

*Microwave tower, North Florida Telephone Co.  
(description page 5)*

# electronics and communications



an age publication

FEBRUARY 1959

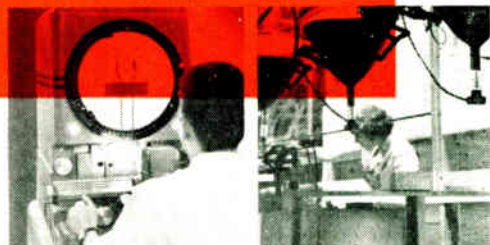
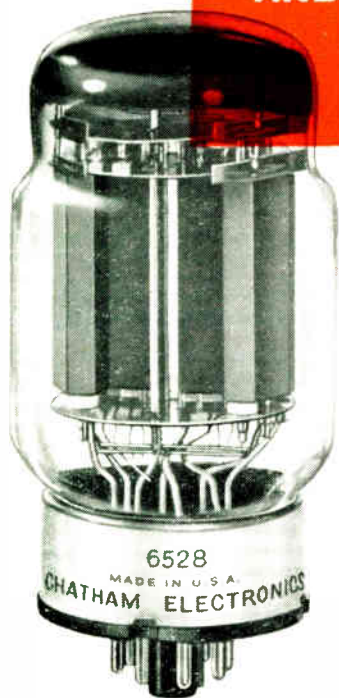
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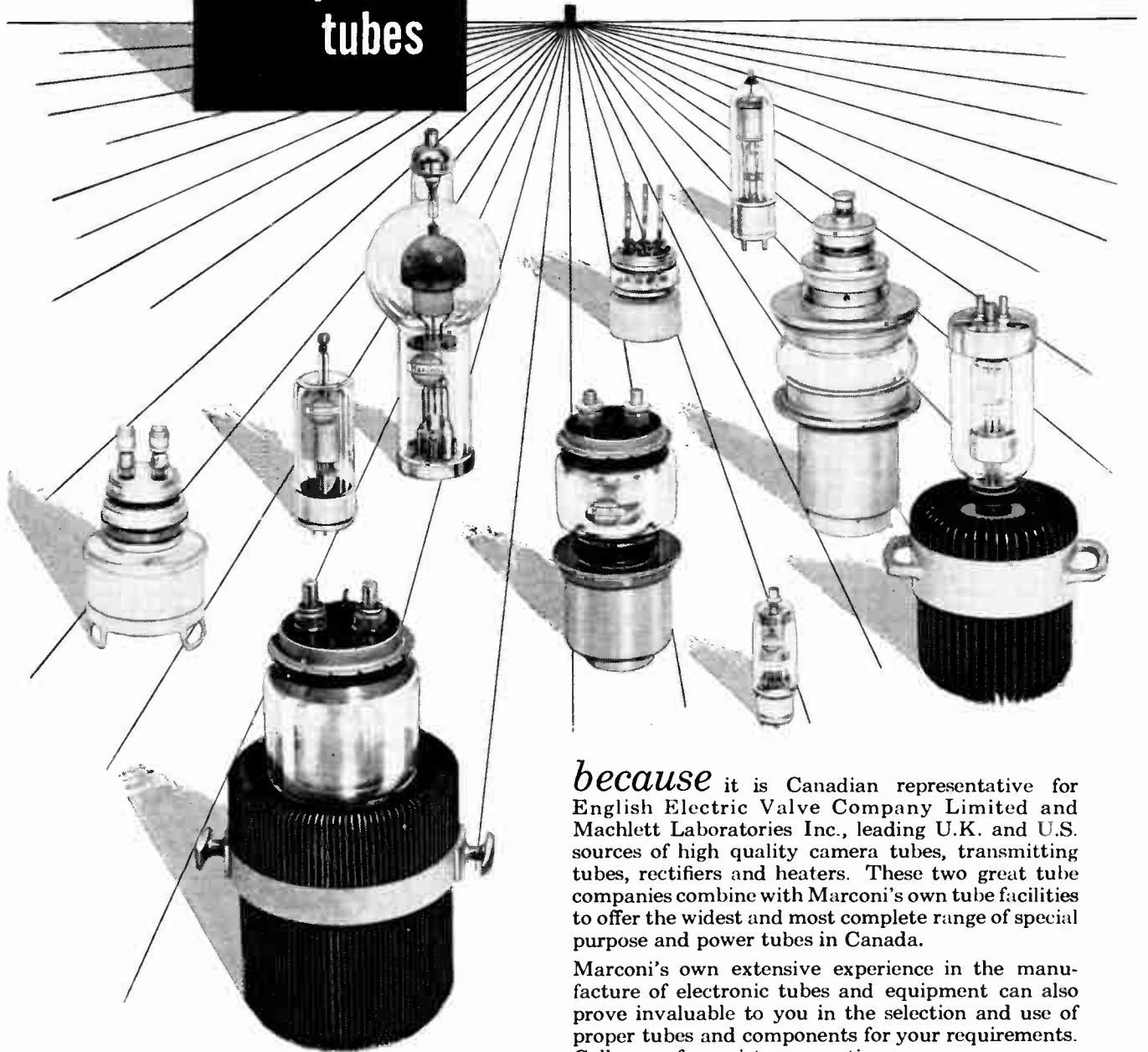
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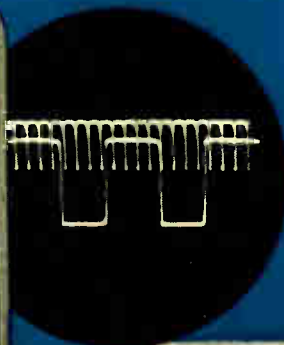
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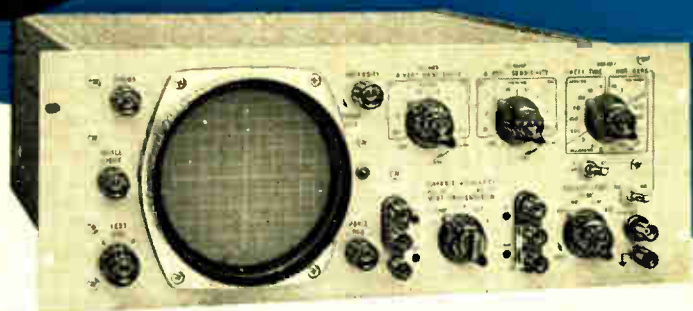
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an age publication

# Electronics and Communications

Canada's pioneer journal in the field of electronics and communications engineering

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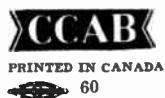
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### COVER STORY

Ranging in size from 100 to 225 feet, the towers of the North Florida Telephone Company were installed at Branford, Jasper, Live Oak, Mayo and White Springs. The unusual cover photo design is a skyward view within the 100-foot high Jasper tower.



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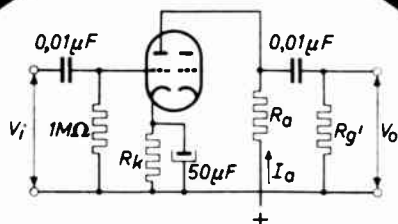
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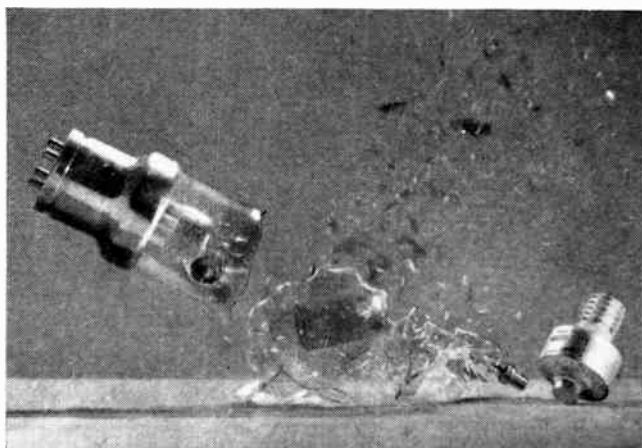
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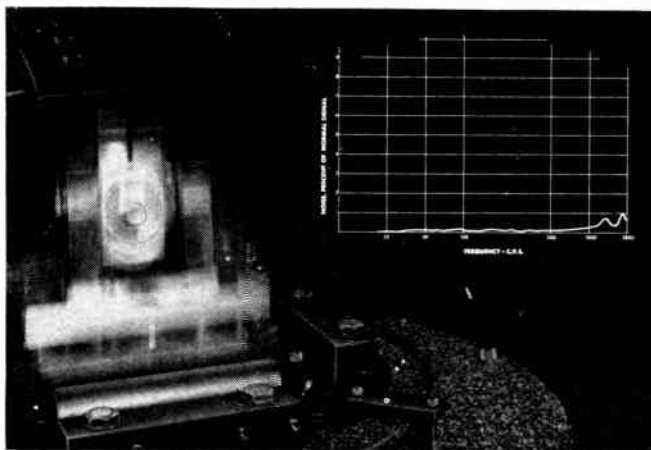
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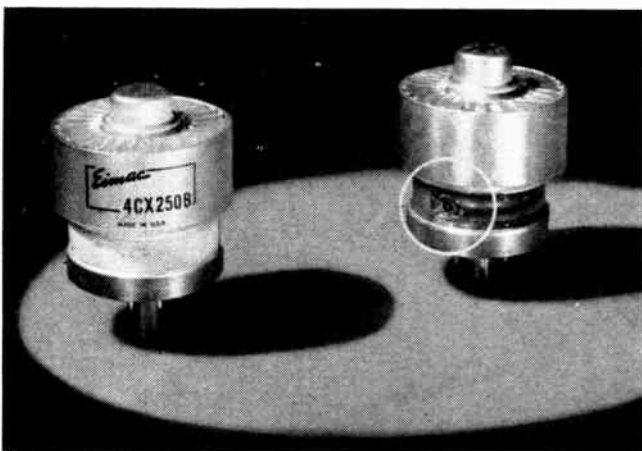
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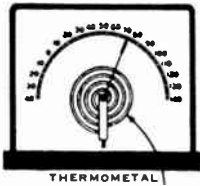


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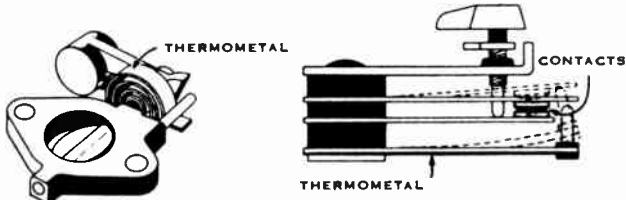
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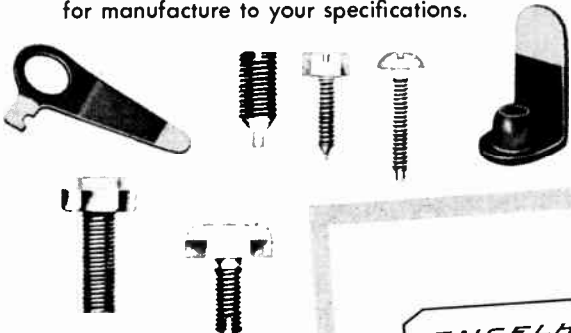


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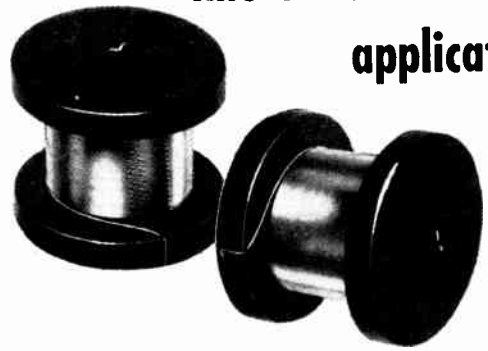
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# EIA Report

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By Basil Jackson, A.R.Ae.S., Tech. M.C.A.I.

## **Industrial Relations Committee**

At the Industrial Relations Committee meeting held on January 28 final arrangements were made for the Industrial Relations Panel to be held in Toronto in February.

During the course of the meeting a discussion took place regarding the United States control of union activity in Canada. Also under discussion was the certification of engineering technicians, and a consideration of Report No. 6 "Outline of Technical Training in the United Kingdom". This came under an item referring to the Federal Department of Labor's research program on the training of skilled manpower in industry.

## **Board of Directors Meet In Montreal**

On February 4 the Board of Directors met in Montreal. The divisional reports for the Receiver Division, Components Division, and the Electronics Division, were presented together with the Engineering Advisory Committee report, the Government Liaison Committee report, and the Government Acts and Regulations Committee reports. Various other committees which report to the EIA Board of Directors were also presented and discussion took place on the relevant points.

## **Divisional Meetings**

A meeting of the Electronics Division of EIA took place in Montreal on February 3. Among the business discussed was one item presented as a recommendation of the EIA Director of Engineering suggesting that the Electronics Division be renamed the Military and Technical Products Division in the interests of consistency. The other proposal put forward by the Director of Engineering was in the form of a slight change in the divisional structure to provide a better service to the members. This was to have a Sales and Merchandising Section comprising a chairman and several committee members for each of the areas of interest of the Division such as the Land Mobile Service, Maritime Mobile Service, Broadcasting Service, Point-to-Point Communications, and Microwave. Such sections would serve to guide the activities of the Engineering Committees and, it was suggested, would be of great value to the members on such questions as effective dates and amortization periods for equipment on which the Department of Transport and the Canadian Radio Technical Planning Board are preparing or have prepared licensing specifications.

## **Receiver Division Meeting**

The Receiver Division met in Montreal on February 4. Under discussion, among other business, was the serious situation resulting from the importation of radio receivers which had affected the Canadian industry considerably. Also under discussion was the "Made In Canada" promotion and EIA's participation in National Radio Week in May.

## **Color And UHF Committee**

The Color and UHF Committee, which reports to the Receiver Division, held a meeting at the end of January to discuss the question of color television programming in Canada.

## **Tariff Groups**

Various meetings have been held during the past month by the different tariff groups of the Components Division. Each group is charged with the responsibility for surveying and making recommendations on tariff changes in the particular electronic component which concerns it. These discussions are being co-related so that a comprehensive and fully co-ordinated tariff brief can be prepared dealing with the components segment of the electronics industry.

## **Components Trade Directory Committee Meeting**

The Trade Directory Committee of the Components Division met on February 17 to review the various questionnaires which had been returned to the EIA Office from the various members of EIA. Data in the questionnaires will be reviewed before it is inserted in the 1959 Seventh Edition of the EIA Components Trade Directory. It is hoped to compile this directory in readiness for issuing at the time of the Thirtieth Annual Meeting of EIA which takes place the third week in June. The response of the membership in sending in these questionnaires has been very good and it is very likely that the deadline will be met successfully.

## **Transformer Engineering Sub-Committee**

The very active Components Engineering Sub-Committee on Transformers met in Toronto at the end of January. Among the items of business discussed was the finalization of a questionnaire to be sent to the engineers and purchasing personnel of companies in the electronics industry on their requirements for power transformers. This survey of the requirements of the industry is being made before the Transformer Engineering Sub-Committee meet to work on a specification for power transformers for radio and television receivers suitable for Canadian conditions. The Sub-Committee has successfully compiled a specification to cover audio transformers for radio and television receivers.

## **Receiver Service Committee Meeting**

The Receiver Service Committee of EIA met in Toronto on February 19. Under discussion was the progress of the twenty-one students taking the EIA sponsored night school course at the Ryerson Institute of Technology in Toronto on the subject of television servicing.



# Newsletter

Canadian Radio Technical Planning Board

## WHO'S WHO IN THE PLANNING BOARD

### No. 11 — The Telephone Association of Canada

The Telephone Association of Canada is an association of companies or systems engaged in the provision of telecommunication service in Canada.

The first annual meeting of the Association was held in 1921, the systems represented at that time being: Alberta Government Telephones, British Columbia Telephone Company, Manitoba Telephone System, Maritime Telegraph & Telephone Company Ltd., The New Brunswick Company Ltd., Saskatchewan Government Telephones, and The Bell Telephone Company of Canada.

In addition to the above systems, the Association now includes in its membership The Avalon Telephone Company Ltd., Newfoundland, Quebec Telephone, The Island Telephone Company, P.E.I., North-West Telephone Company, B.C., Okanagan Telephone Company, B.C.

The objectives of the Association are to cultivate cordial relations between the member organizations and to do all things necessary to systematize, unify and provide efficient telecommunication service throughout Canada. In addition to the internal business of the industry, the Association has been an effective agency for the presentation of the needs of its members to other organizations on a national and international scale. Its relations with the CRTPB are in this category.

The Association's affairs are directed by an Executive Council which meets semi-annually. An annual meeting of the Association is held for the interchange of information on problems of mutual interest.

### Recent Meetings

Few meetings have taken place during February. However, this trend will not continue for long as new technical business in hand will necessitate meetings of the various groups and committees to deal with it and resolve problems as they arise.

The Tropospheric Scatter Committee, which met on January 16 in the CRTPB Conference Room in Toronto, discussed a report on frequency utilization as presented by the committee chairman, Mr. S. Bonneville. Also under discussion was the matter of interference and propagation prediction methods. It was recommended that a sub-committee be established for investigating the limiting values of the field strength radiated in scatter systems, with the object of avoiding hazards to personnel, and causing heating of gas stores and dynamite caps which might be in the radiation field. Mr. R. Williamson was appointed chairman of this new sub-committee.

DOT Specification 101 entitled "Data Required With Applications For Single or Multiple Hop Radio Links Operating In The Band 30 mc/s to 30,000 mc/s" was also discussed and recommendations for amendments made.

### New Radio Center Opened At Churchill

A step of major importance to Canada's northern communications and to international aviation was taken with the opening recently of the Department of Transport Aeradio-Marine Radio station at Churchill, Manitoba.

The new station replaces a marine radio station built in 1930 and an aeradio station built in 1942. It comprises four major units, a transmitter station four miles from the control point, a remote receiver station shared with the RCAF, the control center and 20 apartments to house the staff located at Fort Churchill.

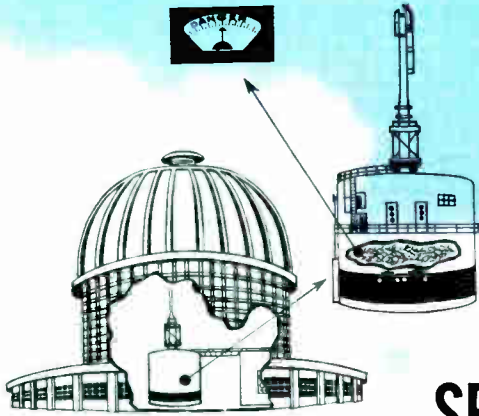
The new station provides a radio beacon for sea navigation, weather broadcasts and ice reports by both message and radio facsimile charts for shipping. It serves northern aviation, including international flights using the trans-Polar route, by providing a radio range for navigation, weather information and a fast message service from aircraft to their despatch centers. For example, an aircraft over Hudson Bay can send a report to its headquarters in San Francisco in eight minutes, the message being received at the new Churchill station, sent to the Department's Winnipeg station by direct teletype, and then forwarded by another direct circuit to San Francisco.

The Churchill station also serves as a main link for message service to the Canadian north, beyond the areas covered by telephone and telegraph lines. It is connected with meteorological stations, Hudson Bay posts, mining camps and missions, many of which reach it via the Department's radio teletype at Coral Harbour on Southampton Island.

---

Canadian Radio Technical Planning Board  
200 St. Clair Avenue West, Toronto 7, Ontario

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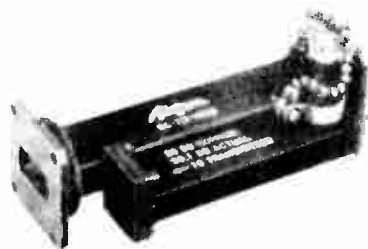
- Specialized types in all waveguide sizes.
- 0.5 to 100 db coupling ranges with broad band characteristics and various directivities.
- Standard and special designs available.

Write for Catalog

**Airtron CANADA LIMITED**

300 CAMPBELL AVE. TORONTO 9, ONTARIO

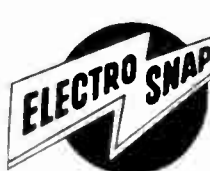
For complete details check No. 77 on handy card, page 51



## "PLUS" VALUE NEW PRODUCTS

# Switching Problems? . . . .

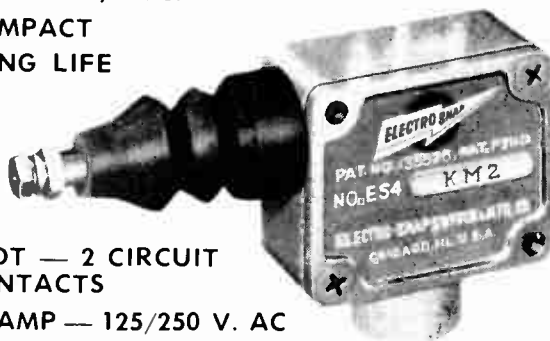
in Electronic or Industrial Applications



# DIE CAST LIMIT SWITCHES

RESISTS ENTRANCE OF DUST, OIL,  
MOISTURE, ETC.

COMPACT  
LONG LIFE



SPDT — 2 CIRCUIT  
CONTACTS  
10 AMP — 125/250 V. AC  
CHOICE OF SWITCHING ACTIONS

Write for Catalog

**J.R. LONGSTAFFE CO. LTD.**

300 CAMPBELL AVE. • TORONTO 9, ONTARIO

For complete details check No. 64 on handy card, page 51



# SANBORN *Transducers*

FOR LINEAR MEASUREMENTS...

## DISPLACEMENT

### LINEARSYN Differential Transformers

Six series of Sanborn Linearsyns — three of the shielded type, three unshielded — are available, with five models in each series. Linearity is better than 1% of full scale output in all models. Temperature range is from  $-50^{\circ}$  to  $205^{\circ}$ F.

Special design features include coil assemblies hermetically sealed in epoxy, laminated phenolic jackets (unshielded types) or heavy plated steel jackets (shielded types), improved lead wire strain relief, high permeability alloy cores. Models with axial leads are also available on special order. Within each series all models have identical diameters, tap sizes, lead wires; only the lengths of coil assemblies and cores vary.

### Typical Linearsyn Characteristics

Series* (Unshielded)	Series* (Shielded)	Strokes* (=Inches)	Freq. Ranges	Sensitivities* (Volts/inch per volt of excitation at std. carrier freq.)
575DT	585DT	.050 - 1.00	400 cps - 10 kc	56 - 3.70
576DT	586DT	.050 - 1.00	60 cps - 400 cps	70 - .90
590DT	595DT	.005 - .100	400 cps - 20 kc	1.60 - 2.60

\*Maximum and minimum values available within each series; data on individual models on request.

## VELOCITY

### LVsyn Velocity Transducers

LVsyn pickups may be used to measure *linear velocity* directly, *displacement* with a simple integrating circuit, or *acceleration* with a differentiating circuit. There are twenty-four models, all self-generating with shielded cylindrical coil assemblies and high coercive force permanent magnets. Twelve models use regular magnet cores; twelve have *non-breakable* magnet cores. Characteristics of the two groups are the same except for output sensitivity, core length and weight. Features include high sensitivity, single-ended or push-pull output, accurate and stable calibration, unlimited resolution, wide range of sensitivities and sizes, temperature range of  $-50^{\circ}$  to  $200^{\circ}$ F. They can be immersed in hydraulic fluid. No mechanical connection between coil and core permits low friction level. End stops or displacement limits not needed; undamaged if limits are extended.

### Typical LVsyn Characteristics

Model	Displacement		Electrical Characteristics		
	Nominal Working Range (Inches)	Maximum Usable Stroke (Inches)	Voltage Output mv/inch	Total Impedance R phms	Series Connection L henrys
3LVA5*	0.50	1.30	120	2,000	0.085
6LV2*	2.0	3.4	500	19,000	2.4
6LV2-N	2.0	3.4	250	19,000	2.4
7LV9*	9.0	11.0	350	17,000	2.8

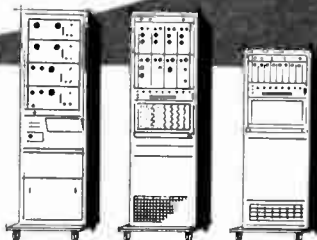
\*Four of the twenty-four models available, selected to show minimum, approximate mid-range and maximum working ranges as well as the difference in sensitivity between a regular magnet core model (6LV2) and a non-breakable magnet core model (6LV2-N).

**NEW!**

### COMPLETE DISPLACEMENT TRANSDUCER

"Probe" style, uses differential transformer. With cable and adapter for connection to Sanborn 150, 350 Series Carrier Amplifiers. Stroke  $\pm 0.070"$ , high sensitivity, linearity 0.5%, infinite resolution, contact pressure as low as 10 grams. Stainless steel body, carbide tipped contact rod, jeweled bearings. Two models: 580 — plug-in cable, flange mounting; 581 — miniature, integral cable.

### for MULTI-CHANNEL RECORDING



Sanborn direct writing systems now include 1- to 8-channel "150" Series, with a choice of 12 plug-in Preamplifiers; new single-cabinet, compact 6- and 8-channel "350" and "850" Series with interchangeable Preamplifiers, flush-front recorder with electrical pushbutton chart speed control and transistorized Power Amplifiers, and numerous features for high reliability and operating convenience.

For complete facts, call your local Sanborn Industrial Sales-Engineering Representative or write the Industrial Division in Waltham.

(All data subject to change without notice)

# SANBORN COMPANY

Industrial Division

175 Wyman Street, Waltham 54, Mass.



*A view of the digital computer and personnel placed at strategic positions, namely the tabulator, the magnetic tape units, the flexowriter and the console.*

The points brought out in this article may seem a far cry from the performance of a Canadair Argus in flight and include some of the less glamorous aspects of automatic computing, but it is believed that they contribute largely to the success of the aircraft performance program.

## Some automatic computing aspects in evaluating aircraft performance

by Roy Harvey\*

An Electrodata Datatron 205 Digital computer with paper tape and punched card peripheral equipment has been in operation at Canadair on a 1½ shift, closed shop basis since February of 1957. In February of 1958 two magnetic tape data reader units were added to this equipment.

The computer has been used to solve a wide variety of problems, the majority being connected with the performance of an aircraft or parts of it under various conditions. These include structural analysis, aircraft performance, aeroelasticity and flutter analysis and this article will describe briefly some typical programs and consider some computational aspects rather than the problems themselves. Aircraft performance programs which have been made and used are those for calculating the engine performance, propeller efficiency, cruise and climb performance. In addition, take-off and landing performance programs are desirable.

The turbo propeller performance program computes the shaft horsepower, fuel flow and jet thrust as

functions of atmospheric conditions, engine power settings, air bleed requirements and engine configuration. For one such set of conditions the computer carries out these computations in approximately one minute as compared with about 1.3 hours if the same job were carried out by hand on a desk machine.

The propeller efficiency program computes the efficiency of a propeller, defined as the ratio of thrust horse power to brake horse power, as a function of two broad classes of parameters, the propeller geometry and the aircraft flight conditions. This program is used for both design purposes and performance calculations. In the former case a set of flight conditions might be fixed and the propeller geometry parameters varied. In the latter case the propeller geometry is fixed and flight conditions are varied. It is a necessary tool for the subsequent take-off, cruise, climb and other performance calculations for propeller driven aircraft.

\* Group Leader, Automatic Computing Dept., Canadair Ltd., Montreal.

The program takes about one minute for one case as compared with about 40 minutes by hand.

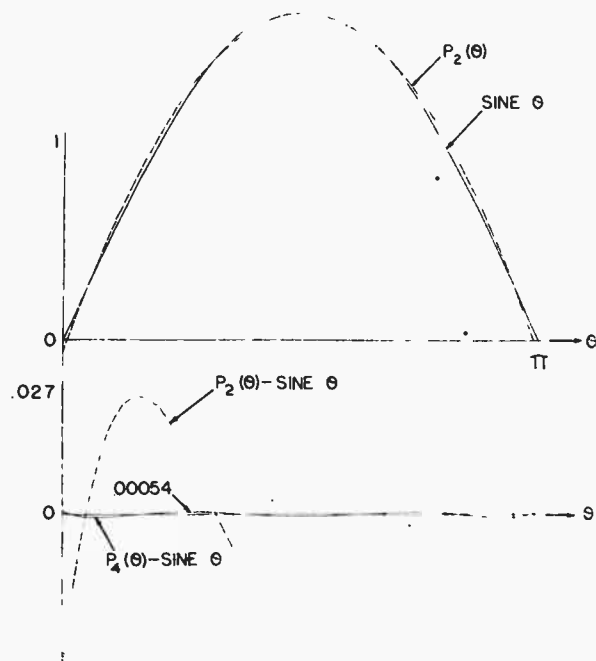
The cruise performance program computes the stabilized level speed and specific range in terms of nautical miles per pound of fuel as functions of aircraft configuration, that is, number of engines operating, engine performance, propeller geometry and atmospheric data.

The climb program, for the same conditions as cruise, computes the rates of climb and speeds at which they occur. Hence the maximum rate of climb may be deduced. By an integration over the various altitudes the time, distance and fuel to height may be calculated.

In general, the programs so far made have been for specific engines and aircraft, but it is hoped that a more general integrated program will eventually be made.

Each of these programs, and the conditions associated with their use, have many features in common. They each consist of a long flow of calculations with occasional iteration loops and frequent reference to blocks of data. Each requires a large amount of data, some built in with the program and some specifying the conditions. Hence, there is quite a problem associated with preparation of data. Much of the information that is used in the programs is empirical data initially given in numerical or graphical form. This calls for wide use of table look up and interpolation techniques. There is the question of how to present the answers in a form in which they are easily assimilated. This is often of great importance, as deadlines have usually to be met. Therefore, efficient methods of program debugging are essential and also simple methods of programming, which lead to the use of compiling and interpretive routines.

I shall try to deal with these points in turn. Over a period of time procedures have been established for such things as the way data should be given to the Computing Department by other departments, the way sum checks are applied, the way results are presented and so on.



Dataplotter Output. Upper frame shows  $\sin x$  and the second order least squares polynomial fit. Lower frame shows the error functions for the 2nd and 4th order fits. Points are joined by hand.

## Preparation of data

In general programs are punched on paper tapes and data on IBM cards. Initially, it was found that a large percentage of errors occurring were due to faulty read-in of data, or, to a lesser extent, errors in the punching which had escaped detection by visual checking. Although a fairly high standard of performance is obtained from the computer, of the computer errors which do occur, faulty card read-in is high on the list. It is true to say in general that the weakest links of any digital computer are the input and output units.

To spot these errors more or less as soon as they occur we can make it a rule to always carry out a sum check on all blocks of information as they are read into the machine, and more recently, whenever a block is transferred from magnetic tape on to the magnetic drum. With each block of information a number is carried which is the sum of all the elements in some form or other. Whenever this block is transferred from one medium to another the elements are summed afresh and this sum compared with the old sum. Only if they agree does the computation proceed. The convenient block size depends on the particular program and would normally be that amount of information transferred at any one time. This checking does not obviate the need for verifying or visual checking however as a few mistakes would be costly in terms of machine time.

In the case of a program, the final, fully debugged program is punched on to paper tape using the computer under control of a punch out routine which forms the sum by summing the instructions as numbers losing any overflow from the most significant end, and adds to the tape the appropriate instructions for the high speed paper tape reader and a short sum checking routine which checks any subsequent reading in of the tape.

Most of the arithmetic carried out is in the machine floating point mode where the coded exponent or power of ten is packed with the mantissa into one ten digit machine word. A number is arranged in the form  $a \times 10^b$  where  $a$  has a leading decimal point followed by up to eight digits, the first of which must be non zero. The number is then recorded as  $50 + b$  in the first 2 digit places of the machine word followed by  $a$  making ten digits in all. An exception is zero which is recorded as all zeros. As an example unity would be coded as 511000000, and 0.123 as 5012300000.

The sum for data, usually on cards, should initially be found off the computer and two types of sum suggest themselves, the floating point sum or the fixed point sum. It is desirable of course that the sum formed initially should be identical with that formed by the computer, assuming no errors.

There are two disadvantages with floating point sums. Errors in small numbers will escape detection. As for example:

5112345678	5112345678
4012345678	4012435678
5112345678	5112345678

In this case this sum would result whatever the mantissa of the second number.

With a fixed point sum this interchange of digits would be detected.

5112345678	5112345678
4012345678	4012435678
9124691356	9124781356



Sometimes, when summing in the floating point mode a large number of different sums may be obtained from the same set of numbers by summing the elements in different orders. For example:

+5112340000	+5010000004	+4910000002
-5111230000	+5112340000	+5010000004
+5010000004	-5111230000	+5112340000
-5020100000	-5020100000	-5112300000
+4910000002	+4910000002	-5020100000
<hr/>		
+4920000042	+4920000002	+4920000000

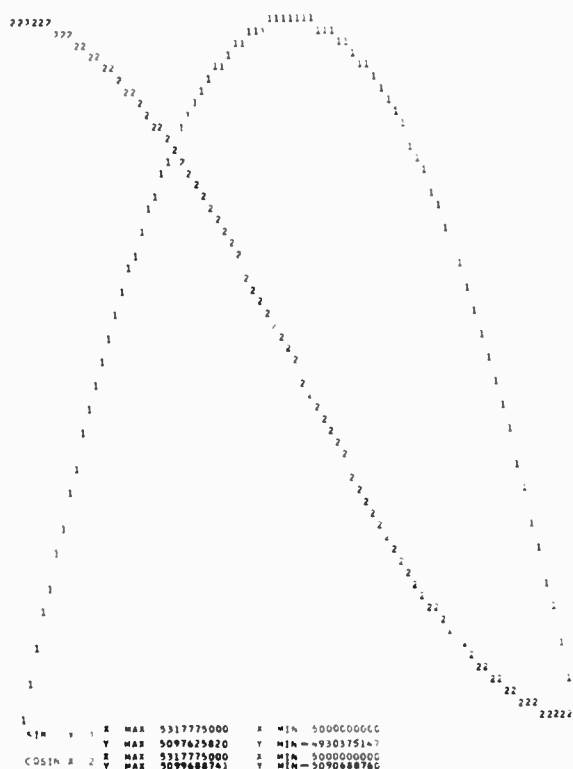
This may even be true for elements which are all positive.

+5050000005	+5110000000
+5050000005	+5050000005
+5110000000	+5050000005
<hr/>	
+5120000001	+5120000000

For a set of positive numbers the fixed point sum produced by the computer is just the conventional sum ignoring overflow digits from the 10th most significant digit and is unique, independent of order of summing. However, for a set of numbers with mixed signs the resulting fixed point sum as produced by the Datatron is not necessarily unique as for instance:

+5220000000	+5220000000
-5210000000	+5110000000
+5110000000	-5210000000
<hr/>	
+5120000000	-4880000000

This is because negative numbers are not stored as complements but as absolute values with signs. It is easily proved that there can be at most two distinct



A sample of Quick Look Plotter Output direct from computer. The curves shown are for cubic polynomials fitted to  $\sin x$  and  $\cos x$  for  $0 \leq x \leq \pi$ .

results when summing a set of numbers for all permutations and when there are two such results they differ by one in the eleventh place. This can easily be allowed for.

To sum up, if the expression is pardonable, the procedure we have adopted is to carry a fixed point sum with each block of data, whether the elements are in fixed point or floating point, losing any overflow from the most significant end. When summing inside the Datatron in fixed point mode, provision is made to ignore overflow at any stage. Finally the read-in sum is subtracted from the result of summing inside the machine and the result examined. If it is zero either with or without overflow, the calculation proceeds. If not either the machine is programmed to stop, displaying a standard failure instruction, or the summing operation is repeated.

When cards are punched by the computer which might subsequently be read-in a sum is included.

Carrying out this sum checking has been found to be well worth while from the point of view of efficiency but has added to another type of problem, namely, preparation of data for the machine. All punching is carried out by key punch operators and an attempt has been made to make their job as near to pure key punching as possible without any conversion etc. Special data sheets are used for recording the exact information in the format in which it is to be punched on cards — it is in any case necessary to carry out the conversion from fixed to floating beforehand to obtain the fixed point sum. There is provision on the sheets for entry of row and column sums. Usually these sheets are filled in by the people who submit the problems rather than computing staff. The use of these data sheets has resulted in an increased punching rate, a reduction of errors and happier key punchers. For example, the sheets are of manageable size and people have been encouraged to write large by having large spaces to receive the numbers.

Filling in these sheets does present a problem however. Many solutions carried out are for matrix type problems and it is undesirable that the engineers who produce the elements of the matrices should have to convert all their numbers to floating point form, enter them on the data sheets in a rearranged format, and compute the sums. A 19 x 19 matrix takes more than two hours assuming row sums and column sums are calculated. We have come round to the way of thinking that this tedious, menial work should be done as far as possible by the computer itself even though it is trivial in nature. Consequently some effort has been made to make some of the stages automatic. The version of Datatron we have does not accept alphabetical information directly which means that the decimal point of a number cannot be punched in any position of a word. The I.B.M. 407 Tabulator is made use of to accept cards containing two fixed point numbers, with decimal points appearing as a Y-punch, scale the numbers, and summary punch cards with two numbers per card scaled, each with a two digit exponent. These cards are then fed to the Datatron which completes the coding to the floating point form, rearranges the matrix into a suitable format for the relevant matrix program, and produces a new sum for checking purposes. A sum check is carried out at each stage.

This means we can accept a matrix written in a natural partitioned format, in unscaled fixed point form with convenient sum.

Please turn to page 48

The success of a standardization program depends on the willingness of the designers to sacrifice some of their freedom in exchange for convenience, expedience and economy. The system described, developed to secure this co-operation, achieves this result in a satisfactory manner.

# Electronics parts standardization in equipment manufacturing

by S. F. Coolsma\*

Product cost can be effectively reduced by a standardization program that sets practical limitations on the variety of components parts and materials used.

The objectives and degree of standardization will depend upon the particular needs of the industry concerned. At the Canadian Westinghouse Electronics Division, one main concern has been with parts and materials standardization in products for both military and commercial markets.

Variety reduction is an important part of standardization for while it limits the variety of materials and parts, it must satisfy all requirements with a minimum but adequate selection of individual types. Its full realization is only possible, under ideal circumstances.

In reality, the rapid development and changes in products and components, coupled with the natural timelag between inception and completion of engineering projects, requires a continual revision of the selection. Before variety reduction is attempted it must be analyzed under the following headings.

## 1. Principal function

The principal function of any item in the product is directly related to its basic property, e.g. capacitor, fastener, insulating material, socket for plug-in component.

## 2. Generic type

The generic type comprises all items with the same principal function, and which are of a similar design, construction, or composition. For example, capacitors, fixed, paper-dielectric in hermetically-sealed metallic case; screws, machine, fillister head; laminated phenolic resin sheet; and electron tube sockets, are in this category.

## 3. Performance level

The performance level of an item indicates the degree of severity of temperature, humidity, acceleration, corrosion, etc. it can withstand for a specified time before it deteriorates below a useful level (e.g. capacitance, breakdown voltage and insulation resistance of a capacitor.)

## 4. Type parameters

An item of a given generic type and performance level is identified by its type parameters — those

properties which are imposed by the project requirements which consist of:

- (a) The particular value of the principal function (capacitance; screw length and thread size; dielectric strength; tube type) and
- (b) functional limitations (rated voltage of a capacitor; head type and finish of a screw; mechanical strength of an insulating material and frequency limitation of a tube socket).

## Example

A miniature dc paper-dielectric capacitor in a hermetically sealed insulated metallic case, for military application, may have the military type designation CP05A1GF105K

where

C	= Capacitor	— Principal function
P	= Paper-dielectric, in hermetically sealed metallic case	— Generic type
G	= Characteristic	— Performance level
05	= Style: insulated miniature case with dimensions depending on capacitance and rated voltage	
A	= Terminal	} — Type parameters
1	= Circuit	
F	= Rated voltage	
105	= Capacitance	
K	= Tolerance of capacitance	

The principal function is, of course, not standardizable within the limits of parts and materials standardization. Reduction in number of generic types, however, is possible where these overlap.

The performance level leaves a wide area for variety reduction. The basic problem is the large variety of environments for which products are designed: from fixed station operation in temperate climates to the extreme conditions of temperature and acceleration in

\* Standards Engineer, Electronics Div., Canadian Westinghouse Company Limited.

Figure 1

# STANDARD

## RESISTORS, FIXED, COMPOSITION (INSULATED), 1/2 WATT, MIL & COML

ES- 450 - 000

ISSUE - 6

DATE - 8 - 1 - 57

PAGE 1 OF 2

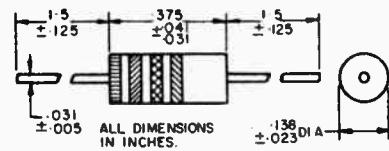
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**A. SCOPE**

This Standard covers military Standard items and their commercial equivalents.

**B. STANDARD RESISTANCE VALUES AND DIMENSIONS**

Nom. Res. Ohms	C.W.Co. ES No. (1)	MIL-R-11 Designation	(2) RCWV	Nom. Res. Ohms	C.W.Co. ES No. (1)	MIL-R-11 Designation	(2) RCWV
10	450-100	RC20GF100K*	2.2	2200	450-222	RC20GF222K*	33
12	450-120	RC20GF120K	2.4	2700	450-272	RC20GF272K*	37
15	450-150	RC20GF150K	2.7	3300	450-332	RC20GF332K*	41
18	450-180	RC20GF180K	3.0	3900	450-392	RC20GF392K*	44
22	450-220	RC20GF220K	3.3	4700	450-472	RC20GF472K*	48
27	450-270	RC20GF270K	3.7	5600	450-562	RC20GF562K*	53
33	450-330	RC20GF330K	4.1	6800	450-682	RC20GF682K*	58
39	450-390	RC20GF390K	4.4	8200	450-822	RC20GF822K*	64
47	450-470	RC20GF470K	4.8	10,000	450-103	RC20GF103K*	71
56	450-560	RC20GF560K	5.3	12,000	450-123	RC20GF123K*	77
68	450-680	RC20GF680K	5.8	15,000	450-153	RC20GF153K*	87
82	450-820	RC20GF820K	6.4	18,000	450-183	RC20GF183K*	95
100	450-101	RC20GF101K*	7.1	22,000	450-223	RC20GF223K*	105
120	450-121	RC20GF121K*	7.7	27,000	450-273	RC20GF273K*	116
150	450-151	RC20GF151K*	8.7	33,000	450-333	RC20GF333K*	128
180	450-181	RC20GF181K*	9.5	39,000	450-393	RC20GF393K*	140
220	450-221	RC20GF221K*	10	47,000	450-473	RC20GF473K*	153
270	450-271	RC20GF271K*	12	56,000	450-563	RC20GF563K*	167
330	450-331	RC20GF331K*	13	68,000	450-683	RC20GF683K*	184
390	450-391	RC20GF391K*	14	82,000	450-823	RC20GF823K*	202
470	450-471	RC20GF471K*	15	100,000	450-104	RC20GF104K*	224
560	450-561	RC20GF561K*	17	120,000	450-124	RC20GF124K*	245
680	450-681	RC20GF681K*	18	150,000	450-154	RC20GF154K*	274
820	450-821	RC20GF821K*	20	180,000	450-184	RC20GF184K	300
1000	450-102	RC20GF102K*	22	220,000	450-224	RC20GF224K*	332
1200	450-122	RC20GF122K*	24	270,000	450-274	RC20GF274K*	350
1500	450-152	RC20GF152K*	27	330,000	450-334	RC20GF334K*	350
1800	450-182	RC20GF182K	30	390,000	450-394	RC20GF394K*	350



Nom. Res. Ohms	C.W.Co. ES No.	MIL-R-11 Designation	(2) RCWV
470,000	450-474	RC20GF474K*	350
560,000	450-564	RC20GF564K*	350
680,000	450-684	RC20GF684K*	350
820,000	450-824	RC20GF824K*	350
1 Meg	450-105	RC20GF105K*	350
1.2 Meg	450-125	RC20GF125K*	350
1.5 Meg	450-155	RC20GF155K*	350
1.8 Meg	450-185	RC20GF185K*	350
2.2 Meg	450-225	RC20GF225K*	350
2.7 Meg	450-275	RC20GF275K*	350
3.3 Meg	450-335	RC20GF335K	350
3.9 Meg	450-395	RC20GF395K	350
4.7 Meg	450-475	RC20GF475K*	350
5.6 Meg	450-565	RC20GF565K	350
6.8 Meg	450-685	RC20GF685K	350
8.2 Meg	450-825	RC20GF825K*	350
10 Meg	450-106	RC20GF106K*	350
12 Meg	450-126	RC20GF126K	350
15 Meg	450-156	RC20GF156K*	350

\* Stocked in WT Storeroom 691. All values are stocked in the Laboratory Stores.

- When ordering the commercial equivalent of a military standard item, replace the hyphen between the two groups of numerals in the C.W.Co ES-designation by a capital letter "C". e.g. ES-450C100.
- See General Note 1.

**C. APPLICABLE DOCUMENTS**

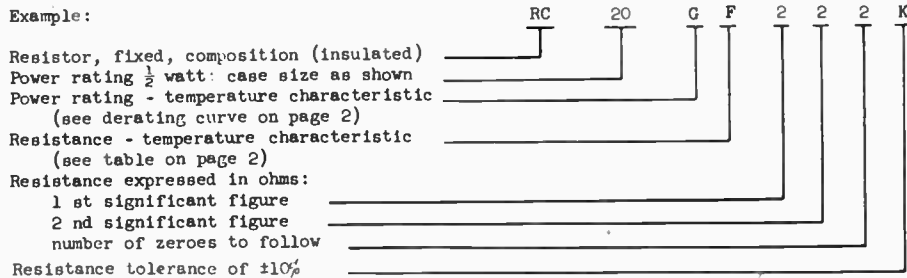
The CAMESA approved issue of U. S. military specification MIL-R-11, together with the Canadian military additions, if any, and effective at the date of the order, forms part of this Standard. These documents are applicable to both military standard items and equivalent commercial items specified in this Standard.

For commercial items, CAMESA qualification approval and supervision of the inspection tests by a Government inspector is not a requirement of this Standard.

**D. BASIS OF STANDARDIZATION**

The resistors specified herein are selected from CAMESA preferred list SB-13/PL-RES-3

**E. MILITARY TYPE DESIGNATION**



**EXAMPLE OF ORDERING DESIGNATION**

APPLICATION	DESCRIPTION AND/OR MATERIAL	PART DWG. & ITEM OR STYLE NO.
MILITARY	RESISTOR RC20GF222K	ES-450-222
COMMERCIAL	RESISTOR	ES-450C222



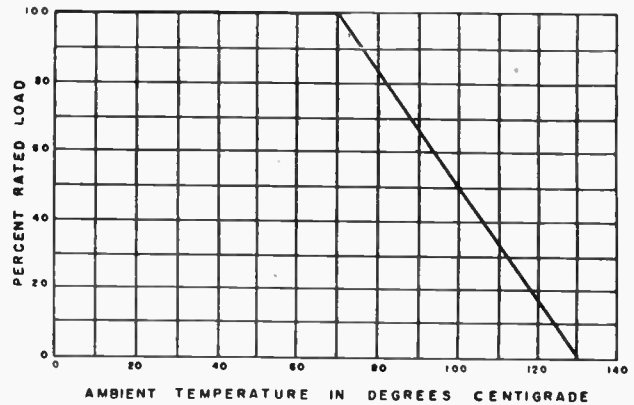
Figure 1

<h1 style="margin: 0;">STANDARD</h1>	<h2 style="margin: 0;">ES- 450 - 000</h2>	
<b>RESISTORS, FIXED, COMPOSITION (INSULATED), 1/2 WATT, MIL &amp; COML</b>	ISSUE - 6	PAGE 2 OF 2
	DATE - 8 - 1 - 57	
	ISSUED BY <i>MP/ENW</i>	

1. RESISTANCE-TEMPERATURE CHARACTERISTIC

Nominal Resistance	Maximum allowable change in resistance from resistance at ambient temperature of 25°C.	
	Symbol F	
	At -55°C. (ambient)	At 105°C. (ambient)
Ohms	Percent (±)	Percent (±)
1,000 and under	6.5	5
1,100 to 10,000	10	6
11,000 to 0.1 megohm	13	7.5
Megohms		
0.11 to 1.0	15	10
1.1 to 10	20	15
11 and over	25	20

2. DERATING CURVE FOR HIGH AMBIENT TEMPERATURE



F. GENERAL NOTES

1. Voltage Rating

Resistors shall have a rated dc continuous working voltage (RCWV) or an approximate sine-wave rms continuous working voltage at commercial-line frequency, corresponding to the rating indicated in Table 1, determined by the formula:

$$E = \sqrt{PR}$$

where,

E = rated dc or rms continuous working voltage.

P = nominal power rating at 70°C ( $\frac{1}{2}$ w)

R = nominal resistance of resistor.

In no case shall the rated dc or rms continuous working voltage be greater than 350v.

Application of rated continuous working voltage on the low side of a wide resistance tolerance of a resistor will result in application of more than rated power with possible shortening of resistor life.

2. Soldering

The length of lead left between resistor body and soldering point should not be less than  $\frac{1}{4}$  inch, nor should the required soldering time exceed 3 seconds.

Figure 1 shows how these functional requirements can be met. Section B contains all information needed for parts selection and ordering. A size reduction of 1.5:1 permits the whole of Section B on the first page so that all important information is available "at a glance".

spaceflight. The environmental gamut can not be economically covered with items of one single performance level.

The medium-sized industry could not think of purchasing items for each individual project. Therefore, items have to be selected from the few or even the one performance level, which satisfy a majority of project requirements.

Type parameters are selected the same way. For function and functional limitation value the smallest series is chosen which allows the designer to realize the design. This can be illustrated with the principle followed in the standardization of components for electron tube circuits.

The tolerance of electron tube characteristics enables

optimum circuit conditions with capacitors and resistors with values taken from the preferred 12-series. Most resistors can be in  $\frac{1}{2}$  watt rating, and plate supply voltages seldom exceed 400 volts. From this consideration, it is a simple step to a standard selection of fixed composition resistors, composition film resistors, paper-dielectric capacitors, electrolytic capacitors and mica capacitors. Once standards have been established, selection of parts for more exacting requirements can be undertaken on the same principles.

Naturally the final choice is made from available items. Values and performance level are selected so the general requirements of the average project are covered. Special requirements which vary with the project, have to be disregarded.

## Practical principles

In establishing a parts and materials standardization program for the Electronics Division of Canadian Westinghouse, two questions of a practical nature arose:

1. On which general principles should we base this variety reduction?
2. How can adherence to the resulting standards be achieved?

The answer to the first question was found by using military standard parts exclusively. From an engineering standpoint this is acceptable because the performance requirements imposed on these items by the design requirements of our average commercial products coincide with those of military standard parts.

In accepting this principle, the variety of parts to be considered is roughly halved. Although the temptation is great to standardize special parts to meet special design requirements, this principle is rigidly adhered to.

The benefits of standard, mass-produced items are low item cost, proved performance, availability, good delivery, and a tightly controlled quality level.

As a result of military contract requirements, the final selection has to be from the military preferred lists. This extra limitation is actually an additional advantage as preferred items are already selected to cover a maximum of applications with a minimum variety of individual types.

The objection is often heard that military standard parts are too expensive for commercial use. However, in the unusual cases where a difference in cost exists, it is compensated by the cost advantage of combining military and commercial requirements. This is true for all parts and materials we have standardized, except when very large quantities are considered, or unless

the average performance requirements of the two groups differ so widely that parts of a different performance level are warranted on an overall cost basis.

The principle of adherence to military preferred lists is not followed blindly. It is used as a guide. If experience over a longer period shows our general military design requirements can better be met by a selection which differs from the preferred lists, we submit a recommendation for a change in the applicable list.

Acceptance of and adherence to these standards posed the second problem, which was solved by the following measures:

### (1) Get agreement first:

Our standards are arrived at in a democratic way, so they reflect the general needs of all concerned. The electronics division standardization committee in which all interested departments are represented on management level determines standardization policies and maintains a program for future standardization.

The members of this committee vote and comment on proposed standards by letter ballot. It is their responsibility to obtain comments from all concerned within their respective departments.

The secretariat of this committee is provided by the Materials and Standards Section. It conducts standards research, drafts proposed standards, and promulgates standards after approval by the committee members.

### (2) Engineering stock:

An engineering stock of standard items is carried in sufficient quantities to cover the needs of experimental work, prototype production in the model shop, and short production runs.

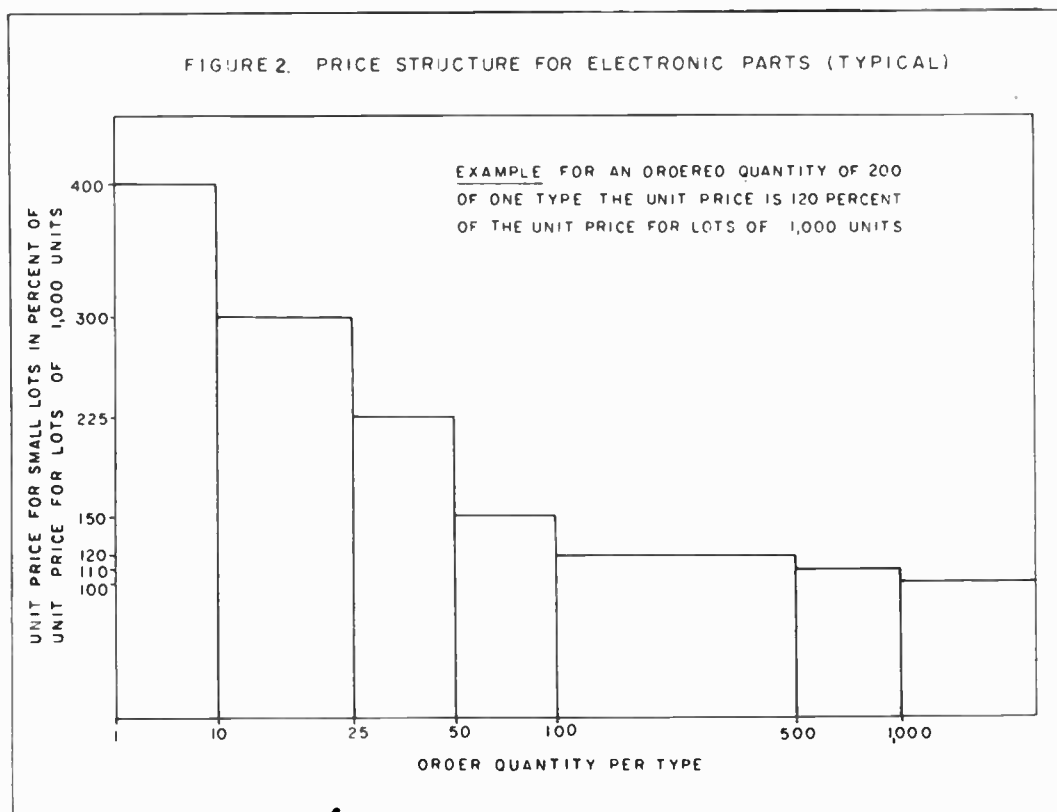


Figure 2 shows a typical discount schedule in graphical form for a low-priced, mass-produced part.

**Cost of separate ordering versus stock forming** (typical)  
 Example: Fixed Composition resistors, ½ watt, 10% tolerance.  
**Assumptions:** 1. Ratio military/commercial: 50/50.  
 2. Number of purchase orders reduced to 40%.  
 3. Stock order quantity 500 average per value.

**Comparison:** (Average over 3 month period).

(a) Cost of separate ordering—		
Average separate ordering quantity 200 @ \$71.94/M	\$	14.39
Inspection 10% of 50%		.72
		<hr/>
Cost of 500 ordered in lots of 200	\$	15.11
		37.78
		<hr/>
(b) Cost of stock ordering — 500 @ \$34.76/M	\$	17.38
Inspection 10% of whole lot		1.74
		<hr/>
	\$	19.12
		<hr/>
Advantage per value	\$	18.66
		<hr/>
Total advantage for preferred 12 series, range 100 ohms to 5 Megohms (57 values)		\$1,063.62

*Figure 3 shows the effect of quantity discounts, small order penalties, and source inspection charges. It will be seen that the higher cost of source inspection is a low percentage of the advantage derived from quantity buying.*

The immediate result of this direct availability is close adherence to our standards, and an active interest in our standardization program. This interest is demonstrated by a flow of questions and suggestions from the users of these standards to the Materials and Standards Section, either direct or via their department committee member.

**(3) Production stock:**

Certain items are used on all orders in quantities large enough to warrant bulk stocking.

**(4) Psychological advantage:**

No means have been established to enforce these standards. In this way it has been possible to avoid the cost of policing the application. In spite of this freedom, designers specify items in accordance with these standards whenever possible and without opposition.

**(5) Publicity:**

Over 200 copies of the company's standards books have been distributed within the Electronics Division. It provides a handy catalog of available, approved, preferred parts, materials and finishes together with other useful information including up-to-date price information on standard parts. It eliminates catalog research, specifications study, reading standardization documents, and results in a preference for the standard items listed.

**(6) Periodic review:**

Development of the art, amendments, new issues of military specifications, and changes in our product package necessitate a rigid review program lest our standards become rapidly obsolete.

Proposed military standardization documents are circulated for comments. This permits the preparation and distribution of revised standards at the time significant changes become effective.

**Standards format**

The format of a standard is itself the result of standardization, based on the consideration that standards should provide all information required to select, order, inspect, include in and withdraw from stock, and, where necessary, assemble the standard item.

It has the following functions:

- (a) procurement specification — intended to form part of purchase orders.

- (b) engineering specification — providing all information necessary for item selection and application and for item specification on drawings and parts lists.

- (c) engineering stock catalog.

- (d) catalog of items stocked in bulk for general application.

- (e) test specification — indicating directly or by reference to subsidiary specifications which tests shall be performed by Incoming Inspection.

- (f) assembly instruction — where applicable, mounting dimensions, available tooling for mounting holes, etc. are given.

**Resulting economies**

It has been stated, perhaps too often, that most of the advantages of industrial standardization, however defensible on economical grounds, are intangible.

However, it is possible to measure the economical advantages accruing from standardization. The following factors are involved:

- lower order cost; better quantity discounts; better availability — stock or short delivery — resulting in a small minimum stock; reduction in handling cost in receiving, incoming inspection and stores; reduced clerical effort; reduced storage requirements; no job-end shortages; no delays in engineering.

The relationship between variety reduction and cost improvement becomes quite apparent when considering the price structure for mass-produced electronic parts.

In addition, many parts manufacturers have set a minimum order charge, or a billing charge, in order to discourage the placing of small orders still further.

For military standard items a source inspection charge is usually made to cover the cost of additional testing.

For smaller quantities, the savings potential is even more prominent; under the same assumptions as in the example given, but for stock orders of 50 per value as compared with separate ordering quantities of 20 per value the total advantage is \$256.50.

The apparent conclusion is that it is costly to maintain separate ordering for each project as compared with ordering a selection of military standard parts for even a moderate engineering stock at appropriate time intervals.



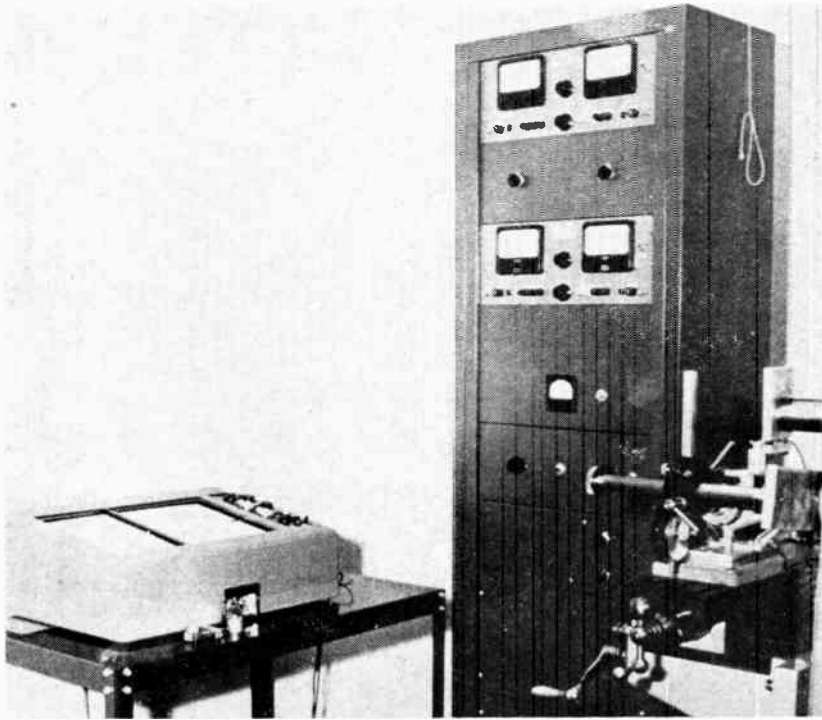


Figure 1 shows the electronic relay rack containing all necessary power supplies, amplifiers, and a simple analog computer circuit.

The design of relays with predictable reliability has been achieved by a unique technique for measuring hitherto unobtainable forces.

## Prediction of relay performance with force-function measurements

by T. Ross Welch\*

For years, the manufacture of relays has been based upon more or less empirical design data. The very nature of an electromechanical relay that involves the magnetic forces of a solenoid in conjunction with friction and spring forces makes the rigorous mathematical design of the device extremely difficult, as evidenced by technical papers of Prof. Charles Cameron. The nonlinear velocity and acceleration that the moving armature in a typical relay undergoes have made analytical design of relays a technique to be avoided by manufacturers "in the know."

One of the major reasons empirical design has been necessary in lieu of careful analytical design in the past has been the absence of precise measurement data concerning the motion of the relay armature. The minute forces resulting from combinations of magnetic fields and electromotive forces induced by current flow, bearing friction, spring deflection, changing contact resistance, and nonlinear bending of moving contact metal strips have often defied careful definition. This lack of measuring ability has been due, in large part, to the lack of instruments and machines to provide the accurate force measurements needed for relay design.

A technique has now been developed, however, that

allows reliability to be designed into the relay. The new technique may well be a major breakthrough in the art of relay design. Recognizing the need for measuring the forces of a relay, and also realizing the extremely delicate nature of the forces involved, a small group of relay specialists, originally in the Research Department of Neomatic, Inc., later with Elgin National Watch Co., and now a part of Telecomputing Corporation and Brubaker Electronics Inc., began to develop a method of making meaningful static force measurements. This technique was originally conceived by the author over three years ago and has been continually refined ever since.

Basically, the technique is a method of balancing forces. The balance is obtained by electrical means, for direct readout on a conventional  $x-y$  plotter. A more detailed description of the apparatus and technique will follow later.

The measuring technique was developed for two reasons. First, it helps relay designers predict the force developed in the moving armature as a function of ampere-turns applied to the relay coil. Second, and more significant, the measurement scheme enables the design engineer to predict relay reliability accurately.

\* Manager, TC Components of Telecomputing Corporation, Los Angeles, California.

Reliability has often been a statistical record type of feature up to now. Relays are built, refined, and put into operation. Then, after an extended period of time, failure records are compared to arrive at reliability figures. The force function curve technique presented in this article reverses this procedure.

### Force function curves

With suitable application of the force function technique in the early design stages of a relay, the reliability of the relay to be mass-produced can be accurately predetermined. This is due primarily to the fact that the force function technique allows the designer to determine the magnetic and spring tension tolerances that are realistic.

The amount of magnetic force a relay coil exerts on the moving armature is not only a function of the actual number of amperes flowing in the coil and the total number of turns of wire, but also to a great extent depends upon the magnetic characteristics of the metal armature itself and surrounding supporting structure. The shape of the armature, for example, and the material these parts are made of, along with the geometrical arrangement of the various parts, affect the net result of magnetic vs. spring restraining force. These metal parts are not easy to control to tight magnetic tolerances in mass-production setups. It is essential, however, that these parts be controlled in order to achieve over-all reliability.

It is always desirable to design and build a relay that has an ample reserve of contact pressure, spring tension, and magnetic moving force. The big question in the relay designer's mind is how much overage, how much reserve. If too little reserve is built in, the relay is entirely unreliable in its operation; if too much overage is put in, the resulting relay is too bulky or too heavy, or perhaps uneconomical.

The amount of reserve is especially critical in the case of miniature relays. When stringent military environmental requirements are added to miniature space requirements, the need for reserve goes up.

The answer to this problem of how much to virtually "overdesign" has been difficult bounty for relay manufacturers for years on end. Most designers solve the vexing question by trial and error. But whether or not the relay resulting from such trial and error design takes optimum advantage of possible tolerances is often completely unknown. The trial that worked may be a borderline design. In order to adequately determine the optimum by trial and error, literally thousands of trials must be made.

The force function technique allows much of the empirical testing to be eliminated. Proper interpretation of force function curves drawn automatically by an electrical  $x-y$  plotter can make it possible for the designer to specify all the important parameters, such as ampere-turns, amount of armature travel, contact overtravel and force, return spring action, pull-in, etc. The force function curves, in short, become somewhat analogous to the electronic circuit designer's vacuum tube plate characteristic curves.

Force function curves, such as the one shown in Figure 2, consist of a plot of the armature travel in the  $x$  axis vs. force exerted upon the armature in the  $y$  axis. Naturally, the force exerted is the result of several forces acting in unison. The major forces, shown here, are the restraining forces due to spring tension and the magnetic force exerted by the relay coil. While the armature is at rest, the spring force

holds the moving arm against its stop. As soon as the magnetic force becomes equal to the restraining force, the armature begins to move. As the ampere-turns build up in value, the force created by magnetism increases. The result is that the armature travels across its open gap and approaches the energized position. As the armature actuates the contacts, more restraining forces come into play.

Conservative relay design dictates that the restraining force created by spring action must hold the armature open under anticipated environmental conditions. Therefore, a spring force must be included to hold the armature open; but, at the same time, a magnetic force must be created to close the armature with sufficient force to make good electrical contact and withstand environmental forces in the energized position.

Careful examination of this force function curve will indicate that, as ampere-turn force increases gradually, there is a relatively large area of gray zone. In this gray zone, the armature is almost ready to go, but not quite. A desirable condition is that the armature remain open until the magnetic pulling force surpasses the restraining spring forces, at which time it is allowed to suddenly break free with stored-up potential energy.

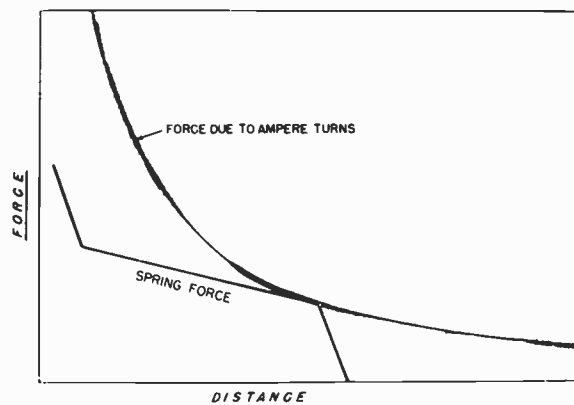


Figure 2. Force function curves showing plot of armature travel in the  $x$  axis vs. force exerted on armature in the  $y$  axis.

This condition can be met by examining the force function curve and modifying the relay design accordingly.

The equipment for accomplishing the plotting of these useful force function curves is shown in Figure 1. The electronic relay rack contains all the necessary power supplies, amplifiers and a simple analog computer circuit. The working beam equipment beside the rack consists of a jig to hold the relay, a balanced sensitive beam mounted on a fulcrum and a system for returning the beam to its zero or null position with great precision. At each static point at which a force reading is to be taken, the following steps are carried out. First, the beam is attached to the relay armature via a small force pickup arm. Then the relay is energized with the desired amount of electrical current. Weight is then electrically adjusted until balance is reached. This is done by watching a microammeter that indicates deviation from center through a digital circuit. Positive accuracy to 0.0002 inch can be obtained. When balance is attained, the force value is transmitted to an  $x-y$  plotter. The result is that the  $x-y$  plotter records, incrementally, a graph in exact proportion to the force and travel of the relay armature.

**AUTHOR'S NOTE:**  
The valuable assistance of Engineer Jack Burgess and Lab Technician Ernest Taylor is gratefully acknowledged in the development of the force function measurement technique and equipment.



*The K1028 Multi-Channel Trace Reader and associated equipment with separate linear and non-linear calibration facilities for each channel.*

Despite the increasing complexity of engineering systems a means of fast and accurate function examination can be accomplished by . . .

## The use of physical parameters in system performance analysis

The analysis of the performance of modern complex engineering systems is often accomplished by measuring a wide range of physical parameters in the form of electrical analogs. Such analog signals, obtained from the system itself or from transducers fitted to it, can be stored graphically or magnetically using an oscilloscope or tape recorder. For analysis purposes, it is usually necessary to make a large number of measurements from the record and translate these into numerical values of the original parameter. Alternatively, the analog signal may be converted directly to digital form and displayed or printed out in a suitable manner.

If measurements are made using a voltage analog of the required parameter, linear or non-linear elements may be readily introduced to enable the final digital read-out to be in practical units equivalent to the original input parameter. It is simpler to achieve this result by operating on an analog signal than it is if a digital output is obtained direct from the systems under analysis.

The Sindak equipment described below provides

all the facilities necessary for performing these operations.

### **Sindak K1028 Trace Reading Equipment.**

This equipment comprises the following main items:

- 1) 12-channel trace reader.
- 2) Programmer, digitizer and read-out control.
- 3) Read-out device.

The photograph shows a typical complete equipment.

The trace reader and read-out device, in this case an electronic typewriter, are placed on a table beside the rack which houses the rest of the equipment.

In the latest design of the trace reader (of which an earlier version is depicted), considerable attention has been paid to convenience of layout as well as simplicity of operation. This minimizes fatigue of the operator over long periods of continuous use. The record to be analyzed appears in a vertical frame facing the operator. It can be explored throughout its length by motors which move the record in either direction at slow or fast speed by the operation of switches. Below the record frame, there is a drum to which calibration curves, drawn on ordinary graph paper, can



be attached. The drum is manually operated by thumb-wheels at each end and is coupled to a precision potentiometer from which the analog output signal is derived. Two coupled reading cursors can be traversed across the record and the drum by means of a rotatable knob. A datum cursor is coupled to the horizontal shift of the calibration drum to enable the zero or datum line on the record to be aligned with the calibration chart. The calibration curves can be drawn from known characteristics of the measuring system. Alternatively, using the coupled cursors, curves can be constructed from calibration lines or points on the record being measured.

Read-out can be initiated either by a finger button or foot-switch, and a row of lights indicates the channel to be read.

#### Choice of read-out units

The operator motors the record until the reading cursor is at the required station then brings the cursor over the first trace, and finally rotates the drum until the second cursor coincides with the appropriate calibration curve before operating the read-out switch. This can be repeated for up to twelve traces at each station. In this way, the ordinates of the traces are converted to angular displacement of the drum, taking into account the calibration curves applicable to each trace. Thus the voltage output from the drum potentiometer is proportional to the parameter originally recorded.

The analog signal from the trace reader is fed through a DC amplifier to the program unit where scale factors are inserted to represent the output quantity in any one of the following scales:

- 0 to 1000 (Positive or Negative)
- 0 to 2000 ( " " " )
- 0 to 5000 ( " " " )

± to 500

± to 1000

± to 2500

Provision is made to supply any of the above scale factors to each of the twelve channels. By using appropriate combinations of these scale factors and calibration charts any full scale range can be accommodated and full use made of the available travel of the drum potentiometer.

The final analog voltage is next fed to the digitizer where it is converted into a binary coded decimal form and displayed visually as illuminated numerals. There are four numerals together with plus and minus signs and a choice of full scale ranges of ±1000, ±2000 and ±5000.

By using interchangeable control units the digitizer display can be arranged to read out onto a typewriter, tape perforator, card punch or any combination of these. A control unit provides power supplies and drive circuits for the above and is actuated by a signal from the digitizer when conversion is complete. Interlocking circuits ensure that re-operation cannot take place before printing-out is complete.

The typewriter control unit can feed a solenoid operated typewriter which may be arranged to print in a single column or tabulate in rows. Provision is also made for inserting a decimal point in the correct position. Perforator controls are available for the production of tape suitably coded for most computers.

The maximum speed of analogs to digital conversion and visual display is about 0.2 seconds.

The rate at which readings can be taken, therefore, depends on how fast the operator can set the cursor or on the speed of operation of the typewriter, tape punch or other read-out device when permanent digital records are required.

## White Alice world's largest 'tropo' system

Alaska has the longest and most modern over-the-horizon telecommunications system in the world.

The 3,100 mile telephone and telegraph network, known as White Alice, was put into full operation last March to provide continuous, reliable communications to the military, the Civil Aeronautics Administration and people of Alaska.

The system also provides a link among the Alaskan stations of the Distant Early Warning (DEW) Line, the 3,000 mile radar web that spans the northernmost reaches of Canada from northwestern Alaska to the east coast of Baffin Island, north of the Arctic Circle.

The White Alice project is maintained and operated by Federal Electric Corporation, worldwide service organization of I.T. and T. Corporation — an associate of Standard Telephones and Cables Mfg. Co. (Canada) Ltd.

Public use of the White Alice network is made possible through the Alaska Communications System, which provides commercial long distance telephone and telegraph service to the people of Alaska.

Although there are enough long distance circuits to accommodate military and civilian needs simultaneously, the major user of White Alice facilities is the Alaskan Air Command, which needs fast, reliable

communications for the defense of the continent in the event of an air attack from the north or the west.

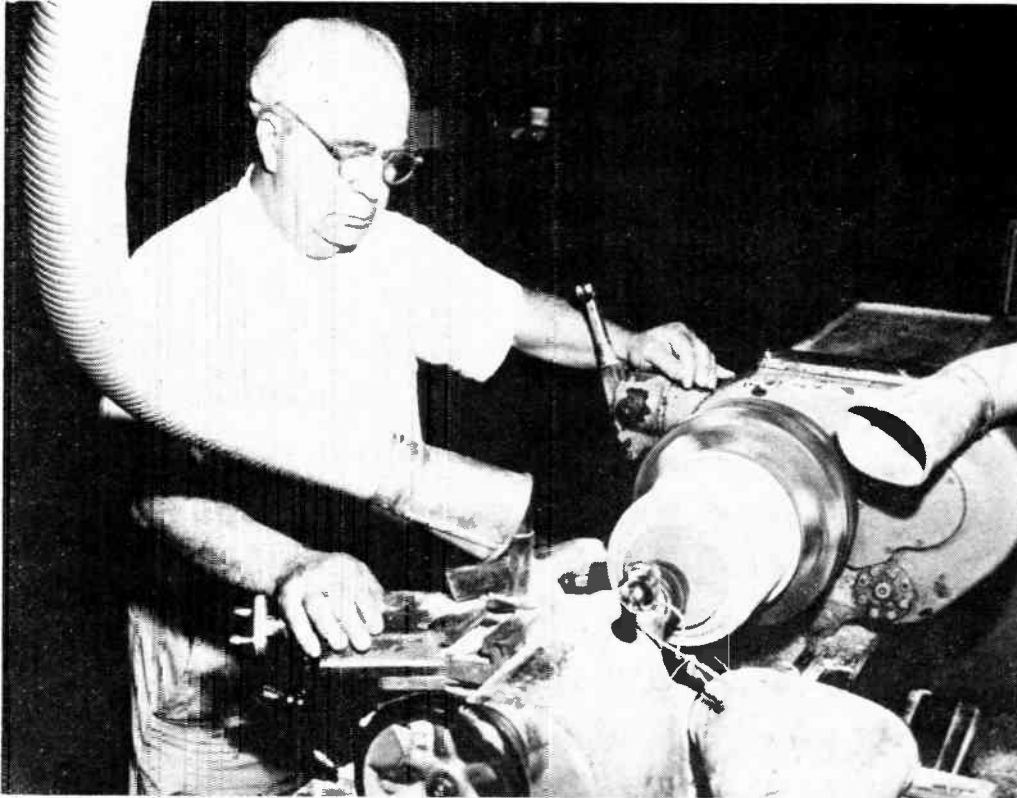
The White Alice system extends to Cape Lisburne, at the northwest tip of North America, and to St. Lawrence Island in the Bering Sea, some 50 miles from the coast of Soviet Russia. Its 36-station network covers 3,100 route miles, more than 170,000 miles of circuit voice and 50,000 miles of teletypewriter circuit.

Built at a cost of \$140,000,000, the White Alice system is based on a brand new type of radio transmission. Its full technical name is "Forward Propagation Tropospheric Scatter", but it is commonly known either as "Over-The-Horizon (O/H)" radio or, more simply, as "Tropo".

More than 800 contractor employees are engaged in the maintenance and operation of the project. They include skilled engineers and electronics technicians, administrators and supporting personnel.

Before completion of the White Alice network huge areas of Alaska did not have telephone or telegraph service. In the case of remote areas served only by bush pilots sometimes three weeks were required for delivery of a telegram.

Now telephone and telegraph service in most of Alaska is as reliable and fast as in the rest of North America.



*Turning glass base tubing on standard lathe. Machining operations such as turning, boring, facing and milling can be done on standard metal working machines using carbide-tipped tools and cutters.*

**Glass base laminated plastics used effectively in low-loss electronic equipment now bows to advanced techniques permitting the . . .**

## **Successful machining of glass base laminated plastics**

by E. C. Graesser \*

In an age when dramatic technological breakthroughs are occurring with increasing frequency, the high performance characteristics of glass base laminated plastics are becoming increasingly important to the design engineer. Originally developed and made available to industry in the thirties, these laminates offer advantages of good flame and heat resistance, high mechanical strength, and increased moisture resistance.

Unfortunately, coupled to these desirable physical properties are certain problems in manufacturing. Because of the toughness of glass base laminates, there originally was a doubt in many minds as to the practicability of volume production of these materials.

However, over the years, specific techniques have been developed for the successful machining of these laminates and, at this date, most problems have been resolved. The following basic recommendations for machining should be of interest not only to those who are encountering these materials for the first time but perhaps even to those who have already had some experience in machining glass base laminates.

It is important to bear in mind that when machining these materials parallel to the laminations, there is always the danger of splitting. However, this problem

\* Chief Engineer, Quality Control and Standards, National Fibre Company of Canada, Ltd., Toronto, Ontario, Canada.

can be virtually eliminated if the piece is firmly clamped during machining and if care is exercised during cutting operations. In many cases, the same machining operations employed in the fabrication of metals and wood may also be adapted to glass base laminates. However, certain slight changes in tools and the use of proper speeds are necessary. The following observations are a result of the writer's 20 years of experience in dealing with glass base grades of Phenolite laminated plastic.

### Sawing

A diamond impregnated wheel with copper body  $\frac{1}{16}$  in. thick and 12 in. diam run at 3000 to 3600 rpm will give good results cutting dry with a good exhaust system. The material is fed by hand into the saw as fast as it will cut without forcing the saw. Idling creates friction and heat, which cause excessive dulling and burning. A flood of water on the work and wheel can be used when necessary to prevent overheating. Abrasive wheel cutting under water is also recommended.

Band sawing is one of the most difficult and expensive operations. For good results, steel blades with hardened teeth and a soft back can be used. Work should be fed lightly and the blade should be kept sharp. Diamond coated band saw blades are now available and are superior to steel. Sawing can be done dry with a good exhaust system.

### Shearing and slitting

Thicknesses up to  $\frac{3}{32}$  in. can be sheared and slit. The same standard practices are used for shearing and slitting laminated plastic sheets.

### Punching

Punching practices for glass base materials are the standard ones used for laminated plastics generally, although die life is shorter. The use of carboloy and special die steels will help to increase die life. Sheets up to  $\frac{3}{32}$  in. thickness can be punched with good results.

### Drilling

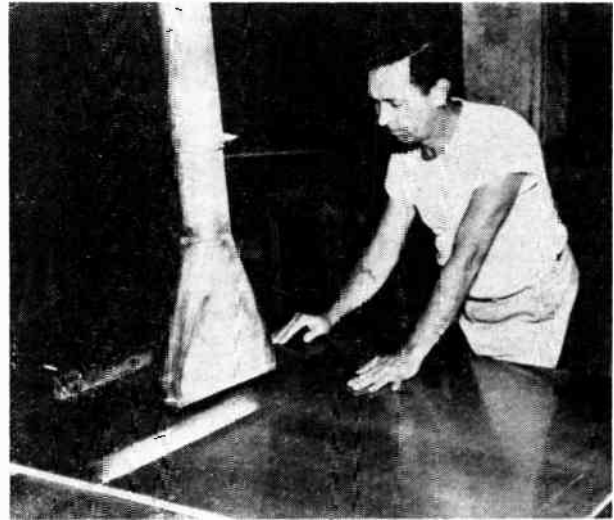
When drilling these grades, a carbide drill should be used. The materials can be drilled dry with a good exhaust system to remove dust. A flood of water on the work and drill can be used when necessary to prevent overheating and dulling of drills. High speed drills, nitrate treated, can be used, but must be sharpened more often. Care should be taken when sharpening so that the drill is cut back far enough to the original body diameter of drill. Spindle speed for these grades is 4800 rpm for  $\frac{1}{4}$  in. diam drills.

### Tapping and threading

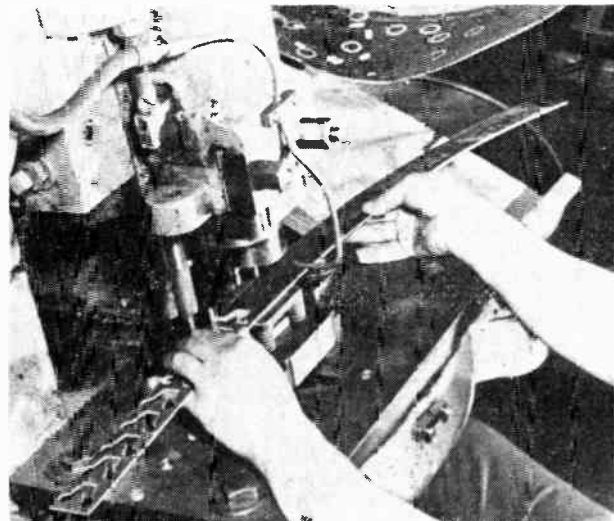
The methods for tapping these materials are much the same as for tapping paper base laminated plastics. The abrasiveness may cause taps to cut very close to size, resulting in a tendency toward binding when backing out. Standard high speed steel taps can be used on short runs. For any sizeable quantity, carbide taps should be used. Taps should be purchased over-size. Coolant can be used, but is not necessary if a good exhaust system is available.

### Threading

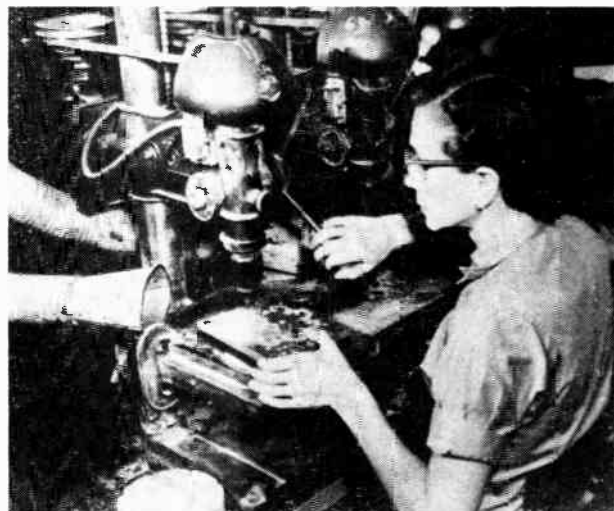
External threads and internal threads can be cut dry on a lathe with a carbide-tipped tool. Fine cuts should be taken to give best results. A coolant can be used, but is not necessary.



*Sawing a full sheet of glass base laminate with circular saw. Material is fed as fast as saw will cut without forcing.*

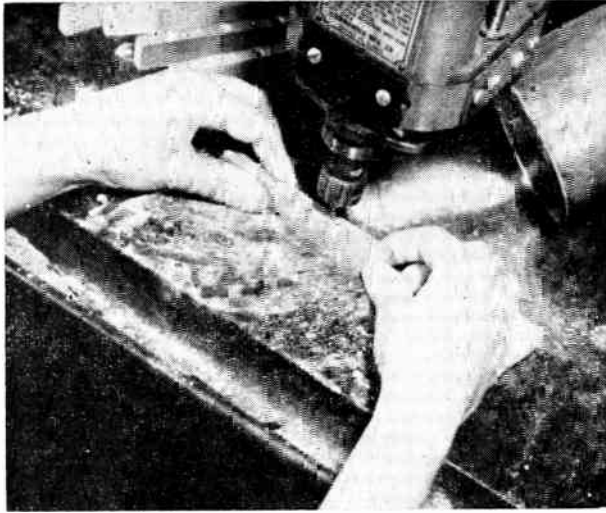


*Punching glass base material. Sheets up to  $\frac{3}{32}$  in. can be punched with good results.*

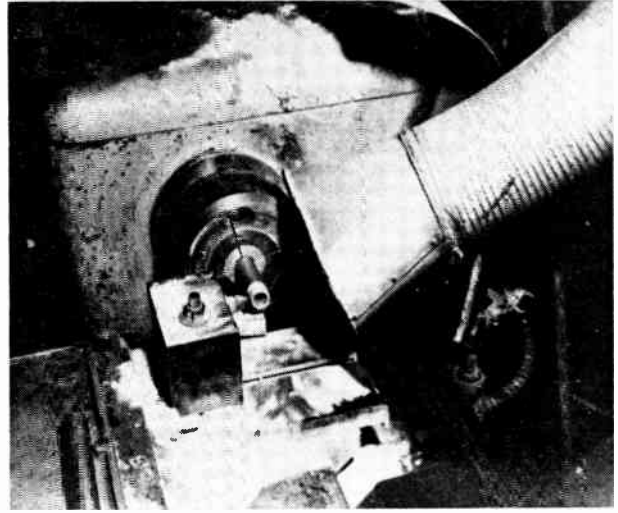


*Drilling glass base laminate part. Carbide drills are used with spindle speed of 4800 rpm for  $\frac{1}{4}$  in. drill.*





*Tapping operation is much the same as for paper base grades. Coolant can be used, but is not necessary when good exhaust system is available.*



*Threading, both internal and external, can be done on a lathe. Fine cuts should be taken for best results.*

### **Machining**

Conventional machining, such as turning, boring, facing and milling of these grades, can be done on automatic screw machines, standard and production lathes, hard turret lathes and standard milling machines. Carbide-tipped tools and cutters should be used with surface speeds below those used for paper base laminated plastics. Tools should be ground with a zero rake and machining can be done dry with an exhaust system to remove the dust. A coolant can be used, but is not necessary.

Today, the demand is more and more for materials that have good heat resistance with mechanical strength, in switch gears, low loss electronic equipment, and for other Class B and Class H insulation. New varieties of resins, including epoxies, silicones, melamines and phenolics, are being introduced. The progress in machining of glass base laminates is timely and continuing. Techniques are being refined almost daily so that glass base machined parts, though impossible in the recent past, can be turned out with speed and perfection, if operators are kept up to date with new and changing techniques.

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## **'Alf' and 'Elsie' bound for Canada**

Two newcomers to the British Post Office — "Alf" and "Elsie" — were introduced recently to business men and industrialists at the Mount Pleasant Post Office in London.

The illustration shows an operator sitting at the central panel of the new automatic letter sorting machine. — "Elsie" (Electronic Letter Sorting Indication Equipment), which will replace the men who now sort letters by hand. The operator sits at one end of the machine in front of a keyboard. The machine shows the letters to him one at a time, and the operator presses a key; the letter is whisked away to one of 144 boxes for various parts of Britain.

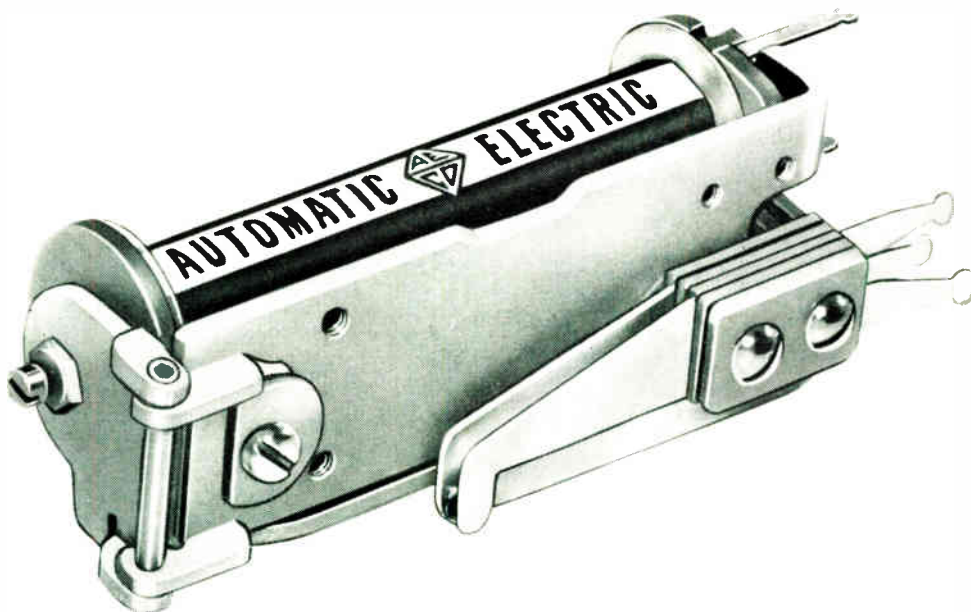
The first electronic sorting office is expected to be in operation in Norwich, England, during 1959.

"Alf" is an "Automatic Letter Facer" — which means one of its jobs is to face all letters the same way in readiness for cancellation of stamps. It undertakes the cancellations too, as well as separating second class mail from the rest. Already there is a machine of this kind working in the Southampton area of Britain.

It is hoped that this equipment will be on display in the British Section of the National Industrial Production Show to be held in Toronto from May 4 to 8 inclusive.



*France, Great Britain, the United States and Canada for some years have been engaged in the development of automatic mail sorting equipment. The above equipment which is of British origin is sure to attract the attention of Canadian postal officials when exhibited in Toronto in May.*



# DESIGNED FOR **HUNDREDS OF MILLIONS** OF OPERATIONS!

The telephone type relay shown above is just one of the millions that have been manufactured by Automatic Electric during the last 65 years—carefully designed, precision engineered relays in a wide range of types, capacities and characteristics—tested and proven across Canada, and in almost every country of the world.

In industry, telephony, avionics—whatever the application, the quality of Automatic Electric relays tells—every time. Contact springs show no sign of shifting after hundreds of millions of operations, and the resistance welded contacts are still rigidly attached—after years of continuous service.

*Automatic Electric Relays are made in Canada and distributed by*

*Automatic Electric Sales (Canada) Limited, 185 Bartley Drive, Toronto 16, Ontario. Branches in Montreal, Ottawa, Brockville. Hamilton, Winnipeg, Regina, Edmonton, Vancouver.*

**AUTOMATIC  ELECTRIC**

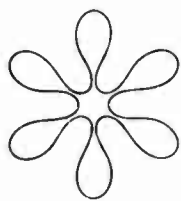
PIONEERS IN AUTOMATIC CONTROL



For complete details check No. 39 on handy card, page 51



# Greater efficiency means greater



# CONVERTER

TO MEET REALLY HEAVY GROWTH, ADD A FRAME WITH AS MANY SHELVES OF SWITCHES AS YOU NEED.

## WITH STROWGER C.A.X. YOU GET

### all these benefits today:

- Selection, supply and installation of necessary equipment.
- Vastly improved service to your customers.
- Much more economical operation.
- Ready expansion with simple jack-in equipment.
- Simplified checking, fast, easy testing of lines.
- Low maintenance and fast call tracing.
- Trunk repeaters, automatic time announcing and weather reporting.

### plus all these extra benefits tomorrow:

- Intertoll dialing with the latest supervisory standards.
- Easy adaptation to direct distance dialing.
- Easy adaptation to automatic toll ticketing.
- Ready expansion to director operation.
- "Four-wire" toll switching.





ter earnings

# IT TO DIAL NOW!

WITH STROWGER C.A.X.

ADD A SWITCH TO TAKE CARE OF MODERATE GROWTH.

Strowger C.A.X. equipment is custom built to your exact requirements. All you do is ring Automatic Electric—and a highly trained equipment engineer takes over from there. From initial planning and layout of buildings, to selection, supply and installation of every item of equipment, Automatic Electric will handle the entire project.

Strowger has been tested and proven in towns and cities in almost every part of the world. It incorporates all the latest advances in design and quality construction—remains absolutely reliable over very long periods of time. In fact in some exchanges, Strowger equipment installed 40 years ago, is still in constant use.

With Strowger the same basic units are used for small *and* large exchanges. So you simply install extra switches, or banks, or frames, step-by-step as your community grows. Every item is designed for extreme ease of maintenance, and the few parts that inevitably wear out with prolonged use—wipers and wiper cords for instance—can be quickly and easily replaced, at very low cost, and without your service being interrupted.

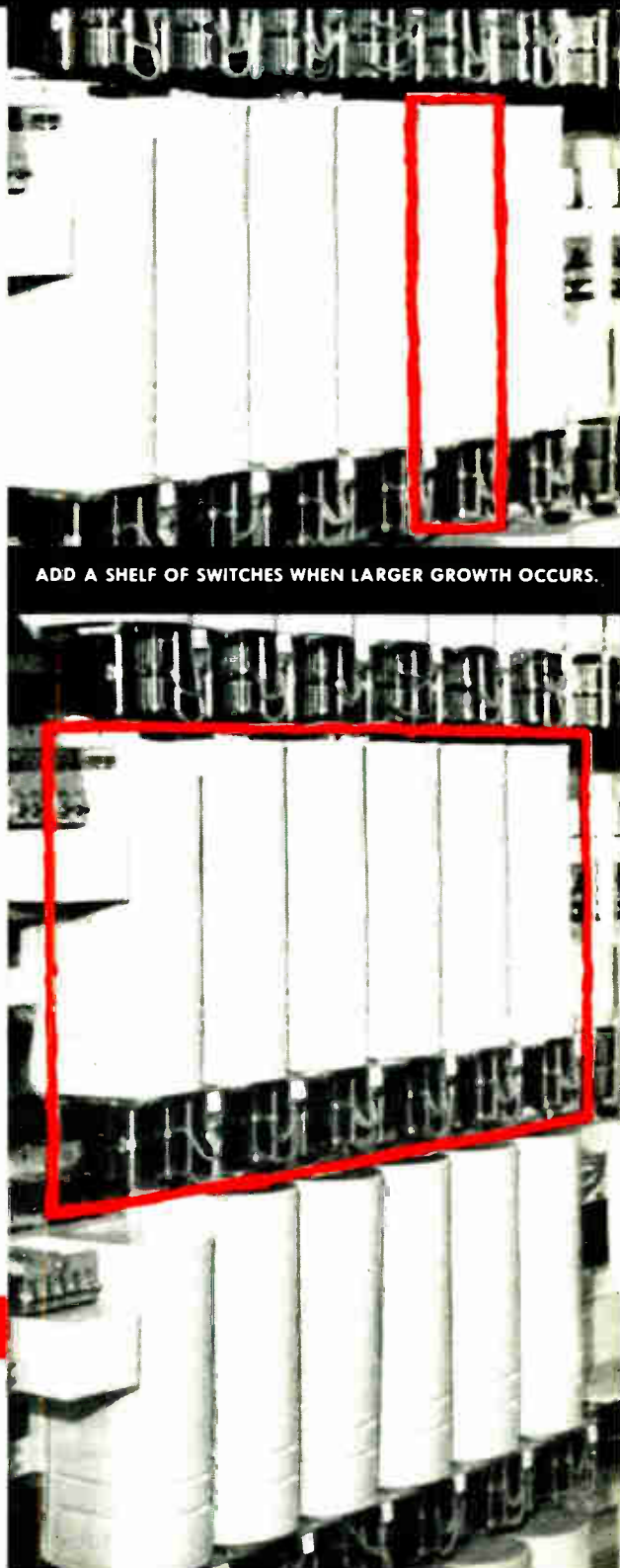
When you convert to dial with Strowger, you invest in up-to-the-minute equipment that can be readily adapted to your changing needs—however fast your community grows.

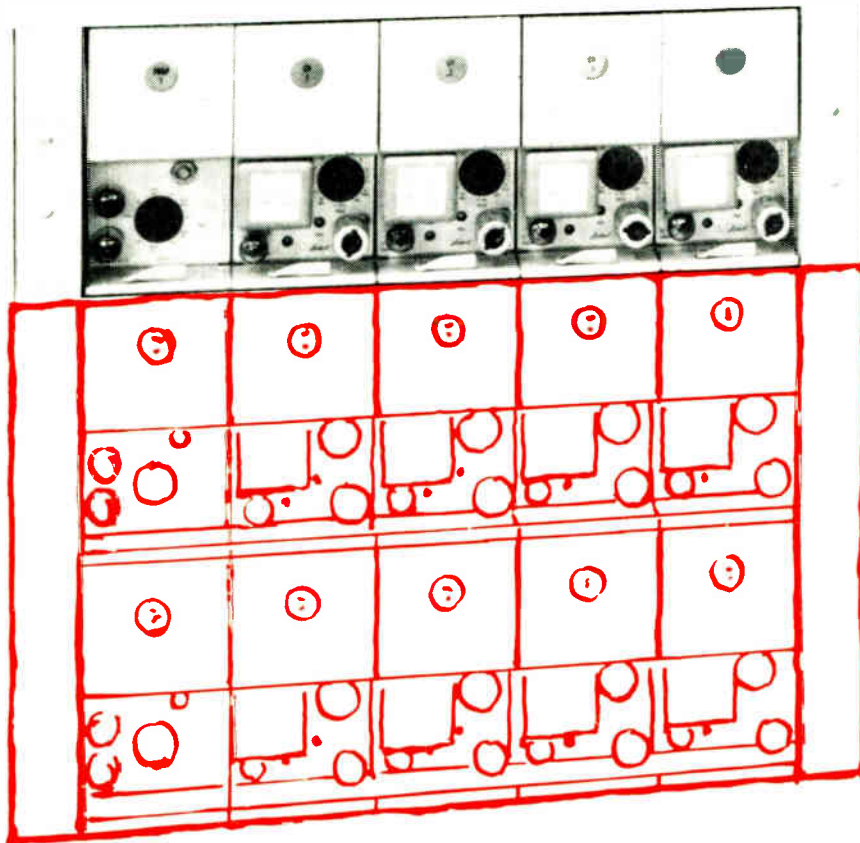
If you would like further information, call or write any Automatic Electric office today.

*Automatic Electric Sales (Canada) Limited, 185 Bartley Drive, Toronto 16, Ontario. Branches in Montreal, Ottawa, Brockville, Hamilton, Winnipeg, Regina, Edmonton, Vancouver.*

**AUTOMATIC**  **ELECTRIC**

ORIGINATORS OF THE DIAL TELEPHONE





*You need only install a partially equipped carrier system—with any number of channels from 4 up. This keeps your immediate outlay to an absolute minimum. Then as demand increases, you add the extra circuits you need, simply by plugging additional equipment into place on the pre-wired shelves.*

## “PLUG-IN” EXPANSION

By making maximum use of existing facilities, and by eliminating the need for channel equipment at connecting points, Lenkurt 45-class carrier systems provide still further important savings. And because all components have been miniaturized, the complete systems can be

installed in surprisingly little space.

Lenkurt 45-class Carrier Systems—available in Canada exclusively from Automatic Electric—provide toll quality multi-channel communication over wire lines, cable or radio circuits, using identical channel terminal equipment.

### ADDITIONAL SERVICES

- Engineering, supply and installation service.
- Drawing, publication, and information service.
- Training for your personnel.
- Factory repair and replacement service.

*Lenkurt* 

*For complete information write or call your nearest Automatic Electric office. AUTOMATIC ELECTRIC SALES (CANADA) LIMITED, 185 Bartley Drive, Toronto 16, Ontario. Branches in Montreal, Ottawa, Brockville, Hamilton, Winnipeg, Regina, Edmonton, Vancouver.*

**AUTOMATIC  ELECTRIC**

ORIGINATORS OF THE DIAL TELEPHONE



For complete details check No. 41 on handy card, page 51

# New Products

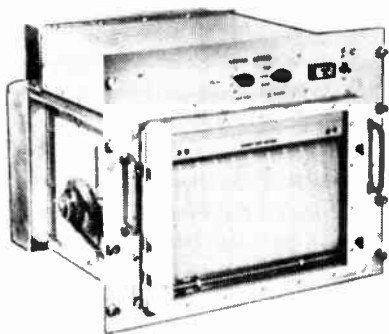
New Product specifications published in Electronics and Communications have been briefed for your convenience. If you require further information on any of the items published you may readily obtain such by using our Readers' Service, Page 51. Just mark the products you are interested in on the coupon on Page 51 and the information will be in your hands within a few days.

## 100 channel operations monitor

Item 2251

A 100 channel Operations Monitor for military (MIL-E-4158B) and rigorous industrial applications is being manufactured by Brush Instruments, division of Clevite Corporation, Cleveland.

The instrument will record, simultaneously, up to 100 separate and distinct operations and events on a moving chart only 12 inches wide. It provides a permanent record of operations and events, indicating their duration and time relationship to each other.



The 100 channel Operations Monitor has been designed by Brush to meet the requirements of such military applications as the checkout of missiles, rockets and other instrumentation involving complex circuitry.

Industrial and commercial applications include the monitoring of control processing equipment, checking automated production lines, traffic monitoring, and the testing of telephone switching equipment.

Among Operations Monitor features are electric writing — which provides ideal unattended operation, a rapid response of up to 500 signal changes per second, instantaneous selection of eight chart speeds by local or remote control, preprinted chart paper and a paper roll capacity of 500'.

Dimensions of the Operations Monitor are 19" x 15 1/2" (panel) x 17 1/2" (deep). It may be mounted in a standard 19" rack and weighs 100 lbs. net. Shipping weight is 175 lbs. Power requirements are 105-125 volts, 60 cps, 250 watts.

Additional information may be obtained from Brush Instruments, Division of Clevite Corporation, 37th and Perkins, Cleveland 14, Ohio, U.S.A.

## Switch no bigger than a paper clip

Item 2252

A new switch not much bigger than a paper clip automatically shuts off a tape recorder if the tape should break.

The device, being marketed by the Acro Division, Robertshaw-Fulton Controls Company, incorporates a non-magnetic nylon leaf with rounded surfaces, over which the tape passes. In the event of tape breakage, pressure upon the leaf is released, shutting off the recorder.

The main body of the switch is less than 1 1/2" in length. It is UL approved at 3 amperes, 250 V.A.C. Movement differential is .233" maximum, and operating force is as low as 6 grams.

Further information is available from Acro Division, Robertshaw-Fulton Controls Company, P.O. Box 449, Columbus 16, Ohio, U.S.A.

## Communication masts up to 300 feet

Item 2253

The new Beatty heavy duty 20 series masts for AM, FM, HF, VHF and UHF installations permit greater heights than can be attained with class "10" masts. The 20 series (20 inch face) goes to 300 feet as a vertical radiator. It is also ideal for carrying antenna wind loads up to 2,000 lbs. at lesser heights.

CSA approved, the 20" triangular steel structure is designed to withstand winds up to 100 MPH. The staggered bracing and overlapping splice connection give maximum structural strength. All girts and braces are resistance welded to the Canadian Welding Bureau Code to ensure absolutely accurate sections. Complete hot-dip galvanizing after fabrication provides lifetime protection from the elements.

Erection is simple and easily accomplished due to the convenient size of each section (10 ft.) and the weight (10.8 lbs. per foot).

These 20 series masts can be used with a hinged base as an antenna supporting structure or with an insulated base for AM transmission.

A complete line of accessories are available to suit this mast to various antenna types. Accessories include such items as the 6-way torsion resistor, lighting kits, antenna mounting plates, anchors, strain insulators, turnbuckles, etc.

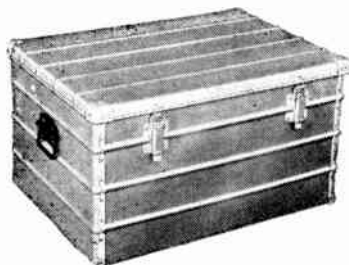
Complete information on this mast, including a mast selection chart can be had by writing to the Engineering Department, Beatty Bros. Limited, Fergus, Ontario.

## Light aluminum containers

Item 2254

More economical than wood or cardboard over a long period, the Trabox K400 is one of a wide range of aluminum handling containers of the Lacon design. It is fitted with a tight closing lid with spring tension clips. Lifting handles are provided at both ends and hardwood slide bars are fitted to the floor to take rough handling and dragging.

By using a special alloy of aluminum a combination of light weight and strength is obtained. Heat treatment does away with contamination by oxidizing, enabling the container to be used to advantage where cleanliness is an important factor. Extra strength is given to the product by using the patented Lacon beading process. The customer's name and suitable serial numbers can be indelibly embossed to specification.



Other Lacon items include trays, tote boxes, heavy duty shipping containers, both collapsible and rigid and hand trucks.

All Lacon products are handled exclusively by The Thornley Engineering Co. Ltd., 49 Milford Avenue, Toronto 15, Ontario, Canada.

## "Wire-wrap" hand tools

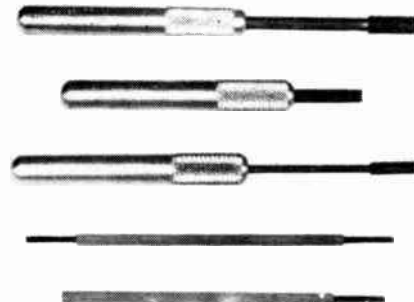
Item 2255

A series of "Wire-Wrap" hand tools for wrapping and unwrapping solderless wrapped connections has been introduced by Gardner-Denver Company.

The tools will provide for the maintenance and servicing of the growing number of solderless wrapped connections being used in the telephone, television and electronics industries, and can be used most ideally where a limited number of connections are to be wrapped or unwrapped.

The hand wrapping tools are used similarly to a screw driver. The wire is inserted in the wire slot, the tool placed on the terminal and rotated clockwise to produce a standard right-hand wrapping. Available in eight sizes with various terminal hole diameters and depths to handle wire from 26 to 14 gauge, the tools use the same wrapping bit utilized on "Wire-Wrap" tools to produce reliable solderless wrapped connections.

The unwrapping tools also are used similarly to a screw driver. The tool is placed over the terminal, snugly against the connection and rotated counter-clockwise, picking up the wire and removing it from the terminal. The wire remains on the tool for easy removal in hard-to-reach places.



Three unwrapping tools are offered to handle wires from 26 to 18 gauge on terminals of various size and length. They are available for unwrapping either standard right-hand wrapped connections or can be ordered to handle left-hand wrapped connections produced by the 14E-1 Two Spindle Keller "Wire-Wrap" machine.

Gardner-Denver Company, Quincy, Ill., U.S.A.

## Double drawn glass silicone coil bobbin

Item 2256

This deep drawn bobbin with the lead wire extrusion formed in the flange, represents a new achievement in high temperature solenoids.

Requirements included close tolerance I.D. and O.D. dimensions to fit the precision made case. In addition, an extrusion to protect the lead wires passing through the end plate was required.

Using glass silicone laminates, this manufacturer was able to draw core section, flange and lead wire extrusion in one piece to produce this bobbin for Class "H" application.

Stevens Products, 86-88 Main Street, East Orange, New Jersey, U.S.A.



# New Products

## Catalog describing multimeters

Item 2257

The J. W. Ellis Industries of Toronto, Ontario, announce a new eight page catalog describing the multimeters known under the trade mark "Multavi".

The inexpensive "Multavi II" has 22 ranges for DC and AC current and voltage measurements with a DC accuracy of  $\pm 1\%$ , AC accuracy of  $\pm 1.5\%$  between 15 and 500 cps. The voltage drop in the current ranges is 1.2 volts the sensitivity of the voltage ranges 333 ohms per volt.

The "Multavi 5" has 32 ranges with a voltage drop of only 300 microvolts in the current ranges and a sensitivity of 666 ohms per volt in the potential ranges. Its accuracy is  $\pm 1\%$  DC and  $\pm 1.5\%$  sine-wave AC 20-20,000 cps. A special model "Multavi 5F" has a special protection against external fields.

The "Multavi HO", specially designed for telecommunication, radio and TV, has a total of 30 ranges, with a DC sensitivity of 8,000 ohms per volt. Its accuracy is  $\pm 1\%$  DC,  $\pm 1.5\%$  AC, 30-30,000 ohms. It has also two resistance ranges of 10 kilohms and 1 megohm.

The "Multavi 5R" is a universal voltmeter with 16 ranges from 1.5 volts - 600 volts DC and AC and, at the same time an output-meter with seven ranges 1.5 - 150 volts for 15 - 30,000 cps.

The "Multavi S" with 23 ranges is designed for power engineering, its built-in AC current ranges go as high as 150 amps. Its accuracy is  $\pm 1.5\%$  DC and AC 15 - 30,000 cps.

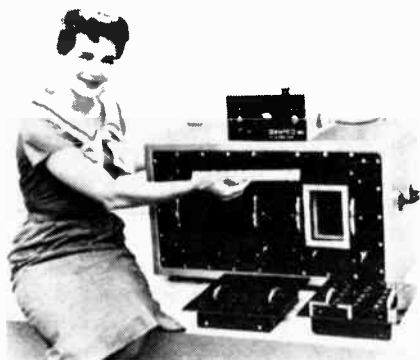
The new catalog EB 1.3 "H & B Multavi" is available from The J. W. Ellis Industries, 80 Richmond St. East, Toronto 1, Ontario.

## Miniature test chamber

Item 2258

Mantec Inc., El Segundo (Calif.) has announced a new miniature high-low temperature test chamber with dry ice coolant capacity adequate to maintain  $-65^\circ\text{F}$  for more than 12 hours. Other miniature test chambers can maintain such a low temperature only a fraction as long without replenishment of coolant, according to the announcement.

The new chamber, Mantec Model D-106, is only 28" long by 16" high by 15" deep and has a 10" x 10" x 10" test compartment. Weight is only 90 pounds.



The chamber is available with either top or side loading. An exclusive Mantec feature is the plug-in type test compartment doors supplied with windows, ports, electrical connectors, or shelves, or any combinations of these features. Alternate doors permit installation and instrumentation of specimens while testing is proceeding in the test chamber. Thus, units which have been tested can be removed and new units placed in test with no loss of time for set-up.

Unit can be supplied to use either block dry ice or liquid  $\text{CO}_2$ . Heating is electric.

Temperature is controlled automatically by a sensitive thermostat, and a dial indicates the temperature setting. Temperature range is from  $-100^\circ\text{F}$  to  $+400^\circ\text{F}$  (or, optionally, to  $+600^\circ\text{F}$ ) meeting MIL-5272A and most other MIL specifications.

Further information is available by writing to Wyle Associates (exclusive representatives of Mantec Inc.), 128 Maryland Street, El Segundo, California.

## Electronic micrometer

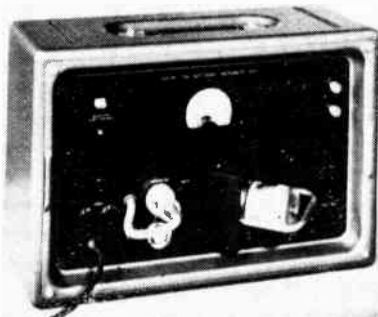
Item 2259

Designed to measure distances in the 0 to 45,000 micro-inches range with very high accuracy, the new Electronic Micrometer, Type B-721, affords a unique method of measuring small distances without physical contact.

The instrument, being marketed by Wayne Kerr Corporation, Philadelphia, measures small distances to an accuracy of one per cent. Measurement is by means of a transformer coupled bridge in conjunction with a non-contacting probe. The distance is measured in terms of the capacitance change between the test surface and the non-contacting probe.

This Wayne Kerr instrument is particularly suited to measurements on rotating objects, and for monitoring distance with reference to a predetermined value. Because no physical contact is necessary, accurate determinations of temperature coefficient, moduli of elasticity, rigidity and bulk, Poisson's ratio and dilation are possible on fragile samples.

The standard for the bridge circuit is a three-terminal capacitor whose value is adjusted by a micrometer. The range covered by a particular probe is determined by the area of its end-surface, which is arranged to produce an accurate ratio with the standard micrometer capacitor plates.



The micrometer scale is then magnified by the ratio of these two areas. The measured distance is given directly from the micrometer scale, thereby maintaining the normal reading precision associated with a micrometer.

With the three-terminal arrangement on this Electronic Micrometer, the capacitance of the probe cable can be counteracted, enabling measurements to be made remote from the bridge whenever lack of space or safety considerations preclude the presence of an operator. The probe is unaffected by strong external magnetic fields.

Wayne Kerr Corporation, P.O. Box 801, Philadelphia 5, Pa., U.S.A.

## Non-shorting cable cutter

Item 2260

Having a highly specialized missile application, a new propellant-actuated guillotine cutter includes a hitherto unavailable feature in that individual conductors in the cable bundle are not short-circuited when the cutting action takes place. This is accomplished by the use of a ceramic cutter blade being driven through the cable bundle onto a ceramic anvil. Driving power comes from a standard screw-in explosive cell (visible at the left in the illustration).

Designed for an application problem of eliminating all switches, plugs, relays, contactors, or receptacles, this cutter permits the solidly permanent wiring of all circuit elements to an un-activated battery.

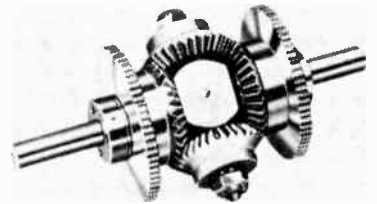
Activating the battery energizes the circuit and firing the cutter de-energizes it. Other potential applications would exist in cases where electrical circuits were to be severed with the certainty of no electrical contact between separate circuits.

Beckman & Whitley, Inc., 985 E. San Carlos Ave., San Carlos, Calif., U.S.A.

## Miniature differentials

Item 2261

The Helipot Division of Beckman Instruments, Inc., Toronto, Ontario, announces the availability of miniature differentials for use as speed controllers, or as sensing devices for mechanical comparison or error measurement. In many servo systems they are used as basic computing elements for the addition or subtraction of two shaft movements.



Gleason-Coniflex type bevel gears provide fine tooth-to-tooth action and long life. Spur input and bevel gears are cut to AGMA class II; input gears are piloted directly on the same pre-loaded ball bearings that support the bevel gears to increase end gear runout accuracy. All models feature minimum backlash, high accuracy and low breakaway torque.

In stock for immediate delivery are BP-301 with  $\frac{1}{4}$ " shaft, .065 oz. in. breakaway torque, maximum recommended torque 150 oz. in. and maximum recommended speed 1,800 rpm; BP-310 with  $\frac{3}{8}$ " shaft, .060 oz. in. breakaway torque, maximum recommended torque 100 oz. in. and maximum recommended speed 1,800 rpm; BP-320 with  $\frac{1}{2}$ " shaft, .060 breakaway torque, 90 oz. in. maximum recommended torque and maximum recommended speed 1,400 rpm.

Units are available for delivery from R-O-R Associates, Limited, 1470 Don Mills Road, Don Mills, Ontario, sales representatives for Helipot Division of Beckman Instruments, Inc.

## Microwave field intensity receiver

Item 2262

A new calibrated microwave field intensity receiver, permitting absolute measurements of microwave power within the frequency range 1,000 to 10,000 mc, has been developed by Polarad Electronics Corporation, 43-20 34th Street, Long Island City 1, New York.

Designated Model FIM, it is the first single test instrument capable of making not only precise measurement of the absolute level of radiated or conducted interference, but also of the susceptibility of other instruments and components to such interference. It combines a calibrated antenna system, a calibrated receiver and an internal calibrated signal generator.

The instrument features four interchangeable plug-in tuning units, each with UNIDIAL control that simultaneously tunes both the receiver and signal calibrator; a calibrated meter to indicate average, peak or quasi-peak value of r-f signals; audio, video and recorder outputs; and special aural tuning aid circuit to facilitate detection of weak or unmodulated signals.

The model FIM also serves for precision field intensity measurements, propagation studies, antenna pattern analysis, r-f leakage measurements, and analysis of characteristics of transmitters, receivers and other microwave components.

For further information please contact Polarad Electronics Corporation, 43-20 34th St., Long Island City 1, N.Y., U.S.A.

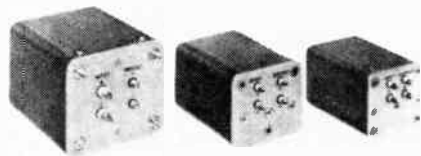
# New Products

## Transistorized DC to DC converters

Item 2263

Sorensen & Company, South Norwalk, Connecticut, announces a new line of transistorized DC to DC converters designed for incorporation into a wide variety of battery-powered airborne and mobile electronic equipment.

The new supplies, Sorensen's QC Series, provide an economical efficient means of obtaining higher voltages from standard 6-, 12- or 28-volt DC sources. Standard output voltages range from 50 volts DC (30, on 12-volt models) to 1000 volts DC. Powers to 200 watts in 12v models; to 150 watts in 28v models and to 90 watts in 6v models.



Convenient, rugged, packaged construction makes the new QC supplies as easy to apply as conventional potted electronic components. Tubeless circuitry, instantaneous starting, and low noise levels recommend the QC series for both commercial and military applications such as radio receivers, mobile telephone equipment, PA amplifiers, telemetering equipment, radiation measuring equipment and the like.

For complete specification data request Product Data Sheet QC503 from Sorensen & Company Inc., Richards Avenue, South Norwalk, Connecticut, U.S.A.

## Multi-trace oscilloscope

Item 2264

The new model 2400 oscilloscope uses a single-gun 17-inch cathode-ray tube to display information from up to 12 different sources simultaneously. Each channel as well as the sweep circuit consists of individual plug-in units with front panel controls for position, gain and intensity. Input stages consist of high-gain, push-pull low noise DC coupled amplifiers, using differential circuits.

The manufacturer (Railway Communications Inc.) has developed an entirely new design principle of multi-trace reproduction whereby time modulation of a pulse generator by the input signals intensity modulates the CRT beam. High resolution is obtained by means of a high rate on the vertical component of the raster and extremely short pulse duration.

Sensitivity is 10 millivolts peak-to-peak for 1 inch deflection. Frequency response DC to 2500 cps. Input circuits are two megohms impedance. A separate power supply is furnished.

Full specifications from Tele-Radio Systems Ltd., 3534 Oundas St. W., Toronto 9, Ont., Canada.

## Transistorized switch

Item 2265

New EECO T-Series plug-in circuits T-120, T-121, T-122, and T-128 are transistorized plug-in circuits that will switch a 400 ma load with as little as 50 ua input current. They are normally operated directly from EECO T-Series germanium plug-in digital circuits (flip-flops, one shot, multivibrator, squaring circuit, etc.), which have standard signal levels of -11 volts for "0" and -3 volts for "1". Case measures  $\frac{7}{8}$ " diam. by

$2\frac{3}{16}$ " seated height, weighs approximately 1 oz., and plugs into standard 9-pin miniature tube socket. Input signal frequency range 0-1 kc for 400 ma resistive load.

In typical application (as a relay driver) circuit actuates relay at -11 volts nom.; releases at -3 volts nom. Range of operation for Model T-122 is from 400 ma max. at 6 volts or less to 35 ma max. at 110 volts max. Power curve for other models is identical, except T-128 has max. of 24 volts, T-120 a max. of 48 volts, and T-121 a max. of 84 volts.

Available in repairable or encapsulated models from manufacturer: Engineered Electronics Co., 506 E. First St., Santa Ana, Calif., U.S.A.

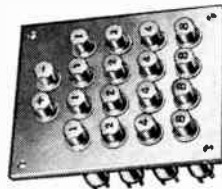
## Data strip with replaceable lamp cartridges

Item 2265

The Dialco Data Strip is designed to provide a number of ultra-miniature indicator lights — as a unit — ready for mounting in a minimum of space. This requirement is often encountered in the making of computers, program boards, read-out panels, etc.

The basic indicator light in a Data Strip consists of a lampholder with a plug-in lamp cartridge — specifically Dialco's own neon or incandescent lamp cartridges. The lamps used are the T-1 $\frac{3}{4}$  incandescent lamp in a voltage range from 1.35 to 28v; or the NE-2E neon lamp for 105 to 125v circuits.

Each lampholder has 2 terminals and is completely insulated without the use of insulating shoulder washers. The cartridges are capped with short, or long, cylindrical lenses which can be hot-stamped with one or two numerals, symbols, or letters.



Data Strip No. DSV-7538-10 holds 10 lamp holders; but Data Strips can be made with any desired number of lampholders on the aluminum channel — for vertical or horizontal reading. Each lampholder is on  $\frac{1}{2}$ " centers and every adjacent Data Strip has  $\frac{1}{2}$ " spacing. The Data Matrix is similar to the Data Strip but rectangular in shape. No. DM-7538-18, a typical Binary computing application, holds 18 lampholders (as illustrated).

For additional information, write to Dialight Corp., 60 Stewart Ave., Brooklyn 37, N.Y., U.S.A.

## Solid state batteries

Item 2267

A group of solid state batteries, small enough to hold in the palm of your hand but capable of delivering a combined voltage of 1600 volts, are now available from the Patterson, Moos Division, Universal Winding Company, Inc., Jamaica, N.Y.

The batteries, called "Dynox", come in four different sizes — Dynox "95", with a 95 volt potential in 0.14 cubic inches, Dynox "190", with a 190 volt potential in 1.15 cubic inches, Dynox "380" with a 380 volt potential in 1.57 cubic inches, and Dynox "950", with a 950 volt potential in 2.87 cubic inches. The latter is said by the manufacturer to be the smallest solid state battery on the market with such a high voltage rating.

The company states that the batteries

have a functional place in modern electronics systems where miniaturization and reliability of performance in extreme environments are required. These applications include power sources in missiles, avionics, alarm systems, instrumentation — such as computers — and telemetering as well as capacitor charging applications.

For further information contact the Canadian Representative: Lake Engineering Co. Ltd., 767 Warden Avenue, Scarborough, Ontario.

## Four pole crystal can relay

Item 2268

The first Four Pole Crystal Can Relay, Branson's Type AR, is now available. A truly new and advanced design, withstands 125°C temperature and 2,000 cycles vibration.

With header leads arranged on a one-tenth inch grid and several case styles available, the Branson Type AR is compatible with printed circuits, miniature packaging and micro modular construction.

Dry circuit to 2 amp contact rating plus nominal operating voltages up to 115 volts DC, make the Branson Type AR a versatile space and weight saving relay.

Branson Corp., 41 So. Jefferson Road, Whippany, N.J., U.S.A.

## Rugged silicon solar cell modules

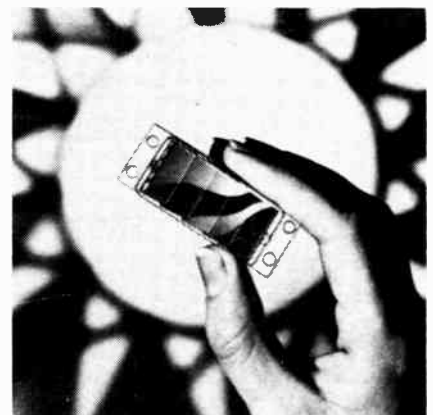
Item 2269

Rugged, high efficiency silicon solar converter modules that will supply 100 watts of power per 14 sq. ft. of cell area are now available from International Rectifier Corporation, El Segundo, California.

These high efficiency "building block" modules — capable of converting up to 8% of the radiant energy falling on their surface — make practical the supply of hundreds of watts of power for industrial or military applications. Modules with even higher rates of conversion efficiency may be obtained for satellite and other special applications.

The modules are assemblies of series and parallel connected silicon solar cells with specially processed, ruggedized contact strips that assure optimum conversion efficiency. Each module contains five series-connected 1 cm. x 2 cm. solar cells embedded in an epoxy mold that provides a rugged, shockproof, weatherproof housing.

These solar converter modules may be used in conjunction with storage batteries to supply continuous power where unattended performance and long life are desired. A typical installation can supply a charging current of from 25 ma to greater than 1 amp into a 12-volt nickel cadmium



battery in bright sunlight. Modules may be interconnected in series-parallel configurations to supply any desired power rating.

For more detailed data on panels of this type, or individual modules, write for Bulletin SR-276 to International Rectifier Corp., 1521 E. Grand Ave., El Segundo, California, U.S.A.

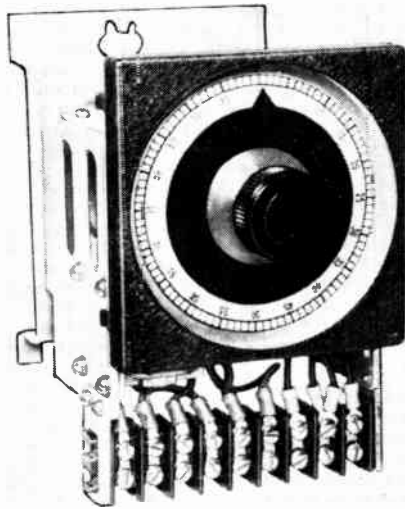


# New Products

## Add-subtract counter

Item 2270

The new Eagle Add-Subtract Counter provides automatic control for conveyor systems, inventory systems, automatic storage hoppers, etc. Add and/or subtract pulses may be fed to this unit in any sequence, or simultaneously, without a miscount. S.P.D.T. switches are actuated when minimum or maximum count is reached.



Add pulses over one circuit advance the counter counter-clockwise to a preselected maximum set on the dial, where an integral S.P.D.T. load switch is actuated. This switch may be connected to stop a motor, energize a valve, ring a bell, etc. It can also be used to cut off the add pulse to stop further counter-clockwise dial rotation until at least one subtract pulse has been received.

Subtract pulses over a second circuit return counter dial clockwise towards zero where another integral S.P.D.T. zero switch is actuated. This switch may likewise be used to perform external functions as well as to cut off the subtract pulse, stopping the dial at zero.

This counter, wired for continuous count, will also receive add or subtract pulses continuously, 100 pulses per revolution. With the maximum switch set at 50 on the dial, an output pulse will be secured every 50 pulses. Special cams are available for 5, 10, 20 and 25 counts per output pulse.

This new Add-Subtract Counter has 10 ampere contacts and is available in 115 volts or 230 volts, 60 cycle models. Write Davis Automatic Controls Ltd., P.O. Box 360, Islington, Ontario, for your copy of descriptive literature, Bulletin 740.

## Planimeter integrates flow from strip chart records

Item 2271

Continuous, accurate integration of existing regular size chart records and the 3" or 4" wide charts used extensively with pneumatic control systems can now be accomplished with a new, portable Planimeter recently developed by Royson Engineering Co., Hatboro, Pa. Conversion of the unit from linear use to square root or visa versa is easily accomplished by changing a cam. Linear accuracy is said to be 1/2 of 1% while accuracy on square root charts is 1/2 of 1% at the upper half of the scale and 1% at the lower end of the scale.

The Royson Planimeter is easily operated with the chart being fed through the unit by a variable speed electric motor, speed

being controlled by a foot rheostat to permit accurate tracing with optimum chart speeds. As the chart is run through, a large hand knob permits the operator to cause the small index point to follow the curve on the chart for integration purposes. Thus, if the chart is recording rate of flow, the integrated total on the Planimeter will be the actual gallons or pounds of material that have gone through the meter. The output of the Planimeter is read on a five digit counter which can be reset to zero.

Size of the ruggedly built unit for 4" wide charts is 8" wide by 15" long by 4 1/4" high and it can be set on a desk top and plugged into the 110 volt AC line.

For additional information on the Royson Planimeter or on continuous integrator installations which integrate as they record, write Royson Engineering Co., Hatboro, Pa., U.S.A.

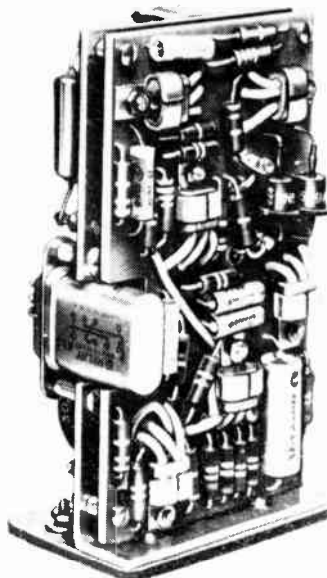
## All transistor voltage comparator

Item 2272

A new basic test module, capable of greatly simplifying test and control equipment design, the 200 Series Voltage Comparator trips a DPDT relay output when the unknown signal input exceeds the value of the known reference input.

Utilizing direct voltage comparison, the most reliable technique for making accurate programmed measurements with computer speed, the small (2 1/8" x 1 1/8" x 4 1/8"), light-weight (12 ounces) test control device has virtually unlimited applications, e.g., military ground support equipment, airborne instrumentation, modular test equipment, alarm/control systems and many data gathering and processing systems.

This new all-transistor device has outstanding features of high sensitivity, 5 millivolts AC, 10 millivolts DC; high input impedance 2 megohms (min.); low power requirement, 115 volts, 400 cycles, 1 watt with relay operating (0.1 watt with relay non-operating); phase or polarity sensitivity; and no zero drift with DC inputs. The output relay contact ratings are 2 amps at 28 volts DC.



The comparator has a repeatability of trip point of  $\pm 1$  microvolt, overload capacity of 1,000 times the rated sensitivity, is completely transistorized and utilizes printed circuitry and miniature components throughout. Its performance will fully meet or exceed applicable portions of MIL-E-5400A and MIL-E-5272.

For additional information contact Trio Laboratories, Inc., Plainview, Long Island, New York, U.S.A.

## Duplexer with high reject attenuation

Item 2273

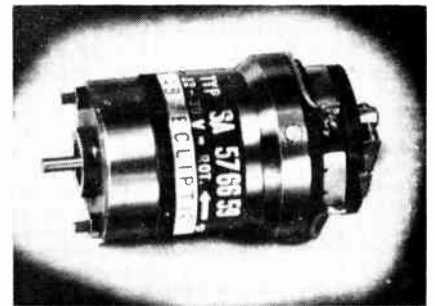
A duplexer having a reject attenuation greater than 100 db has recently been introduced by D. S. Kennedy & Co. of Cohasset, Mass. The component, designed for operation in the 755 to 985 mc band, is especially suited to tropospheric scatter applications. The duplexer enables the same antenna to be used simultaneously for both transmitting and receiving. It is made of high strength aluminum alloy. The transmitter and receiver ports are equipped with transitions which are fitted with coaxial inputs.

For additional information contact D. S. Kennedy & Co., Cohasset, Mass., U.S.A.

## DC governor motor holds uniform speed within one per cent

Item 2274

A new, small, constant speed DC motor equipped with a governor that controls shaft speed variation within 1%, has been announced by Carter Motor Co., 2766A W. George St., Chicago, manufacturers of fractional HP electric motors.



Overall dimensions are approximately 1 1/2" x 3", including the shaft which protrudes about 1/2" beyond the motor frame proper. Weight is about 7 ounces.

The motor is rated up to 1/100 HP at 4,500 to 9,000 rpm, with a rotor torque of 3.5 oz. in. for intermittent duty. Rotation may be supplied clockwise, or counter-clockwise. A wide range of outputs is available, with input voltage ranging from 24 to 48 volts DC. Shaft diameters from .109" to .118". Stud mountings available for 4-40 thread.

Body of the M-120 motor is solid aluminum with anodized finishes available in 6 colors without extra cost. Construction is high quality throughout, using best materials and workmanship. The sealed ball bearings require no lubrication.

AC input models will also be available later in 1959.

For full details, performance charts, dimensional drawings and price list, inquiries should be addressed direct to Carter Motor Co., 2766A W. George St., Chicago 18, Illinois, U.S.A.

## Coaxial cable lightning arrester

Item 2275

Something new has been added to the lightning arrester field. While lightning protection has been available in balanced lines for television as well as communications systems, Cush Craft of Manchester, New Hampshire, has developed a Coaxial Cable Lightning Arrester ("The Blitz Bug").

This all new lightning arrester fits any standard coaxial cable. It is designed to eliminate heavy static charge build-up protecting valuable radio equipment.

The "Blitz Bug" will handle 1 kw, fully modulated, and it will protect the cable from punctures caused by high standing wave ratios. There is no insertion loss from "Blitz Bug" and it will not affect performance to 500 mc.

For further particulars contact Cush Craft, 621 Hayward Street, Manchester, New Hampshire, U.S.A.



## New Products

### Transistorized power supplies

Item 2276

New Universal Transistor Products Corp. Transistorized Power Supplies for communications and navigation applications provide built-in protection against the spikes and transients disturbing system voltages in air-ground systems as described in MIL-E-7894A.

Model #6073 shown is a transistorized replacement for DY-103, the dynamotor for the ARC 34 transceiver, which features protection against input polarity reversal and short circuits as well as control of over-voltage.

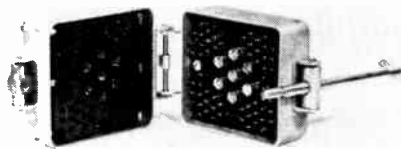
Plug and mounting facilities are designed for simple mount-to-mount replacement of electro-mechanical supplies. Operating efficiency is 87%. Size is only 6¼" x 3½" diameter. Weighs only 2 lbs. 12 oz. It produces 300 volts and 100 volts from 27 volts DC input. The supply operates in temperatures from -40°C to +80°C. Other models are available with inputs from 6-110 volts DC and outputs to 2,000 watts.

For further details write: **Universal Transistor Products Corporation, 17 Brooklyn Avenue, Westbury, L.I., N.Y., U.S.A.**

### Multi-contact connectors

Item 2277

New Amphenol Multi-contact Rack & Panel Connectors, for use with RF transmission wire in multiple circuits, circuit analyzers or test equipment, are now available.



Known as the 115 series they are available in a variety of shells and contact arrangements with seven co-axial contacts and up to 93 knife blade #16 contacts.

For further information write to: **Amphenol Canada Limited, 300 Campbell Avenue, Toronto 9, Ontario.**

### Ultra small choke coil

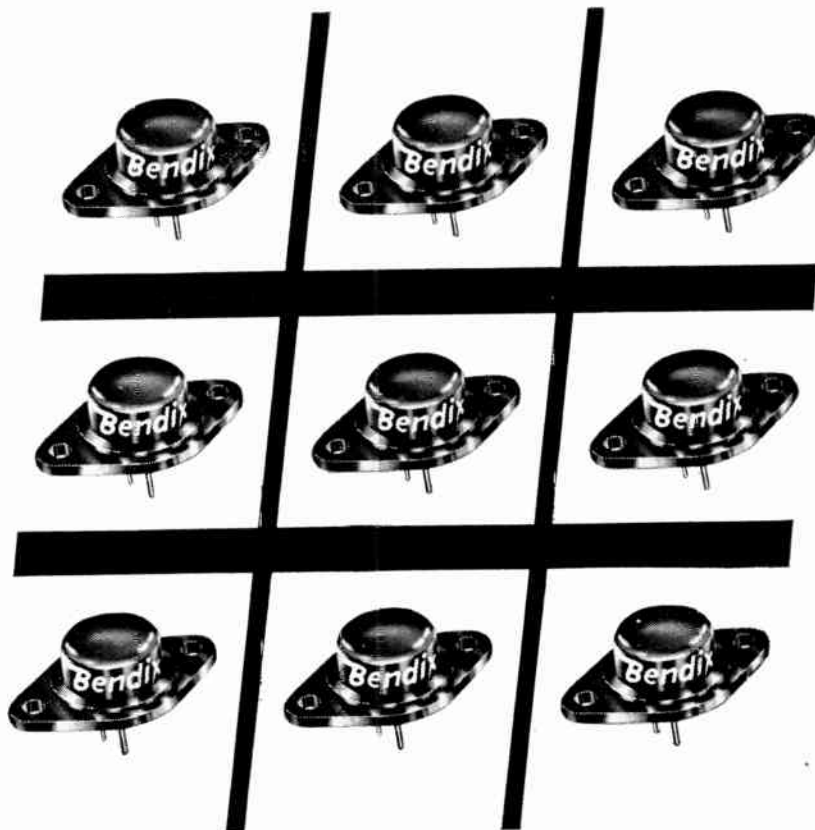
Item 2278

A new ultra small miniature R.F. Choke Coil known as the WEE-DUCTOR is announced by Essex Electronics, Berkeley Heights, N.J.

The tiny new choke covers a full range of inductances from 0.10  $\mu$ H to 1,000  $\mu$ H, yet it measures only 0.150" in diameter by 0.375" long, occupying a volume of less than 0.0066 cubic inches. The WEE-DUCTOR design allows for a high current rating at 125°C operating temperature. Because of its unique new design construction which consists of a high permeability ferrite sleeve and core sealed in epoxy resin for moisture resistance to MIL-C-15305A, the new choke covers a wide range of inductances in a small package size.

In development for more than two years at the laboratory of Essex Electronics in Berkeley Heights, N.J., the WEE-DUCTOR is now available as a standard part of the Essex Electronics line of R.F. chokes, coils, delay lines, and pulse transformers.

A detailed data sheet describing this new choke is available on request from **Essex Electronics, Berkeley Heights, N.J., U.S.A.**



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## NEW BENDIX SWITCHING TRANSISTORS

# Now the new Bendix series of nine Power Switching Transistors lets designers select exactly the transistor they need to design each circuit for maximum efficiency and economy.

Especially engineered as high current switching devices for DC-DC converter circuits and DC-AC inverter circuits, these transistors are capable of switching up to 250 watts. Available in three current gain ranges for optimum matching, the transistors also have three voltage breakdown ratings to eliminate burn out. Easy to design into circuits, easy to mount, Bendix Power Switching Transistors come in the standard transistor "package". Some other common applications are: relay replacements, drivers for relays, magnetic clutches,

solenoids, and other loads requiring high current.

For a wide choice in performance and price to meet your transistor needs exactly, select Bendix Power Switching Transistors. Write for further information to

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Current Gain At 3 Adc	Collector-to-Emitter Voltage		
	40	70	80
15-30	2N639	2N539A	2N639B
20-40	2N638	2N638A	2N638B
30-60	2N637	2N637A	2N637B



## COMPUTING DEVICES OF CANADA LIMITED

For complete details check No. 48 on handy card, page 51

# News Report

*A monthly roundup of news and personnel changes in the Canadian electronics industry*

## Varian and Bomac combine operations

The board of directors of Varian Associates, Palo Alto, California, announced recently that negotiations had been completed, subject to final settlement of legal and accounting matters, whereby Varian Associates and Bomac Laboratories, Inc., of Beverly, Massachusetts, would combine operations through an exchange of common stock, with Varian acquiring an 80 per cent interest in Bomac and having an option to acquire the balance of the outstanding Bomac common stock.

In making this announcement, Dr. Russell H. Varian, chairman of the board, and H. Myrl Stearns, president of Varian Associates, stated: "This combination marks a significant step forward in the development of the two companies. We believe that it greatly enhances the scientific and productive resources of both companies giving them increased capabilities to meet the tremendous challenge of the space age."

Henry J. McCarthy and Harold C. Booth, president and executive vice-president respectively of Bomac, according to Mr. Stearns, will continue to head the operation of Bomac Laboratories, Inc., and will join the Varian board of directors upon completion of the exchange of stock. Mr. Booth will be elected a vice-president of Varian Associates.

## Muirhead Instruments make distributor appointment

Muirhead Instruments Limited, Stratford, Ontario, announce the appointment of Constellation Components Company as distributors of Muirhead synchros and servomotors in Ontario, Quebec and the Maritimes.

The Toronto office of Constellation Components Company, which is located at 136 Tower Drive, Scarborough, is under the management of C. G. Bell, P.Eng. E. J. Mulvey, P.Eng., manages the Montreal office.

The Stratford sales department of Muirhead Instruments, managed by R. W. Watler, A.M.I.E.E., continues with all other instruments in the Muirhead range and also full technical liaison and servicing facilities. Sales and service for the rest of Canada continue to be handled by Muirhead's at Stratford.

## Syntron (Canada) Limited appoints sales manager

Syntron (Canada) Limited, Stoney Creek, Ontario, have announced the appointment of Mr. Armand L. Fromanger to the position of sales



A. L. Fromanger

engineer in charge of marketing for the company's complete range of Canadian made rectifier elements. Mr. Fromanger is widely known in the electronic industry and is an active member of the Institute of Radio Engineers. His appointment is in keeping with the company's rapidly expanding growth in the development and manufacture of dry state semi-conductors.

## Canadian Westinghouse "microscatter" test

Canadian Westinghouse designed-and-built "microscatter" communication equipment is undergoing a new test program on a 130-mile hop over water between Trenton and Hamilton, Ontario. It marks the first time in Canada that such equipment has been tested over a water and land link in the same geographical area. A year-and-a-half-long test over land was

recently completed.

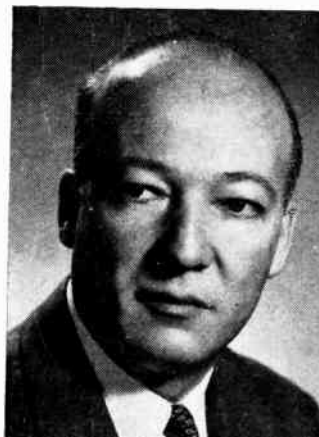
The comparative data obtained will determine whether the signal level of tropospheric scatter is higher over water than a comparable distance over land. The new test also points out one of the most significant advantages of microscatter since a line of sight communications link over the same distance may require four repeater stations and two terminal stations.

The two antennae at Trenton are 12 feet in diameter and mounted on a low wooden platform. At the 4,400-5,000 mc band, dual space diversity is achieved with the focal points of the antennae just 24 feet apart. Two 16-foot antennae are used at the Hamilton end of the link.

A complete quadruple diversity repeater station including antenna may be conveniently installed and transported on a standard 40-foot tractor trailer truck. A standard version of the Trenton, Ontario, equipment is being built by Canadian Westinghouse for use in the establishment and testing of ground control for the Bomarc missile. Another order for a helicopter lifted tactical version of "Microscatter" for the United States Air Force is now also in production.

In addition to voice communication, the new equipment may also be used to send television, facsimile, teletype, general data and radar data type transmission.

## UNITED-CARR FASTENER APPOINTMENTS



J. R. Johnston



G. J. Muir

Two executive appointments are announced by R. M. Healey, president of United-Carr Fastener Company of Canada, Limited, Hamilton. J. Robert Johnston, formerly general sales manager, becomes vice-president in charge of sales. Mr. Johnston, who also served as branch manager in Montreal and Winnipeg, joined the company 22 years ago.

George J. Muir is appointed secretary-treasurer. Mr. Muir has been assistant treasurer since 1952, and has also held a number of administrative positions during his 24 years of service in the head office of the company.



## 1959 IRE Canadian Convention Executive Committee



In preparation for the 1959 IRE Canadian Convention and Exposition to be held in the Automotive Building, Exhibition Park, Toronto, October 7, 8 and 9, the following personalities in the Canadian electronics industry have been appointed to the Executive Committee of the Convention. They are: Standing (left to right): Don K. Ritchie, Chairman Technical Program; S. F. Love, Exhibit Award Committee; George Armitage, Chairman Exhibits Committee; Ron G. Bullock, Chairman Social Activities Committee; Harry F. Shoemaker, Chairman IRE Toronto Section; Tom Purdy, Region 3 Liaison; A. Jones, Chairman Advertising and Publicity Committee; T. M. Lynd, Chairman Finance Committee; Lloyd M. Price, Chairman Registration and Reception Committee. Seated (left to right): A. P. H. Barclay, IRE Region 8 Director; H. W. Jackson, Recording Secretary; Eric L. Palin, General Chairman; Fred J. Heath, Vice-Chairman; Grant Smedmor, Convention Manager. Absent at time of photograph: Dr. George Sinclair, Past General Chairman; H. Ross Smyth, Chairman Exhibit Award Committee.

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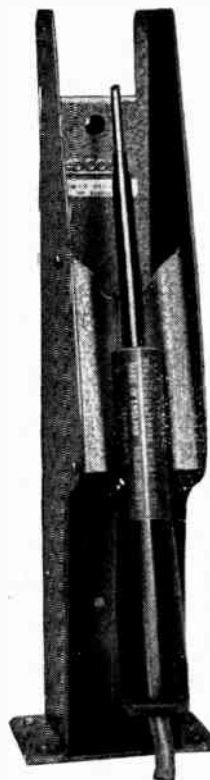
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# DUMONT® 2-WAY RADIO



Now available at competitive prices, 30, 60 and 100 watt mobile equipment for full coverage and extended range. Dumont 30 mc/s and 150 mc/s equipment features "strip chassis" construction utilizing new electrical and mechanical designs to provide base station stability in a mobile unit. Vibrator, dynamotor, or transistorized power supplies now available for most models. All Dumont models fully certified for land-mobile service and comply with D.O.T. type approval requirements for split channel use.



## Features

- Superior receiver sensitivity for crystal-clear reception
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- Rugged mechanical design
- Base station stability in a mobile unit
- New "No Juggle" microphone
- Precision protection circuits
- Low power drain
- Long service life
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- Extremely low maintenance cost

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For complete details check No. 56 on handy card, page 51

### Instronics Ltd. awarded defense equipment order

Instronics Limited of Stittsville, Ontario, have recently been granted an order for 132 Racial Type RA.17C Communications Receivers.

The order was placed after extensive evaluation by the Department of National Defense, Inspection Services, the Defense Research Board, the Royal Canadian Navy, and the Canadian Army.

Delivery is to commence February 15, 1959. An amount of \$170,728.86 is involved in the transaction.

### C. R. Hughes elected president of affiliate

At a recent board meeting of Canadian (B.C.) Telephones and Supplies, C. R. Hughes was elected president. This organization, with headquarters in Vancouver, is affiliated with Automatic Electric (Canada) Limited, and performs installation and service work across Canada for products manufactured by Automatic Electric.



C. R. Hughes

These new responsibilities are in addition to Mr. Hughes' present position as president of Automatic Electric (Canada) Limited, and Automatic Electric Sales (Canada) Limited. This will permit a closer integration of manufacture, sales, installation and service, covering equipment supplied by Automatic Electric to the communication field in Canada.

At the same meeting A. W. Vaughan was elected vice-president and general manager; and D. Armstrong was appointed secretary and treasurer with D. Campbell as assistant secretary and treasurer.

## Electrolabs handles "Chelton" equipment

Chelton (Electrostatics) Limited, Marlow, Bucks., England, have announced the appointment of Electrolabs, 7385 St. Lawrence Boulevard, Montreal, as their exclusive Canadian representative.

"Chelton" makes a line of aircraft aerial equipment for military and commercial use. Their anti-static techniques are based on the most modern specifications of service and maintenance requirements. Distributors and OEM inquiries are invited.

## Southern Ontario engineers hold regional conference

The second annual southern Ontario regional conference of the Engineering Institute of Canada will be held at the Royal Connaught Hotel, Hamilton, Ontario, on Saturday, March 14.

The program for engineers includes a luncheon and panel on the "Engineer - 1965". Papers will be given during the afternoon session. A full program including luncheon and fashion show has been arranged for the ladies.

## R. H. Nichols transfers senior staff members

Two appointments have been announced by H. J. Davie, president and general manager of R. H. Nichols Limited, Downsview, Ontario.

A. W. Bleue, formerly sales manager, has relinquished that position in order to represent the company in Western Canada, from Vancouver. His wide experience with the company's products, obtained over the past 12 years, will enable him to provide a very necessary service to the company's Western customers.

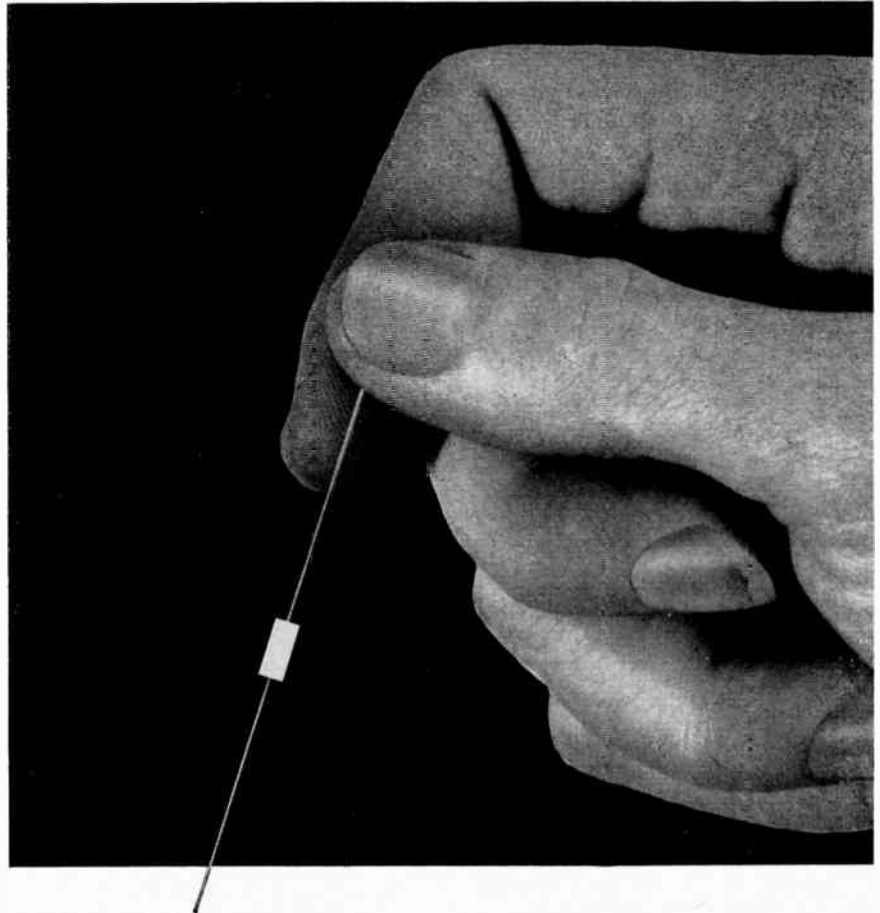


A. S. Thomson



A. W. BLEUE

A. S. Thomson has assumed the position of manager, Supervisory Control Design. During the last ten years he has contributed greatly to improvements in the design, operation and application of the company's remote supervisory control equipment. He is a recognized authority in this field in Canada.



# Amazing New **WEEDUCTOR**

## The R. F. Choke that's so small you can pack 200,000 to a cubic foot

Tiny, new WEEDUCTOR covers a full range of inductances from 0.10  $\mu$ H to 1,000  $\mu$ H, yet it measures only 0.150" x 0.375" and occupies a volume of less than 0.0066 cubic inch!

Unique, new, ferrite sleeve and core construction provides 10,000 to 1 inductance range in a tiny package . . . yet it still allows for a high current rating at 125°C operating temperature.

WEEDUCTOR is the latest addition to the Essex Electronics line of standard R.F. Choke Coils . . . write today for detailed data sheet describing this amazing new miniature choke with the expanded range of inductances!



### Essex Electronics Standard Line of R.F. Chokes

Essex Part Number	L $\mu$ H	Max. Res. $\Omega$	I Max. ma	Dia.	Length
WEEDUCTOR	0.10 - 1,000	0.035 - 14.9	3000 - 150	0.150	0.375
RFC-S	0.10 - 100	.02 - 6.0	4000 - 220	0.188	0.44
RFC-M	1.0 - 1,000	.04 - 21.0	2700 - 125	0.25	0.60
RFC-L	1.0 - 10,000	.03 - 80.0	4000 - 80	0.31	0.90

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For complete details check No. 58 on handy card, page 51



## IRE Toronto section hears talk on solar corpuscles

The Toronto section of the Institute of Radio Engineers was addressed recently by Dr. T. R. Hartz, Defense Research Telecommunications Establishment, Defense Research Board, on the subject, "Measurements on Solar Corpuscles and their Relation to Ionospheric Storms."

Dr. Hartz, who is section leader of the Upper Atmospheric Physics Section of the Radio Physics Laboratory of the Defense Research Telecommunications Establishment, is currently engaged in solar radio noise measurements and research on solar-terrestrial relations.

## CGE appoint rep for two-way radio

Gordon Ruth & Company of London, Ontario, has been appointed an authorized Canadian General Electric manufacturer's representative for Progress Line two-way radio, according to an announcement by P. T. Wilson, sales manager of CGE communication equipment unit, Royce Works, Toronto. Mr. Wilson said the appointment will help meet the increasing demand for mobile radio by police, fire, public works, transportation, construction, civil defense and utilities.

Mr. Gordon Ruth will utilize existing sales headquarters at 354 Princess Street in handling the GE Progress Line mobile radio.

## Sensitive Research appointments

Sensitive Research Instrument Corporation, 310 Main Street, New Rochelle, N.Y. announces the appointment of Marvin I. Steinberg and Leonard J. Patterson as executive vice-presidents and members of the board of directors.



M. I. Steinberg



L. J. Patterson

Mr. Steinberg, sales manager, has been associated with the company for 14 years and will also continue in his present capacity until a successor has been appointed. He is a graduate of Cornell University.

Mr. Patterson, formerly special assistant to the director of engineering was graduated from the University of Scranton, and has been with Sensitive Research for three years.

## Quality control forum scheduled for March 7

The Toronto section of the American Society for Quality Control will hold its Sixth Annual All-Day Forum at

Hart House, University of Toronto, on Saturday, March 7, 1959. Registration at 8.30 a.m.

The program will feature an all-day basic training course in Statistical Quality Control, presented by W. A. MacCrehan, Quality Manager of Bendix Radio, Baltimore, Md.

Also included in the Forum program are fourteen other sessions covering a diversified series of Quality Control applications in industry. Each lecture will be given by a well known authority an everyone attending is assured of interesting and informative talks.

The Forum will conclude with a banquet to be addressed by J. W. Morgan, vice-president of the British American Oil Company Limited, Toronto.



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**25 to 500 mc. At Low Cost!**

### LAMPKIN 205-A FM MODULATION METER

- Indicates instantaneous peak modulation, plus or minus, on 0-12.5 or 0-25.0 KC scales.
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  - Tunable 25 to 500 MC in one band, with fast and slow controls.
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For complete details check No. 63



## Beatty Telemasts

**FOR COMMERCIAL COMMUNICATIONS**

Masts to 200 ft.—single, twin-H, and quadruple — designed to CSA specifications. Hot galvanized steel, resistance welded to Canadian Welding Bureau standards, in accurate jigs that insure easy and perfect erection. 10-foot sections completely hot galvanized after all fabrication. Galvanized hinged steel base and complete line of attachment fittings.

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For complete details check No. 43 on handy card, page 51

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For complete details check No. 67 on handy card, page 51



## JBT Instruments appoint Canadian rep

Airborne Equipment Ltd., 920 McEachran Ave., Outremont, Montreal 8, Que., have recently been appointed to represent JBT Instruments Inc., of New Haven, Connecticut, in Canada.

JBT Instruments Inc. manufacture industrial and aircraft rotary and toggle switches. They are on the QPL list for aircraft type JAN, MIL, AN and MS switches and have Underwriters Laboratory approval for industrial type switches.

Other products of this company include vibrating reed frequency meters, lever action switches, portable frequency testers, instrument and tester switches, elapsed time meters, appliance temperature testers, pyrometers.

## CNT appoints labor relations personnel

Two major staff appointments in labor relations for Canadian National Telegraphs were recently announced by John R. White, general manager.

R. S. Finegan, formerly employee relations supervisor, eastern region, has been appointed supervisor of labor relations.

W. A. Young, former general per-

sonnel assistant, has been named employee relations supervisor, eastern region.

Both positions have headquarters at Toronto.

Mr. Finegan joined CNT as a messenger at Winnipeg in 1937. He subsequently held various clerical positions there before transferring to the research and development department of Canadian National Railways at Montreal in 1944. In 1945 he rejoined CNT and since then has held positions in various capacities until he became employee relations supervisor of the eastern region.

Mr. Young, a native of Toronto, joined the telegraph company in Toronto in 1927 as a clerk. He has held positions as district accountant, chief clerk, training supervisor and general personnel assistant in the general manager's office.

## Kester Solder Company vice-president passes

Word has been received of the death on September 30, 1958, of Ednyfed H. Williams, long associated with Kester Solder Company of Chicago, Illinois, in the capacity of vice-president and corporation counsel. Mr. Williams was 76 years of age at the time of his death.

## MAJOR INTERNATIONAL CARRIERS SELECT

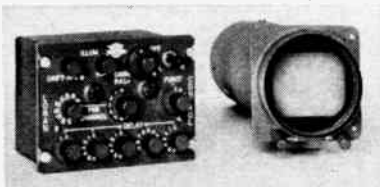


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- QANTAS ●
- SABENA ● VARIG ●



LORAN, long recognized as a reliable, highly accurate system of long range air navigation, has achieved new practicality with the development by Edo of a simplified, lightweight, *pilot-operated* unit.

After thorough testing in trans-oceanic operation, Edo LORAN has been ordered by these international airlines for installation in their upcoming fleets of jet aircraft.

The compact Edo equipment weighs only 26 pounds installed. Control panel and three-inch scope shown at left, mounted in the cockpit, enable the pilot to obtain directly read line-of-position information, without having to consult tables or make complicated calculations.

Receiver, which can be remotely installed, occupies  $\frac{3}{4}$  ATR rack.

Edo LORAN is designed and manufactured by Edo, a major producer of advanced electronic systems. For complete data on Edo Model 345 Airborne LORAN, send for Technical Manual to Dept. A-9.

(CANADA) Ltd.

CORNWALL, ONTARIO

For complete details check No. 53 on handy card, page 51  
ELECTRONICS AND COMMUNICATIONS, February, 1959

World Radio History

## New ROHN SELF SUPPORTING COMMUNICATION TOWER



- ★ 120 ft. in height, fully self-supporting!
- ★ Rated a true HEAVY-DUTY steel tower, suitable for communication purposes, such as radio, telephone, broadcasting, etc.
- ★ Complete hot-dipped galvanizing after fabrication.
- ★ Low in cost—does your job with BIG savings—yet has excellent construction and unexcelled design! Easily shipped and quickly installed.

FREE details gladly sent on request.  
Representatives coast-to-coast.

## ROHN Manufacturing Co.

116 Limestone, Bellevue,  
Peoria, Illinois

"Pioneer Manufacturers of  
Towers of All Kinds"

For complete details check No. 69

## Dectra electronic system guides BOAC Comets

British Overseas Airways Corporation will install the Decca/Dectra Navigation System in their new fleet of Comet 4 aircraft, according to a recent announcement by a London spokesman for the Decca Navigator Company Limited. The announcement follows extensive trials carried out in a Comet 2E over the United Kingdom, the North Atlantic, and Eastern Canada over the past year.

Decca is a high accuracy, area coverage navigation system which shows the geographical position of an air-

craft continuously by tracing an inked line on a moving chart. Dectra is a long-range version capable of providing accurate position information across the Atlantic.

Two transmitters in Newfoundland and one in Scotland provide the Dectra coverage across the Atlantic. The Canadian installations are operated by Computing Devices of Canada Limited, Canadian licensees of the Decca Navigator system.

Major advantage of the Decca/Dectra system, according to the Decca spokesman, is that it will provide an adequate number of defined flight paths enabling full use to be made of

the air space to allow the rapidly increasing numbers and types of aircraft to operate safely and efficiently in their desired altitude levels.

## Industrial Wire & Cable executive appointments

Carl P. Clare, recently appointed president of Industrial Wire and Cable Limited of Toronto, announces the appointment of Mr. T. Harrison Smith as general manager.

Harold D. Percy, P.Eng. of Brockville, Ontario, has been appointed as assistant general manager and works manager.



T. Harrison Smith



H. D. Percy

Industrial Wire and Cable Limited, a Canadian firm established in 1937, was recently purchased by Universal Controls Incorporated, of New York, and will be operated as a wholly-owned subsidiary, manufacturing more than 75 lines of wire and cable, including aluminum and copper wire, drawn, woven, metallic sheathed and non-metallic sheathed. Industrial Wire is a major Canadian producer of wire and cable for building, communications and industry.

Industrial Wire's 110,000 square foot plant was constructed last year on a ten acre tract providing room for future expansion. In addition to the head office and factory in Toronto there are Industrial sales offices and warehouse stock across Canada: Vancouver, Calgary, Edmonton, Winnipeg, Montreal and St. John's.

## British management consultant visits U.S. and Canada

After lecture engagements on business administration at California University, Cornell, North Carolina and Northwestern (Chicago) Universities, Colonel L. Urwick, British management consultant, will visit Toronto and Montreal on his homeward route in April.

The Canadian connection of Urwick, Orr & Partners Ltd. of London, England, with whom the British business expert is associated is Urwick Currie Limited of 80 King Street West, Toronto, with an office also located in Montreal.

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1153 QUEEN ST. W. • TORONTO 3

For complete details check No. 44 on handy card, page 51



## Lake Engineering Company appoint product manager

Lake Engineering Co. Limited, who have recently moved to larger quarters at 123 Manville Road, Scarborough, Ontario, have recently announced the appointment of Raymond J. A. Turner as product manager with responsibility for component application engineering liaison with commercial electronic and coil manufacturers.

Mr. Turner served as signals officer with the British Army before and during the last war in several parts of the Commonwealth and on the Continent.



R. J. A. Turner

Prior to his discharge in 1947 he was on the staff of the Allied Military Government in West Germany with responsibility for rebuilding the communications system.

He then joined Philips in Eindhoven, Holland, as a commercial engineer in their radio and television receiver group.

In 1950 Mr. Turner emigrated to Canada and held engineering positions successively with Stewart Warner and Motorola, leaving the latter as chief engineer to re-join Philips in Leaside in 1954 as a commercial engineer in their radio and TV receiver division.

Mr. Turner has taken an active part in the Institute of Radio Engineers as Senior Member, serving for the past three years on the technical program committee of the Canadian IRE Convention and is currently chairman of the Convention Record committee and vice-chairman of the Toronto IRE Section.

## Non-power reactors to be marketed by Westinghouse

Canadian Westinghouse Company Limited, Hamilton, Ontario, has announced it will market a complete line of research, training and educational nuclear reactors manufactured by Aerojet-General Nucleonics of San Ramon, California.

J. A. Campanaro, vice-president, project development group, reported a distributor agreement has been signed covering all six of Aerojet-General's reactor models — from the smallest "subcritical" unit to a large material testing unit with 10,000 kilowatts thermal output.

The reactors will be sold to universities and medical and industrial research centers. Aerojet will assist in training customer personnel to operate the units.

Please turn to page 50

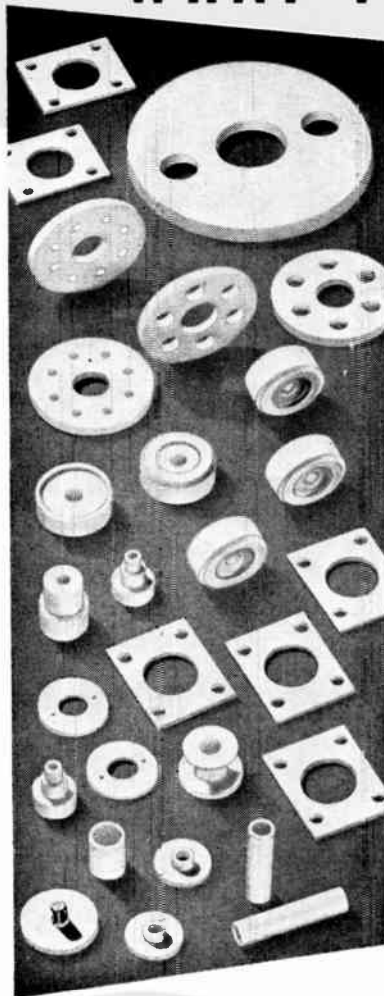


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"John Crane's" complete fabrication facilities assure you prompt delivery on *exactly* what you want. If you have an entirely new requirement, no standard design or procedure—"John Crane's" laboratory facilities, know how, research and engineering experience go to work on *your particular* need.

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\* **TEFLON** DuPont trademark

Dielectric Strength: 480 v/mil.  
Dielectric Constant (60 to 10<sup>8</sup> cycles): 2.0  
Power Factor (60 to 10<sup>8</sup> cycles): < 0.0005  
Volume Resistivity: 10<sup>15</sup> ohm-cm  
Surface Resistivity: 3.6 x 10<sup>6</sup> megohms  
Surface Arc-Resistance: does not track  
Temperature Range: -450° to +500°F.  
Chemical Resistance: completely inert  
Moisture Absorption: zero

Crane Packing Co.,  
Ltd., Box 134,  
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Hamilton, Ontario.



**CRANE PACKING COMPANY, LTD.**

OFFICES IN PRINCIPAL CANADIAN CITIES

For complete details check No. 49 on handy card, page 51



WESTON INSTRUMENTS: STANDARDS OF STABILITY IN SCIENCE AND INDUSTRY



WESTON  
Model 633  
Clamp Ammeters  
and Volt-Ammeters

# ACCURATELY MEASURE CURRENTS UP TO 2000 AMPS ...700 VOLTS

Here are the ideal tools to fill your on-the-job testing needs. The range, reliability and safety of these hand instruments have earned for them acceptance as *standards* by major utilities. Without breaking a circuit, the Weston '633' measures A-C currents up to 2000 amperes . . . and, in the volt-ammeter model, A-C voltages up to 700 volts. Accuracies are assured within  $\pm 3\%$  of full scale values. Flexible potential leads are supplied with the volt-ammeter. Carrying cases, adapters and 50-foot extension cords are also available.

Check all the advanced features of Model 633 in Weston Catalog R-36. Write to Daystrom Limited, 840 Caledonia Road, Toronto 19, Ontario, 5430 Ferrier Street, Montreal, Que., a subsidiary of Daystrom, Incorporated.

**WESTON**  
 Instruments

5903

For complete details check No. 51 on handy card, page 51

## Automatic Computing

Continued from page 18

In addition programs have been made or are being made to carry out the following operations:

- Read in a matrix with sum attached and substitute for some elements, new numbers, and make corresponding change in sum.
- Read in a triangular matrix and build up into a symmetric matrix.
- Read in the band of a band matrix and build up into a full matrix with zeros.

### Table look-up

Many programs relating to aircraft performance calculations require that at some stage in the computation some sort of table look-up be carried out. Many of these are for looking up a function of two variables, that is, given values of two independent variables  $x$  and  $y$  say, the table look-up routine provides a value for the dependent variable  $z(x, y)$ . Usually these tables are initially given in the form of a family of curves or a numeric table which may have been derived from bench tests, manufacturer's data, etc. In general, one or other of two methods have been employed or a combination of both, namely, representing functions by polynomials in the least square sense or the Lagrangian sense.

In the case of a function of one variable, say  $y = f(x)$  the least squares method is to take a series of values  $(x_i, y_i)$  representing the function at discrete points and find the polynomial,  $P_n(x)$  of some fixed order  $n$ , which satisfies the criterion that this is the polynomial of order  $n$  which makes the sum of the squares of the differences

$$\sum_i [P_n(x_i) - f(x_i)]^2$$

a minimum at the discrete points.

In the Lagrangian case a polynomial is found of order  $n$  which passes exactly through  $n + 1$  points.

Although the least squares criterion is in many ways superior, the method does tend to smooth out curves, which is not always desirable. Kinks sometimes should be present.

Programs are used which will automatically fit polynomials to numerical data by least squares fitting for a range of orders, sometimes splitting a curve into two or three sections at points decided on beforehand, and fitting a polynomial to each section, evaluating the polynomials at various points and printing differences between observed and calculated values etc.

A three dimensional Lagrange interpolation program has been made by one of our programmers which has a rather neat device for detecting when function values are called for, which are limiting values or are outside the range altogether. In the case of a function of two variables a matrix of function values would be given over some rectangular mesh and used by the program for interpolating first in one direction, fitting Lagrange polynomials of low order to neighboring points of the point in question, then similarly interpolating in the other direction.

Usually there is some region within the rectangular network system for which the format is undefined and also an intermediate region for which function values

have been extrapolated. Since the accuracy of the numbers involved is usually of the order of about three significant figures only, the least significant digits are used to record when any of these limiting conditions occur. There are four limiting conditions which may occur in any combination.

- a) Extrapolated values used.
- b) Point is in the undefined region.
- c) Point is outside range of x considered.
- d) Point is outside range of y considered.

A true zero is recorded in the table as a very small number to distinguish it from an undefined blank.

The least significant digits of the resulting function value indicate with a binary code which limiting conditions have occurred, if any. This has proved very useful to engineers receiving results who might otherwise have had no indication that some limiting conditions had occurred at some stage in the computation. It is better to do this than have the machine stop whenever such a situation arises.

### Quick look plotter

Many results which are produced by the digital computer in numerical form are required in graphical form and plotting by hand is a laborious task. A program was made which, in effect, uses the IBM on-line printer as a plotter. A picture of the plotted page is built up in a section of machine memory which is finally printed. Each point to be plotted is automatically scaled in both directions by scaling factors obtained by the program on an initial scan of the data, rounded off, and a digit inserted in the appropriate place in store. If a number of graphs is to be plotted on the same page a different digit is used for each. One or two versions of this program exists. One adds digits going into any position, another allows only the first digit to go into any position and loses any following digits. In the final print out all zeros are suppressed.

Since making this program we have heard of similar programs in use at other installations. One uses a novel feature to obtain extra accuracy. The digit used in the plot depends on the size of the most significant digit dropped.

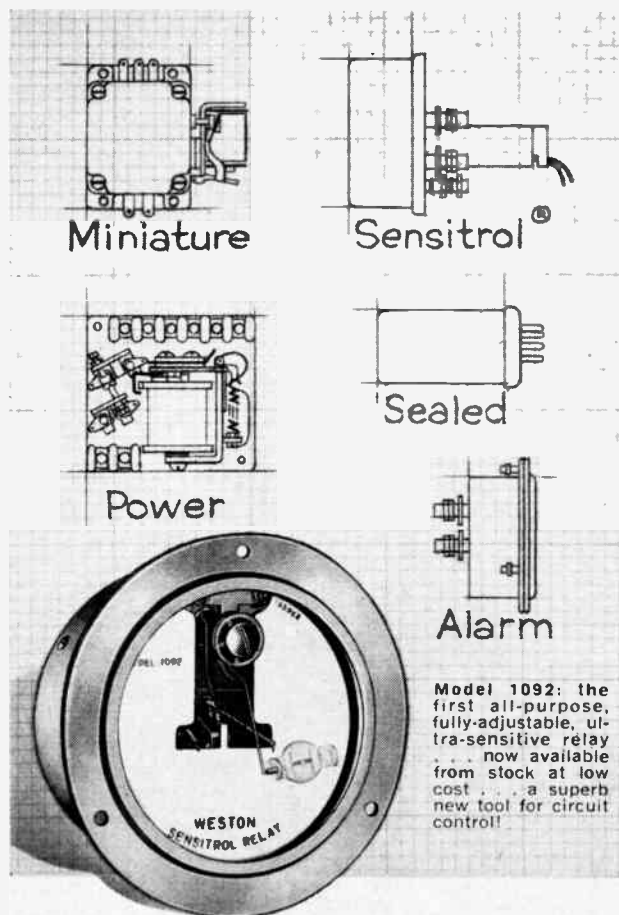
Recently an xy plotter unit was installed at Canadair which, when linked to a card reader will read a card and plot a point at the rate of about one point a second with about four figure accuracy.

### Remote control debugging

For some time now we have been working as far as possible with a remote control debugging system where the programmer has very little contact with the machine and an operator carries out all debugging with the aid of diagnostic routines. When a program is to be debugged it is given to the operator with a completed Operators Initial Settings Sheet. This is a standard sheet containing all console switch positions to be ticked off by the programmer, and other information including a block of memory not used, times and failure indications. Initially we started in a simple way with just two debugging-aid routines. The first is a routine which fills machine memory with nines, which is followed by the program to be debugged. The reason for the nines is twofold. If such a number is used as data the chances are there will be an immediate overflow and the machine will stop more or less at the offending stage. Similarly if a nines cell is interpreted as a machine instruction the computer will stop. When

Please turn to page 56

## WESTON INSTRUMENTS: STANDARDS OF STABILITY IN SCIENCE AND INDUSTRY



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Weston Sensitive Relays have enjoyed an industry-wide reputation for reliability for many years. Today, with new applications cropping up continually, Weston's broad relay series has developed into the most versatile line available anywhere . . . ready to meet your most exacting needs . . . assuring dependable service wherever contacts are closed or opened.

Weston Catalogue B-25 will give you complete details on all varieties of the relay-types listed above, as well as accessories. For special applications, the services of Weston relay engineers are freely available to you. Write to Daystrom Limited, 840 Caledonia Road, Toronto 19, Ontario, 5430 Ferrier Street, Montreal, Que., a subsidiary of Daystrom, Incorporated.

5902

*Take advantage of Weston's unusually fast prototype service!*

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 Instruments



For complete details check No. 52 on handy card, page 51

# SWEEP RESOLVERS



Muirhead have added the Size 23 Sweep Resolver type 23M7A1 to their wide range of synchros and resolvers.

The Sweep Resolver, designed for resolution of radar sweep voltages in P.P.I. displays, has the following features:—

**Wide Band Operation:** The flat frequency response of the 23M7A1, extending up to 100kc/s and peaking at 500kc/s, makes the receiver particularly suitable for accepting the time base waveforms met in radar sweep systems.

**Compensator Windings:** In addition to the two main windings the stator is wound with two compensator windings which can be used with suitable amplifiers to provide negative feedback and maintain proportionality between input and output voltage over a wide range of input voltage. In this way sweep linearities of better than 0.1% may be obtained.

## Brief Specification:

Housing:		Standard Size 23 outline dimensions
Stator:		2-phase with compensator windings
Inductance	- - - - -	Each main winding 17.0mH Each compensator 17.0mH
Resistance	- - - - -	Each main winding 1.6 ohms Each compensator 5.0 ohms
Rotor:		2-phase
Inductance	- - - - -	Each phase 19.0mH
Resistance	- - - - -	Each phase 2.6 ohms
Voltage rating at 1000c/s		0 to 30V
Resolution Accuracy:		
Maximum departure from sinusoidal characteristic		0.2% of max. voltage

359

**MUIRHEAD INSTRUMENTS LIMITED**  
**STRATFORD · ONTARIO · CANADA**

For complete details check No. 65 on handy card, page 51

## Subscriber trunk dialling in Great Britain

The introduction by the British Post Office of the first stage of nation-wide Subscriber Trunk Dialling brings to fruition many years' behind-the-scenes work on the development of electronic components and systems techniques.

As far back as 1953, Standard Telephones & Cables Mfg. Co. (Canada) Ltd. installed electronic registers using cold-cathode tubes at the Richmond Exchange of the British Post Office.

The introduction of STD, as the Subscriber Trunk Dialling system is known as, in the Bristol area foreshadows the gradual conversion of all Britain's 6,000 exchanges, including the two most important London exchanges — London Toll and London Trunks. In the last 20 years Standard Telephones & Cables has supplied 1,400 manual switchboards for the Toll and Trunk exchanges in London and has converted the inward positions to automatic working, thus eliminating a large number of manual positions.

Already Standard Telephones & Cables has brought direct dialling to the European Continent a stage nearer by providing operator direct dialling equipment to the operators on the Continental positions at London Trunks.

## Potter & Brumfield Canada appoint sales manager

Alan Laws has been appointed sales manager of Potter & Brumfield Canada Ltd., according to R. M. Brumfield, president of the company.



Alan Laws

Alan Laws was born in Lloydminster, Saskatchewan and received his education there and in England where he found himself at the beginning of the Second World War. Rather than return to Canada to enlist, he joined the British Army and served with the Somerset Light Infantry Regiment, rising to the rank of Major. He commanded a Bomb Disposal Unit from the war's end until 1947. On returning to civilian life he took a position as an industrial relations officer and in 1949 joined Newman Industries Ltd. of Bristol, England as publicity manager.

In 1954 he returned to Canada to become advertising and sales promotion manager of Leland Electric.



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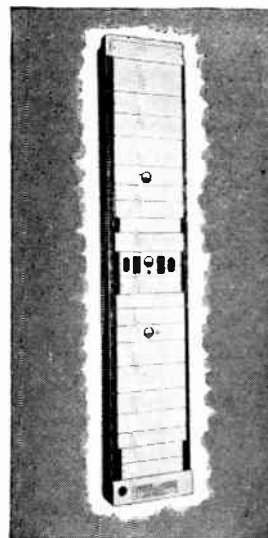
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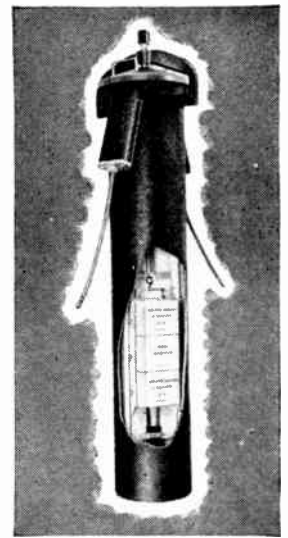
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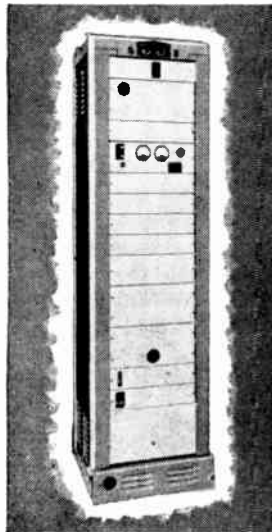


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## CARRIER-ON-CABLE TELEPHONE SYSTEMS

## CARRIER PROGRAMME CHANNELLING EQUIPMENT

For complete details check No. 72 on handy card, page 51



## Westinghouse microwave handles bushland communications

Canadian Westinghouse microwave radio equipment has been installed by the Spruce Falls Pulp and Paper Company as a 33-mile long trunk circuit between Kapuskasing and Shack Lake, Ontario.

The 2000 mc "line of sight" equipment handles all traffic between the company's center of operation and the main repeater station at Shack Lake. Twenty-one fixed stations operate on a high-frequency system serving 6400

square miles of rugged bushland. More than 1,500 men, working out of approximately 20 permanent and temporary camps, depend on the system as a communications link with other camps and the headquarters at Kapuskasing.

The new equipment will handle anticipated expansion by the simple addition of channelizing units as overloading occurs. The equipment is designed to operate under extreme weather conditions and handles voice and any indicating and operating function that can be translated into telegraphic type of signals.

## Kester Solder observes 60th anniversary

An important chronological milestone was marked recently by a Chicago manufacturer prominent in the electronic, automotive and hardware fields, when Kester Solder Company completed its 60th year in a business that has grown to world wide dimensions.

The growth of the complex electronics industry saw the firm develop special purpose solders, used to secure the wiring circuits of everything from do-it-yourself kits to the radars, missiles and rockets of national defense.

In addition to its Chicago plant, Kester manufactures its numerous trademarked products for industrial and re-sale markets at Newark, New Jersey, and Brantford, Ontario.

## CBC hosts to IRE Toronto section

The Canadian Broadcasting Corporation were hosts to the IRE Toronto Section during January when a record crowd of over 300 toured the CBC facilities on Jarvis Street.

Prior to the tour R. (Reg) Horton, CBC Technical Director, addressed the group briefly explaining the things they would see. The tour covered: Radio Master Control, Recording Room, two transmitter booths; Television Studio 7; CBLT Television Transmitter; CBC-FM Transmitter; Television Studio 5 (News); Telecine Room; Television Master Control.

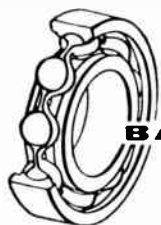
## SALES MANAGER



H. Rae Smith

Acme Electric Corporation of 50 Northline Rd., Toronto 16, announces the appointment of H. Rae Smith, P. Engineer, as sales manager. Mr. Smith was previously with Gresham Transformers (Canada) Ltd. and will now be responsible for marketing Acme's wide range of transformers for industrial and military requirements.

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**R. C. Poulter, P.Eng.,  
Associate Editor of  
Electronics and Communications**

Robert C. Poulter, Director of Education of the Radio College of Canada, is now, in addition to his many other activities, serving as Associate Editor of Electronics and Communications magazine.



**R. C. Poulter, P.Eng.**

Mr. Poulter has been actively connected with the Canadian electronics industry for over 30 years, in research and engineering, and as a writer, editor and technical educationist.

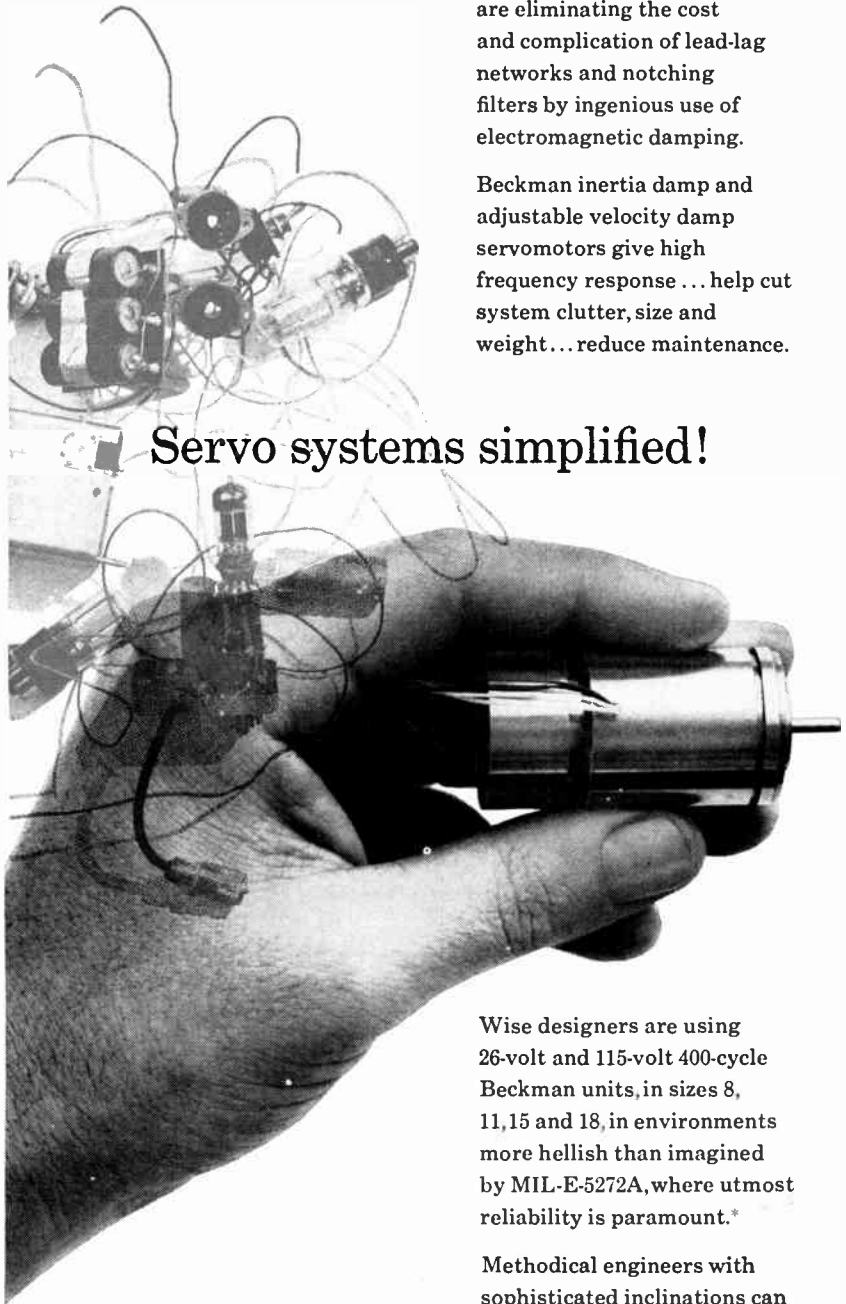
Mr. Poulter is a member of the Association of Professional Engineers of Ontario and has been a member of the Association's public relations committee for many years. In the field of technical journalism he served as editor of the A.P.E.O.'s official publication, "The Professional Engineer". He is a member of the Certification Board for Engineering Technologists and Technicians, recently established by the A.P.E.O.

As an advisory member of the editorial staff of Electronics and Communications, Mr. Poulter's broad experience and knowledge in the field of electronic engineering will be applied to shape the editorial policy of the magazine towards further increasing its service to the Canadian electronics and communications industry.

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Methodical engineers with sophisticated inclinations can get the inside story by writing for Data File E 23... a brief of inertia and velocity damp theory and practice.

\*Names of companies now using these Beckman units are available on request.

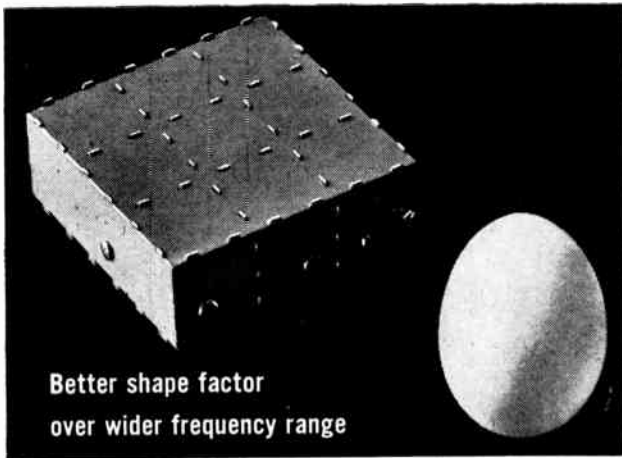
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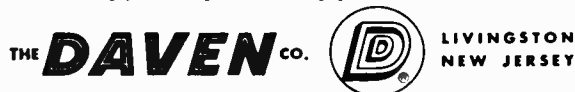


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For complete details check No. 45 on handy card, page 51

## Automatic computing

Continued from page 49

the program stops, gets into a loop or exhibits other unnatural behavior the mode of stopping is noted and the second program is read in, to any unused block of memory. This produces a print out of all locations which do not contain nines, with addresses.

With a medium sized machine like the Datatron opinions vary as to whether a saving can be effected or not by adopting such a system. Our experience was that there was an immediate saving in debugging time with no corresponding slowing down of production of programs. More recently however, the debugging time has increased, due mainly to the fact that magnetic tapes are now in wide use and many programs are now much larger than before. A lot of time is spent on the machine getting to the stage which needs debugging. Efforts are being made to cut down this time by a more careful choice of a test case, using memory dumps to and from magnetic tapes between debugging sessions to eliminate repetition of calculations, and using more sophisticated diagnostic routines.

One method which almost completely eliminates the coding type of error is to proceed through the usual stages of programming, namely, preparation of a flow diagram, a coding sheet, and finally a punched tape, then to put away the flow diagram and coding sheet, take the paper tape, list it, and produce a new flow diagram from it, by working back, which should correspond of course to the original.

A diagnostic routine has been developed which enables a variety of diagnostic operations to be carried out at arbitrary points in the program including memory dump, monitor and others, quite automatically. It is an interpretive type of routine which allows diagnostic instruction cards to be interspaced with data cards at strategic points.

### Compilers and interpreters

An increasing use is being made of Compiling and Interpretive Routines. The debugging techniques associated with programs made in these pseudo codes are rather different. Often there are no built in aids, the philosophy being that mistakes are difficult to make and if one is made it should be apparent by a re-scanning of the program statements. This has been found to be true although we have not made extensive use as yet of the newest Compiler, namely the one written by Purdue University. We have used Datacode 1 Compiler successfully for a number of programs and this does have optional intermediate print out facilities.

A matrix interpreter has been made at Canadair which has an alphabetic card input, one matrix instruction per card. Although the cards are punched alphabetically, AD for add etc., only the numeric part is read. The instructions correspond to all the common matrix operations, transpose, add, multiply, invert etc. It enables a problem which consists of a series of matrix operations to be coded very simply.

### Conclusion

The points brought out in this article may seem a far cry from the performance of a Canadair Argus in flight. They include some of the less glamorous aspects of automatic computing, but it is believed that they contribute largely to the success of the aircraft performance program.

### Acknowledgment:

I acknowledge with thanks the interest and encouragement shown by the management of Canadair Limited in the presentation of this paper. R. H.



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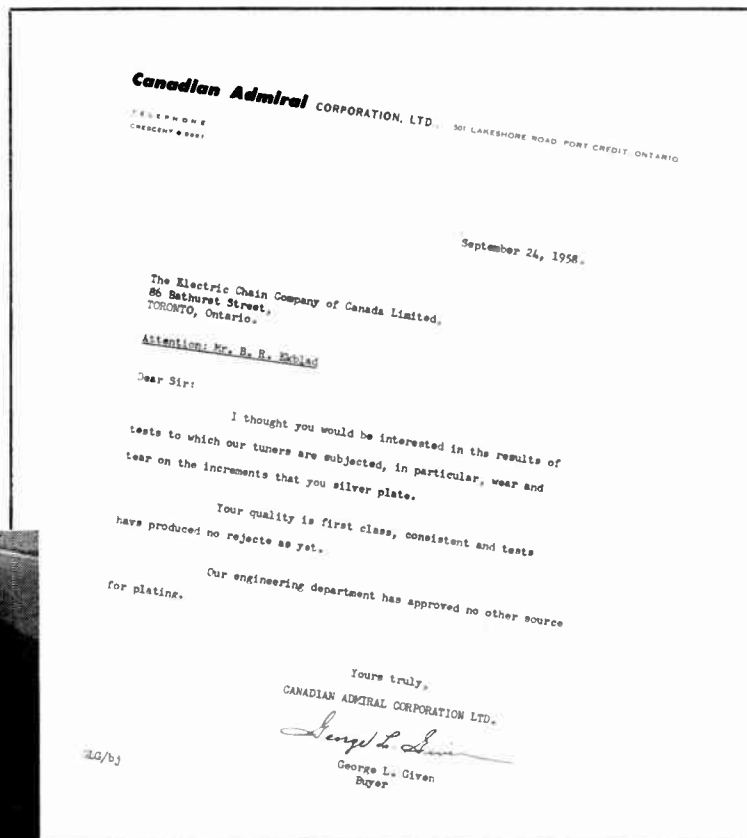
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ELECTRONICS AND COMMUNICATIONS, February, 1959

57

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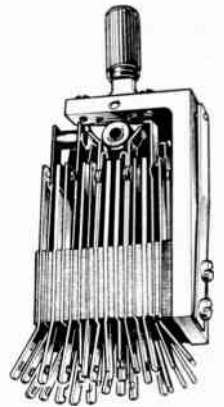


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January 8th, 1959.

Stark Electronic Instruments Limited,  
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Attention Mr. M. J. Stark

Dear Mr. Stark:

As with any progressive professional service company, we are continually expanding our service facilities, and must from time to time, obtain additional equipment

As with any professional service organization, it is imperative that we obtain the best for the least cost. Therefore, upon obtaining new types of equipment, we are continually maintaining a check by comparison against our service laboratory standards

We recently obtained for portable and bench use, your model SWG58 Sweep Generator, and your model MHG48, Marker Generator. Since our service standards at all times must be within the manufacturer's specifications, it is imperative that our test equipment is calibrated and maintained within the standards required

Before putting the above equipment to use, it was necessary to check the accuracy of the equipment for frequency range, sweep deviation, amplitude variations, output impedance over a wide range of frequencies, stabilization of output voltages, etc., etc.

We have, in the past, had to institute a number of modifications in commercial electronic equipment, to suit our purpose, since invariably they do not meet our standards for professional service and this is one of the reasons I am pleased to advise you that your SWG58 Sweep Generator has met our requirements for professional service, and has maintained the characteristics as listed by the manufacturer.

Of great importance to us was the amount of drift in frequency which in some equipment commercially will exceed 5%. We are pleased to advise you that accuracy of your equipment was within 1% on all bands used and maintained calibration under sustained operations.

When we calibrated the attenuator for output in microvolts, the variation was less than 3DB which is more than acceptable. The blanking

cont'd .....

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For alignment of TV, RM and VHF receivers. Frequency Range: 3 Mc to 260 Mc in 2 bands. Sweep deviation: 0 to 12 Mc. Sweep Method: vibrating capacitor, sinusoidal. Amplitude Variation less than 3 Db at 12 Mc deviation. Output Impedance: 75 ohms, unbalanced Output Voltage: 100,000 microvolts, variable. Horizontal Phasing Voltage: adjustable Blanking Control: Ample Output for all TV alignment. 4 tube complement. AC, 115 V., 50-60 cycles, 35 watts, approx. Size 8 x 12 x 15 inches. Wt. 15 lbs.

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## Model MHG-48 MARKER GENERATOR

A compact Marker Generator designed especially for use in the alignment and servicing of receivers for TV, FM, and VHF. Frequency Range: 3.5 MC to 250 MC covered in 6 bands. Frequency Calibration within 1%. Quartz crystal: 4.5 MC, 0.002% accuracy. Output Voltage: 100,000 microvolts, variable. Output Impedance: 75 ohms, unbalanced. 5-tube complement. AC, 115V., 50-60 cycles, 30 watts. Size: 8" x 12" x 5". Wt. 7-1/2 lbs.

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Page - 2

feature in the sweep generator certainly is advantageous, and not available normally except in much higher priced equipment.

I was extremely surprised at the accuracy of the generator and the degree of reliability when servicing tuners with the SWG58, since this is normally a critical operation except for oscillator adjustment. The other feature of having a horizontal phasing adjustment certainly has proved advantageous over certain other types of equipment we use at the present time.

We have also used the SWG58 for the alignment of FM receivers with excellent results. It has proved a real time saver in the alignment and service diagnosis of television receivers.

The companion instrument, the MHG48, has proved equally satisfactory and the dial calibration is much more accurate than I had anticipated, and required very little compensation. The frequency calibration of the equipment is excellent, and maintains its accuracy over a considerable length of time. The advantage of the 720 cycle and 250 KC modulated signal for checking linearity, is extremely handy, especially in the field. One of our problems has been caused by various types of equipment radiating and influencing the information obtainable on other equipment. I am pleased to advise you that this factor is considerably reduced with these two pieces of equipment, and has resulted in less cost in shielding.

The MHG48 has been extremely satisfactory when aligning sound IF amplifiers in television receivers, and has proved advantageous when adjusting local oscillators in television receivers of certain types. We have calibrated against our laboratory standards, and are now using the MHG48 in the realignment of short wave receivers up to and including commercial types. The most amazing thing I find is that these features are incorporated, not only in a small package very easily portable, but at such a low cost.

Thanking you again, I remain

Yours very truly,

REALE & GOLDMAN LIMITED

*E. P. Reale*

E. P. Reale.

epr/8



# editorial

## The choice should be simple

Will a British air navigation system be selected for world airline routes? Certainly many people think that the Decca/Dectra system is admirably suited for this purpose.

The Society of British Aircraft Constructors has emphasized the need for a universal system, and this was pointed out with some force at the recent International Air Transport Association meeting in New Delhi. Now the International Civil Aviation Organization (a United Nations body) is to select an international short-range navigation aid for aircraft.

A Comet fitted with Decca/Dectra gave a series of demonstration flights to observers from a number of different countries in Europe in January, and from North America in February.

Decca is a short-range aid and Dectra, long-range. The former consists of a "master" and three "slave" stations — red, green and purple — normally deployed in star formation at distances of 70 miles from the "master". They continuously transmit signals which are picked up by the aircraft and displayed in three dials — one for each color. The Decca Flight Log translates this information onto a moving chart which shows the aircraft's exact position and flight path. More than a dozen Decca "chains" are already in use.

Dectra, derived from Decca, is designed to provide area coverage over longer routes. Two stations, placed approximately on an 80-mile base line at one end of the route, emit signals covering the whole distance. The Flight Log, as with Decca, gives a picture of the path followed by the aircraft.

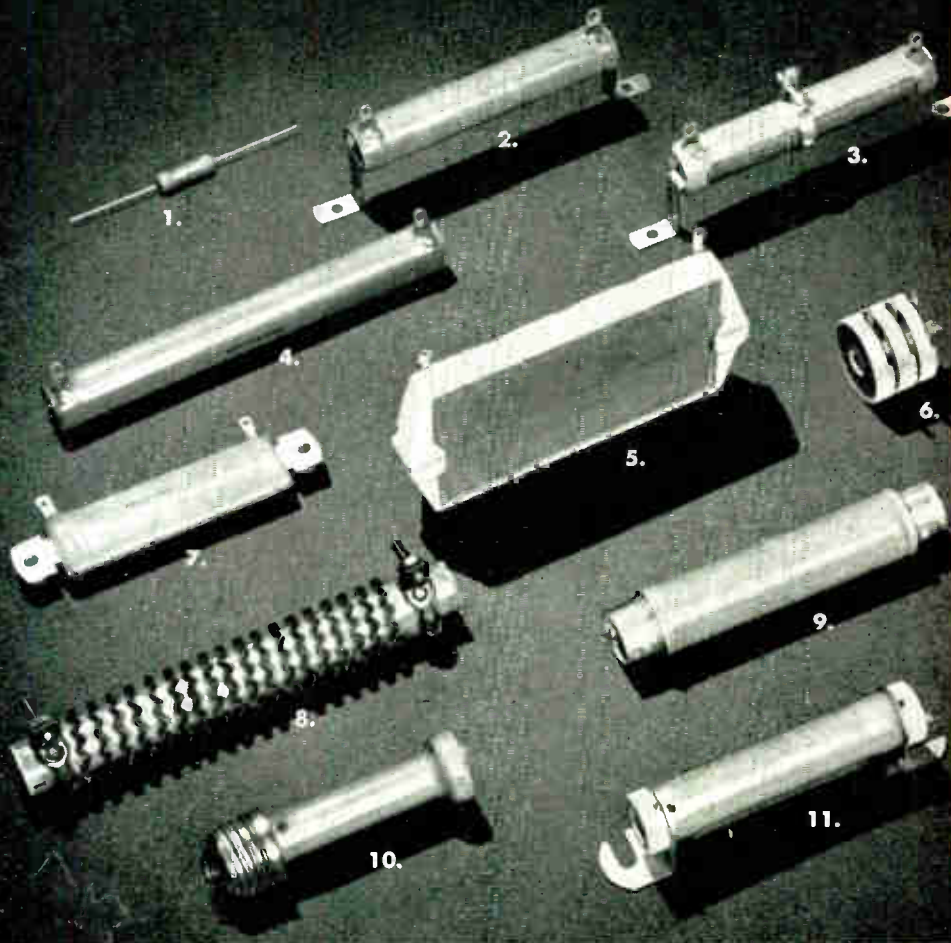
According to the manufacturers, Decca/Dectra has several marked advantages: aircraft's flying, climb, descent and holding patterns can be charted easily and accurately; exact position can be reported precisely and swiftly since the actual position and course of the aircraft can be seen by the pilot on a moving chart; Decca/Dectra are integrated to form a comprehensive system using unified airborne equipment, and they provide greater simplicity of navigation, particularly on the North Atlantic route.

The Atlantic was crossed both ways in May, 1957, by a Valiant equipped with this system. This year, Pan American Airways tried it out on that route and reported it "reliable, highly accurate, simple to operate" and that it "provided a new concept in the presentation of navigational fixing through the Flight Log. The accuracy of Dectra was found superior to the standard navigational systems against which it was checked."

At the recent Montreal meeting of ICAO where delegates from 32 nations gathered to make a decision on the type of equipment to be used for navigational aids American air lines pilots leaned strongly in favor of the British system while American air lines operators favored retention of the presently employed VOR system with refinements. In view of the opinion expressed by the men who have to operate commercial airliners it would seem that a decision in the matter of choosing between the two systems would be a simple one based on the premise that the workman knows with which tools he can best perform his job, in this case, the pilots who fly our commercial air liners.

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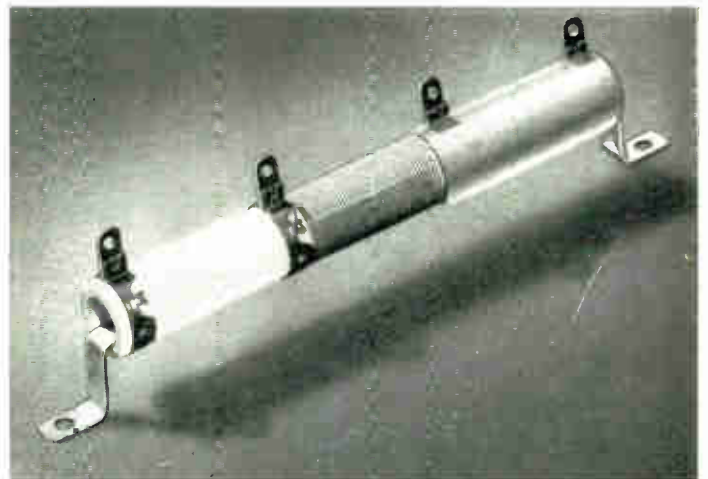
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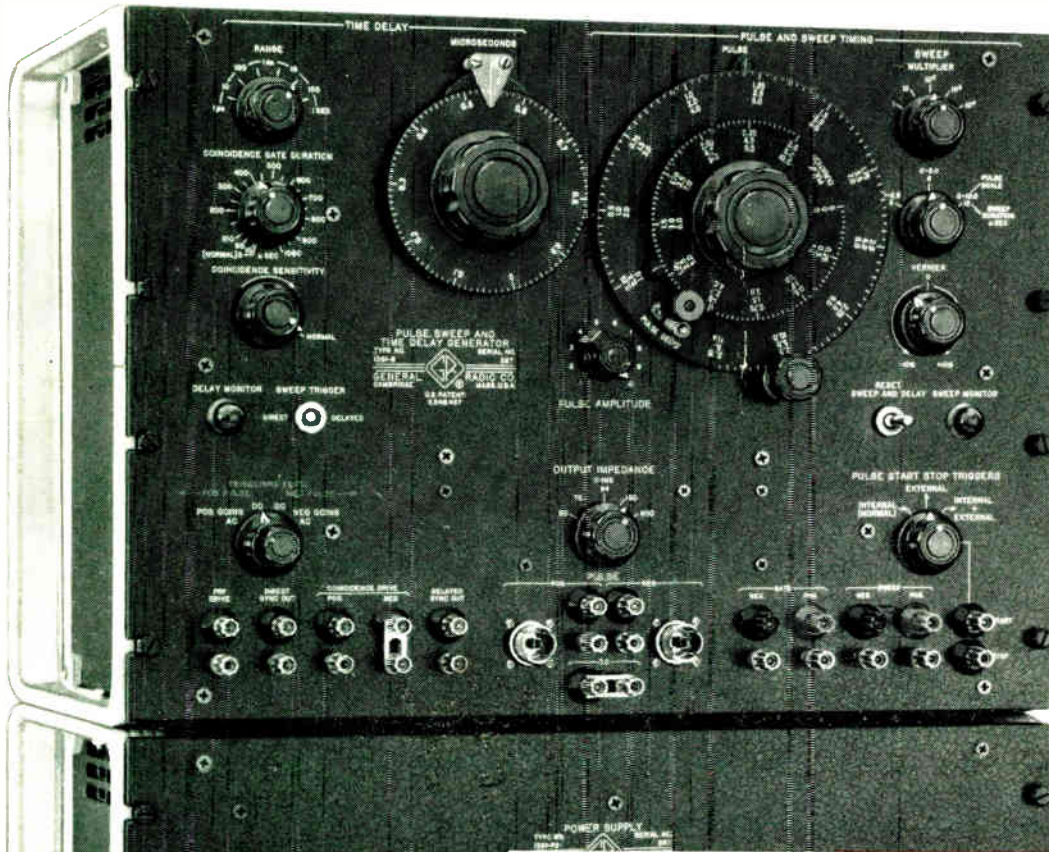
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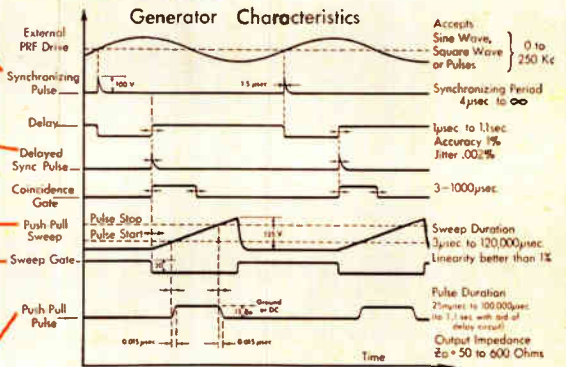
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