

CATALOG K
1950



FOREWORD

Progress in the very new field of radioactivity has been and will continue to be largely dependent on commercial suppliers of apparatus, supplies, and services. As one of the leaders in this new industry, NUCLEAR recognizes its responsibility and has made significant contributions to the rapid advancement of measurement techniques. Only by continued contributions can instrumentation suppliers satisfy the need and justify their existence commercially.

Many of the leading members of our staff were connected with the Manhattan Project from 1943 to 1946. In the latter year the pile-produced isotopes were first made available for non-military use, and the founders of this company commenced commercial manufacture of the instruments which are so vital to this new field. Our present design engineers, thoroughly trained and supervised by the men from the Project, control the quality and development of our instruments. This background of experience, plus a desire to constantly improve our products, produces a combination that is uniquely qualified to render a complete service to users of NUCLEAR instruments.

The research staff of NUCLEAR Instrument and Chemical Corporation is at your service at all times, not only to match our standard apparatus and supplies to your particular requirements, but also to develop special products and techniques to suit your specific need.

It is our earnest hope that the products described in the following pages will win the hearty approval of our friends everywhere.

James A. Schoke President

PRECISION INSTRUMENTS

for Nuclear

To efficiently employ precious scientific effort, too much thought cannot be given to the selection of the proper tools. "NUCLEAR" products are designed with convenience second only to accuracy and reliability, so that the user is assured maximum usability.

ENGINEERING & DEVELOPMENT: The engineering and development of new and better instruments for nuclear measurement is the prime activity of our Engineering Department. It is in this department that a new product has dependability built into it. Here, also, the catalog instruments are kept "modern" by design improvements.

MANUFACTURING: On the Production line, where carefully trained personnel build all cataloged instruments, extreme care is taken to mount all parts

rigidly, to cable all wiring neatly, to individually select certain components where necessary, and to take other precautions to assure outstanding quality and performance.

QUALITY CONTROL: A very small but important link in the manufacturing system is the Quality Control Department, where the components which we do not make ourselves are constantly tested to be sure that they meet our exacting specifications.

INSPECTION & TESTING: The quality of work done in the Inspection and Testing Department is reflected over the entire manufacturing process because the degree of care a worker exercises is directly proportional to the stiffness of the inspection he anticipates. In view of this fact, we have built up very stringent test procedures. Tests are made on all instruments to be sure they meet performance specifica-



Constant development work



INSTRUMENTATION

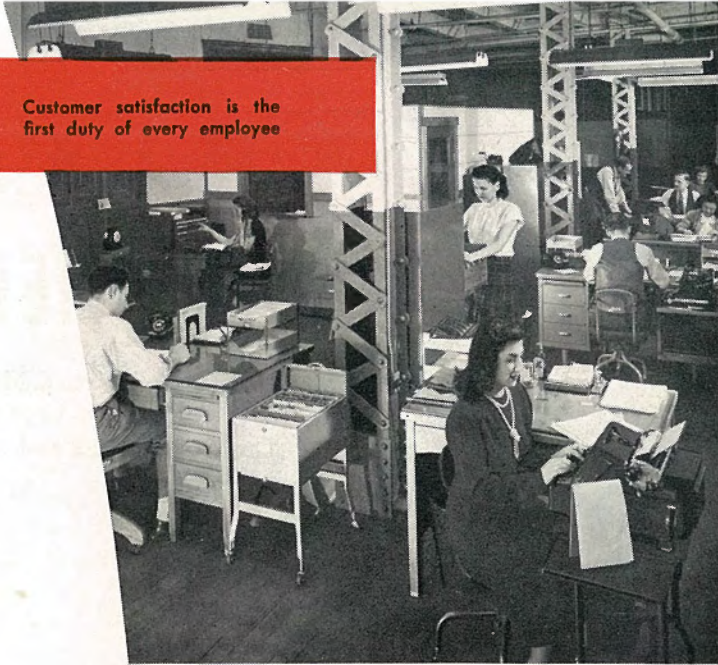
Measurements

tions. As an additional precaution, all instruments are run continuously for several days and then retested before shipment.


SHIPPING: Final inspection includes attachment, to the shipment, of the Instruction Manual, cables, extra connectors, etc. After careful checking and packing, the instruments are ready for shipment to the customer.

SPECIAL PRODUCTS: Although NUCLEAR'S line of catalog products will fit most radioactivity instrumentation problems, there are some measurement techniques that require tailor-made tools. Our thoroughly trained engineering staff is at your service, not only to modify standard products to fit your needs, but also in the development of special instruments for specific purposes.

CHEMISTRY DIVISION: As research in nuclear science daily penetrates more deeply into applications, especially in the medical field, the need for more available radioactive isotopes and compounds has grown. We are setting up a complete Chemistry Division to complement the services of the Instrument Division. As this catalog is prepared no final list of chemical products is available; this will be published when adequate facilities are ready to provide quick service to users.



Customer satisfaction is the first duty of every employee



Sensitive instruments are assembled under controlled conditions



Radioactive compounds will complete NUCLEAR'S services

Carefully controlled manufacture provides "built-in" quality

OUR CUSTOMER LIST *is world-wide*

The following is a partial list of our customers, drawn from a total list of thousands. It is a cross-section view of the people — all over the world — who confidently use "Nuclear" instruments and services in all kinds of radioactivity research.

Abbott Laboratories
Able Scientific Glass Apparatus Co.
African Metals Corporation
Air Reduction Sales Company
Alabama Polytechnic Institute
University of Alabama
American Chemical Society
American Cyanamid Company
American District Telegraph
American Medical Association
American Scientific Company
Amperex Electronic Company
Anaconda Wire and Cable Company
Antioch College
Armaur Research Foundation
Argonne National Laboratory
Barber-Colman Company
Bartol Research Foundation
Batelle Memorial Institute
Baylor University
Beloit College
Bell Telephone Laboratories
Big Spring Hospital Corporation
British Supply Office

University of Buffalo
Boston University
University of California
California Cedar Products
Cape Cod Hospital
Carnegie Institute of Technology
Canadian Radium & Uranium Corp.
University of Chicago
University of Cincinnati
Colorado School of Mines
Columbia University
Copperweld Steel
Cornell University
Cornell University Medical School
Cutler-Hammer, Inc.
Dow Chemical Company
E. I. DuPont Company
Eastman Kodak
Farnsworth Radio Company
Federal Telecommunications Labs.
University of Florida
Florida Agriculture Experiment Station
Fordham University
General Electric Company
General Foods Corporation
Harper Hospital
Harvard University
Hektoen Institute
High Voltage Engineering Company
Johns Hopkins University
Howard University
Illinois Institute of Technology
State of Illinois
University of Illinois
Indiana University
Institute of Textile Technology
State University of Iowa
Iowa State College
Johnson Radio Laboratory
University of Kansas
Kelley-Koett Manufacturing Company
Kelly Clinic
Lakeside Laboratories
Leeds and Northrup
Eli Lilly Company
Arthur D. Little, Inc.
Louisiana State University

Loyola University
Magneon Company
Magnolia Petroleum Company
Marquette University
Marietta College
H. S. Martin Company
University of Maryland
Massachusetts General Hospital
Mayo Clinic
Medical Products Company
Meharry Medical College
Memorial Hospital, Sloan-Kettering Institute
Michigan State College
University of Michigan
Miles Laboratories
University of Minnesota
University of Missouri
Monsanto Chemical Company
National Technical Laboratories
Michael Reese Hospital
Maimonides Hospital
New York University
North American Aviation, Inc.
North Carolina State College
Northwestern University
Notre Dame University
New England Deaconess Hospital
City College of New York
Oberlin College
Ohio Agriculture Experiment Station
Ohio State University
Ohio University
Ordnance Department
University of Oregon
Parke Davis Company
University of Pennsylvania
Pennsylvania State College
Philco Corporation
Presbyterian Hospital
Princeton University
Purdue University
Queens College
Radiation Counter Laboratories
Radio Corporation of America
Radium and Radon Corporation
Reed Institute
Raytheon Manufacturing Company
Reed Research, Inc.
Rensselaer Polytechnic Institute
Rice Institute
St. Louis University
Sinclair Refining Company
Socony-Vacuum Oil Company
Southern Research Institute
Stanolind Pipe Line Company
Syracuse University
Technical Material Corporation
Technical Products International
University of Tennessee
University of Texas
Tulane University of Louisiana
Union College
United Shoe Machinery Corporation
U.S. Department of Agriculture
U.S. Department of Commerce
U.S. Department of the Interior
U.S. Navy
U.S. Naval Gun Factory
U.S. Atomic Energy Commission
U.S. Public Health Service

U.S. Radium Corporation
U.S. Rubber Company
U.S. Treasury Department
Upjohn Company
University of Utah
Vanadium Corporation
Vanderbilt University
Vassar College
University of Virginia
Virginia Medical College
War Department
Washington University
University of Washington
State College of Washington
Waukesha Motor Company
Wesleyan University
Westinghouse Electric Corporation
University of West Virginia
Wheaton College
University of Wisconsin
Veterans Administration of St. Paul
Veterans Administration of Hines
Veterans Administration of Dallas, Tex.
Yale University
Wake Forest College
Industrial Testing and Welding Lab.
Joslyn Manufacturing and Supply Co.
Texas State Research Foundation
Rockefeller Foundation
Gilbert X-Ray Company of Dallas
E. J. Davis Engineering Company
Dept. of Trade & Commerce—Canada
Canadian Commercial Corporation
University of Basel, Switzerland
Eldorado Mining & Refining Ltd.
Instrumental Otico, Rio de Janeiro
Manitoba Cancer Relief & Research Institute
McGill University
McMaster University
National Research Council
New Zealand Government Trade Commission
Queen's University
University of Saskatchewan
University of Toronto
Connaught Laboratories
Fysisk Institut, Trondheim, Norway
Geophysics Institute, Bergen, Norway
Fysiska Institutionen, Upsala, Sweden
Chalmers Institute of Technology, Goteborg, Sweden
Department of Mines and Resources, Canada
Academia Sinica, Nanking, China
Department of Agriculture, Canada
French Supply Council
Honolulu Experiment Station
Laboratoire des Applications Radiations, Paris, France
Montreal General Hospital
Swedish Consulate General
L'Ecole Polytechnique, Paris, France
Province of Saskatchewan
Forskings Institutet for Fysik, Stockholm, Sweden
Stenhardt Engineering Company, Stockholm, Sweden
Union Miniere du Haut-Katanga, Brussels, Belgium
University of Calcutta, India



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Certificate of Quality

This is a quality instrument. The circuit is simple, practical, and of the fewest parts consistent with reliability. It was made by expert craftsmen, proud of their workmanship, and of the reputation of their company for producing the optimum in quality.

This instrument (except for tubes and batteries) is guaranteed to be free from defects due to faulty material or workmanship for a period of one year from date of shipment. Irregularities developing within this period will be corrected without charge. Be assured that the performance of this instrument will continue to be of vital interest to us.

NUCLEAR INSTRUMENT AND CHEMICAL CORP.
CHICAGO 10, ILL.

Every NUCLEAR instrument on which this certificate appears is guaranteed, for one year[▲] after receipt by the customer, against faulty construction of any kind. In addition, we are ready to provide low-cost service to every customer regardless of the age of his instrument.

▲ — indicates exclusive Nuclear feature.

MODEL 172

Scaling Unit



ULTRASCALER

COUNTOMATIC GEIGER, PROPORTIONAL, SCINTILLATION COUNTING

- Only scaler designed for use with all types of detectors.
- Counts for predetermined time or number of counts.
- Includes built-in dual timer.
- Scale of 128 Higinbotham circuit with scale selection.

Model 172 Ultra-Scaler is the most versatile commercially manufactured scaling unit, providing functions beyond the scope of any previously available instrument. It incorporates all of the features of the Model 162 and Model 163 scaling units described on the following pages, and therefore permits Geiger, proportional or scintillation counting to be accomplished by predetermined count, predetermined time, or manual methods.▲ It may be used for monitoring with a probe, or for demonstration or teaching purposes if desired. All of these varied elements are incorporated in one compact system which allows you to do nearly every conceivable counting job, research or routine. Where your program is unpredictable there can be no better choice of a scaling instrument.

▲ — indicates exclusive Nuclear feature.



OPERATION

The unique NUCLEAR Model 172 permits the user to do counting by any one of four different methods. Geiger counting is accomplished by connecting the counter to the Geiger input on the front panel of the instrument. Proportional, scintillation, or crystal counting can be done by utilizing the built-in linear amplifier connection. This amplifier has a one millivolt sensitivity and is provided with a means of pulse height selection.

The Ultra-Scaler can be set to count automatically a predetermined number of counts and indicate the duration of time on the timer. The range of selection is from 80 to 128,000 counts, in 15 steps.

Counting for a predetermined length of time and recording the number of counts within that period of time can also be accomplished. The NUCLEAR Model T1 timer mounted on the front panel of the instrument opens the counting circuit when the preset time has elapsed.

In addition to these extremely precise methods of counting, Model 172 can also be operated manually or used as a monitor by switching to a low scaling factor and utilizing the clicking of the register as an aural indication. NUCLEAR Model P1, P2, P10, P12, AP1, AP2, or AP3 probe can be attached directly to the scaler for this purpose.

FEATURES

Model 172 Ultra-Scaler is as easy to use as any of the other scalers which provide less flexibility. In addition to the features described above, the following are important reasons for selecting this outstanding instrument.

DUAL HIGH VOLTAGE SUPPLY▲ is variable from 650 to 2500 volts, with electronic regulation of .01% per percent change in line voltage. Voltage is read on a double scale, depressed zero, 4" meter. The high voltage primary circuit is fused and a spare fuse is mounted on the chassis.

TWO OSCILLOSCOPE TERMINAL SETS▲ are mounted on the front panel. One is for viewing pulses after passing through the high gain linear amplifier. The other is for viewing Geiger pulses directly without loading the counter.

SCALE SELECTOR SWITCH is provided for scaling factors of 8, 16, 32, 64, or 128.

OPERATION SWITCH offers selection of 10, 100 or 1000 times the selected scaling factor for a predetermined count. It also permits manual or predetermined time counting.

PREDETERMINED TIME circuit operates in conjunction with timer mounted conveniently on the front of the scaler.

AUTOMATIC TIME DELAY▲ insures against accidental, uncontrolled high voltage surges across the Geiger tube.

HIGINBOTHAM TYPE SCALE OF 128 has resolution time of 2 microseconds in the first two stages and 5 micro-seconds in the last five stages.▲ This is a proven circuit known for its reliability.

INTERPOLATION LAMPS are provided for determining exact count between multiples of the scaling factor. These lamps, as well as all pilot lamps, are easily replaced from the front of the unit.

OUTPUT STAGE will drive the built-in register up to 1000 numbers per minute. This four digit register is easily read and is simply reset to zero at the start of a "count".

G-M INPUT of fixed .25 volt sensitivity.

LINEAR AMPLIFIER▲ with maximum sensitivity of 1 millivolt and flat frequency response from 10,000 cycles to 1.5 megacycles.

ATTENUATION SWITCH▲ on panel provides attenuation ratios of 10:1, 5:1, and 1:1.

PULSE HEIGHT CONTROL▲ on panel for pulse height selection. Calibrated dial enables settings to be reproduced accurately.

OPERATION is independent of line voltage variations between 95 and 130 volts.

CHASSIS cadmium plated for corrosion resistance.

ATTRACTIVE CABINET with a smooth simulated hammered finish and enamiled panel permits easy decontamination.

MODEL 172 ULTRA-SCALER shipped with high voltage cable, jumper cable, and instruction manual. (Please specify detector to be used so correct cable can be provided.)

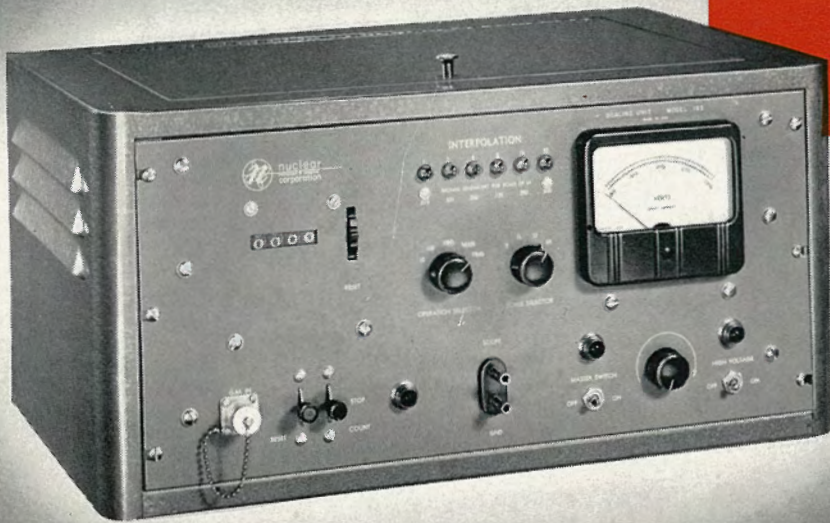
OVERALL DIMENSIONS of Model 172 are 21 $\frac{3}{4}$ " wide x 19 $\frac{1}{4}$ " high x 15" deep.

Shipping Weight — 196 lbs.

▲ — indicates exclusive Nuclear feature.

MODEL 163

Scaling Unit



VERSATILE COUNT-O-MATIC

- Count-o-matic switch for predetermined count operation.
- Counting for predetermined time with a relay-type timer.
- Easy-to-read 4" meter.
- Scale selection by panel switch.
- Provision for accessories.
- Reliable Higinbotham scaling circuit.
- Built-in number register.

Model 163 Scaling Unit is NUCLEAR'S most versatile scaling instrument for use in counting with Geiger-Mueller radiation detectors. While it may be used for manual operation, and contains all of the basic features necessary for such work, this unit also provides complete facilities for predetermined count and predetermined time operation when used with Model T1 Timer.

The basic electronic circuit of Model 163 is the dependable Higinbotham circuit, which has a wide-spread reputation for dependable operation over long periods of time. This is the same circuit used in many "NUCLEAR" and "idl" scalers which have been in satisfactory service for years.



OPERATION

NUCLEAR Model 163 offers four distinct counting methods. Thus, it is possible to use the most convenient technique and method of counting for the type of sample which is being analyzed.

The scaler can be set to count automatically a predetermined number of counts and indicate, on an attached electric timer, the duration of time required to register the preset number of counts. It is possible to arrange the scaler switches so that it will automatically shut off after 160, 320, 640, 1600, 3200, 6400, 16,000, 32,000, or 64,000 counts.

Counting for a predetermined length of time, and recording the number of counts in that period of time, can be accomplished with this instrument by connecting a relay-type electric timer, such as NUCLEAR Model T1. This timer closes the circuit of the automatic shut-off after a preset period of time has passed.

In addition to these two extremely precise methods of counting, Model 163 can also be operated manually, or it can be used as a monitor by switching to the scaling factor of two and listening to the clicks of the register as an aural indication. The latter method is especially practicable when using a probe such as NUCLEAR'S Model P1 which can be attached directly to the scaler.

No preamplifier is required with this scaler for cables up to four feet in length if self-quenching Geiger tubes are used. Connectors are provided on the rear of the chassis so that quenching circuits or preamplifiers can be used with non-self-quenching counters.

FEATURES

Model 163 Scaler can be operated with ease, either as an automatic scaler or as a manually operated instrument. The following design features indicate the scope and versatility of the instrument:

HIGH VOLTAGE SUPPLY is variable from 650 to 2500 volts, with electronic stabilization of 0.01% per percent change in line voltage.

HIGH VOLTAGE METER has depressed zero with the scale calibrated from 650 to 2500.▲ Thus, the 4-inch meter has no wasted portion of its scale, and maximum accuracy and readability are obtained. A time delay relay providing automatic warm-up of the high voltage control tube prevents accidental over-voltage on the Geiger counter.▲

DEGENERATIVE AMPLIFIER built into the unit permits viewing the Geiger pulse on an oscilloscope without loading the counter.▲

SCALE SELECTING SWITCH is provided to select scaling factors of 2,16,32, or 64.

COUNT-O-MATIC SWITCH offers selection of 10, 100, or 1000 times the selected scaling factor for a predetermined count. This switch has a position for manual counting and for predetermined time counting.

PREDETERMINED TIME circuit operates in conjunction with a relay-type timer. Connector is on rear of chassis.

TIME CLOCK plugs conveniently into the rear of the chassis and is synchronized with the stop-count switch and automatic shut-off.

SCALING STAGES are Higinbotham trigger circuits noted for their reliability in continuous operation.

RESOLVING TIME is less than 5 microseconds, much shorter than resolving time of the Geiger counter.

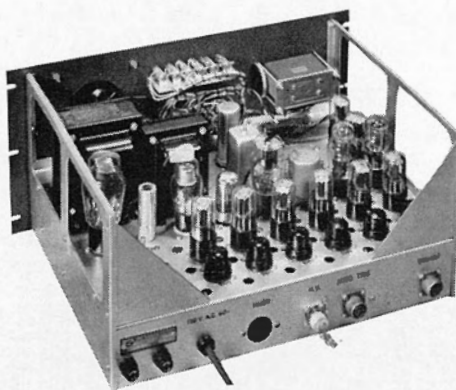
INTERPOLATION LAMPS are provided for determining exact count between multiples of the scaling factor. These lamps, as well as all pilot lamps, are easily replaced from the front of the unit.

OUTPUT STAGE will drive the built-in register at up to 10 to 15 numbers per second. This four-digit register is easily read, and is simply reset to zero at the start of a "count."

MODEL 163 is supplied complete with high voltage cable and instruction manual.

Shipping weight — 66 lbs.

▲ — indicates exclusive Nuclear feature.



Rear view of scaler shows circuit components and new type register.

MODEL 162

Scaling Unit



GEIGER, PROPORTIONAL, SCINTILLATION COUNTING

- Fast scaler for low resolution loss.
- Both G-M and linear amplifier inputs provided.
- Dual range, well stabilized high voltage supply.
- Scale of 128 Higginbotham circuit with scale selection.

Model 162 Scaling Unit is an unusually adaptable instrument because it permits the user to do Geiger, proportional, or scintillation counting.▲ Its wide adaptability makes it an excellent choice for research work where the work program is not always predictable for a long period ahead.

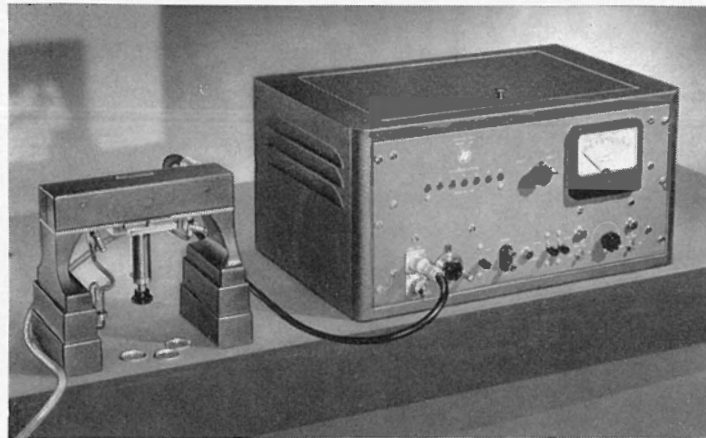
Most nuclear research work today is done with Geiger and proportional counters, but the trend in research is increasingly toward the use of scintillation counters. NUCLEAR'S Model 162 is already in use in many laboratories doing these three types of counting. It is a wise choice, especially for a research program.

▲ — indicates exclusive Nuclear feature.





Model 162 Scaler with Model M2 Mount and Model D33 Geiger Counter.



Model 162 Scaler With Model D45 Proportional Counter (above), and an experimental scintillation counter (below).



OPERATION

Model 162 Scaling Circuit can be used with any Geiger counter by attaching the counter to the appropriate connector on the front of the panel. It can also be used as a proportional counter by use of the input connector to a linear amplifier with one millivolt sensitivity. With certain types of counters, such as NUCLEAR Model D46A "Q-Gas" Counter, this change from Geiger to proportional counting can be accomplished with no more trouble than making this connector change and adjusting the built-in high voltage.

FEATURES

The following design features make the Model 162 outstanding for use in nuclear research:

G-M INPUT to amplifier of fixed .25 volt sensitivity.

LINEAR AMPLIFIER▲ with maximum sensitivity of one millivolt and flat frequency response from 10,000 cycles to 1.5 megacycles.

ATTENUATION SWITCH▲ on panel provides attenuation ratios of 10:1, 5:1, and 1:1.

PULSE HEIGHT CONTROL▲ on panel for pulse height selection. Calibrated dial enables settings to be reproduced accurately.

SCALE SELECTION of 8, 16, 32, 64, or 128.

HIGINBOTHAM TYPE SCALE of 128 has resolution time of two microseconds in the first two stages, and five microseconds in the next five stages.▲

STABILIZED HIGH VOLTAGE SUPPLY with two ranges.▲ Either 500 to 1500 volts or 650 to 2500 volts obtainable over a continuously variable scale.

HIGH VOLTAGE is read on a double scale, four inch meter for good reading accuracy.▲ The high voltage primary circuit is fused and a spare fuse is mounted on the chassis.

STOP-COUNT switch is synchronized with a time clock circuit connected to outlet on rear of chassis.

OUTPUT CIRCUIT, to connector on rear of chassis, delivers pulses capable of driving an impulse register such as NUCLEAR Model EC84.

NEON LAMP INTERPOLATION with lamps easily replaceable from front of panel.

CONNECTOR PROVIDED for plugging in quenching circuit or preamplifier if necessary.

OPERATION is independent of line voltage variation between 95 and 130 volts.

CHASSIS cadmium plated for corrosion resistance.

ATTRACTIVE CABINET with a smooth, simulated hammered finish is provided. Smooth surface permits easy decontamination when necessary.

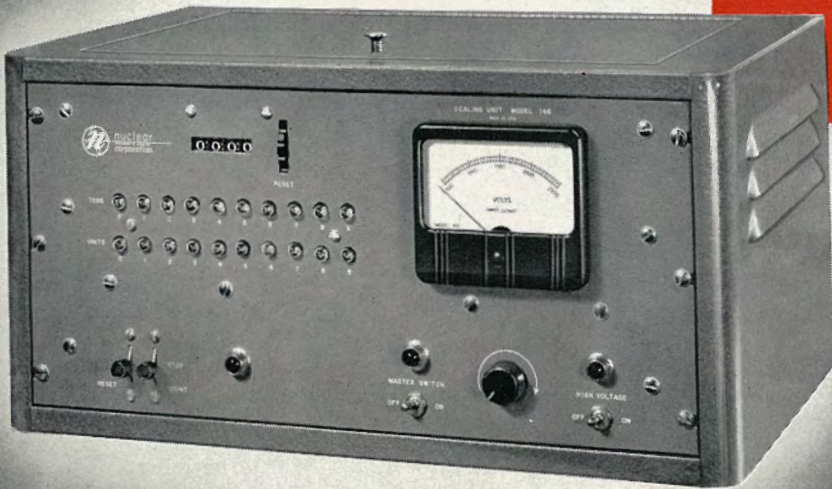
MODEL 162 shipped complete with high voltage cable, jumper cable and instruction book. (Please specify detector to be used so correct cable can be provided.)

Shipping Weight — 62 lbs.

▲ — indicates exclusive Nuclear feature.

MODEL 166

Scaling Unit



DECADE TYPE NO ADDITION REQUIRED

- Completely new, reliable decade circuit*.
- Indicating lights arranged for easy reading of total counts without cumbersome interpolation.
- Simple to operate for Geiger counting.
- Built-in impulse register.

For those who prefer the simplicity of readings available in a decade scaler, NUCLEAR has developed Model 166 Scaling Unit, based on a completely new decade circuit.* Since recycling binary type decades were felt to be inferior to the Higinbotham scale-of-two circuit with respect to reliability, NUCLEAR engineers would not design any units of that type for production.

Model 166 embodies a completely new circuit which provides decade indication and still retains the high standard of dependability for which NUCLEAR instruments are known. The NUCLEAR decade circuit is basically a ring of five, followed by a scale of two.▲

This instrument is easily operated by non-technical personnel, and is applicable

*—Patent applied for

▲ — indicates exclusive Nuclear feature.



to both research work and routine counting. It may be used with any Geiger-Mueller counter which provides a pulse of .25 volt or greater. It may be used in medical applications for diagnostic or therapeutic purposes; for qualitative or quantitative work; for identifying or checking homogeneity of alloys in metallurgy; for geological assaying; for monitoring with NUCLEAR probes; and for many other research or routine counting jobs.

OPERATION

Operation of Model 166 Scaling Unit is very simple. Stabilized high voltage supply is controlled from the front panel, and a stop-count switch controls the counting procedure. An electric timer such as NUCLEAR SM60 can be attached to the scaler so that it is controlled by the stop-count switch.

Reading the count recorded by Model 166 is easy. Merely record the register reading followed by the reading of tens and units. No interpolation or addition is necessary. This feature makes the decade scaler an extremely simple one to operate.

FEATURES

The special NUCLEAR decade circuit which has been developed for Model 166 makes this instrument reliable and easy to use. Some of the important features are:

BUILT-IN IMPULSE REGISTER shows number of hundreds of counts.

TWO ROWS OF LIGHTS complete the count reading without addition of interpolation numbers.

RESOLVING TIME is better than 5 microseconds. This is much less than resolution time of Geiger counters.

NO PREAMPLIFIER NEEDED for cables of normal length.

SELF-CONTAINED, well-stabilized high voltage supply variable from 600 to 2500 volts, easily read on large 4" meter.

PULSE HEIGHT SELECTION is set at 0.25 volt sensitivity for Geiger counters.

CONNECTOR PROVIDED for attaching linear amplifier, Model 1061, or count rate meter, Model 1014.

ALL LAMPS are easily replaced from the front of the panel.

EXTERNAL TIMING CLOCK can be plugged into a convenient a-c outlet controlled by the stop-count switch, thus providing automatic shut-off when counting is stopped.

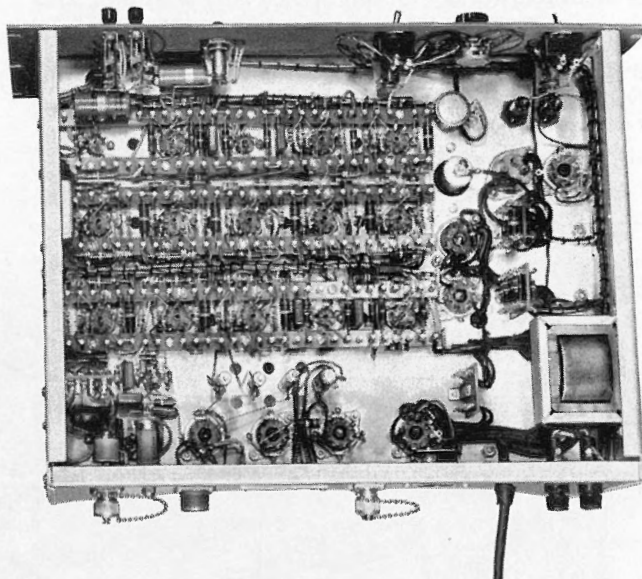
ATTRACTIVE CABINET has a smooth, simulated hammered finish which is easily decontaminated when necessary.

CHASSIS IS CADMIUM PLATED for resistance to corrosion.

INSTRUMENT FITS STANDARD RELAY RACK when removed from cabinet.

MODEL 166 shipped complete with high voltage cable and instruction manual.

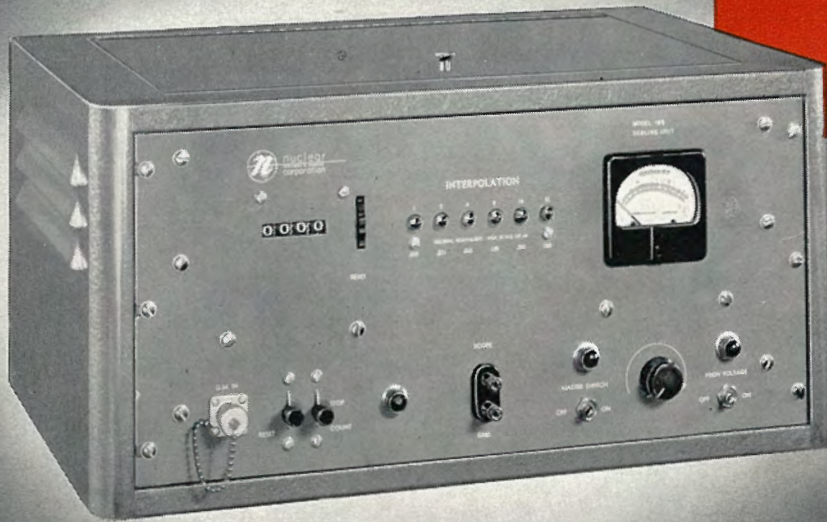
Shipping weight — 60 lbs.



Bottom view of Model 166 Scaling Unit

MODEL 165

Scaling Unit



BASIC SCALER FOR GEIGER COUNTING

- Built-in impulse register and scale of 64.
- Self-contained, well stabilized high voltage supply.
- Reliable Higinbotham scaling circuit for trouble-free operation.
- Provision for external timing clock.

Model 165 is a basic instrument for both research work and routine counting of radiation. It may be used for diagnostic or therapeutic purposes in medical applications; for qualitative or quantitative work in chemistry; for tracing, identifying, or checking the homogeneity of alloys in metallurgy; for geological assaying; for monitoring work with NUCLEAR probes; and for many other research or routine counting jobs. It is designed for easy operation by inexperienced personnel, and is a complete electronic unit which requires no preamplifier for cables of normal length. The only accessories needed for most counting problems are a Geiger counter and an accurate timer.



OPERATION

Operation of the Model 165 Scaler is easily accomplished, even by untrained personnel. The register and interpolation lamps are first reset, and the stop-count switch is then turned to count. When the desired time has elapsed, the switch is returned to STOP position, automatically stopping the attached timer.

(For complete description of this scaler with its related accessories, see Model L-165 Packaged Laboratory on page 20).

FEATURES

Careful engineering design and the reliable basic circuits provide dependable operation of this scaling unit, which has the following important features:

SCALE OF 64, with impulse register which shows number of counts divided by 64.

HIGINBOTHAM TRIGGER CIRCUITS used in scaling stages. This circuit is noted for its reliability in continuous operation.

RESOLVING TIME is better than five microseconds.

NO PREAMPLIFIER NEEDED for cables of normal length (4 feet or less).

THE SELF-CONTAINED HIGH VOLTAGE SUP-

PLY is well filtered and stabilized. It is continuously variable from 600 to 1500 volts d-c.

OUTPUT STAGE drives register mounted conveniently in front panel.

PULSE HEIGHT SELECTOR is set at 0.25 volt sensitivity for Geiger counting.

NO QUENCHING CIRCUIT is normally needed. Connector on rear of scaler provides necessary voltages for quench circuit if needed for non-self-quenching Geiger tubes.

INTERPOLATION LAMPS are provided for showing exact count between multiples of 64. All lamps are easily replaced from the front of the unit.

EXTERNAL TIMING CLOCK can be plugged into a convenient a-c outlet which is controlled by the stop-count switch, thus providing automatic shut-off when counting is stopped.

ATTRACTIVE CABINET has a smooth, simulated hammered finish which makes decontamination easy. Chassis is cadmium plated for resistance to corrosion. Instrument fits standard rack when removed from cabinet.

MODEL 165 shipped complete with high voltage cable and instruction manual.

Shipping weight — 59 lbs.

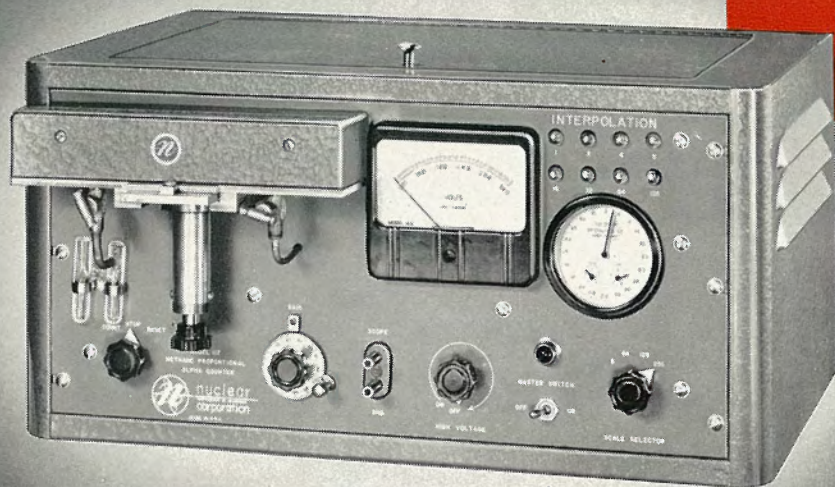
MODEL 161 *Scaling Unit*



Model 161 is NUCLEAR'S "custom" scaler. It is similar to Model 165 except that a number of special features are built in to take care of unusual counting problems, and it does not have a register. This scaler has a total scale of 256 for fast counting, and a switch permitting scale selection of 4, 8, 16, 32, 64, 128, or 256. The built-in high voltage supply provides up to 2500 volts. Other special features can also be provided on quantity orders.

MODEL 117

Counting System

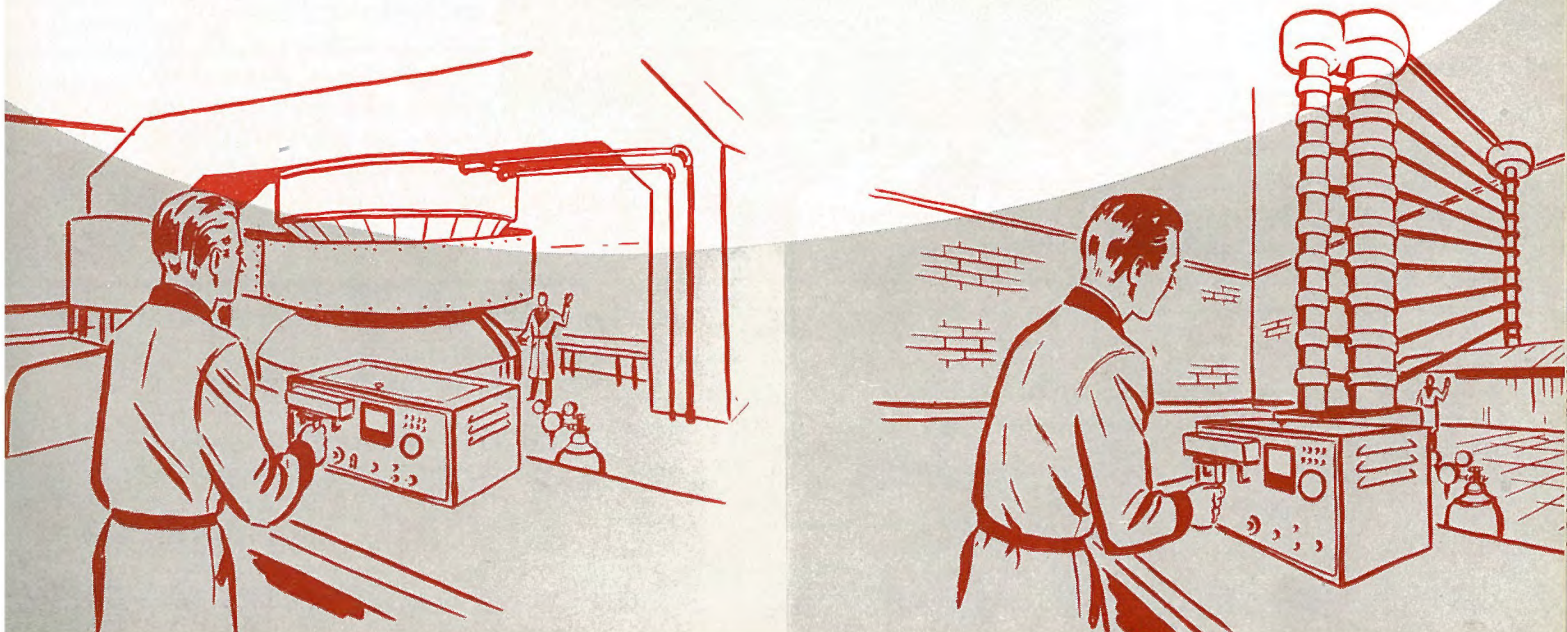


METHANE FLOW PROPORTIONAL COUNTER

- Counts alphas in the presence of high beta activity.
- Embodies a complete counting system.
- Higginbotham scaling circuit for reliability.
- Will accurately record 500,000 counts/minute.
- Built-in, stabilized high voltage supply.
- Built-in proportional counter with variable geometry sample holder.

Model 117 Methane Flow Proportional Counter is a complete counting system for counting alpha particles in the presence of strong beta activity. It is the first commercial instrument of its kind, and was perfected by NUCLEAR engineers in cooperation with the Atomic Energy Commission and some of the nation's foremost nuclear scientists.

Model 117 Counting System embodies the features of several instruments and accessories in one cabinet. It consists of: (1) a methane flow proportional counter with sample holder, attached to the front of the cabinet for greatest convenience; (2) a built-in, variable gain, high gain linear amplifier, with control knob calibrated for reference; (3) a Higginbotham-type scaling circuit of 256 to 1;



(4) a built-in high speed impulse recorder; and (5) a variable, stabilized high voltage supply. The present instrument represents many improvements over earlier instruments of this type.

COUNTING CHAMBER: The counting chamber has a very highly polished cylindrical cathode and a .002" tungsten wire anode mounted between ceramic insulators. The sample holder provided allows the use of standard one inch diameter samples, and includes a means for raising the sample up into the counting volume for improved geometry.▲ A bubbler is connected to the exhaust valve of the chamber to monitor the rate of methane gas flow through the chamber.

AMPLIFIER: The high gain linear amplifier, with a flat frequency response between ten thousand cycles and 1.5 megacycles, has variable gain. The gain is controlled and set on the panel by a dial which is calibrated for reference purposes. It can be set so that pulses from the counter exceeding any desired amplitude between two and twenty millivolts will trip the scaler. This pulse height selection allows discrimination between the pulses caused by beta particles and those of alpha particles.

SCALING CIRCUIT: The scaling circuit is of the binary Higinbotham type, and is employed chiefly because of its reliability. There are eight scaling stages, giving a scaling factor of 256 to 1. The first

two stages of the scaler have a resolving time of 2 microseconds, while the remaining six stages will resolve pulses 5 microseconds apart. A scale selecting switch, permitting selection of scaling factors of 8, 64, 128, or 256, is mounted on the front panel.

IMPULSE RECORDER: The built-in impulse recorder is a clock type unit driven by the last scaling stage. Utilizing the built-in scale of 256, the impulse recorder will accurately register an input counting rate of 500,000 counts per minute.

HIGH VOLTAGE SUPPLY: High voltage for the proportional counter is supplied by a built-in, stabilized, variable voltage supply. High voltage is available from 1500 to 3000 volts, and is read on a 4" depressed zero meter.

The complete unit is conveniently constructed on a single chassis. It is mounted in a steel cabinet attractively painted with smooth, simulated, hammered effect gray enamel. This enamel has a high gloss to make decontamination easy when necessary. When the chassis is removed from the cabinet, it fits a standard relay rack. Overall dimensions of the cabinet are 10-1/2" x 21-1/2" x 14".

MODEL 117 is shipped complete with bubbler, bubbler oil, slide grease, and instruction manual.

Shipping weight — 100 lbs.

▲ — indicates exclusive Nuclear feature.



Closeup of chamber and sample holder, with slide pulled out.

MODEL 1014

Counting System



PLUG-IN TYPE COUNT RATE METER

- Attaches to most Nuclear scalars.
- Selection of five ranges.
- Speaker for audible monitoring.
- Provision for attaching continuous chart type recorder.

Model 1014 Count Rate Meter indicates the counting rate conveniently when used with NUCLEAR Model 161, 163, 165, or 166 Scaler. It is especially adaptable to medical work or work where continuous count rate readings are desired. In addition to providing a visible count rate on the meter, it can also be used for audible monitoring. A built-in loud speaker is provided which has variable volume control.

Provision is also made on the rear of the instrument for the attachment of a recording instrument with 1 milliamperes sensitivity, full scale, such as the Esterline-Angus recorder shown on page 39. Both the Model 1014 and the scaler to which it is coupled can be used simultaneously, or the Count Rate Meter turned off and the scaler operated independently without disconnection.

Model 1014 does not have its own power supply, but uses that of the scaler. It is not recommended for use on Model 162 because there is not sufficient extra power available from that scaler.

Model 1014 Count Rate Meter has a three position switch which permits selection of time constants such

that readings may be made with either 3% or 20% standard error.▲ The third position is a momentary 20% position to allow the user to bring the meter to approximate counting rate in a few seconds before returning to the 3% position.

Five different count rate ranges (500, 1500, 5,000, 15,000 and 50,000, counts per minute)▲ make it possible to choose the optimum range for any counting rate. The range selector mounted on the front panel includes a CALIBRATE and a ZERO ADJUST position. These positions permit checking or setting the meter range accurately.

Installation of the count rate meter is simple. Special cables provided attach to the quench circuit connector on the back of the scaler chassis and also to an adapter which is plugged between the first 6H6 scaling tube and its socket. With Model 166 scaler only one cable is needed. (When ordering, specify scaler with which meter is to be used.)

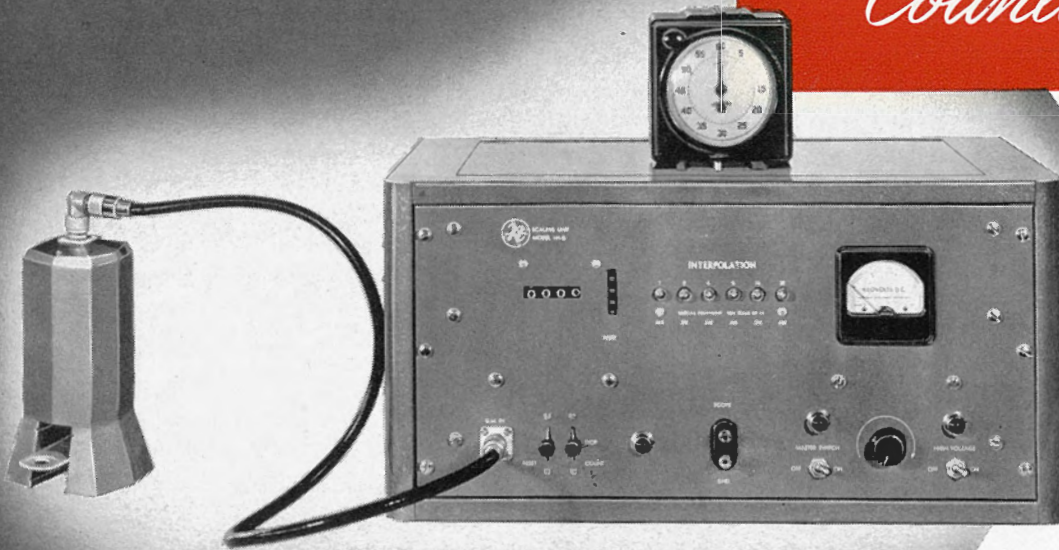
Model 1014 Count Rate Meter is supplied complete with the necessary cables and operation instructions.

Shipping weight — 20 lbs.

▲ — indicates exclusive Nuclear feature.

MODEL L-165

Counting System



PACKAGED LABORATORY

- Simple, reliable operation.
- Designed for standard laboratory counting and monitoring.
- Ideal for classrooms, demonstration, teaching.

Model L-165 Packaged Laboratory is a suggested grouping of instruments which will permit a laboratory worker to do precise research or to monitor radioisotope containers, laboratory table tops, etc. It includes a complete scaling unit, a thin mica end window tube for detecting, and the necessary tube mount, cables, and sample dishes to permit radio-tracer research.

This group of instruments is adaptable to both research and teaching purposes. It contains all the essential equipment for demonstration, as well as actual laboratory work. One "Nuclearule" Calculator is also included without charge.

Monitoring is accomplished with this group by attaching the Model D33 End Window Counter to the Model 165 Scaler with the cable provided. The counter is light in weight and easily used as a probe. Quantitative exploration can also be accomplished in this manner.

For precise research work, the counter is placed in the Model M2 Mount and Sample Holder, which is then attached on a different cable to the same input connection on the scaler.

Model SM60 Timer, shown on top of the scaler above, is not included in Model L-165 because many users already have a suitable timer. It should be ordered in addition to Model L-165 on a new installation of instruments.

(Note: Do not order Model T1 for use with Model 165 scaler. These instruments are not constructed to operate together.)

The items included in Model L-165 are:

- 1 Model 165 Scaling Unit Complete
- 1 Model M2 Mount and Sample Holder
- 1 Model D33 Mica End Window Counter
- 1 Model PC2 Probe Cable
- 12 Model SA125 Cupped Sample Pans (1-1/4")
- 12 Model SB125 Flat Sample Pans (1-1/4")
- 1 Model N1 "Nuclearule" Calculator

Shipping weight — 66 lbs.

MODEL L-163

Counting System

RADIOISOTOPE ANALYST

- Counts soft radiation efficiently.
- Low background system speeds up counting.
- Count-o-matic switch for predetermined count operation.
- Use with Model T1 Timer for predetermined time operation.

Model L-163 Radioisotope Analyst is another complete group of laboratory instruments, especially planned for the analysis of radioactivity. It consists of Model 163 Scaler and NUCLEAR'S exclusive Model D46A "Q-Gas" counter which has a low background and high sensitivity for low energy radiation. Extremely precise and complete research work can be done with these instruments, working with either hard or soft radiation. When this combination is used with Model T1 Dual Timer, either predetermined time or predetermined count operation can be accomplished.

Complete descriptions of these two instruments can be found on the respective pages devoted to them. Model 163 is a complete scaling unit, incorporating scale selection and Count-o-matic switches as well as its own voltage supply. Model D46A Counter is a flow counter with extremely good characteristics for Geiger counting. The necessary high voltage signal cable is supplied with Model 163.

This group of instruments has proven very popular in laboratories all over the world because of the many variations in counting technique which are possible. The only necessary addition in setting up a working laboratory is that of a survey instrument.

In order to complete your laboratory set-up, the Model 2610A or 2611 Portable Count-Rate Meter, described on Pages 23 and 24, should be added for use as a monitor. Such a monitor is much more convenient than a probe type detector attached to a scaler, and can also be used as a portable tracing instrument.

If the user does not already have a suitable timer, one should be included when ordering this group. Model T1 Timer is recommended because it provides predetermined time operation with Model 163 Scaler.

When this group is ordered together, a "Nuclearule" Calculator is also supplied without charge.

Shipping weight — 81 lbs. plus 75 lb. tank.

Counting System

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When this group is ordered together, a "Nuclearule" Calculator is also supplied without charge.

Shipping weight — 81 lbs. plus 75 lb. tank.

MODEL 2111

Monitor

ALPHA PORTABLE COUNT RATE METER



- Detects only alpha in presence of other radiation.
- Entire circuit easily removable as a unit.
- Convenient reset button.

Model 2111 Portable Alpha Proportional Counter is an easily portable instrument designed for detection of alpha particles only.▲ It may be used to determine alpha activity in laboratories, on table tops and hands, and in similar locations.

With the probe attached to the instrument, it will detect only alpha radiation in the presence of other radiation and produce a popping noise in the ear-phones. 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. There are two count-rate scales; 0 to 2,000 counts per minute and 0 to 20,000 counts per minute.

As an operating convenience, a pushbutton is provided to immediately reset the meter after exposure to a strong alpha source, which would otherwise require considerable delay before the meter returned to zero.

The instrument is well balanced for ease in carrying, and a canvas bag with strap holders into which the instrument will fit is available at extra cost. Ear-phones are supplied with the instrument. The necessary operating voltages are supplied by the following batteries: two 1200 volt batteries for the proportional counter with arrangement for voltage adjustment; B

plus voltages are supplied by one 67-1/2 volt battery; and filament power is supplied by two 1-1/2 volt batteries.

One of the unusual features of the Model 2111 is the plug-in 4-tube circuit chassis.▲ The entire circuit is easily removed for servicing in case of damage or tube failure. Servicing is greatly simplified by this arrangement.

The Model 2111 circuit and power supply is housed in one all-aluminum gray anodized case measuring 5-3/8" X 8" X 11-7/8". The smooth finish makes the surface easy to decontaminate and also prevents accumulation of foreign matter.

The complete instrument is convenient to carry and weighs only 16 pounds. It is shipped with an instruction manual only. The probe must be ordered separately. (See page 33).

Shipping weight — 18 lbs.

▲ — indicates exclusive Nuclear feature.

MODEL 2610A

Monitor

BETA-GAMMA PORTABLE COUNT RATE METER

- Light-weight for easy portability.
- Watertight case and probe.
- Simple, one hand operation.
- Large, easy-to-read meter shows intensity.
- Shield for beta and gamma distinction.

Model 2610A count rate meter is a light weight, dependable, battery operated instrument designed for general survey work and for the location of small amounts of radioactivity in rooms, laboratories, on desks, laboratory coats, and similar areas. It has also been found useful for X-ray monitoring and geological surveying for radioactive ore.

This instrument is ruggedly constructed for long operating life, with both case and probe sealed against moisture. The probe is conveniently mounted in the handle and is easily removed. The range switch below the handle can be controlled with a fingertip while the probe is carried in the other hand.▲

▲ — indicates exclusive Nuclear feature.



A rotating shield is provided so that a distinction between beta particles and gamma rays may be made. When the shield covers the window of the probe, beta particles are then prevented from reaching the Geiger tube so that only gamma rays are counted.

The plug-in Geiger tube (Model D50) requires no soldering, and the probe is quickly disassembled when necessary by a simple twist.

The circuit of Model 2610A is the same circuit that has been used for years in Model 2610 and is known for its reliability in operation. The instrument is sensitive enough for detection of normal cosmic ray background. At the same time it will read intensities well above health tolerance level. This range is adequate for most ordinary laboratory work.

OPERATION

Operation of Model 2610A Count Rate Meter is extremely simple. The Geiger counter may be used in its attached position if desired, or removed for probing in confined spaces or small areas. An "off" position (meter shunted for protection in "off" position) and three ranges are provided (0.2, 2, and 20 milliroentgens per hour full scale) on a selector switch. Tolerance level (12.5 mr. per hour for an 8 hour day) is slightly over half scale on the 20 mr range. The unit is calibrated before shipment with a standardized radium gamma source, and the source which is normally shipped with the instrument is intended only for checking this calibration when necessary.

PHYSICAL DESCRIPTION

Model 2610A Count Rate Meter is housed in an attractive aluminum case painted with simulated ham-

mered finish. The finish is smooth enamel to make the surface easy to decontaminate when necessary, and also to prevent accumulation of dust or dirt. The interior cannot become contaminated since the entire case is sealed. A radioactive source is provided with the instrument for purposes of checking calibration, and is mounted in a convenient holder at the end of the instrument.▲ Strap holders are also included so that a shoulder strap can be used if desired.

Earphones are provided with the instrument, which is supplied with a complete set of batteries. The necessary high voltage for the Geiger tube is supplied by three 300 volt battery packs plus one 67½ volt battery. There is also one 1½ volt battery for "A" supply.

All components are chosen to insure low battery drain. Two hearing aid type tubes, a 20 microampere meter, and crystal earphones are used in the Model 2610A instrument. These parts make possible a battery life of over 250 hours when operated four hours a day. Overall dimensions of the case are 10" x 4¾" x 5¾" deep, and the complete instrument weighs only 9½ pounds. Supplied complete with earphones, all batteries, calibration source, and instruction book.

Shipping weight — 13 lbs.

CARRYING STRAP — A plastic shoulder strap for carrying Model 2610A or Model 2611 Portable Meter is available at a nominal charge. This strap is 1½" wide and extends to a maximum length of 53". It is adjustable in length and is provided with clips which attach to the above meters or those of other manufacture.

MODEL 2611 *Count Rate Meter*



▲ — indicates exclusive Nuclear feature.

Model 2611 Count Rate Meter utilizes the same circuit, voltage, and general construction as Model 2610A, except that the probe has a thin end window counter for detecting such materials as carbon 14 or sulphur 35.▲ The mica window has a density of only 1.4 milligrams per sq. cm. and will therefore monitor alphas as well as more penetrating radiation. This counter, Nuclear Model D35, has an effective window diameter of ¾". Counting life is unlimited by use. (See page 33.) The probe is provided with a metal cover to permit the unit to be used for gamma surveying only, or the cover may be removed for monitoring alphas and all betas.▲

Model 2611 count rate meter is provided complete with batteries, headphone, calibration source, and instruction book.

Shipping weight — 13 lbs.

MODEL 1615

Monitoring Instrument



“RADIATION SENTINEL”

- Excellent for monitoring any isotope.
- Long cable (optional) allows use of probe 10 feet from instrument.
- Provision for attaching chart-type recorder.
- Magnetic probe for universal mounting.

Model 1615 “Radiation Sentinel” is a general purpose alpha-beta-gamma count rate instrument with wide utility. It was designed for checking clothing, benches, glassware, and hands or fingertips for contamination in a simple and rapid manner, and may also be used for continuous monitoring of background, air contamination, or isotope decay. For such purposes it may be used with a chart type recorder for maintaining a continuous record.▲

In addition to these surveying and monitoring applications, the “Radiation Sentinel” can also be used to count samples with activities between 100 and 50,000 counts per minute where accuracy of measurement need not be better than 3 % standard error.

▲ — indicates exclusive Nuclear feature.



The count rate circuit of the "Sentinel" is a simple trigger pulse shaper followed by a step charging integrator. The five position range selection switch[▲] on the front of the instrument selects ranges of 500, 1500, 5000, 15,000 and 50,000 counts per minute full scale, permitting choice of the optimum range for reading accuracy. The time constant for each of these ranges is such that either a 3% or 20%[▲] standard error is read, depending on the position of the switch controlling this factor. These two errors may be selected for any range, and a momentary position is also provided on the switch to permit the needle to correct rapidly to an approximate reading before using the 3% position.[▲]

For audible counting a loud speaker is built into the instrument. Its volume is controlled from a knob on the front panel. A high voltage supply is built into this instrument, and is variable between 600 and 1500 volts, stabilized so that line voltage fluctuations between 95 and 130 volts give a change of only 20 volts at 1000 volts.

The probe and Geiger counter provided with the "Radiation Sentinel" consist of a light-weight probe assembly having the unusual feature that it may be mounted at any position on the "Sentinel" cabinet by means of a built-in magnet.[▲] With this magnet the counter may be placed on one side of the cabinet or may even be placed vertically and used as a mount for the counter tube so that a sample may be placed under it. This unique magnetic holder makes possible mounting of the probe on a ring stand, vacuum line, or any ferromagnetic material.

In many laboratories it will be desirable to use a longer cable, either for placing the "Sentinel" in one position and monitoring a large area, or for use in clinics and hospitals to study the uptake of radioactive

materials in the human body. For such purposes Model P10 probe is available at extra cost. This probe includes a preamplifier and a 10' cable for maximum utility.[▲]

The detector used in Model 1615 "Radiation Sentinel" is a halogen quenched mica window counter with a life which is unlimited by counting. The "Sentinel" is supplied as standard with a counter having a window thickness of 3.5 mg/cm². One having the window thickness of 1.4 mg/cm² may be supplied upon request at small additional cost.

A feature of either one of these mica window counters is the rugged construction used. The anode has a large diameter to make it very strong, and the stainless steel cathode minimizes the danger of breaking the counter. The end window is so constructed that stresses are equalized and touching the window of the counter is not apt to break it. This counter will withstand severe pressure changes without damage, so that normal shipping or handling procedures will not affect its life.

Provision is made on the back of the Model 1615 "Radiation Sentinel" for a recording meter having sensitivity of 1 milliamperes full scale.[▲] NUCLEAR recommends the Esterline-Angus recorder which can be supplied and which is shown on the attached price list. This instrument records the counting rate which is also shown on the meter on the front panel of the "Sentinel".

As a constantly available check on calibration there is a built-in pulse generator which permits calibration adjustment. Zero adjustment is also provided.

Model 1615 "Radiation Sentinel" is supplied complete with probe, cable, and detector.

Shipping weight — 30 lbs.

▲ — indicates exclusive Nuclear feature.

MODEL 2050A and MODEL 3340A

Monitoring

Instruments

FOR PERSONNEL PROTECTION

- Light-weight, rugged, hermetically sealed pocket chamber.
- Diaphragm prevents accidental discharge of chamber.
- All-electronic model 2050 reads and charges simultaneously.
- Reading easily visible on large meter.

Laboratory personnel working with X or gamma radiation require sensitive detectors to provide daily indication of radiation to which they have been subjected. Model 3340A pocket chambers, used with Model 2050A charger-reader, are designed for this purpose. This new chamber, with a capacity of .2r, is plastic and weighs only $\frac{1}{2}$ ounce. The instrument is not affected by atmospheric conditions, because a vapor-tight diaphragm isolates the interior from humidity effects. The use of a contact button in that diaphragm prevents accidental discharge because the button touches the inner electrode only when depressed.▲ Severe shock tests, as well as moisture resistance tests at various temperatures, have proven the ruggedness of this chamber. A strong spring clip is provided, and each chamber is numbered for convenience in recording.

Model 2050A charger-reader is an all-electronic▲ device for reading and recharging Model 3340A pocket chamber. It will also charge and read chambers of other manufacture. A light is provided behind the charging socket so that self-reading type dosimeters may also be charged easily.

Model 2050A is very convenient to use because readings are made on a large meter.▲ The chamber is simply inserted in a socket on the panel and one button pressed. Reading and charging are accomplished simultaneously without any special adjustment. There are no delicate parts to cause trouble because the instrument is vacuum-tube operated and extremely rugged. Stable operation is provided at any line voltage between 95 and 130 volts. Its smooth metal case makes decontamination easy. Each pocket chamber and charger reader is provided with operating instructions.

Shipping weight of Model 2050A — 13 lbs.



NEW CONSTRUCTION — Both instruments were changed and improved just before this catalog was printed.

▲ — Indicates exclusive Nuclear feature.

MODEL 2301

SUPER

Sniffer

**PORTABLE
GEIGER
COUNTER**

- Small, light-weight for greatest convenience.
- Flashing neon light.
- Uses only flashlight batteries.

The new Model 2301 "Sniffer" is really a "Super-Sniffer", since it is a greatly superior instrument as compared to the widely used "Sniffer" which has already become world famous as a light weight, inexpensive and dependable prospector's tool. In addition to its use in the field, Model 2301 may also be used for fairly accurate monitoring or in searching for lost radioactive materials.

(Since uranium ore has become strategically important to the country, the U.S. government offers a \$10,000 reward for a certain grade of ore which will meet conditions set up. This prize, as well as a generous price for other uranium ore, has spurred prospecting all over the country. The "Sniffer" is ideal for such use.)

The new Model 2301 "Sniffer" provides visual indication by means of a flashing neon light, in addition to the audible sound in the earphones. Battery installation is very easy, since two flashlight cells supply all power. Removal of a snap cover▲ on one end of the unit permits insertion of batteries. Instrument covers need not be removed at any time.

A beta window is provided in the bottom of the

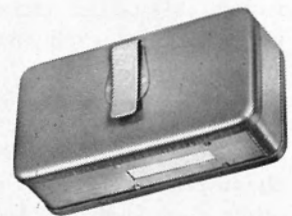
new "Sniffer" so that, in conjunction with a new thin wall brass Geiger counter,▲ the portable instrument will detect betas of medium energy. This change will improve its sensitivity for many purposes.

The "Sniffer" is made without a separate probe because its small overall size makes possible the use of the entire instrument as a probe. It may be lowered into wells, fissures, mines, or other ground openings.

The circuit of the new "Sniffer" is a completely new one which may be said to be so simple as to be almost beyond failure. The number of electronic components is minimized because voltage transformation, regulation, and signal amplification are obtained by utilizing a unique, single circuit. This design insures long life without failure.

Model 2301 "Sniffer" is shipped complete with headphones, batteries, a radioactive checking source, and the government booklet "Prospecting for Uranium."

Shipping weight — 4 lbs.



Opposite view shows belt clip, beta window, and battery cover.

▲ — indicates exclusive Nuclear feature.

MODEL 1613

Demonstrator

"CLASSMASTER"

- Clear indication on large meter.
- Speaker for demonstration to class.
- Complete accessories permit carrying out course of study.

Nuclear Model 1613A "Classmaster" is the first complete radioactivity teaching unit which is adaptable to every need, from lecture or demonstration use to that of a complete course in elementary nucleonics.▲ It is more than just an interesting "toy" or "gadget", because it includes radioactive sources, an extendable probe on a three-foot cable, a calibrated mounting board, absorbers, other study accessories, and a thorough manual of instruction. An oscilloscope connection is also provided.

While the "Classmaster" was designed especially for teaching purposes, it is also ideal for persons giving talks on radioactivity phenomena to nonacademic audiences.

▲ — indicates exclusive Nuclear feature.



The central unit of the set is an electronic demonstrator which shows various radioactivity phenomena both audibly and visually. A built-in speaker gives clicks and a neon lamp flashes simultaneously for each disintegration detected by the Geiger counter. At the same time the rate of counts is shown clearly on a large calibrated meter on the front of the instrument.

The major accessory supplied with the "Classmaster" is a 26" mounting fixture▲ with a probe clamp and slots to hold absorbers upright next to the counter. The balance of the length of the fixture contains a calibrated slot for the radioactive source. The fixture is calibrated in both inches and centimeters.

Two radium beta-gamma sources▲ are also included, as well as a number of rectangular lead, aluminum, and cardboard absorbers and a set of similar cylinders for scattering experiments.▲ The sources are each marked to make it possible for several persons to reproduce any experiment. No special government approval is necessary to purchase or use the "Classmaster."

The complete instruction manual is provided with drawings, instructions, and experiments so that the set may be used simply as a classroom demonstrator in junior high, high school, junior college, or college physics lectures; or as a complete laboratory tool for use by more advanced students in carrying out a course in elementary nucleonics.

OPERATION

Putting the "Classmaster" into operation is simple. The line cord is plugged in and the voltage set to the operating level. The unit is then ready for use. A panel knob allows control of speaker volume and a meter range knob permits selection of "volts", "counts per minute times 10" or "counts per minute times 1". The operation and experiments are described in detail in the accompanying manual.

FEATURES

The complete Nuclear Model 1613A "Classmaster" has the following important features:

ELECTRONIC MONITOR provides aural and visual indication.

SPEAKER VOLUME CONTROL provided on the front panel.

LARGE METER shows count rate or voltage.

COUNTER IN PROBE with 3-foot cable for greater utility. Uses Model D51 Geiger counter.

MOUNTING FIXTURE▲ permits sources to be placed at known distances up to 50 cm. from the G-M tube.

ABSORBERS▲ included for experiments . . . 20 cardboard, 15 aluminum, 10 lead.

SHIELDING CYLINDERS▲ of lead, aluminum, and cardboard included for scattering experiments.

TWO RADIUM BETA-GAMMA SOURCES in convenient, plastic enclosed form. Each one is marked distinctively for identification.

LIGHTWEIGHT UNIT weighs only 16 pounds, making it easily portable.

COMPLETE ELEMENTARY COURSE▲ in nucleonics provided by the instruction manual.

POWER REQUIREMENT . . . 120 volt, 60 cycle A-C.

Shipping weight — 30 lbs.

DEMONSTRATION METER▲ — Large, seven inch Model MR1 Meter may be used where a large group must be able to see the meter reading on Model 1613A "Classmaster." This meter is easily connected to the rear of the "Classmaster" with leads provided.

▲ — indicates exclusive Nuclear feature.

Nuclear "Classmaster" with Model MR1 classroom meter.



MODEL D46A

Detector

"Q-GAS" FLOW COUNTER

- Provides maximum efficiency for counting soft radiation.
- Background shielded only 17-18 cpm.
- Low potential and atmospheric pressure.
- Complete with gas, sample holder, sample pans, and regulator ready for simple connection to scaler.
- Rapid pre-flushing when changing samples.

Model D46A is an improved model of the well-known "Q-Gas" Counter, a combination of a specially constructed counting chamber and a helium-butane counting gas for the efficient detection of soft ionizing radiation like that of C^{14} and S^{35} . It is used primarily to detect alpha particles and very soft beta radiation — simply and with maximum efficiency. Efficient counting is possible because it operates at atmospheric pressure with the sample placed within the counting chamber. The counter operates with an anode potential of only 1250 volts.

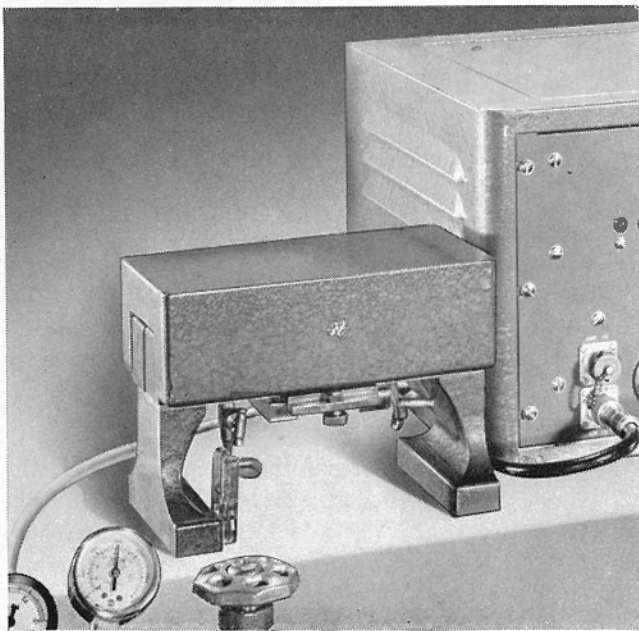
Improvements to be found in Model D46A consist of certain mechanical changes, plus a background (shielded) of only 17-18 counts per minute* to permit faster counting of low activity samples. Short preflush time — only 10 seconds between samples — speeds counting still further.

The "Q-Gas" Counter is primarily a Geiger counter, and operates equally well whether the gas is flowing or static. The usual operating procedure is to allow the gas to flow slowly to eliminate the possibility of air leakage. Preflushing between samples is simple and quick. When the sample is introduced, the slide is not quite closed for about 10 seconds, allowing gas to flow through the slide opening.

An unusually long plateau is another attractive feature of the "Q-Gas" Counter. Counting starts at 1025 volts. Plateau threshold is at 1100 volts. The plateau is 400 volts long with an overall slope of less than 3% per 100 volts. This characteristic permits counting without critical voltage control.

Model D46A is relatively insensitive to temperature or atmospheric pressure changes, and has a pulse output that will operate any scaling unit with an input sensitivity of .25 volts.

*At 600 feet above sea level.



Model D46A Q-Gas Counter shielded with Model 3032 Lead Shield to minimize background count.

cosmic ray background is 25 counts per minute unshielded. When used with Model 3032 Lead Shield the background count is reduced to 17-18 counts per minute.

The internal parts of this counter are simple in design, and all surfaces are easily cleansed. The sample holder is 1-1/4" in diameter and is mounted in a stainless steel slide. It will accommodate sample trays with rims up to 1/8" in height. Provision is also made for the use of suitable absorbers.

Desired flow rate and pressure of "Q-Gas" are controlled with a small valve, and a specially designed bubbler is provided for monitoring the rate of gas flow.

Model D46A "Q-Gas" Counter is supplied complete with one tank of gas, pressure regulator, one dozen sample pans, and the necessary plastic tubing. Additional supplies of "Q-Gas" are available from stock.

Shipping weight — 15 lbs. plus 42 lb. tank.

MODEL D45

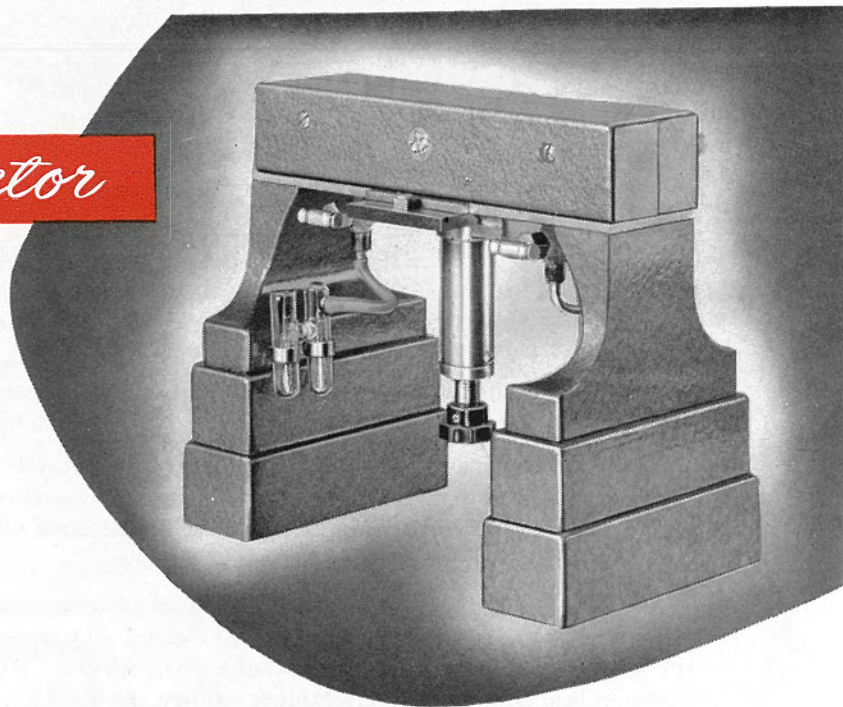
Detector

METHANE FLOW ALPHA COUNTER

- Counts alphas in presence of high beta activity.
- Variable geometry up to 50%.

Model D45 Methane Flow Proportional Counter is designed to count alpha particles in the presence of high beta activity with 50% geometry and low coincidence losses. When used with a high gain linear amplifier and a relatively fast scaler (such as NUCLEAR Model 162), it is possible to count alpha particles in the presence of beta activity in the range of $5(10)^9$ disintegrations per minute. Measurements of this type are particularly useful in chemical and biological research.

The counter chamber has a highly polished cylindrical cathode with an anode of .002" diameter tung-



sten wire mounted in glass insulators. Decontamination is easily accomplished. The sample holder, mounted in a stainless steel sample changer, is designed for 1" diameter samples which may be raised up into the counting volume for improved geometry.▲ Flow of methane gas is controlled by means of valves and a bubbler.

Shipping Weight — 15 lbs.

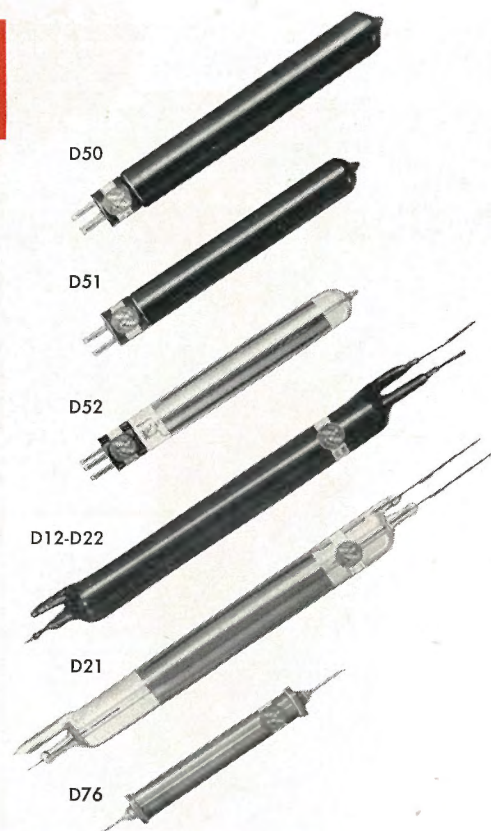
▲ — indicates exclusive Nuclear feature.

Detectors

NUCLEAR self-quenching Geiger counters are available in several types and dimensions. Models D21 and D22 are useful for gamma detection only, and the other glass counters detect both beta and gamma of over .2 mev. Model D76 is brass and will detect all gamma rays and also beta radiation with energy of .4 mev or greater. Minimum life is 10^8 counts. Cathode materials vary as listed below.

	D12	D21	D22	D50	D51	D52*	D76
Max. Diameter (Inches)	$\frac{9}{16}$	$\frac{9}{16}$	$\frac{9}{16}$	$\frac{3}{4}$	$2\frac{1}{32}$	$2\frac{1}{32}$	$\frac{9}{16}$
Overall Length (Inches)	$8\frac{1}{4}$	$8\frac{1}{4}$	$8\frac{1}{4}$	6	$5\frac{1}{4}$	$5\frac{1}{4}$	$3\frac{1}{2}$
Cathode Length (Inches)	3	3	3	3	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
Cathode Material	Carbon	Silver	Carbon	Carbon	Carbon	Silver	Brass
Base	None	None	None	3 pin	3 pin	3 pin	None
Window Thickness (mg/cm ²)	35	300	300	35	35	35	100
Plateau Length (Volts)	150	150	150	150	150	150	300
Plateau slope (%)	3	3	3	3	3	3	5
Operating Voltage	970	950	970	925	925	950	1200
Threshold Voltage	880	880	880	850	850	875	1050

*Model D 52 is specially insulated for use as a dip counter.



Model D33-D34 **Mica End Window-Counters** are exceptionally long lived because of their rugged construction and the fact that their counting life is not limited by use. They will stand repeated over-voltage without appreciable effect. A heavy gauge anode and stainless steel cathode-envelope make this counter very sturdy. The mica window, even as thin as 1.4 mg/cm², may be tapped with the finger without damage, because of the fused mica-to-glass seal. This window withstands great pressure changes, and is excellent for use in vacuum systems because it is filled at low pressure. Operating voltage is 900 volts.

Window thickness of Model D33 is 3.5 mg/cm². Model D34 is 1.4 mg/cm².

Shipping weight — 1 lb. each.

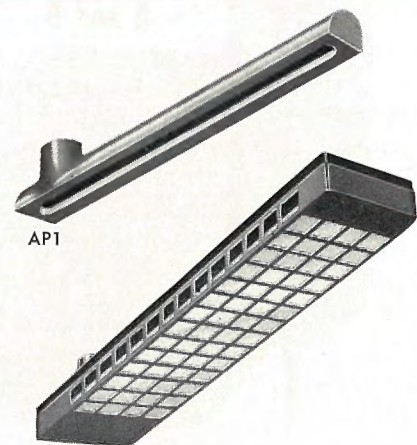


D33-D34

Air proportional probes for alpha survey purposes are available in two types. These may be used with Model 2111 Monitor, Model 162, or Model 172 Scaler. The probes have extremely low background because they are sensitive only to alpha radiation. Each has a thin window of about one mg/cm² thickness.

Model AP1 Pencil Probe is intended for use in small spaces or for checking small spots.

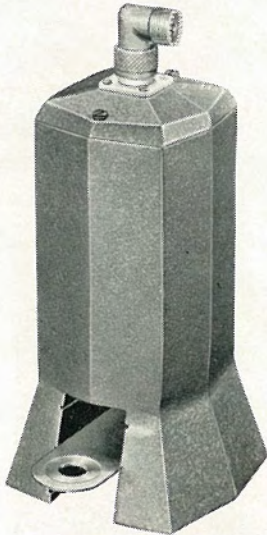
Model AP2 Flat Probe has a sensitive area of 75 sq. cm. for checking large areas for alpha contamination. (Health tolerance is expressed in terms of 150 sq. cm. areas.)



AP1

AP2

MODEL M2 Mount



NUCLEAR Model M2 Mount and Sample Holder provides a support for standard mica end window counters, and contains several slots for predetermined geometries. It is lightweight aluminum, finished in a smooth gray enamel. A plug-in connector for the mica window tube is provided. When used within a lead brick wall, it produces extremely good shielding because the aluminum mount reduces scatter radiation background to a minimum.

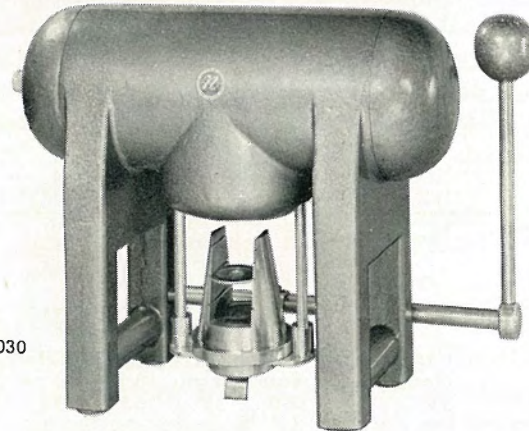
Shipping weight—16 lbs.

MODEL 3033 A and B



Model 3033A Shield permits use of mica window counters as directional probes. It includes a three foot cable and connector. Model 3033B includes a preamplifier and 10 foot cable.

Shipping weight—8 lbs.



Model 3030

LEAD Background Shields

Model 3030 Horizontal Lead Shield is a cylindrical shield mounted horizontally on four legs spaced to give stability. An aluminum lining reduces scatter radiation. The shield is designed for use with a standard glass wall counter and includes simple provision for connecting the counter to a cable. A sample-lifting mechanism is provided with accurately reproducible geometries.

Shipping weight—110 lbs.



Model 3031A

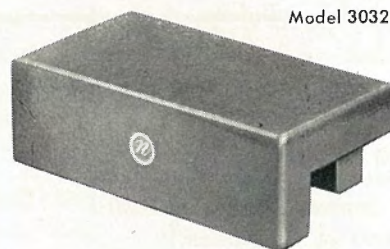
Model 3031A Vertical Lead Shield is a new and greatly improved two inch shield for use with Models D31, D32, D33, or D34 counters or other type 1B84 & 1B85 tubes.

The outer shell is aluminum, and the inner aluminum liner, together with the special lucite pieces[▲] provided, reduces backscatter to a minimum. Three accurately reproducible geometries are available, and sample changing is simple, because samples may be introduced from either side of the shield. Two sample holders are supplied, with adapters[▲] to accept various diameter samples from 1" up to 1 $\frac{3}{4}$ " diameter.

Shipping weight—115 lbs.

Model 3032 Lead Shield fits on Model D46A "Q-Gas" Counter and can be used only with this counter. In use it reduces background count of the "Q-Gas" Counter approximately 40%. A cut-out position at one end prevents interference with the connection on the counter.

Shipping weight—54 lbs.



Model 3032

▲— indicates exclusive Nuclear feature.

MODEL 1090 High Voltage Supply

Model 1090 High Voltage Supply provides continuously variable d-c from 0 to 5000 volts, plus or minus, for ionization measurements and other low drain applications. Maximum output is 200 microamperes dc. The ac component is less than 0.1 volts ac at 5000 volts dc, and is approximately proportional to the output voltage. It is not affected by the amount of current drawn. Output voltage varies less than .01 percent for line voltage change from 95 to 130 volts, over the entire range.

The cadmium plated steel chassis with anodized gray panel is mounted in a standard 10½" by 21½" by 14" steel cabinet finished in smooth gray enamel. Shipping weight — 75 lbs.



MODEL 1061 Linear Amplifier

Model 1061 Linear Amplifier, used with NUCLEAR G-M scalers, permits the user to do proportional counting. Convenient sensitivity adjustment, calibrated in millivolts, and a choice of 1 or 10 millivolt maximum sensitivity, with flat frequency response from 10,000 cycles to 1.5 megacycles. Resolution time is five microseconds. A set of 'scope terminals are on the front panel, and other connections on the rear. ON-OFF switch permits the scaler to operate independently without disconnection.

Shipping weight—25 lbs. (Specify scaler to be used.)



MODEL 1022 Pulse Generator

Model 1022 Pulse Generator is designed for checking scaler sensitivity, and for other general test work. It provides pulses, either positive or negative, with a choice of 1, 10, or 100 microsecond width. Maximum amplitude is 20 volts, in three ranges of 0-5, 0-5, and 0-20 volts. Pulse frequency on 60 cycle supply is 60 per second, or an external oscillator may be connected for as high as 200,000 per second.

Variations in line voltage between 110 and 125 volts do not appreciably affect the output pulse. Accuracy of meter readings is within 5% over the entire range. Shipping weight — 25 lbs.



MODEL T1 Dual Timer

NUCLEAR Model T1 Dual Purpose Timer is designed especially for use with Model 163 Scaler. It will either stop the scaler after a preset time,▲ or will show elapsed time. It will control from two seconds to 60 minutes, with ½ second increments.

Model T1 Timer is 4½" on each edge and is operated by a 110 volt, 60 cycle, supply from the scaler. Connectors, cable, and instructions are furnished. Shipping Weight — 7 lbs.

Model SM60 Timer (not shown) is an electric stop clock for showing elapsed time only. Shipping weight — 6 lbs.

▲ — indicates exclusive Nuclear feature.

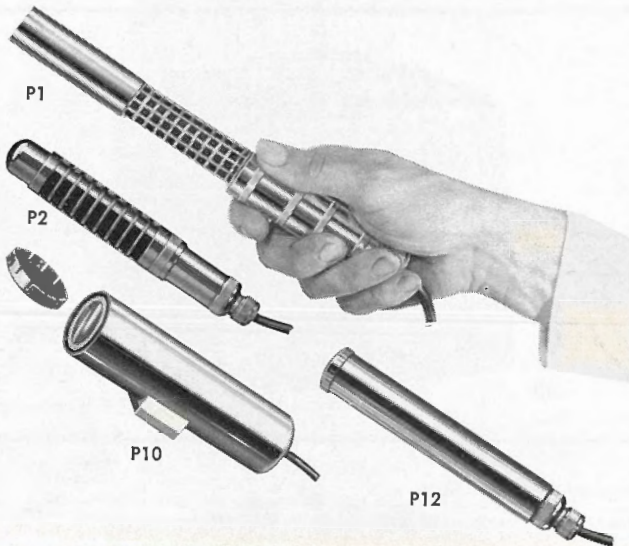




MODEL CA2 Scaler Cart

Model CA2 Scaler Cart is designed to transport a scaling instrument and accessories around the laboratory or in a hospital. These carts are of stainless steel construction with Bassick casters and 3" rubber wheels. The top shelf is intended for the scaler, and also has room for notebooks, pencils, counter, etc. A ridge around the outside prevents such items from falling off. Accessories may be stored on the lower shelves. Size of the cart is 18 in. by 27 in. by 32 in. high.

Shipping weight — 37 lbs.



GEIGER Probes

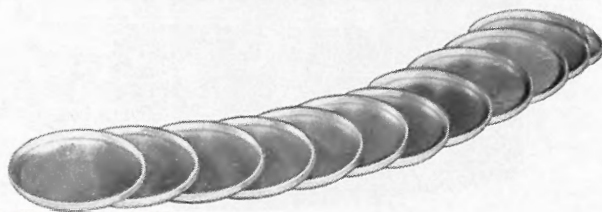
The following probes are normally supplied with other equipment, but are also available separately. They are of chrome plated brass construction, with cable and connector.

Model P1 and P2 probes are used with glass Geiger counters. Model P1 uses an Eck & Krebs type counter and has a 360° sliding shield for discrimination. Model P2 uses a plug-in three-pin counter (Model D50) and has a revolving shield which exposes a 180° angle.

Model P10 incorporates a preamplifier and a ten-foot cable, and accepts Nuclear Model D33 or D34 end window counter or other similar counters.

Model P12 accepts NUCLEAR Model D35 end window counter. (1" diameter).

(Order counter separately—see page 33)



Sample Pans

Nuclear sample pans are available in three types: flat Model SB125 and cupped Model SA125 (aluminum), and cupped Model SC125 (cellulose acetate). All are 1¼ inches in diameter, and the cupped pans are ⅛" deep. They are expressly designed to fit Model D46A Q-gas Counter, but may also be used with other counters.



MODEL R2 Radium Source

Model R2 calibrating source is intended for checking calibration of Model 2610A or 2611 Count Rate Meter, but it may also be used for other purposes. The source consists of 2 or 3 micrograms of radium in a plastic cylinder. One end of the cylinder gives a reading of approximately 10 times that of the opposite end. The exact strength, as read on Model 2610A, is stamped on the corresponding end of the cylinder.

Radium sources used with Model 1613A "Class-master" are of different intensity and not calibrated. Orders for sources are filled with Model R2 unless otherwise specified.

Liquid Counter Set

Model LC1 Liquid Counter Set permits counting of radioactive solutions in a simple manner. It consists of ring stand, clamps, a ring support with a beaker support, a dipping type Geiger counter and cable which will attach to NUCLEAR scalars, and one each Marinelli beaker and test tube.

The Marinelli beaker has a glass tube sealed through the center so that the Geiger counter may be surrounded by gamma emitting liquid without wetting the counter. This arrangement simplifies cleaning. The counter may be mounted upright and the beaker placed over it. (See inset).

The test tube holds 20 cc of liquid when the counter is inserted as far as possible. The liquid then surrounds the sensitive portion of the counter for maximum geometry when counting beta emitters. Additional quantities of test tubes or Marinelli beakers are obtainable as listed below.

Shipping weight — 7 lbs.



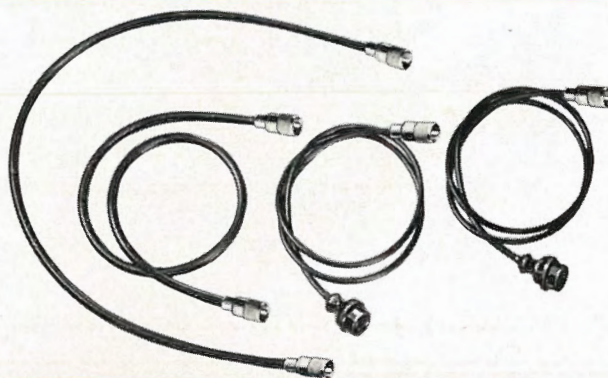
Model LB1 Marinelli-type beaker for use with counter set.
Model LT1 test tube for use with counter set shown above.



High Voltage Cables

The cables listed below are specially designed for use with NUCLEAR equipment. All cables are assembled from high quality components and are fully shielded throughout.

MODEL NO.	CONNECTIONS MADE
PC1	Two alligator clips to standard 4-pin socket
PC2	Scaler (161, 163, 165, 166) to standard 4-pin socket
PC3	Scaler (162, 172) to standard 4-pin socket
PC4	Scaler (162, 172) to Model D46 Counter
PC6	Scaler (161, 163, 165, 166) to standard 3-pin socket
PC7	Adapter — Type HN to type UHF connectors



NUCLEARULE[▲] Calculator

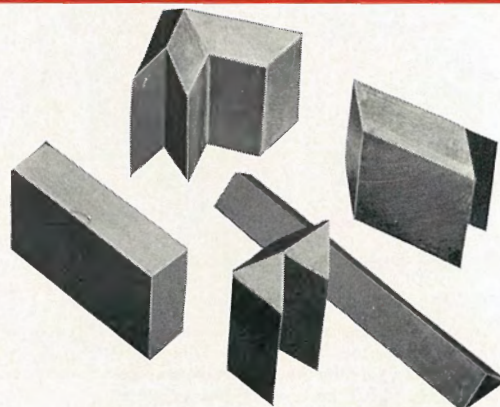
NUCLEAR'S exclusive Nuclearule is a special combination of scales arranged in circular slide rule form to simplify many of the calculations which must be made in nuclear laboratories. A great many of these rules are already in use. Available at a nominal charge, the Nuclearule will aid in determining the following information: count rate, statistical error, coincidence loss, activity of sample versus half life, radiation flux after passage through absorbers, and other useful data.



LEAD BRICKS for Shielding

NUCLEAR Lead Bricks are available in two types. Model 3038 Bricks are rectangular in shape and weigh 26 lbs. each. Dimensions are 2" x 4" x 8".

Model 3039 Interlocking Bricks are especially designed to eliminate the low density "joint space" between ordinary, smooth faced bricks. Interlocking sections are designed so that a complete dense wall may be obtained, and provision is made for corners and similar construction. Complete instructions on how to order will be furnished on request.



▲ — indicates exclusive Nuclear feature.



Special Instruments

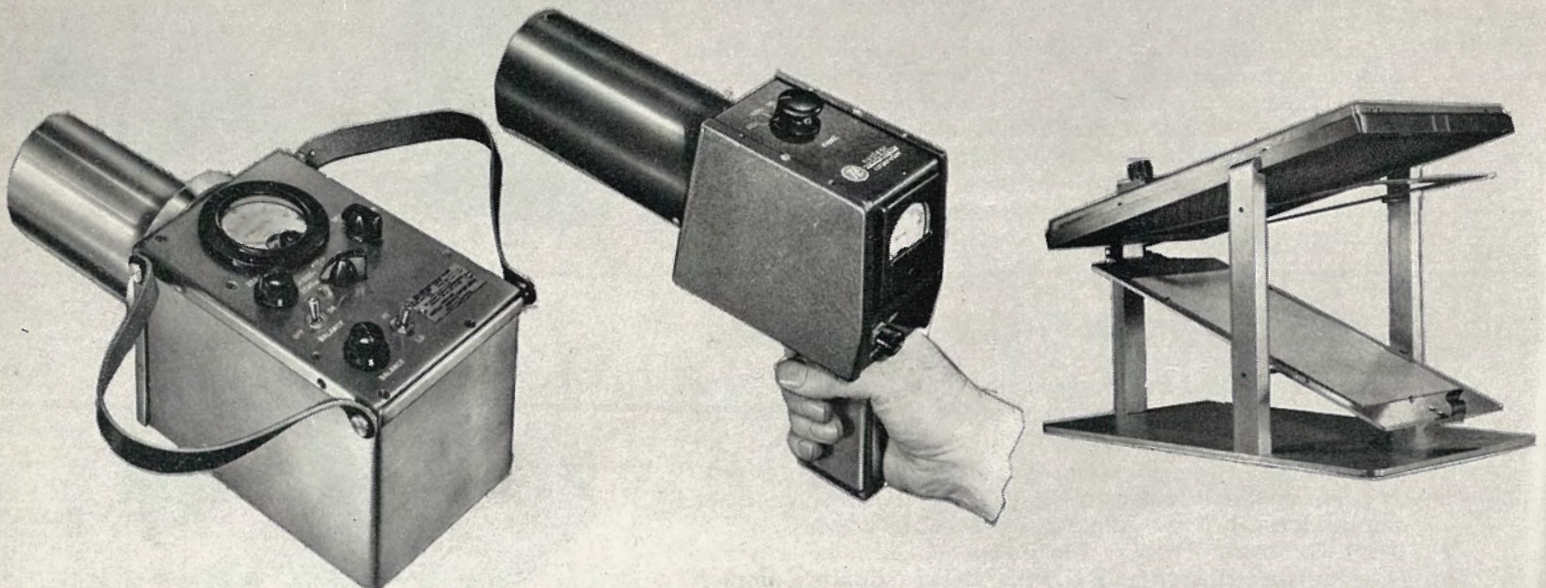
The very nature of research work, as well as the ever-expanding fields of use into which applied nucleonics is reaching, make the need for special instruments and special services inevitable. In order to be of greatest aid to its customers, NUCLEAR maintains a complete engineering department which is prepared to develop and build custom-made instruments and accessories as the need arises.

In general, we consider an instrument special when it must be built to specifications other than those applying to standard catalog instruments. Special features may be as simple as changes in physical construction or as complex as new electronic circuits or counting methods. Where considerable research time is required we will accept development contracts.

The illustrations on this and the opposite page are indicative of the special products we can build, but our facilities are not limited to the types of equipment shown. Your needs, even in different or new branches of nuclear research or related fields, can be met to your full satisfaction.

As an additional service NUCLEAR will send you a *Segre' Chart of Nuclear Properties* or a *Table of Scaling Factors* at no charge, on request.

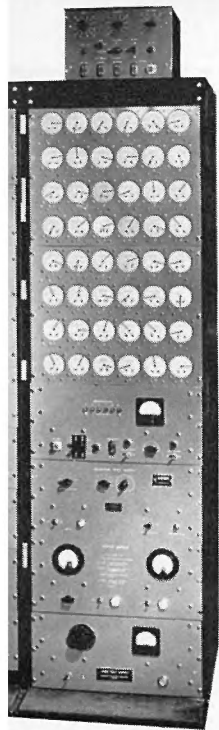
Your inquiries are invited.



Ion chamber instruments, as exemplified by the fast neutron detector and modified "Cutie Pie", can be built to meet particular needs. Such instruments are expected

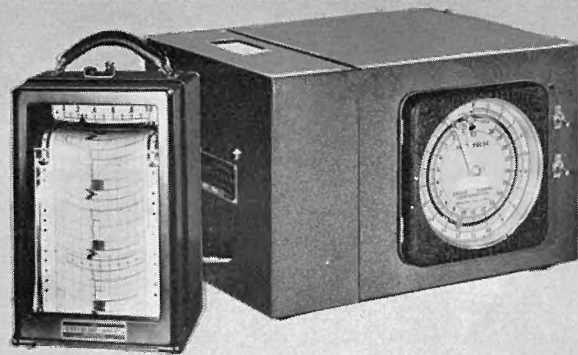
to have both military and civilian use, and NUCLEAR is prepared to manufacture this type of detector as well as proportional and Geiger counters.

Special detectors like this one can be developed for specific counting problems using any type of detector.



channel differential is an example of γ to build complex instrument to customer such instruments may developed or built NUCLEAR circuits.

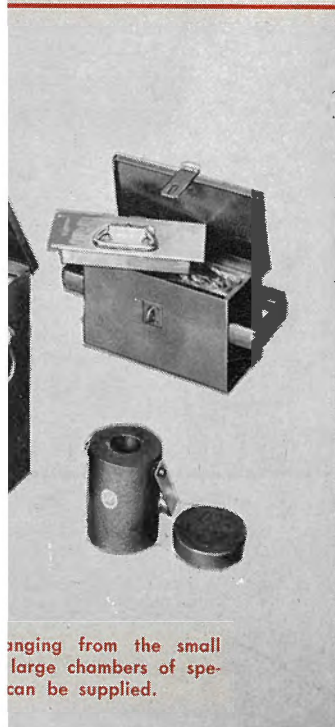
ACCESSORIES—Such devices as Esterline Angus recorders and Streeter-Amet printers can often be used to advantage with Nuclear instruments. We will be glad to supply these, table registers, and other accessories on request.



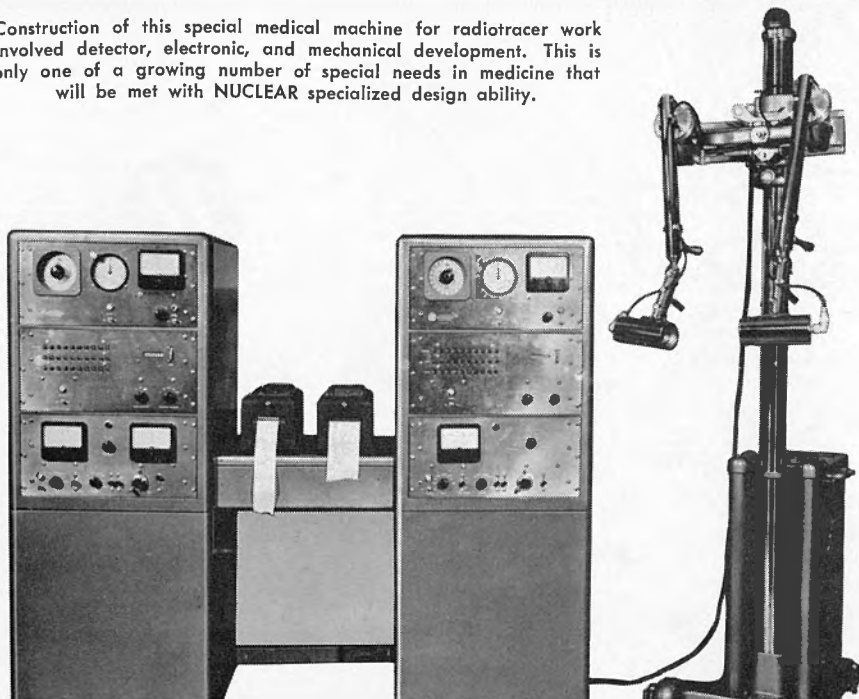
Standard NUCLEAR instruments sometimes must be modified in some special way for a particular use. When a quantity of such instruments are needed we can usually build them at prices competitive with standard units. The same thing is true with such special circuits as Barnaby II (shown at right).



Construction of this special medical machine for radiotracer work involved detector, electronic, and mechanical development. This is only one of a growing number of special needs in medicine that will be met with NUCLEAR specialized design ability.



anging from the small large chambers of spe- can be supplied.



Service Information

Nuclear Instrument and Chemical Corporation instruments rarely need servicing. However, when service is necessary, the instrument is given top priority and every effort is made to return it to the customer in first class condition as soon as possible. We feel that any instrument out of service for any reason is

a loss to its user as well as a reflection on its maker.

When you send an instrument in for repair or request guidance on servicing an instrument yourself, always give the model and serial number, together with full information about its behavior.

Suggestions for Ordering

It is the desire of this company to have our products in use where they are well matched to the job. Occasionally, we learn that one of our instruments is being used where all of its features are not utilized and the particular tasks could be accomplished by another one of our instruments having fewer extra features and at a lower price. Therefore, we recommend that before ordering you give us a brief description of your projected work, and allow us to recommend a suitable complement of instruments to match your project.

When submitting a request for quotation or an order, do not forget to include the following information:

- (1) Model number (Upon receipt of your formal order and written request, we can also inform you of the serial number of the equipment you will get. This is often necessary for Atomic Energy Commission Application Number AEC 313).
- (2) Desired f.o.b. point (prices listed are all f.o.b. Chicago factory.)
- (3) Desired delivery.

- (4) Full information concerning address to which the order is to be shipped.
- (5) All shipments will be Railway Express unless otherwise specified.
- (6) Invoice terms are 1% 10 days, net 30 days, except in the case of foreign orders.

Many NUCLEAR products are in use in various foreign countries and we, of course, will be pleased to supply equipment to foreign customers. Foreign orders and correspondence should be directed to our Export Department, listed at the bottom of the page. All foreign orders require an AEC Export License which we apply for upon receipt of your formal order. In general, each foreign order must be prepaid in U.S. funds before shipment.

It is our policy to quote and make deliveries on a first come — first serve basis. Should an urgent situation arise, we suggest you contact us giving the details of your particular situation via telephone, telegraph, cable, etc., and we will immediately do what we can to assist you.



Nuclear Instrument and Chemical Corporation

223 West Erie St., Chicago 10, Illinois

EXPORT DEPARTMENT

13 East 40th Street

New York 16, New York

U. S. A.

Cable Address: ARLAB New York

PRICE LIST

Effective
April 1, 1951

SCALING UNITS

	On catalog page	Price		On catalog page	Price
Model 172	7	\$945.00	Model 166	13	450.00
Model 163	9	600.00	Model 165	15	395.00
Model 162	11	525.00	Model 161	16	350.00

When the above Scalers are supplied in quantities, prices of special modifications will be furnished upon request.

COUNTING SYSTEMS

Model 117	17	950.00	Model L-165	20	470.00
Model 1014	19	180.00	Model L-163	21	891.00

MONITORING INSTRUMENTS

Model 2111	22	490.00	Model 2383 "Civion"	New	49.50
Model 2610A	23	220.00	Model 2050A	27	175.00
Model 2610A with Model 2091	New	240.00	Model 3340A	27	13.00
Model 2611	24	265.00	Model 2301	28	49.50
Carrying strap	24	5.00	Model 1613A	29	139.50
Model 2091 Power Supply	New	35.00	Model MR1 Auxiliary Meter	30	31.50
Model 1615 (3.5 mg/cm ²)	25	260.00	Model 2584 "An/Pdr-T1"	New	On request
(1.4 mg/cm ²)	25	270.00	Model 2585 "Cutie Pie"	New	220.00

DETECTORS

Model D46A	31	291.00	Model D52	33	15.00
Model D45	32	375.00	Model D76	33	5.00
Model D12	33	15.00	Model D33	33	37.50
Model D21	33	15.00	Model D34	33	47.50
Model D22	33	15.00	Model D35	33	50.00
Model D50	33	11.50	Model AP1	33	25.00
Model D51	33	11.00	Model AP2	33	30.00
			Model PC-5 Handle-cable for AP1-AP2		15.00

ACCESSORIES

Model M2	34	32.00	Model P2	36	25.00
Model 3030A	New	200.00	Model P10	36	47.50
Model 3031A	34	200.00	Model P12	36	30.00
Model 3032	34	49.50	Model SA125	36	3.00/c
Model 3033A	34	50.00	Model SB125	36	2.00/c
Model 3033B	34	70.00	Model SC125 (Cell. Acetate)	New	3.00/c
Model 1090	35	375.00	Model R2	36	5.00
Model 1061	35	130.00	Model R4	New	1.00
Model 1022	35	150.00	Model LC1	37	35.00
Model EC84 Register	New	36.30	Model LT1	37	1.80/doz.
Model T1	35	102.50	Model LB1	37	4.50
Model T2	New	60.00	Model PC1, PC2, PC6	37	4.50
Model SM60	35	55.00	Model PC3, PC4	37	7.50
Model CA2	36	35.00	Model PC7	37	6.50
Model P1	36	20.00	Model PC8	New	7.50
			Model PC9	New	10.00
			Model N1 "Nuclearule"	37	5.00
			Model 3038	37	On request
			Model 3039	37	On request
			Model 1616 "Ore Caster"	New	199.50

All prices are f.o.b. factory (Chicago), and do not include Illinois Retailer's Occupational Tax which will be added to orders for delivery in this state. These prices apply to U.S. and Canada orders.

All prices subject to change without notice. Terms are 1% 10 days. net 30.