

**Radio Electronics &
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1948-1999**

RADIO — ELECTRONICS

formerly RADIO-CRAFT

Incorporating
SHORT WAVE CRAFT • TELEVISION NEWS •
RADIO & TELEVISION
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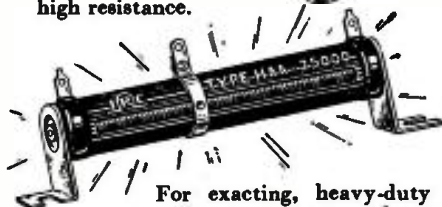
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SPECIAL TELEVISION ISSUE NEXT MONTH!

Television will be the theme of next month's special 144-page issue. Technicians who know and leaders of the industry will describe television progress, television servicing, television accessories and test equipment, and all other phases of this new and important subject. The issue will feature tabulations and charts showing television receiver characteristics, television coverage and other TV information. Non-television articles will not be neglected, and will deal with audio, amateur, theory, and electronics.

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ON THE COVER: The Spirit of Television. Statuette by Lilly Rana after an original idea by Hugo Gernsback. Kodachrome by Avery Slack.

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ON THE COVER: Miss Mary Jane Padgett checks the charge on an electret.
Kodachrome by Avery Slack.

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ON THE COVER: Experimental Television Relay Station W3XBR; Dick Hughes and R. Barrett in front of the shack. Kodachrome by Avery Slack. See article on page 27.

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ON THE COVER: The Radio Hat, posed by Hope Lange. From an Ektachrome original by Avery Slack. See article on page 32.

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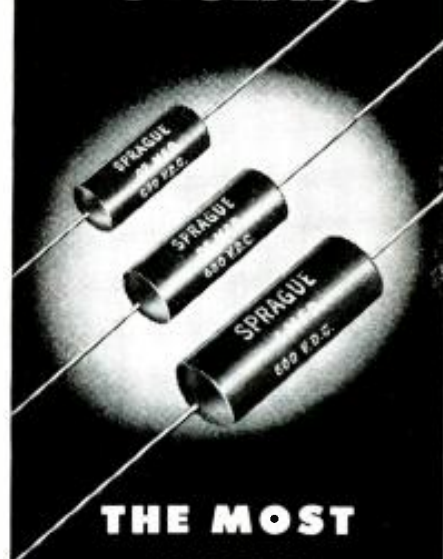
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ON THE COVER: The high-fidelity tuner-amplifier (see p. 32) being checked over by the editor-in-chief's grandson (age 4) while father gets ready to make audio measurements on the amplifier. Kodachrome by Avery Slack.

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ON THE COVER: Robert Witherspoon tunes the transmission line with a capacitive slider while Joon MacClay adjusts the television receiver. Decorations by John Wanamaker. Miss MacClay's dress by Frances Sider. Kodachrome by Avery Stock.

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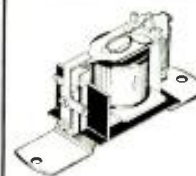
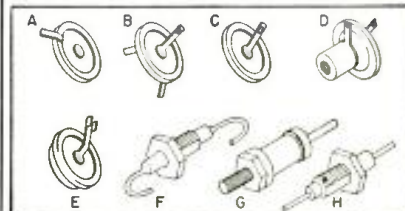


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ON THE COVER: Part-time prospector John Flood investigates a rock crevice for possible uranium deposits. Kodachrome by Avery Slack.

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ON THE COVER: One of the benches of the Abington television service, showing the built-in viewing tubes for models to be checked on that bench. Service technician John Mend making the adjustments. Kodachrome by Avery Slack.

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ON THE COVER: Tex (Mrs. Rose Ann) Barbarite, television engineer, doing maintenance work on the equipment at RCA's Exhibition Hall, Radio City, New York, N. Y. Kodachrome by Avery Slack.

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ON THE COVER: Part of the superstructure of the Coast Guard's Ocean Station Vessel *Spencer*, showing the many radio and radar antennas. Kodachrome by Avery Slack.

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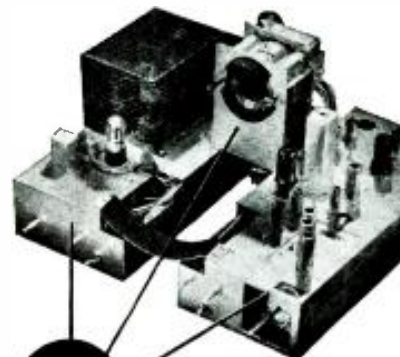
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ON THE COVER: Voltage check on the underchassis of a television receiver. Kodachrome by Avery Slack.

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ON THE COVER: Dr. J. D. Cobine melting a quartz rod with
General Electric's new nitrogen-atom torch.
Kodachrome courtesy General Electric Co.

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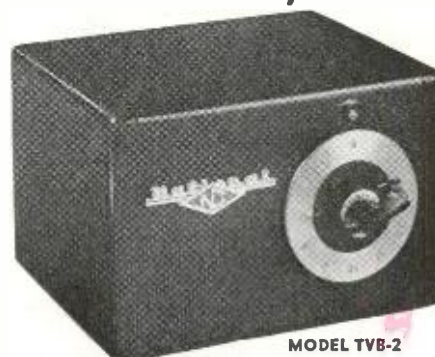
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ON THE COVER: The new Fairchild Tape recorder beside one of the standard record cutters in the master recording room of Reeves Sound Laboratories. Posed by Bobbie Shaw for a Kodachrome by Avery Slack.

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ON THE COVER:

Margaret Latham, of Beane Radio Service, Newark, New Jersey, engaged in a typical aircraft servicing operation. Kodachrome by Avery Slack.

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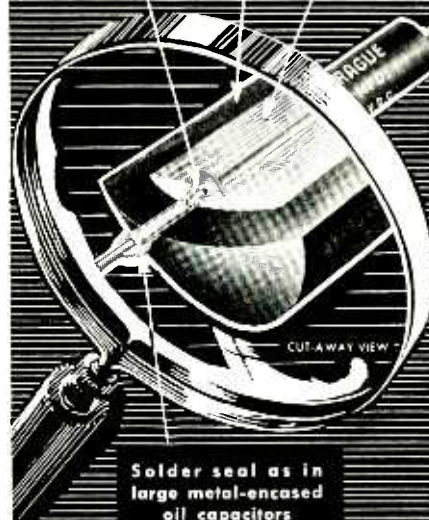
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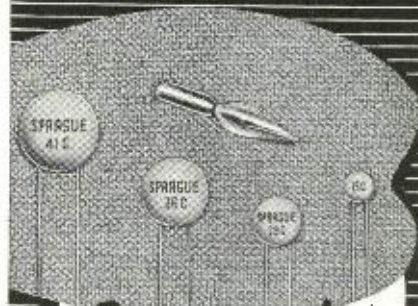
NBC's experimental ultra-high-frequency television station KC2XAK at Bridgeport, Conn. Engineer Vic Bary is at the controls and technician John Piorek logging the dials.

Kodachrome by Avery Slack.

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Automatically sprayed picture tubes dry under heat lamps at Sylvania's Ottawa, Ohio, plant. More pictures of tube production on page 22. Kodachrome courtesy Sylvania Electric Products.

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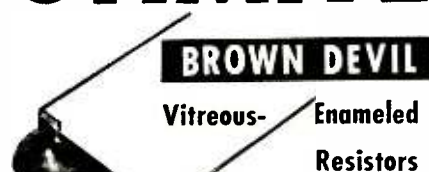
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Miss Doris Fesette feeds Simon the perforated tape on which his instructions are programmed. Kodachrome by Avery Slack.

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Warren Goodell adjusts the absorber changer used in Columbia's high-speed neutron study. Intercom in the red box communicates with the control position.
Kodachrome by Avery Slack.

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Larry Le Kashman and his daughter Patricia
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ON THE COVER:

Model Naomi Riordan poses for the three-color camera in a demonstration of Du Mont closed-circuit 18-mc color television. Insert shows her appearance on the screen, with breakup into the three primary colors.
Kodachrome by Avery Slack.

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The unattended omnirange and direction measuring equipment station at Erie, Pa., first of the new type omnirange transmitters in operation.
Kodachrome by Avery Slack

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ON THE COVER:

Bab Gunderson and test gear in his radio lab, sound studio and ham shack at the Institute for the Education of the Blind, New York, N. Y. Kodachrome by Avery Slack

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Instructor and student at work in the semi-darkened radar classroom of the Signal Corps at Fort Monmouth, N. J.
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ON THE COVER:

In this very typical scene in Dave Krantz' Philadelphia Television Service Corporation Frank Krantz is aligning a completed job and Pete Maugeri is touching up an installed combination unit which has just been converted. Kadachrome by Avery Slack

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L. O. Schott of the Bell Telephone Laboratories operates the electric voice which is used by the Laboratories in speech research work.
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ON THE COVER:

Western Union Telecar in typical residential area, with pioneer Telecar operator Wallace Woodward at the wheel. Note microphone on steering column. Recorder cover was removed for photography, would normally be in place. Kodachrome by Avery Slack

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ON THE COVER

Miniature magnetron and tuner, with its power supply and a wavemeter, in a test setup.
Kodachrome original by Avery Slack

August, 1951

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ON THE COVER

Radiomarine installation in the radio room of the Esso tanker *Bermuda*, one of the most modern of our merchant marine radio stations. Ektachrome original by Avery Slack



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ON THE COVER:

The new mobile television service station of Appliance Distributors, Inc., Chicago, with technician Ben Schneider at the service bench. Ektachrome original by Fran Byrne

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October, 1951

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ON THE COVER:

Paul Chirlian, New York University, and the antenna designed by the university's Electrical Engineering College to range from 100 kc to 4,000 mc.

Ektachrome original by Avery Slack

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ON THE COVER:

Squee, the electronic squirrel, prepares to follow a lighted flashlamp held by one of his builders, Jack Koff.

Ektachrome original by Avery Slack

WATCH FOR THE 5TH ANNUAL TELEVISION NUMBER NEXT MONTH

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ON THE COVER:

The television truck designed to increase the number of students who might be able to "see" a military problem under actual field conditions. (Color photo courtesy of RCA.)

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ON THE COVER:

These special-design radio antennas on the roof of the Wallop's Island control building are used to receive data telemeasured from rocket-launched research models. (Color photograph courtesy N.A.C.A.)

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ON THE COVER:
Technician Ed Walter, of the RCA Service Company's Bushwick (Brooklyn) branch, adjusts a TV receiver in the customer's home (See P. 48).

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ON THE COVER:

Staff Sergeant Wm. L. Stevens instructs Pfc. Nancy A. Edwards and Anna M. Lockard in the vagaries of the electron tube with the help of the demonstrator shown on page 42. Color original by Avery Slack.

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ON THE COVER
Dr. Lee de Forest and Dr. William Shockley hold a transistor and an Audion, respectively, during de Forest's recent visit to the Bell Telephone Laboratories in New Jersey.
Color original courtesy Bell Telephone Labs.

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ON THE COVER

Model Claudia Laymon compares the quality of two Audiotoneer-controlled musical selections. Battery of speakers is part of the demonstration room described in the article on page 36.

Color original courtesy
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ON THE COVER

An action photograph (taken during the actual broadcast) of the *Today* broadcast from the studio in the RCA Exhibition Hall, New York City. Garroway is the middle one of the three standing men. Color original by Avery Slack

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ON THE COVER (See page 50)
The new sound trailer which
Electro-Voice uses to bring
music to areas which are not
served by dealer's demonstra-
tion rooms.
Color original courtesy of
Electro-Voice, Inc.

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ON THE COVER (See page 50)
The transistor sawtooth oscillator which was developed by Dr. H. Gunther Rudenberg for Raytheon. The transistor is behind the magnifying glass and its output is delineated on the cathode-ray scope screen.

Color original courtesy of Raytheon Mfg. Co.



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ON THE COVER

Measurements and tests on new u.h.f. TV antennas on roof of one of the RCA buildings at Camden, N. J. Vertical bars at rear are part of Philadelphia bridge, not a new antenna.

Color original courtesy of RCA

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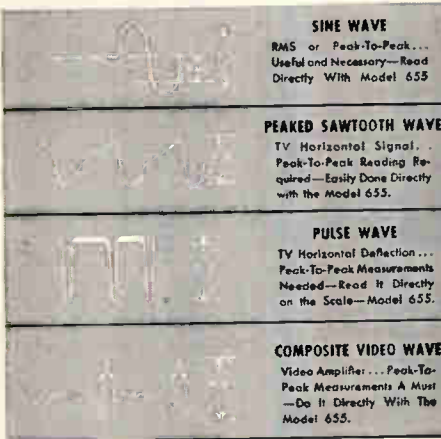
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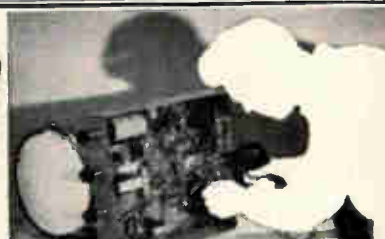
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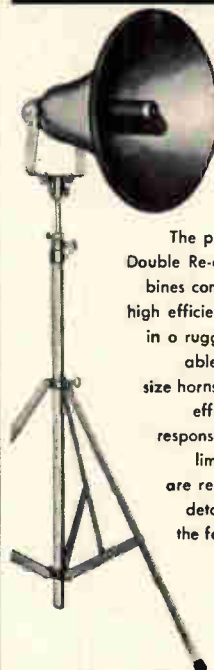
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KEY TO ABBREVIATIONS

ClinicTelevision Clinic
Comms.Communications
Q.B.Question Box
R.E.C.Radio-Electronic Circuits
R.M.Radio Month
T.T.O.Try This One

Items so marked appeared in monthly departments of RADIO-ELECTRONICS. Since these departments could not be fully indexed because of space limitations, a selection was made on basis of most common interest and value. Other regular departments not indexed here are Radio Business, With the Technician, New Devices, Technotes, People, Electronic Literature, Book Reviews, and TV Dx Reports.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) of RADIO-ELECTRONICS published monthly at Mt. Morris, Illinois, for October 1, 1954.

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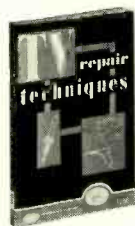
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KEY TO SYMBOLS & ABBREVIATIONS

*Construction Articles

†Section of a full length article

ClinicTelevision Clinic
QBQuestion Box
RECRadio-Electronic Circuits
RMRadio Month
TTOTry This One
Items as marked above appeared monthly. Regular departments not indexed are Radio Business, With the Technician, New Devices, Technotes, People, Electronic Literature, Book Reviews. In most entries the author's name is included.

CORRECTION

There is an error in the diagram of the portable receiver in the article "A More Compact Battery Portable" on page 90 of the September issue. The 15,000- and 120,000-ohm resistors in the last two audio stages should return to the *negative* side of the 4.5-volt battery—not the positive side as in the diagram.

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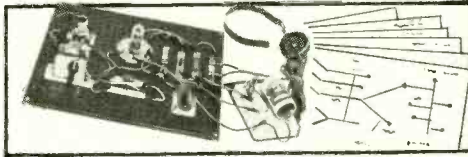
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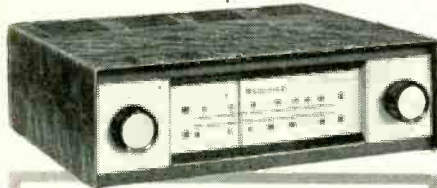
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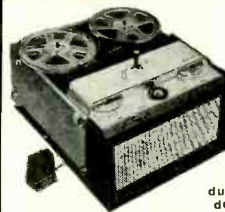
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ramic and bakelite. 25
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ues. famous Allen Bradley
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mf. up to 1000V. Wt. 3
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silver. 5¢ too! Wt. 1/2 lb.
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ton. disc types. 20 radio-TV
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1000V. Duals, too! Set-
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thru 1/4" fine twisted
steel; plastic case. To fit
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teite tubulans; disc ce-
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to 40 mf. to 500V. Multiple
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TV, lab. Some work
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STRIPS. Ass'd. binding
posts, screw & solder lug
strips (1 to 9 terms). Wt.
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ues. concentric & WW. too!
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TORS. 40 values: 100
ohms to 1 meg; 1/4, 1/2, 1
& 2 w. Many 5¢. American
made! Wt. 1 lb. \$1
Reg. \$21 \$1

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to 10,000 ohms: 5 to 50w;
candohm & tubular. Wt. 1
lb. Reg. \$12 \$1

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atures, 4- & 9-pin mini-
atures: 4, 7, 8 pins. Radio-
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100 CERAMIC INSULA-
TIONS. Ass'd. sizes. Wide
asst. stand-off, panel,
bushings. Wt. 3 lbs. \$1
Reg. \$15 \$1

15 PRECISION RESIS-
TORS. Up to 1 meg.
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ues. 1/2 to 2 w. Many 5¢.
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12 TOGGLE MICRO &
PUSH SWITCHES.
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riety w/10 "ON-OFF" plat-
es. Wt. 1 lb. \$1
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KIT. Shockproof plastic
handle, tempered steel
drivers. All different. In
plastic case. Wt. 1/2 lb. \$1
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CEPTACLES. Wide va-
riety. For AC lamps, pilot
lites, audio. UHF, pow-
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BLIES. Permeability-
tuned front ends. Cover
broadcast band. Push button
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KEY TO SYMBOLS AND ABBREVIATIONS					
* Construction Articles					
† Section of full-length article					
Clinic _____ Television Clinic					
Pat _____ Patents					
QB _____ Question Box					
REC _____ Radio-Electronic Circuits					
RM _____ Radio Month					
TTO _____ Try This One					
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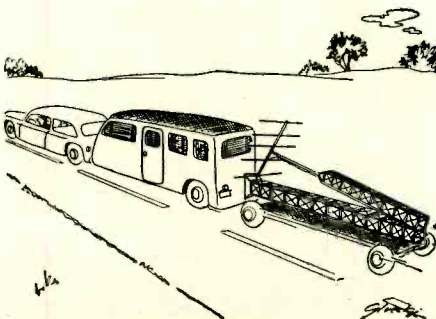
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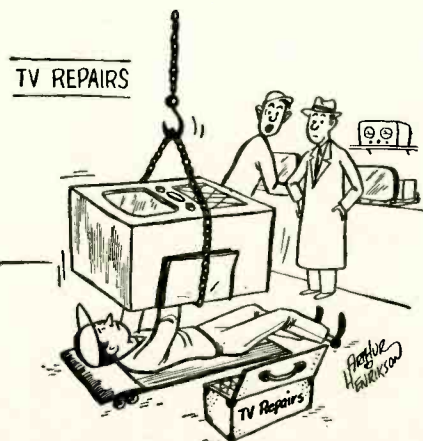
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"And you say this set has been working perfectly for the past two years?"

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RADIO-ELECTRONICS

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* Construction Articles
† Section of full-length article
ClinicTelevision Clinic
CorresCorrespondence
NBNews Briefs
PatPatents
QBQuestion Box
RECRadio-Electronic Circuits
TTOTry This One

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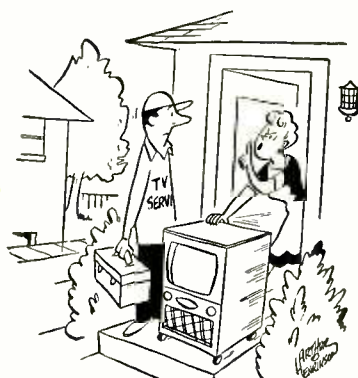


"You sure charge plenty! Smith's TV used to do my servicing for half your rates right up to the day it went bankrupt."

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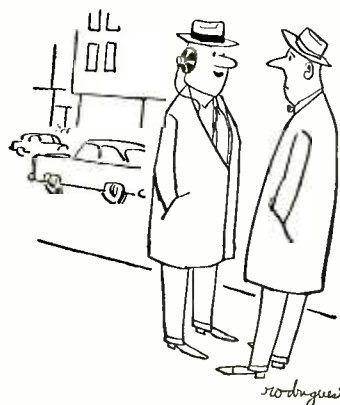
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"First high-fidelity hearing aid on the market!"

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"I'm afraid I'm going to have to take him into the shop."

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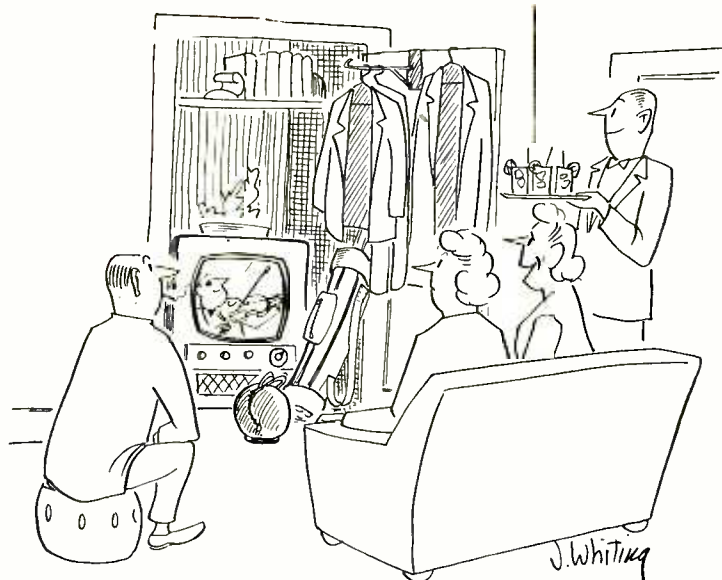


"Most severe case of corona I ever saw. Turn the light back on."

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"We like the idea of having it built in but it leaves us a little short of closet space."

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NB News Briefs
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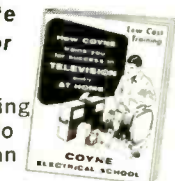
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* Construction Articles	
† Section of Full-length article	
Cl Television Clinic	
Corr Correction	
Corres Correspondence	
NB News Briefs	
NC Noteworthy Circuits	
Pat New Patents	
Tech Techniques	
TTC Try This One	
WN What's New	
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KEY TO SYMBOLS AND ABBREVIATIONS

* Construction Articles	
† Section of Full-length article	
Cl	Television Clinic
Corr	Correction
Corres	Correspondence
NB	News Briefs
NC	Noteworthy Circuits
Pat	New Patents
Tech	Techniques
TTO	Try This One
WN	What's New

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Stroboscope, Battery-Operated (NC)	Jul	110
Supply, Voltage-Limited (NC)	Oct	113
Switch, FluxLink (NB)	May	6
Telemeter, Ignition Operated (Schotz)*	Dec	54
Telephone Cable, Long (NB)	Apr	6
Telephone Service Expanded (NB)	Oct	16
Thermometer, Acoustic (NB)	Sep	12
Thermostat (Pat)	Aug	100
Thermostat, Transistor (Pat)	Sep	119
Timer, Automatic Recycling (Fannon)*	Jul	36
Darkroom (NC)	Apr	127
Corr	Jun	106
Integrating (Shields)*	Dec	28
Transformer (Woods)*	Jun	98
Transformers, Smallest (WN)	Sep	59
Ultrasonics Measures Liquid Flow†	May	58
Voltage Regulator for Car, All-Transistor (Meyers)*	Feb	107
Corres	Apr	22
V-R Pulse Circuit (Pat)	Nov	99
Waveguide, Transoceanic (NB)	Mar	6
Weather Station, Unmanned (WN)	Jul	45
Wheatstone Bridge, Divide and Multiply with (Frantz)*	Jun	48
Equipment Can Be Easy to Service	Sep	46
Experimenter's Dual Electroscop (Moen)*	Jun	99
F		
Feed TV Audio into Hi-Fi Systems (Leonard)	Mar	56
Feedback in PA Systems, Stop (Schroeder)	Feb	40
Field-Check Color CRT's (Egan)	Jun	96
50 Years Ago	Jan 107; Feb 149; Mar 132; May 111; Jun 93; Jul 113; Aug 111; Sep 124; Oct 124; Nov 120; Dec 116	
Fix Radios Faster (and Make More Money) (Darr)	Nov	43
Fix That Multimeter (Bohr)	Jan	74
Flare, Electronic, Flashes Warning Signals (Kaufman)*	Mar	72
FM		
-AM		
Detector Switching (Blonder-Tongue R-98)†	Jul	94
Portable, All-Transistor	Jun	52
Portables, Transistor, Are Here (Scott)	Apr	43
Stereo System, Tests to Single Out Best	Sep	58
Tuning Indicator (RCA TPM-13)†	Jul	95
Auto Radio(s)		
Interference, Eliminate (Steckler)	Jan	124
Marketed (Motorola) (NB)	Feb	18
Transistor-Powered	Aug	52
Converter for TV, Simple (Vanderwall)*	Nov	80
Crystal Oscillator for (Pat)	Aug	100
Detector, Self-Tuned (Pat)	May	129
Distortion Eliminator†	Mar	47
DX in 1959 (Cooper)	Jan 49; Feb	83
Finally Makes It (Lachenbruch)	Nov	39
Front End, Miniature, for Receivers (Lucas)	Mar	38
Highway, Economical (Borznier)*	Nov	56
Increasing (NB)	Jan 6; Oct	12
Medical Net (NB)	Apr	6
Multiplex in England	Jul	74
Sensitivity Switches	Mar	39
Station Given Away (NB)	Feb	6
Tuner, Wide-Band (Pat)	Jun	106
Flash, Better Photos with Transistor Slave (Merkler)*	Oct	39
Foldover, Halos and Cure (Algarra)	Aug	78
Four-Track Stereo, Matchbox-Size (Johnson)*	Jul	76
Corr	Sep	116

G		
Gibbons Substituter (Davis)	Jul	61
Grid-Current Limiting Resistors (Darling)	Aug	59
Guided-Grid, TV Tuner with (Lucas)	Jan	43
H		
Hand-Sized Grid-Dip Meter (Queen)*	May	42
Headlight Tattletale (Young)	Apr	41
Headphones for TV (Rasmussen)	Jan 56; (NC)	Feb 148
Heart, Electronics Can Save (Post)	May	54
High Power for Twin-Coupled Amplifier (Crowhurst)	Oct	34
Highlights of 1959 (NB)	Jan	6
Hints from Transisthiast's Workshop, More (Klein)	Jan	98
How to Fix Radios Faster (and Make More Money) (Darr)	Nov	43
How Much Rf? (Chapel)	Jul	97
How Valid Are Speaker Response Curves? (Augsburger)	Mar	50
I		
Identify Calibration Signals (Ives)*	Sep	56
Corres	Dec	18
Ignition Operated Tachometers (Schotz)*	Dec	54
Ignitrons, Be Careful with (Lytle)	Dec	70
Impedance, What's with Characteristic? (Middleton)	Mar	74
Corres	Jun 18; Jul 22; Sep 21;	Dec 21
Improving PA Systems (Sands)	Nov	71
Improving TV Receiver (Feingold)	May	86
Indicator, Miniature	Sep	49
INDUSTRIAL ELECTRONICS		
Audio Generator for Industrial Service (Jobs (Kernin)*)	Mar	60
Automatic Control (NB)	Mar	16
Diagrams, Understanding (Jaski)	Jun	64
Electronic Balancing for Better Motors (Essex)	Feb	58
Fishing, Electronics Goes (Milanowski)	Jan 36; (NB)	Mar 10
Grid-Current Limiting Resistors (Darling)	Aug	59
Ignitrons, Be Careful with (Lytle)	Dec	70
Industry Controls, Warns, Indicates, Counts Photoelectrically (Lytle)	Jun	70
Infrared in Industry (Kemp)	Aug	57
Injec-Check, Industrial Test Unit (Kernin)*	Oct	88
Leak Detectors, How They Work	Mar	59
Machines That Read (Gronich and Brielel)	Sep	64
Magnetron, Industrial Power Generator (Jaski)	Oct	68
Molten Glass, Electronics Controls Level (Barlowe)	Mar	58
Motors, Electronic Balancing for (Essex)	Feb	58
Oscillographs in Action (Thomas)	Jul	49
Photoelectric Control Made Easy (Winklepleck)*	Mar	62
Photoelectric Register Controls (Lytle)	Feb	54
Part	Jan 38; Part II	Dec 56
Strain Gauge, Look at (Kramer)	Aug	53
Power Supply, Regulated Low-Voltage (Murphy)*	Aug	53
Relays, Preventive Maintenance Keeps Them Working (Conant)	Apr	71
Safety Interlock (Ives)	May	39
Semiconductors for Controls (Jaski)	Jul	46
Servicing (See also Servicing) (Corres)	Feb 22, 26; Mar	18
Servomechanisms, How They Work (Safford)	Jul	53
Signal-Trace, Industrial Circuits (Kernin)*	Sep	72
Solder Removal Made Easy (McGuinness)	Jun	68
Corres	Nov	29
Static Controls (Jaski)	Apr	63
Corres	Sep	21
Mere (Jaski)	May	36
Strain Gauge, Look at (Kramer)	Dec	56
Subcarrier Techniques in Telemetry (Bukstein)	Nov	49
Television		
ITV Camera, Setting Up (Noll)	Jan	32
ITV Lens and Lighting System (Noll)	Feb	51
Tech to Military Technician (Kaufman)	Jan	42
Tech Repairs Weld Timer (Darling)	May	32
Transient Capacitor—What Is It? (Darling)	Nov	79
Transitone Locates Hidden Wiring (Parker)*	Dec	35
Ultrasonics, Introduction (Jaski)	Aug	54
Ungrounded Equipment Can Be Fatal Using 24-28-Volt Relays (Oberto)	Sep	75
Weld Timer, TV Tech Repairs (Darling)	May	35
Whaling by Electrolocation	Jan	42
Industry Controls, Warns, Indicates, Counts Photoelectrically (Lytle)	Jun	70
Infrared in Industry (Kemp)	Aug	57
Infrared Guides Missiles (Spencer)	Jan	22
Corres	May	96
Injec-Check, Industrial Test Unit (Kernin)*	Oct	88
Integrating Timer (Shields)*	Dec	28
Intercom, Automatic Doorbell (Kampf)*	Sep	34
Intercom Booster Aids TV Director (Hahr)*	Jun	76
Intercoms and Boat Hailers Improved by Transistors (Scott)	Aug	34
Interference—Causes, Remedies and Location (Frantz)	Jul	98
Corres	Oct	21
Intermittents, Licking (Greenlee)	Mar	95
International Electronic Meet at Paris (Garcin)	Jun	46
Ionized Band Encircles Earth (Warsaw)	Jun	38
IRE, New at 1960 Convention (NB)	May 6; May	58
ITV Lens and Lighting Systems (Noll)	Feb	51
K		
Kits, Turntables and Pickup Arms (Graham)	Mar	44

L			NOTEWORTHY CIRCUITS (Cont'd)			R		
Languages, Electronics Labs Help Teach (Johnson)	Jun	33	Sleep Alarm	May	124	RADAR		
Leak Detectors, How They Work	Mar	59	Supply, Voltage-Limited	Oct	113	Equipment Can Be Easy to Service	Sep	46
Legal Pitfalls (Parker)	Nov	84	Television			Largest (NB)	Jan	14
Lightning, TV Antennas Invite	Oct	92	Headphones	Feb	148	MADRE (NB)	Mar	12
Limiting Resistors, Grid-Current (Darling)	Aug	59	Hum-Cancelling Circuit	Feb	148	Mapping (NB)	Jul	12
LITERATURE, NEW	Jan 146; Feb 152; Mar 144; Apr 132; May 129; Jun 126; Jul 118; Aug 117; Sep 128; Oct 117; Nov 127; Dec 125		Width Stabilization	Jan	139	Missile Tracking (WN)	Mar	43
"Little Handful" Citizens-Band Transceiver (Queen)*	Aug	50	Test Instruments	Jun	109	New for	Nov	55
Look at Electronic Strain Gauge (Kramer)	Dec	56	Alpha Tester, Transistor	Jun	109	Principles of Modern (McQuay)		
Low-Cost, Starved-Current Amplifier (Lederer)*	Aug	36	Beta Tester, Transistor	Aug	98	Part I—AM and FM	Jun	42
Lows Are Directional Too	Mar	49	Probe, Battery-Current	Apr	128	Part II—Pulse Doppler	Jul	34
M			Stereoscope, Battery-Operated	Jul	110	Range Increased (NB)	Jun	10
Magnetometer at Work in Outer Space (Mansir)	Apr	38	Substitution Box, Improved	Aug	99	River Navigation (NB)	Mar	12
Machines That Read (Gronich and Briefel)	Sep	64	Timer, Darkroom	Apr	127	Radiation Detector, New Semiconductor (Shunaman)	Apr	42
Magnetron, Industrial Power Generator (Jaski)	Oct	68	Touch-Plate Relay	Jun	106	RADIO		
Match Those Peaking Coils (Shaw)	Aug	95	Transistor Class-B Circuits, Four	Jun	107	Alarms, Electronic, in Clock Radios (Maxwell)	Feb	115
Matchbox Radio (Martin)*	Jun	58	Transistors, Power, Mounting	May	122	Amateur(s)		
Corres	Jul	20	Novel "Talkie" Outfit for Slide Projectors (Costigan)*	Jun	36	Break-in, Faster (NC)	Mar	137
Measure Millivolts with Decade Amplifier (Henry)*	Sep	94	NPN-PNP Transistor Oscillator (Merkler)*	Nov	91	Corres	Nov	26
Medicine—See Electronics, Medicine			O			Cleveland Ham Wins Edison Award (NB)	Apr	6
Metal Detector, Underwater (Richardson)*	Jul	30	Ohmmeters Can Be Accurate (Conant)	Jan	84	Honored (NB)	Nov	6
Corres	Sep 21; Oct 21		Old-Timer Gives Safety Lecture (Darr)	Dec	41	License Rise (NB)	Jun	12
Microammeter, Clamp Type Ac	Feb	39	Oscillators			Moon Bounce (NB)	Oct	6
Micromodules, Today and Tomorrow (McQuay)	Feb	96	Code, Economy (Martin)	Feb	128	Satellite Bounce (NB)	May	6
Miniature Front End for FM Receivers (Lucas)	Mar	38	Crystal, for FM (Pat)	Aug	107	Antenna, Spiral Conical	Apr	49
Mini-capacitance Test Set (Stone)*	Mar	66	Crystal, Multipurpose, Transistor (Merkler)*	Jan	82	Auto		
Missile Control and Guidance (Hobbs)	Aug	60	Corres	May	28	FM (Motorola) (NB)	Feb	18
Molten Glass, Electronics Controls Level (Barlowe)	Mar	58	Microwave (Pat)	Dec	114	Eliminate Interference (Steckler)	Jan	124
Mini-tracer Speed Radio Repairs (Stone)*	May	44	PNP-NPN Transistor (Merkler)*	Nov	91	Transistor-Powered	Aug	52
Mixing and Matching to Audio Inputs (Reed)	Jul	88	Solar-Powered (NC)	Mar	136	Hybrid (Motorola 406)†	Jul	95
Modern Picture-Tube Testers (Kelvin)	Dec	59	Stable (Pat)	Sep	119	Transistor, Build This (Martin)*	Mar	40
More Bass from Smaller Speakers (Crowhurst)			Tunnel-Diode (Grossman and Friedman)*	Sep	40	Corres	May	130
Part I—Miniaturizing Speakers and Enclosures; Principles	Jul	81	Universal 2-Terminal (Lederer)*	Mar	63	Varicaps Tuned	May	58
Part II—5 More Ways to Get More Bass	Aug	37	Oscillographs in Action (Thomas)	Jul	49	Arc for Hallicrafters S-94 (NC)	Nov	120
Corres	Oct 26		Output Watt, What Is? (Graham)	Jan	60	Battery-less (Pat)	Feb	136
Motors, Electronic Balancing for Better (Essex)	Feb	58	P			Cabinet Repair, Rapid (Bohr)	Feb	118
Mouse Transmits Own Temperature (Griffith)*	Feb	101	PA Systems, Improving (Sands)	Nov	61	Cabinets, Repair, Retouch, Refinish (Markell)		
Multipurpose Transistor Crystal Oscillator (Merkler)*	Jan	82	Paperthin Radio (Fiction) (Fips)	Apr	46	Part I	Mar	109
N			Parallel/Series Resistance Calculator (Salva)*	Aug	72	Part II	Apr	60
Neon Lamps Make Voltage Indicator (Greenlee)*	Sep	98	PATENTS, NEW			Calibration Signals, Identify (Ives)*	Sep	56
New			Adder	Nov	99	Corres	Dec	18
at New York Hi-fi Show	Dec	92	Alarm, Power-Line	May	130	Circuitry, New Developments in (Maxwell)	Jul	94
Departure in Soldering Irons	Jun	69	Alertness Indicator	Sep	118	Citizens Band		
Departures in Tubes and Semiconductors (Steckler)	Aug	68	Amplifier			Apelco AR-9†	Sep	52
Developments in Audio (Scott)	Mar	47	Diode	Jan	142	Arc for Hallicrafters S-94 (NC)	Nov	120
Developments in Radio Circuitry (Maxwell)	Jul	94	Diode Pulse	Feb	137	Break-in, Faster (NC)	Mar	137
Features in Stereo Packages (Scott)	May	68	Direct-Coupled	Nov	100	Corres	Nov	26
PRODUCTS	Jan 133; Feb 38; Mar 119; Apr 119; May 125; Jun 111; Jul 104; Aug 102; Sep 107; Oct 98; Nov 102; Dec 104		Magnetic	Jul	109	Building Your Own (Sands)	Jan	110
Stereo Pickups (Hirsch)			Series Transistor	Dec	114	Canadian? (Corres)	Jun	22
Part I—Ceramics	Sep	30	Audience Survey System	Mar	128	Citizens Hamming up Status of FCC Warns Against Rag-Chewing	Jun	51
Part II—Grado Master, Neumann DST, Dynaco TA-12, G-E VR-22, London-Scott 1000	Oct	48	Beam-Registration Circuit	Mar	136	Field-Strength Meter, Transistor (Greenlee)*	Oct	76
Part III—ESL C99 Micro/Flex, Empire 88, Pickering 380, Shure M212/M216, Stereotwin 210/D, Fairchild SM-1	Nov	52	Camera-Radio-Telescope	Mar	128	Radio Control with Oomph (Thomas)*	Oct	52
NEWS (Redgrave)	May	48	Comparator, Diode	Jul	109	Remote-Control Transmitter (NC)	Nov	120
Nickel-Cadmium Battery, How Live? (Rhita)	Oct	38	Cooling Electric Blanket	Oct	118	Radson†	Sep	30
Night Switch for Hi-Fi (Bemis)*	May 64; (NC)	Dec 117	Crystal Oscillator for FM	Oct	117	Transceiver Circuitry (Scott)	Sep	52
No-Band-Switching Preselector (Abbatecola)	Feb	116	Deflection Correction	Jul	109	Transceiver, "Little Handful" (Queen)*	Aug	50
No More Ovens!	Aug	49	Flasher, Electronic	May	125	Two-Way Radios for (Scott) (Corr)	Jan	91
NOTEWORTHY CIRCUITS			FM Detector, Self-Tuned	Jun	109	Vocaline EP-27†	Sep	55
Audio			Frequency Meter, Direct-Reading	Jan 143; Dec 113		Weather Radio?	Jun	47
Amplifier			Ignition System	Aug	100	Clocks, Electronic Alarms in (Maxwell)	Feb	115
Cathode-Follower	Jul	111	Intermodulation Indicator	Jul	109	Code, Learns at 5	Jan	121
Stereo, Simple (NC)	Nov	119	Microphone, Hidden	Nov	99	Code Oscillator, Economy (Martin)	Feb	128
Transistor	Sep	120	Missile Measurement	Sep	119	Conelrad Alert Monitor (Reed)*	Jan	108
Bias Circuit, Class-B	Jan	139	Motion Study, Ultrasonic System for	Sep	119	Control with Oomph (Thomas)*	Oct	82
Feedback Tone Control	Jul	111	Oscillator, Stable	Sep	119	Control Transmitter, Portable (Queen)*	Sep	50
Megaphones, Two	Feb 148; Oct 112		Oscillator, Microwave	Dec	114	Direction Finder, Poor Man's (Craig)	May	94
Night Switch for Hi-Fi	Dec	117	Radiation Detector	Nov	100	Distance Record (NB)	May	6
Blinker, Light	Mar	137	Radio, Battery-less	Feb	136	Fix (Pat)	Jun	105
Corr	Jun	110	Radio Fix	Jan	105	FM—See also FM		
Detector, Improved	May	122	Recovery Time, Reducing	Mar	123	Front End, Miniature (Lucas)	Mar	38
Flash-Unit Control	Aug	98	Reflex Stage	May	130	Sensitivity Switches	Mar	39
Latching Circuit Uses Standard Relay	Mar	136	Remote Viewer	May	129	Frequency Standard (NB)	Jun	6
Light-Control Circuits, Two	May	122	Rf Transmitter, Automatic Tuning	Jan	142	Interference		
Meter Scales, Expand	Jun	109	Semiconductor Gate	Aug	100	BCI Trap, Novel (NC)	Dec	117
Oscillator, Sun-Powered	Mar	136	Sky Spy, Automatic	Aug	100	Causes, Remedies and Location (Frantz)	Jul	28
Pulse Integrator, Transistor	Nov	119	Squelched Carrier Current	Apr	100	Corres	Oct	91
Radio			Stereo, Simplified	Aug	100	Short-wavers Cooperate (NB)	Nov	6
AM Detector Improvement	Dec	118	Thermostat, Electronic	Sep	119	Inventors of [Edison] (Leslie)	Apr	48
Avc for Hallicrafters S-94	Nov	120	Thermostat, Transistor	Oct	117	Luna Part of Signal System	Apr	45
BCI Trap, Novel	Dec	117	Transistors, Regenerative Pair	Oct	118	Marine—Radio-Telephones for Small Boats (Robberson)	Mar	34
Break in Faster	Mar	137	Transistors, Triple	Nov	106	MARS Schedule (NB)	Jan 6; Feb 6; Apr 18; May 18	
Corres	Nov	26	Tuner, Wide-Band	Nov	99	Mobile, Installing, Hints (Hendrick)	Mar	22
Interference, Variable Filter Eliminates Man-Made	Sep	121	V-R Tube Circuit			(Corres)	Aug	49
Remote-Control Transmitter	Nov	120	Photoelectric Control Made Easy (Winklepleck)*	Mar	62	No More Ovens!	Apr	46
Snitcher, More on	Oct	113	Photoelectric Register Controls (Lytel)	Jan	38	Paperthin (Fiction) (Fips)	Apr	46
Superheterodyne, I-Transistor	Dec	118	Part I	Feb	54	Oscillator, Tunnel-Diode (Grossman and Friedman)*	Sep	40
Rectifier Stack, Simplified	Aug	99	Part II			Paging System, Bell (NB)	Nov	10
			Photoflash, Shoot with All-Transistor (Ahrons)*	Apr	36	Portable(s)		
			Photos, Better with Transistor Slave Flash (Merkler)*	Oct	39	FM-AM Here (Scott)	Apr	43
			Pickup Arms and Turntables Built from Kits (Graham)	Mar	44	FM-AM All-Transistor	Jun	52
			Picture-Tube Testers, Modern (Kelvin)	Dec	59	Matchbox (Martin)*	Jun	58
			PNP-NPN Transistor Oscillator (Merkler)*	Nov	71	Pocket, 7-Transistor (Wittlinger)*	Mar	18
			Polyoptic Sealing Makes Batter Tubes	Jul	52	(Corres)		
			Poor Man's Direction Finder (Craig)	May	94	Shirt-Pocket Reflex for Local Listening (Mason)*	Jul	92
			Portable R/C Transmitter (Queen)*	Sep	50	Super-Eight (Klein)*	Aug	44
			Postage-Stamp Amplifier (Bohr)*	May	59	Corr	Sep	116
			Power Supply, Portable (Queen)*	Feb	37	Transitube Pocket (Davidson)* (Corr)	May	130
			Power Supply, Transistor, for Service Bench (Pugh)*	Aug	29	World Series Special (Stanley)*	Sep	57
			Power Tester, Make a (Winklepleck)	Sep	102	Preselector, No-Band-Switching (Abbatecola)*	Feb	116
			Practical Tester for Electrolytics (Conant)*	Oct	46	Receiver, Souping Up That Old (Jaski)*	May	106
			Preamp—See Audio, Preamp			Remo-Nemo (Reed)*	Dec	77
			Preventive Maintenance Keeps Relays Working (Conant)	Apr	71	Remote-Control Transmitter (NC)	Nov	120
			Principles of Modern Radar (McQuay)			Rf		
			Part I—AM and FM	Jun	42	How Much? (Chapel)	Jul	97
			Part II—Pulse Doppler	Jul	34	Stage Boosts Sensitivity (Foldi)	Jun	60
			Proximity Relay (D'Airo)*	Sep	48	Transmitter, Automatic Tuning (Pat)	Jan	142
			Puzzled About Output Transformers? (Crowhurst)	Dec	33	(Continued on page 138)		

RADIO (Cont'd from p. 134)

Single-Sideband Transmitter Adjustments (Noll)	Aug	47
Small, Uses Original Transistor Amplifier (Ciardi)*	Dec	86
Snitcher, More on (NC)	Oct	113
Souping Up That Old Receiver (Thomas)*	May	106
Speaker, 8-Inch, Single Transistor Operates (Grace)*	Oct	52
Squelch Without Tubes (Shaum)*	Jun	50
Stars, Locating (NB)	Jun	6
Stereo AM 558 Broadcasting, Foreign (NB)	Mar	16
Stereo System, Tests to Single Out Best Telescope, Largest (WN)	Sep	58
Time Standard, New	Mar	43
Transistorized—Transistor(ized), Radios	Jul	55
Troubleshooting with FCC	Sep	51
Ultra-Sensitive, 3-Transistor (Amorose and Hoffmeister)*	Dec	39
Underground (NB)	Oct	6
Voice of Africa? (NB)	Nov	6
Voice of America's New Transmitter (NB)	Mar	10
Wave Duct (NB)	Apr	6
Waves and Life (Jaski)	Sep	43
Corres	Nov	30
Radiotelephones, Small-Boat (Robberson)	Mar	34
Rally-Pal Computer (Allison)*	Nov	46
Rapid Cabinet Repair (Bohr)	Feb	118
Record Changers, Servicing Faster (Sheneman)	Jan	57
Regulated Low-Voltage Power Supply (Murphy)*	Aug	53
Remo-Nemo (Reed)*	Dec	77
Reserve Power for Survival (Prensky)	Jul	96
Resistance Calculator, Parallel/Series (Salva)*	Aug	72
Retouch, Repair, Refinish Cabinets (Markell)	Mar	109
Part I	Apr	60
Part II	Apr	60
Reverberation, And Now	Aug	43
Rf Stage Boosts Sensitivity (Foldi)	Jun	60
Roundword Puzzle (Nahrwald)	Jul	31

6DZ7 Amplifier (Voss)* Nov 40
 6ES for Transistor Circuits (Turner)* Nov 98
 Safety Interlock, Industrial (Ives) May 39

SEMICONDUCTORS—See also Transistor(s); Transistor(ized)

Diode(s)	Nov	99
Adder (Pat)	Jan	142
Amplifier (Pat)	Feb	137
Amplifier, Pulse (Pat)	Jul	109
Comparator (Pat)	Apr	12
High-Frequency (NB)	Mar	128
Recovery Time, Reducing (Pat)	Oct	51
Duo-junction (Queen)*	Aug	100
Gate (Pat)	Jul	46
Industrial Controls (Jaski)	Jul	46
New—See also New Tubes and Semiconductors		
Departures in Tubes and (Steckler)	Aug	68
Material (NB)	Feb	21
Radiation Detector, New (Shunaman)	Apr	42
Something New in (Crawford and Milligan)	Jan	105
Corres	Apr	22
Tunnel Diode(s)	Nov	42
Noise Generator (Queen)*	Sep	40
Oscillator (Grossman and Friedman)*	Oct	58
Really Works (Queen)*	Jul	26
Story (Walters and Clays)	Aug	42
Zener Diodes Prevent Speaker Burnout (Ives)	Aug	42

SERVICING—See also specific subject; Technotes; Test Instruments; Try This One

Adapter, Phone-Tip (TTO)	Jul	115
Air-Conditioner Fan Motors (Tech)	May	115
Audio		
Distortion (Soundmirror BK 414) (Tech)	Feb	133
Hum (RCA 6RF9) (Tech)	Jun	119
Plug Adapter (TTO)	Apr	107
Record Changers, Servicing Faster (Sheneman)	Jan	57
Recorder, Noisy (Soundmirror 414) (Tech)	Jan	141
Speaker Transformers, Mounting (TTO)	Sep	123
Tape Recorder Kink	Mar	56
Tape Recorder Wow (Tech)	Sep	114
Tape Splicer, Cleaning (TTO)	Mar	133
Turntable, New Flocking (TTO)	Oct	120
Cabinet(s)		
Repair, Rapid (Bohr)	Feb	118
Retouch, Repair, Refinish (Markell)	Mar	109
Part I	Apr	60
Part II	Apr	60
Clippings, Saving (Corres)	Jan 26; May	26
Electrolytics, Discharging	Feb	129
Hole Shrinking (TTO)	Aug	114
Industrial Electronics—See also Industrial Electronics		
Corres	Feb 22, 26; Mar	18
Ignitrons, Be Careful with (Lytel)	Dec	70
Inject-Check (Kernin)*	Oct	88
Signal-Trace Industrial Circuits (Kernin)*	Sep	72
Intermittents, Capacitor Test Box Finds (Fred)	Jul	44
Intermittents, Foil Foils (TTO)	Feb	145
Legal Pitfalls (Parker)	Nov	84
Meter Scales, Brighten (TTO)	Jul	114
Military Technician, TV Tech to (Kaufman)	Jan	42
Parts Substitution in Dogs (TTO)	Sep	114
Power Supply, Transistor, for Service Bench (Pugh)*	Aug	29

SERVICING, Radio (Cont'd)

Printed-Circuit Grounds (Tech)	Nov	110
Projectors, Parts for Natco (Corres)	Oct	21
Radio		
Audio Output (Tech)	Jan	140
Auto		
Coil Slugs, Freeing If (Tech)	May	115
Generator Noise (Tech)	Aug	109
Power Supply (Tech)	Dec	115
Sound		
Distorted (Ford 74BF) (Tech)	Oct	111
Out (Philco P5703) (Tech)		
Sep 115; (Tech)	Nov	111
Squeals (Motorola 78MF) (Tech)	Nov	111
Weak (Ford 74BF) (Tech)	Aug	110
Stations Off Frequency (Ford 74BF) (Tech)	Jun	120
Transistor, Heat Damage (Ford 74BF, 75BF) (Tech)	May	116
Battery, Check Shorted (Tech)	Apr	116
Earpiece Repair (TTO)	May	114
Fix Radios Faster (and Make More Money) (Darr)	Nov	43
FM-AM, Lightning-Struck (Zenith 7T04) (Tech)	Aug	110
Fringe Reception, Boost (TTO)	Mar	133
Goodwill Kink (TTO)	Oct	124
Grid-Cap Leads, Mark (Tech)	May	117
If Transformer, Leaky (Tech)	Feb	133
Interference		
Causes, Remedies, Location (Frantz)	Jul	98
Corres	Oct	21
Man-Made, Variable Filter Eliminates (NC)	Sep	120
Loopslick Tracking (Tech)	Jul	113
Rf, How Much? (Chapel)	Jul	97
Safety Lecture, Old-Timer Gives (Darr)	Dec	41
Selenium Rectifiers, Replacing (TTO)	Mar	133
Tough Dog; (Fred)	Feb	125
Trace Speeds Servicing of Transistor (Steckler)	Dec	36
Tracking (G-E 646 Portable) (Tech)	Jan	141
Tricky Radios, Those (Craig)	May	100
Warmup Time, Eliminate (TTO)	Jun	122
Relay, Cure Sticky (TTO)	Aug	114
Relay Sensitivity, Improve (TTO)	Feb	145
Solder		
Removal Made Easy (McGuinness)	Jun	68
Corres	Nov	29
Spaghetti Insulates (TTO)	Apr	108
Soldering		
Aid (TTO)	Sep	124
Cold Iron (TTO)	Jun	122
Corres	Jun	26
Heat Sink, Handy (TTO)	Aug	114
Transistor Life Saver (TTO)	Oct	122
Soldering Iron		
Cleaner (TTO)	Oct	120
Holder (TTO)	Jul	115
Maintenance (TTO)	Jul	114
New Departure in Rest (TTO)	Jun	69
Tips, Custom (TTO)	Feb	145
Streamlining I-Man Shop (Miller)	Nov	125
May	88	
Television		
Agc Slow (Capehart 301M) (CI)	Dec	69
Agc Trouble (Admiral 21Z1) (CI)	Aug	80
Agc-Width Coil (Stromberg-Carlson TC-19) (CI)	Oct	68
Alignment (Mattison 630) (CI)	Mar	118
Antenna(s)		
Community (CI)	Jan	50
Distribution Systems (Beever)	Nov	60
Part I	Dec	51
Part II	Apr	58
Improvement (CI)	Feb	77
Lead-in Cable (CI)	Dec	63
Lightning (CI)	Oct	92
Antennas Invite	Jul	115
Arrester Tent (TTO)	Jul	59
Stacking (CI)	Aug	113
Unusual Job (TTO)	Feb	82
Anti-ringing Capacitor (CI)	Jan	141
Barkhausen Oscillation (G-E 14P1209) (Tech)	Apr	52
Benchwork Can Be Tricky (Middleton)	May	115
Bending Pix (CBS U3T616) (Tech)	May	84
Bounce in Pix (Sylvania 225MU) (CI)	Aug	80
Buzz and Hum (CI) Aug 80; (RCA TI00) (Tech)	Dec	116
Business Primers, Two	Oct	44
Channels Shifted (Bendix TS 17DU) (CI)	Jul	59
Check Tube (CI)	Apr	59
Christmas-Tree Effect (Philco 51T 2130) (CI)	Feb	80
Color		
Black-and-White Temperature Adjustments (RCA 700, 800 Series) (Tech)	Mar	143
Chroma Demodulators (Middleton)	Feb	62
Controls, About Those (Middleton)	Jun	80
CRT's, Field-Check (Egan)	Jun	96
Demodulators (CI)	Apr	57
Fringing (Silvertone 7140-A) (Tech)	Oct	110
Hum Bars (Motorola TS 902) (CI)	May	82
Set or Station Causing Trouble? (Darr)	Aug	90
Side Convergence (RCA CTC7A) (CI)	Aug	83
Signal Voltages in Chroma Matrix (Middleton)	May	74
Sync Out on Purpose (Tech)	May	116
Compressed Pix (CBS 1021-2) (Tech)	Apr	115
Control Assembly, Dual (TTO)	Jul	114
Controls Charred (RCA 21T74 17U) (CI)	Jun	90
Convergence (CI)	Oct	60

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Conversion(s)		
16GP4 for 16ZP4 (Philco 51-T-1604) (CI)	Apr	59
to 16- or 17-Inch (Dumont RA-103) (CI)	Apr	58
16- to 21-Inch (Sentinel 1U416,416) (CI)	Feb	82
to 17- or 21-Inch (Arvin 3160) (CI)	Feb	82
Gassy Replacements (CI)	Jul	60
Inadvisable (RCA KCS-82D) (CI)	Nov	64
Metal to Glass (CI)	May	82
(Silvertone 25WG-3075) (CI)	Dec	68
(Stewart-Warner 21T9210) (CI)	Sep	79
Corona on Agc Line	May	81
Corona Cures (Tech)	Aug 109;	Sep 115
CRT Coating (TTO)	Aug	112
DcRestorer (Capehart 1C213) (CI)	Jan	51
Detail Lacking in Pix (RCA 21T207) (CI)		
Detectors, First and Second (CI)	Aug	80
Dim Pix (Capehart 324) (CI)	Feb	80
Distortion, Scope Detects (CI)	Apr	57
Dogs, We Learned from (Centerville)	Nov	64
Electrostatic-Focus CRT's (Tech)	Jun	71
Fine Tuning (Admiral 12YP3D) (CI)	May	117
Flyback Hot (Silvertone 132.045-5) (CI)	Sep	78
Focus Adjustments, Easing	Aug	82
Focus Off (DuMont RA-164) (CI)	Feb	88
Foldover, Halos and Cure (Algarra)	Sep	80
Height Insufficient (Crosley G17TOMH) (CI)	Aug	78
Herringbone Pattern (Tech)	Jan	52
High Voltage	Sep	115
Boost (Transvision A41) (CI)		
Doubler Trouble (Sylvania 512-1) (CI)	Oct	66
None (Admiral 21B1) (CI) Jun 88;		
(Emerson 163-D) (Tech) Jan 141;		
(Hallicrafters 730) (CI)	Jun	90
Holes, Compound Fills (TTO)	Jan	52
Horizontal	Aug	114
Foldover (Tech) Jan 141; (Capehart 3C312M) (CI)		
Hold Critical (Admiral 18XP48Z) (CI) May 83; (G-E 14T017) (CI) Jul 60; (Philco 9H25U) (Tech)	Apr	58
Instability (CI) Jun 88; (Westinghouse H736T17) (Tech)	Jul	112
Jitter, Stop (Shaw)	Dec	115
Oscillator	Aug	84
Bad (Capehart 14F215) (CI)		
Critical (CBS 1621) (CI)	Aug	83
Troubleshoot (Jacques)	Mar	118
Output Stages (Jacques)	Apr	55
Roll (Motorola 1S-425) (CI)	Jul	56
Sync (G-E 21T14) (CI)	Dec	68
Hum (Crosley 11-459MU) (CI)	Dec	68
Buzz and (CI)	Nov	65
Pickup (Bendix T-19) (Tech)	Aug	80
Identifying (DeForest 20A-05A) (CI)	May	115
If Oscillation, Spotting (Smith)	Sep	78
Interference	Feb	74
Causes, Remedied, Location (Frantz)		
FM (Tech)	Jul	98
Snivet (Tech)	Sep	114
Intermittents, Don't Use Heat Lamp (TTO)	Nov	110
Intermittents, Licking (Greenlee)	Jan	144
Knobs, Plastic (TTO)	Mar	95
Marginal Defects (CI)	Oct	112
Mask-Removal Tool (TTO)	Jun	88
Minus Rf (Dille)	Apr	108
Motorola's New Transistor	Feb	88
New Complaint (Spracklen)	Sep	82
One-Man Shop, Streamlining (Miller)	Nov	93
Oscillation, Transient (RCA KCS-68C) (CI)	May	88
Oscillator Troubles (CI)	Feb	79
Output and Vertical Oscillator Stages, Troubleshooting (Jacques)	Oct	61
Overload (Westinghouse H21T104) (Tech)		
Peaking Coils, Watch (Shaw)	Aug	133
Piecrust Pix (Magnavox) (Tech)	Feb	95
Pulling (Raytheon C-21A) (CI)	Nov	111
and Tearing (Philco 51 T 2130) (CI) at Top (Capehart CX33) (CI)	Nov	70
Raster	Feb	80
Dim (CBS) (CI) May 85; (Sentinel 1U-1101-T) (CI)	Jan	51
Hole in (Crosley G21TOWH) (CI)	Jan	52
Lost (Coronado 15TV4) (Tech) Oct 111; (G-E 21T7) (CI) Sep 81; (Zenith 122T1) (Tech)	Mar	117
Small, No Pix or Sound (G-E Portable MM) (Tech)	Apr	116
Reception, Poor (CI)	Jan	143
Rectifier Bad? (Emerson 1184) (CI)	Apr	57
Remote Uncontrol (Zenith 16Z21Q) (CI)	Oct	61
Resistors	Nov	65
Burning (Packard-Bell 2301) (CI) Feb 79;		
(Philco 7640) (CI)	Sep	79
Charred (RCA 21T7417U) (CI)	Jun	90
Retrace Eliminator (CI)	Jan	52
Ringling (Sylvania 1-523) (CI)	Nov	70
Roll (Philco F4628) (CI)	Jan	51
Scope		
Troubleshooting with (CI)	Sep	78
Waveforms, Voltage and Current (CI)	Feb	78
Corr	May	130
Wide-Band (CI)	Feb	77
Zero-Reference Levels (CI)	Mar	116
Shock-Absorbing Ride (TTO)	Jul	115

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Shrinking Pix (Setchell-Carlson 551) (CI)	Sep	78
Silver Lining in Pix (Admiral 122DX121) (Tech)	Aug	109
Smeared Pix (Admiral 14YP3) (CI)	Mar	116
Sound		
Noisy and Intermittent (Tech)	Jun	119
Slow and Intermittent (Philco E-2006-11 Portable) (CI)	Oct	66
Takeoff (Schloemer)	Jan	45
Unsound (Packard Bell 2111-Z) (CI)	Dec	68
Streaks and Flashes (Tech)	Oct	110
Sweep Circuits, Troubleshooting (Sykes)	Jul	37
Sync (Stewart-Warner 21T9300A) (Tech)	Feb	133
Buzz (AMC) (CI) Jan 52; (Hyde Park 172) (CI)	Mar	118
Drifting (Trav-Ler 729-17A Portable) (CI)	Nov	70
Loss (Sparton 21322) (Tech)	Jan	140
Unstable (Magnavox CT257) (Tech)	Jul	112
(Zenith 2229) (Tech)	Dec	116
Transistor, Motorola's New	Sep	82
Traps Out of Tune (Freed-Eisemann 1916) (CI)	Nov	65
Tube(s)		
—Changing Tough Ones (Darr)	Oct	84
Check, Remember	Jul	58
Pix		
Breakdown (Muntz 1786) (CI)	Jan	42
Cathode Open (Tech)	Mar	143
Cleaning Aid (TTO)	Sep	123
Shields, Replace (Tech)	May	117
Short Life (Motorola 21T25CH) (CI)	Jun	89
Tuner		
Inoperable (Bendix T20) (Tech)	Jul	112
Noisy (Philco UG3052-BL) (Tech)	Oct	110
Trouble (RCA 7T1033) (CI)	Apr	58
Vertical		
Circuits, Compensating Capacitors for (Tech)	Jun	119
Compression (Sylvania 1-554-1) (Tech)	Nov	110
Foldover (G-E 17P1330) (Tech)	Jun	119
Hold Critical (CBS 22C07M) (CI)	May	84
Instability (CI) Jun 88; (RCA KCS-124) (CI)	May	85
Jitter (Motorola 17P3-1) (Tech)	Apr	118
Line (RCA 800 Portable) (Tech)	May	117
(RCA KCS-68) (CI)	Aug	83
Linearity Poor (Zenith Super K) (CI)	Jun	88
Oscillator and Output Stages, Troubleshooting (Jacques)	Oct	40
Raster Collapsed (CBS-Columbia U3T602) (Tech)	Aug	111
Roll (RCA KCS-92) (CI)	Oct	61
Roll and Poor Sync (G-E 17T14) (CI)	Apr	59
Sync Trouble (Philco TV-300) (CI)	Apr	58
Voltages Missing (Stromberg-Carlson TC-19) (CI)	Jun	90
Video If Systems, Taming (Lemons)	Dec	30
Width		
Coil Burnout (Sentinel 416) (CI)	Jul	59
Excessive (G-E 17P1329) (Tech)	Oct	111
Insufficient (G-E 14P1210) (Tech)	Mar	142
Yoke(s) (CI)	Mar	114
Coils, Save (Tech)	Dec	116
Flashover (RCA 2T60) (CI)	Sep	78
Magnets Not Used (CI)	Dec	68
Test Instruments		
Marker Generator Trouble (CI)	Aug	82
Meter Case Nonmagnetic (TTO)	Aug	113
Sine Waves, Using (Tech)	Nov	110
Vtvm Readings Low (EICO 221, 221K) (Tech)	Jun	120
Test Lead Extensions (TTO)	Jun	122
Weld Timer, TV Tech Repairs (Darling)	May	32
Wiring, Transistor, Locates Hidden (Parker)*	Dec	55
Servomechanisms, How They Work (Safford)	Jul	53
Set or Station Causing Color TV Troubles? (Darr)	Aug	90
Setting Up ITV Camera (Noll)	Jan	32
Shirt-Pocket Reflex for Local Listening (Mason)*	Jul	92
Shoot with All-Transistor Photoflash (Ahrons)*	Apr	36
Signal-Trace Industrial Circuits (Kernin)*	Sep	72
Signal Voltages in Chroma Matrix (Middleton)	May	74
Single-Control Multimeter (Stratmoen)*	Feb	34
Single-Pulse Generator (Thomas)*	Apr	79
Single-Sideband Transmitter Adjustments (Noll)	Aug	47
Single Transistor Operates 8-Inch Speaker (Grace)*	Oct	52
Small-Boat Radiotelephones (Robberson)	Mar	34
Solar Cells, How to Make (Chapin)	Mar	89
Solder Removal Made Easy (McGuinness)	Jun	68
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Souping Up That Old Receiver (Thomas)*	May	106
Speaker Response Curves, How Valid (Augspurger)	Mar	50
Special Effects with Tape Recorder (Larson)	Aug	40
Spotting Video If Oscillation (Smith)	Feb	74
Squelch Without Tubes (Shaum)*	Jun	50
Static Controls in Industry (Jaski)	Apr	63
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More (Jaski)	May	36
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Stop Feedback in PA Systems (Schroeder)	Feb	40
Stop Horizontal Jitter (Shaw)	Aug	84
Strain Gauge, Look at (Kramer)	Dec	56
Streamlining One-Man Shop (Miller)	May	88

Strobe for Tape (McCormick)*	May	40
Stroboscope Flasher (Taylor)	Jun	35
Subcarrier Techniques in Telemetry (Bukstein)	Nov	49
Super-Eight, Build (Klein)*	Aug	44
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Sweep Generator, Simple, Uses Varicap (Barron)*	Nov	58
T		
Tachometers, Ignition-Operated (Schotz)*	Dec	54
"Talkie" Outfit for Slide Projectors, Novel (Costigan)*	Jun	36
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Air-Conditioner Fan Motor	May	115
Audio		
Distortion (Soundmirror BK414)	Feb	133
Hum (RCA 6RF9)	Jun	119
Phono Inoperative (Sylvania 4312)	Sep	114
Recording Noisy (Soundmirror 414)	Jan	141
Tape Recorder Wow	Sep	111
Printed-Circuit Grounds	Nov	110
Radio		
Audio Output (RCA 7-BT-9J)	Jan	140
Auto		
Generator		
Noise	Aug	109
Hint	Mar	142
Power Supply	Dec	115
Sound		
Distorted (Ford 74BF)	Oct	111
Out (Philco P5703)	Nov	111
Squeals (Motorola 78Mf)	Nov	111
Weak (Ford 74BF)	Aug	110
Stations Off Frequency (Ford 74BF)	Jun	120
Transistor, Heat Damage (Ford 74BF, 75BF)	May	116
Battery, Check Shorted	Apr	116
FM-AM, Lightning-Struck (Zenith 7T04)	Aug	110
Grid-Cap Leads, Mark	May	117
If Transformer, Leaky	Feb	133
Loopstick Tracking	Jul	113
Tracking (G-E 446 Portable)	Jan	141
Sine Waves, Using	Nov	110
Television		
Barkhausen Oscillation (G-E 14P1209)	Jan	141
Capacitors, Compensating	Jun	119
Color		
Black-and-White Temperature Adjustments (RCA 700, 800 Series)	Mar	143
Fringing (Silvertone 7140 A)	Oct	110
Sync Out on Purpose	May	116
Compressed Pix (CBS 1021-2)	Apr	116
Corona Cures	Aug 109; Sep	115
Electrostatic-Focus CRT's	May	117
FM Interference	Sep	115
High-Voltage Lacking (Emerson 163-D)	Jan	141
Horizontal Foldover	Jan	141
Horizontal Hold Critical (Philco 9H25U)	Jul	112
Hum Pickup (Bendix T-19)	May	115
Overload (Westinghouse H21T104)	Feb	133
Picture Bends (CBS U3T616)	May	115
Piecrust Pix (Magnavox 105)	Nov	111
Pix-Tube Cathode Open	Mar	143
Raster Lost (Coronado 15TV4) (Zenith 16Z21)	Oct 111; Apr	116
Raster Small, No Sound, No Pix (G-E Portable MM)	Jan	140
Silver Lining on Pix (Admiral 122DX121)	Aug	109
Shivet Interference	Nov	110
Sound Buzzy and Weak (RCA T100)	Dec	116
Sound Noisy and Intermittent (Zenith 23H22)	Jun	119
Streaks and Flashes in Pix	Oct	110
Sync		
Critical (Stewart-Warner 21T9300A)	Feb	133
Loss (Sparton 21322)	Jan	140
Unstable (Magnavox CT257)	Jul	112
(Westinghouse H736T17)	Dec	115
(Zenith 2229)	Dec	116
Tube Shields, Replace	May	117
Tuner Inoperable (Bendix T20)	Jul	112
Tuner Noisy (Philco UG3052-BL)	Oct	110
Vertical		
Blanking Poor (G-E 17P1330)	Sep	114
Compression (Sylvania 1-544-1)	Nov	110
Foldover (G-E 17P1330)	Jun	119
Jitter (Motorola 17P3-1)	Apr	118
Line, Jagged (RCA 800 Portables)	May	117
Raster Collapse (CBS-Columbia U3T602)	Aug	111
Width Excessive (G-E 17P1329)	Oct	111
Width Insufficient (G-E 14P1210)	Mar	142
Yoke Coils, Save	Dec	116
Test Instruments		
Square Waves, Using	Mar	142
Vtvm Readings Low (EICO 221, 221K)	Jun	120
Teleducated Techs (Melton)	Apr	50
Telemetry, Subcarrier Techniques in (Bukstein)	Nov	49
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Antenna(s)		
Community (CI)	Jan	50
Distribution Systems, Servicing (Beever)	Dec	51
Part I	Nov 60; Part II	Dec
Invite Lightning to Strike	Oct	92
Yagi, Build-It-Yourself (CI)	Nov	65
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Feed into Hi-Fi Systems (Leonard)	Mar	56

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Headphones br (Rasmussen)	Jan	56
Hum-Cancelling Circuit (NC)	Feb	148
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Booster Operators Cooperate (NB)	Nov	12
Brightness Control, New Automatic (Maxwell)	Sep	91
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Repair, Rapid (Bohr)	Feb	118
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Lens and Lighting Systems (Noll)	Feb	51
Setting Up (Noll)	Jan	32
Channel Allocation (NB)	Apr	8
Closed-Circuit, Elevator, for Safety (NB)	Nov	14
Color		
Beam-Registration Circuit (Pat)	Feb	136
Controls, About Those (Middleton)	Jun	80
Japan, 2-Color (NB)	Sep	12
Set or Station Causing Trouble? (Darr)	Aug	90
Signal Voltages in Chroma Matrix (Middleton)	May	74
Upswing (NB)	Jun	14
Design Trends, 1960 (Lemons)	Jan	46
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Improving the Receiver (Feingold)	May	86
Intercom Booster Aids TV Director (Haahr)*	Jun	76
Interference—Cause, Remedies and Location (Frantz)	Jul	98
Corres	Oct	21
Intermittents, Licking (Greenlee)	Mar	95
Japanese, Coming (NB)	Nov	14
Key TV for Rating Shows (WN)	Sep	59
Minus Rf (Dilley)	Feb	88
Number up to 94,000,000 (NB)	Nov	20
Portable, New Products for? (NB)	Apr	6
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Sky Spy, Automatic (Pat)	Aug	100
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Tech Repairs Weld Timer (Darling)	May	32
Toll Trial (NB)	Apr	18
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19-Inch (Motorola) (NB)	Jul	12
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Motorola's New, Servicing	Sep	82
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Tuner with Guided Grid (Lucas)	Jan	43
Tuner, Wide-Band (Pat)	Jun	106
Uhf Tests (NB)	Sep	6
Underground (NB)	Dec	14
Video Width Stabilization (NC)	Jan	139
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Visible Sound, British Deaf Want	Nov	81
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Adapters (Simpson) (Scott)	Jul	40
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Attenuator-Padder for Low-Level Testing (Reed)*	May	46
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Generator for Industrial Service Jobs (Kernin)*	Mar	60
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Signal Tracer for Industrial Circuits (Kernin)*	Sep	72
Wattmeter Out of Vtvm (Casey)	Aug	31
Corres	Oct	26
Bridge Accuracy, Boost with Null Amplifier (Frantz)*	Aug	32
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Capacitance Meter (Sutton)*	Dec	90
Capacitor Test Box Finds Intermittents (Fred)	Jul	44
Chroma Tracer	May	45
CRT's Field-Check (Egan)	June	96
Decade Amplifier, Measure Millivolts with (Henry)*	Sep	94
Dry-Cell Tester	Apr	82
Electron-Ray Tube, Versatile (Shields)*	Mar	64
Electrolytics, Practical Tester for (Conant)*	Oct	46
Electroscope, Experimenter's Dual (Moen)*	Jun	99
Field-Strength Meter, Transistor, for Citizens Band (Greenlee)*	Oct	76
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Generator, Single-Pulse (Thomas)*	Apr	79
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Injec-Check, Industrial Test Unit (Kernin)*	Oct	88
Meter		
Dress Up That (Henry)*	Jun	94
Faces, Brighten	Jun	101
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Microammeter, Clamp Type Ac	Feb	39
Mini-capacitance Test Set (Stone)*	Mar	66
Mini-tracer Speeds Radio Repairs (Stone)*	May	44
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Panel Meter Uses Printed-Circuit Coils (WN)	Jul 45
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Deflection Correction (Pat)	Oct 117
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Signal-Trace Industrial Circuits (Kernin)*	Sep 72
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Spiral, Better Yet Use (Jaski) (Corres)	Jan 26
Square Waves, Using (Tech)	Mar 142
Strobe for Tape (McCormick)*	May 40
Stroboscope, Battery-Operated (NC)	Jul 100
Stroboscope Flasher (Taylor)	Jun 35
Substituter, Gibbons (Davis)	Jul 61
Substitution Box, Improved (NC)	Aug 99
Sweep Circuits, Troubleshooting (Sykes)	Jul 37
Sweep Generator, Simple, Uses Varicap (Barron)*	Nov 58
Tachometer, Ignition-Operated (Scholtz)*	Dec 54
Test-Load Box, Amplifier (Smith)	Nov 98
Trace Speeds Transistor Radio Servicing (Steckler)	Dec 36
Transformer, Electronic (Woods)*	Jun 98
Transistor(s) Checker	Apr 83
Alpha Tester (NC)	Jun 109
Beta Tester (NC)	Aug 98
Substitution Box (D'Airo)*	Feb 38
Voltage Indicator, Neon Lamps Make (Greenlee)*	Sep 98
Voltmeter, Transfer Standard Calibrates (Lederer)*	Jun 100
Vtvm	
Ac, Automatic (Marshall)	Aug 26
Double Value from (Guertin)	Apr 73
Readings, Equalize (Sutton)	May 41
Wire Stripping with Foot Pedal (Hughes)	Sep 92
Third Speaker, Add Easy Way (Burststein)	Oct 45
Timer, Automatic Recycling (Fannon)*	Jul 36
TIROS in Sky (Steckler)	Jun 86
Tough Dog! (Fred)	Feb 125
Trace Speeds Transistor Radio Servicing (Steckler)	Dec 36
Transfer Standard Calibrates Voltmeter (Lederer)*	Jun 100
Corres	Sep 22
Transformer, Winding Transistor-Power-Supply (Winklepleck)	Oct 55
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New Departures in Tubes and Semiconductors (Steckler)	Aug 68
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KEY TO SYMBOLS AND ABBREVIATIONS

* Construction Articles	
† Section of full-length article	
CI	Television Clinic
Corr	Correction
Corres	Correspondence
NB	News Briefs
NC	Noteworthy Circuits
Pat	New Patents
Tech	Techniques
TTO	Try This One
WN	What's New

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Does It Follow Its Own Theory? (Crowhurst)	Oct 59	Klystron Tube for Outer Space (Jaski)	Feb 46	Broadcasting 40 Years Old (NB)	Jun 61
From Your Own Tuner (von Recklinghausen)	Aug 26	L			
G.E., Zenith Start (NB)	Aug 6	Lawnmower, Automated (Carlson)*	Apr 35	Citizens Band	
Leads Hi-Fi Show (NB)	Nov 6	Light Beam, Talk On (Pittet)*	Sep 56	200,000 Citizens-Banders (NB)	Aug 6
Not So Tough	Oct 84	Lightmeter		Canadian (NB)	Sep 14
Receivers, "Wireless"? (NB)	Jul 6	Sensitive, Directional (Tullsen)*	Jul 37	Circuitry, What's New (Scott)	Aug 44
Speakers, How to Place (Augsperger)	Oct 91	Corres	Nov 20	Hushpuppy for Squelch	May 78
Special Report (Lachenbruch)	Aug 57	Ultrasensitive Photographic (Gordon)*	Oct 43	Modulation Monitor Checks Transmitter (Greenlee)*	May 53
Zenith, G-E Start (NB)	Aug 6	Light Wave, Communication by	Mar 49	Modulator Puts CB Transmitter in Car (Thomas)*	Nov 54
Tuners					
Alignment (Marshall)	Sep 61; Oct 73	M			
Improving (NC)	Feb 110	Marine Radio—See Radio		Pages Listener (Thomas)* Jan 62; (Corr)	Apr 101
TV Sound Added to (Maggi)	Nov 38	Maser		Pocket Vhf Receiver (Queen)*	Jan 39
Unique Circuits (Scott)	Jul 44	Communications on 450,000,000 MC (Collins & Nelson)	May 57	Receiver Sensitivity, Double (Davis)	Oct 86
Fuel Cells, Tomorrow's Electric Generators (Austin)					
Fuses Work, How (Steckler)	Apr 39	Optical, Low-Power, Announced by IBM (NB)	Mar 6	Receiver, Special Services (Queen)*	Feb 82
H					
Handie-Talkie Covers 10-Meter Band (D'Airo)* Jan 51; (Corr)	Apr 101	Optical, Works Continuously (NB)	Mar 6	Transmitter Testers, New (Lemons)	Dec 77
Handling Do-It-Yourselfers (Darr)	Jul 33	Medicine		Squelch, Transistorized (Jaski)*	Apr 72
Heat To Electricity (Aisberg)	Mar 58	Analgesic Device, New (NB)	Jul 12	Squelch, Hushpuppy for	May 78
Hum?, Puzzled About (Crowhurst)	Jan 30	Babies, Electronics Soothes (NB)	Jun 8	Test Set, New (Crystalignmeter) (Scott)	Feb 54
I					
Ignition, Electronic For Your Car (Smithy)* Sept 35; (Corres) Dec 21		Blind and Deaf, Electronic Aid for (NB)	Jun 6	Transceiver From Car Radio, Thomas)* (Corr) Aug 91, Sep 124	Jul 48
INDUSTRIAL ELECTRONICS					
Analog Converter, Digital to (Pat)	Dec 120	Cancer, Electronics May Fight (NB)	Jul 6	Transceivers, Guide to Low-Power (Scott) (Corr) Oct 67	Oct 28
Automation, Variation Control for (Mandl)	Sep 94	Circulation Measured Through Eye (WN)	Dec 55	You and (Scott)	Jun 28
Breadboarding (Squires)	Aug 82	Dream Analyzer, Telephone Engineers Develop Electronic (NB)	Feb 8	Conelrad Alert Monitor (NC)	Aug 88
Capacitors, Anti-Chatter (Darling)	Dec 46	Electricity Replaces Ether (NB)	Mar 6	Consolan, Third Station Coming (NB)	Dec 10
Computers Speak English (NB)	Mar 6	Electronics in Physiology Lab etc Corr	Oct 67	Control System, 4 Channel (Stiebel)*	Nov 32
Condition Indicator, Triple (Pat)	May 105	Heart Block, Audio Surgical Instrument Combats (NB)	Oct 8	Controlled Die Protection (Darling)	Nov 86
Counter, Single-Pulse Circuit (NC)	Feb 111	Microscope Shoots "Live" (NB)	May 8	De Forest, What Did He Really Invent? (Shunaman)	Sep 47
Dialthermy, Case of Reluctant (Bukstein)	Apr 80	Progress, Medical Electronic Reported at Convention (NB)	Oct 13	FM—(See also Fue)	
Dictionary (Bukstein) Jul 64, Aug 76, Sep 72, Oct 78, Nov 84; Dec 89		Psychology, Laboratory, Electronics In (Bopkins)	Oct 67; (Corres) Oct 26	Citation III Kit (Steckler)	Apr 53
Die Protection, Radio-Controlled (Darling)	Mar 86	To Walk Again (Steckler)	Aug 42	Communicator, New Short-Range (Foy)	Jan 80
Diodes, 4-Layer, and Controlled Rectifiers; What Are They? (Jackson)	May 44	Ultrasonics Affects Health? (NB)	Oct 6	Free-Power, New and Different (Grace)*	Feb 50
Feed Control, Automatic (Pat)	Jun 92	Model Railroad, Transistor Pack Powers (Lederer)	Feb 40	Heaters Don't Turn Off (NB)	Jul 6
Fuel Cells, Tomorrow's Electrical Generators (Austin)	Apr 39	Multiplex—See FM		Hum, Earth Has (NB)	Mar 10
Gauge, Gas-Pressure (Pat)	Oct 127	N			
Infrared Spectroscopy (Kemp)	Jun 72	Natures Invisible Radio Mirror (Van Detta)	Nov 104	Intercoms (see Intercoms)	
Infrared Radiometer (Bernard)	Nov 68	New Thought in Service Benches (Shunaman)	Dec 38	Inventors—Hughes, David Edward (Bartlett) Right, Augusto (Bartlett)	Apr 66; Dec 96
Klystron Tube For Outer Space (Jaski)	Feb 46	O			
Magnetic Amplifiers, Swinging Chokes to (Mandl)	Nov 52	Organ		Marine	
Magnetic Inspection (Pat)	Feb 102	Percussion, Add To Electronic (Korte)	Sep 92	Beacon, Electronic, Talks Boatmen Home (NB)	Feb 10
"Micrologic" Elements Cut Digital Circuit Size (NB)	Jun 6	Strobo Instrument Tunes (Dorf)	Feb 42	Consolan, What Is It? (Robberson)	Mar 54
Motor-Control, One-Turn (NC)	Feb 110	P			
Portable Scope, Transistorized (Jashi)	Jan 55	Communicator, New Short-Range (Foy)	Jan 80	RF Signal Generator Covers Marine Bands (Stone)*	Oct 56
Psychology Laboratory, Electronics In (Bopkin)	Jul 82	Sound Systems in Schools and Industry (Johnson)	Sep 38	Microwaves	
Quality Control Automated (NB)	Oct 10	Pacific Scatter, New Link In US Defense (McQuay)	Nov 94	Beating Uhf (NB)	Aug 6
Relay Circuits, Unusual (Jashi)	Oct 96	Pathlighter, Electronic (Winklepleck)*	Sep 50	Smog Kills Higher Frequencies (NB)	May 6
Relays and Electronics (Jashi)	Nov 56	Photoflash		Mirror, Nature's Invisible (Van Detta)	Nov 104
Evolution in	Feb 45	Inside Electronic (Henry)	Mar 36; (Corres)	Mobile, Urban (Pat)	May 104
Oscillator Drives (Pasch)	Feb 45	Slave, Composite-Transistor	Jun 18	Molecular Coming? (NB)	Sep 14
Work How (Jaski)		Pocket Vhf Receiver Interesting Project (Queen)	Jan 39	NAA Transmits Again (NB)	Mar 6
Clapper, Solenoid, Induction, Thermal, Stepping and Reed Type	Jun 43	Preamplifier—see Audio-High Fidelity Stereo Printed Circuit(s)		OTL Circuits in Transistor (Scott)	Aug 50
Relay Characteristics, Contacts and Coils	Jul 54	Boards Available (Corres)	Nov 22	Pacific Scatter, New Link in US Defense (McQuay)	Nov 94
Selection	Aug 47	Breadboarding, Industrial Electronic (Squires)	Aug 82	Portable (see also Radio, Transistor) Flip-Top (Taxi)* May 32; (Corres)	Aug 18
		Citizens-Band Transceiver From Car Radio (Thomas)*	Jul 48	Pocket Vhf Receiver (Queen)*	Jan 39
		Desoldering (Kaufman)	Apr 52	Superhet in Headphone (de la Roza)*	Sep 44

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Sporadic-E Opens New Horizons (Leinwoll)	Oct	104
Snitcher, One-Transistor (NC)	Jan	114
Special-Services Receiver (Queens)*	Feb	82
Stations, Silicon Rectifiers Replace Tube Types in Transmitters at (NB)	Oct	16
Telescope to Study Jupiter (NB)	Jun	12
Teletype For Car (NB)	May	14
Transistor		
Circuits, Offbeat (Scott)	Apr	32
Free Power, New and Different (Grace)*	Feb	50
OTL Circuits in (Scott)	Aug	50
Output Circuit (NC)	Sep	116
Service Aids (Finzer)*	Jun	53
Servicing, Circuit Substitution		
Speeds (Borlaug)	Jan	85
Superhet in Headphone (de la Roza)*	Sep	44
Superhet, Regenerative (NC)	Mar	118
Thermogenerator, Kerosene, Powers (NB)	Sep	6
Underground, Sets Record (NB)	Jan	6
Waveguides, Earth Has Magnetic (NB)	Apr	8
WWV Sets Its Clock Back (NB)	Mar	12
Rally-Pal Computer (Corr)	Jan	128
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Ac-Dc, Heavy-Duty Circuit (Pat)	May	100
Composite-Transistor	Jun	61
Evolution in	Feb	45
5- μ a (Patrick)*	Dec	74
Impulse, Improved (NC)	Oct	128
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Oscillator Drives (Pasch)	Feb	45
Photoelectric (NC)	Sep	117
Service Note (Palenberg)	Oct	76
Time-Delay Simplified (Hamilton)	Apr	51
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Lawnmower, Automated (Carlson)*	Apr	39
Television, One-Tube (Sylvania) (De Marinis)	Feb	56
Reverberation Enhances Hi-fi Audio (Scott)	Dec	36

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Semiconductors—See also Transistors, Zener Diodes, etc		
Diamond (NB)	Nov	6
Diodes		
Do It With (Stoner)	Feb	38
4-Layer, and Controlled Rectifiers; What Are They? (Jackson)	May	44
Gallium Arsenide Phototube Highly Sensitive (NB)	Oct	8
Ift, New Solid-State (NB)	Sep	8
Nuvistor Triode, TV Tuner Uses	Feb	72
Silicon Rectifiers Replace Tube Types in Transmitters (NB)	Oct	16
Solid-State Device, New, Rivals Tunnel Diode (NB)	Jan	12
Spacistor, Improved (Pat)	Sep	120
Shooting Gallery, Electronic (Pittet)*	Dec	50
Single-Curve Chart (Thiersch)	Jan	95
Speakers—See Audio-High Fidelity Stereo		
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Strain Gauges, What They Can Do (Kramer)	Jan	64
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Sync Separators and Clippers (Darr)	Feb	86;
	Mar	89;

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Alarm for High Voltage (TTO)	Jan	116
AUDIO SERVICING		
Fuse Blows (Telefunken Stereo 5083-WK) (Tech)	Jun	90
Phono Picks Up FM Station (Mark II Realist) (Tech)	Jan	107
Records and Record Players		
Noise Less, More Poise (TTO)	Oct	130
Turntable Slip (TTO)	Apr	84
Signal Coupling (Allied 83 zx 774) (Tech)	Dec	119
Tape Spills (Steelman Trans tape and Airline 7111-M) (Tech)	Nov	129
Tape and Tape Recorders		
Noise On Tape (Steelman Trans tape and Airline 7111-A) (Tech)	Jul	89
Pressure Rollers, Clean (TTO)	Jun	98
Servicing (Darr)		
Brakes and Pressure Pads	Sep	58
Level Indicators and Tape Erasing	Jun	56
Mikes, Amplifiers, Bias-Erase		
Oscillators	May	47
Recording Head	Jul	78
Switching—Electronic and Mechanical	Aug	39
Sound Intermittent and Noisy (Crestwood CP-201) (Tech)	Sep	115
Take Up Reel Inoperative (Steelman Trans tape and Airline 7111M) (Tech)	Aug	92
Tape Recorders (Darr) May 47; (Corres) Jun 56; Jul 78; Aug 39; Sep 59	Oct 122	
Ticks (Tech)	Dec	38
Benches, New Thought in (Shunaman)	Jun	90
Capacitors, Clues for Checking (Tech)	Oct	62
Gears, Reassembling Spring-Loaded (Cohn)	Feb	116
Line Cord, New (TTO)	Mar 26; Oct 131	
Parts Rack (Corres) (TTO)	Jul	93
Phono-Plug Handle (TTO)	Oct	37
Power Transformers, Checking (COHN)	Apr	52
Printed Circuits	Nov	129
Desoldering (Kaufman)		
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Public-Address Speakers Full of Birds' Nests (Tech)	Sep	114
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Alignment (Tech)	May	97
Antenna, Automatic Repair (Lincolns) (Tech)	Apr	94
Automobile		
Antenna, Inoperative Powered (Tech)	Sep	114
Cuts Out Intermittently (Ford M-4) (Tech)	Jun	91
High-Frequencies Lost (Chevrolet 987891) (Tech)	Jul	88
Noise, Stop (Lemons)	Aug	36
Output Distorted (Philco) (Tech)	Jan	107
Polarity of 12-Volt Input (Ford 67MF) (Tech)	Oct	122
Speaker Terminals Floating (Tech)	Oct	122
Transportable Dead In Car (Oldsmobile) (Tech)	Jan	107
Battery, Repair Rechargeable (TTO)	Apr	84
Dropping Resistor (Gonsel G-12) (Tech)	Nov	128
Hum (Espey 511-B AM-FM) (Tech)	Jan	104
Intermittent (TCA 6-X-5) (Tech)	Apr	96
Motorboating (Transolar P706) (Tech)	Feb	100
Performance, Improving Receiver and Transmitter (NC)	Dec	106
Shorts, Clearing Variable-Capacitor (TTO)	Sep	119
Sound Distorted (Philco T7) (Tech)	May	97
Sound Erratic and Poor (G-E 575) (Tech)	Jul	89
Squegging (RCA 8-BT-7, -8) (Tech)	Aug	92
Transformers 9-meter for service (Tech)	Aug	92
Transistor		
Current Drains (Tech)	May	97
Service Aids For (Finzer)*	Jun	53
Tricks, Basic (Eslick)	May	76
Trouble Chart I (Leslie) Nov 50; II (D'Airo)	Dec 48	
Rectifier, Scope Checks (Tech)	May	98
Relay(s)		
Industrial—See Industrial Electronics		
Service Note (Palenberg)	Oct	76
Speaker, Protect (TTO)	Jul	94
Soldering		
6-Second Solder (TTO)	Jun	98
Aluminum (TTO)	Jul	94
Technician's Guide to Good (McMartray)	Nov	40
Teflon Is Safe (Corres)	Mar	22
TELEVISION SERVICING		
1X2 Breakdown (RCA CT-1708) (CI)	Sep	88
1B3 Failure (Motorola T553) (Tech)	Mar	99
6B6 Failure (Capehart 3006 MP) (CI)	Aug	56
Apc Faulty (RCA 21T6082) (CI)	May	64
Air-Conditioned (TTO)	Aug	97
Alignment, Signal Generators In (CI) (Corres)	Mar 60; May 18	
Amplifier Circuit Quirk (Heathkit EA-1) (Tech)	Feb	101
Analyst Simplifies Servicing (B&K Analyst) (Lemons)	Jul	34
Antenna		
Alignment (TTO)	Feb	116
Coil or Rf Amplifier? (Citron)	Sep	52
Coupling (CI)	Mar	66
Don't Forget (Cunningham)	Jun	34
Installation (Tech)	Feb	100
Standoff Mount (TTO)	Apr	84
Temporary (TTO)	Jul	94
Arcing, High-Voltage (Tech)	May	98
Autodyne Converter Troubles (Philpot)	Sep	57
Bonding Straps (TTO)	Jan	126
Boost Voltage None (Bendix 2070U) (CI)	Jun	81
Brightness Control Band (RCA KCS-82) (CI)	Jul	62
Brightness Out (Admiral 21D1) (CI)	May	61
Buzz (GE- M5) (Tech) Feb 100; (RCA 17-S 6022) (Tech)	Dec	119
During Warmup, (Admiral 21E3Z) (CI)	Mar	64
Color		
Blooming Red (RCA 21CD8845) (CI)	Feb	62
Degaussing Coil, Make (Tech)	Apr	94
Don't Be Afraid (Darr)	Nov	35
Drift (Admiral 322C2) (CI)	Dec	61
Focus Drift (RCA CTC-5) (Tech)	Oct	122
Focus Out (RCA 800 Series) (Tech)	Sep	114
Herringbone (RCA 21CT660U) (CI)	Mar	61
Interference (RCA KCS-81A) (CI)	Nov	64
Shading (RA 21CD7000) (Tech)	Jan	104
Compression, Black or White	Nov	87
Conversion		
Color (CI)	May	61
G-E 21T25 (CI)	Dec	67
Philharmonic 8820 (CI)	Sep	88
RCA KCS 47-A (CI)	Mar	66
RCA 630 (CI)	Jun	81
Sentinal 411 (CI)	Feb	63
Sparton 26SS170 (CI)	Apr	64
Zenith 2438RZ1 (CI)	Aug	56
Zenith 24H21 (CI)	Oct	70
CRT Checker (Tech)	Mar	98
Curious Trouble (Titmus)	Jan	71
Dc Restorer		
Adding (Stromberg-Carlson 21CM2) (CI)	Aug	56
Installing (Hotpoint 21S505) (CI)	Mar	67
Do-It-Yourselfers, Handling, (Darr)	Jul	33
Don't Do Half a Job (Davis)	Jul	40
Drive Line (G-E 21C40) (CI) Mar 61; (Silverstone 528.631-1) (CI) May 64	Feb	101
Dual-Diodes, Identifying (G-E) (Tech)	Dec	61
Electrolytics (CI)		
Flyback		
Burned Out (Mattison 630DXM) (CI)	Feb	62
Replacement (Fada S-1060) (CI)	Mar	66

Frequency Response	Nov	87
Fuse Blows (Philips 3550) (CI) Nov 64; (RCA KC5107-B) (Tech) Oct 123		
Height Poor (Crosley 11-451WV) (CI) Oct 69		
High Voltage (Motorola 21K16TV) (Corres) Nov 18; (RCA KCS68E) (CI) Feb 68		
Hint (Tech)	Mar	98
Lucky Hunts Low (Lemons)	May	82
Horizontal		
Hold (Magnavox U24-04AA) (CI) Jul 63; (Motorola TS-542) (Tech) Feb 100		
Oscillator Drift, Stop (Lemons)	Oct	50
Output Tube Cathode Current		
Measuring (RCA CTC5 & CTC5CN) (Tech)	Jul	88
Phasing Bad (Philco 49-1150) (CI)	Jun	81
Shadows (1930 Techmaster) (CI)	Feb	63
Shrinkage (Philco 9L35) (Tech)	Sep	115
(RCA 21T176) (CI) Apr 64		
Sync (Philco 7640) Jun 90; (Zenith 23T122) (Tech) Mar 98		
Trouble (Philco 50T-1479) (CI)	Nov	65
Wiggling (RCA KCS34C) (CI)	Jun	62
Hum (Sylvania 1-544-3) (Tech)	Jun	91
Inoperative (G-E 14T007) (CI)	Feb	63
Inoperative (Hotpoint 145203) (CI)	Feb	63
Interlace—Cy and Lucky Get Jitters (Lemons)	Nov	102
Intermittent, Cy and Lucky Whip (Lemons)	Sep	76
Interference (CI)	Jul	63
Ion Burns (DuMont RA-110) (CI)	Nov	64
Ion Trap Misplaced? (CI)	Sep	85
Keystoning (Bendix FM 27C) (Tech)	Jan	107
Linearity	Nov	87
Linearity Coil Hot (Hoffman 21M115) (CI)	Oct	70
Marginal Performance (CI)	Jun	80
Markers Meet in Middle (RCA) (CI)	Mar	66
Oscillator Intermittent (Canadian G-E 21C30) (CI)	Feb	63
Picture		
Detail Poor (Raytheon 17AY21) (CI)	Oct	70
Loud (Holtz)	May	39
Picture-Tube Troubles (CI)	Aug	52
Quality Control (NC)	Nov	138
S-Bend (Philco 7H20) (CI)	Jun	81
Weak (Admiral 16B1) (CI)	Apr 65; Feb 68	
(Philco 22C4312) (CI)	Oct	103
Prices		
Raster		
Bloom (Motorola TS-542) (Tech)	Jun	90
None (Westinghouse H14T171) (CI)	May	61
on Strong Stations (Westinghouse V-2192) (CI)	Oct	70
Rectifier Headaches (CI)	Aug	56
Remote Control (Hoffman) (Tech)	Apr	94
(Hoffman 12-10H) (CI)	Nov	64
Retrace Line(s) Intermittent (Packard-Bell) (CI) Sep 88; (Philco) (CI) Apr 52		
Rf Amplifier or Antenna Coil (Citron)	Apr	71
Ribbon Lead, Stripping (Linton) (Corres)	Jul	22
Secret Signals on Screen (Carlson)	Nov	87
Stacked-B Circuits (Darr)	May	67
Stacked-B Trouble (Shaw)	Jun	33
Snow (Philco UE 4200S) (CI)	Aug	53
In If (Wayne)	Dec	51
Sound		
Bounce (Motorola Canadian) (CI)	Jun	81
Distorted (RCA 88T-10K) (Tech)	May	98
Intermittent (RCA KCS120) (CI)	Sep	88
Intermittent or Out (Hoffman 331) (Tech)	Jan	104
Loud (Admiral 18Y4KS) (CI)	Feb	62
Noise Immunity Poor (1955 Fleetwood) (CI)	May	64
Out (G-E) (Tech)	Aug	93
Poor (Hyde Park C11) (CI)	Aug	53
Sound and Picture		
None (Hoffman 175) (Titmus)	Jun	71
Out (Zenith Z1816C) (Tech)	Apr	96
Sweep Alignment (CI)	Dec	64
Sync Separators and Clippers (Darr)	Feb	86
Traps (CI)	Mar	89
Tube		
Burnout Chronic (Sylvania 1-512-1-2) (CI)	Oct	70
Changes, Watch, Those (CI)	Feb	61
Filaments (CI)	Jul	59
Heaters (CI)	Jul	59
Tuner(s)		
Care and Repair (Randall)	Jul	51
Cascode Circuits (CI)	May	60
Cleaning (CI)	Sep	84
Coils (Corres)	Mar	18
Don't Let It Throw You (Davis)	Aug	30
Drift (CI)	Sep	88
FM Problem (Burstin)	Dec	72
If Lower? (CI)	May	65
Replacement (Dumont RA-117A) (CI)	Feb	62
(Philco 53-T-1883) (CI)	Oct	68
Twin-Lead, Stripping (WN)	Oct	53
Vertical		
Amplitude (Muntz M 32) (Corres)	Jan	22
Bars (Emerson 120245D) (CI)	Dec	66
Deflection (RCA 17T172K) (Tech)	Dec	117
Distortion (Crosley H-21COWUC) (CI)	Sep	85
Drifting and Dreaming, Peewee's (Wayne)	Aug	61
Foldover Problems (Lemons)	Sep	54
Height Loss (Motorola TS-60) (CI)	Jul	62
Hold Critical (Motorola TS-542) (Tech)	Feb	100
Hold Weak (Zenith 19R21) (CI)	Feb	62
Jitter Intermittent (Crosley 426) (CI)	Mar	61

Linearity Poor (Tele-Tone TV-208) (Cl)	May 61;	Nuvistor Triode, Uses	Feb 72	Electronic Monitor Is Wide-Range	Aug 74
(Zenith 16C20-U) (Tech)	Sep 115	Transistor, New, What Makes Them Tick?	Apr 44; May 37	(Wrigley)*	
Output Tube Red-Hot (Philco 52T120)					
(Cl)	Aug 53	Uhf		Transistor(s)	
Retrace Eliminator (Philco 52-T2140)		Experimental, FCC Will Construct (NB)	Mar 10	5-Gigacycle (NB)	May 14
(Cl)	Oct 69	FCC Asks for All TV's (NB)	May 14	Bias Regulator (Taylor)	Oct 110
Rolling (G-E 810) (Cl)	Dec 66;	Ultraviolet Now Used for Communications		Compensation of Parallel (Pat)	Jun 111
10VT10K) (Cl)	May 64	(NB)	Mar 6	Handling Hints (Patrick)	Jun 55
Shrinkage (G-E 21C1550) (Cl)	Mar 61	Viewer, Individual (Pat)	Jun 93	In Parallel-T (Taylor)	Jun 38
Stretch (Philco 22B4000) (Cl)	Aug 56	Voltmeter Can't Burn Out (Bartholomew)	Aug 29	MADT, High-Power, Making	Apr 58
Troubles (Raytheon 14AX21) (Cl)	Nov 59	Watchdog	Sep 55	Myth, Exploding	Jul 28; (Corres)
Transformers q-meter for Service				New, Has Gain of 30,000 (Garner)	Sep 26
(Tech)	Aug 92				Jun 59
Video and Sound Out (RCA KCS81-A)		TEST INSTRUMENTS AND CIRCUITS		Radios—see Radios	
(Tech)	Nov 128	Capacitor Analyzer, Low-Voltage (Sprague		Rectifier (Pat)	Mar 115
Video Whiteout (Philco 7L70) (Cl)	May 61	TCA-1) (Lemons)	Aug 80	Roundup (Spencer)	Dec 40
White Streaking (G-E M4) (Cl)	Dec 67	Capacitor Checker Modification (Conaut)		Silicon Star Heart of (WN)	Nov 42
Width Circuits (Cl)	Oct 68; (Cl)	(Corres)	Jan 20	Tester, Speedy	Oct 75
Width Excessive (1960 Hoffmans) (Tech)	Apr 96	CRT Checker (Tech)	Mar 98	Testing IN-Circuit (Sencore TR110 and	
Yoke Replacement (Tegal TV) (Cl)	Jun 81	CRT Substitution Speeds Transistor Radio		Hickok 890)	Sep 66
		Servicing (Borlaug)	Jan 85	Ultraminature (NB)	Sep 6
		Citizens-Radio Test Set, New (Crystallign-		Universal (WN)	Nov 42
		meter) (Scott)	Feb 54	Transitone Locates Hidden Wiring (Parker)*	Jan 117
		Continuity Checker, Billion-Ohm		(Corr)	
		(Lipiner)*	May 66	Translators See Television	
		Decade Boxes, Improvement For (Arditti		Troubleshooting Power Supplies With Scope	Apr 48
		and Pearson)	Nov 74	(Middleton)	
		Dip Tunnel-Diode (Turner)*	Apr 42	Tunnel Diodes	
		Electrolytic?, How Good Is That (Reed)	Jul 73;	Care and Handling (Turner)	May 88
			Nov 22	Solid-State Device, New, Rivals (NB)	Jan 12
		Frequency Meter (Pat)	Jun 93	Loosener	Jul 95
		Gain Checker Transistor (NC)	Jan 114	Oscillator Hint	Jul 93
		Horizon Sweep Analyzer (Lemons)		Panel Bearings, Inexpensive	Mar 123
		(Corres)	Nov 18	Parts Holder, Handy	Sep 118
		Light-Level Indicator (Reed)*	Jun 78	Parts Rack	Oct 131
		(Corres)	Aug 20	Phono-Plug Handle	Jul 93
		Light (Jul) (Corres)	Nov 20	Potentiometer Calibration	Jun 97
		Logarithmic Meter (Rhita)	Feb 59	Radio Battery, Repair Rechargeable	Apr 84
		Meter		Receptacle, Reflecting	Aug 97
		Cam-Angle (Tech)	Dec 117	Rectifier, Silicon Replace Selenium	Jun 97
		Make It Easier To Read (Sands)	Feb 74	Solar-Cell Precaution	Mar 123
		(Corres)	May 16	Solder(ing)	
		New Idea in (WN)	Oct 53	Pencil-Iron Tinning	Feb 117
		Milliammeter, Wide-Range (NC)	Aug 88	Flux-Can Handle	Apr 85
		Missing Spot, Case of (Karroll)	Mar 92	Television	
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* Construction Articles	
† Section of full-length article	
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CI Service Clinic	
Corr Correction	
Corres Correspondence	
NB News Briefs	
NC Noteworthy Circuits	
Pat New Patents	
Tech Technotes	
TTO Try This One	
WN What's New	
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† Section of full-length article	
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Corr Correction	
Corres Correspondence	
NB News Briefs	
NC Noteworthy Circuits	
Pat New Patents	
Tech Technotes	
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Little Dipper (Queen)*§	Feb	70		Amplifier, No Service Needed	May	28	Remote Repair (NB)	Mar	6
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M				Audio Output Circuit, Complementary Symmetry (Roy)	Apr	49	Tiros Makes TV Picture Of Earth's Cloud Cover (NB)	Apr	6
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Medicine				Broadcasts, Setting Up for Remote (Darr)	Mar	35	Semiconductor(s)—See also Transistor		
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Electronic Ear Brings Sound to Deaf	Apr	29		Accessories Improve Operation (Scott)	Jun	50	Madistor (NB)	Mar	10
Hearing Aid in Aspirin Box (de la Roza)*§	Jan	37		Antenna, Put Maximum Power Into (Stiebel)	May	30	Terms, Guide to (Sylvania)	Jan	76
Understanding Aid (NB)	May	8		FCC Rules Proposed (NB)	Feb	6			
Generator, Negative-Ion (Pat)	Jan	113		FCC Takes§ Action (NB)	Jun	16	SERVICING—See also specific subject; Test Instruments		
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N				Inventors of (Bartlett)			Speaker Holes, Odd-Shaped (TTO)		
No Service Need on This Amplifier	May	28		Maxwell (Corres)	Jan 18; Mar	26	Stereo Phono (Philco H-1716, -1814, -1816) (TN)	Jun	89
O				Tesla, Nikola	Apr	35	Tape Recorders (VM) (TN)	Mar	99
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* Construction Articles
† Section of full-length article
‡ Transistorized
Cl Service Clinic
Corr Correction
Corres Correspondence
NB News Briefs
NC Noteworthy Circuits
Pat New Patents
Tech Technotes
TTO Try This One
WN What's New
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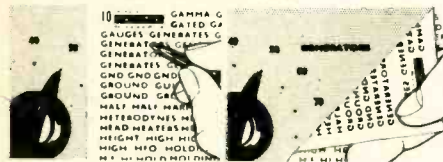
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* Construction Articles	
† Section of full-length article	
‡ Transistorized	
CI Service Clinic	
Corr Correction	
Corres Correspondence	
NB News Briefs	
NC Noteworthy Circuits	
Pat New Patents	
Tech Technicians	
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Bridged-T (Ogdin)	Feb 28
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CB Chatter (Lemons)	Jan 63
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Checking Out Tape Recorders (Burststein)	Mar 35
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First Becomes Antique (NB)	Feb 8
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Telegraph, Automation Takes Over Commercial (NB)	Apr 14
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Control High-Power Dc, Transistors (Rymsha)*§	Jun 37
Cy and Lucky Hunt Sound Bars (Lemons)	May 49
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Space Students Prepare for Out-Of-This-World Careers (NB)	Apr 10
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Bridged-T (Ogdin)	Feb 28
Crystal Growth Secret Found by Bell Scientists (NB)	May 8
Data Transmission, Gallium Arsenide Diode Speeds (NB)	Jan 16
Dc, Transistors Control High-Power (Rymsha)*§	Jun 37
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International Unit Adopted by NBS (NB)	May 12
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Microwave Tubes, Magnetic Fields Eliminate Noise in (NB)	Apr 8
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Plasma-Microwave Interaction (WN)	Apr 43
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G	
G-Line (Patrick) (Corres)	Feb 46; Mar 16
H	
Hexnash (Allison)* (Corres)	May 18
Hi-Fi Pickup Arm, Theory and Practice (Hughes and Gaylord)*	May 60
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Improve FM Reception with Wide-Band Detector (Vincent)	Feb 41
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Inductance Bridge, Precise (Krueger)* (Corr)	Jan 18, 21
In and Around Video I.f. (Darr)	May 44
Installing and Troubleshooting Uhf TV (Davidson)	
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Touch Communication (Pat)	Apr 97
Intercom, Underwater (NB)	Mar 6
Is That Pic Tube Really Gone? (Fitzgibbon) (Corres)	Jan 21
L	
Lab-Quality Audio Generator (Idestam-Almquist)*	May 22
LASER(S)	
Data Processing, Light Deflector Speeds (NB)	Apr 6
Dynamic Modulation Range Increased (NB)	Mar 13
Light, Miniature Gas Laser Emits Visible (NB)	Feb 6
Light for TV Cameras (NB)	May 6
Modulator, Variable Low-Power for (NB)	Apr 14
Precision Holes Bored with Laser Guidance (NB)	Feb 6
"Rifle" Not Death Weapon (NB)	May 12
Rod's Finishing Precise (WN)	Jun 43

33 Feet Long (NB)	Apr 10	Semiconductors Are Circuits (Stern)	Jan 24	Flyback Replacement (Sheraton T-5410) (CI)	Feb 58
Triode Invented (NB)	Mar 10	Diode, Gallium Arsenide, Speeds Data Transmission (NB)	Jan 16	Fuse Blowing, Delayed (RCA KCS-81J) (CI)	May 54
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Lightning Protection for Hams, Swl's and CB'ers (Oberto)	Apr 60	SERVICING —see also specific subject		Horizontal Drift (Zenith 19R21) (C1)	Jan 56
Line Voltage and Amplifier Distortion (Reed)	Feb 37	Audio		Horizontal Drive Low (RCA 21T7152) (CI)	May 58
Low-Power Transmitter (Pat)	Jun 86	Amplifier, Locating Bogen data (C1)	Mar 58	Horizontal Efficiency Coil Adjustment (Tech)	Jun 75
		Amplifiers (CI)	Mar 56	Horizontal Linearity Control Adding (RCA KCS-127) (CI)	Apr 58
M		Front Ends Unstable (CI)	Mar 58	Horizontal Off-Frequency (RCA KCS-40) (CI)	Feb 57
"m" versus "M" (Corres)	Jun 22	Hearing-Aid Conversion, Tube to Transistor (CI)	Jun 58	Horizontal Sync Lost After Warmup (Packard-Bell 2118) (Tech)	Jan 80
Marine Sounds Traced Back to Whales (NB)	Feb 8	Intercom, Transistor, Motorboats (CI)	Mar 58	Horizontal Weave (Philco TV-440) (Tech)	Feb 54
Marvelous Electronic Diaper Change Indicator (Cramp)	Feb 50	Recorder(s)		Hourglasses and Onions (CI)	Feb 54
MC's P.A. (Wortman)*§	Feb 26	Audio Lost (Wilcox-Gay Recordio R-804) (Tech)	Feb 90	Hum, Intermittent (G-E U-Series) (Tech)	May 77
Measuring Nanoamperes (Queen)*§	Jun 39	Recording from High-Level Sources (Bell & Howell Specialist 900) (Tech)	May 76	Hunting Vest Stops Hunting (TTO) I.f.'s, Aligning (Darr)	May 89
MEDICINE		Speaker Intermittents (CI)	Mar 58	Picture, Sound Out (RCA KCS-132A) (Tech)	Apr 88
Defibrillators Safe for Patient (NB)	Apr 8	Start Business? (Eugene)	Jun 40	Pic Tube Really Gone, Is That? (Fitzgibbon) (Corres)	Jan 21
Diathermy, This Is (Jaski)	Jan 38	Stereo Earphones with 3-Channel Stereo (CI)	Jun 58	Picture Tube(s) Diagnosis (CI)	Feb 58
Full Cell Oxygen Detector (WN)	Jan 43	Tape(s) and Tape Recorder(s)		Replacement (21MP4) (CI)	Feb 57
Lasers Treat Cancer (NB)	Jan 6	Automatic Stop, Large-hub Reels Fool (Tech)	Mar 97	Replacement (Capehart CX-33) (CI)	Feb 58
Microscope Focuses Through Hypodermic Needle (NB)	Jan 16	Battery Contacts (Grundig TK1E) (Tech)	May 76	Replacement (Stewart-Warner 9104A) (CI)	Feb 58
Monitor, Physiological, Improves Patient Care (NB)	Jan 8	Frequency Tests (CI)	May 56	What Happens to? (Darr)	Mar 44
Mother Heart Machine (WN)	Mar 43	Give Recorder Air (Tech)	May 78	Power Supply Troubles (Darr)	Feb 31
Meters from Junkbox (Weber)	May 50	Intermittent (Grundig TK42, TK45) (Tech)	Mar 98	Raster, Bulging (Sylvania 421M) (CI)	Jan 51
Mixer, All-Purpose (Ives)*	May 51	Muting (Webcor) (Tech)	Mar 98	Raster Quits (Hotpoint 14S202) (Tech)	Feb 90
Movie Projectors, Servicing Sound (Darr)	Jan 21	On-off Switch (Uher SR III) (Tech)	Mar 97	Reconditioning TV Sets for Profit (McCarty)	Jun 34
Part I (Corres)	Jan 43	Speed Change (Uher SR III) (Tech)	Mar 97	Replacement, Ingenious (Velasquez) Schematic (Monarch) (CI)	Mar 39
Part IV—Lamps and mechanical problems		Speed-Change Lever (Revere TR-1200) (Tech)	Mar 97	Screen Half-black-out (RCA KCS-97) (CI)	Apr 59
		Transformer Flashover (CI)	Mar 56	Short Story (Dunn)	May 56
N		Transistors Hot at High Frequencies (CI)	Jun 58	Snow, Funny (Emerson 1120D) (CI)	Feb 57
New Approach to Transistor Circuit Design (Gottlieb) Feb 76; (Corres)	Apr 16	Turntable Wow, Detecting (Sydnor)	Jun 45	Sound Bars, Cy and Lucky Hunt (Lemons)	May 49
New, Simple R-C Sine-Wave Oscillator (Queen)*§	Apr 49	Cheater Idea (TTO)	Feb 104	Sound, No Video (Crosley 17T0MH) (CI)	May 58
New Uhf Tuners (Lucas)	Apr 26	CliP-Lead Protectors (TTO)	May 91	Sound and Video Out (Emerson 1800) (Tech)	Jun 74
Nanoamperes, Measuring (Queen)*§	Jun 39	Diagnosing, More on (CI)	May 54	Sweep and Boost Out (Motorola TS-552) (CI)	May 59
		Dial Cord, Wire Spares (TTO)	Apr 87	Synchroguide, Adjusting (Sears) (Tech)	May 77
P		Drills, Removing Broken (TTO)	Apr 86	Uhf, no vhf (Motorola 21K26) (CI)	Jan 51
PA Problems, Column Speakers Solve (Briggs)	May 28	Feet for Home-Made Gear (TTO)	Feb 105	Uhf TV, Installing and Trouble-shooting (Davidson)	Part 1—Uhf tuners and converters are not hard to fix
Parallel-R Calculator (Lieberman)*	Jun 50	FM Stereo Circuits (Feldman)	Jun 30	Part 2—Installing uhf adapters in existing sets	May 32
Patent System Not So Bad? (Corres)	Apr 16	Holes (Darr) (Corres)	Jan 18; Mar 14	Unexpected Admiral (Holtz)	Jan 73
Pattern Depends on Probe (Cunningham) (Corres)	Feb 23	Power Transformer Windings, Identify (Cooper)	Jan 42	Vertical Hold Soft (Admiral 25D6) (CI)	Jan 51
Pattern Recognizer Probes Dolphin Speech (Shunaman)	Apr 40	Radio		Vertical Hold Weak (Zenith 16T20, 17T20) (Tech)	Jun 74
Phone Cable Links Canada, South Pacific (NB)	Feb 12	Audio Gain in FM 2-Way Sensitivity Tests (Tech)	Jun 75	Vertical Jitters (Chassis 190) (Tech)	May 77
Photography		Auto		Vertical Sync Critical (Philco 10L41) (Tech)	Jan 84
Bright Genie, Slave of Light (Winklepleck)*§	May 46	Collector Voltage Too High (Chevrolet 987888) (CI)	May 54	Vertical Roll (Emerson 1800) (Tech)	Jun 74
Photo Timer, Auto-Photo (Giannelli)*	Feb 38	Delco AM-FM 1963 (Powell) (Corres)	May 18	(RCA KCS-111-D) (Tech)	May 78
Poor Boy's Vtvm (McCreery)*	Jan 28	Fuses (TTO)	Jun 85	Vertical Roll, Impossible (Emerson 1114) (Tech)	May 77
Power Amplifier, Transistor, Circuit Directory (Geisler) (Corr)	Feb 53	Lead-In (TTO)	Apr 86	Vertical Troubles, Assorted (Zenith C2223) (CI)	May 58
Power Sent by Radio (NB)	Jun 6	Static, Reducing (1955 Fords) (Tech)	Jan 84	Video I.f., In and Around (Darr)	May 44
Power Supply Troubles, TV (Darr)	Feb 31	Vibrators, Waking Up (Tech)	Jan 85	Video Troubles Can Be Simple (Darr)	Apr 46
Printed Circuits for Everyone (Henry)	Apr 36	Boats, Don't Miss the (Lovett)	May 40	Wave-Forming Circuits (CI)	Jun 57
Professional Stereo Line Amplifier (Reed)*	Feb 44	CB Service Needs (CB)	Jan 63; Apr 39	Wiggles, Bad Contrast (Admiral 19CI-19HI) (Tech)	Apr 88
		FM/AM Overhaul (Westinghouse H161) (CI)	Jan 56	Test Instruments	
Q		FM Stereo Circuits (Feldman)	Apr 30	Scope	
Quiet, Please (Drenner)*§	Mar 30	Generator Noise (Thunderbird) (CB)	Apr 39	Trace Thick (Heath 0-9) (Tech)	Jan 84
		Modulation Low (Citi-fone CD5) (CB)	Jan. 63	Transformer Failure (Eico 425) (Tech)	Apr 88
R		—Phono Input Dead (Norelco 400 EL3536A) (Tech)	May 76	Vertical Deflection Out (DuMont 304-A) (Tech)	Jun 75
Radar, Aviation, Now Shows Plane's Altitude (NB)	Jan 12	Resistor Big? (RCA 2BX63) (CI)	Apr 58	Vertical Drift (Precise 300) (Tech)	Jun 79
RADIO(S)		Second Phone, Ticket to Profits (Kyle)	Jun 52	Sine-Square-Wave Generator Hum Pickup (Heath AG-10) (Tech)	Jan 85
Bench Supply for Transistor (Lemons)*	May 38	Squelch Circuits (CB)	Jan 63	Vom, Fusing (Simpson) (Tech)	May 78
CB		Squelch Out (Gonse G11) (CB)	Jan 63	Vom's, Longer Battery Life (Eico 555/565) (Tech)	Feb 90
Chatter (Lemons)	Jan 63; Apr 39	Transceiver Switch (Heath GW-30) (Tech)	May 76	Tinsel Wire, Connections to (CI)	May 54
Circuit Features, New (Scott)	Jan 40	Transistor, Battery Drain (Honey-Tone) (CI)	Apr 59	Transformer, Toy-Train (CI)	Feb 54
Lightning Protection (Oberto)	Apr 60	Transmitter, Low-Power (Pat)	Jun 86	Tube Lifters, Handy (TTO)	May 91
Code Practice Oscillator Records as You Send (TTO)	May 89	Tuner Distortion and Hum (Heath BC-1A AM) (Tech)	Apr 89	Tube-Pin Crimper, Old Pliers Make (TTO)	Jan 101
Europe Heard on Broadcast Band (NB)	Feb 10	2-Way Jobs, Test Set Aids (Barbee)*§	Jun 46	Tubing, Sawing (TTO)	May 90
Dx		Solder Remover (TTO)	Mar 101	Tubes, Plastic Foam Stores (Miller)	Jan 44
WWV Increases Propagation Notices (NB)	Mar 8	Sound Movie Projectors (Darr)	Jan 21	Wire	
Eavesdropping Banned by FCC (NB)	Apr 6	Part I (Corres)	Jan 43	Paperclip Anchor (TTO)	Jun 85
FM—see FM		Part IV—Lamps and mechanical problems	Jun 6	Prestrip for Point-to-Point Connections (TTO)	Apr 87
GI's Get Commands via New Lightweight (NB)	Feb 10	Superconductive Generator (NB)	Feb 89	Tape Tabs Mark (TTO)	May 90
Location by Satellite (Pat)	Feb 92	Television		Simplest Direct-Reading Frequency Meter (Queen)*§	Feb 34
Mobile, Trucking Company Saves with (NB)	Feb 8	Amplifiers, Noisy CCTV (Tech)	Feb 89	Slide Changer, Electronic (Landrieu)	Jun 29
Reconditioning TV Sets for Profit (McCarty)	Jun 34	Agc Action Faulty (Emerson 1800) (Tech)	Jun 74	Snorekill (Fiction) (Fips) Apr 44; (Corres)	Jun 20
Radio		Audio Output Shorted (Emerson 1800) (Tech)	Jun 74	Soldering	
Servicing—see Servicing, radio		Brightness Low, Uncontrollable (RCA KCS-87) (CI)	Jan 51	Gun Lights, Save (TTO)	Apr 87
Short Wave(s)		Channel 13 Gone After Tuner Repair (G-E 17T2) (CI)	May 58	Solder Remover (TTO)	Mar 101
Super Reception on (Churchill)	Jan 34	Circuits, Re-engineering (CI)	Jan 50	Solvent Aids (TTO)	Feb 89
Speaker Switching, Radio-TV (NC)	Mar 96	Cogwheel (Zenith 19R20 etc) (Tech)	Feb 89	Sonar Doppler Navigates Surface Vessels (NB)	May 8
Superregen Monitors Fire and Police Radio (Hawbaker)*	Jan 45	Color		Sonar—Ocean Floor Mapped with Photographs of Sound (NB)	Apr 6
Terminal and Control Markings on Foreign (Sutheim)	Jun 53	Arcing, Intermittent, Under Chassis (Zenith 29CJ20) (CI)	Apr 58		
Time Signals Change (NB)	Jan 12	Intermittent Loss (Zenith 27KC20) (CI)	Apr 58		
"Whistlers" Affect Vlf Signals (NB)	Feb 14	Lost (Motorola TS912) (Tech)	Apr 74		
R-C Sine-Wave Oscillator, New Simple (Queen)*§	Apr 49	Off-Color Troubles (CI)	Feb 54		
Reactance Tables (Thiersch)	Feb 33	CRT Replacement (17TP4) (CI)	May 56		
Records, R-E Guide to Test Tapes and (Scott) Relay	Mar 46	Day at the Bench (Roy)	Feb 64		
Clock Confusion, Relay Prevents (Corres)	Feb 23	Diagnosis (CI)	Apr 55		
Magnetic Fluid (Pat)	Jun 92	Do-It-Yourself Repairs, R-E Reports on (Kramer) (Corres)	Jan 18		
Resistors—Are Fuses (Stiver) (Corres)	Mar 20	Ease Service and Sales with Test CRT (Margolis) Jan 32; (Corres)	Jun 22		
Rf Wattmeter for CB, Simple (Greenlee)*	Feb 49	Filter Capacitor (RCA KCS45-49) (Tech)	Feb 89		
		Flashing (G-E QX) (Tech)	Apr 88		
S					
Satellite(s)					
Map-maker (WN)	May 43				
Radiolocation by (Pat)	Feb 92				
Relay I Won't Quit (NB)	Mar 6				
Weather, Broadcasts Local Reports (NB)	Mar 6				
SCR Basics for Experimenters (Henry)	Jun 26				
SCR Controls Motor Speed	Apr 77				
Second Phone, Ticket to CB Service Profits (Kvle)	Jun 52				

Telescope, 15-Mile-High, Gathers New Data (NB)	Mar 8
Voice of America Broadcasts News (NB)	May 12
Start an Audio Service Business? (Eugene)	Jun 40
Stereo: see Audio—High Fidelity—Stereo; FM Multiplex	
Stetho Stereo (Curtis)	Jan 64
Super Reception on Short Waves (Churchill)	Jan 34
Superregen Monitors Fire and Police Radio (Hawbaker)*	Jan 45

Take-along Amplifier (Adamek)*§	Apr 32
Tape(s) and Tape Recorder(s)—see Audio—High Fidelity—Stereo	

Telescope, Biggest, on Earth Is in the Earth (Leslie)	Feb 36
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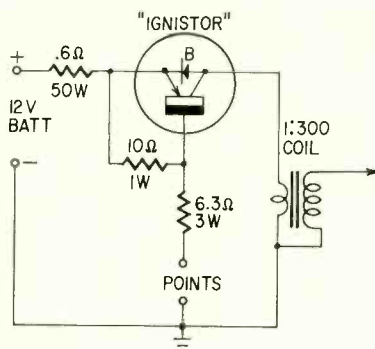
TELEVISION	
Box Cars, Video Checks (NB)	Jan 10
Camera, Battery-Powered (WN)	Apr 43
Cameras, Lasers Provide Light for (NB)	May 6
Channel 37 for Astronomy (NB)	Jan 6
Color Antennas and Boosters (Cunningham) (Corr)	Feb 88
Educational, May Nudge Out Textbooks? (Patrick)	Feb 43
G-Line (Patrick)	Feb 46; (Corres)
Live, From Moon (NB)	Jun 10
Pay, NBC Vp Attacks (NB)	Jan 8
Recorder, Video Playback-Only, First Machine (WN)	Mar 43
Tape Recorder, British, Demonstrated Here (NB)	Mar 6
Tape Recorder, Home (NB)	Jun 6
Servicing—see Servicing, Television	
Speaker Switching, Radio-TV (NC)	Mar 96
Towers: Menace to Birds (Corres)	Mar 14
Uhf	
Detent Tuner (NB)	May 6
Installing and Troubleshooting (Davidson)	
Part 1—Uhf tuners and converters are not hard to fix	May 32
Part 2—Installing uhf adapters in existing sets	Jun 44
Sets on Increase (NB)	Jan 6
Tuners, New (Lucas)	Apr 26
Vertical Linearity Circuit, Unusual (NC)	Apr 90
Vertical Sync Stabilizer Circuit (NC)	May 88
Volume Limiter (NC)	Feb 86
Terminal and Control Markings on Foreign Radios (Sutheim)	Jun 53
Test Compactors on Your Checker (Elick)	May 36

TEST INSTRUMENTS —see also Servicing	
Audio Generator, Lab-Quality (Idestam-Alquist)*	May 22
Audio Sweep Generator (Stein)* (Corres)	Jun 22
Capacitance Checker, Olson KB-147 In-Circuit†	Jan 78
CB Checker†	May 66
Color Generator, Sencore CG126†	Apr 66
Compactors, Test on Your Checker (Elick)	May 36
CR Analyzer† Lafayette TE-46	Mar 65
Distortion Meter and Ac Vtvm, Eico 902†	Apr 66
Dynamic-Conductance Tube and Transistor Tester†, Eico 667	Mar 65
Flutter Meter (Wagner)*	Mar 24
Frequency Meter, CB†, Int. Crystal C-12B	Feb 68
Frequency Meter, Simplest Direct-Reading (Queen)*§	Feb 34
Inductance Bridge, Precise (Krueger)* (Corr)	Jan 18, 21
Meters from Junkbox (Weber)	May 50
Nanoamps, Measuring (Queen)*§	Jun 39
Organ Service Bench, Electronic (Kirk)	Jan 58
Picture-Tube Tester†, Sencore CR-125	Feb 68
Probes, Pattern Depends on (Cunningham) (Corres)	Feb 23
Radio, Test Set Aids 2-Way Jobs (Barbee)*§	Jun 46
R-C Sine-Wave Oscillator, New, Simple (Queen)*§	Apr 49
Scope Face, Clamp Holds Light Shield on (TTO)	May 90
Short Tester, Flatiron Is (TTO)	Feb 105
Signal Generator, Improving SG-8 (Wallace)	Jan 67
Stereo Analyzer, Black Box (White)*	Mar 38
Substitution Box, Binary High-Capacitance (Math)	May 70
Sweep on AM, Try (Weber)*	Apr 34
Transconductance Tester (Pat)	Jan 95
Transistor(s)	
Alignment Easy Way (Carlson)	Jan 68
Analyzer, Triplett 3450-A†	Jun 64
Radio Tester Hickok 810†	Jan 78
Tube and, Dynamic-Conductance Tester Eico 667†	Mar 65
Quick-Checking Power (TTO)	May 90
Tube and Transistor Tester, Dynamic-Conductance Eico 667†	Mar 65
Tube Tester†, GC 36-802	Jun 63
Tube-Testing Gizmo (TTO)	Apr 86
Voltage Calibrator (NC)	Jan 98
Vom, 6-inch Meter, Lafayette TE-900	May 66
Vom, Triplett 630-NS† (Corr)	Jan 56
Voltmeter, Transistor (NC)	May 88
VR-Tube Current, Adapter Measures (TTO)	Feb 104
Vtvm	
Ac, and Distortion Meter (Eico 902)	Apr 66
Poor Boy's (McCreery)*	Jan 28
Wattmeter, Simple Rf, for CB (Greenlee)*	Feb 49
Test Set Aids 2-Way Radio Jobs (Barbee)*§	Jun 46
Test Tapes and Records, R-E Guide to (Scott)	Mar 46

New Semiconductors and Tubes

The Ignistor

A new component for electronic ignition systems, the *Ignistor*, is now being produced by Bendix.



An Ignistor is a transistor with a matched Zener diode connected between

3-Phase Problem (Darr) (Corres)	Feb 18, Mar 70
This Fuse Was Bad News (Sinclair)	Jan 66
This Is Diathermy (Jaski)	Jan 38
Transconductance and How to Measure It (Overholts)	Jan 74

TRANSISTOR(S)IZED	
Alignment Easy Way (Carlson)	Jan 68
Circuit Design, New Approach to (Gottlieb)	Feb 76; (Corres)
Control High-Power Dc (Rymsha)*§	Apr 16
Ohmmeter and (Madison) (Corr)	Jun 37
Power Amplifier Circuit Directory (Geisler) (Corr)	Mar 14
Power, Free-loading (NC)	Feb 53
Save Your Breaker Points (Gyorki)*§	Apr 53; Jun 60
(Corr)	May 88
Timer, Electronic (NC)	May 88
Voltmeter (NC)	May 88
Trimming Resistors and Capacitors (Patrick)	Feb 35
Troubleshooting, Installing and, Uhf TV (Davidson)	
Part 1—Uhf tuners and converters are not hard to fix	May 32
Part 2—Installing uhf adapters in existing sets	Jun 44
Try Sweep on AM (Weber)*	Apr 34
Tube(s)	
Map Fired on CRT-Faceplate (WN)	Jun 43
Microwave, Magnetic Fields Eliminate Noise in (NB)	Apr 8
6BN6, Versatile (Sands)	Jun 54
Traveling-Wave, Unpressurized, for Space (NB)	Apr 14

U	
Uhf—see Television	
Ultrasonic(s)	
Acoustics of Large Halls Simulated by (NB)	Feb 14
Stops Burglars (Fasal)	May 25; (Corres)
Transducers work to 1,000 Mc (NB)	Jun 20
Unexpected Admiral (Holtz)	Jan 73
Unusual Instruments for Control and Measurement (Mandl)	Apr 50
Upgrade Your Home Recording Setup (Carlson)	May 34

V	
Versatile 6BN6 (Sands)	Jun 54
Video Troubles Can Be Simple (Darr)	Apr 46
Video Recorder, Home (NB)	Jun 6

W	
Whales, Marine Sounds Traced Back to (NB)	Feb 8
What Happens to Picture Tubes? (Darr)	Mar 44
What Is a Decibel (King)	Jan 30; (Corres)
What's New in Phono Pickups (Marshall)	Jan 26
Which Tape Is Best? (Fantel)	Mar 27

its emitter and collector, and housed in the same package. This of course takes less space, less time to install; is cheaper to make and cheaper to use than separate semiconductor components.

The new device comes in TO-3 and TO-41 (similar to TO-3 for shape and orientation of connections) packages with a variety of voltage and current ratings to suit particular applications. The diagram shows the simplest of several possible transistor ignition circuits suggested by Bendix for the Ignistors. The devices must be heat-sinked with a thermal resistance of about 2°C/watt.

Rectangular color CRT here

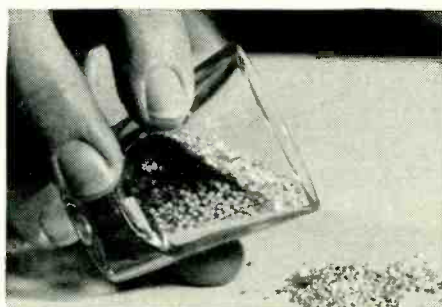
The long-awaited 23-inch rectangular color-TV picture tube is here. Motorola announced the new tube in a full-page ad in the Sunday, April 12 *New York Times*.

The new design became a production reality in late summer 1963. (See *News Briefs*, RADIO-ELECTRONICS, Aug. 1963, p. 16; Sept. 1963, p. 8.)

Compared to the standard 21-inch round tube, the new one has 274 square inches of viewing area, according to Motorola, instead of 261. The tube is 5.2 inches shorter than the conventional design. It is made by National Video Corp.

Tiniest diodes?

A diffused-junction diode with a double-glass hermetic seal may turn out to be the last stand of conventional discrete diodes. It's difficult to imagine complete diode assemblies any smaller (see photo)—these are about .060 inch in diameter and .030 inch high.



The design is available from Hughes Aircraft Semiconductor Div. in 10 varieties covering ratings up to 100 volts and 300 ma with 2-nsec switching speeds. The diode consists of a glass ring, which contains the silicon die already sealed in a layer of glass, and two metal end caps. It can replace several dozen existing diode types.

Sylvania plans 90° color CRT

Samples of a new 25-inch, 90° rectangular color TV picture tube are expected to be available late in 1964, according to Merle W. Kremer, general manager of the Electron Tube Div. of Sylvania.

Tentative specifications are being made available to set manufacturers so they can get started on cabinet designs.

For the time being, Sylvania intends to continue producing its 21-inch 70° round tube.

END

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* Construction Articles	
† Section of full-length article	
§ Transistorized	
CI	Service Clinic
Corr	Correction
Corres	Correspondence
NB	News Briefs
NC	Noteworthy Circuits
Pat	New Patents
Tech	Techniques
TTO	Try This One
WN	What's New
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FEEDBACK WITH A DIFFERENT VOICE-COIL IMPEDANCE

THERE ARE TIMES WHEN YOU WOULD like to change the feedback takeoff point in an audio amplifier from, say, the 16-ohm output tap to the 8-ohm tap. Or perhaps you want to replace a 4-, 8-, or 16-ohm output transformer with one that has only a 600-ohm winding, or only a 70-volt winding. Since, for a given power, the voltage across the voice coil (and hence the feedback voltage) varies with the impedance, you will have to change the feedback resistor. How?

Here is a simple formula you can use:

$$R_2 = R_1 \sqrt{\frac{Z_2}{Z_1}}$$

R_1 is the given series feedback resistor, R_2 the required new value, Z_1 the present voice-coil impedance and Z_2 the new impedance.

This formula gives an acceptably close value only when the series feedback resistor is much larger than the resistor (or other ac impedance) across which the feedback is applied—usually the cathode resistor (or part of it) of an earlier stage. Generally, the series resistor is about 20 times the value of the cathode resistor, and since you will generally be using 10% resistors, the computation isn't too critical anyway (10% voltage equals approximately 1 db).

If there is a phase-shifting capacitor across the series feedback resistor, it must be changed also. Its value is found by the inverse relationship

$$C_2 = C_1 \sqrt{\frac{Z_1}{Z_2}}$$

(Note that Z_1 and Z_2 are interchanged.)
—*Radiotronics (Australia)*

CORRECTION

It looks like our EQ (editorial quality??) slipped when editing this column in the May issue. The polarity of diode D1 was inadvertently reversed in the diagram for the first question. This error was noticed by quite a few sharp-eyed readers. The first to report it was E. Nowak, Jr. of Saginaw, Mich. We are sorry if this error made the problem harder to solve.

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* Construction Articles	
† Section of full-length article	
§ Transistorized	
CI Service Clinic	
Corr Correction	
Corres Correspondence	
NB News Briefs	
NC Noteworthy Circuits	
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TTO Try This One	
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RADIO-ELECTRONICS January-December 1966 of Vol XXXVII

KEY TO SYMBOLS AND ABBREVIATIONS

- * Construction Articles
 † Section of full-length article
 § Transistorized
- | | |
|--------|---------------------|
| CI | Service Clinic |
| Corr | Correction |
| Corres | Correspondence |
| NB | News Briefs |
| NC | Noteworthy Circuits |
| Tech | Techniques |
| TTO | Try This One |
| WN | What's New |
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FM, World's Most Expensive (Sutheim)	Jul 30
Talk Over a Hi-Fi Light Beam (McCarthy)*	Apr 34
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Battery	
Sony-Matic TC-900†	Mar 66
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Standardized with "Musicassette" system? (NB)	Sep 4
Standards set up tentatively? (NB)	Jul 8
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Speech scrambler, portable, now on market (NB)	Aug	6	Continuity Tester Finds Low-Resistance Circuits (Tyler)*§	Apr	82	Laser light beam, radical new TV "tube" uses (NB)	Dec	4
Spring Roundup of Battery Recorders Mar 42; (Corr)	Jun	12	CRT testers, converting for low-G-2 tubes†	Feb	78	Radio, not done for (NB)	Feb	4
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Surplus Printed-Circuit Boards Give That Professional Touch (Pepper)	Oct	47	Flow-rate meter, new, is magnetometer (NB)	Aug	6	Two-Way Radio Has Its Tough Dogs, Too! (Dudley)	Sep	40
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Talk Over a Hi-Fi Light Beam (McCarty)*	Apr	34	Meter, multi-function (Hewlett-Packard 427A)†	Oct	68	Quandries, Light-Meter	Apr	57
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KEY TO SYMBOLS AND ABBREVIATIONS

* Construction Articles	
† Section of full-length article	
§ Transistorized	
CI	Service Clinic
Corr	Correction
Corres	Correspondence
ER	Equipment Report
NB	News Briefs
NC	Noteworthy Circuits
Tech	Techniques
TTO	Try This One
WN	What's New
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Flutter Meter, Compact High-Performance (Hansen)*§	Dec	52
FM		
Antenna coupler, TV/FM (NC)	Jun	90
at Your Fingertips (Buegel)*§	Jul	47
Receiver boom (NB)	Nov	22
Servicing, see Servicing, radio		
Stereo		
Adapter, Modern (Buegel)*§ Aug 32; (Corres)	Nov 14	
Housewife Builds (Tracy and Spencer)	Jun	32
Stations Aug 34; (Corres)	Nov 12	
Fuel Cells—Power for Tomorrow (Smith)	Feb	44

G

Gamma Goat, Solar-Powered (Hoke)*	Dec	34
Generators, see Test instruments		
Gernsback, Hugo, 1884-1967 Oct 6; (Shunaman)	Nov	4
Getting to Know Low-Cost IC's (Scott)	Mar	44
H		
Headphone Control Center, Stereo (Sutheim)*	Nov	35
Hertz not new (Corres)	Jan	16
Hi-Fi		
Hi-Fi, All Around the House	Feb	47
1968	Oct	35
Wider the Band, the Higher the Fi? (Sutheim)	Oct	54

High fidelity, see Audio—high fidelity—stereo		
High-Impedance Transistor Mixer (Lehman)*§	Mar	40
Holography		
Direct-View 3-D Images! (Smith)	Jan	46
Lasers for (NB)	Feb	13
3-D, with ordinary light (NB)	Apr	12
Home Movies Time-Compression Machine (Johnson)*§	Oct	41
House of Tomorrow (Ward)	Jun	34
Housewife Builds FM Stereo (Tracy and Spencer)	Jun	32
Hydronic-Radiation Transmitter (Althouse)*§	May	37
Hydronics, More About	Aug	82

IC (s)		
Designing with Integrated Circuits	Mar	32
Getting to Know Low-Cost IC's (Scott)	Mar	44
Glossary (Scott)	Mar	85
in receivers (NB)	Feb	6
Noninductive tuning (NB)	Aug	4
Projects, 30 Basic (Marston)	Dec	43
Sine-Square-Saw Generator (Hansen)*§	Jul	54
Sound Relay (Greenlee)*§	Jun	77
Voltage regulator (NB)	Nov	22
Imaginary Numbers Are a Cinch (Crowhurst)	May	57
Incentive Licensing and Distinctive Call Signs	Nov	16
Industrial Electronics		
Computers, see Computers		
Light system, emergency (NC)	Nov	96
Servicing, see Servicing, industrial electronics		
Telephone, no-talk (WN)	Jan	45
Zip-code monitor (NB)	Nov	22
Infrared		
Data transmission (NB)	Jul	4
Detector, world's smallest (NB)	Sep	4
Laser beam converted to red (WN)	Jan	45
Integrated Circuits, see IC		
In's and Out's of Lead-ins (Lacy)	Aug	42
Insulation, Shrink on the (Jablin)	Nov	61
Intercom remote will signal master (NC)	Feb	92
Interference Nullers, Two (Althouse and Van Houten)*§	Aug	38
Inverter, Transistorized (Electro Products TI-100A) (ER)	Apr	64
It Can't Be All Bad (Prindle)	Sep	58

K

Know Your L- and T-Pads (Fred)	Sep	36
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L

L- and T-Pads, Know Your (Fred)	Sep	36
Lamp, Two-Way, Two-Way (Wels)*	Dec	59
Laser(s)		
Brake for cars (NB)	Mar	6
Broadband light modulators (NB)	Mar	4
Infrared beam converted to green (WN)	Jan	45
Latest on (NB)	May	12
Medicine and (NB)	Aug	4
More on (NB)	Feb	12
Sun bottle (NB)	Oct	16
Learn Color the Programed Way (Rawlings)	Sep	32
Licensing, Incentive, and Distinctive Call Signs	Nov	16
Light System, emergency (NC)	Nov	96
Generator and detector, new (NB)	Dec	4
Lightning		
Arrester, CB	Apr	46
Plasma and Balls of Fire (Smith)	Apr	40
Lights-on Reminder for Your Car (Montan'e)*, (Corres) Mar 16; (Corres)	Jun	14
Line-voltage indicator	May	53
Luck Is a Lady (Salerno)	Aug	67
Lucky Hunts Horizontal Hold (Lemons)	Feb	42

M

Man's World? Not to These Women (Smyth)	Jul	62
Master-Mounted Preamp (Schenfeld)	Apr	36
MAT • MOST • MOSFET • UFET • FET: Understanding Solid-State Talk (Turner)	Sep	48

Measure Power of Electronic Flash (Norman)	Mar	83
Mechanical Look at Tape Recorder Servicing (Mohan)	May	71
Medicine		
Color blindness, electronic cure for (NB)	Nov	22
Hearing aids (NB)	Mar	4
Lasers and (NB)	Aug	4
Meter temperature compensation (NC)	Jul	90
Microscope, biggest (NB)	Nov	22
Midyear Report on Electronics (Allen)	Jun	37
Mini-Tester, Transistor and Diode (Randall)*	Oct	46
Mixer		
Amplifier, All-Transistor (Inman)*§	Aug	54
High-Impedance Transistor (Lehman)*§	Mar	40
Modern FM Stereo Adapter (Buegel)*§ Aug 32; (Corres)	Nov	14
More About Hydronics	Aug	82
MOS FET, What'sa (Jackson)	Oct.	50
Movies, airborne, without video (NB)	May	4
Mr. IC—Tracer of Lost Signals (Greenlee)*§	Jul	66

N

Need a Power Resistor? Try a Transistor (Pepper)	Feb	51
1967 Color-TV Roundup (Lemons)	Jan	36
Nomorule		
in Electronic Calculations (Fasal)	Apr	48
Complete Calculator on Sheet of Paper (Fasal)	Mar	52
Nonpolarized Zener Clipper (Ives)	Feb	55
Nullers, Two Interference (Althouse and Van Houten)*§	Aug	38

O

Ohm Splitter (McCormick)*§	Sept	67
Organ Music, Special Sounds of (Dorf)	Jun	52
Oslo, What Happened at (Haskett)	Jan	41

P

Pattern Generator, DOTnBAR—Professional Quality (Lancaster)*§	Jul	36
PHOTOGRAPHY		
Camera, Solid-State, Is Here (Clifton)	Jun	58
Flash		
Power of Electronic, Measure (Norman)	Mar	83
Slave, for \$5, Electronic (Keith)*	Jun	45
Strobe Slaves, Twin 200-Watt-Second (Rice)*§ Mar 49; (Corres)	Sep	6
Holography		
Direct-View 3-d Images! (Smith)	Jan	46
Lasers for (NB)	Feb	13
3-D, with ordinary light (NB)	Apr	12
Home Movies Time-Compression Machine (Johnson)*§	Oct	41
Slide changer, transistor (NC)	Aug	94
Timers, Double Feature, Starring (Chesson and Ives)*	Feb	56
Weather photos, low-cost, by satellite (NB)	Jun	12
Plasma and Balls of Fire, Lightning (Smith)	Apr	40
Plastic Transistors—Future Billions (Bose)	Mar	55
Polarity-reversal hint†	May	54
Poor Man's Digital Voltmeter (Todd)*§, (Corres)	Jan 22; Apr	16
Portable Color Recorder (Roizen)	Mar	38
Power Resistor, Need a? Try a Transistor (Pepper)	Feb	51
Power Supply		
All-Silicon Regulated (Rogers)*§, (Corres)	Aug	16
(Pace 5803 Laboratory) (ER)	Feb	70
Preamp		
Mast-mounted (Schenfeld)	Apr	36
Solid-State and High-Z Too (Wherry)*§, Corr	Jan	12
Printed-Circuit Boards, How to Make (Montan'e)	Nov	62
Professional Quality Transmitter Monitor (Neil)*§	Dec	56
Professional Touch for CB (Darr)	Jan	44

PUBLIC ADDRESS		
Amplifiers (CI)	Oct	22
Remote Control for PA Systems (Darr)	May	47
Switching circuit, audio (NC)	Sep	98
Tape recording from PA output (CI)	Nov	26
Tone control, five-channel (NC)	Oct	94
Purity and Convergence Interaction (Murphy and Carr)	Jan	32

Q

Q & A on an Electronics Career	Dec	40
Quick-Checker for Controlled Rectifiers (Anglin)*	Mar	70

R

Race Drivers, Reaction-Time Testing of (Davis)	May	32
Radar, solid-state (NB)	Mar	12
RADIO, see also Servicing, radio		
Amateur—Incentive Licensing and Distinctive Call Signs	Nov	16
Auto, Solid-state (Motorola FM106M AM-FM) (ER)	Apr	66
CB		
Antenna Rotation, Electronic (Thrower)*	Aug	47
Field Meter, Remote-Reading (White)*§	Aug	60
Hits the road (NB)	Oct	16
Lightning Arrestor	Apr	46
Nullers, Two Interference (Althouse and Van Houten)*§	Aug	38
Revocations (NB)	Mar	14
Squelch circuit, unusual (NC)	Sep	98
Transceiver (Lafayette HB-525 (ER)	Feb	67
Transmitter Monitor, Professional Quality (Neil)*§	Cec	56
Troubleshooter's Casebook (Mueller)	Aug	83
Type acceptance (NB)	Jun	6
Commercial overseas (NB) Jan 6; (NB) Jun 4; (Corres)	Jun	14
Communications		
Antenna Rotation, Electronic (Thrower)*	Aug	47
Nullers, Two Interference (Althouse and Van Houten)*§	Aug	38
FM, see FM		
Hydronic-Radiation Transmitter (Althouse)*§	May	37
Hydronics, More About,	Aug	82
IC's in (NB)	Feb	6
Intercom remote will signal master (NC)	Feb	92
Law, Electronics and (NB)	Jun	6
Licensing, Incentive, and Distinctive Call Signs	Nov	16
Missile base, teenage students discover Soviet (NB)	Mar	12
Police—big brother listens (NB)	May	4
Receiver (Eico 711) (ER)	Oct	67
Shortwave		
Broadcasting, more (NB)	Jan	12
Receiver, Your Own (Queen)* Aug 57; (Corr)	Sept	12
Squelch circuit, unusual (NC)	Sep	98
Superregenerator, remote-tuned†	May	53
Time signals (NB)	Jul	4
Transmitter		
Hydronic-Radiation (Althouse)*§	May	37
Microwave microtransmitter (NB)	Mar	4
Transistor—Be Brave! Take On! (Davidson)	Sep	51
Walkie-Talkie		
Power Booster (Crane)*§ Mar 60; (Corres) May 16; Corr	Jul	4
Rule change (NB) Apr 6; (NB)	Jul	4
Radio-Electronics Interviews Consumers Union (Belt)	Jun	60
R/C Job, World's Toughest (Smith)	May	39
Reaction-Time Testing of Race Drivers (Davis)	May	32
Record and Play Video Tapes with Your TV Set (McGinty)*§	Apr	32
Relay		
Capacitance, unusual (NC)	Jan	102
Self-Holding, Updating the (Ives)	Sep	61
Sound IC (Greenlee)*§	Jun	77
Time-delay, SCR†	May	53
Remote Control		
Blackboard (NB)	Jan	6
PA Systems (Darr)	May	47
Sequential tone control†	May	54
Sound Relay, IC (Greenlee)*§	Jun	77
World's Toughest R/C Job (Smith)	May	39
Remote-Reading Field Meter (White)*§	Aug	60
Repair CB Talk Troubles (Rice and Mueller)	Oct	48
Resistor		
Breakthrough (NB)	Oct	16
Power, Need a? Try a Transistor (Pepper)	Feb	51
Rf Meter, and Dummy Load (Rice and Mueller)*	Nov	50
Rotary Stepping Switches—They're Everywhere (Jaski)	Nov 39; Dec	46

S

Satellite(s)		
Comsat: Communication in the Space Age (Thrower)	May	49
Missile base, teenage students discover Soviet (NB)	Mar	12
Pacific, in regular service (NB)	Apr	4
R/C Job, World's Toughest (Smith)	May	39
Weather photos, low-cost (NB)	Jun	12

Schools Directory, Electronic	Dec	40
Scopes, see Test instruments		
SCR(s)		
Quick-Checker for Controlled Rectifiers (Anglin)*	Mar	70
Time-delay relay†	May	53
Selected Circuits from an Experimenter's File (Scott)	May	53
Semiconductors, see IC; SCR(s); Solid-state; Transistor(ized)		
SERVICING, see also specific subject; Test Instruments		
Antenna		
Grounding (CI)	Oct	26
Lead-in's, In's and Out's of (Lacy)	Aug	42
masts, stowing (TTO)	Apr	89
Rotor harness, quick (TTO)	Oct	95
Anvil, hand light-duty (TTO)	Feb	89
Audio—High Fidelity—Stereo Servicing		
Amplifier		
Diode filtering (CI)	Jun	26
Performance, Verifying (Sutheim)	Jul	80
T-40/40, output problem in (CI)	Jun	22
Cartridge Tracking Tests (Ward)	Oct	32
Changer pushoff adjustments (Webcor stereo) (CI)	Mar	23
PA amplifiers (CI)	Oct	22
Power supply, transistor (T-40/40) (CI)	Jun	22
Recorder		
POP (RCA VGT 66) (Tech)	Oct	82
Stereo, hum (RCA YGG '45) (Tech)	Oct	82
Tape recorders		
Mechanical Look at (Mohan)	May	71
Noise Annoys a Tape? What Kind of (Stillwell)	Sept	43
Battery eliminator from tube tester (TTO)	Aug	95
Circuit-Breaker Testing (Darr)*	Feb	38
Coils		
Forms, quick, from tape (TTO)	Apr	89
Toroids, Simple Winding Aid for (Null)	Mar	81
Creative Electronic (Allen)	Sep	39
Dial-cord tension (Tech)	Apr	85
Drill bits, protect (TTO)	Nov	97
Hints on New Color-TV Sets (Mandi)	Nov	37
Industrial		
Ignition contactors, indicator for (TTO)	Feb	89
Interlock (Remington CardVeyor) (Tech)	Apr	85
Lathe		
Chattering (Monarch EE-10) (Tech)	Apr	85
Speed change (Cleveland) (Tech)	Feb	74
Insulation, Shrink on the (Jablin)	Nov	61
It Can't Be All Bad (Prindle)	Sep	58
Lead-bending jig (TTO)	Jul	91
Lead-ins, In's and Out's of (Lacy)	Aug	42
Man's World? Not to These Women (Smyth)	Jul	62
PA amplifiers (CI)	Oct	22
Radio Servicing		
and TV Troubles (Davidson)	Oct	52
Auto		
Interference (Tech)	Jun	84
Intermittent (Delco/Chevrolet, 1965) (Tech)	Sep	92
Overload (1962 Chevrolet) (CI)	Sep	26
Remote volume control (CI)	Aug	27
Squelch and audio (Motorola Motran U51LLT) (Tech)	Aug	86
Battery eliminator from tube tester (TTO)	Aug	95
CB		
Frequencies, Check with BC-221 and a Converter (Gunn)*	Aug	50
Professional Touch for (Darr)	Jan	44
Range (CI)	Aug	22
Talk Troubles (Rice and Mueller)	Oct	48
Troubleshooter's Casebook (Mueller)	Aug	83
Hum (Silverstone 6023) (Tech)	Nov	97
Knob pointers (TTO)	Nov	97
PC board cracked (Pilot 602MA) (Tech)	Apr	84
35W4 tubes pop (Motorola 56CD) (Tech)	Jun	84
Table-Model AM/FM (Davidson)	Nov	52
Transistor		
Be Brave! Take On! (Davidson)	Sep	51
Speaker matching, solid-state (CI)	Jul	25
Tuners, Signal-Trace FM-Radio and TV, with a Field-Strength Meter (Fitzgibbon)	Oct	57
Series-string service, speeding (TTO)	May	99
Socket wrenches, midget (TTO)	Mar	93
Soldering		
Caddy for bench or box (TTO)	Feb	88
Desoldering		
Blow, don't suck (Tech)	Jul	84
Iron kink (TTO)	Jan	98
Tool (TTO)	Jun	91
Masking tape as aid (TTO)	Aug	95
Technician		
Training grows (NB)	Apr	4
Vanishing (NB)	Jun	4
Television Servicing		
and Radio Troubles (Davidson)	Oct	52
Antenna		
Rotor (Tech)	Sep	92
Tuning stub, "second chance," (TTO)	Feb	88
Audio		
Distortion (G-E TB chassis) (Tech)	Mar	82
Sound-tuning range (G-E SB and SC chassis) (Tech)	Mar	82
Boost (CI)	Jan	24
Checking out (CI)	Sep	22
Color		
Bending (Heath GR-25) (CI)	Feb	26

Servicing (continued)			Socket wrenches, midget (TTO)			Television (continued)		
Television servicing (continued)			Solar-powered Gamma Goat (Hoke)*			\$50 (NB)		
Blue misconvergence (Olympic CTC-19, -20, -21) (Tech)			Nov	86		Dec	34	IC's in (NB)
Chroma, Troubleshooting, with vtm (Babcoke)			May	60	Soldering	Feb	88	Image enhancer (NB)
Conversions (CI)			May	22; Jun 26	Caddy for bench or box (TTO)			Microwave/video pictures for pilots (NB)
Degaussers in metal cabinets, automatic (RCA CTC11) (CI)			Jan	26	Desoldering	Jul	84	Multiplex, with printed copy (NB)
Exploring the Jungle of Color Troubles (Davidson)			Jan	56	Blow, don't suck (Tech)	Jun	91	Picture size (NB)
Horizontal streaking (Zenith 25MC36) (CI)			Jul	25	Tool (TTO)	Jan	98	Pocketable (NB)
Linearity, Don't Neglect (Mandl)			Jan	76	Iron kink (TTO)	Aug	95	Portable
Loss, selective (CI)			Sep	26	Masking tape as aid (TTO)	Jan	12	Color, small-screen (NB)
Pix dim, raster small (RCA CTC16) (Tech)			Jan	97	Solid State and High-Z Too (Wherry)*§, Corr	Jun	58	Pocketable (NB)
Purity and Convergence Interaction (Murphy and Carr)			Jan	32	Camera Is Here (Clifton)	Apr	6	Tiny black-and-white (NB)
Red intermittent (RCA CTC15) (CI)			Jan	26	C-D Ignition under \$25 (Ward)*§ Feb 32; Corr	Jul	41	Tiny, tiny (NB)
Remote control (Admiral) (Tech)			Aug	86	Electric Appliances (Haskett)	Jun 42; Jul	41	Preamp, Mast-mounted (Schenfeld)
Screen won't light (CI)			Nov	24	MAT • MOST • MOSFET • UFET • FET: Understanding Solid-State Talk (Turner)	Sep	48	Satellite(s)
Servicing Hints on New (Mandl)			Nov	37	Radar (NB)	Mar	12	Comsat: Communication in the Space Age (Thrower)
6CB5 life short (RCA 21CS7815U) (CI)			Jun	24	Relay, Updating the Self-Holding (Ives)	Sep	61	Pacific, in regular service (NB)
Socket, burned-up (Zenith) (CI)			Aug	27	Strobe Slaves, Twin 200-Watt-Second (Rice)*§ Mar 49; (Corres)	Mar	12	Slow-motion replay (NB)
Test-jig adapter (Admiral) (Tech)			Dec	87	Tape/Slide Synchronizer (Havenhill)*§	Sep	6	Station, one-man (NB)
Triggered Scope for (Allen)			Jan	50	Television, color (NB)	Dec	32	Tape recorder
Trouble That Couldn't Happen (Lowens)			Jan	94; Feb 72	TV Camera pickup "tube" (NB)	Feb	4	Color
Troubles (G-E CB chassis) (Tech)			Jan	97	Something New in Color Generators (Allen)	May	42	Home, \$500 (NB)
Vertical retrace (Dumont) (Tech)			Jul	84	Sound Relay, IC (Greenlee)*§	Jun	77	More low-cost color on tape (NB)
Vertical roll (Zenith 25MC36) (Tech)			Jun	84	Special Sounds of Organ Music (Dorf)	Jun	52	Portable (Roizen)
Vertical roll during warmup (RCA CTC5) (Tech)			Jan	97	Stereo, see also Audio—high fidelity—stereo; FM, stereo	Nov	12	Dielectric camera (WN)
Weak (CI)			Jun	16	FM Stations Aug 34; (Corres)	Nov	35	Record and Play Video Tapes with Your TV Set (McGinty)*§
Width coil (Admiral 25-in.) (Tech)			Jan	97	Generator, Transistor (Payne)*§	Jul	32	Video visit from Vietnam (NB)
Worms (Zenith 29C20) (CI)			Jan	26	Headphone Control Center (Sutheim)*	Nov	35	Uhf
D • U • D, Servicing with (Goodman) (fiction)			Apr	39	Superregenerator, remote-tuned†	May	53	Multiantenna tower, world's first (WN)
Five-in-One TV Shop (Smith)			Jun	55	Switch(es)	Jan	12	Translator (Lectrotech U-75) (ER)
Flybacks run hot (CI)			Dec	16	No-contact (NB)	Nov 39; Dec	46	Weather photos, low-cost, by satellite (NB)
Heater-siring electrolytic (Star-Lite TV-810) (CI)			Oct	26	Rotary Stepping—They're Everywhere (Jaski)	Dec	32	X-ray
Height insufficient (Philco 8H25) (Tech)			Feb	74	Synchronizer, Solid-State Tape/Slide (Havenhill)*§			Callbacks (NB)
High voltage, shorting stick for (TTO)			Sep	99				Radiation, What You Should Know About (Lachenbruch)
Horizontal								Television's 40th Birthday (Ives)
Hold, Lucky Hunts (Lemons)			Feb	42				
Sync instability (Admiral 14UY3B) (Tech)			Oct	82				
Intermittent sound and pix (DuMont RA-400 and RA-401) (Tech)			Apr	84				
Knob Twisting, Down With (Hadrick and Michelotti)			Jul	79				
Line adjustment transformer (Tech)			Nov	86				
Luck Is a Lady (Salerno)			Aug	67				
Pricing (NB)			May	4				
Raster								
Gray spot (CI)			Feb	27				
Intermittent (RCA KCS 140) (Tech)			Aug	86				
Rectifier								
Substitution of HV (RCA CTC 16X) (Tech)			Dec	87				
Testing with scope? (CI)			Jul	22				
Shop, Five-in-One (Smith)			Jun	55				
6JE6's, watch those (Tech)			Apr	84				
Transistor, Tools and Tests for (Darr)			Mar	35				
Trouble That Couldn't Happen (Lowens)			Jan	94; Feb 72				
Tuners, Signal-Trace FM Radio and TV, with a Field-Strength Meter (Fitzgibbon)			Oct	57				
Vertical								
Output transformer (Tech)			May	91				
Sweep Manual (Davidson)			Dec	49				
Troubles (Admiral C2227X) (Tech)			Mar	82				
Video amplifiers, transistor (CI)			Jul	16				
Voltage reading reversed? (Zenith R2229R) (CI)			Jul	22				
Why Services Like Servicing (Glass and Tracy)			May	45				
Width, bars and blooming (Olympic CTC17, CTC18) (Tech)			Apr	85				
X-ray callbacks (NB)			Aug	6				
Test Instrument Servicing								
Meter-rectifier hookups, ac (CI)			Mar	25				
Scope								
Adjusting kit (Eico 460) (CI)			Apr	26				
Signal-tracing vertical amplifier in (Eico 460) (CI)			Feb	26				
Tubes interchangeable? (Eico 425) (CI)			Feb	27				
Waveshape (Eico 435) (Tech)			May	92				
Test-lead shorting, prevent (TTO)			Oct	95				
Toroids, Simple Winding Aid for (Null) (Corres)			Mar 81; Aug	16				
Transistor(s)								
Fundamentals (CI)			Mar	22				
Kink (TTO)			Feb	89				
Replacement (Admiral) (Tech)			Jun	85				
Ultrasonic Cleaners (Roetger)			Sep	62				
Vise jaws, electrical tape softens (TTO)			Dec	93				
Voltage, peak, measuring with scope and diode (TTO)			Jan	98				
Wire, stripping enameled (TTO)			Jul	91				
with D • U • D (Goodman)			Apr	39				
Shrink on the Insulation (Jablin)			Nov	61				
Signal-Trace FM-Radio and TV Tuners with a Field-Strength Meter (Fitzgibbon)			Oct	57				
Simple Winding Aid for Toroids (Null) (Corres)			Mar 81; Aug	16				
Slave Flash for \$5, Electronic (Keith)*			Jun	45				

Time-delay relay, SCR†
 Timers, Double Feature, Starring (Chesson and Ives)*
 Time signals (NB)
 Tone-Burst Generator, Audio (DeSa)*\$
 Tools and Tests for Transistor TV (Darr)
 Toroids, Simple Winding Aid for (Null) Mar 81;
 (Corres)
 T-Pads, Know Your L- and (Fred)
 Transmitter Monitor, Professional Quality (Neil)*\$

TRANSISTOR(IZED)(S), see also IC; subject article with \$ following author's name

Audio, Engineer Talks About (Sutheim) Apr 57; May 55
 Characteristic Plotter (Fasal)*\$ Sep 44;
 (Corres)
 Circuits from Scratch (Van Houten)
 Fundamentals (CI)
 Gain control, variable (NC)
 Kink (TTO)
 Mini-Tester, Diode and (Randall)
 Mixer, High-Impedance (Lehman)*\$
 MOS FET, What's a (Jackson)
 Plastic—The Future Billions (Bose)
 Power Amplifier, Convert Heath WA-P2 for (Olson)
 Power Resistor, Need a? (Pepper)
 Radios—Be Brave! Take On! (Davidson)
 Replacement (Admiral) (Tech)
 Slide changer (NC)
 Stereo Generator (Payne)*\$
 Test Set, Experimenter's (Hicke)*\$
 Socket markings (Corr)
 Three for a penny? (NB)
 TV, Tools and Tests for (Darr)
 Voltmeter, 22-Meohm FET Dc (Jaques)*\$
 Treasure Finder (Rakes)*\$
 Triggered Scope for Color (Allen Jan 51;
 (Corres)
 Trouble That Couldn't Happen (Lowens) Jan 94; Feb 72
 Troubleshooting Chroma with Vtvm (Babcoke) May 60
 Tube(s)
 Brighter color ahead (NB)
 Dimensions, TV (NB)

May 53
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 Tube(s) (continued)
 Popularity Chart, Color-TV
 Solid-state TV camera pickup "tube" (NB)
 Tester
 Battery eliminator from (TTO)
 CRT rejuvenator repair (Sencore CR-133) (Tech)
 Sencore MU-140 (ER)
 Twin 200-Watt-Second Solid-State Strobe Slaves (Rice)*\$
 Two Interference Nullers (Althouse and Van Houten)*\$
 Two Useful Pitched-Roof Antenna Mounts (Pyle and Strand)
 Two-Way, Two-Way Lamp (Wels)*

Nov 6
 Mar 41
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 Uhf
 Multiantenna tower, world's first (WN)
 Translator (Lectrotech U-75) (ER)
 Ultrasonic Cleaners, Servicing (Roetger)
 Updating the Self-Holding Relay (Ives)

Jan 100
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 V
 Verifying Amplifier Performance (Sutheim) Jul 80
 Vertical Sweep Manual (Davidson) Dec 49
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Coming Next Month . . .

COLOR TELEVISION

Learn how to get rid of color ghosts and see the best possible picture. Keep up to date on modern high-voltage and shunt-regulator circuits in color sets. Find out how to make purity adjustments, and attack intermit-tents in chroma circuits.

SERVICING

Take a guided tour of your scope—how to get the most out of it. Learn how to troubleshoot relays and keep them in tiptop condition. Add to your file of case his-tories in CB transceiver troubles.

PLUS

Painless dB's—or how to use decibels without know-ing logarithms. More applications for an 80-cent IC. Story of an unusual problem (how to use two-way radio in a subway tunnel) and its unusual solution. All these—and more construction projects—you'll find in our January issue.

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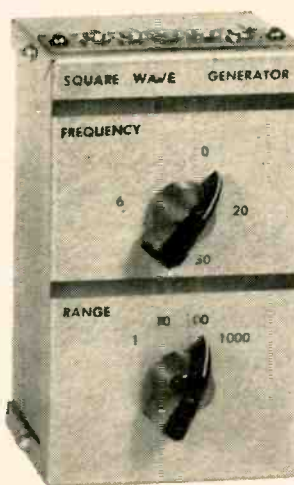
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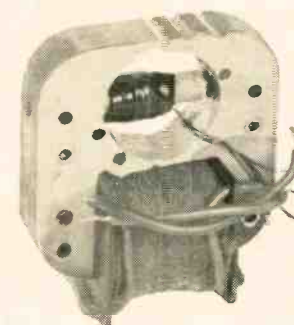
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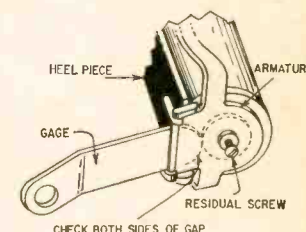
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COVER FEATURE



Today's color-TV set is better than ever but requires specific skills to keep in tip-top shape. Starting on page 34 you can read about the foundation for color setup—purity adjustments. Then, on page 36, learn about the critical high-voltage regulator circuit.



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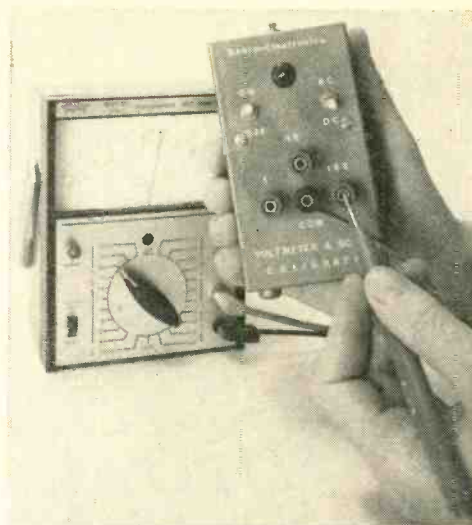
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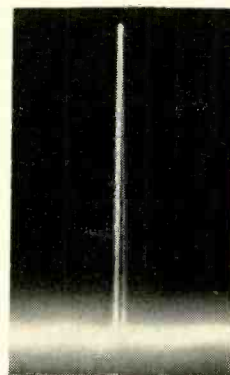
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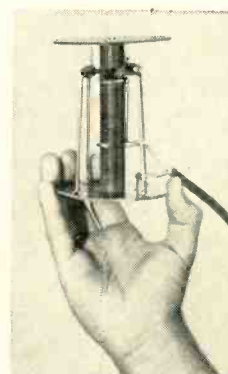
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Handy voltmeter and scope calibrator, covers both ac and dc, with calibrating voltages of 1, 10 and 100. Uses only a handful of parts. Meter shown is a Triplet 600 transistorized volt, ohmmeter. See page 42



Pulses are used everywhere in electronics. How much do you know about them? Find the answers and enlarge your electronics knowledge. See page 38



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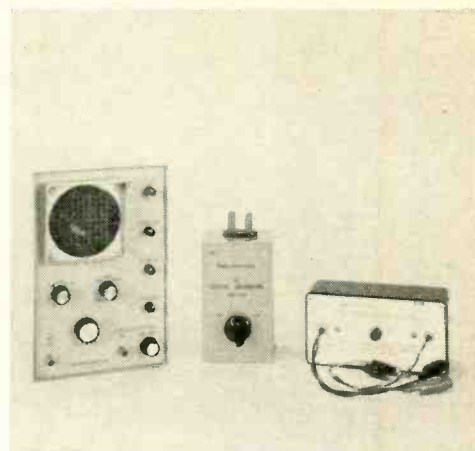
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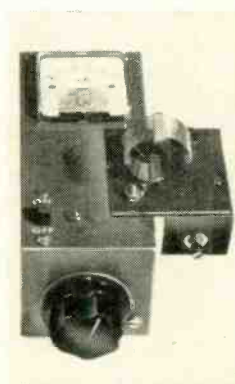


Modulation Scope Monitor has relatively few parts, is easy to build and lets you see your signal's waveform. Simple, low-cost 100 kHz crystal calibrator, useful for troubleshooting and alignment work, has 0.0001% accuracy. With the R-Scale Divider you can check ground connections, switch contacts and other low-resistance devices.



Improve your tape recorder techniques and get more mileage out of your tapes. Norelco's Carry-Corder 150 portable Cassette tape recorder shown here is typical of the newest generation of popular type of battery-operated units.

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Join the FET set with this sensitive field strength meter. You can tune it to a specific frequency and gauge the output of most any CB, ham or commercial transmitter.

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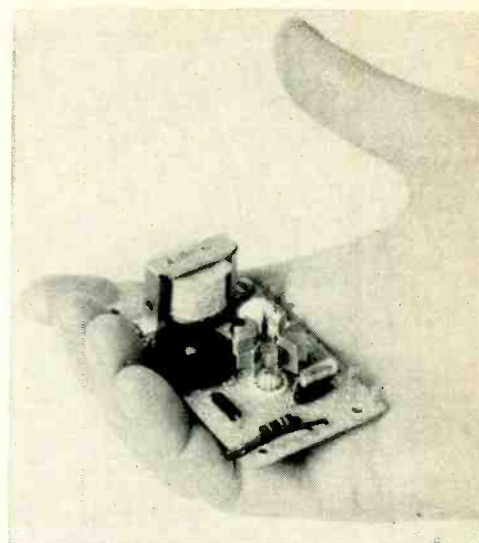
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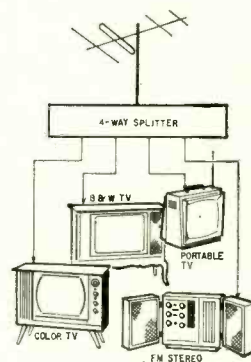
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Integrated circuits are now available for almost any electronics application. Among the new crop of IC's is RCA's CA3020, a low-priced, high-gain (58dB) device with enough power output to drive a speaker. With a microscope, you can find 7 transistors, 3 diodes and 11 resistors all on one chip in one TO-5 transistor case. Construction project described on page 32 tells how to assemble and use this high-gain audio amplifier.



Liberate your TV set from its fixed location. A home antenna system can make it possible for you to hookup a TV set in any one or every room. From bigger and better antennas on your roof down to the last line splitter, you will find well engineered equipment and suitable installation instructions. See page 38



A single tuning fork, a stopwatch and knowledge of tonal relationships can make you an expert organ tuner. Even if you don't intend to ever tune an organ, your appreciation for organ music discipline will be much enhanced. See page 52

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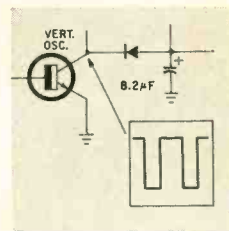
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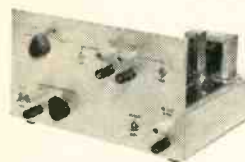
Get in on the new boom in sound. It's not what it used to be—new portable earsplitting equipment includes close-talking microphones, high-powered amplifiers and shatterproof speakers.

See page 46



Components closely knit to printed circuit boards resist separation without destruction. The finer the isolation of trouble, the less the destruction.

See page 36



Solid state stereo FM multiplex generator features audio preamplifiers with built-in pre-emphasis, 40 to 50 dB channel separation, hum and noise down 52 dB from reference output and simple construction. A printed circuit board is available.

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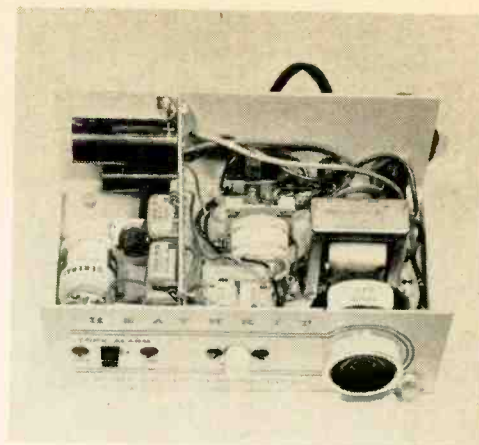
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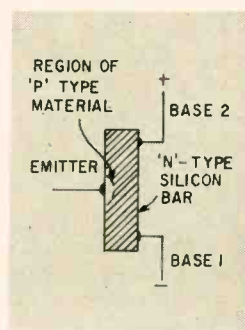
New way to protect life and property. Fire, smoke and other types of sensors can be made to trigger a transmitter which sends a pulsed signal into the house power line. One or more receivers can be used to pick up the signal and sound an alarm. It's fail-safe and in kit form.

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Take the guess work out of engine tune up and operation. Compare engine rpm with road speed... could be your transmission is slipping.

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Meet the unijunction transistor (UJT) and get to know how to make it work for you.

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- Do It Yourself Language Lab 86 Byron G. Wels
A cord that speaks

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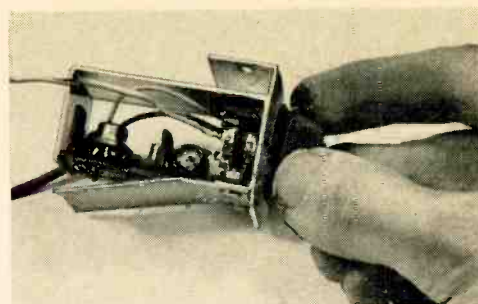
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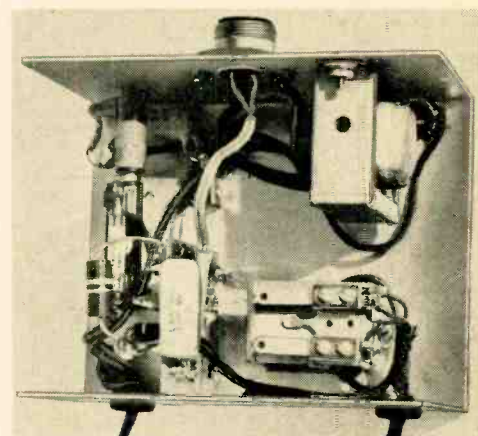
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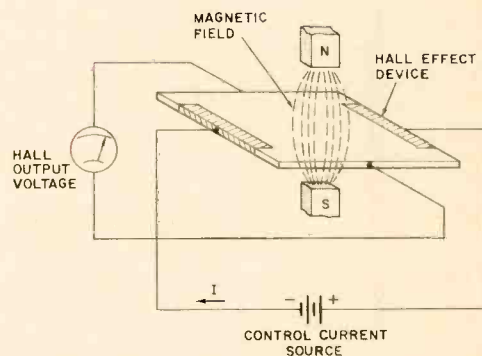
Now there's no need to reach for the windshield wiper knob every few seconds when driving through light mist or on slush-covered roads. You can set this Automatic Pause Controller to obtain any desired pause between sweeps, while the wiper still operates at normal speed.

See page 32



Power relays are useful in dozens of projects, but usually lack sensitivity because of heavy contacts. Find out how to soup-up relay sensitivity and trigger 30-amp jobs as little as 200 μ A.

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Hall-effect devices are growing in number as today's technology makes possible new uses for Hall's 19th-century discovery. Learn about this important principle, and its applications in science and industry.

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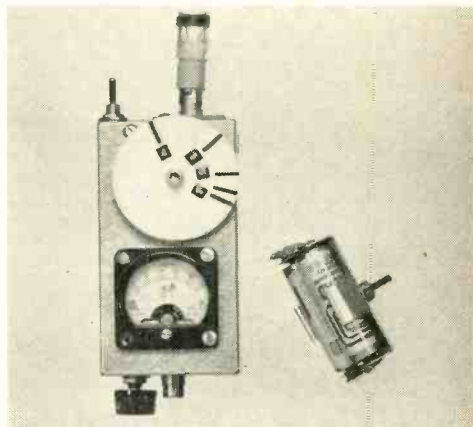
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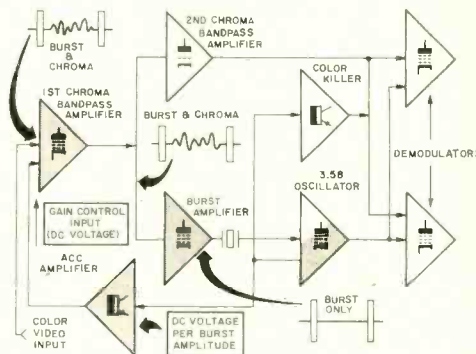
VHF receivers tune in police, fire, aircraft, marine, weather and other broadcasts. Get up to date on what's happening. Listen in on some of the 5-million 2-way radio listeners now licensed by the FCC.

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Grid dip meter uses a 1-transistor circuit to check resonant frequencies of tank circuits and to test the values of unknown coils or capacitors.

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17 detector diodes play an important part in the deflection systems of b-w and color TV receivers. Yet they often develop faults that can be hard to find. See how they work and learn how to spot the troubles they can cause.

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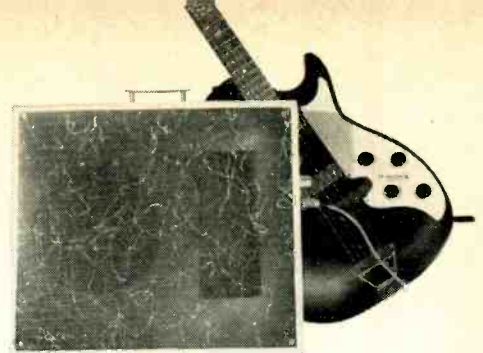
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IC music maker converts any guitar into an electronic guitar. Take a few hours and build a miniature amplifier for yourself. It's easy to build and fun to use indoors or out.

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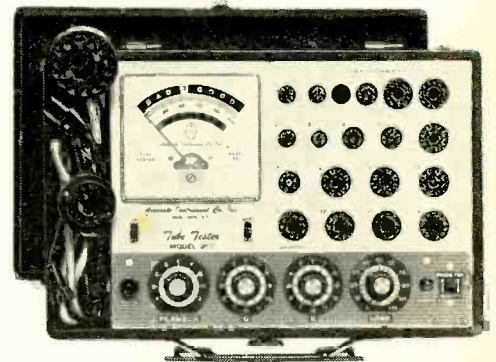
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Know what this is? It's the latest in blind-riveting tools. There are lots of other new tools around too. Find out what's new in hand and power tools.

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Getting started in TV repair? Then you've just got to know about the latest TV and radio test gear. We'd like to bring you up to date on what's available and what it can do.

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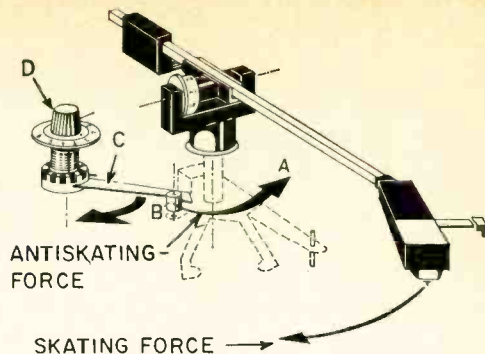
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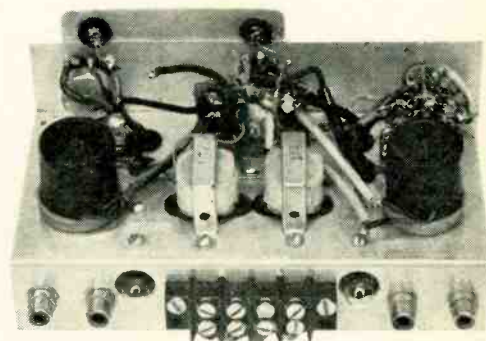
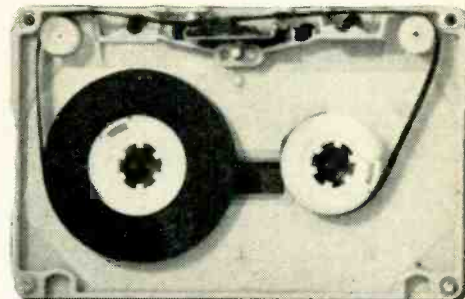
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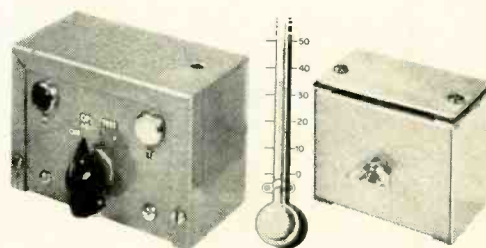
Record changers and cassette recorders. They may look the same, but what's under the hood has changed. Here's 13 pages of the latest happenings in Stereo & Tape Recorders.

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Do-it-yourself Compandor makes your records sound like you were sitting in the concert hall.

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Make winter driving safer this year. The Road Icing Alarm (above) tells you when roads may be icy.

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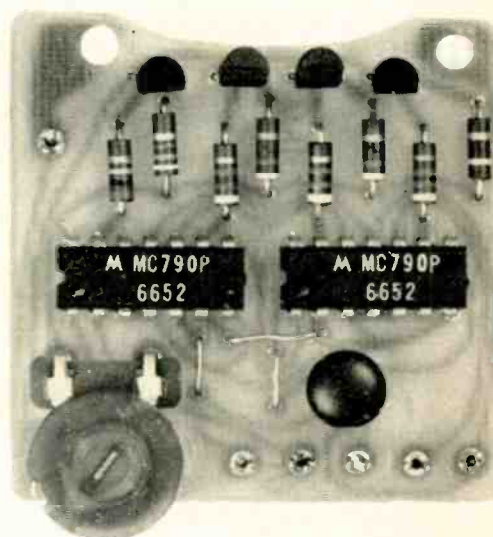


Build a 10-watt guitar amplifier. First of an exclusive eight-part R-E series. See page 40 for more projects to come.

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Decade counting module. A decimal readout that uses three IC's and costs only \$10.

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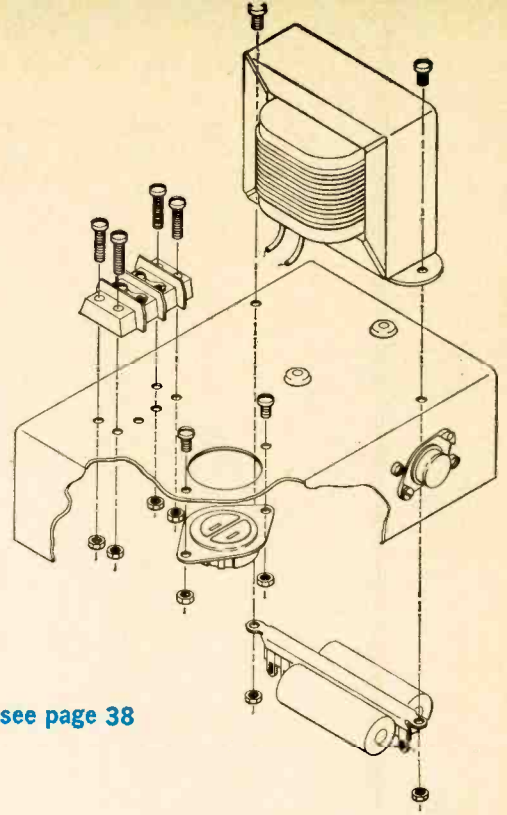
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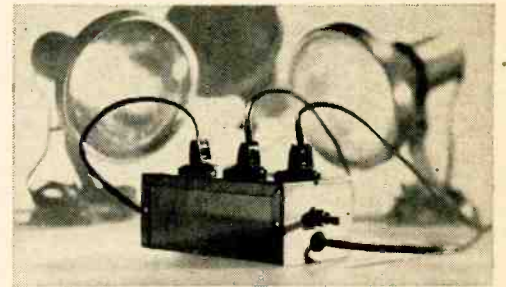
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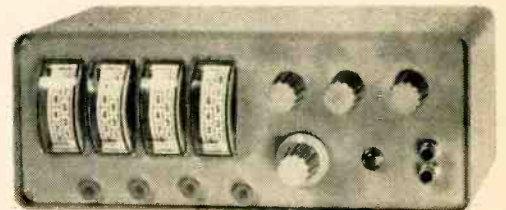
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Portable ac outlet delivers up to 50 watts. Just hook it up to a 12-volt battery. Simplified exploded diagrams make it easy to build.



Dancing lights this Christmas? It's a cinch with this tricky SCR circuit to automatically vary the intensity of outdoor lighting.

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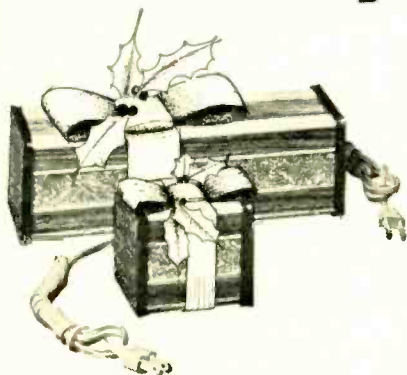
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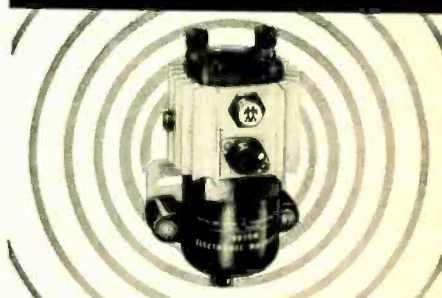
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Too Much Contrast, No Control

The picture in an RCA CTC31 got gradually darker; color, sound, etc. ok. Brightness control works, but contrast control doesn't seem to have much effect. Video peaking control has very little effect if any. Contrast control checks ok. Video output tube ok. Where is this?—H. T., Houston, Tex.

The contrast control here is a "variable degeneration" type, like so many of them. What it actually does is move a big electrolytic cathode-bypass capacitor up and down on the cathode resistor. If this capacitor opens, your picture will be "pale," and the control will have no effect.

However, you have the opposite effect; too much contrast. Note that this circuit actually has three branches: the contrast control itself; a small fixed peaking network, 270 ohms and 680 pF in series; and the video peaking network. I have a distinct feeling that something is shorted in here.

If the electrolytic were shorted, the control would still show some effect. Therefore, the short is most apt to be "at the top of the control" or

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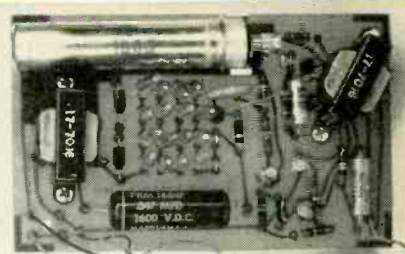
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X-Ray Detector is great for that final check before you button up the back of the TV. . . . see page 36



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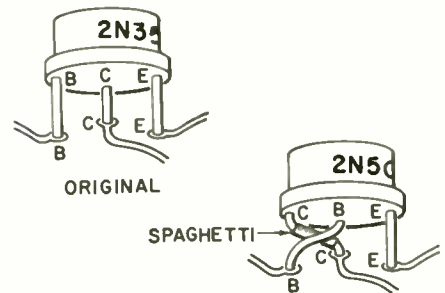
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Low-Cost audio generator is built around one IC, yet offers extremely low-distortion output. You'll want one for your bench. Get complete details. . . . see page 37



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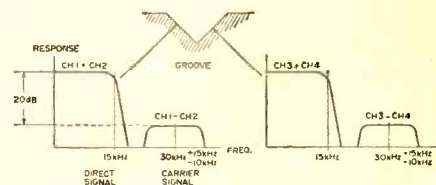
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ON THE COVER . . .

A four-channel stereo disc made by JVC is being played on Dual record changer. Across the lower right hand corner of the cover is a microphotograph of the 4-channel grooves. For more information on the cover and how the photographs were taken **see page 38.**



4-Channel Stereo is as new as today. Here's the lowdown on tape-disc-FM.

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Use Your Wattmeter when servicing appliances. It will save you a lot of time and effort. See how it can be done.

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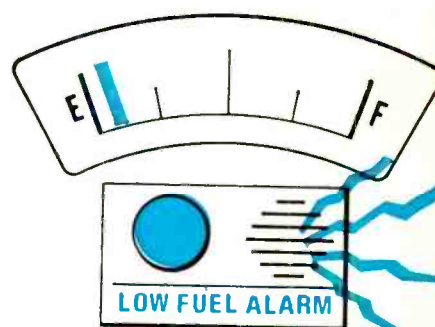
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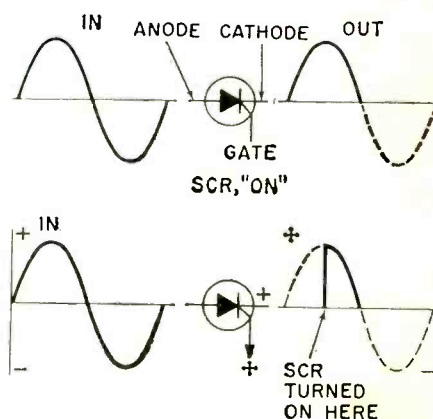


Stereo tape is ready for your car now, both cassettes and cartridges; two channels and four channels. Find out what's happening. **see page 41**

ALARM



Don't run out of gas. Build this low-fuel alarm and be warned, before the tank runs dry. **see page 44**



SCR's are vital to appliances. Jack Darr explains how they work in this month's Home Appliance Electronics column. **see page 26**

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Radio-Electronics

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May 1971 • Over 60 Years of Electronics Publishing

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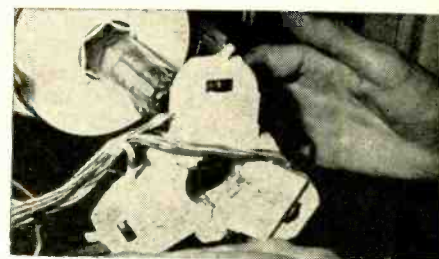
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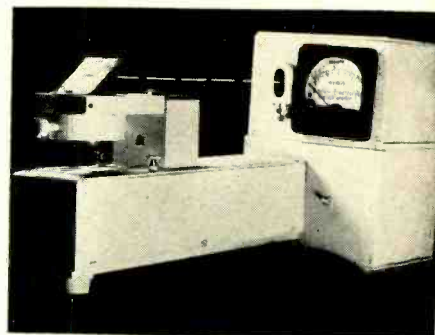
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Changing Color Pix Tubes can be easy. Just follow the steps in this article and you'll be able to do the job faster than ever before. . . . see page 33



Buying A PA System? Learn the key selection factors, and don't get trapped into buying too much or too little amplifier. . . . see page 45



Ideal Darkroom Project is what this densitometer is. Build it and use it, you'll get better prints from your enlarger every time. . . . see page 48

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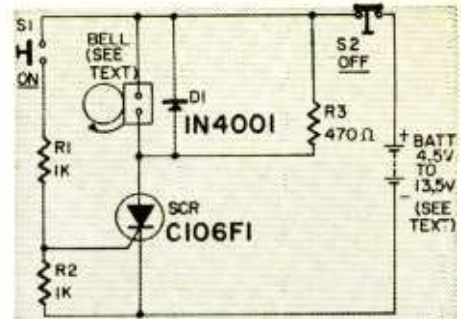
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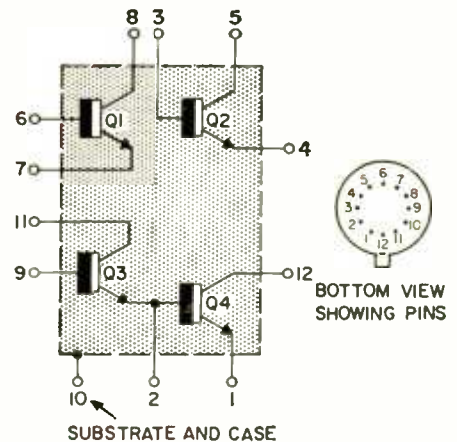
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Printed-circuit breadboard makes it a cinch to try these 24 burglar alarm circuits. We present the first eight in this issue. Get started today.

... see page 23



ICs are great. To find out what's inside those tiny "black boxes" and see what you can do with them don't miss this great feature.

... see page 58



This is Dolby. A simplified explanation tells how his noise reduction system works in tape recording and FM broadcasting.

... turn to page 38

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- More Burglar Alarm Circuits** **38** R. M. Marston
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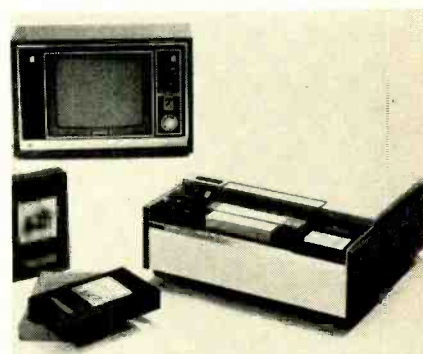
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Using the μA 723 in a regulated circuit
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- Easy Parts Storage** **80** D. J. Holiford

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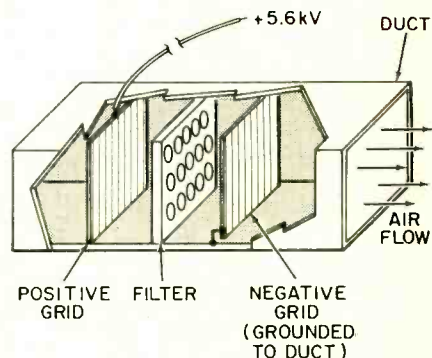
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Better sound can be yours by following the easy tips in this story on using tape cassettes effectively. . . . **see page 51**



New TV recorders cost less and have cartridge or cassette loading. Price must still come down. . . . **see page 13**



Appliance repairs got you stumped? This month we show how to handle electrostatic air cleaners. . . . **see page 32**

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Radio-Electronics

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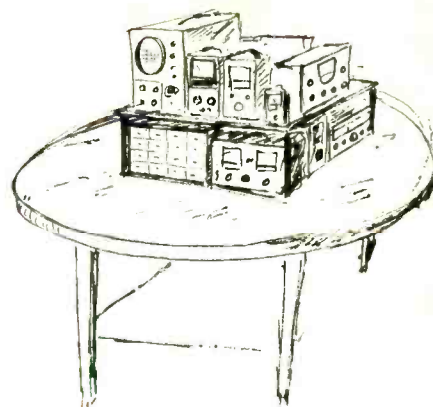
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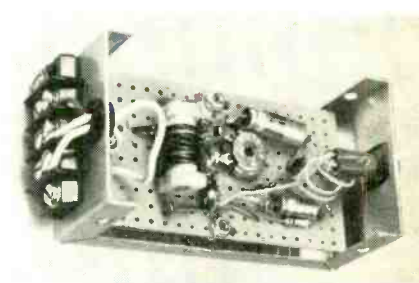
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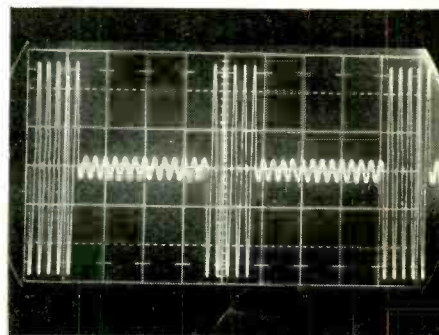
If you could build your ideal workbench what would it look like? Compare your choices with those of two popular authors.

... see technicians bench on page 36
... see experimenters bench on page 41



Tail-light monitor tells you when a brake light has failed to operate. It could keep you out of a nasty accident.

... see page 60



Know what a tone-burst generator is? See how they can be used to do all kinds of electronic troubleshooting.

... see page 32

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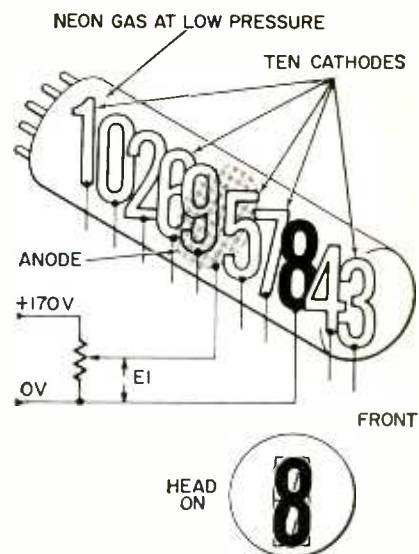
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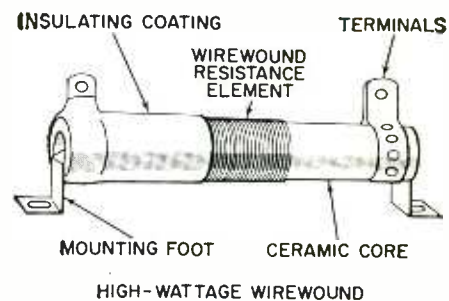
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Digital readouts are popping up all over the place. Here's a look at how they work and what they do. . . . see page 50



Resistors are vital to every electronic circuit. Review your knowledge and add some new facts. . . . see page 58



Dual-function generator is a modern instrument used to test and build digital circuits. It's easy to make your own. . . . see page 36

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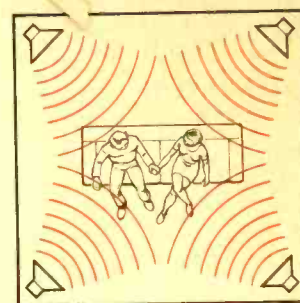
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4-channel sound is now. Find out what's been happening. Look at the equipment, the tapes, the records.

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4-channel amplifier uses four new power IC's. Build this new R-E circuit and find out what a hybrid IC amplifier can do.

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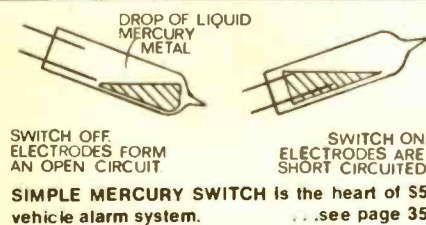
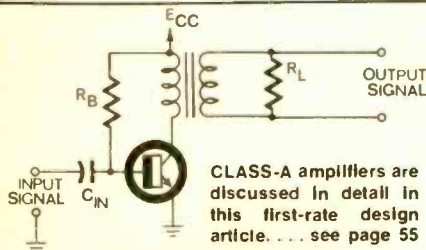
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November 1971

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GET BETTER SOUND from your component system. Try these record player hints and see what happens. ... see page 32

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FOR MEN WITH IDEAS IN ELECTRONICS

December 1971

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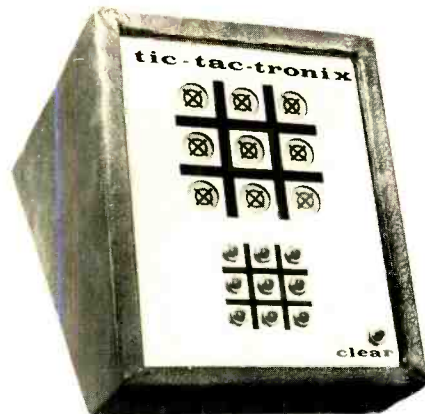
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TIC-TAC-TRONIX is a hard-wired game computer that is a champion tic-tac-toe player. In fact it can't be beat . . . we think. . . see page 32



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*—Construction article
†—Part of article
Ckt—Circuits
Cl—Service clinic
Corr—Correction
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R-E's substitution guide for replacement transistors

PART X

compiled by ROBERT & ELIZABETH SCOTT

ARCH—Indicates the Archer brand of semiconductors sold only by Radio Shack and Allied Radio stores. Allied Radio Shack, 2725 W. 7th St., Ft. Worth, Texas 76107

DM—D. M. Semiconductor Co., P.O. Box 131, Melrose, Mass. 02176

GE—General Electric Co., Tube Product Div., Owensboro, Ky. 42301

ICC—International Components, 10 Daniel Street, Farmingdale, N.Y. 11735

IR—International Rectifier, Semiconductor Div., 233 Kansas St., El Segundo, Calif. 90245

MAL—Mallory Distributor Products Co., 101 S. Parker, Indianapolis, Ind. 46201

MOT—Motorola Semiconductors, Box 2963, Phoenix, Ariz. 85036

RCA—RCA Electronic Components, Harrison, N.J. 07029

SPR—Sprague Products Co., 65 Marshall St., North Adams, Mass. 01247

SYL—Sylvania Electric Corp., 100 1st Ave., Waltham, Mass. 02154

ZEN—Zenith Sales Co., 5600 W. Jarvis Ave., Chicago, Ill. 60648

Radio-Electronics has done its utmost to insure that the listings in this directory are as accurate and reliable as possible; however, no responsibility is assumed by Radio-Electronics for its use. We have used the latest manufacturers material available to us and have asked each manufacturer covered in the listing to check its accuracy. Where we have been supplied with corrections, we have updated the listing to include them. The first part of this Guide appeared in March 1973.

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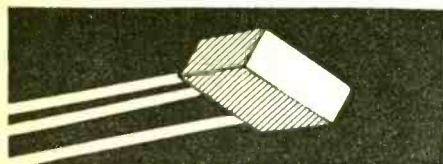
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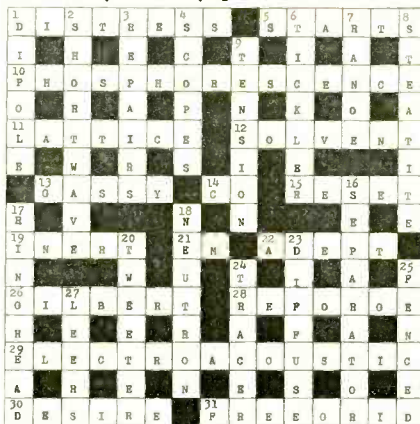
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NEXT MONTH

Communications is the special subject for January 1973. We've got articles on CB Circuits, New CB Gear, Short Wave Receivers, and CB Repairs. In addition there's a story on New Hi-Fi circuits and a construction article that tells how to build a meter for your electronic flash. Then too there are all the regular monthly features like Step-By-Step Troubleshooting, Service Clinic, Transistor Replacement Guide, and Appliance Clinic. You won't want to miss this one.

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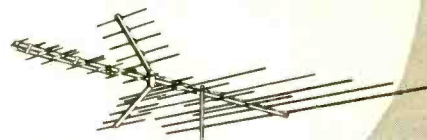


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Circle 77 on reader service card

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Anybody who's into electronics

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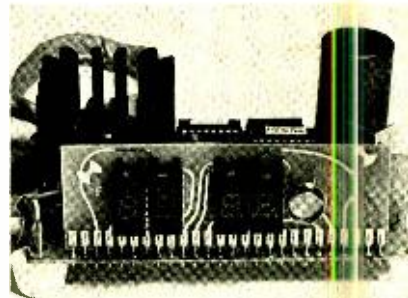
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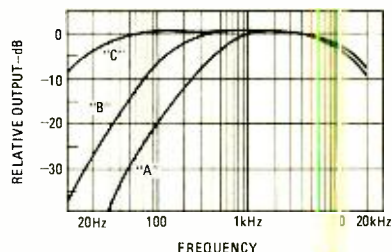
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ON THE COVER

Electronic music organs have been around for quite awhile, but portable organs are really unique. This one is completely self-contained with speaker, battery and keyboard, and it covers a five-octave range. The construction details start of page 31.



Spice up your car with this Digital LED Clock. The construction details start on page 35.



You can't compare noise specs for hi-fi gear unless you know how they are measured. An in-depth look at how noise measurements are made starts on page 49.

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- 45 **Antennas For 40-Channels**
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- 47 **Phase Lock Loop**
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- 50 **New FCC Rules**
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- 51 **Manufacturers of 40-Channel CB Transceivers**
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- 61 **Digital Car Clock**
It's easy to build and puts digital time in your car. **by Robert Arp**

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- 55 **Color TV '77**
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- 79 **Reader Questions**
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- 75 **Analog Multimeters**
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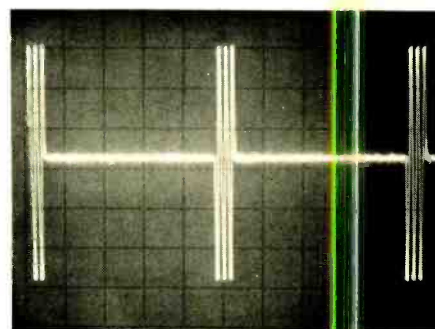
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How microcomputers make a decision. **by John Titus, David Larsen and Peter Rony**
- 100 **State of Solid State**
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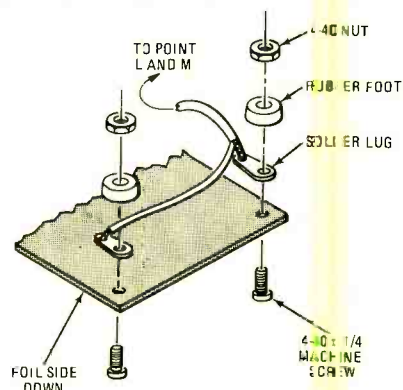
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ON THE COVER

40-channel CB went into effect January 1, 1977. Right now, all kinds of 40-channel gear is on sale. The 40-channel dial on our cover symbolizes this development. To bring you all the latest information we have produced the special 16-page section starting on page 39 of this issue.



THIS TEST SIGNAL was used to test a new concept in speaker design. Get the whole story. See story starting on page 64.



PITCH BENDER BOARD is important part of keyboard synthesizer. See page 58.

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Precise spatial effects are possible. Read about a new JVC system that makes it work. **by Len Feldman**
- 40 **Tomorrow's Hi-Fi Gear**
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- 43 **Get Rid of RFI**
It can really destroy hi-fi reproduction but can usually be cured. Discover what you can do to stop this kind of interference. **by Len Feldman**
- 47 **R-E Lab Tests Garrard GT-55**
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- 22 **Komputer Korner**
Stacking computer data. **by Tim Barry**
- 52 **Auto Search Finds the Cassette Program**
New circuit looks for and looks on to the music passage you want to hear. **by Karl Savon**
- 80 **State-Of-Solid State**
Music generating and synthesizing IC's. **by Karl Savon**

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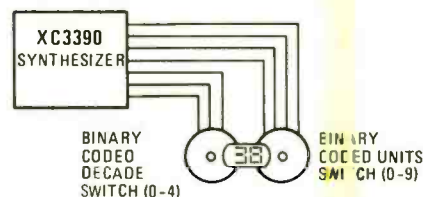
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ON THE COVER

That's Len Feldman sitting in JVC's special biphonic chair. If you want to know what he is hearing, see our special story starting on page 40.



PLL FREQUENCY SYNTHESIZERS are hot. Here's how BCD switches deliver binary signals to the synthesizer IC..... see page 58



INFRARED SIGNALS link these headphones to the amplifier. For the story behind them and other new equipmentsee story on page 40

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BUILD ONE OF THESE

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Part I. NMOS processor on a single PC board does some nifty things. **by Jeff Roloff**
- 36 **Experiments With IC Function Generator**
Part I. Practical circuits you can build using versatile XR-2206 IC. **by R.M. Marston**
- 39 **Build Teleswitch For Your Phone**
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How a microprocessor addresses an I/O device. **by Peter Rony, David Larsen, and John Titus**
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How they work in CB gear. **by Robert F. Scott**

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Compression/Expansion for better hi-fi. **by Len Feldman**
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- 70 **Install A Tower**
How to get your antenna to where the signal is. **by Jerry Schwartz**
- 77 **Jack Darr's Service Clinic**
High-voltage hold down.
- 79 **Clinic Questions**
R-E's service editor solves technician problems.

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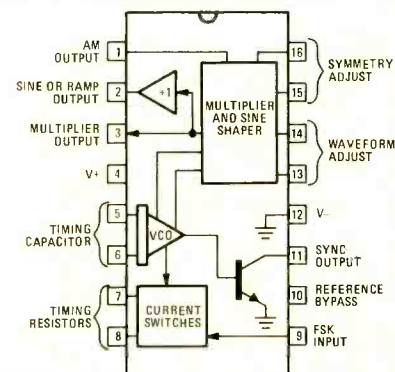
- 4 **Looking Ahead**
Tomorrow's news today. **by David Lachenbruch**
- 58 **IC Data Sheet-Reticon SAD-1024**
How to use the Reticon analog delay.

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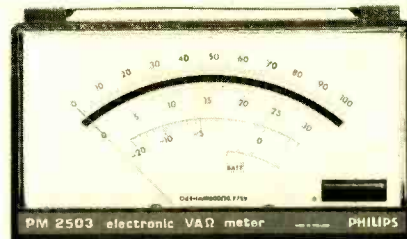
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ON THE COVER

A 2650-based microcomputer with impressive features. Built on a single PC board, the microcomputer contains RAM, ROM, video and cassette interface. Add a power supply, keyboard and video monitor for a complete working system. Get started in the microcomputer revolution today. Construction details starts on page 31 of this issue.



VERSATILE XR-2206 FUNCTION GENERATOR is put through its paces in practical circuits you can build. Story starts on page 36.



SELECTING THE RIGHT MULTIMETER for servicing is important. Tips start on page 57.

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It's a programmable frequency divider.
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- 45 **Build A 2650 Microcomputer**
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by Jeff Roloff
- 60 **Make This Speaker Phone Yourself**
Easy project offers hands-off phone use.
by Jules Gilder
- 66 **Experiments With IC Function Generators**
Part III: More circuits using the XR-2206.
by R.M. Marston
- 70 **Boost Performance With This CB Preamp**
Simple solid-state unit plugs between your
CB antenna and rig. Enhances receiver performance.
by George Sante

ON THE COVER

Programmable divider provides a wide range of frequency division by using three cascaded 555-timer IC stages. The divisor is selected by three 10-turn potentiometers and indicated by an LED readout. Complete story starts on page 37 of this issue.

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Microcomputer interfacing and internal registers within the 8080 chip.
by David Larsen, Jon Titus, and Peter Rony
- 30 **VIZ Pulse Generator (Equipment Report)**
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- 77 **New Radio Rules**
Special report tells how WARC '79 can affect you.
by Stanly Leinwoll

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Shure equalization analyzer speeds setup of graphic equalizers for overall flat response.
by Len Feldman
- 56 **R-E Lab Tests Nikko Integrated Amplifier.**
Nikko TRM-750 rated "excellent" in overall sound quality.
- 58 **R-E Lab Tests Heath Preamp**
Heath AP-1615 earns a "very good" in our lab.



THIS KEYBOARD CONTROLS channel selection and programs a new TV set to automatically switch channels for you. It's an important part of Heath's programmer system. For full details turn to page 49.

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Automatic circuitry changes channels for you. Digital program readout on the screen. Discover how it works.
by Art Kleiman
- 81 **Jack Darr's Service Clinic**
How does your service shop rate? by Jack Darr
- 87 **Reader Questions**
Radio-Electronics Service Editor helps solve reader problems.

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6IX GREAT PROJECTS

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Infinitune uses pink-noise sources to produce pink-noise music.
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It works like a conventional clock but doesn't have hands and does have digital circuitry. by Terry A. Walters
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Works with dial phone. Automatically redials numbers and stores frequently-used numbers. by Dick Finwell
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Display 4-channel signals on your single-trace scope. by Stephen Dunifer
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- 54 **CB Noise Limiters**
A look at how these automatic circuits work. by Robert F. Scott

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"Excellent" is the rating the Sony EL-5 earned.
- 59 **R-E Lab Tests Integrated Stereo**
Amplifier. Sherwood HP-2000 checks out "Very Good".
- 65 **Solving the dB Mystery**
Don't misunderstand dB notations used in hi-fi specifications.
by Len Feldman

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- 68 **Jack Darr's Service Clinic**
Quick response voltage regulator.
by Jack Darr

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ON THE COVER

Four of the six projects in this issue are shown on this month's cover. In addition to those illustrated, you will want to see the Quad Scope Adapter and Build A Computer stories. See the listing at the left for page numbers.



AUTOMATIC NOISE LIMITERS are used extensively in CB transceivers. This story tells how they work. . . . turn to page 54



VOLTMETER WITH dB SCALE referenced to 0.775 volt. See **Solving The dB Mystery** for more data. . . . turn to page 65

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THE MAGAZINE FOR NEW IDEAS IN ELECTRONICS

Electronics publishers since 1908

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Connect it to your set for a digital readout of the time.
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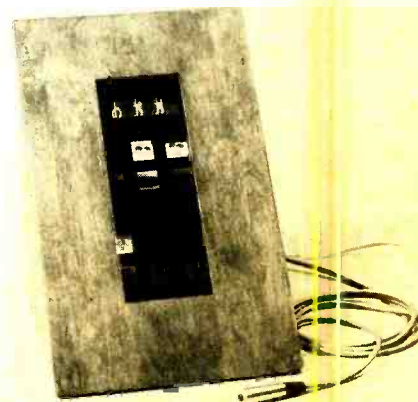
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ON THE COVER

Another great construction project from **Radio-Electronics**. This one updates your TV set with an on-screen digital readout of the time. The clock is built around a character generator from National Semiconductor that provides you with a choice of either a 4- or 6-digit readout of the time. Get started today; turn to page 35.



ELECTRONIC SLOT MACHINE you'll want to build. Digital readout of the score plus realistic odds makes this a great addition to your game room. Construction details start on page 39.

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- 36 **10-Function Digital Clock**
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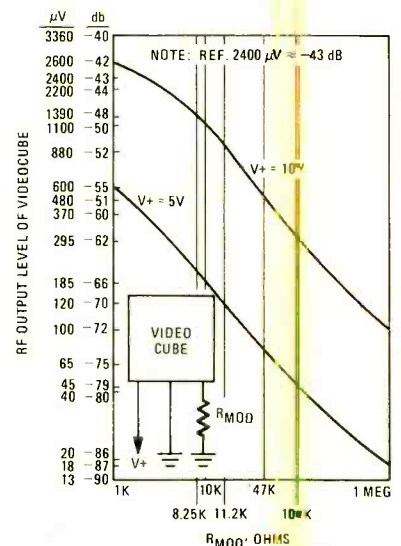
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ON THE COVER

Two major new computer systems are now available to the hobbyist. Teamed with a video terminal and a tape reader/punch/duplicator we photographed them for this month's cover. For full details see the complete story starting on page 43.



VIDEOCUBE INTERFACES video to RF antenna inputs of TV set. One resistor sets RF output level.

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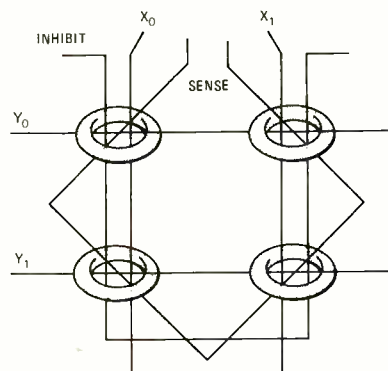
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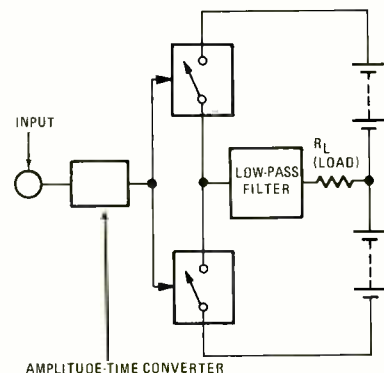
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ON THE COVER

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CORE MEMORIES ARE GREAT for the computer hobbyist if he understands how they work. . . . see page 54



PULSE-WIDTH MODULATION amplifier looks like this. To find out how it works see page 59

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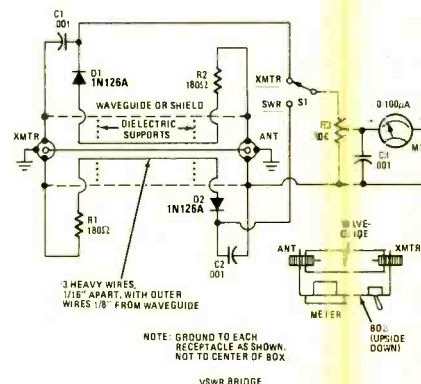
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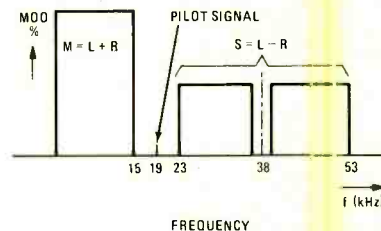
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Special music effects just your style? Then try building the Phlanger—it's a honey of an effect generator, and you use it with your hi-fi system. Complete details start in this issue on page 42.



SWR BRIDGE is only one of 3 inexpensive CB test meters. ... **see page 40**



THIS IS A PROPER FM signal. A misaligned FM tuner will destroy it. Restore the good sound by realignment. ... **see page 53**

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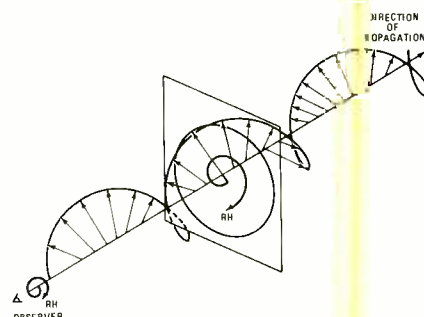
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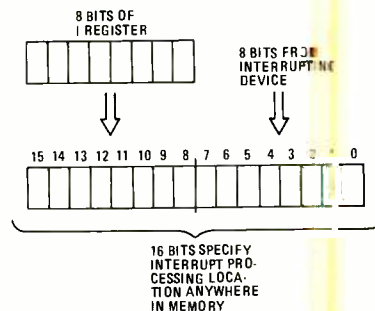
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ON THE COVER

Biorhythm clock keeps you up to date on good versus bad days. Three-color digital read-out tells at a glance where you are in your Physical, Intellectual and Sensitivity cycles. For full details on how to build your own turn to page 33.



RIGHT-HAND POLARIZED TV signal can bring better TV reception in US. For the whole story turn to page 38 now.



INTERRUPT PAGE MONITOR is one aspect of the Z-80 microprocessor. For more data on the Z-80 see Computer Corner on page 78

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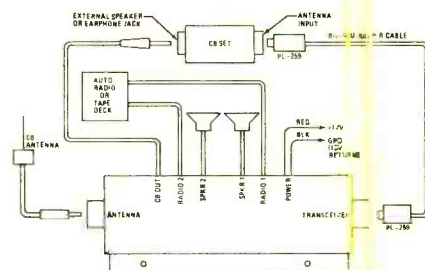
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*The editors and staff
of Radio-Electronics
join in sending
holiday greetings and
our best wishes for
a happy new year*



CB SWITCHER lets you listen to music between CB calls . . . automatically. Complete construction details start on page 40.

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Finding a replacement power transformer.
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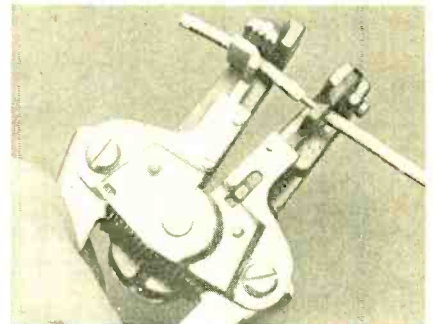
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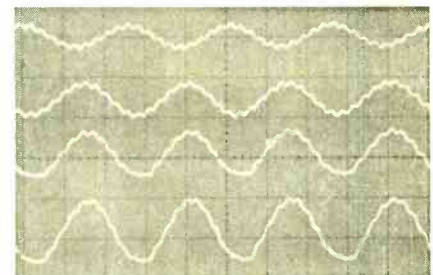
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ON THE COVER

Sitting atop the stereo receiver is this month's featured construction project. It provides a digital readout of the frequency that the receiver is tuned to. Works with AM/FM receivers; and, when not displaying frequency, it's a digital clock. For complete details on how to build your own, turn to page 21.



HANDY TOOLS AND GADGETS for the hobbyist, experimenter and service technician that will make life a little easier and will give your work that professional look. Story starts on page 33.



HOW TO TEST PHONO CARTRIDGES yourself by using readily available test records. The waveforms shown are recorded on a test record to test for IM distortion. For the whole story, turn to page 51.

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Electronics publishers since 1908

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Measures from 0-30 MPH. Discrete LED readout. NiCad battery power supply. **by Robert Beaber**
- 41 **Programmable Drums**
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- 45 **Mainframe Roundup**
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- 72 **Z-80 Computer Corner**
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- 68 **Sherlock Holmes And The Missing Transistor Clues**
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- 70 **Hobby Corner**
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- 74 **State of Solid State**
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- 84 **Service Questions**
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ON THE COVER

We've combined an Apple II hobby computer, an RCA Videotape machine and an RCA 19-inch color TV to put this month's cover together. We used the VTR to record the many different color displays the Apple produced. For more info on hobby computers turn to page 45. If it's the VTR you want to know about turn to page 52.



JOIN THE MASTER SUPER SLEUTH as he untangles a baffling web of clues and fixes the mysterious Oriental amplifier. Turn to page 68.



COMPUTER MAINFRAMES. For a look at who's offering what, turn to page 45.

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61. Servicing Synthesizers
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- 35 **Portable Frequency Counter**
Palm-sized 30 MHz counter with a 4-digit LED display that delivers 6-digit resolution. by Gary McClellan
40 **Digital Multimeter**
Start by building a 3½-digit panel meter; add a few shunts and range switches, and end up with a digital multimeter.
by Dr. E. H. Borneman and Robert Benward
45 **Programmable Drums—Part II**
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- 68 **Z-80 Computer Corner**
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How to make a decade counter IC count by some number other than 10. by Fred Blechman

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Vertical OTL (Output Transformerless) output stages. by Jack Darr
81 **Service Questions**
R-E's Service Editor solves reader problems.

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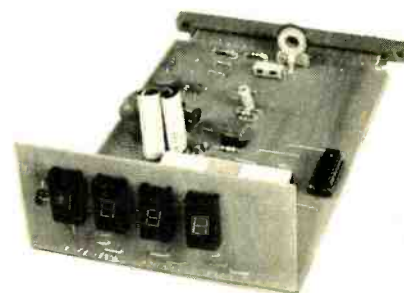
- 24 **Motorola HEP Educator II Microcomputer kit.**
26 **Tenna PS69RD Mindblower stereo speaker/amplifier for your car**
32 **Sabtronics 2000 Digital Multimeter**
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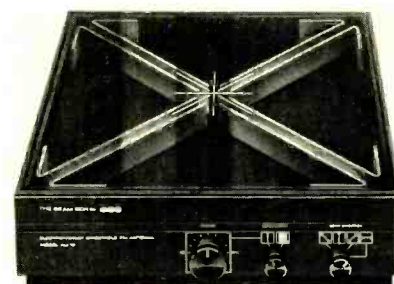
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ON THE COVER

This month's feature construction project is a hand-held portable frequency counter. The unit measures to 30 MHz with a 90 mV sensitivity. The readout is a 4-digit LED display that provides 6-digit resolution. A must for any workbench. The complete construction details start on page 35.



A BASIC DIGITAL PANEL METER. Turn to page 40 to see how to build this and then turn it into a complete digital multimeter.



B.I.C.'s MODEL FM-10 BEAM BOX indoor FM antenna. R-E's Hi-Fi Lab puts it through its paces. For a complete report, turn to page 66.

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APRIL 1978 Vol. 49 No. 4

BUILD ONE OF THESE

- 37 **Digital Tachometer For Car Or Boat**
2-digit LED display. Works with 2- or 4-cycle; 4-, 6- or 8-cylinder engines.
- 46 **Tuner Frequency Display**
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JUST FOR EXPERIMENTERS

- 67 **Modifying Electronics Hardware**
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- 82 **Hobby Corner**
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- 45 **All About The S-100 Bus**
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- 51 **S-100 Directory**
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- 80 **Z-80 Computer Corner**
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- 74 **XR-2208 Operational Multiplier**
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- 52 **New RIAA Equalization For Records**
Delivers more dynamic range, requires preamp changes you can do yourself.
- 59 **R-E Lab Tests Toshiba ST-910 FM Tuner**
It gets a "Perfect" for dial tuning accuracy.
- 61 **R-E Lab Tests U.S. Pioneer RT-707 Tape Deck**
It earns a "Superb" for 3 1/4-IPS wow and flutter.

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- 40 **Unusual Digital Clocks**
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- 63 **Selecting DMM's**
What to look for when buying a digital multimeter. Get the most for your money.
- 72 **All About Audio Oscillators**
Everything you ever wanted to know about this valuable piece of test equipment.
- 79 **VTR Update**
Latest data on video tape recorders. Updates our February 1978 report.
- 84 **State Of Solid State**
Delta modulation IC decodes and encodes.

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- 86 **Jack Darr's Service Clinic**
Troubleshooting horizontal sweep circuits.
- 87 **Service Questions**
Jack Darr solves technician problems.

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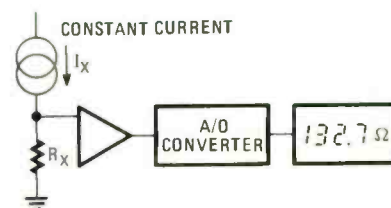
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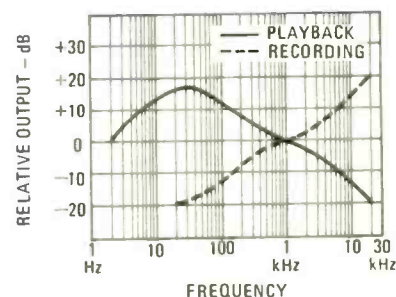
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ON THE COVER

Ever see electronic clocks with digital readouts equipped with pendulums and tick-tock sound and chimes? We did! And here's a story on how they operate. It's an exploration into interesting circuitry you may not have seen before. The story starts on page 40.



OHMS CONVERTER IS A VITAL section of a digital multimeter. It's only one of many items to be considered when selecting a unit. For full selection data turn to page 63.



NEW RIAA EQUALIZATION CURVES. Note the rolloff in playback response in the low-frequency region. For full details turn to page 52.

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Electronics publishers since 1908

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- 37 **Graphic Equalizer For Your Stereo System**
12-band-per-channel unit is a cinch to build and custom tailors your hi-fi system to your listening room.
- 41 **Automatic Telephone Dialer**
Preprogrammed dialer gets your number. Can be used with burglar alarm to give prerecorded messages.

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- 82 **Computer Corner**
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- 51 **Unusual Digital Clocks**
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- 56 **Hobby Corner**
Part II: All about breadboards and breadboarding
- 84 **State of Solid State**
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- 65 **R-E Lab Tests Rotel-803 Receiver**
Overall FM performance rated "Excellent".
- 67 **R-E Lab Tests Garrard MRM-101 Phono Preamp**
Noise suppressing unit removes objectionable clicks and pops.

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ON THE COVER

That's a 12-band graphic equalizer you can build for your stereo system. It's just about everything a graphic equalizer should be plus it's fun to build. Check it out. Turn to page 37 now.

FIRST QUARTER



LORD THROUGH THIS HOUR,
BE THOU OUR GUIDE
SO, BY THY POWER
NO FOOT SHALL SLIDE.

HALF HOUR



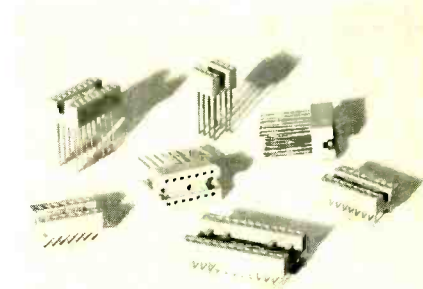
THREE QUARTERS



FULL CHIME



THIS MELODY IS PLAYED by some of the electronic clocks described in this issue. You'll find more details on page 51.



IF YOU ARE PROTOTYPING you'll need sockets like these plus a lot of other hardware. Find out what's available and where you can get it. Turn to page 57.

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- 78 LED Bar Graph
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It's easier to install and costs less to run. The circuitry is what makes it run.
- 96 Service Clinic
Write it down—it's a dollar saver.
- 98 Service Questions
R-E's Service Editor solves reader problems.

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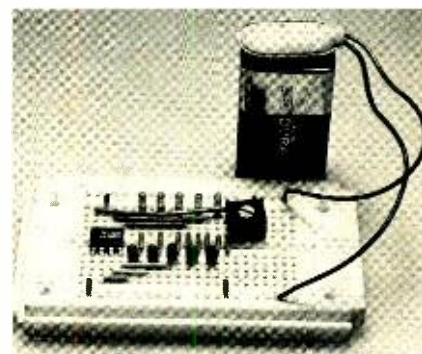
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ON THE COVER

When you want to keep track of long-distance phone charges, the first thing you need is a record of how long you've been talking. Digi-Toll does just that. It also reminds you, with a bright red digital readout right at your phone, of how long you've been talking. See construction details starting on page 69.



LED BAR GRAPH is a nifty substitute for an analog meter . . . and it's easy to read. Turn to page 78



CABINETS FOR PROJECTS helps answer that problem question of "What cabinet should I use?". Five pages of listing start on page 73.

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- 72 **State-Of-Solid-State**
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Highly accurate timer has a range of from 0.1 second to 99 minutes and 99 seconds
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- 57 **Digital Hi-Fi Recording**
A new way to increase signal-to-noise ratio and dynamic range in audio recordings

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- 54 **CET Test**
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- 76 **Service Clinic**
Troubleshooting faulty high-voltage shutdown
- 77 **Service Questions**
R-E's Service Editor solves technician problems

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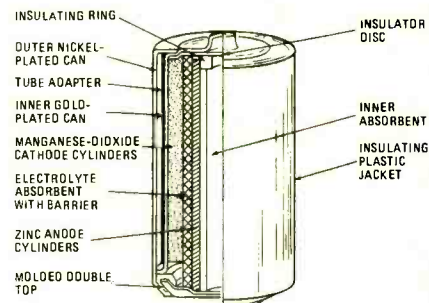
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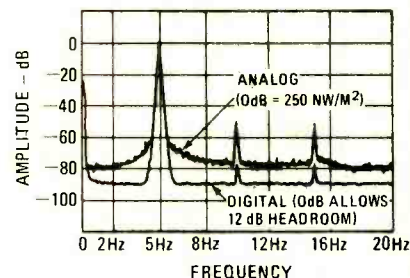
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ON THE COVER

Unique darkroom timer counts down in either seconds or minutes and seconds. Precise digital readout and audible pulses too. See page 33.



TYPICAL ZINC-CARBON CELL is one of the three basic disposable cells described in this story. Turn to page 44.



SPECTRAL PURITY of analog recorder vs digital recorder. For complete details on recording sound as a digital signal, turn to page 57.

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Radio-Electronics®

THE MAGAZINE FOR NEW IDEAS IN ELECTRONICS

Electronics publishers since 1908

AUGUST 1978 Vol. 49 No. 8

SPECIAL FEATURES

- 38 **Video Modulator Roundup**
A look at the many different units currently available, their circuitry, their specs, and what we think of them.
- 47 **Using RF Generators**
The easy way to troubleshoot stereo systems.

BUILD ONE OF THESE

- 29 **Digital Thermometer Add-On For Your DMM**
Connect it to your digital multimeter and read temperature in °C or °F. An extremely accurate yet easy-to build unit.
- 33 **Digital Darkroom Timer**
Part II: Final construction and adjustment procedures get this unit ready for your darkroom.

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- 3 **Looking Ahead**
Tomorrow's news today.
- 56 **Reducing TV Interference**
Use the right test equipment and it's easy to prevent unwanted interference from CB transceivers.
- 66 **Hobby Corner**
Build an inexpensive expanded-scale voltmeter to monitor AC line voltage.
- 72 **State-Of-Solid-State**
Temperature transducer and precision voltage reference all in one IC.

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- 42 **R-E Lab Tests Revox FM Tuner**
B-760 Stereo tuner earns a "Very Good" for overall FM performance.
- 44 **R-E Lab Tests Shure V15 Type IV**
New stereo cartridge rates a "Superb."

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- 32 **Investment Evaluation Program**
Lets you determine if your investment earned more for you than a savings account.
- 64 **Computer Corner**
Intel 8253—a programmable interval timer.

TELEVISION

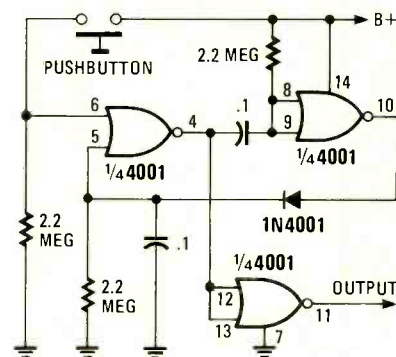
- 24 **Equipment Report**
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- 74 **Jack Darr's Service Clinic**
Pulse-width modulated DC power supplies and how to troubleshoot them.

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ON THE COVER

Sitting on a background of video modulators is a digital thermometer add-on for a digital multimeter. It's a highly accurate instrument that reads out in both °C and °F at the flip of a switch. Story starts on page 29.



SIMPLE TEST CIRCUIT is used to set up your new digital darkroom timer. For details on how to build the timer turn to page 33.



NEW PHONO CARTRIDGE plays stereo discs so well that it earns a "Superb" from our test lab. For all the details turn to page 44.

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Electronics publishers since 1908

SEPTEMBER 1978 Vol. 49 No. 9

BUILD ONE OF THESE

- 37 **Digital Capacitance Meter**
4-digit LED readout gives direct reading of all capacitor values from 1 pF to 9999 μ F
- 41 **Flue Bug**
Energy saver warns you that the fireplace flue is open after the fire has gone out.

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- 60 **Antique Radios**
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- 76 **Hobby Corner**
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- 55 **R-E Lab Tests Leader LAS-5500 Audio Analyzer**

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- 58 **CET Test**
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- 63 **Special Report on TV Troubleshooting**
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 - 64 Modern Generators Make It Easy
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- 80 **Jack Darr's Service Clinic**
Low-voltage regulators and how to handle them.
- 80 **Service Questions**
R-E's Service Editor solves reader problems.

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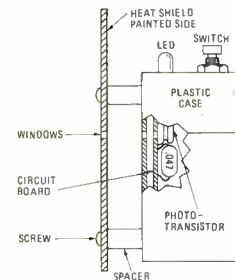
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ON THE COVER

A low-cost build-it-yourself capacitance meter you'll want on your bench. Get all the details. Turn to page 37 now.



Final Assembly of Flue-Bug. Spend a few dollars and save a bundle. Story starts on page 41.



ATV Research Pixe-Plexer. One of many video modulators reviewed in this issue. Turn to page 47.

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OCTOBER 1978 Vol. 49 No. 10

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Everything you ever needed to know before you buy your next FM tuner.
- 56 **FM Tuner Directory**
Listing of FM tuners and their specifications makes buying a new one an easier choice.
- 63 **R-E Lab Tests SME Pickup Arm**
"Supurb" sound quality is the rating for this \$294 arm.
- 64 **R-E Lab Tests Marantz 2265B Receiver**
Overall sound quality rates an "Excellent"

BUILD ONE OF THESE

- 37 **Function Generator For Your Bench**
Sine, square and triangle waves from 2 to 200,000 Hz. A project that's fun to build and easy to complete.
- 41 **Electronic Security Alarm**
Easy-to-build system features both open- and closed-loop wiring—uses COSMOS IC's.
- 67 **Digital Frequency Probe**
It looks like a fat ball point pen, but it's really a self-contained digital frequency meter. You'll want one for your shirt pocket.
- 74 **Modules For Experimenters**
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- 60 **Videotape Recorders**
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- 80 **Hobby Corner**
How to keep IC projects tiny.
- 82 **State-Of-Solid State**
A look at IC peak-detectors and how they work.

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- 84 **Jack Darr's Service Clinic**
Cutoff problems are often overlooked when troubleshooting a chassis.
- 84 **Service Questions**
R-E's Service Editor solves reader problems.

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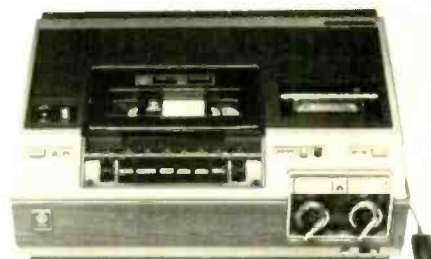
- 26 **EICO Model 242 FET-TVOM**
- 32 **McKay Dymek Model DR22 Communications Receiver**

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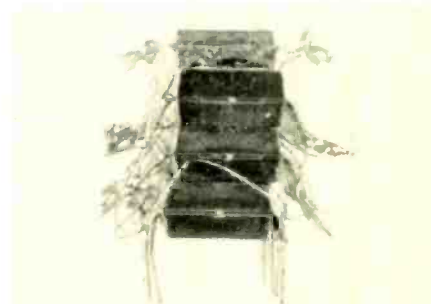
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ON THE COVER

Compact function generator has a place on every readers bench. It delivers sine, square and triangle waves with minimal distortion. Build your unit from the details in this issue. The article starts on page 37.



VIDEOCASSETTE RECORDERS ARE IN. This Q & A story answers typical user questions about this exciting new consumer electronics product. For all the answers, fast-forward to page 62



KEEP IC PROJECTS SMALL. It's easy to do once you know the basics. This month's Hobby Corner tells all. Turn to page 80 now.

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NOVEMBER 1978 Vol. 49 No. 11

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- 52 **Tank!**
A dedicated TV battle game. Use your cannon to destroy your opponent, but watch out for the land mines.
- 60 **Automatic Wiper Delay**
Digital system for your car provides intermittent windshield wiper operation and is programmed automatically.
- 64 **2 to 200,000-Hz Function Generator**
Part 2: Build it around the latest state-of-the-art waveform generator IC.
- 67 **Digital Capacitance Meter**
Part 2: 4-digit display reads out between 1 pF and 9999 μ F.
- 71 **Frequency Counter In A Probe**
Part 2: Self-contained in a probe this 6-digit counter makes a worthwhile project.

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A look at typical faults, troubleshooting techniques, and test equipment to speed the job.
- 45 **Digital Logic Charts**
4-pages of tear-out reference sheets that are chock full of logic circuit information.
- 77 **Circuit Ideas**
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- 82 **Computer Corner**
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- 37 **New! All-In-One Speakerphone**
Standard phone and speakerphone in a single compact ultra-modern package. Here's the circuitry and how it works.
- 80 **Hobby Corner**
Where to get parts, substituting parts and wiring prototype projects.

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Metal-particle tape for audio recording provides increased output level, reduced distortion, added high-frequency response and improved signal-to-noise ratio.

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- 84 **Jack Darr's Service Clinic**
Locating replacement parts for orphan sets.
- 84 **Service Questions**
R-E's Service Editor solves reader problems.

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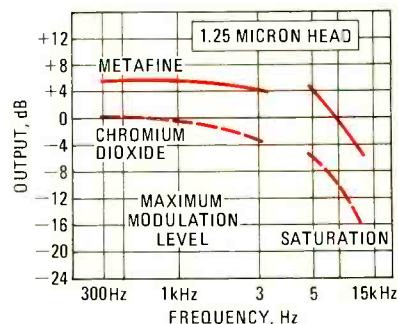
- 26 **Data Precision Model 1350 Digital Multimeter**
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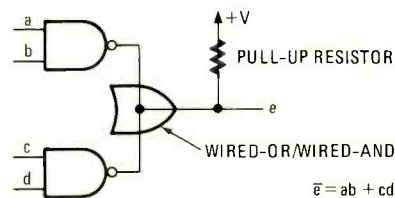
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ON THE COVER

That brick wall is made up of a large number of very special telephones. Take a look at the circuitry and how it works. Just turn to page 37.



NEW METAL-PARTICLE TAPE promises higher output levels with lower distortion. Story starts on page 49 and presents full details.



WIRED-OR/WIRED-AND is just one kind of digital circuit covered in digital troubleshooting story on page 41.

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DECEMBER 1978 Vol. 49 No. 12

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A guide to interfacing and controlling solar energy panels.
- 38 **Time-Compensated Speaker System**
State-of-the-art design you can build yourself for true hi-fi sound.
- 45 **NOM Card For The 1802**
Number crunching math board for 1802-based microcomputers speeds execution time and saves memory.
- 67 **Remote Telephone Ear**
Lets you monitor the sounds in your home from a remote location.
- 74 **Tank**
Part II: Final details of this dedicated TV battle game.

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- 43 **Making PROM's Work For You**
New applications make digital circuits simpler.
- 56 **Designing Hobby Computer Power Supplies**
How to design and add a power supply for your S-100 mainframe.
- 63 **Digital Circuit Design**
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- 78 **Computer Corner**
Software required to control an 8-channel analog signal monitor.

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- 52 **R-E Lab Tests Lectrotech Peak Power Indicator**
A new add-on for your hi-fi.
- 53 **Dynamic Headroom**
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- 60 **Hi-Fi Speaker Cables**
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- 80 **Jack Darr's Service Clinic**
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- 81 **Service Questions**
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- 14 **Radar Speed Traps, Detectors, etc.**
Editorial
- 76 **Hobby Corner**
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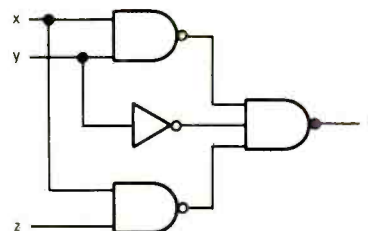
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SEASON'S GREETINGS

*The editors and staff
of Radio-Electronics
join in sending
holiday greetings and
our best wishes for
a happy new year*



$$a = xy + xz + y$$

DESIGNING DIGITAL CIRCUITS from scratch.
The step-by-step approach starts on page 63.

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JANUARY 1979 Vol. 50 No. 1

BUILD ONE OF THESE

- 35 **Audio Test Station**
5 in 1 instrument is a must for any audio bench.
- 39 **600-MHz Frequency Counter**
At less than 17-cents a megahertz, this instrument is worth its weight in gold.
- 44 **TV Motorcycle Game**
General Instruments chip makes this game work.
- 58 **NOM Card For the 1802**
Part 2: Add-on math board. Final instructions for construction and use.

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- 62 **Hobby Corner**
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A great deck gets a "Superb" from our lab.
- 56 **R-E Lab Tests Pioneer TVX-9500 TV Audio Tuner**
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- 64 **Computer Corner**
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Don't jump to conclusions.
- 66 **Service Questions**
R-E's Service Editor solves technician problems.

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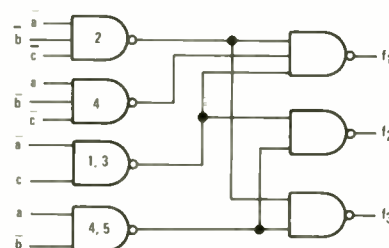
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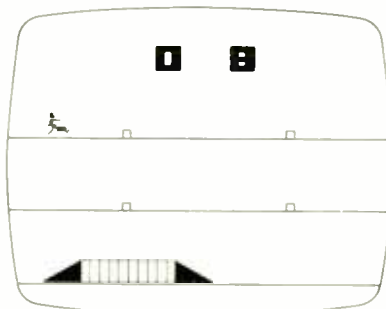
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ON THE COVER

Harvey Sound's midtown Manhattan store provides the backdrop for a complete audio test bench in a single instrument. It combines a digital AC multimeter, digital frequency counter, two sine/square/triangle wave generators and a pulse generator. It's "the" instrument for audio testing. Turn to page 35 for all the details.



SIMPLIFIED LOGIC CIRCUIT is just one type of circuit design covered in this article. Turn to page 47.



RACE MOTORCYCLES across your TV screen. New TV game built around General Instruments chip makes it work. Story starts on page 44.

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FEBRUARY 1979 Vol. 50 No. 2

BUILD ONE OF THESE

- 37 **Pro Quality String Synthesizer**
Latest Innovation in electronic music synthesizers is easy to build yet gives the soloist and small groups the background needed to enhance the performance.
- 42 **Solar Tracking System**
Electronic servo system swivels the solar collector panel so it follows the sun.
- 45 **Audio Test Station**
Part 2: Not an easy project. This all-in-one unit combines several important test instruments. Build it a section at a time.

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- 49 **Cases & Cabinets for Everyone**
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- 53 **PC/Wire Wrap—New Construction Technique**
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- 68 **You Can Be A CET**
Another quiz to help you get ready to take the NESDA/ISCET CET test.

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- 63 **Troubleshooting Communications Receivers**
The right signal generator plus good diagnostic ability and precise bench techniques lead to rapid 2-way radio repairs.
- 65 **FM Detector and Filter Tests**
Proper operation of FM detectors is vital to reliable operation of 2-way radio gear. Here's how they work and how to keep them working.

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- 56 **New IHF Amplifier Specifications**
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- 59 **R.E.A.L. Audio Tests Yamaha CR-420 AM/FM Receiver**
Earns a "Very Good" for overall sound quality.
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Rates an "Excellent" for overall sound quality.

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Learn solid-state circuitry as you complete your monophonic music maker.
- 76 **Computer Corner**
8085—A look at two memory IC's that are among the 8085 family of devices.
- 80 **Jack Darr's Service Clinic**
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- 81 **Service Questions**
R-E's Service Editor solves technician problems.

EQUIPMENT REPORTS

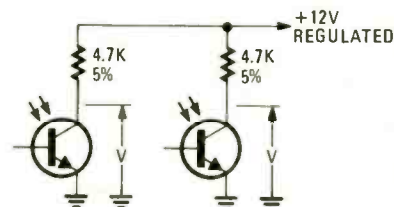
- 24 **A.P. Products Powerace 103 Breadboard & Power Supply**
- 26 **Simpson 462 Digital Multimeter**
- 32 **C.W. Moser 6502 Editor Assembler**
- 34 **Hustler MOT Monitor Antenna**

DEPARTMENTS

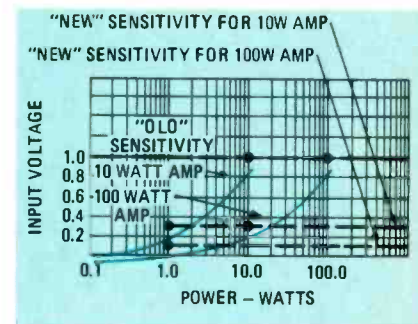
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ON THE COVER

It looks like an electronic organ, but it isn't. It is a string synthesizer. Plunk the keys and play a banjo, or guitar, or piano, or. . . Build one for yourself. Construction details start on page 37.



PHOTOTRANSISTOR SENSORS for the heart of this solar tracking device that follows the sun. Use it with your solar energy collection system. Complete details start on page 42.



NEW IHF SENSITIVITY RATING specifies the input voltage required to produce a 1-watt output. Story starts on page 56.

Radio-Electronics, Published monthly by Gernsback Publications, Inc., 200 Park Avenue South, New York, NY 10003. Phone: 212-777-6400. Second-class postage paid at New York, NY and additional mailing offices. One-year subscription rate: U.S.A. and U.S. possessions, \$9.98, Canada, \$12.98. Other countries, \$14.98. Single copies \$1.25. © 1979 by Gernsback Publications, Inc. All rights reserved. Printed in U.S.A.

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THE MAGAZINE FOR NEW IDEAS IN ELECTRONICS
Electronics publishers since 1908

MARCH 1979 Vol. 50 No. 3

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- 47 "Your Own Computer"
- 48 Introduction to Personal Computers
- 53 How Computer Printers Work
- 57 All About Floppys
- 60 CRT Terminals For Home Computers
- 63 Roundup Of Floppys—Manufacturers & Specs
- 66 Roundup Of Printers—Manufacturers & Specs
- 70 Roundup Of CRT Terminals—Manufacturers & Specs

GENERAL ELECTRONICS

- 4 Looking Ahead
Tomorrow's news today.
- 14 What's Your Application
An Editorial challenge to our Readers
- 41 LCD DMM's Are Here (cover story)
Low price, high precision DMM's threaten to obsolete older equipment. See what makes them so good and so simple.
- 44 Application Note
Combination of LED bar graph and IC driver couple with our Editorial challenge—what can you design around these items?
- 94 Hobby Corner
Four different ways to make prototype printed-circuit boards.

BUILD ONE OF THESE

- 71 String Synthesizer
Part 2: Complete the project with these foil patterns, instructions and setup data.
- 76 Audio Test Station
Part 3: This issue we cover the pulse generator, sweep shaper and audio sweep generator.

STEREO HI-FI PRO-SOUND

- 84 New Cassette Deck for Metal Particle Tape
A look at the first in this new family of high-performance equipment. It comes from Tandberg.
- 87 R.E.A.L. Sound Lab Tests Lafayette LR-120DB Stereo Receiver
"Excellent" rating earned for overall sound quality.

TELEVISION

- 98 Jack Darr's Service Clinic
Switching supplies are tricky, but you have to know how to handle them.
- 100 Service Questions
R-E's Service Editor solves technician problems.

EQUIPMENT REPORTS

- 24 Krohn-Hite Model 1200 Sweep Generator
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| 121 Market Center | 118 | Stereo Products |

ON THE COVER

Liquid crystal digital multimeters appear to be the wave of tomorrow. They are inexpensive, highly accurate, offer multiple ranges and are readily available. In this issue we examine the circuitry and IC that have made this possible. For more info see the story starting on page 41.



PERSONAL COMPUTERS are the first two words out of the mouths of electronics activists these days. If you want to learn why they think computers first, our "Your Own Computer" Special Section that starts on page 47 is must reading.

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APRIL 1979 Vol. 50 No. 4

SPECIAL FEATURE

- 37 **Videodisc Is Here!**
2 systems—they are not compatible. See how they work.

VCR SERVICING

- 57 **Forest Belt Tells What You Need To Know About VCR's**
58 **What Will You Do About VCR's?**
59 **VCR Tools & Instruments**
62 **Servicing VCR's—A Fundamental Approach**
64 **Where To Learn**

BUILD ONE OF THESE

- 40 **Intrusion Protection System**
Stop burglars fast—as soon as they enter.
44 **Motion Detector**
Light-sensing IC spots nearby movement.
48 **Three Special Projects For April 1.**
1- One-Station Intercom. 2- Solar-Powered Night Light. 3- Single-Shot Logic Indicator With Memory.

GENERAL ELECTRONICS

- 4 **Looking Ahead**
Tomorrow's news today.
66 **Troubleshooting Communications Receivers**
How to use the test gear needed for this job.
70 **Hobby Corner**
Identifying unmarked transformers.

STEREO HI-FI PRO SOUND

- 50 **Magnetic Field Amplifier—A New Technology in Sound**
It can't be true, but it is; and it works. We tell how.
53 **R.E.A.L. Sound Lab Tests Nikko Preamp & Amplifier**
Nikko Beta II Preamp/Alpha II Power Amp earns a "Very Good."
55 **R.E.A.L. Sound Lab Tests Realistic SCT-30 Cassette Deck**
"Excellent" is the overall sound quality rating from our lab.

TELEVISION

- 47 **How Comb Filters Work**
The way it's used by Magnavox.
76 **Jack Darr's Service Clinic**
Tuners that use solid-state bandswitches.
78 **Service Questions**
R-E's Service Editor solves technician problems.

EQUIPMENT REPORTS

- 26 **Lab Science Model VLA-1000 Logic Analyzer**
34 **Data Precision Model 248 DMM**
35 **Apple Computer ROM Card**

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ON THE COVER

Videodisc by Magnavox. The background is the MCA optical videodisc itself. The player is superimposed. At the top right you can see it in action. At the bottom the disc is being inserted. For more information on this system as well as the RCA system turn to page 37.

(Cover photos supplied by Magnavox)



THIS IS ONE OF THREE marvelous construction projects specially designed just for April 1, 1979. The one shown here is a one-station intercom. For full construction details along with two more turn now to page 48.

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MAY 1979 Vol. 50 No. 5

BUILD ONE OF THESE

- 35 **Time/Voltage Calibrator**
Provides the time and voltage references that you must have to calibrate your digital test equipment.
- 40 **Bowling Game**
Electronic game that simulates rolling that ball down the alley. Requires some mechanical construction.
- 59 **Audio Test Station**
Part 4—The voltmeter and digital frequency meters are described.

GENERAL ELECTRONICS

- 4 **Looking Ahead**
Tomorrow's news—today.
- 6 **What's News**
Pictures and briefs of news highlights.
- 44 **What's New in Rechargeable Batteries**
NiCad, Alkaline . . . and now Lithium.
- 86 **Computer Corner**
Direct memory access—What it is and how it's used.
- 94 **State of Solid State**
The mysterious I^2L logic process revealed.

HI-FI STEREO PRO-SOUND

- 47 **Buyers Guide to Hi-Fi Amplifiers**
- 48 **How to Select the Best Amplifier**
- 53 **Front-Panel Controls and Features**
- 55 **Amplifier Specifications Roundup**

RADIO

- 64 **Troubleshooting CB Receivers**
Basic circuits and suitable test equipment.
- 68 **Communications Corner**
New monthly column devoted to developments in CB, SWL, UHF, VHF, and amateur radio.
- 80 **Hobby Corner**
BFO for shortwave receivers helps clarify reception.

TELEVISION

- 98 **Jack Darr's Service Clinic**
Fast recovery diodes and DC power supplies.
- 98 **Service Questions**
R-E's Service Editor solves technician problems.

EQUIPMENT REPORTS

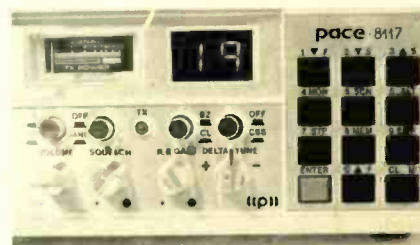
- 24 **Heath H17 Floppy Disc System**
- 26 **Sylvania Module Extension Cable Kits**
- 32 **Microproducts Apple II Assembler/Editor**

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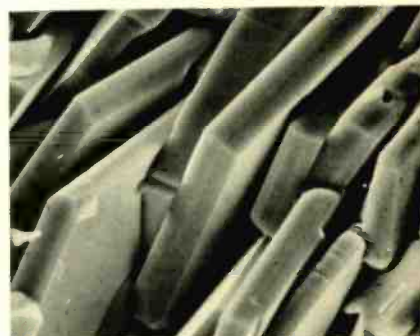
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ON THE COVER

A Time/Voltage Calibrator is a must if you have digital test equipment. It's the only way available to most of us to keep our test gear calibrated. Learn how to build your own calibrator. Story starts on page 35.



PACE 8117 is a computerized CB transceiver. For more data see our new Communications Corner on page 68.



TITANIUM DISULFIDE COMPOUND is used in new Exxon rechargeable lithium battery. Read the whole story starting on page 44.

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JUNE 1979 Vol. 50 No. 6

SPECIAL FEATURE

- 41 **What's New in Car Stereo**
There's real hi-fi gear available—right down to graphic equalizers. Here's a complete update on everything new.
by Fred Petras

BUILD ONE

- 35 **Programmable Thermostat Minimizes Fuel Bills**
Controls up to 4 different temperature levels each day. Turns on furnace or air conditioner as needed. Provides optimum comfort and maximum energy savings.
by Peter Gise
- 59 **Time/Voltage Calibrator**
Part 2: Wind up your unit. Final assembly details.
by Doug Farrar
- 62 **Telecorder for Your Phone**
Inexpensive way to connect a tape recorder to your telephone line.
by Jules Gilder
- Audio Test Station**
This story does not appear in this issue. It will continue next month.

AUDIO

- 47 **All About TIM Distortion**
How we measure this previously unknown type of IM distortion.
by Len Feldman
- 54 **R.E.A.L. Sound Lab Tests Scott 530-T Tuner**
AM/FM stereo tuner earns an "Excellent."
- 56 **R.E.A.L. Sound Lab Tests JVC JR-S501 Receiver**
AM/FM stereo receiver earns a "Very Good."

VIDEO

- 50 **Videodisc—Look at the Circuitry**
The laser and its circuits.
by Larry Steckler
- 76 **Jack Darr's Service Clinic**
How the automatic brightness limiter works and how to troubleshoot it.
by Jack Darr
- 78 **Service Questions**
R-E's Service Editor solves technician problems.

TECHNOLOGY

- 4 **Looking Ahead**
Tomorrow's news today.
by David Lachenbruch
- 64 **Switching Power Supplies**
You should know how these supplies work. They offer greater efficiency and lower power loss in series-pass transistors than more conventional supplies.
by L. Steven Cheairs
- 70 **Hobby Corner**
A look at Zener diodes.
by Earl "Doc" Savage, K4SDS
- 72 **Communications Corner**
News about UHF, VHF, CB and more.
by Herb Friedman

EQUIPMENT

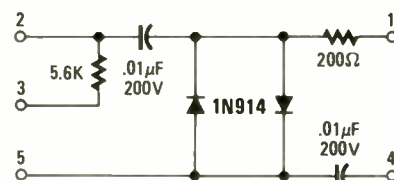
- 23 **Sabtronics 2010A 3 and 1/2 Digit DMM**
- 24 **Ohio Scientific Superboard II Computer**
- 25 **Continental Specialties Max 50 Frequency Counter**
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- 33 **VIZ DC Power Supplies**

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ON THE COVER

Intelligent Thermostat can save you big fuel dollars. It not only adjusts the temperature several times a day, but it also sets it at different levels on different days of the week. Interested? Read all about it starting on page 35.



INTERFACE DEVICE provides matching and isolation between telephone and Telecorder. Want to build Telecorder? Story starts on page 62.



VIDEODISC PLAYER uses LASER to scan the disc. We tell how the laser circuits work. Turn to page 50.

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JULY 1979 Vol. 50 No. 7

BUILD ONE

- 35 **Heart Rate Monitor**
Provides a direct readout of your pulse rate in beats-per-minute.
by Mark C. Worley
- 42 **Digital Thermometer**
With a 3½-digit LED display this device measures temperature in Celsius and Fahrenheit to 0.1 degree resolution.
By Bill Owen
- 54 **Audio Test Station**
Concluding article provides the step-by-step calibration procedures.
by Ray Davison

VIDEO

- 39 **Videodisc—A Look At The Circuitry**
Part 2—What's inside the new videodisc players
by Larry Steckler
- 74 **Service Clinic**
Intermittents can cause strange symptoms
by Jack Darr
- 74 **Service Questions**
R-E's Service Editor solves technician problems.

AUDIO

- 47 **DC Amplifiers**
New audio amplifier circuitry provides ultra-wide frequency response.
by Len Feldman
- 50 **R.E.A.L Sound Lab Tests Yamaha CR-2040 Receiver**
Top-of-the-line receiver rates excellent

TECHNOLOGY

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Tomorrow's news today
by Dave Lachenbruch
- 58 **Make Your Own PC Boards**
A look at the tools and techniques.
by James Temple
- 61 **Switching Power Supplies**
How to design your own
by L. Steven Cheairs
- 64 **Secret Weapon Against Tough Dogs**
Temperature measurement helps localize faults
by Henk Onstee and Stu Rauch
- 66 **Hobby Corner**
Modification for digital clocks provide long delay alarm.
by Earl "Doc" Savage, K4SDS
- 68 **State-Of-Solid-State**
New A/D converter fast enough to digitize video signals
by Karl Savon

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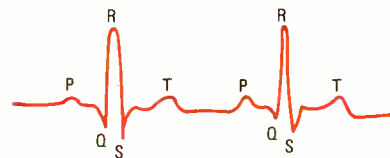
- 24 **Graymark Model 540 Binary Clock**
- 25 **BSR System X10 AC Remote Control**
- 26 **RCA COSMAC Evaluation Kit**

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ON THE COVER

Using an infrared sensor that clips to your finger, this Heart Rate Monitor provides a direct readout of your pulse rate in beats-per-minute. It also "beeps" to provide an audible indication. Sounds interesting? Read about it starting on page 35.



HEART WAVEFORM is detected by Heart Rate Monitor circuit to provide a direct readout in beats-per-minute. To see how it works, turn to page 35.



COMPLEX WAVEFORMS are needed to compare the performance of DC amplifiers. To find out why, turn to page 47.

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AUGUST 1979 Vol. 50 No. 8

BUILD ONE

- 37 **4½-Digit Precision DMM**
Lab grade instrument with true-RMS and temperature.
by Bill Owen
- 43 **Adaptive Noise Filter**
Add-on for your hi-fi system reduces noise by 14-dB.
by Tim Skormond and Gene Garrison
- 53 **AC Polarity Checker**
Don't get zapped! Simple device checks AC outlet sockets for correct polarity and ground connections.
by William D. Kraengel, Jr.

VIDEO

- 47 **Home TV Reception Via Satellite**
The TV satellite network—broadcasts and frequencies.
by Robert Cooper
- 50 **TV Add-On Gadgets—Do They Really Work?**
A look at ghost eliminators, interference filters, etc., and their effectiveness.
by Robert B. Grove
- 72 **Service Clinic**
Don't forget the filter capacitors.
by Jack Darr
- 72 **Service Questions**
R-E's Service Editor solves technician problems.

AUDIO

- 57 **New FM Tuner Circuits**
A look at the circuitry behind the super performance and features of today's FM tuners.
by Len Feldman
- 60 **R.E.A.L. Sound Lab Tests Sony STR-V7 Receiver**
Sony's most powerful receiver.
- 63 **R.E.A.L. Sound Lab Tests dbx Model 2BX Expander**
2 band expander increases dynamic range.

TECHNOLOGY

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Tomorrow's news today.
by Dave Lachenbruch
- 54 **Wiring Systems For Projects**
A look at the different ways you can wire your projects.
by Earl "Doc" Savage, K4SDS
- 66 **Hobby Corner**
How to modify an alarm clock for multiple alarms.
by Earl "Doc" Savage, K4SDS
- 68 **Communications Corner**
Are computerized CB's really computerized?
by Herb Freidman
- 70 **Computer Corner**
A look at the 8085 and how it compares to the 8080.
by P. Rony, C. Titus, D. Larsen and J. Titus

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- 24 **PTS Model 8001 Component Analyzer**
- 26 **Apple Disk II Floppy Disc System**
- 33 **Realistic Model DX-300 Receiver**

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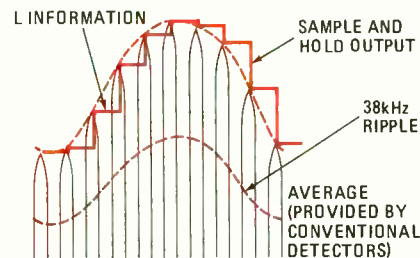
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ON THE COVER

Precision 4½-digit DMM has lab-grade performance and features, including true-RMS and temperature measurement. Basic DC accuracy is better than .05%. Internal rechargeable nickel-cadmium battery pack provides portability. Sounds interesting? Construction details start on page 37.



SATELLITE RECEIVING ANTENNA being mounted on posts in authors' backyard. To find out what's being broadcast and the frequencies, turn to page 47.



SAMPLE-AND-HOLD STEREO DECODING circuit is just one of the new circuits manufacturers are using for increased FM tuner performance. To find out what the circuits look like and how they work, turn to page 57.

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SEPTEMBER 1979 Vol. 50 No. 9

BUILD ONE

- Cover Story**
43 Polytonic Percussion Synthesizer
 Easy-to-build modular system simulates congas, bongos, wood blocks and timpani. **James J. Barbarello**
- 54 Adaptive Noise Filter**
 Part 2: Dynamic variable-cutoff low-pass filter removes the snap, crackle and pop from records and tapes.
Tim Skormond & Gene Garrison

VIDEO

- 47 Home Reception Via Satellite**
 What's up there that you might want to watch. As many as 40 channels of more television than you've ever seen before.
Robert B. Cooper, Jr.
- 63 VCR Video Signal Processing**
 How the video is handled by VHS and Betamax VCR's. **Forest Belt**
- 83 Service Clinic**
 Those pesky electrolytics. **Jack Darr**
- 83 Service Questions**
 R-E's Service Editor solves reader problems.

AUDIO

- 57 Antistatic Record Care**
 Spray treatment stops static electricity problems permanently.
Len Feldman
- 60 R.E.A.L. Sound Lab Tests Setton Receiver**
 Model RS-660 Stereo receiver earns an "Excellent." **Len Feldman**

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 Application note tells how to build one. **Fairchild Semiconductor**
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 The programmable calculator—an important tool.
Earl R. "Doc" Savage, K4SDS
- 80 Communications Corner**
 Electronic amplification for weak signals is feasible.
Herb Friedman

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ON THE COVER

Fascinating percussion synthesizer simulates a variety of percussion instruments. Modular accessories make it even more valuable. Circuits are straightforward....construction is easy....equipment is inexpensive. Full details begin on page 43.



Commercial satellite TV receiving station uses huge dish and supersensitive receiver, but you can build your own. Story starts on page 47.



Build this adaptive noise filter to remove the snap, crackle and pop from your records and tapes.

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Radio-Electronics®

THE MAGAZINE FOR NEW IDEAS IN ELECTRONICS

Electronics publishers since 1908 OCTOBER 1979 Vol. 50 No. 10



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- 39 50TH ANNIVERSARY ISSUE**
32 pages lead you through a memorable look at the past 50 years and the next 50 years.

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ON THE COVER

The photograph shows the front cover of the first issue of **Radio-Craft** (which eventually changed its name to **Radio-Electronics**). That first issue was printed in 1929 and to celebrate this occasion, we've put together a memorable look at those 50 years. The voyage starts on page 39.



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THE MAGAZINE FOR NEW IDEAS IN ELECTRONICS

Electronics publishers since 1908

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- 43 **TRS-80 Breadboard Interface**
Let's you safely interface almost any prototype circuit to the TRS-80.
Jon Titus, Chris Titus, David Larsen
- 53 **Music On Hold**
It's easy to provide music to telephone callers while they wait.
Jules Gilder

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- 48 **Telephone Dialer Roundup**
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Fred Blechman
- 67 **Desoldering—The Methods and Equipment**
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- 70 **How to Protect Op-Amps**
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- 77 **Hobby Corner**
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- 82 **Jack Darr's Service Clinic**
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- 83 **Service Questions**
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- 54 **Tune Up Your Tape Recorder**
How to set the bias for optimum recording performance.
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- 62 **R.E.A.L. Sound Lab Tests McIntosh Amplifier**
Model MC-502 power amplifier earns an "Excellent." Len Feldman
- 65 **R.E.A.L. Sound Lab Onkyo Tuner**
Model T-4090 AM/FM Tuner rates an "Excellent." Len Feldman

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- 84 **Communications Corner**
Receivers are getting more complex, but are doing more.
Herb Friedman

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- 26 **Antler B12 CB Base Antenna**
- 32 **Zemco Model 44 Compucruise Car Travel Computer**

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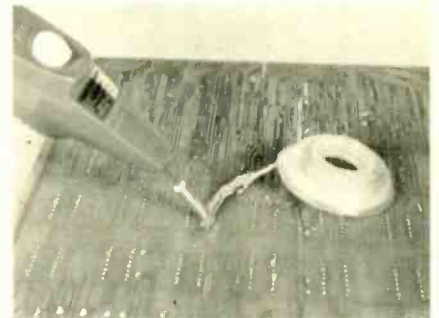
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ON THE COVER

This is one of the most exciting computer projects we've seen. It will enable you to interface almost any prototype circuit to a TRS-80 computer. Modified, it can probably do the same job for any other computer system. If you've got a computer, this story is must reading. If you don't own a computer, read this article first.....story starts on page 43



TELEPHONE DIALER Roundup. Some even come equipped with a calculator and clock. Story starts on page 48.



JUST ONE OF THE MANY desoldering techniques illustrated in this issue. To see the other approaches you should know about, turn to page 67

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SEASONS GREETINGS
From All Of Us At
RADIO-ELECTRONICS

DECEMBER 1979 Vol. 50 No. 12

BUILD

- 47 **PERCUSSION SYNTHESIZER ACCESSORIES**
Add a snare synthesizer and sequencer to expand your music system. **James Barbarello**
- 51 **TRS-80 BREADBOARD**
Part 2: Interfaces the TRS-80 with all the circuits that are used when designing or prototyping.
Jon Titus, Chris Titus, David Larsen
- 55 **SUPER AUDIO AMPLIFIER**
Bridge-type power-output configuration lets you use inexpensive transistors to provide a wide frequency response and a 100 dB signal-to-noise ratio.
Dan Talbot

TECHNOLOGY

- 5 **LOOKING AHEAD**
Tomorrow's news today.
David Lachenbruch
- 43 **TELEPHONE DIALER ROUNDUP**
Part 2: A look at the equipment and how it works.
Fred Blechman
- 64 **CUSTOMIZE YOUR PC BOARDS**
How to re-work finished PC boards so that they fit into desirable cabinets. **Earl "Doc" Savage, K4SDS**
- 66 **ALL ABOUT AUDIO OSCILLATORS**
How to get the most out of your test equipment. **Charles Gilmore**
- 78 **STATE-OF-SOLID STATE**
Two new IC's make a DMM. **Karl Savon**

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- 39 **6-FOOT PROJECTION TV FROM A KIT**
Heath's newest TV saves you dollars. **Larry Steckler**
- 70 **CET TEST**
Check your technical knowledge.
Dick Glass
- 83 **JACK DARR'S SERVICE CLINIC**
Identifying blanking problems.
Jack Darr
- 84 **SERVICE QUESTIONS**
R-E's Service Editor solves technician problems.

STEREO

- 58 **DOLBY HX NOISE REDUCING SYSTEM**
New Dolby system for tape provides better headroom.
Len Feldman
- 61 **R.E.A.L. SOUND LAB TESTS SHERWOOD RECEIVER**
Sherwood model S-7210CP
AM/FM receiver earns a "very good".
Len Feldman

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- 74 **COMMUNICATIONS CORNER**
Directional Wattmeter—What it will do for you. **Herb Friedman**

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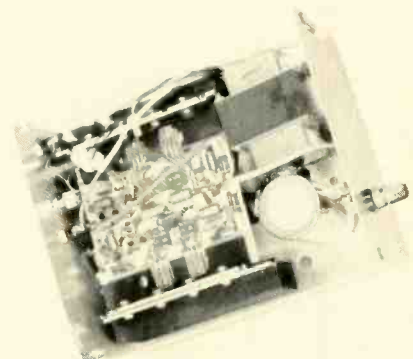
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ON THE COVER

Projection TV is one of the most rapidly growing consumer products available today. This newest set comes in a kit and delivers 6-foot pictures. Learn more about it. Turn to page 39 now.



FREEDOM DIALER IS JUST ONE of the many electronic telephone dialers covered in this issue. To see them all turn to page 43.



SUPER AUDIO AMPLIFIER has a bridge-type power-output configuration you'll want to know more about. Find the details on page 55.

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THE MAGAZINE FOR NEW IDEAS IN ELECTRONICS
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JANUARY 1980 Vol. 51 No. 1

SPECIAL FEATURES

- 37 **PUT AN ANDROID IN YOUR HOME**
Hints on designing an intelligent robot. **Martin Weinstein**
- 55 **BACKYARD SATELLITE TV RECEIVERS**
So you want to build an inexpensive earth station—we'll here's what you need to know. **Robert Cooper**

BUILD

- 40 **SLOT MACHINE**
Easy to build; fun to use. Hit the jackpot if you can. **Fred Blechman and David McDonald**
- 49 **CONFERENCE CALLER FOR YOUR PHONE**
Add one to your phone today. **Jules Gilder**
- 52 **TRS-80 BREADBOARD**
Part 3: Now that it's complete here are some practical applications. **Jon Titus, Chris Titus, David Larsen**

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- 5 **LOOKING AHEAD**
Tomorrow's News Today. **David Lachenbruch**
- 45 **HOW TO IDENTIFY UNMARKED IC's**
Computer board bargains really pay off when you know how. **Kirrland H. Olson and Ann L. Zevnik**
- 50 **50 YEARS OF RADIO**
Reprinted from 1956, this article tells how radio was 73 years ago.
- 66 **NEW IDEAS**
A winning circuit application from our readers.
- 68 **HOBBY CORNER**
Easy to build circuit monitors sound level; lets you know if it rises above or falls below a preset level. **Earl (Doc) Savage**

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- 60 **R.E.A.L. SOUND LAB TESTS REALISTIC RECEIVER**
Realistic model STA-2200 rates Very Good. **Len Feldman**
- 63 **WHAT'S IMPORTANT IN TURNTABLE DESIGN**
A look at the factors in turntable design that affect how your records wear and play. **Len Feldman**

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- 74 **JACK DARR'S SERVICE CLINIC**
Christmas-tree pattern reveals itself again. **Jack Darr**
- 74 **SERVICE QUESTIONS AND ANSWERS**
R-E's Service Editor solves technician problems.

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- 72 **COMMUNICATION CORNER**
Recording tells all about shortwave listening plus a tri-band monitor antenna. **Herb Friedman**

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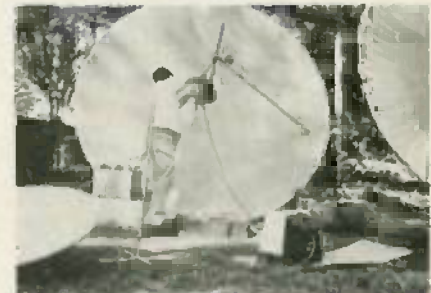
ON THE COVER

The radio-controlled R2-D2™ robot toy manufactured by Kenner Products contains two PC boards, 3 motors, a 3-cell battery pack and even a speaker, but it has nowhere near the capability of a true android. To find out what a household android would require and how you can go about designing your own, turn to page 37.

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IDENTIFYING UNMARKED IC's can be a real headache unless you know how to go about it. The full story starts on page 45.



THIS INEXPENSIVE SATELLITE ANTENNA makes backyard reception of satellite TV broadcasts a reality. If you're interested in building an inexpensive earth station, turn to page 55.

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FEBRUARY 1980 Vol. 51 No. 2

BUILD

- 43 **AUDIO POWER LEVEL METER**
Hook it up to your hi-fi and protect your amplifier and speakers against power overload. Joseph Gorin
- 47 **SATELLITE TV EARTH STATION**
Build your own backyard installation for under \$1000. Bob Cooper
- 56 **VERSATILE SWITCHING REGULATOR**
This circuit can be programmed for step up, step down, positive, negative, voltage and current regulation. Robert Frostholt
- 61 **NOT JUST ANOTHER DIGITAL CLOCK**
5½-inch high single-digit LED readout makes this clock unique. John D. Warblew

ON THE COVER

The LED bar-graph audio power level meter shown is not a wattmeter, but a level indicator that is calibrated to your amplifier's clipping level. Use the device to protect your amplifier and speakers from power overloads. Shown in contrast to the LED bar-graph display is an analog power level meter. Get started building your own LED bar-graph power level meter today. Construction details start on page 43.

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- 4 **LOOKING AHEAD**
Tomorrow's news today. David Lachenbruch
- 53 **HOUSEHOLD ANDROID**
Hints on how to design your own. Martin Bradley Weinstein

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- 66 **UNDERSTANDING TURNTABLE SPECIFICATIONS**
A look at the factors that affect how your records wear and play. Len Feldman
- 69 **R.E.A.L. SOUND TESTS TECHNICS CASSETTE DECK**
Technics model RS-M7 rates Very Good.

VIDEO

- 71 **JACK DARR'S SERVICE CLINIC**
Automatic brightness limiters. Jack Darr
- 72 **SERVICE QUESTIONS AND ANSWERS**
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1979

To present the maximum number of articles to our readers, we have not published the Annual Index as part of this issue. A 4-page brochure containing this index is available for those who need one. To get your free copy, send a *stamped self-addressed envelope (legal size)* to:

Radio-Electronics
Annual Index
45 East 17th Street
New York, NY 10003

Any requests postmarked on or before April 30 are free. After that date there is a 50¢ fee. Questions and comments about anything other than the index that are included with your request cannot be handled. Send them separately to our Editorial Offices.

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THE MAGAZINE FOR NEW IDEAS IN ELECTRONICS

Electronics publishers since 1908

MARCH 1980 Vol. 51 No. 3

SPECIAL FEATURES

- 46 **NIFTY WIRE-WRAP TRICKS**
A few tricks that make wire-wrap projects easier, quicker and sturdier to build. **Otto Slack**
- 53 **SPEECH SYNTHESIZERS**
Part 1—The new breed of circuits that talk back. **Martin Bradley Weinstein**

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- 35 **AUTOMOTIVE BURGLAR ALARM**
Build it for less than \$20. Automatic feature protects your car without having to turn the alarm on or off. **Steve R. Stout**
- 38 **BACKYARD SATELLITE TV RECEIVER**
Details of the LNA front-end gets you started building your own backyard installation. **Robert B. Cooper, Jr.**
- 56 **THUNDERSTORM ALARM**
Simple radio accessory provides early warning of approaching storm. **Calvin R. Graf**

TECHNOLOGY

- 4 **LOOKING AHEAD**
Tomorrow's news today. **David Lachenbruch**
- 12 **SATELLITE TV NEWS**
The latest happenings in an exciting new industry. **Robert B. Cooper, Jr.**
- 48 **IC APPLICATION NOTE**
14 nifty applications for Harris Semiconductor's HA-2400 programmable amplifier.
- 60 **HOBBY CORNER**
A digital temperature sensor, a mosquito repelling circuit, plus more. **Earl "Doc" Savage, K4SDS**
- 64 **NEW IDEAS**
A winning circuit application from our readers.

AUDIO

- 57 **SUPER CLASS-A AUDIO AMPLIFIERS**
New circuit technique radically reduces crossover distortion. **Len Feldman**

VIDEO

- 42 **WHAT'S NEW IN 1980 TV RECEIVERS**
A look at the new circuitry being introduced in this year's TV sets. **Karl Savon**
- 66 **SERVICE CLINIC**
Troubleshooting automatic brightness limiters. **Jack Darr**
- 67 **SERVICE QUESTIONS AND ANSWERS**
R-E's Service Editor solves technician's problems.

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- 25 **RCA Mini-State TV Antenna**
- 30 **Data Precision Model 938 Digital Capacitance Meter**
- 32 **American Beauty Micro-Soldering Station**

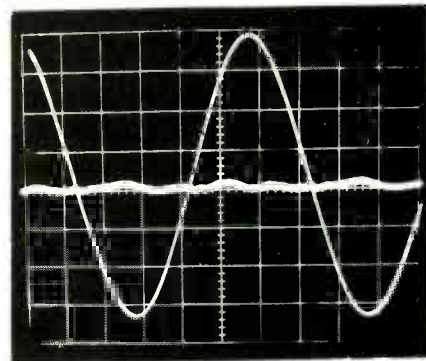
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ON THE COVER

Featured on our newly designed cover is OK Machine and Tool Corporation's *Just Wrap* tool shown being used to wire wrap a prototype board. Also shown is Vector Electronics *P183* forming and cutting tool.

Wire-wrap construction has many advantages over printed circuit boards for prototype construction. However, there are also several disadvantages. To find out how to overcome many of these disadvantages and how to make your wire-wrap projects faster, easier and sturdier, turn to page 46.



SUPER CLASS-A AMPLIFIER uses new circuit techniques to radically reduce crossover distortion without any of the drawbacks associated with negative feedback. To discover how it's done, turn to page 57.

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BUILD

- 39 TRIGGERED OSCILLOSCOPE**
A 2-MHz bandwidth and a zero-baseline display for under \$125.
Daniel Metzger and Dennis Perry
- 47 BACKYARD SATELLITE TV RECEIVER**
This concluding part describes how to recover the video and audio signals from the satellite signal and then display them on your TV set. **Robert B. Cooper, Jr.**
- 53 PORTABLE ELECTRONIC ORGAN**
Learn to play a keyboard instrument on either one of the two inexpensive organs described. One plays melody, the other plays melody and chords. **I. Queen**
- 61 3½ DIGIT DMM**
Specifically designed for accuracy and minimal cost, this DMM lets you select and add the features you need. **Carson Chen**

TECHNOLOGY

- 5 LOOKING AHEAD**
Tomorrow's news today. **David Lachenbruch**
- 6 APRIL NEWS AROUND THE WORLD**
Exclusive report on the technological developments around the world during just the month of April. **Martin Bradley Weinstein**
- 12 SATELLITE TV NEWS**
The latest happenings in an exciting new industry.
Robert B. Cooper, Jr.; Gary H. Arlen
- 44 SPEECH SYNTHESIZERS**
Part 2—A look at the hardware designed to talk back to you.
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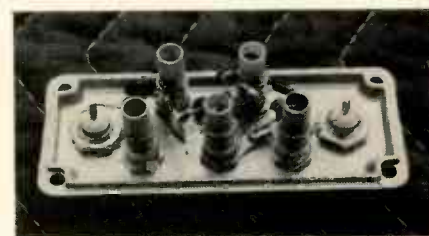
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MULTI-LINGUAL VOICE SYSTEM from Votrax can talk to you in seven languages. To find out what other speech synthesizer equipment is available, turn to page 44.



IF BANDPASS FILTER provides satellite TV receiver with the required selectivity. To find out the other missing components of the receiver, turn to page 47.

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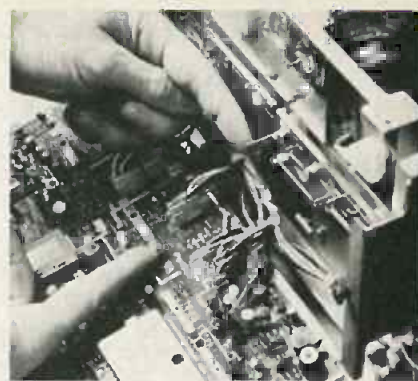
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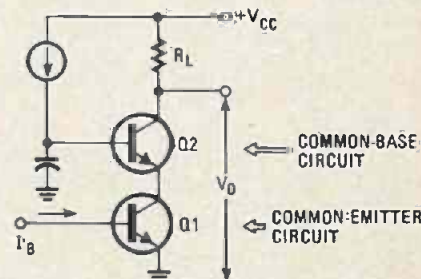
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This professional drum synthesizer consists of four individual modules that combine to provide features found only on synthesizers costing several times more. A unique pressure-sensitive transducer mounted inside the practice pad lets you literally pound out a tune. Get started building your own today, the story starts on page 49.



IT LOOKS COMPLICATED, and in fact, it is! It's the transport mechanism of a Beta-type video-cassette recorder. But don't let looks scare you off. To find out how to troubleshoot and fix it, turn to page 65.



CASCODED CONFIGURATION of a common-emitter and common-base amplifier stages provide ultra-low distortion. To find out how this circuit works, turn to page 72.

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THE MAGAZINE FOR NEW IDEAS IN ELECTRONICS

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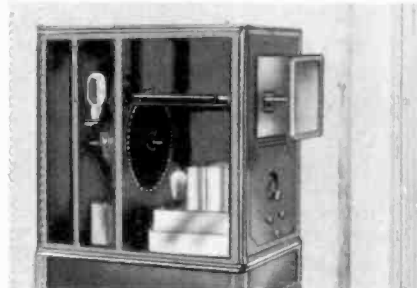
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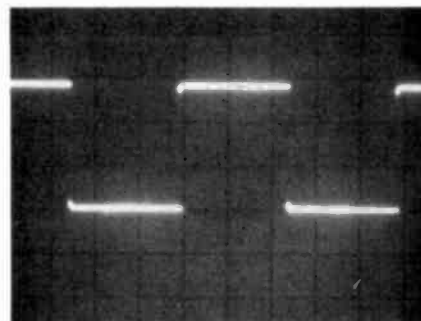
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This unique function generator uses phase-locked-loop technology to overcome many of the shortcomings of commercially-available units. Frequency stability is superb. Sine, square, and triangular waveforms are provided via a 50-ohm output jack. The generator also has a separate set of outputs to drive TTL loads.



TELEVISION—from the drawing board to a reality. Shown above is the Jenkins Projection Radiovisor, developed in 1931. For a look at the history of television, turn to page 43.



DIGITAL AUDIO for the 1980's. The squarewave response of Toshiba's PCM recorder shows the improved performance of this new audio technology. For the rest of the details, turn to page 63.

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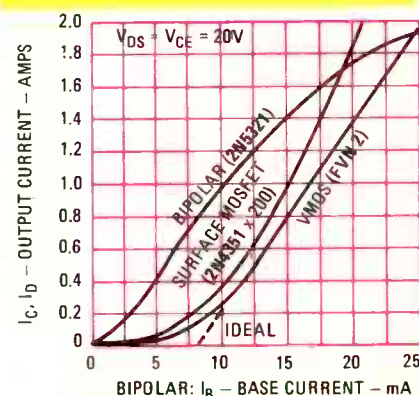
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Sitting on the desk in front of the window is the thermostat portion of the Environmental Control System. This system connects to your heating, air conditioning and ventilating systems and controls their operation in accordance with inside and outside temperature, and humidity. Energy savings of up to 20% can be realized with this system. Get started building yours today. The construction details starts on page 43.



VMOS DEVICES have near ideal characteristics. For the complete story on VMOS, turn to page 55.



COAX VS. TWINLEAD for your TV antenna. Shown above is one of 9 steps in making ideal coaxial connections. For the other 8 steps and the full story, turn to page 48.

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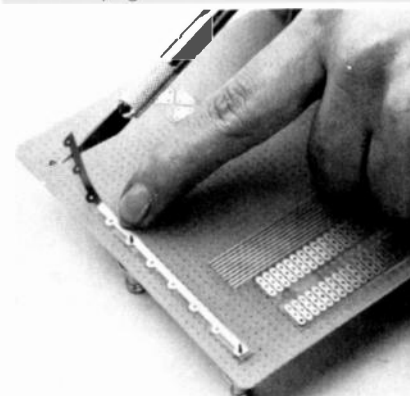
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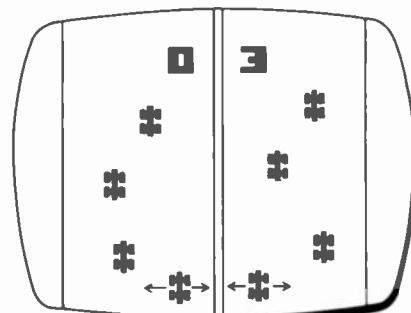
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Finally, the construction article you've all been asking for: An 8-part series describing a full blown, fully mobile robot complete with manipulator arms. Options include remote control operation, operation via external computer via the remote-control link and an on-board computer. Suggestions are given for adding senses such as sight and feel. The basic robot, minus the options, can be built for under \$400. Get started building yours today. Complete details start on page 37.



A QUICK AND EASY way to make one-of-a-kind printed circuit boards. The details start on page 66.



RACEWAY VIDEO GAME you can build lets you pretend to be an *Indy 500* race-car driver without ever leaving the comfort of your armchair. Construction details start on page 42.

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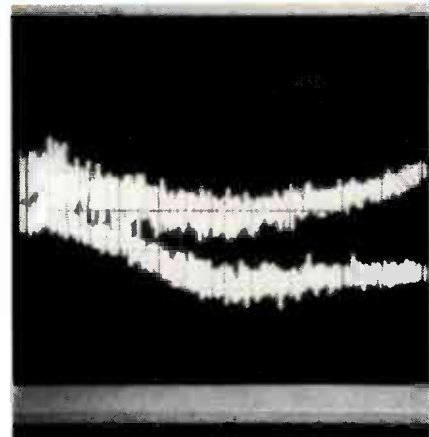
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You can turn on and off lamps and appliances without ever leaving your armchair with BSR's System X-10. To install the system, you simply plug the various modules into existing AC wall outlets. The system features a hand-held ultrasonic remote control unit and a programmable timer. For a look at the circuitry and how the system works, turn to page 47.



NEW NOISE REDUCTION SYSTEM for tape recorders provides 18-dB more noise reduction than Dolby B. For the complete details, turn to page 61.



HANDS FOR THE UNICORN-1 ROBOT are solderless activated. For details on how to assemble the manipulator arms and hands, turn to page 55.

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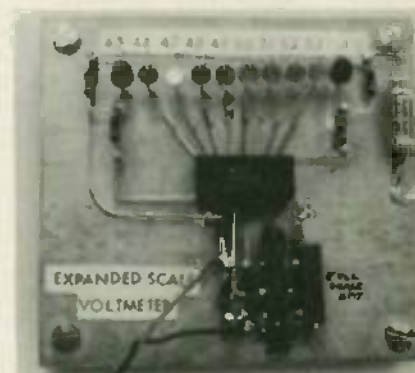
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A synthesized pulse generator that goes from 0.1 Hz to 1 MHz. All CMOS design, this device is ideal for putting logic circuits through their paces and for use as an AF and RF signal generator. Synthesizer allows exact selection of frequency and guarantees repeatability. Construction details begin on page 87.



SPECIAL COMPUTER SECTION covers recent developments in the personal computer field. Find out what's for you, starting on page 45.



LED DISPLAYS are showing up in more and more designs. Learn how to design your own on page 96.

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ON THE COVER

The experimenter's circuit design station will make a great addition to your workbench. Use it to prototype and debug your circuits before hardwiring them. The station is battery powered and includes a two-phase clock oscillator, LED status indicators, debounced switches, and a solderless breadboard. Get started building yours today. Construction details start on page 47.



TV INTERFERENCE can be more than just annoying. For a look at the different types and what you can do to eliminate them, turn to page 70.



BUILD YOUR VERY OWN ROBOT with manipulator arms and mobile base. Multi-part construction series continues on page 61.

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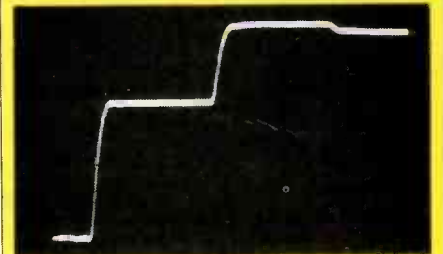
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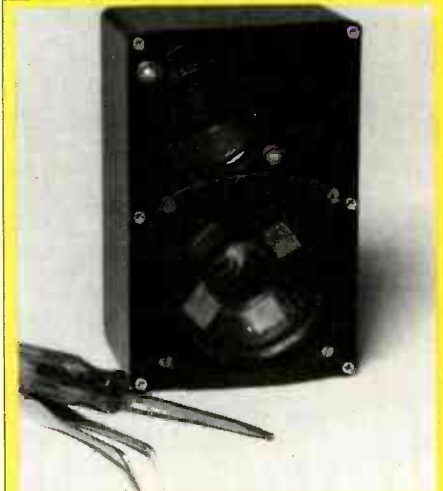
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ON THE COVER

Digital dashboards, trip computers and microprocessors—electronics is finding its way into automobiles. This first part of a four-part series will explore how electronics is being applied to the automobile and its impact on the driver. For an in-depth look at digital dashboards, turn to page 45.



USING EQUIPMENT you already have, you can pinpoint the location of faults along coaxial transmission cables. This technique is especially useful for buried cables. For the complete story, turn to page 67.



HIGH-PERFORMANCE MINI SPEAKERS you can build for your hi-fi system. Complete construction details start on page 52.

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Looking under the hood will reveal advanced engine-control systems, including microprocessors. Here's a look at those new systems and how they function.
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A new breed of test instrument for the technician and experimenter. Here's how they're used and what's available on the market. **Martin Bradley Weinstein**

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Adaptor connects to the video-detector output inside your TV to descramble over-the-air pay-TV signals.
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Adaptor lets you modify your TV set for use as a video monitor. **David E. Cartier**
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Modifying the arms to provide a twist-of-the-wrist function plus adding LED motor-direction indicators.
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The latest happenings in an exciting new industry.
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Majority-logic IC's can make designing some digital circuits easier. Here's how those IC's work and how you can use them in your digital circuits.
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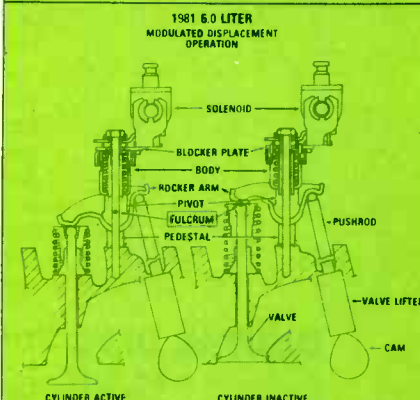
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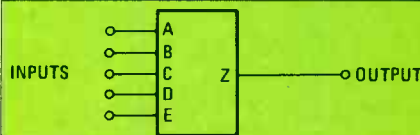
Over-the-air pay-TV stations are sprouting up across the country. Those stations broadcast encoded recently-released movies. An adapter connected internally to your TV set will enable you to decode those over-the-air broadcasts. The lower right-hand corner of the cover shows what the encoded broadcast looks like. The upper left-hand corner of the photo shows Bo Derek in a scene from the recent movie "10".

For a look at how the over-the-air pay-TV encoding system works, and how you can build your own decoder, turn to page 41.

*Copyright ©1979 by Orion Pictures Company



YOUR NEXT CAR. A look under the hood and how microprocessors will be controlling the engine in the next generation of U.S. cars.



MAJORITY-LOGIC IC's that will make designing digital circuits easier are available. To find out what majority logic is, and how you can use it, turn to page 64.

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Radio-Electronics

THE MAGAZINE FOR NEW
IDEAS IN ELECTRONICS

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- 59 **UNICORN-1 ROBOT**
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The spectacular display of lightning is being produced by the largest Tesla coil in the United States. Erected inside an airplane hanger at Wenhov Air Force base, it is a duplicate of Tesla's original coil, and is being used in a search for an answer to nuclear fusion.

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1980

To present the maximum number of articles to our readers, we have not published the Annual Index as part of this issue. A 4-page brochure containing this index is available for those who need one. To get your free copy, send a *stamped self-addressed envelope (legal size)* to:

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Annual Index
45 East 17th Street
New York, NY 10003

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MARCH 1981

Vol. 52 No. 3

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Microprocessors now make it possible for your car to tell you what's wrong with it. **Martin Bradley Weinstein**

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The latest happenings in an exciting new industry. **Gary H. Arlen**
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- 86 **SERVICE QUESTIONS**
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The ASRU (Audio Signal Restoration Unit) is a combination noise-reduction and signal-expander device that offers features not even found on some commercial units. Build one yourself and hear things from your records and tapes that you never heard before. The first part of this project begins on page 41.



FIND OUT HOW laser videodisc players handle the complex signals inscribed on those shiny platters. The story starts on page 67.



UNMARKED IC's can be a bargain. Learn how to find out what's inside those plain black packages on page 55.

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THE MAGAZINE FOR NEW
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ON THE COVER

Within a few months, three different videodisc systems will be competing in the marketplace. Each has its own advantages...and drawbacks. Find out how the systems compare with one another beginning on page 47.



INTERFACING AN IBM SELECTRIC mechanism to your computer doesn't have to be complicated. A four-IC solution begins on page 52.



ELECTRONIC SERVICING is entering a new era. Discover how a small shop can provide the services of a large organization. Story starts on page 79.

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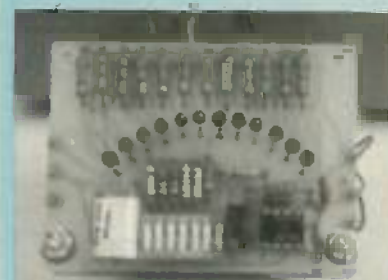
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ADD AN LED DIGITAL VU meter to your hi-fi system for precise recording. Construction details start on page 59.



SPEED VIEWING allows you to listen to the sound while the VCR is scanning the tape. For this and other video innovations being introduced in Japan, turn to page 56.

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ON THE COVER

There are many things your computer can do when it can communicate with other computers. This modem—that you can build for under \$60—will allow your computer to use the telephone to interact with computers all over the country. The project begins on page 39.



SOLID-STATE MICROWAVE DEVICES are vital to our efficient use of the upper end of the RF spectrum. A history of these devices, along with a description of how they function, starts on page 43.



A **FREQUENTLY OVERLOOKED** part of a videotape system is the tape itself. To find out what qualities you should be looking for, turn to page 54.

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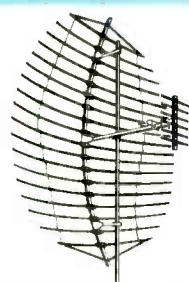
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Cordless telephones offer all the conveniences—and then some—of the wired kind. For a detailed description of what they have to offer and how they work, turn to page 31.



WE HAVE BEEN DELUGED by requests for plans for a negative ion generator. At long last we have one for you. The project starts on page 36.



UHF-TV PROGRAMS OFFER a lot and would have a larger audience if the stations could be received better. The survey starting on page 39 can help you pull in their sometimes-elusive signals.

Due to space restrictions, the second part of the article on Solid-State Microwave Devices, scheduled to appear this month, will appear in the August issue.

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ON THE COVER

The first integrated circuit made its appearance 20 years ago. It held four transistors. Today, devices containing well over 50,000 transistors are available and IC's with several hundred thousand transistors on a single silicon chip are in the planning stage. Learn where we've been and where we're headed. The story starts on page 41.



ALTHOUGH PRICES are slowing coming down, satellite TV antennas still represent a substantial investment. You can build the 8-Ball for under \$750, using readily available materials. Plans for this antenna begin on page 45.



DIGITAL AUDIO RECORDING is now available to anyone owning a VCR. Turn to page 67 for a detailed explanation of the method involved and the standards that have been established for this technique.

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A reverberation system adds a sense of realism to any hi-fi system by duplicating the echoes associated with large concert halls. The reverberation device described in this issue is based on analog bucket-brigade IC's and it expands your listening room into a full-sized concert hall. The construction details start on page 43.



LISTENING TO A SCANNER receiver is becoming a popular pastime. This month we look at programmable scanners starting on page 53.



3D TELEVISION is just one of the amazing products that we describe. All are close to commercial introduction. Take a close look at this and other products starting on page 49.

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Flat-screen displays to make truly-portable, or "skinny" large-screen, TV's have been long awaited. Now, not one, but two, totally different means for achieving that goal have been demonstrated in working prototypes. The story of how those displays function starts on page 39.



SPECIAL COMPUTER SECTION explains what to look for in setting up a system for home or business use. The section begins on page 51.



MANY FINE RECORDINGS have been made without using noise-reduction techniques. A dynamic noise-reduction system can improve their sound. Find out how the process works starting on page 90.

Due to lack of space in this issue, Part 3 of the Programma-2 RF generator project will appear next month. We apologize for any inconvenience that may cause.

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ON THE COVER

Television has already revolutionized the way we live. A second TV revolution is now under way with the introduction of videotex. Videotex will allow you to use your TV set to receive information on almost any subject you desire—news of all sorts, local special events, and even restaurant menus. In addition, it will permit you to transact much of your personal business—shopping, banking, etc.—from home. For a look at what's in store, turn to page 43.



VIRTUALLY ALL STEREO records contain very-low-frequency signals that can be annoying to listen to and, potentially, can damage your sound system. A low-frequency filter will remove those signals, and plans for such a device begin on page 47.



SOMETIMES IT'S DESIRABLE to connect several TV sets to the same VCR. If you have a master-antenna setup, you can use it for that purpose. Several methods for taking advantage of your MATV facilities are described, starting on page 72.

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Radio- Electronics

THE MAGAZINE FOR NEW
IDEAS IN ELECTRONICS

Electronics publishers since 1908

DECEMBER 1981 Vol. 52 No. 12

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*The editors and staff
of Radio-Electronics
join in sending
holiday greetings and
our best wishes for
a happy new year*

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CBS's new CX noise-reduction system for records is the latest happening in hi-fi—and the system works! Build our CX decoder and take advantage of the new CX records. They're available now and more are being introduced every day. Turn to page 43.

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Here's a video accessory that you can build for your videocassette recorder. It reforms the video sync pulse and produces rock-steady pictures from pre-recorded videotapes. To get started, turn to page 45.

Radio- Electronics Video Entertainment

A GUIDE TO VIDEO ENTERTAINMENT IN THE HOME

Video Entertainment Center	Video Cameras
Video Disc Systems	Projection TV
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Accessory Gadgets	Video in The Future



SPECIAL 32-PAGE SECTION covering Video Entertainment. Complete coverage of all the products that make up a video-entertainment center and what the future may bring. Story starts on page 49.

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Due to space limitations caused by the Special Video-Entertainment Section, we were unable to include the conclusion of the Videotex series. Videotex Part 3 will appear, however, in our next issue.

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To present the maximum number of articles to our readers, we have not published the Annual Index as part of this issue. A 4-page brochure containing this index is available for those who need one. To get your free copy, send a *stamped self-addressed envelope (legal size)* to:

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Annual Index
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New York, NY 10003

Any requests postmarked on or before April 30 are free. After that date there is a 50¢ fee. Questions and comments about anything other than the Index that are included with your request cannot be handled. Send them separately to our Editorial Offices.

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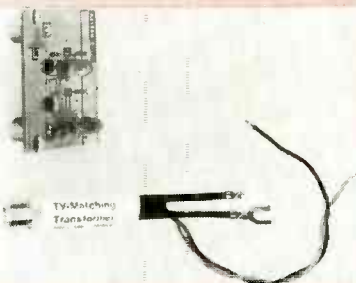
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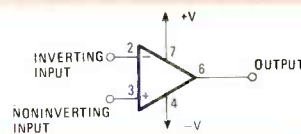
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ON THE COVER

So far, the only way you could hear real digital sound reproduced on your own equipment was to invest in a \$3000 PCM attachment for your VCR. Shortly, though, digital audio, using your existing amplifier and speakers, will be available for about the cost of a good turntable. New techniques—particularly in the area of laser scanning—will put 60 minutes of ultra-high-fidelity audio on one side of a disc you can hold in the palm of your hand. To find out what's in store, and how it works, turn to page 39.



GOOD UHF TELEVISION RECEPTION has always been more difficult to get than VHF. Part of the solution lies in a good antenna-system. An antenna-mounted preamplifier can also help. A preamp you can build that offers 25-dB of gain is described starting on page 59.



OPERATIONAL AMPLIFIERS (OP-AMPS) are an important—but frequently misunderstood—member of the IC family. Learn what makes them so useful and how to work with them beginning on page 54.

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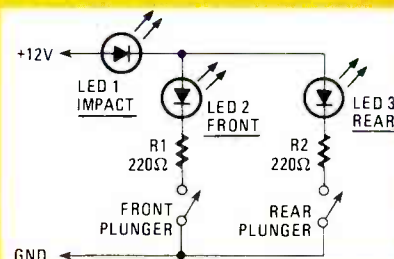
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The video titler is a graphics and alphanumeric character generator for the amateur videophile. Connect it to your VCR and video camera setup and use it to add titles to your home video movies. Get started today building this microprocessor-based video accessory. The story starts on page 39.



A SIMPLE COLLISION DETECTOR is just one of six easy-to-build projects for your car that were designed especially for April 1. Turn to page 46.



IBM's PERSONAL COMPUTER is just one of the many hardware systems covered in this month's special section. Both hardware and software are covered. Turn to page 51.

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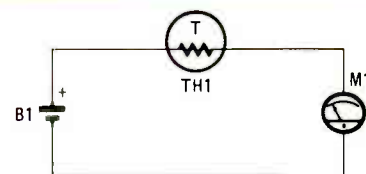
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Build this high-quality satellite TV receiver for under \$500. Add a satellite TV antenna and LNA for a complete TV earth station. The kit comes with a pre-aligned IF strip and LNA power supply. Get started building your satellite receiver today. Turn to page 49.



HOW TO DESIGN analog circuits is a new 11-part series on analog components and how to apply them. This month, thermistors and varistors are covered. The story starts on page 57.



AUTOMATIC POWER SWITCHER solves the problem of having to turn on multiple power switches in your hi-fi or computer system. Throw one switch and the power switcher does the rest automatically. Construction starts on page 54.

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Turn your listening room into a "sonic stage" with this easy-to-use imager. **Joel Cohen**
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A lot has been written recently about "sonic imagers." Those devices modify the sound reproduced by your stereo system so that it appears to come from outside of, behind, and even in front of your two speakers—in fact, the speakers almost seem to disappear. To find out how you can build your own stereo image expander for under \$100, turn to page 45.



STEREO AND BILINGUAL programs are regularly broadcast on Japanese and German TV. The German system uses a technique quite different from the former, and it may be better. Learn how it works, starting on page 58.



HOW ACCURATE is your test equipment? You can check out volt- and ohmmeters—as well as oscilloscopes—with the easy-to-build pocket-size calibrator described, beginning on page 49.

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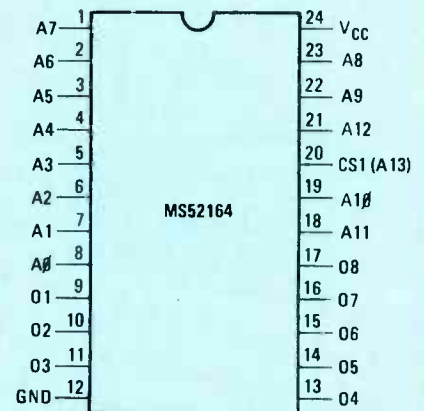
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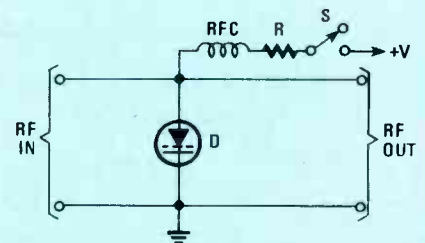
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A behind-the-scenes look at the **Radio-Electronics** Videogame Testing Laboratory. Many long hours were spent gathering data for this month's special section on video and handheld electronic games. For an overall look at what's available in video and handheld games, turn to page 49.



SPEECH SYNTHESIZER uses this ROM and 4 more IC's. For the complete construction details, turn to page 43.



PIN DIODES are just one of the many specialized diodes covered in this month's installment of the analog-design series. The story starts on page 72.

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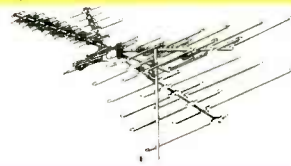
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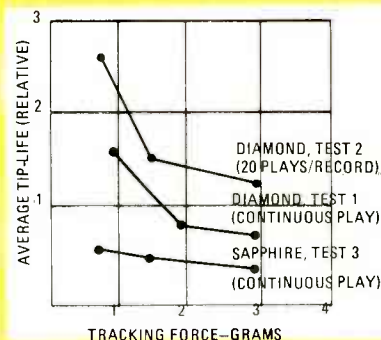
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ON THE COVER

Up to now, about the only way you could add video to your telephone conversation was to go to one of a very few specially equipped Bell System centers. Even then, you could only talk with someone in another similarly equipped center—not a particularly convenient setup. Build a Picture Phone, and you can exchange pictures with anyone, anytime, anywhere, as long as both of you have one, and a telephone. The story starts on page 43.



GOOD VHF and UHF TELEVISION RECEPTION depends on many factors. Choosing the best system or configuration for your particular situation can be difficult, but for information that will make the task easier, turn to page 49.



THE SOUND QUALITY of even the best stereo systems can only be as good as the signal that is input from the phone cartridge. Find out more about phono cartridges, and whether you are getting the most out of yours. The story begins on page 61.

For those of our readers who have been awaiting the second part of our article on the stereo image expander, we promise that it will run in next month's issue.

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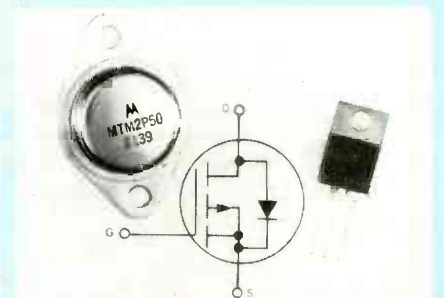
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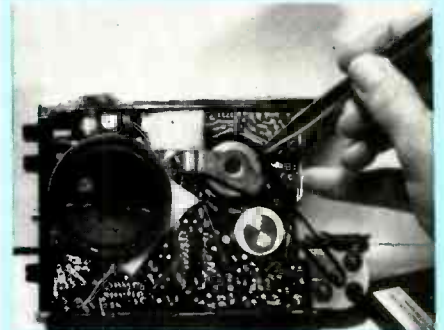
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ON THE COVER

Using an opto-electronic sensor that attaches to your finger, this battery-powered monitor displays your heart rate in beats-per-minute on a digital display. Knowing how your heart rate varies under different circumstances can give you an idea of your physical condition. Get started building yours today. The story starts on page 45.



HOW TO PROPERLY BIAS a transistor circuit is the subject of this month's analog design series. Must reading if your designs are to function the first time you plug them in. The story starts on page 59.



HOW TO TROUBLESHOOT AND REPAIR portable cassette recorders. The best results are obtained with a logical troubleshooting approach. The story starts on page 66.

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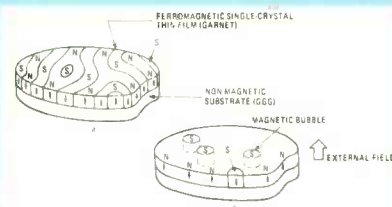
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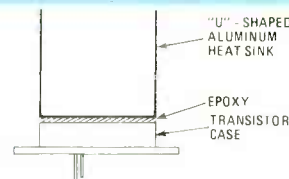
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ON THE COVER

Microcomputers—for the home and for business—come in all sizes and prices. You can pay as little as \$100 (or less!) or as much as \$6000 (or more). To help you make an intelligent choice in selecting a computer that meets both your needs and your budget, our Special Section, "Your Own Computer," groups computers and computer systems by price. Also included are descriptions of software and services that you may find useful. And, to round things out, there's a discussion of 8-bit vs. 16-bit computers. "Your Own Computer" starts on page 43.



BUBBLE MEMORIES combine the read/write features of RAM with the non-volatility of ROM, and approach tape and disk systems in storage capacity. Find out how they work and how they're used starting on page 39.



DERATING CIRCUIT-COMPONENTS can extend their life and make the equipment in which they're used more reliable. This month's Service Clinic covers that topic, beginning on page 150.

Due to lack of space we are unable to include Part 2 of the "Heart-a-Matic" in this issue. It will appear next month.

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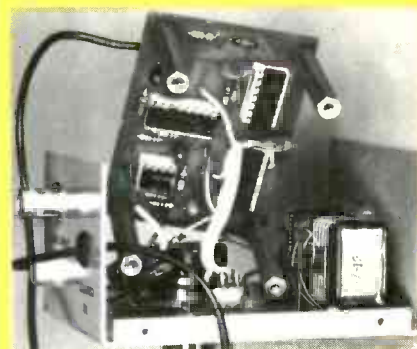
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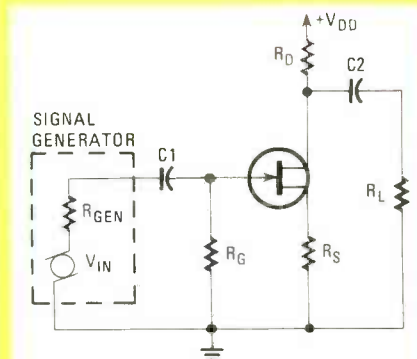
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ON THE COVER

Cordless telephones are more than just a convenience; they can also save you money. Rather than have multiple-extension phones, you can use just one cordless phone and answer the telephone from anywhere inside the house—or from up to 1000 feet away. For an in-depth look at what's available, including prices and features, turn to page 39.



BUILD THIS FREQUENCY MULTIPLIER and increase the low-frequency range and accuracy of your frequency counter. Complete construction details start on page 43.



HOW TRANSISTOR AMPLIFIERS WORK, and how to design them, are covered in this month's installment of our back-to-school series. For the full details, turn to page 67.

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SEASON'S GREETINGS

*The editors and staff
of Radio-Electronics
join in sending
holiday greetings and
our best wishes for
a happy new year*

ON THE COVER

If you like to tape those vintage black-and-white movies that show up late at night on TV—but don't like to tape the commercials that accompany them—this automatic commercial editor is for you! It watches the movie along with your VCR and; when a commercial turns up, stops the tape until the movie begins again. The result is a tape of the movie, and nothing else. It's easy to build, and will...literally...provide you with hours of pleasure. Get started building your own editor. Plans begin on page 43.

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- 39 **PROGRAMMA III DIGITAL IC TESTER**
A versatile device that puts IC's through their paces and indicates how they function. **Gary McClellan**
- 47 **LOW-BAND CONVERTER**
There are lots of interesting things going on on the frequencies below the AM broadcast-band. Build this converter and find out for yourself what they are. **Stan Gibilisco**

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The plug-programmable Programma III allows you to perform static and dynamic testing of all TTL and CMOS digital IC's, and presents you with a graphic visual indication of the logic state at each pin of the IC under test. Instructions for building this valuable addition to your test equipment begin on page 39.

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1982

To present the maximum number of articles to our readers, we have not published the Annual Index as part of this issue. A 4-page brochure containing this index is available for those who need one. To get your free copy, send a *stamped self-addressed envelope (legal size) to:*

Radio-Electronics
Annual Index
45 East 17th Street
New York, NY 10003

Any requests postmarked on or before April 30 are free. After that date there is a 50¢ fee. Questions and comments about anything other than the Index that are included with your request cannot be handled. Send them separately to our Editorial Offices.

Because of space restrictions, the second part of the "Automatic Commercial Editor" will not appear in this issue. It will appear next month.

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ON THE COVER

Once considered a dream, the computer-controlled airplane has become a reality, with the introduction of the Boeing 757/767 aircraft into commercial service. This month, we'll take you into the cockpit of that fascinating airplane, and show you the systems and features that help make it one of the most sophisticated in the sky.



You don't always need a long antenna to get good VLF reception. The active antennas shown here are just one meter long but often outperform ones many times their length. Find out more about active antennas, beginning on page 63.



If you are one of those that love to spend hours at a time with your home videogames, your hands are probably taking a beating. Give them and yourself a break, and build this controller for your Atari VCS system. The story starts on page 42.

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Portable shortwave-receivers with features like microprocessor-controlled PL tuning and digital readouts, and pocket-sized shortwave receivers with "big"-radio performance, were once just dreams. Both types are now realities, as you'll see in our story on pocket-sized and portable shortwave receivers. The article begins on page 49.



IF YOU'RE LOOKING for a DVM for your workbench, one of those described here may be for you. Thanks to the use of LSI IC's, the circuits are small and inexpensive to build. The story begins on page 55.



EVEN THOUGH MODERN RADIOS are sleek, and are great performers, there's something about the old ones that makes most of us feel nostalgic. Find out how you can restore an old radio's original sound and appearance starting on page 56.

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ON THE COVER

The fascinating world of micro-computers—whether it be a simple entry-level machine for education or entertainment, or a complex, full-featured computer for your business—there's something there for everyone. And there's something for everyone in our Special Section, "Your Own Computer." This month we take an in-depth look at the hardware and the things you should know before you buy. To round things out, "Your Own Software" takes a look at one of the most popular types of software—the electronic spreadsheet—and a look at some software you may never have heard of, but that's surprisingly useful and/or inexpensive. It all starts on page 57.



A CUSTOM CASE will give your project a professional look and get it the attention it deserves. It can be surprisingly easy and inexpensive to build if you know how. Find out more starting on page 49.

COMING NEXT MONTH On Sale April 19

- **Build A Talking Clock.** This clock not only tells the time, it says it.
- **Car Alarm.** Connect it to your car to help keep the burglars away.
- **All About LSI Music Synthesizers.** A look at the different IC's available to build your own music synthesizers.
- **And more.**

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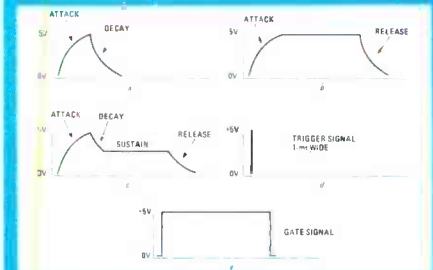
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ON THE COVER

Timepieces have come a tremendous way in the past few years—from wind-up and electric clocks to those with LED and LCD displays and—now—to clocks with no display at all! The talking alarm clock featured in this issue will announce the time either automatically or on request, and can also be set to *tell* you when it's time to get up. Modern speech-synthesis IC's make it extremely easy to build, as you'll find out starting on page 57.



THE MAINSTAY of today's popular music is the synthesizer. Once, incredibly difficult and expensive to design and build, its current popularity is due in part to the versatility built into the LSI IC's that are found at its heart. The story of those IC's can be found on page 65.

COMING NEXT MONTH

On Sale May 19

- **Special Videogames Section:** What's new for 1983...and what's in store for the future.
- **Add-on RAM.** A non-volatile 8K memory expansion you can build for your Timex/Sinclair 1000.
- **LF Loop Antennas.** The next installment on our continuing series on VLF-LF receiving techniques.
- **And lots more!**

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ON THE COVER

Electronic games, both video and handheld, have been extremely popular for several years now. But this past year has seen the introduction of more videogame consoles, hardware add-ons, and game software than in all previous years combined. This month, we present a special section dedicated to helping you find your way through the ever-more-confusing world of electronic games. We'll tell you what's new, what's hot, and how to get the most out of your videogame system. The section begins on page 55.



FRONT PANEL of the audio frequency-response meter. This instrument will, among other things, allow you to set your tape recorder's bias and equalization controls with extreme precision. The story starts on page 51.

COMING NEXT MONTH

On Sale June 16

- **Automotive navigation systems.** With these computer-based systems you'll never get lost again.
- **Loran-C.** A look at this fascinating low-frequency, long-range navigational system.
- **Add-on RAM.** The article on how to add 8K of non-volatile RAM to your Timex/Sinclair 1000, bumped from this issue because of lack of space will appear in July.
- **And lots more!**

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Computer-aided navigation is expected to play a big part in the car of the future. But, as this report shows, that future is not all that far away. **Danny Goodman**

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To most drivers, one of the most exasperating experiences is getting lost in completely unfamiliar territory. But an independent California inventor and a giant Japanese automobile manufacturer are hard at work trying to make that situation a thing of the past. If their efforts are successful, it won't be long until a common automotive accessory will be a navigational computer complete with a video display. This month, we'll preview the future and take a look at both systems. The story begins on page 43.



This upgrade for the Timex/Sinclair 1000 adds 8K of non-volatile RAM. The add-on can be used to increase the system/user memory, or more usefully, for the permanent storage of machine-language routines—thus, in effect, expanding the operating system. Find out more about it starting on page 47.

COMING NEXT MONTH

On Sale July 19

A special section devoted to electronics and photography. Among the things we'll look at are:

- The Sony Mavica system
 - Autofocus and autoexposure electronics
 - Electronics in the darkroom
- And lots more!

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ON THE COVER

One field that has been strongly affected by microelectronics is that of photography. Once-bulky equipment is now built right into pocket-size cameras. And, in the darkroom, microprocessors are making things as easy as 1-2-3. Sony has even unveiled a completely filmless electronic-photography system. All that, and more, is covered in our special section on electronics and photography beginning on page 57.



AS YOUR CAR creeps along in the stop-and-start summertime traffic, its most dangerous enemy is probably the heat. And you have no idea how badly your engine is suffering until the "idiot light" marked "TEMP" comes on...and the radiator blows its top! This digital temperature gauge will let you know at any time exactly how hot the engine is, and allow you to cool things off before it's too late. Construction details start on page 92.

COMING NEXT MONTH

On Sale August 18

- **The Pianomatic.** An attention-getting programmable music maker you can build yourself.
- **ECL.** A tutorial on emitter-coupled logic.
- Plus lots more!

Because of lack of space, the installment of "Analog Design" scheduled to appear this month will appear in next month's issue.

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ON THE COVER

Projects that are built just for fun are sometimes enjoyed most of all. But what's even better is a fun project that can teach you something new. The Pianomatic mini player-piano does just that. Sure to be an entertaining conversation piece when it is finished, building it will introduce you to such topics as computer memory organization and retention, digital logic, keyboard encoding and decoding, and the like. As a bonus, the techniques you'll pick up here can easily be adapted for use in your own designs. The story begins on page 43.



THE KOALAPAD from Koala Technology, Inc., allows you to control your computer's cursor movement by just tracing on the touch-sensitive pad. It's just one of the most innovative products of the past year as honored at the Summer CES. Turn to page 49 to find out more about it, and others similarly honored.

COMING NEXT MONTH On Sale September 15

Our special supplement: Your Own Computer. Among the things we'll look at are:

- **Hardware**—a comprehensive look at systems, and their cost!
- **Word-processing software**
- **Software and hardware compatibility**
- **Everything you need to know about CP/M**
- **And lots more!**

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ON THE COVER

There's little doubt that personal computers have become the fastest growing segment of the consumer-electronics market. In the past year many new companies have been founded, and scores of new machines have been introduced. In addition, most of the "established" manufacturers (in this industry that's anyone that's been around longer than two years) have either unveiled new systems, or beefed-up their existing ones, to remain competitive. The result has been greatly increased selection, generally lower prices, and just about utter confusion for the consumer. That's where this special section comes in—it's designed to help you make sense out of the jumble of systems by summarizing what's available. To help make comparisons easier, everything is organized by list price. The section begins on page 75.

TO OUR READERS

Due to our large computer-hardware section, several articles that were originally scheduled for this issue could not appear, due to space limitations. Those articles will be published in coming months.

COMING NEXT MONTH

On Sale October 20

- **Test Equipment.** A look at what's new and unusual.
- **Audio Tape.** Audio-cassette tapes and how they differ.
- **How To Design Analog Circuits.** All about filters.
- **And lots more!**

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ON THE COVER

When you think about the products in the various different categories of electronic products—be they video, audio, broadcast, or what have you—there are always some that shine above the rest. The reason why they are thought of as superior may be due to a sophisticated design, the use of state-of-the-art technology, better reliability or accuracy, or any one of a number of similar reasons. The same holds true, of course, for test instruments. This month we bring you a special look at the ultimate in sophisticated or unusual test instruments. The story begins on page 59.



FEW PEOPLE REALIZE that the quality of your TV sound is limited only by the quality of your TV's audio section. Unfortunately, the quality of the audio in an average set is just not very good. But there is something you can do about it—build the TV sound converter and get audio quality you never thought possible from your TV. The story starts on page 45.

COMING NEXT MONTH

On Sale November 17

- **Video Color Processor.** An accessory you can build for your home-video system.
- **Digital TV.** A look at this fascinating new technology.
- **Designing Analog Circuits.** Another installment in our back-to-school series.
- **And lots more!**

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*The editors and staff
of Radio-Electronics
join in sending
holiday greetings and
our best wishes for
a happy new year*

ON THE COVER

If you're like many home-video hobbyists, your videotapes leave something to be desired. Your colors may appear washed out, the picture is filled with noise, or, perhaps your edits are far from smooth. Well, there's a way around those problems, whether you're making new tapes or duplicating old ones. With the color processor you can create fade-ins and fade-outs, reduce background noise, and you can vary color saturation from black-and-white to full chrominance. The article describing its construction—which is only one of our special video features this month—begins on page 49.

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THE MAGAZINE FOR NEW
IDEAS IN ELECTRONICS

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The answer to that question, and a bit of history about that device we now take for granted. George Delucenay Leon

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ON THE COVER

As you are probably aware, stereo broadcasts are now legal on the AM band. Because of the FCC's "let-the-market-decide" approach, there are now four systems in competition. One that is very promising is Motorola's C-QUAM (Compatible Quadrature Amplitude Modulation) system. We'll take a look at Motorola's MC13020 decoder IC and build a stereo converter for your radio. The story begins on page 41.



The telephone shown above is the one that the now-famous words "Mr. Watson, come here. I want you" were spoken in 1876. Our look back at the telephone begins on page 47.

COMING NEXT MONTH On Sale January 19

- Cable-TV descrambling
- Digital voltmeter modules
- And lots more!

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IDEAS IN ELECTRONICS

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FEBRUARY 1984 Vol. 55 No. 2

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A look at cable-TV scrambling and descrambling techniques by investigating a descrambling circuit. **Fred Means**

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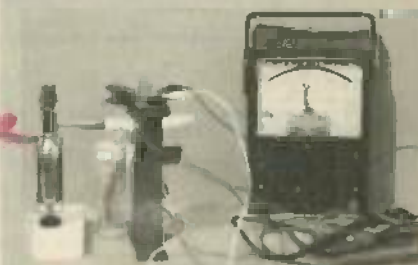
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ON THE COVER

To say that cable-TV has undergone tremendous growth over the past few years would be an understatement. One of the biggest reasons for that growth is the presence on cable of first-run movies and live sporting events. Of course, that programming is most often offered as a premium service, which means that the viewer must pay a charge to receive it. To prevent unauthorized reception, the material is scrambled. This month, we'll use an experimental descrambling circuit to illustrate the theory behind the techniques used to encode video signals. The story begins on page 47.



ELECTRIC POWER GENERATION is among the most important areas of electronics. One method of power generation that has received quite a bit of attention is MHD. This month, we'll show you the theory behind that technique and build a working model of an MHD generator. The story starts on page 51.

COMING NEXT MONTH On Sale February 21

- **Video Test Generator.** A valuable instrument for video servicing.
- **Airplane Landing Systems.** A look at landing systems and the electronics behind them.
- **And lots more!**

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FEBRUARY 1984

Radio-Electronics

THE MAGAZINE FOR NEW
IDEAS IN ELECTRONICS

Electronics publishers since 1908

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Though many people are afraid to fly, airplanes are the safest way to go—thanks to instrument landing systems. **Bill Sewell**

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- 67 **HOW TO DESIGN POWER SUPPLIES**
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ON THE COVER

There are many manufacturers who sell TV-test equipment such as dot-pattern generators. But if you want to service video equipment other than TV's, then you need something more. This month we'll describe how to build and how to use a full-feature video test generator. You can use it to test VCR's, monitors, video amplifiers—just about any video equipment. It not only generates standard test patterns. It even has provision for external inputs (from a computer, for example) so that you can create your own test patterns for your own specific purpose. The story begins on page 43.

ANNUAL INDEX JANUARY—DECEMBER 1983

To present the maximum number of articles to our readers, we have not published the Annual Index as part of this issue. A 4-page brochure containing this index is available for those who need one. To get your free copy, send a stamped self-addressed envelope (legal size) to:

Radio-Electronics
Annual Index
45 East 17th Street
New York, NY 10003

Any requests postmarked on or before April 30 are free. After that date there is a 50¢ fee. Questions and comments about anything other than the Index that are included with your request cannot be handled. Send them separately to our Editorial Offices.

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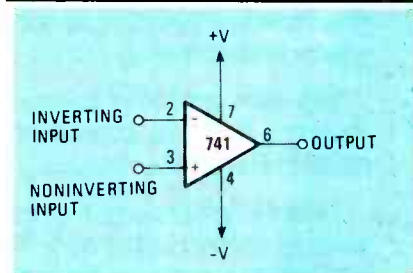
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ON THE COVER

Owners of personal computers know that one of the natural uses for those devices is as a controller for the appliances, lights, or what have you in your home. But if you use it for that, your computer can not be used for any other task at the same time. This month we show you a way around that problem—a computer that you can build that's specifically for use as a controller. The story begins on page 47.



KNOWING ABOUT LINEAR IC's and how to use them in your designs can greatly improve your enjoyment of electronics. But if you missed out on learning about those devices, where can you get the information you need to use them successfully? One place is in our new back-to-school series on designing with linear IC's. It all begins on page 89.

COMING NEXT MONTH On Sale April 19

- **Automotive Exhaust Analyzer.**
A unique device to help get your car ready for those tough emissions tests.
- **3-D TV.** A look at what's coming in 3-D television.
- **Home Control Computer.** Part 2 of our build-it-yourself computer.
- **And lots more!**

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Radio-Electronics

THE MAGAZINE FOR NEW
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- 61 **NO MORE WRONG NUMBERS**
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- 64 **HOME CONTROL COMPUTER**
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ON THE COVER

Does your state require that your car pass an annual emissions tests? In those states that do, many "do-it-yourselfers" are beginning to feel left out. After all, who else but the state-licensed inspection shop can make the emission test? If you build this month's featured project, you'll be able to keep tabs on your own emissions—even while you're driving! The story begins on page 47.



WILL THERE EVER BE A 3-D TV system that will give us more than eye strain? Carl Laron, our Associate Editor takes a look at three systems that look promising. Each has its own advantages—and drawbacks. But one thing is sure: You'll be hearing a lot more about those systems in the future. But read about them here first, starting on page 57.

COMING NEXT MONTH On Sale May 22

- **Satellite TV.** A special section that deals with antennas, down-converters, receivers, and more, including a look at DBS.
- **Repairing PC Boards.** It's easy—we'll show you
- **Tuning Microwave Downconverters.** It's easier than you think and you don't have to perch yourself on your roof!
- **And lots more!**

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Charging indicators. **Robert Grossblatt**
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Fixing half of a computer. **Jack Darr**
- 95 **SERVICE QUESTIONS**
Radio-Electronics' Service Editor solves technicians' problems.

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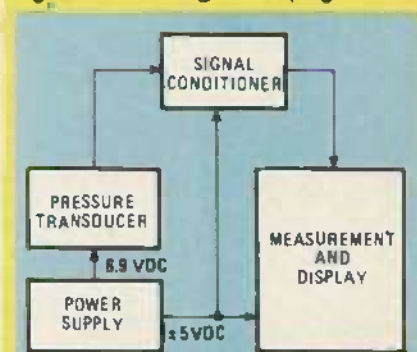
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ON THE COVER

Satellite TV offers a lot of attractions, what with its promise of nearly unlimited viewer selection of TV programming. But is it for you? This month, **Radio-Electronics** turns its attention to satellite-TV, with a special section devoted, among other things, to home reception of satellite signals. It all begins on page 45.



BEFORE WEATHER SATELLITES, perhaps the most useful tool for weather prediction was the barometer. In this issue, we show you a solid-state barometer that you can build. The story starts on page 41.

COMING NEXT MONTH On Sale June 21

- **Energy Mizer.** This useful project will help you get the most out of your air conditioning system.
- **Interfacing the ZX81.** Put your Timex/Sinclair computer to work with this practical interface.
- **A Unique Ammeter.** Here's a DC clamp-on ammeter you can build.
- **Repairing PC Boards.** Fixing those broken PC boards is easier than you think.
- **And lots more!**

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Radio-Electronics

THE MAGAZINE FOR NEW
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You don't have to make yourself uncomfortable to save money on your air-conditioning bills. **Bill Owen**
 - 61 **CLAMP-ON DC AMMETER**
This ammeter eliminates the undesirable side effects of measuring DC current; it uses Hall-effect transducers and a clamp-on probe. **Hardin Stratman**

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Tomorrow's news and technology in this quickly changing industry. **David Lachenbruch**
 - 12 **SATELLITE/TELETEXT NEWS**
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If you've ever had a PC board that you thought was ruined forever—it probably wasn't. **Robert Grossblatt**
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 - 65 **POWER-SUPPLY CIRCUITS**
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A look at how some TV-servicing problems that—although they took some time—were eventually solved. **Frank A. Salerno**
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- 57 **INTERFACING THE ZX81**
The ZX81 (or Timex Sinclair 1000) computer can be turned into a very powerful machine. **Neil Bungard**

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ON THE COVER

You can save money on your air-conditioning bills and stay comfortable at the same time. No, it's not magic—it's what's known as time cycling. The energy miser lets your air conditioner operate more efficiently than it does when it is controlled by just a thermostat. Best of all, you can build the device just in time for the hot weather! The story begins on page 43.



THE TIMEX SINCLAIR 1000 or ZX81 has been described as being worse than a toy. Well, it doesn't have to be. You can put your ZX81 to work as a control computer with as many features as your imagination permits. This month, interfacing basics are discussed, and an interface circuit is presented. The story begins on page 57.

COMING NEXT MONTH On Sale May 22

- **Electronics And The Heart**. The heart may have more in common with electronic devices than you think.
- **An Infrared Transmitter/Receiver**. How many uses for one can you come up with?
- **ComputerDigest**. Another tear-out edition of our magazine-with-in-a-magazine.
- **And lots more!**

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Electronics publishers since 1908

AUGUST 1984 Vol. 55 No. 8

SPECIAL FEATURE

- 73 **HUGO GERNSBACK: A MAN WITH VISION +**
On the 100th anniversary of his birth, Radio-Electronics looks back at the life of its founder. **Robert A. W. Lowndes**

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A color-bar generator is one of those pieces of equipment that is needed only occasionally. But when that device is needed, nothing else will do in its place. That is, until now. This month we present an inexpensive alternative—a plug-in cartridge for your Atari 2600 that generates color bars and other patterns required for proper color-TV alignment. To learn more about it, turn to page 41.



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*The editors and staff
of Radio-Electronics
join in sending
holiday greetings and
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Analog Delay Lines (Marston)	Oct 67
Antenna (see listing under RADIO)	
Antique Radios (DXFitch)	Jan 97, Feb 108, Mar 86, Apr 92, May 85, Jun 80, Jul 86, Aug 76, Sep 88, Oct 94, Nov 76, Dec 84
Automatic Tuners	Jun 80
Back to the Present	Apr 92
Battery-Powered	Jan 97
Cabinets	Oct 82
Contributions by Hams and SWL's	May 85
Early Radio History	Feb 108, Mar 86
Letters From our Readers	Dec 84
Restoring AC-DC Radios	Nov 76
Speakers and Headphones	Sep 88
Test Equipment	Aug 77
Trimming AM Auto Radio	Sep 12
Tuning "Eyes" and AVC	Jul 86
Ask R-E (D)	Jan 22, Feb 12, Mar 8, Apr 6, May 8, Jun 8, Jul 8, Aug 8, Sep 12, Oct 14, Nov 23, Dec 20
Aircraft Radio on the FM Band	Jul 8
Audio Distortion Meter	Jul 10
Balun for TV Rhombic	Aug 8, Oct 16
Battery, Dual Auto	Nov 24
Building a Joystick	Feb 12
Composite Video from RGB Input	Aug 8
Electric Locks	Mar 10
Fluorescent Lights	Sep 12
FM Notch Filter	Apr 14
Frequency and Period	Feb 12
Magnetic Phone Preamp	Mar 8
Measuring Speaker Impedance	Apr 6
Needs Tuning Capacitor	Apr 12
P-C Board Ground Plane	Apr 6
Parts For Crystal Radio	Apr 12
Pest Repeller Questions	May 6
Power Line Interference	Jul 8
R-J Speaker Enclosure	Mar 8
Reporting Shortwave Reception	Jan 26
Resistor Decade Box	Jan 22
Simple	
Power Supply	May 9, LTR Sep 22
RF Field Meter	Apr 14
Stroboscope	Aug 8
Speakerphone Information	Apr 6
Time Delay, Electronic	Oct 16
True North, Where Is?	Oct 14
Wiring Extension Speakers	Jan 26
World Time Conversion	Jun 8
Zener Diodes, Sorting	Nov 23
Zero Crossing	Jun 8
Audio (see STEREO)	
Audio Oscillator, An (DN)	Aug 83
Automatic Tuners (AR)	Jun 80
Automotive	
Battery, Dual (ARE)	Nov 24
Simple Circuit Fails Car Thieves (NI)(Goens)	May 32

B

B&K	
IC Tester, TTL (ER)	Aug 22
B + Too Low (SQ)	Feb 111
Back to the Present (AR)	Apr 92
Balun for TV Rhombic (ARE)	Aug 8, Oct 16
Bank-Switching (DB)	Aug 73
Battery	
Charger, Universal (C)(Wright)	Jul 67
Powered Antique Radios (AR)	Jan 97
Bearcat (see UNIDEN)	
Beckman	
Logic Probe, Circumate LP25 (ER)	Dec 24
Logic Pulser, Circumate PRM1 (ER)	Dec 28
Bandit	
BBT (SQ)	Aug 76
Black Box Descrambling (STV)	Jun 75
brainstorm to Breadboard, from (Sweeney)	Sep 61
Breaker, Tripping (SQ)	Aug 76
Buyer's Guide to Personal Robots (SPECSECT)(Robillard)	Mar 41
C, Ku, and DBS (STV)	Jan 92
C-Band DBS? (STV)	Feb 103
Cable Tester (see listing under TEST EQUIPMENT)	
Camers (see listing under VIDEO)	
Can't Tune The Lower Channels (SQ)	Oct 85
Capacitance Tester (see listing under TEST EQUIPMENT)	
Capri	
Scanner (SQ)	Sep 79
Car (see AUTOMOTIVE)	
CD Players (see listing under STEREO)	
Charger, Universal Battery (C)(Wright)	Jul 67
Chop-Amps (SOSS)	Aug 79
Click and Pop Filter (see listing under STEREO)	
Closed Captioning (COMMC)	Oct 92
Decoder (C)(Gifford)	Nov 41, Dec 61
CMOS Switching Circuit, A Simple (DN)	Jan 108
Color Coil Replacement (SC)	Sep 79
Communications (see RADIO)	
Communications Corner (see listing under RADIO)	
Compact Disc Players (see listing under STEREO)	
Composite Video from RGB Input (ARE)	Aug 8
Computer	
Aided Electronics Design (Grossblatt)	Dec 49
Memory	
Expansion (DB)	Apr 102
Management (DB)	Jul 84
On The Workbench (Grossblatt)	Dec 45
Printer, 150, Diconix (ER)	Oct 32
Software	
Doesn't Smoke (DB)	Jan 102
Program Connections and Lab Set-up (DB)	Sep 92
Construction	
Amplifier, Walkman	Mar 59
Battery Charger, Universal (Wright)	Jul 67
Burglar Alarm, Phony (Ringenberger)	Sep 44
Capacitance Leakage Tester (McClellan)	May 51, LTR Sep 22
Click and Pop Filter for your Stereo (Gorin)	May 46, Jun 55
Continuity Tester, Latching (Knight)	Nov 49
Crystal Alarm, Old Time (O'Brien)	Oct 54
EPROM Programmer (Sawlow)	Oct 61, Nov 55

C

Home Security System (LaMartina)	Jan 49
Humidity Monitor (Worley)	Feb 61
Joystick (ARE)	Feb 12
Laser, Helium-Neon (Grossblatt and Iannini)	Jun 42
Music Synthesizer, Mini	Feb 75
\$99 Satellite-TV Receiver (Maddox)	Jan 45
1.2-GHz Frequency Counter (Huff)	Jul 47
Power Supply, Versatile Bench Top (Swain and Ubiand)	Jun 51
Radar Speed-Gun Controller (Slavens)	Aug 39, LTR Sep 14
Remote Controlled Power Switch (Cooper)	Aug 43
Robot	
R-E (Sams)	Dec 54
Your Own (Robillard)	Mar 47
Satellite TV Descrambler (Terrio and Perodi)	Oct 50
Stereo	
High Power FET Amplifier (Simpson and Clarke)	Jun 53, Jul 56, Aug 67, LTR Nov 10
TV Decoder (Solopolski)	Mar 51, LTR Jun 20
Stun Gun (Grossblatt and Iannini)	Sep 41, LTR Nov 10
Telephone Line Tester (Friedman)	Apr 50, LTR Jun 10
Teletext Decoder (Gifford)	Apr 48, May 67, LTR Jun 12
Two Nifty Projects (Oof)(Fiction)	Apr 80
Video	
Camera Link, Wireless (Sheets & Graf)	Feb 51, LTR Mar 14
Trier (Flack)	Jan 57, Mar 62
Walkman Amplifier	Mar 59
Continuity Tester (see listing under TEST EQUIPMENT)	
Contributions by Hams and SWL's (AR)	May 85
Cross-Country Networking (COMC)	Mar 92
Crystal	
Radio, Old Time (C)(O'Brien)	Oct 84
Timebase, An Inexpensive (NI)(Roher)	Feb 46
Curing Electromagnetic Interference (Violette)	Jan 53, Feb 71, Apr 66
Customer Psychology (SQ)	Sep 78

D

DC	
On CRT Heater (SQ)	Jul 83
To Microwave (SPECSECT)(Bernard)	Sep 45
Dead-Set Servicing (SC)	Jul 82
Decade of Change, A: The Microprocessor (Grossblatt)	Apr 61
Decoder	
Closed Caption (C)(Gifford)	Nov 41, Dec 61
DTFM Encoding and (Nassar)	Dec 65
Teletext (C)(Gifford)	Apr 45, May 67, LTR Jun 12
Delay Lines, Analog (Marston)	Oct 67
Descrambling	
Black Box (STV)	Jun 75
Satellite TV (C)(Terrio and Perodi)	Oct 50
TV Signal (Sheets and Graf)	Jun 47, Jul 44, Aug 51, Sep 64, Nov 46, Dec 57
Design Oscillator Circuits (Carr)	Oct 72, Nov 63, Dec 71
Designer's Notebook (D) (Grossblatt)	Jan 108, Mar 80, Apr 98, May 88, Jun 71, Aug 83, Aug 83, Mar 80, Jun 71, May 88, Jan 106, Apr 98
Audio Oscillator, An	
More Single-Gate Designs	
Precision Rectifiers	
Schmitt Triggers	
Simple CMOS Switching Circuit, A	
Voltage Doublers	
Designing With Digital IC's	
One Shots and Clocks (Carr)	Jan 71
Diconix	
Printer, Portable, 150 (ER)	Oct 31

Digital IC's, Designing With One Shot and Clocks (Carr) Jan 71
 Diodes, Zener, Sorting (ARE) Nov 23
 Diversity Reception, The Return of (COMC) Feb 96
 Drawing Board (DX) Grossblatt Jan 102, Feb 112, Mar 86, Apr 102, Jul 84, Aug 73, Sep 92, Dec 86, Aug 73
 Bank Switching Memory Expansion Apr 102
 Management, More On Jul 84
 Program Corrections and Lab Setup Sep 92
 Remote Control System Dec 86
 Software Doesn't Smoke! Jan 102
 Z80 Demo Program Feb 112, Mar 88
 DTFM Encoding and Decoding (Nassar) Dec 83
 Dual-Condition Sensing (SOSS) Oct 89
 OVM (see MULTIMETER listing under TEST EQUIPMENT)

E

Early Days of Radio, The (Clifford) Jul 80, Nov 60
 Radio History (AR) Feb 106, Mar 86
 Editorial (D) Feb 4, Mar 4, Jul 12, Oct 4, Feb 4, Jul 12, Mar 4
 Radio-Electronics is on the move! (Fenton) Feb 4
 Scrambling: Another View (Giner) Jul 12
 What is the "Robotics Revolution"? (Fenton) Mar 4
 Electric Locks (ARE) Mar 10
 Electromagnetic Interference, Curing (Violetta) Jan 53, Feb 71, Apr 66
 EPROM Programmer (CNSawlow) Oct 61, Nov 53
 Equipment Reports (D) Jan 32, Feb 28, Mar 22, Apr 26, May 22, Jun 20, Jul 22, Aug 22, Sep 22, Oct 27, Nov 26, Dec 24, Jun 24, May 22
 Antenna, VHF, JV-2X, Mirage-KLM Cable Tester, 6500, Triplett Compact Disc Cleaner, Phot-On-Off, Melville Technologies (Fiction) Apr 34, LTR Oct 22
 Frequency Counter, WD-757, VIZ Function Generator, 205, OK Industries IC Tester, TTL, B&K Logic Analyzer, 16-Channel, 318, Tektronix Probe, Circumate LP25, Beckman Pulser, Circumate PR41, Beckman Multimeter DMV, 3430, Sola OVM-638, Scope Printer, Portable, 150, Diconix Prototyping Kit, Surface Mount, Vector Remote Control, Programmable, Control Center, G-E Mar 22
 Scanner Receiver 800XLT, Under-Bearcat MX-7000, Regency May 26, LTR Sep 14
 Stereo Synthesizer, Teledapter TE-600 Rhoades Feb 40
 Telephone Tester, Radio Shack Television, Projection Kit, GR-4500, Heathkit Tracker, 2000, Huntron VCR Distribution System, Rabbit Systems Video Board, Chaufer, STB Systems Wireless Speaker System, WTS-1, Nady Aug 27

F

4007, Versatile, the (Marston) Sep 83
 FET, High Power Stereo Amp (CJSimpson and Clarke) Jun 83, Jul 56, Aug 57, LTR Nov 10
 Fiber Optic Communications (COMC) May 90
 Flasher, Sequential (NI) Dec 32
 Fleetwood (SQ) Aug 78
 Flood Alarm (NI)(Cook) Apr 100
 Fluorescent Lights (ARE) Sep 12
 Flyback Hot (SQ) Aug 78
 Shorted (SQ) Jul 83
 FM (see listing under RADIO)
 Foreign Radio (SQ) Sep 79
 French Connection (SQ) Jul 83
 Frequency and Period (ARE) Feb 12
 Frequency Counter (see listing under TEST EQUIPMENT)
 Function Generator (see listing under TEST EQUIPMENT)

G

General Electric M-722 (SQ) Aug 78
 Remote Control, Programmable, Control Central (ER) Mar 22
 Gravitational Waves? (Hodowanoc) Apr 53, LTR Aug 12

H

HBO, The Raid On (Sheets and Graf) Oct 47
 Hearing with Electronics (Fish) Apr 78
 Heat Proofing Your Projects (Davis) Jan 83
 Heath New Hero (R) May 83
 Television, Projection Kit, GR-2400 (ER) Oct 27
 Helium-Neon Laser (C)(Grossblatt and Iannini) Jun 42

Hi-Fi (see STEREO)
 High Fidelity (see STEREO)
 High Power FET Stereo Amp (CJSimpson and Clarke) Jun 83, Jul 56, Aug 57, LTR Nov 10
 Home Security System, Build This (C)(LaMarbna) Jan 49
 Hot Resistors and Shorted Capacitors (SC) Apr 68
 How To Design Oscillator Circuits (Carr) Jul 65, Aug 54, Sep 58, Oct 72, Nov 63, Dec 71
 Make Kirlian Photographs (Iovine) May 43, LTR Sep 14, LTR Oct 22
 Horizontal Sweep, No (SQ) Sep 79
 Humidity Monitor (C)(Worley) Feb 61
 Huntron Tracker 2000 (ER) Apr 26

I

IC Everywhere, I See (SC) Feb 110
 Making Measurements with (Thietley) May 63
 Packaging, A Revolution in (Byers) May 58, LTR Oct 25
 Temperature Sensors and More (SOSS) Jan 99
 Tester (see listing under TEST EQUIPMENT)
 Inexpensive Robotics Arms (R) Jul 80
 Inside the Telephone (Graf and Graf) Oct 56, Nov 51
 Interference, Curing Electromagnetic (LaViolette) Jan 53, Feb 71
 It's Kate—Bar the Door! (STV) Mar 81

J

Joystick, Building a (ARE) Feb 12

K

Kirlian Photographs, How to Make (Iovine) May 43, LTR Sep 22, LTR Oct 22

L

Lasers (SPECSECT) Jun 39
 Helium-Neon (C)(Grossblatt and Iannini) Jun 42
 Looking at (Bernard) Jun 39, LTR Oct 22
 Letters (D) Jan 12, Feb 15, Mar 14, Apr 22, May 12, Jun 10, Jul 14, Aug 12, Sep 14, Oct 22, Nov 10, Dec 8
 Locks, Electric (ARE) Mar 10
 Logic Analyzer (see listing under TEST EQUIPMENT)
 Logic Probe (see listing under TEST EQUIPMENT)
 Logic Pulser (see listing under TEST EQUIPMENT)
 Looking at Lasers (Bernard) Jun 39, LTR Oct 22
 Low Voltage (SQ) Sep 79

M

Magnavox E34018 (SQ) Oct 85
 Magnetic Photo Preamp (ARE) Mar 8
 Measurements with IC's, Making (Thietley) May 63
 Measuring Speaker Impedance (ARE) Apr 6
 Medical Electronics Healing with Electronics (Fish) Apr 78
 Melville Technologies Compact Disc Cleaner Phot-On-Off (ER) (Fiction) Apr 34, LTR Oct 23
 Memory (see listing under COMPUTER)
 Microprocessor, The, A Decade of Change A (Grossblatt) Apr 61
 Microwave (see listing under TEST EQUIPMENT)
 Mini Music Synthesizer (C) Feb 78
 Mirage-KLM Antenna, VHF, JV-2X (ER) Jun 24
 Misconvergence (SQ) Sep 79
 Morse Electrophonic 7800 (SQ) Jul 83
 Multimeter (see listing under TEST EQUIPMENT)
 Music Synthesizer, Mini (C) Feb 75
 Mystery Computer Revealed (R) Apr 81

N

Needs Tuning Capacitor (ARE) Apr 12
 New Ideas (D) Feb 46, Mar 32, Apr 100, May 32, Jun 32, Aug 29, Nov 38, Dec 32
 Cable Tester, Simple (Dowling) Aug 29
 Crystal Timebase, An Inexpensive (Rohrer) Feb 46
 Flood Alarm, Easy to Build (Cook) Apr 100
 Robot Eyes (Ellis) Mar 32
 Light Seeking (Tavros) Nov 38
 Sequential Flasher Dec 32
 Simple Circuit Fails Car Thieves (Goors) May 32
 Telephone Answering System (Yokursur) Jun 32

Products (D) Jan 111, Feb 24, Mar 30, Apr 40, May 38, Jun 28, Jul 30, Aug 30, Sep 34, Oct 42, Nov 31, Dec 38
 World of Communications (SPECSECT)(Kobbi) Sep 49
 Nady Systems Wireless Speaker System (ER) Aug 27
 Nifty Projects, Two (C)(O'Neil)(Fiction) Apr 60

O

OK Industries Function Generator, 205 (ER) Jul 26
 1-GHz Frequency Counter (C)(Muffi) Jul 47
 Op Amps, New (SOSS) May 88
 Oscillation (SQ) Jul 83
 Oscillator Circuits, How to Design (Carr) Jul 65, Aug 54, Sep 58, Oct 72, Nov 63, Dec 71, Mar 94
 Overload Protection (SOSS)

P

P-C Board Ground Plane (ARE) Apr 8
 Parts for Crystal Radio (ARE) Apr 12
 Pest Repeller Questions (ARE) May 8
 Pet Robot (R) Jun 74
 Photo (see listing under STEREO)
 Phony Burglar Alarm (C)(Rangerberger) Sep 44
 Photographs, How to Make Kirlian (Iovine) May 43, LTR Sep 22, LTR Oct 22
 Pocket Television Receivers (Blechnan) Jul 39, Aug 47
 Position Sensing (R) Sep 74
 Power Line TV Interference (ARE) Jul 8
 Supply (also see TEST EQUIPMENT) Supply, Simple (ARE) May 9
 Switch, Remote-Controlled (C)(Cooper) Aug 43
 Printed Circuit (see P-C)
 Printer (see listing under COMPUTER)
 Private Amateur Communications (COMC) Nov 80
 Programmer, EPROM (C)(Sawlow) Oct 61, Nov 53
 Programs (see listing under COMPUTERS)
 Projection Television (see listing under TELEVISION)
 Prototyping Kit, Surface Mount, SMT, Vector (ER) Sep 32

R

Rabbit Systems VCR Signal Distribution System (ER) Nov 26
 Radar Signal Detector (Hodowanoc) Jul 52
 Speed-Gun Controller (C)(Sivens) Aug 38, LTR Sep 14
 Radio (also see ANTIQUE RADIO)
 Aircraft Radio on the FM Band (ARE) Jul 10
 Antenna, VHF, JV-2X, Mirage-KLM (ER) May 24
 Communications (SPECSECT) Sep 45
 From DC to Microwave (Bernard) Sep 45
 New World Of (Kobbi) Sep 49
 Communications Corner (DX)(Friedman) Feb 96, Mar 92, Apr 105, May 90, Jul 69, Aug 81, Aug 84, Oct 92, Nov 80, Jul 89, Apr 105, Oct 92, Sep 84, Mar 92, Feb 96, May 90, Nov 80, Aug 81, Oct 84
 Early Days Of, The (Clifford) Jul 61, Nov 60
 History (ARE) Feb 106, Mar 86
 FM Notch Filter (ARE) Apr 14
 Reporting Shortwave Reception (ARE) Jan 26
 Scanner Booster (SQ) Sep 79
 Receiver 800XLT, Under-Bearcat (ER) Mar 26
 MX-7000, Regency (ER) May 26, LTR Sep 14
 Telephone Tester (ER) Jul 23
 Trimming All Auto (ARE) Sep 12
 Radio-Electronics is on the Move (E)(Fenton) Feb 4
 Raid On HBO, The (Sheets and Graf) Oct 47
 RCA CTC-71 (SQ) Sep 78
 CTC-76 (SQ) Mar 85
 CTC-107 (SQ) Jul 83
 Reader Input (SQ) Oct 85
 Rectifiers, Precision (DN) Jun 71
 Red Hot Damper Tube (SQ) Jan 109
 Regency Scanner Receiver, MX-7000 (ER) May 26, LTR Sep 14
 Remote Control Power Switch (C)(Cooper) Aug 43
 Programmable, Control Central, G-E (ER) Mar 22
 Repairing (see SERVICING)
 Replacing Transistors (SC) Aug 75
 Reporting Shortwave Reception (ARE) Jan 26

Resistor	
Burnt, Simple Cure for (SQ)	Mar 85
Decade Box (see listing under TEST EQUIPMENT)	
Revolution in IC Packaging: A (Byers)	May 59, LTR Oct 24
Rhoades	
Stereo Synthesizer, TE-600 Teledapter (ER)	Feb 40
Robot (see ROBOTICS)	
Robotics (D)(Robillard)	Jan 84, Feb 94, Apr 81
	May 83, Jun 74, Jul 80,
	Aug 71, Sep 74, Oct 82,
	Nov 74, Dec 81
Brains	Feb 84
Health's New Hero	May 83
Inexpensive Arms	Jul 80
More On Vision Systems	Dec 81
Mystery Computer Revealed	Apr 81
Pol	Jun 74
Position Sensing	Sep 74
Probers Revisited	Oct 82
Simple Solid-State Vision	Nov 74
Tactile Sensing	Aug 71
Voice Recognition, and	Jan 84
(SPECSECT) (Robillard)	Mar 41
Personal (Robillard)	Mar 41
Your Own, Build (Robillard)	Mar 47
Revolution, Where Is (E)(Fenton)	Mar 4
Robot	
Eyes (N)(Ellis)	Mar 32
Light Seeking (N)(Tavara)	Nov 38
Personal, Buyer's Guide To (Robillard)	Mar 41
Pet (R)	Jun 74
R-E IC (Sams)	Dec 84
Your Own, Build (Robillard)	Mar 47
Probers Revisited (R)	Oct 82

S

Sanyo	
91C63 (SQ)	Sep 79
Satellite TV (D)(Cooper)	Jan 82, Feb 103, Mar 81,
	Apr 82, May 80, Jun 78,
	Jul 78, Aug 69, Sep 72,
	Oct 86, Nov 70, Dec 79
Black-Box Descrambling	Jun 75
Breaking VideoCypher	Dec 79
Budget DBS System	Nov 70
C, Ku, and DBS	Jan 92
C-Band DBS?	Feb 103
It's Kale—Bar the Door	Mar 81
Kale Test, The	Apr 82
Ku Change, the	Oct 86
Microwave Test Equipment	Sep 72
Scrambling	
And TVRO Systems	Aug 69
Update	May 80
Woes	Jul 78
Black Box Descrambling (STV)	Jun 75
Breaking VideoCypher (STV)	Nov 70
Budget DBS System (STV)	Nov 70
C, Ku, and DBS (STV)	Jan 92
C-Band DBS?	Feb 103
Descrambler (C)(Terno and Perodi)	Oct 80
It's Kale—Bar the Door (STV)	Mar 81
Kale Test, the (STV)	Apr 82
Ku Change, the (STV)	Oct 86
Microwave Test Equipment (STV)	Sep 72
Raid on HBO, The (Sheets and Graf)	Oct 47
Receiver, Build This \$99 (C)(Maddox)	Jan 45
Scrambling	
And TVRO Systems (STV)	Aug 69
Another View (E)	Jul 12
Update (STV)	May 80
Woes (STV)	Jul 78
Scanner (see listing under RADIO)	
Schmitt Triggers (DN)	May 88
Scope (also see listing under TEST EQUIPMENT)	
Multimeter, DVM-638 (ER)	Jan 36
Scrambling	
Another View (E)	Jul 12
Update (STV)	May 80
Woes (STV)	Jul 78
Screwdriver Serviceman (SQ)	Oct 83
Seam	
564-4173	Jan 109
564-417700400 (SQ)	Mar 85
Security System, Build This Home (C)(LaMartina)	Jan 49
Sensors, IC Temperature and more (SOSS)	Jan 99
Service Clinic (D)(Darr)	Jan 106, Feb 110, Mar 84,
	Apr 88, Jul 82, Aug 76
	Sep 78, Oct 85, Dec 88
Customer Psychology	Sep 78
Dead-Set Servicing	Jul 82
Hot Resistors and Shorted Capacitors	Apr 88
I See IC's Everywhere	Feb 110
Repairing Old TVs	Jan 108
Replacing Transistors	Aug 75
Screwdriver Serviceman	Oct 85
Signal Tracing	Dec 88
Voltage Regulators	Mar 84
Service Questions (D)(Darr)	Jan 109, Feb 111, Mar 85,
	Apr 90, Jul 83, Aug 76,
	Sep 78, Oct 85, Dec 89
Servicing	
B.I.G. Turntables (L)	Apr 90
Compact Disc Players (Lenk)	Jan 87, Feb 79, Mar 73
Repairing Old TVs (SC)	Jan 108
Troubleshooting the Tough Ones (Salerno)	Mar 76
Shrunken Video (SQ)	Jan 109

Simple	
Circuit Fails Car Thieves (Goers)	May 32
Power Supply (ARE)	May 9, LTR Sep 22
RF Field Monitor (ARE)	Apr 14
Single	
Chip Sync/Sweep Circuit (SOSS)	Jun 72
Gate Designs, More (DN)	Mar 90
Slow Guns (SQ)	Aug 76
Soar	
Digital Multimeter, 3430 (ER)	Sep 24
Schwartz (see listing under COMPUTER)	
Sony	
IX-2501 (SQ)	Apr 90
Misconvergence (SQ)	Sep 79
Static Convergence (SQ)	Apr 90
Walkman Amplifier (C)	Mar 59
Speaker (see listing under STEREO)	
Speakerphone (see TELEPHONE)	
Spikes and Cures (COMMC)	Aug 61
State of Solid State (D)(Scott)	Jan 99, Mar 94, Apr 106,
	May 89, Jun 72, Aug 78,
	Oct 89
Chop-Amps	Aug 79
Dual-Condition Sensing	Oct 89
IC Temperature Sensors and More	Jan 99
New Op Amps	May 88
Overvoltage Protection	Mar 84
Single-Chip Sync/Sweep Circuit	Jun 72
Temperature Alarm IC	Apr 106
STB Systems	
Video Board, Chauffer (ER)	Jan 22
Stereo	
Amplifier	
High Power FET (C)(Simpson and Clarke)	Jun 83, Jul 86, Aug 57,
	LTR Nov 10
Walkman (C)	Mar 59
Audio Distortion Filter (ARE)	Jul 10
Click and Pop Filter for your (CHGorn)	May 48, Jun 55
Compact Disc	
Cleaner, Phot-On-Off, Melville	Apr 34, LTR Oct 24
Technologies (ER)	Jan 87, Feb 79, Mar 73
Repairing Players (Lenk)	Aug 63
Bit-By-Bit (Bernard)	Jul 10
Distortion Filter, Audio (ARE)	Mar 8
Phono Preamp, Magnetic (ARE)	
Speaker	
Enclosure, R-J (ARE)	Mar 8
Headphones, and (AR)	Sep 88
Measuring Impedance (ARE)	Apr 6
System, Wireless, WTS-1, Nady (ER)	Aug 27
Wiring Extension (ARE)	Jan 26
Stroboscope, Simple (ARE)	Aug 8
Synthesizer, Teledapter TE-800, Rhoades (ER)	Feb 40
TV Decoder (C)(Sokolowski)	Mar 51
Stroboscope (see listing under STEREO)	
Stun Gun, Build This (C)(Grossblatt and Lennin)	Sep 41, LTR Nov 10
Surface Mount Technology, Prototyping Kit	
Vector (ER)	Sep 32
Switches, Transistor, All About (Cebik)	Feb 83
Switching, Bank (DB)	Aug 73
Sylvania	
GC4152W (SQ)	Aug 76
Synthesizer (see MUSIC, also see STEREO, also see TELEVISION)	

T

Tactile Sensing (R)	Aug 71
Teknisk	
3248 (SQ)	Feb 111
Tektronix	
Logic Analyzer, 16-Channel, 318 (ER)	Feb 28
Telephone	
Answering System (P)(Yoursurs)	Jun 32
Inside the (Graf and Graf)	Oct 58, Nov 81
Line Tester (C)(Friedman)	Apr 50, LTR Jun 10
Speakerphone Information (ARE)	Apr 8
Tester (ER)	Jul 23
Teletex (see listing under VIDEO)	
Television (see listing under VIDEO, also see SATELLITE TV)	
Temperature	
Alarm IC (SOSS)	Apr 106
Sensors and more, IC (SOSS)	Jan 99
Test Equipment	
Antique (AR)	Aug 77
Cable Tester	
Simple (N)(Doering)	Aug 29
8500, Triplet (ER)	May 22
Capacitance Leakage Tester	
(C)(McChellan)	May 51, LTR Sep 22
Continuity Tester, Latching (C)(Knight)	Nov 49
Frequency Counter	
All About (Martin)	Apr 89, May 71
12-GHz (C)(Huff)	Jul 47
WD-757, VIZ (ER)	Jun 20
Function Generator	
205, OK Machine (ER)	Jul 26
IC Tester, TTL, B&K (ER)	Aug 22
Logic	
Analyzer, 16-Channel, 318,	
Tektronix (ER)	Feb 28
Probe, Circumate LP26, Beckman (ER)	Dec 24
Pulsar, Circumate PR41, Beckman (ER)	Dec 28
Microwave (STV)	Sep 72

Multimeter	
Digital, 3430, Soar (ER)	Sep 24
DVM-638, Scope (ER)	Jan 36
Power Supply, Variable Bench Top (C)	
(Swain and Ubaud)	Jun 81
Revisor Decade Box (ARE)	Jan 22
Scope For TV, What Kind (SQ)	Apr 90
Telephone	
Line Tester (C)(Friedman)	Apr 50, LTR Jun 10
Tester (ER)	Jul 23
Tracker, 2000, Huntron (ER)	Apr 26
Time Delay, Electronic (AR)	Oct 18
Titler, Video (C)(Fleck)	Jan 87, Mar 62
Toshiba	
C998 (SQ)	Oct 85
Tractor-Radio Problems (SQ)	Aug 76
Transistor Switches, All About (Cebik)	Feb 83
Triplet	
Cable Tester, 8500 (ER)	May 22
Troubleshooting (see SERVICING)	
True North, Where is? (ARE)	Oct 14
Tuning "Eyes" and AVC (AR)	Jul 86
TV (see TELEVISION listing under VIDEO, also see SATELLITE TV)	
Two Nifty Projects (C)(Oddy)(Fiction)	Apr 50
Uden-Bearcat	
Scanner Receiver, 800XLT (ER)	Mar 28
Universal Battery Charger (C)(Wright)	Jul 87

U

V

VCR (see listing under VIDEO)	
Vector	
Prototyping Kit, SMT (ER)	Sep 32
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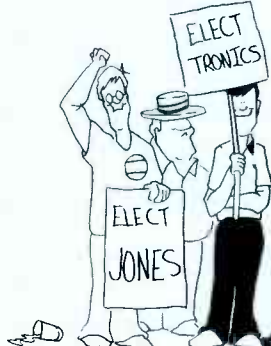
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"They use them in vacuum cleaners."



"No. There's no such thing as a tall circuit."

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(CC)Computer Connections; (CD)Computer Digest; (D)Department;
(DB)Drawing Board; (DN)Designer's Notebook; (EW)Editor's Workbench;
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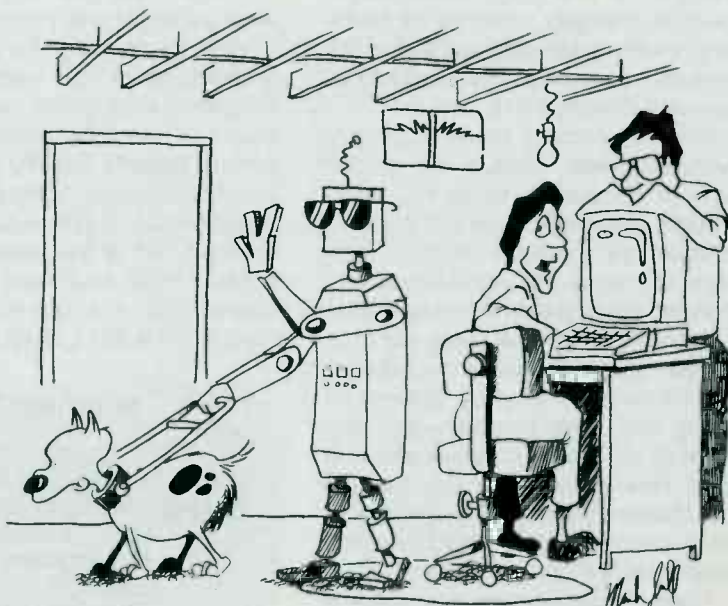
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Where did you think robotic arms came from?



I haven't got the eyesight figured out yet

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(CC) Computer Connections; (CD) Computer Digest; (D) Department;
(DB) Drawing Board; (ER) Equipment Reports; (HH) Hardware Hacker;
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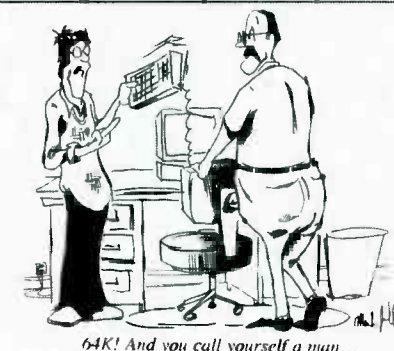
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WORLD BAND RECEIVER

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in Fig. 8-a) in the center series arm. This is the most important bandpass filter in the receiver and it must be aligned correctly.

Check the filter in the receiver by listening with the headphones for a stable signal within the 16.45 to 17.1 MHz range. The 11th harmonic at 16.5 MHz of the band 5 (refer to Fig. 4-d) oscillator/divider output of 1.5 MHz will be satisfactory.

Tune across the band while monitoring the DC voltage on the detector AGC line. The voltage should rise very rapidly to more than 5 volts, hold steady, and then drop rapidly to zero. With a frequency counter connected to capacitor C48 and a voltmeter calibrated in decibels on the AGC line, verify that your filter output matches the curve in Fig. 9.

Obtain an RF signal generator and an RF voltmeter. Mount the four inductors on the copper-clad side of the 1 × 3-inch board 4. Then connect the end capacitors (fixed and variable) as shown in Fig. 10. To check the LC resonant circuit at each end, set the RF generator to the filter's mid frequency (16.772 MHz) and adjust the 1—16 pF capacitor in parallel with the 110 pF capacitor that forms C1 for a peak reading (parallel resonance) on the RF voltmeter.

Now connect inductor L4 and the two capacitors forming C2 (a 39 pF capacitor in parallel with a 1 to 16 pF capacitor) shown in Fig. 11. Set the RF signal generator for 17.897 MHz, and adjust for a null (series resonance). Repeat this step with L5 and C3 tuning for a null at 15.713 MHz. Then without

changing capacitor settings, connect the filter components in their final positions as shown in Fig. 8-b. Frequencies for the other bands are shown in Table 2.

The first mixer converts each of the popular shortwave bands to the 16.45 to 17.1 MHz range. The mixer in this receiver is a double-balanced mixer.

Filter construction

Build the four crystal-controlled oscillators that tune the six bands of the receiver by referring to the schematics in Fig. 4. Note that 7 MHz-crystals are used in both the band 1 and 2 oscillators (XTAL 7 and XTAL 8), but a 10 MHz crystal (XTAL9) is used in the band 3 oscillator (Fig. 4-c). The oscillator in Fig. 4-d is able to provide three different frequencies because of its output countdown circuitry (IC8, IC9, IC10 and IC11).

Filter details are given in Table 2. Filters are built with fixed-value capacitors and tuning is accomplished by adjusting the position of the wire turns on the toroid cores. Compressing the turns to less than 360 degrees of the toroid's circumference increases their inductance and lowers their resonant frequency.

For example, compressing a coil whose turns are spread out over 360° down to about an angle of coverage of about 120 degrees increases the inductance 75%, shifting the frequency 32% lower. Follow the procedure outlined for the first IF bandpass filter, but use the frequencies listed in Table 2. Filter components are mounted directly on the 6 × 3 1/4-inch circuit board 1. (See Figs. 1 and 2.)

Automatic gain control

Refer to Fig. 3 and build the

automatic gain control (AGC) circuit last. It allows this receiver to cope with a wide range of signal strengths while the listener tunes across the band. The volume control knob can be left in a fixed position and all tuning can be done with the TUNE control.

Set the 10K potentiometer, R68, for 5 volts DC at the cathode of diode D5 with no signal input to the receiver. This level will increase to about 6 volts in the presence of strong signals, causing a reduction in the gain of the IF amplifiers. Refer to Fig. 12 and build the 9.83 MHz crystal filter on board 5 whose dimensions are given in Table 1.

Precision tuning dial

Cut and bend a mounting bracket for the air-dielectric tuning capacitor C49 from aluminum stock and drill a hole in it to accept the capacitor shaft and two holes at its base flange 1/4 inch back from the front edge so it can be mounted to the baseplate as shown in Fig. 13. (Capacitor C49 is part of the variable-frequency oscillator circuit.)

Mount tuning capacitor C49 on the bracket positioned about 1 1/4 inches behind the front panel as shown in Fig. 13. The tuning capacitor is rotated by an assembly shown in Fig. 13 consisting of a 3-inch diameter pulley turned by a nylon cord wound over the tuning knob spindle and located in the vee groove of the pulley.

The pulley can be turned from sheet plastic in a lathe or a suitable one might be obtained from electronic salvage. Two slots cut in the edge of the pulley allow the cord ends to pass through the wall of the vee-groove for fastening. A small

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A Mini computer? Do they make Mickey, Donald, and Goofy computers too?



This one must be really difficult. You've been working on it for five years!



Shouldn't we plug these holes up so all the electricity doesn't leak out?

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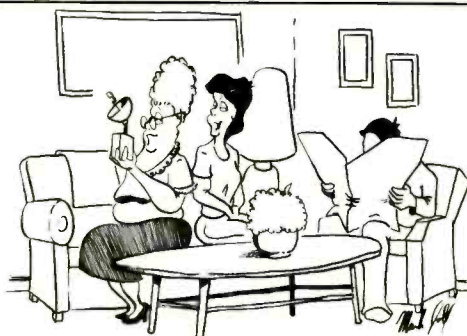
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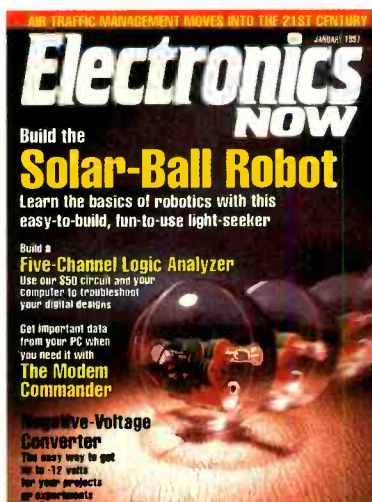
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ON THE COVER

29 BUILD THE SOLAR BALL ROBOT

Down through the ages, Man has been fascinated by devices that mimic animal behavior. In centuries past, clockwork-driven automata were all the rage. Today, industrial robots have become common on the factory floor. Tomorrow might bring us the endearing, self-aware "droids" popularized in movies such as *Star Wars*. While we can't bring you *R2-D2*, at least not this month, we can and will show you an interesting light-seeking robot with an unusual, ball shape. It makes a fun project on its own or a great starting point for further experiments.

— John Iovine

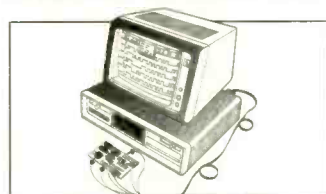


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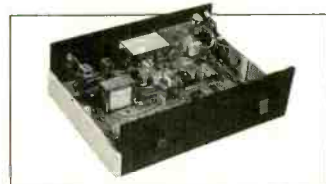
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Use our remote-booting device to make sure that you are never caught without crucial data. — Raymond C. Buck

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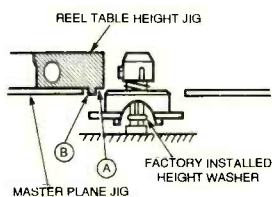
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35 BUILD THE PCDRILL

Except when dealing with the simplest of circuits, electronics projects invariably turn out best when a PC board is used. The problem is that making the board is often more work than building the project itself. And if you need to make several of the same board, the task can get to be overwhelming. This month, we present a project that can simplify at least one part of the task. It is a precision x/y drilling table that lets you make perfectly centered holes on even the tiniest of pads. Best of all, at under \$100 to build (including drill), it costs just a fraction of what a commercial unit would command. — *James J. Barbarello*



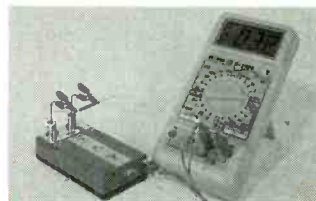
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55 FREEZER SENTRY FOOD-FREEZER MONITOR



Keep your expensive frozen meats and other foods safe from disastrous thaws with this monitor that warns you before trouble strikes. — *Dave Sweeney*

61 CONDUCTANCE ADAPTER FOR YOUR MULTIMETER



Measure very large resistances, very small leakage currents, and more with this reliable, precision add-on for your DMM. — *Skip Campisi*

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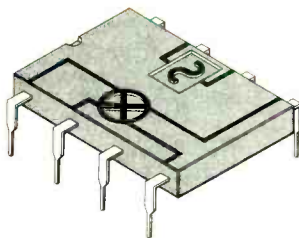
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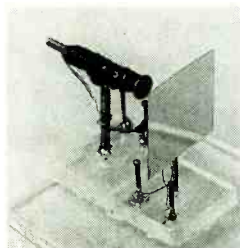
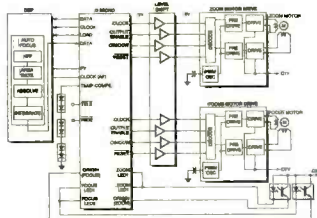
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When it comes to auto theft, the statistics tell a cold, almost staggering story. What they don't tell is the gut-wrenching feeling you get when you discover that you have just become a statistic. This month, we present a project that could help prevent that from happening to you. Called the Guardian, it is an electronic watchman that keeps an eye on your car when you can't, and alerts you if trouble is pending. As a bonus, it uses a sensing technique that keeps false alarms to a minimum.

— Anthony J. Caristi



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41 BUILD THE PCDRILL

A precision, computer-controlled drilling table that simplifies the task of making PC boards.

— James J. Barbarello



46 PHONE LINE MONITOR



It triggers your security system into action any time your telephone line is cut.

— James Melton

60 ANIMAL SOUNDS PIANO

A fun-to-use 10-key music synthesizer that plays barnyard animal sounds.

— David Williams



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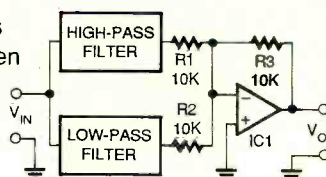
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52 DESIGNING ACTIVE AC FILTERS

Learn how these filters work, when to use them, and how to design practical circuits you can use in your own projects.

— Joseph J. Carr



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150-MHz oscilloscope.



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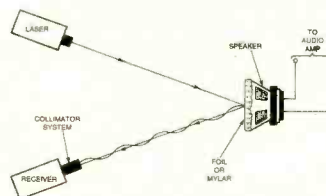
The idea-mortality curve, table lookups, and more.

— Don Lancaster

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Modulating a laser beam.

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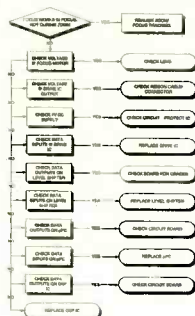
Troubleshooting camcorder zoom lenses.

— Ray Furlong

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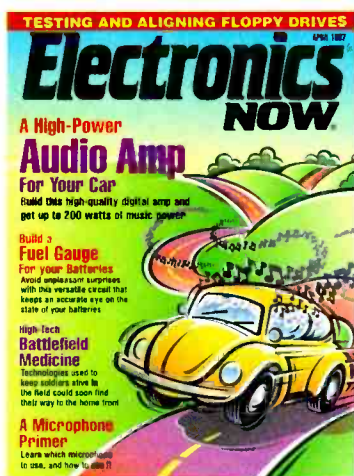
APRIL 1997

ON THE COVER

33 BUILD A 200-WATT DIGITAL AMPLIFIER FOR YOUR CAR

Nothing beats a high-power amplifier for adding zip and excitement to your mobile audio experience. The problem is that once you get to serious wattage levels, the size and heat issues associated with standard amplifier designs become difficult to overcome. Not so with class D switching amps like the one described in this month's cover story. That amp can deliver up to 200 watts into a 4-ohm load, or 100 watts into 8 ohms, yet is relatively compact and efficient. Even better, it delivers great sound with low distortion.

— Alan Bayko



TECHNOLOGY

45 TESTING AND ALIGNING FLOPPY DRIVES



Modern software makes it easier than ever to pinpoint drive problems, and this article shows you what to do about them. — Stephen J. Bigelow

53 HIGH-TECH BATTLEFIELD MEDICINE



New technologies designed to save soldiers' lives on the battlefield will soon make their way home. — Bill Siuru

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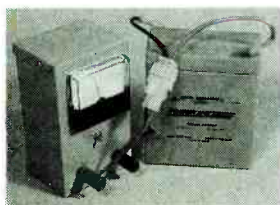
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58 "FUEL GAUGE" FOR YOUR BATTERIES

Know at a glance just how much juice your batteries have left with this easy-to-build project.

— John Pivnichny



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Olympus SYS.230 Magneto-Optical Drive.

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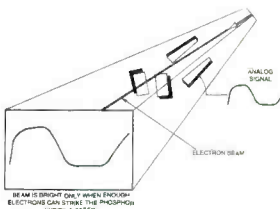
New oscilloscopes blend the best of digital and analog.

— Bob Oblack



28 COMPUTER CONNECTIONS

How not to be a bad coder. — Jeff Holtzman



60 AUDIO UPDATE

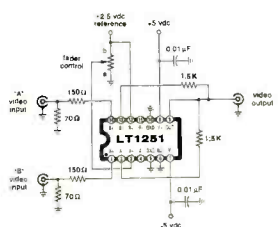
A microphone primer.

— Franklin J. Miller

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Video, video editing, video generators, and more.

— Don Lancaster



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MAY 1997

ON THE COVER

29 BUILD THE CALLDIRECTOR

If you're like many, you probably have several telephones scattered around the house. After all, telephones are relatively inexpensive these days, and doing that can be a great convenience. That is, unless you answer a call in one part of the house that's intended for someone in another. Then, you have to find whomever the call is for, tell them to pick up the phone, and go back to the first phone and hang it up. If you have a teenager, or anyone else who gets a lot of calls, that can become a real nuisance. Well, while this month's cover story won't stop the phone from ringing, it can make the rest a lot easier to deal with. It is a PBX system that's ideal for a home or small office. Best of all, it uses the existing telephone wiring for easy installation.

— John G. Koller



BUILD THIS

45 BUILD THE MOD BOX



A great way to perk up the sound of your guitar, bass, or keyboard. — Thomas Henry and Jack Orman

50 EASY POCSAG SIGNAL DECODER



Learn how alpha-numeric pagers work and set up your own pager-signal monitor

— Robert B. Whitaker

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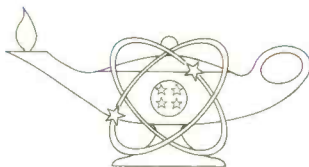
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A great opportunity to join the ranks of the servicing professionals who have proven their skills and ability.
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— Hitachi Technical Services Staff

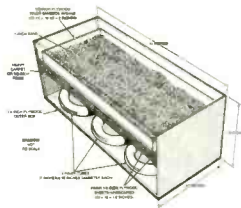


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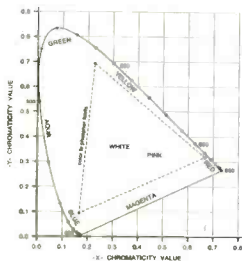
OS/2, the on-line world, Java, Delphi, and more.
— Jeff Holtzman

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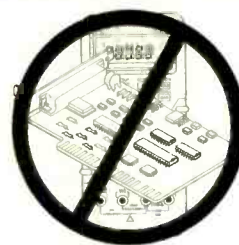
Are you tired of radio stations that play everything except the music you like, or have you ever envisioned yourself as a budding Howard Stern or Rush Limbaugh? If so, here's the perfect vehicle to get you on the air, even if only in a small way. It is an FM-stereo transmitter that offers several advantages over similar units, including better fidelity and sound quality, freedom from frequency drift, and more. Yet, it is easy to build either from scratch or from an available kit. You can also use it to pipe the music to every radio in your home or office, as a wireless FM microphone, and in many other ways.

— William Sheets, K2MQJ and Rudolf F. Graf, KA2CWL



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A new standard that makes it easier than ever to test complex digital ICs, even when still in circuit. — J. Daniel Connell

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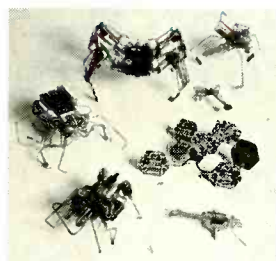
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BUILD THIS

44 BUILD YOUR OWN BEAM ROBOT

Design and build a simple mechanical creature that seems to have a life of its own, then enter it in a competition against others of its kind. — *John Iovine*



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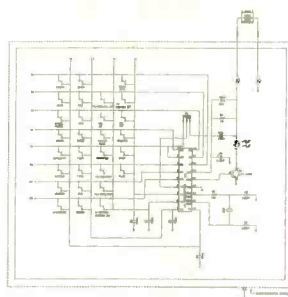


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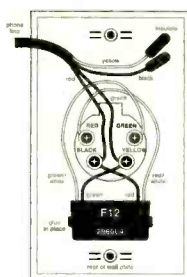
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ON THE COVER

25 BUILD THE SMARTBOX

While driving this summer, have you hit the gas pedal only to find that the pick-up you expect is missing? Or have you noticed that your vehicle is not getting the gas mileage it normally does? The reason for that, in many cases, is your car's air conditioner. One solution would be to stop using it—hardly acceptable, especially on those scorching 90-degree days. Another, better, solution would be to build this month's cover project, the Smartbox. That unit synchronizes the air conditioner's operation to the engine, improving your car's performance when accelerating or climbing, and saving money in the process.

— Anthony J. Caristi



BUILD THIS

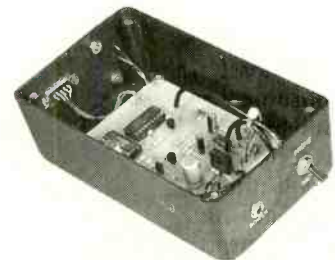
30 BUILD THE REACT-TIME



Use this reaction timer as a game of skill, or to see if you've had a few too many.

— John Fleischer

46 BUILD THE DTMF-PLUS



Capture, decode, and display telephone tones on any personal computer.

— Raymond C. Buck, III

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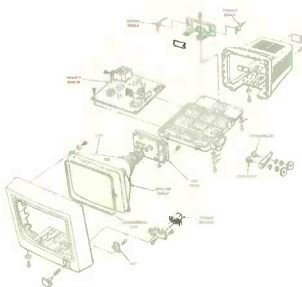
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- 33 ALL ABOUT MONITORS**
Often overlooked, or considered only as an afterthought, here's how one of the most important parts of a personal computer works. — *Stephen J. Bigelow*

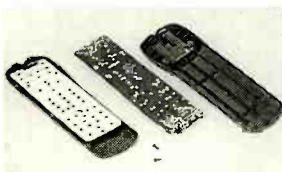


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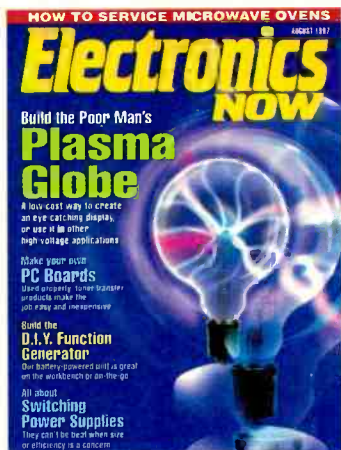
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AUGUST 1997

ON THE COVER

31 BUILD THE POOR MAN'S PLASMA GLOBE

Since its earliest days, mankind has been fascinated by lightning and other kinds of high-voltage discharges. Even today, high-voltage experiments and displays remain among the most popular areas of the electronics hobby. This month, we present a way to have a little high-voltage fun of your own, without breaking the bank to invest in exotic display devices or electronics. In fact, the project uses a common incandescent light bulb as the display device.

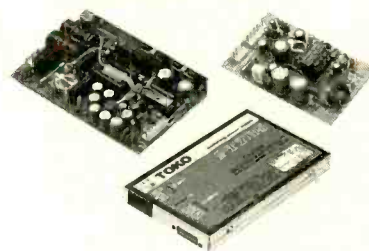


You can also use the circuit for other high-voltage experiments and displays, including a Jacob's Ladder.

— Robert Iannini and Marc Spiwak

TECHNOLOGY

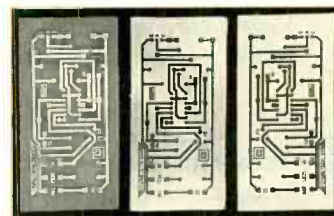
40 ALL ABOUT SWITCHING POWER SUPPLIES



When size and efficiency are important, these supplies are hard to beat.

— Stephen J. Bigelow

48 MAKE YOUR OWN PC BOARDS



Once you've learned the right way to use toner-transfer products, there's no easier way to make PC boards.

— Larry Ball

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BUILD THIS

56 BUILD THE D.I.Y. FUNCTION GENERATOR

Great for your workbench, this battery-operated generator is equally comfortable in the field. Use it to generate accurate sinewaves, squarewaves, and triangle waves at frequencies of up to 100 kHz. — *Skip Campisi*



DEPARTMENTS

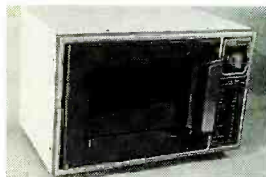
21 COMPUTER CONNECTIONS

Hacking the Pilot Palm computer.

— *Jeff Holtzman*

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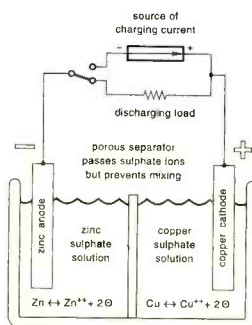
RadioShack AC circuit-breaker identifier.

**28 SERVICE CLINIC**

How to service microwave ovens. — *Sam Goldwasser*

63 TECH MUSINGS

Understanding source impedance, the energy density of gasoline, electrochemistry basics, and more. — *Don Lancaster*



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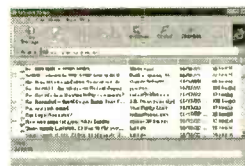
31 BUILD THESE NOISE-CANCELING HEADPHONES

In the roar and din of modern society, a little bit of peace and quiet is becoming an increasingly rare commodity. Well, while the demands on your time might make a trip to a gentle forest or an isolated mountaintop impossible, this month we bring you at least a measure of the solitude those locations offer with a device that blocks out annoying background noise. Even better, our Noise-Canceling Headphones let you mix in the output from a CD or tape player so you can listen to your favorite music quietly, and without distractions.— *Jules Ryckebusch*



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How technology is helping to get polluting vehicles off the road. — *Bill Siuru*

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BUILD THIS

38 BUILD A VIDEO SWITCHER

Watch the outputs from several cameras using just a single monitor with this versatile switching circuit.

— Frank Montegari



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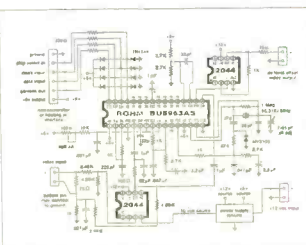
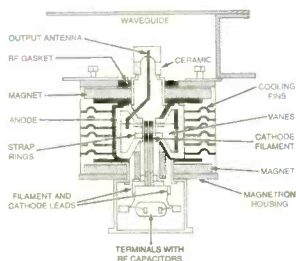
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OCTOBER 1997

ON THE COVER

41 BUILD THE MARINELIFE UNDERWATER ACOUSTIC SENSOR

Most of us think of the sea as a quiet, tranquil place. In truth, however, it is anything but. The denizens of the deep create a wide variety of sounds—some familiar, some mysterious. Then there are the sounds created by Man. The problem is, human ears are just not built to hear the cacophony of sound that exists under the sea. But this month's cover story, about an educational and fun listening device with a special transducer that's designed to withstand the rigors of undersea use, gives Humans a way to eavesdrop on the wondrous world that exists under the water. — *Bill Green*



TECHNOLOGY

45 A NEW VOLTAGE STANDARD
How superconductor technology is being used to create a new, programmable voltage standard.
— *Douglas Page*

50 RECRUITING TOMORROW'S ELECTRONICS TECHNICIANS



What can be done today to prevent a shortage of technicians tomorrow.
— *Joel Goldberg, Ph. D, CET, CA*

56 ENERGY FROM FUEL CELLS



Will fuel cells help us extract the most energy possible from our dwindling fuel reserves?
— *Alvin Sydnor*

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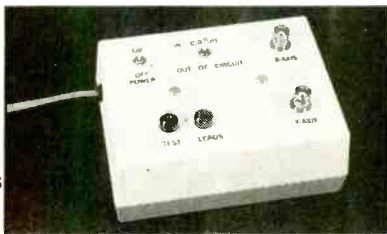
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BUILD THIS

53 BUILD THE QUICK-TESTER

Test a wide variety of devices—even in-circuit—with an oscilloscope and this handy tester.

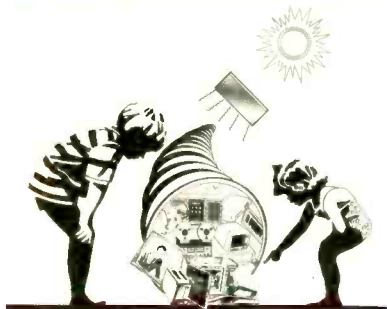
— James Melton



59 BUILD A SOLAR-CHARGE CONTROLLER

Get the maximum efficiency from your solar-power system.

— Blake Reed



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RF-Link Wavecom Sr. A/V rebroadcaster.



22 AUDIO UPDATE

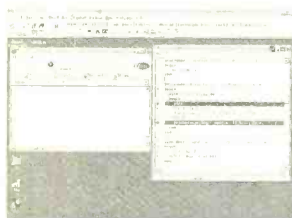
Setting up the Wien-bridge audio generator.

— Franklin J. Miller

29 SERVICE CLINIC

Repairing microwave ovens.

— Sam Goldwasser



34 COMPUTER CONNECTIONS

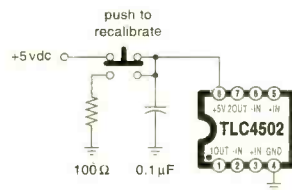
The Internet, Java, and hype aplenty.

— Jeff Holtzman

69 TECH MUSINGS

Measuring low-voltage signals, reading Web site log files, and more.

— Don Lancaster



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NOVEMBER 1997

ON THE COVER

33 BUILD THE JUMPER CABLE WIZARD

It has happened to all of us: We get in our car, turn the key in the ignition, and nothing happens. The battery is dead. The fix is simple; all we need is a set of jumper cables, a good Samaritan, and we are set—or are we? The truth is that this seemingly simple procedure results in many serious injuries and damaged automobiles each year. Well, thanks to this month's cover project, the Jumper Cable Wizard, that's all in the past. Not only will this device make sure your cables are connected properly before disaster can strike, it also lets you check the condition of your car's battery and alternator.

— Tom Fox



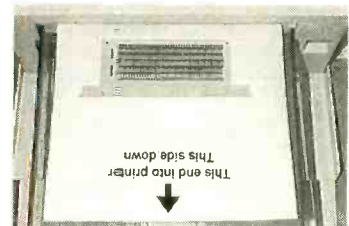
TECHNOLOGY

40 ROADSIDE REPAIRS FOR YOUR CAR'S ELECTRICAL SYSTEM



These simple hints and some common supplies will get you back on the road again in a hurry.
— Tom Fox

52 A NEW WAY TO MAKE PC BOARDS



Flexible copper is the secret behind what could be the easiest way to make your own PC boards.

— Bill Green

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BUILD THIS

37 BUILD THE LAZER FAZER

Give your car's LIDAR detector a check up, then use this device to play a fun game.

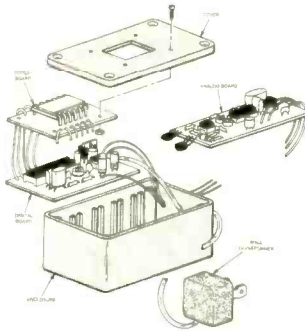
— Douglas Page



48 SOLID-STATE WIND-SPEED INDICATOR

Measure wind speed with a device that uses no moving parts.

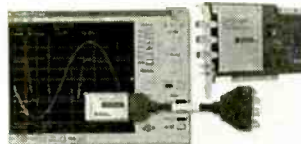
— Anthony J. Caristi



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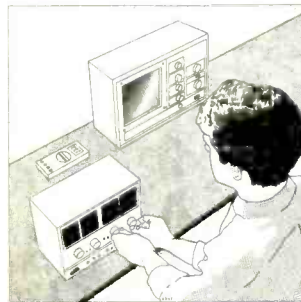
An introduction to troubleshooting.

— Sam Goldwasser

28 COMPUTER CONNECTIONS

Command line C.

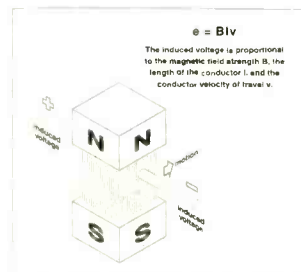
— Jeff Holtzman



57 TECH MUSINGS

Homopolar generators, electromagnetic principles, melody and speech ICs, and more.

— Don Lancaster



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35 BUILD THE ASTRO-TREKER

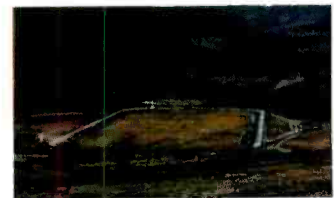
Every once in a blue moon, a project crops up that has nearly no practical applications, yet still is so impressive that everyone who sees it in action wants to try it for themselves, or better still, get one for themselves. This month's cover story is just such a project. Called the Astro-Treker, it puts the user at the controls of a simulated hovercraft. But this is no video game; instead it is an electromechanical device that obeys all the laws of physics, and is as hard to master, and fun to do, as flying a helicopter or even piloting a lunar lander. It can even be modified to provide a variety of different diversions and games, and makes a great Christmas gift.

— G. Randy Slone



TECHNOLOGY

9 PROTOTYPE



Driverless cars for intelligent roads, a biology lab on a chip, and lots more.

51 ALL ABOUT DVD



A look at what DVD is, how it works, and why it could soon replace CDs, laserdiscs, and CD-ROMs.

— Stephen J. Bigelow

59 READING AUTOMOBILE COMPUTER-SERVICE CODES

It's easy to do, can save you lots of money, and you don't even need any special equipment. — Thomas Fox

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42 TWINKLING HOLIDAY ORNAMENT

It's just the thing to brighten up your holidays with some electronic sparkle.

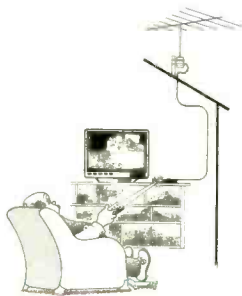
— *David Williams*



45 A REMOTE CONTROL FOR YOUR ANTENNA

Add the convenience of a remote control to any outdoor antenna rotator system.

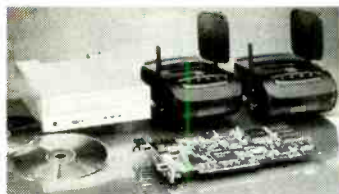
— *William G. Grimm*



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Hi-Val combination DVD-ROM/DVD-video player.



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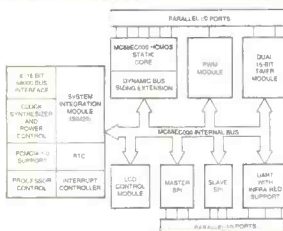
On-line tech tips, tools, and test gear for the troubleshooter.

— *Sam Goldwasser*

25 COMPUTER CONNECTIONS

Inside the Pilot palmtop computer.

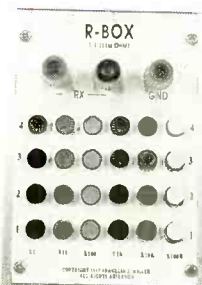
— *Jeff Holtzman*



28 AUDIO UPDATE

Building a resistor-substitution box.

— *Franklin J. Miller*



64 TECH MUSINGS

Radio astronomy, the enigma of the Faraday disc, and more.

— *Don Lancaster*

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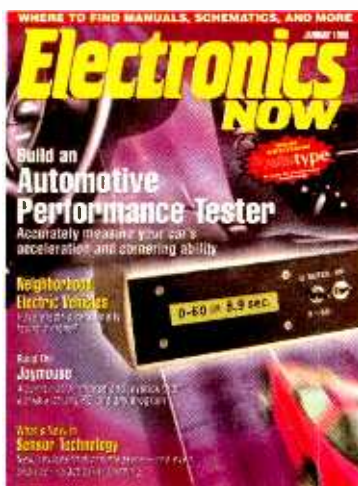
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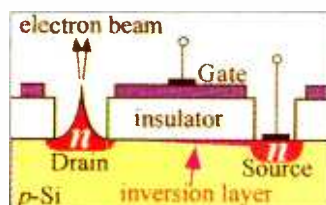
33 BUILD THE AUTOMOTIVE PERFORMANCE TESTER

Many, if not most, Americans have a love affair with their cars. They wax; they wash; then try every new performance-enhancing gizmo or gadget that comes down the pike. Still, every so often, it seems like our favorite chariot's get-up-and-go has got-up-and-went. What gives? Is our car just having a bad day? Was that premium gas we just purchased not up to snuff? Or are we simply playing mind games with ourselves? This month's cover story gives you a way to quantitatively measure your car's acceleration and cornering ability and to make sure all is as it should be. — *Dan Harrison*



TECHNOLOGY

13 PROTOTYPE



A new MOSFET leads to micro vacuum tubes, space-age medicine, and lots more.

40 WHAT'S NEW IN SENSOR TECHNOLOGIES

New advances have led to an explosion of new sensor types and even to complete laboratories on a chip.— *Tom Petruzzellis*

47 NEIGHBORHOOD ELECTRIC VEHICLES



Has electric-powered transportation finally found its niche? — *Bill Siuru*

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BUILD THIS

- 51 BUILD THE JOYMOUSE**
Use your joystick as a mouse. It works with any PC and any software application.
— *Brian Beard*



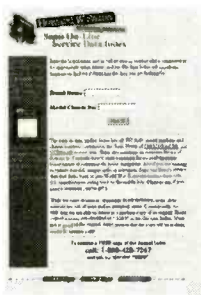
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Performing our first tests.
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33 BUILD A MULTICHANNEL OSCILLOSCOPE TRIGGER

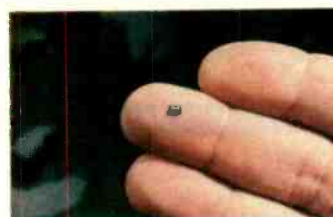
While an oscilloscope is among the most useful pieces of test gear one could own, there are times it falls short of our needs, such as when troubleshooting a computer or another complex digital circuit. For example, have you ever tried to confirm that data was being written to the correct address or that the correct bit is being set during a memory operation, using just a standard, two-channel scope? Impossible, you say? Well, not anymore—thanks to this month's cover story. If you troubleshoot digital electronics, this is one accessory that you just can't do without.

— Thomas Peterick



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Tiny medical sensors, 50-inch high-definition plasma TVs, using space technology to treat tumors, and more.

37 THE GREAT COMPRESSION
MPEG is what makes many of today's high-capacity multimedia technologies possible; here's how it works.
— Yasuda Hiroshi

46 RESTORING A "REEL" RECORDER



Bring those marvelous open-reel recorders of yesteryear back to life. — Phil Van Praag

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BUILD THIS

42 BUILD THIS POCSAG ENCODER

Generate your own pager signals with your computer and this simple interface.

— Robert B. Whitaker



51 BUILD THIS PRECISION VOLTAGE/CURRENT REFERENCE

Perform laboratory-grade measurements on your own workbench.

— Skip Campisi



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Nomai 750.c portable SCSI hard drive.



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Pilot port I/O.

— Jeff Holtzman

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A tiny TV test generator, investigating Brown's Gas, and more.

— Don Lancaster



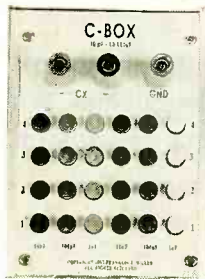
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How printers and copiers work.

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Build a capacitance-substitution box. — Franklin J. Miller



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ON THE COVER

33 BUILD A HIGH-PERFORMANCE LOGIC ANALYZER

If you've done any amount of digital-circuit troubleshooting, you no doubt know how valuable an instrument a logic analyzer can be. But if you've ever shopped for an analyzer, you also know how expensive a top-flight unit can be. Yes, there are a number of lower-cost PC add-ons that can be bought or built, but most have limitations; either they have a low sampling rate or have only a few sampling channels. That is until now. This month's cover story introduces a PC-based logic analyzer that features a 40-MHz maximum sampling rate, 16 channels, and more. Even better, it's expandable. — *Robert G. Brown*



TECHNOLOGY

23 PROTOTYPE

Miniature unmanned aircraft, a radar flashlight, analyzing blood disorders, smartcard ICs, and more.



44 MAINTAINING YOUR OWN PC



These simple steps can ensure the health of your personal computer and your valuable data.

— *Stephen J. Bigelow*

51 RESTORING A "REEL" RECORDER

This month we show you the first steps in bringing your cherished treasure back to life.

— *Phil Van Praag*



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BUILD THIS

59 BUILD A "HOME-BREW" TEMPERATURE CONTROLLER

One key to making your own beer and wine is precise temperature control, and this unit makes achieving that a snap. — *David W. Boertjes*



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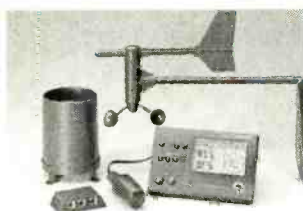
RadioShack AccuWeather personal weather station..

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Pilot graphing, Small C, e-mail, and more. — *Jeff Holtzman*

18 SERVICE CLINIC

Servicing CD players and CD-ROM drives.
— *Sam Goldwasser*

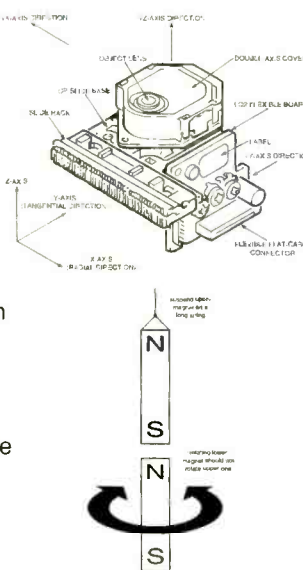


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APRIL 1998

ON THE COVER

33 BUILD THE DATA MONITOR

In the lab, on the workbench, or around the house, there are many instances where we need to gather information over a period of time. The traditional approach is to use a computer to first collect that information, and later to analyze it. But is it really a good idea to tie up an expensive piece of hardware like a computer for hours, days, weeks, or even longer? Of course not, and thanks to the Data Monitor there is now a better, lower-cost way to perform the information-gathering part of the task. What's more, through the use of simple plug-in modules, it can be configured to handle virtually any data-collecting application.

— Jon Varteresian



TECHNOLOGY

13 PROTOTYPE

Using technology to fight crime and terrorism, a camera on a chip, geothermal heating, and more.



49 EXPERIENCE THE FECHNER PHENOMENON



Astound your friends and family when you conduct this simple workbench experiment that explores

how we perceive colors.

— Dave Sweeney

52 RESTORING A "REEL" RECORDER

This month we show you how to return your treasure to its original glory

— Phil Van Praag



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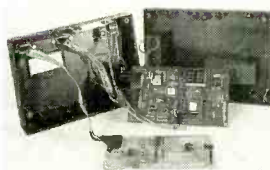
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BUILD THIS

44 BUILD THIS PERSONALITY MODULE FOR YOUR DATA MONITOR

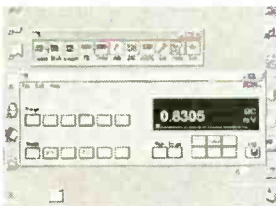
Put your Data Monitor to work with this general-purpose I/O module that can accept both analog and digital data, and includes a temperature sensor. — *Jon Varteresian*



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12 EQUIPMENT REPORT

National Instruments virtual digital multimeter.



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How to "repair" CD and CD-ROM discs, and an introduction to repairing CD players and CD-ROM drives.

— *Sam Goldwasser*



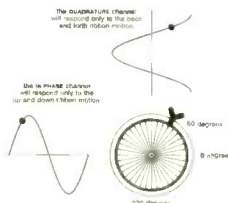
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MAY 1998

ON THE COVER**37 BUILD THE INFOCARD CARD SCANNER**

We've seen them in airports, office buildings, laboratories, and anywhere else where it is important to restrict access to any area to only those who have legitimate business there. We've also used them on an almost daily basis to gain access to our money at an ATM and even to buy groceries or gas. What we are talking about are the now ubiquitous swipe cards that are used to provide an extra measure of security to people, places, and information. In this month's cover story, we'll show you how to add that same type of security with a system that can be integrated with computers, locks, and more. — J. J. Barbarello

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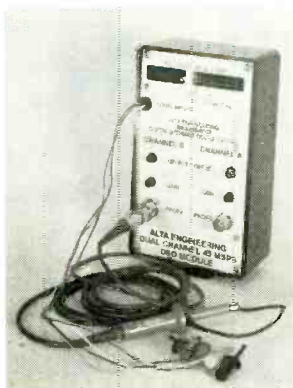
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Combine this add-on module, the High-Performance Logic Analyzer from last March's issue, and almost any PC, and get a powerful digital storage scope for your workbench.

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Individuals have been fascinated with the concept of sending their words and ideas to others located at some distant point since the days of our earliest ancestors. Of course, these days radio, especially AM radio, is not exactly a cutting-edge technology. However, the medium still holds a lot of fascination for many. After all there are millions of ham-radio operators world wide. Then there's the phenomenon of "pirate" radio. This month, we present a modern version of an all-time classic. It's a low-power AM transmitter that meets FCC part 15 requirements. It won't let you challenge the "big boys," but it could make you the most popular "jock" on your block.

— William Sheets K2MQJ and Rudolf F. Graf KA2CWL



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— Albert Lozano-Nieto, Ph.D

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This super-sensitive vibration sensor can help protect your property and your life.
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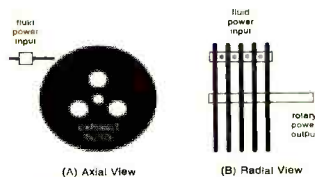
This handy accessory works with different broadcast standards and can be set to pick out any individual line.
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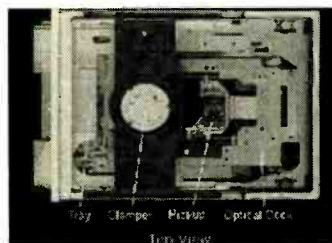
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There has never been a better time to be a videophile. For one thing, in recent years there has been an explosion of high-quality video sources, such as DSS, DVD, S-VHS VCRs, laser discs, digital camcorders, and more. But there is one catch: To get the highest-quality images from those sources you need to use something other than standard composite video. Most often, that something is S-video, and most high-end gear is equipped to handle those signals. This month, we present a unit that lets up to four devices share S-video signals from a single source. It's great for things such as tape dubbing, or as the heart of a multi-room S-video system.

— *Tod T. Templin*



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Pulling faster chips out of thin air, an "intelligent" highway in NYC, growing virus antibodies in space, and more.

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Using flux-gate sensors to build practical magnetometers and gradiometers. — *Joseph J. Carr*

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40 BUILD A PORTABLE PULSE GENERATOR

An economical and easy-to-build instrument that's equally at home in the field or on your workbench.

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— Sam Goldwasser



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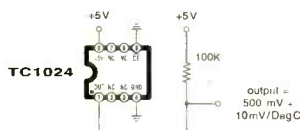
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35 BUILD A SUPER-SENSITIVE HEAT DETECTOR

One look at your heating bill and you know that you have a problem. Despite all of the insulation and weather stripping you've installed, some of your expensive heat is clearly escaping, but from where? You could painstakingly search every inch of your work, but that could take hours, and you might still not find the weak spot. Now there's a better way—the Heat Detector. It will make quick work of the task as it can easily pinpoint even tiny temperature differences. It can also be used to find hot spots on circuit boards, car engines, and more. — *Skip Campisi*



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Pinpointing lightning strikes in seconds, coming closer to sustainable nuclear fusion, using ultrasound to improve tire safety, and more.

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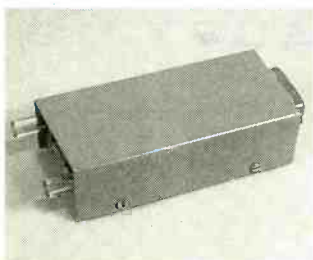
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42 BUILD A TELEPHONE-USAGE MONITOR AND CONTROLLER

It keeps a running log of every call received or placed, and can also be used to control up to eight devices using any telephone.

— Dave Dage



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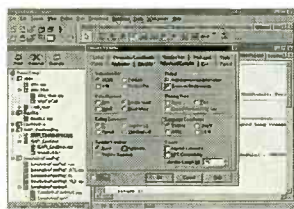
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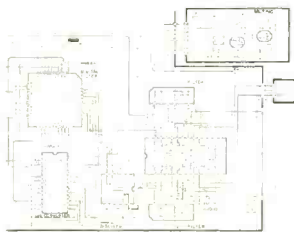
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35 BURN YOUR OWN MICROCONTROLLERS

As if you did not already know it, a quick look at the pages of this or any other electronics magazine will reveal that microcontrollers are at the heart of many projects and products these days. The reason is simple: One microcontroller can replace handfuls of active and passive components and do their job better and more economically. However, they do present one problem—they need to be programmed to do their job. Actually, that is no problem at all as this month's featured project will prove. Called the "No Parts" PIC Programmer, it is possibly the simplest and easiest solution to programming some of the most popular microprocessors on the market. — *Michael A. Covington*



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39 STORM-WARNING LIGHTNING MONITOR

Even in normal times, everyone always talks about the weather. But this year has been something else again. Between El Niño, La Niña, killer tsunamis, increased tornado activity, a predicted very active hurricane season, paralyzing ice storms, scorching heat waves, droughts, and more, it seems like no one is talking about anything else — and, at least this month, that includes us! Our cover story this month is a circuit that can give you a few precious extra minutes to prepare in the face of an approaching storm. It monitors the airwaves for the telltale RF crackle caused by dangerous lightning and signals that trouble is on the way when it detects it. — *Kenton Chun*



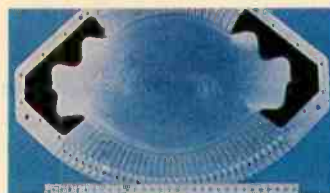
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48 A SMALL ANTENNA WITH A BIG FUTURE

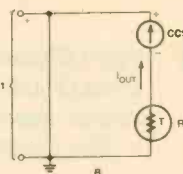


Learn about an inexpensive, highly reliable antenna that can operate at frequencies up to 37 GHz. — *Douglas Page*

53 USING CONSTANT-CURRENT SOURCES

They're often overlooked, but constant-current circuits are easy to use, and make other circuits work better.

— *Joseph J. Carr*



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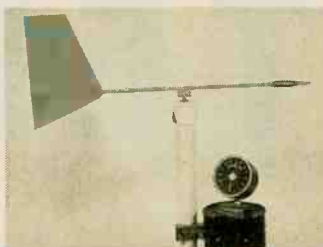
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41 AN ELECTRONIC WIND VANE

Build this attractive and useful addition to any home weather station. — *Steve Botts*



50 ADD DAYTIME-RUNNING LIGHTS TO YOUR CAR

An easy-to-build and install circuit that can add this valuable safety enhancement to cars that don't already have it. — *Dan Harrison*



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Tektronix TX-3 digital multimeter.



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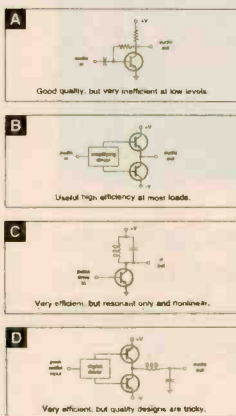
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31 A SOLAR-POWERED ROBOT BUG

If you are a fan of science fiction, you know that the literature is full of tales of robots. In most cases, those robots are creatures that faithfully mimic the behaviors of a living creature—Man. Well, while such robots are still science fiction, robots themselves are very real and have been for some time. Most are industrial devices that perform repetitive tasks either under direct control of a person or by following a set program. But there is another, more interesting class of robot—the kind that reacts to its environment just like simple creatures do. While such robots are a far cry from the robots of fiction, if human-like robots ever become real, these robot creatures—including the subject of this month's cover story—will be remembered as their early ancestors. — *David Williams*



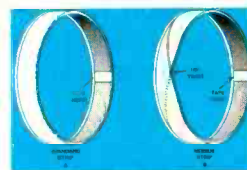
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The current mirror, a basic IC building block, has some interesting properties.
— *Skip Campisi*

45 FAST BUT FORGOTTEN

It's one of the fastest display devices available, yet few modern engineers have ever seen a sampling oscilloscope.
— *Tom Napier*



48 NO MORE ACCIDENTS

Here's how engineers hope to some day eliminate dangerous intersection accidents.
— *Bill Siuru*

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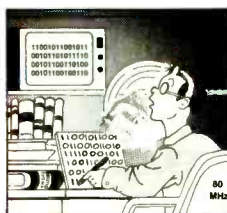
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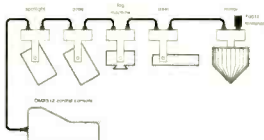
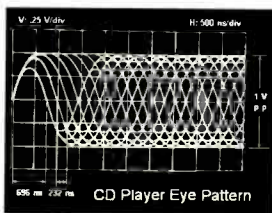
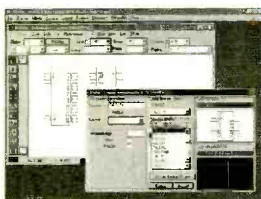
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- 38 A SPEED-DOUBLING ADAPTER FOR THE HIGH-SPEED LOGIC ANALYZER**
Build this adapter for one of our most popular recent projects and capture samples at an 80-MHz rate.
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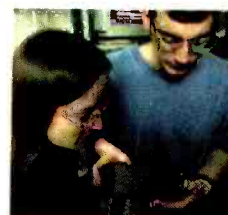
31 A MICROCONTROLLER-BASED PRECISION PULSE GENERATOR

If you do any amount of benchtop design or troubleshooting, you know how important it is to have a reliable, accurate source of test signals at your disposal. It would also be handy to have one with as wide a range as possible. This month's cover story is just such a unit. And, as a bonus, it is inexpensive and easy to build. The secret to that is a PIC microprocessor, and a careful balance of hardware and software. The result is a compact unit that can produce pulses as short as 100 nanoseconds, and is accurate to nearly 100 ppm. — *Tom Napier*



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40 SOLID-STATE SOLDERING GUN SWITCH

Give your aching hands a rest when you replace your gun's stiff switch with a modern tactile sensor.

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Whether you miss the good old days or are just looking for a different sound for your music, this month's cover project is one you won't want to pass up. It is an easy-to-build vacuum-tube-based amplifier that's perfect for the "retro" musician. It also makes it easy to experiment with the vintage sound and mellow distortion that tube amplifiers produce, and could perhaps settle the question, at least in your own mind, of whether tubes are really better than semiconductors. — *Fred Nachbaur*



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MARCH 1999

ON THE COVER

33 SURFACE-MOUNT SHORTWAVE RADIO

Every once in a while we come up with a project that has something to offer almost everyone. This month's cover story is just such a project. The key is its unique circuit board—it is designed so that either traditional through-hole components OR surface-mount devices (SMDs) can be used at almost every location. The result is a project that's an effective yet inexpensive way to listen in on shortwave broadcasts, and/or is a valuable teaching tool to help you master the techniques required to build circuits using SMDs. Either way, it's a winner.

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32 The Y2K Bug...And a Few Other Worries

Unless you've been in hiding the last little while, you no doubt are aware of the so-called Y2K bug that some feel could end civilization at midnight on December 31. Well, while nothing that dire is likely to really happen, the end of the century could still cause headaches for many, especially computer users. This month we look at what's behind the Y2K problem, ratchet up your paranoia level just a little bit more by introducing you to a couple of other less publicized but still nasty date-related surprises, and show you how to get through the coming "bug season" as painlessly as possible—if you don't count your New Year's Day hangover. — *Bob Dyball and Greg Swain*



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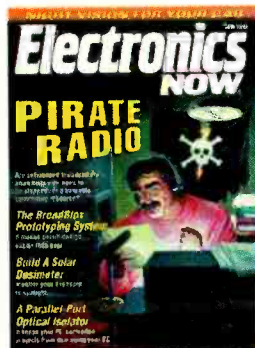
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27 Pirate Radio

You may have heard about radio pirates on the news or from an acquaintance, or you might have heard one of their broadcasts, but what is it that makes these clandestine broadcasters so interesting to listeners and the authorities? In this month's cover story, we take a behind-the-scenes look at the ever-changing world of uncensored radio stations, the motivations of the individuals who run them, why they are so well loved by those who listen to them, why the government wants to shut them down at all costs, and where you can hear them for yourself. — *Andrew Yoder*



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31 DJ MixMaster

Have you ever wondered why some party DJs seem to sound better than the competition? Have you ever tried your hand at spinning tunes at a party only to find your efforts less than stellar? Well, the answer may lie largely in the mixing board. A good one can help anyone sound great; a less ideal one will make your mixes sound, well, less than ideal. The problem is that a good board can be very expensive, unless you build this month's cover project: A professional-grade mixing board with top-notch sound and some features not found on even the best commercial products.

— Jules Ryckebusch



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31 Automate Your Home With an Expandable X-10 Controller

Say "automated home" and many will conjure up an image of cartoon-character George Jetson's house. Well, we're not quite there yet, but we're coming closer. For example, consider the venerable X-10 standard. Though it's been with us since the late 1970s, products using the standard are still very viable, and new capabilities are being added all the time. Its one shortcoming, however, is that it is difficult to control the various modules in a system in a unified, logical way—until now. This month's cover story is an expandable controller that lets you take complete control of your X-10 system and your home. — *Christopher A. Nielsen*



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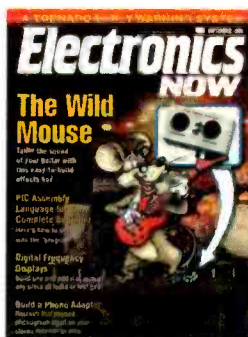
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29 The Wild Mouse

Often individuals have more than one hobby or interest, and often those hobbies or interests intersect. One common example of that is music and electronics. While the price of music-related electronics is lower than ever, if you like picking up a soldering iron when you are not playing your guitar, this month's cover project is one you'll surely want to try. It's an easy-to-build guitar-effects box that can dramatically change the sound of your instrument with the tap of a button.

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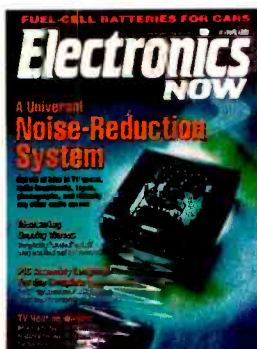
OCTOBER 1999

ON THE COVER

27 Universal Noise-Reduction System

Most noise-reduction techniques require that the original source material be specially encoded. One example of that is Dolby noise reduction that is often used with pre-recorded audio tapes. However, there are countless other audio sources that suffer from white noise—or hiss—that could benefit from some noise reduction...and this month's cover project provides it. The Universal Noise-Reduction System is easy to install and does not require pre-processed material to be effective. It also features an audio compressor that can be used to reduce the volume of excessively-loud TV commercials.

— Richard Panosh



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34 PIC Assembly Language for the Complete Beginner

This month we "PIC" up the pace as we look in more depth at what the various instructions do and tackle a more advanced project.

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33 A Seismic Detector

Recent events in Turkey and elsewhere around the world have once again shown us that the solid Earth is not nearly as solid as we often assume. If in light of such things you want to keep a closer eye on the ground under your feet, or if you want to investigate earthquakes and similar natural phenomena, then you'll want to build this month's cover project. It is a computer-based seismic detector that's great in the lab, and—since it is battery powered and portable—even better in the field. — Ron Newton



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