AT5350/1 Dosimeter

X and gamma radiation standard dosimeter

Measurement accuracy ≤3%

Applications

- Ionization radiation metrology
- Low level current and charge measurement
- Physical research of photon radiation fields
- Clinical dosimetry
- Radiation therapy

Features

- The dosimeter can be graduated for the following units of measure: air kerma, air absorbed dose, water absorbed dose, exposure dose, ambient equivalent dose
- Delivered ionization chambers library is stored in the dosimeter non-volatile memory
- Extra chambers can be added to the library
- Integrated high-voltage source is provided for powering the ionization chambers with output voltage setting range of ± (1-500) V with a 1 V step
- Automatic correction of measurement results respecting the air density for unpressurized chambers according to the entered temperature and pressure values
- Automatic compensation of spurious input current
- Measurement units can be selected (Gy, Sv, R, A, C) according to the measured physical values
- Mathematical and logical processing of measurement results by 8 internal resident programs
- Up to 500 measurement results can be stored in the dosimeter memory for later review, processing and documenting
- RS232C interface and dedicated digital inputs/outputs

Ionization chambers

Cylindrical
(volume – 0.125 cm^3)
TM31010

Parallel-plane X-ray
(volume – 0.02 cm^3)
TM23342

Cylindrical
(volume – 30 cm^3)
TM23361

Thimble
(volume – 0.6 cm^3)
TM30010

Spherical
(volume – 1000 cm^3)
TM32002

AT5350/1 Dosimeter is a high accuracy class instrument with high functional capabilities. The dosimeter is composed of electrometer measurement unit (electrometer) and a set of ionization chambers of different volume, manufactured by PTW-Freiburg: 0.02; 0.125; 0.6; 30 and 1000 cm^3.

Measurement

- Air kerma rate for X radiation and gamma radiation
- Air kerma for X radiation and gamma radiation
- Air kerma of X-radiation and gamma radiation by numerical integration of the air kerma rate
- DC current
- Charge
- Charge by numerical integration of the current

AT5350/1 Dosimeter

Specification

DOSIMETER

AIR KERMA RATE MEASUREMENT

Measurement range with PTW-Freiburg ionization chamber

TM30010	TM23361	TM32002	TM31010	TM23342
0.6…300 mGy/min	0.012…6 mGy/min	0.4…200 µGy/min	0.003…1.5 Gy/min	0.02…10 Gy/min
0.06…30 Gy/min	1.2…600 mGy/min	0.04…3 mGy/min	0.3…150 Gy/min	0.002…1 kGy/min
6…300 Gy/min	0.12…2 Gy/min	—	30…500 Gy/min	0.2…10 kGy/min

Radiation Type: *X and gamma radiation*
Measurement relative error: *≤ ± 3%*

AIR KERMA MEASUREMENT

Measurement range with PTW-Freiburg ionization chamber

TM30010	TM23361	TM32002	TM31010	TM23342
0.1…5 mGy	2…100 µGy	0.05…2.5 µGy	0.5…25 mGy	3…150 mGy
1…500 mGy	0.02…10 mGy	0.5…250 µGy	0.005…2.5 Gy	0.03…15 Gy

Radiation Type: *X and gamma radiation*
Measurement relative error: *≤ ± 3%*

MEASUREMENT OF AIR KERMA BY NUMERICAL INTEGRATION OF AIR KERMA RATE METHOD

Measurement range with PTW-Freiburg ionization chamber

TM30010	TM23361	TM32002	TM31010	TM23342
0.1 mGy…300 Gy	2 µGy…6 Gy	0.05 µGy…150 mGy	0.5 mGy…1.5 kGy	3 mGy…9 kGy
10 mGy…30 kGy	0.2 mGy…600 Gy	5 µGy…3 Gy	50 mGy…150 kGy	300 mGy…900 kGy
1 Gy…300 kGy	20 mGy…2 kGy	—	5 Gy…1.5 MGy	—

Radiation Type: *X and gamma radiation*
Measurement relative error: *≤ ± 3%*

HIGH-VOLTAGE SOURCE

Range	Resolution	Accuracy ± (% of U_{nom} + % of U_F) [1]
± (1…500) V	1 V	0.2 + 0.1

[1] U_{nom} – *Nominal set voltage*
U_F – End range value
RMS Ripple Voltage: *≤ 50 mV*
Load Current: *≤ 50 µA*

ADDITIONAL FEATURES

Registered Energy	0.008...1.33 MeV [1]
Energy dependence:	
- In the following range: 0.03…1.33 MeV [1]	≤ ±5% with TM32002
- In the following range: 0.1…1.33 MeV [1]	≤ ±4% with TM30010, TM23361, TM31010
- In the following range: 0.03…0.1 MeV [1]	≤ ±6% with TM30010, TM23361, TM31010
- In the following range: 0.008…0.035 MeV [2]	≤ ±5% with TM23342
Units of Measurement	Gy, Sv, R, A, C [3]

[1] *X and gamma radiation*
[2] *X radiation*
[3] *According to selected operation mode*

PTW-Freiburg IONIZATION CHAMBERS USED [1]

TM23342	Parallel-plane X-ray chamber (0.02 cm^3)
TM30010	Thimble ionization chamber (0.6 cm^3)
TM23361	Cylindrical ionization chamber (30 cm^3)
TM31010	Cylindrical ionization chamber (0.125 cm^3)
TM32002	Spherical ionization chamber (1000 cm^3)
Connector Type	PTW, M-type
Library	The number of ionization chambers in the library - 20
Cable	Electrometric cable, 10 and 20 m length

1) PTW-Freiburg ionization chambers of other types or similar chambers with a separate metrological certification are allowed

INTERFACE FUNCTIONS

RS-232C	Data Transfer (Receive) speed: 75, 150, 300, 600, 1200, 4800, 9600 bit/s Selection of Parity mode and the number of stop bits
Programming Language	SCPI "Standard Commands for Programmable Instruments"

ELECTROMETER MEASUREMENT UNIT

DC CURRENT MEASUREMENT

Full scale	Resolution	Measurement Range	Accuracy ± (% of reading + counts)
100 pA	$1{\cdot}10^{-15}$ A	$1{\cdot}10^{-14}$ … $1{\cdot}10^{-13}$ A	0.5 + 5
		$1{\cdot}10^{-13}$ … $1{\cdot}10^{-10}$ A	0.5 + 1
10 nA	$1{\cdot}10^{-13}$ A	$1{\cdot}10^{-12}$ … $1{\cdot}10^{-8}$ A	0.25 + 1
1 µA	$1{\cdot}10^{-11}$ A	$1{\cdot}10^{-10}$ … $1{\cdot}10^{-6}$ A	0.1 + 1

CHARGE MEASUREMENT

Full scale	Resolution	Measurement Range	Accuracy ± (% of readings + counts)
100 pC	$1{\cdot}10^{-15}$ C	$1{\cdot}10^{-14}$ … $1{\cdot}10^{-13}$ C	0.5 + 5
		$1{\cdot}10^{-13}$ … $1{\cdot}10^{-10}$ C	0.5 + 1
10 nC	$1{\cdot}10^{-13}$ C	$1{\cdot}10^{-12}$ … $1{\cdot}10^{-8}$ C	0.25 + 1

CHARGE MEASUREMENT BY NUMERICAL INTEGRATION OF DC CURRENT METHOD

Full scale	Resolution	Measurement Range	Accuracy ± (% of readings + counts)
10 µC	$1{\cdot}10^{-15}$ C	$2{\cdot}10^{-13}$ … $1{\cdot}10^{-5}$ C	0.5 + 1
1 mC	$1{\cdot}10^{-13}$ C	$2{\cdot}10^{-11}$ … $2{\cdot}10^{-10}$ C	0.5 + 1
		$2{\cdot}10^{-10}$ … $1{\cdot}10^{-3}$ C	0.25 + 1
100 mC	$1{\cdot}10^{-11}$ C	$2{\cdot}10^{-9}$ … $2{\cdot}10^{-8}$ C	0.5 + 1
		$2{\cdot}10^{-8}$ … $1{\cdot}10^{-1}$ C	0.1 + 1

ADDITIONAL FEATURES

Noise RMS value reduced to input	≤ $2{\cdot}10^{-15}$ A [1]
	≤ $5{\cdot}10^{-15}$ A [1] [2]
The number of indication outbreaks	≤ 20 for 1 h [1]
Zero level instability	≤ $5{\cdot}10^{-15}$ A for 24 h [1]
Spurious leakage current	≤ $1{\cdot}10^{-15}$ A
Spurious charge drift	≤ $6{\cdot}10^{-14}$ C for 1 min
Interval time	1…99999 s
Read rate	10 readings per second (4.5 digits)
Verification interval	12 Months

[1] *For 100 pA*
[2] *For 1000 pF Load capacitance and* $1{\cdot}10^{11}$ *Ω Load impedance*

SERVICE FUNCTIONS

Message Language	Russian, English
Processing Programs	Addition, Multiplication, Division, dB ratio, Drift, Limit, Statistic, Extremum
Results Correction	Pressure and Temperature, Energy dependence, Polarization, Recombination
Results Storage	500 Measurement
Measurement Start	Internal and External
Generation of Auxiliary Signals	"END OF MEASUREMENT", "ALARM" (Overload)

GENERAL SPECIFICATIONS

Operating environment:	
Temperature	0…40°C
Relative humidity	≤80% at 25°C (non-condensing)
Air pressure	84…106.7 kPa
Storage	-20…+50°C
Power supply	230 V, 50 Hz
Power consumption	12 VA
Casing protection class	IP40
Dimensions (W x H x D)	294 x 112.5 x 250 mm
Weight	3.8 kg (Without accessories)
Complete set	Power cable, Interface cables, Measurement accessories, PTW-Freiburg ionization chambers

Design and specifications are subject to change without notice

AT5350/1 Dosimeter meets Safety standard requirements: IEC 61010-1:1990
EMC requirements: EN 55011:1998, IEC 61000-4-2:2008, IEC 61000-4-3:2008, IEC 61000-4-4:2004, IEC 61000-4-5:2005, IEC 61000-4-6:2008, IEC 61000-4-11:2004.

AT5350/1 Dosimeter may be operated as standard instrument.

AT5350/1 Dosimeter has the pattern approval certificates of Republic of Belarus, Russian Federation, Kazakhstan, Ukraine, Lithuania.

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