Radcal®

Accu-Dose™ Radiation Measurement System

Quick-Start

Radcal
426 West Duarte Road
Monrovia, CA 91016-4591 USA
USA (626) 357-7921
Fax USA (626) 357-8863
email Service@radcal.com
www.radcal.com

Radcal Part # MNL/2086
4091183 Rev:B4
Firmware V7.03/7.23
Printed: Apr 2022

Accu-Dose

Thank you for choosing the Radcal Accu-Dose Analyzer for your diagnostic x-ray measurement needs. Accu-Dose is one of the family of the Accu-series analyzers. This Quick-Start Guide will step you through *Getting Started*, which includes the basic connections of the various ion chambers and battery charger as well as the *Operation* of the system including the set-up menu and making a measurement. Further details, including individual chamber specifications, can be found in the User's Guide on the CD included with your system.

INTRODUCTION

The Accu-Dose™ system measures dose, time, and more. Measurements are processed and displayed by a microprocessor-based control unit. To eliminate cable noise, dose sensors connect to the control unit via a 4-m cable that carries only digital signals and operating voltages.

Dose is measured using ion chamber or diode-dose sensors connected directly to a digitizer-electrometer.

The table on page 6 lists available dose sensors.

The Accu-Dose Basic system measures dose and dose rate.

The Accu-Dose Advanced measures dose, dose rate and more for radiography, fluoroscopy and leakage measurements. A USB interface on the Accu-Dose Advanced allows a PC to control and

process measurements performed by the Accu-Dose™ System. XLPRO, an Excel add-in, uses this capability to produce reports, graphs and to automate measurements.

The Accu-Dose™ may be operated from a rechargeable NiMH battery, from alkaline C cells, or from mains power.

The control unit is shown on page 5. The *UP*-arrow, *DN*-arrow, ***select*** and ***test*** buttons and a 2-line display are on the front panel. The green ***power*** button is located on the left end. The battery charger connects at the rear.

The *UP*-arrow, *DN*-arrow and ***select*** pushbuttons are used to navigate the menu and to activate measurements. The ***test*** pushbutton provides a simulated x-ray signal so you can observe how the measurements work. The ***power*** pushbutton provides for orderly startup and shutdown.

Measurement results are presented on the display and are available in digital formusing the USB connection (see XLPRO page 29).

Accu-Dose™ Diagnostic Ion Chamber Components

A. Accu-Dose (2186) Control Unit
B. 10X6-6 Ion Chamber Sensor
C. 9660 Ion Chamber Digitizer
D. 90C6-4 Sensor Cable


A
D
Radcal Accu-Dose
AutoDose 1469ms
9.682 R
test
select
MODEL 9660
ION CHAMBER DIGITIZER
S/N:01-1099
C
B

Available Sensors	Description
DDX6-W, M	Dose diode sensors
10X6-6	In-beam, diagnostic x-ray ion chamber
10X6-6M	Mammographic x-ray ion chamber
10X6-3CT	CT measurement ion chamber
10X6-60	General-purpose ion chamber
10X6-180	100 cm^2 scatter and leakage ion chamber
10x6-1800	1800 cc high-sensitivityion chamber

Measurement Functions

Dose	Dose Rate	Time
Dose Accum/Hold	Dose Rate	Seconds*
Auto Dose*	Max Dose Rate*	Minutes*
Last Dose*	Dose/pulse*	Hours*

* available with the Accu-Dose Advanced only

Ion Chamber Dose Timing Specifications

Measuring time (pulse width)

The Auto-Dose mode Accu-Dose Advanced only provides a pulse width (time) measurement capability when you use either ion chambers or dose diodes.

For ion chambers, the 10X6-6 and 10X6-6M are recommended. The range of pulse width extends from 10 ms to 9999s. The uncertainty is 4 ms (or 50 ms for the 10X6-1800 only) plus 0.1% of width.
The minimum dose rate for the 6cc Chamber is 650 mR/min or 95 µGy/s.
Minimum total dose for the 6cc Chamber is 0.54 mR or 4.7 µGy.
For other 10X6-series chambers, these minimums are inversely proportional to chamber volume.

When using adapters for 10X5 or 10X9 chambers, time measurements are valid for the -6 and -6M chambers only.

For time less than 10ms, dose diodes are recommended.
For the DDX6 diodes in Auto Dose the width uncertainty is 1.2 ms plus 0.1% of width over a range from 5 ms to 9999 s. Minimum dose rate is 102 µGy/s or 700 mR/min.

GETTING STARTED

This describes assembly and operation of the Accu-Dose™ System on page 5 comprising a control unit, a diagnostic kV sensor and a 6cc ion chamber with an ion-chamber digitizer.

IMPORTANT: Stabilization is required before making any ion chamber measurements. Stabilization is best done by putting the unit in Dose Rate mode/High Sensitivity and waiting for 3 minutes. See page 21 for details.

Assembly

Connect the sensor cable to the control unit:

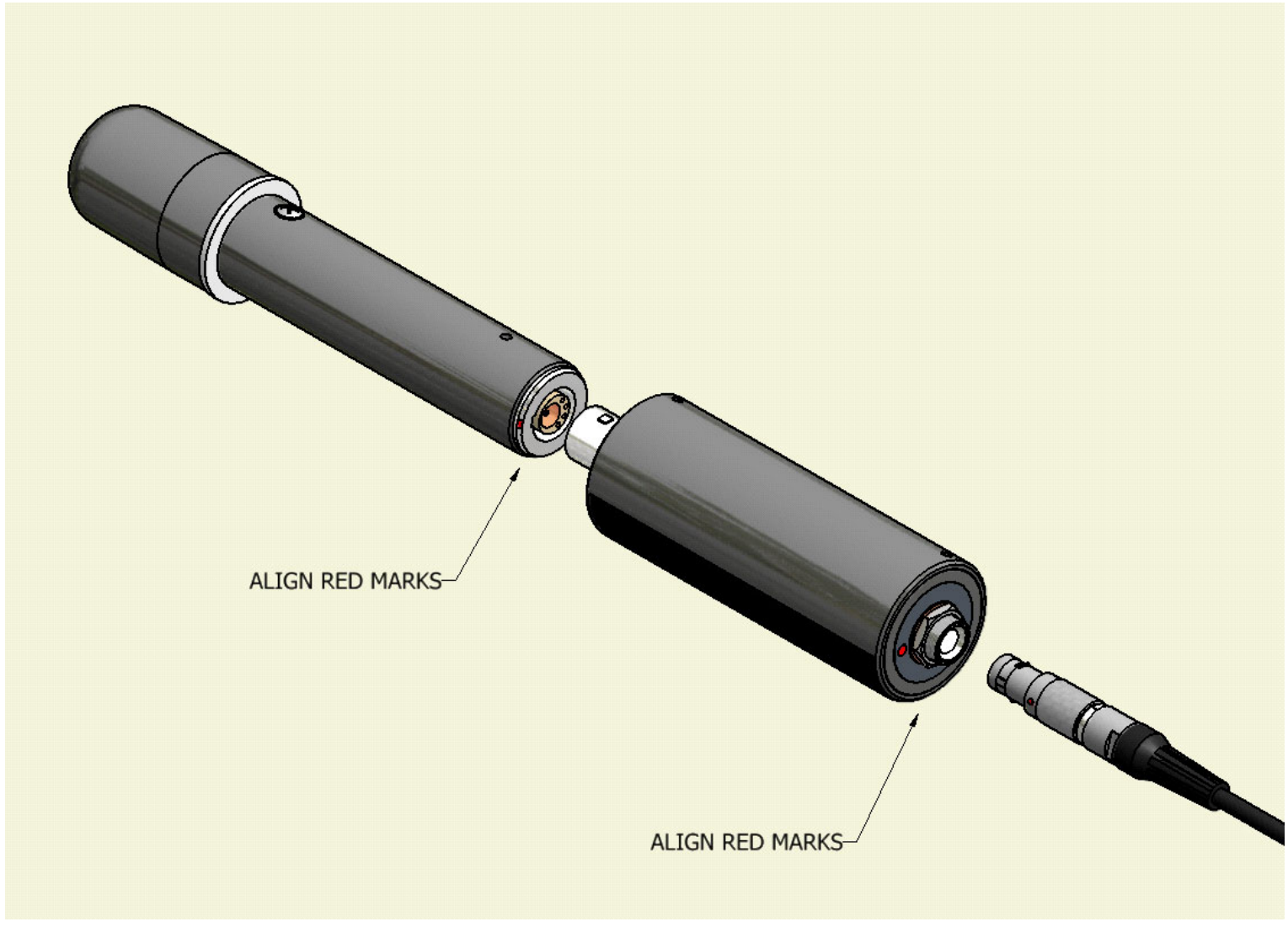
Insert the rectangular connector on the sensor cable into the socket on the right side of the instrument with the Radcal logo facing you. It will click into place. To disconnect, pinch the levers on the side of the connector and pull it from the socket.

Sensor cable connection

Connect the ion chamber digitizer:
Align the red dots of the smaller round connector of the sensor cable and corresponding connector of the digitizer and push to engage. Pull on the ribbed metal ring to disconnect.

Connect the ion chamber:
Connect the ion chamber to the larger circular connector on the ion chamber digitizer. Align the red dots and push the connector until the mating surfaces contact one another.

Never attempt to unscrew the connector.


ALIGN RED MARKS
ALIGN RED MARKS

Connect the battery charger:

The batteries are fully charged when they leave the factory and may be charged before use. The charger connects to the rear of the control unit. Plug it into an ac outlet. The charge indicator should turn orange indicating the battery is being charged. The instrument can operate while charging.

Operation

Turn on the Accu-Pro™:

Press the green ***power*** button. A beep sounds and a set of vertical rectangles marches across the display to assure it is operating, the calibration date is displayed, and self-test is performed. During turn-on the control unit reads the type and calibration factors of each sensor, measures the ion chamber temperature and the ambient pressure. When self-test completes, the display will show the chamber information:

6cc Corr 1.03
HV Stabilize 13s

while the ion chamber and bias supply stabilize. The 6cc Corr value is the temperature/pressure correction that will be applied to ion chamber readings. The stabilize value counts down to zero.

When it reaches zero, pressure and temperature display:

Press 99.2 kPa
Temp 20.1 deg C

The top line of the display will then show:

Change or SELECT

and the second line will show setup or whatever measurement mode was active the last time power off occurred.

If self-test is unsuccessful, a failure message is displayed. Pressing *UP* or *DN* allows operation to proceed; however you must resolve the problem before accurate measurements can be performed. See the User's Guide for error message information.

Display

Instrument operating status and measurement results are shown on the 2-line display. In some cases there are more measurements than will fit on 2 lines. Press ***select***to scroll additional readings onto the display.

Characters at the left side of the display have special meaning:

For dose measurements:
? indicates dose-sensor signal was outside calibrated range.

> indicates high-sensitivity mode measurement.

[indicates low-sensitivity mode measurement.

] indicates cumulative (zero-corrected) dose is negative.

> in *Setup* indicates a parameter choice. Press ***select*** to chose.

Sounds:
A short beep signals a key-press. A long beep signals an error.

Making a measurement:
The *UP* and *DN* arrows move through the main menu. The top line of the display continues to show

Change or SELECT

while the second line shows the measurement you may select. Pressing ***select*** starts the measurement. Pressing *UP* or *DN* during a measurement while a function is selected ends the measurement and returns to the main menu. Pressing ***select*** during a measurement may restart the function or scroll the display.

In the following section the ***test*** button simulates an x-ray exposure. Normal measurements would be performed in the same manner.

Dose Rate

Use *UP* or *DN* to reach *Dose Rate* then press ***select***.
The display will briefly show

6cc Corr 1.02
measuring zero

after which it will become

[Dose Rate
0.0 mR/min

The up arrow indicates low-sensitivity mode.
Press and hold ***test*** (or make an exposure).
The display becomes

[Dose Rate
999.5 mR/min

Once the measurement has been completed, the display retains the values. A subsequent exposure does not replace them until the measurement is complete. The > appears to the left of the exposure value to indicate signal-present. When it disappears, a beep sounds and the new reading is displayed.

MAKING ION CHAMBER MEASUREMENTS

1. Allow the system to reach equilibrium by selecting dose rate mode and waiting at least three minutes. Do not touch digitizer. One does not need to shut the system off when replacing chambers, however, do not disconnect the chamber when actual measurements are being made. Each time a new chamber is used, the system must re-stabilized.

   Note: For changing environments, allow 10 minutes per 10 C for the sensor/electronics to equilibrate.

2. Ensure that the system is set to high sensitivity on (Setup->Mode SELECT->High sensitivity->On). This ensures that the system performs a fine zero (as opposed to a coarse zero) prior to every measurement.

3. Do not move or touch the digitizer or the ion chamber during the zero measurement interval. If low-level measurements are being made and there is a significant delay between

measurements (> 2-3 minutes) it is prudent to force a full re-zero by exiting the mode and re-entering.

Setup options

The *Setup* menu allows control of a number of options. The defaults are listed below. See the User's Guide for more information. (* Accu-Dose Advanced only)

Main menu:

Dose Rate, Auto Dose*

Mode:

Ion chamber correction:	temperature, pressure.
Ion chamber high sensitivity:	disabled
Auto shutdown:	30 min
Units:	Roentgens, minutes

To reset options to factory defaults:
Press *UP* until

Change or SELECT
Setup

appears. Press ***select*** to enter *Setup*.
Press *DN* twice until

SELECT restores
setup defaults

appears. Press ***select***:

Accept changes ?
> OK

should appear. Press *DN* until

Press SELECT to exit Setup

appears. Press ***select***.

Accept changes?
> OK

appears again. Press ***select*** to return to the main menu with all *SETUP* options at factory defaults.

PERFORMANCE

(See User's Guide for complete specifications)

Ion Chamber Measurement Specifications

Accuracy: ±5% at reference conditions.
See User's Guide for detailed specifications

Dose-Diode Measurement Specifications

40kVp - 120kVp, 2.5mm Al

Energy dependance: ±5%

25kVp - 30kVp, 30 µm Mo

Energy dependance: ±5%

These sensors are calibrated for Mo/Mo. No corrections are applied for other anode/filter combinations.

ACCESSORIES

90E6-2 - Extension cable

The extension cable allows one to place the ion chamber up 2 meters away from the digitizer. (Other lengths available)

10A96 Ion chamber Adapter

This adapter adapts the 10X5 ion chambers to the 9660 ion chamber digitizer. It contains a microprocessor that translates between the jumpers, resistors and potentiometer located within the probe stem of 10X5-series ion chambers into signals that mimic the EAROM that holds calibration and chamber-type information the Accu-Pro™ requires. A temperature sensor is included to provide that information also. Its diameter is slightly larger than that of the chamber stem, with a hard-mounted 1015 connector on one end and a 9096-style connector on the opposite end. It draws power from the 9660 Ion Chamber digitizer.


10X5
Radcal®
9096
MODEL 10A96 ADAPTER

WARRANTY for the Accu-Dose™ Measurement System

Radcal warrants that, in the event that any defects in material or workmanship should develop within one year of the date of shipment, the company assumes full responsibility for servicing equipment of its manufacture without charge upon return of the equipment to Radcal, with shipping costs prepaid by the customer. Costs to return-ship to customer by ground transportation will be paid by Radcal if the repairs are warranty-applicable. This warranty excludes batteries.
Radcal shall not be held liable for damages or delays caused by defects beyond making repairs or furnishing replacement parts, nor shall Radcal be liable for any defective material replaced without Radcal's consent during the period of this warranty. Radcal reserves the right to perform warranty services at its own factory.

Non-Warranty Repairs

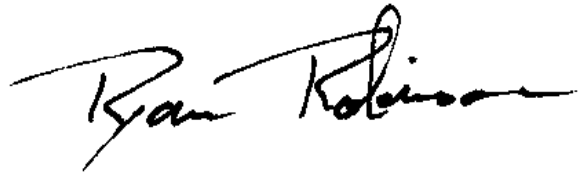
The calibration of this instrument was correct within specified limits when the instrument left our factory. Radcal cannot be responsible for injury or damage resulting from improper use or calibration errors which develop subsequent to our shipment of the instrument.
If Radcal determines that a fault has been caused by misuse, abnormal operating conditions, or repairs by unauthorized personnel during the warranty period, repairs and shipping costs will be billed at normal rates.
If the equipment is found to be in proper working condition, Radcal will return-ship the equipment at customer expense.

Declaration of Conformity

According to ISO/IEC 17050 and EN 45014

The Radcal declares, under our sole responsibility, that the **Accu-Dose™** Measurement System conforms to the following product specifications.

EMC:EN 61326-1



QA Manager
Date: 2008 May 12

Radcal
426 West Duarte Road
Monrovia, CA 91016-4591 USA