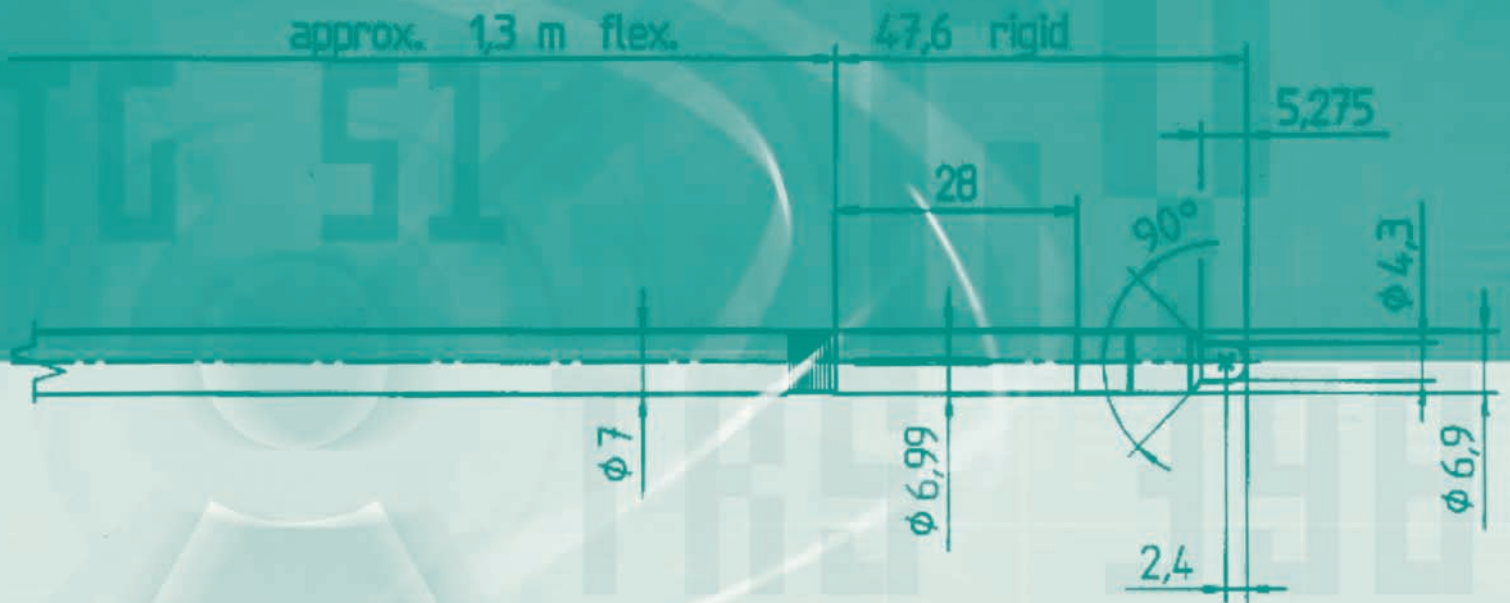


RADIATION THERAPY



DETECTORS

For Small Field Dosimetry



0.125 cm³ Semiflex Chamber

Type 31010

Standard therapy chamber for scanning systems and for absolute dosimetry

Features

- ▶ Waterproof, semiflexible design for easy mounting in scanning water phantoms
- ▶ Minimized directional response
- ▶ Sensitive volume 0.125 cm³, vented to air
- ▶ Radioactive check device (option)

The 31010 semiflexible chamber is the ideal compromise between small size for reasonable spatial resolution and large sensitive volume for precise dose measurements. This makes the 31010 chamber to one of the most commonly used chambers in scanning water phantom systems. The chamber volume of 0.125 cm³ gives enough signal to use the chamber also for high precision absolute dose measurements. The sensitive volume is approximately spherical resulting in a flat angular response and a uniform spatial resolution along all three axes of a water phantom.

Specification

Type of product	vented cylindrical ionization chamber
Application	absolute dosimetry in radiotherapy beams
Measuring quantities	absorbed dose to water, air kerma, exposure
Reference radiation quality	⁶⁰ Co
Nominal sensitive volume	0.125 cm ³
Design	waterproof, vented, fully guarded
Reference point	on chamber axis, 4.5 mm from chamber tip
Direction of incidence	radial
Nominal response	3.3 nC/Gy
Long-term stability	≤ 1 % per year
Chamber voltage	400 V nominal ± 500 V maximal
Polarity effect at ⁶⁰ Co	< 1 %
Photon energy response	≤ ± 2 % (140 kV ... 280 kV) ≤ ± 4 % (140 kV ... ⁶⁰ Co)
Directional response in water	≤ ± 0.5 % for rotation around the chamber axis and for tilting of the axis up to ± 10°
Leakage current	≤ ± 4 fA
Cable leakage	≤ 1 pC/(Gy·cm)

Materials and measures:

Wall of sensitive volume	0.55 mm PMMA, 1.19 g/cm ³ 0.15 mm graphite, 0.82 g/cm ³
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Total wall area density	78 mg/cm ²
Dimension of sensitive volume	radius 2.75 mm length 6.5 mm
Central electrode	Al 99.98, diameter 1.1 mm
Build-up cap	PMMA, thickness 3 mm

Ion collection efficiency at nominal voltage:

Ion collection time	100 μs
Max. dose rate for ≥ 99.5 % saturation	6 Gy/s
≥ 99.0 % saturation	12 Gy/s
Max. dose per pulse for ≥ 99.5 % saturation	0.5 mGy
≥ 99.0 % saturation	1.0 mGy

Useful ranges:

Chamber voltage	± (100 ... 400) V
Radiation quality	66 kV ... 50 MV photons (10 ... 45) MeV electrons (50 ... 270) MeV protons
Field size	(3 x 3) cm ² ... (40 x 40) cm ²
Temperature	(10 ... 40) °C (50 ... 104) °F
Humidity	(10 ... 80) %, max 20 g/m ³
Air pressure	(700 - 1060) hPa

Ordering Information

- TN31010 Semiflex chamber 0.125 cm³, connecting system BNT
- TW31010 Semiflex chamber 0.125 cm³, connecting system TNC
- TM31010 Semiflex chamber 0.125 cm³, connecting system M

Options

- T48012 Radioactive check device ⁹⁰Sr
- T48002.1.004 Chamber holding device for check device



PinPoint Chambers

Type 31014, 31015

Ultra small-sized therapy chambers for dosimetry in high-energy photon beams

Features

- ▶ Small-sized sensitive volumes of only 0.015 cm³ and 0.03 cm³, 2 mm and 2.9 mm in diameter, vented to air
- ▶ Very high spatial resolution when used for scans perpendicular to the chamber axis
- ▶ Aluminum central electrode
- ▶ Radioactive check device (option)

The PinPoint chambers are ideal for dose measurements in small fields as encountered e.g. in IORT, IMRT and stereotactic beams. Relative dose distributions can be measured with very high spatial resolution when the chambers are moved perpendicular to the chamber axis. The waterproof, fully guarded chambers can be used in air, solid state phantoms and in water.

Specification

Type of products	vented cylindrical ionization chambers
Application	dosimetry in high-energy photon beams with high spatial resolution
Measuring quantities	absorbed dose to water, air kerma, exposure
Reference radiation quality	⁶⁰ Co
Nominal sensitive volume	0.015 cm ³ , 0.03 cm ³
Design	waterproof, vented, fully guarded
Reference point	on chamber axis, 3.4 mm from chamber tip
Direction of incidence	radial, axial (31014)
Pre-irradiation dose	2 Gy
Nominal response	400 pC/Gy, 800 pC/Gy
Long-term stability	≤ 1 % per year
Chamber voltage	400 V nominal ± 500 V maximal
Polarity effect	≤ ± 2 %
Directional response in water	≤ ± 0.5 % for rotation around the chamber axis, ≤ ± 1 % for tilting of the axis up to ± 20° (radial incidence) ± 15° (axial incidence)
Leakage current	≤ ± 4 fA
Cable leakage	≤ 1 pC/(Gy·cm)

Materials and measures:

Wall of sensitive volume	0.57 mm PMMA, 1.19 g/cm ³ 0.09 mm graphite, 1.85 g/cm ³
Total wall area density	85 mg/cm ²
Dimensions of sensitive volume	radius 1 mm, 1.45 mm length 5 mm
Central electrode	Al 99.98, diameter 0.3 mm
Build-up cap	PMMA, thickness 3 mm

Ion collection efficiency at nominal voltage:

Ion collection time	20 μs, 50 μs
Max. dose rate for ≥ 99.5 % saturation	265 Gy/s, 29 Gy/s
≥ 99.0 % saturation	580 Gy/s, 55 Gy/s
Max. dose per pulse for ≥ 99.5 % saturation	3.5 mGy, 1.2 mGy
≥ 99.0 % saturation	7 mGy, 2.3 mGy

Useful ranges:

Chamber voltage	± (100 ... 400) V
Radiation quality	⁶⁰ Co ... 50 MV photons
Field size	(2 x 2) cm ² ... (30 x 30) cm ²
Temperature	(10 ... 40) °C (50 ... 104) °F
Humidity	(10 ... 80) %, max 20 g/m ³
Air pressure	(700 ... 1060) hPa

Ordering Information

- TN31014 PinPoint chamber 0.015 cm³,
connecting system BNT
- TW31014 PinPoint chamber 0.015 cm³,
connecting system TNC
- TM31014 PinPoint chamber 0.015 cm³,
connecting system M
- TN31015 PinPoint chamber 0.03 cm³,
connecting system BNT
- TW31015 PinPoint chamber 0.03 cm³,
connecting system TNC
- TM31015 PinPoint chamber 0.03 cm³,
connecting system M

Options

- T48012 Radioactive check device ⁹⁰Sr
- T48002.1.007 Chamber holding device for check device



PinPoint 3D Chamber Type 31016

*Ultra small-sized therapy chamber
with 3D characteristics for dosimetry
in high-energy photon beams*

Features

- ▶ Small-sized sensitive volume 0.016 cm³, vented to air
- ▶ Minimized directional response
- ▶ Aluminum central electrode
- ▶ Radioactive check device (option)

The 31016 PinPoint 3D chamber is ideal for dose measurements in small fields as encountered e.g. in IORT, IMRT and stereotactic beams. Relative dose distributions can be measured with high spatial resolution in any direction. The waterproof, fully guarded chamber can be used in air, solid state phantoms and in water.

Specification

Type of product	vented cylindrical ionization chamber
Application	dosimetry in high-energy photon beams
Measuring quantities	absorbed dose to water, air kerma, exposure
Reference radiation quality	⁶⁰ Co
Nominal sensitive volume	0.016 cm ³
Design	waterproof, vented, fully guarded
Reference point	on chamber axis, 2.4 mm from chamber tip
Direction of incidence	radial
Pre-irradiation dose	2 Gy
Nominal response	400 pC/Gy
Long-term stability	≤ 1 % per year
Chamber voltage	400 V nominal ± 500 V maximal
Polarity effect	≤ ± 2 %
Directional response in water	≤ ± 0.5 % for rotation around the chamber axis, ≤ ± 1 % for tilting of the axis up to ± 110°
Leakage current	≤ ± 4 fA
Cable leakage	≤ 1 pC/(Gy·cm)

Materials and measures:

Wall of sensitive volume	0.57 mm PMMA, 1.19 g/cm ³ 0.09 mm graphite, 1.85 g/cm ³
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Total wall area density	85 mg/cm ²
Dimensions of sensitive volume	radius 1.45 mm length 2.9 mm
Central electrode	Al 99.98, diameter 0.3 mm
Build-up cap	PMMA, thickness 3 mm

Ion collection efficiency at nominal voltage:

Ion collection time	60 μs
Max. dose rate for ≥ 99.5 % saturation	19 Gy/s
≥ 99.0 % saturation	38 Gy/s
Max. dose per pulse for ≥ 99.5 % saturation	1.0 mGy
≥ 99.0 % saturation	1.9 mGy

Useful ranges:

Chamber voltage	± (100 ... 400) V
Radiation quality	⁶⁰ Co ... 50 MV photons
Field size	(2 x 2) cm ² ... (30 x 30) cm ²
Temperature	(10 ... 40) °C (50 ... 104) °F
Humidity	(10 ... 80) %, max 20 g/m ³
Air pressure	(700 ... 1060) hPa

Ordering Information

TN31016 PinPoint 3D chamber 0.016 cm³,
connecting system BNT
TW31016 PinPoint 3D chamber 0.016 cm³,
connecting system TNC
TM31016 PinPoint 3D chamber 0.016 cm³,
connecting system M

Options

T48012 Radioactive check device ⁹⁰Sr
T48002.1.008 Chamber holding device for check device



microLion Chamber

Type 31018

Liquid filled ion chamber for dose distribution measurements in radiotherapy with high spatial resolution

Features

- ▶ Liquid filled sensitive volume of 0.002 cm³
- ▶ Suitable for dose scanning in radiotherapy beams with a superior spatial resolution
- ▶ Suitable for use in water
- ▶ Connector types: BNT, TNC or M

The waterproof micro liquid ion chamber¹ (microLion) has been specially designed for relative beam profile and depth dose curve measurements in a motorized water phantom. It is used for characterization of LINAC radiation fields where superior spatial resolution is desired, like stereotactic fields. Due to the liquid filling, the microLion chamber delivers a high signal in relation to its very small sensitive volume.

The recommended chamber voltage of 800 V is delivered by an additional HV-Supply. The HV-Supply can be connected to the UNIDOS^{webline} or the latest version of the TANDEM dosimeters.

Specification

Type of product	liquid filled ionization chamber
Application	dose distribution measurements in high-energy photon beams with high spatial resolution
Measuring quantity	absorbed dose to water
Reference radiation quality	⁶⁰ Co
Nominal sensitive volume	0.002 cm ³ (exactly 1.7 mm ³)
Design	liquid filled, waterproof
Reference point	on chamber axis, 0.975 mm from entrance window
Direction of incidence	axial
Pre-irradiation dose	≥ 3 Gy
Nominal response	9.8 nC/Gy
Long-term stability	≤ 1 % per year
Chamber voltage	800 V nominal ± 1000 V maximal
Polarity effect	< 1 %
Directional response in water	≤ ± 0.5 % for rotation around the chamber axis, ≤ ± 1 % for tilting of the axis up to ± 40°
Leakage current	≤ ± 1 pA

Cable leakage	≤ 1 pC/(Gy·cm)
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Cable length	1.3 m
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Materials and measures:

Entrance window	0.5 mm polystyrene 0.28 mm graphite 0.02 mm varnish
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Total window area density	107 mg/cm ²
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Dimensions of sensitive volume	radius 1.25 depth 0.35 mm
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Central electrode	graphite
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Ion collection efficiency at nominal voltage:

Ion collection time	5.3 ms
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Max. dose rate at f ≤ 190 Hz for	
≥ 99.5 % saturation	13.1 Gy/min
≥ 99.0 % saturation	26.4 Gy/min

Max. dose per pulse at f ≤ 190 Hz for	
≥ 99.5 % saturation	1.36 mGy
≥ 99.0 % saturation	2.73 mGy

Useful ranges:

Chamber voltage	± (400 ... 1000) V
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Radiation quality	⁶⁰ Co ... 25 MV photons
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Field size	(1 x 1) cm ² ... (20 x 20) cm ²
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Temperature	(10 ... 35) °C (50 ... 95) °F
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Humidity	(10 ... 80) %, max 20 g/m ³
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Air pressure	(700 ... 1060) hPa
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Ordering Information

TN31018-1,3 microLion chamber 0.002 cm³,
connecting system BNT

TW31018-1,3 microLion chamber 0.002 cm³,
connecting system TNC

TM31018-1,3 microLion chamber 0.002 cm³,
connecting system M

T16036 HV-Supply for ionization chambers,
range ± 950 V

T4316/U331 TBA detector holder

¹ The microLion chamber was designed in collaboration with Göran Wickman and Thord Holmstrom, University of Umeå, Sweden and is based on a well-tested and patented LIC concept.



Diamond Detector

Type 60003

Waterproof diamond detector for dose measurements in high-energy photon and electron beams

Features

- ▶ Very small sensitive volume of 1 to 6 mm³ and typically 0.3 mm thickness
- ▶ Good tissue-equivalence
- ▶ Suitable for dose scanning in IMRT and stereotactic fields because of its excellent spatial resolution

The Diamond Detector, based on a naturally grown diamond, is a nearly tissue-equivalent radiation detector. It is designed for dose distribution measurements in high-energy photon and electron beams, featuring a favorable signal-to-noise ratio. Because of its small sensitive volume, the detector is applied for IMRT, stereotactic beams, brachytherapy and water phantom scanning, and is especially well suited for beams with very small field sizes or steep fluence gradients. The Diamond Detector responds with an excellent spatial resolution, low energy and temperature dependence, high sensitivity, nearly no directional dependence and high resistance to radiation damage. The cable length is 1.5 m.

Specification

Type of product	diamond detector
Application	dosimetry in radiotherapy beams
Measuring quantity	absorbed dose to water
Reference radiation quality	⁶⁰ Co
Nominal sensitive volume	(1 ... 6) mm ³
Design	waterproof, disk-shaped sensitive volume perpendicular to detector axis
Reference point	on detector axis, 1 mm from detector tip
Direction of incidence	radial or axial
Pre-irradiation dose	(5 ... 15) Gy
Nominal response	(50 ... 500) nC/Gy
Energy response	at higher depths than d_{\max} , the percentage depth dose curves match curves measured with ionization chambers within ± 0.5 %
Detector bias voltage	+ 100 V (± 1 %)
Directional response	$\leq \pm 2$ % for tilting $\leq \pm 170^\circ$

Leakage current	≤ 5 pA
Cable leakage	≤ 1 pC/(Gy·cm)
Charge collection time	≤ 10 ns

Measures:

Sensitive area	(3 ... 15) mm ²
Thickness of sensitive area	(0.1 ... 0.4) mm
Water-equivalent window thickness	1.15 mm
Outer dimensions	diameter 7.3 mm

Useful ranges:

Dose rate	(0.05 ... 30) Gy/min
Radiation quality	80 keV ... 20 MV photons (4 ... 20) MeV electrons
Temperature	(10 ... 40) °C (50 ... 104) °F
Humidity	(10 ... 80) %, max 20 g/m ³
Air pressure	(700 ... 1060) hPa

Ordering Information

TM60003 Diamond Detector, connecting system M, cable length 1.5 m



Dosimetry Diode P

Type 60016

Waterproof silicon detector for dosimetry in high-energy photon beams up to field size 40 cm x 40 cm

Features

- ▶ Useful for measurements in small and large photon fields
- ▶ Excellent spatial resolution
- ▶ Minimized energy response for field size independent measurements up to 40 cm x 40 cm

The 60016 Dosimetry Diode P is ideal for dose measurements in small photon fields as encountered in IORT, IMRT and stereotactic beams. The excellent spatial resolution makes it possible to measure very precisely beam profiles even in the penumbra region of small fields. The superior energy response enables the user to perform accurate percentage depth dose measurements which are field size independent up to field sizes of (40 x 40) cm². The waterproof detector can be used in air, solid state phantoms and in water.

Specification

Type of product	p-type silicon diode
Application	dosimetry in radiotherapy beams
Measuring quantity	absorbed dose to water
Reference radiation quality	⁶⁰ Co
Nominal sensitive volume	0.03 mm ³
Design	waterproof, disk-shaped sensitive volume perpendicular to detector axis
Reference point	on detector axis, 2 mm from detector tip
Direction of incidence	axial
Nominal response	9 nC/Gy
Dose stability	≤ 0.5 %/kGy at 6 MV ≤ 1 %/kGy at 15 MV ≤ 0.5 %/kGy at 5 MeV ≤ 4 %/kGy at 21 MeV
Temperature response	≤ 0.4 %/K
Energy response	at higher depths than d_{max} , the percentage depth dose curves match curves measured with ionization chambers within ± 0.5 %
Detector bias voltage	0 V
Signal polarity	negative

Directional response in water	≤ ± 0.5 % for rotation around the chamber axis, ≤ ± 1 % for tilting ≤ ± 40°
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Leakage current	≤ ± 50 fA
Cable leakage	≤ 1 pC/(Gy·cm)

Materials and measures:

Entrance window	1 mm RW3, 1.045 g/cm ³ 1 mm epoxy
Total window area density	220 mg/cm ²
Water-equivalent window thickness	2.21 mm
Sensitive volume	1 mm ² circular 30 μm thick
Outer dimensions	diameter 7 mm, length 47 mm

Useful ranges:

Radiation quality	⁶⁰ Co ... 25 MV photons
Field size	(1 x 1) cm ² ... (40 x 40) cm ²
Temperature	(10 ... 40) °C (50 ... 104) °F
Humidity	(10 ... 80) %, max 20 g/m ³

Ordering Information

TN60016 Dosimetry Diode P, connecting system BNT
 TW60016 Dosimetry Diode P, connecting system TNC
 TM60016 Dosimetry Diode P, connecting system M



Dosimetry Diode E

Type 60017

Waterproof silicon detector for dosimetry in high-energy electron and photon beams

Features

- ▶ Useful for measurements in all electron fields and for small photon fields
- ▶ Excellent spatial resolution
- ▶ Minimized energy response
- ▶ Thin entrance window for measurements in the vicinity of surfaces and interfaces

The 60017 Dosimetry Diode E is ideal for dose measurements in small electron and photon fields as encountered in IORT, IMRT and stereotactic beams. The excellent spatial resolution makes it possible to measure very precisely beam profiles even in the penumbra region of small fields. The superior energy response enables the user to perform accurate percentage depth dose measurements which are field size independent up to field sizes of (40 x 40) cm². The waterproof detector can be used in air, solid state phantoms and in water.

Specification

Type of product	p-type silicon diode
Application	dosimetry in radiotherapy beams
Measuring quantity	absorbed dose to water
Reference radiation quality	⁶⁰ Co
Nominal sensitive volume	0.03 mm ³
Design	waterproof, disk-shaped sensitive volume perpendicular to detector axis
Reference point	on detector axis, 0.77 mm from detector tip
Direction of incidence	axial
Nominal response	9 nC/Gy
Dose stability	≤ 0.5 %/kGy at 6 MV ≤ 1 %/kGy at 15 MV ≤ 0.5 %/kGy at 5 MeV ≤ 4 %/kGy at 21 MeV
Temperature response	≤ 0.4 %/K
Energy response	at higher depths than d _{max} , the percentage depth dose curves match curves measured with ionization chambers within ± 0.5 %
Detector bias voltage	0 V
Signal polarity	negative

Directional response in water	≤ ± 0.5 % for rotation around the chamber axis, ≤ ± 1 % for tilting ≤ ± 20°
Leakage current	≤ ± 50 fA
Cable leakage	≤ 1 pC/(Gy·cm)

Materials and measures:

Entrance window	0.3 mm RW3, 1.045 g/cm ³ 0.4 mm epoxy
Total window area density	140 mg/cm ²
Water-equivalent window thickness	1.33 mm
Sensitive volume	1 mm ² circular 30 μm thick
Outer dimensions	diameter 7 mm, length 45.5 mm

Useful ranges:

Radiation quality	(6 ... 25) MeV electrons ⁶⁰ Co ... 25 MV photons
Field size	(1 x 1) cm ² ... (40 x 40) cm ² for electrons (1 x 1) cm ² ... (10 x 10) cm ² for photons
Temperature	(10 ... 40) °C (50 ... 104) °F
Humidity	(10 ... 80) %, max 20 g/m ³

Ordering Information

TN60017 Dosimetry Diode E, connecting system BNT
 TW60017 Dosimetry Diode E, connecting system TNC
 TM60017 Dosimetry Diode E, connecting system M



Dosimetry Diode SRS

Type 60018

Waterproof silicon detector for dosimetry in 6 MV photon beams up to field size 10 cm x 10 cm

Features

- ▶ Useful for measurements in small photon fields with maximum 6 MV
- ▶ Excellent spatial resolution
- ▶ High response
- ▶ Very low noise
- ▶ Thin entrance window for measurements in the vicinity of surfaces and interfaces

The 60018 Dosimetry Diode SRS is ideal for dose measurements in photon fields with a maximum field size of 10 cm x 10 cm and with a maximum energy of 6 MV. The very high response of this detector allows to measure beam profiles with a very high resolution and very short dwell time. Typical use is beam profile measurement for stereotactic radio surgery (SRS).

Specification

Type of product	p-type silicon diode
Application	dosimetry in radiotherapy beams
Measuring quantity	absorbed dose to water
Reference radiation quality	^{60}Co
Nominal sensitive volume	0.3 mm ³
Design	waterproof, disk-shaped sensitive volume perpendicular to detector axis
Reference point	on detector axis, 0.74 mm from detector tip
Direction of incidence	axial
Nominal response	175 nC/Gy
Dose stability	$\leq 0.8\%$ at 6 MV
Temperature response	$\leq (0.1 \pm 0.05)\%$ /K
Energy response	at higher depths than d_{max} , the percentage depth dose curves match curves measured with ionization chambers within $\pm 0.5\%$
Detector bias voltage	0 V
Signal polarity	negative

Directional response in water	$\leq \pm 0.5\%$ for rotation around the chamber axis, $\leq \pm 1\%$ for tilting $\leq \pm 20^\circ$
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Leakage current	$\leq \pm 50$ fA
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Cable leakage	≤ 1 pC/(Gy·cm)
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Materials and measures:

Entrance window	0.3 mm RW3, 0.27 mm epoxy
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Total window area density	140 mg/cm ²
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Water-equivalent window thickness	1.31 mm
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Sensitive volume	1 mm ² circular 250 μm thick
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Outer dimensions	diameter 7 mm, length 45.5 mm
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Useful ranges:

Radiation quality	^{60}Co ... 6 MV photons
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Field size	(1 x 1) cm ² ... (10 x 10) cm ²
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Temperature	(10 ... 40) °C (50 ... 104) °F
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Humidity	(10 ... 80) %, max 20 g/m ³
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Ordering Information

TN60018 Dosimetry Diode SRS, connecting system BNT
 TW60018 Dosimetry Diode SRS, connecting system TNC
 TM60018 Dosimetry Diode SRS, connecting system M

Africa Egypt Morocco South Africa America Argentina Brazil Canada Chile
 Colombia Costa Rica Ecuador Mexico Panama Uruguay USA Venezuela Asia
 Bahrain Bangladesh China Hong Kong India Indonesia Iran Israel Japan Jordan
 Korea Lebanon The objective from the start was to be a trustworthy and
 competent partner for our customers throughout the world. Malaysia Pakistan
 Philippines Saudi This also includes maintaining quality standards and com-
 Arabia Singapore
 Syria Taiwan prehensive service and support. We will continue to do every-
 Thailand Vietnam
 Australia Australia thing possible in the future to manufacture high-quality
 dosimetry products, which users and patients can trust.
 Europe Austria **We know what responsibility means.** Belarus Belgium
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PTW-Freiburg
Physikalisch-Technische Werkstätten
Dr. Pychlau GmbH
 Lörracher Straße 7
 79115 Freiburg · Germany
 Phone +49 761 49055-0
 Fax +49 761 49055-70
 info@ptw.de
 www.ptw.de

PTW-France SARL
 41 Chemin de la Cerisaie
 91620 La Ville du Bois · France
 Phone +33 1 64 49 98 58
 Fax +33 1 69 01 59 32
 info@ptw-france.com
 www.ptw-france.com

PTW-UK Ltd.
 Old School House
 Station Road East
 Grantham
 NG31 6HX · United Kingdom
 Phone +44 (0) 147 657 7503
 Fax +44 (0) 147 657 7503
 sales@ptw-uk.com
 www.ptw-uk.com

PTW-New York Corporation
 205 Park Avenue
 Hicksville · New York 11801
 Phone (1-516) 827 3181
 Fax (1-516) 827 3184
 ptw@ptwny.com
 www.ptwny.com

PTW-Asia Pacific Ltd.
 Unit 2203, 22/F, The Metropolis Tower
 10 Metropolis Drive
 Hung Hom, Kowloon
 Hong Kong
 Phone +852 2369 9234
 Fax +852 2369 9235
 info@ptw-asiapacific.com
 www.ptw-asiapacific.com

PTW-Beijing
 Room 712, JinJiYe Building
 No. 2 ShengGuZhongLu
 ChaoYang District
 100029 Beijing · P. R. China
 Phone +86 10 6443 0746-0764
 Fax +86 10 6442 7804
 info@ptw-beijing.com
 www.ptw-beijing.com

PTW-Latin America
 Av. Evandro Lins e Silva
 840 Sala 2018 · Barra da Tijuca
 22631-470 Rio de Janeiro-RJ · Brazil
 Phone +55 21 2178 2188
 Fax +55 21 2429 6234
 info@ptw.com.br
 www.ptw.com.br

