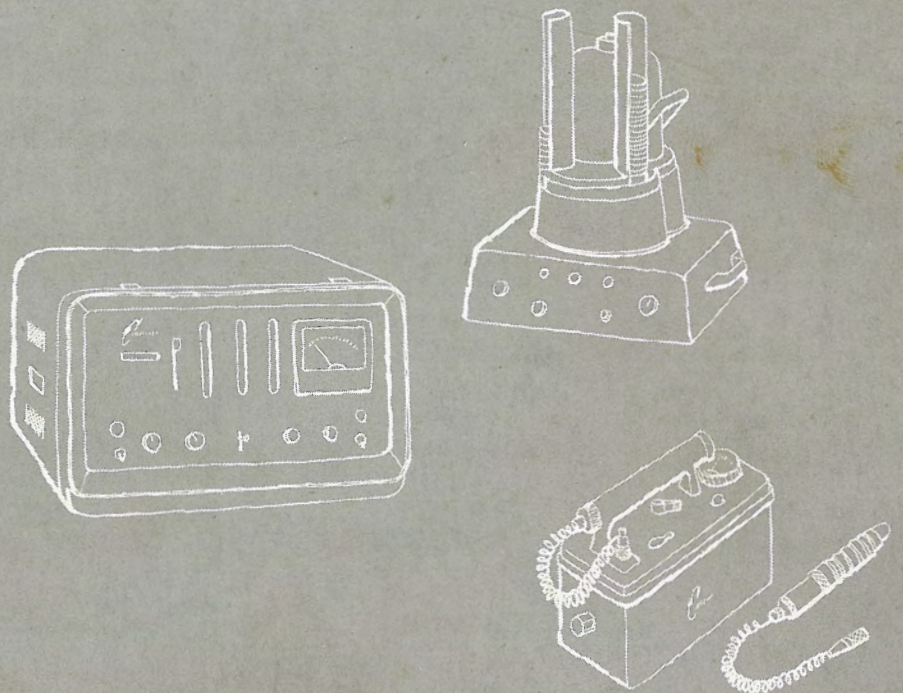


catalog P



**nuclear instrument and chemical corporation**

*radiation measuring  
instruments, radiochemicals  
and accessories*



effective  
June 15, 1955



catalog P  
price list



The five districts and District Sales Offices of the **Nuclear Instrument and Chemical Corporation** are shown below. Your orders and inquiries will be expedited by contacting the branch manager serving your area.

district	branch manager	serving
1	Edward Reible 223 West Erie Street Chicago 10, Illinois DElaware 7-3060	Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin.
2	Melvin E. Shepherd 8208 Fenton Street Silver Spring, Maryland JUniper 8-2862	Alabama, Delaware, D.C., Florida, Georgia, Maryland, North Carolina, South Carolina, Tennessee, Virginia, West Virginia and southwestern Pennsylvania.
3	William J. Palenscar 1063 Colorado Blvd. Los Angeles 41, Calif. CLinton 5-4711	Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.
4	L. Gordon Grinnell 3639 Bruckner Blvd. New York 61, New York TYrone 2-6611	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and all of Pennsylvania except southwestern counties.
5	W. J. Lepeska 3206 Gaston Avenue Dallas, Texas TRemont 8887	Arkansas, Louisiana, Mississippi, Oklahoma, Texas.



# CATALOG P PRICE LIST

	catalog page	price		catalog page	price
<b>timers</b>			<b>probes</b>		
Model T-101 Timer	46	55.00	Model P15 Probe	47	35.00
Model T1 Dual Timer	46	102.00	Model P10 Probe	47	75.00
			Model P11 Probe	47	49.50
			Model P16 Probe	47	40.00
<b>sample handling</b>			<b>scaler carts</b>		
Model PM-1 Sample Spinner	46	49.50	Model CA3 Scaler Cart	48	54.50
Model PM-2 Dryer Attachment	46	18.00	Model CA2 Scaler Cart	48	37.50
Model PM-3 Lamp Attachment	46	7.50	Model CA4 "Carette"	48	395.00
<b>step-down transformer</b>			<b>nuclearule</b>		
Model PS6 Step-Down Transformer	46	25.00	Model N1 Nuclearule	48	5.00
<b>line filter</b>			<b>warning signs and stickers</b>		
Model PS7 Line Noise Filter	46	29.50	Model N2 Radiation Warning Tape	48	6.00
			Model N5A Radiation Warning Signs	48	2.00/pkg.
			Model N5B Radiation Warning Stickers	48	2.00/pkg.
<b>recorder</b>			<b>batteries</b>		
Esterline-Angus Chart Recorder	46	345.00	Model BA-002	48	.75
			Model BA-003	48	1.65
			Model BA-005	48	2.75
			Model BA-006	48	11.00
			Model BA-007	48	1.65
			Model BA-010	48	.50
			Model BA-011	48	75.00
			Model BA-015	48	.60
			Model BA-021	48	.50
			Model BA-022	48	.65
			Model BA-026	48	1.00
			Model BA-027	48	3.00
			Model BA-028	48	4.00
			Model BA-029	48	1.95
			Model BA-030	48	1.50
			Model BA-031	48	1.25
			Model BA-032	48	3.00
			Model BA-033	48	2.70
<b>sample pans and storage cabinet</b>			<b>cables</b>		
Model AF-12 Flat Aluminum Sample Pans	47	3.00 / (c) 20.00 / (M)	Cables	48	on request
Model AC-12 Cupped Aluminum Sample Pans	47	4.00 / (c) 25.00 / (M)			
Model PC-12 Cupped Plastic Sample Pans	47	4.00 / (c)			
Model SC-12 Stainless Steel Cupped Sample Pans	47	6.00 / (c)			
Model N4 Sample Storage Cabinet	47	49.50			
<b>liquid counter set</b>					
Model LC-1 Liquid Counter Set	47	65.00			
Extra Model LB-1 Marinelli Beaker	47	6.00			
Extra Model LT-1 Test Tubes	47	2.00 / doz.			
<b>absorbers</b>					
Model C-101 Absorber Set	47	85.00			

## film badges

Prices for the NUCLIBADGE service are as follows:

quantity of badges per shipment	charge per badge
1	\$1.00
2	.875
3-24	.65
25-49	.60
50-99	.55
100-499	.50
500 and over	on request

When only one or two shipments are ordered, a setup charge of 25% will be made. No setup charge will be made to customers already subscribing to regular service should they request extra or special shipments or service.

frequency of service	contract term	discount
Weekly	50 weeks or more	5%
Bi-Weekly	50 to 99 weeks	2%
	100 weeks or more	5%
Monthly	12 to 23 months	2%
	24 months or more	5%

Lost or damaged badges will be charged for at the rate of \$1.00 each.

Terms: Net 30 days, 1% 10 days, billed quarterly in advance. Government and other institutions and firms prohibited from paying in advance for services will be billed quarterly after service received and not allowed the 1% 10 days discount, nor any of the above quantity discounts:

All prices are f.o.b. factory (Chicago). All prices subject to change without notice. Prices quoted do not include any State, Local Sales, Use Tax or Federal Excise Tax. All taxes imposed on items involved herein, if payable by seller, will be added to the price shown. Invoice terms are 1% ten days, net thirty days. Packing—Instruments are packed in cartons for shipment. Wood case packing, if required and specified in order, is charged extra.

# Nuclear-Chicago Authorized Factory Service Representatives

Nuclear-Chicago instruments should operate for years without need of repair except for occasional replacement of vacuum tubes. If trouble should develop in your instrument, time loss and inconvenience can be minimized by utilizing the services of your nearest service representative. These men understand our instruments and their correct application in a wide variety of medical, industrial, scientific and research problems. Their services are available at any time.

When repair work is needed, please write or call your nearest service representative before shipping your instrument. In many cases our representatives will be able to determine the cause of your trouble without seeing the instrument. If repair work is necessary, you will be promptly advised.

## authorized factory service representatives are:

### NEW ENGLAND

Fred Timperley & Co., 43 Clover Street  
Milford, Connecticut, State 7-3131 X2274

### MIDDLE ATLANTIC

Electronic Research Laboratories  
P. Nicholas, 85 Surrey Street  
Brighton, Massachusetts, Stadium 2-3116

Noye Laboratories, 240 Colvin Avenue at Hertel  
Buffalo, New York, Delaware 3400

Herman Glasser, Radiological Service Co.  
92-15 172nd Street, Jamaica 32, New York, Republic 9-7339

L. Gordon Grinnell, 3639 Bruckner Blvd.,  
New York 61, New York, Tyrone 2-6611

Stuart C. Black, Room O-71  
P.O. Box 287, Station 3,  
Rochester 20, New York, Monroe 2000, X2685

William J. Mueller, Electronic Engineer  
State University of New York  
766 Irving Avenue, Syracuse 10, New York, 76-3181

H. J. Ratsch, 717 Locust Street  
Irwin, Pennsylvania, Underhill 3-8961

Martin R. Barrows, 2008 McKinley Street  
Philadelphia 49, Pennsylvania, Jefferson 5-8407

### SOUTH ATLANTIC

Alvin Blum, 350 Madeira  
Coral Gables, Florida, 485762

William B. Miller, 795 Martina Drive N.E.,  
Atlanta, Georgia, Cherokee 5619

Charles C. Eckloff, 8208 Fenton Street  
Silver Spring, Maryland, Juniper 8-2862

Harold A. Lamonds, Physics Department  
North Carolina State College, Raleigh, North Carolina, 45211 X 229

Samuel Levine, 7709 Castleton Place  
Norfolk, Virginia, Norfolk 8-2519

Frederick H. Schmidt, Ray C. Williams  
523 North 12th Street, Richmond 19, Virginia, 79851 X 740

### NORTH CENTRAL

Missouri Electronics Corporation  
6058 Maple Avenue  
St. Louis 12, Missouri, Delmar 0043

Engineering Specialties, 7706 Shawnee Run Road  
Madeira, Ohio, Locust 9926

Anthony J. Pierce, 3316 New Brighton Rd.  
St. Paul 13, Minn.

### SOUTH CENTRAL

William Wenger, Maintenance Department  
University of Alabama Medical Center  
Birmingham 5, Alabama, 54-2481 X752

Workshop for Electronics, 621 Classen Blvd.,  
Oklahoma City, Oklahoma, Regent 6-5150

B. P. McKay, Room 2A, 875 Monroe Street  
Memphis, Tennessee, 8-8892 or 33-7386

W. J. Lepeska, 3206 Gaston Avenue  
Dallas, Texas, Remont 8887

### MOUNTAIN

C. A. Hedberg, University of Denver  
Denver, Colorado, Sherman 4-1811 X 241

Garth Westenskow, University of Utah  
College of Medicine, Radiobiology Laboratory  
Salt Lake City, Utah

### PACIFIC

William L. Bulger, 2110 McKinley Avenue  
Berkeley 3, California, TH 3-8540

Ross W. Farmer, 18313 Domino Street  
Reseda, California

W. J. Palenscar, 1063 Colorado Blvd.  
Los Angeles, California,  
Clinton 5-4711

John E. Scott, Jr., Scott Instrument Laboratory  
3927 Third Avenue, San Diego 3, California, W-6926

Hawthorne Electronics  
700 S.E. Hawthorne Boulevard  
Portland 14, Oregon, VE 5585

Van Deventer & Johnson Electronics Co.  
1639 S.E. 104th St.,  
Bellevue, Washington

### CANADA

W. L. Oliver, Phys. Enterprises, 1629 Dundas Street  
East London, Ontario, Fairmont 7629J

R. Spencer Soanes, Canadian Research Inst.,  
46 St. George Street, Toronto 5, Ontario, Canada

**nuclear** INSTRUMENT AND CHEMICAL CORPORATION  
223 West Erie Street, Chicago 10, Illinois

effective

July 15, 1955



## radiochemical price list

Nuclear-Chicago is proud to present for your consideration the most complete listing of carbon-14 labelled compounds available from any source. Many of the items are exclusive with us, and all are prepared to meet the highest standards of chemical and radiochemical purity. Careful inventory control together with a high sales volume insure that stocks are fresh and available in most cases "off the shelf". Purities are carefully checked by paper chromatographic methods and by dilution analysis to assure you that your tracer experiments will not be invalidated by unsuspected impurities.

Radiochemicals are available in a variety of convenient package sizes at the highest possible specific activities consistent with purity and radiation stability. We invite your inquiry for special compounds and your advice on additions to our constantly expanding list. We are always happy to advise you on the use of radiochemicals in your individual problem.

Nuclear-Chicago is an outstanding supplier of fine nuclear instrumentation and maintains an excellent staff of physicists, chemists and engineers to help you in the application of nuclear techniques to problems in industrial, medical and academic fields.

Nuclear-Chicago should be your first stop for chemicals, instrumentation or service in the nucleonic field.

### packaging

Dry materials are generally supplied in screw-capped vials except where protection from the atmosphere is required. Non-volatile liquids are supplied in sealed

tubes. Volatile compounds are supplied in sealed tubes equipped with break-off tips suitable for manipulation in a vacuum system.

### ordering information

Radiochemicals may be shipped only with U.S. Atomic Energy Commission authorization. Application Form AEC-313 should be submitted in triplicate to the Isotopes Division, Atomic Energy Commission, Oak Ridge, Tennessee.

One copy of the approval form AEC-374 must be submitted with your order. If you wish, you may ask that the approval form be sent directly to us by the Isotopes Division.

If the radioactive material is intended for drug use or investigation on experimental animals or human beings,

your order must also include one completed copy of Certificate of Compliance with Federal Food, Drug, and Cosmetic Act (Form AEC-465). If your use of the radioactive material DOES NOT require consumption by animals or humans, PLEASE SO STATE ON YOUR ORDER.

Copies of Forms AEC-313 and AEC-465 and assistance in fulfilling AEC requirements are available at all Nuclear-Chicago offices and from the U.S. Atomic Energy Commission, Isotopes Division, Oak Ridge, Tennessee.

please contact your nearest **nuclear-chicago office** for further information

223 West Erie Street  
Chicago 10, Illinois  
DElaware 7-3060

8208 Fenton Street  
Silver Spring, Maryland  
JUUniper 8-2862

1063 Colorado Boulevard  
Los Angeles 41, California  
CLinton 5-4711

3639 Bruckner Boulevard  
New York 61, New York  
TYrone 2-6611

3206 Gaston Street  
Dallas, Texas  
TRemont 8887

# nuclear-chicago radiochemical price list

Code	Compound	Specific Activity (millicuries/ millimole)	Package Price			
			1.0	0.5	0.1	
			millicurie			
CFA 13	Acetic-1-C <sup>14</sup> acid (Sodium salt)	2	\$150	\$80	\$25	
CFA 14	Acetic-2-C <sup>14</sup> acid (Sodium salt)	2	250	125	35	
CFA 86	Acetic-1-C <sup>14</sup> anhydride	2	250	125	42	
CFA 42	Acetone-1,3-C <sup>14</sup>	1	300	150	42	
* CFA 43	Acetone-2-C <sup>14</sup>	2	375	187.50	50	
—	Acetonitrile (see Methyl cyanide)					
* CFA 52	Acetyl-1-C <sup>14</sup> bromide	1	195	100		
CFA 53	Acetyl-2-C <sup>14</sup> bromide	1	340	170		
CFA 40	Acetylene-C <sup>14</sup>	2	150			
CFA 49	Adenine-8-C <sup>14</sup> sulfate	1	450	225	55	
CFB 7	L-Alanine-C <sup>14</sup> (uniformly labelled)	3	1475	737.50	147.50	\$42/0.01 mc
CFA 91	DL Alanine-1-C <sup>14</sup>	2	350	175	50	
CFB 5	Algae-C <sup>14</sup> ( <i>Chlorella vulgaris</i> , freeze-dried)	30 mc/g	210	118	35	
CFB 6	Algal protein-C <sup>14</sup> (uniformly labelled, denatured)	30 mc/g	420	210	55	
** CFB 25	Algal protein hydrolysate	30 mc/g	500	250	55	
* CFA 71	Aniline-C <sup>14</sup> hydrochloride (uniformly labelled)	0.5	700	350	70	
CFB 8	L-Arginine-C <sup>14</sup> (uniformly labelled)	6	1475	737.50	147.50	42/0.01 mc
CFB 9	L-Aspartic-C <sup>14</sup> acid (uniformly labelled)	4	1475	737.50	147	42/0.01 mc
CFA 4	Barium carbide-C <sup>14</sup>	2	100			
* CFA 60	Benzaldehyde-C <sup>14</sup> (uniformly labelled)	1	550	275	55	
CFA 58	Benzene-C <sup>14</sup>	1	600	300	60	
CFA 61	Benzoic-C <sup>14</sup> acid (uniformly labelled)	1	550	275	55	
CFA 26	Benzoic-carboxyl-C <sup>14</sup> acid	1	190	105	30	
CFA 32	N-Benzoyl(glycine-1-C <sup>14</sup> )	1	450	225	55	
CFA 33	N-Benzoyl(glycine-2-C <sup>14</sup> )	1	500	250	60	
CFA 17	Bromoacetic-1-C <sup>14</sup> acid	1	275	137.50	40	
CFA 18	Bromoacetic-2-C <sup>14</sup> acid	1	300	150	42	
* CFA 15	Butyric acid (Sodium salt)	3	190	105	30	
CFA 75	Carbon-C <sup>14</sup> (amorphous)	1	200	100	35	
CFA 76	Carbon-C <sup>14</sup> (amorphous, low specific activity)	0.01	165	95	30	
CFA 6	Carbon-C <sup>14</sup> monoxide	1	145			
** CFA 101	Cetane-1-C <sup>14</sup>	1	460	230	50	
* CFA 70	Cetyl-1-C <sup>14</sup> alcohol	1	420	210	55	
** CFB 27	Chlorophyll B (uniformly labelled)	100			420	42/0.01 mc
CFB 23	Cholesterol-C <sup>14</sup> (biosynthetic)	0.1	Quotation upon request			
CFA 98	Cuprous cyanide-C <sup>14</sup>	2	210			
—	Cyanide (see Potassium and cuprous cyanide)					
CFA 19	Cyanoacetic acid (Sodium salt)	1	300	150	42	
* CFA 54	Cyclohexane(carboxylic-C <sup>14</sup> ) acid (Sodium salt)	1	190	105	30	

\*New Reduced Prices

\*\*New Compounds

Code	Compound	Specific Activity (millicuries/ millimole)	Package Price			
			1.0	0.5	0.1	
			millicurie			
CFA 81	Paraformaldehyde-C <sup>14</sup>	1	\$275	\$137.50	\$40	
** CFA 117	Pentanoic-1-C <sup>14</sup> acid (Sodium salt)	1	190	105	30	
* CFA 69	Phenylacetic-1-C <sup>14</sup> acid	1	190	105	30	
CFB 16	L-Phenylalanine-C <sup>14</sup> (uniformly labelled)	9	1475	737.50	147.50	\$42/0.01 mc
CFA 35	DL-Phenylalanine-2-C <sup>14</sup>	0.5	675	337.50	67.50	
CFX 4	Phosphoglyceric-C <sup>14</sup> acid (uniformly labelled, Barium salt)	0.2 mc/g	Quotation upon request			
** CFA 87	Potassium cyanide (crystalline, alkali-free)	2	140			
** CFA 98	Potassium cyanide (low specific activity)	0.2		100	30	
CFB 17	L-Proline-C <sup>14</sup> (uniformly labelled)	5	1475	737.50	147.50	42/0.01 mc
CFA 48	Propionic-1-C <sup>14</sup> acid (Sodium salt)	1	190	105	30	
** CFA 88	Propionic-2-C <sup>14</sup> acid (Sodium salt)	2	590	295	60	
—	Protein (see Algal protein)					
CFA 85	Pyruvic-1-C <sup>14</sup> acid (Sodium salt)	1	500	250	50	
CFA 79	Pyruvic-2-C <sup>14</sup> acid (Sodium salt)	1	650	325	65	
CFA 80	Pyruvic-3-C <sup>14</sup> acid (Sodium salt)	1	760	380	76	
CFB 18	L-Serine-C <sup>14</sup> (uniformly labelled)	3	1475	737.50	147.50	42/0.01 mc
** CFA 92	DL-Serine-3-C <sup>14</sup>	1	590	295	60	
* CFA 3	Sodium bicarbonate-C <sup>14</sup>	1	80	50		
* CFA 2	Sodium carbonate-C <sup>14</sup>	1	80	50		
* CFB 1	Starch-C <sup>14</sup> (tobacco, uniformly labelled, amorphous)	50 mc/g	450	225	55	
* CFA 24	Stearic-1-C <sup>14</sup> acid	2	190	105	30	
* CFA 25	Stearic-2-C <sup>14</sup> acid	0.5	500	250	50	
* CFA 82	Stearyl-1-C <sup>14</sup> alcohol	1	420	210	55	
CFA 66	Succinic-1-C <sup>14</sup> acid	2	375	187.50	50	
CFB 4	Sucrose-C <sup>14</sup> (uniformly labelled)	1-2 mc/g	480	240	58	25/0.02 mc
CFB 19	L-Threonine-C <sup>14</sup> (uniformly labelled)	4	1475	737.50	147.50	42/0.01 mc
CFA 59	Toluene-C <sup>14</sup> (uniformly labelled)	1	500	250	50	
** CFA 96	N,N,N-Trimethyl(cetyl-1-C <sup>14</sup> ) ammonium bromide	2	450	225	55	
—	Tripalmitin (see Glyceryl tripalmitate)					
—	Tristearin (see Glyceryl tristearate)					
CFB 20	L-Tyrosine-C <sup>14</sup> (uniformly labelled)	9	1475	737.50	147.50	42/0.01 mc
* CFA 55	DL-Tyrosine-2-C <sup>14</sup>	0.5	900	450	90	
** CFA 100	Undecane-1-C <sup>14</sup>	2	460	230	50	
** CFA 99	Undecanoic-1-C <sup>14</sup> acid	2	250	125	40	
* CFA 41	Urea-C <sup>14</sup>	1	135	67.50	20	
CFB 21	L-Valine-C <sup>14</sup> (uniformly labelled)	5	1475	737.50	147.50	42/0.01 mc
—	Valeric acids (see Pentanoic acid)					
CFA 97	DL-Valine-1-C <sup>14</sup>	1	350	175	50	
CFA 34	DL-Valine-4-C <sup>14</sup>	0.5	840	420	84	

\*New Reduced Prices

\*\*New Compounds



# nuclear-chicago radiochemical price list

Code	Compound	Specific Activity (millicuries/ millimole)	Package Price			
			1.0	0.5	0.1	
			millicurie			
CFA 13	Acetic-1-C <sup>14</sup> acid (Sodium salt)	2	\$150	\$80	\$25	
CFA 14	Acetic-2-C <sup>14</sup> acid (Sodium salt)	2	250	125	35	
CFA 86	Acetic-1-C <sup>14</sup> anhydride	2	250	125	42	
CFA 42	Acetone-1,3-C <sup>14</sup>	1	300	150	42	
* CFA 43	Acetone-2-C <sup>14</sup>	2	375	187.50	50	
—	Acetonitrile (see Methyl cyanide)					
* CFA 52	Acetyl-1-C <sup>14</sup> bromide	1	195	100		
CFA 53	Acetyl-2-C <sup>14</sup> bromide	1	340	170		
CFA 40	Acetylene-C <sup>14</sup>	2	150			
CFA 49	Adenine-8-C <sup>14</sup> sulfate	1	450	225	55	
CFB 7	L-Alanine-C <sup>14</sup> (uniformly labelled)	3	1475	737.50	147.50	\$42/0.01 mc
CFA 91	DL Alanine-1-C <sup>14</sup>	2	350	175	50	
CFB 5	Algae-C <sup>14</sup> ( <i>Chlorella vulgaris</i> , freeze-dried)	30 mc/g	210	118	35	
CFB 6	Algal protein-C <sup>14</sup> (uniformly labelled, denatured)	30 mc/g	420	210	55	
** CFB 25	Algal protein hydrolysate	30 mc/g	500	250	55	
* CFA 71	Aniline-C <sup>14</sup> hydrochloride (uniformly labelled)	0.5	700	350	70	
CFB 8	L-Arginine-C <sup>14</sup> (uniformly labelled)	6	1475	737.50	147.50	42/0.01 mc
CFB 9	L-Aspartic-C <sup>14</sup> acid (uniformly labelled)	4	1475	737.50	147	42/0.01 mc
CFA 4	Barium carbide-C <sup>14</sup>	2	100			
* CFA 60	Benzaldehyde-C <sup>14</sup> (uniformly labelled)	1	550	275	55	
CFA 58	Benzene-C <sup>14</sup>	1	600	300	60	
CFA 61	Benzoic-C <sup>14</sup> acid (uniformly labelled)	1	550	275	55	
CFA 26	Benzoic-carboxyl-C <sup>14</sup> acid	1	190	105	30	
CFA 32	N-Benzoyl(glycine-1-C <sup>14</sup> )	1	450	225	55	
CFA 33	N-Benzoyl(glycine-2-C <sup>14</sup> )	1	500	250	60	
CFA 17	Bromoacetic-1-C <sup>14</sup> acid	1	275	137.50	40	
CFA 18	Bromoacetic-2-C <sup>14</sup> acid	1	300	150	42	
* CFA 15	Butyric acid (Sodium salt)	3	190	105	30	
CFA 75	Carbon-C <sup>14</sup> (amorphous)	1	200	100	35	
CFA 76	Carbon-C <sup>14</sup> (amorphous, low specific activity)	0.01	165	95	30	
CFA 6	Carbon-C <sup>14</sup> monoxide	1	145			
** CFA 101	Cetane-1-C <sup>14</sup>	1	460	230	50	
* CFA 70	Cetyl-1-C <sup>14</sup> alcohol	1	420	210	55	
** CFB 27	Chlorophyll B (uniformly labelled)	100			420	42/0.01 mc
CFB 23	Cholesterol-C <sup>14</sup> (biosynthetic)	0.1	Quotation upon request			
CFA 98	Cuprous cyanide-C <sup>14</sup>	2	210			
—	Cyanide (see Potassium and cuprous cyanide)					
CFA 19	Cyanoacetic acid (Sodium salt)	1	300	150	42	
* CFA 54	Cyclohexane(carboxylic-C <sup>14</sup> ) acid (Sodium salt)	1	190	105	30	

\*New Reduced Prices

\*\*New Compounds

Code	Compound	Specific Activity (millicuries/ millimole)	Package Price			
			0.1	0.5	0.1	
				millicurie		
** CFA 103	Decane-1-C <sup>14</sup>	1	\$460	\$230	\$50	
** CFA 102	Decanoic-1-C <sup>14</sup> acid	1	190	105	30	
CFA 28	2,4-Dichlorophenoxy(acetic-1-C <sup>14</sup> ) acid	1	500	250	60	
CFA 27	2,4-Dichlorophenoxy(acetic-2-C <sup>14</sup> ) acid	1	500	250	60	
* CFA 22	Diethyl (malonate-1-C <sup>14</sup> )	1	325	162.50	40	
CFA 21	Diethyl (malonate-2-C <sup>14</sup> )	1	375	187.50	50	
* CFA 56	DL-3-(3,4-Dihydroxyphenyl)-alanine-2-C <sup>14</sup>	0.5	1450	725	145	
** CFA 95	N,N-Dimethyl(cetyl-1-C <sup>14</sup> ) amine	2	450	225	55	
CFA 44	Ethanol-1-C <sup>14</sup>	1	300	150		
** CFA 110	Ethanol-2-C <sup>14</sup>	1	420	210	55	
CFA 46	Ethyl-1-C <sup>14</sup> iodide	1	350	175	50	
** CFA 111	Ethyl-2-C <sup>14</sup> iodide	1	460	230	60	
—	Formaldehyde (see Paraformaldehyde)					
CFA 11	Formic-C <sup>14</sup> acid (Sodium salt)	2	165	90	30	
CFB 3	D-Fructose-C <sup>14</sup> (uniformly labelled)	1-2 mc/g	480	240	58	\$25/0.02 mc
CFX 3	D-Fructose-C <sup>14</sup> -1,6-diphosphate (uniformly labelled, Dibarium salt)	0.2 mc/g	Quotation upon request			
CFA 67	Fumaric-1-C <sup>14</sup> acid	2	450	225	55	
* CFA 73	D-Glucono- $\delta$ -lactone-1-C <sup>14</sup>	1	700	350	70	
* CFB 2	D-Glucose-C <sup>14</sup> (uniformly labelled)	1-2 mc/g	700	350	70	35/0.02 mc
* CFA 72	D-Glucose-1-C <sup>14</sup>	2	700	350	70	
CFB 10	L-Glutamic-C <sup>14</sup> acid (uniformly labelled)	5	1475	737.50	42	
CFA 45	DL-Glutamic-1-C <sup>14</sup> acid	1	500	250	60	
* CFA 47	Glycerol-1-C <sup>14</sup>	1	550	275	55	
CFA 64	Glyceryl tri(palmitate-1-C <sup>14</sup> )	1	380	190	50	
CFA 63	Glyceryl tri(stearate-1-C <sup>14</sup> )	1	380	190	50	
* CFA 65	Glyceryl tri(stearate-2-C <sup>14</sup> )	1	650	325	65	
CFB 11	Glycine-C <sup>14</sup> (uniformly labelled)	2	350	175	50	
CFA 30	Glycine-1-C <sup>14</sup>	1	325	162.50	45	
CFA 31	Glycine-2-C <sup>14</sup>	1	375	187.50	50	
** CFA 105	Guanine-8-C <sup>14</sup>	1	420	210	55	
** CFA 119	Heptanoic-1-C <sup>14</sup> acid (Sodium salt)	1	190	105	30	
—	Hexadecane (see Cetane)					
CFA 118	Hexanoic-1-C <sup>14</sup> acid (Sodium salt)	1	190	105	30	
—	Hippuric acid (see Benzoylglycine)					
CFB 12	L-Histidine-C <sup>14</sup> (uniformly labelled)	6	1475	737.50	147.50	42/0.01 mc
** CFA 112	Hypoxanthine-8-C <sup>14</sup>	1	650	325	65	

\*New Reduced Prices

\*\*New Compounds

Code	Compound	Specific Activity (millicuries/ millimole)	Package Price			
			1.0	0.5	0.1 millicurie	
CFA 57	Iminodi(acetic-2-C <sup>14</sup> ) acid	2	\$420	\$210	\$55	
* CFA 77	Isocaproic acid (Sodium salt)	1	190	105	30	
CFB 14	L-Isoleucine-C <sup>14</sup> (uniformly labelled)	6	1475	737.50	147.50	
** CFA 83	Isonicotinic (carbonyl-C <sup>14</sup> ) hydrazide	2	450	225	55	
CFA 9	Isopropyl alcohol (2-Propanol-1,3-C <sup>14</sup> )	1	325	162.50		
CFA 10	Isopropyl iodide (2-Iodo-propane-1,3-C <sup>14</sup> )	1	350	175		
** CFA 89	DL-Lactic-1-C <sup>14</sup> acid (Sodium salt)	1	380	190	50	
** CFA 90	DL-Lactic-2-C <sup>14</sup> acid (Sodium salt)	1	890	445	89	\$55/0.05 mc
** CFA 106	Lauric-1-C <sup>14</sup> acid	1	190	105	30	
** CFA 107	Lauryl-1-C <sup>14</sup> alcohol	1	420	210	55	
CFB 13	L-Leucine-C <sup>14</sup> (uniformly labelled)	6	1475	737.50	147.50	42/0.01 mc
CFA 78	DL-Leucine-1-C <sup>14</sup>	1	380	190	50	
** CFA 104	Linoleic-1-C <sup>14</sup> acid	1	295	147.50	42	
CFB 15	L-Lysine-C <sup>14</sup> (uniformly labelled)	6	1475	737.50	147.50	42/0.01 mc
CFA 68	Maleic-1-C <sup>14</sup> anhydride	2	500	250	50	
* CFA 74	D-Mannose-1-C <sup>14</sup>	1	700	350	70	
—	Malonic ester (see Diethyl malonate)					
* CFA 62	Margaric-1-C <sup>14</sup> acid	0.5	190	105	30	
* CFA 7	Methanol-C <sup>14</sup>	1	165	100	30	
** CFA 94	Methyl bromoacetate-2-C <sup>14</sup>	2	500	250	60	
CFA 16	Methyl-C <sup>14</sup> cyanide	1	250	125		
CFA 20	Methyl cyanoacetate-2-C <sup>14</sup>	1	375	187.50	50	
* CFA 8	Methyl-C <sup>14</sup> iodide	1	190	105	35	
** CFA 114	2-(Methyl-C <sup>14</sup> )-naphthalene	1	280	140	40	
** CFA 115	2-(Methyl-C <sup>14</sup> )-1,4-naphthoquinone	1	840	420	84	
** CFA 108	Myristic-1-C <sup>14</sup> acid	1	190	105	30	
** CFA 109	Myristyl-1-C <sup>14</sup> alcohol	1	420	210	55	
CFA 36	Naphthalene-1-C <sup>14</sup>	2	650	325	65	
** CFA 113	2-Naphthoic (carboxyl-C <sup>14</sup> ) acid	1	190	105	30	
CFA 37	1-Naphthol-1-C <sup>14</sup>	2	700	350	70	
CFA 38	2-Naphthol-8-C <sup>14</sup>	2	725	362.50	72.50	
CFA 39	2-Naphthylamine-8-C <sup>14</sup>	2	725	362.50	72.50	
** CFA 120	Nonanoic-1-C <sup>14</sup> acid (Sodium salt)	1	190	105	30	
** CFA 116	Octadecane-1-C <sup>14</sup>	1	460	230	50	
* CFA 93	Octanoic acid (Sodium salt)	2	190	105	30	
* CFA 84	Oxalic-C <sup>14</sup> acid	1	190	105	30	
CFA 23	Palmitic-1-C <sup>14</sup> acid	2	190	105	30	

\*New Reduced Prices

\*\*New Compounds

Code	Compound	Specific Activity (millicuries/ millimole)	Package Price			
			1.0	0.5	0.1	
			millicurie			
CFA 81	Paraformaldehyde-C <sup>14</sup>	1	\$275	\$137.50	\$40	
** CFA 117	Pentanoic-1-C <sup>14</sup> acid (Sodium salt)	1	190	105	30	
* CFA 69	Phenylacetic-1-C <sup>14</sup> acid	1	190	105	30	
CFB 16	L-Phenylalanine-C <sup>14</sup> (uniformly labelled)	9	1475	737.50	147.50	\$42/0.01 mc
CFA 35	DL-Phenylalanine-2-C <sup>14</sup>	0.5	675	337.50	67.50	
CFX 4	Phosphoglyceric-C <sup>14</sup> acid (uniformly labelled, Barium salt)	0.2 mc/g	Quotation upon request			
** CFA 87	Potassium cyanide (crystalline, alkali-free)	2	140			
** CFA 98	Potassium cyanide (low specific activity)	0.2		100	30	
CFB 17	L-Proline-C <sup>14</sup> (uniformly labelled)	5	1475	737.50	147.50	42/0.01 mc
CFA 48	Propionic-1-C <sup>14</sup> acid (Sodium salt)	1	190	105	30	
** CFA 88	Propionic-2-C <sup>14</sup> acid (Sodium salt)	2	590	295	60	
—	Protein (see Algal protein)					
CFA 85	Pyruvic-1-C <sup>14</sup> acid (Sodium salt)	1	500	250	50	
CFA 79	Pyruvic-2-C <sup>14</sup> acid (Sodium salt)	1	650	325	65	
CFA 80	Pyruvic-3-C <sup>14</sup> acid (Sodium salt)	1	760	380	76	
CFB 18	L-Serine-C <sup>14</sup> (uniformly labelled)	3	1475	737.50	147.50	42/0.01 mc
** CFA 92	DL-Serine-3-C <sup>14</sup>	1	590	295	60	
* CFA 3	Sodium bicarbonate-C <sup>14</sup>	1	80	50		
* CFA 2	Sodium carbonate-C <sup>14</sup>	1	80	50		
* CFB 1	Starch-C <sup>14</sup> (tobacco, uniformly labelled, amorphous)	50 mc/g	450	225	55	
* CFA 24	Stearic-1-C <sup>14</sup> acid	2	190	105	30	
* CFA 25	Stearic-2-C <sup>14</sup> acid	0.5	500	250	50	
* CFA 82	Stearyl-1-C <sup>14</sup> alcohol	1	420	210	55	
CFA 66	Succinic-1-C <sup>14</sup> acid	2	375	187.50	50	
CFB 4	Sucrose-C <sup>14</sup> (uniformly labelled)	1-2 mc/g	480	240	58	25/0.02 mc
CFB 19	L-Threonine-C <sup>14</sup> (uniformly labelled)	4	1475	737.50	147.50	42/0.01 mc
CFA 59	Toluene-C <sup>14</sup> (uniformly labelled)	1	500	250	50	
** CFA 96	N,N,N-Trimethyl(cetyl-1-C <sup>14</sup> ) ammonium bromide	2	450	225	55	
—	Tripalmitin (see Glyceryl tripalmitate)					
—	Tristearin (see Glyceryl tristearate)					
CFB 20	L-Tyrosine-C <sup>14</sup> (uniformly labelled)	9	1475	737.50	147.50	42/0.01 mc
* CFA 55	DL-Tyrosine-2-C <sup>14</sup>	0.5	900	450	90	
** CFA 100	Undecane-1-C <sup>14</sup>	2	460	230	50	
** CFA 99	Undecanoic-1-C <sup>14</sup> acid	2	250	125	40	
* CFA 41	Urea-C <sup>14</sup>	1	135	67.50	20	
CFB 21	L-Valine-C <sup>14</sup> (uniformly labelled)	5	1475	737.50	147.50	42/0.01 mc
—	Valeric acids (see Pentanoic acid)					
CFA 97	DL-Valine-1-C <sup>14</sup>	1	350	175	50	
CFA 34	DL-Valine-4-C <sup>14</sup>	0.5	840	420	84	

\*New Reduced Prices

\*\*New Compounds

**CARBON-14 PLASTIC REFERENCE SOURCES**

CFP 1	} Polymethyl-C <sup>14</sup> methacrylate sheets 3 cm.x3 cm.x1 mm (approximately 1.75 g.)	0.1 microcuries/gram	\$ 6
CFP 2		1.0 microcuries/gram	12
CFP 3		10.0 microcuries/gram	18

July 15, 1955—Prices subject to change without notice.

All quantities listed are standard stock packages. Other quantities and activities available on special order.

Quantity discount available on orders of 2 millicuries or more.

**NUCLEAR INSTRUMENT AND CHEMICAL CORPORATION**  
223 West Erie Street • Chicago 10, Illinois

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**a**



**b**



**c**

- a.** Complete Customer satisfaction is the first duty of every employee in the sales division
- b.** Our plant personnel have been carefully trained to produce only the highest quality nuclear instruments
- c.** Especially sensitive detectors are assembled in the "counter shop" by highly skilled employees
- d.** A well equipped machine shop in our factory turns out close tolerance machined parts and accessories
- e.** Complete maintenance facilities are available at our factory and at authorized service representatives throughout the United States and Canada.



**d**



**e**

## **precision instrumentation for . . . .** *Nuclear Measurements*

Progress in the new field of radioactivity measurements has been and will continue to be largely dependent on commercial suppliers of radiation instruments, accessories, and services. Nuclear Instrument and Chemical Corporation, a leading manufacturer in this new industry, recognizes its responsibility and has made significant contributions to the rapid advancement of radioactivity measuring techniques.

Many of the leading members of our staff have been connected with Nuclear-Chicago since this company began manufacture of radiation instrumentation. This background of experience, dating back to 1946 when pile-produced isotopes were first made available for non-military use, plus a real desire to constantly improve and enlarge our line of products, produces a combination which is uniquely qualified to render a complete service to users of our equipment.

Every instrument manufactured by the Nuclear Instrument and Chemical Corporation is guaranteed to be *sensitive, rugged*, and above all, *highly reliable*. Only the finest electronic components, crystals, tubes, and meters are used in our products. Our plant personnel have been trained to produce quality rather than quantity. Once quality has been achieved, we attempt by every efficient production means to keep the cost as low as possible.

We are extremely proud of the instruments described in this catalog. Our line of scalers, ratemeters, portables, detectors, automatic systems, accessories and radiochemicals is the most complete in the entire field. Many of these standard products are available on immediate delivery. In addition, the research staff of Nuclear-Chicago is at your service at all times, not only to match our standard instruments and accessories to your particular requirements, but also to develop special products and techniques to suit your specific need.



## scaling units

# model: 192 ULTRASCALER

*for Geiger, scintillation  
or proportional counting*

*automatic preset count  
and preset time operation*

*decade indication  
regulated high voltage*



The Nuclear-Chicago Model 192 Ultrascaler is an all-purpose laboratory unit for extremely reliable measurement of radioactivity, with features to provide the greatest flexibility possible in a nuclear counting instrument. A wide sensitivity range and well regulated high voltage supply permit its use with all commercially available radiation detectors. Because of its great adaptability the Model 192 is our recommended choice for any laboratory where all types of radiation counting problems may arise.

Reliability of the Model 192 is obtained by conservative circuit design, the use of quality components, good construction techniques, and a thorough 50 hour test before shipment. The double chassis provides a generous amount of space for all components; keeps temperatures down to a minimum and allows easy servicing.

**features**—The Ultrascaler features (1) three direct reading plug-in decade circuits, (2) mechanical register, elapsed time clock, and Eagle preset timer, (3) a stable high voltage supply which provides power for an external Geiger, scintillation or proportional detector, (4) a high gain linear amplifier providing a wide range of input sensitivities, and

(5) a stable discriminator circuit to provide a constant height pulse for driving the decades. The instrument is also provided with a number of automatic counting features and a 60 cycle calibrating circuit for checking proper operation of the decades at any time.

**operation**—With the Ultrascaler, a radiation measurement may be manually controlled by the operator, automatically controlled by the scaler itself, or controlled by a remote device such as the Model C-110A Automatic Sample Changer. With any mode of operation, the lighted number on each decade together with the number on the mechanical register following the decades determine the total number of disintegrations detected.

If *manual* operation is chosen, the count is begun by simply placing the stop-count switch in the *count* position. Throwing the switch into the *stop* position will interrupt the count at any desired time, and the decades, register and timer may be read. The timer indicates to 9999.99 minutes the length of time necessary to accumulate a count. Depressing the *reset* switch at the end of a count operates electrical reset of the register, timer and decades.

## specifications

ades provide an electronic scaling factor of e mechanical register following the decades 999. Additional scaling factors of 4, 10, 40, have been provided and these coupled with a selector switch of 10, 100 or 1000 times the g factor permit ten different *predetermined* (covering a range from 40 to 1,000,000 en the count has been accumulated, the scaler stops and the elapsed time may be read on the predetermined count settings permit maximum n the Model C-110A sample changer.

*predetermined time* operation, the Eagle timer may preset time from nine seconds to 60 minutes. er then records the number of disintegrations g this time interval. At the end of the count-agle timer is automatically reset to the same for the next count.

predetermined time and predetermined count "time-count" circuit may be utilized to stop ion at a preset time or preset number of counts upon which occurs first). This feature is useful with the Automatic Sample Changer, will be stopped after a certain length of time the total count has not been reached.

**supply**—The high voltage is electronically continuously variable with coarse and fine 500 to 2500 volts (with 500 to 5000 volt ole at a slight extra cost). A time delay pre-ot of the high voltage when the supply is The four-inch high voltage panel meter is within  $\pm 2\%$  of full scale. A high voltage ch is provided, so that the high voltage may approximately 300 volts at any time without position of the coarse and fine controls.

The input sensitivity of the amplifier circuit by fixed attenuators and may be varied from o 800 millivolts in 18 steps. In addition, eamplifier circuit with 0.1 to 0.8 volt input provided for G-M and scintillation detec-ic range at all gain settings is greater than 1000 ent double pulsing or appreciable change in e. 0.25 microsecond amplifier rise time al-unting rates with minimum losses. A Schmitt circuit having a one microsecond resolving o assure low coincidence losses and high over- for change in line voltage. In addition, the r voltage supply increases the overall stability of plifier circuit. Shock mounting of input tubes, ng and careful overall construction reduces s, stray pickup and line noises.

**range**—Three direct reading decade plug-in units with scale selection of 4, 10, 40, 100, 400 and 1000.

**register**—Electro-mechanical register follows decades, can total-ize 9999. Preset count circuit can stop scaler after 40, 100, 400, 1,000, 4,000, 10,000, 40,000, 100,000, 400,000 or 1,000,000 counts. Register will operate at 1000 counts per minute for periodic signals.

**timers**—Odometer type timer reads total of 9999.99 minutes with an accuracy of 0.01 minute. Eagle preset timer can stop scaler at any predetermined time between 9 seconds and 60 minutes. Eagle can be set to  $\pm 3$  seconds.

**amplifier sensitivity**—Variable from 1 millivolt to 800 millivolts in 18 steps with stable attenuator networks. Separate position provides 0.1 to 0.8 volt input for G-M or scintilla-tion counters.

**amplifier**—Single input connector with all switching done internally. All transformers electrostatically shielded. Input section shielded and shock mounted. Useful frequency response extends beyond two megacycles, allows high speed counting. Two three-tube feedback loops provide high gain stability and independence of tube characteristics. A count rate meter output provides a standardized pulse for oper-ating any count rate meter or another scaler.

**resolving time**—Decades will count to 100 kilocycles on a con-tinuous basis. Resolving time is 5 microseconds for pulse pairs.

**power supplies**—High voltage variable from 500 to 2500 volts (500 to 5000 volts available at extra cost as Model 192X). Sealed transformer provides high reliability. Flutter-free voltage reference tube. Less than 0.002% change in high voltage for 1% line voltage change between 100 and 130 volts. Rectifier tubes submounted. High voltage on-off and standby switches provided. Regulated low voltage supply with oil-filled condensers in filter section.

**test signal**—Sixty cycle test signal permits check of scaler at any time.

**at rear of chassis**—High voltage and master fuses, ground connector, external A-C timer outlet, 115 volt A-C outlet, external pre-amp power connector, auxiliary connector for remote operation with C-110A Automatic Sample Changer, ratemeter connector pre-amp input connector, input connector, decade input connector, A-C line cord.

**power requirements**—200 watts, 100 to 130 volts, 60 cycles. Available for 50 cycle operation on request. For 220 volts operation we recommend the use of Model PS6 step-down transformer.

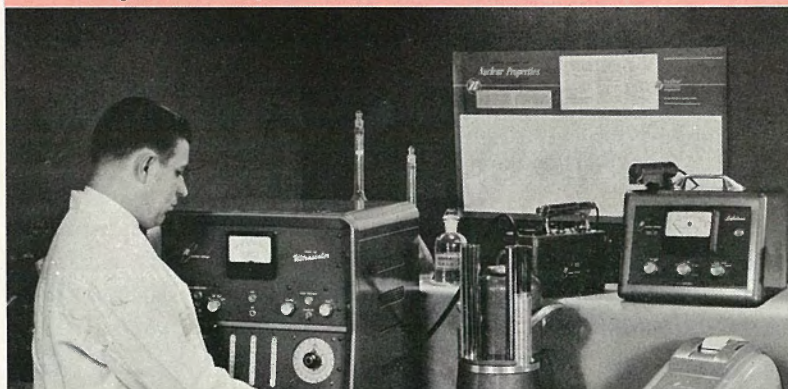
**dimensions**—20" x 20" x 21" high.

**weight**—135 lbs., shipping weight 150 lbs.

**supplied with**—PC9, PC10, PC30 cables, PC7 cable adapter, and instruction manual.

**models available**—Model 192 with 500 to 2500 volt supply. Model 192X with 500 to 5000 volt supply.

*A radioisotope counting laboratory using the C-110A automatic sample changer in conjunction with the Ultrascaler. An a-c operated laboratory monitor and a beta-gamma survey meter are shown on the rear shelf.*



## scaling units

### model: **182** AMPLI-COUNT SCALER

*for Geiger, scintillation  
or proportional counting  
manual or remote operation  
provision for preset time  
operation  
electronic scale of 256  
regulated high voltage*



The Model 182 "Ampli-Count" scaler is an extremely reliable and accurate laboratory instrument for manual or automatic measurement of radioactivity. A stable, well regulated high voltage supply and a wide input sensitivity range permits its use with all commercially available Geiger, scintillation or proportional detectors. A two microsecond resolving time and an electronic scaling factor of 256 make this scaler ideally suited for high counting rates.

Finest quality components, highest construction standards, conservative circuit design, and a thorough 50 hour test before shipment assures high accuracy and reliability of the Ampli-Count scaler.

**features**—The Model 182 Ampli-Count scaler features (1) eight binary scaling stages providing a maximum scaling factor of 256, (2) built-in mechanical register and timer, (3) a stable high voltage supply which provides power for an external Geiger, scintillation or proportional radiation detector, (4) a calibrated continuously variable high gain linear amplifier, and (5) provision for manual, automatic, or remote operation of the instrument. In addition, a 60 cycle test signal permits a check of the scaling stages.

**operation**—With the Model 182, a radiation measurement may be manually controlled by the operator, automatically controlled by the scaler itself when used in conjunction with an external Model T1 timer, or controlled by a remote installation such as the Nuclear-Chicago Model C-110A Automatic Sample Changer system. Under any mode of operation, the lighted neon interpolation lamps together with the scaling factor chosen and the number appearing on the mechanical register determine the total count.

If *manual* operation is chosen, the count is begun by simply placing the stop-count switch in the *count* position. The count may be interrupted at any time by throwing the switch back into the *stop* position. A count is determined by multiplying the reading on the mechanical register by the scaling factor and adding to this figure the sum of the numbers above the neon interpolation lamps which remain lit. When the total count is computed, the *reset switch* is depressed to operate electrical reset of the register, timer, and interpolation lamps.

The eight binary scaling stages with their associated interpolation lamps provide an electronic scaling factor of 256.

## specifications

A *scale selector switch* is provided so that additional scaling factors of 4, 8, 16, 32, 64, or 128 may be selected. A mechanical register follows the scaling stages and can totalize 999999 counts. The built-in timer indicates to 9999.99 minutes the length of time necessary to accumulate the count. The large number of scaling factors provided in this unit permit great flexibility with the Model C-110A sample changer.

*Predetermined time* operation may be utilized when the Model 182 is used in conjunction with an external Model T1 dual timer which may be set to any predetermined time from two seconds to 60 minutes. The scaler then records the number of disintegrations detected during this time interval and automatically stops counting when the time has elapsed.

**high voltage supply**—The high voltage supply is electronically regulated and continuously variable with coarse and fine controls from 500 to 2500 volts (with 500 to 5000 volt supply available at slight extra cost). A time delay prevents overshoot of the high voltage when the supply is turned on. The high voltage is indicated on a four-inch panel meter. Meter is calibrated to within  $\pm 2\%$  of full scale. The high voltage may be reduced to approximately 300 volts at any time without changing the coarse and fine controls by simply turning the operation switch into the *stand-by* position.

**sensitivity**—The input sensitivity of the amplifier circuit is continuously variable from 1 millivolt to 1 volt by means of the gain controls on the front panel of the unit. A separate position with 0.1 to 1 volt sensitivity is provided for G-M and scintillation counter pulses. Provision has been made for receiving signals from an external preamplifier circuit if desired.

Dynamic range of the amplifier circuit is greater than 1000 to 1 so that abnormally large pulses will not cause double pulsing. Amplifier rise time is 0.25 microsecond to allow high counting rates with minimum losses. Shock mounted input circuit, good construction, and careful shielding minimizes microphonics, stray pickup, and line noises.

*The Model 182 Ampli-Count scaler* is an excellent choice for any nuclear counting problem requiring a fast scaler with good amplifier characteristics.

*Rear view of scaler shows circuit components and careful overall construction.*

**range**—Higinbotham scale of 256, with scale selection of 4, 8, 16, 32, 64, 128, and 256 followed by six-digit built-in mechanical register.

**timer**—Odometer type timer reads total of 9999.99 minutes with an accuracy of 0.01 minute. External Model T1 timer may be utilized to stop scaler at any predetermined time between two seconds and 60 minutes.

**amplifier sensitivity**—Continuously variable from 1 millivolt to 1 volt, with 0.1 to 1 volt for G-M and scintillation pulses.

**amplifier**—Shock mounted and shielded input circuit. Amplifier rise time of 0.25 microsecond and 2 microsecond resolution time allows high speed counting. Dynamic range is greater than 1000 to 1 at all gain settings for normal pulses.

**resolving time**—Resolving time is less than two microseconds for pulse pairs. Up to 300,000 counts per minute result in less than 1% coincidence loss.

**high voltage**—Continuously variable from 500 to 2500 volts with coarse and fine controls (500 to 5000 volt supply available at extra cost). Four inch expanded scale meter. Sealed transformer provides high reliability. Flutter-free voltage reference tube. Less than 0.002% change in high voltage for 1% line voltage change between 100 and 130 volts. Rectifier tubes submounted. High voltage on-off and stand-by positions provided.

**test signal**—Sixty cycle test signal permits check of scaler at any time.

**at rear of chassis**—High voltage and master fuses, external A-C timer outlet, high voltage connector, auxiliary connector for remote operation with C-110A automatic sample changer, pre-amp power connector, oscilloscope connector, remote reset switch, input connector, linearity screwdriver adjustment, A-C line cord.

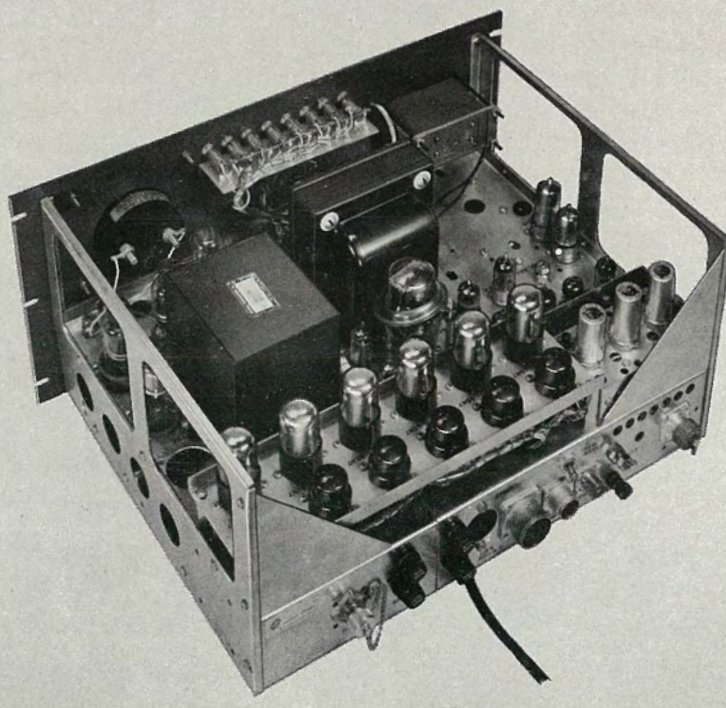
**power requirements**—200 watts, 100 to 130 volts, 60 cycles. Available for 50 cycle operation on request. For 220 volts operation we recommend the use of Model PS6 step-down transformer.

**dimensions**— $12\frac{1}{4}$ " x 20" x 20". Chassis and panel slope mounted in well ventilated cabinet. Instrument may be rack mounted if desired. Recessed handles facilitate moving.

**weight**—80 lbs., shipping weight 90 lbs.

**supplied with**—PC7, PC8, and PC9 cables and instruction manual.

**models available**—Model 182: 2500 volt supply with timer and electrical reset. Model 182X: 5000 volt supply with timer and electrical reset. Model 182A: 2500 volt supply without timer and manual register reset. Model 182AX: 5000 volt supply without timer and manual register reset.



## scaling units

### model: 183 COUNT-O-MATIC SCALER

for Geiger or scintillation  
counting

manual, remote, or  
preset count operation

provision for preset  
time operation

electronic scale of 256  
regulated high voltage



Nuclear-Chicago's Model 183 Count-O-Matic scaler is a complete laboratory unit designed for precise measurements of radioactivity when used in conjunction with a Geiger or scintillation detector. The instrument is widely used in biological, clinical, and radiochemical laboratories and is ideal for counting a large number of samples either with a manual or automatic sample changer since provisions for both preset time and preset count operations are provided.

A wide range high voltage supply, one-quarter volt sensitivity, and preamplifier voltages (if needed) permit the instrument's use with all commercially available Geiger-Muller or scintillation detectors. The use of quality components, good construction techniques, and conservative circuit design assure high reliability and accuracy over long periods of use.

**features**—The Model 183 Count-O-Matic scaler features (1) eight binary scaling stages providing scaling factors to 256, (2) built-in mechanical register and timer, (3) a stable high voltage supply which provides power for an external Geiger or scintillation detector, (4) an input circuit with one-quarter volt sensitivity, and (5) provisions for manual, automatic, or remote operation of the instrument. In addition,

a 60 cycle test signal permits a convenient check of the scaling action at any time.

**operation**—With the Model 183 scaler and an appropriate detector, a radiation measurement may be manually controlled by the operator, automatically controlled by the scaler itself, or controlled by a remote installation such as the Nuclear-Chicago Model C-110A Automatic Sample Changer system. Under any mode of operation, the lighted neon interpolation lamps together with the scaling factor chosen and the number appearing on the mechanical register determine the total number of disintegrations detected.

If *manual* operation is chosen, the count is begun by simply placing the stop-count switch in the *count* position. The count may be interrupted at any time by throwing the switch back into the *stop* position. A count is then determined by multiplying the reading on the mechanical register by the scaling factor and adding to this figure the sum of the numbers above the neon interpolation lamps which remain lit. When the total count is computed, the *reset* switch is depressed to operate electrical reset of the register, timer, and interpolation lamps.

## specifications

The eight binary scaling stages with their associated interpolation lamps provide an electronic scaling factor of 256. A *scale selector switch* is provided so that additional scaling factors of 4, 8, 16, 32, 64, or 128 may be selected. A mechanical register follows the scaling stages and can totalize 9999 counts. The built-in timer indicates to 9999.99 minutes the length of time necessary to accumulate the count. The large number of scaling factors provided in this unit permit great flexibility with the Model C-110A automatic sample changer.

The seven positions of the scale selector switch, coupled with the "pre-count" selector switch of 10, 100, or 1000 times the scaling factor, permit a wide flexibility of *pre-determined count settings* (covering a range from 40 to 256,000 counts). When the predetermined count has been accumulated, the scaler automatically stops and the elapsed time may be read on the timer. This wide range of pre-determined count settings permit maximum flexibility with the Model C-110A automatic sample changer.

*Pre-determined time* operation is possible when the Model 183 is used in conjunction with an external Model T1 dual timer. The T1 may be set to any predetermined time from two seconds to 60 minutes. The scaler then records the number of disintegrations detected during this time interval and automatically stops counting when the time has elapsed. A separate position of the operation selector switch is used for predetermined time counting.

**high voltage supply**—The high voltage supply is electronically regulated and continuously variable with coarse and fine controls from 500 to 2500 volts. A time delay prevents overshoot of the high voltage when the supply is turned on. The high voltage applied to the detector is indicated on a 4-inch panel meter which is calibrated to within  $\pm 2\%$  of full scale. The high voltage may be reduced to approximately 300 volts at any time without changing the coarse and fine controls by simply turning the operation switch into the *stand-by* position.

*The Model 183 Count-O-Matic scaler is a logical choice for any work program where Geiger or scintillation counters may be used. The short resolving time and scaling factor of 256 makes possible rapid counting with low coincidence losses. The automatic counting features of this instrument make it extremely useful when a large number of samples are counted routinely.*

*A mobile clinical laboratory. The scaler rests on Model CA4 "Carette." Flexible arm allows easy positioning of the DS-1 scintillation detector. The T1 timer permits predetermined time operation.*

**range**—Higinbotham scale of 256, with scale selection of 4, 8, 16, 32, 64, 128, and 256 followed by four-digit built-in mechanical register.

**timer**—Odometer type timer reads total of 9999.99 minutes with an accuracy of 0.01 minute. External Model T1 timer may be utilized to stop scaler at any predetermined time between two seconds and 60 minutes.

**amplifier sensitivity**—Factory set at 0.25 volt. Can be varied with screwdriver chassis adjustment from 0.1 to 0.6 volts.

**resolving time**—Resolving time is less than two microseconds for pulse pairs. Up to 300,000 counts per minute result in less than 1% coincidence loss.

**high voltage**—Continuously variable between 500 to 2500 volts, with coarse and fine controls. Four inch expanded scale meter. Sealed transformer and sub-mounted rectifier tubes provide high reliability. Flutter-free voltage reference tube. Regulation is such that there is less than 0.002% change in high voltage for 1% line voltage change between 100 and 130 volts. High voltage on-off and stand-by positions provided.

**test signal**—Sixty cycle test signal permits check of scaler at any time.

**pre-determined count**—Pre-count switch of 10, 100, or 1000 times the scaling factor provides wide range of predetermined count positions (ranging from 40 to 256,000 counts). Scaler may be set to automatically stop when predetermined number of counts have been accumulated.

**at rear of chassis**—High voltage and master fuses, external A-C timer outlet, high voltage connector, auxiliary connector for remote operation with Model C-110A automatic sample changer, preamplifier power connector, oscilloscope connector, input connector, A-C line cord.

**power requirements**—200 watts, 100 to 130 volts, 60 cycles. Available for 50 cycle operation on request. For 220 volts operation we recommend the use of Model PS6 step-down transformer.

**dimensions**— $12\frac{1}{4}$ " x 20" x 20". Chassis and panel slope mounted in well ventilated cabinet. Instrument may be rack mounted if desired. Recessed handles facilitate moving.

**weight**—77 lbs., shipping weight 84 lbs.

**supplied with**—PC10 cable and instruction manual.

**models available**—

Model 183 with timer and electrical reset.

Model 183A without timer and with manual register reset.



## scaling units

### model: **161A** BINARY SCALER

*for Geiger or scintillation  
counting  
manual or remote operation  
provision for preset time  
operation  
electronic scale of 256  
regulated high voltage*



Nuclear-Chicago's Model 161A Scaling Unit is a basic counting instrument for both research work and routine counting of radiation. It may be used with Geiger or scintillation counters for a wide variety of counting jobs involving radioactivity. A wide range high voltage supply, one-quarter volt sensitivity, and preamplifier voltages (if needed) permit the instrument's use with all commercially available Geiger or scintillation detectors.

The Model 161A may be used for diagnostic or therapeutic purposes in medical applications; qualitative or quantitative work in radiochemistry; for monitoring work; and for many other routine radioactivity counting jobs. The use of quality components, good construction techniques, and conservative circuit design assure high reliability and accuracy over long periods of use. In addition, a thorough 50 hour operating test is made on each instrument before shipment.

**features**—The Model 161A Scaling Unit features (1) eight binary scaling stages providing scaling factors to 256, (2) built-in mechanical register and provisions for connecting an external timer, (3) a stable high voltage supply which provides power for an external Geiger or scintillation

detector, (4) an input circuit with one-quarter volt sensitivity, and (5) provisions for manual or remote operation of the instrument.

**operation**—With the Model 161A scaler and an appropriate detector, a radiation measurement may be manually controlled by the operator, automatically controlled by an external T1 dual timer, or controlled by a remote installation such as the Nuclear-Chicago Model C-110A Automatic Sample Changer system. Under any mode of operation, the lighted neon interpolation lamps together with the scaling factor chosen and the number appearing on the mechanical register determine the total number of radiation disintegrations detected.

An external Model T-101 timer can be plugged into the convenient A-C outlet which is energized by the stop-count switch, or a Model T1 dual timer may be used to indicate elapsed time or to permit *predetermined time counting*.

If *manual* operation is chosen, the count is begun by simply placing the stop-count switch in the *count* position. The count may be interrupted at any time by throwing the switch

## specifications

back into the *stop* position. A count is then determined by multiplying the reading on the mechanical register by the scaling factor and adding to this figure the sum of the numbers above the neon interpolation lamps which remain lit. The total count may be divided by the reading in minutes on the external timer to arrive at an average counts per minute. When the total count is computed, the register may be manually reset, and the *reset switch* used to reset the scaling stages.

The eight binary scaling stages with their associated interpolation lamps provide an electronic scaling factor of 256. A *scale selector switch* is provided so that additional scaling factors of 4, 8, 16, 32, 64, or 128 may be selected. A mechanical register follows the scaling stages and can totalize 999999 counts. The large number of scaling factors provided in this unit permit great flexibility with the Model C-110A automatic sample changer.

*Predetermined time operation* is possible when the Model 161A scaler is used in conjunction with an external Model T1 dual timer. The T1 may be set to any predetermined time from two seconds to 60 minutes. The scaler then records the number of disintegrations detected during this time interval and automatically stops counting when the time has elapsed.

**high voltage supply**—The high voltage supply is electronically regulated and continuously variable with a front panel control from 600 to 2500 volts. The high voltage applied to the external detector may be easily read on the four-inch panel meter which is calibrated to within  $\pm 2\%$  of full scale. The high voltage supply is well filtered and stabilized, and regulation is such that there is less than 0.01% change in high voltage for a 1% change in line voltage between 100 and 130 volts.

*The Model 161A Scaling Unit* is a fine choice for any radioisotope laboratory. This instrument, though economically priced, is built to careful specifications for accuracy and reliability. The instrument is designed for easy operation, and is a complete electronic unit requiring only a Geiger or scintillation detector and an external timer.

For medical applications, the Model 161A scaler may be used with a Nuclear-Chicago Model DS-1 scintillation detector, Model T1 dual timer, and the Model CA4 "Carette". This system is versatile, economical, and practical for routine clinical applications such as thyroid uptake studies.

*A basic sample counting laboratory consisting of (A) the 161A scaler, (B) a 3031B shield containing a thin window G-M counter, (C) Model T-101 timer, and (D) Model 2612 alpha-beta-gamma survey meter.*

**range**—Higinbotham scale of 256, with scale selection of 4, 8, 16, 32, 64, 128, and 256 followed by six-digit built-in mechanical register.

**mechanical register**—Register follows scaling circuit, can totalize 999999. High speed register can record as many as 1000 counts per minute.

**external timer**—Provision has been made for connecting either a Model T-101 timer for indicating elapsed time or a Model T1 dual timer to indicate elapsed time or for predetermined time counting.

**amplifier sensitivity**—Factory set at 0.25 volt. Can be varied with screwdriver chassis adjustment from 0.1 to 0.75 volt.

**resolving time**—Five microseconds for paired pulses. As many as 120,000 counts per minute result in less than 1% coincidence loss.

**high voltage**—Continuously variable from 600 to 2500 volts with front panel control. High voltage is well stabilized and filtered and is indicated on a four-inch panel mounted meter. Regulation is such that there is less than 0.01% change in high voltage for a 1% change in line voltage between 100 and 130 volts.

**connectors**—Counter input and scope connectors on front panel. Pre-amplifier connector, timer outlet, high voltage connector, auxiliary connector for remote operation with Model C-110A automatic sample changer, normal-remote switch, master fuses, and line cord at rear. High voltage fuses on chassis.

**power requirements**—150 watts, 100 to 130 volts, 60 cycles. Available for 50 cycle operation on request. For 220 volts operation we recommend the use of Model PS6 step-down transformer.

**dimensions**—12 $\frac{1}{4}$ " x 20" x 20". Chassis and panel are slope mounted in well ventilated cabinet. Instrument may be rack mounted if desired. Recessed handles facilitate moving.

**weight**—69 lbs., shipping weight 77 lbs.

**supplied with**—PC10 cable and instruction manual.





## scaling units

### model: **181** DECADE SCALER

*for Geiger or scintillation  
counting  
manual or remote operation  
provision for preset time  
operation  
decade indication  
regulated high voltage*



Nuclear-Chicago's Model 181 Decade Scaler is a basic nuclear counting instrument with versatile features which include decimal readout for ease in determining the total number of counts recorded. A stable, wide range high voltage supply, one-quarter volt sensitivity, and a connector providing voltages for operation of a preamplifier circuit permit the unit's use with all commercially available Geiger or scintillation detectors.

The instrument is simple in operation, making it extremely useful in medical diagnosis, radiochemical work, routine sample counting, and in many other radiation counting problems. Low power dissipation, minimum number of tube types, reliably rated circuit components, and good construction techniques assures high reliability and provides long operational life. The Model 181 scaler is an excellent choice for any radioisotope facility wherever Geiger or scintillation counting is carried out.

**features**—The Model 181 Decade Scaler features (1) three direct reading plug-in decades providing a maximum scaling factor of 1000, (2) built-in mechanical register and provisions for connecting an external timer, (3) a stable high

voltage supply which provides power for an external Geiger or scintillation detector, (4) an input circuit with one-quarter volt sensitivity, and (5) provisions for manual or remote operation of the instrument. In addition, a 60 cycle test signal permits a convenient check of the scaling action at any time.

**operation**—With the Model 181 scaler, a radiation measurement may be manually controlled by the operator, automatically controlled by an external Model T1 dual timer, or controlled by a remote installation such as the Nuclear-Chicago Model C-110A Automatic Sample Changer system. Under any mode of operation, the lighted number on each decade together with the reading on the mechanical register determines the total count recorded.

An external Model T-101 timer can be plugged into the convenient A-C outlet which is energized by the stop-count switch, or a Model T1 dual timer may be used to indicate elapsed time or to permit *predetermined time counting*.

If *manual* operation is chosen, the count is begun by simply placing the stop-count switch in the *count* position. The

## specifications

count may be interrupted at any time by throwing the switch back into the *stop* position. The total count is then determined by recording the reading on the register followed by the lighted number appearing on each decade. The total count may be divided by the reading in minutes on the external timer to arrive at an average counts per minute. When the total count is recorded, the register and decades may be reset by depressing the single *reset* lever.

The three decade scaling stages provide an electronic scaling factor of 1000. A *scale selector* switch is provided so that additional scaling factors of 10 or 100 may be selected. A mechanical register follows the scaling stages and can totalize 999999 counts.

The Model 181 scaler may be operated for a *predetermined time* when it is used in conjunction with an external Model T1 dual timer. The Model T1 may be set to any predetermined time from two seconds to 60 minutes. The scaler then records the number of disintegrations detected during this time interval and automatically stops counting when the time has elapsed.

**high voltage supply**—An R-F type high voltage supply is used in the Model 181 scaler. The supply is well regulated and continuously variable with coarse and fine controls from 400 to 3000 volts. The high voltage applied to the external detector may be easily read on the four-inch panel meter which is calibrated to within  $\pm 2\%$  of full scale. The high voltage supply is well shielded and stabilized, and regulation is such that there is less than 0.01% change in high voltage for a 1% change in line voltage between 100 and 130 volts.

**sensitivity**—The input sensitivity of the Model 181 is factory set at 0.25 volt for Geiger and scintillation detectors. The input sensitivity can be adjusted from 0.1 to 1.0 volt by a screwdriver adjustment on the chassis.

*The Model 181 Decade Scaler is an excellent choice for any clinical, research, or industrial laboratory because of the simplicity of reading and reliable, trouble-free operation.*

This scaler is the newest addition to Nuclear-Chicago's complete line of scaling instruments. It has been carefully engineered and thoroughly tested for accuracy and long operational life. For those using Geiger or scintillation detectors, and preferring decade indication, we recommend the Model 181. Like all instruments manufactured by Nuclear Instrument and Chemical Corporation, it is fully guaranteed for one year against all defects in workmanship or materials.

*Bottom view of Model 181 showing terminal board construction and simple circuitry. Major emphasis is on conservative trouble-free design.*

**range**—Three decade plug-in units provide scaling factor of 1000. Additional scaling factors of 10 and 100 are provided.

**mechanical register**—Register follows scaling circuit, can totalize 999999. High speed register will operate at 1000 counts per minute for periodic signals.

**reset**—Single lever is depressed to reset register and decades.

**external timer**—Provision has been made for connecting either a Model T-101 timer for indicating elapsed time or a Model T1 dual timer to indicate elapsed time, or for predetermined time operation.

**amplifier sensitivity**—Factory set at 0.25 volt. Can be varied with screwdriver chassis adjustment from 0.1 to 1.0 volt.

**resolving time**—Five microseconds for pulse pairs. As many as 120,000 counts per minute result in less than 1% coincidence loss.

**high voltage**—Well shielded R-F type high voltage supply, continuously variable with coarse and fine panel controls from 400 to 3000 volts. Stabilization is such that there is only 0.01% change in high voltage for 1% change in line voltage between 100 and 130 volts. High voltage supply will deliver 100 microamperes to load at 3000 volts. A 250 volt adjustment is provided by the fine control. A stabilized B+ supply is provided for amplifier and high voltage stabilizer circuit.

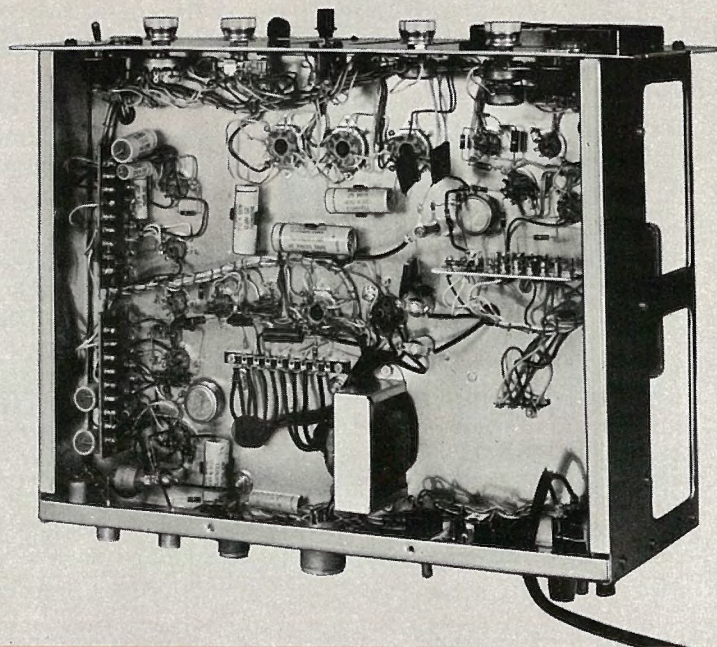
**at rear of chassis**—Auxiliary connector for C-110A automatic sample changer or remote T1 timer, timer outlet, pre-amp power connector, oscilloscope connector, fuses, counter input connector, high voltage connector, line cord.

**power requirements**—100 watts, 100 to 130 volts, 60 cycles. Available for 50 cycle operation on request. For 220 volt operation we recommend the use of Model PS6 step-down transformer.

**dimensions**—12 $\frac{1}{4}$ " x 20" x 20". Chassis and panel are slope mounted in well ventilated cabinet. Instrument may be rack mounted if desired. Recessed handles facilitate moving.

**weight**—45 lbs., shipping weight 50 lbs.

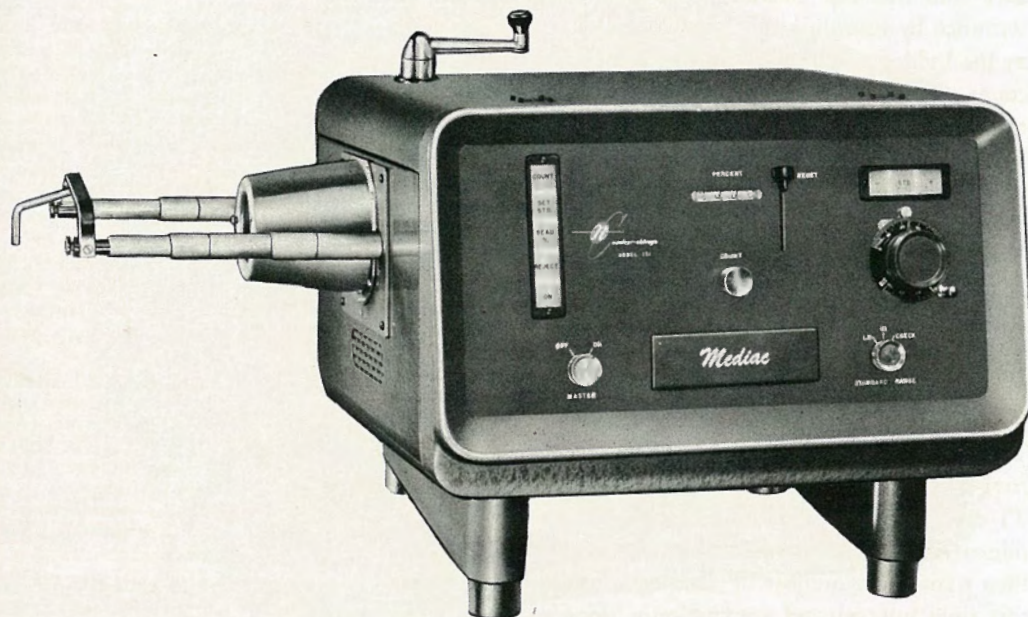
**supplied with**—PC10 cable and instruction manual.



## scaling units

model: **131**  
M E D I A C

*direct reading percentage  
scaler for diagnosis of  
thyroid function and other  
medical applications*



The Mediac 131 Scaler Computer by Nuclear-Chicago introduces to the medical profession the first complete and compact instrument designed specifically for the measurement of thyroid function using radioactive iodine (I-131).

The Mediac is a precision analytical unit which provides accurate uptake percentages without mathematical calculations in the shortest possible period of time. A well shielded scintillation detector and an exclusive and unique electronic circuit which provides a direct *percentage reading* of iodine uptake make up the self-contained unit.

Although the Mediac is generally used in diagnosis of thyroid function, it nevertheless retains all the versatility required for other medical radioisotope applications. Blood volume, plasma volume, red cell mass, and red cell survival studies can be easily performed with the unit. A Mediac accessory group consisting of liquid sample bottles and a lead plug to hold the bottle against the scintillation detector is available for those wishing to make blood volume determinations using iodinated human serum albumin. If desired, external radiation detectors may be connected to the Mediac, and the instrument used as a conventional scaler. Eight

interpolation lamps are mounted behind a door in the front panel, and scaling factors of 64 or 256 may be selected. A 60 cycle signal permits an operational check at any time.

**the mediac in thyroid diagnosis**—In diagnosis of thyroid function, the physician administers orally a small (10 to 50 microcuries) radioiodine tracer dose either in capsule or solution. At the same time, an identical dose is set aside to be used later as the "standard."

In most laboratories the radioactivity measurements are made 24 hours after the administration of the I-131 dose. During this 24 hours, the patient's thyroid gland will have absorbed most of the radioiodine in the body not excreted in the urine.

When the patient returns, the "standard" is placed in the neck phantom and positioned at the desired distance (usually 25 to 40 cm.) from the scintillation detector built into the Mediac. The instrument counts the radiation from the standard until the mechanical register on the Mediac reads 100%. At the same time, a timing unit "remembers" how long it took to record this 100%.

## specifications

neck is then removed and the patient's thyroid is positioned at the same distance with respect to the detector. An extendable positioner and a height multiplier simplifies the placement of the patient. A second is now made, the Mediac automatically counts radiation emanating from the thyroid gland for a time equal to that required for the standard measurement, the number portrayed on the register at the same time period represents the percent of the activity present in the patient's thyroid gland. Hydroradiometer usually take up over 50% of I-131 in 24 hours. A low 10% is indicative of hypothyroidism. This is used with clinical judgment and evaluation of the patient in arriving at the final diagnosis.

**detector**—A 1 1/2" in diameter by 1/2" sodium iodide activated crystal in the scintillation detector provides extremely high sensitivity, and the special lead shield assures excellent ratios of background to source. Detection efficiency is approximately 4400 counts per microcurie or one microcurie of I-131 at 15 cm. while background is approximately 200 cpm. (equivalent to 0.05 microcurie of I-131 at 15 cm.). In actual uptake measurements background will normally amount to less than 10% and in exceptional cases will require a correction be necessary.

**phantom**—The phantom neck manufactured by Nuclear Associates is a plastic cylinder 5 inches in diameter by 12 inches long, containing cavities at three different distances from the thyroid gland. These cavities permit correction for different thyroid gland sizes in the patient. The phantom (Model 100) has the same absorption and scattering properties with respect to gamma rays of I-131 as does human tissue, and no corrections for these effects are unnecessary.

For an uptake measurement on a patient, the technician estimates (by means of palpitation and clinical knowledge) the most probable position of the thyroid gland. The tube containing the iodine standard is placed in the appropriate cavity.

Accurate determination of the radiation center of the thyroid gland can be made by measuring the intensity of radiation emitted from the neck of the patient in a forward and a backward position. By comparing this forward to backward ratio found on the patient with the ratios found in the phantom, one can determine the phantom cavity which most closely simulates the patient.

**measurements**—Urine measurements can be made by the standard in the neck phantom with an equal volume placed in a carton containing water and following the same measurement procedure as for the thyroid uptake.

**crystal**—Sodium iodide, thallium activated. 1 1/2" in diameter by 1/2".

**background**—Approximately 200 cpm. Approximately 100 cpm. with lead plug used in blood volume determinations. IHSAs doses of 10 microcuries or less result in samples which may be counted with high statistical accuracy.

**directionality**—Over a 6 cm. lateral range at 30 cm., the count for a point source remains constant within 1%; over a 12 cm. range at 30 cm., it is constant within 10%. The count is reduced to 50% of the maximum at 15° from the axis and to 10% at 25° from the axis.

**resolving time of electronic circuit**—Five microseconds.

**input sensitivity**—Variable from 30 to 200 millivolts. Factory set at 50 mv. with change to 0.25 volt by chassis switch when used with external G-M or scintillation counters.

**high voltage**—1200 to 1400 volts variable by control at rear of cabinet. Stabilization is such that there is less than 0.01% change in high voltage for 1% line voltage change between 100 and 130 volts.

**timer**—provision is made for connecting a T1 timer to the unit for predetermined time counting.

**test signal**—Built-in 60 cycle test signal may be utilized to check scaling action at any time.

**power requirements**—100 watts, 100 to 130 volts, 60 cycles. Available for 50 cycle operation on request. For 220 volts operation we recommend the use of Model PS6 step-down transformer.

**dimensions**—15" x 20" x 20" not including scintillation detector which protrudes from side of cabinet.

**weight**—120 lbs., shipping weight 130 lbs.

**supplied with** Model SS-1 phantom neck, assembly for holding urine container, plastic holder for capsule, test tube for liquid solutions, built-in scintillation detector, and instruction manual.

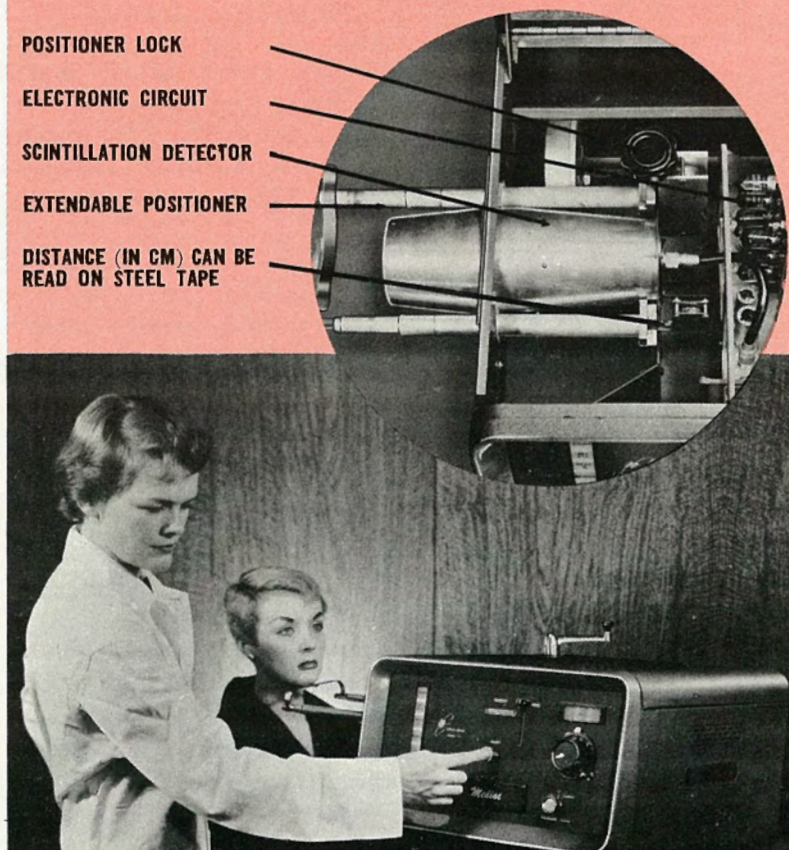
POSITIONER LOCK

ELECTRONIC CIRCUIT

SCINTILLATION DETECTOR

EXTENDABLE POSITIONER

DISTANCE (IN CM) CAN BE READ ON STEEL TAPE





counting system

model: **C110A**  
AUTOMATIC SAMPLE CHANGER

*a completely automatic sample handling system for radioisotope analysis*

Nuclear-Chicago's Model C-110A Automatic Sample Changer is designed to simplify making routine radioassays on large numbers of radio-active samples. The system makes possible substantial savings in the number of technicians required for radioassay work in addition to providing accurate, more reproducible results.

Model C-110A changer, when used with (1) any Nuclear-Chicago scaler, (2) Model C-111A "time interval" printer, (3) a lead shield, and (4) a radiation detector such as Model D34 mica-end window counter, Model DS-1 scintillation counter, or Model D47 gas flow counter, provides automatic detection, counting and recording of the length of time required for each sample to reach a predetermined number of counts. Tedious and time-consuming manual sample counting is completely eliminated since as many as 35 samples may be counted without attention on the part of the technician.

**features**—Radioactive samples may be prepared in  $1\frac{1}{4}$ " x  $\frac{1}{8}$ " or 1" x  $\frac{5}{16}$ " sample pans which fit into the thirty-five 2" sample adapter rings furnished with the instrument.

16 The adapter rings are numbered 1 through 35 and are in-

serted (lowest number first) into the right-hand (loading) magazine from where they will be moved under the detector.

The number of counts which will be accumulated on each sample is determined by the setting of the *count selector switch* times the preset scaling factor on the scaler. Thus, when the unit is used with a scaler having a scaling factor variable from 4 to 256, the lowest possible number of counts which can be accumulated on each sample is 20 and the highest is 25,600 with many possible combinations between these figures. Changing the scaling factor on the scaler or the setting of the count selector switch on the changer will increase or decrease the total number of counts taken on each sample and thus increase or decrease the "statistical error" obtained. The user will strike his own compromise between the percentage of accuracy desired and the length of time available to accumulate the necessary counts.

The *operation selector switch* provides three types of operation: (1) in *one-cycle-stop* each sample is counted once and then the unit stops; (2) in *normal* position the changer goes through one complete cycle and then automatically takes background counts until the instrument is shut off; (3) in

*auto-recycle* the unit will restack the samples in proper sequence at the end of each complete cycle and then automatically recount the samples.

Under each mode of operation, the Model C-111A printer automatically prints the length of time required for each sample and each background count to reach the preset number of counts. This length of time, together with the "identity" number of the sample, is recorded on a paper tape in minutes and hundredths of a minute to 999.99 minutes maximum. Background counts may be taken at any point in the cycle by leaving one or more of the sample pans empty.

**operation**—The radiation detector is inserted into the appropriate lead shield and connected to the scaler in the regular manner. The changer is attached to the printer and the scaler by means of two nine-conductor cables. The radioactive samples to be counted are then loaded into the right hand vertical tubular magazine.

The *operation selector* switch is placed in the desired position, the scaler is turned on, the high voltage set at the proper level for the detector, and the stop-count switch is thrown to the *count* position. To start the operation, the *start* button on the sample changer is depressed momentarily.

When the preselected count has been accumulated, the counting will stop, the printer will record the length of time which was required to reach the count, and a new sample will be raised into the counting position within the lead shield. Samples being counted are fully surrounded by lead and are elevated to the exact position each time, thus assuring precise geometrical reproducibility.

Although the sample changer is designed to operate without modification with all the Nuclear-Chicago scalers shown in this catalog, it is particularly versatile when used with the Model 192. With this scaler, the changer may be set to change samples when either a preset count or preset time has elapsed (whichever occurs first). Thus, a counting run can be stopped after a certain length of time even though the preselected count has not been reached. When the changer is used with either Model 192 or 183 scalers, the *pre-count* control on these scalers may also be used to select the desired count for each sample.

The complete sample changer system is the product of constant research and development, and incorporates the finest mechanical and electrical workmanship. Its compactness and versatility makes this instrument an excellent choice for any laboratory counting a large number of samples.

Order—Model C-110A, C-111A, detector, scaler, and appropriate lead shield for complete system.

## specifications

### Model C-110A Sample Changer

**capacity**—Up to 35 samples. Samples may be prepared in  $1\frac{1}{4}$ " x  $\frac{1}{8}$ " or 1" x  $\frac{5}{16}$ " sample pans which fit into the 35 two-inch sample adapter rings furnished. 35 AC-12 sample pans furnished.

**cycle time**—15 seconds for changing each sample.

**operation selector**—Selects complete cycle and stop, continuous cycling in proper order, or count with background. Separate start-reject switch interrupts or starts operation. Line-off-scaler switch provides power from A-C line or from scaler. For 220 volts operation, the power must be taken from a scaler operating at 110 volts from the PS6 step-down transformer.

**count selector**—Presets 5, 10, 20, 40, 80, or 100 times scaling factor, and provides switch positions for preset time or scaler controlled operation.

**index reset** (at rear)—Resets the index number on the C-111A to zero at any desired time.

**scaler reset**—Prevents the register on the scaler used from electrically resetting on automatic operation.

**connectors**—Nine-pin to scaler, nine-pin to printing timer, two PC28 cables furnished. Separate line input connector for testing purposes.

**power**—100 to 130 volts, 60 cycles (50 cycles on request).

**dimensions**— $14\frac{1}{4}$ " x 15" x  $18\frac{1}{2}$ " high.

**weight**—50 lbs., shipping weight 60 lbs.

### Model C-111A Printing Timer

**capacity**—99 samples to 999.99 minutes each.

**accuracy**—Prints time within 0.01 minute.

**record**—Prints time in minutes and hundredths with sample "identity" number on paper tape.

**power**—50 millisecond signal pulse and 115 volt, 60 cycle power obtained from C-110A sample changer.

**connector**—9-pin connector. Printing timer is attached to changer by means of PC28 cable.

**dimensions**—9" x 14" x 12".

**weight**—32 lbs., shipping weight 35 lbs.

### LEAD SHIELDS

**order model 3037** lead shield for use with Model D34 or similar mica end window counters.

**order model 3037A** lead shield for use with Model DS-1 or similar scintillation counters.

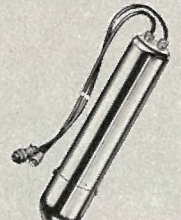
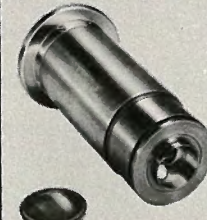
**order model 3037B** lead shield for use with Model D47 Gas Flow counter.

*Typical detectors which may be used with the Automatic Sample Changer system.*

D34 thin window G-M tube

D47 gas flow counter

DS-1 scintillation coun



## rate meters

model: **1620**  
RATEMETER

*six ranges to  
100,000 counts per minute*

*four time constants*

*individual and master range  
calibrations*

*regulated high voltage*



The Model 1620 Analytical Count Rate Meter is a precision integrating instrument to provide highly accurate quantitative measurements of radioactivity. As such, the instrument converts randomly spaced pulses from an external Geiger or scintillation detector into average count rate per minute, and presents this average on the large panel meter.

The high accuracy of the Model 1620 permits it to compete favorably with a scaler. For many applications a ratemeter presentation is preferred since changes in count rate are indicated sooner, and permanent chart recordings of activity over long periods are easily made.

**features**—Six ranges covering any radiation intensity to 100,000 counts per minute are provided. Average counting rate is indicated on the  $4\frac{1}{2}$ " panel meter which is calibrated in counts per minute.

The meter also serves to indicate the high voltage supplied to the external detector, and a separate meter scale is provided for this purpose. The CRM-HV control switches the meter to read in volts or counts per minute. To decrease the possibility of error, the kilovolt scale is printed in red.

Front panel controls of the Model 1620 include the master on-off switch, high voltage on-off switch, high voltage adjustment control, CRM-HV control for the meter, four-position time constant switch, six-position range switch, and a three-position operation selector switch. In addition, master and high voltage on-off lights are provided.

**operation**—When the high voltage for the external Geiger or scintillation detector has been adjusted, the meter control set at CRM and the operation selector switch to USE, the only other controls which need be adjusted by the user are the time constant switch and the range switch.

Four time constants of 0.5, 2.0, 10, and 50 seconds are available and permit easy calculation of probable error and equilibrium times. The shortest time constants are used when individual peaks are of interest, and the longer time constants when the overall average counting rate is of primary importance. A quick charge circuit for the unused condensers allows equilibrium times to be quickly reached. On the 300 count-per-minute range probable error readings as low as 2.5% can be obtained very quickly by utilizing the pre-charged time constant capacitors.

## specifications

ranges of 300, 1000, 3000, 10,000, 30,000, counts per minute are provided, thus permitting in meter reading over an extremely wide range rates. The basic circuit non-linearity from 0 to less than 0.25 per cent. Individual scales for the 1000 cpm. ranges insure high reading accuracy. In individual calibration control is provided within 1% for each range. In normal use, the master calibration at the rear of the instrument will compensate calibration shifts which might occur.

Counting losses for counting random pulses is less than 1% in all ranges. A high gain, completely fed-back circuit is used to achieve linearity and independence of operating characteristics. The meter is part of a balanced bridge circuit to achieve stability for line voltage changes. Meter linearity is primarily determined by the accuracy of the meter.

**Calibration and meter zero** — The operation selector switch can be moved to the normal operation position (USE), CAL or ZERO positions for checking calibration or zero during operation. A multivibrator type 60 is used and a convenient calibration check is provided for 3600 cpm. on the meter. Calibration and zero are very stable. Master calibration and zero set points are located at the rear of the chassis.

**Power supply**—The Model 1620 incorporates a well regulated high voltage supply for the external radiation detector mounted HV on-off switch and time-delay circuit provided to protect counter tubes.

**Features**—The instrument has all terminal board connections for better component cooling and easier servicing. The chassis is housed in a compact, well ventilated cabinet.

A connector located at the rear of the chassis is provided for either an Esterline-Angus (1 ma.), or Brown (10 ma.) type recorder. A selector switch at the rear of the instrument provides A-C power for the recorders. No circuit breakers are necessary.

A 6-inch loud speaker, normally mounted on the top of the cabinet, is provided. A control at the rear of the instrument adjusts for the desired volume and sufficient power for audible hearing at considerable distances. This feature enables the speaker to be used remotely for counting purposes.

The instrument, because of its high accuracy and wide versatility, is recommended for quantitative use as part of any radioisotope laboratory.

**range**—Six full scale ranges of 300, 1000, 3000, 10,000, 30,000, and 100,000 counts per minute indicated on 4½" panel meter. Separate meter scales for the 300 and 1000 cpm. ranges.

**time constants**—Four time constants of 0.5, 2.0, 10, and 50 seconds. A three section special Mylar film condenser in the circuit is used to obtain high insulation resistance and low dielectric absorption at temperatures to 85° C.

**sensitivity**—A wide band input amplifier is used. Input sensitivity is variable from 0.1 to 1 volt by means of a chassis control and is preset to 0.25 volt at the factory.

**operation switch**—Normal operation position is USE. CAL and ZERO positions provided for checking calibration or zero at any time during operation. In normal use, the meter zero and calibration will remain stable to within ±1% for periods of 24 hours or more. Calibration will remain constant to within ±2% for line changes from 100 to 130 volts.

**accuracy**—Basic circuit accuracy is better than 0.25 per cent. Overall accuracy is determined by the meter and is better than ±2 per cent of meter reading.

**resolution losses**—Resolution loss for pulse pairs is less than 1 per cent at full scale. Loss is constant on all ranges.

**high voltage**—Continuously variable with front panel control. Rated 600 to 1800 volts. Will deliver 100 microamperes to load at 1800 volts and 0.5 milliamperes at 650 volts. Compensating circuits allow less than 0.01% change in output voltage for a 1% line voltage change between 100 and 130 volts. The low voltage supplies in the instrument are regulated to increase zero and calibration stability.

**at rear of chassis**—Volume control for loud speaker, master zero and calibration controls, speaker plug, input connector, preamplifier connector, recorder connector, and switch for normal, 10 mv or 1 ma recorder operation, 6 screwdriver calibration controls for individual ranges, input sensitivity adjustment, high voltage calibration, A-C line cord, fuse.

**power requirements**—65 watts, 100 to 130 volts, 50-60 cycles. Available for 220 volts operation on request. On 50 cycle operation, calibration point will be at 3000 cpm on the meter.

**dimensions**—13½" x 11" x 12".

**weight**—27 lbs., shipping weight 33 lbs.

**supplied with** instruction manual, PC32 recorder cable for use with E-A or Brown recorders.

*One of the many uses of the Model 1620 is in medical diagnosis and therapy. Here the unit is used with the DS-1 scintillation counter in a routine thyroid uptake study.*





## rate meters

### model: **1619** LABORATORY MONITOR

*for use with G-M counters  
four ranges to 20,000 cpm  
provision for chart recorder  
time constants  
changed by range switch*



The Model 1619 "Labitron" is a laboratory count rate instrument used with a Geiger-Muller counter for monitoring radioactivity. As such, the instrument converts randomly spaced pulses from the external detector into average counts per minutes, and presents this average on the four-inch panel mounted meter.

The Labitron is especially useful for (1) routine surveying for radiation contamination on hands, clothing, benches, glassware, etc., (2) steady monitoring of laboratory "background" in order to detect large fluctuations from various sources which might interfere with precise experiments, and (3) routine measurement of radioactivity for medical diagnosis, tracer work, or process control where the use of a scaler is inconvenient.

The instrument is normally used with a Model D34 thin window Geiger tube mounted in a Model P11 probe which is connected to the count rate meter by means of a three-foot flexible cable.

**features**—Four separate ranges covering 0-500, 0-2000, 0-5000, and 0-20,000 counts per minute are provided, per-

mitting high accuracy in meter reading over a wide range of counting rates. Average counting rate is indicated on a four-inch panel meter which is calibrated in counts per minute. The simplicity of the circuit is such to insure high reliability and long operational life.

Front panel controls of the Model 1619 Labitron include an on-off switch which also serves as a volume control for the built-in loud speaker, a continuously variable high voltage control which provides 900 to 1100 volts for the external Geiger counter used with the unit, and a four-position range selector switch. In addition, a master on-off neon pilot lamp is provided.

**operation**—Operation of the instrument is as simple as turning the unit on, setting the high voltage at the proper point for the Geiger counter, and turning the range switch to the appropriate range. The user may then read the radiation, in terms of counts per minute, directly on the meter. In addition, a loud speaker within the unit sounds a "pop" for each pulse produced by the counter, thus giving an audible indication of counting rate. The volume control on the front panel may be adjusted to suit the user.

## specifications

**high voltage supply**—The high voltage supply of the Labitron is continuously variable from a reference voltage ("V") to "V" + 200 volts. "V" is determined by the voltage regulator tube supplied with the instrument, and is equal to 900 volts unless another voltage is specifically requested. High voltage regulation is such that there is less than 0.1% change in high voltage for a 1% line voltage change between 105 and 130 volts.

**special features**—The instrument has been designed so that there is absolutely no zero shift. Calibration for evenly spaced pulses is accurate to better than  $\pm 5\%$  of full scale on all ranges. This calibration will remain stable for long periods of time and is unaffected by line voltage fluctuations. The effective time constants of the count rate circuit are changed by the range switch and have been chosen to provide the best compromise between probable error in reading and speed of response. Probable error is approximately 5 per cent on the 500 counts per minute range and  $1\frac{1}{2}$  per cent on the 20,000 counts per minute range. The panel meter has been overdamped to reduce meter fluctuations.

A connector has been provided at the rear of the chassis for connecting an Esterline-Angus chart recorder to maintain a continuous record of the count rate vs. time. No circuit modifications are necessary. Recorder on-off switch is located at the rear of the chassis.

The instrument is housed in an attractive, compact cabinet finished in gray hammertone enamel. Low power dissipation, minimum number of tubes, reliably rated circuit components, and good construction techniques assure reliability and long operational life.

A complete monitoring system consisting of the Model 1619 Labitron, Model D34 mica end window Geiger counter, and Model P11 probe is available at a special price.

**ranges**—Four ranges of 0-500, 0-2000, 0-5000, and 0-20,000 counts per minute. Individual range calibration for evenly spaced pulses is within 5%.

**calibration**—Independent of line voltage from 100 to 130 volts and vacuum tube replacement. Separate adjustment for each range.

**time constant**—Fixed for each range.

**resolution**—Resolution loss for random pulses approximately 10% at 20,000 counts per minute. Less than 5% on lower ranges.

**input sensitivity**—Fixed at approximately 0.75 volt.

**meter**—Four inch panel meter is calibrated in counts per minute.

**controls**—On-Off-Volume control, four position range selector switch, high voltage adjust, recorder on-off switch at rear. Screwdriver calibration controls on chassis.

**high voltage**—900 volts, corona tube regulation with 200 volt adjustment provided by front panel control. Regulation is such that there is less than 0.1% high voltage change for 1% line voltage change between 105 and 130 volts.

**loud speaker**—Loud speaker is mounted on chassis, volume is adjustable with front panel control. Easily audible at considerable distances.

**tube complement**—6SL7 amplifier, 2050 trigger, VR75 voltage regulator, 1B3-GT high voltage rectifier, 6X5-GT low voltage rectifier, CK1038 900 volt corona regulator.

**at rear of chassis**—Input, recorder connectors, recorder on-off switch, scope connector, line cord, fuse.

**power requirements**—36 watts, 105 to 130 volts, 60 cycles. Available for 50 cycle operation on request. For 220 volts operation we recommend the use of the Model PS6 step-down transformer.

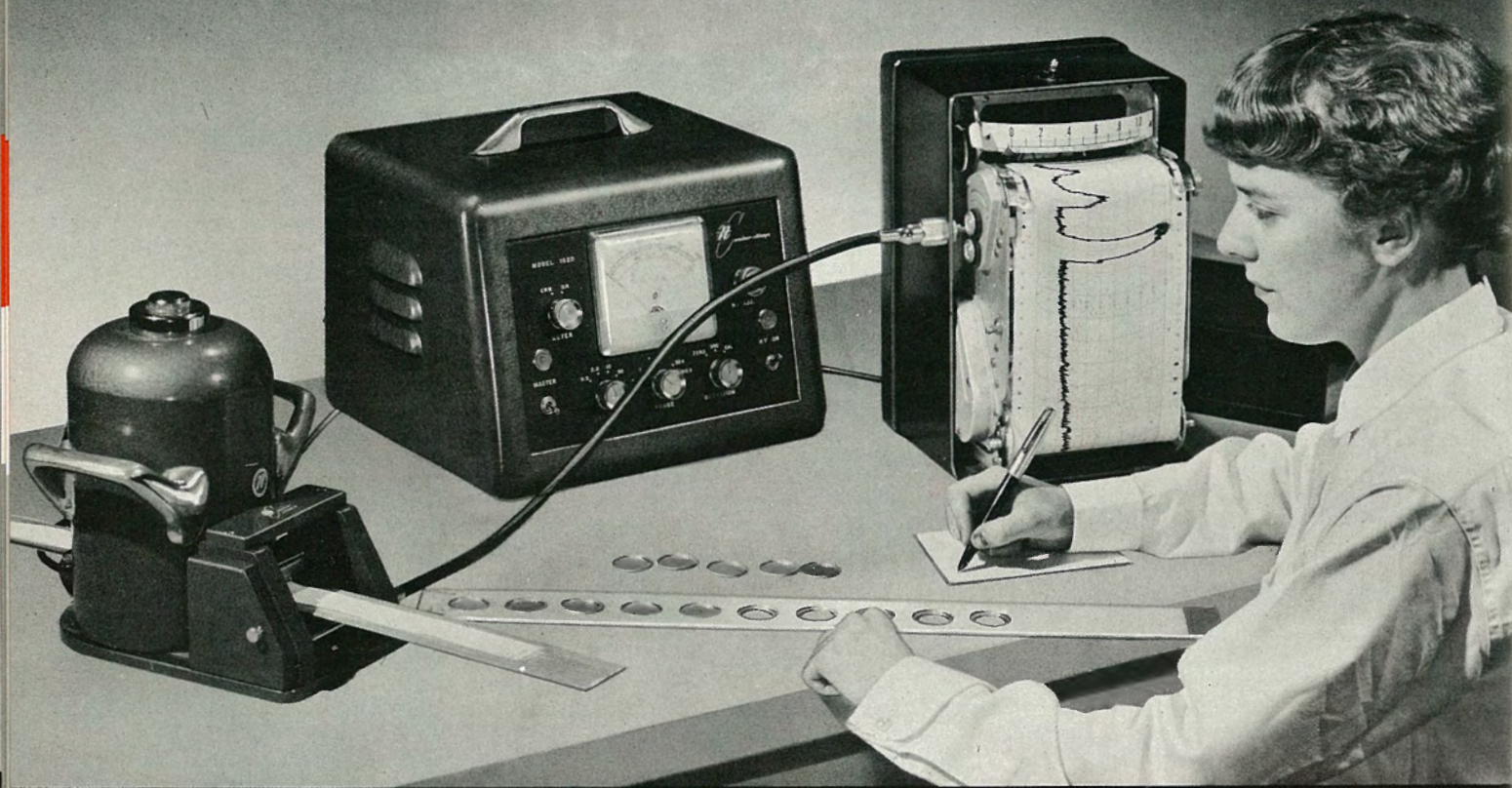
**dimensions**— $13\frac{1}{2}$ " x 11" x  $9\frac{1}{2}$ ".

**weight**—23 lbs., shipping weight 29 lbs.

**supplied with instruction manual.** Instrument may be ordered with Model D34 Geiger counter and Model P11 probe at a special price.

*A carbon-14 counting laboratory. Model 1619 (A) is used as part of an "Actigraph" system for counting paper radiochromatographic strips. Model 182 scaler (B) is used with the automatic sample changer system (C) and a D47 gas flow detector for counting carbon-14 samples. Model 2612 survey meter (D) completes this well equipped installation.*





**counting system**

model: **C100**  
ACTIGRAPH

*an automatic scanning system for paper  
radiochromatograms*

The Model C-100 Actigraph is part of a complete system designed to automatically scan a strip chromatogram in order to obtain a permanent graphic recording of the radioactivity distributed along its length. Continuous exploration of a strip with the Actigraph not only locates the separated radioactive components but also permits a quantitative estimate of the total activity. Since the technique permits the separation and detection of as little as one microgram of material, it has been widely used for testing chemical radiopurities, in biological applications, and in other uses where chemical analyses of very small samples is desired.

The complete Actigraph laboratory consists of the Model C-100 strip feeder with accessories, a suitable thin-window radiation detector mounted in a lead shield which rests on the strip feeder, a Model 1620 (or similar) count rate meter, and an Esterline-Angus chart recorder.

**operation**—Strip chromatograms are taped to the aluminum strip table, passed through the lead shield holding the radiation detector, and through the rollers of the strip feeder. The Esterline-Angus chart drive mechanism is coupled to the rubber rollers by means of a flexible coupling cable.

Thus, as the chart advances, the rubber rollers move the aluminum strip carrying the chromatogram past the thin window of the detector. Since the movement of the paper strip is synchronized with the movement of the recording chart, close correspondence between the linear distribution of radioactivity as it exists on the strip and as it is indicated on the chart is assured.

The Actigraph is designed to provide constant geometry, suitable collimation, and an appropriate and constant scanning speed during the entire scanning operation.

Constant geometry is assured by the fixed distance maintained between the window of the detector mounted within the lead shield and the strip table which is drawn through a strip guide positioned within a machined slot in the lead shield.

While imposition of a collimating slit between the radiochromatogram and the detector window reduces the total recorded count rate, such "focusing" is frequently necessary in order to resolve two relatively closely-spaced radioactive zones. Four collimating slits, 1/4, 1/8, 1/16, and 1/32

inches in width are provided for this purpose. They are of an improved design which maximizes the sensitivity of detection at any slit width selected by the operator.

Since the rate of response of the count rate meter as well as the accuracy of its readings depend upon the number of radioactive events detected per unit time, low activities require a slower scanning rate than will high activities for the same statistical accuracy. If only a qualitative indication of the activity distribution on a highly radioactive chromatogram will suffice, fast rates of scanning are convenient.

Three pairs of easily-changed color-coded gears provided with the Actigraph afford a choice of eight different scanning speeds ranging from 0.75 to 360 inches per hour. When the scanning is completed, a contact switch automatically stops the chart drive and the strip table.

**simple sample changer**—A special table furnished as an accessory with the Actigraph permits the instrument's use as a simple automatic sample changer. The table will accommodate up to ten standard 1-inch or 1¼-inch diameter by ⅛-inch sample planchets and may be drawn past the detector in the same manner as the strip chromatogram. The activity of each sample is then read directly on the chart recorder.

**absorber table**—Another table furnished with the instrument will hold eight 1⅛-inch diameter absorbers (Nuclear-Chicago Model C-101 set or equivalent). The absorbers may be automatically drawn over a radioactive sample placed in the shield under the detector to produce a characteristic absorption curve.

**choice of detectors**—The choice of detectors will be determined by the degree of sensitivity desired. In a series of experiments with the Actigraph system, the following data was obtained:

The Model D34 detector detected carbon-14 in concentrations of  $0.67 \times 10^{-3}$  microcuries per square centimeter. The Model D36 detector detected carbon-14 in  $0.33 \times 10^{-3}$  microcuries per square centimeter concentrations. The Model D47 gas flow counter using the "Micromil" window detected  $0.17 \times 10^{-3}$  microcuries per square centimeter. Thus, the use of the Model D47 increases by at least a factor of two the dilution of activity permissible in a given experiment or will permit an increase in scanning speed without loss of statistical accuracy.

Order the Model C-100 strip feeder, count rate meter, suitable detector with an appropriate lead shield, and an Esterline-Angus chart recorder for the complete Actigraph system. See "specifications" for detailed ordering information.

## specifications

### STRIP FEEDER

**model C-100 strip feeder**—Includes a flat plate with rubber rollers in a frame. A microswitch and cable assembly (PC27) are permanently attached, will stop drive when end of table is reached. Shipped with strip feeder are: strip table, sample pan table, absorber table, flexible shaft to connect to Esterline-Angus recorder, speed gears, guide table with collimating slits.

**dimensions**—Feeder is 10" long by 6½" wide by 6" high. Mounting tables and strip holder are 36" long.

**weight**—11 lbs., shipping weight 14 lbs.

**shipped with** instruction manual, items listed above.

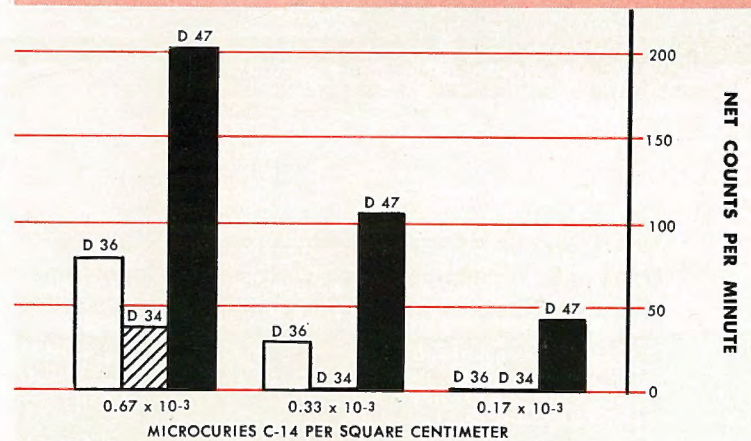
### COUNT RATE METER AND RECORDER

Either Model 1620 Analytical Count Rate Meter or Model 1619 Labitron and the Esterline-Angus recorder may be used with the system.

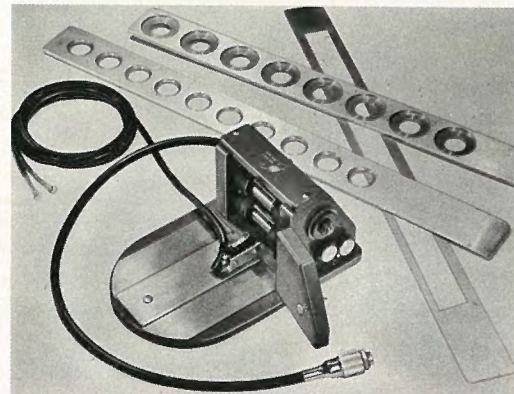
### LEAD SHIELD AND DETECTOR

Model D34 or Model D36 thin window counters are used with Model 3031B lead shield and with either the Model 1620 Analytical Count Rate Meter or Model 1619 Labitron.

Model D47 gas flow counter is used with Model 3036 lead shield and with the Model 1620 Analytical Count Rate Meter only.



Relative sensitivities of various detectors used with the Actigraph system. The D47 was used with its Micromil window. Net counts per minute=observed counts per minute less background.

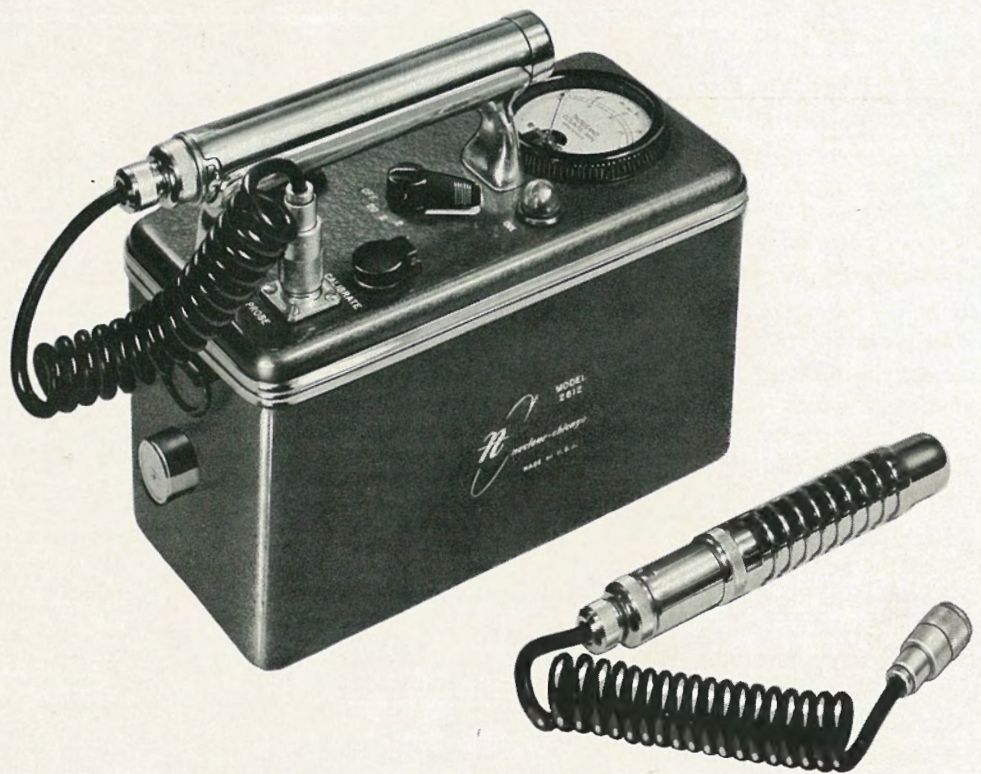


Model C-100 Strip Feeder. Tables for holding sample planchets and absorbers are included as standard accessories. Strip table, rollers, speed gears, contact switch and flexible coupling cable are shown.

portables

model: **2612**  
COUNT RATE METER

*portable Geiger counter  
three ranges to 20 mr/hr  
choice of probes  
250 hour battery life*



Model 2612 is a portable battery operated Geiger-Muller survey meter for measuring alpha, beta, and gamma radiation of low and medium intensities. It uses a proven, reliable electronic circuit which is housed in a weatherproof aluminum case to assure dependable operation under all conditions.

The instrument is available with choice of probes utilizing either a Model D50 thin glass wall Geiger counter for measuring both beta and gamma radiation with energies over 0.2 mev, or a Model D35 thin mica end window counter for measuring alphas and soft betas in addition to harder radiations.

This versatile and precision count rate instrument has found wide application in checking for radioactive contamination in radioisotope laboratories, determining necessary shielding, monitoring x-radiation, locating leaks in piping systems, prospecting for uranium ores, etc.

**operation**—A single range switch located directly beneath the handle turns the instrument on and selects the desired range. Operation is as simple as turning the switch to the lowest scale which will give a satisfactory reading.

The meter scale is direct reading in terms of milliroentgens per hour and counts per minute. Three ranges cover radiation intensities of 0.2, 2, and 20 mr/hr, full scale corresponding to 600, 6000, and 60,000 counts per minute.

The instrument is sensitive enough for detection of the normal cosmic ray background and yet can read intensities well above the health tolerance level. Tolerance level (7.5 mr/hr for a 40 hour week) is slightly under half scale on the 20 mr/hr range.

The probe mounts in the handle by a simple friction fit, and can be used in that position or may be easily removed for surveying benchtops, radioactive spills, hands, clothing, rock crevices, etc. A 40-inch coiled cable connects the probe to a connector on the panel.

The time constants of the Model 2612 are automatically changed to the fastest possible response time consistent with statistical fluctuations. Special circuit design assures no zero drift. A compensating circuit minimizes coincidence losses at high counting rates. The supply voltage for the ratemeter circuit is regulated to keep the calibration constant.

## specifications

6 probe (shown in position in the handle of Model D35 mica end window counter) with a probe cap which permits gamma sur-temoving the cap from the end of the probe mg/cm<sup>2</sup> window and permits monitoring radiation with energies as low as 40 kev.

15 probe (shown next to the unit) holds glass wall counter and has a revolving beta exposes a 180° angle. When closed, the shield out beta radiation.

es are interchangeable. The radium calibrated on the case may be used in recalibrat-ent should the probes be interchanged in the

The instrument is carefully calibrated at the is of gamma rays from radium in equilibrium lived decay products. A calibrated radiation ted at one end of the case and may be re-ved next to the Geiger tube for checking cali- time. If necessary, the instrument can be ted by means of a screwdriver adjustment ed jack on the panel. Accuracy of the Model than  $\pm 10\%$  of full scale on all ranges.

circuit uses two hearing aid type tubes, a 25 meter, crystal earphones, and a 900 volt o oscillator high voltage supply for the Geiger v drain circuit makes possible an extremely fe of over 250 hours for continuous operation e equal to shelf life when operated two hours n-off pilot light is mounted on the front panel. vides a visual indication of battery failure.

-The internal layout of the instrument has for easy servicing when required. Electronic e located in the cover of the unit and are hinged shelf. The entire instrument is easily ess to all parts. The two portions of the case er by screws and pressed against twin rubber omium joining strip to insure water tightness.

ernal parts, including the meter, are firmly bber to prevent water leakage. The outside of smooth gray enamel finish which makes the decontaminate and also prevents accumulation t. Strap holders are provided. A sealed ear- id a set of earphones are provided for aural The instrument is lightweight for easy port-

**ranges**—0.2, 2.0, and 20 mr/hr and 600, 6,000, and 60,000 counts per minute full scale.

**circuit**—Time constants are automatically changed by the range selector switch to the fastest response time consistent with statistical fluctuations. Absolutely no zero drift. Compensating circuit minimizes coincidence loss at high counting rates.

**probe and detector**—Available with Model P16 probe and D35 mica end window counter as Model 2612P which should be ordered when it is desired to count soft radiation from carbon-14, sulfur-35, etc. Available with Model P15 probe and D50 glass wall counter as Model 2612M which should be ordered by those working with iodine-131, phosphorous-32, prospectors, and all those desiring to monitor higher energy beta or gamma radiation.

**controls**—Range switch operable by hand carrying the instrument. Off position and three scale ranges are provided. A sealed earphone jack and a set of double earphones are provided for aural monitoring.

**calibration**—Instrument is carefully calibrated at the factory in terms of gamma rays from a cesium-137 source, which is radium equivalent for this instrument. A calibrated reference source is mounted on the instrument case.

**accuracy**—Better than  $\pm 10\%$  on all ranges.

**power**—Uses 900 volt stabilized audio oscillator high voltage supply for the Geiger tube. Two 67½ volt and two 1½ volt batteries. Battery life is 250 hours continuous operation or equal to shelf life when operated 2 hours per day.

**meter**—2½" waterproof meter with counts-per-minute and mr/hr scales.

**case dimensions**—10" x 4¾" x 5¾".

**weight**—10 lbs., shipping weight 15 lbs.

**supplied with** batteries, double earphones, calibration source, probe and detector as specified, and instruction manual.

**models available**—Model 2612M for general beta-gamma survey work and prospecting. Model 2612P for monitoring alphas and soft betas as well as harder radiations.

*Model 2612 is suitable for measuring alpha and soft beta surface contamination when used with the D35 thin window counter.*



portables

model: **2586**  
CUTIE PIE

*portable beta-gamma  
ionization chamber  
survey meter*



The Nuclear-Chicago Model 2586 is a new, completely redesigned version of the wartime "Cutie Pie" gun-type survey meter. The instrument is battery operated and is used for measurement of beta and gamma radiation where fairly high field intensities may be encountered.

Model 2586 is convenient for determining the amount of radiation which laboratory and other workers are receiving from experimental work with radioisotopes, to monitor shipping containers for excess radiation, for remote monitoring purposes, for civil defense use, industrial radiography uses and decontamination and clean-up purposes. The unit is especially designed for use where activities on the order of millicurie amounts of radioactivity are present.

**features**—The Model 2586 features a 500 cc. cylindrical ionization chamber which in normal use is connected to the body of the instrument. It may be remotely operated by means of a cable if desired. This exclusive feature permits location of the ionization chamber up to 100 feet from the operator of the instrument, and permits continuous monitoring of areas of high radiation intensity without danger to the user. A 10 ft. cable for remote operation may be ordered

separately at extra cost, and special cables (up to 100 ft. in length) may be specified.

A 0.0002 inch rubber hydrochloride window with a density of 0.7 mg/cm<sup>2</sup> covers one end of the ionization chamber and permits entry of beta radiation with energies as low as 40 kev. The thin window has an active area of 30 cm<sup>2</sup> and permits a full scale sensitivity of one microcurie for carbon-14 beta radiation. The axial beta geometry is within 20% of the gamma geometry, thus giving a REP calibration factor of 80%.

A one gram/cm<sup>2</sup> beta shield is supplied with the instrument and may be placed over the thin window to shield out beta radiation. The "Cutie Pie" will then read only gamma radiation excluding all but the highest energy beta rays commonly encountered. With the beta shield in position over the window, the instrument is suitable for measuring roentgen dosage rates from x-rays with energies as low as 50 kev.

**operation**—Three linear, direct reading ranges of 0-25, 0-250 and 0-2500 milliroentgens per hour permit quick and

accurate measurement of relatively high radiation dosage rates. In turning the instrument on, the range switch passes through a battery check position, a position for checking meter zero, and finally the three range positions. The accepted tolerance level (6.25 mr/hr for a 48 hour week) is one-quarter scale on the most sensitive range, and is indicated by a mark on the 2½ inch meter.

In the "battery check" position of the range switch, the meter needle will move to a check point on the meter to indicate proper battery voltage. Batteries should be replaced when the needle no longer swings to the check point. The "set" position of the range switch permits zero setting of the meter in the presence of ionizing radiation and may be used to check the meter zero at any time during operation. The circuit design is such that there is no need to make a zero set adjustment when changing ranges.

The meter zeroing control is located at the top of the instrument and is normally used in zero setting the meter. If the electrometer tube in the instrument is changed, it may be impossible to zero the meter with this control. A coarse zero control located beneath a snap plug on the side of the instrument may then be used.

**calibration**—The instrument is carefully calibrated at the factory in terms of gamma rays from a cesium-137 source which is radium equivalent for this instrument. Calibration is made with the beta shield in place. Therefore, the instrument should be used with the beta shield when measuring gamma radiation in order to preserve the calibration. Calibration will remain constant throughout the life of the batteries and is accurate to ±10% of full scale at normal air density and room temperature. If desired, the user may recalibrate the instrument to a known source of ionizing radiation. A calibration control, located beneath a second snap plug on the side of the case, is provided for this purpose.

**circuit**—The Model 2586 "Cutie Pie" utilizes a three tube electrometer circuit employing both positive and negative feedback. The time constant is less than two seconds on all ranges. All critical components are hermetically sealed and the instrument will operate from 0 to 98% relative humidity. Zero drift is less than 5% of full scale for 8 hours of operation. The ionization chamber collector is supported by a polystyrene insulator mounted in a volumetric guard ring. All components are conservatively rated for long trouble-free operation.

*The ion chamber may be disconnected from the body of the unit to monitor areas of high radiation intensity without danger to the operator.*

## specifications

**range**—Three linear, direct reading ranges of 0-25, 0-250 and 0-2500 milliroentgens per hour.

**calibration accuracy**—±10% of full scale on all ranges.

**calibration**—Calibrated at the factory in terms of gamma rays from a cesium-137 source which is radium equivalent for this instrument. Calibration remains constant throughout battery life. Screwdriver calibration control on side of case.

**time constant**—Less than two seconds on all ranges.

**gamma ray energy dependence**—Linear within ±10% from 50 kev to 2 mev.

**ionization chamber**—500 cc. cylinder. Aquadag inner coating. A 0.7 mg/cm<sup>2</sup> rubber hydrochloride window at one end of the chamber permits entry of low energy beta radiation. Window is normally covered with a 1 gram/cm<sup>2</sup> beta shield when measuring gamma radiation. Chamber may be remotely operated up to 100 ft. from the body of the instrument by cable connection.

**zero drift**—Less than 5% of full scale for 8 hours of operation.

**warm-up**—Instrument reads within 2% of equilibrium value on most sensitive range in one minute.

**panel meter**—2½ inch panel meter with 2⅜ inch scale length. 6.25 mr/hr tolerance rate and battery check points marked.

**power supply**—Uses four 30 volt (BA-030), two 15 volt (BA-031) and four 1.3 volt (BA-026) batteries. Battery life is 350 hours continuous operation or 400 hours at two hours per day.

**electronic circuit**—Three tube electrometer circuit employing both positive and negative feedback. Uses one 5886 electrometer tube, one 526AX pentode and one VX-10 switch tube.

**controls**—Single range switch selects meter zero, battery supply or selects one of three ranges. Meter zero control located at top of instrument case. Coarse meter zero control and calibration control are screwdriver adjustments located beneath snap plugs at side of instrument case.

**dimensions**—3½" x 8" x 12½".

**weight**—4 lbs., shipping weight 6 lbs.

**supplied with** complete set of batteries and instruction manual. 10 ft. cable is available for remote operation as Model PC33. Extra length cables are available on special order.





## portables

model: **2111**  
P E E W E E

*portable proportional counter for detection of alphas only in presence of other radiation*



The Model 2111 "Pee Wee" is a portable proportional survey instrument used with Nuclear-Chicago's Model AP2 alpha probe for the detection of alpha radiation only. It may be used to determine alpha activity on clothing, on table tops and hands, and in similar locations.

With the Model AP2 probe attached to the instrument, it will detect only alpha radiation in the presence of other radiation and produce a "popping" noise in the earphones. In addition, the integrating circuit will show on the meter the average count-rate between a range of 0 and 20,000 counts per minute. Two count-rate scales are provided: 0 to 2000 counts per minute and 0-20,000 counts per minute.

**circuit**—The Model 2111 amplifier has better than 2 millivolt sensitivity, and batteries provide up to 2400 volts dc for proportional counting with arrangement provided for voltage adjustment. As an operating convenience, a pushbutton is provided to immediately reset the meter to zero after exposure to a strong alpha source. The instrument is calibrated for 20% overall detection efficiency when used with Model AP2 probe.

Panel controls consist of the probe connector, jack for earphones, on-off switch, reset button, range switch and pulse height selector control. The pulse height selector varies the critical size of the pulse necessary for operation of the trigger circuit and is used in calibrating the instrument for alpha radiation.

**model AP2 probe**—The Model AP2 alpha probe is ordinarily used with the Model 2111, but may also be used with Models 182 or 192 scalars. It has a sensitive area of 75 sq. cm. with a 1 mg/cm<sup>2</sup> rubber hydrochloride window protected by a metal grill.

## specifications

**range**—Two ranges covering 0-2000 and 0-20,000 counts per minute for alphas. Average counting rate is indicated on the three-inch panel meter which is calibrated in counts per minute.

**amplifier**—Two-stage resistance coupled amplifier with two-tube trigger circuit mounted on a plug-in terminal board.

**reset**—A pushbutton is provided so that the meter will quickly return to zero after exposure to a strong alpha source.

**discriminator**—Pulse height selector control permits counting alphas only in the presence of beta or gamma radiation.

**bias adjustment**—A screwdriver control is provided at the side of the case so that the grid bias on the multi-vibrator circuit may be set to the proper position by the operator.

**vacuum tubes**—Two CK512AX; two CK552AX tubes.

**batteries**—Two 1½ volt (BA-010), one 6½ volt (BA-005) and two 1224 volt (BA-011) batteries. Battery life of high voltage batteries is approximately equal to shelf life (one year), life of low voltage batteries is approximately 80 hours of service each. Provision is made for easily changing output of high voltage batteries.

**calibration**—Calibration is made with the pulse height selector control by the operator using an alpha or mixed source of known activity.

**response time**—Meter reaches 90% of correct value in 20 seconds.

**dimensions**—8" x 5½" x 12".

**weight**—16 lbs., shipping weight 20 lbs.

**supplied with** PC5 cable, earphones, batteries and instruction manual. Model AP2 Probe should be ordered separately.

### MODEL AP2 PROBE

**sensitive area**—75 sq. cm protected by a metal grill.

**operating voltage**—approximately 2250 volts.

**beta threshold**—approximately 2500 volts.

**dimensions**—2" x 9".

**weight**—6¾ oz.

portables

model: **2582**  
SAMSON

*ionization type count  
rate meter for monitoring  
low level surface  
contamination*



## specifications

**range**—Three ranges covering 0-500, 0-2500 and 0-12500 counts per minute for alphas. For radium gamma radiation, these ranges correspond to approximately 0-0.5, 0-2.5 and 0-12.5 milliroentgens per hour respectively. Average counting rate is indicated on  $3\frac{1}{4}$  inch panel meter calibrated in counts per minute.

**ionization chamber**—40 cubic inch ion chamber located at bottom of case. Rubber hydrochloride window  $4 \times 4\frac{3}{8}$  inch with density of approximately  $0.5 \text{ mg/cm}^2$  and a stainless steel grill separate the chamber from monitored surface. Grill may be easily decontaminated by dipping in nitric acid. Ionization chamber is  $5\frac{1}{8} \times 4\frac{3}{4} \times 1\frac{5}{8}$  inches deep.

**input resistance**— $5 \times 10^{12}$  ohms.

**amplifier**—Three stage direct coupled, with electrometer input and 100% negative feedback. Circuit may be easily serviced if necessary without disturbing the ionization chamber or its thin window.

**vacuum tubes**—One CK5886 electrometer; two CK512AX amplifiers.

**batteries**—Seven  $22\frac{1}{2}$  volt (BA-003), four 1.3 volt mercury cells (BA-026), one 6.5 volt (BA-027) and one 9.1 volt (BA-028) mercury batteries. Battery life is at least 300 hours at eight hours per day except for the 9.1 volt mercury cell which has a life of approximately two months.

**calibration**—Calibration made at the factory with a uranium oxide ( $\text{U}_3\text{O}_8$ ) alpha particle standard.

**warm-up time**—Two minutes.

**response time**—Five to eight seconds on all ranges.

**alpha background**—Two counts per minute.

**temperature range**— $50^\circ \text{C}$  to  $-5^\circ \text{C}$  with a change in calibration of not more than 10%.

**probe connector**—A connector is provided for attaching an external detector for monitoring surfaces of unusual contour. A switch on the panel switches the external probe or built-in ionization chamber into the circuit.

**dimensions**— $6\frac{1}{8} \times 8\frac{5}{8} \times 7\frac{7}{8}$  inches high including handle.

**weight**—8 lbs., shipping weight 10 lbs.

**supplied with** batteries and instruction manual.

The Nuclear-Chicago Model 2582 "Samson" is a portable battery operated survey meter, containing a thin window ionization chamber to measure alpha surface contamination. The instrument is factory calibrated directly in counts per minute for uranium alpha particles. It may also be used to detect low level beta and gamma radiation, and can be calibrated by the user for this purpose. The "Samson" combines maximum sensitivity with high stability to provide the finest instrument of its kind for checking benches, floors, etc. for surface contamination.

**ionization chamber**—The "Samson" features a 40 cubic inch ionization chamber at the bottom of the instrument's case. An extremely thin rubber hydrochloride window and a stainless steel grill separate the ion chamber from the surface to be monitored. When placed on a flat surface, the window is located  $\frac{7}{32}$  inch from the monitored area. The design of the instrument permits the detection of alpha radiations with energies as low as 1 mev or beta radiations with energies as low as 15 kev.

**circuit**—The electronic circuit design insures high reliability. The output of the ion chamber is fed to a CK5886 electrometer followed by two stages of amplification. 100% negative feedback results in exceptional stability since it makes the circuit practically independent of tube characteristics and battery drift. Zero drift is less than 5% of full scale on the most sensitive range after a two minute warm-up.

All batteries in the "Samson" are contained in a compact plug-in unit which may be removed through a door in the side of the case without unsoldering connections. A neon flasher is mounted at the end of the handle, and flashes at regular intervals when the instrument is turned on.

portables

model: **2715**  
N E M O

*portable survey meter for  
separate measurement  
of thermal  
and fast neutrons*



Nuclear Chicago's Model 2715 "Nemo" is a portable battery operated survey meter for the measurement of thermal and fast neutron fluxes from  $10$  to  $10^4$  neutrons/cm<sup>2</sup>/second. It measures thermal and fast neutrons separately. The instrument contains two enriched BF<sub>3</sub> proportional counters, an amplifier, a scale of two, a limiter circuit, a voltmeter circuit, and a high voltage supply and batteries.

One of the proportional counters measures thermal neutrons, and is mounted directly on the circuit board. The other measures fast neutrons only, and is in a wax block which is surrounded by a cadmium shield. It is sensitive only to neutrons whose energy is above the cadmium resonance at 0.176 electron volts. The instrument will give no response in a gamma flux of 100/mr/hr.

The selector switch has five positions marked Off, Fil, B+, Thermal, and Fast. The selector switch is the only control used in normal operation. The Fil and B+ positions are used to check battery life, and battery check points are indicated by a mark on the meter scale. Screwdriver Calibration and Sensitivity controls are provided. The calibrate control consists of a current divider across the meter and varies the meter sensitivity. The sensitivity control can be adjusted to vary the feedback in the last amplifier stage.

Headphones may be plugged into a jack on the panel if aural monitoring is desired. A pair of neon lights which are alternately lit with each detected neutron provide an indication of proper operation and permit fluxes of less than 10 neutrons/cm<sup>2</sup>/second to be estimated. The meter scale is logarithmic and covers a range from 10 to  $10^4$  neutrons/cm<sup>2</sup>/second.

## specifications

**range**—10 to  $10^4$  neutrons per cm<sup>2</sup> per second for thermal and fast neutrons.

**circuit**—Four tube degenerative amplifier with exceptional high frequency response. Mid-frequency amplifier gain is adjustable from approximately 600 to 5000. Its response is down 3db at approximately 200 kc. Input sensitivity is from 1.2 to 10 mv. and is normally set at 2 millivolts. Pulse operated high voltage supplies 1500 volts to proportional counters. Special logarithmic rate circuit is practically independent of tube characteristics.

**controls**—"Off, Fil, B+, Thermal, Fast" radial switch. Screwdriver sensitivity and calibrate controls.

**detectors**—BF<sub>3</sub> proportional counters, 5/8" in diameter, 4" long with enriched BF<sub>3</sub> to a pressure of 20 cm of Hg. One detector is surrounded by a 4 1/2" x 4 1/2" x 2 1/2" wax block which is surrounded by a cadmium shield thick enough to absorb all the thermal neutrons, so that this counter responds only to fast neutrons, the other counter to thermal neutrons.

**calibration**—Calibration is made with a radium-beryllium neutron source having a maximum number of emitted neutrons at approximately 3 mev, an average energy of 4 mev, and a maximum energy of 13 mev. The meter calibration accuracy for this source is within  $\pm 15\%$  for neutrons. Counter efficiency is approximately 10%. Calibration is constant throughout battery life.

**scale of two**—Provides a pulse of constant average duty cycle for the operation of the voltmeter circuit over the entire range of frequencies to be encountered. Neon lights on panel are connected to this circuit.

**limiter**—Pulse from scale of two is brought to a constant amplitude by the limiter circuit to drive the voltmeter circuit.

**battery supply**—Instrument uses five 45 volt batteries (two BA-029, three BA-032), four mercury cells (three BA-021, one BA-033). Battery life is 40 hours continuous or more than 150 hours at two hours per day.

**dimensions**—6" x 6" x 12 3/4" exclusive of handle.

**weight**—16 1/2 lbs., shipping weight 20 lbs.

**supplied with** batteries, earphones and instruction manual.

portables

model: **2613**  
ORACLE

*portable survey  
instrument for uranium  
prospecting*



## specifications

**ranges**—0.02, 0.2 and 2 milliroentgens per hour.

**circuit**—Time constants are automatically changed by the range switch to the fastest response time consistent with statistical fluctuations. Absolutely no zero drift. Instrument uses two CK6088 hearing aid type tubes and a NE-51 neon tube which is used as a pilot lamp and voltage regulator tube.

**detector pack**—Ten Nuclear-Chicago Model D77 Geiger tubes are mounted in a pack behind bulls-eye on instrument case. Tubes are of special design to increase sensitivity to uranium gamma radiation. Tubes may be easily replaced, or entire pack may be replaced as a unit.

**controls**—Range switch operable by hand carrying the instrument. Off position and three scale ranges are provided. A sealed earphone jack and a set of double earphones are provided for aural monitoring.

**calibration**—A sealed container is provided which holds a mineral sample assaying approximately 0.1%  $U_3O_8$ . This sample may be used in checking calibration of the instrument or a find may be compared to this sample to determine the approximate percent uranium.

**accuracy**—Better than  $\pm 10\%$  of true value on all ranges.

**power**—Uses 900 volt stabilized audio oscillator high voltage supply for the detector pack. Two 67½ volt (BA-005) and two 1½ volt (BA-002) batteries. Battery life is 250 hours continuous operation or approximately one year when operated two hours per day.

**construction**—All electronic components are mounted on a hinged shelf for easy access to all parts. The two portions of the case are pressed against twin rubber gaskets in a chromium joining strip to insure water tightness. Circuit board and chassis area are sprayed with Durad moisture and fungus resistant varnish.

**meter**—2½" waterproof meter with mr/hr scale.

**case dimensions**—10" x 4¾" x 5¾".

**weight**—8 lbs., shipping weight 12 lbs.

**supplied with** ten tube detector "pack," complete set of batteries, sealed uranium sample and identical empty container, earphones, carrying strap, instructions and U.S. Govt. Manual "Prospecting for Uranium."

Model 2613 "Oracle" is a portable battery operated Geiger-Muller survey meter containing a "pack" of ten specially treated Geiger tubes for maximum sensitivity when prospecting for uranium ores. Its circuit is identical to the Nuclear-Chicago Model 2612 survey meter.

A single range switch turns the instrument on and selects the desired range. The meter scale is direct reading in terms of milliroentgens per hour and covers radiation intensities of 0.02, 0.2 and 2 mr/hr. Normal background is less than half scale on the most sensitive range. The high sensitivity of the instrument results in a background fluctuation of less than 10% even on the most sensitive range. Thus, small variations above background caused by a uranium deposit may be easily observed.

Supplied with every "Oracle" is a mineral sample containing approximately 0.1%  $U_3O_8$ . The ore is in a sealed container and is used for calibration and comparison tests. Rocks or earth found in the field may be crushed and placed in the identical container supplied with the unit and compared with the sample to determine the approximate percent uranium in the find. A bulls-eye is located on the case of the instrument for ease in making the assay. Operating instructions describe simple method of estimating percent uranium from the meter reading.

The circuit board and chassis area are moisture resistant and fungus proofed with Durad moisture and fungus resistant varnish. In addition, the meter and case are firmly mounted in rubber to prevent water leakage. The circuit is designed to operate at any temperature from 0° F to 120° F. A leather carrying strap is provided as well as a set of double earphones for aural monitoring.

## detectors

### model: **D-47** GAS FLOW COUNTER

*high efficiency*  
*windowless or*  
*thin window operation*  
*geiger or*  
*proportional counting*



The Nuclear-Chicago Model D47 Gas Flow Counter is an efficient soft beta radiation detector which may be operated as either a windowless or thin window counter in either the Geiger or proportional regions. The instrument is used with the C-110A automatic sample changer or M5 manual sample changer for counting radioactive samples, or as a thin window counter with the C-100 Actigraph.

Model D47 features a trochoidally shaped counting chamber through which a flow of Geiger or proportional counting gas is maintained during operation. Its life is practically infinite since the constant renewal of the gas eliminates counter aging effects. An anode wire loop in the center of the trochoid is used to obtain a symmetrical electrostatic field so that the entire chamber volume is effective for counting. Since the chamber volume is as small as practicable, background is reduced to a minimum.

**windowless counting**—When the greatest sensitivity is necessary, or when extremely soft radiations from isotopes such as tritium, nickel-63, etc. are to be detected, the D47 is used as a windowless counter. The C-110A automatic sample changer and the M5 manual sample changer position the radioactive samples so that they make a tight seal with a rubber "O" ring mounted on the end of the counting chamber. Thus, the unit operates as a 2 pi counter with the maximum geometry obtainable using a flat sample.

**micromil window counting**—A "Micromil" window with a density of only 120 micrograms/cm<sup>2</sup> may be placed on the end of the counter in seconds, allowing the unit to be used as an extremely efficient thin window counter. The loss in detection efficiency with the window in place (including the absorption in the air layer between the sample and the win-

dow) is less than 20% for carbon-14. A chart comparing the detection efficiency of the D47 with conventional thin window counters is shown on page 23.

For most biological and medical applications where soft beta emitters such as carbon-14, sulfur-35, etc. are counted, the use of the Micromil window is preferred since excellent reproducibility of counts is assured. The window eliminates common windowless counter faults such as chamber contamination, electrostatic charge effects, and vapor transmission from liquid or moist samples. It greatly simplifies many sample preparations, and gives more freedom in sample counting techniques.

**gas system**—An extremely simple gas system is used in order to keep the gas free of impurities and to eliminate all critical adjustments. Gas flows from the supply tank through a two stage pressure regulator and then into a small-bore glass capillary, which determines the gas flow. A three foot length of polyethylene tubing conducts the gas to an inlet at the top of the counter. Gas enters the counting chamber through orifices at its top. The smooth contour of the chamber assures a uniform flow of gas, preventing accumulation of impurities. Final exhaust passes through holes in the window ring or sealing ring. Air is prevented from entering the chamber by the outward flow of gas.

**operation**—The Model D47 may be operated in the Geiger region when used with Nuclear-Chicago "Q-Gas" and a scaler having 0.25 volt sensitivity. When used with "PF Gas" and a scaler having a one-millivolt sensitivity, the unit may be operated in the proportional region so that it is possible to discriminate between different beta energies, and to count alpha radiation in the presence of other radiation

## specifications

**background**—Alpha proportional — 8 counts per hour. Beta proportional — 15 counts per minute. Geiger — 15 counts per minute.

**resolving time**—100 microseconds with Geiger operation.

**plateau length**—200 volts in Geiger region. 400 volts in proportional region using Model D47P preamplifier.

**plateau slope**—2% in Geiger and proportional region. 0.5% in proportional region using Model D47P preamplifier.

**approximate operating potential**—Geiger—1250 volts; beta proportional—2200 volts using "PR-Gas," 3100 volts with pure methane; alpha proportional 1200 volts using "PR-Gas," 1500 volts using pure methane.

**counting gas**—Geiger "Q-Gas," 98.7% helium, 1.3% butane. Proportional "PR-Gas," 90% argon, 10% methane. Available in steel cylinders with 855 cubic inch capacity, filled to approximately 1500 pounds pressure.

**sample size**— $\frac{3}{32}$ " x  $1\frac{1}{4}$ " diameter or  $\frac{5}{16}$ " x 1" diameter.

**chamber**— $1\frac{7}{16}$ " inside diameter.

**dimensions**—Body diameter—3". Total height— $9\frac{1}{8}$ ".

**weight**—14 lbs., shipping weight 18 lbs.

**supplied with** three Micromil windows, sealing ring, polyethylene tubing with glass capillary, accessories, instruction manual. Gas regulator, gas, T3 valve, and D47 preamplifier must be ordered separately.



model: **M-5**

## MANUAL SAMPLE CHANGER

**model D47P preamplifier**—It is not necessary to make any changes in the counter itself when switching from Geiger to proportional counting. However, best results are obtained in the proportional region when the Model D47P preamplifier circuit is connected to the D47. The use of the D47P greatly improves the plateau characteristics and keeps the input capacity small so that long cables can be used between the counter and scaling unit. Power for operation of the two-stage feedback amplifier circuit in the D47P is obtained from the preamplifier connector on the scaler.

**model T3 time delay**—The Model T3 time delay should be ordered when the D47 is used as a windowless counter with the C-110A automatic sample changer. The T3 is used to conserve gas and to prevent the scaler from counting during flushing of the detector. The regulated gas pressure is set high enough to cause flushing. During the sample changing portion of the cycle and for 55 seconds after the chamber is sealed, the T3 valve remains open, allowing a flushing rate of gas to flow. The T3 valve then automatically throttles the gas flow to a lower rate, and simultaneously activates the scaler for counting.

The Model M5 manual sample changer, especially designed for use with the Model D47 gas flow counter, permits Geiger or proportional counting, windowless or Micromil window operation, thus taking full advantage of the D47's versatility.

The M5 features a rotating lower table with three recesses containing adapters for holding  $\frac{3}{32}$ " x  $1\frac{1}{4}$ " diameter or  $\frac{5}{16}$ " x 1" diameter sample containers. While a sample is being loaded into the exposed recess, the second is being preflushed, and the third is being counted. When a count is completed, the handle at the side of the table is moved 120° so that the preflushed sample is brought into the counting position beneath the chamber of the D47. Since the sample has been preflushed, a count may be started immediately with no waiting time.

Gas flows through the D47 counter, through a small bore in the upper platform, through a short length of polyethylene tubing, preflushes the next sample to be counted, and finally is exhausted. If desired, the polyethylene tube may be removed, and a second gas tank used to preflush the uncounted sample. This prevents the possibility of contamination from the sample being counted.

Model M5 is shipped complete with a 3037B lead shield, sample adapters, polyethylene tubing with glass capillary, and instruction manual. Total weight is approximately 75 lbs.

model T3  
automatic valve



gas regulator  
and gas tank



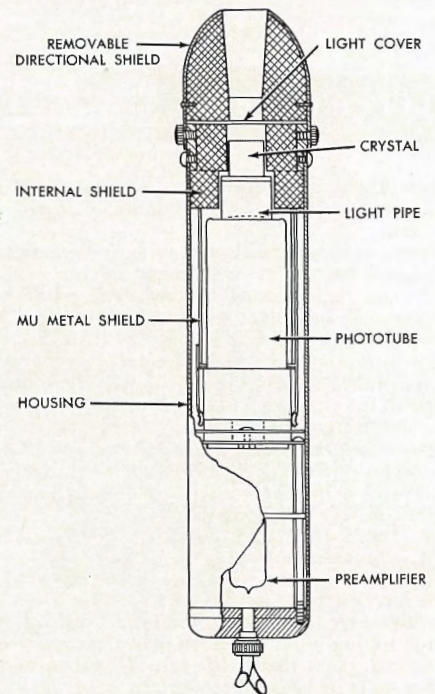
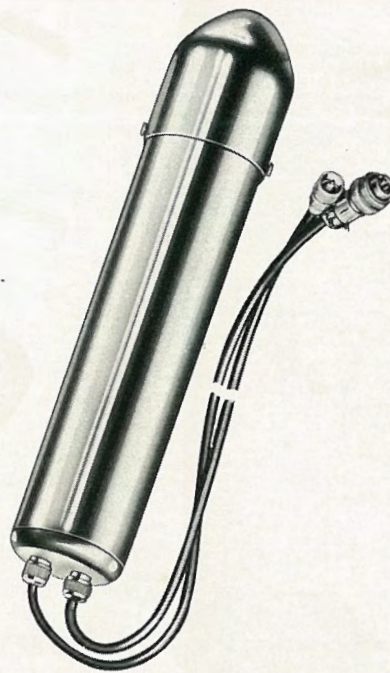
model D47P  
preamplifier



## detectors

model: **DS-1**

*directional  
scintillation  
detector*



Nuclear-Chicago Models DS-1 and DS-3 scintillation detectors are designed for efficient gamma counting in both clinical and laboratory applications. The thallium activated sodium iodide crystal absorbs gamma rays emitted from iodine-131, cobalt-60, etc., with high efficiency, converting their energy into scintillations of light. A photomultiplier tube coupled optically to the crystal produces a current pulse at its output for each scintillation. These pulses, after amplification in the preamplifier mounted in the body of the detector, are fed into the input circuit of any Nuclear-Chicago (or equivalent) scaler or count rate meter for measurement.

Since the sensitivity of scintillation detectors to gamma radiation is considerably higher than conventional Geiger-Muller detectors, significantly smaller tracer doses of radioactive isotopes may be administered for clinical tests. In addition, the arrangement of the lead shielding provides excellent ratios of "background" to source counts.

These scintillation detectors, excellent for medical applications where gamma emitting isotopes are used, *are equally suitable for any non-medical application where efficient gamma counting is desired.*

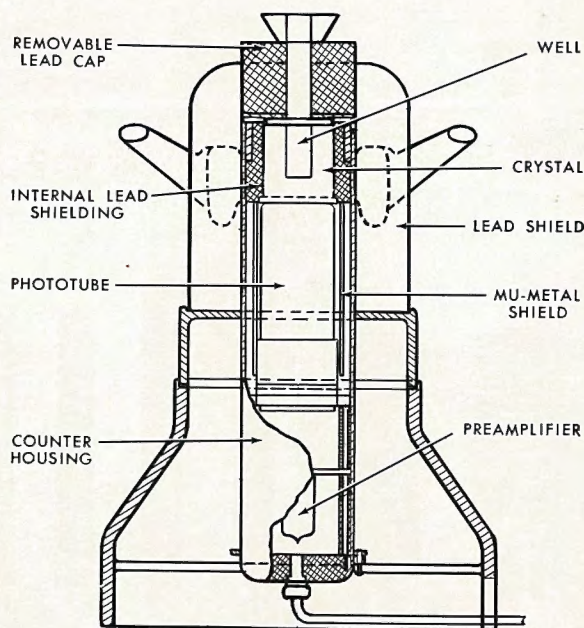
**model DS-1 scintillation detector**—Model DS-1 is primarily designed for use in thyroid uptake studies using radioiodine-131, in localization of brain tumors or metastatic carcinoma of the liver, and for the measurement and localization of any isotope which emits gamma radiation.

A removable directional shield discriminates sharply against activity more than  $15^\circ$  off the axis of the probe enabling the detector to be used for accurate localization of concentrations of radioactivity. With the directional shield removed, the detector serves to measure activities from larger areas.

When used for thyroid uptake studies, the DS-1 detector, with the directional shield removed, is positioned in front of the patient at a distance (usually 30 to 50 cm) which will permit it to "see" the entire thyroid gland. A comparison of the counts per minute obtained from the patient with that obtained from a sample of the radioiodine solution administered previously allows the calculation of the avidity of the gland for iodine. The sensitivity of the DS-1 permits tracer doses of 10 microcuries or less to be used.

In detection and localization of brain tumors, the DS-1, with the directional shield in place, is positioned over predetermined areas of the head after the patient has been given radioactive diiodofluorescein, sodium iodide or iodinated human serum albumin intravenously. Concentration of the radioactive tracer around the tumor results in higher counts than are obtained over contralateral normal areas.

For medical applications, the unit is most convenient when mounted on the flexible arm of the CA4 "Carette" which allows easy positioning of the detector around a patient's head or body. The DS-1 may also be mounted in the Model 3036 lead shield for manual sample counting, used with the C-110A automatic changer, or with the C-100 Actigraph.



detectors

model: **DS-3**

*well-type  
scintillation  
detector*

## specifications

**model DS-3 well-type scintillation detector**—The Model DS-3 adapts scintillation counting to the measurement of gamma emitting samples of radioactive materials in liquid or solid form. The unit features a large "well" crystal which accommodates a test tube or centrifuge tube containing the sample. The excellent counting geometry permits much faster measurements and enables the user to rapidly obtain maximum statistical accuracy with minimum amounts of radioactivity.

The DS-3 has found wide application in the measurement of protein bound  $I^{131}$  and urinary  $I^{131}$  content in thyroid function studies, radioactive iodinated serum albumin in the estimation of plasma volume, chromium-51 in the measurement of red cell mass and red cell survival, iron-59 in studies of red cell production and survival and cobalt-60 in studies on the absorption of labeled vitamin  $B_{12}$  in pernicious anemia.

The low absorption coefficients of most biological materials and water for gamma radiation permits in many cases neglect of corrections for self-absorption by the solutions. The DS-3 is relatively insensitive to differences in sample volume up to 3 ml. and its high sensitivity permits activities of the order of  $10^{-11}$  curies of radioiodine-131 to be detected and  $10^{-9}$  curies to be measured with high accuracy.

The instrument serves as the most sensitive and convenient unit for measurement of any gamma ray emitting isotope in liquid or solid form.

### Common Characteristics

**circuit**—DuMont 6292 phototube magnetically protected by a MuMetal shield. Built-in preamplifier circuit utilizes 12AX7 double triode tube with gain of 10.

**output pulse**—Greater than 0.25 volt. "Coincidence losses" at 100,000 counts per minute are less than 1%.

**plateau**—Production tolerance requires plateau length of 250 volts and a slope not exceeding 5% per 100 volts over that range using cobalt-60 as a radiation source.

**power requirements**—High voltage: 900 - 1500 volts at 20 microamperes. Preamplifier voltages: 6.3 volts a.c., 150-300 volts d.c. at 2.5-5 ma.

**shipped with** instruction manual.

### Model DS-1

**efficiency without external directional shield**—For iodine-131, 60%; for cobalt-60, approximately 35% for each individual gamma.

**crystal**—Sodium iodide, thallium activated,  $\frac{3}{4}$ " x  $\frac{3}{4}$ " diameter. Hermetically sealed in spun aluminum case with a glass window. Lucite light-pipe with DC200 optical coupling fluid between crystal and phototube.

**background**—Less than 200 counts per minute. 50 counts per minute when used with Model 3036 lead shield.

**dimensions**—16" long with directional shield, 3" in diameter. Cable length 6 ft. unless shorter cable requested.

**weight**—18 lbs., shipping weight 22 lbs.

### Model DS-3

**overall efficiency\***—For iodine-131, 50%; for cobalt-60, 45%.

**crystal**—Sodium iodide, thallium activated. Hermetically sealed in  $\frac{1}{32}$ " spun aluminum case with a glass window. Dimensions:  $1\frac{7}{8}$ " diameter by  $2\frac{1}{4}$ "; well is  $2\frac{1}{32}$ " in diameter,  $1\frac{1}{2}$ " deep. DC200 optical coupling fluid between crystal and phototube.

**background**—Approximately 300 counts per minute.

**dimensions**— $17\frac{1}{2}$ " high, base is 11" in diameter.

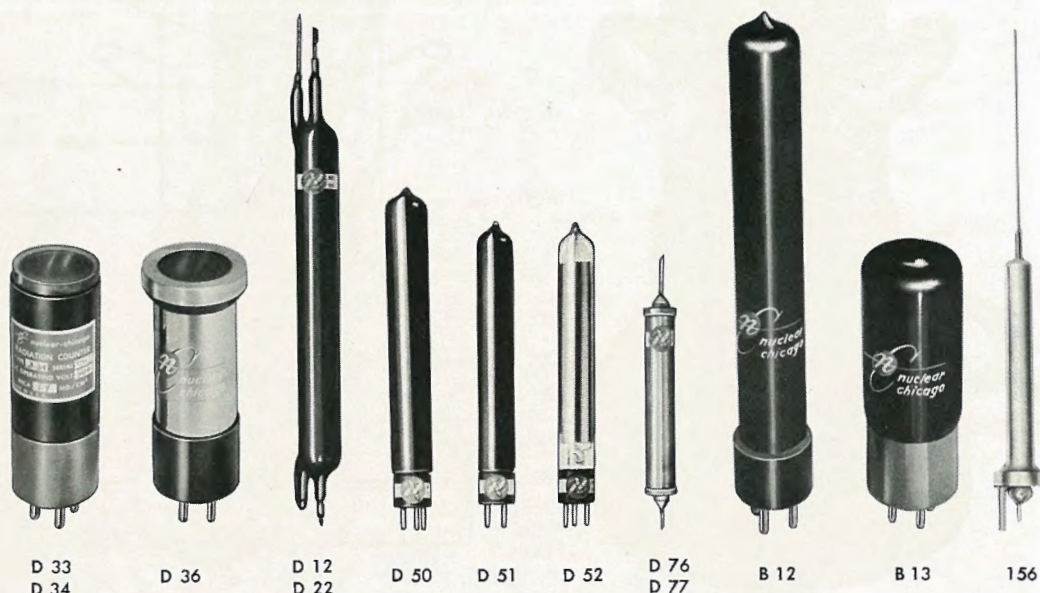
**weight**—85 lbs., shipping weight 100 lbs.

\*Overall Efficiency =  $\frac{\text{Recorded number of counts/minutes} - \text{background}}{\text{Actual number of disintegrations/minute}}$



# detectors

*thin window,  
miscellaneous,  
bismuth cathode,  
geiger-muller  
counters*



**thin window**—Models D33, D34 and D35 are rugged halogen quenched detectors with long life characteristics. They may be overvoltaged without change in characteristics. Model D36 is a self-quenching G-M tube filled with helium and an organic quenching gas. It is 99% efficient for betas.

**miscellaneous G-M tubes**—Available in several types and dimensions. Model D22 is useful for gamma detection only. Models D12, D50, D51 and D52 detect both beta and gamma radiation of over 0.2 mev. Model D76 and D77 are specially designed for use in portable prospecting instruments and will detect gamma rays and beta radiation with energies of 0.4 mev or greater.

**bismuth cathode counters**—Models B12 and B13 bismuth cathode counters provide high efficiency in the counting of gamma radiation and are thus especially useful for medical use. They are from 5 to 8 times as efficient for iodine-131 gammas as are similarly shaped mica window counters. Model B12 is a "side window"; B13 is "end window."

**needle probe**—The Model 156 probing Geiger counter is designed for brain tumor localization using phosphorous-32 or sodium-24. The sensitive end of the counter, only 2mm. in diameter, is sufficiently rugged for continuous surgical use. The probe is shipped with a special cable to attach to any Nuclear-Chicago scaler or count rate meter.

## SPECIFICATIONS

	D33	D34	D35	D36†	D12	D22	D50	D51	D52	D76	D77	B12	B13	156
Window or Wall Thickness/mg/cm <sup>2</sup>	3.5	1.4	1.4	1.4	35	300	35	35	35	100	120	300	300	
Operating Voltage	900	900	900	1100	970	970	925	925	950	825	825	1100	1100	1000
Plateau Length (volts)	200	200	180	300	150	150	150	150	150	300	300	300	300	100
Plateau Slope (%)	5-10	5-10	10	1	3	3	3	3	3	5	5	1	1	10
Cathode Material	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Carbon	Carbon	Carbon	Carbon	Silver	Brass	Brass-Lead	Bismuth	Bismuth	Stainless Steel
Counting Life	5x10 <sup>10</sup>	5x10 <sup>10</sup>	5x10 <sup>10</sup>	10 <sup>9</sup>	10 <sup>8</sup>	10 <sup>8</sup>	10 <sup>8</sup>	10 <sup>8</sup>	10 <sup>8</sup>	10 <sup>8</sup>	10 <sup>8</sup>	10 <sup>9</sup>	10 <sup>9</sup>	5x10 <sup>7</sup>
Background—CPM Shielded with 2" Lead	50	50	75	20	50	50	50	50	50	40	40	40	30	negligible
Effective Diameter of Mica Window (inches)	1 <sup>1</sup> / <sub>32</sub>	1 <sup>1</sup> / <sub>32</sub>	2 <sup>5</sup> / <sub>32</sub>	1 <sup>1</sup> / <sub>8</sub>	—	—	—	—	—	—	—	—	1 <sup>3</sup> / <sub>8</sub>	—
Maximum Diameter (inches)	1 <sup>3</sup> / <sub>8</sub>	1 <sup>3</sup> / <sub>8</sub>	1	1 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>16</sub>	3/4	2 <sup>1</sup> / <sub>32</sub>	2 <sup>1</sup> / <sub>32</sub>	5/16	5/16	1	1 <sup>1</sup> / <sub>2</sub>	needle 2mm
Overall Length (inches)	4 <sup>11</sup> / <sub>32</sub>	4 <sup>11</sup> / <sub>32</sub>	6	4 <sup>1</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>4</sub>	8 <sup>1</sup> / <sub>4</sub>	6	5 <sup>1</sup> / <sub>4</sub>	5 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>2</sub>	8	3 <sup>5</sup> / <sub>8</sub>	needle 3 <sup>1</sup> / <sub>2</sub> overall 9
Base (type)	4 Pin	4 Pin	Min'ture Cap	4 Pin	None	None	3 Pin	3 Pin	3 Pin	None	None	4 Pin	4 Pin	Special

†Model D36 requires a special filling when used above 2000 feet. Please specify altitude.

## counting system

*the Van Slyke-Steel  
gas phase assay  
system for radiocarbon*

If a system for carbon-14 measurement with the virtues of highest possible counting efficiency, extremely small sample size and minimal uncertainty in interpretation of assay results is required, the Van Slyke-Steel procedure<sup>(1, 4)</sup> should be considered.

The procedure involves the wet combustion of an organic sample and the manometric measurement of its content of total carbon by the quantitative method of Van Slyke and Folch<sup>(2)</sup>. The purified carbon dioxide is transferred to a Bernstein-Ballentine counter tube<sup>(3)</sup> where it forms a component of the filling gas. A second component, methane, is added to bring the tube filling to atmospheric pressure. The counter tube is operated in the proportional region for the measurement of the radioactivity of the carbon dioxide contained within the tube.

Both the chemical apparatus as well as the electronic instrumentation required for the assay of carbon-14 as carbon dioxide are supplied by Nuclear-Chicago. The use of an assay procedure wherein carbon dioxide forms part of the counting gas possesses several advantages: solid, liquid, and gaseous carbonaceous substances are relatively easily converted to this common product of oxidation. Their contents of carbon-14 may, therefore, be directly compared. The uncertainties concerning the effects of backscatter, differing from compound to compound, and of uniformity of plating, in the case of solid samples, on the apparent count rate are eliminated<sup>(5)</sup>.

The Bernstein-Ballentine counter tube, which contains the sample as part of the filling mixture, is extremely efficient. 98% of the total number of carbon-14 disintegrations occurring within its sensitive volume (approximately 90% of the

total volume) are detected. The high counting efficiencies attainable with these tubes are due in part to the elimination of self-absorption, window absorption, and air absorption effects.

Further advantages unique to this procedure: Both the total carbon as well as its radioactivity are determined on a single sample. A single transfer of carbon dioxide (from the manometric chamber to the counter tube) is involved. A wide range of sample sizes can be handled with modification of the apparatus (0.1 to 15 mg of carbon/sample).

Available from Nuclear-Chicago are: (A) the Arthur H. Thomas Co. Magne-matic Van Slyke-Folch Manometric Apparatus, (B) the Model 182X or 192X scaler which meet the specifications for operation of the system, and the auxiliary glassware for calibration and filling of the counter tubes, including (C) a connecting tube containing a freezing coil for removing water vapor, (D) a vessel for supplying dry methane to the counter tube, an adapter for measuring toluene into the counter tube for purposes of calibration (not shown), and (E) Bernstein-Ballentine counter tubes. A Model M4A shield and mount (F) is also available for the counter tube.

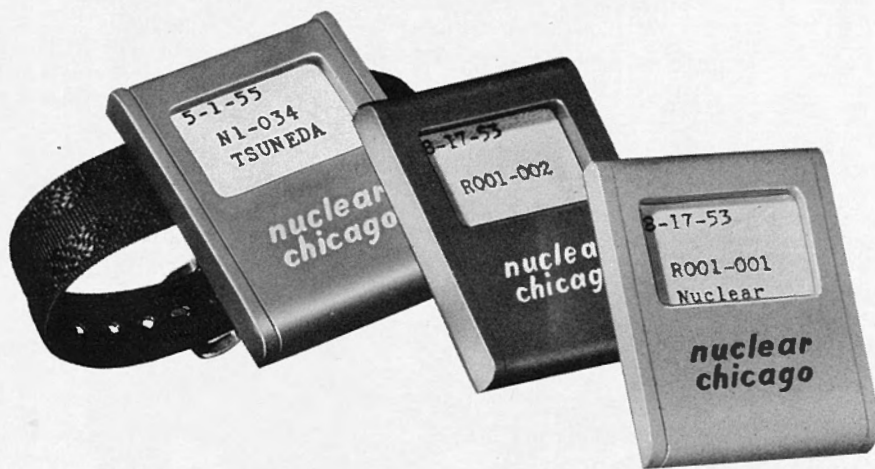
## references

1. Van Slyke, D.D., Steele, R. and Plazin, J. *Jour. Biol. Chem.* 192, 769 (1951).
2. Van Slyke, D.D. and Folch, J. *Jour. Biol. Chem.* 136, 509 (1940).
3. Bernstein, W. and Ballentine, R., *Rev. Scient. Instruments*, 21, 158 (1950).
4. Sinex, F.M., Plazin, J., Clareus, D., Bernstein, W., Van Slyke, D.D., and Chase, R. *Jour. Biol. Chem.* 213, 673 (1955).
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## personnel protection

### F I L M   B A D G E S

*the nuclibadge  
personnel monitoring  
service*



Film badges should be worn by all persons exposed to hazardous external radiation from x-rays or radioactive materials. With the Nuclear-Chicago "Nuclibadge" service, routine personnel monitoring is provided for x-ray laboratories, industrial plants, radioisotope laboratories, and doctors' and dentists' offices. This service is a low cost, easy way to warn of overexposure, protect employer and employee, and check to be sure safe practices are observed.

A light-weight, color-coded plastic Nuclibadge is furnished each user regularly. The badge number and the date the badge is to be worn are clearly printed at the window. This data is also marked on the film emulsion for permanent identification. Accompanying the badges (if there are three or more) is a control badge to monitor radiation accumulated in transit and during off hours.

The badges are worn for the desired time and then returned to us. A new set, which arrives several days ahead of time, is then put into use. When the badges are received at Nuclear-Chicago, they are promptly developed and evaluated by interpretation of the blackening of the film in terms of standard films which have been exposed to a known radiation dosage. A complete set of calibrated films of the same film lot are processed with each group of films and used in the evaluation. The user receives a complete exposure report for his information and records. Nuclear-Chicago keeps the films and a copy of the report on file.

The Nuclibadge utilizes a special multiple filter system and an extremely wide range film packet. These features plus a new and carefully tested method of interpretation make possible the evaluation of a much wider range of types and energies of ionizing radiations, including hard beta radia-

tion and x-rays and gamma rays from 25 kev to 5 mev. In addition, they make possible the evaluation of mixed exposure from any combination of x-rays and gamma radiations within this wide range.

Nuclibadges contain a high range film for measuring roentgen exposure up to 30 times the range of other badges. For gamma and x-ray radiation at most energies the film is read for exposures from 50 mr to 300,000 mr (300 r).

Regular Nuclibadges may be fastened to any garment by a convenient fastener on the back of the badge. Wrist badges are also available and contain the same film packet as regular Nuclibadges. When a customer subscribes to the regular service, the entire badge (holder and film packet) are returned for evaluation. When wrist badges are ordered, the customer returns only the film packet for development. Regular holders and wrist holders remain the property of Nuclear-Chicago and must be returned at the end of the service.

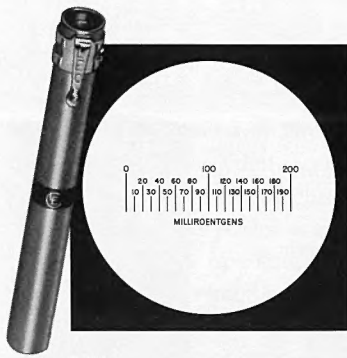
**ordering information** — Please provide name, address, number of badges per shipment, identification desired on the badge (maximum of 12 characters and spaces), frequency of shipments (weekly, bi-weekly, or monthly), and number of shipments desired. Also state desired starting date (at least 10 days after receipt of order) and whether you wish to be notified by collect wire of exposures greater than 300 mr.

To prevent loss of service, we suggest placing a standing order subject to cancellation at the end of each quarter year period. A yearly service discount is available if you make the order subject to cancellation at the end of each one year period. The service is payable in advance for each quarter. Oak Ridge type packets are also available.

## personnel protection

### DOSIMETERS AND POCKET CHAMBERS

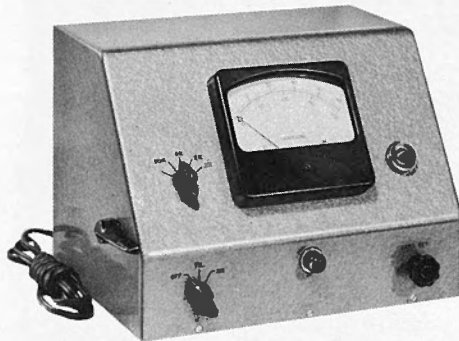
*for personnel monitoring,  
dosage determinations  
and civil defense use*



L 28



L 24K



L 62



L 65

Pocket ionization chambers are compact detecting instruments designed to accurately indicate radiation exposure accumulated by laboratory personnel working where appreciable amounts of radioactivity or x-radiation are used. They may be conveniently carried in a pocket and consist essentially of a chamber which is charged to a specific voltage by a suitable charger. Ionization produced by any incident radiation then partially discharges the chamber, and the resultant change in charge is measured to indicate radiation dosage.

**model L28** is a direct reading self-contained electrometer, complete with optical system which permits frequent personal checks on exposure. The unit consists of a small, specially designed quartz fiber voltmeter which is supported in a highly insulated condition within a small ionization chamber. The chamber is charged so that the image of the fiber falls on the zero mark of the reticle within the unit. When x-rays or gamma rays pass through the chamber, the voltmeter is partially discharged. The accumulated dose is indicated directly in milliroentgens by the new position of the image on the reticle. When completely discharged, the unit reads 200 mr. The instrument is easily read at any time by pointing it at a source of light. Natural leakage is less than 2% of full scale per day. The calibration error is less than 5% of full scale for the gamma rays of cobalt or radium. Dimensions are 1/2" dia. by 4" long; weight is 1/3 oz.

**model L24K** is a battery operated instrument used to charge the L28 dosimeter. It is contained in a sturdy grey leatherette covered case 6" x 8" x 3" high. The charger is built into the case at one end. The only control is the potentiometer which "zeroes" the dosimeter. The switch for the

socket lamp and for the potential circuit is mounted in the socket. It operates automatically when a dosimeter is inserted into the socket. A single size D cell provides 200 volts to the potentiometer for charging, and also provides current for the socket lamp. One cell will charge a dosimeter hundreds of times. Clips for holding four dosimeters are mounted in a recessed area at the other end of the case.

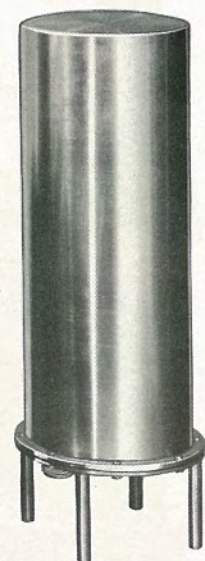
**model L65** pocket chamber differs from the Model L28 in that it has no self-contained quartz fiber voltmeter. It must, therefore, be not only charged *but read* on an auxiliary device known as a charger-reader. Model L65 is sensitive to gamma and x-radiation, and has a full scale range of 200 milliroentgens. The unit may be read as often as desired when a charger-reader is available. Calibration is exceptionally independent of the energy of the x or gamma rays and is uniform to within  $\pm 6\%$  from 1.4 mev to 30 kev. The barrel is polished black conducting bakelite. It is 3 1/2" long, 1/2" in diameter, and weighs about 1/3 oz.

**model L62** Charger-Reader is a 110 volt 60 cycle a-c operated unit used to charge and read Model L65 pocket chamber. It may also be used to charge Model L28 Dosimeter. The indicating meter is mounted on the sloping front panel. The 4" scale is linear to  $\pm 2\%$  and is marked 0 to 200 and 0 to 50 milliroentgens. A range selector switch is provided for other chambers with 50, 5 and 2 roentgen capacities. A lever type recharge switch is conveniently located for operating by the thumb of the left hand. The on-off switch and the control potentiometer are located on the vertical front panel. The case is finished in silver hammertone enamel. Overall dimensions are 9" x 12" x 8 1/2" high. Weight 10 1/2 lbs., shipping weight 13 lbs.

## monitors

### model: 1310 REMOTE MONITRON

*area monitor featuring  
remote ion chamber*



The Model 1310 Remote Monitron is an area monitor developed at Oak Ridge National Laboratory for detecting, measuring, and warning of relatively high levels of gamma or neutron activity. Its drift-free design is based on an extremely stable vibrating reed electrometer circuit.

The system consists of a 4000 cc. ion chamber with a built-in preamplifier circuit, a panel meter for continuous monitoring of radiation level, an alarm system, and provisions for driving an external recorder. The chamber is coated with carbon film and is normally sensitive to gamma radiation. It can also be supplied with a neutron sensitive boron coating.

The ionization chamber may be located either at the main instrument or up to 100 feet away, allowing its usage in inaccessible places, or places of high radiation level, without exposure of the operator. "Fail-safe" features are incorporated so that the alarm system is automatically actuated upon occasion of any of the common causes of failure.

## specifications

**range**—Two ranges of 125 mr/hr and 25 mr/hr full-scale.  
**linearity**— $\pm 2\%$ .

**external recorder**—Provisions are made for driving a 10 millivolt or 1 milliamper external recorder.

**alarm**—A panel "alarm" light indicates any meter reading arbitrarily preset, from 0.2 full-scale to full-scale on both ranges. Provisions are made for the operation of an external alarm system, such as a bell, simultaneously with the functioning of the "alarm" light.

**chamber**—4000 cc. with built-in preamplifier. Polished aluminum finish. Overall dimensions— $6\frac{1}{2}$ " dia. x 17".

**cable**—A 50 ft. multiconductor cable is furnished with the instrument to connect the ion chamber to the main chassis. Longer cables are available on special order. The instrument is shipped completely calibrated with the particular cable supplied.

**power requirements**—90 watts, 100 to 130 volts, 60 cycles.

**main chassis dimensions**— $12\frac{1}{4}$ " x 20" x 20".

**weight**—85 lbs., shipping weight 100 lbs.

**supplied with** interconnecting cable and manual.

### model 3782 neutron thermopile

The Model 3782 is a differential thermopile type detector for the measurement of high level slow neutrons. It is comprised of 21 hot junctions coated with boron and 21 cold uncoated junctions. In the presence of slow neutrons, the boron at the hot junction transmutes to lithium emitting a 2 mev alpha particle which is dissipated as heat in the hot junction, thereby raising its temperature over the cold junction. The EMF generated by a flux of  $2 \times 10^{11}$  neutrons/cm<sup>2</sup>/second is approximately 1 millivolt with linear response at fluxes from  $10^7$  to  $10^{12}$  neutrons/cm<sup>2</sup>/second. A simple galvanometer can be used to monitor output at high neutron fluxes. Overall length is  $6\frac{1}{2}$ "; case material is aluminum.



model: **1500**  
HAND AND FOOT COUNTER

*completely automatic  
monitoring of beta-gamma  
contamination*

Model 1500 "Hand and Foot Counter" provides automatic monitoring of beta-gamma contamination on the hands and feet of radiolaboratory technicians. It consists of a five channel scaler and power supply with automatic controls to time the counting operation in proper sequence. One scaling channel is provided for each side of each hand, and one for the soles of both feet.

Typical operation finds a green "Ready to Use" sign lighted when the user steps up to be tested. The counting process is started and maintained by pressure of the finger tips at the rear of the hand pockets. During the test, the user sees five banks of decade indicators at eye level. Each of these decade indicators will present a single number to indicate the degree of contamination of hand and foot surfaces. After a preset time, the timer will shut off the scalers. If the number of counts in any channel exceeds the scaling factor in that channel, a "Decontamination Required" sign will light. If it does not, a "Check OK" sign will light.

If the hands are removed before the complete counting time has elapsed, "Check Incomplete—Reset and Repeat" will light. In ordinary operation, the user simply leaves the counter after his check, and the unit automatically resets itself after a preset length of time. Time intervals are variable from six to sixty seconds.

Each hand channel is operated by two long-life Halogen quenched thinwall counting tubes which are individually shielded to provide low background. The foot channel is operated by eight shielded counting tubes, four to each foot.

Scaling factors are 100 for the hand channels and 200 for the foot channel.

The unit is made with all controls locked inside to prevent the possibility of tampering, or of injury to casual personnel. When a chassis is pulled out, interlock switches disconnect the power for the entire unit. B+ and HV primary circuits are fused, and if the counter voltage falls below a predetermined value, the "Ready for Use" legend will be shut off automatically. The automatic design of this instrument makes it extremely safe and foolproof to operate even by untrained personnel.

### specifications

**detectors**—16 thinwall (35–40 mg/cm<sup>2</sup>) stainless steel halogen type G-M counters.

**sensitivity**—Minimum beta energy 200 kev.

**high voltage**—600 to 3000 volts continuously adjustable. Voltmeter is mounted on chassis. Well stabilized—less than 0.05% change in high voltage for line voltage change over 100 to 130 volt range.

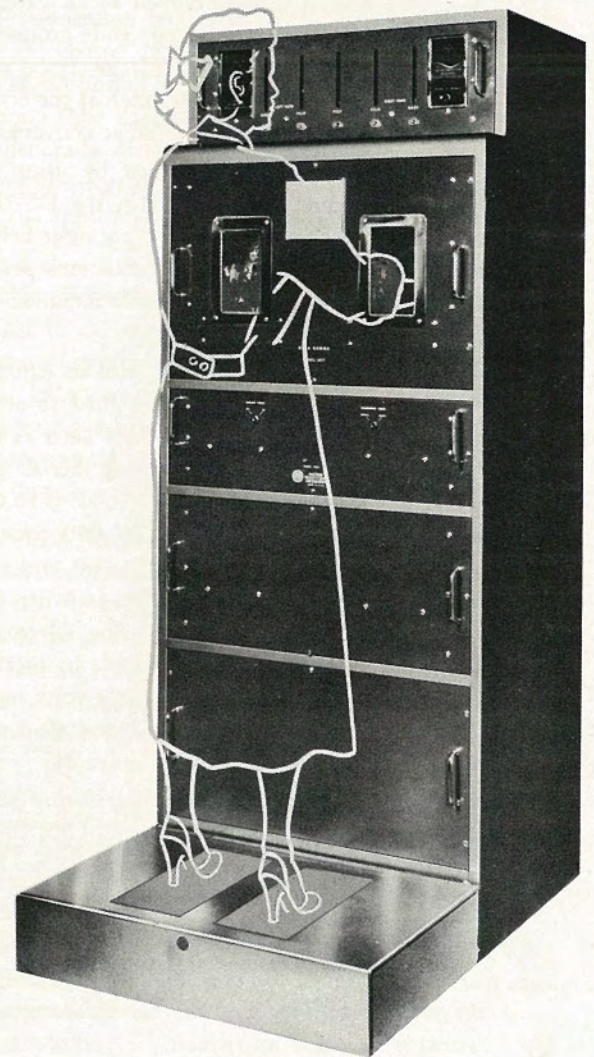
**tolerance**—10 cpm to 1200 cpm for the hand channels. 10 cpm to 2400 cpm for the feet channel.

**power requirements**—Approximately 325 watts, 100 to 130 volts, 60 cycles. For 220 volts operation we recommend the use of Model PS6 step-down transformer.

**dimensions**—76" high, 32" wide, 24" deep without platform, 49" deep with platform.

**weight**—440 lbs. without platform, 565 lbs. with platform.

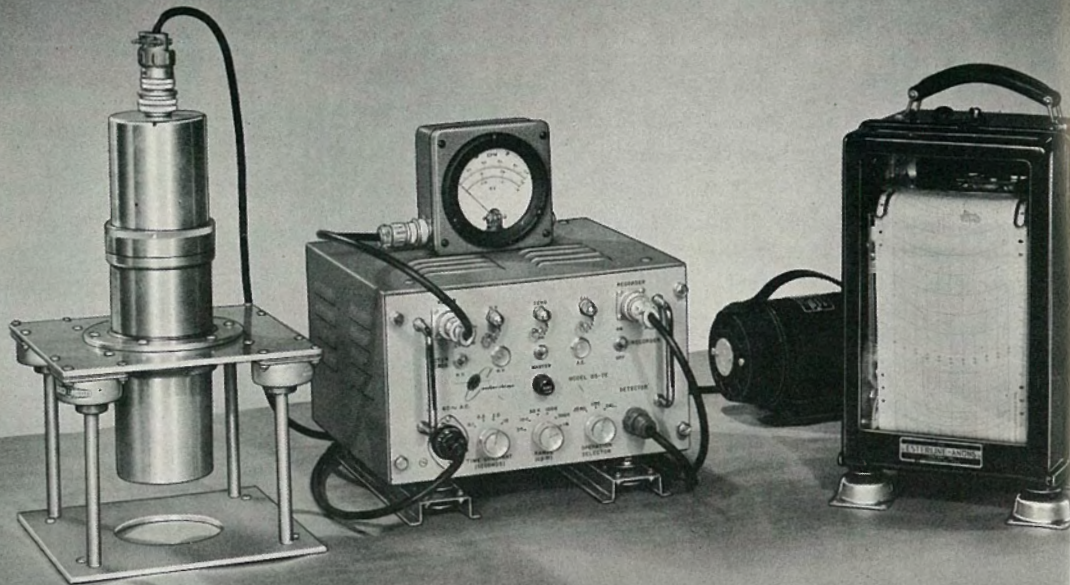
**supplied with** all necessary interconnecting cables and instruction manual.



## counting system

model: **DS-7**

*for airborne  
or carborne uranium and  
oil exploration*



the **DS-7** system was developed as an extremely sensitive exploration system for aerial and ground radioactivity measurements. It consists of: a large crystal scintillation detector, a count rate unit with external meters, an Esterline-Angus chart recorder, and a dc to ac converter.

Maximum sensitivity is obtained by using a 1 1/2" x 3" diameter sodium iodide crystal in the DS-7D scintillation detector. In a one milliroentgen per hour field, the detector produces more than  $3 \times 10^6$  scintillations per minute. Phototube and crystal are triple shock mounted and thermally insulated.

**model DS-7C** count rate unit, with its external meter and recorder, has been especially designed to accurately detect rapid changes in radiation intensity such as those obtained from anomalies discovered during aerial reconnaissance. Six ranges cover intensities of 0-3000, 0-10,000, 0-30,000, 0-100,000, 0-300,000 and 0-1,000,000 counts per minute and four time constants of 0.1, 0.5, 2.0, and 10 seconds may be chosen. Calibration and meter zero may be checked at any time by means of the operation selector switch. The high voltage is continuously variable by means of a screwdriver adjustment from 600 to 1800 volts and may be read on the external meter. The unit is aircraft construction with all cable connections made on the front.

the **DS-7M** meter has waterproof O-ring seals and shock mounted jewels and pivots. It is designed for long trouble-free operation in all environments. The Model DS-7A alarm meter (not shown above) may be preset at any level of radiation. Any anomaly reaching this radiation level sets off an audible alarm to alert the pilot or observer.

*An eight-page brochure completely describing the DS-7 system is available on request.*

## specifications

### **DS-7D DETECTOR**

Supplied with 1.5" x 3" diameter sodium iodide crystal, 3" photomultiplier tube, preamplifier and cathode follower circuit. Weather-proof high voltage cable 10 ft. long attaches to DS-7C ratemeter. Mounting stand and shock mounts supplied. Detector is a cylinder 15 inches long, 4.5 inches in diameter. Total weight approximately 9 lbs.

### **DS-7C COUNT RATE UNIT**

Supplied with shock mounts and 10 ft. line cord to be used between converter and ratemeter. Resolution losses for counting random pulses is less than two percent for all ranges except on the highest range where it is less than five percent. Screwdriver adjustment on front panel varies high voltage for use with other detectors such as a drill hole counter, etc. A 1% change in line voltage will change the output by less than 0.01% of its dc level. DS-7C is 12 3/8" x 7 5/16" x 11 1/8". Total weight 24 lbs.

### **DS-7M Meter**

Meter dimensions: 4 3/4" x 4 3/4" x 2 1/2". Holes provided at rear for mounting. Supplied with 10 ft. cable to connect to ratemeter. Weight 1 1/2 lbs.

### **DS-7A ALARM METER**

The alarm meter consists of a Model 261C Assembly Products Meter relay and circuits for actuating a built-in buzzer alarm. The unit can be preset to actuate the alarm at any point on scale. Weight approximately 2 lbs.

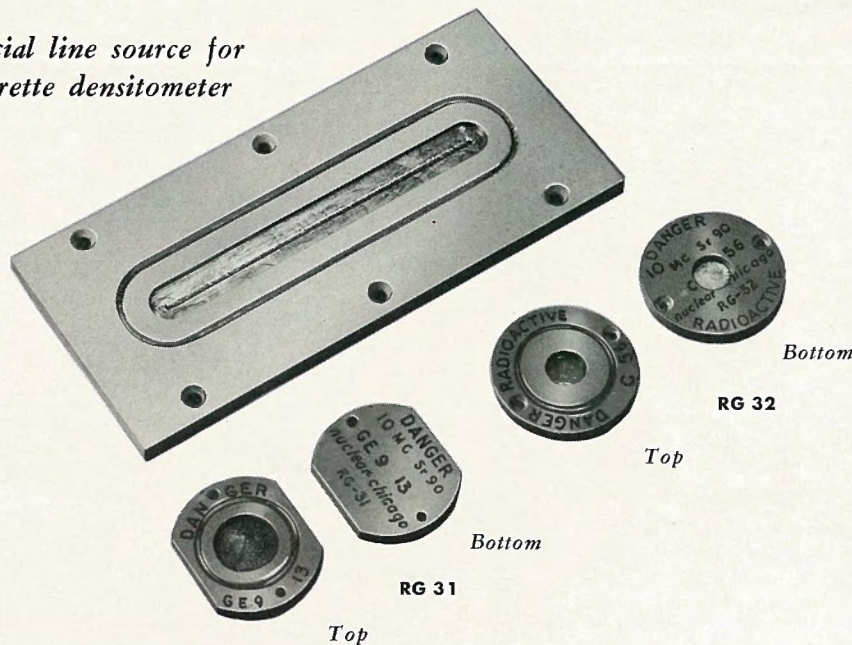
### **DS-7S CONVERTER**

Carter Super Converter or equivalent. Power rating—80 watts. Provided with a 115 volt receptacle for power output. The dc leads which are connected to battery supply are 3 ft. long and permanently attached. Dimensions: 8 1/4" x 4 1/2" x 5". Weight 13 lbs. Available for use with 6, 12, 24, 28, 32, 64 or 115 volt dc battery supplies.

### **DS-7R RECORDER**

Esterline-Angus Model AW, 115 volts, 60 cycle chart motor. Supplied with shock mounts and mounting plate, 10 ft. cable to attach to ratemeter. Dimensions 15 1/4" x 8 5/16" x 9 5/16". Weight 34 lbs.

*Special line source for  
cigarette densitometer*



**model: RG-31  
RG-32**

*strontium 90  
gauge and  
irradiation sources*

**specifications**

**RG-31**

**material**—Stainless steel and mica.  
**mounting holes**—Two #42 drill holes 1.062"  $\pm$ .005" between centers.  
**container dimensions**—length 1.25", width 1", thickness  $\frac{1}{8}$ ".  
**source activity**—10 millicuries Sr -90  $\pm$ 15 percent.  
**radioactive diameter**—.25" to .5".  
**source thickness**—10 mg/cm<sup>2</sup>  $\pm$ 2 mg/cm<sup>2</sup>.  
**window thickness**—7 mg/cm<sup>2</sup>  $\pm$ 2 mg/cm<sup>2</sup>.

**RG-32**

**material**—Stainless steel and mica.  
**mounting holes**—Two #42 drill holes 1.062"  $\pm$ .005" between centers.  
**container dimensions**—diameter 1.25" thickness  $\frac{1}{8}$ ".  
**source activity**—10 millicuries Sr -90  $\pm$ 15 percent.  
**radioactive diameter**—.25"  $\pm$ .0625".  
**source thickness**—5 mg/cm<sup>2</sup>.  
**window thickness**—25 mg/cm<sup>2</sup>  $\pm$ 5 mg/cm<sup>2</sup>.  
**Special sources available on request.**

**reference sources**

Nuclear-Chicago offers three uncalibrated sources as references for instrument checking.



**model R2** is intended for checking Model 2612. It contains 2 to 3 micrograms of radium in a plastic cylinder 1" in diameter by  $\frac{1}{2}$ ". One cylinder end gives approximately 10 times the radiation of the opposite end.



**model R20** is a carbon-14 source giving approximately 12,000 disintegrations per minute for checking sensitive counters such as the Model D47. Housed in 1" diameter plastic disk  $\frac{1}{8}$ " thick.

**model R4** is a weak source for checking prospecting and monitoring units. Contains extremely small amount of radium salts. 2" in diameter by  $\frac{1}{8}$ " thick.

Thickness gauging of opaque or soft materials is a problem for which the absorption techniques of nucleonics offer a solution. For thicknesses in the range of .001 lb/sq. ft. to 1.0 lb/sq. ft. absorption of beta radiation is the unique and specific solution. The special requirements of a sheet or film process generally dictate custom designing of gauges and sources to some degree, but the RG-31 design is suitable for any industrial application needing strong sources of Sr-90.

**the RG-31** is a thin, flat source designed to be incompressible and practically indestructible in a mill accident. The activity is fused to the container and cannot be separated from it except by repeated abrasion. It is labeled on both sides with red letters on a yellow background so that the serial number and hazard markings are visible at a glance. The method of manufacture is easily adapted to make flat sources up to three inches in diameter.

**the RG-32** design results in a source of nearly pure beta radiation. It therefore makes it possible to devise irradiation set-ups where all the bremsstrahlung radiation originates in the target material and no correction need be made for source bremsstrahlung. The double window design also permits a single source to be detected by two chambers on either side of it. This makes for compact arrangement in null-type gauges.

One step of the manufacture of the sources involves the solution of the radiostrontium in a melt of a low melting glaze. This insures uniformity regardless of the source shape. Mica is used as a window because of its toughness, chemical inertness, and absolute freedom from porosity in thin laminations. The low average atomic number of mica also reduces bremsstrahlung production by a factor of 5 over most suitable metallic windows.



## classroom demonstrator

model: **1613A**  
CLASSMASTER

*for classroom demonstrations of complex nuclear phenomena*



The Model 1613A "Classmaster" Radioactivity Demonstrator is a simple radioactivity monitor complete with all accessories to make it adaptable for lecture or demonstration use, or for a complete course in elementary nucleonics. Properties such as absorption, scattering, coincidence loss, detector efficiency, or health hazard are easily and plainly demonstrated, and the same accessories can be used for tracer study demonstrations in biological classes. The "Classmaster" includes, in addition to the electronic unit, a Model D51 Geiger tube in a separate probe, a calibrated mounting board, radioactive sources, set of absorbers, and a complete manual of instructions and experiments.

The count rate unit provides triple indication of radioactivity. A neon light flashes and a built-in speaker clicks for each disintegration detected. In addition, the count rate is indicated on a large panel meter. Since results obtained with the unit are easily reproducible, it is also useful as a laboratory monitor.

### model 1413 cloudmaster

The Model 1413 "Cloudmaster" is a continuous cloud chamber to provide a spectacular display of "tracks" caused by alpha, beta, gamma, and meson radiation: These vapor "tracks" occur in a sensitive layer about three-quarters of an inch thick near the floor of the chamber. The sharp change in temperature necessary for the creation of the supersaturated "sensitive" layer is produced by easily-obtainable isopropyl alcohol and dry ice. 110 volt ac operated unit provides necessary spot light and a 1200 volt dc "sweep voltage" to the cloud chamber. Radiation source provided.

### specifications

**range**—Two ranges, 0 to 1500 and 0 to 15,000 counts per minute indicated on panel mounted meter.

**controls**—Front panel volume control for loud speaker. High voltage—on-off control, operation selector switch with three positions: volts, cpm x 1, and cpm x 10.

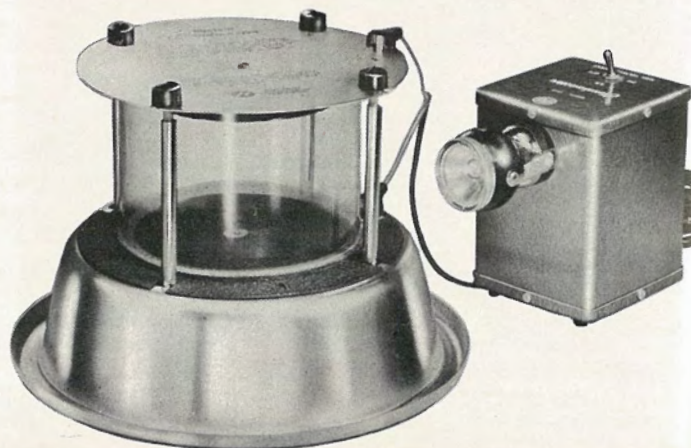
**high voltage**—Continuously variable from 500 to 1200 volts by means of front panel control. Operation selector switch switches meter to read in volts instead of counts per minute.

**power requirements**—60 watts, 100 to 130 volts, 60 cycles.

**dimensions**—Cabinet 10" x 14" x 9½". Calibrated board 3⅞" x 25⅞" x 1".

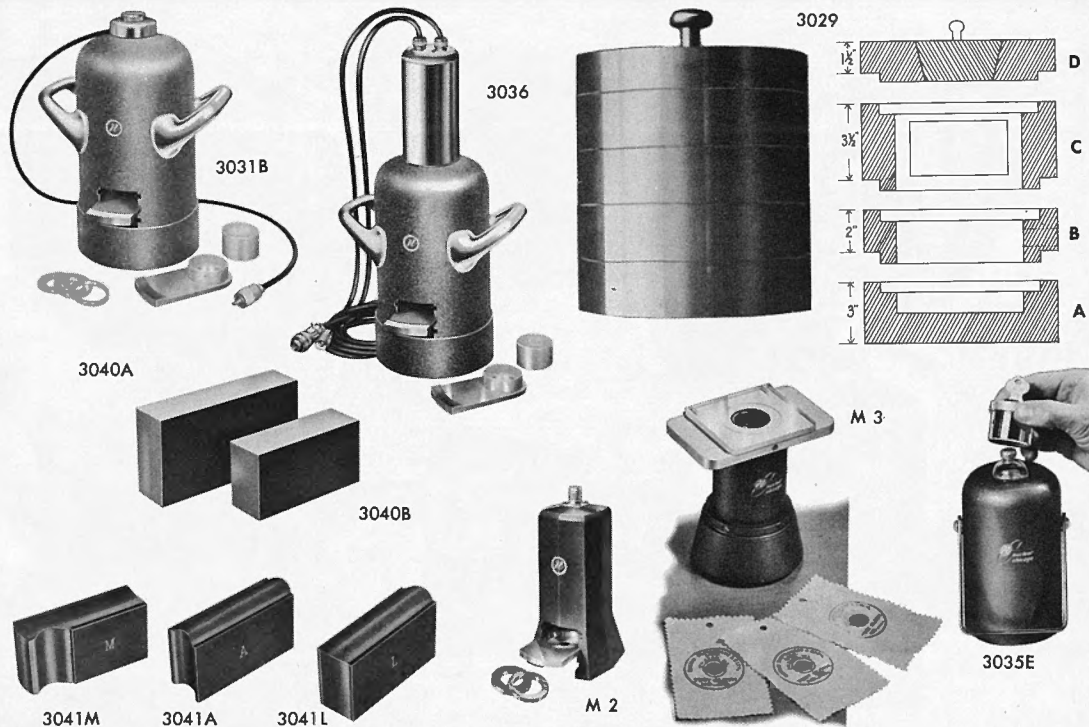
**weight**—24½ lbs., shipping weight 32 lbs.

**accessories supplied**—One electronic demonstrator with extendable probe, one calibrated mounting board, two radium beta-gamma sources, one Model D51 Geiger counter, 14 flat aluminum absorbers, 20 flat cardboard absorbers, 10 flat lead absorbers, one aluminum cylinder, one cardboard cylinder, one lead cylinder, and instruction and experiment manual.



SHIELDS AND MOUNTS

*manual sample changers  
lead shielding  
special mounts*



**model 3031B** shield and manual sample changer provides approximately two inches of lead shielding for sample counting with end window counters. Knob raises or lowers G-M tube to permit optimum counting geometry with tubes of different lengths. Three sample positions are provided, and two sample holders, six adapter rings for 1", 1 1/4", and 1 1/2" sample planchets, and four lucite scatter shields are supplied as accessories. Without adapters, holders will accept 1 3/4" sample planchets. 6" diameter, 12" high, weight 95 lbs.

**model 3036** is used with Model DS-1 for gamma sample counting, reduces background to about 50 cpm, permits detection of 10<sup>-10</sup> curies of activity in urine and blood samples. Hole in shield is 3" in diameter, lead shielding is approximately 1 1/2". Sample positions, dimensions, accessories supplied are similar to 3031B shield. Weight 80 lbs.

**model 3029** adjustable lead shield can be used for additional shielding, to enclose G-M or scintillation counters, or for storage of isotopes in 1 1/2" of lead. Sectional construction permits building any reasonable height, with provision for bringing in cable by ordering one 3029-E section. Section 3029-C provides a side opening to insert counter or to grasp sources. Open inside diameter is 6"; outside diameter is 9". Sections are cast entirely of antimonial lead with nickel alloy plating to prevent deformation. 3029-A base section 56 lbs. 3029-B center section 28 lbs. 3029-C center with door 55 lbs. 3029-D top with plug 46 lbs. 3029-E center with cable hole 28 lbs.

**model 3040A and 3040B** are conventional flat-sided lead bricks available in two sizes: Model 3040A is 2" x 4" x 8", weighs approximately 26 lbs., Model 3040B is 2" x 3" x 6", weighs approximately 20 lbs.

**models 3041M, 3041A and 3041L** are lead bricks with all significant joining faces curved so that there is no straight-line-of-break in barrier construction. These bricks stack compactly and easily since all tops are convex and all bottoms concave. Model 3041M is a female corner brick with one male end and one female end. Model 3041A is a standard brick with one female and one male end. Model 3041L has two male ends. All three types are 2" x 4" x 8", weigh approximately 26 lbs. each. For bench installations requiring full-area surface contact, lead "foundation strip," Model 3041F, is available. Please specify length of strip desired.

**model M2** Mount and Sample Holder provides an unshielded support for end window counters. Cast aluminum provides minimum scatter. Three accurate sample geometries are provided. Supplied with holder for 1 3/4" sample planchets, adapters for 1", 1 1/4" and 1 1/2" sample planchets. 8" high, weight 5 lbs., shipping weight 8 lbs.

**model M3** "Soil-O-Cator" Mount holds a standard mica end window counter in an upright position to permit counting radioactive carbon-14 "dirt" swatches. A lucite cover with a bulls-eye is used in positioning the swatches over the counter's thin window. With the technique it is possible to evaluate the efficiencies of washing machines, soaps, detergents and solvents, etc. Complete information on request.

**model 3035E** Shielded Carrier is useful for both carrying and storing radioactive material, especially bottled isotopes used in medical applications. It features a key-operated locking mechanism and a "well" into which the bottle may be lowered. Spring platform raises the bottle when lock section at top of shield is removed. 3 1/2" diameter by 6" high. Well is 1 1/2" diameter by 4 1/2" deep. Weight 20 lbs.

TIMERS  
SAMPLE SPINNER  
STEP-DOWN  
TRANSFORMER  
LINE FILTER  
CHART RECORDER



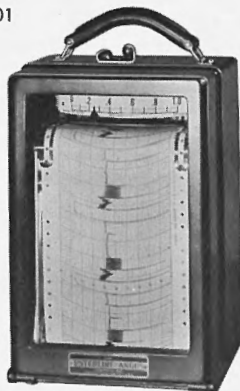
T 101



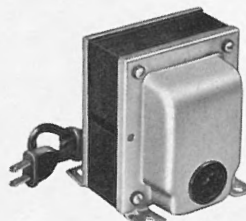
T 1



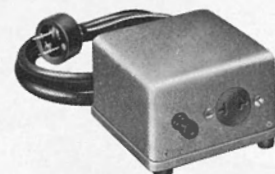
PM 1-2-3



E-A Recorder



PS 6



PS 7

**model T-101 timer** is a reliable five digit drum type timer which indicates elapsed time in minutes and hundredths of minutes. Operates with any Nuclear-Chicago scaler, or by itself directly from 110 volt 60 cycle line. Convenient push button on-off switch mounted in base. Complete with six foot cord and plug. Weight 2½" lbs., shipping weight 4 lbs. Dimensions: 5" x 3½" x 4¼" high.

**model T1 dual timer** provides either preset time or elapsed time from two seconds to 60 minutes with ½ second increments, when used with all Nuclear-Chicago scaling units. Uses 110 volt 60 cycle supply from auxiliary connector on scaler (50 cycle model available). Incorporates own switch for other control purposes. With connecting cable (specify scaler Model number) and instructions. Dimensions: 4¾" x 4½" x 4½". Shipping weight 6 lbs.

**model PM-1 sample spinner** is designed to simplify the problem of sample preparation. It consists of a constant speed turntable rotating the sample pan. Hand may be rested on top surface as sample material is spread on the rotating pan. An air-blower unit, Model PM-2, to aid in drying homogenous solutions evenly, and Model PM-3, consisting of an upright, clamp, and socket to hold an infrared bulb (not supplied) should also be specified for a complete unit. Turntable speed is 20 rpm. Any sample size up to 2" may be accommodated. Connectors: inlet for compressed air, nitrogen, etc. for PM-2 air blower unit, line cord, two female plugs for powering other instruments. On-off switch provided. Power—95 to 130 volts, 60 cycles. Base is 8½" x 6¼" x 2". Weight 9 lbs., shipping weight 15 lbs.

**esterline-angus chart recorder** gives a continuous chart record of radiation count rate vs. time and may be connected to either Models 1619 or 1620 ratemeters. A duplication of the count rate as indicated by the ratemeter is provided, full-scale reading on the ratemeter corresponding to full swing deflection of the recording pen. Full swing across the active width of the chart requires only 0.5 second. The recorder is an integral part of the Model C-100 Actigraph system. Supplied with carrying handle and synchronous motor for 120 volt, 60 cycle operation. Weight 34 lbs., shipping weight 45 lbs. F.O.B. Indianapolis.

**model PS6 step-down transformer** converts 230 line voltage into 115 volt for operation of standard Nuclear-Chicago equipment. Rated 500 watts, 50-60 cycles. Shielded construction with four hole corner mounting. Eight ft. line cord permanently attached. 115 volt output is obtained from female receptacle mounted on side of case. Designed for continuous duty. Dimensions 4⅝" x 3⅜" x 4⅜". Weight 11 lbs., shipping weight 14 lbs.

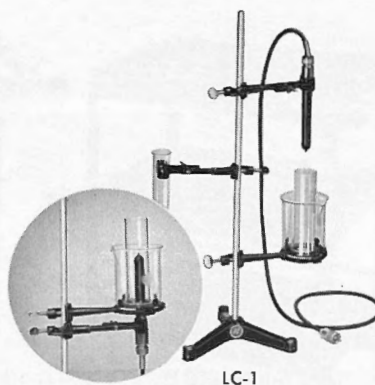
**model PS7 line noise filter** is particularly designed for nuclear counting applications. Has extremely high attenuation from 10 kc to more than 10 megacycles. The unit will effectively eliminate line noise counts due to electric typewriters, motors, and most diathermy machines. It is a balanced pi-section filter rated 115 volts at 3 amperes. Ground terminals are provided at the case and at the end of the line cord to prevent shocks due to the electronic chassis not being at ground potential. Dimensions 4¼" x 4¼" x 2½". Weight 2 lbs., shipping weight 4 lbs.



N 4



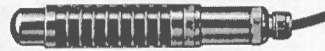
Sample Pans



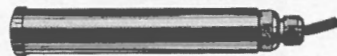
LC-1



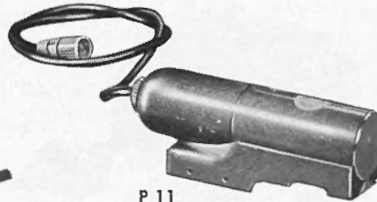
C 101



P 15



P 16



P 11

SAMPLE STORAGE  
SAMPLE PANS  
LIQUID COUNTER  
ABSORBERS  
PROBES

**model N4 sample storage cabinet** utilizes exclusive plastic Adaptocups pressed into sample trays to accommodate 100 samples from 1" to 1 $\frac{3}{8}$ " in diameter. The 10 drawers each have 10 sample holders, each numbered for reference. Sample holders or trays are easily replaced in case of contamination. Sturdy metal cabinet with tab holder on each drawer to permit labeling drawer contents. Measures 7" x 8" x 8". Dust cover included. Shipping weight 7 lbs.

**sample pans** are available in four types. All types are 1 $\frac{1}{4}$ " diameter. Cupped models are  $\frac{3}{32}$ " deep. Model AF-12 are flat aluminum pans. Model AC-12 are cupped aluminum pans. Model PC-12 are cupped clear plastic pans. Model SC-12 are cupped stainless steel pans.

**model LC1 liquid counter set** is designed for counting radioactive material in solution. It consists of a laboratory stand, clamps, a ring support with a beaker support, Model D52 Geiger counter, Model PC6 cable, one Model LB1 Marinelli beaker, and one LT1 test tube. The Marinelli beaker has a glass tube sealed in through the center so that the counter may be surrounded by gamma emitting liquid without wetting the counter. The test tube holds 20 cc of liquid when the counter is fully inserted, and the liquid will then surround the sensitive portion of the counter. Shipping weight of complete LC1 counter set is 10 lbs.

**model C-101 absorber set** provides a range of aluminum and lead absorbers from 1.7 to 6700 mg. per sq. cm. They may be used to determine the energies of photons and beta radiations, check isotope purity, identify radioactive species, to count one isotope in the presence of another, etc. The set consists of 23 calibrated discs mounted in uniform plastic

rings. An additional empty ring is provided for zero absorption. The set is constructed for rugged, long-term duty and is housed in a handsome walnut case. They may be used on the top shelf of the Model 3031B Lead Shield or Model M2 mount, or with the Model C-100 Actigraph when it is desired to obtain absorption curves automatically. Each absorber is 1 $\frac{7}{8}$ " diameter x  $\frac{3}{16}$ ". Seventeen aluminum absorbers range from 1.7 mg/cm<sup>2</sup> to 1670 mg/cm<sup>2</sup>; six lead absorbers range from 401 mg/cm<sup>2</sup> to 6700 mg/cm<sup>2</sup>. Case dimensions 7" x 10" x 2 $\frac{1}{2}$ ". Weight 2 lbs., shipping weight 5 lbs.

**geiger probes** are available for use with scalers or ratemeters. Model P15 and P16 are chrome plated brass; P10 and P11 are finished in gray hammertone paint. All probes are furnished with cable and connector.

**model P15 probe** accepts Model D50 counter, has revolving shield which exposes a 180° angle to permit entry of beta radiation. 40" coiled cable. Shipping weight 3 lbs.

**model P10 probe** incorporates a preamplifier and ten-foot cable, accepts four-pin end window counters (such as Model D34). Has built-in magnet for positioning on any ferromagnetic material. Shipping weight 6 lbs.

**model P11 probe** is similar to P10 except it has a 3 ft. cable and no preamplifier. Shipping weight 3 lbs.

**model P16 probe** accepts Model D35 end window counter, has cap at end of probe for gamma surveying. 40" coiled cord cable. Shipping weight 3 lbs.

# accessories

SCALER CARTS  
NUCLEARULE  
WARNING TAPE  
WARNING SIGNS  
CABLES  
BATTERIES



CA 3



CA 4



N 1



N 2



N 5B

N 5A

**model CA3** is a heavy duty, all-welded stainless steel laboratory cart, designed for moving the heaviest equipment safely. Rubber wheel casters are 4" in diameter, and three deep tray shelves 18" x 32" with safety bars prevent accessories from sliding off open side. Equipped with push bar and rubber bumpers. 18" x 27" x 32". Shipping weight 52 lbs.

**model CA2** is a lighter-duty cart, with 3" rubber wheels and three shelves, the upper two with raised edges on three sides. Shipping weight 35 lbs.

**model CA4 "Carette"** is similar to Model CA3 with a flexible arm which allows easy positioning of a detector around a patient's head or body. The probe arm may be set in a wide range of positions, extends to 44" maximum, carries any 3" diameter detector up to 23 lbs., and is counterpoised so that the counter will remain in the position in which it is set. A clamp at the end of the arm holds the DS-1 scintillation detector or a smaller detector or shield with a suitable adapter.

**model N1 nuclearule** is a special circular slide rule to quickly determine count rate, statistical error, coincidence loss, activity of sample vs. half life, and other useful information. Measures 5<sup>3</sup>/<sub>4</sub>" diameter. Complete with instructions and carrying case.

**model N2 radiation warning tape** is a series of individual labels 11<sup>1</sup>/<sub>2</sub>" long by 1" wide, printed in standard AEC colors on a continuous roll of tape. A quick, convenient method of labeling small bottles, boxes and source containers. More than 1700 labels per roll.

**model N5A radiation warning signs** uses "glowing" color to warn personnel of radiation danger. Reads "Radiation Hazard" with standard AEC symbol, and has space for writing in type or level of radiation. Size 4" x 6". Shipped in packages of 12, weight 2 lbs.

**model N5B radiation warning stickers** have "Kleenstick" coating on back. Removable paper back protects adhesive until used. Size 2<sup>3</sup>/<sub>4</sub>" x 9". Shipped in packages of 6, weight 1 lb.

BATTERIES FOR PORTABLES

part no.	description	battery										
		model number of instrument and quantity of each battery used										
		2111	2582	2585	2586	2610A	2610AP	2611	2611P	2612	2613	2715
BA-002	1.5 v, Burgess 2F					1	2	1	2	2	2	
BA-003	22.5 v, Eveready 412E		7	4								
BA-005	67.5 v, Eveready 467	1				1	1	1	1	2	2	
BA-006	300 v, Eveready 493					3		3				
BA-007	1.5 v, Eveready 742						1		1			
BA-010	1.5 v, Burgess TE	2										
BA-011	1224 v, Eveready W-5	2										
BA-015	Mercury cell, General RG3				1							
BA-021	Mercury cell, Mallory RM1											3
BA-026	1.3 v, Mallory RM12		4		4							
BA-027	6.5 v, Mallory 302435 IRX		1									
BA-028	9.1 v, Mallory 302437 IRX		1									
BA-029	45 v, Burgess XX30P1											2
BA-030	30 v, Eveready 413				4							
BA-031	1.5 v, Eveready 411				2							
BA-032	45 v, Burgess U30											3
BA-033	1.3 v, Mallory RM-42R											1

## cables

When ordering cables, be sure to specify manufacturer of equipment, model numbers to be interconnected, type of coaxial connector on each end. In the case of multipin connectors, specify the number of pins on each end. Applied voltages, currents and signal sensitivities should be stated where applicable. When ordering a cable equivalent to that normally provided with a Nuclear-Chicago unit, it is only necessary to specify the instrument with which it was provided and a brief description.

**warranty**—Nuclear-Chicago warrants its manufactured equipment to be free from defects in workmanship or materials under normal use for one year. If any part of such equipment, with the exception of vacuum and detector tubes, crystals, and batteries, proves to be defective within one year after original date of shipment, it will be repaired or replaced without charge.

On vacuum and detector tubes, crystals, batteries, and accessories furnished by us but manufactured by others, we will extend the same guarantee which we receive from the manufacturer thereof, and repair or replacement will be made at no charge within that period.

**terms of warranty**—All repairs or replacements under the above warranties are f.o.b. company's factory, or company's authorized service representative. If any question arises within these warranty periods, contact the company or its nearest Branch Office for assistance or instructions. No liability shall attach to us, however, for damages or delays caused by defects, beyond making such repairs or furnishing duplicate parts, nor shall we be liable for any defective material repaired or replaced without our consent.

**shipping damage**—The company is not responsible for instrument damage which occurs during shipment, but it is our practice to make every effort to obtain restitution from the carrier. If you receive an instrument which is damaged in any respect, an immediate inspection by the carrier should be requested. We will make arrangements for repair or replacement of the equipment upon receipt of the carrier's inspection report.

**service information**—Our Customer Service Department, with headquarters in Chicago, has established authorized service representatives at many points throughout the U. S. and Canada. For information about service representatives in your area, contact our nearest Branch Office. Where necessary, our factory in Chicago is ready to make repairs promptly. No charge will be made on repairs within warranty, but on other repairs it will be necessary to issue an invoice against your purchase authority.

**suggestions for ordering**—When submitting an order or a request for a quotation, please supply the following information:

1. Model number. When ordering accessories please give the model and serial number of the instrument with which the accessories are to be used so we can furnish proper cable or connectors or adapters.
2. Desired f.o.b. point (our published prices are all f.o.b. Chicago).
3. Desired delivery date.
4. Full information concerning shipping and billing addresses.
5. Method of shipment—all shipments will be Railway Express collect unless otherwise specified.

**export orders**—Nuclear-Chicago products are in use throughout the world and we are pleased to supply equipment to foreign customers. Orders and correspondence from countries except the U. S., U. S. possessions, and Canada should be directed to our Export Department.



**nuclear · chicago**



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