THE General Radio EXPERIMENTER

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ELECTRICAL MEASUREMENTS AND THEIR INDUSTRIAL APPLICATIONS®

A NEW UNIT OSCILLATOR—50 to 250 Mc (TYPE 1215-A)

Also IN THIS ISSUE

● **GENERAL RADIO** Unit Oscillators,[1] particularly those covering the v-h-f and u-h-f ranges, have found a wide acceptance in the electronics industry as power sources for use in measurements and testing. These compact, low-priced units cover wide frequency ranges with single-dial control, furnish adequate power for measurement purposes, and are equipped with coaxial fittings at the output terminals to facilitate connection to coaxial equipment.

[1]Eduard Karplus, "V-H-F and U-H-F Unit Oscillators," *General Radio Experimenter*, Vol. XXIV, No. 12, page 7, May, 1950.

Figure 1. View of the Type 1215-A Unit Oscillator.

Two models have hitherto been available, the TYPE 1209-A, which has a frequency range of 250 to 920 megacycles, thus including all u-h-f television channels, and the TYPE 1208-A, 65 to 500 megacycles. A new model, TYPE 1215-A, which will be available for sale next month, covers a frequency range of 50 to 250 megacycles. Both the TYPE 1209-A and the TYPE 1215-A Unit Oscillators use butterfly[2]-type tuning units that are, essentially, the same as those used in the oscillator sections of the TYPE 1021-AU and 1021-AV Standard-Signal Generators.[3] Their frequency stability and their precision of setting are very good. Hence they can be used with confidence for applications that involve heterodyning the operating frequency to produce low-frequency beats.

The TYPE 1208-A Unit Oscillator has the important advantage of a considerably wider frequency range, which is obtained at some sacrifice of stability and ease of setting. The tuned circuit in this unit is a sliding contact type, which is inherently less stable than the butterfly. There has, therefore, been a definite need for a more stable unit oscillator in the v-h-f range.

Like other General Radio Unit Oscillators, the TYPE 1215-A operates from the TYPE 1203-A Unit Power Supply,[4] connection being made through a multipoint connector. The oscillator tube is a 12AT7-type twin-triode miniature, operating in a push-pull circuit. The oscillator unit with its cast aluminum support is mounted on an L-shaped bracket which serves as panel and base. A cylindrical shield is clamped over the oscillator to keep leakage to a minimum. As in the TYPE 1209-A, the output coupling system is a short length of 50-ohm coaxial line with a coupling coil at one end and a TYPE 874 Coaxial Connector at the other end. The assembly is mounted on the cylindrical shield, and the output level is set by rotating or retracting the output assembly. A large wing nut permits clamping the output coupling assembly firmly in any selected position.

Modulation terminals are provided in the cathode circuit for amplitude modulating the new oscillator over the

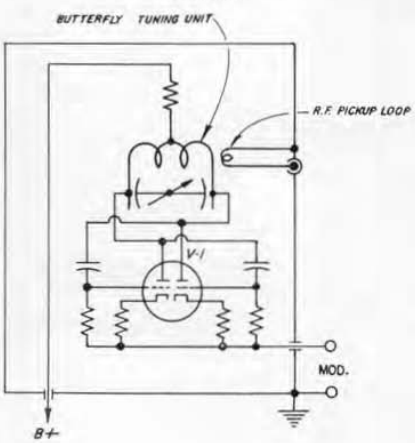
[2]Eduard Karplus, "The Butterfly Circuit," *General Radio Experimenter*, Vol. XIX, No. 5, October, 1944.

[3]Eduard Karplus and E. E. Gross, "A Standard-Signal Generator for Frequencies between 50 and 920 Mc," *General Radio Experimenter*, Vol. XXIV, No. 10, March, 1950.

[4]"New Unit Instruments—Power Supplies—Modulator," *General Radio Experimenter*, Vol. XXVI, No. 2, July, 1951.

Figure 2. Interior view of the Type 1215-A Unit Oscillator with shield cover removed.

Figure 3. Elementary schematic circuit diagram of the oscillator.



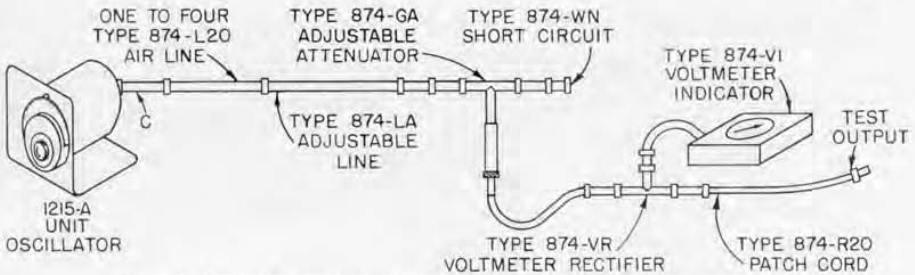


Figure 4. The Unit Oscillator can be assembled with simple auxiliary equipment to form a test-signal generator.

audio frequency range. The TYPE 1214-A Unit Oscillator[4] (400 and 1000 cycles) is well suited for use as the modulating oscillator and provides about 25 per cent amplitude modulation. If amplitude modulation with no significant incidental f-m is desired, the output can be modulated with the TYPE 1023-A Modulator[5] (up to 220 Mc) or with the TYPE 1000-P6 Crystal Modulator.[6]

USES

The usefulness of General Radio u-h-f and v-h-f unit oscillators is greatly enhanced by the availability of coaxial accessories, by means of which the oscillators can be conveniently adapted for specific purposes. Important among these are the TYPE 1000-P6 Crystal Diode Modulator[6] and the TYPE 874-MR Mixer Rectifier.[7] The crystal modulator permits the output to be picture modulated, thus converting the oscillator to a test-signal generator for television frequencies. With the mixer rectifier, the unit oscillator is used as the local oscillator of a heterodyne converter system with a communications receiver as the i-f detector. This system is a universal null detector for high frequencies. It has the further advantage that much less shielding is required than is necessary when the detector and the generator operate at the same frequency.

The output connector is a General Radio TYPE 874 Coaxial Connector which allows connection to be made directly to the various coaxial elements of the TYPE 874 series, as well as the TYPE 874-LB Slotted Line and the TYPE 1602-A U-H-F Admittance Meter. Connection to other coaxial types can be made through TYPE 874-P[8] Adaptors, which are available for both plug and jack types of N, BNC, C, and U-H-F connectors.

— A. G. BOUSQUET

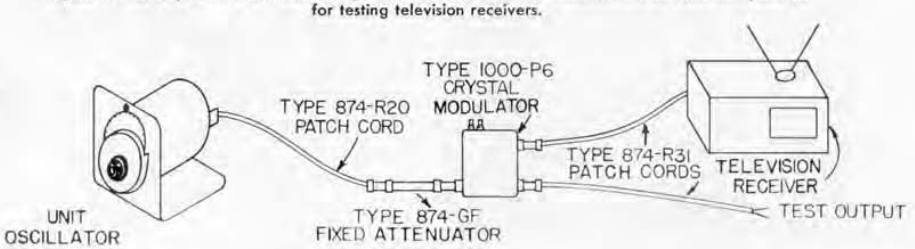
[5] D. B. Sinclair, "A Versatile Amplitude Modulator for V-H-F Standard Signal Generators," *General Radio Experimenter*, Vol. XXIV, No. 6, November, 1949.

[6] W. F. Byers, "An Amplitude Modulator for Video Frequencies," *General Radio Experimenter*, Vol. XXIV, No. 10, March, 1950.

[7] W. R. Thurston, "Simple, Complete Coaxial Measuring Equipment for the U-H-F Range," *General Radio Experimenter*, Vol. XXIV, No. 8, January, 1950.

[8] R. A. Soderman, "New Coaxial Accessories," *General Radio Experimenter*, Vol. XXVII, No. 5, October, 1952.

Figure 5. The Crystal Diode Modulator permits the oscillator to be modulated at video frequencies for testing television receivers.



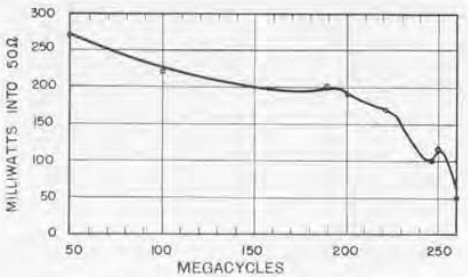


Figure 6. Typical curves of output vs. frequency for the Type 1215-A Unit Oscillator.

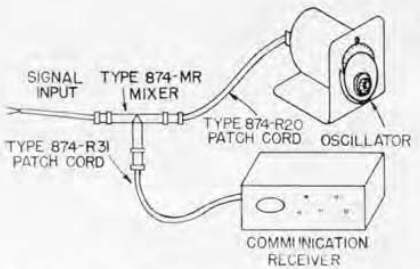


Figure 7. The Unit Oscillator and Mixer Rectifier used as a frequency converter.

SPECIFICATIONS

Frequency Range: 50-250 Mc.

Tuned Circuit: A semi-butterfly with no sliding contacts.

Frequency Control: A 6-inch dial with direct frequency calibration over 140 degrees. Slow motion drive, 4:1 ratio.

Frequency Calibration Accuracy: 1 per cent at no load.

Warm-up Frequency Drift: 0.4 per cent.

Output System: Short coaxial line with a coupling loop at one end and a TYPE 874 Coaxial Connector on the other end. Maximum power can be delivered to load impedances normally encountered in coaxial systems.

Output Power: At least 80 milliwatts into a 50-ohm load.

Power Supply Requirements: 370 volts d-c at 25 ma and 6.3 volts a-c or d-c at 0.3 ampere. The TYPE 1203-A Unit Power Supply is recommended.

Modulation: Direct amplitude modulation over the audio-frequency range can be obtained with an external audio oscillator. The impedance at the modulation terminals is about 15,000 ohms. A convenient audio source is the TYPE 1214-A Unit Oscillator which will deliver about 55 volts at 400 or 1000 cycles and will yield about 25 per cent modulation. The TYPE 1000-P6 Crystal Diode Modulator can be used for modulation at video frequencies essentially free of fm. TYPE 1023-A Amplitude Modulator can be used (up to 220 Mc) to obtain accurately calibrated amplitude modulation with no incidental fm.

Tube: TYPE 12AT7 miniature twin-triode which is supplied with the instrument.

Mounting: The oscillator is mounted in an aluminum casting and is shielded with a spun-aluminum cover. The assembly is mounted on an L-shaped panel and chassis.

Accessories Supplied: TYPE 874-R20 Patch Cord, TYPE 874-C Cable Connector, TYPE 874-P Panel Connector, and TYPE CDMS-466-4 Multipoint Connector.

Accessories Available: TYPE 1000-P6 Modulator, TYPE 1023-A Modulator, TYPE 1203-A Power Supply, TYPE 1204-B Power Supply, TYPE 1214-A Oscillator, and the TYPE 874 Coaxial Elements such as adaptors, attenuators, voltmeters, mixer, etc.

Dimensions: 7 x 8 x 9½ inches, over-all.

Net Weight: 7½ pounds.

Type		*Code Word*	*Price*
1215-A	**Unit Oscillator, *50 to 250 Mc**	ADOPT	**$190.00**
1203-A	**Unit Power Supply**	ALIVE	**47.50**

*U. S. Patents Nos. 2,367,681; 2,548,457; 2,125,816.

SOUTHWESTERN I.R.E. CONFERENCE

General Radio products will be exhibited in Booths 6 and 7 at the Southwestern I.R.E. Conference and Electronic Show to be held at the Plaza Hotel, San Antonio, February 5, 6, and 7. The General Radio exhibit will include equipment for the measurement of sound and noise, u-h-f impedance measuring devices, and bridges for production testing. Members of our engineering staff will be in attendance. Drop in and talk over your measurement problems with us.

TEST CELL FOR POWER FACTOR MEASUREMENTS ON TRANSFORMER OIL

An improved test cell for the power-factor testing of insulating oil used in transformers is described in a recent article in *Electric Light and Power*.[1] The conventional test cell gave results that were often erratic and too low for accurate reading when the water content in the oil was small.

To improve the accuracy of the measurements, the oil samples were passed through filter paper, and the filter paper was then tested between flat-plate electrodes. The consistent results obtained led to the design and construction of the test cell shown in Figure 1. A disk of filter paper, previously heated to eliminate moisture, is clamped between metal electrodes, which are perforated to allow the oil to pass through. The dissipation factor is measured on a General Radio TYPE 740-BG Capacitance Test Bridge.[2] An initial reading without oil is taken as a check on the dryness of the paper.

A sample of the oil to be tested is then poured in the upper container. The moisture is held by the filter paper, while the oil passes through, and the power factor rises in proportion to the moisture content of the oil, as shown in Figure 2.

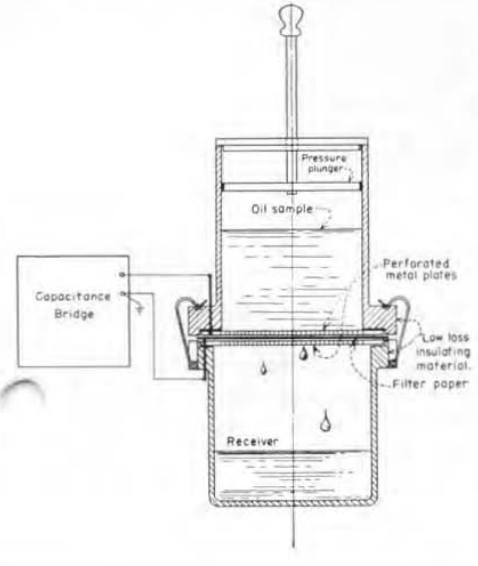


Figure 1.

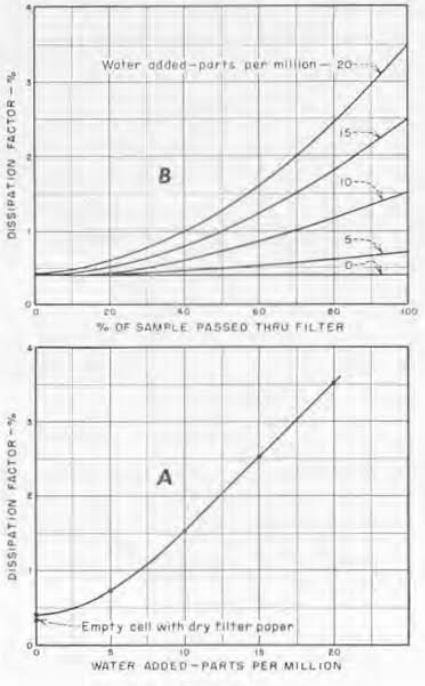


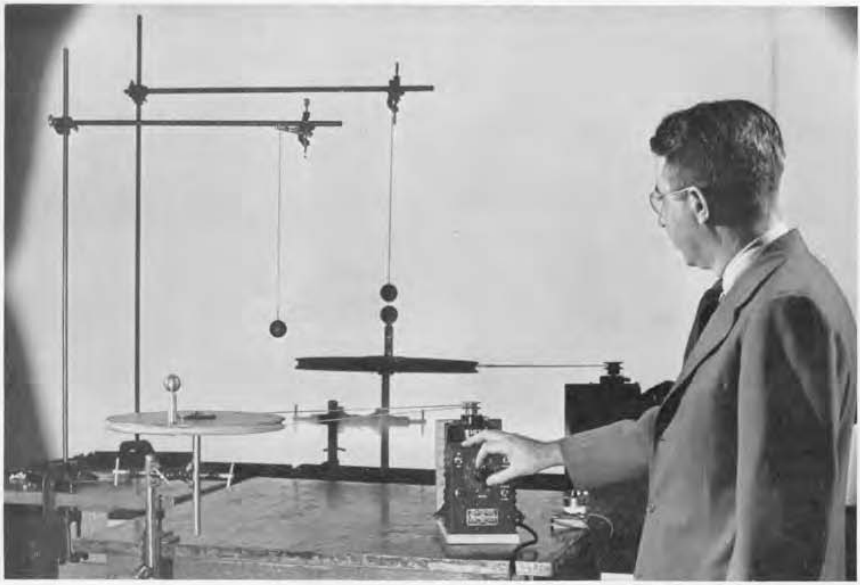
Figure 2.

According to the author, absorption of moisture by the filter paper simulates the actual conditions in a transformer, in which water carried by the oil is absorbed by the organic insulating materials on the winding. The filter paper soaks up water to about the same extent as the transformer insulation.

[1] E. C. Schurch, "Improved Test Cell Stabilizes Oil Measurements," *Electric Light and Power*, July, 1952.

[2] This bridge has been discontinued, but the current TYPE 1611-A Capacitance Test Bridge can be used equally well.

VARIAC® SPEED CONTROL HELPS TO DEMONSTRATE SIMPLE HARMONIC MOTION



The close adjustment of d-c motor speed obtainable with the Variac® Speed Control is well illustrated by a demonstration used by the Physics Department of Cornell University. A horizontal turntable is rotated just below an oscillating pendulum, and, when the turntable speed is properly adjusted, the shadow of a ball mounted on the periphery of the turntable will track closely with the shadow of the pendulum. This demonstration aptly illustrates the equivalence of simple harmonic motion and the projection of uniform circular motion, a concept on which mathematical analysis of periodic mechanical motion and a-c electrical operation is based.

The Physics Department informs us that this experiment had been unsuccessful in the past because of the difficulty in making the turntable speed correspond precisely to the period of the pendulum. The Variac Speed Control now does the job perfectly.

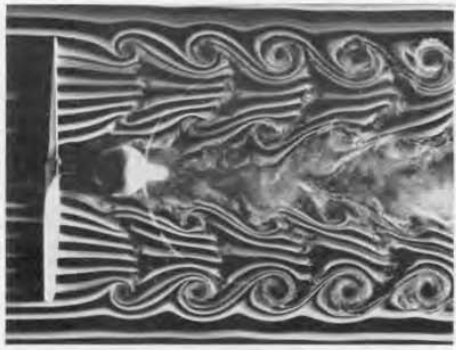
AIR CURRENTS MADE VISIBLE

This interesting Strobolume photograph comes to us through the courtesy of Prof. F. N. M. Brown, Head of the Department of Aeronautical Engineering at the University of Notre Dame, and was taken in the wind tunnel at that institution. The propeller (left) is one foot in diameter and is turning at

4080 rpm. The air speed is about 45 feet per second, design advance for the model propeller.

The smoke that makes the air currents visible is produced by burning wheat straw under a slight pressure, but with insufficient oxygen. Tars are removed from the smoke by condensation in a bank of water-cooled pipes and by filtering.

The General Radio Type 1532-B Strobolume is the light source used for photography. The duration of the light flash from this instrument is about two one-hundred-thousandths of a second. Conventional camera equipment was used, with a lens opening of f6.3. The film was Eastman Type B. To produce extreme contrast, the film is overdeveloped in D-11, developing time being fifteen minutes instead of the usual five.



Smoke techniques in this wind tunnel have been used for the study of many phases of fundamental aerodynamics, results of which were reported by Professor Brown in a paper presented at the Second Midwestern Conference on Fluid Dynamics.

NEW BRANCH PLANT

(concluded)

In our last issue we noted the opening of our new manufacturing branch in West Concord, Massachusetts, which first went into operation in April, 1952.

Production has been steadily increasing, and now the plant is in virtually full operation.

It is by no means a simple operation to increase the production of precision equipment. It is necessarily a careful process if the quality and accuracy of the finished products are to be maintained. Operations of the new plant are now, however, going smoothly, and the beneficial effect of this added capacity is already attested by the fact that many popular items, including Variacs, Strobotacs, and impedance bridges, are available either from stock or with no more than thirty days' delay in delivery.

Our main offices and about two-thirds of our manufacturing operations are still at the Cambridge plant where all communications to the Company should be addressed.

MISCELLANY

RECENT VISITORS from overseas to the General Radio plant and laboratories include Mr. Michael Nomikos, Director of Communications, Civil Aviation Department, Greek Air Ministry, Athens; Mr. André Danzin, Director General of Societé Le Condensation Ceramique, Paris; and Mr. Paul Fabricant of Radiophon, Paris, exclusive representatives for General Radio products in France and the French Colonies.

CREDITS—The TYPE 1482 Standard Inductors described in the November *Experimenter* were originally developed by Robert F. Field. Manufacturing techniques and mechanical design were handled by H. S. Wilkins. After Mr. Field's retirement in December, 1950, the project was completed by H. W. Lamson.

Like the TYPE 1652-A Resistance Limit Bridge described in the January, 1952, *Experimenter*, the TYPE 1604-A Comparison Bridge described last month is the outgrowth of a survey of General Radio's own production-test requirements. Prototype versions have been in use in our own laboratories and shops for several years.

Several engineers contributed to the development of this instrument. The early development was done by A. M. Eames under the direction of D. B. Sinclair. Several features of mechanical design were contributed by H. C. Littlejohn, while the author of the foregoing article completed the over-all development.

INSTRUCTION MANUAL FOR THE ADMITTANCE METER

A complete instruction manual for the TYPE 1602-A U-H-F Admittance Meter is now available. Copies have been sent to all who returned the cards that were enclosed with admittance meters already shipped. If you are using the admittance meter and have not yet received a copy of the instruction book, please request it on your company letterhead.

THE General Radio EXPERIMENTER is mailed without charge each month to engineers, scientists, technicians, and others interested in communication-frequency measurement and control problems. When sending requests for subscriptions and address-change notices, please supply the following information: name, company address, type of business company is engaged in, and title or position of individual.

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