





\* "Evaluation of a Water-proof, Homogeneous Farmer-Type Ion Chamber for Orthovoltage and High Energy X-Rays and Electron Beams". V.M. Tello, A. Lawyer, C. Chu, J.A. BenComo and W.F. Hanson, presented at AAPM July 1996

## The Exradin Advantage

#### **Better Components**

- Waterproof construction eliminates the need for sleeves or protective coatings.
- Robust materials are more durable than typical chambers (i.e. PMMA thimble tips), and therefore are more suitable for routine measurements.
- Excellent inherent conductivity negates the need for coatings found in other chambers, which can flake off and require careful handling.
- Collector, guard and shell are made of conductive material developed by Dr. Francis Shonka, the creator of A150 tissue-equivalent, C552 air-equivalent and D400 polystyrene-equivalent plastics.

#### **Unmatched Durability**

• An Exradin A12 farmer-type chamber survived three 1 meter drop tests onto a hard floor, in three different orientations, without a change in calibration.\*

#### **Superior Stability**

- Advanced guard design creates a consistent collecting volume with uniform field lines, providing a stable, repeatable signal.
- Exradin detectors feature some of the quickest settling times of any manufacturer.
- Exceptionally wide guard rings on all parallel plate chambers eliminate perturbation volume effects.

#### Ideal Design for Improved Accuracy

- The Collecting volumes of Exradin Ion Chambers are defined by the guard, not an insulator, creating a significantly more stable signal than competing detectors.
- Axially symmetric design ensures a uniform isotropic response.
- Collection efficiencies of 99.9% or greater.
- Chamber vents through a flexible tube surrounding the triaxial cable; ideal for use in water or plastic phantoms.
- Homogeneous construction on most chambers.

#### Quick Response upon Hookup

- Ionization currents can be read immediately after electrometer and extension cable transients subside because Exradin Ion Chambers do not exhibit voltage soakage or stem effect.
- Exradin chambers typically have ± 10 x 10-15 amp leakage

## Thimble Ion Chambers

Strict manufacturing tolerances and waterproof construction make Exradin Thimble Ion Chambers ideal for dosimetry calibrations in water, air and other phantom materials.

## EXRADIN A19 ION CHAMBER 0.62 cc Classic Farmer

The A19 fits existing plastic phantom cavities and build-up caps, limiting perturbation and minimising settling time in absolute dosimetry calibration. This chamber is characterised for TG-51 procedures.

MR COMPATIBLE VERSION AVAILABLE



## EXRADIN A12 ION CHAMBER 0.64 cc Classic Farmer

Characterised in TG-51 and TRS-398, the A12 has fast settling time and a removable stem for superior absolute dosimetry calibrations in water, air or phantoms.

MR COMPATIBLE VERSION AVAILABLE



## EXRADIN A12S ION CHAMBER 0.24 cc Farmer-type

The A12S is designed for absolute dosimetry calibrations in water, air or phantoms. The collector of the A12S is approximately one-third the size of the A12, confining collecting volume to the tip of the chamber.

MR COMPATIBLE VERSION AVAILABLE



## EXRADIN A2 ION CHAMBER 0.53 cc Spokas - P2, T2 also available

The A2 is ideal for precise measurement of exposure and air kerma in photon beams and absorbed dose in photon, electron, proton and other beams. This chamber is available in air, polystyrene and tissue equivalent plastic. It is also available in magnesium with gas flow capabilities.



### EXRADIN A1SL ION CHAMBER 0.053 cc Slimline Minature Shonka

The A1SL, available in air or tissue equivalent plastic, provides a perfect balance between fast scanning and point-dose measurements within 1cm in water, air or phantom materials. This chamber is characterised for TG-51 procedures.



MR COMPATIBLE VERSION AVAILABLE

## EXRADIN A1 ION CHAMBER 0.053 cc Minature Shonka - T1 also available

The Exradin A1 has the same internal dimensions and collecting volume as the A1SL, yet the larger diameter is ideal for use in solid phantoms. This chamber is characterised in TG-51 and TRS-398.



### EXRADIN A28 ION CHAMBER 0.125 cc Scanning

The Model A28 Chamber features exceptional omni-directional spatial resolution for relative dosimetry scanning in water phantoms and use in minute field measurements.

MR COMPATIBLE VERSION AVAILABLE

8 9 9 8 2 1.00	×			
0.40	100	1000	10000	
	Energ	y [kdv]		



## Micro Ion Chambers

Superior small-field dosimetry to assess pinpoint radiation in IMRT, stereotactic, orthovoltage, x-rays and superficial skin therapy.

## EXRADIN A26 ION CHAMBER 0.015 cc Micropoint

Nearly-spherical collecting volume for omni-directional scans.

MR COMPATIBLE VERSION AVAILABLE

Chamber Spot Size <sup>+</sup> Ø 4.3 mm

#### Small Field Excellence

Experience the same measurement quality in a microchamber you have come to expect from your reference chamber.

- Rapid settling
- Stable, reproducible measurements
- Realistic and meaningful ion recombination corrections
- Minimal polarity dependence
- Minimal energy dependence

#### Reduced Volume Averaging Effects

Uniform 4.3 mm diameter spot size reduces volume averaging effects and eliminates angular dependencies of volume averaging.

Fully-Guarded Micro-Chamber

Each Exradin thimble chamber has a guard that extends well beyond the insulator's surface, ensuring that the electric field defining the chamber's collecting volume is cleanly shaped by the guard.

## EXRADIN A16 ION CHAMBER 0.007 cc Micropoint

The model A16 microchamber measures extremely small field sizes (3.4 mm x 3.4 mm); allowing for exceptional spatial resolution and exact pinpoint beam profile characterisation. These attributes make the A16 ideal for stereotactic radiosurgery and IMRT applications.



## EXRADIN A14SL ION CHAMBER 0.015 cc Slimline Microchamber

The model A14SL is capable of measuring extremely small field sizes of 4 mm by 6 mm, allowing for exceptional spatial resolution and exact pinpoint beam profile characterisation. This helps assess radiation fields during IMRT and stereotactic radiosurgery.



## EXRADIN A14 ION CHAMBER 0.015 cc Microchamber - T14 also available

The model A14 microchamber has the exact internal dimensions and collecting volume as the model A14SL, yet a larger diameter is ideal for use in solid phantoms.



# Parallel Plate Ion Chambers

Exradin Parallel Plate Chambers ensure precision in depth-dose measurements by providing uniform field lines even at low energies.

### EXRADIN A10 ION CHAMBER 0.050 cc Markus®-type Parallel Plate



The A10 Markus-type chamber provides excellent spatial resolution for dose distribution measurements in a water phantom. An acrylic waterproof cap is included with this chamber for use in TG-51 electron beam protocols.



### EXRADIN A11 ION CHAMBER 0.62 cc Parallel Plate - T11. P11 also available



Waterproof A11 Roos-type chamber may be operated while fully submerged without any protective sheath; ideal for repeated TG-51/TRS-398 dose distribution measurements in a water phantom.





## EXRADIN A11TW ION CHAMBER 0.93 cc Thin Window Parallel Plate



The A11TW is tailored for use in superficial therapy and low energy diagnostic beams. The thin-window design provides nearly constant response over the entire diagnostic energy range.





#### EXRADIN MAGNA A600 ION CHAMBER 1.50 cc Diagnostic Parallel Plate



The A600 chamber is designed for consistent air kerma, absorbed dose and exposure measurements. Vented and fully-guarded, this chamber is perfectly suited for mammography and general diagnostic x-ray regions.



EXRADIN MAGNA A650 ION CHAMBER 3.46 cc Diagnostic Parallel Plate



The A650 chamber is a vented and fully guarded ion chamber for use in mammography and general diagnostic energy x-ray regions.

### EXRADIN A20 ION CHAMBER 0.074 cc Low Energy X-Ray

The A20 is a low-energy x-ray chamber for assessing and calibrating pinpoint radiation fields for x-rays, stereotactic and TG-61 compliant superficial skin therapy.



# Spherical Ion Chambers

Exradin Spherical Ion Chambers are relied upon worldwide for precise measurement of radiation exposure and exposure rates. They are easily positioned for in-air measurements.

## EXRADIN A3 ION CHAMBER 3.6 cc Shonka-Wyckoff Spherical

3.6cc collecting volume is ideal for laboratory transfer standards and secondary standards for exposure measurements.



## EXRADIN A4 ION CHAMBER 30 cc Shonka-Wyckoff Spherical

30cc collecting volume is ideal for laboratory transfer standards, secondary standards for exposure measurement and integrating exposure over a large area.





## EXRADIN A5 ION CHAMBER 100 cc Shonka-Wyckoff Spherical

100cc collecting volume is ideal for secondary standards for exposure measurement, integrating exposure over a large area and room scatter measurements.





## EXRADIN A6 ION CHAMBER 800 cc Shonka-Wyckoff Spherical

800cc collecting volume is ideal for secondary standards for exposure measurements, integrating exposure over a large area and room scatter measurements.





## EXRADIN A8 ION CHAMBER

15.7 litre Shonka-Wyckoff Spherical

15.7 litre collecting volume is ideal for secondary standards for extremely low exposure measurements, integrating exposure over a large area and room scatter measurements.

## CT Ion Chambers

Exradin CT Chambers are durable detectors for performing the measurements necessary in the CTDI (computed tomography dose index) calculations described in TG-74.

## EXRADIN A101 ION CHAMBER 4.54 cc CT

The A101 performs the measurements necessary for calculating the CTDI as described in TG-74. It has excellent response uniformity over the chamber length, with variation less than ±3%.

## EXRADIN A17 ION CHAMBER 1.91 cc Slice Therapy

The A17 is tailored for MV and tomotherapy applications such as weekly QA checks or patient dose verification with phantoms and water tanks. It has excellent response uniformity over the chamber length, with variation less than ±1.5%.

## **EXRADIN W1** SCINTILLATOR

The Exradin W1 Scintillator is a near-water equivalent detector that achieves paramount precision by significantly decreasing beam disturbance.

Minimise Beam Perturbation and Corrections

The unprecedented characteristics of the W1 Scintillator closely mimic water, easing data collection by negating many measurement corrections required with other detectors.

- Near water equivalence (within 5% of physical density)
- Linear dose response
- Dose rate independence
- Energy independence within the MV range
- Minimal temperature dependence

Ideal for Measurement and Characterisation of Small Fields

1mm spatial resolution makes the W1 a perfect tool for stereotactic radiosurgery (SRS) and stereotactic body radiation therapy (SBRT) QA. This includes compatibility with the Lucy 3D QA Phantom and use in the following systems:

- Gamma Knife®
- CyberKnife®
- BrainLab®

#### Automatically Correct for Cherenkov Effect

Pair the W1 Scintillator with the SuperMAX Electrometer to effectively eliminate Cherenkov effect without the need for extraneous hand calculations.

#### Consistent, Convenient Setup

Integration with the Exradin Scintillator Calibration Slab and solid water phantoms allows for easy, repeatable measurements.





## EXRADIN D1H & D1V DIODES

The Exradin D1V and D1H Diodes maximize spatial resolution and minimize angular dependence, allowing for consistent, accurate small-field stereotactic measurements.

#### Why use an Exradin Diode?

Exradin diodes produce flatter profiles and sharper resolution with a smaller active measurement area than traditional ion chambers. This allows for the precise measurement of minute fields while still achieving high visibility of the beam's penumbra.

#### Specialised for Small Fields

The Exradin D1V and D1H Diodes facilitate several measurement modalities in small fields.

• The diode face of the D1V is perpendicular to the beam when upright, making it ideal for photon scanning applications and use in water phantoms.

• The diode face of the D1H is perpendicular to the beam when flat, for use inside traditional plastic phantoms.

Both the D1V and D1H provide superior measurement of field sizes up to  $20 \times 20$  cm2 with excellent spatial resolution and minimal noise.

#### Minimise Angular Dependence

A common problem when performing measurements using diode-based detectors is angular dependence or significant variation in signal depending on the orientation of the detector. Exradin diodes help minimize this concern with less than 0.5% angular dependence when tilted up to 20° to the beam, providing more confidence in your results when measuring the penumbra or edge of the beam.

## **EXRADIN ION CHAMBERS** PRODUCT MATRIX

	THIMBLE ION CHAMBERS								MICRO ION CHAMBERS			
MODEL	1	A1SL	2	A18	A28	A19	A12	A125	14	A14SL	A16	
Collecting Volume(cc)	0.053	0.053	0.53	0.123	0.125	0.62	0.64	0.24	0.015	0.015	0.007	
Spot Size(mm)	8.0	8.0	14.0	10.8	8.0	26.2	26.5	13.1	6.4	6.4	3.5	
Centroid of Collecting Volume from exterior tip of shell (mm)	3.86	4.06	6.96	5.26	4.47	13.0	12.9	5.79	2.21	2.39	1.65	
Centroid of Collecting Volume from exterior surface of window (mm)												
Outside Diameter of Shell (mm)	6.0	6.35	11.4	6.9	8	7.1	7.1	7.1	6.0	6.35	3.4	
Inside Diameter of Shell (mm) Collecting Volume Outer Diameter	4.0	4.0	9.5	4.9	5.8	6.1	6.1	6.1	4.0	4.0	2.4	
Window Collector Gap (mm)												
Shell Wall Thickness (mm)	1.0	1.1	1.0	1.0	1.1	0.5	0.5	0.5	1.0	1.1	0.5	
Collector Diameter(mm)	1.0	1.0	4.6	1.0	1.0	1.0	1.0	1.0	0.3	0.3	0.3	
Guard Ring Width (Radial) (mm)												
Collector Length (mm)	4.4	4.4	8.4	6.4	6.4	21.6	21.6	7.5	1.5	1.5	1.27	
Window Material*												
Window Thickness												
MR Compatibility Available		MR			MR	MR	MR	MR				
Shell/Entry Window, Collector	A.T	А	A.T	А	А	А	А	А	SHELL ON		ILY	
and Guard Materiaf									A	A	A	
Nominal Air Kerma Calibration Factor †	5.4E+8 Gy/C	5.4E+8 Gy/C	5.4E+7 Gy/C	2.3E+8 Gy/C	2.3E+8 Gy/C	4.5E+7 Gy/C	4.4E+7 Gy/C	1.2E+8 Gy/C	1.9E+9 Gy/C	1.9E+9 Gy/C	4.1E+9 Gy/C	
Recommended Polarizing Voltage(V)	300	300	300	300	300	300	300	300	300	300	300	
Nominal Leakage (amp)						±10	x 10 <sup>-15</sup>					
Maximum Polarizing Voltage (V)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
Waterproof	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Included Buildup Cap	None	None	None	Co-60	Co-60	Co-60	Co-60	Co-60	None	None	Co-60	

\* MATERIAL: A – C552 Shonka air-equivalent plastic P – D400 polystyrene-equivalent plastic T – A150 Shonka tissue-equivalent plastic K – 3.86 mg/cm2 Kapton 2K – 7.72 mg/cm2 Kapton

+ Nominal calibration factor for Co-60 at 22° C

(1) comes included with an acrylic sleeve to adapt chamber to fit Ø0.50 in (12.7 mm) phantom holes

(2) waterproofing cap is PMMA, 1.0mm entry window, TG-51 compliant



### Chamber Spot Size the smallest circle that inscribes the chamber's collecting volume and shell (not minimum field size)





	CT ION CI	HAMBERS		PARA	LLEL PLAT	TE ION CH	AMBERS		SPHERICAL ION CHAMBERS				
A26	A101	A17	A10	11	11TW	A20	Magna A600	Magna A650	A3	A4	A5	A6	A8
0.015	4.54	1.91	0.050	0.62	0.93	0.074	1.50	3.46	3.6	30	100	800	15.7 L
4.3													
1.98													
			1.0	2.0	1.5	1.8	4.0	4.0					
4.3	10.0	12.7							19.6	39.1	63.1	120.4	323.2
3.3	8.0	6.0							19.1	38.1	57.2	114.4	311.2
			2.0	2.0	3.0	5.0	7.95	7.95					
0.5	1.0	3.3							0.25	0.5	3.0	3.0	6.0
0.75	2.5	2.5	5.4	20.0	20.0	1.93	12.7	21.9	2.1	4.1	6.5	11.6	22.4
			4.3	4.4	4.4	1.2	3.9	7.6					
1.78	100	80							13.3	24.9	37.3	74.0	166.7
			к	1.0 mm, A, P, or T	к	2K	к	к					
			0.05 mm	1.0 mm	0.05 mm	0.09 mm	0.05 mm	0.05 mm					
MR													
A	A	A	A	A, P, T	A, P, T	A	A	A	A	A	A	A	A
1.85E+9 Gy/C	6.2E+6 Gy/C	1.5E+7 Gy/C	5.6E+8 Gy/C	4.6E+7 Gy/C	3.0E+7 Gy/C	3.8E+8 Gy/C	1.9E+7 Gy/C	8.2E+6 Gy/C	9.0E+8 R/C	1.1E+8 R/C	3.3E+7 R/C	4.2E+6 R/C	2.1E+5 R/C
300	300	300	300	300	300	300	300	300	300	500	800	1000	1000
							± 10 x 10 <sup>-15</sup>						
1000	1000	1000	1000	1000	1000	1000	400	400	1000	1000	1000	1000	1000
Yes	No	Yes	Yes (2)	Yes	Yes (2)	No	No	No	No	No	No	No	No
Co-60	None (1)	Co-60 integral	None	None	None	None	None	None	None	None	Co-60 integral	Co-60 integral	Co-60 integral



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