RADIATION MEDICINE QA

SOLUTIONS

2011/2012

PTW

Radiation Medicine Products from PTW

Ionizing Radiation

When the German physicist Wilhelm Conrad Röntgen discovered the X-rays in 1895 and French physicist Antoine-Henri Becquerel discovered the nuclear radiation of uranium in 1896, which Marie Curie later on called "radioactivity", they initiated a fascinating development in the science of ionizing radiation. Today modern techniques in medical radiology are essential for human welfare. Modern sciences and industrial production also depend on the use of ionizing radiation.

Contrary to the many positive aspects, the major drawback of ionizing radiation is the radiation risk. When irradiated, healthy human tissue can be damaged. The higher the radiation load to a person, the higher is the risk for the development of diseases. In the case of intended irradiation of patients in radiation medicine, the radiation exposure to healthy tissue should always be as low as possible. Quite a number of international standards and regulations have settled the principles of radiation protection for all fields of radiation use.

To ensure proper functioning of technical equipment producing ionizing radiation and to avoid unintended exposure, the radiation output and the equipment quality have to be checked carefully after installation and frequently over time. Since 1922, PTW-Freiburg has been supplying specialized dosemeters to measure the quantity of ionizing radiation with different beam qualities in a most precise manner. A calibration laboratory has been in continuous operation to provide for correct measurement of radiation quantities by the measuring equipment from PTW production from the beginning. In addition, test tools for quality control of medical radiation equipment and radiation monitoring devices have always been part of the PTW product line.

About this catalog

Technical details are not included in this catalog, which would expand it too much. If you need more details about certain products, please feel free to ask for specification sheets or other documents.

Trademarks®

The following product names are registered trademarks of PTW-Freiburg and PTW-New York:

- CONNY
- CURIEMENTOR
- DAVID
- DIAMENTOR
- DIAVOLT
- FILMSCRIBOR
- FIPS Plus
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- Markus
- MEPHYSTO
- MLCSoft
- MULTIDOS
- OCTAVIUS
- OPTIDOS
- PinPoint
- PLEXITOM
- PTW Farmer
- Roos
- UNIDOS
- VeriSoft
- VIVODOS
- WedgeCheck
- X-Check

Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation.

Product Information

Some of the products are used for multiple purposes. Therapy detectors, for example, are used for absolute dosimetry in conjunction with an electrometer and for relative dosimetry in conjunction with an automatic beam analyzer. Notes with the '▸' symbol at the end of the product descriptions refer to related items.

Many of the products presented in this catalog require the use of a computer. Electronic devices are microprocessor controlled and may be connected to a computer for control and data transfer. The required minimum computer configurations vary.

Due to fast technological progress, computer requirements are not included in the descriptions. We suggest that you contact us for advice about an appropriate solution in each specific case.

International Standards

The medical and electric products from PTW are manufactured in strict accordance with valid international standards. The medical products are CE marked in accordance with the European Medical Device Directive MDD and have the 510(k) approval of the FDA, USA (if applicable). They comply with the valid IEC standards within their defined range of use. The major IEC standards are:

IEC60601-1 Medical electrical equipment – General requirements for safety

IEC60601-2-9 Medical electrical equipment - Particular requirements for the safety of patient contact dosemeters used in radiation therapy with electrically connected radiation detectors

IEC60731 Medical electrical equipment – Dosemeters with ionization chambers as used in radiotherapy

IEC61674 Medical electrical equipment – Dosemeters with ionization chambers and/or semiconductor detectors as used in X-ray diagnostic imaging

Further standards and international dosimetry protocols are listed in the chapter introductions and in the product descriptions.

Delivery

Instruction manuals and software user interfaces are written in English.

Contents

There is no good – unless you do it

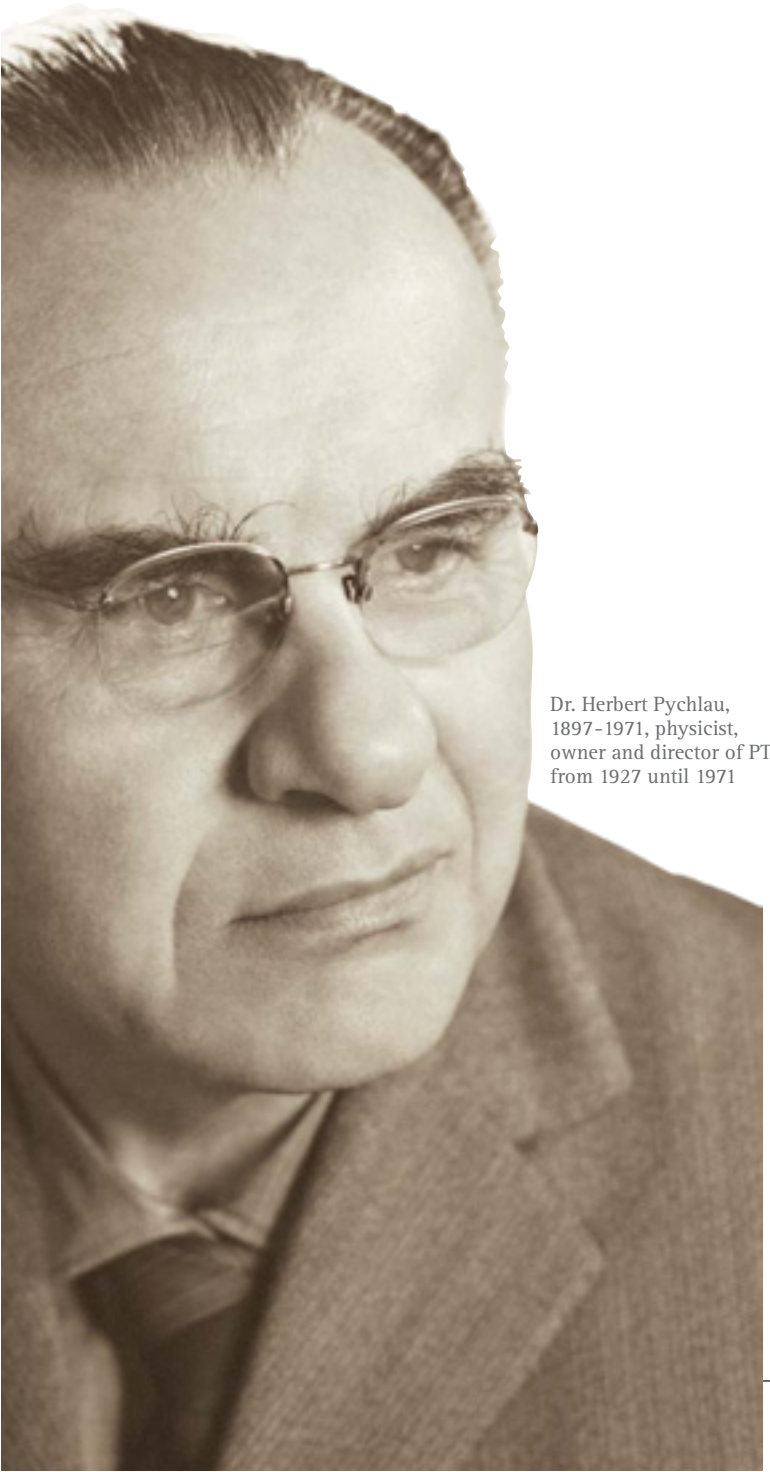
Excerpt from the autobiography of Dr. Herbert Pychlau (1897-1971)

Prof. Wilhelm Hammer, 1885-1949, inventor of the relay-based Hammer dosemeter and founder of PTW

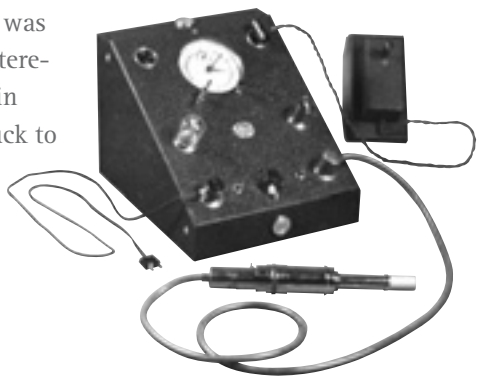
"When I returned to Freiburg as a 27-year-old after a serious illness, I thought about what I wanted to do in my future professional life. I considered qualifying as a university lecturer. But in the end, fate would have it that I met Dr. Hammer (Dr. Pychlau's supervisor (annotation of the translator)) in the street. He invited me to have a look at what he had been doing in the meantime and told me about his having set up a business for the production of his invention, a dosemeter based on an electrostatic relay. It was out of sheer friendship back then that I went on a series of trips either to set up dosemeters or to instruct their users in the operation. Dr. Hammer himself had serious financial difficulties to contend with and couldn't take many trips owing to his official duties at the university.

In this way I came to know all the leading radiologists in person. After two years, the situation of Dr. Hammer's business was so precarious that he wanted to close it. But, knowing how much the radiologists were in need of such a device and how highly they appreciated it, I thought it irresponsible to throw in the towel due to mere financial or secondary technical problems. Thanks to my efforts for the dosemeter, the radiologists on one hand as well as an important company in the radiology branch on the other had gained a lot of confidence in my person. The latter even agreed to back the further work of our business if I were willing to take over its management.

And so that is how in the year 1927 I took over the direction of the PTW in an honorary capacity, as it were. Still I had to earn my living with the translation of patents. It was not until after several hard initial years that the business could pay me a salary. Dosimetry was an exceptionally interesting field of work in those years; so I stuck to it and abandoned all other plans I had once fostered."



Dr. Herbert Pychlau, 1897-1971, physicist, owner and director of PTW from 1927 until 1971



It set global standards for dosemeters: the first dosemeter designed by Dr. Hammer

Knowing what responsibility means

The Directors Dr. Edmund Schüle and Dr. Christian Pychlau together with Günter Hein, former Director of Sales and Marketing (from left), discussing a new improvement

In 1922, twenty-seven years after Röntgen discovered X-rays, Professor Hammer from the Physics Institute of Freiburg University founded PTW to produce and market his development of an X-ray dosemeter based on electrostatic relay, a revolutionary new electromechanical component for measuring very small electrical charges.

In 1927, Dr. Herbert Pychlau took over the company and developed it during four decades into an internationally recognized manufacturer of quality dosemeters for medical radiology.

During the second half of the 20th Century, the business grew into an acknowledged international company, acquiring a good reputation as a pioneer with both scientists and users.

Technical improvements from electrometer tubes and transistors to microprocessor control and computer communication modernized the growing spectrum of products. Increasing exports finally led to a further milestone in the company's history: the foundation of PTW-New York as an independent subsidiary to distribute and service PTW products all over the American continent. In January 2002, PTW-France was established. Subsidiaries in Rio de Janeiro, Hong Kong, Beijing and the UK followed.

PTW Freiburg's production area, which in the very beginning was located in Professor Hammer's garden shed, covers a total area of 7000 m² today. PTW employs a staff of more than 230 all over the world. The company, which scores steady growth, is the recognized market leader in dosimetry today.

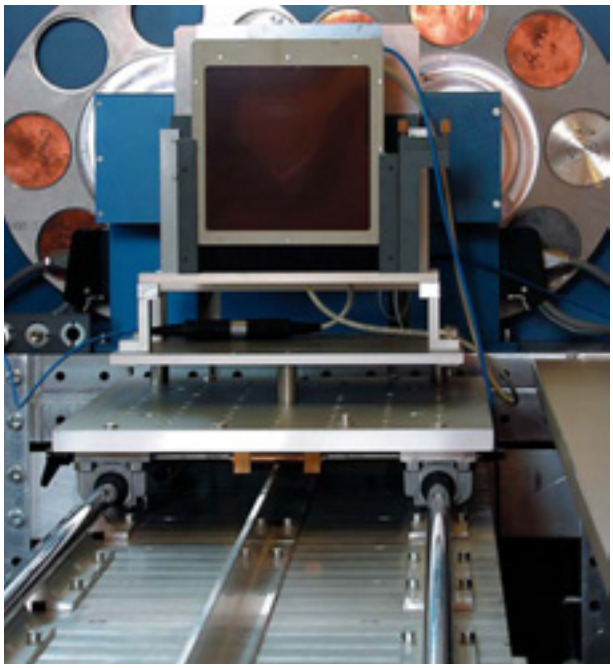
We at PTW constantly strive to be competent and reliable partners for our customers all over the world, which includes maintaining demanding quality standards as well as comprehensive service and support standards. We will continue our efforts to develop the most reliable and highest quality dosimetry products in the future as we have in the past, products in which users and patients put their trust.

We are committed to upholding this trust, because we know what responsibility means.

Welcome to PTW! Visit our head office in Freiburg, Germany

The rules of the market are stringent – so are our principles.

PTW is the global market leader in all essential product lines, which is not least thanks to our historic commitment to first-class production – not mass production! The fact that PTW systems are still being used, which were installed more than 30 years ago, testifies for the quality of our products.
In contrast to common practice, we still maintain a highly qualified R&D department. In contrast to common practice, we design, develop and produce whatever we consider useful inhouse. And in contrast to general practice, we structure sales in such a way that our customers realize one thing for sure: Not selling, but performance is our motivation!
The areas of application of our products include radiation therapy, diagnostic radiology, nuclear medicine and health physics. Our product range includes absolute and relative dosimetry, quality control equipment and patient dosimetry for radiation therapy, diagnostic radiology and nuclear medicine as well as radiation monitoring in radiation protection.
Radiological calibration services are an essential part of our activities. PTW operates the first secondary standard dosimetry laboratory for ionizing radiation accredited by DAkkS (German Calibration Service) in Germany. We perform radiological calibrations for dosemeters used in medical radiology and health physics, which are directly traceable to the primary standard. Our calibration lab provides a complete range of radiological calibrations from low X-ray energies up to ^{60}Co and from low to high dose rates.
With nine calibration benches in continual use, the accredited PTW calibration lab, which is under regular control of the national laboratory (PTB), is one of the most active calibration labs for ionizing radiation in the world. It also is a member of the IAEA/WHO network for dosimetry in radiation therapy.

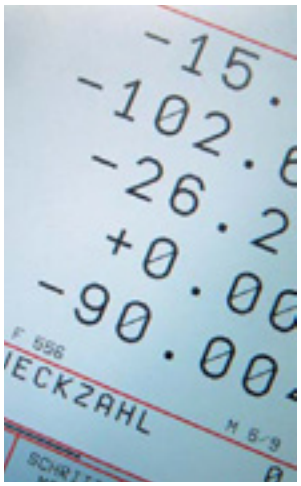


One out of eight calibration benches making PTW one of the busiest calibration facilities for ionizing radiation in the world

For many products detailed technical data are available upon request. Ask your local PTW agent or order them via e-mail.

Quantity can be counted – Quality counts

PTW has always been a synonym for quality. Equipment from the company's initial years such as the second generation dosemeters Simplex and Duplex are still in use.



From development to production, precision counts

To our customers' utmost satisfaction and in the service of medical technology, PTW has committed itself to the design, development and production of high quality devices and systems. To do justice to these high expectations, PTW introduced a system of quality assurance at an early stage, which meets the requirements according to DIN ISO 9001 and EN 46001. Additionally, our quality management is constantly scrutinized, updated and adjusted to fulfill national and international standards. In this way, we ensure that our standards – and our products – not only comply with standards, but even surpass them.

Motivated and responsible staff: the basis for reliable medical products

Employee training sessions at regular intervals, expanded service applications and customer support are just as much a part of our daily business as the continual promotion of innovative product ideas and developments.
Our medical products are CE-marked according to the European Medical Device Directive and they are FDA 510(k) approved (if applicable).
We introduced the testing and calibration of our products in realistic conditions as early as 1931. Today, our own inhouse calibration laboratory is an essential component in ensuring the precision and reliability of our products.

Why we are close to our customers – even to the remote ones

PTW products are well known for their outstanding reliability. Our service standards obligate us to repair and recalibrate each and every PTW product – regardless of where it is in operation.
This is by no means a matter of course in our time, but we take pleasure in offering our customers the most comprehensive service and support possible. For instance, PTW runs a service hotline, which provides professional advice to resolve minor problems free of charge. We also provide software and regular updates for our products, which you can obtain from your local PTW agent.

Recalibration and repair: Just a selection of our after-sales services

You can find PTW agents on all continents, but it is also possible to have PTW products shipped to Freiburg or our branches for repair and maintenance. We strongly recommend contacting your local PTW agent for recalibration of nearly all kinds of dosimetry equipment.

For details please visit our website at **www.ptw.de**

RADIATION THERAPY

PTW Products for Medical Physics in Radiation Therapy

Introduction

Radiation therapy is one of the most powerful weapons for an effective fight against the painful disease of human cancer. The treatment techniques and the irradiation equipment have been developed continuously in the past to meet the goal of delivering radiation loads to cancer tissue in an optimal way and to protect patients against radiation damage. Dosimetry and quality assurance procedures are essential for precise radiation treatment and avoiding unintended irradiation.

Medical physics experts are responsible for the scientific and technical services and consultations in hospitals to guarantee correct cancer treatment using ionizing radiation. Medical physics in general is a branch of applied physics, and radiation therapy physics is the main area of activity of medical physicists worldwide. These physicists are trained to use special concepts and methods of physics to help diagnose and treat human disease, and they have collected practical experience dealing with medical problems and using equipment.

Because medical physics departments in radiation therapy are involved in therapy dosimetry and quality assurance procedures, they need to be equipped with appropriate measuring and test instruments to provide the best possible cancer treatment including modern treatment techniques.

Product Information

PTW offers a comprehensive range of measuring and test equipment for medical physics in radiation therapy. The products are of high quality and have been tried and tested to ensure that responsible medical physicists can fulfill their duties and provide continual patient treatment on high quality levels.

Medical physics in radiation therapy includes a number of different measuring and quality control tasks. Therefore, the product catalog is divided into four chapters:

- Absolute Dosimetry

  Presents dosemeters, electrometers, radiation detectors and calibration phantoms for absolute calibrated dosimetry.

- Patient and Brachytherapy Dosimetry

  Presents in-vivo dosemeters for direct patient dosimetry during treatment and medical physics equipment for brachytherapy dosimetry.

- TBA Therapy Beam Analysis

  Presents automatic measuring equipment for dose distribution measurement and analysis of therapy beams.

- Quality Control

  Presents test equipment for various quality control procedures.

Absolute Dosimetry

Absolute Dosimetry Equipment

Absolute Dosimetry

Introduction

The quantification of ionizing radiation and the manufacture of reliable radiation dosemeters has been a challenge for medical physics experts since in 1895 W. C. Röntgen discovered the X-rays in Würzburg, Germany.

PTW-Freiburg presented the first industrially produced therapy dosemeter, the Hammer dosemeter, in 1922, of which approximately 1000 units have been delivered. During the period of meanwhile eight decades PTW-Freiburg developed, produced and distributed thousands of high quality radiation detectors and electrometers for absolute dosimetry in radiation therapy to the medical physics community around the world.

Product Information

The present product line includes a wide range of top level dosemeters, ionization chambers, solid state detectors, check devices and calibration phantoms in different designs for multiple dosimetry purposes. Radiation detectors, dosemeters and connection cables can be supplied with different connecting systems. The standard triax connector types are BNT, TNC and PTW-M. Upon request the chambers and connection cables can optionally be supplied with BNC connectors for signal transfer and banana plugs for high voltage transfer. When ordering radiation detectors, the appropriate connector code can be added to the chamber type number. The codes are N for BNT, W for TNC and M for PTW-M type connectors. As an example, the order number for a Roos electron chamber with BNT connector would be TN34001.

The **DosiCom** software program is freeware, which you can download from our website at www.ptw.de. It is used for communication between any type of our therapy dosemeters and a computer. DosiCom enables the user to set measuring modes at the dosemeter and to perform dose measurements by remote control. The measurement data can be read and stored by the PC.

Calibration

Since the first days PTW-Freiburg put efforts to provide for accurate calibration of the radiation measuring instruments.

The calibration facilities and the content of the calibration certificates are described in the health physics chapter. When ordering ionization chambers please specify the desired calibration including beam quality, measuring quantity and reference temperature.

International Standards

The dosemeters are developed and produced in accordance with the international IEC standards as listed on page 2. The UNIDOS*webline* and the UNIDOS dosemeters as secondary standard dosemeters in addition are based on the IPEM guidelines. The dosemeters are used according to the international protocols for therapy dosimetry. The major standards are:

IPEM Guidelines on dosimetry transfer instruments as a secondary standard dosemeter

IAEA Report TRS-381
The Use of Plane Parallel Ionization Chambers in High Energy Electron and Photon Beams

IAEA Report TRS-398
Absorbed Dose Determination in External Beam Radiotherapy: An International Code of Practice for Dosimetry based on Standards of Absorbed Dose to Water

AAPM TG-25, Report #32
Clinical electron beam dosimetry

AAPM TG-51, Report #67
Protocol for clinical reference dosimetry of high-energy photon and electron beams

DIN 6800-2
Dosismessverfahren nach der Sondenmethode für Photonen- und Elektronenstrahlung
Teil 2: Ionisationsdosimetrie

UNIDOS*webline* Universal Dosemeter

High performance secondary standard and reference class dosemeter / electrometer with integrated network features

Features

- High quality reference class dosemeter for radiation therapy, diagnostic radiology and health physics
- Integration in a LAN with the internet standard TCP/IP
- Remote access functionality
- E-mail capability, eg. to initiate self tests and to send a status report
- Configurable TFT display with wide viewing angles
- Easy and fast menu-driven handling with navigation knob and help system

The UNIDOS*webline* is a high-precision, secondary standard reference class dosemeter combined with modern network features. This unique dosemeter offers high quality, reliability and an excellent adaptation to the measuring tasks. It has the best performance on the market.
The Ethernet interface based on the TCP/IP protocol makes it possible to integrate the UNIDOS*webline* in a LAN for remote access and e-mail capability. Important settings can be password protected (different levels). The operation language is selectable. A comprehensive statistic and data logging function is implemented.
Chamber data are stored in a comprehensive chamber library. Air density is corrected by keying in air pressure and temperature or by means of radioactive check devices. The check device data are stored in a database. An internal clock calculates the isotope radioactivity decay. The device features both mains and battery operation.
UNIDOS*webline* surpasses the requirements for reference class dosemeters according to IEC60731, the IPEM secondary standard dosemeter guidelines, IEC 61674 for diagnostic radiology and IEC 60846 for health physics.

Ordering Information

T10023 UNIDOS*webline*, connecting system BNT
T10022 UNIDOS*webline*, connecting system TNC
T10021 UNIDOS*webline*, connecting system M

Option

L522021 UNIDOS Carrying case

UNIDOS® Universal Dosemeter

High performance secondary standard and reference class dosemeter / electrometer for universal use

Features

- Suitable for universal dosimetry in radiation therapy, diagnostic radiology and health physics
- Suitable for monitor calibration and patient dosimetry
- High accuracy, excellent resolution (1 fA) and wide dynamic measuring ranges
- Exceeds requirements of calibration labs for leakage, linearity, reproducibility and stability
- Measures integrated dose (or charge) and dose rate (or current) simultaneously

UNIDOS is a high precision reference class therapy dosemeter according to IEC 60731, a secondary standard dosemeter according to IPEM guidelines, an in-vivo dosemeter for patient contact measurement according to IEC 60601-2-9, an X-ray diagnostic imaging dosemeter according to IEC 61674, and a health physics dosemeter. It fulfills the general requirements for safety of medical electrical equipment according to IEC 60601-1. Ion chambers and solid-state detectors can be connected. A comprehensive chamber library makes it possible to store calibration data of up to 30 chambers. Air density corrections are done by keying in air pressure and temperature, or by means of radioactive check devices. UNIDOS displays the measured values of dose and dose rate in Gy, Sv, R, Gy/min, Sv/h, R/min or Gy·m. The electrical values of charge and current are displayed in C or A. The device includes automatic leakage compensation, an automatic built-in system test and an RS232 interface. It features both mains and battery operation.

Ordering Information

T10005 UNIDOS, connecting system BNT, 115/230 V
T10002 UNIDOS, connecting system TNC, 115/230 V
T10001 UNIDOS, connecting system M, 115/230 V

Options

S100002 UniSet Software for computer communication
L522021 UNIDOS Carrying case

- UNITEST Electric Test Device *page 23*
- Radiation Detectors *page 16ff.*

UNIDOS® E Universal Dosemeter

Easy to use reference class or field class dosemeter / electrometer for routine dosimetry

Features

- An economical high quality dosemeter for universal use in radiation therapy and diagnostic radiology
- Complies with the following standards:
  - IEC 60731 as a field class dosemeter
  - IEC 60731 as a reference class dosemeter (option)
  - IPEM guidelines on dosimetry transfer instruments as a secondary standard dosemeter (option)
  - IEC 61674 as a diagnostic dosemeter
- High accuracy, excellent resolution (1 fA) and wide dynamic measuring ranges
- HV power supply (0 ... ± 400) V in increments of ± 50 V
- Measures integrated dose (or charge) and dose rate (or current) simultaneously
- RS232 interface for device control and data output

The lightweight and compact UNIDOS E is an easy to use dosemeter, mainly used for daily routine dosimetry in radiation therapy. Ion chambers and solid-state detectors can be connected. A chamber library makes it possible to store calibration data. Air density corrections are done by keying in air pressure and temperature. UNIDOS E displays the measured values of dose and dose rate in Gy, R, Gy/min, R/min or Gy·m. The electrical values charge and current are measured in C and A. The large, high-contrast LC display is easy to read. The device includes automatic leakage compensation and an RS232 interface. The high voltage between the ion chamber electrodes is checked automatically. UNIDOS E features both mains and battery operation.

Ordering Information

T10010 UNIDOS E, connecting system BNT, 115/230 V
T10009 UNIDOS E, connecting system TNC, 115/230 V
T10008 UNIDOS E, connecting system M, 115/230 V

Options

E10101 UNIDOS E Reference class certificate
T11003.1.020 UNIDOS E Carrying case

- UNITEST Electric Test Device *page 23*
- Radiation Detectors *page 16ff.*

TANDEM Dual Channel Electrometer

Dual channel electrometer for absolute dosimetry with TanSoft software and for relative dosimetry with TBA systems

Features

- Dual channel therapy dosemeter in accordance with IEC 60731 (field class), resolution 10 fA
- Absolute dose measurement with TanSoft software
- Fast scanning measurements in motorized water phantoms (time constant 10 ms)
- Variable voltage supply
- Accepts ion chambers and solid state detectors to be connected
- High resolution for small size ion chambers

The TANDEM electrometer is calibrated in electrical current (A). It can be operated by a PC as an absolute therapy dosemeter. The TanSoft software provides calibration and correction factors for various detectors and displays the measurement results. The chamber voltage for both channels is individually programmable in 50 V increments up to 400 V with reversible polarity. The TANDEM is very fast and makes it possible to set minimum measuring intervals of 10 ms. It features auto-range and offset compensation. TANDEM is also designed to perform radiation field measurements referenced to an ionization chamber. In conjunction with a TBA therapy beam analyzer, MEPHYSTO software controls TANDEM for fast and accurate beam data acquisition. A trigger input synchronizes measurements with external signals.

Ordering Information

T10015 TANDEM Electrometer, connecting system BNT
T10016 TANDEM Electrometer, connecting system TNC
T10011 TANDEM Electrometer, connecting system M
T99030 Power supply 110 V ... 240 V

Option

S080028 TanSoft software

- UNITEST Electric Test Device *page 23*
- Radiation Detectors *page 16ff.*
- TBA Therapy Beam Analyzers *page 41ff.*

HV-SUPPLY

Separate device to supply adjustable high voltage to ionization chambers

Features

- Precise adjustable high voltage
- Internal HV-error detection

The HV-SUPPLY is an external high voltage supply. It can be used for all ionization chambers which need a high chamber voltage. Most dosemeters work with an internal high voltage supply delivering a maximum chamber voltage of ± 400 V. If a higher chamber voltage is needed, an external high voltage source must be used.

The chamber voltage of the HV-SUPPLY can be adjusted precisely by a rotating knob. The chamber voltage is displayed on an easy to read 4 digit LCD. The polarity can be changed by a push button.

The dosemeter must have an input for an external HV-source. UNIDOS*webline* and TANDEM accept the connection of a HV-SUPPLY.

The HV-SUPPLY is equipped with a BNC connector for the HV-output.

Ordering Information

T16036 HV-SUPPLY for ionization chambers

- microLion Chamber *page 19*

OPTIDOS® Brachytherapy Dosemeter

Brachytherapy dosemeter with scintillation detector to verify intravascular and ophthalmic radiation sources

Features

- Serves as a dosemeter for QC in intravascular therapy according to AAPM TG-60[1] and DGMP-Report No. 16 and for ophthalmic radiation therapy
- Small, water-equivalent plastic scintillation detector for low energy beta and photon radiation
- With $^{90}Sr/^{90}Y$ and ^{32}P calibration traceable to NIST[2]
- Measures dose, dose rate and time

The OPTIDOS[3] is designed for dose verification in intravascular brachytherapy (for reduction of arterial restenosis risk). With its extremely small scintillation detector of 1 mm Ø x 1 mm, OPTIDOS is ideally suited for the calibration of beta-emitters in catheter systems according to AAPM TG-60[1]. Using optional measuring phantoms, the source strength and the depth dose curve as well as the longitudinal and rotational homogeneity of line sources can be determined. OPTIDOS is also suitable for dosimetry of ophthalmic plaques. It features auto-start, auto-range and timer functions. An RS232 interface is included. The unit operates on mains or rechargeable batteries. A radioactive check source is required to compensate for the decrease of detector sensitivity independence of the total absorbed dose.

[1] Intravascular Brachytherapy Physics, Report #66 of AAPM Radiation Therapy Committee Task Group #60, Medical Physics 26(2), February 1999

[2] National Institute of Standards and Technology, USA

[3] The method on which OPTIDOS is based has been developed in close scientific cooperation with the Medical Physics Department of the University Hospital Essen, Germany.

All applications other than quality control and dose verification in intravascular brachytherapy are off-label uses according to the FDA and therefore at users own responsibility.

Ordering Information

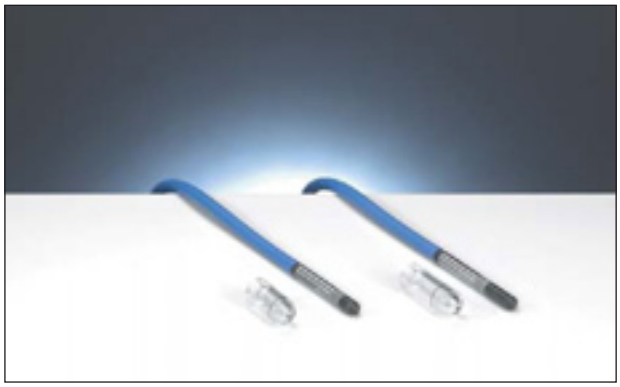
T10013 OPTIDOS Scintillation dosemeter
T60006 OPTIDOS Scintillation detector
T48010 Radioactive check device ^{90}Sr
T48007 Detector / check source holding device

Option

T11003.1.020 OPTIDOS Carrying case

- OPTIDOS Measuring phantoms *page 36*

Semiflex Ionization Chambers



Waterproof thimble chambers for measuring high-energy photon and electron radiation in air, water and phantom material

Features

- Vented sensitive volumes of 0.125 cm^3 and 0.3 cm^3
- Suitable for use in water phantoms
- Flat energy response within a wide energy range

The semiflex chambers are designed for therapy dosimetry, mainly for dose distribution measurements in motorized water phantoms. They have a short stem for mounting and a flexible connection cable. The nominal useful energy range is from 30 kV to 50 MV photons and 6 MeV to 50 MeV electrons. The wall material is graphite with a protective acrylic cover. The guard rings are designed up to the measuring volume. An acrylic build-up cap for in-air measurement in ^{60}Co beams is included with each chamber, as well as a calibration certificate for calibration in absorbed dose to water or in air kerma. Air density correction is required for each measurement, and a radioactive check device is available as an option. Both chambers are shaped cylindrically with an inner diameter of 5.5 mm; they differ only in the length of the measuring volume. The 0.125 cm^3 chamber is ideal for 3D dosimetry in a water phantom, since the measuring volume is approximately spherical resulting in a flat angular response over an angle of ± 160° and a uniform spatial resolution along all three axes of a water phantom.

Ordering Information

Semiflex chambers, connecting system BNT, TNC or M:

31010 Semiflex chamber 0.125 cm^3
31013 Semiflex chamber 0.3 cm^3

- Therapy Dosemeters *page 13f.*
- Radioactive Check Devices *page 23*
- Calibration Service *page 150*

Rigid Stem Ionization Chambers

Thimble chambers for measuring high-energy photon and electron radiation in air and in phantom material

Features

- Vented sensitive volumes of 0.3 cm^3 and 1 cm^3
- Suitable as reference chambers for use in solid phantoms
- Very flat energy response within a wide range

The rigid stem chambers are designed as reference chambers for absolute dosimetry to be used in radiation therapy or by secondary standard dosimetry laboratories (SSDL). They have very small variations of response with radiation quality from low X-ray energies up to high-energy photon and electron radiation. The nominal useful energy range is from 30 kV to 50 MV photons and 6 MeV to 50 MeV electrons. Both chambers are shaped cylindrically (thimble chambers). The wall material is graphite with a protective acrylic cover. The electrodes are made of graphite-coated aluminum. The guard rings are designed up to the measuring volume. Both chambers are constructed with a long stem of approx. 25 cm length for easy mounting in the radiation beam.
An acrylic build-up cap for in-air measurement in ^{60}Co beams is included with each chamber, as well as a calibration certificate for calibration in absorbed dose to water or in air kerma. Air density correction is required for each measurement. A radioactive check device is available as an option.

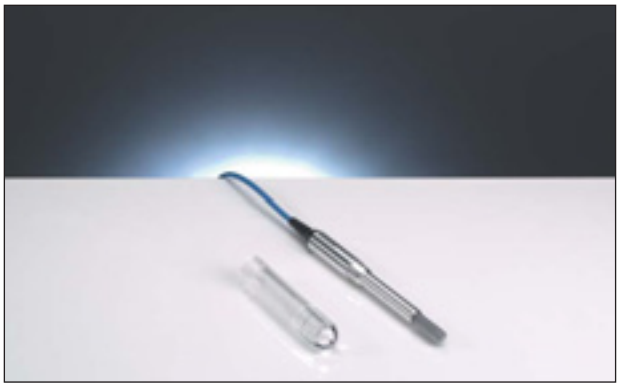
Ordering Information

Rigid stem chambers, connecting system BNT, TNC or M:

30016 Rigid stem chamber 0.3 cm^3
30015 Rigid stem chamber 1 cm^3

- Therapy Dosemeters *page 13f.*
- Radioactive Check Devices *page 23*
- Calibration Service *page 150*

PTW Farmer® Ionization Chambers



Thimble chambers for measuring high-energy photon and electron radiation in air or in phantom material

Features

- Vented sensitive volumes of 0.6 cm^3
- Suitable as therapy chambers for use in solid phantoms
- Flat energy response
- A variety of different versions is available

The 0.6 cm^3 PTW Farmer chambers are designed for absolute photon and electron dosimetry with therapy dosemeters. Three chamber types for measurements in air or in solid state phantom material are available:

- Type 30010 is the standard chamber. The wall material is graphite with a protective acrylic cover, and the electrode is made of Al. The nominal photon energy range is from 30 kV to 50 MV.
- Type 30011 with graphite wall and graphite electrode is used for therapy dosimetry, where a completely graphite-built chamber is required. The nominal photon energy range is from 140 kV to 50 MV.
- Type 30012 is used for therapy dosimetry, where a chamber with graphite wall and Al electrode is required. The nominal photon energy range is from 60 kV to 50 MV.

The electron energy range of all chambers is from 6 MeV to 50 MeV. The chambers type 30011 and 30012 with their graphite caps are of delicate construction and should be handled with extreme care. The guard rings of all chamber types are designed up to the measuring volume. An acrylic build-up cap for in-air measurement in ^{60}Co beams is included with each chamber, as well as a calibration certificate.

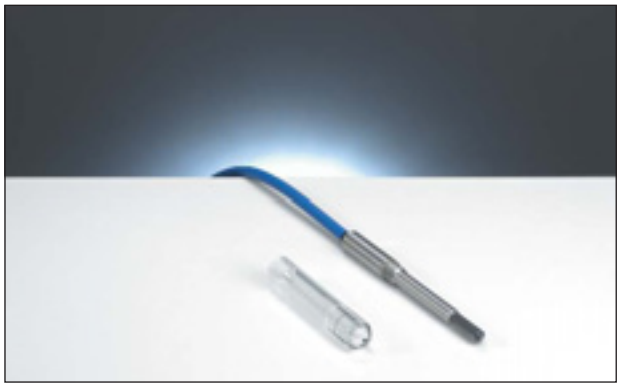
Ordering Information

PTW Farmer chambers with connecting system BNT, TNC or M (only 30010) and a cable length of 1 m or 10 m:

30010 PMMA/Al Farmer chamber
30011 Graphite/graphite Farmer chamber
30012 Graphite/Al Farmer chamber

- Therapy Dosemeters *page 13f.*
- Radioactive Check Devices *page 23*
- Calibration Service *page 150*

Waterproof PTW Farmer® Chamber



Waterproof thimble chamber for measuring high-energy photon and electron radiation in water

Features

- Vented sensitive volume of 0.6 cm^3
- Suitable as therapy chamber for use in water
- Flat energy response

The 0.6 cm^3 PTW Farmer chamber type 30013 is a waterproof standard chamber for absolute photon and electron dosimetry with therapy dosemeters to be used in water or in solid-state material. The nominal photon energy range is from 30 kV to 50 MV, the electron energy range is from 6 MeV to 50 MeV. This chamber type is of rugged construction, since the wall material is graphite with a protective acrylic cover and the electrode is made of aluminum. The guard ring is designed up to the measuring volume. The chamber is supplied with a cable of 1 m length. Different connector types are available.
A calibration certificate for calibration in absorbed dose to water or air kerma is included with each chamber. Air density correction is required for each measurement. A radioactive check device is available as an option.

Ordering Information

TN30013 Waterproof PTW Farmer chamber, connecting system BNT
TW30013 Waterproof PTW Farmer chamber, connecting system TNC
TM30013 Waterproof PTW Farmer chamber, connecting system M

- Therapy Dosemeters *page 13f.*
- Radioactive Check Devices *page 23*
- Calibration Service *page 150*

PinPoint® Ionization Chambers

Waterproof ion chambers for dose measurements in radiotherapy with high spatial resolution

Features

- Vented sensitive volumes of 0.015 cm^3, 0.016 cm^3 and 0.03 cm^3
- Suitable for dose scanning in radiotherapy beams with a superior spatial resolution
- Suitable for use in water

The waterproof PinPoint chambers have been specially designed for relative beam profile measurements in a motorized water phantom for characterization of LINAC radiation fields where superior spatial resolution is desired. The PinPoint chambers are ideally suited for this purpose with their inner diameters of only 2 mm (model 31014) and 2.9 mm (model 31015/31016). The chamber model 31016 shows a flat angular response, since the measuring volume is approximately spherical. When calibrated against a PTW Farmer chamber, the PinPoint chambers can be used for depth dose and absolute dose measurements. The sensitive volume is vented. The wall material is graphite with a protective acrylic cover. The chambers are fully guarded up to the measuring volume. The nominal energy range is ^{60}Co up to 50 MV photons. The chambers have a short stem for mounting and a flexible connection cable. They can be supplied with different connector types.

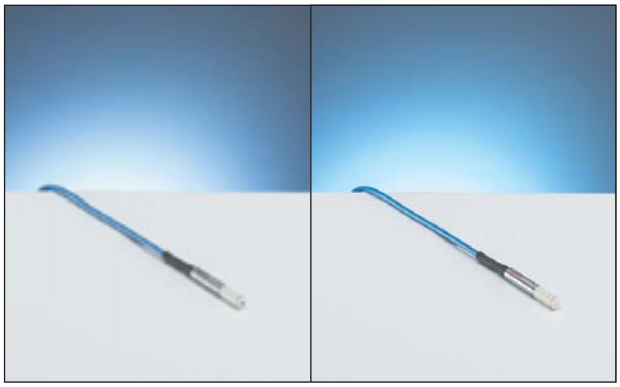
Ordering Information

PinPoint chambers, connecting system BNT, TNC or M:

31014 PinPoint chamber, 0.015 cm^3
31015 PinPoint chamber, 0.03 cm^3
31016 PinPoint 3D chamber, 0.016 cm^3

- TANDEM Dual Channel Dosemeter *page 14*
- Detector Extension Cables *page 28*
- TBA Detector Holding Devices *page 46*

Dosimetry Diodes



Waterproof p-type Si diode detectors for dose distribution measurements in high-energy photon and electron beams

Features

- Dosimetry Diode P type 60016:
  ^{60}Co ... 25 MV photons, field size 1 x 1 cm^2 ... 40 x 40 cm^2
- Dosimetry Diode E type 60017:
  (3 ... 25) MeV electrons, field size 1 x 1 cm^2 ... 40 x 40 cm^2
  ^{60}Co ... 25 MV photons, field size 1 x 1 cm^2 ... 10 x 10 cm^2
- Extremely small sensitive volume of 1 mm^2 x 30 µm
- Suitable for dose scanning in stereotactic and IMRT fields because of the superior spatial resolution
- Suitable for use in a remote controlled water phantom

The Dosimetry Diodes are p-type Si diode detectors designed for dose distribution measurements in high-energy photon and electron beams. Applications are IMRT, stereotactic beams, brachytherapy and water phantom scanning. The Dosimetry Diodes feature an extremely small sensitive volume shaped as a disk with an area of 1 mm^2 and a thickness of only 30 µm. This makes it possible to use the Dosimetry Diodes in small beams and to perform data acquisition with a very good spatial resolution. Because of the favorable signal-to-noise ratio, the Dosimetry Diodes are suitable for high precision dose distribution measurements. Since the Dosimetry Diodes are waterproof, they can be used in water phantoms without additional protective sleeves. After calibration by the user in comparison with a calibrated therapy chamber, the Dosimetry Diodes can be used for absolute dosimetry. They have a short stem for mounting to a water phantom mechanism and a flexible connection cable of 1.5 m in length to be connected to a dosemeter. The cable can be supplied with different connector types. The Dosimetry Diodes are usually irratiated in axial direction.

Ordering Information

Dosimetry Diodes, connecting system BNT, TNC or M:

60016 Dosimetry Diode P for photons
60017 Dosimetry Diode E for electrons and photons

- TANDEM Dual Channel Electrometer *page 14*
- Detector Extension Cables *page 28*
- TBA Detector Holding Devices *page 46*

Diamond Detector

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

Features

- Very small sensitive volume of 1 to 6 mm^2 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 angular response in water is better than ± 2 %
- Suitable for use in remote controlled water phantoms

The Diamond Detector[1], 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 nominal photon range of the detector is from 100 keV up to 20 MeV. The nominal electron range is 4 to 20 MeV. The detector has a short stem for mounting to a water phantom mechanism and a flexible cable of 1.5 m in length to be connected to a dosemeter with connecting system M, which supplies the required bias voltage of 100 V.

[1] The Diamond Detector was developed in cooperation with the IPTP Institute, Riga.

Ordering Information

TM60003 Diamond Detector, connecting system M

- TANDEM Dual Channel Electrometer *page 14*
- Detector Extension Cables *page 28*
- TBA Detector Holding Devices *page 46*

microLion Ionization Chamber

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

Features

- Liquid filled sensitive volume of 0.002 cm^3
- 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 chamber[1] (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 versions of the TANDEM dosemeter.

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

Ordering Information

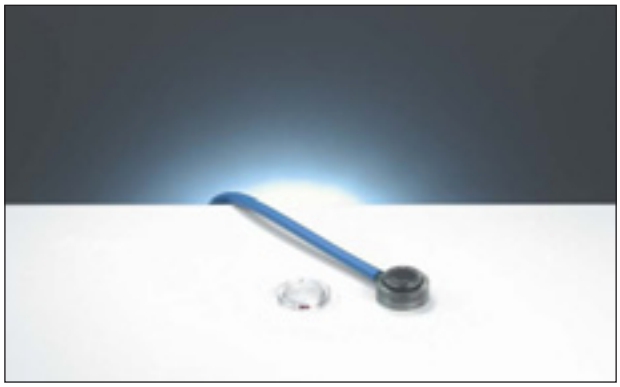
TN31018 microLion chamber 0.002 cm^3, connecting system BNT

TW31018 microLion chamber 0.002 cm^3, connecting system TNC

TM31018 microLion chamber 0.002 cm^3, connecting system M

- UNIDOS^{webline} *page 13*
- HV-SUPPLY *page 15*
- TBA Detector Holding Devices *page 46*

Advanced Markus® Electron Chamber



Plane parallel ion chamber for high-energy electron measurements in water and solid state phantoms

Features

- Vented sensitive volume of 0.02 cm³
- Same outer dimensions as the classic Markus chamber
- Wide guard ring design
- Suitable for relative and absolute electron dosimetry
- The chamber is waterproof when used with protective cap

The Advanced Markus chamber[1] is a further development of the classic Markus chamber, featuring a wide guard ring design to avoid perturbation effects by reducing the influence of scattered radiation from the housing. Since the outer shape is identical with the Markus chamber, all existing Markus chamber phantom plates and adapters can be used with the Advanced Markus chamber. The small sensitive volume makes the chamber ideal for dose distribution measurements in a water phantom, giving a good spatial resolution. The chamber features a flat energy response within the nominal energy range from 2 MeV to 45 MeV. With the very thin membrane of only 0.03 mm polyethylene, the chamber is suitable for use in solid state phantoms. The chamber comes with a protective acrylic cover of 0.87 mm thickness (1 mm water equivalence) for use in water. A calibration certificate with a ^{60}Co calibration factor given in absorbed dose to water is included. Air density correction is required for each measurement. A radioactive check device is available as an option. The chamber cable length is 1.05 m.

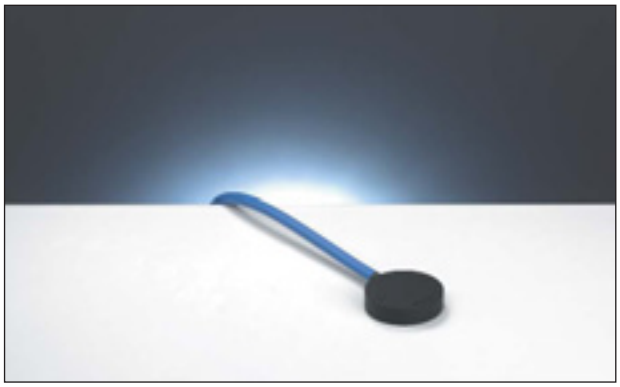
[1] The Advanced Markus chamber was developed in cooperation with Prof. Rosenow, Göttingen University, Germany

Ordering Information

Markus chambers, connecting system BNT, TNC or M:
34045 Advanced Markus electron chamber, 0.02 cm³
23343 Classic Markus electron chamber, 0.055 cm³

- Therapy Dosemeters *page 13f.*
- Radioactive Check Devices *page 23*
- Calibration Service *page 150*

Roos® Electron Chamber



Precision plane parallel chamber for absolute dosimetry of high-energy electron radiation in water and solid state phantoms

Features

- Vented sensitive volume of 0.35 cm³
- Reference chamber for precise absolute electron dosimetry
- Perturbation-free design and minimal polarity effect
- Suitable for use in water and in solid state phantoms

The Roos electron chamber[1] is used as a reference electron chamber. It is recommended by the IAEA[2] for high precision electron dosimetry in radiation therapy. The chamber has a 4 mm wide guard ring to exclude any perturbation effect even at low electron energies. The polarity effect is negligible (< 0.5 % at 10 MeV). The energy response is only influenced by the stopping power ratios water / air. The chamber is waterproof for absolute dose and depth dose measurements in a water phantom. The acrylic entrance window has a thickness of 1 mm. The nominal useful energy range is from 2 MeV to 45 MeV.
A calibration certificate with a ^{60}Co calibration factor given in absorbed dose to water is included. Air density correction is required for each measurement. A radioactive check device with adapter is available as an option. The chamber cable length is 1.08 m.

[1] The Roos electron chamber was developed in cooperation with Dr. Roos, PTB-Braunschweig, German Federal Institute of Physics and Metrology (National Laboratory of Germany)

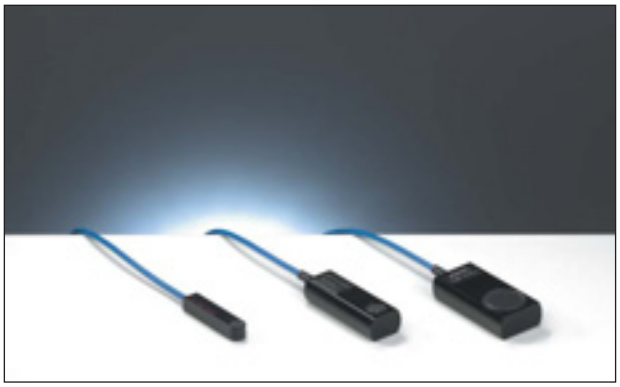
[2] Technical Report No. TRS-381. The Use of Plane Parallel Ionization Chambers in High Energy Electron and Photon Beams, IAEA (International Atomic Energy Agency), Vienna 1997

Ordering Information

Roos chamber, connecting system BNT, TNC or M:
34001 Roos electron chamber

- Therapy Dosemeters *page 13f.*
- Radioactive Check Devices *page 23*
- Calibration Service *page 150*

Soft X-Ray Ionization Chambers



Plane parallel chambers with thin membranes for measuring therapeutic X-rays in air and solid state phantoms

Features

- Vented sensitive volumes of 0.0053 cm^3, 0.02 cm^3 and 0.20 cm^3
- Very thin flat entrance windows for dose measurements of low energy X-ray beams
- Suitable for use in air and in solid state phantoms

The 0.02 cm^3 soft X-ray chamber type 23342 is the standard ionization chamber for dose measurements in superficial radiation therapy. The 0.20 cm^3 chamber type 23344 with its bigger sensitive volume is used for similar purposes, where a higher response is required. The usual calibration of both chambers is done at 15 kV to 70 kV. The chambers have a very flat energy response in the range from 10 kV to 100 kV.
The 0.0053 cm^3 soft X-ray chamber type 34013 has an extremely small sensitive volume and makes it possible to measure therapeutic X-ray beams with very small field sizes or with steep fluence gradients. The calibration is typically done at 15 to 50 kV. The energy response within this range is ± 2 %.
The membrane material is polyethylene of 0.03 mm thickness. The guard ring borders the measuring volume. A calibration certificate is included. Air density correction is required for each measurement. A radioactive check device is available as an option.

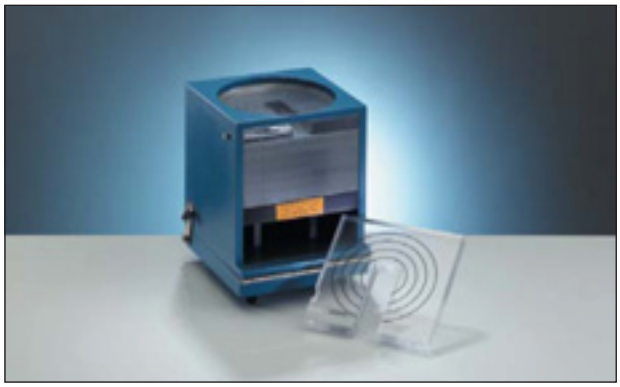
Ordering Information

Soft X-ray chambers, connecting system BNT, TNC or M:

34013 Soft X-ray chamber 0.0053 cm^3
23342 Soft X-ray chamber 0.02 cm^3
23344 Soft X-ray chamber 0.20 cm^3

- Therapy Dosemeters *page 13f.*
- Radioactive Check Devices *page 23*
- Calibration Service *page 150*
- Soft X-Ray Slab Phantom *page 21*

Soft X-Ray Slab Phantom



Small size acrylic slab phantom for soft X-ray dosimetry with soft X-ray chambers

Features

- Suitable for soft X-rays up to 100 kV
- Makes it possible to perform absolute dose and depth dose measurement in a solid state phantom
- Supplied with chamber adapter plate and solid housing

The slab phantom type 2962 is designed for therapy dosimetry on X-ray therapy equipment in the energy range from 7.5 kV to 100 kV bremsstrahlung. It is used for depth dose measurements and for calibration purposes, using the soft X-ray chambers type 23342 (0.02 cm^3) or 23344 (0.2 cm^3). The slab phantom consists of 1 plate 1 mm thick, 2 plates each 2 mm thick, 2 plates each 5 mm thick and 5 plates each 10 mm thick. This combination enables the user to vary the measuring depth from the surface to a depth of 6 cm in increments of 1 mm. To provide for backscatter, slabs are placed below the radiation detector. The size of the slabs is 13 cm x 13 cm. Two models with adapter plates are available for both above-mentioned chamber types. The slab phantom is supplied in a solid storage case, which is also used for the measurement set-up.

Ordering Information

L981035 Acrylic slab phantom for chamber type 23342
L981034 Acrylic slab phantom for chamber type 23344

- Soft X-ray Ionization Chambers *page 21*

Bragg Peak Ionization Chambers

Waterproof plane-parallel chambers for dosimetry in proton and heavy ion beams

Features

- Waterproof, wide guard ring design
- Sensitive volumes 10.5 cm^3 and 2.5 cm^3, vented to air

The Bragg peak chambers are designed to measure the exact location of the Bragg peak in therapy proton and heavy ion beams. The large diameters of the chambers allow the measurement of the complete beam diameter (non-scanned) including the scattered particles. The chambers are waterproof and consequently can either be used in air behind a water column or in a water phantom.
In water, both Bragg peak chambers can be used for measurements of horizontal beams. Due to the thicker entrance and exit windows, the 34070 Bragg peak chamber can additionally be used in vertical beams where measurements are performed in different water depths. The cable length is 2.5 m.

The Bragg peak chamber 34070 can also be used as a large area chamber for photon measurement. The large entrance window with a diameter of 84 mm makes the chamber suitable for the measurement of the dose area product of narrow photon beams.

Ordering Information

TN34070-2,5 Bragg peak chamber 10.5 cm^3, connecting system BNT

TW34070-2,5 Bragg peak chamber 10.5 cm^3, connecting system TNC

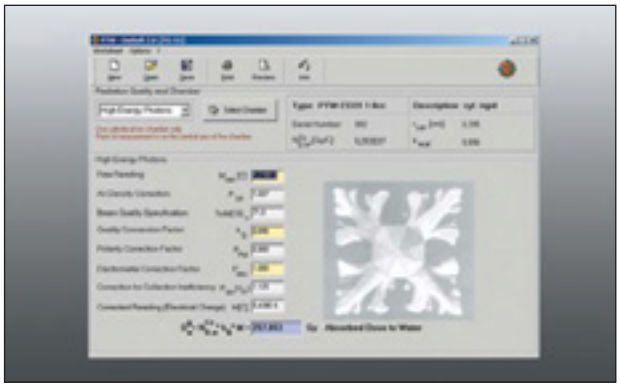
TM34070-2,5 Bragg peak chamber 10.5 cm^3, connecting system M

TN34073-2,5 Bragg peak chamber 2.5 cm^3, connecting system BNT

TW34073-2,5 Bragg peak chamber 2.5 cm^3, connecting system TNC

TM34073-2,5 Bragg peak chamber 2.5 cm^3, connecting system M

UniSoft Dosimetry Software



Software for radiation therapy dosimetry according to international dosimetry protocols

Features

- Determines chamber correction factors and calculates absorbed dose to water
- Put out data in worksheet format
- Two versions are available to support all established international therapy dosimetry protocols

The UniSoft software is designed to determine the absorbed dose to water of high-energy photon and electron radiation out of dosemeter readings from ionization chambers based on ^{60}Co calibrations.

UniSoft software, Edition 2000 supports the AAPM TG-51 and IAEA TRS-398 therapy dosimetry protocols by calculating the relevant correction factors for air density, polarity effect, saturation effect, radiation quality and displacement. A software module to control the dose meter and to position the detector is included.
UniSoft features ionization chamber libraries to store chamber data necessary for the determination of correction factors. Dosimetry worksheets can be defined for different dosimetry protocols, beam qualities, types of ionization chambers and two kinds of air density correction.

Ordering Information

S100009 UniSoft Software, Edition 2000

- UNIDOS*webline* / UNIDOS Universal Dosemeter *page 13*
- UNIDOS E Universal Dosemeter *page 14*
- MULTIDOS Multi Channel Dosemeter *page 32*
- TANDEM Dual Channel Electrometer *page 14*
- Radiation Detectors *page 16ff.*
- Radioactive Check Devices *page 23*
- MEPHYSTO *mc²* Software *page 49*

Radioactive Check Devices

Radioactive check devices for air density correction and constancy checks of therapy dosemeters

Features

- Make it possible to perform air density corrections when using vented ionization chambers
- Check proper functioning and constancy of the complete dosemeter
- Two types for thimble and flat chambers are available
- Include encapsulated low activity of 33 MBq (type T48012) resp. 20 MBq ^{90}Sr (type T48010)

The radioactive check devices are recommended for high precision dosimetry. They enable medical physicists to check the stability of ionization chamber response and to determine air density correction factors. For sealed in-vivo ionization chambers the use of a radioactive check device is mandatory (IEC 60731). Check readings should be done each time before starting a dose measurement. The chamber calibration certificate includes the reference reading under standard conditions. The check reading will decrease over time due to the decay of the activity. The ^{90}Sr half-value time is 28.7 years. Both check devices include shielding containers, and the check device T48012 is supplemented by a thermometer for controlling the check device temperature. Various holding devices for the adaptation of different ion chambers are available. Due to the arrangement of the radioactive source of the check device model T48012, the measuring volume of the inserted thimble chamber is irradiated from all directions. The cylindrical source of the check device model T48010 is placed near to the entrance window of flat ion chambers by means of the appropriate holding device. The source T48012 is equivalent to ISO class C64444, the source T48010 is equivalent to class C6X444. The dose rate in 10 cm distance is below 1 µSv/h (with cover closed). Please observe the national regulations for transport and use of radioactive material. Before shipping, we need a confirmation certifying that the purchaser is allowed to handle the radioactive sources.

Ordering information

T48012 Radioactive check device for thimble chambers
T48010 Radioactive check device for flat chambers
Chamber/check source holding devices upon request

- Ionization Chambers *page 16ff.*

UNITEST Electric Test Device

Electric test device to check the proper functioning of UNIDOS, UNIDOS E, MULTIDOS and TANDEM dosemeters

Features

- Helps to check the electrical performance of dosemeters
- Checks the electrical stability, the amplifier ranges and the internal high voltage supply
- Connects to the dosemeter like a detector

The UNITEST test device behaves like an electric current source for checks of the consistent performance of therapy dosemeters. It makes it possible to test the response of the dosemeter's dose and dose rate ranges, the different amplifier ranges and the internal high voltage power supply.
The UNITEST device connects like a detector to the dosemeters UNIDOS, UNIDOS E, MULTIDOS and TANDEM. The easy to use, lightweight and portable device does not require a power cord or a battery.

Ordering Information

T47003 UNITEST Test device, connecting system BNT
T47002 UNITEST Test device, connecting system TNC
T47001 UNITEST Test device, connecting system M

- UNIDOS Universal Dosemeter *page 13*
- UNIDOS E Universal Dosemeter *page 14*
- MULTIDOS Multi Channel Dosemeter *page 32*
- TANDEM Dual Channel Electrometer *page 14*

Build-Up Caps for Ionization Chambers

Acrylic and brass build-up caps for thimble chambers for use in high-energy photon beams

Features

- Photon energy ranges from ^{60}Co up to 30 MV
- Establish electron equilibrium for in-air measurement
- Suitable for PTW Farmer and semiflex chambers
- Made of acrylic or brass

Build-up caps are used with thimble ionization chambers for in-air measurements in photon beams when electron equilibrium is desired. Each standard delivery of a thimble chamber includes an appropriate acrylic build-up cap for ^{60}Co. Optionally, a variety of build-up caps is available for different ionization chamber types and for different photon energy ranges. Acrylic material is usually used for build-up caps. Acrylic build-up caps are more water-equivalent than brass build-up caps, but their size may be disadvantageous when used in small beams.
Acrylic build-up caps are available for the chamber types:

- 0.6 cm^3 PTW Farmer chambers
- 0.125 cm^3 and 0.3 cm^3 Semiflex chambers

The acrylic build-up caps are designed with wall thicknesses for various energy ranges from ^{60}Co up to 30 MV photons.

Brass build-up caps are available for the chamber types:

- 0.125 cm^3 and 0.3 cm^3 Semiflex chambers

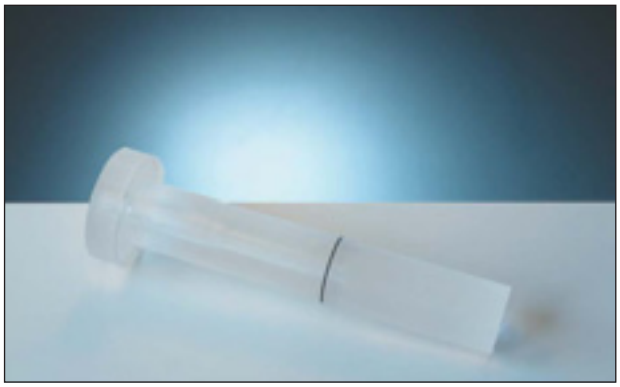
The wall thicknesses cover the energy range from ^{60}Co to 20 MV photons.

Ordering Information

Variety of acrylic and brass build-up caps upon request

- Semiflex Ionization Chambers *page 16*
- PTW Farmer Ionization Chambers *page 17*

ESTRO Mini Phantoms



Acrylic phantoms for „in air“ measurement acc. ESTRO recommendation

Features

- “In air” measurement according to ESTRO
- Accommodate a Farmer type chamber or 0.3 cm^3 semiflex chamber

The acrylic cylinder mini phantoms are designed for “in air” measurements or the measurement of volume scatter ratios, described in the ESTRO booklet 3 /1997. They have a height of 188 mm and a diameter of 40 mm each.

Different types accommodate a Farmer type ion chamber perpendicular or longitudinal to the phantom axis at a depth of 100 mm. T40036.1.020 accommodates a 0.3 cm^3 semiflex chamber.

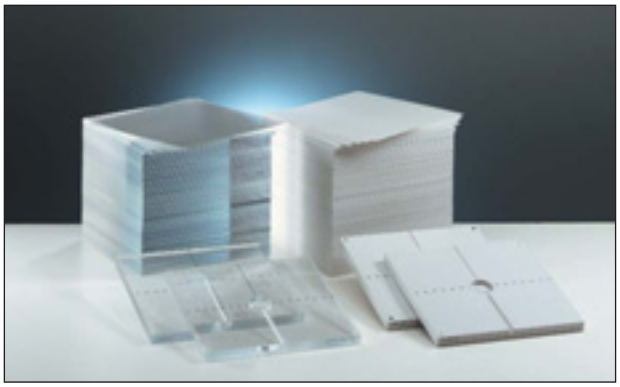
Ordering Information

T40023.1.010 ESTRO Mini Phantom longitudinal for Farmer chamber

T40036.1.010 ESTRO Mini Phantom perpendicular for Farmer chamber

T40036.1.020 ESTRO Mini Phantom perpendicular for 0.3cm^3 semiflex chamber

Acrylic and RW3 Slab Phantoms



Acrylic and water-equivalent RW3 slab phantoms with chamber adaptation plates for therapy dosimetry

Features

- Make it possible to perform monitor calibrations and depth dose measurements in a solid state phantom
- Suitable for high energy photon and electron dosimetry
- Make it possible to vary the measuring depth up to 30 cm in increments of 1 mm
- Made of acrylic material or water-equivalent RW3 material (Goettingen White Water) with thickness tolerance of ± 0.1 mm

The acrylic slab phantom is designed for the use with photon radiation in the range from 70 kV up to 50 MV and for electron radiation from 1 MeV up to 50 MeV. The RW3 phantom is water-equivalent in the energy ranges from ^{60}Co to 25 MV photons and from 4 MeV to 25 MeV electrons. The phantoms are used for monitor calibration and quality assurance measurements. Depth dose measurements are made by varying the measuring depth. To provide for backscatter, slabs are placed below the radiation detector. The slab phantoms each consist of 1 plate 1 mm thick, 2 plates each 2 mm thick, 1 plate 5 mm thick and 29 plates each 10 mm thick. This combination makes it possible to vary the measuring depth in increments of 1 mm. The size of the complete phantoms is 30 cm x 30 cm x 30 cm. Adapter plates for a number of detector types are available for both phantoms. Each plate is precisely machined for a thickness tolerance of only ± 0.1 mm.

Ordering Information

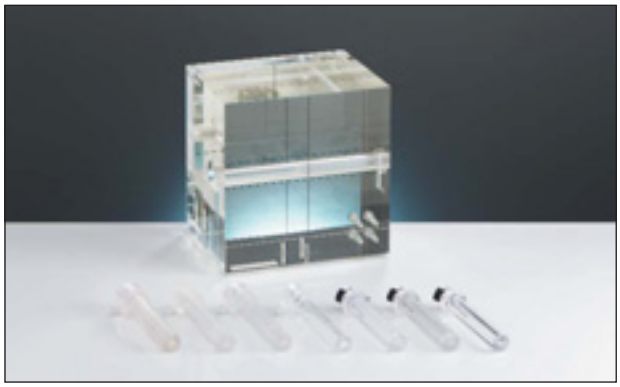
T2967 Acrylic slab phantom
T29672 Water-equivalent RW3 slab phantom
T2967/12 Carrying case for slab phantom

Option

Detector plates upon request

▸ Radiation Detectors *page 16ff.*

ICRU Acrylic Calibration Phantom



Acrylic block phantom according to ICRU 23[1], suitable for tip-to-tip calibrations of therapy chambers

Features

- Suitable for chamber calibration in high energy beams
- Complies with ICRU 23[1] for determination of absorbed dose rate
- Makes it possible to calibrate chambers using the tip-to-tip or the replacement method
- A variety of chamber adapters is available

The solid state phantom type 2966 is designed according to ICRU report 23[1] and consists of a 200 mm x 200 mm x 120 mm acrylic block with a chamber hole and a 200 mm x 200 mm x 30 mm plate. The phantom makes it possible to place thimble chambers in measuring depths of 50 mm, 70 mm and 100 mm. The reference chamber and the chamber under calibration can be placed in the phantom tip-to-tip and irradiated simultaneously, which is the preferred calibration method if both chambers are of the same type. A variety of adapters for a number of ionization chamber types is available. The phantom has a 3/8 inch thread by which it can be mounted on a tripod to avoid backscatter radiation.

[1] ICRU 23: Measurement of Absorbed Dose in a Phantom Irradiated by a Single Beam of X or Gamma Rays, January 1973.

Ordering Information

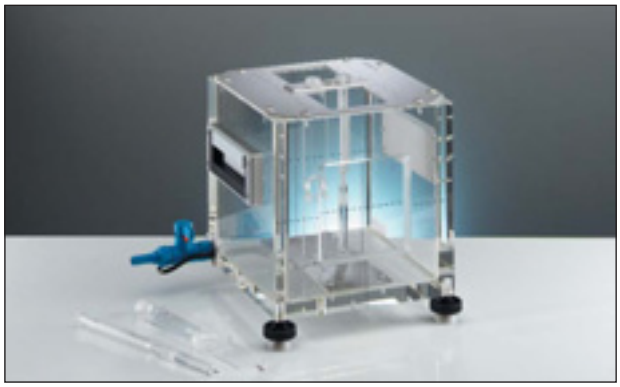
T2966 Acrylic block phantom

Option

Chamber adapters upon request

▸ Radiation Detectors *page 16f.*

Water Phantom 4322 for Horizontal Beams



Small size water phantom for absolute dosimetry in photon and electron beams with horizontal beam incidence

Features

- Suitable for calibration of ionization chambers in high-energy photon and electron beams
- Suitable for monitor calibration in water
- Makes it possible to irradiate up to three chambers simultaneously
- Makes it possible to vary the measuring depth from 15 mm up to 250 mm in increments of 5 mm

The water phantom type 4322 is designed for calibration measurements in radiation therapy using a horizontal beam. Up to three ionization chambers (alternatively TL detectors and $FeSO_4$ ampoules) can simultaneously be placed at different water depths with a distance of 50 mm from chamber axis to chamber axis by using appropriate waterproof acrylic adapters. The external phantom dimensions are approximately 30 cm x 30 cm x 30 cm. The entrance window in one of the walls has the thickness of 3 mm and the size of 150 mm x 150 mm. Holding devices on the top and on the bottom of the phantom make it possible to position the chambers precisely by means of adapters in depths from 15 mm up to 250 mm in increments of 5 mm. The phantom has two handles for easy carrying, three adjustable supports for leveling, etched cross hairs for alignment and a collision protected drain tap for emptying without tilting or changing the phantom's position.

Ordering Information

T4322 Stationary water phantom

Option

Detector adapters upon request

- Radiation Detectors *page 16ff.*

Water Phantom 41023 for Horizontal Beams

Small size water phantom with sliding caliper for absolute dosimetry with horizontal beam incidence

Features

- Suitable for calibration of ionization chambers in high-energy photon and electron beams
- Suitable for monitor calibration in water
- Makes it possible to irradiate up to three chambers simultaneously
- Makes it possible to vary the measuring depth continuously

The water phantom type 41023 is designed for calibration measurements in radiation therapy using a horizontal beam. Up to three ionization chambers (alternatively TL detectors and $FeSO_4$ ampoules) can simultaneously be placed at different water depths with a distance of 50 mm from chamber axis to chamber axis by using waterproof acrylic adapters. The measuring depth can be adjusted continuously by means of a caliper on the phantom top. Appropriate adapters enable users to position thimble chambers precisely in depths from less than 15 mm up to 260 mm and plane parallel electron chambers as well as thermoluminescent detectors from 6 mm up to 260 mm. The external phantom dimensions are approximately 30 cm x 30 cm x 30 cm. The entrance window in one of the walls has the thickness of 3 mm and the size of 150 mm x 150 mm. The phantom has two handles for easy carrying, three adjustable supports for leveling, etched cross hairs for alignment and a collision protected drain tap for emptying without tilting or changing the phantom's position.

Ordering Information

T41023 Stationary water phantom

Option

Detector adapters upon request

- Radiation Detectors *page 16ff.*

Water Phantom 41001 for Vertical Beams

Small size water phantom for absolute dosimetry in photon and electron beams with vertical beam incidence

Features

- Suitable for calibration of ionization chambers in high-energy photon and electron beams
- Suitable for monitor calibration in water
- Makes it possible to irradiate a thimble chamber in water with vertical beam incidence
- Makes it possible to vary the measuring depth by water level adjustment

The water phantom type 41001 is designed for calibration measurements in radiation therapy with vertical beam incidence directly into the water surface. Measurements are done with a horizontally mounted thimble chamber, put into position through a hole in one side wall by using an appropriate waterproof acrylic adapter. To seal the hole, the adapter is supplied with an O-ring. By inserting the adapter tip into a cavity on the opposite wall, which serves as support, the adapter is fixed. Adapters are available for a variety of thimble chambers. The measuring position is 150 mm below the upper edge of the tank. The measuring depth can be varied by height adjustment of the water level by means of a vertical scale on the phantom wall. The external phantom dimensions are approximately 30 cm x 30 cm x 30 cm. The phantom has two handles for easy carrying, three adjustable supports for leveling, etched cross hairs for alignment and a collision protected drain tap for emptying without tilting or changing the phantom's position.

Ordering Information

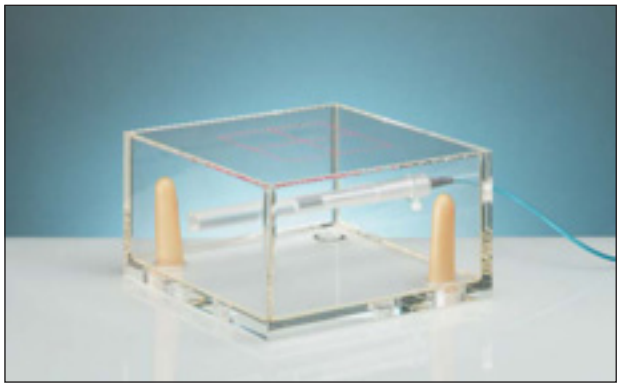
T41001 Stationary water phantom

Options

T41001.1.002 Adapter for chamber 23331
T41001.1.003 Adapter for chamber 23332
T41001.1.005 Adapter for PTW Farmer chambers
T41001.1.006 Adapter for chamber 31002/31010
T41001.1.007 Adapter for chamber 31006

▸ Ionization Chambers *page 16f.*

Stationary Water Phantom



Completely closed stationary water phantom for high energy photon dosimetry with PTW Farmer chambers

Features

- Makes it possible to perform quick and reproducible photon calibration measurements
- Accommodates a PTW Farmer chamber at a fixed measuring depth of 50 mm
- Beam markers on the top plate
- Compensates changes of the water volume caused by ambient temperature changes

The phantom T41014 is a stationary water phantom for absolute dosimetry and calibration measurements in radiation therapy. It is completely covered by acrylic (PMMA) plates. The external dimensions are approximately 20 cm x 20 cm x 10 cm. The entrance wall thickness is 3 mm, the measuring depth 50 mm. PTW Farmer ionization chambers fit exactly into the built-in chamber holder. The top plate features markers for beam adjustment.
The phantom is filled with approximately 4 liters of water through a sealed fill plug. It is fitted with two elastic expansion vessels to adapt the phantom to different ambient temperatures and to ensure a constant measuring depth.

Ordering Information

T41014 Stationary water phantom

▸ PTW Farmer Ionization Chambers *page 17*

Detector Extension Cables

High quality triax extension cables with BNT, TNC and PTW-M connectors

Features

- Serve as low noise triax cables for the connection of radiation detectors to electrometers
- Low cable leakage caused by irradiation
- Resistance against radiation damage
- Available in lengths of up to 100 meters

The low noise extension cables for the connection of radiation detectors to dosemeters and electrometers are of high quality for precise current measurements down to 10^{-15} A. When irradiated, the cable leakage is less than 10^{-12} C/(Gy·cm). The triaxial cables provide insulated potentials for the measuring signal, the guard electrode, and high voltage. Besides the standard version, a 'heavy duty' version is available for rugged use. The standard extension cables of 20 m length can be supplied on cable reels. The cables can be supplied with various connector types. The BNT connector with bayonet mounting and the TNC connector with threaded mounting put high voltage to the chamber guard ring while the PTW-M connector grounds the guard. (BNC and banana pin upon request.) For through-wall installations, the extension cables with BNT, TNC, and M connectors can be supplied with a flexible armored metal tube to protect the cable against damage

Ordering Information

T26005.1.002-10 BNT Extension cable, 10 m length
T26002.1.001-10 TNC Extension cable, 10 m length
T2954/K2-10 M Extension cable, 10 m length

Other lengths, 'heavy duty' execution, armored versions and 20 m cable on reels upon request

- Dosemeters and Detectors *page 13ff.*

Barometer Thermometer

Precise air pressure and temperature measuring instruments for air density correction of ion chamber readings

Features

- The barometers provide precise measurement of absolute air pressure in hPa
- Official calibrations traceable to primary standards are optionally available for barometers and thermometer

The precision barometers and the thermometer are used to determine air density correction factors for absolute dosimetry.

The precision barometers are calibrated against sea level.

The temperature-compensated barometers have a circular analogue scale with 115 mm diameter. The scale resolution is 0.5 hPa. The metal housing is supplied with a flange for wall mounting.

The analogue precision thermometer is a mercury thermometer with a glass capillary. The measuring range is from 0 to 50 °C, and the scale resolution is 0.2 °C.

The digital combined barometer and thermometer device is equipped with an RS 232 interface for data transfer to a PC.

Ordering Information

L991133 Precision barometer (870 ... 1050) hPa
L991237 Precision barometer (870 ... 1050) hPa with German calibration
L991134 Precision barometer (760 ... 950) hPa
L991238 Precision barometer (760 ... 950) hPa with German calibration
L991361 Precision barometer (750 ... 1100) hPa and thermometer (-20 ...50) °C, digital with RS232
L654004 Precision thermometer (0 ... 50) °C
L654003 Precision thermometer (0 ... 50) °C, officially calibrated

Patient and Brachytherapy Dosimetry

Patient and Brachytherapy Dosimetry Equipment

Patient and Brachytherapy Dosimetry

Patient Dosimetry

To check the correct performance of patient irradiations according to the treatment plans and to avoid irradiation by mistake, on-line measurements of accumulated doses during patient treatments are suggested. Regulations such as the European Directive 97/43/EURATOM on health protection in medical radiology require to determine, record and verify radiation loads on patients.

For patient dosimetry during radiotherapy, multiple semiconductor probes are fixed to the patient body and connected to a multi-channel dosemeter. Compared with ionization chambers, semiconductor detectors have the advantage of small sensitive volumes. Since they do not need a bias voltage for operation, the existence of high voltage in the patient environment is avoided.

The PTW product line includes patient dosemeters for three applications:

- Dosimetry in external beams
  Up to twelve in-vivo probes with single semiconductor detectors are placed at the patient body and connected to a multi-channel dosemeter to integrate the total doses during standard treatment or during total body irradiation (TBI) by external beams from a linear accelerator or a ^{60}Co unit.
- Dosimetry on afterloading brachytherapy units
  A single detector probe is placed into the patient bladder and a five-fold probe with five equally spaced semiconductor detectors is inserted into the rectum for dose integration during gynecological afterloading treatments.

Source strength measurement in brachytherapy

Radioactive sources are positioned inside the target volume for direct contact to human tissue in brachytherapy procedures. These radiotherapy techniques are becoming more and more important for the treatment of various diseases. Besides the traditional afterloading techniques for gynecological radiotherapy, modern techniques for seed implantation and for intravascular brachytherapy are used now.
For correct irradiation according to the treatment plan, the radiation strength of each individual radioactive source has to be determined before starting brachytherapy treatment.

PTW offers a range of products to measure the source strength of different source types for brachytherapy:

- Intracavitary afterloading sources
  - Afterloading calibration phantom
  - Well-type chamber
- Intravascular brachytherapy sources
  - OPTIDOS scintillation dosemeter and phantoms
  - SOURCECHECK chamber
- Radioactive seeds and seed strands for implantation
  - SOURCECHECK chamber
- Unsealed radioactive sources for intravascular brachytherapy
  - CURIEMENTOR 3 / 4

Our patient and brachytherapy products comply with international standards:

AAPM TG-56, report #59
Code of Practice for Brachytherapy Physics

AAPM TG-60, report #66
Intravascular Brachytherapy Physics

ESTRO Booklet #1: Methods for in vivo dosimetry in external radiotherapy; Physics for clinical radiotherapy

ESTRO Booklet #5: Practical guidelines for the implementation of in vivo dosimetry with diodes in external radiotherapy with photon beams (entrance dose); Physics for clinical radiotherapy

VIVODOS®
In-Vivo Dosemeter

12 channel dosemeter for in-vivo dosimetry during external treatment and during afterloading brachytherapy

Features

- Connects up to twelve semiconductor detectors
- Measures patient entrance and exit doses from external beams and intracavitary doses from afterloading sources
- Complies with safety standard IEC 60601-2-9 as dosemeter suitable for patient contact

The VIVODOS twelve channel dosemeter is designed for patient dosimetry during radiation therapy treatment. In-vivo dosimetry is generally recommended to record and verify the radiation load to patients and consequently to fulfill radiation protection requirements. VIVODOS connects up to twelve semiconductor detectors for in-vivo dosimetry of external beams from LINACs including TBI (total body irradiation) via a special connection box. For in-vivo dosimetry during gynecological afterloading brachytherapy, a five-fold and a single intracavitary detector are connected via a connection box to measure the doses in the rectum and in the bladder.

VIVODOS features a high measuring accuracy of better than ± 0.5 % and a very good long-term stability of less than ± 0.5 % per year.

The VIVODOS does not have high voltage supply, which is not needed for semiconductor detector operation. An RS232 interface is included, as well as the MULTICAL software for calibration purposes.

Ordering Information

T10018 VIVODOS Twelve channel dosemeter, 115V/230V

- VivoSoft / MultiSoft Software *page 34*
- In-Vivo / Afterloading Probes *pages 32 and 35*
- Connection boxes *pages 32 and 35*

VIVODOS®E
In-Vivo Dosemeter

4 channel dosemeter for in-vivo dosimetry during external treatment

Features

- Connects up to four semiconductor detectors
- Measures patient entrance and exit doses from external beams
- Complies with safety standard IEC 60601-2-9 as dosemeter suitable for patient contact

The VIVODOS E four channel dosemeter is designed for patient dosimetry during radiation therapy treatment. In-vivo dosimetry is generally recommended to record and verify the radiation load to patients and consequently to fulfill radiation protection requirements. VIVODOS E connects up to four semiconductor detectors for in-vivo dosimetry of external beams from LINACs.

The diodes are connected directly to the BNC connectors on the rear panel.

VIVODOS E features a high measuring accuracy of better than ± 0.5 % and a very good long-term stability of less than ± 0.5 % per year. VIVODOS E does not have high voltage supply, which is not needed for semiconductor detector operation. An RS232 interface is included, as well as the MULTICAL software for calibration purposes.

Ordering Information

T10028 VIVODOS E Four channel dosemeter, 115V/230V
T26059-10 BNC extension cable, 10 m

- VivoSoft Software *page 34*
- In-Vivo detectors *page 32*

MULTIDOS® Multi Channel Dosemeter

Multi channel dosemeter for absolute dosimetry, in-vivo measurements and quality control in radiation therapy

Features

- Dual channel therapy dosemeter according to IEC 60731 (field class); HV +400 V, only M connecting system available
- Twelve channel in-vivo dosemeter for diode measurements (connection box required)
- Six channel in-vivo dosemeter for diode measurements in rectum and bladder (connection box required)
- LINAC constancy check device for homogeneity and symmetry tests (check probe required)
- 48 channel electrometer for field analysis (LA48 linear array and extender ME48 required)
- Complies with safety standard IEC 60601-2-9 as a dosemeter for patient contact
- Measures dose and dose rate or charge and current simultaneously

MULTIDOS can be used with ionization chambers and semiconductor detectors. It meets or exceeds the standards for field class dosemeters as specified in IEC 60731. The calibration factors are stored in the unit and additional correction factors can be entered. Air density corrections are done by keying in air pressure and temperature. The large LC display shows the measuring results in Gy, Gy/min, R, R/min, C or A. MULTIDOS features a high measuring accuracy of better than ± 0.5 % and a very good long-term stability of less than ± 0.5 % per year. An RS232 interface is included as well as the MultiCal software for calibration purposes.

Ordering Information

T10004 MULTIDOS Multi channel dosemeter, 115/230 V

- Radiation Detectors *page 16ff.*
- UniSoft Dosimetry Software *page 22*
- UNITEST Electric Test Device *page 23*
- In-Vivo Probes *pages 32 and 35*
- LA48 Linear Chamber Array *page 47*

In-Vivo Probes

Semiconductor detectors for in-vivo dosimetry during external radiation treatment with linear accelerators

Features

- Measure patient dose during external radiotherapy
- Suitable for any irradiation technique including TBI
- Types for different beam qualities are available
- Comply with safety standard IEC 60601-2-9
- Risk organ diode with homogenous directional response available

The semiconductor probes for in-vivo dosimetry are fixed to the patient's body to measure the patient skin, entrance or exit dose during external radiation treatments. Additionally a risk organ diode with increased sensitivity and homogenous directional response is available. Three different detector types with integrated build-up caps for photon energies from ^{60}Co to 25 MV and one type for electron measurements are available. The detectors do not require a bias voltage. They have a connection cable of 4 m length with BNC connector.

Ordering Information

In-vivo semiconductor probes

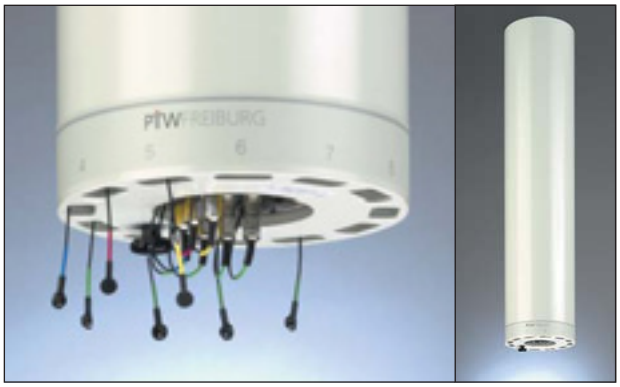
T60010L In-vivo semiconductor probe, ^{60}Co to 5 MV
T60010M In-vivo semiconductor probe, 5 MV to 13 MV
T60010H In-vivo semiconductor probe, 13 MV to 25 MV
T60010E In-vivo semiconductor probe, electrons
T60010RO In-vivo semiconductor probe for risk organ monitoring
T16009 In-vivo detector connection box, 12 x BNC
T26024-20 Connection cable for connection box to the dosemeter, 20 m

Options

L981064 Cable installation set, 20 m
T16006.1.001 C-Box for wall mounting, 2 units required

- MULTIDOS Multi Channel Dosemeter *page 32*
- VIVODOS / VIVODOS E In-Vivo Dosemeter *page 31*
- VivoSoft In-Vivo Software *page 34*

DCMS Diode Ceiling Mount System



Ceiling mounted support to accommodate in-vivo diode detectors near to the table-top of treatment units

Features

- Accommodates up to 12 semiconductor detectors
- Provides up to 3.2 m extension length for each detector to be placed at the patient's skin for in-vivo dosimetry
- Extension cable can be easily locked at any extracted length

The DCMS diode ceiling mount system facilitates the handling of measuring probes to be located at the patient's skin for patient dose determination during external beam treatment for cancer therapy. The system is designed for robust daily use and for long-term reliability. It accommodates up to 12 in-vivo probes for high-energy photon and electron dose measurement (see *page 34*). The maximum cable length mounted to the probes is 4 m and the maximum cable extension length is 3.2 m. The desired cable length can be locked individually for each probe at any length in the extension range. The DCM system is firmly mounted to the ceiling of the treatment room near to the patient table-top of the radiation treatment unit. Its height is 1142 mm, and the diameter is 250 mm. The weight including 12 probes is approximately 28 kg.

Ordering Information

T20007 DCMS Diode ceiling mount system

Options

L981064 Cable installation set, 20 m
T16006.1.001 C-Box for wall mounting, 2 units required
T20007.1.100 Mounting set for false ceilings

- MULTIDOS Multi Channel Dosemeter *page 32*
- VIVODOS / VIVODOS E In-Vivo Dosemeters *page 31*
- In-Vivo Probes *page 32*

DIODE MATE Mobile Unit

Mobile support to accommodate in-vivo diode detectors near to the table-top of treatment units

Features

- Accommodates up to 12 semiconductor detectors
- Provides up to 3.2 m extension length for each detector to be placed at the patient's skin for in-vivo dosimetry
- Extension cable can be easily locked at any extracted length

The DIODE MATE unit is equipped with a mobile frame with 5 rollers and a push handle. It can be moved into any desired position next to the patient couch or the storing place. Two rollers are equipped with locking devices.

The system is designed for robust daily use and for long-term reliability. It accommodates up to 12 in-vivo probes for high-energy photon and electron dose measurement (see *page 34*). The maximum cable length mounted to the probes is 4 m and the maximum cable extension length is 3.2 m. The desired cable length can be locked individually for each probe at any length in the extension range.

The DIODE MATE is 1275 mm high, the outer diameter is 550 mm. The weight including 12 probes is approximately 36 kg.

Ordering Information

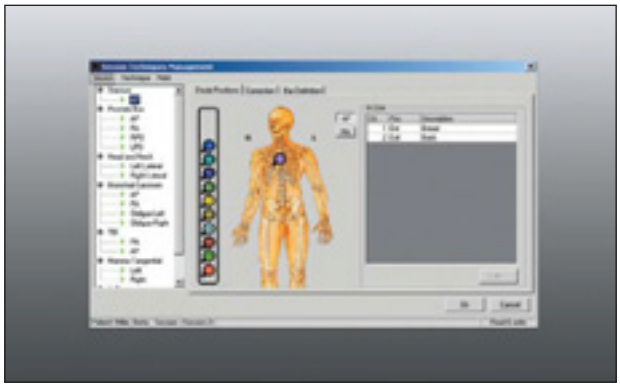
T20010 DIODE MATE mobile unit

Options

L981064 Cable installation set, 20 m
T16006.1.001 C-Box for wall mounting, 2 units required

- MULTIDOS Multi Channel Dosemeter *page 32*
- VIVODOS / VIVODOS E In-Vivo Dosemeters *page 31*
- In-Vivo Probes *page 32*

VivoSoft In-Vivo Software



Software for patient dosimetry during radiation therapy with external beams from linear accelerators and telecobalt units

Features

- Controls the multi channel dose integration during external beam treatment and records the measuring data
- Operates up to 12 semiconductor probes connected to a multi channel dosemeter
- Determines target doses
- Includes patient data base

The Microsoft Windows based VivoSoft software program enables the user to control the multi channel dosemeters VIVODOS, VIVODOS E and MULTIDOS for dosimetry during external beam treatment and to store patient data together with associated dose values in a data base. It supports different treatment techniques and multiple treatment sessions. In addition, it determines organ doses according to the ESTRO booklet #1. VivoSoft is prepared to control the measurement with in-vivo probes for dose measurement on the patient's skin. VivoSoft stores user defined probe sets and the associated calibration factors. The measurement screen shows the measurement values of up to 12 single detector probes together with a graphical dose display for all detectors.

Administrative data including patient data are also shown.

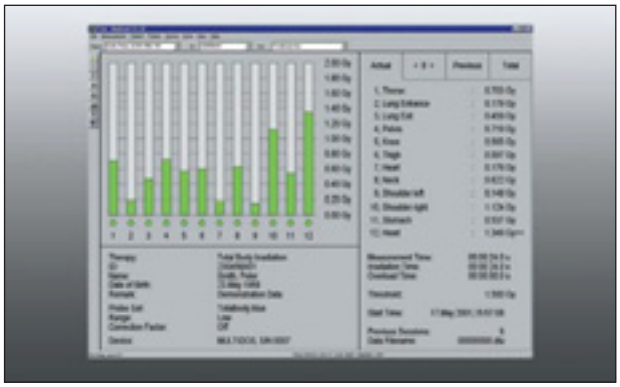
Printouts for each session make it possible to document the treatment in accordance with radiation protection regulations, e.g., the European Council Directive 97/43 on health protection in medicine.

Ordering Information

S090004 VivoSoft in-vivo software

- MULTIDOS Multi Channel Dosemeter *page 32*
- VIVODOS / VIVODOS E In-Vivo Dosemeters *page 31*
- In-Vivo Probes *page 32*

MultiSoft Afterloading Software



Software program for patient dosimetry during radiation therapy with brachytherapy afterloading sources

Features

- Controls the multi channel dose integration during afterloading treatment and records the measuring data
- Operates a 5-fold rectum probe and a single bladder probe connected to a multi channel dosemeter
- Includes patient data base

The Microsoft Windows based MultiSoft software program enables the user to control the multi channel dosemeters VIVODOS and MULTIDOS for afterloading dosimetry and to store patient data together with associated dose values in a database. MultiSoft is prepared to control the measurement with intracavitary afterloading probes for dose measurement in a patient's rectum and bladder, the most critical organs in gynecological brachytherapy. MultiSoft stores user defined probe sets and the associated calibration factors. The measurement screen shows the measurement values of five detectors of the rectum probe and the detector of the bladder probe together with a graphical dose display for all detectors. The detector with the maximum dose is marked. Administrative data including patient data are also shown.

Printouts for each session make it possible to document the treatment in accordance with radiation protection regulations, e.g., the European Council Directive 97/43 on health protection in medicine.

Ordering Information

S090002 MultiSoft afterloading software

- MULTIDOS Multi Channel Dosemeter *page 32*
- VIVODOS In-Vivo Dosemeter *page 31*
- Afterloading Probes *page 35*

Afterloading Probes

Semiconductor detectors for in-vivo dosimetry during gynecological afterloading treatment

Features

- Measure rectum and bladder dose during intracavitary afterloading brachytherapy
- A five-fold rectum probe and two types of single bladder probes help to protect patients against radiation overdose
- Comply with safety standard IEC 60601-2-9

For intracavitary dosimetry during gynecological afterloading brachytherapy, the five-fold semiconductor probe is positioned in the patient's rectum and a single detector probe is placed in the bladder to monitor the radiation load to the most radiation sensitive organs automatically. The five-fold probe has five individual detectors spaced 15 mm apart from each other to increase the chance to measure the maximum dose. The rectrum probe and the bladder probe type 9111 are inserted using a protective sleeve, while the probe type 9113 with 3 mm diameter is used in combination with a catheter. All probes are flexible and have a connection cable of 2.5 m length. The probes connect to the detector connection box, which is linked to a VIVODOS or MULTIDOS multi channel dosemeter, placed in the control room.

Ordering Information

T9111 Single semiconductor bladder probe
T9113 Single semiconductor bladder probe, catheter use
T9112 Five-fold semiconductor rectum probe
T16008 AL detector connection box
T26024-20 Connection cable to the dosemeter, 20 m
Protective sleeves for the probes upon request

Options

L981064 Cable installation set, 20 m
T16006.1.001 C-Box for wall mounting, 2 units required

- MULTIDOS Multi Channel Dosemeter *page 32*
- VIVODOS In-Vivo Dosemeter *page 31*
- MultiSoft Afterloading Software *page 34*
- Afterloading Calibration Phantom *page 35*

Afterloading Calibration Phantom

Acrylic cylinder phantom for afterloading source strength measurement and for afterloading probe calibration

Features

- Makes it possible to measure the source strength of afterloading sources in a phantom
- Makes it possible to calibrate afterloading probes against a reference chamber
- A variety of adapters for different afterloading applicators, dosimetry probes and reference chambers is available

The Afterloading Calibration Phantom is an acrylic cylinder with a diameter of 20 cm and a height of 12 cm. It is a practical tool for afterloading source strength measurement in a solid state phantom. In addition, it is used for calibration of semiconductor probes for afterloading dosimetry. For both calibration purposes, the radioactive afterloading source is positioned into the afterloading applicator in the center hole of the phantom by remote control after the reference chamber has been placed into one of the peripheral holes. On a circle with a radius of 8 cm, there are four holes situated 2 cm from the rim of the phantom for detector positioning at 0°, 90°, 180° and 270° by using appropriate adapters.

For detector calibration, the afterloading probes and the reference chamber are positioned in the holes on the circle. To equalize the scattered radiation, holes not used are closed by dummy plugs and the phantom is mounted on a tripod by means of the thread at the bottom. A variety of adapters for applicators, probes and chambers is available.

Ordering Information

T9193 Afterloading calibration phantom
L651002 Tripod for afterloading calibration phantom
Adapters for afterloading applicators, afterloading probes and reference chambers upon request

- Afterloading Probes *page 35*
- Ionization Chambers *page 16f.*

OPTIDOS® Brachytherapy Dosemeter

Brachytherapy dosemeter with scintillation detector to verify intravascular and ophthalmic radiation sources

Features

- Serves as a dosemeter for QC in intravascular therapy according to AAPM TG-60[1] and DGMP-Report #16 and for ophthalmic radiation therapy
- Small, water-equivalent plastic scintillation detector for low energy beta and photon radiation
- With $^{90}Sr/^{90}Y$ and ^{32}P calibration traceable to NIST[2]
- Measures dose, dose rate and time

The OPTIDOS[3] is designed for dose verification in intravascular brachytherapy (for reduction of arterial restenosis risk). With its extremely small scintillation detector of 1 mm Ø x 1 mm, OPTIDOS is ideally suited for the calibration of beta-emitters in catheter systems according to AAPM TG-60[1]. Using optional measuring phantoms, the source strength and the depth dose curve as well as the longitudinal and rotational homogeneity of line sources can be determined. OPTIDOS is also suitable for dosimetry of ophthalmic plaques. It features auto-start, auto-range and timer functions. An RS232 interface is included. The unit operates on mains or rechargeable batteries. A radioactive check source is required to compensate for the decrease of detector sensitivity independence of the total absorbed dose.

[1] Intravascular Brachytherapy Physics, Report #66 of AAPM Radiation Therapy Committee Task Group #60, Medical Physics 26(2), February 1999

[2] National Institute of Standards and Technology, USA

[3] The method on which OPTIDOS is based has been developed in close scientific cooperation with the Medical Physics Department of the University Hospital Essen, Germany.

All applications other than quality control and dose verification in intravascular brachytherapy are off-label uses according to the FDA and therefore at users own responsibility.

Ordering Information

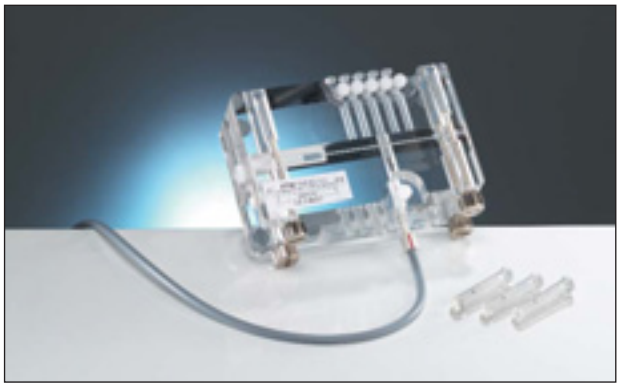
T10013 OPTIDOS Scintillation dosemeter
T60006 OPTIDOS Scintillation detector
T48010 Radioactive check device ^{90}Sr
T48007 Detector / check source holding device

Option

T11003.1.020 OPTIDOS Carrying case

▸ OPTIDOS Measuring Phantoms *page 36*

OPTIDOS® Measuring Phantoms



Acrylic phantoms for dose verification of intravascular brachytherapy sources using the OPTIDOS dosemeter

Features

- Serve for source strength verification of intravascular low energy radiation sources
- Accommodate the scintillation detector of the OPTIDOS dosemeter very precisely
- Different phantoms for various types of intravascular brachytherapy units are available

The OPTIDOS phantoms are needed to verify the source strength of low energy beta and photon sources for intravascular brachytherapy (for reduction of arterial restenosis risk). The acrylic (PMMA) phantoms accommodate the OPTIDOS scintillation detector at a distance of 2 mm from the catheter axis according to AAPM TG-60. The phantoms are also intended for dose distribution measurement of brachytherapy sources by measuring the depth dose curve as well as the longitudinal and rotational homogeneity of line sources at given measuring positions of the scintillation probe. Each phantom accommodates a catheter of a radiation unit for source positioning inside the phantom. Different phantom types are used for various types of radiation units. A catheter is not included in the delivery. Optionally a carrying case is available, suitable for an OPTIDOS dosemeter, a phantom and accessories.

All applications other than quality control and dose verification in intravascular brachytherapy are off-label uses according to the FDA and therefore at users own responsibility.

Ordering Information

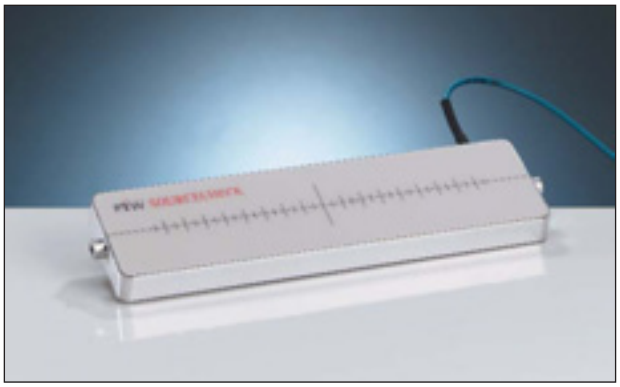
T43013.1.010 OPTIDOS Measuring phantom, Novoste
T43022.1.010 OPTIDOS Measuring phantom, Cordis

Options

T10013.1.020 Carrying case
T43013.1.011 Radiation protection device

▸ OPTIDOS Brachytherapy Dosemeter *page 36*

SOURCECHECK Source Strength Test



Flat ionization chamber for measuring the source strength of radioactive seeds and intravascular brachytherapy sources

Features

- Measures the source strength with 4π geometry
- Accommodates the source inside the chamber volume
- Vented sensitive volume of 55 cm^3
- Connects to a PTW electrometer with 400 V chamber bias voltage supply

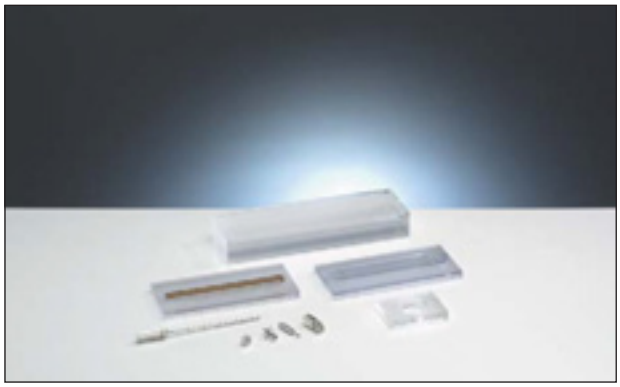
The SOURCECHECK ionization chamber is the ideal device for measuring the source strength of radioactive seeds, which are used in radiation therapy for permanent implantation into cancer tissue and of sources used in intravascular brachytherapy (IVB). It is specially designed to feature a full 4π geometry for high precision source strength measurements. An acrylic guide tube of 3.6 mm inner diameter and 0.2 mm wall thickness is located in the center of the chamber to accommodate the radioactive source to be measured. The SOURCECHECK chamber makes it possible to measure single seeds or seed trains of up to 130 mm length. The outer chamber dimensions are 220 mm x 60 mm x 14 mm. A wide guard ring reduces the influence of scattered radiation from the housing to improve the measuring accuracy. Since the sensitive volume is vented, air density corrections are required. The chamber is supplied with a connection cable of 1 m length on which a connector type BNT or TNC or PTW-M is mounted. For measurements, the SOURCECHECK chamber is connected to an high sensitive electrometer type UNIDOS, UNIDOS*webline* or UNIDOS E.

Ordering Information

TN34051 SOURCECHECK, connecting system BNT
TW34051 SOURCECHECK, connecting system TNC
TM34051 SOURCECHECK, connecting system M

- UNIDOS*webline* Universal Dosemeter *page 13*
- UNIDOS Universal Dosemeter *page 13*
- UNIDOS E Universal Dosemeter *page 14*

SOURCECHECK Optional Accessories



Accessories to use SOURCECHECK for source strength measurement in various brachytherapy applications

Features

- Adapters for single seed or Strands measurement
- Adapters for the measurement of sources for intravascular brachytherapy
- Backscatter phantom and radioactive check device available

The SOURCECHECK ionization chamber provides the possibility of connecting various adapters to the chamber and therefore use the chamber for specific applications.
An adapter for single seed measurement can be loaded manually with a single seed or connected to the Nucletron seedSelectron.
RAPID Strands and INTER Strands can be placed on the chamber by using the appropriate adapter to measure the entire strand in one run. This adapter can be sterilized.
A backscatter phantom, consisting of two acrylic plates of 30 mm thickness is used to provide for defined scattered radiation conditions. The radioactive check device T48010 with adapter serves for checking the performance and long-term stability of the SOURCECHECK chamber.

Ordering Information

T34051.1.070 Adapter to place a seed inside the SOURCECHECK
T34051.1.060 Adapter for Nucletron seedSelectron afterloader
T34051.1.080 Adapter for INTER Strands
T34051.3.102 Adapter for RAPID Strands
T34051.1.040 Backscatter phantom
T34051.3.103 Adapter for radioactive check device

- SOURCECHECK Source Strength Test *page 37*
- Radioactive Check Device *page 23*

HDR Chamber for AL Source Calibration

Well-type ionization chamber for afterloading source strength measurements

Features

- Vented sensitive volume of 200 cm^3
- Makes it possible to measure the source strength of afterloading sources according to AAPM TG-56
- Accommodates suitable applicator adapters for commercial afterloading brachytherapy systems

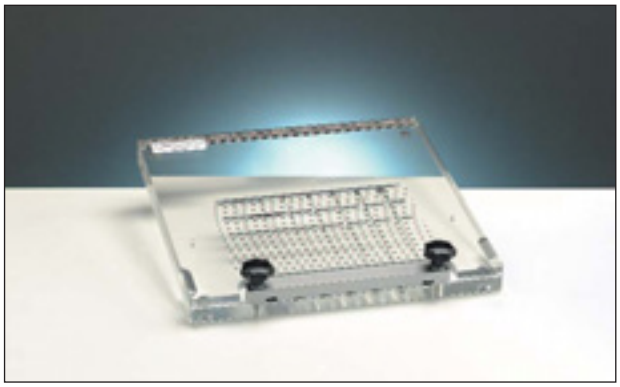
According to AAPM TG-56, the well-type chamber is required for the source strength measurement of radioactive afterloading sources. The recommended calibration factor is the air kerma strength (cGy m^2 h^{-1}). The PTW calibration certificate also includes factors for apparent activity (GBq or Ci) and exposure strength (R m^2 h^{-1}). Suitable applicator adapters and calibrations are available for the commercial standard afterloading systems. The calibration of the well-type chamber is traceable to NIST, USA and PTB, Germany. For measurements, the chamber is connected to a sensitive PTW electrometer (UNIDOS, UNIDOS*webline*, UNIDOS E, MULTIDOS, TANDEM), which has a reading in pA, a wide dynamic range and an interval time function. The HDR chamber is suitable for the calibration of high dose rate (HDR) and pulsed dose rate (PDR) sources such as ^{192}Ir and ^{60}Co. Calibrations for low dose rate sources (LDR) such as ^{137}Cs are available upon request.
The chamber can be supplied with BNT, TNC or M connectors.

Ordering Information

TN33004 HDR chamber, connecting system BNT
TW33004 HDR chamber, connecting system TNC
TM33004 HDR chamber, connecting system M

- UNIDOS*webline* Universal Dosemeter *page 13*
- UNIDOS Universal Dosemeter *page 13*
- UNIDOS E Universal Dosemeter *page 14*
- MULTIDOS Multi Channel Dosemeter *page 32*
- TANDEM Dual Channel Electrometer *page 14*

POSICHECK Source Position Check



Test device for checking the dwell positions of afterloading sources

Features

- Checks the positioning of radioactive sources by remote-controlled afterloading systems for brachytherapy
- Includes seven grooves for different applicator sizes
- Includes 14 lead lines for position check

For quality control of the radioactive source positioning by remote-controlled afterloading systems, a straight applicator is placed into one of the applicator grooves of the POSICHECK, which is made of acrylic glass. Seven grooves with different widths of 1.7 mm, 2.2 mm, 3.2 mm, 4.2 mm, 5.2 mm, 6.2 mm and 8.2 mm are available. One of three adjustable stop positions for the applicator tip can be selected. A radiographic film of 30 cm x 25 cm is placed under the cover plate of the POSICHECK and fixed by two needles. The typical exposure time for one source position is one second. The lead lines with 10 mm spacing are marked on the film by scattered radiation. Consequently, the source position in relation to the lead line position can be checked easily on the exposed film to verify consistence between the position displayed on the afterloading control desk and the actual source position.

Ordering Information

T43006 POSICHECK Test object

Therapy Beam Analysis

TBA Therapy Beam Analysis Equipment

Therapy Beam Analysis

Dose distribution measurements and analyses of radiotherapy beams are major tasks of medical physics departments. The user must rely on the measuring equipment and handling should be easy and time-saving. Our widespread and proven TBA Therapy Beam Analyzers fulfill these requirements ideally. Various different types of phantom tanks in combination with common electronic devices and software and a variety of waterproof radiation detectors enable the user to measure easily and accurately pulsed photon, electron and proton radiation from all types of accelerators as well as continuous radiation from ^{60}Co teletherapy units. The TBA beam analyzers take full advantage of the latest developments in microprocessor technology and provide the user with the greatest latitude in beam data acquisition. They truly make beam data acquisition in radiation therapy easier, faster and more accurate than ever before.

No matter how demanding: The TBA Therapy Beam Analyzers are ideally suited to perform all of the measurement tasks of a physics department in radiation therapy:

- Acceptance tests of therapy treatment units after installation
- Measurements after repair or replacement of major treatment unit components
- Beam data analyses according to international therapy dosimetry protocols, such as AAPM TG-51
- Acquisition, formatting and transfer of basic data to treatment planning systems
- Data acquisition and analyses of irregular and IMRT fields
- Periodic quality control
- High precision data acquisition for scientific research

The 3D systems enable the user to acquire data of beam profiles, depth dose curves and isodose distributions even at arbitrary angles of beam incidence. The systems can easily perform measurements at any point, along any vector or in any complete plane.

The dual channel TANDEM electrometer performs integrated dose measurements within 10 ms, and the high precision tank mechanics are controlled by stepper motors that can position the measuring probe to 0.1 mm at a speed of 50 mm/s.

Therapy beams of modern treatment techniques with irregular fields, virtual (dynamic) wedges, multi-leaf collimators (MLC) and intensity modulated radiation therapy (IMRT) can be analyzed very conveniently by using the linear array LA48 or the 2D ion chamber arrays.

The MEPHYSTO software package integrates data collection, analysis, output and storage into an intuitively easy-to-use WINDOWS user interface. Data can be collected and analyzed using a variety of data analysis protocols, formatted and transferred to treatment planning systems, and exported in ASCII format, so it can be used by other applications and programs.

The minimum configuration for operation of an automatic beam analyzer includes the following components:

- Phantom tank with moving mechanism
- Measuring probe with holding device
- TANDEM dual channel electrometer
- Electronic control unit and control pendant
- Connection cables
- MEPHYSTO software
- Computer and printer

Optional components are:

- OCTAVIUS Detector 729 with 729 ion chambers in a plane
- Linear array LA48 with 47 ion chambers
- TPR option
- Phantom positioning and water reservoir devices
- Air scanners for table top placement or gantry mount
- PLEXITOM motor-driven acrylic phantom
- FilmSoft software for film evaluation

MP3 Water Phantom System

Large size motorized 3D water phantom system for dose distribution measurement of radiation therapy beams

Features

- Truly integrated solution, perfectly equipped for the most demanding relative and absolute dosimetry tasks
- Extra large, 3D water tank with scan range of up to 60 cm and reinforced tank walls to prevent deformation or leaking
- Calibration-free, high-speed stepper motor drives offering superior positioning accuracy (0.1 mm, 50 m/s)
- Rotable positioning device for precise horizontal and vertical tank alignment
- Quick and easy detector positioning using TRUFIX
- Powerful MEPHYSTO *mc²* software platform with customizable drag and drop task lists

The MP3 system is based on the MP3 water tank, a large-size, remote-controlled 3D acrylic water tank with 20 mm thick walls and a scanning range of 60 x 50 x 40.8 cm³. It comes with a rotable positioning device and a 3D stainless steel moving mechanism driven by three calibration-free, high-speed stepper motors.
The water tank is controlled by the TBA Control Unit. A removable control pendant with TFT display and menu-controlled interface allows a manual control of the water tank moving mechanism. The control pendant can be connected to the TBA Control Unit or directly to the water tank.
The MP3 Lifting Carriage is a high-precision electro-mechanical lifting carriage to allow for height adjustment of the MP3 water tank. A specially designed water reservoir carriage stores the complete water volume of an MP3 water tank (up to 220 l) before and after use. The built-in centrifugal pump can be operated automatically (via PC) or manually. The carriage includes storage compartments for dosimetry accessories.

With the unique, patented TRUFIX Detector Positioning System PTW ionization chambers and solid state detectors can be quickly installed in the water phantom and their effective point of measurement quickly positioned to the water surface.
The measurements are performed with the TANDEM Dual-Channel Electrometer with user-selectable measurement times. The TANDEM is designed for fast and precise beam data acquisition in PTW water phantoms and absolute dose measurements.
MEPHYSTO *mc²* Software Suite is a modular, workflow-oriented software platform for comprehensive beam data acquisition and analysis using the PTW water phantom system.

Ordering Information

L981160/L981163 MP3 Water Phantom
(230 V/115 V), complete, BNT connector

L981161/L981164 MP3 Water Phantom
(230 V/115 V), complete, TNC conntector

L981162/L981165 MP3 Water Phantom
(230 V/115 V), complete, M connector

consisting of:

- MP3 phantom tank with positioning device
- TBA control unit, TANDEM dosemeter, control pendant
- 2x Semiflex 0.125 cm³ ion chamber, TRUFIX
- MEPHYSTO *mc²*, software options PLAMO and Absolute Dosimetry
- Lifting carriage, reservoir
- Accessories

MP3-M Water Phantom System

Medium size motorized 3D water phantoms for automatic dose distribution measurement of radiation therapy beams

Features

- Integrated system for the most demanding relative and absolute dosimetry tasks in a wide variety of applications
- Robust, fully automatic 3D water phantom for 50 cm x 50 cm scans, equipped with reinforced tank walls to prevent deformation or leaking
- Calibration-free, high-speed stepper motor drives offering superior positioning accuracy (0.1 mm, 50 m/s)
- All-in-one solution with easily manoevrable lift table and built-in water reservoir for convenient and quick setup
- Rotable positioning device for precise horizontal and vertical tank alignment
- Quick and easy detector positioning using TRUFIX
- Powerful MEPHYSTO *mc²* software platform with customizable drag and drop task lists

The MP3-M system is based on the MP3-M water tank, a medium-size, remote-controlled 3D acrylic water tank with 20 mm thick walls and a scanning range of 50 x 50 x 40.8 cm³. It comes with a rotable positioning device and a 3D stainless steel moving mechanism driven by three calibration-free, high-speed stepper motors.
The water tank is controlled by the TBA Control Unit. A removable control pendant with TFT display and menu-controlled interface allows a manual control of the water tank moving mechanism. The control pendant can be connected to the TBA Control Unit or directly to the water tank.
The SCANLIFT is a specially designed, high-precision electro-mechanical lift table/carriage on wheels, with 500 mm range of movement to allow for height adjustment of the MP3-M water tank. It includes a 190 l water reservoir with PC-controlled pump for TPR measurements.
With the unique, patented TRUFIX Detector Positioning System PTW ionization chambers and solid state detectors can be quickly installed in the water phantom and their effective point of measurement quickly positioned to the water surface.
The measurements are performed with the TANDEM Dual-Channel Electrometer with user-selectable measurement times. The TANDEM is designed for fast and precise beam data acquisition in PTW water phantoms and absolute dose measurements.
MEPHYSTO *mc²* Software Suite is a modular, workflow-oriented software platform for comprehensive beam data acquisition and analysis using the PTW water phantom system.

Ordering Information

L981166 MP3-M Water Phantom, complete, BNT connector

L981167 MP3-M Water Phantom, complete, TNC conntector

L981168 MP3-M Water Phantom, complete, M connector

consisting of:

- MP3-M phantom tank with positioning device
- TBA control unit, TANDEM dosemeter, control pendant
- 2x Semiflex 0.125 cm³ ion chamber, TRUFIX
- MEPHYSTO *mc²*, software options PLAMO and Absolute Dosimetry
- SCANLIFT
- Accessories

MP3-P Phantom Tank

Motorized 3D water phantom for horizontal radiation therapy beams for protons and heavy ions

Features

- High precision 3D water tank for proton and heavy ion therapy
- Size and moving range optimized for horizontal beam
- Thin entry window for highest precision

The MP3-P water tank is a 3D phantom for remote controlled scans with 100 µm increments to determine the Bragg peak position of proton and heavy ion beams. The scanning range is 350 mm x 250 mm horizontally and 380 mm vertically. A thin exchangeable entrance window of 250 mm x 250 mm x 5 mm PMMA makes the system suitable for horizontal beams with highest precision measurements. Dual chamber holders allow the fixation of Bragg peak chambers to the MP3-P. One chamber is mounted to the entrance window outside of the water tank, the second chamber is mounted to the moving mechanism for relative dose measurements.

To operate the tank, MEPHYSTO *mc²* software and TBA electronics are required.

Ordering Information

L981236 MP3-P Water phantom, connecting system BNT
L981237 MP3-P Water phantom, connecting system TNC
L981233 MP3-P Water phantom, connecting system M
L981442 Dual chamber holder for fixation of two Bragg peak chambers 34073 to the MP3-P tank
L981423 Dual chamber holder for fixation of two Bragg peak chambers to the MP3-P tank. Chamber type 34070 or 34080 as reference and chamber type 34070 measures depth dose distributions

- MP3-P Configured Basic Systems *page 154*

PEAKFINDER Water Column

Water column system for highest precision peak detection in proton and heavy ion therapy

Features

- Measures position of Bragg peak within (20 ... 350) mm with a spatial resolution of 10 µm
- Built-in monitor and measuring chambers
- Gate input for spill-by-spill measurements

The PEAKFINDER water column is especially designed for highest precision peak detection of proton and heavy ion beams in particle therapy. It is a closed water column for scans up to 35 cm depth with increments of 10 µm. Because of its sealed construction it can be used in any spatial orientation. Windows allow a visible inspection of the column inside. The signals of the built-in thin window Bragg peak chamber T34080 and the monitor chamber T34082 are read out by the TANDEM ^{XDR} electrometer. A TCP/IP interface is implemented for software control.
The included PeakScan software package allows precise measurements and a detailed Bragg peak analysis.

Ordering Information

L981257 PEAKFINDER water column, including electronics, dosemeter, measurement and reference chamber, PeakScan software

MP3-T Phantom Tank

3D water phantom for automatic dose distribution measurement at TomoTherapy® treatment units

Features

- High precision 3D water tank
- Size, moving range and motor positions optimized for TomoTherapy® Hi·Art® Systems
- 3D stainless steel moving mechanism with high speed stepper motors

The MP3-T water tank is optimized for the use with TomoTherapy® Hi·Art® treatment units with dynamic arc techniques. Once adjusted to the therapy unit, the water tank has not to be moved to cover all measuring tasks.

The 20 mm thick acrylic walls do not bulge during prolonged period of use and feature etched lines for precise tank alignment. Precision stepper motors are mounted on a position for the use in the TomoTherapy® Hi·Art® gantry. They provide for high detector moving speed of 50 mm/s and high positioning accuracy of ± 0.1 mm. In contrast to analog drives, stepper motor drives do not require regular recalibrations.
To operate the tank, MEPHYSTO *mc²* software and TBA electronics are required.

TomoTherapy and Hi·Art are registred trademarks of TomoTherapy Incorporated

Ordering Information

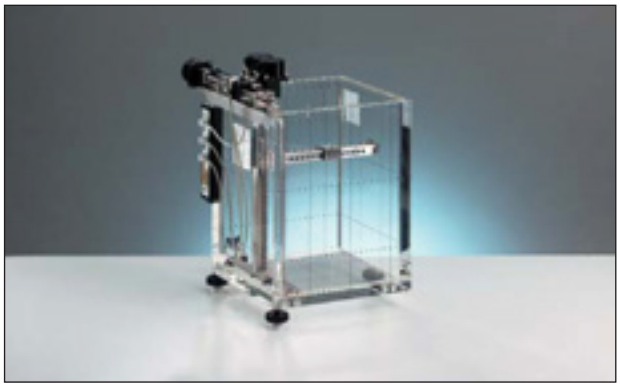
T41026.1.001 MP3-T Acrylic water tank
T41026.1.100 MP3-T Semiflex chamber holding device

MP3-T water phantom sets including dosemeter, chamber, cables and software MEPHYSTO mc²

L981199 MP3-T Water phantom, connecting system BNT
L981183 MP3-T Water phantom, connecting system TNC
L981182 MP3-T Water phantom, connecting system M

▸ MP3-T Configured Basic Systems *page 154*

MP3-XS Phantom Tank



Small size motorized 3D water phantom for automatic dose distribution measurement of radiation therapy beams

Features

- High precision small volume 3D water tank, especially designed for stereotactic or IORT dose distribution measurements
- 3D stainless steel moving mechanism with high speed stepper motors

The MP3-XS water tank is a small 3D phantom for remote-controlled dose distribution measurements of small radiation fields as used for example in stereotaxy or intra-operation radiation therapy IORT. The horizontal moving range is 200 mm x 200 mm and the vertical range is 300 mm. The phantom has three adjustable supports for leveling, etched crosshairs for alignment and a collision protected drain tap for emptying without tilting or changing the phantom's position.

The 20 mm thick acrylic walls and bottom do not bulge during prolonged period of use. Precision stepper motors are mounted close above the tank making it possible to adjust distances between the LINAC head and the water surface as small as 120 mm. They provide for high detector moving speed of 50 mm/s and high positioning accuracy of ± 0.1 mm. In contrast to analog drives, stepper motor drives do not require regular recalibrations. Stainless steel drive mechanics are used to minimize water perturbation and to preserve positioning accuracy during movement. They do not disturb or affect the measurement accuracy. The delivery includes a cable connection box mounted to the tank, a spirit level and an ion chamber-adjusting device. To operate the tank, MEPHYSTO software and TBA electronics are required.

Ordering Information

L981069 MP3-XS Phantom tank

▸ MP3-XS Configured Basic Systems *page 154*

MP2 Phantom Tank

Remote controlled 2D water phantom for automatic dose distribution measurement of radiation therapy beams

Features

- High precision 2D water phantom for two-dimensional dose distribution measurements
- Includes a sturdy 2D stainless steel moving mechanism, manually movable along the third coordinate
- Includes two stepper motors for a detector positioning speed of 50 mm/s and a positioning accuracy of ± 0.1 mm
- Acrylic walls and etched lines for precise tank alignment
- A rotatable leveling device is available as an option

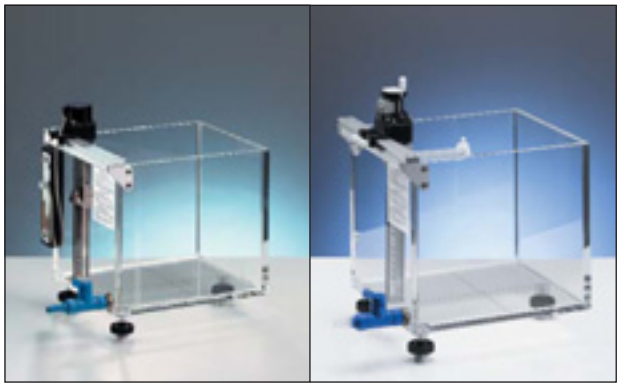
The MP2 water tank is an economical remote-controlled phantom for two-dimensional dose acquisition. The third coordinate can be varied manually. A scale at the top of a phantom wall enables the user to precisely position the 2D mechanism within a range of 400 mm. Two stepper motors and a sturdy moving mechanism made of stainless steel move a radiation detector controlled remotely within a horizontal moving range of 500 mm and a vertical range of 407.5 mm. The optional rotatable leveling device rotates the MP2 tank for measurement of both principle axes and the diagonals. Detector holding devices are optionally available. Beam incidences may be vertical or horizontal. The acrylic walls are 10 mm thick and feature etched lines for precise tank alignment.
The delivery includes a cable connection box mounted to the tank, a spirit level and an ion chamber-adjusting device. To operate the tank, MEPHYSTO software and TBA electronics are required.

Ordering Information

T41020.1.001 MP2 Phantom tank

- MP2 Configured Basic Systems *page 155*

MP1, MP1-S, MP1-M Phantom Tanks



1D water phantoms for absolute dosimetry and measurement of depth dose curves

Features

- High precision 1D water tanks for absolute dosimetry and depth dose measurement of high energy photon and electron beams
- Comply with the dosimetry protocols AAPM TG-51, IAEA TRS-398 and DIN 6800-2
- Easy setup with alignment and fill lines and adjustable supports for leveling

The MP1, MP1-S and MP1-M water tanks are small 1D phantoms for depth dose measurement to determine beam qualities and measure absolute doses according to international dosimetry protocols. The tank sizes meet the AAPM TG51, IAEA TRS 398 and DIN 6800-2 requirements for absorbed dose determinations in reference conditions. MP1 and MP1-S tanks are remote controlled and require TBA electronics and MEPHYSTO *mc²* software for operation. Using the MP1-M tank the detector positions are adjusted by hand. It is equipped with a precise moving mechanism and a digital display of the detector position.

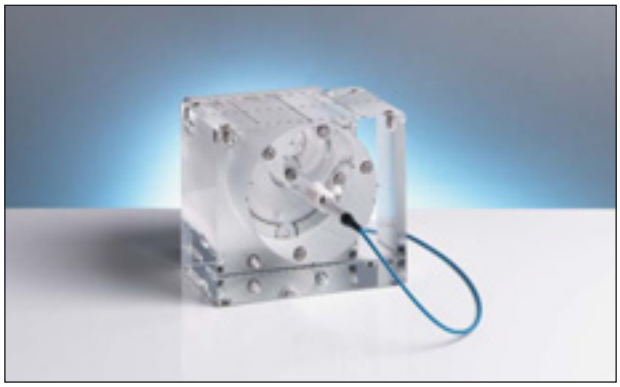
The tanks have vertical moving ranges of 254 mm and external horizontal phantom dimensions of 320 mm x 370 mm (MP1 and MP1-M) and 225 mm x 275 mm (MP1-S). Holding devices to mount semiflex, Farmer and electron chambers to the moving mechanism are available. Each phantom has three adjustable supports for levelling and a collision-protected drain tap for emptying without tilting or changing the phantom's position. Alignment and fill lines ensure an easy setup.

Ordering Information

T41019 MP1 Phantom tank
T41018 MP1-S Phantom tank
T41025 MP1-M Manual phantom tank
Chamber holding devices upon request

- UniSoft Edition 2000 *page 22*
- MEPHYSTO *mc²* Software *page 49*

PLEXITOM®
2D Positioning Device



Motor-driven acrylic phantom for dose distribution measurements in a solid state phantom

Features

- Makes it possible to measure profiles and depth dose curves in a solid state phantom automatically
- Makes it possible to position an ion chamber in 1 mm increments by remote control
- Dose verification phantom, easy and quick to set up
- Includes PlexControl software

PLEXITOM's unique design makes it possible to measure continuous profiles and depth dose curves of high-energy photon and electron beams in solid acrylic material. It closes the gap between automatic water phantoms and solid state phantoms. The phantom contains two excentrically mounted rotary acrylic cylinders inside a solid acrylic block. Its double rotation principle serves for quick and precise positioning of a detector along the central beam axis as well as for off-axis measurement within an area of 122 mm in diameter. A suitable adapter accommodates a 0.6 cm^3 PTW Farmer chamber or a 0.125 cm^3 flexible chamber. Using the PLEXITOM, the absolute dose at different specific points in the target volume can be checked without the need to enter the treatment room after each measurement while the cumbersome setup of a remote controlled water phantom is avoided. The phantom is powered by two stepper motors remotely controlled by the TBA control unit (additionally required) and by the PlexControl software (included). Alternatively, the MEPHYSTO *mc²* software can be used.

Ordering Information

T40012 PLEXITOM motor-driven acrylic phantom including PlexControl software

T40012.1.010 PLEXITOM / 0.6 cm^3 ion chamber adapter

T40012.1.011 PLEXITOM / 0.125 cm^3 ion chamber adapter

- Ionization Chambers *page 16f.*
- Therapy Dosemeters *page 13f.*
- MEPHYSTO *mc²* Software *page 49*

TRUFIX
Detector Positioning

Positions the effective point of measurement of different therapy detectors exactly to the water surface in TBA systems

Features

- Positioning of effective points of measurement of detectors on the water surface
- Interchangeability of various detector types without resetting the effective points of measurement
- Can also be used for horizontal irradiation
- Maintains minimum distance to the metal parts of the moving mechanism

The TRUFIX precision attachment system is used for simple installation of various ionization chambers and detectors in TBA systems. It serves for fast and precise positioning of effective points of measurement of various detectors on the water surface in water phantoms.

Ordering Information

L981150 TRUFIX Basic equipment
Holders for various detectors upon request

TBA Detector
Holding Devices

There is a variety of holding devices for attaching therapy detectors to the mechanism of TBA phantom tanks available. Special holders enable the user to fix a cylindric ion chamber, an electron chamber, a diode detector, a diamond detector or a light probe to the moving mechanism. Other holders are designed to fix a detector cable plug or a reference chamber to the tank wall.

Ordering Information

Details of TBA detector holding devices upon request

- Radiation Detectors *page 16ff.*
- TBA Phantom Tanks *page 41ff.*

TBA Scanning Detectors

Ionization chambers and solid state detectors for measuring high-energy dose distributions and light beams

Features

- Specific detectors for all applications are available
- Exceed the high requirements of radiotherapy dosimetry
- Exemplify the historic skills of PTW-Freiburg in developing and manufacturing radiation detectors

The scanning detectors are suitable for use in a water phantom and provide high performance in radiotherapy dose distribution measurements. The semiflex 0.125 cm^3 ion chamber is the detector of choice for standard dosimetry. For absolute dosimetry, the waterproof 0.6 cm^3 PTW Farmer chamber can be used. The PinPoint chambers with their small sensitive volumes of 0.015 cm^3 and 0.03 cm^3 are applied to the dosimetry of small field sizes, especially in stereotaxy. The small volume solid-state detectors, the diamond detector and the dosimetry diodes are suitable for both stereotactic and standard field measurements and provide a favorable signal-to-noise ratio. Dose distribution measurements of electron beams are performed by means of the small volume Advanced Markus or Markus chamber. High precision absolute electron dosimetry or percentage electron depth dose measurements are done with the Roos chamber. The Bragg peak chamber is used for relativ measurements for determination of the depth dose curve of a thin proton beam. The distribution of LINAC light fields is measured with the light probe. All detectors are available with BNT, TNC or PTW-M connector.

Ordering Information

Details of TBA scanning detectors page 16ff.

- Radiation Detectors *page 16ff.*
- Detector Extension Cables *page 28*
- TBA Detector Holding Devices *page 46*

LA48 Linear Chamber Array

Linear Array with 47 ion chambers and MULTIDOS/ME48 dosemeter for fast profile measurements

Features

- Suitable for IMRT and dynamic field measurements
- The latest development in fluid-filled ion chamber technology
- Includes small volume ion chambers with high spatial resolution
- Records the data of a complete profile within 1 s

The LA48 linear chamber array is specially designed for fast, accurate and reliable dynamic field dosimetry measurements of virtual wedges and multileaf collimators. It incorporates the latest development in fluid-filled ion chamber technology into an advanced ion chamber array. The combination of speed, accuracy and spatial resolution down to 1 mm featured by the LA48 is simply not possible with other systems. The array has a measuring length of 37 cm and contains 47 fluid filled 8 mm^3 ion chambers, each 4 mm x 4 mm x 0.5 mm, spaced 8 mm on center. The LA48 array is used in conjunction with a MULTIDOS multichannel dosemeter and an ME48 extender. The MEPHYSTO *mc²* software is required for operation. A software module to control the measurement, store the data and evaluate the results is included. For measurements in water, the LA48 array is mounted to the moving mechanism of an MP3, MP3-M or MP2 phantom tank. By using the appropriate holding devices, the LA48 array may also be used as an air scanner.

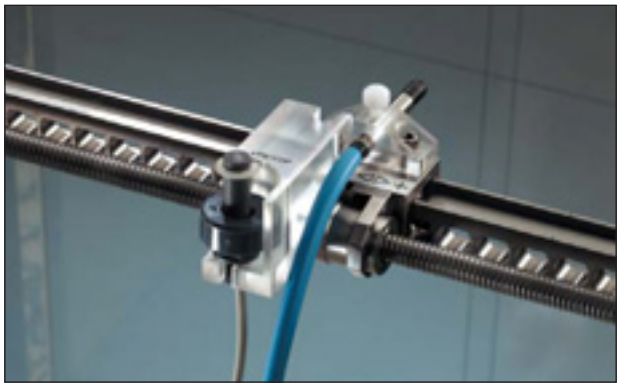
Ordering Information

L981099 LA48 Option for MP3/MP3-M including MULTIDOS dosemeter and ME48 extender

S080045.002 Option MLCSoft for MEPHYSTO *mc²* to check leaf positioning

- MULTIDOS Multi Channel Dosemeter *page 32*
- MP3/MP3-M Phantom *page 41f.*
- MEPHYSTO *mc²* Software *page 49*
- ME48F Fast Measurement System *page 48*
- LA48/SLA48 Air Scanner Mounts *page 52f.*

TPR Options



Options for automatic TPR measurement, including water sensor and MEPHYSTO mc² software module

Features

- Measure tissue-phantom-ratio automatically
- Include a water sensor to be mounted on the moving mechanism for calibration of the water surface lowering
- Operated by MEPHYSTO *mc²* software

The TPR options are used for the MP3 and MP3-M systems to measure tissue-phantom-ratios by keeping the detector at a fixed position and varying the water level between detector and radiation source. The water level is automatically lowered by self-draining. The draining process is initially calibrated by a water sensor, which is mounted to the moving mechanism of the TBA Therapy Beam Analyzer. The TPR procedures are controlled by the MEPHYSTO *mc²* software. The required TPR software module with a stepping mode and a fast continuous mode is included in the TPR options. The water reservoir carriages of the MP3 and MP3-M systems are required respectively to operate the TPR options.

To utilize the entire vertical detector moving range of the MP3 phantom tank, we recommend the optional elevation set for shifting the lifting carriage height positioning by 100 mm.

Ordering Information

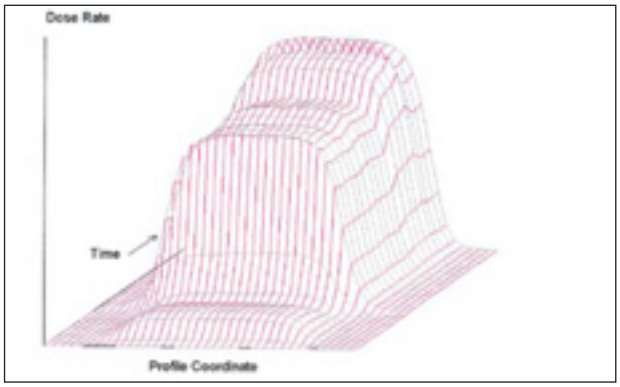
L981007 TPR Option for MP3
L981017 TPR Option for MP3-M

Option

T43162/SL20 Option MP3 lifting carriage elevation set

- MP3 Phantom *page 41*
- MP3-M Phantom *page 42*
- MEPHYSTO *mc²* Software *page 49*

ME48F Fast Measurement System



High speed measurement option for up to 100 profiles per second, using an existing LA48 linear array

Features

- Analyses the start-up behavior of linear accelerators
- Measures up to 100 complete profiles per second
- Uses the LA48 chamber array and MEPHYSTO *mc²* software

Due to the growing importance of conformal radiation therapy, the start-up behavior of linear accelerators is becoming more and more important. The ME48F fast measurement system makes it possible to measure a complete profile within 10 ms. This is achieved by the innovative ME48F preamplifier with its very low time constant to follow very fast input signals correctly. The measuring time for all 47 ion chamber signals of the LA48 is 2 ms, followed by a 8 ms processing time interval. The ME48F fast preamplifier is located in the treatment room near the LA48 array and connected to a suitable data acquisition board (DAB) in the computer, which is located in the control room. The special software module ME48F-Soft measures up to 100 profiles per second and stores them in a MEPHYSTO *mc²* export file. MEPHYSTO *mc²* can import up to 250 profiles at the same time for further evaluation.

For owners of the MULTIDOS/ME48 dosemeter, a more economical fast measurement option is available that makes it possible to measure up to 10 profiles per second.

Ordering Information

L981080 Fast measurement option with ME48F
L981081 Fast measurement option for MULTIDOS/ME48
S070013 ME48F-Soft software

- LA48 Linear Chamber Array *page 47*
- MULTIDOS Multi Channel Dosemeter *page 32*
- MEPHYSTO *mc² page 49*

MEPHYSTO® *mc²* Software Medical Physics Control Center

Software for therapy beam data acquisition and data analysis in radiation therapy

Features

- Customizable Control Center for all dosimetry tasks in radiotherapy
- Fast beam data acquisition with integrated graphical TaskList
- Fast and accurate commissioning with batch conversion for all established TPS
- Supports online data analysis with linear array

The Medical Physics Control Center MEPHYSTO *mc²* is the most advanced, comprehensive and self explaining user interface for TBA control and data evaluation. Solutions of all important dosimetry tasks in radiotherapy are implemented in modules with optimized workflows. The Control Center is customizable and allows the adaptation to the available equipment. Additional software or documents can be integrated.
By means of intuitive graphics with two tabs for accelerator and measurement parameters, the user can quickly and easily start a measurement. Predefined measurement programs for PDDs, profiles, matrices for isodoses, and points are available. Axis definition for each defined radiation device with name and direction is possible.
Beam data collection for LINAC commissioning and TPS beam data collection can be done very fast and structured due to an implemented TaskList with multiple energies, applicators, wedges, blocks, field sizes, SSDs, depths and even multiple queues.
An optimized batch conversion module for each established TPS is available.
All established international protocols including the LINAC vendor specifications are available. User specific protocols can be generated. Curve comparison with percentage difference or 1D gamma analysis is possible.
Besides many other operations, ion depth curves can be converted into water absorbed energy dose curves according to all established international protocols. Matrix operations allow adding treatment fields. A table generator for OCR table creation and PDD conversion into TPR curves is available.

Data can be imported and exported with copy and paste function. A plot generator allows scaled and customizable printouts, html print preview is also available. Data can be stored anywhere in the network, with filenames in windows convention. New programming technique allows drag and drop functionality and customizable screens and colors.
Isodoses and rotational 3D Display in color wash or lines. Dual cross hairs, zoom and various normalization functions are available.

Additional functions:

- Linear Array
  A module to adjust the beam with online analysis is included. Static fields as well as dynamic (IMRT) fields and wedges can be measured and analyzed.
- TPR
  Allows easy and precise TPR measurements with an optimized module with stepping mode and fast continuous mode.
- MLCSoft
  Includes MLCSoft software for calibration and QA to verify the radiological MLC positions for 48 leaves in one run.
- Absolute Dosimetry
  TanSoft for absolute dose measurement with TANDEM electrometer in accordance with IEC 60731 and UniSoft Edition 2000 is included.
- Film Analysis
  Full functionality of FilmSoft for film dosimetry with a GAFCHROMIC optimization for RGB scanners is included.
- Planning Module (plamo)
  Format and transfer TPS data according to their specification.

Ordering Information

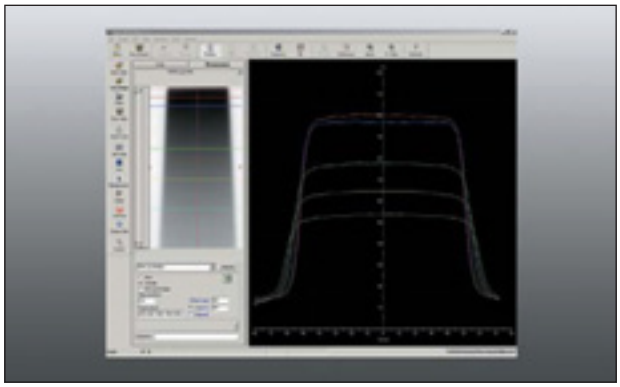
S080045 MEPHYSTO *mc²* basic software
S080045.001 Option LA48
S080045.002 Option MLCSoft
S080045.003 Option TPR
S080045.004 Option Film Analysis
S080045.005 Option Absolute Dosimetry
S080045.006 Option Planning Module (plamo)
The type of TPS has to be specified

L981154 TBA hardware and software upgrade, connecting system M

L981155 TBA hardware and software upgrade, connecting system BNT

L981156 TBA hardware and software upgrade, connecting system TNC

FilmSoft Software



Software package for automatic film evaluation including film scanning and calibration

Features

- Full computer control of film digitizers for scanning radiographic films
- Records and evaluates the density distribution of radiographic films for film dosimetry in radiotherapy
- Support of TWAIN Interface
- Evaluation of GAFCHROMIC® EBT films

The FilmSoft software package and the FilmAnalysis option for MEPHYSTO *mc²* are designed for dose distribution determination by irradiated radiation therapy films. Evaluation of beam data according to international protocols can be done. The software is prepared to control the density measurement of radiographic films by an automatic film digitizer as well as the import of many file formats from EPIDs or TPS. FilmSoft supports direct communications for various scanner types and scanners with TWAIN Interface. A GAFCHROMIC optimization for RGB scanners is included. FilmSoft features self calibration routines prior to each scan and customizable look-up tables for calibration in optical density or dose.

Ordering Information

S080047

- MEPHYSTO *mc² page 49*

Film Digitizers for Film Densitometry

Film Scanners for digitizing radiographic films irradiated for film dosimetry in radiotherapy

Features

- Computer controlled 48 bit (16 bit) scanners to digitize radiographic films
- Dynamic measuring ranges of up to 4.0 optical density
- Support TWAIN Interface

The VIDAR DosimetryPro Advantage (Red)
16 bit HD-CCD scanner, measuring range (0 ... 4.0) OD. For the use of GAFCHROMIC® EBT and X-ray films (20 ... 35.6) cm width, and (20 ... 43.2) cm length, resolution max. 89 µm. Universal power supply (85 ... 264) V, (47 ... 63) Hz

The EPSON Expression 10000XL
A3 flatbed color scanner (RGB 48 bit) for the use of GAFCHROMIC® EBT films. Resolution 2400 dpi, measuring range max 3.8 OD, USB 2.0 computer interface, includes transmission light unit and universal power supply (110 ... 120) V, (220 ... 240) V, (50 ... 60) Hz

All above mentioned types of scanners can be operated by computer control, using USB interface and TWAIN drivers with the FilmSoft or VeriSoft software packages or the FilmAnalysis option in MEPHYSTO *mc²* for dosimetry evaluation.

Ordering Information

Detailed information on film digitizers upon request

- MEPHYSTO *mc² page 49*
- FilmSoft *page 50*
- VeriSoft *page 59*

TBA Trolley

Trolley with three plane storage space for TBA electronics, computer and peripheral devices

Features

- Accommodates electronic water phantom components for mobile use
- Includes three storage planes and a key-board plane
- Includes a multi-way grounding type mains plug

The TBA trolley has three planes to store the electronic devices including the computer and peripheral devices such as a printer. A movable plate accommodates the computer keyboard. Four wheels make it possible to move the electronic components to different control rooms of radiotherapy treatment units. The electronic components can be powered by a switchable multi-way mains plug.

Ordering Information

L656004 Trolley

Cable Sets for Fixed Cable Installation

Installation sets for fixed cable installation, including C-Boxes for wall mounting in treatment and control rooms

Features

- Help to protect the sensitive connection cables of therapy dosimetry equipment against mechanical damage
- Let you avoid handling of long cables during routine work
- Help to protect the sensitive connectors of dosimetry cables

The cable installation sets are used for fixed installation of dosimetric connection cables between treatment rooms and control rooms. Two C-Boxes mounted to the walls in the treatment room and in the control room serve as cable terminal boxes. The dosimetry equipment is simply connected to the C-Boxes by means of short-length cables that are removed after use.
Two versions of cable sets for firm installation are available:

- Cable set for the connection of the TBA control unit installed in the control room,
- Cable set for the connection of the TBA control unit installed in the treatment room.

If other dosimetry equipment, like the MULTIDOS has to be connected, additional cable components are required, depending on the various applications. Please ask for our suggestions to achieve the optimum solution.

Ordering Information

Installation sets for control unit set up in control rooms:

L981062 TBA cable installation set including cable for field and reference detector, cable length 20 m

L981063 TBA cable installation set including cable for field detector, cable length 20 m

T16006.1.001 C-Box for wall mounting (2 units required)

Installation set for control unit set up in treatment rooms:

T25023 RS232 cable installation set

LA48 1D-Air Scanner Gantry Mount Device

Air scanner holding device for mounting the LA48 linear array to the LINAC gantry

Features

- Accommodates the LA48 linear array for fast profile measurements of dynamic and conventional fields
- Mounts on the LINAC gantry for profile recording at arbitrary gantry angles
- Includes two acrylic build-up plates for profile measurements at different depths

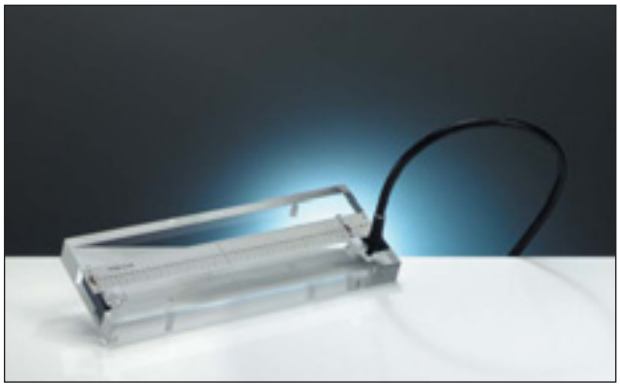
The air scanner holding device makes it possible to mount the LA48 linear array on the accessory tray of a linear accelerator for profile measurements free in air with a spatial resolution of 8 mm. The device includes an adapter plate, which fits into the guide rails of the LINAC accessory tray. It can be inserted into the rails by 90° rotation to measure inplane and crossplane profiles. The design of the adapter plate depends on the accelerator type, which the customer has to specify. Since the linear array is fixed to the accelerator gantry, profile measurements can be done at different gantry angles to check the consistent performance of the LINAC collimators. Two acrylic build-up plates for profile measurements at depths of 10 mm and 25 mm are included.

Ordering Information

L981020 LA48 Air scanner holding device for gantry mount

- LA48 Linear Chamber Array *page 47*
- MULTIDOS Multi Channel Dosemeter *page 32*
- MEPHYSTO *mc²* Software *page 49*

LA48 1D-Air Scanner Table-Top Device



Air scanner holding device for positioning the LA48 linear array on table-tops

Features

- Accommodates the LA48 linear array for fast profile measurements of dynamic and conventional fields
- Can be placed on table-tops for profile recording at 0° gantry angle
- Includes two acrylic build-up plates for profile measurements at different depths

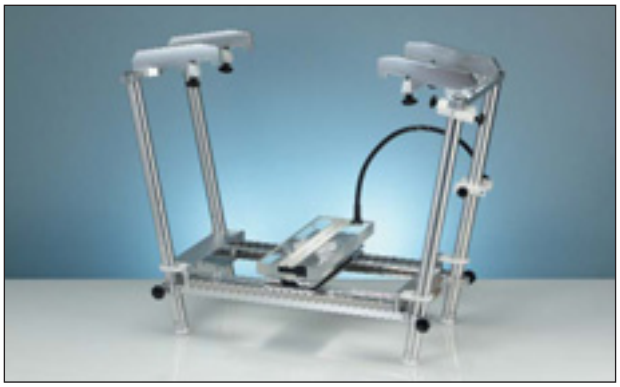
The air scanner holding device makes it possible to position the LA48 linear array on the table-top of a treatment couch for profile measurements free in air with a spatial resolution of 8 mm. It is designed to record profiles at vertical beam incidence under 0° gantry angle. The device is independent of the accelerator type, since it is not mounted to the accessory tray. It can be rotated manually by 90° to measure inplane and crossplane profiles. Two acrylic build-up plates for profile measurements in the depths of 10 mm and 25 mm are included.

Ordering Information

T41009 LA48 Air scanner holding device for table-top positioning

- LA48 Linear Chamber Array *page 47*
- MULTIDOS Multi Channel Dosemeter *page 32*
- MEPHYSTO *mc²* Software *page 49*

SLA48 2D-Air Scanner Gantry Mount Device



Gantry-mounted motorized moving mechanism for dose distribution measurement using the LA48 array

Features

- Accommodates the LA48 linear array for the verifying of dose distribution and locating of radiation fields
- Mounted on the LINAC gantry for motorized 2D data recording under arbitrary gantry angles
- Includes up to 100 mm acrylic build-up material for measurements at different depths

The SLA48 air scanner makes it possible to mount the LA48 linear array firmly on the gantry of a LINAC. The accelerator type has to be specified. The device is used for one-dimensional measurements of inplane/crossplane profiles and of diagonals as well as for two-dimensional data recording of complete radiation fields in acrylic phantom material of up to 100 mm thickness. The SLA48 device is suitable for LINAC acceptance testing of open and dynamic fields. It is also used for routine quality-control measurements. Photon beams as well as electron beams can be evaluated, since the device does not interfere with electron cones. The source to chamber distance is adjustable. The maximum field size is 400 mm x 400 mm, and a spatial resolution of 1 mm can be realized by shifting the measuring device by PC control. Crosshairs at the acrylic phantom and at the array enable the user to verify the location of the measured dose distribution with respect to the LASER alignment. For 2D measurements, two precision stepper motors move the chamber array, which is controlled by the measuring program. The LA48 array, the TBA electronics and MEPHYSTO *mc²* software are required to operate the SLA48 device.

Ordering Information

T41015 SLA48 Air scanner for gantry mount

- LA48 Linear Chamber Array *page 47*
- MULTIDOS Multi Channel Dosemeter *page 32*
- MEPHYSTO *mc²* Software *page 49*

SLA48 2D-Air Scanner Table-Top Device

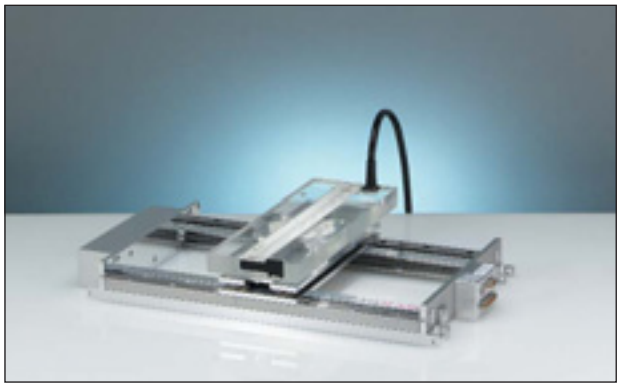


Table-top motorized moving mechanism for dose distribution measurement using the LA48 array

Features

- Accommodates the LA48 linear array for verifying dose distribution and locating radiation fields
- Can be positioned on table-tops for motorized 2D data recording under vertical beam incidence
- Includes up to 100 mm acrylic build-up material for measurements in different depths

The air scanner makes it possible to position the LA48 linear array on the table-top of a treatment couch for one-dimensional measurements of inplane/crossplane profiles and of diagonals as well as for two-dimensional data recording of complete radiation fields in acrylic phantom material of up to 100 mm thickness. It is designed to record dose distribution data at vertical beam incidence under 0° gantry angle. The device is independent of the accelerator type, since it is not mounted to the gantry.
The SLA48 device is suitable for LINAC acceptance testing of open and dynamic fields. It is also used for routine quality-control measurements. The maximum field size is 400 mm x 400 mm, and a spatial resolution of 1 mm can be achieved by shifting the measuring device by PC control. Crosshairs at the acrylic phantom and at the array enable the user to verify the location of the measured dose distribution with respect to the LASER alignment. For 2D measurements, two precision stepper motors move the chamber array, which is controlled by the measuring program. The LA48 array, the TBA electronics and MEPHYSTO *mc²* software are required to operate the SLA48 device.

Ordering Information

T41017 SLA48 Air scanner for table-top placement

- LA48 Linear Chamber Array *page 47*
- MULTIDOS Multi Channel Dosemeter *page 32*
- MEPHYSTO *mc²* Software *page 49*

Notes

Quality Control

Quality Control Equipment

Quality Control

Regular quality control procedures are mandatory to secure patient radiation treatment on high quality levels. Since quality checks have to be done quite frequently by the responsible medical physics staff, the PTW test tools are designed for time-saving, accurate results with easy handling and minimum loss of treatment unit operation time.

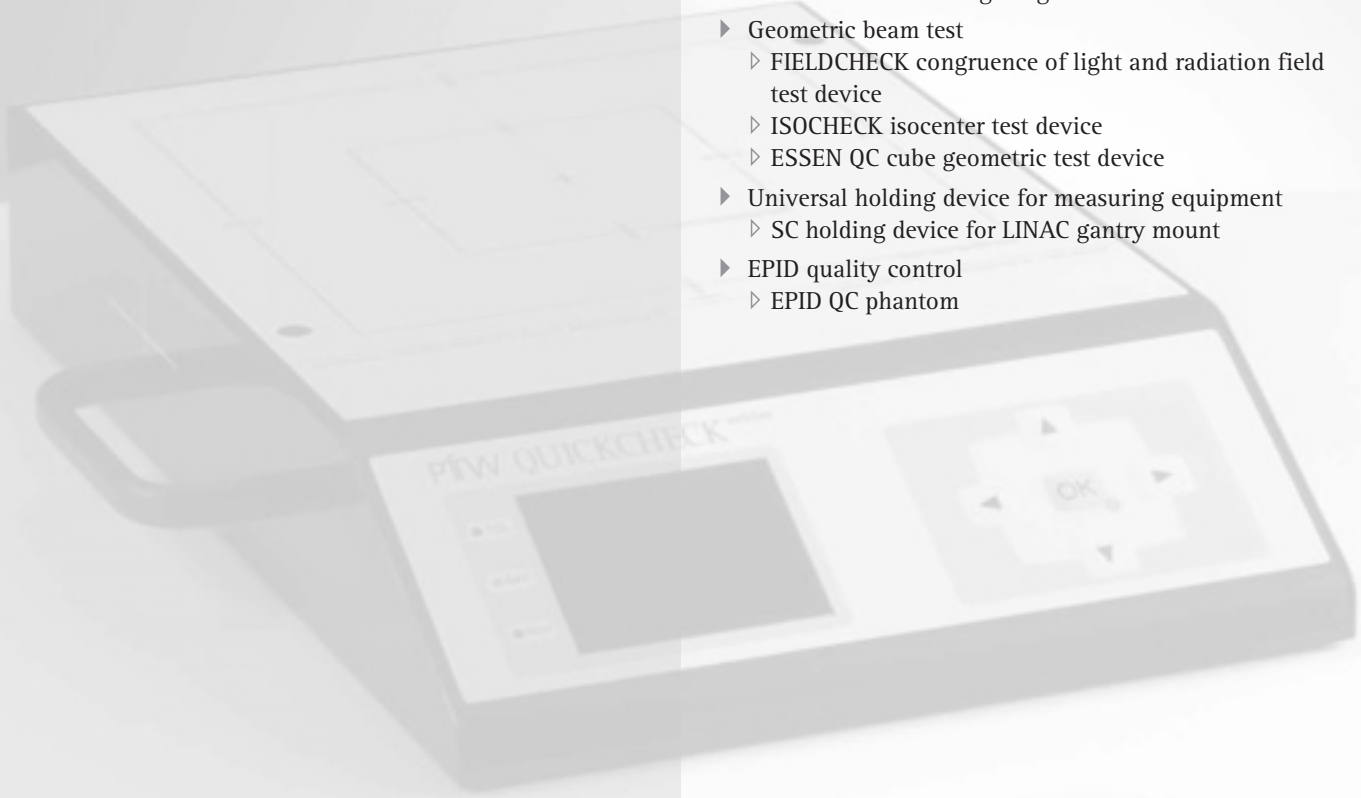
The quality test devices enable the responsible medical physics experts to comply with international standards, such as:

IEC60976
Medical electrical equipment – Medical electron accelerators – Functional performance characteristics

AAPM TG 24, report #13
Physical Aspects of Quality Assurance in Radiation Therapy

The following quality control tasks can be fulfilled with the equipment presented in this chapter:

- IMRT verification
  - OCTAVIUS system
  - VeriSoft IMRT dose verification software
  - IMRT verification phantoms
- MLC test
  - DAVID system
  - MLCSoft, MLCSoft *epid*
  - MLC test film holding device
- Monitor calibration test
  - LINACHECK monitor test device
  - MONICHECK monitor test device
- Daily LINAC performance test
  - OCTAVIUS Detector 729
  - STARCHECK 2D Ion chamber array
  - QUICKCHECK*webline*
  - BQ-CHECK beam quality test object
- Wedge angle test
  - WEDGECHECK wedge angle test device
- Geometric beam test
  - FIELDCHECK congruence of light and radiation field test device
  - ISOCHECK isocenter test device
  - ESSEN QC cube geometric test device
- Universal holding device for measuring equipment
  - SC holding device for LINAC gantry mount
- EPID quality control
  - EPID QC phantom



OCTAVIUS® I

IMRT patient plan verification and LINAC QA

Features

- 27 x 27 (729) vented cubic ionization chambers regularly arranged to MLC leafs across the complete field size of 27 cm x 27 cm
- Pioneering ionization chamber array, flat and lightweight (5.4 kg)
- Gold Standard ionization chamber technology
- Absolute dose calibration at ^{60}Co
- Complete field coverage with Merge *seven29*
- One detector – multiple applications

The OCTAVIUS Detector 729 is a new concept of an ion chamber matrix in a plane for IMRT verification and quality control in radiation therapy. Utilizing ion chambers avoids radiation defects, the major drawback of solid-state detectors. The vented plane-parallel ion chambers are 5 mm x 5 mm x 5 mm in size, and the center-to-center spacing is 10 mm. In total there are located 729 chambers in a matrix of 27 x 27, providing a maximum field size of 27 cm x 27 cm. The array is only 22 mm flat and 5.4 kg light. Due to the square chamber technology the array can be moved 5 mm to close the gaps between chambers. By shifting the array 3 times the whole area is covered. The number of measuring points can be increased to 2916.

The OCTAVIUS Detector 729 can be used for IMRT plan verification, LINAC QC (with optional MultiCheck software) and online LINAC adjustment (with optional BeamAdjust software). Using the Universal Gantry Mount the array can be mounted to the gantry and irradiated under various gantry angles.
OCTAVIUS I contains the OCTAVIUS Detector 729 and VeriSoft software. The option LINAC QA contains BQ-CHECK, MultiCheck and BeamAdjust.

Ordering Information

L981297 OCTAVIUS I

▸ OCTAVIUS Accessories *page 58*

OCTAVIUS® II

IMAT Patient Plan Verification and LINAC QA

Features

- Unique chamber and phantom geometry: Superior directional response at different gantry angles without gantry angle corrections
- Flexible positioning for measurements in the clinically relevant direction and PTV
- Pioneering ionization chamber technology
- Ready for measurement (^{60}Co calibrated), no commissioning required
- Complete field coverage with Merge *seven29*
- Improved angular response during irradiation at different gantry angles due to built-in semicircular air cavity and advanced cubic detector design
- No gantry angle input, angular corrections and cable connections to LINAC required

Including the complete functionality of the OCTAVIUS I, OCTAVIUS II adds a specially designed phantom along with dedicated tools to enable fast and precise verification of composite IMRT plans or IMAT plans. With an optional inclinometer the dose can be recorded as a function of gantry angle or time to verify partial plans.
OCTAVIUS II contains the OCTAVIUS Detector 729, VeriSoft software and the OCTAVIUS phantom.

The OCTAVIUS Phantom was designed by Ann van Esch and Dominique P. Huyskens from 7Sigma, Belgium.

Ordering Information

L981298 OCTAVIUS II

▸ OCTAVIUS Accessories *page 58*

OCTAVIUS® III

IMAT patient plan verification and in-vivo dosimetry

Features

- Patient plan verification and in vivo verification of dose delivery and MLC accuracy during actual patient treatment provided in one solution, using a novel, clinically validated QA technique
- Customizable, color-coded alarm levels to quickly detect serious (e.g. lost MLC positions) as well as minor leaf malfunctions and plan deviations during each session
- Ingeniously simple installation and everyday operation
- Available for all standard MLCs

Designed to close the gap in IMRT QA, OCTAVIUS III cleverly combines pre-treatment verification using OCTAVIUS II with the DAVID Detector, a truly innovative real-time in vivo dosimetry system for IMRT. By integrating DAVID, OCTAVIUS III gives you a powerful, yet highly practical QA solution at hand to verify whether the planned dose is actually being delivered over the entire treatment period. It is the ultimate safety layer for complex IMRT treatments.
DAVID features a transparent multiwire ionization chamber (MIC) which is installed below the MLCs. Measurement wires are stretched parallel to the running direction of the MLCs. Each measurement wire monitors the opening of a leaf pair. The evaluation software compares the dose measured during radiotherapy to a reference dose, which was taken during a reference measurement. DAVID can be used independent of the IMRT method (Step and Shoot, Sliding Window or Dynamic Arc).

The DAVID system was developed in collaboration with PIUS Hospital and CARL VON OSSIETZKY University, Oldenburg as well as Goettingen University, Germany.

Ordering Information

L981229 OCTAVIUS III

▸ OCTAVIUS Accessories *page 58*

OCTAVIUS® Accessories

Optional accessories for OCTAVIUS systems

OCTAVIUS mobile QA Trolley (T40053)

Robust, functionally designed trolley to conveniently store and move OCTAVIUS™ phantom and detector.

Inclinometer (L981316)

Device to measure the gantry angle. Allows dose measurements as a function of time and gantry angle to verify partial plans. Typically use for IMAT measurements.

Film Measurement (T40054.1.015)

Polystyrene holding device for OCTAVIUS phantom to insert a GafChromic® EBT / EBT 2 film (max. size 20.32 cm x 25.4 cm, 8″ x 10″) for film measurements.

Chamber Measurement (T40042.1.010)

Insert plates for OCTAVIUS phantom with cavities to allow point measurements with up to nine 0.125 cm^3 semiflex ionization chambers. Unneeded cavities can be closed with blind plugs.

Inhomogeneity Phantom (L981296)

Acrylic phantom to test TPS system with consideration of inhomogeneities

▸ *page 60*

BQ-CHECK (T42030)

Energy verification phantom

▸ *page 66*

Positioning Device (T42030)

Positioning phantom for OCTAVIUS Detector and for STARCHECK

▸ *page 67*

Universal Gantry Mount (T41021)

Vendor-specific gantry holding device designed to keep PTW ionization chamber arrays secure at isocenter at any gantry position

▸ *page 63*

DIAMOND™ MU Calculation

MU calculation software

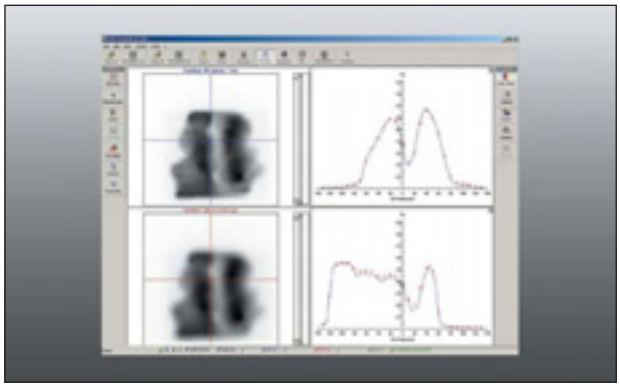
Features

- Calculates the dose of standard and routine IMRT plans using three new proprietary dose calculation algorithms
- Compares dose at one or multiple measurement points (field-by-field, composite)
- Provides basic and advanced calculation capabilities (e.g. electron and photon, blocks, MLCs, dynamic wedges)
- Offers enhanced fluence mapping with color wash and contour lines
- Supports multiple treatment techniques (conformal, static and dynamic IMRT, e.g. step and shoot, sliding window, RapidArc®, VMAT)

DIAMOND is a clinically proven[1], independent MU calculation software designed as an addition to OCTAVIUS systems for routine dose verification of less complex IMRT plans.

[1] Evaluation and Commissioning of K&S Associates Inc. Diamond Monitor Unit Calculation Software; R Kukdchadker et al., The University of Texas MD Anderson Cancer Center, Houston, TX 77030, Poster Presentation, AAPM Annual Meeting 2006

VeriSoft® Verification Software



IMRT patient plan verification software

Features

- Verifies IMRT treatment plans
- Compares any two data records from planning systems, OCTAVIUS Detector 729 or film
- Provides comprehensive data evaluation routines with Gamma Index analyses and traffic light function for fast checking
- Enables overlaid isodose display
- Contains list function for importing several fields
- Supports inclinometer measurements to verify dose over gantry angle or time
- 3D Gamma Index analysis

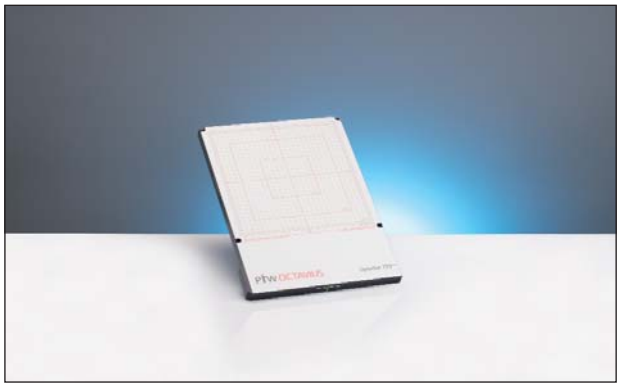
VeriSoft helps the medical physics expert to verify the IMRT treatment plan by comparing data measured in an IMRT verification phantom with data computed for the same phantom by a radiotherapy treatment planning system.
Matrices of measured and calculated points of an IMRT beam are read and displayed by VeriSoft. Isodoses, profiles and numerical values can be compared. VeriSoft features several display modes.
VeriSoft offers different ways to evaluate the deviation between treatment plan and measured beam, including the Gamma Index method.
VeriSoft reads calculated dose matrices from all major radiation therapy planning systems (DICOM or own data formats) as well as all customary image formats.
To acquire 2D measuring matrices for the evaluation by the VeriSoft software, a beam data acquisition system is required (Therapy Beam Analyzer, OCTAVIUS Detector 729 or film digitizer with TIFF format).

Ordering Information

S070009 VeriSoft software

- IMRT Verification Phantoms *page 61ff.*

OCTAVIUS Detector 729 *XDR*



Patient Plan Verification and Quality Assurance for proton and heavy ion beams

Features

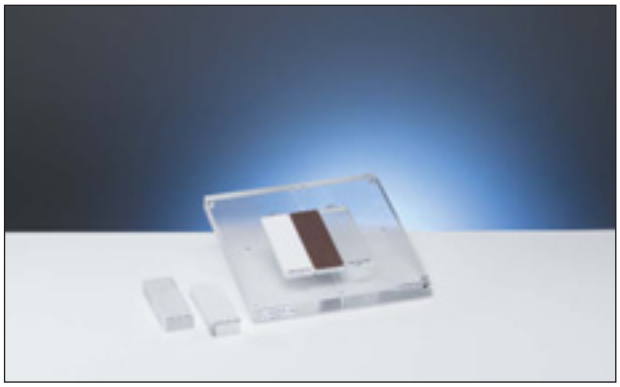
- Outstanding detector and matrix design: 729 vented cubic ion chambers, uniformly arranged on a 27 cm x 27 cm matrix
- Largest field coverage with 2916 measurement points (VeriSoft Merge)
- Pioneering ionization chamber array, flat and light-weight (5.4 kg)
- Gold Standard ionization chamber technology
- Absolute dose calibration at ^{60}Co
- One detector – multiple applications
- Suitable for proton and heavy ion beams

The OCTAVIUS detector 729 *XDR* is a new concept of an ion chamber matrix in a plane for patient plan verification and quality control in radiation therapy. Utilizing ion chambers avoids radiation defects, the major drawback of solid-state detectors. The vented plane-parallel ion chambers are 5 mm x 5 mm x 3 mm in size, and the center-to-center spacing is 10 mm. In total there are located 729 chambers in a matrix of 27 x 27, providing a maximum field size of 27 cm x 27 cm. The array is only 22 mm flat and 5.4 kg light. Due to the square chamber technology the array can be moved 5 mm to close the gaps between chambers. By shifting the array 3 times the whole area is covered. The number of measuring points can be increased to 2916. The OCTAVIUS detector 729 *XDR* can be used in a flat phantom or in the octagonal phantom OCTAVIUS. OCTAVIUS detector 729 *XDR* is compatible with the PTW software.

Ordering Information

L981998 OCTAVIUS Detector 729 *XDR*
T40054 OCAVIUS Phantom
S070009 VeriSoft software
S070011 MultiCheck software
S080032 BeamAdjust software

Inhomogeneity Phantom



Inhomogeneity phantom mimicking body like inhomogeneities for dose measurement

Features

- Inserts are mimicking tissue, bone, lung
- Dose measurement with ionization chamber, film or OCTAVIUS Detector 729
- Inserts fit into a slab phantom

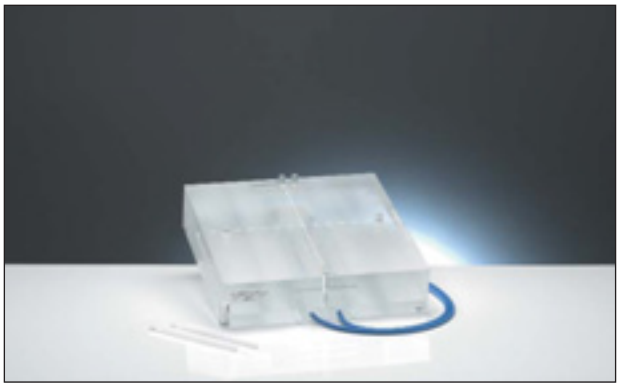
The IMRT Inhomogeneity Phantom is used to verify basic data of a radiotherapy treatment planning system (TPS). The corrections of the TPS for inhomogeneities are verified by the phantom.
The IMRT Inhomogeneity Phantom is composed of a base plate and five inserts of four different materials. Three inserts are mimicking inhomogeneities in the human body (1 x bone, 1 x tissue, 1 x lung). Two inserts are made of acrylic glass (PMMA).
The phantom can be placed on the bottom part of the Universal IMRT phantom T40020.1.010 for use with film or ionization chambers or on the OCTAVIUS Detector 729 or it can be placed on a 30 cm x 30 cm slab phantom.
The size of the Inhomogeneity Phantom is 30 cm x 30 cm x 2.5 cm. The inserts can be exchanged according to the users requirements. The IMRT Inhomogeneity Phantom is not a CT test phantom. The Hounsfield units of the phantom must be determined by a CT scan.

Ordering Information

T40037 Inhomogeneity Phantom

- IMRT Universal Phantom *page 61*
- OCTAVIUS Detector 729 *page 57*

Universal IMRT Verification Phantom



Acrylic phantom for IMRT dose verification using radiographic film and 0.125 cm³ ionization chambers

Features

- Makes it possible to verify IMRT dose delivery
- Checks either IMRT sub beams or total beams
- Accommodates radiographic film and up to five ionization chambers
- Marks the film position by perforation

The purpose of IMRT dose verification phantoms is to verify dose distributions and absolute dose values produced by IMRT beams, either sub beams or total beams. The verification is done by irradiating an IMRT verification phantom and by comparing the measured phantom values and the calculated values of the radiotherapy treatment planning system.
The Universal IMRT Verification Phantom type T40020[1] enables the user to check the spatial distribution of IMRT beams using a radiographic film. Ion chambers connected to integrating dosemeters measure absolute dose values. The phantom accommodates a film of 25 cm x 30 cm and up to five 0.125 cm³ ion chambers type 31002/31010. The position of the film is marked by needles with respect to the phantom and the chamber orientation. The phantom is composed of two 30 cm x 30 cm acrylic blocks, the depth of the film is 50 mm, and the depth of the ion chambers is 60 mm. The simple shape of the phantom makes it easy to enter its dimensions into the treatment planning system.

[1] The design of the phantom was suggested by Jörg Bohsung of the University Hospital Charité in Berlin, Germany.

Ordering Information

T40020.1.010 Universal IMRT verification phantom

▸ Semiflex Ionization Chambers *page 16*

IMRT Verification Head Phantom

Cylindric PMMA phantom for verification of stereotactic IMRT beams by an LA48 linear chamber array

Features

- Enables the user to verify stereotactic treatment plans
- Made of acrylic (PMMA) material in cylindric shape to simulate a human head
- Accommodates the LA48 linear chamber array
- Can be attached to the stereotactic system and the couch

The LA48 IMRT head phantom[1] consists of an acrylic cylinder, 22 cm in height and 20 cm in diameter, which accommodates the LA48 linear chamber array. This combination makes it possible to measure the IMRT dose profile in the axis of the cylindrical phantom, which can be attached to the stereotactic system and to the treatment couch. The LA48 linear array is connected to the MULTIDOS dosemeter with extender ME48 and operated by using a PC software.

The phantom can be attached to the stereotactic system and the couch by a special holding device.

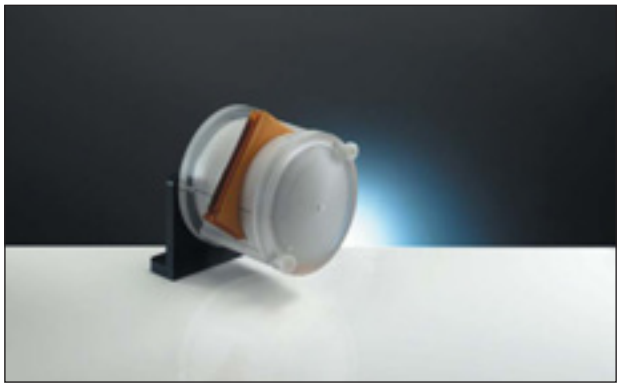
[1] The phantom was designed by Bernhard Rhein from the German Cancer Research Center DKFZ Heidelberg, Germany.

Ordering Information

T40014 LA48 IMRT head phantom
T40015.1.010 IMRT phantom holder

▸ LA48 Linear Chamber Array *page 47*

IMRT Verification Head/Neck Phantom



Cylindric sliced RW3 phantom for verification of stereotactic IMRT beams by radiographic films

Features

- Enables the user to verify stereotactic treatment plans
- Made of sliced RW3 water-equivalent material in cylindric shape to simulate a human head and neck
- Accommodates radiographic films and an ion chamber in the phantom axis
- Can be attached to the stereotactic system and the couch

The IMRT head/neck phantom[1] model T40015 is a 20 cm high cylinder composed of 1 cm thick plates of water-equivalent RW3 material. The cylinder with a diameter of 20 cm is supplied with a cover, decreasing to zero in cranial direction. Single packed films can be placed between the plates, which are aligned and fixed by means of acrylic rods on two sides of the cylinder. Five holes in the plates make it possible to mark a coordinate system on the films using a needle. Ionization chamber data can be taken using a hole along the axis of the cylinder, where a 0.125 cm^3 or a 0.3 cm^3 semiflex ionization chamber can be inserted.

The phantom can be attached to the stereotactic system and the couch by a special holding device.

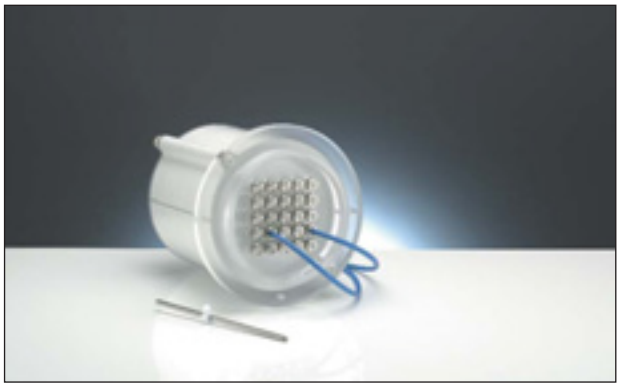
[1] The phantom was designed by Bernhard Rhein from the German Cancer Research Center DKFZ Heidelberg, Germany.

Ordering Information

T40015 IMRT head/neck phantom
T40015.1.010 IMRT phantom holder

▸ Semiflex Ionization Chambers *page 16*

IMRT Verification Matrix Phantom



Cylindric RW3 phantom with chamber holes for verification of stereotactic IMRT beams by semiflex chambers

Features

- Enables the user to verify stereotactic treatment plans
- Made of RW3 water-equivalent material in cylindric shape to simulate a human head and neck
- 25 holes in a matrix can accommodate semiflex ionization chambers at different phantom locations and depths
- Can be attached to the stereotactic system and the couch

The IMRT matrix phantom[1] model T40026 is a 20 cm high cylinder composed of water-equivalent RW3 material. The diameter of the cylinder is 20 cm, and the height is 20 cm. The phantom is supplied with 25 holes through the entire height to place semiflex ionization chambers inside the phantom. The chambers are inserted up to the desired position in any of the holes, and then securely fixed. The holes not in use are closed by means of dummy plugs.

The phantom can be attached to the stereotactic system and the couch by a special holding device.

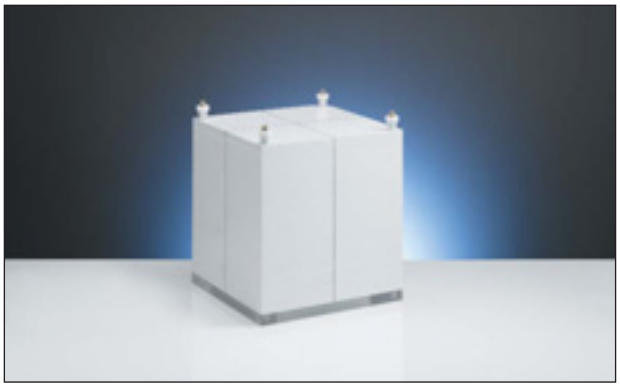
[1] The phantom was designed by Bernhard Rhein from the German Cancer Research Center DKFZ Heidelberg, Germany.

Ordering Information

T40026 IMRT matrix phantom
T40015.1.010 IMRT phantom holder

▸ Semiflex Ionization Chambers *page 16*

IMRT Body Phantom



Slab sliced RW3 phantom for verification of IMRT beams by radiographic films

Features

- Enables the user to verify IMRT treatment plans
- Made of RW3 water equivalent material in slab shape
- Accommodates radiographic films

The IMRT body phantom consists of 30 slabs, each 30 cm x 30 cm x 1 cm. The phantom is made of water equivalent RW3 material. The slabs are tight together with plastic screws. The films can be placed between the slabs, each film can be marked by a needle. Markers for adjustment with the lasers are at the end cuttings of the slabs.

Ordering Information

T40025 IMRT Body Phantom

- VeriSoft *page 59*

SC Holding Device Universal Gantry Mount

Universal sturdy holding device for gantry mounts of any measuring equipment to different LINAC types

Features

- Mounts to different LINAC types without interfering with accessory tray guide rails and with electron cones
- Accommodates any detector and phantom assembly for measurements in the isocenter
- Universal tool for any therapy dosimetry task at arbitrary gantry angles

The SC holding device is a very stable mechanism, which is available for different types of LINAC gantries. It does not interfere with the guide rails of the accessory tray and with an attached electron cone. These features make the SC holding device a real universal tool for therapy dosimetry using any dosimetry assembly at any gantry angle. A solid mounting frame at the holding device makes it possible to position any phantom-detector combination in the isocenter. As an example, single radiation detectors can be placed in an acrylic or RW3 phantom, or the LA48 linear chamber array can be fixed for profile measurements, or a 2D chamber matrix can be attached for on-line measurements in a plane. Alternatively a radiographic film could be adapted for film dosimetry.

Ordering Information

L981023 SC Gantry holding device
Please specify type of linear accelerator!
T41021.1.110 Chamber plate holder
L981078 LA48 Linear array holder
T41021.1.130 Film Holder for film densitometry
T41021.1.140 QC6Plus holder
T41021.1.150 Chamber/cable clamping device
T41021.1.170 Holder for OCTAVIUS Detector 729 and STARCHECK
T41021.1.210 Holder for OCTAVIUS Detector 729 and STARCHECK incl. 10 cm PMMA build-up

- Radiation Detectors *page 16ff.*
- Acrylic and RW3 Slab Phantoms *page 25*
- LA48 Linear Chamber Array *page 47*
- FilmSoft Film Densitometry System *page 50*

STARCHECK 2D Chamber Array

Chamber matrix system to measure high resolution star profiles of high-energy therapy beams in real-time

Features

- Measures high resolution profiles along the principal axes and along the diagonals with 3 mm spatial resolution
- Checks the start-up behaviour
- Checks positions of MLC leaves
- Checks congruence between light field and radiation field and beam quality with dedicated phantoms

STARCHECK is a precise and reliable tool for fast measurements in radiation therapy beams. Typical applications are quality control and LINAC beam adjustment measurements with the detector panel embedded in a solid state phantom. The ionization chambers feature an excellent relative response stability, avoiding the need of frequent recalibration. A full set of four profiles is measured every 200 ms, making the device useful for real-time measurements. The excellent spatial resolution of only 3 mm ensures precise measurements even in penumbra regions. The scanning lengths covered by the detectors are 25.2 cm along the principal axes and 34.5 cm along the diagonals.
Two rows of detectors allow MLC leaf positions to be verified. Up to 53 leaf pairs with a width of 5 mm can be checked in one run. Deviations of (0.5 ... 1) mm can be detected by STARCHECK. The delivery includes the detector panel, an interface box which connects to a PC via RS232 interface, real time analysis software (BeamAdjust), and a quality control software (MultiCheck).

Ordering Information

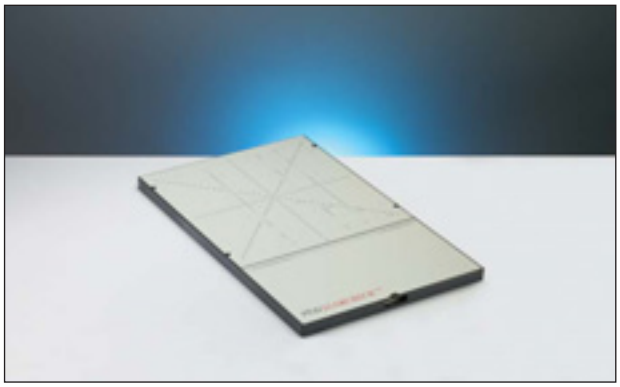
L981366 STARCHECK system with 527 ionization chambers, incl. interface software

Option

T41021 SC Gantry Holding Device

- Gantry Mount Holder *page 63*

STARCHECK *maxi* Full Size Chamber Array



Chamber matrix system to measure high resolution star profiles for fields up to 40 cm x 40 cm

Features

- Measures fields up to a size of 40 cm x 40 cm
- Measures high-resolution (3 mm) profiles along the principal axes and along the diagonals
- Checks the start-up behaviour
- Checks congruence between light field and radiation field and beam quality with dedicated phantoms

STARCHECK *maxi* is a precise and reliable tool for fast measurements in radiation therapy beams. Typical applications are quality control and LINAC beam adjustment measurements with the detector panel embedded in a solid state phantom. The ionization chambers feature an excellent relative response stability, avoiding the need of frequent recalibration. A full set of 4 profiles is measured every 200 ms (or one profile every 100 ms), making the device useful for realtime measurements.
The excellent spatial resolution of only 3 mm ensures precise measurements even in penumbra regions. The scanning lengths covered by the detectors are 40 cm along the principal axes and 56.5 cm along the diagonals.
BeamAdjust software displays up to four profiles in realtime. The profiles can be analyzed according to selectable dosimetry protocols and the protocols of the accelerator manufacturers.
The software displays the start-up behaviour with a time resolution of 100 ms.

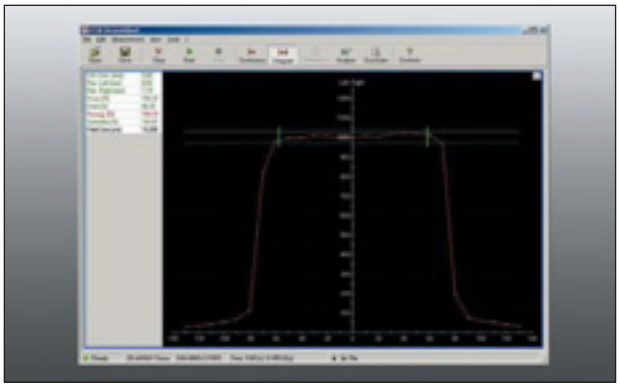
With an additional accessory plate BQ-CHECK phantom and FIELDCHECK phantom can be used with STARCHECK *maxi*

Ordering Information

L981377 STARCHECK *maxi* measuring system
T10033.1.050 Build up plates for STARCHECK *maxi*
T10033.1.550 Carrying case for build up plates
T10033.1.150 STARCHECK *maxi* accessory plate for BQ-CHECK and FIELDCHECK

- FIELDCHECK phantom *page 66*
- BQ-CHECK Energy test phantom *page 66*

BeamAdjust Software



QA software for online display of profiles acquired by different PTW arrays

Features

- Displays up to four profiles in real-time
- Online analysis with color coded adjustment parameters
- Displays reference curve
- Creates a comprehensive data analysis according to selectable dosimetry protocols and the protocols of the accelerator manufacturers
- Checks start-up behaviour of the LINAC (with STARCHECK detectors only)

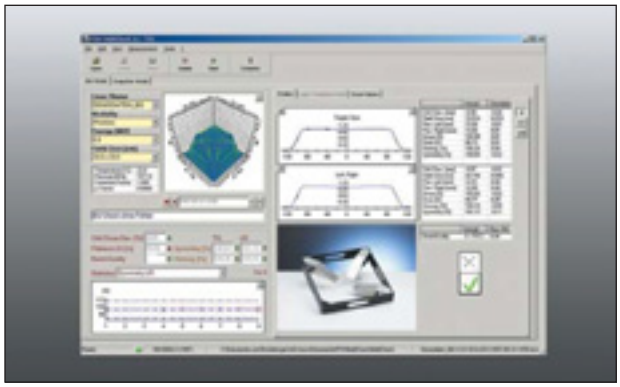
BeamAdjust software makes it possible to display the profiles along the main axes and diagonals in real-time. Various one- or two-dimensional PTW detector arrays can be connected.
A reference curve can be displayed. The adjustment parameters are displayed for each curve. They change their color from green to red if a parameter is outside the limits. The limits are adjustable.
The curves can be analyzed following different selectable dosimetry protocols and the protocols of the accelerator manufacturers.
Together with STARCHECK the setup of a water phantom can sometimes be replaced, e.g. after service or repair.
BeamAdjust is part of STARCHECK and part of MEPHYSTO *mc*^{2}. It can be used as a stand alone software e.g. with OCTAVIUS Detector 729 or Linear Array LA48.

Ordering Information

S080032 BeamAdjust software

- OCTAVIUS Detector 729 *page 57*
- STARCHECK *page 64*
- LA48 *page 47*

MultiCheck LINAC QC Software



Software program to check the consistent performance of linear accelerators by using PTW 2D ion chamber arrays

Features

- Suitable for fast and easy daily constancy tests of photon and electron beams from LINACs using PTW 2D arrays
- Checks flatness, symmetry, dose deviation in the central axes, wedge angle of dynamic, virtual and fixed wedges as well as the congruency of light and radiation fields
- Checks beam quality with BQ-CHECK phantom
- Compares all parameters to a reference data record and displays deviations
- Enables tracking parameters via a statistic function
- Creates a comprehensive data analysis according to selectable dosimetry protocols and the protocols of the accelerator manufacturers
- Provides snapshoot mode for fast checking of the beam

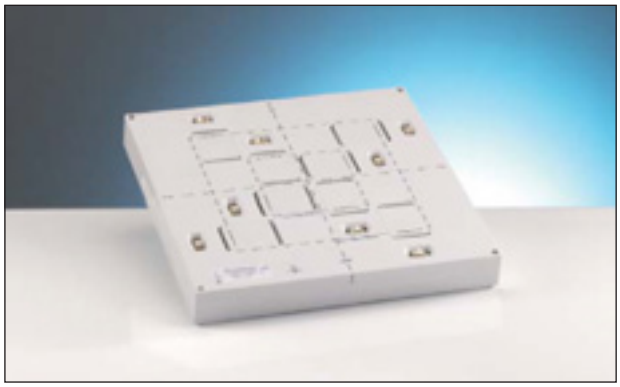
MultiCheck is a Windows based software for fast and easy-to-handle routine constancy tests of high-energy photon and electron beams from linear accelerators. Reference files for different accelerators and different beam parameters can be defined. MultiCheck is based on two-dimensional dose measurements by the 2D flat panel arrays. By evaluating the dose matrices, the relevant LINAC quality parameters are compared to original reference values, which are stored together with tolerance thresholds. Measuring results, parameter variations and tolerance excesses are presented in either numeric or graphic format. The progress of test results combined with statistical evaluations is shown. Profiles can be analyzed after different protocols.
The software offers air density correction of the ion chamber measuring values. The data can be exported to Excel sheets for further evaluation.

Ordering Information

S070011 MultiCheck software

- OCTAVIUS Detector 729 *page 57*
- STARCHECK *page 64*
- BQ-CHECK *page 66*
- FIELDCHECK *page 66*

FIELDCHECK



Checks congruence of light field and radiation field of linear accelerators

Features

- Checks congruence of light field and radiation field in combination with STARCHECK and STARCHECK *maxi* 2D ionization chamber array
- Field size 10 cm x 10 cm and 20 cm x 20 cm
- Single shot measurement
- Highest precision, no film required
- Measurement analysis and documentation by MultiCheck software

Combined with the STARCHECK 2D ionization chamber array, the FIELDCHECK device is used to check the congruence of light field and radiation field. Performance and analysis of the measurements are done by means of the MultiCheck software (version 3.3 or higher).
To detect the exact position of the light field, four movable sliders are adjusted to the margins of the light field. The sliders move markers on the measuring diagonals of the STARCHECK detector.
With "beam on" the markers are displayed on the diagonals while the limits of the field size are measured on the main axes of the STARCHECK detector.

With an additional accessory plate the FIELDCHECK phantom can be used together with STARCHECK *maxi*.

The evaluation software MultiCheck shows size and position of both, light field and radiation field and displays the values and trends. Adjustable limits help to keep track of all parameters.

Ordering Information

T40052 FIELDCHECK phantom

- STARCHECK measuring system *page 64*
- STARCHECK *maxi* measuring system *page 64*
- STARCHECK *maxi* accessory plate *page 64*
- MultiCheck *page 65*

BQ-CHECK Test Object

Test object for constancy checks of photon and electron beam qualities using STARCHECK or OCTAVIUS Detector 729

Features

- Checks the beam quality of photon and electron beams in combination with STARCHECK or OCTAVIUS Detector 729
- No interference with profiles on the main axes
- Comprehensive data analysis by MultiCheck software

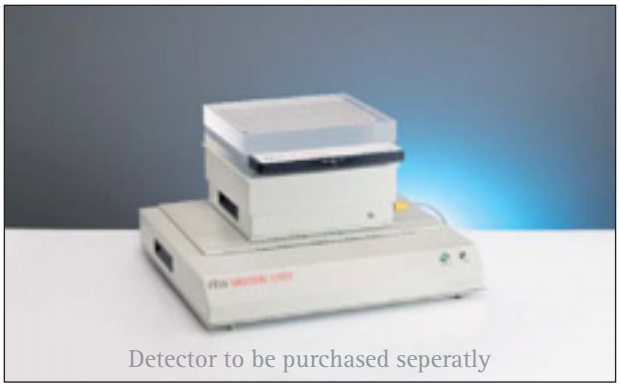
BQ-CHECK is a phantom with 300 mm x 300 mm x 47 mm in size. It can be placed on the PTW 2D ion chamber arrays OCTAVIUS Detector 729 and STARCHECK to check the constancy of the beam quality of high energy photon and electron beams.
Wedges of different materials are placed over the diagonals of the arrays. The MultiCheck software checks the constancy of the beam quality and displays a figure for each beam quality. Limits of acceptance can be adjusted. The beam quality can be tracked with a statistic function.
Because the main axes are not affected by the use of BQ-CHECK the beam quality can be checked without additional workload.
The beam quality analysis is part of the MultiCheck software. For the use of BQ-CHECK, MultiCheck software is needed.

Ordering Information

T42030 BQ-CHECK Test object

- OCTAVIUS Detector 729 *page 57*
- STARCHECK *page 64*
- STARCHECK *maxi* measuring system *page 64*
- STARCHECK *maxi* accessory plate *page 64*
- MultiCheck *page 65*

MOTION UNIT Moving Table


Detector to be purchased seperatly

Enhances the OCTAVIUS Detector 729 to a measuring system for full field coverage and respiratory gating

Features

- Software controlled motor driven movement of the OCTAVIUS Detector 729 in 5 mm steps for full field coverage
- Periodical movement of the OCTAVIUS Detector 729 for respiratory gating
- 40 cm profile scanning by moving the OCTAVIUS Detector 729 ± 100 mm in x-direction

The Motion Unit software allows different applications:

- **X-Y-Z Positioning:** In this mode, the X, Y (and Z, if the Z module is connected) positions can be set directly by the user.
- Merge *seven29*: In this mode, the system performs 5 mm shifts in asquare pattern to allow the OCTAVIUS Detector 729 to acquire complete X-Y planar data.
- **Profile Scanning:** In this mode, the system moves the OCTAVIUS Detector 729 to extreme positions along the X axis which allows for large field data acquisition via the OCTAVIUS Detector 729.
- **Respiratory Simulation:** In this mode, the OCTAVIUS Detector 729 can be moved along periodic trajectories to simulate respiratory motion.

The range of movement is ± 100 mm in x-direction, 5 mm in y-direction and ± 25 mm in z-direction. The movement increments are 0.1 mm, the position accuracy is 0.05 mm. The outer dimensions of the x-y stage are 550 mm x 580 mm x 101 mm. The weight is approx. 15 kg.

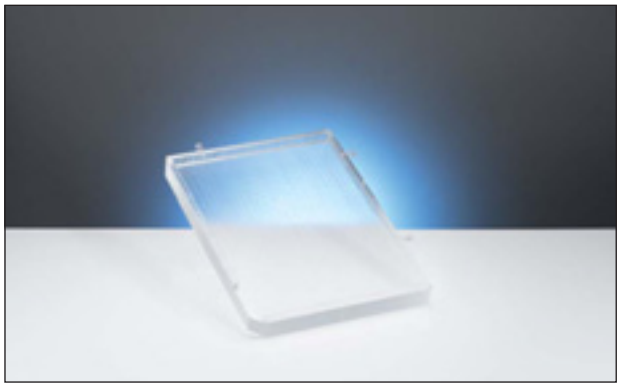
The z-direction is an option. Detector not included.

Ordering Information

L991264 MOTION UNIT XY
L991265 MOTION UNIT Z

- OCTAVIUS I *page 49*
- STARCHECK *page 43*

Positioning Phantom for 2D-Detectors



Acrylic phantom for precise adjustment of a detector panel

Features

- 3 cm acrylic backscatter
- Vernier adjustment for horizontal alignment
- Allows to move the detector panel 5 mm in x- and y-direction
- Dimensions 445 mm x 320 mm x 45 mm
- Backscatter material 30 mm
- Positioning accuracy 0.1 mm

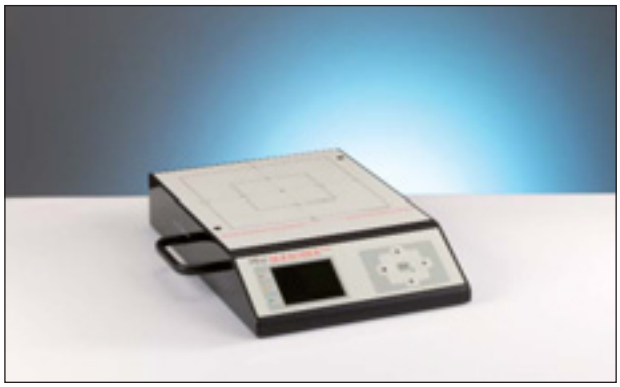
The positioning device consists of a acrilic base frame, two distance strips and three positioning screws.
The detector array, OCTAVIUS Detector 729, OCTAVIUS Detector 729 ^{XDR} or STARCHECK, is inserted into the base frame. It can be moved 5 mm by inserting the acrylic distance strips. Alternatively the detector array can be aligned precisely by means of the three positioning screws on the sides.
The engraved lines are used for aligning the positioning device by means of the laser system of the radiation device.

Ordering Information

T40049 Positioning Phantom

- OCTAVIUS I *page 57*
- OCTAVIUS Detector 729 ^{XDR} *page 60*
- STARCHECK *page 64*

QUICKCHECK*webline* Constancy Test Device



Compact and easy to use portable check device for daily constancy tests of the relevant LINAC parameters

Features

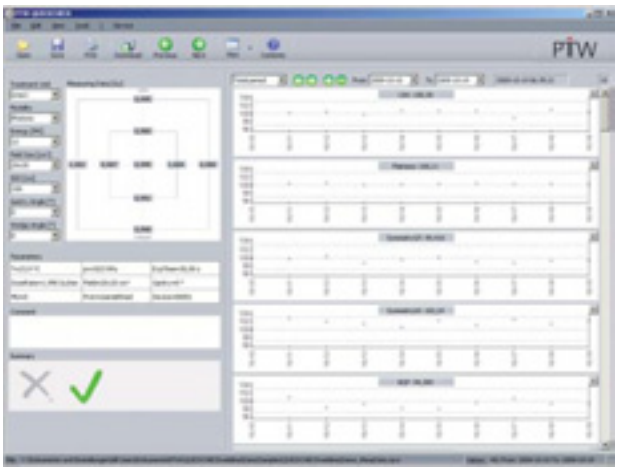
- Standalone, truly wireless operation
- Fully automatic workflow using predefined worklists
- Integrated auto functions (start, stop, stand-by, shutdown, calendar)
- Immediate display of measurement results via large, full-color display and LED status indicators
- Gold standard ionization chamber technology
- Password-protected access

Application Highlights

- Constancy check of all essential beam parameters in one go and at any gantry angle
- Built-in beam energy check
- Field sizes 10 cm x 10 cm and 20 cm x 20 cm
- Automatic air density correction
- All major dosimetry protocols included
- Vendor-specific gantry mounts for rotational testing optionally available

The QUICKCHECK*webline* is a highly reliable and very easy to use QC measurement device especially designed to make daily routine measurements for LINAC constancy tests as convenient as possible. With 13 vented ionization chambers, integrated in a housing that also contains the complete electronics, the QUICKCHECK*webline* combines very high accuracy with the highest level of usability. Air density corrections of the open ionization chambers are performed automatically.
QUICKCHECK*webline* features all the measuring tasks for daily constancy tests of the relevant LINAC parameters as symmetry, flatness, central beam dose, energy, irradiation time or wedge filtering. All these tasks can be performed with this single portable wireless device.

Settings and readings can be done directly at the device as a bright full-colour display is built in. Autostart, autostop, autopower-off and autocalendar functions allow hassle-free measurements. While not used for measurements, the device can be stored in an optional docking station.



A comprehensive software package enables the user to set up worklists and to read out and analyze measured data.

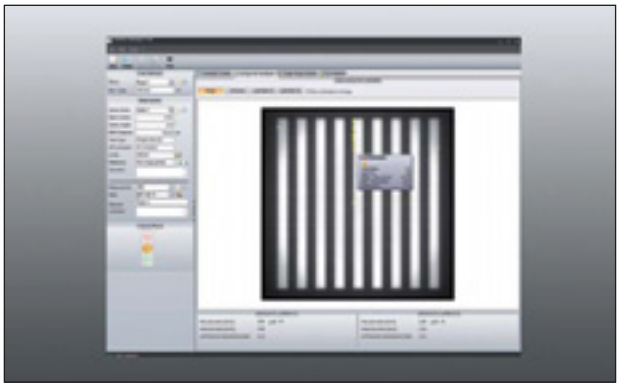
Ordering Information

L981975 QUICKCHECK*webline* including software and power cables

L981976 QUICKCHECK*webline* including docking station, software and power cables

L981024 QUICKCHECK Gantry Mount Quality Control Equipment

MLCSoft *epid* MLC QA Software



Software for quality control of multileaf collimators used for IMRT treatment by linear accelerators

Features

- Does MLC QA by analysing MLC leaf positions on EPID images
- Suitable for all common types of MLCs including collimators with more than one leaf width
- Provides several levels of positioning information from visual information for quick checks to numerical data tables for thorough analysis

The software MLCSoft *epid* helps the medical physics expert to ensure the correct positioning of the LINAC MLC leaves. This is done by comparing leaf positions on a current set of images to positions on a "gold standard" set.

Alternatively it is also possible to compare current leaf positions with positions defined externally. The results can be displayed visually or numerically. Trends over time can be displayed in a separate QA statistics tab.

Ordering Information

S070022 MLCSoft *epid* Software

MLCSoft® MLC Test Software

Software for calibration and quality control of multileaf collimators used for IMRT treatment by linear accelerators

Features

- Helps to ensure precise leaf positioning when using multileaf collimators for patient treatment
- Presents the measuring results as a table showing the actual leaf positions and individual deviations to the nominal value
- Offers easy offset correction by calculating the mean deviation
- Works on the basis of measurements performed with the LA48 linear array
- Determines the 50 % dose values for each leaf by measuring up to 47 profiles in one run

The accuracy and, at least as important, the reproducibility of the leaf positioning of multileaf collimators are important parameters that must be checked frequently to ensure precise IMRT treatment. Leaf position checks are part of the quality assurance procedures and should be carried out in a fast and accurate way.

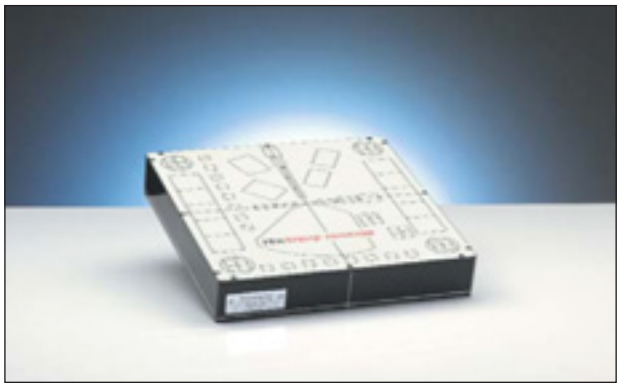
The easy-to-handle MLCSoft Software determines and evaluates the leaf positions of multileaf collimators by means of a LA48 linear chamber array in combination with a TBA Therapy Beam Analyzer MP3, MP3-M or SLA48. The measuring results are presented both as a diagram and as a table showing the actual positions and the deviations from the nominal leaf position with a display resolution of 0.1 mm.

Ordering Information

S070014 MLCSoft Software
S080045.002 Option MLCSoft for MEPHYSTO *mc²*

- LA48 Linear Chamber Array *page 47*
- MP3 Phantom *page 41*
- MP3-M Phantom *page 42*
- SLA48 Air Scanners *page 53*
- MEPHYSTO *mc² page 49*

EPID QC PHANTOM



Test object for quality control of Electronic Portal Imaging Devices used in high-energy photon beams

Features

- Suitable for conventional EPIDs and flat Panel Imagers
- Checks linearity, isotropy, noise, low and high contrast resolution with test elements in focal spot geometry
- High contrast resolution in horizontal, vertical and diagonal direction
- Measurement of all parameters with a single beam in one image

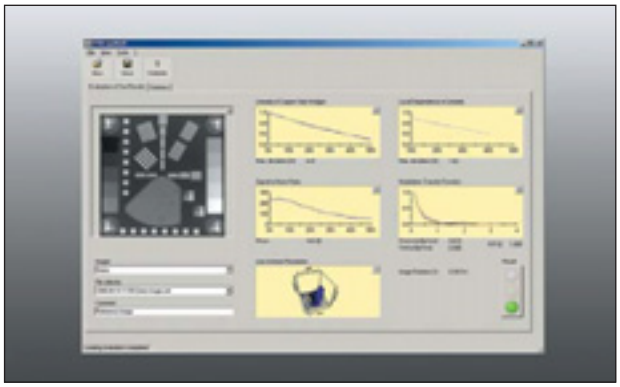
Electronic Portal Imaging Devices (EPID) are used in radiation therapy to verify the patient's position in the radiation beam during treatment. EPIDs are intended to detect physiological structures of the patient and to refer to them to the photon beam's coordinate system. Regular quality checks of the EPIDs are therefore crucial to ensure constant image quality and thus a high safety level for the patient.
The EPID QC PHANTOM[1] is easy to use. Baseline images and subsequent test images are taken by irradiating the phantom with a suitable dose, depending on the type of EPID. The phantom includes test elements for all relevant parameters for a complete quality control procedure measured in a single beam. It checks linearity, isotropy, noise, low and high contrast resolution in a focal spot geometry. The phantom includes a wide range of high-contrast test patterns to perform tests even of the most advanced EPIDs available.
Due to horizontal and vertical resolution in one beam, the focal spot size can be controlled with flat panel imagers. An optimized 'Las Vegas' like phantom is included for low contrast analysis which enables service personnel to adjust EPID brightness and contrast using well-established procedures.

[1] The EPID QC PHANTOM was designed by Schmidt, Decker, Winkes, Rittler, Kretner and Herbig, Westpfalzklinikum Kaiserslautern, Germany

Ordering Information

T42025 EPID QC PHANTOM

epidSoft Software



QC Software to evaluate EPID images acquired by EPID QC PHANTOM

Features

- Automatic evaluation of all parameters
- A traffic light indicates a fast 'Go'
- User defined set of limits for each imager
- Statistic functions for all relevant parameters
- Supports file formats of all established EPIDs

The epidSoft software package reads images which are acquired by the EPID QC PHANTOM. An automatic position calibration and evaluation makes it very easy to use. A traffic light indicates the result of the evaluation according to the limits which can be defined by the user for each imager separately. All parameters are on a single screen and can be enlarged for detailed analysis. A statistic function allows to follow up the QC history over the whole lifetime of the imager. A long term degradation of the imager can be easily detected.
All evaluations will be stored together with the images. Printout of all parameter values and ASCII export function are available as well as an acceptance test sheet.

Ordering Information

S070010 epidSoft Software

- EPID QC PHANTOM *page 70*

WEDGECHECK® Wedge Angle Test Device

Acrylic block with gantry holding plate including software for LINAC wedge angle determination

Features

- Makes it possible to determine wedge angles of dynamic (virtual) and mechanical wedges fast and easy
- Complies with IEC 60976
- Requires only a dual chamber dose measurement
- Mounts to the LINAC accessory tray
- Includes WedgeAngle software

Since the wedge angle of wedge filters is defined according to IEC 60976 by the 50 % isodose, usually an isodose measurement with an automatic 3D water phantom is required for wedge angle determination. WEDGECHECK[1] only requires the measurement of two off-axis dose values, either simultaneously or in two runs. 0.125 cm^3 chambers model 31002/31010 are placed into holes of a solid acrylic phantom at a measuring depth of 87 mm. The acrylic block is mounted to an acrylic plate, which fits into the accessory tray of the accelerator. The type of the accelerator has to be specified to provide for the appropriate adapter plate. Both chamber connectors can be fixed by a clamp mounted to the adapter plate.

The WedgeAngle software calculates the wedge angle with an accuracy of ± 1 % based on the beam quality and both dose values. The dose values may be keyed in, or they are automatically recorded via the serial interface of the dual channel dosemeter MULTIDOS or TANDEM.

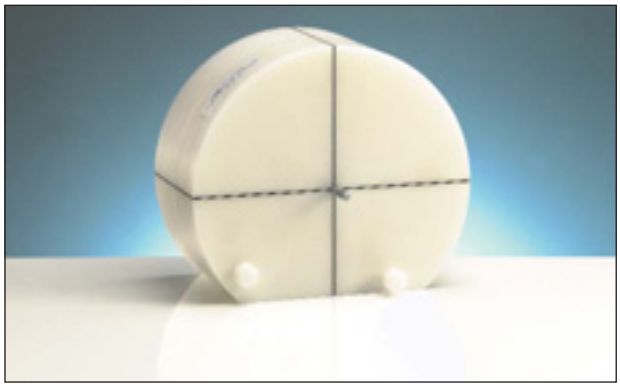
[1] The procedures and algorithms on which WEDGECHECK is based have been developed by Ernst-Ludwig Schmidt and Jürgen Rittler, Westpfalz-Klinikum Kaiserslautern, Germany.

Ordering Information

T40013 WEDGECHECK Test device and software

- Semiflex Ionization Chambers *page 16*
- MULTIDOS Multi Channel Dosemeter *page 32*
- TANDEM Dual Channel Electrometer *page 14*

ISOCHECK Isocenter Test Device



Film phantom for checks of the LINAC isocenter geometry

Features

- Checks the size and position of the isocenter sphere
- Checks the conformity of the mechanical and the radiation isocenter
- Line marks and crosshairs for LASER adjustment on the table-top

The ISOCHECK test object consists of two cylindrical POM plates, each of 20 cm in diameter and 5 cm in thickness with a segment cut away to form a base. Both plates have circumferential line marks and front side crosshairs to perform easy adjustment by means of the LASER beams. The LASERs should be adjusted to the mechanical rotation axis of the accelerator gantry. An X-ray film, packed in an opaque envelope, is put between the plates and fixed by means of plastic screws. The mechanical isocenter is marked by a needle on the test film through the hole in the center of the test object. Then the test object and the film are irradiated by pencil beams under various angles of incidence. The developed film shows the pencil beams, indicating the location and size of the radiation isocenter, as well as the position of the mechanical isocenter, identified by the needle mark.

Ordering Information

T42004 ISOCHECK Test object and needle

ESSEN QC Cube Geometric Test Device

Cubic test object for checking the conformity of light and radiation fields and the gantry angle adjustment

Features

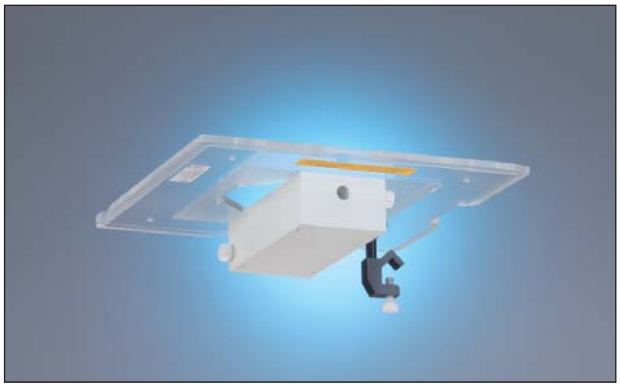
- Acrylic cube for quality control of geometric field parameters
- Enables the user to insert individually packed radiographic films for four directions of beam incidence
- Includes a needle for marking reference points on the test film
- Line marks serve for the adjustment to the LASER beams by a three-point bearing

The ESSEN QC cube is a helpful device for the comparison of the radiation field and the light field of linear accelerators and ^{60}Co therapy units. Cross lines and a height adjustable four-point bearing make it possible to adjust the cube to the LASER lines of the therapy unit. The cube has four double walls to insert individually packed radiographic test films of up to 18 cm x 24 cm size. It is designed for two horizontal and two vertical directions of beam incidence. Radiographs can be taken with the gantry positioned at 0°, 90°, 180° and 270°. Holes in the walls enable the user to mark reference points on the inserted films using a needle. The exposed film shows the light field (needle marks) in relation to the radiation field (exposed area). This makes it possible to check the conformity of the light field and the radiation field as well as the isocenter position.
The gantry angle adjustment is checked by irradiating two opposite films simultaneously.

Ordering Information

T2965 ESSEN QC Cube and needle

MONICHECK Monitor Test Device



RW3 block with chamber hole and gantry holding plate for constancy tests of LINAC dose monitor calibration

Features

- Makes it possible to check the monitor calibration by inserting an ionization chamber into a hole of the RW3 block
- Slides into the accessory tray of the LINAC

The MONICHECK test object is an acrylic device to check the constancy of the dose monitor calibration of linear accelerators easily, which is the most important parameter for correct patient treatment. The basic component is an RW3 block with a hole to insert a 0.3 cm^3 ionization chamber model 31003/31013. Adapters for other chamber types are available upon request. The chamber is connected to a dosemeter such as the UNIDOS. The measuring depth of the chamber is 16 mm or 33 mm depending on the orientation of the RW3 block. The block is mounted to an appropriate plate, which is inserted into the accelerators accessory holder. The type of the accelerator has to be specified, since the mechanical design of the accessory holder geometry differs with the type of linear accelerator. For constancy tests, the measuring results are compared with previous measurements under identical irradiation conditions.

Ordering Information

T40050 MONICHECK monitor test device

Options

Semiflex chambers, connecting system BNT, TNC or M:

31003/31013 Semiflex chamber 0.3 cm^3

- Semiflex Ionization Chambers *page 16*
- UNIDOS Dosemeters *page 13f.*
- MULTIDOS Multi Channel Dosemeter *page 32*
- TANDEM Dual Channel Electrometer *page 14*

LINACHECK® Monitor Test Device

Dosimetric test device for automatic constancy tests of the LINAC dose monitor calibration

Features

- Checks the monitor calibration in a simple and reliable manner
- Measures dose, dose rate and irradiation time simultaneously
- Does not need air density correction due to the built-in sealed ionization chamber
- Stores up to 99 measurements
- Communicates with a computer using the optional LinaSoft software

LINACHECK is suitable to verify very quickly and easily the most important parameter of a linear accelerator, the monitor calibration. For measurements, the lightweight device is put on the table-top in a 10 cm x 10 cm field. As the radiation detector is a built-in sealed plane parallel ionization chamber, no air density correction is required. The LINACHECK features auto-start, auto-stop and auto-zeroing. The bright and large display serves for easy reading from a distance.
As up to 99 measurements can be stored, all LINACs may be checked one after the other, using different photon and electron energies. When the measurements are finished, data can be evaluated. The easy-to-use LinaSoft software helps to download the logged data via the RS232 interface to an MS Excel sheet for storage and evaluation. The user can recalibrate the chamber.

LINACHECK is operated by rechargeable batteries.

Ordering Information

T42010 LINACHECK Test device
L991042 Plug-in power supply, (100 ... 240) V

Option

S070001 LinaSoft Software

IGRT QC Set

Test objects for image quality control of MV and kV imagers at IGRT radiation treatment devices

Features

- Optimized phantoms for MV and kV beam imagers
- Measurement of all parameters with a single beam in one image

In Image Guided Radio Therapy (IGRT), most radiation treatment devices are using a kV beam to detect and correct the patient's position in the MV beam. For both beam types typically a flat panel imager is used for the image read out. To ensure a high imager quality the IGRT set contains optimized test phantoms for kV and MV imagers for consistency checks.
The EPID QC PHANTOM checks linearity, isotropy, noise, low and high contrast resolution. All test elements are focused to 100 cm focus distance, for use in 4-25 MV photon beams. A dedicated software epidSoft allows an automatic evaluation of image files acquired with the EPID QC PHANTOM. A statistic function allows following up the QC history over the whole lifetime of the imager.
The NORMI 4 FLU test object is designed for consistancy tests X-ray installation for fluoroscopy in diagnostic radiology. The test object include a structure plate with a copper step wedge for testing the dynamic range, a resolution test pattern, low contrast and detail test elements as well as a kV test area for the determination of the radiation quality. The NORMI 4 FLU structure plate allows to check all parameters in one shot. For patient simulation, a 1mm copper plate and a 30 mm PMMA is included in the set.

Ordering Information

L981097 IGRT QC set

- epidSoft *page 70*
- EPID QC PHANTOM *page 70*
- NORMI 4 FLU *plus* Set PMMA *page 98*

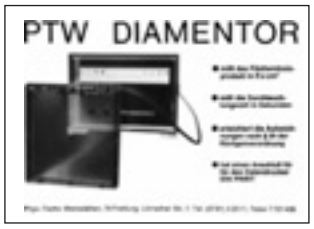
Notes

DIAGNOSTIC RADIOLOGY

50 Years DIAMENTOR

The Story of the Dose Area Product Meter

In **1957** *Herbert Pychlau* had the idea of a new diagnostic measuring device determining the patient load during medical X-ray examinations. This measuring device was meant to show young radiologists working in a teaching hospitals the patient dose consequences of radiological procedures also considering minimizing techniques like collimation or filtration adjustment. *Herbert Pychlau* invented a new measuring quantity based on the inverse square law, which he named the "Dose Area Product (DAP)". The DAP is the product of the multiplication of the entrance dose and the area of the irradiated field. Doubling the distance increases the radiation area by factor four, while the dose decreases simultaneously by factor four. Both effects cancel out each other and therefore the new unit [Rcm^2] was ideal for educational measurements as it is independent of the focus patient distance.



Two years later in **1959** PTW-Freiburg released the first DAP meter worldwide called DIAMENTOR. The measuring principle: An ionization chamber installed to the X-ray collimator determines the patient radiation load during X-ray examinations while the DIAMENTOR electronics measure and display the DAP value.

The following years *Herbert Pychlau* and his son *Peter* struggled with a host of problems introducing the DIAMENTOR into routine clinical work. Starting with technical issues (non-transparency of the first original chamber) and continuing through user handling difficulties (chamber maintenance and problems in understanding the meaning of the new measuring quantity) up to difficulties with public authority acceptance.

In **1964** the study *"Messung der Patientendosis in der Röntgendiagnostik"* was published by *E. Bunde* and *Peter Pychlau*, showing the correlation between the DAP and the patient load. This work found such a great national and international recognition that a working group was founded with the aim to define a national German standard establishing legal rules how to use DAP meters in X-ray diagnostic departments.

In **1987** the first German *"X-Ray Directive"* called *"Röntgenverordnung"* was published, having the ultimate objective to keep radiation levels in general and especially during high dose and high risk X-ray examinations such as fluoroscopy as low as possible. This was the breakthrough for the use of the DIAMENTOR.

In June **1997** the Council of Ministers approved the European Directive 97/43/EURATOM with the aim to optimize diagnostic efficiency at the lowest reasonable dose to the patient. This Medical Exposure Directive (MED) had to be implemented into national law by all members of the European Union.

Germany accommodated the MED by introducing the second edition of the German *"Röntgenverordnung"* in **2002**. Indication of the patient load became an official legal requirement for special diagnostic X-ray examinations. Moreover reference values for X-ray examinations based on the unit DAP are a standard in X-ray departments since **2003**.

Another milestone came up when the FDA issued the final rule to amend the *"Federal performance standard for diagnostic x-ray systems and their major components"*. FDA 21 CFR Part 1020 Federal Register became effective in June **2006** stating that fluoroscopic equipment manufactured on or after June 10, 2006 has to display the dose values during the examination.

Today the DIAMENTOR is going stronger then ever before. It is a must in X-ray diagnostics worldwide, not only helping to reduce patient exposure, but also being an independent quality control tool, informing the operator about any deviation of the X-ray unit constancy. Since five decades the measuring principle is still the same while the PTW DIAMENTOR product portfolio of course changed: PTW Freiburg provides integrated, built-in, multi channel and combined dose and DAP DIAMENTOR solutions. Over the years PTW as pioneer of the DAP meter has delivered many thousands of reliable instruments to satisfied customers worldwide.

50 DIAMENTOR

DIAMENTOR – The Diamond Standard for DAP meters!

Patient Dosimetry

Patient Dosimetry Equipment

Patient Dosimetry

Patient exposure has to be determined, documented and evaluated according to international regulations. The DIAMENTOR® patient dosimetry systems are our solution for diagnostic radiology to fulfill these requirements.
Its major features are:

- Helps to fulfill the European Directive 97/43/EURATOM on health protection in medical radiology and the proposed rules of the performance standard for diagnostic X-ray systems, published by the Food and Drug Administration FDA, USA, in the 21 CFR Part 1020 Federal Register
- Measures and protocols the dose area product (DAP) and/or dose during X-ray examinations, especially during high dose and high risk examinations such as:
  - Angiography, including DSA
  - Cardiology
  - Interventional radiology
  - Pediatrics
  - Fluoroscopy
- Informs the practitioner of the amount of radiation applied to the patient
- Mounts firmly to the X-ray unit without disturbing routine work
- Consists basically of a transparent ionization chamber and a display unit

Starting in May 2000, radiation protection procedures are mandatory in the countries of the European Community. The Food and Drug Administration FDA in the USA requires health physics procedures in medical radiology. Dose area product (DAP) meters and dosemeters, firmly installed to the X-ray unit, make it possible to determine the radiation loads to which patients are exposed during X-ray examinations. Patient exposures can differ in hospital routine practices. The exposures can be reduced by a measuring device informing the practitioner of the total amount of radiation applied to the patient. Especially the above-mentioned high dose and high-risk X-ray examinations require such a device.

DIADEM
Patient Dosemeter

Dosemeter for patient entrance dose and dose rate measurement during diagnostic X-ray examinations

Features

- Economic single channel patient dosemeter
- Complies with IEC 60601-1 and IEC 60601-2-43 within the ranges of use
- Complies with FDA 21CFR Part 1020
- Measures kerma and kerma rate at a reference distance
- Provides an interface to connect a label printer

DIADEM is an economic and easy-to-handle device for measuring the entrance dose and the entrance dose rate during radiographic and fluoroscopic examinations. The basic unit consists of the measuring amplifier with a bright, easy-to-read LED display. It is fitted with a test, reset and print button, which make it possible to check the calibration, setup the device and print the measuring results via a connected label printer.
The transparent rectangular DIADEM ionization chamber is mounted directly to the collimator of the X-ray tube by using appropriate adaptation rails.

The DIADEM dosemeter is particularly suitable for retrofitting existing equipment and for use with mobile X-ray installations. It meets the requirements of international standards including the proposed rules of the performance standard for diagnostic X-ray systems, published by the Food and Drug Administration, USA.

Ordering Information

L981951 DIADEM reference kerma meter

TA34057-1 DIADEM chamber, transparent, connecting system A (adaptation rails required)

- Label Printer *page 84*

DIAMENTOR® M4-KDK
DAP/Dose Meter

Device for simultaneous measurements of DAP, dose and dose rate in radiography and fluoroscopy

Features in addition to the DIAMENTOR M4

- Displays the dose and the dose rate of the chamber plane besides the dose area product (DAP)
- Provides calculation of the effective dose and the organ doses by using the DiaSoft software

The dual channel DIAMENTOR M4-KDK features the innovative "Chamber-in-Chamber" transmission ion chamber. Using this unique design technology, the unit can measure dose, dose rate and dose area product easily and simultaneously during radiographic and fluoroscopic procedures. The KDK chamber, firmly fixed to the collimator by adaptation rails, is transparent for light and X-rays. The chamber structures are not shown on the X-ray images.

Ordering Information

T11017 DIAMENTOR M4-KDK display unit, 115/230 V, connecting system V

TV34044-1 DIAMENTOR chamber KDK, transparent (adaptation rails required)

T11025 DIAMENTOR M4-KDK display unit, 115/230 V, connecting system A

TA34044-1 DIAMENTOR chamber KDK, transparent (adaptation rails required)

- DIAMENTOR Chambers *page 83*
- DiaSoft Software *page 84*
- Label Printer *page 84*

DIAMENTOR® M4 DAP Meter

Multifunctional dual channel dose area product (DAP) meter for patient dosimetry in diagnostic radiology

Features

- Dual channel device for single plane and bi-plane fluoroscopic and radiographic X-ray units
- Complies with the international standard IEC 60580
- Displays the selectable DAP units µGym², cGycm², Gycm², Rcm² and the exposure time
- Displays DAP rate during fluoroscopy, switches automatically over to DAP after the examination

DIAMENTOR M4 is a state-of-the-art dose area product meter. The dual channel device measures the total diagnostic dose area product (DAP) during radiography and fluoroscopy according to international regulations. Its digital display shows simultaneously the readings from both channels. In addition, exposure time during fluoroscopy is measured without the need of any connection to an X-ray generator. The RS232 interface enables the user to transfer data to a RIS.

Ordering Information

T11006 DIAMENTOR M4 display unit, 115/230 V, connecting system V

TV34028-1 DIAMENTOR chamber, transparent (adaptation rails required)

T11024 DIAMENTOR M4 display unit, 115/230 V, connecting system A

TA34028-1 DIAMENTOR chamber, transparent (adaptation rails required)

Option

T11011 DIAMENTOR SD secondary display, backlit

- DIAMENTOR Chambers *page 83*
- DiaSoft Software *page 84*
- Label Printer *page 84*

DIAMENTOR® C2 DAP Meter

Dual channel dose area product (DAP) meter for patient dosimetry in diagnostic radiology

Features

- Dual channel device connects two ion chambers
- Complies with the international standard IEC 60580
- Built-in printer optionally available

The DIAMENTOR C2 is a microprocessor-controlled measuring system with two separate measuring channels, enabling simultaneous measurements with two chambers. The system can also be used at two separate X-ray rooms, if these are operated from one control desk. Each channel can be reset separately and the measured values of channel A and B can be printed alternatively. The measuring results of both channels can be shown simultaneously on the digital display. Two different DIAMENTOR C2 versions, with and without an internal printer, are available. The RS232 interfaces enable the user to transfer data to a RIS.

Ordering Information

T11038A DIAMENTOR C2 display unit

T11038AP DIAMENTOR C2 display unit with built-in printer

TA34028-1 DIAMENTOR chamber size B (adaptation rails required)

Options

S020011 DiaSoft without dose option

S020003 DiaSoft software with dose option

S020007 DiaSoft software upgrade to dose option

- DIAMENTOR Chambers *page 83*
- DiaSoft Software *page 84*

DIAMENTOR® E2 DAP Meter

Economy dose area product (DAP) meter for patient dosimetry in diagnostic radiology

Features

- Single channel patient dosemeter
- Complies with international standard IEC 60580
- Particularly suitable for retrofitting existing equipment and for use with small X-ray equipment
- Provides an interface to connect a label printer or for easy connection to a RIS

DIAMENTOR E2 is an economic and easy-to-handle device for measuring the dose area product (DAP) during radiography and fluoroscopy according to international regulations. The RS232 interface enables the user to transfer data to a RIS.

Ordering Information

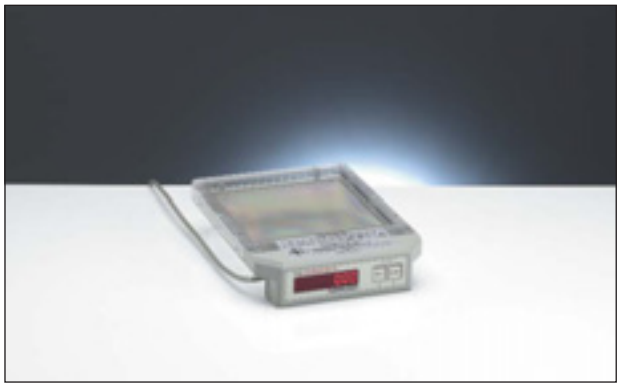
T11033 DIAMENTOR E2 display unit
TA34028-1 DIAMENTOR chamber, transparent (adaptation rails required)

Options

L981997 Power supply 110 V ... 240 V
L981249 Power limitation for DIAMENTOR E2

- DIAMENTOR Chambers *page 83*
- Label Printer *page 84*

DIAMENTOR® CX DAP Meter



Compact dose area product (DAP) meter for patient dosimetry

Features

- All-in-one chamber and electronics housing
- Complies with IEC 60580
- Mounts directly on the collimator of the X-ray unit

By integrating the electronic parts into the flat size B chamber, the whole DIAMENTOR CX is made suitable for firm mounting on the collimator of radiography and fluoroscopy units using appropriate adaptation rails. The transparent chamber neither blocks the light field nor interferes with patient routine work. The DIAMENTOR CX includes a built-in small size display unit. The internal RS232 interface enables printing or data transfer to a RIS. An external power supply is included.
The DIAMENTOR model CX provides digital resolution of 0.01 µGym² and a minimum dose rate of 0.01 µGym²/s and consequently is suitable for measurements in pediatric radiology.

Ordering Information

L981961 DIAMENTOR CX DAP meter incl. external power supply 110V ... 240V (adaptation rails required)
L981967 DIAMENTOR CX DAP meter incl. power limitation (adaptation rails required)

DIAMENTOR® Set CI DAP System

Dose area product measuring system with communication between single CAN components

Features

- All-in-one chamber and electronics housing
- Flexible display positioning
- Easy connection to a RIS via RS232 interface
- Internal test function for fast calibration and constancy checks

The well-priced DIAMENTOR Set CI includes a DIAMENTOR chamber size B with integrated measuring electronics, a power supply, extension cable and a separate display unit. By integrating the electronic parts in a chamber the whole device is made suitable for firm mounting on the collimator of radiographic and fluoroscopy units. For presenting the measuring results, a separate small-sized display can be connected and fixed arbitrary e.g. next to the control desk. An easy and uncomplicated RIS connection can be realized straightforward via an optional RS232 interface. Apart from that, fast calibration and constancy checks can be performed by means of a built-in test function. For mobile X-ray installations a power limitation can be connected. Providing a digital resolution of 0.01 µGym² the DIAMENTOR Set CI is suitable for measurements in pediatric applications and fully complies with the requirements of IEC 60580.

Ordering Information

L981196 DIAMENTOR Set CI

Option

L981250 Power limitation for CAN system

▸ DIAMENTOR Accessories *page 84*

DIAMENTOR® Set CM DAP System

Compact dose area product system with communication between single CAN components

Features

- Highly integrated single channel built-in DAP meter
- Flexible positioning of the small electronics
- Flexible display positioning
- Easy connection to a RIS via RS232 interface
- Internal test function for fast calibration and constancy checks

The well-priced DIAMENTOR Set CM includes a separate electronics, a DIAMENTOR chamber size B, a separate display unit as well as a power supply and extension cable. The miniature DAP meter electronics can be mounted arbitrary e.g. behind the housing of the X-ray installation. For presenting the measuring results, the separate small-sized display can be connected and fixed flexible e.g. next to the control desk. An easy and uncomplicated RIS connection can be realized straightforward via an optional RS232 interface. Fast calibration and constancy checks can be realized by means of a built-in test function. For mobile X-ray installations a power limitation can be connected. Providing a digital resolution of 0.01 µGym² the DIAMENTOR CM is suitable for measurements in pediatric applications and fully complies with the requirements of IEC 60580.

Ordering Information

L981197 DIAMENTOR Set CM
L981198 DIAMENTOR Set CM mobile
for mobile X-ray units

Option

L981250 Power limitation for CAN system

▸ DIAMENTOR Accessories *page 84*

DIAMENTOR® Built-in Solutions

Compact dose area product systems for patient dosimetry in diagnostic radiology

Features

- Different built-in DIAMENTOR systems and dosemeters are available
- Multifunctional and dual channel devices for single plane and biplane X-ray units
- Systems with an internal RS232 interface for easy connection to a RIS
- Internal test function for fast calibration and constancy checks

Various built-in DIAMENTOR systems have been developed in cooperation with well known manufacturers of X-ray installations worldwide.
Built-in solutions with one or two measuring channels, all-in-one chambers and electronic systems with or without an internal RS232 interface are available. For presenting the measured dose area product or dose results, the display of the control desk as well as secondary display units can be used. An easy and uncomplicated RIS connection can be realized straightforward via the internal RS232 interface. Apart from that, fast calibration and constancy checks can be performed by means of a built-in test function. The optimally coordinated DIAMENTOR built-in solutions enable convenient and fast installations and comply fully with the requirements of IEC 60580.

Ordering Information

Built-in DIAMENTOR solutions upon request

- DIAMENTOR Chambers *page 83*
- DIAMENTOR Accessories *page 84*

DIAMENTOR® Chambers

Flat ionization chambers for DIAMENTOR patient dosemeters

Features

- Very simple measurement of patient exposures
- Do not interfere with routine work, as the chambers are transparent and mounted directly to the X-ray collimator
- The combined KDK chamber measures dose area product and dose simultaneously

The flat, transparent and rectangular DIAMENTOR chambers size B are suitable for firm mounting on the collimator of radiography and fluoroscopy units using appropriate adaptation rails. Moreover many different ionization chambers are available. The chambers are supplied with a firmly attached connecting cable of 1 m length. Using an extension cable of max. 40 m length, the chamber is connected to the DIAMENTOR display unit, which usually is located in the control room of the X-ray installation. The chambers show a very low filter absorption and beam hardening effect. The large chambers are designed for a maximum beam size of 141 mm x 141 mm.

Ordering Information

TA34028-1 Standard 'B' Chamber
More chambers and adaptation rails upon request

- DIAMENTOR M4-KDK *page 79*
- DIAMENTOR M4 *page 80*
- DIAMENTOR C2 *page 80*
- DIAMENTOR E2 *page 81*

DIAMENTOR®
Accessories

Optional accessories for DIAMENTOR systems

DIAMENTOR chamber universal mount

- Easy and flexible adjustment of rail distances between 133 mm and 177 mm are possible
- Allows the correct arrangement of any filter and the chamber without influencing the measurement
- Optional rails for use of filters or cones are available

DIAMENTOR universal cone mount

- Special DIAMENTOR mount for the usage of max. 3 kg heavy (max. 30 cm long) cones in 90° orientation
- Universal adjustment of rail distances between 133 mm to 177 mm are possible

DIAMENTOR chamber adaptation rails

- Various (distance) adaptation rails for different collimators are available
- Can be screwed easily to the ionization chamber
- Distance adaptation rails enable the use of fade out filters

DIAMENTOR power limitation

- Ideal for mobile installations, which fulfill IEC 60601-1
- Small and convenient solution for operation with 24 V
- For use with a DIAMENTOR CX, CI, CM, E2

DIAMENTOR RS232 interface

- For easy connection to a RIS or PACS
- For use with a DIAMENTOR CX, CI, CM

DIAMENTOR RS232, extension and adapter cable

- Different lengths are available

DIAMENTOR Label Printer

- Various label printer for patient exposure recording are available
- Printing is automatically controlled by the dosemeter

Pediatric Filters

- Transparent filters for reducing the patient entrance dose during pediatric X-ray examinations
- Slide into the rails of the collimator or of the universal mount
- Two filter types with different beam hardening values are available:
  1.0 mm Al + 0.1 mm Cu (2.4 mm thickness)
  1.0 mm Al + 0.1 mm Cu (4.3 mm thickness)

Ordering information

T34028.1.210 DIAMENTOR universal mount
T34028.1.212 DIAMENTOR universal cone mount
L981250 Power limitation for DIAMENTOR CX, CI, CM
L981249 Power limitation for DIAMENTOR E2
L981255 CAN-RS232 interface for DIAMENTOR CI/CM
L981254 RS232 interface for DIAMENTOR CX
S020003 DiaSoft software incl. dose option
L991427 Thermal label printer CT-S 281RSE-WH-PL for DIADEM, DIAMENTOR M4, M4-KDK, E2, C2, CI, CM
L991056 Thermal label printer CBM-270RF-L-232 for DIADEM, DIAMENTOR M4, M4-KDK, E2, C2
L991096 Matrix label printer DP8340 for DIAMENTOR M4, M4-KDK

Details and printer accessories upon request

Absolute Dosimetry

Absolute Dosimetry Equipment

Absolute Dosimetry

The dose output of X-ray tubes is one of the most important parameters for image quality and patient exposure to radiation in diagnostic radiology. The dose output has to be checked very carefully during acceptance tests after installation and regularly during routine quality control. PTW manufactures a variety of high precision dosemeters for this purpose, including the NOMEX system, connecting ionization chambers and the multipurpose diagnostic dosemeters DIADOS and DIADOS E, connecting semiconductor probes and a special CT chamber. The detectors are calibrated exactly for their range of use. Depending on the application, our secondary standard dosimetry laboratories perform calibrations in a wide energy range from low energy X-rays up to ^{60}Co and in a wide dose rate range. Calibration factors are given for measurements in the unfiltered beam or behind an absorber. A variety of patient equivalent absorbers for different purposes complete the range of dosimetry accessories.

The dosimetric test equipment from PTW is widely used by X-ray technicians working in companies manufacturing X-ray equipment and by public agencies monitoring technical standards, as well as by medical physicists and technicians in hospitals. The instruments are self-explanatory and consequently easy to use. Many satisfied customers worldwide could not imagine working without their reliable dosemeters from PTW.

NOMEX Multimeter

Measuring System for R/F/DENT/CT/MAM

Features

- Combined electronics and detector matrix
- Connection via USB directly to a notebook or PC
- Automatic range for dose and kV measurement
- Software running in different languages

The NOMEX Multimeter is a miniaturized non-invasive measuring system for absolute dosimetry and quality control in X-ray diagnostic radiology. It can be used for radiography, fluoroscopy, dental, CT and mammography (Mo/Mo, Mo/Al, Mo/Rh, W/Al, W/Rh, W/Ag, Rh/Rh) application. NOMEX measures the dose, dose rate, irradiation time, dose per pulse, pulses, kV_p, the total filtration (TF, not in mammography) and the half value layer (HVL) in one single shot. Additionally, the kV and dose rate waveform is stored.

Example of use. Notebook shown may differ from the optionally available notebook.

The smart NOMEX Multimeter can be directly connected via USB to a notebook or PC running the NOMEX Software. No additional accessories like a power supply or display are required for putting the NOMEX into operation. Measurements are automatically started upon detection of radiation. The dose and kV ranges are set fully automatically almost in real-time, so that multiple exposures are avoided. The NOMEX Software allows most convenient and clear data handling. Statistics functions are provided as well as data export as XLS, XML or CSV file.

Ordering Information

L981815 NOMEX Multimeter
including NOMEX Software, 2 m USB cable and 5 m long active extension cable and a transport bag. Requires connection to a notebook or PC

Options

L991422 Touch notebook
T20016 NOMEX Multimeter holder
T20017 NOMEX cassette adapter

DIADOS
Diagnostic Dosemeter

Diagnostic acceptance test dosemeter for radiography, fluoroscopy, mammography, dental X-ray and CT

Features

- For use in conbination with a DIADOS detector or a CT ion chamber
- Measures dose, dose rate, dose per pulse, dose length product and irradiation time
- Complies with IEC 61674

DIADOS is an all-round acceptance test device for measuring dose values and exposure time of different X-ray equipment using various accessories. The measurements of radiographic, fluoroscopic, mammographic and dental X-ray equipment are based on solid state detectors. The CT measurement is based on a CT ion chamber connected to a separate high voltage supply. The calibration factors of the detectors are selectable for different X-ray filtration. The autostart feature for the dose, dose per pulse and exposure time measurement starts as soon as the DIADOS detects radiation. The measuring ranges in general feature wide dynamics. The automatic zeroing function is another very helpful feature. The DIADOS can be operated by mains power or by rechargeable batteries. An RS232 interface for computer control is included. Data can be downloaded from the DIADOS unit by means of the DiaControl software.

Ordering Information

T11003 DIADOS dosemeter, 115/230 V
S030004 DiaControl software

Options

T60004 DIADOS diagnostic detector
T60005 DIADOS MAM detector
TM30009 CT chamber, length 10 cm
TM30017 CT chamber, length 30 cm
T16018 DIADOS CT adapter

- DIADOS Dental Dosimetry *page 89*
- CTDI Set for CT Dosimetry *page 89*

DIADOS E
Diagnostic Dosemeter

Diagnostic routine dosemeter for QC of radiographic, fluoroscopic, mammographic, dental and CT X-ray installations

Features

- For use in conbination with a DIADOS detector or a CT ion chamber
- Valuable small size dosemeter for acceptance tests and service of any X-ray equipment
- Measures dose, dose rate, dose per pulse, pulses, dose length product and irradiation time
- Complies with IEC 61674

The DIADOS E is a small size dosemeter for acceptance tests and routine quality control of any type of diagnostic X-ray installation, which measures dose values and irradiation time. It utilizes semiconductor detectors except for CT measurement, which is based on a pencil ion chamber connected to a separate high voltage supply. The calibration factors of the detectors are selectable for different X-ray filtration. The auto-start feature for the dose and exposure time measurement starts as soon as the instrument detects radiation. The measuring ranges in general feature wide dynamics. The automatic zeroing function is another helpful feature. The DIADOS E can be operated by the mains power supply or by rechargeable batteries.
Data can be downloaded from the DIADOS E unit by means of the DiaControl *expert* software.

Ordering Information

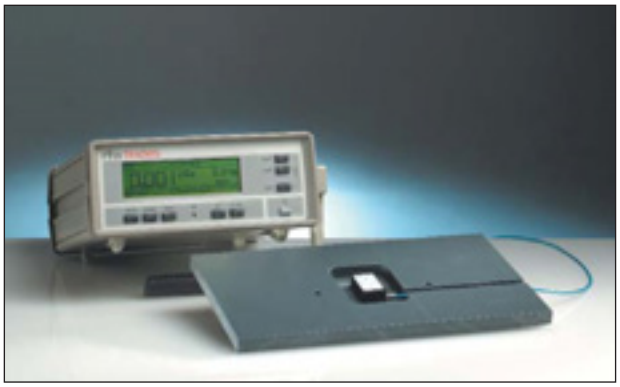
L981239 DIADOS E dosemeter
S030006 DiaControl *expert* software

Options

T60004 DIADOS diagnostic detector
T60005 DIADOS MAM detector
TM30009 CT chamber, length 10 cm
TM30017 CT chamber, length 30 cm
T16018 DIADOS CT adapter

- DiaControl *expert* Software *page 96*
- DIADOS Dental Dosimetry *page 89*
- CTDI Set for CT Dosimetry *page 89*

DIADOS / DIADOS E Dental Dosimetry



Optional DIADOS accessories for dental X-ray dosimetry

Features

- Makes it possible to measure doses of all types of dental, intraoral, remote and panoramic X-ray units
- Provides all DIADOS features by operating in conjunction with the DIADOS dosemeter
- Calibration factors for dental use are stored in the DIADOS data base

The different types of dental X-ray units require different setup for dose measurements. Transmission doses from intraoral units are determined behind a 6 mm Al absorber. Remote X-ray units require the dose measurement behind an absorber of 6 mm Al and 0.8 mm Cu. Alternative filters of 0.3 mm Cu and 8 mm PTFE can be used. Dose measurements of panoramic X-ray units with movable film cassette are made by means of a cassette adapter of 15 cm x 30 cm size to which the detector is mounted. The filter setting for this type of dose measurement is 6 mm Al + 0.5 mm Cu for film-screen systems and 0.8 mm Cu for digital systems. All filters required are included in the absorber set T42018. The filters are placed between focus and detector. Dental doses are measured using the DIADOS diagnostic detector connected to the DIADOS dosemeter. The calibration for dental use has to be ordered separately. All appropriate calibration factors are stored in the DIADOS data base.

Ordering Information

T60004 DIADOS diagnostic detector
E21232 Diagnostic dental detector calibration
T42018 Absorber set for dental dose measurement
T20003 Dental cassette adapter
L981234 DIAset DENT
T42033 NORMI DENT analog test object
T42034 NORMI DENT digital test object

▸ DIADOS, DIADOS E *page 88*

CTDI Set for CT Dosimetry

Accessories for determination of CTDI in computed tomography

Features

- For measurements acc. IEC 61223-3-5 and 60601-2-44
- CT ion chamber, sensitive length 10 cm or 30 cm
- Body phantom, 32 cm Ø, and head phantom, 16 cm Ø, both acrylic cylinders of 15 cm height
- Combined head and body phantom is available

The CT chamber T30009 is inserted for CTDI measurements into one of the five holes of the head or body phantom. Holes not used are filled by acrylic dummy plugs. Etched crosshairs on the phantoms allow exact alignment.

The CT chamber T30017 is used for dose length product (DLP) measurements free in air.

Ordering Information

CT chambers, connecting system BNT, TNC or M:

30009 CT chamber, length 10 cm
30017 CT chamber, length 30 cm
T40016 CT body measuring phantom
T40017 CT head measuring phantom
T40027 CT head and body phantom

Options

T16018 DIADOS CT adapter
T40016.1.010 Carrying case for body phantom
T40017.1.010 Carrying case for head phantom, DIADOS and CT chamber
T40027.1.050 Carrying case for head and body phantom, DIADOS E and CT chamber

▸ UNIDOS E *page 90*
▸ DIADOS, DIADOS E *page 88*

UNIDOS® E Dosemeter

Highly sensitive and precise dosemeter for dosimetry in diagnostic radiology

Features

- Suitable for standard dosimetry in diagnostic radiology and radiation therapy
- Features high accuracy and excellent resolution (1 fA)
- Meets and exceeds the requirements for field-class dosemeters according to IEC 61674 and IEC 60731

The lightweight and compact UNIDOS E is ideally suited for acceptance tests and routine measurements in diagnostic radiology. It measures dose, dose rate, dose length product, charge and current. The displayed units are Gy, Gy/min, R, R/min, Gy·m, C and A. It can be used with a variety of ionization chambers and solid state detectors. A CT probe can be connected to measure the dose length product in Gy·m for dosimetry in computed tomography. Air density corrections of the sensitive chamber volume are made by keying-in the air pressure and temperature.

Ordering Information

T10010 UNIDOS E (connecting system BNT), 115/230 V
T10009 UNIDOS E (connecting system TNC), 115/230 V
T10008 UNIDOS E (connecting system M), 115/230 V

Option

UNITEST electric test device

- SFD Chambers *page 90*
- CTDI Set for CT Dosimetry *page 89*

SFD Chambers for Diagnostic X-Rays

Shadow free ionization chambers 6 cm³ and 75 cm³ for absolute dosimetry

Features

- Plane parallel chambers for the measurement and monitoring of radiation output in diagnostic radiology
- Shadow free design causes hardly no interference with automatic exposure control (AEC)
- Do not influence the X-ray image
- For measurements in front of and behind a phantom

The high precision SFD chamber suitable for mammography has a sensitive volume of 6 cm³. The energy response for mammography radiation qualities (25 ... 35) kV is better than ≤ ± 2 %, and better than ≤ ± 3 % within the conventional range (50...150) kV.
The high precision SFD chamber for conventional radiology has a sensitive volume of 75 cm³. The energy response within the conventional range is better than ≤ ± 2 % and better than ≤ ± 3 % within the mammography range (25 ... 35) kV. Both flat SFD chambers are used for dose and dose rate measurements in front and behind of a patient-equivalent phantom. Because of their shadow free construction and low attenuation both chambers give near to no interference with the phototimer, reduce effects with the AEC and cause almost no influence like shadows on the image. Furthermore HVL measurements can be performed conveniently using special chamber holders which enable to use the SFD chamber easily in combination with the HVL measuring stand. Both chambers comply fully with IEC 61674. The cable length is 2.5 m each.

Ordering Information

SFD chambers, connecting system BNT, TNC or M:
34069-2,5 SFD mammo chamber 6 cm³
34060-2,5 SFD diagnostic chamber 75 cm³

Options

T34069.1.050 Chamber holder for SFD chamber 34069-2.5
T34060.1.050 Chamber holder for SFD chamber 34060-2.5
T20011 Cassette adapter for SFD chamber 34060
T20012 Cassette adapter for SFD chamber 34069

HVL Measuring Stand

Measuring stand for an ideal performance of half value layer (HVL) measurements

Features

- Accommodates an Al or a Cu filter
- Accommodates a radiation detector
- Suitable for HVL measurements at overcouch and undercouch tube installations

Measurements of the half value layer (HVL) are performed during acceptance tests to determine the beam quality of X-ray installations in diagnostic radiology as well as in diagnostic therapy. The HVL measuring stand enables the user to position a detector and a HVL filter easily. Convenient undercouch measurements as well as HVL measurements in computed tomography can be carried out by using the HVL measuring stand with its U-shaped tripod.

The set includes an universal detector holder enabling the user to fix different detectors to the stand. An optional carrying case to accommodate the HVL measuring stand and up to 13 HVL filters is available.

Ordering Information

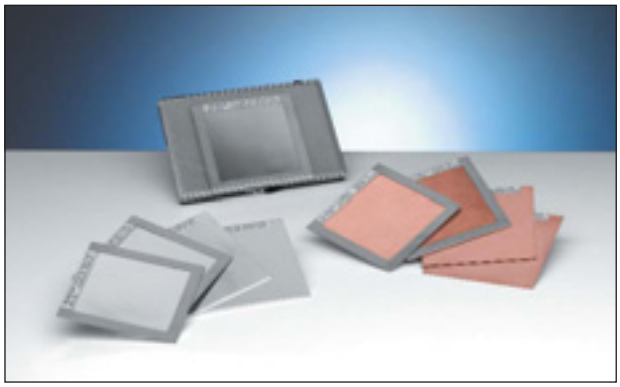
T20008 HVL measuring stand

Options

T20008.1.020 Carrying case for HVL measuring stand and 13 filters
34069-2,5 SFD mammo chamber 6 cm^3
34060-2,5 SFD diagnostic chamber 75 cm^3
23261 30 cm^3 Cylindrical chamber
30004 0.6 cm^3 Farmer chamber graphite
30012 0.6 cm^3 Farmer chamber Al
Chambers with BNT, TNC and PTW-M connector available

Al and Cu Filter Sets *page 91*

Al and Cu Filter Sets



Al and Cu filters for precise half value layer (HVL) measurements

Features

- Include 99.99 % high purity Al and Cu material
- Comply with IEC 60601-1-3

The extremely high purity of the aluminium and copper filter material enables high precision measurements of the X-ray beam quality in diagnostic radiology and in diagnostic therapy. The useful filter size is 80 mm x 80 mm and the outer dimensions are 100 mm x 100 mm.

Ordering Information

L981957 99.99 % Al filter set RAD/FLU
(7 Al-layers; 1 x 0.1 mm; 2 x 0.2 mm; 1 x 0.5 mm; 1 x 1 mm and 2 x 2 mm thickness)
L981956 99.99 % Al filter set MAM
(4 Al-layers; 1 x 0.1 mm; 2 x 0.2 mm and 1 x 0.5 mm thickness)
T43026 99.5 % Al filter set RAD/FLU
(7 Al-layers; 1 x 0.1 mm; 2 x 0.2 mm; 1 x 0.5 mm; 1 x 1 mm and 2 x 2 mm thickness)
T43025 99.0 % Al filter set RAD/FLU/DENT
(11 Al-layers; 4 x 0.1 mm; 2 x 0.5 mm and 5 x 1 mm thickness)
T43024 99.45 % Al filter set MAM
(6 Al-layers, each 0.1 mm thickness)
T43009.1.910 99.9 % Cu filter set
(11 Cu-layers; 2 x 0.02 mm; 0.05 mm; 0.1 mm; 2 x 0.2 mm; 0.5 mm; 2 x 2 mm; 5 mm; 10 mm thickness)
Single Al and Cu filters are available

HVL Measuring Stand *page 91*

Notes

Quality Control

Quality Control Equipment

Quality Control

The quality of X-ray images is influenced by a number of parameters. To maintain the consistent performance of X-ray installations, quality checks have to be conducted regularly. International regulations demand quality test procedures for all types of X-ray equipment. Regular quality controls ensure proper functioning of the medical X-ray devices, reduce patient exposure, avoid unnecessary double exposures and consequently even reduce the costs of X-ray departments. The various components of the imaging chain are ideally tested independently to identify malfunctions and eliminate those detected easily.

PTW offers a variety of diagnostic test tools for different X-ray equipment. The PTW product line includes non-invasive kV_p meters and test objects for quality checks of radiographic, fluoroscopic, mammographic, dental, DSA and CT installations. Additionally, sensitometers and densitometers are available to check the quality of the film processing independently from X-ray units. The QC sets include the basic test instruments. Further test tools are available for checking the focal spot size, image resolution, screen-film contact and image quality of image display devices and film viewers.

NOMEX Multimeter

Measuring System for R/F/DENT/CT/MAM

Features

- Combined electronics and detector matrix
- Connection via USB directly to a notebook or PC
- Automatic range for dose and kV measurement
- Software running in different languages

The NOMEX Multimeter is a miniaturized non-invasive measuring system for absolute dosimetry and quality control in X-ray diagnostic radiology. It can be used for radiography, fluoroscopy, dental, CT and mammography (Mo/Mo, Mo/Al, Mo/Rh, W/Al, W/Rh, W/Ag, Rh/Rh) application. NOMEX measures the dose, dose rate, irradiation time, dose per pulse, pulses, kVp, the total filtration (TF, not in mammography) and the half value layer (HVL) in one single shot. Additionally, the kV and dose rate waveform is stored.

The smart NOMEX Multimeter can be directly connected via USB to a notebook or PC running the NOMEX Software. No additional accessories like a power supply or display are required for putting the NOMEX into operation. Measurements are automatically started upon detection of radiation. The dose and kV ranges are set fully automatically almost in real-time, so that multiple exposures are avoided. The NOMEX Software allows most convenient and clear data handling. Statistics functions are provided as well as data export as XLS, XML or CSV file.

Ordering Information

L981815 NOMEX Multimeter
including NOMEX Software, 2 m USB cable and 5 m long active extension cable and a transport bag. Requires connection to a notebook or PC

Options

L991422 Touch notebook
T20016 NOMEX Multimeter holder
T20017 NOMEX cassette adapter

DIAset QC Kits for Diagnostic Radiology

Sets of measuring equipment for comprehensive non-invasive quality control of diagnostic X-ray installations

Features

- Various portable sets of QC meters for X-ray services
- Include small size and lightweight measuring devices for non-invasive quality control of any X-ray equipment
- Measure dose, dose rate, dose per pulse, dose length product, kV_p, PPV and exposure time

The DIAset kits for quality control of X-ray installations in general include a DIADOS E dosemeter with appropriate detector and any type of DIAVOLT non-invasive kV-meter. This combination of measuring instrumentation covers the complete range of measuring tasks in diagnostic quality control. For practical reasons, the dose parameters and the voltage parameters are measured by two separate and independent devices. There is a choice of different QC kits for different applications.

Ordering Information

L981240 DIAset UNIVERSAL R/F/DENT/CT/MAM
L981241 DIAset MULTI R/F/DENT/CT
L981242 DIAset FLU/RAD
L981245 DIAset MAM
L981234 DIAset DENT

Options

T20002 Cassette adapter 18 cm x 24 cm
T26333 Cable holding device for cassette adapter T20002
T20003 Dental panorama cassette adapter
T42018 Absorber set for dental dose measurement

- DIADOS E *page 88*
- DIAVOLT QC Meters *page 96*

DIAVOLT
All-in-one QC Meters

Non-invasive X-ray meters for kV_p, PPV[1], dose and exposure time measurements at X-ray installations

Features

- Compact universal meters for quality control of different X-ray installations
- Measures kV_p, PPV[1]), dose and exposure time in one shot according to IEC 61676
- Independent of orientation
- Very fast sampling frequency
- Convenient use for under couch tubes

The DIAVOLT is designed for measurements of kV_{pmean}, kV_{pmax}, PPV[1], exposure time and dose of X-ray installations for CT, radiography, fluoroscopy, mammography and for dental applications.
The key features of the small and light-weight all-in-one device provide easy handling because of automatic functions like auto start, auto stop and auto range. The display reading switches automatically when used for measurements on under couch tubes.
The DIAVOLT has an analogue output which connects to an oscilloscope for displaying the voltage waveform. Furthermore because of the fast sampling frequency, precise measurements can be performed even on very demanding X-ray units with high substantial ripples. Moreover no test shots for determination of the right detector orientation are necessary and no external accessories are required for operation. Via the optional DiaControl *expert* software for automatic data evaluation, quality parameters like the accuracy, reproducibility and linearity can be checked fast and easily.

[1] Practical Peak Voltage

Ordering Information

L981810 DIAVOLT UNIVERSAL (RAD/FLU, CT, DENT, MAM)
L981811 DIAVOLT MULTI (RAD/FLU, CT, DENT)
L981812 DIAVOLT RAD/FLU
L981813 DIAVOLT MAM

Options

S030006 DiaControl *expert* software
L22038 Bag for DIAVOLT

DiaControl *expert*
QC Software

Comprehensive QC software for automatic data evaluation in diagnostic radiology

Features

- Software for fast and precise measurement analysis for use with all DIAVOLT types and DIADOS E
- Offers device operation by remote control
- Automatically sorted data presentation
- Evaluates data according to defined limits
- Implements HVL calculation, statistic functions and report modification

With the combination of the MS Windows based DiaControl *expert* software and the components out of the DIAset systems - DIAVOLT and DIADOS E - a complete and powerful technical solution is provided for determination, evaluation and documentation of all relevant parameters in diagnostic radiology.
The user-friendly DiaControl *expert* software acquires and evaluates the measured values by means of an automatically sorting function. Quality parameters such as the accuracy, reproducibility and linearity can be checked easily. The measuring results are presented both in table form and graphically, showing the deviations from the limit values e.g. according to international standards.
Furthermore HVL calculations and automatic exposure control (AEC) tests can be determined, based on dose measurements by using the DIADOS E.
Moreover DiaControl *expert* presents the kV waveform graphically and provides statistical evaluation. Measured data can be stored or exported to Excel sheets and the analysis results can be added to a report for subsequent documentation. The report can be modified individually.

Ordering Information

S030006 DiaControl *expert* software

- DIAset *page 95*
- DIAVOLT QC Meters *page 96*
- DIADOS E *page 88*

CONNY® II QC Dosemeter

Dosemeter for constancy tests of X-ray installations for radiography, fluoroscopy and mammography

Features

- Represents a valuable small size dosemeter for routine QC
- Measures the entrance dose and dose rate in front of a phantom at 30 kV (Mammo) and 70/100 kV (conventional X-rays)
- Complies with IEC 61674 within the ranges of use
- Displays dose and dose rate in Gy and Gy/s (R and R/s optional) and time in s

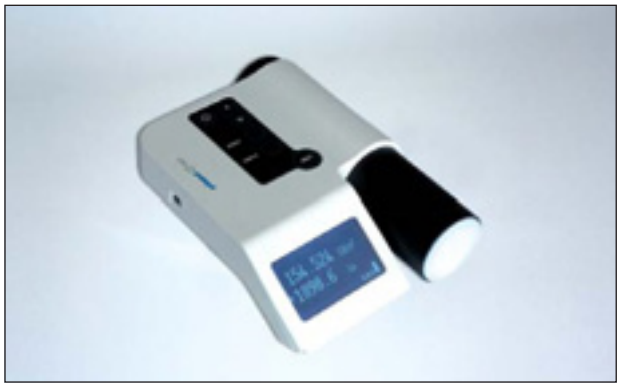
The dose of X-ray beams is the most important parameter of consistent performance of X-ray equipment. Each constancy check should include a dose measurement. The CONNY II dosemeter is especially designed for this purpose. It is used in combination with the REX phantom for QC of radiography and fluoroscopy devices and with the NORMI and X-Check phantoms for QC. CONNY II is calibrated in air kerma, and the measuring results are represented on a high contrast digital display. The battery operated device features auto start, auto shut-off and timer functions. The measuring probe includes a calibrated semiconductor detector.

Ordering Information

T11007 CONNY II dosemeter

- REX *page 102*
- NORMI MAM *page 100*
- NORMI 13 *page 98*
- X-Check FLU *page 102*
- NORMI 4 FLU *page 98*
- NORMI PAS Set 1054 *page 99*

CDmon Meter Light Measurement



Digital luminance and illuminance meter for quality control of viewing boxes and image display devices

Features

- Measures the luminance and illuminance during quality checks of viewing boxes and image display devices
- Includes two lasers tool for correct distance adjustment of the detector
- Combination of spacer and laser positioning aid for easy handling
- All relevant parameters eg. acc. DIN can be measured in combination with a test picture

The quality of film viewing boxes and monitors in X-ray diagnostics has to be monitored regularly. Boxes and image display devices are tested easily by using the battery operated CDmon Meter, which measures the luminance in cd/m² and the illuminance in lux.
A laser positioning aid helps to place the detector at the right distance and allows correct positioning by indicating the measuring spot. The CDmon Meter includes a USB 2.0 interface.

The optional Mavo-Max is a self-contained small measuring device designed for the monitoring of the ambient light in the surrounding of image display devices for continuous operation. Two LEDs indicate directly if the ambient light is within the permissible light range.

Ordering Information

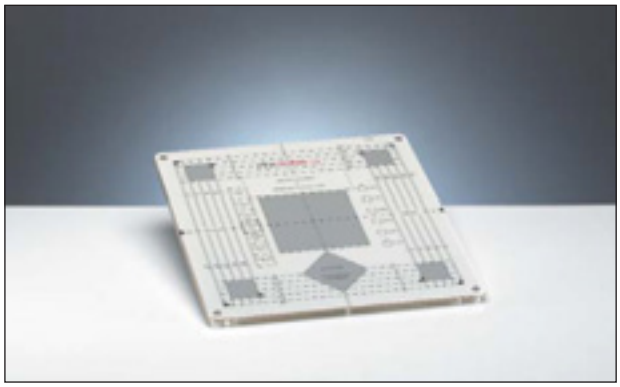
L991266 CDmon Meter for luminance and illuminance measurement

Options

L991262 Mavo-Max
S030007 RadiCS software

- NORMI 13 *page 98*
- NORMI 4 FLU *page 98*
- NORMI PAS Set 1054 *page 99*

NORMI 13 X-Ray Test Object



Test object for quality control of digital X-ray installations

Features

- Checks the relevant parameters of digital X-ray equipment (DR and CR systems)
- Suitable for acceptance tests and constancy tests
- For use with an attenuation plate for patient simulation and a diagnostic dosemeter for entrance dose measurement
- Complies with DIN 6868-13/-58

The NORMI 13 test object is designed for acceptance tests and constancy tests of X-ray equipment with a digital image intensifier or plate. It includes a structure plate with radiological visible line marks for the light field adjustment and the test of the light field/radiation field congruency, a gray scale test, a low-contrast test, a line group resolution test pattern, an area for entrance dose measurement and homogeneous areas for homogeneity tests and signal normalization.

The structure plate is used in combination with a 30 mm thick acrylic attenuation plate or a 25 mm Al plate to simulate patient absorption. A 1.3 mm thick Cu plate is used in addition for tests at 100 kV. The external dimensions of the plates are 300 mm x 300 mm.

The entrance dose is measured by the CONNY II or the DIADOS E dosemeter.

Ordering Information

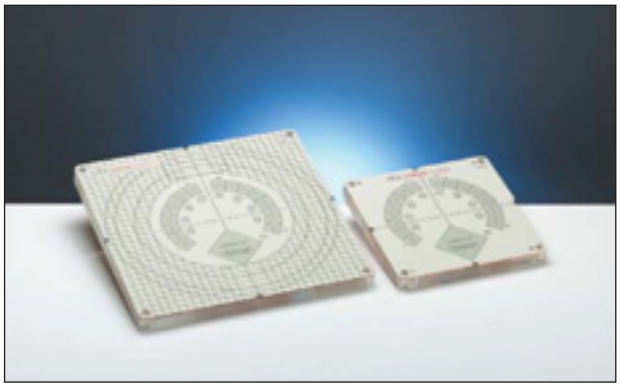
L981247 NORMI 13 Set
L981246 NORMI 13 Focus

Options

T42023.1.010 NORMI 13 carrying case
T20005 Bucky mounting device
L104089 Bucky mounting device for NORMI 13 structure plate only

- CONNY II *page 97*
- DIADOS E *page 88*

NORMI 4 FLU X-Ray Test Object



Test object for quality control of analogue and digital fluoroscopic X-ray installations

Features

- Checks all relevant parameters of analogue and digital fluoroscopic X-ray units
- Suitable for routine quality checks on over couch tubes, under couch tubes and C arms
- Includes an attenuation plate for patient simulation
- Complies with DIN 6868-4: 2007

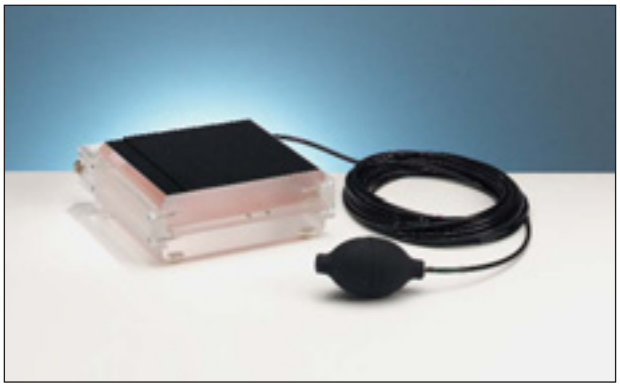
The NORMI 4 FLU test object is used for constancy tests of analogue and digital X-ray installations for fluoroscopy acc. to DIN 6868-4. The NORMI 4 FLU packages include a structure plate with a copper step wedge for testing the dynamic range, a resolution test pattern, low contrast and detail test elements as well as a kV test area for the determination of the radiation quality. The NORMI 4 FLU structure plate allows to check all parameters in one shot.
Four different NORMI 4 FLU packages are available, either with the outer dimensions 200 mm x 200 mm x 18.5 mm or 300 mm x 300 mm x 18.5 mm (NORMI 4 FLU^{plus}) and either with a 30 mm thick PMMA and a 1 mm thick copper plate or with a 25 mm thick aluminium absorber for patient simulation. Furthermore, each NORMI 4 FLU package includes assembling parts which allow a convenient adjustment on over couch tubes, under couch tubes and C arms. The entrance dose can be measured with a CONNY II or DIADOS E dosemeter.

Ordering Information

L981307 NORMI 4 FLU Set PMMA
L981309 NORMI 4 FLU Set Al
L981301 NORMI 4 FLU^{plus} Set PMMA
L981302 NORMI 4 FLU^{plus} Set Al
L981374 NORMI 4 FLU^{plus} retrofit set

- CONNY II *page 97*
- DIADOS E *page 88*

X-Check® DSA Test Object



X-ray test object for quality control of DSA installations

Features

- Suitable for acceptance and constancy tests of DSA installations
- Complies with IEC 61223-3-3 and DIN 6868-4: 2007
- Simulates the contrast agent within vessels
- Includes pneumatic remote control of the movable slider, extension 8m

X-Check DSA is a test object for quality checks of DSA equipment (Digital Subtraction Angiography). The size of the acrylic phantom is 150 mm x 150 mm x 57 mm. X-Check DSA includes a 6 mm thick acrylic slider with manual remote-control and contains four Al strips for vessel simulation to check dynamic range and artifacts. Sensitivity checks are conducted by means of a copper step wedge with 7 steps in 0.2 mm increments. An additional copper step of 1.4 to 0.2 mm makes it possible to evaluate logarithmic errors.

Ordering Information

T42003 X-Check DSA test object, including case

Option

T42003.1.006 X-Check DSA frame 300 mm x 300 mm, incl. 4 supports for use with undercouch tubes

- NORMI 4 FLU *page 98*

NORMI PAS Set 1054 Mammo Test Object

Test object for acceptance and constancy tests of digital mammographic X-ray installations

Features

- Checks all relevant parameters of digital mammographic X-ray installations
- ACR test element based on the Mammographic Accreditation Phantom of the American College of Radiology (ACR) included
- Optional test element for acceptance tests available
- Complies with DIN PAS 1054 in combination with IEC 61223-3-2

NORMI PAS Set 1054 is used to test specific values of digital mammographic X-ray installations. The modularly composed phantom includes a basic phantom, a structure plate, three PMMA absorbers and up to five different test elements for insertion into the structure plate:

- Test element PMMA for testing the average gray value
- Test element ACR with micro-calcifications and fibrils
- Test element HK for testing the high contrast
- Test element KRV for testing the signal-to-noise-ratio
- Optional test element AP for testing the low contrast.

The resolution test pattern embedded in the structure plate can be rotated by 45°, 60° and 90°. The basic phantom has an inclined step wedge with 14 ranges for testing the dynamic range. Two lines of five steel balls each symmetrically placed in the structure plate and in the basic attenuation phantom show the limitations on the thoracic wall side. Various acrylic absorbers can be used for testing the automatic exposure control (AEC).

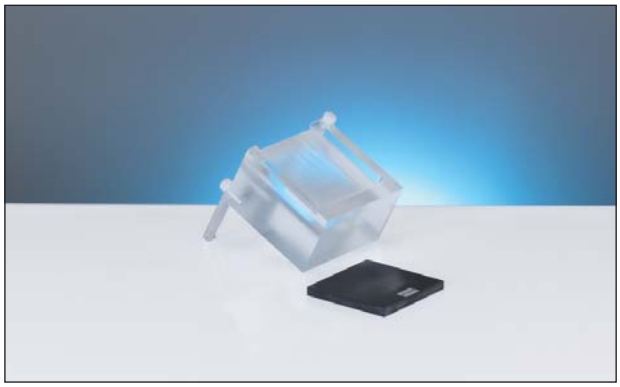
Ordering Information

L981248 NORMI PAS Set 1054/KP
L981279 NORMI PAS Set 1054/AP

Options

T42028.1.020 Test element AP for acceptance tests
T42028.3.050 PAS PMMA step substitute
T42028.1.018 Aluminum step

NORMI MAM Biopsy Mammo Test Object



Test object for quality control of biopsy X-ray units for mammography

Features

- Dimensions 80 mm x 75 mm x 46 mm
- PMMA block with cut-out of 60 mm x 60 mm x 6 mm
- Holds the test element KP-ACR biopsy or the test element AP

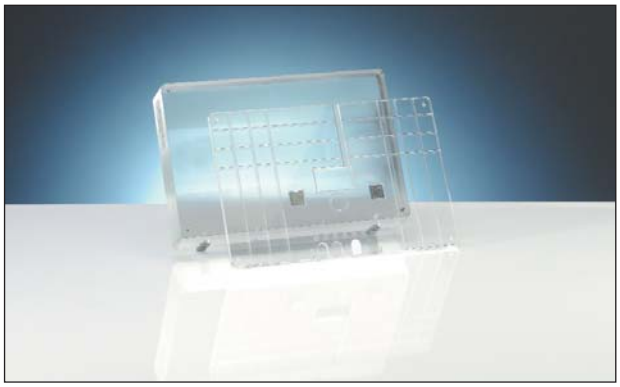
The NORMI MAM Biopsy test object is composed of a base plate with a cut-out for test element, two adjustable stops and a locking bar. The adjustable stops are used for mounting to the locating face and are revolving. The locking bar holds the test element in position if the base plate is used in vertical orientation. You can insert the PTW test element KP-ACR biopsy or the test element AP into the cut-out. The set includes the test element KP-ACR biopsy.

Ordering Information

L981300 NORMI MAM Biopsy Set
incl. base plate and test element KP-ACR biopsy

T42036 NORMI MAM Biopsy
base plate without test element

NORMI MAM Mammo Test Object



Test phantom for quality control of analog mammographic X-ray installations

Features

- Suitable for acceptance and constancy tests of analog mammographic X-ray units
- Complies with DIN standards
- High-contrast test, low-contrast test and steel balls at thorax side
- Checks specific mammography parameters

NORMI MAM is an easy-to-use test phantom, which makes it possible to test specific values of mammographic X-ray systems. The values tested are the optical density of test films, the position and size of the useful radiation field, the contrast resolution, the presence of impurity spots. Two lines of five steel balls each are symmetrically placed in the structure plate and in the attenuation phantom. They show the image limitations at the thorax side on the radiograph. The acrylic plate of 20 mm thickness in combination with the standard 40 mm attenuation phantom can be used for operation tests of the automatic exposure control (AEC). Checks for artefacts are performed with the acrylic plate of 20 mm thickness. Moreover a resolution test pattern (8, 10, 13, 16 lp/mm) is included in the structure plate. An optional second 20 mm plate is used for bigger cassette formats such as 24 cm x 30 cm.

Ordering Information

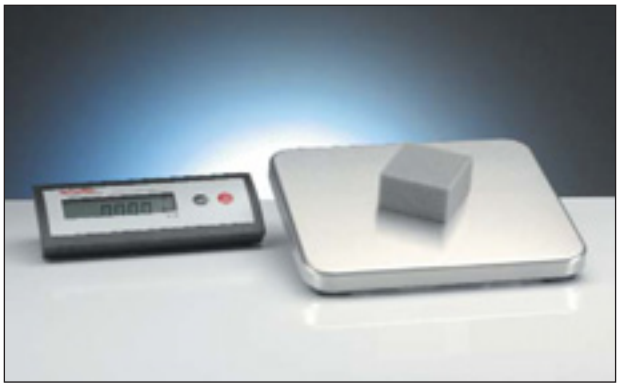
T42024 NORMI MAM test object

Options

T26766/11 NORMI MAM acrylic plate (20 mm)
L653003 Magnifying glass, 8x

- CONNY II *page 97*
- DensiX *page 104*
- SensiX *page 104*

Mammography Compression Test Set



Set for testing the compression device of mammographic installations

Features

- Comprises an electrical compression scaling unit and a foam cuboid
- Complies with IEC 61223-3-2, DIN PAS 1054
- Large LC-Display

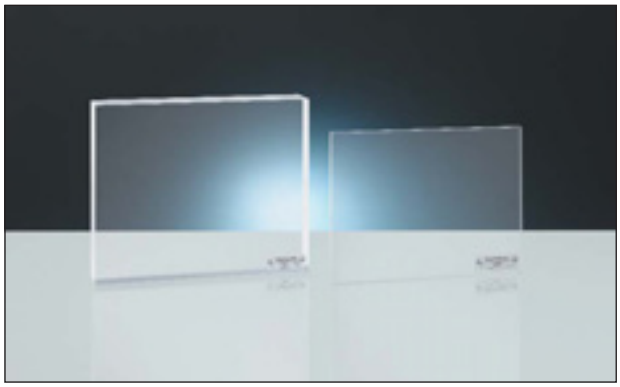
The compression device of mammographic installations has to be checked during acceptance tests. The set for testing the compression device comprises a foam cuboid with a specified density and an non-calibratable electrical device with a scale displaying the mechanical force of the mammo compression device (measuring range 0-300 N ± 5 N; displayed unit is kg). It measures the compression force for all selectable settings, including the maximum value. The measured values and the indicated values at the mammographic X-ray equipment shall agree within the specified tolerances and the maximum force specified shall not be exceeded.

Ordering Information

L981143 Mammo compression test set
L991235 Scale for testing the compression device
L514044 Foam cuboid according to IEC 61223-3-2

- NORMI MAM *page 100*
- NORMI PAS Set 1054 *page 99*

PMMA Absorbers AEC Test Phantoms



Absorbers for testing the automatic exposure control (AEC) of X-ray installations in mammography

Features

- Easy quality checks of the automatic exposure control (AEC) of analog and digital mammographic X-ray installations
- Different sizes and thicknesses according to IEC and DIN are available

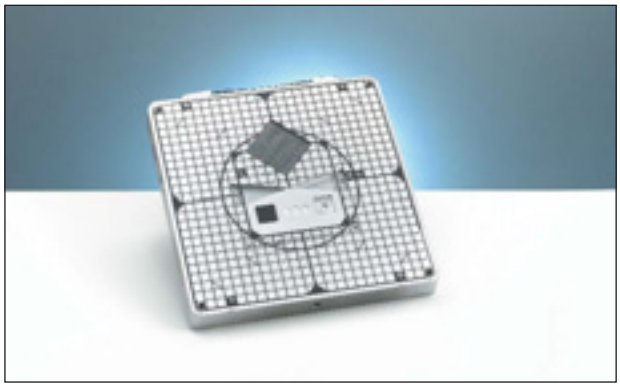
According to IEC and DIN the automatic exposure control (AEC) has to be checked during acceptance and constancy tests of analog and digital X-ray installations in mammography. For exposures under AEC, any variation in the net optical density or grey value has to be in the same direction and closely correlated for different PMMA thicknesses.

Ordering Information

T40033 PMMA absorber 240 mm x 180 mm x 5 mm
T40029 PMMA absorber 240 mm x 180 mm x 10 mm
T40032 PMMA absorber 240 mm x 180 mm x 20 mm
T40034 PMMA absorber 240 mm x 180 mm x 40 mm
T40031 PMMA absorber 240 mm x 180 mm x 45 mm
T40035 PMMA absorber 240 mm x 180 mm x 50 mm
T40030 PMMA absorber 300 mm x 240 mm x 45 mm
T40030.1.003 PMMA absorber 300 mm x 240 mm x 10 mm

- DensiX *page 104*
- CDMon Meter *page 97*

REX
X-Ray Test Phantom



Reference phantom for quality control of X-ray installations for fluoroscopy and radiography

Features

- Suitable for constancy tests and acceptance tests of conventional X-ray equipment
- Complies with IEC 61223-3-1
- Suitable for overcouch and undercouch tubes and wallstand installations
- Suitable for health physics measurements by an optional scattering plate and a survey meter

The REX phantom enables fast and easy control of properties, adjustment and stability of X-ray components and imaging systems. The compact aluminum test object of 250 mm x 250 mm size and 25 mm Al thickness includes well-defined structures with respect to X-ray attenuation and image quality. Requires the CONNY II dosemeter for entrance dose measurements.

Ordering Information

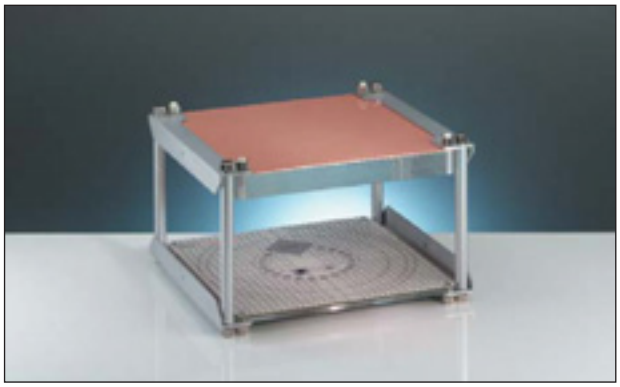
L981030 REX phantom base package, incl. carrying case

Options

L981031 REX scattering plate for health physics measurements
L653003 Magnifying glass, 8x

- CONNY II *page 97*
- DensiX *page 104*

X-Check FLU
X-Ray Test Object



Test object for constancy tests of analogue fluoroscopic X-ray installations acc. IEC 61223-2-9

Features

- Modular package for constancy tests of analogue fluoroscopic X-ray installations
- Suitable for overcouch tubes, undercouch tubes and C arms
- Simulates the patient with respect to attenuation and hardening of the radiation beam
- Includes all relevant test structures and absorbers
- All characteristics can be tested simultaneously

The X-Check FLU test object is used for constancy tests of fluoroscopic and indirect radiographic X-ray equipment according to IEC 61223-2-9. The X-Check FLU package includes a structure plate with a 10 mm grid, a gray-scale test, a low-contrast test and a resolution test pattern. Furthermore, the X-Check FLU package comprises assembling parts as well as a 30 mm thick acrylic plate and a 1.3 mm thick copper plate for beam attenuation. The external plate dimensions are 300 mm x 300 mm. The construction of the X-Check FLU allows to check all parameters in one shot.
Instead of the acrylic absorber, an optional 25 mm thick aluminum absorber can be fixed to the collimator by using adaption rails. The entrance dose can be measured with a CONNY II dosemeter.

Ordering Information

L981319 X-Check FLU base package

Option

T11007 CONNY II dosemeter

- CONNY II *page 97*

Diagnostic QC Set 'A'

Set of test devices for quality control of X-ray film processing

Features

- Enables complete, fast and accurate constancy tests of film processing
- Comprises all relevant test devices: a SensiX sensitometer, a DensiX densitometer and a model 175 thermometer
- Complies with international regulations
- Supplied with a carrying case

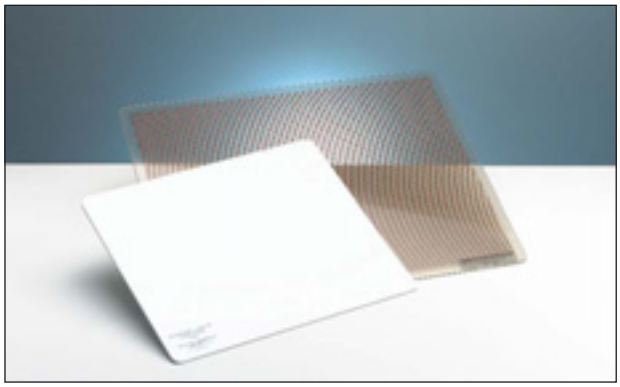
Consistent performance of film processing has to be checked daily to ensure proper processing and good image quality of X-ray films. To check the film developing process independently of X-ray equipment, the 21-step wedge SensiX sensitometer carries out test exposures. After the development by the processor to be checked, the DensiX densitometer evaluates the test film, measuring the optical densities at the step wedge. The model 175 thermometer checks one of the most important processor parameters for good image quality: the temperature of the developing liquid. For processing constancy tests, it suffices to compare the results by always using the same SensiX sensitometer. The optional set 'A Cal' includes a calibrated SensiX Cal sensitometer for calibrated light exposures to a test film.

Ordering Information

L981310 QC measuring set 'A'

- SensiX *page 104*
- DensiX *page 104*

Screen-Film Contact Test Tools



Meshes for checks of the contact between film and screen of X-ray film cassettes

Features

- Enable fast and easy quality checks of film cassettes
- Copper mesh embedded in plastic plate
- Two types are available:
  - Radiography test tool 36.5 cm x 43 cm with 8 wires per inch (≈3 wires per cm), 0.7 mm thick
  - Mammography test tool 26 cm x 31 cm with 40 wires per inch (≈16 wires per cm), 0.26 mm thick

Poor image quality of X-ray films can be caused by film-screen contact problems in the film cassette. These problems can be determined easily by laying the mesh over the cassette and exposing the film. Blurring or distortion of the screen image across the film indicates poor film-screen contact. The screen-film contact of the X-ray film cassettes should be checked frequently to ensure image quality.

Ordering Information

L991077 Radiography screen-film contact test tool
L991078 Mammography screen-film contact test tool

- REX *page 102*
- NORMI MAM *page 100*

SensiX
Film Sensitometer

Sensitometer for exposing a 21-step wedge on X-ray films

Features

- Enables checks of film processing systems independent of X-ray equipment
- Enables light exposures of 21-step wedges on blue or green sensitive X-ray films
- Includes audible exposure control
- Fulfills international regulations
- A calibrated version is available

SensiX is a single-sided, dual color, light-emitting sensitometer for reproducible exposures of a 21-step wedge on X-ray films. SensiX is used in the dark room to check the consistent performance of film processing systems. Light emission can be selected for blue sensitive films (spectral maximum 460 nm) and green sensitive films (spectral maximum 510 nm). The audible exposure control indicates blue, green or no exposure. SensiX is battery operated.

Ordering Information

L981261 SensiX sensitometer, battery operated

Option

L522024 SensiX/DensiX carrying case

DensiX
Film Densitometer

Film densitometer for measuring the optical density of X-ray films

Features

- Suitable for the evaluation of processed test films from sensitometer or X-ray exposure
- Enables manual single point measurement of optical densities in the range (0.00 ... 4.5) OD
- Enables menu-prompted calibration by the user

DensiX is a manually operated film densitometer for measuring the optical density of processed X-ray films, exposed by a sensitometer (light exposure of a step wedge) or by X-ray equipment (X-ray exposure of a test object). It is suitable for constancy measurements on radiographic, mammographic and cine films. The length of the measuring arm is 20 cm, which makes it possible to measure the optical density even in the middle of 35 cm x 43 cm large size films.

Ordering Information

L981263 DensiX densitometer

Option

L522024 SensiX/DensiX carrying case

Focal Spot Measuring Stand

Stand for focal spot measurements by means of a star test pattern or slit camera

Features

- Focal spot measurements according to IEC 60336 and NEMA XR5-1984
- Includes measuring stand with universal holder for ideal positioning of a star test pattern or slit camera

The focal spot measuring stand allows an easy adjustment and precise positioning of a slit camera or star test pattern for the determination of focal spot dimensions and of the modulation transfer function (MTF).

Ordering Information

T20009 Focal Spot measuring stand

Options

T20009.1.002 Holder for slit camera / star test pattern
T20008.1.020 Carrying case

- Slit Camera *page 105*
- Test Patterns *page 106*

Slit Camera

For focal spot measurements and determination of the modulation transfer function (MTF)

Features

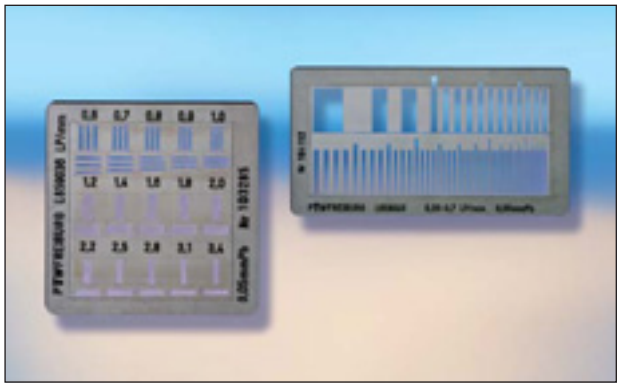
- For the determination of focal spot dimensions and of the modular transfer function (MTF)
- Easy, fast and precise measurements according to IEC 60336 and NEMA XR5-1984

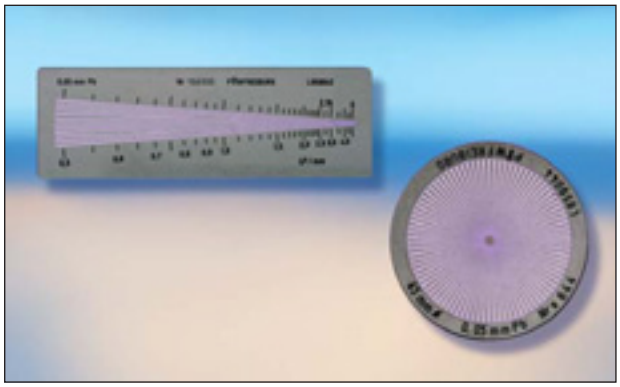
The MTF is developed from the one-dimensional intensity distribution obtained from the slit images.

Ordering Information

L659117 Slit camera 10 µm
L659138 Slit camera 30 µm

Test Patterns for X-Ray Image Tests





Lead foil test patterns for X-ray resolution, focal spot size and MTF tests

Features

- Enable easy quality checks of X-ray imaging chains
- A multitude of different test patterns with various lead thicknesses are available
- Spatial frequencies are given in line pairs per mm (lp/mm)
- Rectangular, circular and high resolution line group tests with various spatial frequency ranges are available
- Focal spot measuring test patterns for easy determination of the size and shape of X-ray focus spots are available

Ordering Information

Model	Resolution [lp/mm] (min. ... max.)	Pb thickness [mm]	Size [mm]	Remarks
Resolution Test Patterns				
Standard rectangular test patterns				
L659005	**0.6** / 0.7 / 0.8 / 0.9 / 1 / 1.2 / 1.4 / 1.6 / 1.8 / 2 / 2.2 / 2.5 / 2.8 / 3.1 / 3.4 / 3.7 / 4 / 4.3 / 4.6 / **5**	0.05	50 x 50	
L659036	**0.6** / 0.7 / 0.8 / 0.9 / 1 / 1.2 / 1.4 / 1.6 / 1.8 / 2 / 2.2 / 2.5 / 2.8 / 3.1 / **3.4**	0.05	50 x 50	2 orthogonal groups per step
L659007	**0.8** / 1 / 1.2 / 1.4 / 1.7 / 2 / 2.4 / 2.8 / 3.4 / 4 / 4.8 / 5.7 / 6.7 / 8 / **9.5**	0.05	50 x 50	
Standard circular test patterns				
L659074	**5** / 5.2 / 5.4 / 5.6 / 5.8 / **6**	0.10	32 ∅	
L659076	**5** / 5.2 / 5.4 / 5.6 / 5.8 / 6 / 6.2 / 6.4 / 6.6 / 6.8 / **7**	0.05	32 ∅	
L659078	**7** / 7.2 / 7.4 / 7.6 / 7.8 / **8**	0.05	32 ∅	
High resolution test patterns				
L659093	**4.5** / 5 / 5.5 / 6 / 6.5 / 7 / 7.5 / 8 / 8.5 / 9 / **9.5**	0.03	24 x 12	e.g. for digital mammography
L659041	**3.55** / 4 / 4.5 / 5 / 5.6 / 6.3 / 7.1 / 8 / 9 / 10 / 11.1 / 12.5 / 14.3 / 16.6 / **20**	0.03	95 x 50	e.g. for mammography
L659039	**2** / 3 / 4 / 5.5 / 7 / 8.5 / 10 / 11.1 / 12.5 / 14.3 / 16.6 / **20**	0.03	24 x 12	e.g. for mammography
Single sector test patterns (continuous)				
L659008	**5** / 6 / 7 / 8 / 10 / 12 / 16 / **20**	0.03	40 x 20	
L659035	**1.5** / 2 / 2.5 / 3 / 3.5 / 4 / 4.5 / 5 / 6 / 7 / 8 / 9 / 10 / 12 / 14 / 16 / 18 / **20**	0.03	60 x 30	1 sector of 20 lp, angle 0.4°
L659042	**0.5** / 0.6 / 0.7 / 0.8 / 0.9 / 1 / 1.5 / 2 / 2.5 / 2.75 / 3 / 4 / **5**	0.05	150 x 50	1 sector of 5 lp, angle 0.4°
Modular Transfer Function (MTF) Test Patterns				
L659046	**0.25** / 0.5 / 0.6 / 0.7 / 0.85 / 1 / 1.2 / 1.4 / 1.7 / 2 / 2.4 / 2.9 / 3.5 / 4.2 / 5 / 6 / 7 / 8.5 / **10** / 8.5 / 7 / 6	0.05	71 x 44	scale on additional sheet
L659045	0.3 / 0.35 / 0.42 / 0.5 / 0.6 / 0.7 / 0.85 / 1 / 1.2 / 1.4 / 1.7 / 2 / 2.4 / 2.8 / 3.4 / **3.7** / **0.05** / 0.1 / 0.25 / 0.3 / 0.35	0.05	95 x 50	scale on additional sheet
L659048	**0.25** / 0.3 / 0.33 / 0.36 / 0.4 / 0.44 / 0.48 / 0.52 / 0.57 / 0.63 / 0.69 / 0.76 / 0.83 / 0.91 / 1 / 1.1 / 1.2 / 1.3 / 1.45 / 1.6 / 1.75 / 1.9 / 2.1 / 2.3 / 2.5 / 2.75 / 3 / 3.3 / 3.6 / 4 / 4.4 / 4.8 / 5.2 /5.7 / 6.3 / 6.9 / 7.6 / 8.3 / 9.1 / **10** / 9.1 / 8.3 / 7.6 / 6.9 / 6.3 / 5.7 / 5.2	0.05	62 x 44	scale on additional sheet
Focus Spot Size Test Patterns				
Full star test patterns				
L659043	0.85 ... 16	0.03	55 ∅	angle 1.5°
L659044	0.64 ... 10	0.05	55 ∅	angle 2.0°
Four sector star test patterns				
L659084	1.27 ... 16	0.03	55 ∅	angle 1.0
L659083	0.63 ... 20	0.03	55 ∅	angle 0.5
L659086	0.64 ... 10	0.03	55 ∅	angle 2.0
Double Slit Test Patterns				
Model	Slit width [mm]	Pb thickness [mm]	Size [mm]	Remarks
L659081	0.2	0.05	50 x 50	absorbing
L659082	0.2	0.05	50 x 50	non-absorbing

This is just a selection. About 60 different patterns are available. More information upon request.

FILMSCRIBOR®
X-Ray Film Marker

Film marker for exposing patient data on X-ray films prior to film processing

Features

- Based on a photoelectric system, it automatically exposes all essential patient data on film
- Works independently of cassette type
- Can be adapted for use in any X-ray department

The Filmscribor ensures automatic exposure of all essential patient data on a film together with the name of the hospital or X-ray department. This eliminates any errors resulting from manual subsequent film marking. The desired text is typed on a paper strip soon after the patient is registered for examination. This text will be photographed on a film before processing in the darkroom. The identification system using the filmscribor can be adapted for use in any X-ray department easily.

Ordering Information

T5345 FILMSCRIBOR film marker, 230 V

Safelights
for Darkrooms

Bright illumination safelights for X-ray film processing darkrooms

Features

- Deliver high brightness for both indirect and direct illumination of the darkroom
- Provide continuous brightness adjustment, enabling film processing without danger of causing fog
- Include a bracket for wall or ceiling mounting

The yellow safelight is supplied with a 25 W krypton lamp in combination with a Schott filter glass. Only yellow light is emitted, fulfilling the requirements for blue sensitive X-ray films used with or without intensifying screens.
The red safelight is supplied with a 40 W krypton lamp and a homogenous Schott filter glass. This combination emits red light only to comply with the requirements for green sensitive X-ray films and other high sensitivity films, which must be handled with red light only.

Ordering Information

Darkroom safelight 230 V, yellow for blue sensitive X-ray films:
T50001.1.010 with bracket for wall or ceiling mounting
L379005 Spare lamp 25 W for yellow safelight

Darkroom safelight 230 V, red for green sensitive X-ray films:
T5418/U10 with bracket for wall or ceiling mounting
L379004 Spare lamp 40 W for red safelight

Centric Cross Image Ruler

Cross ruler to determine image locations on intensifier screens

Features

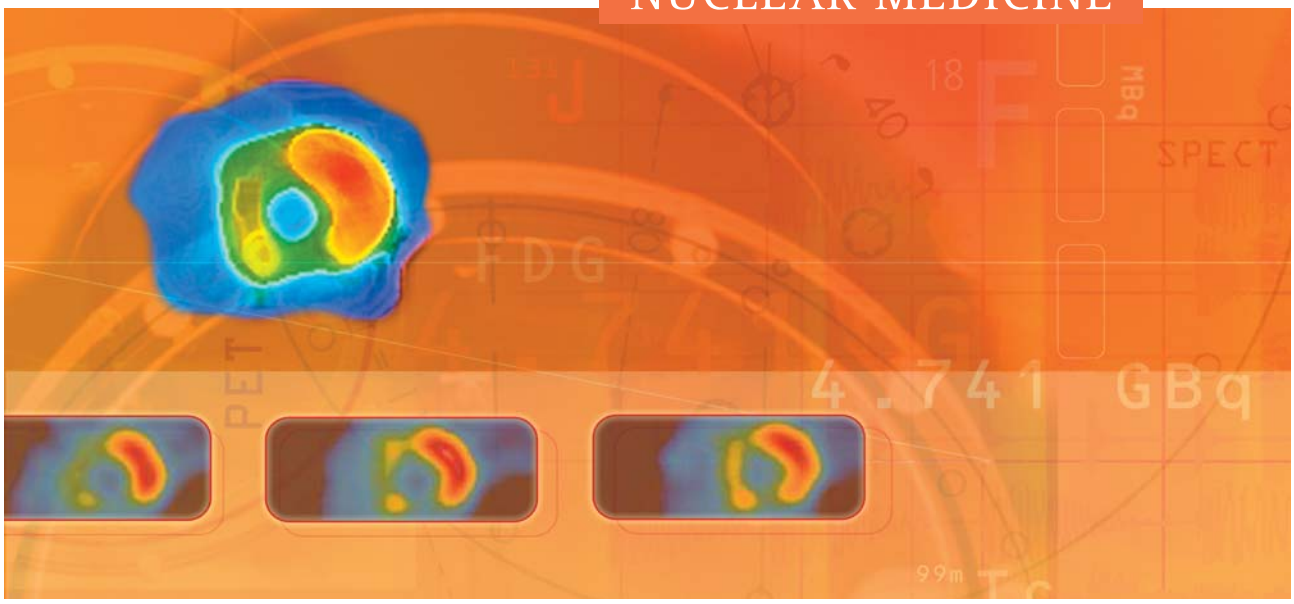
- Small mechanical test tool to check the correct centering of intensifier screens
- Enables easy adjustment at fluoroscopic installations
- Presents radiopaque scales on a fluoroscopic monitor

The centric cross is mounted on a base plate of 16 cm x 16 cm, made of Al. Two 20 cm rulers, starting from the center, can be adjusted as a cross and can be centered easily. The centric cross is fixed by means of suction cups.

Ordering Information

T43010.1.001 Centric cross

NUCLEAR MEDICINE



Radiation Measurement and Quality Control in Nuclear Medicine

Since the discovery of X-rays in 1895 by Röntgen and uranium radioactivity in 1896 by Becquerel, the use of ionizing radiation in medicine has undergone fascinating development. Nuclear medicine started in 1937 with the first clinical use of "artificial radioactivity" for treating a patient with leukemia. Today there are nearly one hundred different nuclear medicine procedures that provide information about virtually every major organ system within the body. Modern computer based techniques such as PET (Positron Emission Tomography) and SPECT (Single Photon Emission Computed Tomography) offer methods for diagnostic imaging that are unique by documenting dynamic organ function and structure.

PET is rapidly becoming a major diagnostic imaging modality. PET images demonstrate the chemistry of organs and other tissues such as tumors. A radiopharmaceutical, especially FDG (fluorodeoxyglucose), marked with the positron emitting isotope ^{18}F, is injected into the patient's body and its emissions are measured by a PET scanner.

SPECT, like PET, acquires information on the concentration of radionuclides introduced to patient's body by rotating a photon detector array around the body. SPECT scanners offer less imaging resolution compared to PET, but the availability of radiopharmaceuticals, particularly for the brain and head and the practical and economic aspects make this mode of emission tomography attractive for clinical studies of the brain.

Scintigraphy with planar gamma cameras and with thyroid uptake measuring equipment are further helpful methods in nuclear medicine.

Besides the diagnostic procedures more and more therapy methods are used in nuclear medicine. From the beginning, patients with thyroid cancer were treated with ^{131}I. Quite a number of further therapy procedures are available today.

Nuclear medicine uses very small amounts of radioactive materials or radiopharmaceuticals to diagnose and treat diseases. Nevertheless the radiopharmaceuticals emit ionizing radiation to which patients and operating staff can be exposed unintentionally. To avoid unnecessary irradiation and to fulfill international regulations, radiation measurement and quality control procedures for determination, recording and evaluation are mandatory in nuclear medicine.

International Standards and Regulations in Nuclear Medicine

IEC 60789 Characteristics and test conditions of radionuclide imaging devices – Anger type gamma camera

IEC 61145 Calibration and usage of ionization chamber systems for assay of radionuclides

IEC 61675-1 Radionuclide imaging devices – Characteristics and test conditions – Part 1: Positron emission tomographs

IEC 61675-2 Radionuclide imaging devices – Characteristics and test conditions – Part 2: Single photon emission computed tomographs

IEC 61675-3 Radionuclide imaging devices – Characteristics and test conditions – Part 3: Gamma camera-based whole-body imaging systems

National Electrical Manufacturers Association, USA
NEMA Standards Publication NU2-2001
Performance Measurements of Positron Emission Tomographs

CEC Concerted Action Project,
Methodologies for Performance Evaluation of Positron Emission Tomographs, J Nucl Biol Med; 35: 141-157

European Council Directive 97/43/EURATOM of 30 June 1997 on health protection of individuals against the danger of ionizing radiation in relation to medical exposure

ICRP 60, International Commission on Radiation Protection, Report #60

Isotope Calibrators

Isotope Calibrators

Isotope Calibrators

Nuclear medicine procedures use many different radioactive isotopes for radiation diagnostics and for therapy. The amount of radioactivity has to be determined exactly before it is applied to a patient. The isotope calibrators have to measure the radioactivity of gamma and beta emitting isotopes with different energies precisely for high quality imaging and for applying the right amount of radiation to treat disease. They must be able to measure low isotope activities for patient application and high activities during isotope production. The isotope calibrators should allow easy and fast operation in routine work as well as quick and effective cleaning in case of contamination. Continuous quality control of isotope calibrators is mandatory according to international standards and guidelines such as IEC 61303 “Medical electrical equipment – Radionuclide calibrators – Particular methods for describing performance”. Those methods include background measurement, accuracy, reproducibility and linearity checks as well as contamination tests. All these parameters influence the quality of activity measurements and consequently the radiation load for the patients. The high quality PTW isotope calibrators assist responsible staffs in nuclear medicine laboratories to perform precise activity measurements and to fulfill the IRCP 60 requirement to keep the radiation load as low as achievable for patients.

CURIEMENTOR® 3 Isotope Calibrator

Standard isotope calibrator for radionuclide activity measurement in nuclear medicine and intravascular brachytherapy

Features

- Combines modern technology with user friendly, straight-forward operation
- Stores calibration factors for all isotopes used in nuclear medicine with direct access to five of them
- Features auto-start, auto-print and auto-reset functions
- Complies with IEC 61145

The CURIEMENTOR 3 isotope calibrator enables users to measure activity of radioactive isotopes as used for all medical applications in diagnostic and therapeutic nuclear medicine and in intravascular brachytherapy. Great importance has been attached to the design of the instrument to focus on the needs of operators. The display and keyboard panel with its flat keys are specially designed for intuitive handling and easy cleaning in case of contamination. The measuring results can either be displayed in Bq, Ci or in A. The pressurized well-type ionization chamber has nearly 4π measuring geometry and connects to the display unit by a 1.8 m connection cable, which makes it possible to shield the chamber separately. A radioactive check device is available to check the proper performance of the device regularly. The display unit is supplied with an RS232 interface. A printer can be connected optionally. The printing mode can be set for labels or endless-paper on the CURIEMENTOR display unit.

Ordering Information

L981108 CURIEMENTOR 3 isotope calibrator 115/230 V incl. display unit, chamber and liner

L981141 CURIEMENTOR 3 isotope calibrator 115/230 V with wall mount display unit, incl. chamber and liner

Options *page 114ff.*

CURIEMENTOR® 4 Isotope Calibrator

Deluxe isotope calibrator for radionuclide activity measurement in nuclear medicine and intravascular brachytherapy

Features

- State-of-the-art development of an isotope calibrator
- Stores calibration factors for all isotopes used in nuclear medicine with direct access to thirty of them
- Displays measuring results continuously for isotopes with very short half-value time
- Provides data logging and data transfer via an RS232 interface
- Complies with IEC 61145

The CURIEMENTOR 4 isotope calibrator is a highly sophisticated instrument for activity measurements in nuclear medicine including PET. It includes and exceeds the features of the CURIEMENTOR 3 isotope calibrator. The user has direct access to 30 different isotope calibrations. When measuring isotopes with rapid decay, the displayed measuring values are updated each half second, which provides continuous display. ^{18}F activities of up to 92 GBq for PET applications can be measured. Up to 140 measuring results including administrative data can be stored internally. The features with respect to the chamber design, check device, RS232 interface and printer option are identical with the CURIEMENTOR 3 features.

Ordering Information

L981142 CURIEMENTOR 4 isotope calibrator 115/230 V incl. display unit, chamber and liner

L981144 CURIEMENTOR 4 isotope calibrator 115/230 V with wall mount display unit, incl. chamber and liner

Options *page 114ff.*

CURIEMENTOR® 4 PET System

Isotope calibrator for high activity measurement in PET nuclide production

Features

- Measures high activities in PET nuclide production
- Displays measuring results continuously for isotopes with very short half-life time
- Stores the nuclide calibration factors non-volatile
- Features auto-start, auto-print and auto-reset functions
- Complies with IEC 61145

The process for the production of nuclides used for applications in PET (positron emission tomography) creates high nuclide activities. Especially the production of the ^{18}F isotope, which is included in the FDG radiopharmaceutical (fluordeoxyglucose), and the ^{15}O isotope require an isotope calibrator suited for high activity measurement. The PET CURIEMENTOR 4 isotope calibrator includes a well ionization chamber with argon gas filling at 1,5 bar pressure. The geometrical design of the PET chamber is identical to the standard chamber design. The ^{18}F measuring range is from 0.1 MBq to 350 GBq. The system measures and displays the activity of nuclides with very short half-life time continuously. The PET isotope calibrator consists of a T33007 PET ionization chamber and a CURIEMENTOR 4 display unit. The chamber cable length is 3 m. The PET isotope calibrator is calibrated for high activity measurement. The use of the CURIEMENTOR 3 or CURIEMENTOR 4 standard units is recommended for low and medium activity measurements.

Ordering Information

L981946 PET CURIEMENTOR 4 isotope calibrator 115/230V; incl. PET well chamber, display unit, liner

▸ Options *page 114ff.*

Radioactive Check Device

^{137}Cs check source for CURIEMENTOR performance checks, including shielded storage container

Features

- Checks the consistent performance of isotope calibrators
- Includes ^{137}Cs nuclide with a long life span
- Classified for class C.23323 according to ISO 2919
- Comes in a stable wooden case with handle and internal lead shielding

The sealed radioactive ^{137}Cs check source of 3.7 MBq (100 µCi) activity is designed for routine checking of isotope calibrators to detect instability. The gamma emitting ^{137}Cs nuclide of 662 keV with 30.17 years half-life has a long live span, so that only little correction for decay is required. The source matches the form of the samples to be assayed. It consists of an outer plastic (PVC) holder, shaped to resemble a 10 ml multidose vial, type P6 (diameter 20 mm, height 57 mm). This contains the ^{137}Cs source, which is incorporated in a ceramic pellet and welded in a stainless steel capsule. The shape of the source enables easy handling using forceps.

The radioactive source is supplied in a wooden container with integral lead shielding of 25 mm thickness for radiation protected storage and transport. The source should only be removed from the case for isotope calibrator checks. The external case dimensions are 20 cm diameter and 22 cm height.

The source is classified according to ISO 2919 and equivalent to class C.23323. Please observe national regulations for transport and use of radioactive material. Before shipment, we need confirmation certifying that the purchaser is allowed to handle the radioactive source.

Ordering Information

L971001 Radioactive check device for CURIEMENTOR

▸ CURIEMENTOR Isotope Calibrators *page 113f.*

Ionization Chamber Lead Shielding

Sectional lead rings for radiation shielding of the CURIEMENTOR ionization chamber

Features

- Makes it possible to shield the CURIEMENTOR chamber type T33003 and T33007 separately
- Protects measurements against falsification by external radioactive sources
- Protects operating staff against irradiation from radioactive sources inside the ion chamber

The separation of the CURIEMENTOR ionization chamber and the display unit makes it possible to fit a lead shielding around the chamber. This concept ensures optimum radiation protection. The operating staff are not exposed to radiation during the measurement of activity placed in the chamber well, and other radioactive sources in the vicinity of the chamber cannot falsify the measurement.

The dimensions of the assembled shielding are:

Outside diameter:	163 mm
Height:	123 mm
Lead wall thickness:	40 mm

An additional cap model T33003.1.132 can be used to close the shielding completely.

Ordering Information

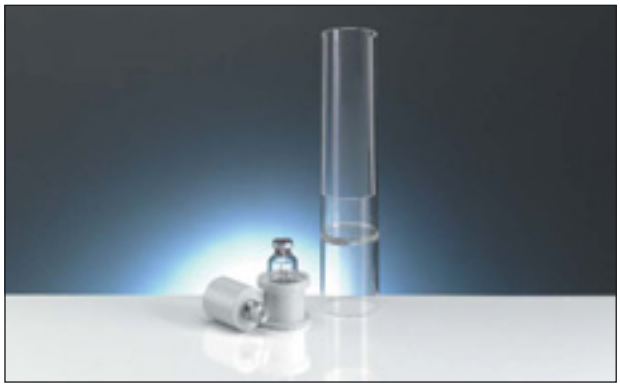
T33003.1.130 CURIEMENTOR lead shield

Option

T33003.1.132 CURIEMENTOR lead shield, cap

▸ CURIEMENTOR Isotope Calibrators *page 113f.*

CURIEMENTOR® Accessories



Optional accessories for sample positioning inside the well chamber of CURIEMENTOR isotope calibrators

Features

- Lead shielding checks the ^{99}Mo breakthrough
- Plastic liners accommodate measuring samples

The lead absorber T33003.1.140 accommodates ^{99m}Tc samples to check a possible molybdenum breakthrough of ^{99m}Tc generators. It absorbs the low-energy ^{99m}Tc radiation totally, but not the high-energy ^{99}Mo radiation.

Plastic liners are used to insert measuring samples such as vials and syringes into the well chamber.

Ordering Information

T33003.1.140 Lead absorber for Mo breakthrough test
T33003.1.110 Plastic liner

▸ CURIEMENTOR Isotope Calibrators *page 113f.*

CURIEMENTOR®
Label Printer

Thermal printer for printing CURIEMENTOR measuring results on labels

Features

- Prints CURIEMENTOR results on label paper
- Printing is automatically controlled by the CURIEMENTOR isotope calibrator
- Connects to the CURIEMENTOR 3 or CURIEMENTOR 4 display units

To print the measuring data of the CURIEMENTOR 3 and CURIEMENTOR 4 isotope calibrators on paper labels, the suitable printer can be connected to the display unit via a serial interface. The user has the possibility to print the measuring results including administrative data on self-adhesive stickers of a thermal paper roll. The width of the paper roll is 58 mm. The label size is 50 mm x 30 mm. The printer is connected to the mains via a power supply, which is included in the delivery.

Ordering Information

L991427 Thermal label printer
including power supply (100 ... 230) V
L178048 Connection cable between printer and CURIEMENTOR isotope calibrator
L502119 Roll with 500 self-adhesive stickers

- CURIEMENTOR Isotope Calibrators *page 113f.*

Quality Control

Quality Control Equipment

Quality Control in Nuclear Medicine

Today nuclear medicine is a well-established imaging modality in many medical fields such as neurology, cardiology and oncology and provides functional information about specific organs. Nuclear medicine diagnostic applications are growing fast and modern technologies result in increased imaging quality.

New CdTe and CdZnTe solid-state detectors replace the NaI scintillation crystals since they provide higher spatial resolution and enhanced contrast of nuclear medicine gamma cameras.

There has also been notable technical progress in single photon emission computed tomography (SPECT) by using new detector technologies combined with improved collimator design such as multiple-pinhole SPECT imaging.

Positron emission tomography (PET) provides an alternative to the use of collimators to form images. Considerable progress has been achieved in the design of PET scanners and thus led to an increase in the use of PET in clinical research and practice. Modern hybrid systems combine PET and CT for image fusion, and specialized PET scanners are designed for small animal diagnosis.

The complex techniques of modern nuclear medicine imaging systems require sophisticated test equipment for regular quality control. The test tools must be adapted to the different imaging techniques according to international standards and national guidelines such as IEC or NEMA standards. Specialized phantoms for quality control procedures of nuclear medicine imaging devices are available from PTW:

- Gamma cameras for planar scintigraphy are tested by flood phantoms, tungsten bar phantoms and orthogonal hole phantoms
- SPECT systems are tested by body shaped phantoms with test inserts
- PET scanners are tested by body-shaped phantoms with test inserts and by NEMA cylinder and tube phantoms
- Cardiology procedures are tested by the dynamic heart phantom
- Animal PET systems are tested by the appropriate phantoms
- Thyroid uptake systems are tested by a thyroid mimicking neck phantom

PET Cylinder Phantom acc NEMA NU2-2001

Cylinder phantom with line source tube for quality control of positron emission tomographs (PET scanners)

Features

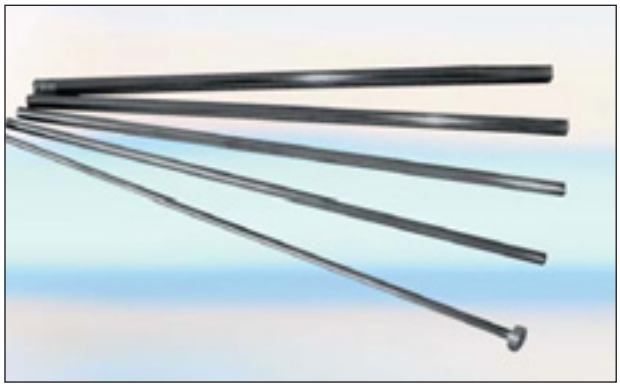
- Enables users to perform scatter fraction, count loss and random measurements on PET scanners
- Consists of a long polyethylene cylinder with an eccentric line source tube
- Complies with Section 4 of NEMA standard NU2-2001

One purpose of the test procedure based on the PET cylinder phantom is to measure the relative system sensitivity of positron emission tomographs to scattered radiation. Another purpose is to measure the effects of system dead-time and the generation of random events at several levels of source activity. The phantom used for these purposes is a polyethylene cylinder of 700 mm length and 200 mm outside diameter. A plastic tube homogeneously filled with ^{18}F liquid is inserted for the measurement at a distance of 45 mm parallel to the central axis. This line source has an outside diameter of approx. 5 mm and a length of approx. 800 mm. The measurement setup, data collection and analysis are described in Section 4 of the NEMA standard NU2-2001.

Ordering Information

L991204 PET Cylinder phantom acc NEMA NU2-2001, Section 4

PET Sensitivity Phantom acc NEMA NU2-2001



Sensitivity tube phantom with line source tube for quality control of positron emission tomographs (PET scanners)

Features

- Enables users to measure sensitivity on PET scanners
- Consists of five metal sleeves with different diameters and a line source tube
- Complies with Section 5 of NEMA standard NU2-2001

The purpose of the test procedure based on the PET sensitivity phantom is to measure the sensitivity or ability of positron emission tomographs to detect positrons. The phantom used for this purpose is a set of five metal tubes of 700 mm length and 2.5 mm wall thickness each. The outside diameters are 9.5 mm, 12.7 mm, 15.9 mm, 19.1 mm and 22.2 mm. A plastic tube homogeneously filled with ^{18}F liquid is inserted for the measurement. This line source has an outside diameter of approx. 5 mm and a length of approx. 800 mm. Successive measurements are made by accumulating the sleeve wall thickness with the uniform line source surrounded by known absorbers. From these measurements, the sensitivity without absorbers can be extrapolated to arrive at an attenuation free measurement. The measurement setup, data collection and analysis are described in section 5 of the NEMA standard NU2-2001.

Ordering Information

L991205 PET Sensitivity phantom acc NEMA NU2-2001, Section 5

PET Emission Phantom acc NEMA NU2-2001

Body-mimicking emission phantom for realistic quality control of PET scanners acc NEMA NU2-2001

Features

- Simulates realistic conditions by utilizing a body-shaped acrylic vessel
- Includes a cover with six spherical inserts and an absorber
- Inserts can be filled and emptied from outside
- Complies with Section 7 of NEMA NU2-2001

The PET Emission Phantom L981606 complies with the phantom design of the NEMA standard NU2-2001. The phantom is described in Section 7 “Image quality, accuracy of attenuation and scatter corrections.” It has the same asymmetric shape as the CEC and the IEC body phantom and simulates the human body in the range of thorax and abdomen. A circular cover with six mounted, hollow glass spheres completes the phantom. The inner active diameters of the spheres are 10 mm, 13 mm, 17 mm, 22 mm, 28 mm and 37 mm and the wall thickness is approx. 1 mm. The hollow spheres can be filled with water for cold lesion imaging and with ^{18}F for hot lesion imaging. They can be filled or emptied easily from outside with the help of a syringe. To simulate the attenuation of a lung, a cylindrical insert of 50 mm outside diameter is attached to the center of the cover with hollow spheres.

Ordering Information

L981606 PET emission phantom,
complete set acc NEMA NU2-2001

Option

L522020 Storage and carrying case

SPECT Phantom acc IEC 61675-2

Body-mimicking emission phantom for realistic quality control of SPECT scanners acc IEC 61675-2

Features

- Includes a head phantom with 200 mm outside diameter
- Includes a cover to insert point and line sources
- Inserts can be filled and emptied from outside
- Complies with IEC 61675-2

The SPECT emission phantom is an acrylic cylinder of 200 mm outside diameter and an active length of 190 mm. It simulates the head and can be supplied with a circular cover to insert point and line sources. The sources are introduced via three thin wall acrylic tubes of 7 mm diameter that are placed in the center and at distances of 45 mm and 90 mm from the center. If the tubes are not in use, they can be filled with scattering material. There are three point source holders of lengths 100 mm, 120 mm and 140 mm for placing small point sources at their tips. The line source is a glass capillary with 1 mm diameter, which is filled by a syringe.

Ordering Information

L981607 SPECT emission phantom,
complete set acc IEC 61675-2

Option

L522020 Storage and carrying case

PET Emission Phantom acc CEC Project

Body-mimicking emission phantom for realistic quality control of PET scanners acc CEC Concerted Action Project

Features

- Simulates realistic conditions by utilizing body-shaped acrylic vessels
- Includes covers with various inserts
- Inserts can be filled and emptied from outside
- Complies with the European PET Instrumentation Program

The PET emission phantom L981602 was published by a task group of the Commission of the European Community (CEC Concerted Action Project). The phantom has been developed in line with the philosophy that assessment of a clinical measuring system should always be made under the most realistic conditions possible to imitate the patient's influence as an absorbing and scattering medium. One of the circular covers with different inserts may be mounted to the head phantom H or to the body phantom B, with a water tight seal in all cases. The possibility of filling and emptying the inserts and phantom from outside is one of the main advantages of this phantom.

The package includes:

- Body phantom B with two arms attached
- Head phantom H
- Cover D with three cylinders, each 50 mm in diameter for different absorbing material
- Cover E with six spheres of 10 mm, 13 mm, 17 mm, 22 mm, 28 mm and 37 mm inner active diameter
- Blind cover G without inserts,
- Cover M with point, line and scatter sources
- Cover R with a rod source of 21 mm inner diameter
- Heart phantom C
- Carrying and storage case

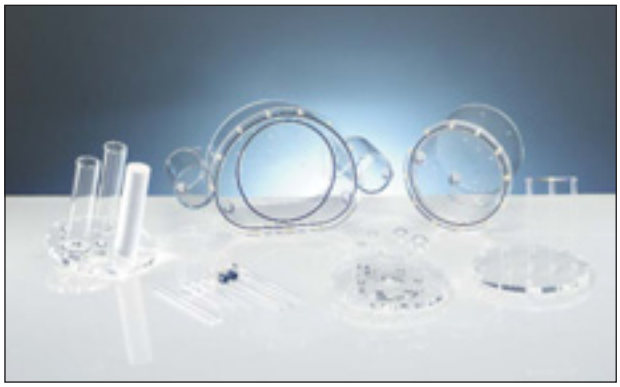
Ordering Information

L981602 PET emission phantom,
complete set acc CEC project

Option

T43004.1.012 Lung equivalent insert

PET Emission Phantom acc IEC 61675-1



Body-mimicking emission phantom for realistic quality control of PET scanners acc IEC 61675-1

Features

- Simulates realistic conditions by utilizing body-shaped acrylic vessels
- Includes covers with various inserts
- Inserts can be filled and emptied from outside
- Complies with IEC 61675-1

The international standard IEC 61675-1 adopted the proven concept of the PET emission phantom according to the European PET program. The major components are identical with the PET phantom based on the European standard. They realistically simulate a patient during a PET examination in the same manner and fulfill the requirements of the IEC standard.

The package includes:

- Body phantom B with two arms attached
- Head phantom H
- Cover D with three cylinders, each 50 mm in diameter for different absorbing material
- Cover E with six spheres of 10 mm, 13 mm, 17 mm, 22 mm, 28 mm and 37 mm inner active diameter
- Blind cover G without inserts
- Cover M with point, line and scatter sources
- Carrying and storage case

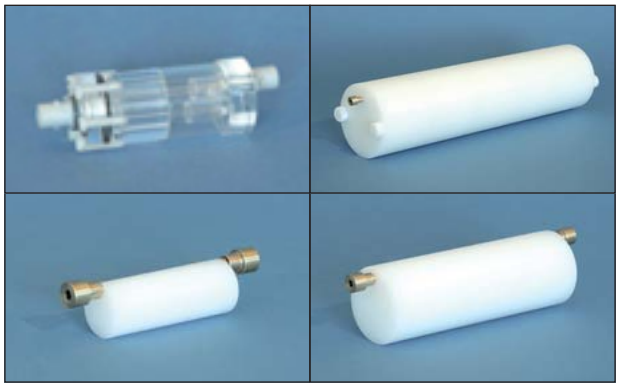
Ordering Information

L981605 PET emission phantom,
complete set acc IEC 61675-1

Option

T43004.1.012 Lung equivalent insert

Animal PET Phantoms acc NEMA NU4-2008



Phantoms for performance measurements of animal PET systems

Features

- Image quality phantom from acrylic glass with removable lid
- 3 different sizes of cylinder phantoms from polyethylene each containing an eccentric bore hole
- Comfortable and bubble-free filling
- Complies with standard NEMA NU4-2008

The Small Animal PET Phantom is an image quality phantom for performance measurements according to NEMA Standard NU4-2008, page 21, for verification or for comparison of animal PET systems. It consists of a fillable cylindrical main chamber as upper part of the phantom, 5 fillable rods drilled through the lower solid part and 2 cold region chambers, to be filled with non-radioactive water or air, reaching into the main chamber. A removable lid is attached for easy drying. The phantom contains application adapters at both sides for bubble-free filling and emptying.
The PET Monkey Phantom, PET Mouse Phantom and the PET Rat Phantom are designed for performance measurements according to NEMA Standard NU4-2008, page 10, for verification or for comparison of count rates of animal PET systems. They consist of a phantom body manufactured from polyethylene with a precise eccentric bore hole for the line source. The line source consists of flexible micro-tube material with an application adapter for filling at one side and a ventilation adapter at the opposite side.

Ordering Information

L991421 Small Animal PET Phantom acc NEMA NU4-2008, page 21

L991420 PET Monkey Phantom acc NEMA NU4-2008, page 10

L991418 PET Mouse Phantom acc NEMA NU4-2008, page 10

L991419 PET Rat Phantom acc NEMA NU4-2008, page 10

L991426 Small Animal PET Phantom Set acc NEMA NU4-2008

Animal PET QC Phantom

Acrylic phantom for quality control of animal PET scanners and of pinhole SPECT systems

Features

- Checks the performance of animal PET and pinhole SPECT systems
- Includes a number of fillable holes
- Phantom is divided into five segments with different hole diameters and hole distances

The animal PET phantom is designed for checking the performance of small animal PET scanners and pinhole SPECT systems in the limit ranges of resolution and image quality. The animal PET phantom consist of an acrylic cylinder accommodating a number of holes with various diameters, which can be filled with radioactive liquid. The circular phantom is divided into five segments with different hole specifications. The hole diameters are 1.0 mm, 1.5 mm, 2.0 mm, 2.5 mm and 3.0 mm, and the hole distances are 4.0 mm, 5.0 mm, 6.0 mm, 8.0 mm and 9.0 mm. All holes in each segment are interconnected to ensure regular liquid dispersion. The segments have two filling holes each to introduce cannulas for activity filling. The phantom has 10 filling holes. The long projections in the picture above are the cannulas.

Model 100/57 is a cylinder of 57 mm diameter and 135 mm height. The total number of holes is 54. The drilling depth for the accommodation of the holes is 105 mm and the height of the measuring field is 100 mm. The total height of the holes is 170 mm.

Ordering Information

L991358 Animal PET phantom model 100/57

Standard SPECT Phantom

Compact acrylic phantom for quality control of SPECT systems

Features

- Checks the resolution by acrylic rods of different diameters
- Checks the contrast by acrylic spheres of different diameters
- Checks the inhomogeneity by homogeneous radioactivity distribution

The standard SPECT phantom is used for the determination of the tomographic specifications of SPECT systems. The phantom consists of a circular acrylic vessel of 200 mm diameter and 214 mm height including various test inserts. Three parameters can be checked simultaneously during one measuring cycle:

- The tomographic resolution is tested by a number of acrylic rods of different diameters located in six phantom sections. The rod diameters are 4.0 / 6.0 / 8.0 / 10.0 / 12.0 and 15.0 mm.
- The tomographic contrast is tested by six fully acrylic spheres with diameters of 9.5 / 14.4 / 19.0 / 25.4 / 31.8 and 38.1 mm, simulating cold spots.
- The tomographic inhomogeneity is checked by a phantom volume with homogeneously distributed radioactive liquid. The height of the homogeneous volume is 26 mm.

The cover plate is sealed and firmly screwed to the phantom body. The phantom can be air-free filled through openings in the cover plate, which are sealed after the filling procedure. Flanges on the cover and bottom plates make it possible to roll the phantom and intermix the radioactive liquid.

The phantom wall thickness is 3 mm, and the thickness of the cover and bottom plates is 12 mm each. The total weight of the liquid filled phantom is 6.3 kg.

Ordering Information

L991359 Standard SPECT phantom

Dynamic Heart Phantom

Dynamic heart phantom simulating the left heart ventricle for quality control of imaging systems in nuclear medicine

Features

- Validates the evaluation programs of imaging systems in nuclear cardiology
- Simulates realistically the cardiac action of the left ventricle by a microprocessor controlled pump station
- Fits into the body-shaped PET and SPECT phantoms

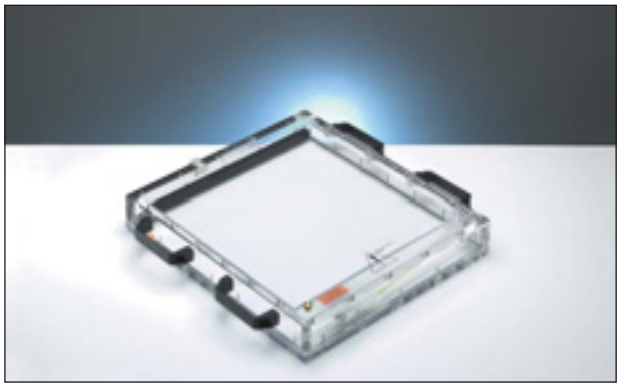
The Dynamic Heart Phantom is designed for validation and optimization of diagnostic imaging systems in nuclear medicine cardiology. It is based on a twin membrane, which simulates the left ventricle realistically. A computer-controlled pumping station compresses and decompresses the inner membrane with variable heartbeat simulation and pump volume. The pumping frequency can be controlled up to 60 cycles per minute. The cardiac volumes can be filled with active or inactive liquids and thus the heart contraction process and the variation of the ventricle wall thickness can be determined for the imaging system to be checked. An ECG triggering at the moments of systole and diastole is available.

The Dynamic Heart Phantom is firmly mounted into a body-shaped thorax phantom according to IEC and NEMA, consequently providing realistic simulation of the heart function to evaluate the processes influencing realistic imaging such as the application of algorithms for attenuation correction.

Ordering Information

L991356 Dynamic Heart Phantom

Flood Phantoms for QC of Gamma Cameras



Rigid flood phantoms with built-in circulation pump for system inhomogeneity tests of gamma cameras

Features

- Utilize an integrated circulating pump for automatic fluid mixing to guarantee a homogenous activity distribution
- Reduce contamination risk thanks to a compact, closed system
- Various sizes for the most types of gamma cameras are available
- Comply with IEC 60789

The purpose of the phantoms is the generation of correction matrices and the performance of regular constancy tests of the system inhomogeneity, the most important parameter for quality control of gamma cameras. The flood phantoms of the FP series are available in various dimensions for different detector sizes. They have some unique features for measuring precisely, saving time and protecting users against radiation exposition: The cuvette wall thickness of 20 mm and a defined extension volume ensure stable geometry and high measuring precision when using the filled phantom. The activity of the test isotope is distributed homogeneously in the filling volume of distilled water by a built-in circulating pump. The special chamber design of the cuvette volume provides for a bubble-free field of view.

Ordering Information

Flood phantoms

L991206 Model FP47 for 24 cm x 40 cm field of view
L991211 Model FP67S for 40 cm x 54 cm field of view
L991256 Model FP73 for Siemens Body Scan
L991213 Power supply (90 ... 264) V

- Flood Phantom Positioning Carts *page 125*
- ATW3 Shielded Transportation Cart *page 125*

Flood Phantom Applications

Gamma Camera Model	Flood Phantom Model
Philips (Picker/Marconi)	
Prism 1000	FP67S
Prism 1500	FP67S
Prism 2000	FP67S
Prism 3000	FP47
AXIS	FP67S
IRIX	FP67S
Philips (ADAC)	
Forte	FP67S
Skylight	FP67S
Vertex	FP67S
Argus Epic	FP67S
Cardio Epic	FP67S
Genesys Epic	FP67S
Solus Epic	FP67S
General Electric	
Millennium MPR	FP67S
Millennium MPS	FP67S
Optima-NX	FP47
Hawk Eye	FP67S
General Electric (Elscint)	
Vari Cam	FP67S
SPX Helix	FP67S
SPX Cardial	FP67S
SPX 6	FP67S
SPX 4	FP67S
General Electric (SMV/Sopha)	
Vision DST XL	FP67S
Vision DSX	FP67S
Vision FX	FP67S
Vision FX 40	FP67S
Vision FX 80	FP67S
Vision DS7	FP67S
Siemens	
E.Cam	FP67S
Multispect 2	FP67S
Multispect 3	FP67S
Diacam	FP67S
Orbiter	FP67S
Body Scan	FP73
Symbia	FP67S
Mediso	
X-Ring R	FP67S
X-Ring C	FP67S

Flood Phantom Positioning Carts

Mobile trestles to position flood phantoms in relation to gamma cameras for homogeneity tests

Features

- Ensure precise, stable and reproducible positioning of FP flood phantoms in relation to gamma cameras
- The trestles are mobile and handling is easy
- Three standard solutions are available

Because of their substantial weight including water filling, especially the large flood phantoms require an appropriate mobile device for precise and reproducible positioning.

Model PW67S:
The PW67S positioning cart is a mobile trestle with frame for positioning the flood phantom model FP67S in relation to the Philips gamma cameras types PRISM 1500, AXIS, IRIX, Forte and Skylight, the Siemens gamma cameras types E.Cam and Symbia and the Mediso gamma cameras types X-Ring R and X-Ring C.

Model APW1:
The APW1 positioning cart is a mobile trestle with 3 mm lead shielding for storage and positioning of the FP65 flood phantom in relation to Philips gamma cameras types PRISM 1000 and PRISM 2000. The GR65 holding frame is required to operate the phantom in combination with the model APW1.

Model HR65:
The HR65 holding frame is an economic alternative to the APW1 model to position the FP65 flood phantom in relation to Philips gamma cameras types PRISM 1000 and PRISM 2000.

Other types of gamma cameras require individual solutions.

Ordering Information

L991215 Positioning cart model PW67S
L991216 Shielded positioning cart model APW1
L991217 Holding frame model GR65 for APW1
L991218 Holding frame model HR65

▸ Flood Phantoms for QC of Gamma Cameras *page 124*

ATW3 Shielded Transportation Cart

Shielded cart for the storage and transport of up to two flood phantoms, filled with radionuclide activated water

Features

- Stores flood phantoms with radioactive filling for shielded decay after use
- Includes two compartments for simultaneous storage of up to two flood phantoms of any type
- Charging and discharging can be done from top and from one side.

The shielded transportation cart ATW3 is used for easy transportation and radiation-protected storage of up to two flood phantoms of the FP flood phantom series. Phantoms up to the size of the FP67S flood phantom can be stored after use. This keeps the filling in the flood phantoms and the radioactive test isotope can decay over time. The emptying and refilling of the flood phantoms are avoided. The interior space of the cart is divided into two compartments by a dividing wall, ensuring that the flood phantoms cannot damage each other in case of double load. Charging and discharging can be done from top after having opened the cover flap as well as laterally after having opened the side door.

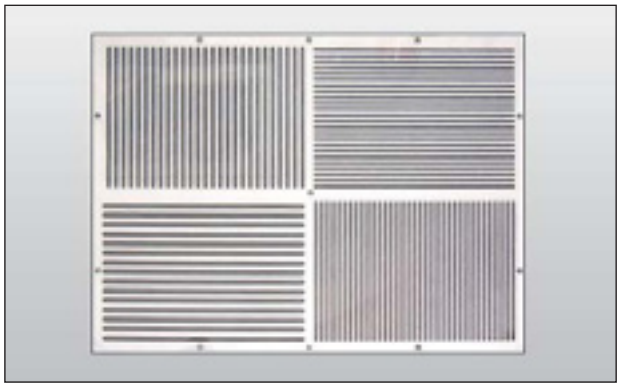
The cart is equipped with a 3 mm lead shielding in all directions. This is destined for safe storage of flood phantoms with radioactive fillings that have not decayed yet. Large castors make the cart easy to move. The weight is approx. 95 kg.

Ordering Information

L991214 Shielded transportation cart model ATW3

▸ Flood Phantoms for QC of Gamma Cameras *page 124*

Tungsten Bar Phantom for Gamma Camera QC



Tungsten bar phantom for spatial resolution and linearity tests of planar gamma cameras

Features

- Checks the spatial resolution and the linearity of planar gamma camera images in nuclear medicine
- Ensures high precision by utilizing tungsten cast bars
- Includes four resolution quadrants
- Suitable for all current gamma camera models

The unique bar phantom uses tungsten bars instead of lead bars to achieve higher precision in spatial resolution and linearity tests of gamma cameras with planar scintillation crystal. The phantom consists of four quadrants with different bar specification:

Quadrant	Number of bars	Bar width and spacing	Bar length
Quadrant 1	41	3.2 mm	190 mm
Quadrant 2	24	4.0 mm	260 mm
Quadrant 3	28	4.8 mm	190 mm
Quadrant 4	15	6.4 mm	260 mm

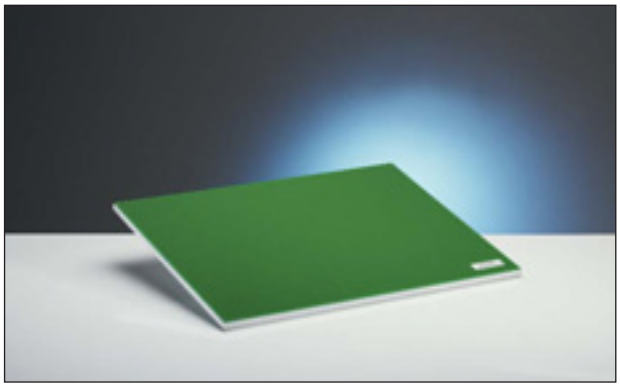
The tungsten bar thickness is 5 mm and the density is 10 g/cm^3. The orientation from quadrant to quadrant is 90° rotated. The cast tungsten bars are embedded in the acrylic phantom body of 1.19 g/cm^3 density. The large size bar phantom offers optimum test conditions for all current gamma camera models.

The external dimensions are 54 cm x 40 cm x 1.75 cm and the weight is approx. 6 kg. Customized versions are available upon request.

Ordering Information

L991360 Tungsten bar phantom

QUASI 3 Orthogonal Hole Phantoms



Imbedded lead plates with hole matrix for geometry tests of gamma cameras for planar scintigraphy

Features

- Enable users to perform geometric tests on gamma cameras
- Four phantom types with different hole diameters are available

The QUASI 3 orthogonal hole phantom is used for constancy tests of single crystal gamma cameras for planar scintigraphy. They enable users to test the spatial resolution, linearity and image scale. The phantoms are based on a lead plate of 3 mm thickness, which is supplied with a matrix of parallel holes. The hole distance is 8 mm and the hole diameter is 1.6 mm, 2.4 mm, 3.2 mm or 4.0 mm, depending on the phantom type. The effective viewing area is 560 mm by 420 mm. The weight is approx. 13 kg.

Ordering Information

L991148 QUASI 3 Orthogonal hole phantom, hole diameter 1.6 mm

L991149 QUASI 3 Orthogonal hole phantom, hole diameter 2.4 mm

L991150 QUASI 3 Orthogonal hole phantom, hole diameter 3.2 mm

L991151 QUASI 3 Orthogonal hole phantom, hole diameter 4.0 mm

L991280 QUASI 3 Orthogonal hole phantom, hole diameter 4.0 mm, with 8 marked holes

L991281 QUASI 3 Orthogonal hole phantom, hole diameter 5.0 mm, for Siemens E.CAM

Thyroid Uptake Neck Phantom

Cylindric polyethylene phantom for realistic simulation of a thyroid for quality control of uptake measuring devices

Features

- Simulates the thyroid with neck realistically
- Made of polyethylene instead of acrylic glass
- Can be used with a vial, a test tube or a capsule with radioactive material

The thyroid uptake neck phantom is used to check the proper performance of uptake measuring devices by simulating a thyroid in its anatomic position with respect to realistic absorption and scattering conditions in tissue. The phantom consists of a polyethylene cylinder (130 mm diameter by 120 mm height) and two inserts. Polyethylene with a density of 0.96 g/cm³ imitates the absorption and scattering conditions more realistically than acrylic material.

The eccentric hole in the phantom cylinder accommodates two inserts to measure the initial pulse rate of radioactive material in a vial, a test tube or a capsule. The position of the thyroid in the phantom and by this the source distance can be varied by turning one of the inserts, supplied with an eccentric hole. There are mark lines on the phantom surface as an adjustment aid. The holes have the following dimensions:

- Hole in the phantom body:
  52 mm diameter by 94 mm height
- Hole in the insert for a test tube:
  33 mm diameter by 97 mm height
- Hole in the insert for a capsule:
  8 mm diameter by 97 mm height

The total weight of the phantom with inserts is approx. 1.5 kg.

Ordering Information

L991220 Thyroid uptake neck phantom

PET Lab Products from TEMA Sinergie

PTW-Freiburg represents TEMA Sinergie, Italy, with respect to PET Lab equipment

Product Line

- Shielded Hot Cells for synthesis modules
  - Single, double, research cells
- Manipulation cells with laminar flow
  - Airtight, unshielded/shielded manipulation cells
  - Cells for sterile dispense and PET/NM handling
  - ^{68}Ga manipulation cell
- Dispensing Hot Cells
  - Cells for automatic and semi-automatic vial dispensing with and without autoclave
- Working benches with laminar flow
  - Microbiologic security bench
  - Bench for nuclide generators
- Semi-automatic / Automatic dispensing stations
  - Stations for syringes, vials and combined system
- Environmental monitoring systems
  - Local and central radiation monitoring systems
  - Air monitoring systems
  - Contamination monitors
- Nuclear medicine accessories
  - Vial and syringe shielding
  - Shielded containers and safes
- Waste management system for diagnostic and therapeutic nuclear medicine
- Cyclotron bunker equipment
  - Shielded sliding and revolving doors
  - Radioisotope supply system
  - Safety control system

Product Information

For more detailed product information please, visit our websites at www.ptw.de or www.temasinergie.it.

Territories

Since the territories are restricted where PTW-Freiburg may deliver, please let us know the intended final destination of the TEMA products you are interested in.

Notes

HEALTH PHYSICS

Health Physics

Radiation protection principles

Any increment of dose from ionizing radiation above natural background causes some additional risk of cancer. The knowledge about deterministic and stochastic radiation effects on human bodies has increased over the past years. The evolution of the recommended dose limits on the total body to ionizing radiation shows a continuous reduction from 36 Sv/year in 1902 to 20 mSv/year in 1990, introduced by the ICRP report 60[1]. ICRP demands justification of exposure practices:
"No practice involving exposures to radiation should be adopted unless it produced sufficient benefit to the exposed individuals or to society to offset the radiation detriment it causes."

Furthermore, ICRP requires optimization by keeping "all doses as low as reasonably achievable, economic and social factors being taken into account."

Finally ICRP has called for observance of individual dose and risk limits: " The exposure of individuals resulting from the combination of all the relevant practices should be subject to dose limits, or to some control of risk in the case of potential exposures. "

In recent years, the risk of exposures by ionizing radiation has increasingly been a subject of discussion and debate. This discussion is still continuing. Nevertheless, awareness of the risk of radiation exposure has increased considerably internationally. Supervision of radiation risks and control by radiation measuring instrumentation are subject to high standards today.

[1] ICRP 60, 1990 Recommendations of the International Commission on Radiological Protection. Report #60.

Radiation protection dosimetry

The measurement of environmental radiation levels and the radiation exposure to persons are major tasks of radiation protection practices. PTW supplies a wide range of products to support radiation protection practitioners in their daily work:

- Personal dosimetry can be performed using various dosimetry systems such as electronic dosemeters, dosimetric film badges, TLD finger rings, phosphate glass dosemeter and Albedo personal neutron dosemeter.
- The radiation monitoring instrumentation is used for surface contamination measurement in radionuclide laboratories such as nuclear medicine laboratories and for the measurement of gamma radiation levels in environments.
- The precise calibration equipment is required for the proper calibration of dosemeters used for radiation monitoring.
- The PTW secondary standard calibration laboratory offers a comprehensive range of calibration services for various radiation beam qualities and dose rates.

Radiation Monitoring

Radiation Monitoring Equipment

Radiation Monitoring

Radiation Protection Considerations

According to the international ICRP 60 standard[1] radiation exposure to humans has to be as low as reasonably achievable (ALARA principle). Furthermore, the ICRP requires control of risk in the case of potential exposures and observance of certain dose limits.

The available radiation monitoring equipment is quite multifarious depending on the differing characteristics of a multitude of beam qualities and dose rate ranges as well as the variety of measuring tasks. The equipment is used for highly sensitive measurement of natural background radiation or for dose level measurements of artificial radiation sources such as nuclear research laboratories, nuclear power plants and medical irradiation units.

The control of potential radiation expositions and the measurement of radiation loads to persons working in areas of exposure risk are basic requirements of radiation protection procedures. PTW supplies radiation monitoring equipment that helps persons in charge to meet these requirements.

[1] ICRP 60, 1990 Recommendations of the International Commission on Radiological Protection. Report #60

Radiation protection dosimetry

- Personal Dosemeters

  A variety of pocket-sized and light-weight digital radiation monitors are available for continual personal dosimetry to safeguard all personnel against the hazards of ionizing radiation. Other personal dosemeters are film dosimetry badges, phosphate glass dosemeters, Albedo neutron dosemeters and TLD finger rings.

- Mobile monitors

  Surfaces in radionuclide laboratories such as nuclear medicine laboratories are monitored by the large area contamination monitor.
  The portable STEP dosemeter enables the user to monitor radiation levels in the environment, e.g., in the surroundings of radiation emitting units.

- Stationary monitors

  Ionization chambers of various volumes to monitor different gamma levels are used in connection with high quality dosemeters.

  The moderator sphere in combination with Albedo dosemeters detects thermal neutron radiation levels.

  The X-ray leakage system checks the leakage radiation of diagnostic X-ray tubes.

- Radiological calibration

  The calibration bench with carriage, tube support, filter wheel and dose monitor is required for dosemeter calibration.

  Various high quality ion chambers are available for precise calibration of dosemeters according to different measuring quantities and dose rates.

  The PTW calibration laboratory offers comprehensive radiological calibration services.

Contamination Monitor

Monitor with plastic scintillator for radioactive contamination measurement of surfaces in nuclear medicine laboratories

Features

- Utilizes a large size thin-layer plastic scintillation detector
- Does not require detector gas filling or gas flow
- Measures alpha, beta and gamma radiation using one detector
- Provides data logging and data transfer via an RS232 interface

Radiation protection regulations require that everybody working with unsealed radioactive materials must be checked regularly to determine whether work areas, protective clothing or body surfaces have become contaminated. The portable contamination monitor model CoMo 170 measures alpha, beta and gamma contamination with a high degree of sensitivity, utilizing a thin plastic scintillation detector of 170 cm^2 measuring area. This detector type causes less operating expenses and repair costs compared to proportional detectors with Xenon gas-filling or gas flow. A background subtraction function with adjustable background measurement time is included. The measuring results are presented on an illuminated large-area graphical LC display. The measurement is menu-prompted, and the measuring data are stored internally. The built-in RS232 interface and optional software make it possible to read and process the data. The monitor is operated by size AA batteries or by rechargeable batteries. A radioactive check device, external probes and optional accessories are available.

Ordering Information

L991221 Contamination monitor model CoMo 170

▸ Contamination Monitor Accessories *page 133*

Contamination Monitor Accessories

Optional wall mounts, floor control device and radioactive check device for contamination monitor

Features

- Helpful tools for extended use of the contamination monitor
- The radioactive check device checks monitor function
- Wall mounts accommodate the monitor for stationary use
- The floor control device simplifies floor checks

The optional radioactive check device with an activity of only 200 Bq ^{90}Sr is suitable checking the proper performance of the contamination monitor.

For stationary use, the monitor can be accommodated by a wall mount device. The operating staff is able to check their hands for radioactive contamination using the stationary monitor or to remove the monitor for surface checks of clothing or other subjects. Two types of wall stations are available: a passive wall mount, which just accommodates the monitor, and an active wall mount, which includes a voltage supply and a light barrier that activates the start of measurements. The active wall mount comes with an inductive voltage supply for 230V mains voltage and a direct cable connection for 115V mains voltage.

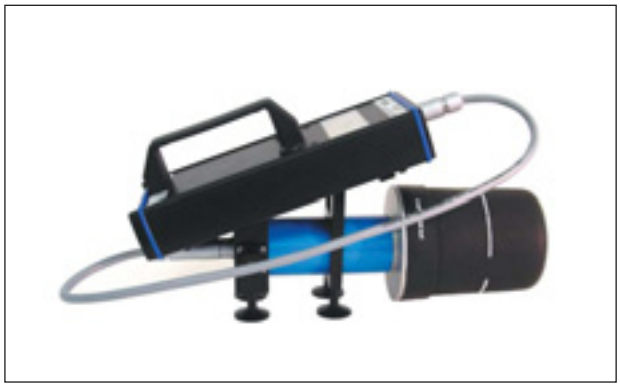
The mobile floor control device with guide rod and accommodated contamination monitor is used for easy contamination checks of floor areas.

Ordering Information

L991222 Radioactive check device 200 Bq ^{90}Sr
L991223 Stationary wall mount, passive
L991224 Stationary wall mount, active
(mains voltage 115V or 230V has to be specified)
L991225 Floor control device

▸ Contamination Monitor *page 133*

STEP OD-01 Survey Meter



Compact portable ion chamber dosemeter for dose and dose H(10), H´(0.07,Ω) rate measurements*

Features

- Serves for protection level dosimetry in a wide energy range of 6 keV to 10 MeV of X-rays and gamma rays (above 3 MeV an optional PMMA cap is necessary)
- Measures beta rays in a range of 80 keV to 3 MeV
- Provides wide measuring ranges for radiation protection levels:
  - Dose: (2 ... 2000) µSv
  - Dose rate: 0 µSv/h ... 2000 mSv/h
- Measures continuous and pulsed radiation

The STEP survey meter is used for protection level dosimetry in nuclear medicine laboratories and in the environment. Nuclear medicine therapy patients can be checked before release. The instrument is based on a 600 cm^3 large volume ionization chamber, which provides high precision and a wide range of health physics measurements. The unit is prepared for chamber volume air density corrections. The chamber can be separated from the display unit and located at a distance of 0.7 m by using the standard extension cable or up to 15 m by using the optional extension cable. The background-illuminated LCD display shows the measuring result in large characters and on a bar graph as well as the operating conditions. The STEP basic set comes with a battery operated display unit, a measuring probe and a carrying case.

Ordering Information

L991282 STEP survey meter OD-01

Options

L991284 PMMA cap for measurements above 3 MeV

L991285 probe extension cable, 15 m

Radioactive check device and more models available upon request

BLEEPER Personal Monitor

Personal pocket-sized radiation monitor

Features

- Suitable for personal X and gamma radiation protection measurements
- Provides audible dose rate indication and generates one bleep per 15 minutes in a natural background
- Two types are available:
  - BLEEPER III, 45 keV ... 6 MeV, audible dose rate indication
  - BLEEPER Sv Sw, 45 keV ... 6 MeV, audible dose rate indication and display of accumulated dose (1 ... 999999) µSv on an LCD, reset function.

The BLEEPER is a simple robust pocket radiation monitor for safeguarding all personnel against the hazards of X and gamma radiation. The available dose rate indication gives immediate warning when entering a higher radiation level. The BLEEPER slips easily into a pocket and is held firmly by a strong clip. A quiet series of "clicks" from the loudspeaker indicates that the instrument is operating correctly. The BLEEPER is battery operated. Its typical operating lifetime using standard batteries is more than one year. A change in bleep length indicates that the batteries need replacing.

Ordering Information

L991005 BLEEPER III Personal Monitor
L991032 BLEEPER Sv Sw Personal Monitor

Thermo EPD® Personal Dosemeter

Electronic personal dosemeter for $H_p(10)$ and $H_p(0.07)$ readouts of gamma, beta and X-radiation

Features

- Highly sophisticated multi-functional personal radiation monitor based upon modern detector technology
- Measures the new radiation quantities $H_p(10)$ and $H_p(0.07)$ according to ICRP

The EPD Mk2 electronic personal dosemeter is a modern digital monitor for personal radiation protection measurements. The nominal useful energy range for gamma radiation is 15 keV to 10 MeV, and the mean energy of beta particles may vary from 250 keV to 1.5 MeV. The dosemeter provides direct readout of dose equivalents $H_p(10)$ - deep/whole body - and $H_p(0.07)$ - shallow/skin - according to ICRP definitions, displayed in Sievert (Sv) or rem. The resolution is 1 µSv or 0.1 mrem. Alarm thresholds for the dose and dose rate measuring modes can be set. A variety of different audible and visual alarms are configurable via IR interface. Several digital readers are available to complement the Thermo EPD dosemeters. Certain functions are only programmable by external readers (e.g. presets of alarm thresholds, timer functions, personal ID numbers). All readers are supplied with the software EasyEPD2. The EPD Mk2 can be delivered with an official German authority calibration.

Ordering Information

L991017 Thermo EPD Mk2 Electronic personal dosemeter
L991362 Thermo EPD Mk2 Electronic personal dosemeter with official German authority calibration

L991218 Thermo EPD Basic IrDa Reader, RS232
L991295 Thermo EPD Basic IrDa Reader, USB
L991019 Thermo EPD Desktop Reader, RS232
L991294 Thermo EPD Desktop Reader, USB
S150004 EPDSYSTEM Software

Film Badges for Personal Dosimetry

Dose measuring film badges for personal dosimetry of the exposition to gamma radiation and X-rays

Features

- Suitable for personal gamma and X-ray dosimetry
- Accommodate a dose integrating radiographic film
- Analyze the beam quality by filter absorption

Persons working in environments with the risk of exposure to ionizing radiation are required to use a suitable personal dosemeter. Radiographic film dosimetry is commonly used for this purpose in many countries. An essential part of this system involves appropriate holders to accommodate radiographic films. The PTW film badges are supplied with sets of absorbing filters of different materials and thickness. Both models available are identical in general, but model 95004 includes a Pb/W filter combination to avoid an overestimation of 83 keV radiation (100 kV X-rays). Examinations of the exposed films after development by optical density measurements give an indication of exposure, and the filter pattern gives an indication of radiation type and energy. The image of pins on the badges show the direction of radiation incidence. Self-adhesive stickers for user identification fit into the recess of the badge front part. The film badges with clip can be combined with an optional neck-chain.

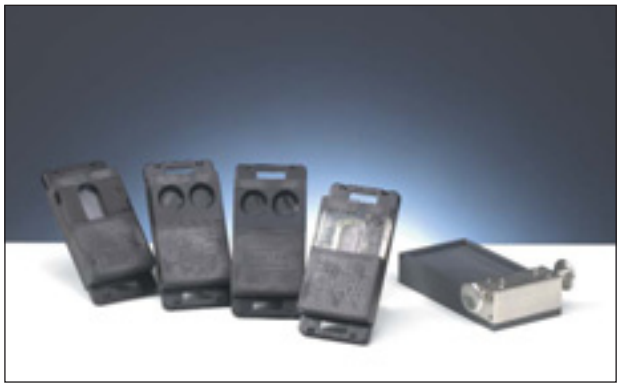
Ordering Information

L981041 Film badge 8621, with clip, orange housing
L981042 Film badge 8621, with needle, orange housing
L981043 Film badge 8621, with clip, yellow housing
L981044 Film badge 8621, with needle, yellow housing
L981045 Film badge 8621, with clip, blue housing
L981046 Film badge 8621, with needle, blue housing
T95004.1.010 Film badge 95004, with clip, orange housing
T95004.1.015 Film badge 95004, with needle, orange housing
T95004.1.020 Film badge 95004, with clip, yellow housing
T95004.1.025 Film badge 95004, with needle, yellow housing
T95004.1.030 Film badge 95004, with clip, blue housing
T95004.1.035 Film badge 95004, with needle, blue housing

Options

L655009 Neck-chain for film badges with clip
L502007 Self-adhesive stickers, 200 stickers per unit

Albedo Neutron Dosemeter Cases



Dosemeter cases for personal dosimetry of thermal neutrons in use with TLD readers from various suppliers

Features

- Measure the personal doses from thermal neutron radiation
- Accommodate thermoluminescent detector cards from various TLD manufacturers

The Albedo neutron dosemeters[1] are used for individual monitoring of personal exposure to thermal neutron radiation. The boron plastic capsules make it possible to measure the thermal neutron backscatter from the body of the wearer and the thermal neutrons from the radiation field. The neutron dose equivalent in the range above 0.03 mSv can be estimated within ± 30 %.

Thermoluminescent detectors in cards are placed in the Albedo dosimetry cases for measurement and then read out by an automatic TLD reader. Four types of Albedo dosemeter cases are available to accommodate the TLD cards of the TLD manufacturers Panasonic, Harshaw/Bicron/Thermo Electron, Vinten and Rados/Alnor.

The opening device is required to open the cases for insertion and removal of the TLD cards. Two types of optional clips with plastic loop are available to attach the cases to the clothing.

[1] The Albedo neutron dosemeters have been developed in co-operation with the Research Center Karlsruhe, Germany.

Ordering Information

L631016 Albedo dosemeter case, Panasonic
L631017 Albedo dosemeter case, Harshaw/Bicron/Thermo
L631091 Albedo dosemeter case, Harshaw/Bicron/Thermo with Al instead of plastic filter
L631018 Albedo dosemeter case, Vinten
L631019 Albedo dosemeter case, Rados/Alnor
T8741 Opening device for Albedo dosimeter cases

Options

L655004 Alligator clip for Albedo cases
L655005 Clip for Albedo cases

Moderator Sphere Neutron Area Monitor

300 mm polyethylene sphere for area monitoring of natural neutron radiation background using Albedo dosemeters

Features

- Suitable for area radiation monitoring
- Measures the neutron component of the annual background radiation in three months periods
- Uses the Albedo neutron dosemeters

The moderator sphere[1] is a passive dose equivalent meter for area monitoring of natural radiation background. It measures the neutron component of the natural annual background radiation of about 30 µSv. The monitoring period is at least 3 months. The passive neutron dose equivalent meter consists of a moderator polyethylene sphere of 300 mm diameter and a detector holder placed at a central position in the sphere. An Albedo dosemeter case with inserted TLD card is placed inside the detector holder for measurement. The user must specify the types of TLD card and Albedo dosemeter case.

In addition to the standard version of the moderator sphere, a waterproof version is available for use in the open air. A special support made of aluminum is used to set up the moderator sphere free in air at a certain distance from backscatter material.

[1] The moderator sphere has been developed in co-operation with the Research Center Karlsruhe, Germany

Ordering Information

T860 Moderator sphere 300 mm
T860/U901 Moderator sphere 300 mm, waterproof
T8601 Albedo dosemeter case insert for moderator sphere

Option

T8602 Support for moderator sphere

- Albedo Neutron Dosemeter Cases *page 136*

3 Liter Chambers for Radiation Monitoring

Cylindrical polyethylene ionization chambers for stationary radiation monitoring of gamma radiation

Features

- Vented sensitive volume of 3 liters
- Suitable as radiation monitoring chambers
- Gamma energy range 80 keV to 1.3 MeV

The 3 liter chambers are used as stationary surveillance devices for environmental radiation monitoring. The chambers are designed to measure protection level dose rates. The response is $1 \cdot 10^{-4}$ C/Sv. The maximum dose rate at 90 % saturation is 10 Sv/h. The chambers are fully guarded up to the measuring volume. Since the sensitive volume is open to the surroundings, air density correction is required for precise measurement.

The cylindrical chambers are made of graphite coated polyethylene with 4 mm wall thickness. The ion-collecting electrode is made of graphite coated polyethylene too. The external chamber diameter is 150 mm and the length is approx. 200 mm. For the transfer of the measuring signal and the polarizing voltage, the chambers are supplied with two coaxial connectors (model 34031) or one triaxial connector (model 32004). The maximum length of an extension cable to connect a dosemeter is 100 m. The maximum chamber polarizing voltage is 1000 V.

The chamber model 34031 is supplied with an integrated adapter for positioning a radioactive check source of type T48010, which make it possible to check the proper performance of the entire measuring system.

Ordering Information

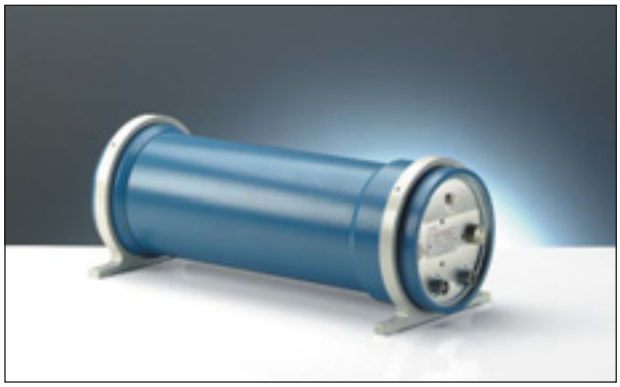
T34031 Monitoring chamber 3 l, 2 Fischer coax connectors
T32004 Monitoring chamber 3 l, 1 LEMO triax connector

Option

T7262/U10-1.5 Connection cable with M connector for the monitoring chamber type T34031, length 1.5 m

- UNIDOS/UNIDOS E Dosemeters *pages 13 and 138*
- Radioactive Check Device *page 23*

50 Liter Chamber for Radiation Monitoring



Cylindrical pressurized steel ionization chamber for stationary gamma radiation monitoring

Features

- Sealed sensitive volume of 50 liters
- Suitable as stationary radiation monitoring chamber
- Gamma energy range 80 keV to 1.3 MeV

The ionization chamber T7262 has a constructive volume of 5 liters filled with Argon gas at the pressure of 10 bar, resulting in an effective measuring volume of 50 liters. This superior design makes the chamber very sensitive and enables performing low level gamma radiation measurements down to the natural radiation background. The chamber is used as highly sensitive stationary surveillance device for environmental radiation monitoring. The response is $2 \cdot 10^{-3}$ C/Sv. The maximum dose rate at 90 % saturation is 10^{-2} Sv/h. The chamber is fully guarded up to the measuring volume. Since the sensitive volume is sealed, no air density correction is required.

The cylindrical 50 liter chamber is made of steel with 3.25 mm wall thickness and a 3 mm aluminum cover. The ion-collecting electrode is made of brass. The external chamber diameter is 195 mm and the length is 538 mm. The chamber is supplied with two coaxial Fischer connectors for the transfer of the measuring signal and the polarizing voltage. Via an optional adapter cable of 1.5 m length, the chamber can be connected to a dosemeter with M connector, which has input circuits on ground potential. The maximum length of an extension cable is 100 m. The maximum chamber polarizing voltage is 1000 V.

Ordering Information

T7262 Radiation monitoring chamber 50 l
T7262A Radiation monitoring chamber 50 l with integrated adapter for check device T48010

Option

T7262/U10-1.5 Connection cable with M connector, length 1.5 m

- UNIDOS/UNIDOS E Dosemeters *pages 13 and 138*
- Radioactive Check Device *page 23*

0.1 Liter Chamber for Radiation Monitoring

Cylindrical Al chamber for stationary and mobile radiation monitoring of high level gamma radiation

Features

- Vented sensitive volume of 102 cm^3
- Suitable as radiation monitoring chamber
- Rigid construction for wall mounting
- Gamma energy range 80 keV to 1.3 MeV

The 0.1 liter chamber is used for environmental radiation monitoring. The rigid and compact construction makes the chamber suitable for stationary radiation monitoring as well as for mobile operation in vehicles. Due to its small size, the chamber only requires little space. The chamber is designed to measure very high dose rates of up to 4000 Sv/h (90 % saturation) as they may occur after nuclear accidents. The response is $3 \cdot 10^{-6}$ C/Sv. Since the sensitive volume is open to the surroundings, air density correction is required for precise measurement. The chamber is fully guarded up to the measuring volume.
The cylindrical chamber is made of aluminum with 4 mm wall thickness. The ion-collecting electrode is made of aluminum too. The external chamber diameter is 60 mm and the length is approx. 150 mm. For the transfer of the measuring signal and the polarizing voltage, the chamber is supplied with two coaxial Fischer connectors. Via an optional adapter cable of 1.5 m length, the chamber can be connected to a dosemeter with M connector, which has input circuits on ground potential. The maximum length of an extension cable is 100 m. The maximum chamber polarizing voltage is 500V.

Ordering Information

T32001 Radiation monitoring chamber 0.1 l

Option

T7262/U10-1.5 Connection cable with M connector, length 1.5 m

▸ UNIDOS/UNIDOS E Dosemeters *pages 13 and 138*

UNIDOS*webline* Dosemeter for Health Physics

High performance health physics dosemeter with trip output and integrated network features

Features

- Health Physics dosemeter for simultaneous dose and dose rate measurement
- Integration in a LAN with the internet standard TCP/IP
- Remote access functionality
- Trip output and data logging function
- Active, configurable TFT display with wide viewing angles
- Easy and fast menu-driven handling with navigation knob and help system

The Ethernet interface based on the TCP/IP protocol makes it possible to integrate the UNIDOS*webline* in a LAN for remote access and e-mail capability, e.g. to initiate self tests and to send a status report. Its large, user-configurable TFT display guarantees visibility from wide angles. UNIDOS*webline* features a easy to use menue-prompting system with help texts. Important settings can be password protected (different levels). A comprehensive statistic and data logging function is implemented. Up to 100 measuring values are stored in a list. The data can be reviewed and exported. Mean value and relative standard deviation are displayed on the measuring screen.
Chamber data are stored in a comprehensive chamber library. Air density is corrected by keying in air pressure and temperature or by means of radioactive check devices. The check device data are stored in a database. An internal clock calculates the isotope radioactivity decay. It features both mains and battery operation.
UNIDOS*webline* surpasses the requirements for reference class dosemeters according to IEC60731, the IPEM secondary standard dosemeter guidelines, IEC 61674 for diagnostic radiology and IEC 60846 for health physics.

Ordering Information

T10023 UNIDOS*webline*, connecting system BNT,
T10022 UNIDOS*webline*, connection system TNC
T10021 UNIDOS*webline*, connection system M

Option

L522021 UNIDOS Carrying case

XLS X-Ray Leakage System

Multi-channel dosemeter for radiation leakage measurements of diagnostic X-ray installations

Features

- Measures dose and dose rate at 18 locations around diagnostic X-ray tubes simultaneously
- High sensitivity and excellent long-term stability
- Complies with IEC 60601-1-3[1]
- Full software control via the RS232 interface

Manufacturers of diagnostic X-ray tubes must ensure that the leakage radiation emitted by the tube outside the useful beam does not exceed certain levels provided by law or by standards such as IEC 60601-1-3[1]. The XLS X-ray leakage system is an effective device to fulfill these requirements. The XLS Measuring unit consists of a specialized MULTIDOS multi-channel dosemeter and an 18 channel measuring extension to connect up to 18 XLS ionization chambers. The system measures dose and dose rate or charge and current of all 18 chambers simultaneously. The maximum and minimum measuring results are displayed together with the channel numbers. The integration time for dose and charge measurements can be selected between 1 second and 18 hours. A built-in high voltage supply for 400 V chamber polarizing voltage is included in the base unit. The measuring results of all chambers can be read via an RS232 interface. The chamber calibration factors are stored in the device and can be read and modified via the serial interface.

[1] IEC 60601-1-3 Medical electrical equipment - Part 1 General requirements for safety - 3. Collateral standard: General requirements for radiation protection in diagnostic X-ray equipment

Ordering Information

T11036 XLS Measuring unit
T26014.1.001-15 Cable set, 15 m length
T26014.1.001-20 Cable set, 20 m length

XLS Chamber for X-Ray Leakage System

Rectangular ionization chamber for radiation leakage measurements of diagnostic X-ray installations

Features

- Vented sensitive volume of 300 cm^3
- Highly sensitive for detection of X-ray leakage radiation
- Up to 18 chambers can be arranged for radiation leakage detection around X-ray tubes

The rectangular plane parallel XLS ionization chamber is used for the XLS X-ray leakage system. The central electrode has an active area of 20 cm x 5 cm. The electrode is made of polycarbonate PC (Makrolon) with a graphite layer. The chamber response is approx. 10 µC/Gy. The external chamber dimensions are 225 mm x 90 mm x 35 mm. The dose rate measuring range of the chamber connected to the XLS electronic devices is from 0.15 mGy/h to 30 mGy/h, and the chamber current measuring range is from 0.4 pA to 100 pA.
Up to 18 chambers can be mechanically arranged on a semicircular arch of 1 m radius according to IEC. The X-ray tube is positioned on a rotatable table and - while the table is continuously rotated - the XLS leakage system monitors the dose rate of all detectors and records the radiation levels of the entire hemisphere around the X-ray tube. The rotatable table and the chamber fixation parts are neither part of the XLS chambers nor the XLS X-ray leakage system.
The individual response and the long-term stability of the chambers can be checked by means of an appropriate adapter between a radioactive check source type T48010 or T8921/8922 and the chambers type TA34055-0.

Ordering Information

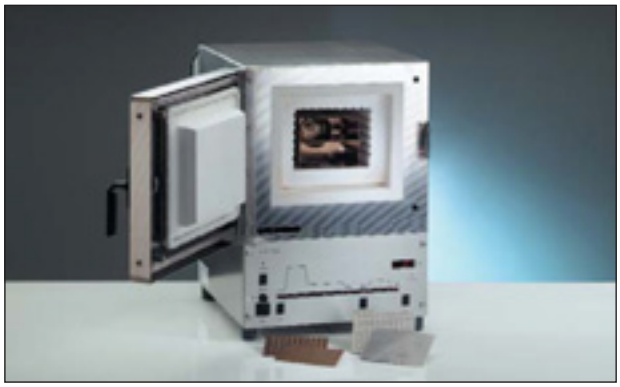
TA34055-0 XLS Ionization chamber
T26014-15 Chamber connection cable, 15 m length
T26014-30 Chamber connection cable, 30 m length

Option

T48011 Chamber adapter for radioactive check source

- Radioactive Check Devices *page 23*

TLDO Annealing Oven



Preheating and annealing oven with two standard programs; Programmable via an RS232 interface with THELDO software

Features

- Microprocessor-controlled oven for precise and reproducible heating of TL detectors
- Suitable especially for TL chips, rods and films (ribbons)
- Includes two standard temperature programs for preheating and annealing
- Arbitrary temperature levels based on both standard profiles are programmable by optional software

The TLDO annealing oven is designed for very precise and reproducible temperature treatment of TLD material. Before irradiating, the TL detectors are heated according to the 7 segment annealing program, and before reading they are heated according to the 5 segment preheating program. During the heating cycle, the hot air stream is circulated by a built-in fan to ensure equal temperature distribution throughout the oven volume. Even the cooling phase is temperature controlled. A digital display shows the actual temperature, and built-in lamps indicate the program progress. The standard oven is supplied with an RS232 interface. The optional THELDO software makes it possible to program any temperature profile based on both basic temperature cycles. In case of failure, a safety circuit prevents heating to temperatures above 450 °C (840°F).

Ordering Information

T1321/U100 TLDO annealing oven, 230 V
T1321/U200 TLDO annealing oven, 115 V

Options

S150002 THELDO Software
T1321/U10 Steel annealing tray, 50 recesses
T1321/U11 Steel annealing tray, 120 recesses, cover plate

RANDO Sliced Body Phantoms

Body-shaped sliced therapy phantoms with hole grids for realistic radiation therapy dosimetry with TL detectors

Features

- Simulate dosimetry conditions of human bodies
- Make it possible to measure doses inside the body phantom at any location using thermoluminescent detectors
- Simulate soft tissue and feature natural skeletons

The anthropomorphic RANDO phantoms are body-mimicking tissue-equivalent therapy dosimetry phantoms with natural skeletons. The phantoms are available in male and female shape. They consist of 25 mm thick slices with 15 mm x 15 mm hole grids to accommodate TL detectors. Phantoms for the use of TL rods feature thin wall acrylic inserts in the drill-holes. The hole grids can be prepared for the use of cylindrical TL rods (1 mm Ø x 6 mm), squared TL rods (1 mm x 1 mm x 6 mm) or cylindrical TL chips (4.5 mm Ø x 0.8 mm). Pairs of breast attachments in five different sizes (A, B, C, D, E) for male and female phantoms are available.
Alternatively, there are tissue-equivalent adult and children phantoms available, totally based on artificial material.

Additional information is available upon request

Radiological Calibration

Calibration Equipment and Services

Radiological Calibration

Calibration Facilities

Radiation detectors and dosemeters are usually calibrated on a calibration bench for correct dose measurement. The bench is combined with a radiation source for defined irradiation of the dosemeters that are to be calibrated. The calibration source is a ^{60}Co source or a ^{137}Cs source, each delivering only one radiation energy, or an X-ray tube, delivering a range of X-ray energies by varying the high voltage and filter settings. Different X-ray beam qualities require different filtration. For this reason a filter wheel, which can move diverse filters into the X-ray beam, is mounted in front of the X-ray tube. A stable support is required to install the X-ray tube together with its heavy lead shielding into the right position. For dose comparison, a reference chamber is mounted in the beam. This chamber is designed as a shadow-free transmission chamber and has to be calibrated traceable to a primary standard.

For calibration, the detectors are fixed on a carriage that can be precisely moved on the rails of the calibration bench by remote control to realize different distances from the radiation source and to establish different dose rates.

PTW's product range comprises calibration benches and accessories, as well as a variety of reference ionization chambers for calibration purposes.

Calibration Services

The PTW calibration laboratory is accredited by the IAEA, the International Atomic Energy Agency, Vienna, as a member of the IAEA/WHO international network of Secondary Standard Dosimetry Laboratories (SSDL) for dose quantities in radiation therapy.

The PTW calibration laboratory is also accredited by the Federal Institute of Metrology, Braunschweig (PTB), which is the German National Laboratory.

PTW operates Germany's first Secondary Standard Dosimetry Laboratory for radiation quantities accredited by the DAkkS (German Calibration Service), under direct supervision of the National Laboratory.

With nine calibration benches in continual use, the PTW calibration laboratory is one of the most active calibration laboratories for ionizing radiation in the world. The calibrations are directly traceable to the primary standards of PTB and BIPM (Bureau International de Poids et Mesure, Paris, France).

The PTW calibration laboratory has a long history. From its very beginning, PTW has always maintained a calibration laboratory for radiation measuring quantities. Although it is an integral part of the company and its comprehensive quality assurance system, the calibration laboratory is proud of its own tradition and achievements. Internal traceability is extended to the point of preserving the original measurement notes for every calibration performed since 1937.

CALIBRATION BENCH

Steel bench with carriage for precise calibration of dosemeters used for ionizing radiation measurement

Features

- Positions radiation detectors very accurately for calibration
- High quality, stable and precise steel construction
- Individually adjustable supports make the bench installation independent of floor conditions on site

The CALIBRATION BENCH is typically a part of a complete calibration facility which can be delivered by PTW with many options as a turn key project.

The high precision CALIBRATION BENCH is designed as a very stable steel construction used for accurate positioning of radiation detectors by remote control with a stepper motor or manual movement for radiological calibration at various distances from a radiation source.

The basic module of 2 m length can be expanded flexibly with extension modules of 1 m length. Each bench module is supplied with four stable supports for individual height adjustment, two at each side with 500 mm distance. Thus the exact adjustment of the entire bench is independent of floor conditions on site.

The remote controlled bench is driven by a control unit with a TCP/IP interface. The BENCH CONTROL UNIT has an option for temperature and pressure measurement with software readout. Two temperature sensors can be used for accurate measurement at monitor chamber and probe position. The software BenchControl controls the motorized bench, shutter, filter wheel, electrometer and read out temperature and pressure. An implemented batch mode allows an automatic calibration work flow.

The carriage runs on rigid cylindrical steel rails and is supplied with special bearings to provide for high precision positioning. The resolution of the positioning is 1 mm. A stainless steel plate with a close-knit grid of thread holes makes it easy to fix the detectors on the platform for calibration.

The carriage has two options for vertical and horizontal movements. Both options are designed for manual adjustment of the carrier platform. The external dimensions of the platform are 500 mm x 500 mm.

- The Calibration Bench height control option enables the user to carry out detector platform height adjustments in the moving range of ± 100 mm.
- The Calibration Bench horizontal control option enables the user to carry out one-dimensional horizontal adjustments of the detector platform in the moving range of ± 50 mm from central position in x- or y-directions. If the platform is intended to be adjustable in both horizontal directions x and y, two of the horizontal control options can be stacked.

Optional connection modules for dosimetry connecting system M, BNT or TNC are available and an interface connection module with TCP/IP, RS232 and temperature sensor connectors at the carriage.

Ordering Information

L981282-X CALIBRATION BENCH, manual controlled
L981283-X CALIBRATION BENCH, software controlled
Where X is the length in full meters

Bench Options

L981284 Connection module for connecting system M
L981285 Connection module for connecting system BNT
L981286 Connection module for connecting system TNC
T90003 CALIBRATION BENCH height control option
T90004 CALIBRATION BENCH horizontal control option

Monitoring Systems for Laboratories and Accessories

T90020 LASER ALIGNMENT System
L981291 TCP/IP camera monitoring system
L981111 LABGUARD surveillance system

Project Management and Installation

E16001 CALIBRATION BENCH installation
E16002 Customized project management

Other Options on request

- X-ray accessories *page 144*
- UNIDOS*webline* *pages 13 and 138*
- UniSoft edition 2000 *page 22*

X-Ray Accessories for Calibration Facilities

Basic construction to accommodate an X-ray tube, X-RAY SHUTTER, FILTER WHEEL and filters

Features

- Basic construction with X-ray tube support
- FILTER WHEEL with 24 positions software controlled
- Filters for calibrations with X-ray radiation qualities
- High speed X-RAY SHUTTER

Calibration benches require a radiation source for radiological calibrations. An X-ray tube in combination with filters and shutter is typically used for calibration with radiological radiation qualities.

- The basic construction with X-ray tube support is a good solution to ensure stable installation and proper shielding of the tube. It consists of a steel table with lead shielded housing. The platform height is 1250 mm from the floor. The table is levelled by means of four adjustable supports. The tube lead shielding is firmly mounted on a suitable frame which is placed on the tube support platform. Form and dimensions of the lead shielding are customized to fit the X-ray tube housing. The lead thickness is 8 mm. The shielding plates are covered by aluminium sheets for protection against direct touch of the lead absorbers. The X-ray tube support with lead shielding can be combined with the CALIBRATION BENCH. A monitor chamber and a diaphragm holder with a set of diaphragm pairs for different field sizes are included.
- The X-RAY SHUTTER can be combined with the X-ray tube support. The X-RAY SHUTTER includes two diaphragms which are customized for the focal spot of the used tube for a basic field size.
  The X-RAY SHUTTER is suitable for X-rays up to 450 kV, the closing time is less than 100 ms and can be controlled by software via TCP/IP.
- The FILTER WHEEL holds up to 24 metal filters and positions them into the beam to setup different X-ray radiation qualities. The filters are interchangeable. The height of the central beam from floor is 1500 mm.
- The metal filters with 92 mm diameter are interchangeable. There is a range of Al, Cu, Sn and Pb filters with different thicknesses. The filters are of high 99.9 % purity. The Pb filter even has 99.95 % purity.

X-RAY SHUTTER, FILTER WHEEL and motorized CALIBRATION BENCH are controlled by the BENCH CONTROL UNIT via network cable with TCP/IP interface. The BENCH CONTROL UNIT is connected via one network cable with the PC. The BenchControl software controls all movements, electrometers and readout of the temperature and pressure. A batch mode allows an automatic calibration with predefined filter positions and shutter control.

Ordering Information

L981288 Basic construction and X-ray tube support for GE MXR320/26

L981293 Basic construction and X-ray tube support for YXLON YTU/320-D03

L981289 Basic construction and X-ray tube support for specified tube

T90012 X-RAY SHUTTER, software controlled
L981194 FILTER WHEEL, software controlled
T43033-MMXX Filter for FILTER WHEEL L981194
MM is the material and XX is the thickness in mm

X-ray tubes and tubes changer on request
Monitor chamber and electrometer required

- CALIBRATION BENCH *page 143*
- Monitor chamber *page 145*
- UNIDOS*webline* *pages 13 and 138*

Monitor Ionization Chambers

Large size plane parallel transmission chambers for use as dose monitors combined with calibration facilities

Features

- Vented sensitive volumes of 94 cm³ and 86 cm³
- Include twin-measuring volumes
- Shadow-free transmission chambers for dose monitoring with calibration facilities

The circular plane parallel transmission chambers are used for dose monitoring in combination with calibration benches. The sensitive volumes are designed as twin-chambers with 2.5 mm measuring depth each and a diameter of 155 mm (model 786) or 148 mm (model 34014). The chamber walls and the electrodes are made of polyimide (PI) of 0.025 mm thickness each with graphite layer. The nominal photon energy range is 7.5 kV up to 420 kV, and the leakage current is less than 1 pA. The chambers are fully guarded. The external diameter of the chamber housing is 230 mm. Two holes with 6 mm threads serve for mechanical chamber fixation.

Two chamber versions are available: model 786 is used together with dosemeters having the input circuits on ground potential, and model 34014 is used together with dosemeters having the input circuits on high voltage.

Ordering Information

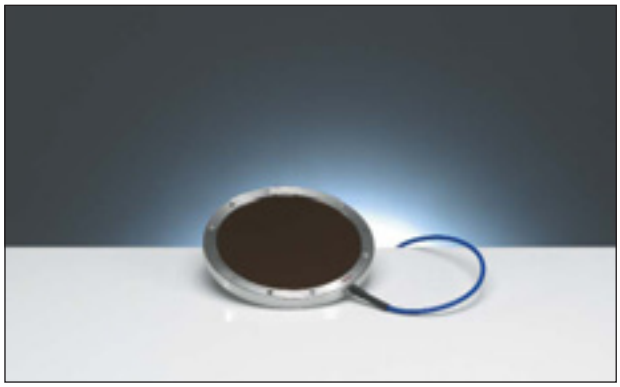
TN34014 Monitor chamber, BNT connector
TW34014 Monitor chamber, TNC connector
TM786 Monitor chamber, M connector
TB786 Monitor chamber, BNC connector and banana pin

Option

Monitor chambers with smaller diameter of sensitive volume upon request

- UNIDOS Dosemeters *pages 13 and 138*

X-Ray Therapy Monitor Ionization Chamber



Large size plane parallel transmission chamber for use as dose monitor combined with X-ray therapy units

Features

- Vented sensitive volume of 17.6 cm³
- Shadow-free transmission chamber for dose monitoring with radiation therapy X-ray equipment

The circular plane parallel transmission chamber model 7862 is used for dose monitoring in combination with radiotherapy X-ray units. The sensitive volume is designed as a very thin cylinder of 2.4 mm thickness and 96.5 mm diameter. The chamber wall and the electrode are made of polyimide (PI) of 0.05 mm thickness each with graphite layer, mechanically protected by another PI foil of 0.05 mm in front of each wall. The nominal photon energy range is 7.5 kV up to 420 kV and the leakage current is less than 1 pA. The chamber is fully guarded. The external diameter of the chamber housing is 119.5 mm. Three holes with 3.5 mm threads serve for mechanical chamber fixation.
The transmission chamber model 7862 is used in connection with dosemeters having the input circuits on ground potential.

Ordering Information

TM7862 Monitor chamber for X-ray therapy units, M connector

- UNIDOS Dosemeters *pages 13 and 138*

Cylinder Stem Ionization Chamber

Cylindrical PMMA ionization chamber with a long rigid stem for radiation protection measurement

Features

- Vented sensitive volume of 30 cm^3
- Suitable as high precision reference chamber for radiation protection dosimetry
- Very flat energy response within a wide range

The cylinder stem chamber is designed as a reference chamber for absolute dosimetry to be used by secondary standard dosimetry laboratories (SSDL) and users with high quality requirements. It has very small variations of response with radiation quality from low X-ray energies up to high-energy photon radiation. The nominal useful energy range is 30 keV up to ^{60}Co radiation. The cylindrical sensitive volume has a diameter of 31 mm and a length of 51 mm. The wall material is graphite with a protective acrylic cover. The electrode is made of graphite-coated aluminum. The guard ring is designed up to the measuring volume. The chamber is constructed with a long rigid stem of approx. 20 cm length for easy mounting in the radiation beam.
An acrylic build-up cap with 3 mm wall thickness for in-air measurement in ^{60}Co beams is included with each chamber, as well as a calibration certificate. Air density correction is required for each measurement. A radioactive check device and an appropriate holding device are available.

Ordering Information

TN23361 Cylinder stem chamber 30 cm^3, BNT connector
TW23361 Cylinder stem chamber 30 cm^3, TNC connector
TM23361 Cylinder stem chamber 30 cm^3, M connector

Option

T23237 Radioactive check source holding device

- UNIDOS Dosemeters *pages 13 and 138*
- Radioactive Check Device *page 23*

TK-30 Spherical Ionization Chamber

Spherical ionization chamber with a long rigid stem for radiation protection measurement

Features

- Vented sensitive volume of 28 cm^3
- Suitable as high precision reference chamber for radiation protection dosimetry
- Very flat energy response within a wide range

The TK-30 spherical chamber is designed as a reference chamber for absolute dosimetry to be used by secondary standard dosimetry laboratories (SSDL) and users with high quality requirements. It has very small variations of response with radiation quality from low X-ray energies up to high-energy photon radiation. The guard ring is designed up to the sensitive volume. The chamber is constructed with a long rigid stem of approx. 20 cm length for easy mounting in the radiation beam. Air density correction is required for each measurement.

Ordering Information

TN32005 TK-30 Spherical chamber, connecting system BNT
TW32005 TK-30 Spherical chamber, connecting system TNC
TM32005 TK-30 Spherical chamber, connecting system M

Option

T48001 Radioactive check source holding device

- UNIDOS Dosemeters *pages 13 and 138*
- Radioactive Check Device *page 23*

1 Liter Spherical Ionization Chamber

Spherical ionization chamber for radiation protection level and low level measurement

Features

- Vented sensitive volume of 1 liter
- Suitable for survey meter calibration and low level measurements
- Superior energy response, reproducibility, directional dependence and long-term stability

Superior features make the chamber suitable as a standard chamber for calibration purposes. It fulfills the requirement for excellent reproducibility and long-term stability of the sensitive volume. The spherical construction ensures a nearly uniform response to radiation from every direction. The energy response is very flat within ± 1.3 % in the energy range from 45 keV to 1.3 MeV. This is achieved by the thin layer of aluminum on the inner wall surface, which provides for an increased photoelectric yield to compensate for the absorption of soft X-rays. The chamber wall is made of graphite coated polyoxymethylene (Delrin) with 3 mm thickness.

The spherical chamber model 32002 is designed for the measurement of ionizing radiation in the protection level range from 0.1 mSv/h to 0.3 Sv/h. The outer chamber diameter is 140 mm. The spherical electrode of 50 mm diameter, made of graphite-coated polystyrene, is located in the center of the chamber sphere.

The chamber is supplied in a custom built case of 530 mm x 190 mm x 190 mm external dimensions to protect them.

Ordering Information

Spherical chamber with BNT, TNC or M connector
32002 Spherical 1 liter chamber LS-01

Option

T48001 Radioactive check source holding device

- UNIDOS Dosemeters *pages 13 and 138*
- Radioactive Check Device *page 23*

10 Liter Spherical Ionization Chamber

Spherical ionization chamber for radiation protection level and low level measurement

Features

- Vented sensitive volume of 10 liters
- Suitable for survey meter calibration and low level measurements
- Superior energy response, reproducibility, directional dependence and long-term stability

Superior features make the chamber suitable as a standard chamber for calibration purposes. It fulfills the requirement for excellent reproducibility and long-term stability of the sensitive volume. The spherical construction ensures a nearly uniform response to radiation from every direction. The energy response is very flat within ± 1.3 % in the energy range from 45 keV to 1.3 MeV. This is achieved by the thin layer of aluminum on the inner wall surface, which provides for an increased photoelectric yield to compensate for the absorption of soft X-rays. The chamber wall is made of graphite coated polyoxymethylene (Delrin) with 3 mm thickness.

Model 32003 is designed for the low level range from 10 µSv/h to 30 mSv/h. The outer chamber diameter is 276 mm. The spherical electrode, made of graphite-coated polystyrene, has a diameter of 100 mm.

The chamber is supplied in a custom built case of 650 mm x 335 mm x 320 mm external dimensions to protect them.

Ordering Information

Spherical chamber with BNT, TNC or M connector
32003 Spherical 10 liter chamber LS-10

Option

T48001 Radioactive check source holding device

- UNIDOS Dosemeters *pages 13 and 138*
- Radioactive Check Device *page 23*

Böhm Extrapolation Chamber

Low energy extrapolation chamber with adjustable volume depth for measurement of absorbed dose in soft tissue

Features

- Measures absolute dose of beta radiation and soft X-rays in soft tissue equivalent material very precisely
- Includes a micrometer screw for the depth adjustment of the measuring volume down to zero
- Suitable for beta calibration at PSDLs and SSDLs

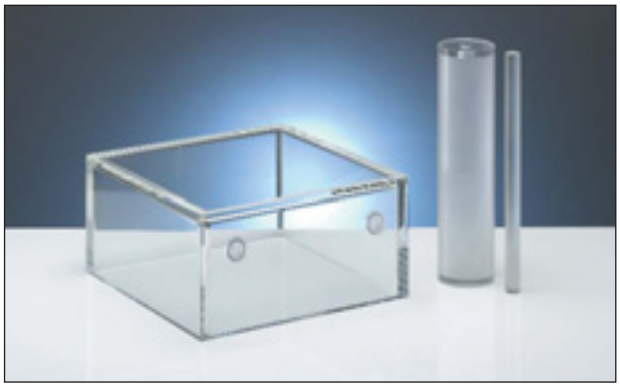
The Böhm extrapolation chamber is a high quality device for absorbed dose measurements of beta and low energy X radiation in certain depths below the surface of the entrance window. Primary standard dosimetry laboratories (PSDL) and secondary standard dosimetry laboratories (SSDL) use it for low energy radiation calibration. The dose is determined from the ionization density in a small air gap, the extrapolation chamber volume, embedded in tissue equivalent material (PMMA). The chamber is supplied with a very thin entrance window of 0.75 mg/cm^2 and a collecting electrode of 30 mm in diameter. By means of the built-in micrometer screw, the collecting electrode surrounded by a guard ring of 15 mm can be moved to adjust the depth of the sensitive volume between 10 mm and 0 mm. The zero point of the chamber depth setting can be obtained by measuring the chamber capaciting charge C versus the chamber depth x and extrapolating C^{-1} towards x=0.
The chamber is equipped with two BNC sockets for signal and polarizing voltage. A connection cable from both BNC sockets to an electrometer with M type connector is available. An electrometer with the input circuits on ground potential is required. The extrapolation chamber comes in a protective storage case.

Ordering Information

T23392 Böhm extrapolation chamber
T23392/U5 Connection cable with M connector for Böhm extrapolation chamber

- UNIDOS Dosemeters *pages 13 and 138*

ISO Calibration Phantoms



Standard test phantoms representing parts of human bodies with regard to back-scattering of incident radiation

Features

- Comply with the standard ISO 4037 part 3[1]
- Represent parts of human bodies with regard to back-scattering of the incident radiation
- Suitable for calibrations and type tests of personal dosemeters, because they measure the quantities $H_p(0.07)$ and $H_p(10)$

The ISO calibration phantoms comply with the standard ISO 4037 part 3[1] which describes standard test phantoms for calibration and type tests of personal dosemeters, that measure the dose quantities $H_p(0.07)$ and $H_p(10)$. The phantom composition is acrylic material (PMMA). Three types representing parts of human bodies in regard to back-scattering of incident radiation are available:

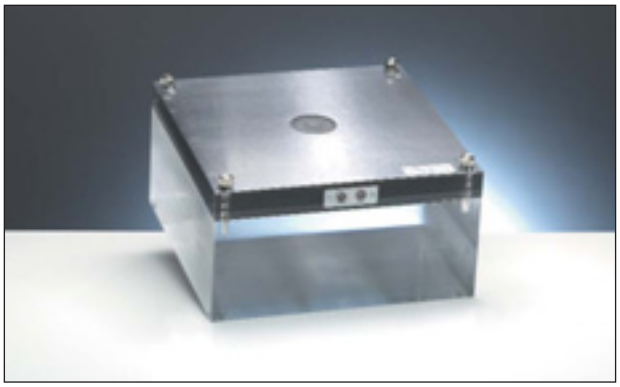
- Slab phantom: The water slab phantom represents the human torso and consists of a 300 mm x 300 mm x 150 mm cube, which is filled with water. The front wall is 2.5 mm thick; all other walls are 10 mm thick.
- Pillar phantom: The water pillar phantom represents a lower arm or leg and consists of a circular cylinder with 73 mm diameter and 300 mm length, which is filled with water. The wall is 2.5 mm thick; the bottom and cover plates are each 10 mm thick.
- Rod phantom: The acrylic rod phantom represents a finger and consists of a circular acrylic cylinder with 19 mm diameter and 300 mm length.

[1] ISO 4037-3:1999 "X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy -- Part 3: Calibration of area and personal dosemeters and the measurement of their response as a function of energy and angle of incidence"

Ordering Information

T41007 ISO water slab phantom, representing a torso
T41011 ISO water pillar phantom, representing arm and leg
T40009 ISO acrylic rod phantom, representing a finger

$H_p(10)$ Secondary Standard Chamber



Parallel plate ionization chamber for direct measurement of $H_p(10)$ personal dose equivalent on a slab phantom

Features

- Vented sensitive volume of 10 cm^3
- Measures the $H_p(10)$ personal dose equivalent directly
- Suitable as a reference chamber for $H_p(10)$ calibration

The parallel plate ionization chamber model 34035[1] is integrated into a slab phantom to measure the $H_p(10)$ radiation protection measuring quantity directly. The high performance chamber is designed to be used as a secondary standard chamber for calibration purposes. The beam calibration with the $H_p(10)$ chamber makes it unnecessary to precisely determine the spectrum of the X-ray beam. The chamber comes uncalibrated; a primary standard calibration by PTB, the German National Laboratory, is available.
The useful gamma energy range is from 10 keV to 1400 keV. The chamber response is approx. 350 nC/Sv. The chamber set includes a phantom slab of 31 mm thickness with chamber assembly and an additional phantom slab of 120 mm thickness. The slab phantom is composed of tissue-equivalent acrylic material (PMMA). The total external dimensions are 300 mm x 300 mm x 151 mm. Both sets include an adapter cable to connect the chamber either to a dosemeter with M connector or with BNC connector and banana pin.
The $H_p(10)$ chamber should be used in connection with a high quality dosemeter such as UNIDOS or UNIDOS E to ensure best performance.

[1] Ankerhold, Ambrosi, Eberle – A chamber for determining the conventionally true value of $H_p(10)$ and $H^*(10)$ needed by calibration laboratories – Rad. Prot. Dos. Vol. 96, Nos 1-3, pp. 133 - 137 (2001), Nucl. Techn. Publishing

Ordering Information

L981937 $H_p(10)$ Secondary standard chamber, M connector
L981938 $H_p(10)$ Secondary standard chamber, BNC connector and banana pin

Option

PTB Primary standard calibration upon request

▸ UNIDOS Dosemeters *pages 13 and 138*

Reference Soft X-Ray Chamber

Acrylic parallel plate ionization chamber for reference dosimetry with soft X-rays up to 20 keV

Features

- Vented sensitive volume of 100 cm^3
- Suitable as a reference standard chamber for measurement of very low energy X-rays
- Includes a large size and extremely thin entrance window

The circular parallel plate ionization chamber model 34047[1] is intended as a reference standard chamber for the measurement of very low energy X-rays free in air. The nominal photon energy range is from 5 keV to 20 keV. The chamber is used in connection with reference class dosemeters for calibration measurements. The response is $5 \cdot 10^{-6}$ C/Gy. The entrance window is a very thin PET foil of 0.0035 mm thickness with a graphite layer. The weight per unit area is 0.55 mg/cm^2. The sensitive volume is fully guarded. The chamber housing is totally made of tissue-equivalent acrylic material (PMMA). To protect the chamber against mechanical damage, a protective cover is mounted in front of the entrance window. The external diameter of the sensitive volume is 100 mm, and the diameter of the chamber housing is 154 mm. A connection cable of 1.5 m length is firmly mounted to the chamber housing. The chamber comes uncalibrated. It must be calibrated by a qualified standard laboratory.
The fixation of the chamber in the radiation beam for measurement can be done by means of an adjustable stainless steel stem of 200 mm length. The stem and the stem holding device on the chamber rear are removable.

[1] The chamber has been developed in co-operation with the Japan Atomic Energy Research Institute, JAERI, Kashiwa, Japan.

Ordering Information

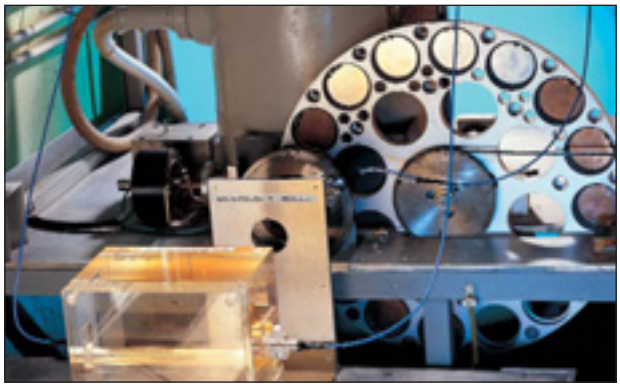
TN34047 Reference soft X-ray chamber, BNT connector
TW34047 Reference soft X-ray chamber, TNC connector
TM34047 Reference soft X-ray chamber, M connector
TB34047 Reference soft X-ray chamber, BNC connector and banana pin

Option

PTB Primary standard calibration upon request

▸ UNIDOS Dosemeters *pages 13 and 138*

Calibration Service - Laboratory



PTW-Freiburg operates an accredited secondary standard dosimetry laboratory for radiological measuring quantities

- PTW-Freiburg is a member of the IAEA international SSDL network and the German Calibration Service DKD
- The calibrations are directly traceable to the primary standards of:
  - BIPM (Bureau International de Poids et Mesure, Paris)
  - PTB-Braunschweig (German Federal Institute of Physics and Metrology)
- Nine calibration facilities for various radiation qualities, measuring quantities and dose rate ranges are available
- Regular external audits are performed by PTB

The calibration laboratory has been a most important part of PTW-Freiburg since its first days. The task to produce accurate dosimetric instrumentation implies the necessity to provide accurate calibration. PTW-Freiburg operates Germany's first Secondary Standard Dosimetry Laboratory for radiation quantities accredited by the DKD German Calibration Service, under direct supervision of the National Laboratory. It operates as an ADCL (Accredited Dosimetry Calibration Laboratory) and it is also a member of the international SSDL network, organized by the International Atomic Energy Agency IAEA. With nine calibration benches in continual use, the PTW calibration lab is one of the most active calibration labs for ionizing radiation in the world. The following radiation therapy beam qualities can be calibrated:

- ^{60}Co (1.3 MeV)
- ^{137}Cs (662 keV)
- X-rays (100 ... 280) kV
- Soft X-rays (15 ... 70) kV

In addition, well-type chambers can be calibrated to measure brachytherapy sources. Besides the therapy dosimetry calibrations, the PTW lab provides for dose and non-invasive kV calibrations in diagnostic imaging, nuclide radioactivity calibrations of isotope calibrators in nuclear medicine and calibrations of health physics dosimetry equipment.

Calibration Service - Radiation Qualities

A variety of ionizing radiation beam quality sets for different applications is available

Radiation Therapy Dosemeters

- X-rays 10, 15, 30, 50, 70 kV
  (T qualities according to DIN 6817)
- X-rays 70, 100, 140, 200, 280 kV
  (T qualities according to DIN 6817)
- ^{137}Cs 662 keV
- ^{60}Co 1.3 MeV

Diagnostic Radiology Dosemeters

- X-rays 50, 70, 90, 120, 150 kV Conventional
  (RQR and RQA qualities according to IEC 61267)
- X-rays 70, 90, 120, 150 kV CT
  (RQR and RQA qualities according to IEC 61267)
- X-rays 100, 120, 150 kV CT
  (RQT qualities according to IEC 61267)
- X-rays 50, 70, 90 kV Dental
- X-rays 25, 28, 30, 35 kV Mammography
  (RQR-M and RQA-M qualities according to IEC 61267
  Mo/Al, Mo/Rh, Rh/Rh, W/Ag, W/Al, W/Mo, W/Rh

Radiation Protection Dosemeters

- X-rays 20, 30, 40 kV
  (Narrow Spectrum Series (N) qualities acc ISO 4037-1)
- X-rays 60, 80, 100, 150, 200, 250 kV
  (Narrow Spectrum Series (N) qualities acc ISO 4037-1)
- ^{137}Cs 662 keV
- ^{60}Co 1.3 MeV

Miscellaneous Calibrations

- Source strength ($cGym^2h^{-1}$) of brachytherapy sources measured by well-type chambers
- Diagnostic X-ray generator high voltage of all types of X-ray equipment measured non-invasively by kV-meters: Different ranges from 20 to 150 kV
- Nuclide activity in nuclear medicine measured by isotope calibrators (only CURIEMENTOR instruments)
- Electrical measuring quantities charge (C) and current (A) measured by highly sensitive electrometers

General Information

According to the PTW definition, each such set of beam qualities represents one calibration point for a certain application and can be ordered with a single order number.

QUICK VIEW

Quick View
Product Families

The size of this product catalog shows that the PTW product range is quite comprehensive. It meets the tasks and needs of users for the measurement of ionizing radiation and the quality control of irradiation equipment in medicine and health physics.

The products are presented in this catalog in the order of their application and use. This chapter includes listings of certain product families and reviews the entire range of the presented product families. Each product is characterized within these reviews by a small picture, the item number, the product name, a short description and the page, where the product is described more comprehensively.

This chapter reviews the following product families:

- TBA Therapy Beam Analyzers

  Various sets of basic equipment for data acquisition and analysis of external beams in radiotherapy are available, depending on different types of phantom tanks. Optional items for the TBA analyzers are also listed.

- PTW Dosemeters

  This guide gives a review of the available dosemeters, which are combined with different detectors for the measurement of ionizing radiation of varying radiation qualities and dose rates.

- PTW Software

  Since the majority of electronic devices for the measurement of ionizing radiation is computer controlled today, a number of software programs for various applications in medicine and health physics are available.

- PTW Detectors

  The PTW product line includes quite a number of different radiation detectors for the measurement of the entire range of ionizing radiation qualities and dose rates and for varying applications in medical radiology and health physics.

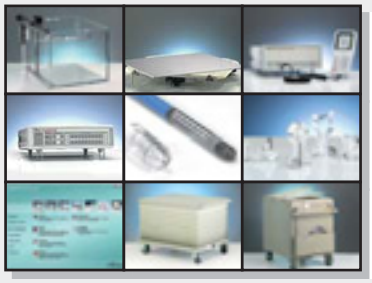
  For detailed information refer to our Detector Catalog

Quick View

Product Family Quick View

TBA Therapy Beam Analyzers

Configured Basic Systems



L981160/L981163 MP3 Water Phantom (230 V/115 V), complete, BNT connector
L981161/L981164 MP3 Water Phantom (230 V/115 V), complete, TNC conntector
L981162/L981165 MP3 Water Phantom (230 V/115 V), complete, M connector
consisting of: - MP3 phantom tank with positioning device
- TBA control unit, TANDEM dosemeter, control pendant
- 2x Semiflex 0.125 cm³ ion chamber, TRUFIX
- MEPHYSTO *mc²*, software options PLAMO and Absolute Dosimetry
- Lifting carriage, reservoir
- Accessories

L981166 MP3-M Water Phantom, complete, BNT connector
L981167 MP3-M Water Phantom, complete, TNC conntector
L981168 MP3-M Water Phantom, complete, M connector
consisting of: - MP3-M phantom tank with positioning device
- TBA control unit, TANDEM dosemeter, control pendant
- 2x Semiflex 0.125 cm³ ion chamber, TRUFIX
- MEPHYSTO *mc²*, software options PLAMO and Absolute Dosimetry
- SCANLIFT
- Accessories

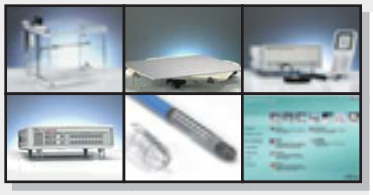
L981172 MP3-XS Water Phantom, complete, BNT connector
L981173 MP3-XS Water Phantom, complete, TNC conntector
L981174 MP3-XS Water Phantom, complete, M connector
consisting of: - MP3-XS phantom tank
- TBA control unit, TANDEM dosemeter, control pendant
- 2x Semiflex 0.125 cm³ ion chamber
- MEPHYSTO *mc²*, software option Absolute Dosimetry
- Accessories

L981199 MP3-T Water Phantom, complete, BNT connector
L981183 MP3-T Water Phantom, complete, TNC conntector
L981182 MP3-T Water Phantom, complete, M connector
consisting of: - MP3-T phantom tank
- TBA control unit, TANDEM dosemeter, control pendant
- PinPoint ion chamber 0.03 cm³ ion chamber
- SFD Mammo ion chamber 6 cm³
- MEPHYSTO *mc²*
- Accessories

L981236 MP3-P Water Phantom, complete, BNT connector
L981237 MP3-P Water Phantom, complete, TNC conntector
L981233 MP3-P Water Phantom, complete, M connector
consisting of: - MP3-P phantom tank
- TBA control unit, TANDEM *XDR* dosemeter, control pendant, TCP/IP interface
- MEPHYSTO *mc²*
- Reservoir
- Accessories

For product details see chapter Therapy Beam Analysis, *page 41ff.*

TBA Therapy Beam Analyzers



L981175 MP2 Water Phantom, complete, BNT connector
L981176 MP2 Water Phantom, complete, TNC conntector
L981177 MP2 Water Phantom, complete, M connector
consisting of: - MP2 phantom tank with positioning device
- TBA control unit, TANDEM dosemeter, control pendant
- 2x Semiflex 0.125 cm³ ion chamber
- MEPHYSTO *mc²*, software options PLAMO and Absolute Dosimetry
- Accessories

Dosimetry Options

TPR Options — *page 48*
L981007 TPR option for MP3 therapy beam analyzer
L981017 TPR option for MP3-M therapy beam analyzer

LA48 Option — *page 47*
L981099 Option LA48 chamber array for MP3 / MP3-M therapy beam analyzer including fittings, carrying case, MULTIDOS / ME48 multichannel dosemeter, cables and MEPHYSTO software module

Solid state detectors — *page 18-19*
TM60003 Diamond detector, M connector
60016 Dosimetry Diode for photons; BNT, TNC or M connector
60017 Dosimetry Diode E for electrons and photons; BNT, TNC or M connector

Thimble ionization chambers — *page 16-18*
31010 Semiflex 0.125 cm³ ion chamber; BNT, TNC or M connector
30013 Waterproof Farmer 0.6 cm³ ion chamber; BNT, TNC or M connector
31014 PinPoint 0.015 cm³ ion chamber; BNT, TNC or M connector

Plane parallel ionization chambers — *page 20*
34045 Advanced Markus 0.02 cm³ electron chamber; BNT, TNC or M connector
34001 Roos 0.35 cm³ electron chamber; BNT, TNC or M connector

Liquid filled ionization chamber — *page 19*
31018 microLion chamber 0.002 cm³; BNT, TNC or M connector

Detector positioning tools — *page 46*
L981150 TRUFIX Basic equipment
Holders for various detectors upon request

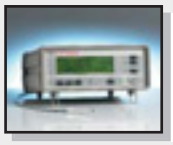
Scanning Options

Motor-driven acrylic phantom — *page 46*
T40012 PLEXITOM motor-driven acrylic phantom
Ion chamber adapters upon request

Air scanners — *page 52-53*
L981020 / T41009 LA48 air scanner gantry mount / table top
T41015 / T41017 SLA48 air scanner gantry mount / table top

Guide to PTW Dosemeters

Therapy Dosemeters

	T10023 BNT T10022 TNC T10021 M	UNIDOS*webline* Universal Dosemeter	High performance reference class dosemeter with integrated network features for universal use; chamber bias voltage supply ± (0 ... 400) V	*page 13*
	T10005 BNT T10002 TNC T10001 M	UNIDOS Universal Dosemeter	High performance reference class dosemeter for universal use; chamber bias voltage supply ± (0 ... 400) V	*page 13*
	T10010 BNT T10009 TNC T10008 M	UNIDOS E Universal Dosemeter	Easy to use reference class or field class dosemeter for routine dosimetry; chamber bias voltage supply ± (0 ... 400) V	*page 14*
	T10015 BNT T10016 TNC T10011 M	TANDEM	Fast dual channel electrometer for absolute dosimetry with TanSoft software and for beam analysis with TBA therapy beam analyzers; chamber bias voltage supply ± (0 ... 400) V	*page 14*
	T10013	OPTIDOS	Brachytherapy dosemeter with scintillation detector T60006 to verify intravascular and ophtalmic radiation sources	*page 15*
	T10018	VIVODOS in-vivo Dosemeter	Twelve channel dosemeter for twelve channel in-vivo dosimetry (diodes) and six channel afterloading dosimetry (diodes)	*page 31*
	T11028	VIVODOS E in-vivo Dosemeter	Four channel dosemeter for four channel in-vivo dosimetry (diodes)	*page 31*
	T10004	MULTIDOS	Field class dual channel dosemeter (chambers with M connector), multi-channel dosemeter for 12-channel in-vivo dosimetry (diodes), 6-channel afterloading dosimetry (diodes), 48-channel beam analysis (LA48 linear array), and quality control (QC6Plus probe)	*page 32*

Diagnostic Dosemeters

	L981815	NOMEX Multimeter	Miniaturized non-invasive measuring system for absolute dosimetry and quality control in X-ray diagnostic radiology	*page 87*
	T11003	DIADOS	Diagnostic dosemeter for acceptance tests of radiographic, fluoroscopic, mammographic, dental and CT X-ray installations, utilizing semiconductor detectors	*page 88*
	T11035	DIADOS E	Diagnostic dosemeter for routine quality control of radiographic, fluoroscopic, mammographic, dental and CT X-ray installations, utilizing semiconductor detectors; hand-held device	*page 88*

	T10010 BNT T10009 TNC T10008 M	UNIDOS E Universal Dosemeter	Easy to use reference class or field class dosemeter for routine dosimetry in diagnostic radiology; chamber bias voltage supply ± (0 ... 400) V	*page 90*
	T11007	CONNY II	Diagnostic dosemeter for constancy tests of X-ray installations for radiography, fluoroscopy and mammography, utilizing a semiconductor detector	*page 97*
	T11039	DIADEM in-vivo Dosemeter	Patient dosemeter for patient entrance dose and dose rate measurement during diagnostic X-ray examinations, utilizing a TA34057-1 DIADEM chamber	*page 79*
	T11017	DIAMENTOR M4-KDK	Patient dosemeter for simultaneous measurement of patient entrance dose and dose rate, and dose area product (DAP) during diagnostic X-ray examinations, utilizing a TV34044-1 DIAMENTOR KDK chamber	*page 79*
	T11006	DIAMENTOR M4	Multifunctional dose area product (DAP) meter for patient dosimetry in diagnostic radiology, utilizing a TV34028-1 DIAMENTOR chamber	*page 80*
	T11038A T11038AP T11038 T11038P	DIAMENTOR C2	Dual channel dose area product (DAP) meter for patient dosimetry in diagnostic radiology, utilizing a TA34028-1 DIAMENTOR chamber; optional version with build-in printer	*page 80*
	T11033	DIAMENTOR E2	Single channel dose area product (DAP) meter for patient dosimetry in diagnostic radiology, utilizing a TA34028-1 DIAMENTOR chamber	*page 81*
	L981961	DIAMENTOR CX	Compact dosemeter for dose area product (DAP) and DAP rate measurement in patient dosimetry during diagnostic examinations with all-in-one chamber and electronics housing	*page 81*
	L981196	DIAMENTOR Set CI	Dose area product (DAP) measuring system for patient dosimetry with communication between single CAN components with chamber-integrated measuring electronics	*page 82*
	L981197 L981198	DIAMENTOR Set CM	Compact dose area product (DAP) measuring system for patient dosimetry with communication between single CAN components	*page 82*

Health Physics Dosemeter

	T10023 BNT T10022 TNC T10021 M	UNIDOS*webline* Universal Dosemeter	High performance reference class dosemeter with integrated network features for dosimetry in health physics; chamber bias voltage supply ± (0 ... 400) V	*page 138*

Guide to PTW Software

This guide gives a review of the complete range of PTW software programs to be used in combination with PTW dosimetry and quality control equipment.

Radiation Therapy

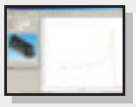
Absolute Dosimetry

	S080028	TanSoft	Absolute dosimetry with the TANDEM dual channel dosemeter	*page 14*
	S100009	UniSoft Edition 2000	Absorbed dose to water calculation according to AAPM TG-51 and IAEA TRS-398	*page 22*
	S100005	DosiCom	Communication between PTW dosemeters and computers (internet freeware for download)	*page 12*
	S100002	UniSet	Data input into the UNIDOS dosemeter. MS-DOS program	*page 13*
	S070008	MultiCal	Calibration factor input into the MULTIDOS / VIVODOS / VIVODOS E dosemeters	*page 32*

Patient and Brachytherapy Dosimetry

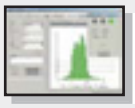
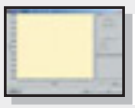
	S090004	VivoSoft	Patient in-vivo dosimetry during external radiation treatment with the MULTIDOS / VIVODOS / VIVODOS E dosemeters	*page 34*
	S090002	MultiSoft	Patient in-vivo dosimetry during brachytherapy afterloading treatment with the MULTIDOS / VIVODOS dosemeters	*page 34*

Therapy Beam Analysis

	S080001	MEPHYSTO *mc²*	Therapy beam data acquisition and data analysis with the TBA Therapy Beam Analyzers	*page 49*
		Options	Options LA48, MLCSoft, TPR, Film Analyzis, Absolute Dosimetry and Planning Modules (plamo) for MEPHYSTO *mc²*	*page 49*
	S080029	PlexControl	Detector positioning with the PLEXITOM phantom (included)	*page 46*
	S080047	FilmSoft	MEPHYSTO software module for automatic film evaluation with a film digitizer supplied with TIFF interface	*page 50*
	S080038	FilmScan	Scanning of radiological film images by film digitizers and storing the data in TIFF format	*page 50*
	S080052	PeakScan	Measurement and analysis of the Bragg peak with the PEAKFINDER	*page 43*

Radiation Therapy

Quality Control

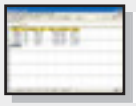
	S070016	DAVID Software	Measurement, evaluation and documentation of IMRT deliveries with the DAVID system	*page 58*
	S080032	BeamAdjust	QA software for online display of profiles acquired by different PTW arrays	*page 65*
	S070009	VeriSoft	IMRT beam dose verification	*page 59*
	S070011	MultiCheck	LINAC quality control with the 2D ion chamber arrays	*page 65*
	S070022	MLCSoft *epid*	Quality control of MLC leaf positions by analysing EPID images	*page 69*
	S070014	MLCSoft	Calibration and quality control of MLC leaf positioning with the LA48 ion chamber array	*page 69*
	S070007	WedgeAngle	Wedge angle determination with the WedgeCheck wedge angle test device (included)	*page 71*
	S070017	QUICKCHECK Software	LINAC constancy tests with the QUICKCHECK*webline* constancy test device	*page 68*
	S070001	LinaSoft	Data export from the LINACHECK monitor test device to Excel sheets	*page 73*
	S070013	ME48F-Soft	Fast profile measurements with the ME48F electronic unit and the LA48 linear ion chamber array	*page 48*
	S070010	epidSoft	Quality control of Electronic Portal Imaging Devices (EPID) using the EPID QC Phantom	*page 70*

Diagnostic Radiology

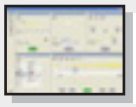
Patient Dosimetry

	S020003	DiaSoft with dose option	Recording and presenting DIAMENTOR measurement results including organ doses and effective dose	*page 84*

Quality Control

	S030008	NOMEX Software	Control of the NOMEX Multimeter and data handling incl. statistics and data export	*page 87*
	S030006	DiaControl *expert*	Comprehensive QC software for automatic data evaluation in diagnostic radiology	*page 96*
	S030004	DiaControl	Download of data from DIAVOLT kV-Meters and DIADOS/DIADOS E dosemeters	*page 88*

Health Physics

	S100009	UniSoft Edition 2000	Absorbed dose to water calculation according to AAPM TG-51 and IAEA TRS-398	*page 22*
	S150002	THELDO	Generating arbitrary temperature profiles delivered by the TLDO oven for TLD preheating and annealing. MS-DOS program	*page 140*
	S160003	BenchControl	Controls FILTER WHEEL, X-RAY SHUTTER, CALIBRATION BENCH with motorized carriage and electrometer, readout temperature and pressure	*page 143*

Notes

Notes

Notes

Product Index

Product Index

Item Number Index

The item numbers of most of the detectors are without the leading letters indicating the connecting system. For information about the available connecting systems see the according product page.

Item Number Index

Africa Egypt Morocco South Africa **America** Argentina Brazil Canada Chile Colombia CostaRica Ecuador Mexico Panama Uruguay USA Venezuela **Asia** Bahrain Bangladesh China Hong Kong India Indonesia Iran Israel Japan Jordan Korea Lebanon Malaysia Pakistan Philippines Saudi Arabia Singapore Syria Taiwan Thailand Vietnam **Australia** Australia and New Zealand **Europe** Austria Belarus Belgium Bulgaria Cyprus Czech Republic Denmark Finland France Germany Greece Hungary Iceland Italy Malta Netherlands Norway Poland Portugal Romania Russia Slovakia Spain Sweden Switzerland Turkey Ukraine United Kingdom

The objective from the start was to be a trustworthy and competent partner for our customers throughout the world. This also includes maintaining quality standards and comprehensive service and support. We will continue to do everything possible in the future to manufacture high-quality dosimetry products, which users and patients can trust.

We know what responsibility means.

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