Interface funtions:
- T5: Talker capability with serial poll, talk only and unaddress if MLA
- L4: Listener capability with unaddress if MTA
- SR1: service request capability
- RL1: Remote-local capability
- DT1: Full device trigger capability

Output data: Parameter measured,
Measuring range
Polarity and measuring data
Input data: Parameter to be measured
Range
Measuring mode
Start command

PM 2521/22 Rechargeable battery version
This battery version has all the features of the standard PM 2521 + the facility of 3 hours mains independant operation on a built-in rechargeable battery. A battery low indication warns user of low battery state (± 3h). Recharging is via the instruments own mains supply in 18 hours.
Overcharging is not possible. A trickle-charge circuit keeps batteries on level during use with mains supply.

Unit	Description	Frequency	Special features	Page
Introduction				170
PM 5107	Sine/square RC oscillator	10 Hz...100kHz	$2V_{RMS}$ output Very low distortion	172
PM 5109	Sine/square RC oscillator	10 Hz...100kHz	$10V_{RMS}$ monitored symmetrical and asymmetricyal output	173
PM 5109S	Sine/square RC oscillator	10 Hz...100kHz	$10V_{RMS}$ monitored asymmetrical output	173
PM 5108L	Function generator	1 Hz...1 MHz	Sine/square/triangle with 50Ω and 600Ω output and output meter	175
PM 5131	Function generator	0.1 Hz...2 MHz (logarithmic)	Sine/square/triangle with $30V_{p-p}$ output	176
PM 5132	Function generator	0.1 Hz...2 MHz (linear)	Sine/square/triangle/ pos. pulse/neg. pulse, DC	178
PM 5133	Function generator	0.01 Hz...2 MHz (log/linear)	Digital display for frequency and voltage	180
PM 5133S	Function generator	0.01 Hz...2 MHz (log/linear)	As PM 5133 plus special sweep according to DIN norms	180
PM 5134	Function generator	0.001 Hz...20 MHz	Sine/square/triangle/pulses/DC, Digital display, X-tal control mode	183
PM 5165	LF sweep generator	0.1 Hz...1 MHz	Digital frequency display 4-decade log internal sweep	186
PM 5171	Amplifier, AC/DC and linear/ log converter	DC...1 MHz	Amplifier plus AC/DC and linear/log conversion; dynamic range 80dB	187
PM 5190	LF synthesizer with μP control	0.001 Hz...2 MHz	Feather-touch keyboard frequency selection with LED indicator	188
PM 5190X	LF synthesizer with μP control	0.001 MHz...2 MHz	As PM 5190 plus enter facility	188

Introduction

Which low frequency instrument?
Even the most experienced technician needs to carefully analyze the performance of to-days' low frequency instruments before making a purchase. Frequency range, wave shapes, output voltage levels and impedances will probably head the selection list. Equally important will be duty cycle, availability of sweep facilities, DC offset and so on.

Then, the more sophisticated features associated with digital generators, such as remote control possibilities, may need to be considered.
All the major features applying to each of the instruments described in this chapter are grouped together in an easy-to-read chart, below, with the object of easing the decision-making process.
Some suggested applications for these instrument groups follow, with the object of further helping the reader in making the most suitable choice of a signal generator for a particular measurement problem. More detailed specifications appear in each individual instrument description.

Three groups
There are several basic concepts employed to produce specific performance features, which help to classify these instruments.

RC oscillators (frequently in the form of Wien Bridge) produce a virtually pure sine wave output, exhibiting very low distortion characteristics. Combined with an excellent cost/performance ratio, these factors make this group popular for service workshop use and education or training.

Voltage-controlled sine oscillators are normally employed to produce square and triangle outputs. In addition to sine waves, a feature of the VCO principle is the elimination of 'bounce' whilst maintaining a favourable distortion characteristic when compared with the Wien Bridge method. The term 'Function Generator' is normally applied to this group. A sweep mode is frequently required and this facility is provided on some function generators, either for external sweep control or with an internal sweep facility.

Function generators can be used therefore in a wide variety of applications, R&D labs, service workshops, education.
More sophisticated features are incorporated in low frequency digital generators (synthesizers) which offer very accurate frequency setting.
Very high frequency stability is derived from a basic crystal – controlled oscillator.

An important aspect of the digital concept is the programming facility, for applications in, say, fully automated systems, on modern production lines.

LOW FREQUENCY INSTRUMENTS SURVEY

Classification	Type no.	Freq. range	Output Vp-p	Waveforms						Variable duty cycle	DC-offset	Output characteristics			Sweep			
															linear		log	
				~	⎍	∧	⎍	⎍	DC			600Ω	50Ω	TTL	Int	Ext	Int	Ext
R-C oscillators	PM 5107	10 Hz...100kHz	6	●	●							●		●				
	PM 5109	10 Hz...100kHz	30	●	●							●	●	●				
	PM 5109S	10 Hz...100kHz	30	●	●							●	●	●				
Function generators	PM 5108L	0.1 Hz...1 MHz	20/4	●	●	●					●	●	●			●		
	PM 5131	0.1 Hz...2 MHz	30	●	●	●			●		●		●	●			●	●
	PM 5132	0.1 Hz...2 MHz	30/15	●	●	●	●	●	●	●	●	●	●	●	●	●		
	PM 5133	0.01 Hz...2 MHz	20	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	PM 5133S	0.01 Hz...2 MHz	20	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	PM 5134*	0.001 Hz... 20 MHz	20	●	●	●	●	●	●	●	●	●	●	●	●	●		
LF synthesizer	PM 5190**	0.001 Hz... 2 MHz	20	●	●	●					●		●	●				
Sweep generator	PM 5165	0.1 Hz...1 MHz	6	●	●	●					●		●				●	●
Amplifier/ converter	PM 5171	0 Hz...1 MHz																

* PM 5134 also provides X-tal and X-tal AM mode and FM
** PM 5190 IEC-bus compatible + ext. AM