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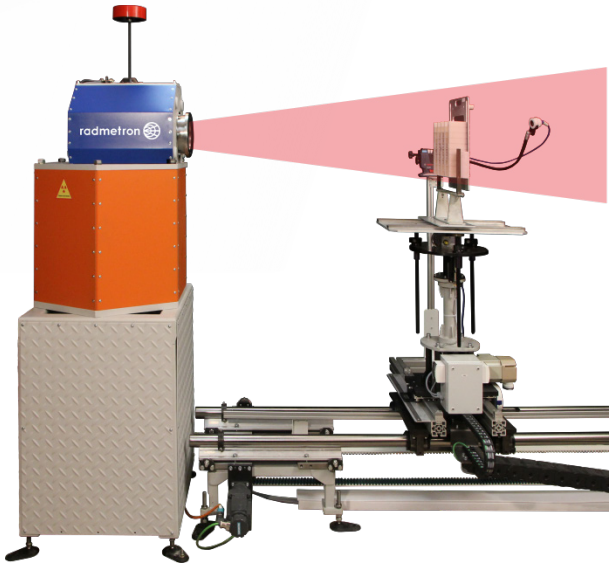
Radiation measurements for your safety

AUTOMATIC IRRADIATION CALIBRATION SYSTEM PM9100

Purpose

Polimaster Automatic Irradiation Calibration System PM9100/PM9101 is designed for the calibration, verification, and quality assurance of radiation detection equipment in the reference radiation field.

It can be used in the instruments calibration laboratories with enough flexibility to calibrate a wide range of portable and semi-portable measurement and test equipment of various manufacturers. It can be also used as reference standard and generate radiation fields that fully comply with ISO4037-01 requirements.



Key components

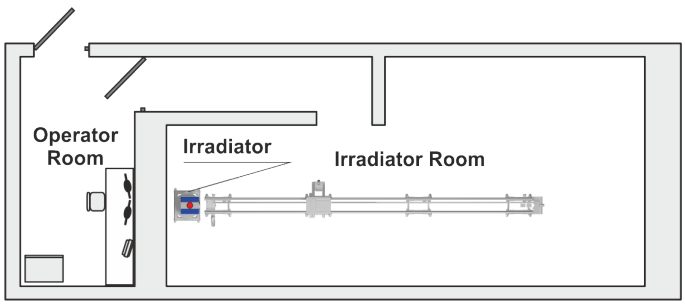
The system equipment is located in two rooms.

Irradiator room

- Fixed gamma beam irradiator
- Linear positioning system, equipped with trolley and operating table
- Safety systems components to ensure radiation safety of the personnel

Operator room

- Control System (operator workstation with installed software, control unit and control panel)
- Safety systems components



System layout in the irradiator room

Irradiator

1 Supporting frame with motorized drive for carousel rotation
2 Shielded carousel with a set of radiation sources
3 Collimator
4 Remotely controlled shutter

Linear positioning system

5 Guide rails
6 Trolley with function of operating table rotation and vertical positioning
7 Drive for trolley horizontal positioning along guide rails

Safety systems

8 Video surveillance system
9 Radiation monitoring system

Operating principle

The system is available with Automatic and Manual operation modes.

Automatic mode

All operations are fully automatic and can be controlled via the LAN interface from the remote operator room. The operator assistance results only in instruments installation on the operating table and removal. The operator selects the type of the equipment for calibration and the system performs a complete calibration procedure: selects the required source, moves the trolley with instruments holder along the reference points, turns On/Off the irradiator exposure and processes the instruments readings. Upon the completion, the system may download the instruments measurement history and generate calibration report and/or calculate and update calibration coefficients. If the history option is not available, the instrument readings are recorded by the operator via the camera.

Positive verification results are generated in the reports (for each instrument) which contain the following information according to ISO 17025 requirements:

- calibration laboratory and customer company details
- information about the calibrated instrument
- environmental conditions when the calibration was made
- calibration system accreditation information
- table with the calibration results.

Manual mode

Using the remote control panel, the operator may select particular radiation source from the revolver, set up exposure time and position the operating table at any distance and angle to the radioactive source. The instrument readings can be recorded based on data received from the video cameras and compared to the reference data, thus generating calibration reports manually

Gamma beam irradiator

The irradiator is used for the generation of X-rays and Gamma radiation beam. It consists of the supporting frame, collimator, remotely controlled shutter and shielded revolver that can be equipped with up to 6 radioactive sources with different activities, depending on the modification.

The source moves from the holder to the collimator through the transportation channel electromechanically. In case of power failure, the source will return from collimator to the storage position automatically thus preventing any unexpected irradiation.

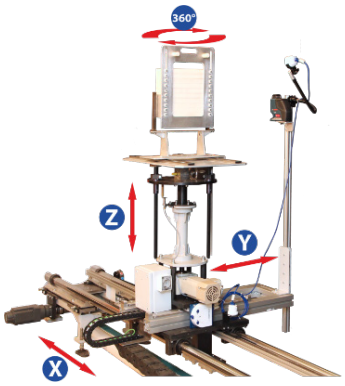
The collimator corresponds to the ISO4037-1 requirements. The shielding made of lead covers the collimator and carousel thus ensuring the reliable radiation safety of the personnel.

Linear positioning system

The linear positioning system is designed for automatically moving the trolley with operating table along the axis of the radiation beam (X axis). The combination of long guide rails and the variety of sources allow making a wide range of exposure rates to be generated within the facility. Positioning can be additionally controlled with the laser or mechanical ruler via video camera.

The trolley is available with up to three additional axes of motion:

- Y axis that is in parallel to the floor and in perpendicular to the radiation beam and X axis
- Z axis that moves operating table in vertical plane
- rotation axis that controls positioning the operating table relative to the angle of irradiation and allows testing the instrument angular response.



Remote control panel

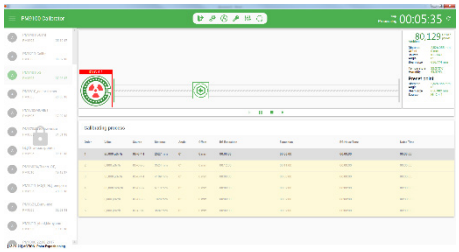
The PM9100/PM9101 calibration system includes a computer-based panel that remotely controls all functions of the system. This includes:

- Setting up exposure time for particular radioactive source
- Selecting the required radioactive source and transferring it from storage to exposure position and vice versa
- Monitoring the source position at any moment during operation
- Setting up exposure time for particular radioactive source
- Emergency switch to transfer radioactive source to storage position.

Radiation monitoring system

The system is used for the continuous radiation monitoring of irradiator and operator rooms to ensure radiation safety of the personnel.

It consists of 3 wall-mounted intellectual gamma detectors, control unit and control panel. Gamma detectors are installed in the irradiator/operator rooms and in the passage between rooms. The system constantly measures background radiation levels and alerts the operator if they exceed the preset alarm thresholds.



Video surveillance system

The system is intended to receive the readings of the radiation equipment, monitor the activities inside the irradiator room and remotely control the linear positioning system.

Interlock system

The system prevents personnel from penetration in the irradiator room when the
irradiator is ON. Main components are:
стальная дверь из комнаты оператора в помещение установки

- The shielded door to the irradiator room
- Sound and Light Alarm Unit alerting the personnel that the door is closed in 10 seconds
- Open/Close door sensor
- The door indicator, alerting that the gamma irradiator is ON
- Electromechanical lock, that enables door opening when the irradiator is OFF.

Transport container

Designed for transportation and temporary storage of up to 4 radioactive sources. The container design complies with the IAEA Regulations for the Safe
Transport of Radioactive Material No. SSR-6.

The transport container consists of protective container and shielding container.

Can be transported by any transport mode.

The container allows to carry out the procedure of sources loading into irradiator without usage of hot cell.

Optional system accessories

Available on the customer request.

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Specifications

	PM9100	PM9101
Number of sources in storage holder	up to 6 (^{241}Am, ^{137}Cs, ^{60}C, etc. available on customer request)	
Maximum gamma source activity (^{137}Cs)	up to 9.6 × 10^{13} Bq	up to 1.3 × 10^{13} Bq
Range of kerma in the air, ^{137}Cs	0.2 µGy/h – 22.2 Gy/h	0.2 µGy/h – 0.3 Gy/h
Dose equivalent rate range, ^{137}Cs	0.2 µSv/h – 26.5 Sv/h	0.2 µSv/h – 0.4 Sv/h
Exposure rate range, ^{137}Cs	24 µR/h – 2530 R/h	24 µR/h – 34.1 R/h
Accuracy of reference radiation field	up to ± 2,5 %	
Beam axis above floor level	1500 mm	
Collimator channel outlet diameter	Ø60 mm or Ø90 mm	
Collimator channel inlet diameter	150 mm	
Equivalent radiation dose rate at a distance of 1 m from the irradiator, no more than	0.5 µSv/h	
Operating distance range	500 – 7000 mm	
Positioning accuracy	± 0,15 %	
Discrete setting and indication of the working distance	0.01 mm	
Trolley movement speed, variable	0.5 mm/s – 0.5 m/s	
Range of the trolley vertical movement (Y axis)	± 200 mm	
Rotation axis	360° (with 15° step)	
Mass of accessory kits for irradiators and linear positioning system, not more than	150 kg	
Operating mode establishment time, not more than	1 min	
System continuous operation time, not less than	24 h	

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