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TREASURE AT YOUR FEET

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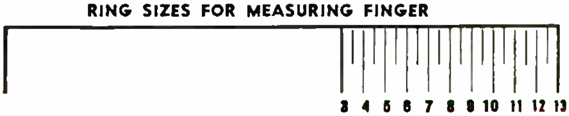

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november/december 1970

volume 27

number 6

Journal

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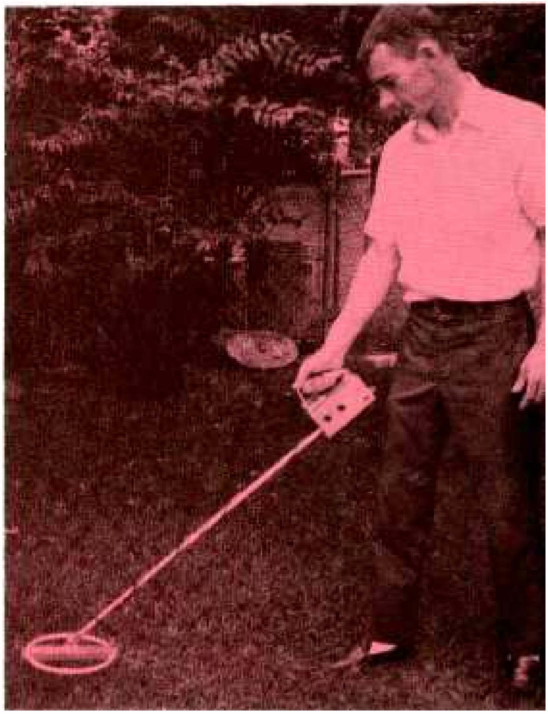
The NRI Journal is published bimonthly by National Radio Institute, 3939 Wisconsin Avenue, Washington, D.C. 20016. Subscription price is $2.00 per year, single copy 35 cents. Second-class postage paid at Washington, D.C.

by Thomas H. Dukes



treasure at your feet

Treasure hunting is becoming an increasingly popular pastime. Almost anyone can participate, regardless of age or tight budget. Unlike the oldtimers who spent their lives combing the wilderness in search of riches, the modern prospector does not need to venture beyond his own backyard. His goal is to locate the small treasures that are scattered everywhere. In all parts of the United States, Mexico and Canada, there is still an abundance of hidden coins, jewelry and relics. Now that electronic detection devices are readily available, locating treasures is a simple project.

Although metal detectors were among the military equipment of World War II, they were heavy, awkward and difficult to use because they used vacuum tubes. Recently, metal detectors have improved tremendously because of the development of transistors and other miniature electronic components. Most of the units available today are lightweight, rugged and completely portable. Some may be disassembled for transporting and reassembled in just minutes. Some units can even be purchased in a pocket version. Most metal detectors are simple enough to operate that a small child can successfully use them.

This part of the article describes the required equipment, explains the operation of metal detectors and discusses some of the techniques for finding buried metal and minerals. Part II, appearing in the next issue, will give the details for constructing a sensitive metal detector designed for locating small coins and metal objects.

There are two basic types of metal detectors. One is especially designed for detecting large, deeply buried objects. The other type finds only smaller objects that are just below the surface.

If your main objective is to locate large objects that are deep down, you will need one of the deep-searching metal locaters. These detectors are capable of locating objects the size of irrigation pipes, cables, treasure chests or cannons that may be buried as deep as twenty feet. However, they do not respond well to small objects such as individual coins, watches and rings.

The deep-searching locaters are often used in industry and agriculture to determine the exact position of pipelines, communication and electric cables, and irrigation pipes. For treasure hunting, this type is ideal for locating large relics and boxes or chests of coins.

Most of the deep-searching metal detectors use the transmit-receive operation principle. A typical unit, as in Fig. 1, comprises a vertically mounted transmitting antenna and a horizontally mounted receiving antenna. The highly directional antennas are mounted at right angles, reducing the signal coupling between them to practically zero. The pivot allows adjusting the position of the transmitter antenna for minimum coupling.

When a metal object is in the vicinity of the two antennas, some of the energy radiated by the transmitting antenna is reflected by the object toward the receiving

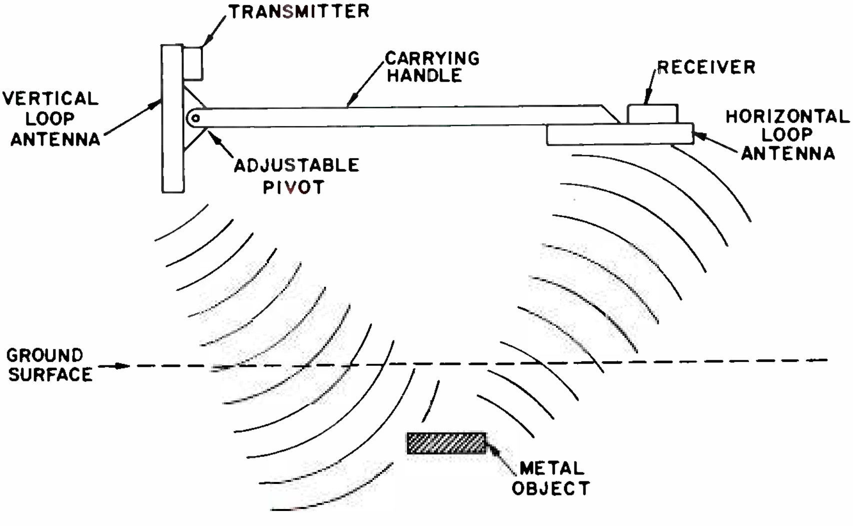


Fig. 1. A typical transmit-receive locater, used for detecting deeply buried objects.

antenna. The null condition is upset: the rf energy picked up by the receiving antenna is amplified, detected and converted to an audible signal.

Some units also use meters to provide an output indication, generally operating in the 100 kHz to 1 MHz frequency range. Higher frequencies are possible but create a point where the rf energy will not penetrate the ground as effectively.

From the standpoints of cost, performance and portability, the transmit-receive locater is probably the best deep-searching device for amateur prospectors. These units usually cost $200.00 or more.

More elaborate types are available but intended for scientific and military use. Typical of these units is the large vehicle or airplane mounted kind. It uses a higher powered transmitter-receiver combination and operates in the pulsed or cw mode. Other types operate on an entirely different principle. They use a type of magnetometer that measures changes in the earth's magnetic field caused by the presence of large metal objects.

For those who are interested in finding smaller objects, another type of metal detector is best. The assortment of commercially available metal detectors designed for this purpose are too numerous to mention. Most of these detectors are designed with the backyard prospector in mind; some units may be bought, fully assembled, for as little as $20.00. The highest quality instrument, however, sells for close to $100.00.

Most of the metal detectors used for locating small objects operate on a heterodyning or beat-frequency principle. Such a unit is shown in Fig. 2. Other types are available, such as the inductive balance and inductive bridge detectors, but they are generally more expensive.

The beat-frequency unit works the same as a superheterodyne radio receiver. It consists of two rf oscillators, a detector, a power amplifier and a speaker. The block

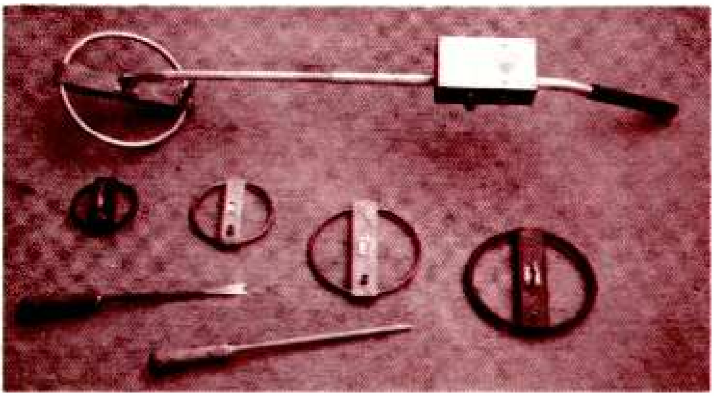


Fig. 2. A beat-frequency metal locater with interchangeable coils and digging-tool accessories.

diagram of a typical unit is shown in Fig. 3. The oscillators are generally Colpitts or Hartley. The search coil is the inductive tuning component for one oscillator; the other is tuned by an adjustable rf coil. Sometimes a tuning capacitor is used to tune the oscillator instead of an adjustable coil. This, however, depends on the type of oscillator.

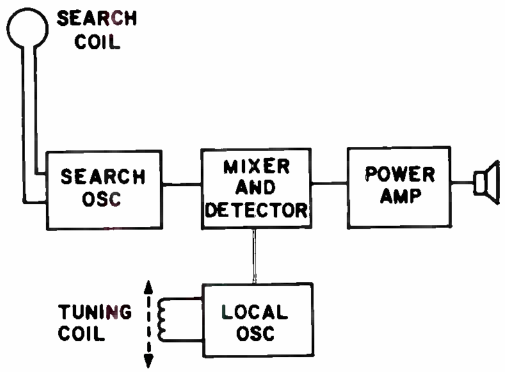


Fig. 3. Block diagram of a typical beat-frequency metal detector.

Beat-frequency detectors also usually operate in the frequency range between 100 kHz and 1 MHz. With no metal nearby to affect the search coil, the tuning coil or capacitor is adjusted until the two oscillators are operating at nearly the same frequency. The outputs from each oscillator are combined in the mixer stage. Since the mixer is a nonlinear device, the signal developed at the output will contain the two original frequencies plus two frequencies equal to the sum and difference of the original two. We are only interested in the difference frequency output of the mixer. The sum frequency and the two original frequencies are filtered out by a simple low-pass filter. If the oscillators are operating at frequencies of 500 kHz and 501 kHz, the difference frequency will be 1 kHz. This frequency is applied to the output power amplifier where it is amplified to a sufficient level to drive the speaker. An output tone of 1 kHz is then heard from the speaker.

When a metal object is in the vicinity of the search coil, the effective inductance of the coil changes. This causes the frequency of the search coil oscillator to change. The difference frequency also changes, for an end result of a tone variation in the speaker output. It is this change in output tone that signals the presence of a metal object.

As the operator passes the search coil over the ground, he listens for a change in output tone. The local oscillator may be tuned either above or below the searching oscillator and still produce the desired output tone. However, it is usually desirable to tune the local oscillator so that the beat-frequency will increase when a metal object is detected; then the pitch of the output tone will rise.

A particular characteristic of the beat-frequency locater is its ability to distinguish between metals and minerals. When the detector is properly tuned to detect metals, the output tone rises as a pure metal comes within range. If a mineral such as quartz or slate is approached, the output tone will lower. This indicates that the oscillator frequency is affected in an opposite manner. By tuning the local oscillator to the other side of the null point, or zero-beat point, you can make the detector respond to minerals in the same way that it responds to metals. On most commercial units, the tuning control indicates in which direction the control should be tuned to detect metals or minerals.

Another inherent feature of the beat-frequency locater is that it may be tuned to reject small objects and respond only to large ones. By adjusting the local oscillator so that its frequency is equal to the frequency of the searching oscillator, no output tone will be heard. If sufficient coupling exists between the two oscillators, they will tend to lock together. This will effectively reduce the sensitivity of the detector since the oscillators must now pull apart to produce an output tone. If sufficient coupling exists, this locking action will prevent small objects from affecting the detector; only the larger objects will be able to produce an output tone. The amount of coupling between oscillators can be controlled to produce the desired effect.

Several factors influence the overall sensitivity of the beat-frequency locater. Most units are designed to operate at the highest possible frequency. Theoretically, at high frequencies a smaller change in inductance produces a larger change in frequency. This results in a greater sensitivity to small objects. However, the effective depth of penetration begins to drop off at frequencies above several megahertz. A good compromise would be about 1 MHz. The frequencies most commonly used fall into the range of 500 kHz to 1 MHz.

The size of the search coil is also an important consideration. For any given frequency of operation, the larger the coil the deeper the penetration. However, a large coil will not respond as well to small objects. A small coil has just the opposite effect. The effective range is reduced, but the response to small objects is improved. For this reason, many manufacturers include two interchangeable coils with the detector. A typical assortment of coils is shown in Fig. 2. The smallest coil is only three inches in diameter while the largest coil is almost ten inches across.

Because it is relatively inexpensive and yet sensitive, the beat-frequency locater is popular among amateurs. However, there is another type that is good for treasure hunting. This unit operates on the inductive-balance principle and is closely related to transmit-receive types.

A simplified block diagram of an inductive-balance locater is shown in Fig. 4. The search and pickup coils are located in the search head, which is attached to a shaft or exploring stem. Most of the electronic circuitry is in a case at the other end of the exploring stem near the carrying handle.

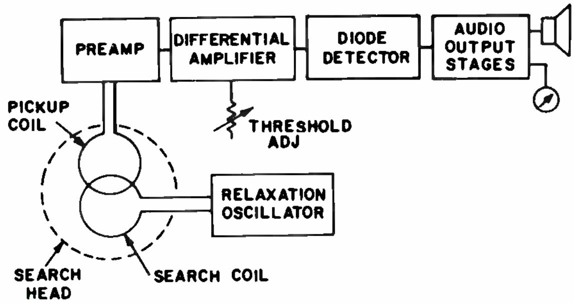


Fig. 4. Block diagram of an inductive-balance metal locater.

The actual unit looks much like the beat-frequency locater. The search head is usually enclosed and may also contain the search coil oscillator. The two coils are arranged so that an inductive balance exists between them; there is little or no coupling between the two coils. The signal radiated by the search coil is not induced into the pickup coil. The search coil oscillator may be either the relaxation type that simply switches off and on periodically at an audio rate or an amplitude-modulated type where the oscillator is modulated by an audio tone from another oscillator. The main objective is to introduce an audio signal component upon the rf signal radiated by the search coil.

When any metal object is placed in the vicinity of the two coils, the initial balance is upset and a signal is induced into the pickup coil. The signal is amplified to a usable level and applied to a differential amplifier. The operating point of the differential amplifier is adjustable by the threshold control. This way the differential amplifier serves as an adjustable control element which will not amplify an input signal until it reaches a specific amplitude.

During normal operation the threshold adjustment is set just to the point where no signal is allowed to pass through the amplifier. When metal is detected, the signal level rises above this threshold point and is amplified by the differential amp. Therefore, the threshold adjustment controls the sensitivity of the detector. The diode detector stage effectively removes the audio signal from the rf carrier and the audio output stages amplify it to a level sufficient to drive the speaker.

The inductive-balance detector has several advantages and disadvantages. No tone is heard in the output speaker until an object is actually detected during normal operation. Also, the sensitivity can be adjusted for detection of either small or large objects at optimum efficiency; interchangeable coils are not required. However, the search head is rather large and completely enclosed, making it somewhat difficult to pinpoint the exact location of coins and other very small objects.

All the detectors discussed so far have one thing in common; they use an rf signal to detect the presence of metal objects. The detector in Fig. 5, however, operates totally within the audio frequency range. This detector uses the inductive-bridge method of detection. The two coils are connected to the input and output stages of a high gain audio amplifier that is tuned to a specific audio frequency.

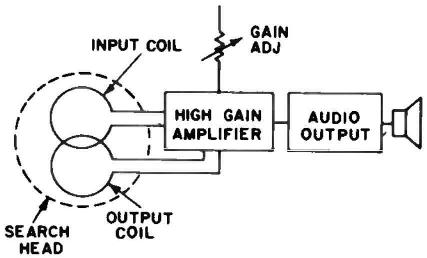


Fig. 5. Block diagram of an inductive-bridge metal detector.

The coils are arranged so that the coupling between them is at a minimum. This is usually accomplished by placing them at right angles to each other. Enough noise is generated in the amplifier output stage to set up a weak magnetic field around the output coil. Metal within the range of the two coils causes the weak magnetic field to become distorted and a small current to be induced into the input coil. Since the input and output coils are connected to provide regenerative or positive feedback, the amplifier will oscillate at the frequency to which it is tuned. The resulting audio signal is amplified and applied to an output speaker.

The gain control provides a means of adjusting the sensitivity of the unit. This type of locater is useful for locating very large objects, but is insensitive to small objects such as coins or jewelry.

The detectors we have described are representative of those most often used for treasure hunting. They illustrate three basic methods of detecting metals. The transmit-receive and inductive-balance locaters depend upon reflection and distortion of a magnetic field while the beat-frequency type depends upon a change of inductance. The inductive-bridge detector also senses a changing magnetic field, but operates in the audio frequency range.

Aside from the metal detector, you will need several small tools for digging. One of the most useful tools is a dandelion digger. This forked instrument is ideally suited for digging up small objects that may be buried as deeply as six or seven inches. With this instrument it is possible to cut out a section of ground, remove the object and replace the section with little or no traces of your digging. This could prove a real asset when you are digging in an area as delicate as a lawn or public park.

Another inexpensive and useful tool is a sod plugger. It greatly simplifies retrieving small objects that are only inches below the surface. Place the sod plugger over the pinpointed object, push down, pull the plugger out and remove the sod. Once you have carefully removed the object, replace the sod plug. This method is ideal for backyard digging.

Although it is possible to pinpoint the location of most objects, it is almost impossible to determine just how deep they are. This problem can be solved with a small probe which can be forced into the ground. By probing around the area, you can also determine the general shape of an object. Ideally the probe should be constructed out of some material that will not damage the buried object. An excellent probe can be made with an old file handle and a one-foot section of 1/4-inch fiberglass rod. Screw the rod into the file handle and file the end of the rod to a tapered point. This kind of probe may also be used for digging. With a little practice, you will find that it is easy to probe and retrieve with this instrument.

If your search is for large items found in open, out-of-the-way areas, almost any type of excavating tool can be used. The primary objective in this case is to prevent damage to the object being retrieved. An object such as a cannon may be easy to retrieve from an old battlefield, but it is a different story altogether if the cannon is buried on a beach. The tactics you use, therefore, are dictated by the situation; stringent rules are not appropriate for searching with a metal detector.

Applying certain techniques and a systematic approach, you increase your chances of finding buried treasure. The object is to comb an area so thoroughly that there is little or no chance of missing buried items. There are a few techniques which should get any treasure hunter off to a good start.

When searching for deeply buried items with a transmit-receive type locater, systematically scan the area by pacing it off east to west in two or three-foot intervals. When you get a response, approach the spot several times from different directions. This will determine the approximate shape and size of the find. If a response is obtained over a considerable distance, the object could be a pipe or cable. When tracing pipes it is best to zig-zag back and forth across the pipe to obtain a distinct indication.

When searching a location for objects such as coins or jewelry, it is best to first section off the location into small areas. Then scan the whole area, one section at a time. If you use a detector designed for locating small objects, move the detector from side to side in a sweeping motion. Keep the detector as close to the ground as possible for maximum penetration. Listen closely for slight tone variations; many objects may be just deep enough or small enough to cause only a faint indication.

If the detector has different sized, interchangeable coils, start with the smallest and examine the same area with each coil. In this way the smallest objects can be retrieved first.

Some detectors have a loudspeaker that provides output indication while others require headphones. One type is no more sensitive than the other. The primary reason for using headphones is to reduce background noise. Headphones are almost a necessity when searching areas are near airports, highways or the ocean. Many detectors designed for speaker operation have provisions for headphones as well.

Indicating meters are also provided with some detectors. These meters are advantageous because they often provide an extremely accurate output indication. They are especially useful in trying to pinpoint objects which are almost out of detection range. Meters are seldom used alone because they are not good for general purpose indications. The extra sensitivity is not always required and the meter is subject to damage if not handled carefully. Indicating meters are most common with the transmit-receive detectors and to a lesser extent with the beat-frequency type.

Out in my backyard I used a beat-frequency metal detector to find the coins in Fig. 6. There are over one hundred coins shown in this photograph. The number of coins and other valuable objects that are lost each day would stagger the imagination. The find to aim for is the coins which are valuable because of their old dates or mint markings. The best place to search for these old coins are old, abandoned estates and properties. Many valuable coins have been found in cans, pots and buckets which were buried near old farmhouses. Sometimes valuables are found hidden under the floors and in the walls of old buildings; years ago it was common practice to hide family jewels, silverware or cash to protect them.

Fig. 6. Coins found with a beat-frequency metal detector in the author's backyard.

If your interest is in locating Indian relics or Civil War mementos, you should first do some research to learn as much as possible about the history of your area. You may discover that you live near an area where Indians once lived or where a battle was fought.

The beach is an excellent place to search for all kinds of valuables. A seemingly inexhaustable supply of treasure is washed ashore daily. Of particular interest are the gold coins and pieces of eight that are occasionally found.

Since most metal detectors will also respond to minerals, don't overlook the possibility of doing some crude metal or mineral prospecting. These instruments are useful in locating ore deposits, tracing rich veins and panning old stream beds for placer gold.

Before you do any prospecting or treasure hunting for really large or valuable items, be sure to investigate local and state laws; what you find may not be legally yours. It all depends on where you are searching and what you have found. Some states are notoriously greedy, while others are quite generous.

SCHOLARSHIP

Beginning in January, 1971, NRI will cooperate with RADIO-ELECTRONICS Magazine in making an annual scholarship award of $125 to a deserving student currently enrolled in NRI. The award will be applied toward furthering the selected student's education in electronics. NRI is one of eight home-study electronics schools chosen to perpetuate the scholarship, newly established by RADIO-ELECTRONICS in memoriam to Hugo Gernsbach, its founder and a notable pioneer in electronics.

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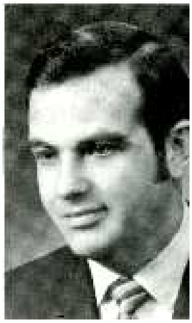
Entries must be postmarked by December 1, 1970, to be considered. A panel of judges chosen by NRI will select the recipient; their decision will be final. Written notification will be sent to the recipient January 1, 1971, and announced in the March/April issue of the JOURNAL.

basic logic gates and their applications



by louis e. frenzel, jr.

the second article in a series on digital techniques

There are two basic types of digital circuits: logic gates, used for decision-making and control operations, and flip-flops, whose purpose is storage and counting. In this article we are going to take a close look at logic gates and how they are used in digital equipment.

LOGIC SIGNALS

Before we begin our discussion of logic gates, let's look carefully at the nature of the logic signals to be processed by these gates. A digital signal is an off/on signal; it is binary, assuming either of two distinct states.

The simplest way to represent the binary numbers 0 and 1 is with a switch. An open or off switch usually represents a binary 0 while a closed or on switch most often signifies a binary 1. In digital systems, switches are frequently used for generating input data.

The common light bulb is the most widely used output device in digital equipment. An off lamp generally represents a binary 0 while an on lamp means a binary 1. These lamps monitor the outputs of logic circuits to determine their output state.

Logic Levels. While switches and lights are external binary symbols, binary numbers are represented within the logic system by voltage levels. Although any voltage level can be used to represent each of the binary numbers, perhaps the most commonly used are 0 and +5 volts. Normally the 0 volt level (ground) represents binary 0 and +5 volts designates binary 1.

Logic signal levels are classified as being either positive or negative. A positive logic signal is one in which the most positive of the two levels is a binary 1. Logic levels of 0 and +5 volts are considered positive when the +5 volts represents a binary 1. If we were to let 0 volts represent binary 1 and +5 volts represent binary 0, we would be using negative logic. With negative logic level representation, the most negative of the two levels (0 volts in our example) will represent binary 1. Notice several examples of both positive and negative logic level assignments:

(positive logic)	binary 0 = −6
	binary 1 = 0
(positive logic)	binary 0 = −3
	binary 1 = +3
(negative logic)	binary 0 = 0
	binary 1 = −12
(negative logic)	binary 0 = +10
	binary 1 = 0

In working with a digital system, it is helpful to know which logic level designation is being used. Positive logic level assignments are more common since they are easier for most people to visualize.

Parallel and Serial Data. There are two popular ways in which data is processed by logic circuits. The voltage levels representing a binary number can be transferred and processed in parallel or serial form. With parallel data all bits are processed simultaneously. Fig. 1A shows the 8-bit number 11011001 in parallel form.

These same bits can also be processed serially, or one at a time. Fig. 1B illustrates this serial transfer.

It is more desirable to process digital data in parallel form whenever possible. Since all the bits in a word are used at the same time, the logic operations occur rapidly. However, processing all digits at one time requires that logic circuitry be available for each bit position. This means that a substantial amount of hardware is necessary for handling the data, despite the high speed that can be achieved.

In comparison, serial data processing requires only a single group of logic circuitry. Since each bit is processed one at a time, multiple circuitry is not required. Unfortunately we have traded valuable speed for this lower operating cost.

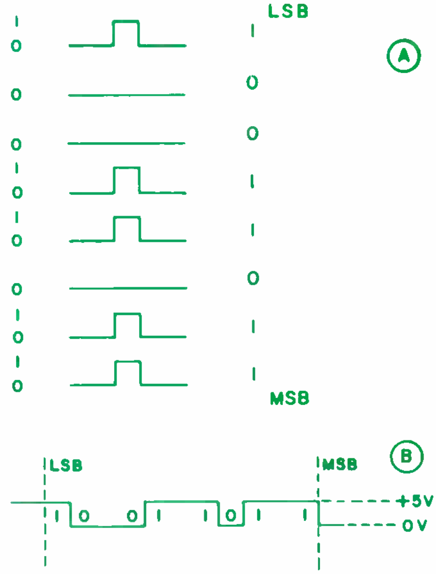


Fig. 1. Parallel (A) and serial representation (B) of the binary word 11011001.

BASIC LOGIC CIRCUITS

All digital systems are constructed from three fundamental digital logic circuits: the inverter, the AND gate and the OR gate. Such circuits can take on a wide variety of forms. They can also be combined to form other types of logic circuits such as the NAND and NOR circuits that are so common in modern digital systems. Let's examine each of these three basic logic circuits.

The Inverter. The inverter is a logic element with a single input and a single output. It accepts an input signal with a voltage level of either a binary 1 or a binary 0. Then it produces an output binary logic level that is the opposite of the input. Whenever we apply a binary 0 to an inverter, the output is a binary 1; applying a binary 1 will produce a binary 0 output. In this way the inverter produces the complement of the input.

In Fig. 2A is a common symbol for an inverter. The letter A designates the binary input signal that can be either a binary 1 or a binary 0. The output line is designated A (pronounced "A not" or "not A"), the complement or opposite of input A.

The operation of the inverter is clearly shown by the truth table in Fig. 2B. The table contains two columns: the input and output columns. The input column

INPUT A	OUTPUT $\bar{A}$
1	0
0	1

(B)

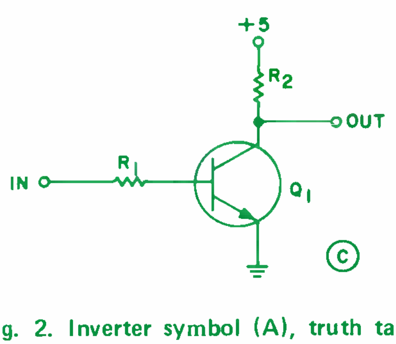


Fig. 2. Inverter symbol (A), truth table for the inverter (B), and a typical inverter circuit (C).

lists all possible combinations of inputs. The output column shows the output state occurring for each given input state. This table completely summarizes the operation of an inverter and can be expanded to show the complete and detailed operation of any logic circuit.

Although a logic inverter can assume any number of different electrical forms, it is basically a transistor switch in modern digital systems. A typical transistor inverter circuit is shown in Fig. 2C. The circuit comprises a transistor (Q_1), its collector resistor (R_2) and an input base resistor (R_1).

Let's assume positive logic levels of binary 0 = 0 volts and binary 1 = +5 volts. If we apply ground to the input, the emitter-base junction of transistor Q_1 will not be forward-biased and the transistor will be cut off. Since the transistor is not conducting, no current will flow through resistor R_2. A voltmeter reading at this moment would show +5 volts through resistor R_2. As you can see, a binary 0 input produces a binary 1 output (+5 volts).

If we now apply a binary 1 to the input, transistor Q_1 will conduct. The size of resistor R_1 is selected so that the transistor is driven hard. The transistor saturates and conducts heavily so that its emitter-to-collector resistance is extremely low compared to R_2. For that reason the output voltage closely approaches zero. Therefore, a binary 1 input has produced a binary 0 output.

AND Gates. An AND gate is a logic circuit that has at least two inputs and only one output. The output of the AND gate will be binary 1 only if all of the inputs are simultaneously at a binary 1 level. At all other times the output of an AND gate will be a binary 0.

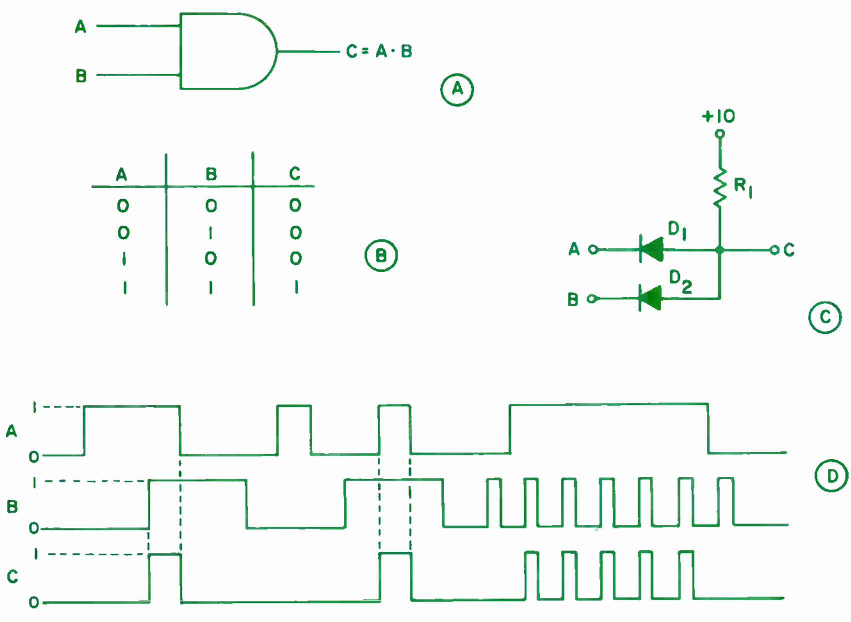
The logical symbol for the AND gate is shown in Fig. 3A. It consists of two input signals (A and B), either of which may assume one of the two logic states. Output C, of course, depends on the states of the inputs. The output expression C = A · B in Fig. 3A indicates the AND operation.

Fig. 3B is a truth table for the AND gate. All possible combinations of the two inputs A and B are shown in the first two columns. You can see from the output column how the AND gate works: the only time the AND gate produces a binary 1 output is when both inputs A and B are binary 1's.

The simplest form of electronic AND circuit is shown in Fig. 3C. It consists of two diodes and resistor R_1. Assume positive logic levels of ground and +5 volts. If both inputs are at the binary 0 level, the diodes will be forward-biased.

Current flows through them and up through resistor R_1 to the 10-volt supply. With both diodes conducting, they represent a very low resistance value. A practical diode will have a voltage drop of about .6 volt across it. Therefore, the output voltage at C will be approximately .6 volt. Since this is relatively small compared to the 10-volt power supply voltage, we can sometimes neglect this small voltage and assume the output voltage to be zero.

If either input is binary 0 while the other is at +5 volts, the output will also be



A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

Fig. 3. An AND gate symbol (A), its truth table (B), circuit (C), and input/output waveforms (D).

about .6 volt. For example, if input A is ground while B is +5 volts, diode D_1 will conduct current up through R_1 to the 10-volt supply. With 5 volts on its cathode and .6 volt on its anode, diode D_2 is reverse-biased and not conducting.

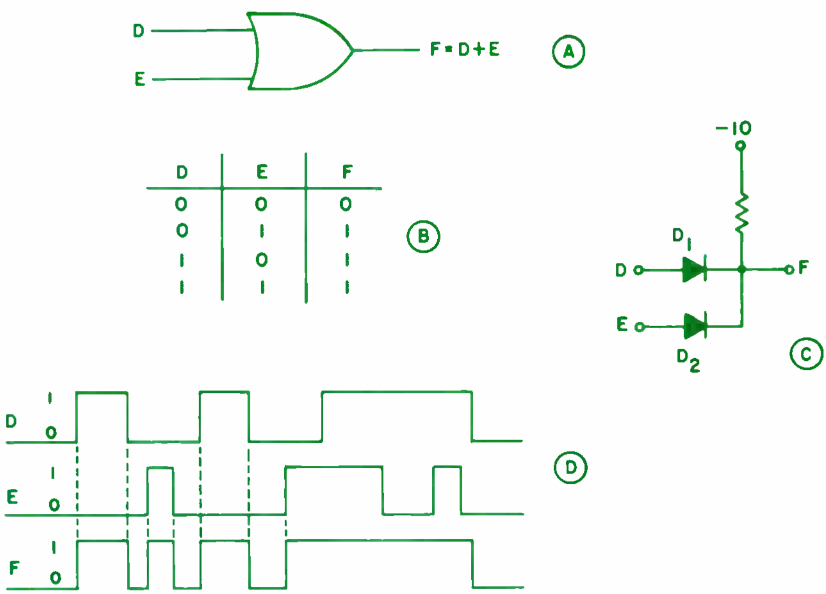
If both inputs A and B are +5 volts, output C will show that voltage. Both diodes are still conducting. Since their voltage drop is very low, almost the entire 5-volt input will appear at the output.

Fig. 3D shows logic signals A and B applied to an AND gate and the resulting output C. At the points when C is binary 1, we could consider one of the inputs as an enable/inhibit signal that permits the signal on the other input to be passed or blocked.

OR Gates. An OR gate is a logic circuit that also has two or more inputs and only one output. If any or all of the inputs are binary 1, its output will be a binary 1. The OR gate detects the presence of a binary 1 at any of the inputs by producing a binary 1 at its output.

The symbol for an OR gate is shown in Fig. 4A. The inputs are designated D and E; the output is labeled F. In the output expression F = D + E, the plus sign indicates the OR function. The expression says that output F is equal to D *or* E: if either or both are binary 1, output F will be a binary 1. This operation is expressed by the truth table of Fig. 4B.

A basic OR circuit is shown in Fig. 4C. Like the AND gate, it has two diodes and a resistor. However, in this circuit −10 volts is used instead of the +10-volt power supply of the AND gate.



D	E	F
0	0	0
0	1	1
1	0	1
1	1	1

Fig. 4. OR gate symbol (A), truth table (B), circuit (C), and representative input/output waveforms (D).

CHRISTMAS VALUES FROM CONAR
DIVISION OF NATIONAL RADIO INSTITUTE

MODEL 230

CONAR Tuned Signal Tracer

Only tuned tracer on the market anywhere near the price. Exclusive cathode-follower probe gives outstanding sensitivity. Easily connects to any RF or IF stage with absolute minimum of detuning. Features audio tracing method through built-in 4" PM speaker plus visual indicator using "eye" tube. Quickly locates sources of hum, noise and distortion. Tracks down intermittents, measures gain per stage, accurately aligns radios without signal generator. (Tracer may also be used as sensitive AM radio.) Has two stages of RF amplification. Assembly-operating instructions include more than 12 pages on uses of Model 230. For beginners as well as experienced technicians.

CATALOG PRICE

KIT 230UK	$49.95
WIRED 230WT	$69.95

NRI STUDENT & ALUMNI PRICE

KIT 230UK	$39.80
WIRED 230WT	$56.70

MODEL 280

CONAR Signal Generator

Widely acclaimed as most accurate signal generator near the price. Uses Hartley type oscillator circuit with six separate coils and capacitors to give accuracy within 1% after easy calibration. High output of the Model 280 simplifies signal injection for rapid alignment and troubleshooting of transistor and tube receivers. Covers 170 kc to 60 mc in six ranges with harmonic frequency coverage over 120 mc. Ideally suited as marker generator for TV alignment. Tuning dial features planetary drive with 6:1 ratio for greater accuracy and elimination of backlash. Scale is full 9" wide with transparent hairline pointer. Has single cable for all outputs, no need to change leads when switching from 400 cycle audio to modulated or unmodulated RF.

CATALOG PRICE

KIT 280UK	$29.95
WIRED 280WT	$43.95

NRI STUDENT & ALUMNI PRICE

KIT 280UK	$26.35
WIRED 280WT	$39.55

MODEL 311

CONAR Resistor-Capacitor TESTER

The Model 311 gives fast, accurate, reliable test on all resistors and capacitors. Measures capacity of mica, ceramic, paper, oil-filled and electrolytics from 10 mmfd. to 1500 mfd., 0-450 volts. Checks for leakage, measures power factor and useful life. Shows exact value of resistors from 1 ohm to 150 megohms. Clearly indicates opens and shorts. Has "floating chassis" design to greatly reduce shock hazards. The Model 311 will also apply actual DC test voltage to capacitors to reveal break-down under normal circuit conditions, a feature far superior to many R-C testers which give low voltage "continuity" tests. Can be used for in-circuit tests in many applications and circuits.

CATALOG PRICE

KIT 311UK	$29.95
WIRED 311WT	$42.50

NRI STUDENT & ALUMNI PRICE

KIT 311UK	$24.40
WIRED 311WT	$33.85

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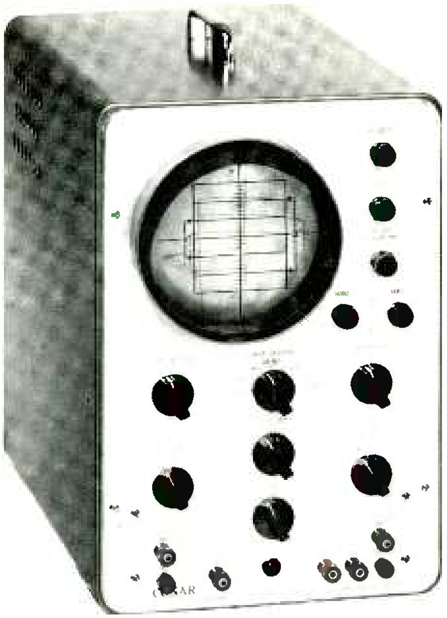

CONAR 5" Wide Band Oscilloscope

KIT 250 UK	CATALOG PRICE $99.90	
	NRI STUDENT AND ALUMNI PRICE	$82.90
WIRED 250 WT	CATALOG PRICE $139.50	
	NRI STUDENT AND ALUMNI PRICE	$129.75

OPTIONAL ACCESSORY

Set of four heavy duty probes designed specifically for use with Model 250. Set includes: Signal Tracing Low Capacity; Resistor Isolated; and Direct Testing Probes; Roll-up Carrying Case. Complete instructions in Model 250 manual.

Stock #250PB. 2 lbs. Parcel Post **$17.70**

ADVANCED DESIGN · NEWEST CIRCUITRY · EXCLUSIVE FEATURES

Advanced design, newest circuitry, exclusive features—a truly professional oscilloscope for laboratory or service shop. The Model 250 is ideally suited for color and monochrome TV, AM-FM and transistor radios, hi-fi and stereo amplifiers, plus numerous industrial electronic applications.

Note these CONAR Model 250 features:

- Uses 2400 volts on the cathode ray tube—50% more than most scopes. Trace remains, clear, distinct, bright, with increase in sweep frequency or vertical-horizontal expansion. Forget about darkening room to observe traces on your Model 250 screen!
- Vertical gain control is calibrated for direct reading of peak-to-peak voltages. Simply multiply vertical gain control setting by attenuator setting by trace height for quick, accurate peak-to-peak readings. No need to remember special formulas or "feed-in" calibrating signals.
- New improved scope circuitry gives excellent linearity at low frequencies without limiting the production of frequency sweep signals.
- **Two stage** retrace blanking amplifier gives 100% retrace blanking at all frequencies produced by the scope sweep generator. Retrace lines **will not** confuse the display at high sweep frequencies.
- Accurately measures ripple output of power supplies; checks auto radio vibrators dynamically.
- Intensity and focus controls use special insulated high voltage potentiometers to eliminate leakage and shock hazards.
- Has push-pull outputs balanced by separate phase splitter tubes in both horizontal and vertical amplifiers.
- Built-in flyback checker gives rapid, in-circuit testing of flybacks, transformers, yokes, coils, loopsticks. Eliminates need for a separate flyback tester costing from $40 to $70.
- Sweep range—10 cps to 500 kc—**five times** the range of most other scopes, using special linearity circuit.

The Model 250 can be assembled in less than 15 hours—even by an inexperienced kit builder. Uses only top grade components. Most components are overrated, giving you an extra margin of dependability plus years of trouble-free service. And—there's no trouble finding replacement parts if ever needed. (Of course, we stock a complete inventory of parts, too.)

Step-by-step assembly instructions include big 17" x 22" picture diagrams plus 12 full pages of comprehensive operating instructions with more than 30 illustrations showing waveforms and connecting points.

SPECIFICATIONS

VERTICAL SENSITIVITY: .023 VRMS. VERTICAL FREQ. RESPONSE: Flat 13 cps to 2.5 mc, Down .05 db at 11 cps, Down 1.5 db at 3.58 mc (color burst), Down 3.5 db at 4.5 mc. HORIZONTAL SENSITIVITY: 1.0 VRMS. HORIZONTAL FREQ. RESPONSE: Flat 20 cps to 90 kc, Down .8 db at 12 cps, Down 3 db at 250 kc. RISE TIME: .05 ms. SWEEP FREQUENCY: 10 cps to 500 kc. TUBES: 11 (equivalent of 19 using dual types). PUSH-PULL ON-OFF does not upset other adjustments. CONTROLS: Intensity, Focus, On-Off, Astigmatism, Horiz. Centering, Vert. Centering, Horiz. Gain, Vert. Gain, Sweep Selector, Vert. Attenuator, Fine Frequency, Sync Selector, Sync. CABINET: Heavy gauge steel, baked-on rich blue finish, rubber feet, chrome handle. PANEL: Satin finish aluminum (not painted) with red lettering. BINDING POSTS: 5-way type to accommodate all connectors. DIMENSIONS: 9⅜" x 13¾" x 15½". POWER SUPPLY: 110-120 volts, 60 cycle AC, fused circuit. ACTUAL WEIGHT: 21 lbs.

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NEW, IMPROVED CONAR
MODEL 681 INTEGRATED CIRCUIT

COLOR GENERATOR

KIT	CATALOG PRICE $89.50	
680 UK	NRI STUDENT AND ALUMNI PRICE	**$79.45**
WIRED	CATALOG PRICE $121.50	
680 WT	NRI STUDENT AND ALUMNI PRICE	**$109.00**

Only The 681 Has All These Features At Any Price!

- EXCLUSIVE Digital Integrated Circuits
- EXCLUSIVE 4 Crystal Controlled Oscillators
- Completely Solid State
- Color Amplitude Control
- Regulated Power Supply
- Stability Control
- TV Station Sync and Blanking Pulses
- Nine Patterns
- Red, Blue and Green Gun Killers
- Compact, Lightweight, Portable

You can pay much more, but you can't buy more exclusive and up-to-date features than CONAR engineers have built into the new Model 681 Color Generator. CONAR is first with digital integrated circuits and 4 crystal-controlled oscillators. Compact and portable, the 681 weighs less than 5 lbs. Peak accuracy and stability are assured by cool all solid state circuitry, regulated power supply and stability control. The 681 incorporates a wide range of test patterns, including single and multiple vertical bar, horizontal bar and crosshatch patterns — all with horizontal lines only one raster line thick, as well as a standard 10-bar color pattern. The most modern and versatile color generator on the market, the 681 incorporates 27 semiconductors: 10 type 914 integrated circuits, 7 type 790 integrated circuits, 3 2N2369 transistors, 1 2N555 transistor, 5 silicon diodes and 1 zener diode. Oscillators include 189kc. timing generator, 3.56 mc. offset color subcarrier, 4.5 mc. sound carrier and 55.25 mc. or 61.25 mc. rf. carrier (channel 2 or 3 as ordered). Until now, no commercially available color generator has offered so many quality features in a single instrument. You get TV station quality composite video signals, including "back porch" color burst. All this, plus CONAR's low prices, make the 681 the absolute tops in dollar-for-dollar value.

Please specify Channel 2 or 3 when ordering the 681. Select the channel which is not broadcast in your area.

SPECIFICATIONS

OUTPUT:
R. F. only — low impedance
Approximately 50,000 microvolts into 300 ohm tuner
100% modulated carrier — composite video
Crystal controlled oscillators:
189 kc timing oscillator
3,563,795 kc offset color subcarrier oscillator
4,500 kc sound carrier oscillator
55.25 mc or 61.25 mc rf carrier oscillator

MODULATION:
Single dot
Single cross
Single vertical line
Single horizontal line
Full dot pattern
Full crosshatch pattern
Full vertical line pattern
Full horizontal line pattern
Keyed rainbow color pattern

POWER REQUIREMENTS:
120 vac — 1.0 watt

REGULATED POWER SUPPLY:
Silicon diode bridge rectifier
Zener diode stabilized transistor regulator

SEMICONDUCTOR COMPLEMENT:
10 type 914 integrated circuits
7 type 790 integrated circuits
3 type 2N2369 NPN silicon transistors
1 type 2N555 PNP power transistor
1 type 1N746A Zener diode
4 silicon rectifier diodes
1 modulator diode

GUN KILLER SWITCHES:
Permanently wired cable
Separate red, blue and green switches
Colored switches for rapid location

CONSTRUCTION:
Aluminum cabinet, chassis and panel for light weight
Printed circuit board, 6" x 9"

SIZE:
10" x 3" x 9" (WxHxD)

WEIGHT:
Less than 4 pounds

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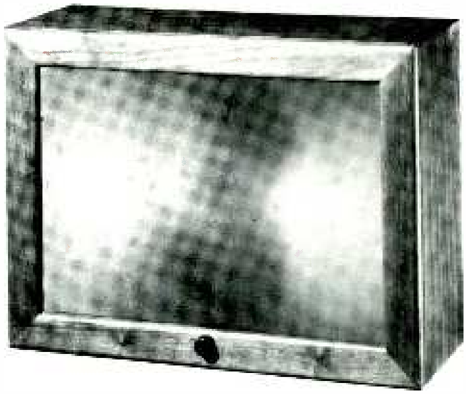
CONAR
Audio Color
An Exciting New Concept in Music

For music lovers and electronics enthusiasts alike, this transistorized marvel attaches quickly to hi-fi sets, stereos, tape recorders and *even most* radios. Simply connect alligator-clip leads to your speaker terminals, and you're ready to enjoy a color spectacle.

While you listen to your favorite melody, beautiful hues of red, orange, yellow, blue, green and violet move across the Audio Color screen in a breathtaking variety of patterns. A frosted screen eliminates glare without filtering the colors.

But Audio Color *does more* than paint the music. It also reproduces the tempo. With each *torrid* beat of the bongos . . . with each *clash* of the cymbals, the colors grow brighter. If the tempo mounts slowly, the colors brighten gradually. A *sharp rise* in volume is matched by a *sudden flash* of colors, bass on the right—treble on the left.

Order the Audio Color in kit form and build it yourself in a few short hours. For those who can't wait to see it, we have a few already assembled.



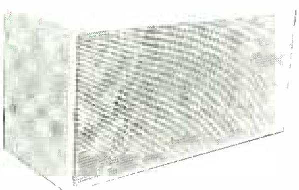
KIT 103 UK — CATALOG PRICE $44.95
NRI STUDENT AND ALUMNI PRICE **$39.85**

WIRED 103 WT — CATALOG PRICE $54.95
NRI STUDENT AND ALUMNI PRICE **$49.45**

CONAR "300" Stereo System

KIT 300 UK — CATALOG PRICE $121.00
NRI STUDENT AND ALUMNI PRICE **$108.00**

WIRED 300 WT — CATALOG PRICE $135.00
NRI STUDENT AND ALUMNI PRICE **$119.95**



- **Power Amplifier Kit**
- **2 Speakers in Enclosures**
- **Garrard Turntable**
- **Stereo Cartridge**
- **All Cable, Wire, Jacks**

Shipped Express Collect

The shock of common sense in STEREO—you *must* hear it to believe it!

The "300" Stereo System is designed for those who consider their *ears* as the best judge of true stereo reproduction. It is not for people who insist on spending $400 or more for stereo or people who thrive on long lists of specifications, technically accurate or not.

Here is quality stereo to compliment your tastes for good listening and fit any budget. A precision engineered system with carefully matched components; yet ruggedly built as a home entertainment center for the entire family.

Whether it's violin, piano solo or bass drum—Beethoven, Belafonte or Brubeck—the "300" urges and invites your comparison with stereo systems costing considerably more. We repeat, let your EARS judge the living sound, superb channel separation, the startling realism that only good component stereo can bring.

FREE STEREO CARTRIDGE — **ELECTRO-VOICE 126A, $10 VALUE DIAMOND-SAPPHIRE NEEDLE**

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Adventures In Electronics Kit

FROM CONAR . . .

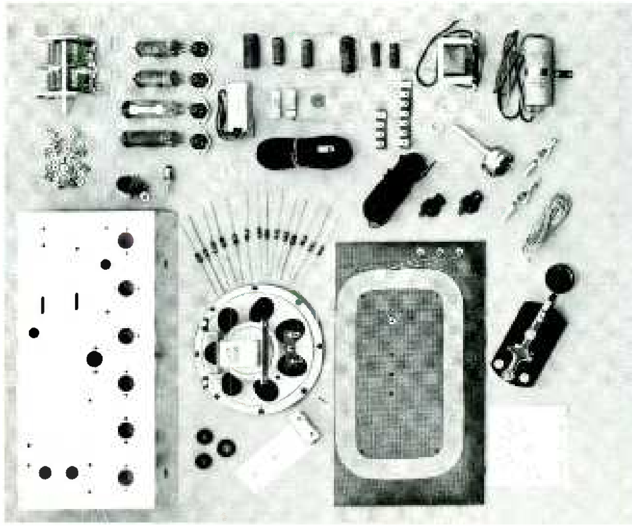
The Perfect Gift for Some Lucky Boy (or his Dad)!

★ More Than 100 Parts

★ A Dozen Experiments

$18.95

Stock #26UKSIP
Weight 6 lbs.
Parcel Post



Ten *fascinating* and *safe* educational projects. This kit is used by teachers in many school classrooms to introduce students to electronics—help them toward satisfying and profitable careers. Here's proof positive of its sound educational value and thorough training.

Kit contains over 100 top-quality parts—name brands you'll recognize. This is not the "*plastic-cardboard-battery*" type experimenter's kit usually found on store shelves. IF PURCHASED SEPARATELY, THE PARTS USED IN THE ADVENTURES IN ELECTRONICS KIT WOULD RUN WELL OVER $30.00.

You learn about electronics and *have fun* doing it. Each project graphically demonstrates a number of electronics principles. You're shown "why" and "how" these principles work. You need *no previous electronic training or experience*. Just follow the simple, concise instructions and large diagrams in the 48-page project manual. The manual includes a glossary of common electronics terms for quick and easy reference.

The projects cover a seemingly endless variety of activities:

• **You build a Radio Receiver** which performs exactly like a manufactured set—picks up local broadcasts and distant stations.

• **You learn about Testing Radio Sets.** In this project you build a signal tracer and use it to find the exact point in a circuit where the signal stops. The signal tracer is a test instrument used by professional electronics technicians.

• **Then you become a Radio Announcer.** You set up a broadcast station, and with the speaker as your "mike," transmit your voice through your radio or a neighbor's set.

• **Now you assemble a "Secret Listener."** The speaker becomes a concealed microphone. Put it in one room and hear any conversations through a receiver without being present. Use it as an electronic "baby sitter." Mother can place the "Listener" near baby's crib and hear cries while she's in another room.

• **You'll experiment with sound.** In one project you build an Audio Oscillator and produce a wide range of sounds. Another experiment teaches how sound is magnified. After putting together an Audio Amplifier, you amplify sounds from a phonograph pick-up.

ALL THE TOOLS YOU NEED ARE INCLUDED FREE

SOLDERING IRON • SCREWDRIVER • PLIERS

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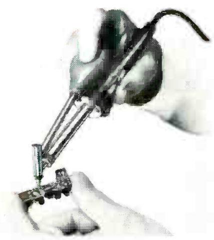
SOLDERING TOOLS AND AIDS

The Revolutionary New

ENDECO

Desoldering Resoldering Tool

One-hand operation



Endeco . . . the first successful desoldering/resoldering iron . . . not only removes soldered components, but also resolders printed circuit boards faster and better than regular resoldering irons. It requires only one hand to operate, leaving the other hand free. Its hollow tip fits over the connection; vacuums all solder for easy removal of the component; leaves terminals and mounting holes clean. Then, it resolders with 360° tip coverage and capillary action of the solder around the component lead for a perfect connection. Pays for itself quickly in time saved.

Stock #1300TO
Wt. 11 oz.
Parcel Post

$11.45

BLIXT

the one-hand operated automatic soldering gun

A technical hit! For both hobby and professional use. With the one-hand operated BLIXT—soldering can be done quickly and accurately in long series without breaks and risk of cold solder joints.

Solder is fed automatically and simply by squeezing the trigger of the comfort shaped handle. Tips can be changed easily according to the character of the work.

Made of impact-resistant nylon-plastic and mirror-finished metal, the BLIXT will give long service.

Stock #1141AC
Wt. 2 lbs.
Parcel Post

$13.95

SOLDERING AID KIT

BEAU-TECH Soldering Aid Kit includes six hard-chrome plated tools: Printed circuit type reamer and scraper tips, angled reamer and forked tips, straight reamer and forked tips, regular type brush and scraper tips, angled reamer and forked tips, and straight reamer and forked tips. Kit comes in handy plastic case.

Stock #1000TO
10 oz. Parcel Post

$5.35

SOLDAPULLT

SOLDAPULLT is the best resoldering tool we've seen yet. This tool incorporates easy handling, swift vacuum action and a self cleaning feature. *Soldapullt* is loaded by pushing plunger knob down until it latches. Molten solder is drawn into its cylinder instantaneously with a high impulsive vacuum by release of the spring loaded piston.

$5.95	**$9.95**
Stock #14TO	Stock #13TO
Standard	**Deluxe**
8 oz. Parcel Post	10 oz. Parcel Post

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WELTRON CASSETTE TAPE RECORDER

Now, the Portable Cassette Tape Recorder that couldn't be easier to use! All Push Button! No tapes to thread! Simply snap in a tape cassette, press a button and record. Press a button to rewind or to move the tape ahead. Inexpensive cassettes can be used as "talking letters" to friends and relatives. Even children can insert or remove cassettes and record and play. Included with the recorder is a carrying strap, an earphone and a microphone with its own case.

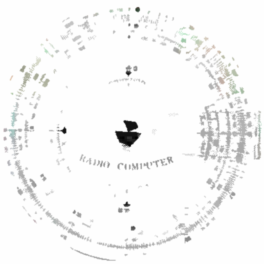
SPECIFICATIONS

TRACK SYSTEM: 2 track monaural. POWER SOURCE: 5 standard "C" cells. TAPE SPEED: 1⅞ IPS. BATTERY LIFE: 10 hours in continuous use. RECORDING TIME: 1 Hr. FREQUENCY RESPONSE: 200-6,000 c/s 5 db. WOW AND FLUTTER: Less than .4%. SIZE: 5" x 9½" x 2½".

Stock #1000EN
4 lbs. P.P. Ins.

$39.95

NEW ELECTRONIC SLIDE RULE



Professional Quality. Anyone in electronics can save time with this precision instrument. Ideal for electronic engineers, 2-way radiomen, TV technicians. Circular computer, $4\frac{7}{16}$ diameter. Precision calculation of surge impedance, resonance frequencies, inductive reactance, capacitive reactance, wave-length frequency, decibels. Includes ten scales. Made of special plastic which will not shrink or expand under most adverse conditions. Scale graduations are deeply imprinted and will not wear off. Light weight, pocket-sized. Leather-grain plastic case. Individually boxed with instructions.

800AC $5.95 Plus 20c Postage

FANON TELEPHONE AMPLIFIER

$14.95

Stock #4AM
5 lbs., P.P. Ins.

Makes Your Phone Twice As Useful!

You'll work smarter—not harder—when you simplify telephone work with the Fanon hand-free phone amplifier. Four-transistor unit is smartly designed, powered by one 9V battery with a life of nearly 500 hours. It's completely portable. There's no need for a line cord. You can talk into any phone while you use both hands for taking notes, type, search files or carry on whatever other work you're doing. Pays for itself in time saved.

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CONAR Cathode Conductance Tube Tester

Catalog Price $49.95

NRI Student and Alumni Price

KIT 223 UK **$44.80**

$5 DOWN, $5 PER MONTH

Catalog Price $75.95

NRI Student and Alumni Price

WIRED 223 WT **$68.25**

$7 DOWN, $7 PER MONTH

Express Collect

Completely new, modestly-priced Tube Tester Kit, designed by men with **unequalled** experience in training technicians -- understanding their equipment needs and servicing problems. No unnecessary frills added to the Model 223's specs. Only those features most essential to a technician's work are built in.

Every technician -- full or part time -- needs the Model 223 for his bench. Helps you make better job estimates and pays for itself quickly in extra profits. Perfect for experimenters and hobbyists, too.

Tests all series string and up-to-date tubes as well as the standard base types -- 4, 5, 6, 7-pin large octal, local, 7, 9 and 10-pin miniatures, 5 pin nuvistor, novar and Compactron. Checks 17 individual filament voltages from .75 to 110 volts. Tests multi-section tubes, gas rectifiers and remote control gaseous types. Has open-close "eye" tests for cathode ray indicator tubes, and visible filament continuity check to show up on filaments regardless of pin position.

12 level element selector-distribution system enables you to select the individual elements of the tube you're checking and simplifies cathode leakage tests and inter-element short tests. Most important this feature provides you with flexibility AND gives you insurance against obsolescence as new tubes reach the market.

Designed around the approved Electronic Industry Association's Emission Circuit, the Model 223 uses a precise, accurate, double-jeweled meter movement. It's balanced and factory calibrated within 2% accuracy. Large, easy to read -- with clear plastic case and two 2-color scales.

Test sequence set up to reveal quickly open filaments and shorts. The time-saving feature rejects an "open" or "shorted" tube and lets you proceed with more detailed checks right away. For maximum safety to you and the instrument, the test circuit transformer is isolated from the power line. Triple-window, high-speed, gear-operated roll chart is illuminated, easy to read, even in darkened areas. Lists over 2,000 tube types.

Durable, black, leather-fabric case makes the Model 223 attractive as well as functional. Hinged lid is removable. When the lid is on, a snap lock holds it securely.

Level switches and other controls conveniently grouped to eliminate wasted motion. This minor but thoughtful feature is typical of the care put into the Model 223.

The instruction manual for the Model 223 is written with the same high standard that went into the circuit design -- with HUGE picture diagrams to guide you every step of the way.

Building the Model 223 is easy. Using it is even easier. The operating simplicity makes it a pleasure to use. Just 10 lbs. -- it's a pleasure to tote along on service calls, too.

PICTURE TUBE ADAPTORS: 70°-90°, Stock 3AD; 110°, Stock 5AD – $3 Each

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Again we assume logic levels of 0 and +5 volts. With the inputs at 0 volts, both diodes will conduct and make the output essentially the voltage drop across these diodes. This is such a low voltage that it can often be considered ground. If one or both of the input diodes should go to +5 volts, the diode to which the +5 volts is applied will conduct more. The 5-volt input will appear at output F, minus the voltage drop across the diode. For all practical purposes, F will be +5 volts. Fig. 4D shows typical input and output waveforms for an OR gate.

Combining Logic Circuits. Logic circuits can be readily combined to form a variety of more complex logic networks. Fig. 5 shows two examples. In Fig. 5A a 3-input AND gate feeds a 2-input OR gate, along with a single input signal. The output of the OR gate will be a binary 1 if input W is a binary 1 or if signals X and Y and Z are simultaneously binary 1.

Fig. 5B shows a 2-input OR gate feeding an AND gate, along with input signal L which is applied to an inverter. The output of this circuit will be a binary 1 if inputs J or K are a binary 1 and input L is a binary 0.

APPLICATIONS OF LOGIC GATES

As you might expect, logic gates can be applied in an almost infinite number of ways. Certain combinations of these gates can implement most common functions.

Decoding. One of the most common digital functions is decoding. This is the process of detecting a particular binary word or number. There are many cases in digital equipment when it is desirable to determine when a specific number occurs.

Decoding can be accomplished with an AND gate as in Fig. 6. The AND gate is set up so that it has the same number of inputs as bits in the word being detected. In this case we are detecting the presence of a 4-bit word. The word is stored in a set of switches labeled A, B, C and D. These SPDT switches have binary 1 and binary 0 voltage levels applied to their two poles. In the up position, the arm of

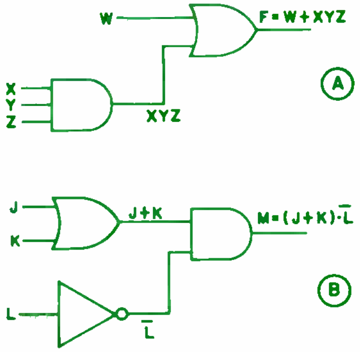


Fig. 5. Two examples of combined logic gates.

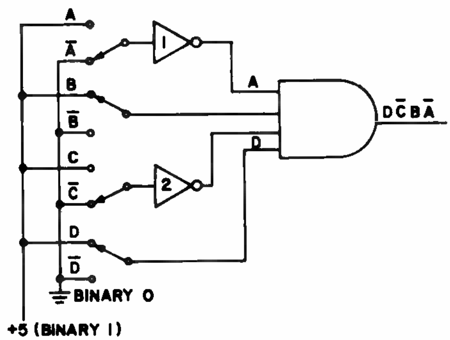


Fig. 6. An AND gate used for decoding the number 1010.

the switch will present a binary 1 output; when the arm is lowered, the output will be a binary 0. The switches are labeled so the upper contact is the normal output and the lower contact is the complement or binary 0 output.

To detect the presence of the number 1010, we connect the switch outputs to the AND gate inputs. The AND gate will generate a binary 1 output only when all its inputs are binary 1 at the same time. Bits D and B are binary 1's, so we connect them directly to two inputs of the AND gate. The other two inputs, A and C, are binary 0's.

In order to have our AND gate detect these bits, they must be inverted. Inverters 1 and 2 are used for this purpose. Now when the number 1010 is set into the switches, the AND gate output will be a binary 1.

If any other 4-bit number is set into the switches, the AND gate output will be a binary 0. The only time a binary 1 will appear on the output is when the switches are set to 1010.

Encoding. Encoding is the process of generating a particular binary code upon command from some logic input. A simple encoder is shown in Fig. 7. It generates the 4-bit code 1101 whenever the switch is closed. With the switch open, the outputs designated 1, 2, 4 and 8 will be at ground. If we assume positive logic levels, the output will be 0000. A positive voltage will be applied to the 8, 4 and 1 resistors when the switch is closed. The output will then be 1101, binary code for the decimal number 13.

A more elaborate encoder circuit is

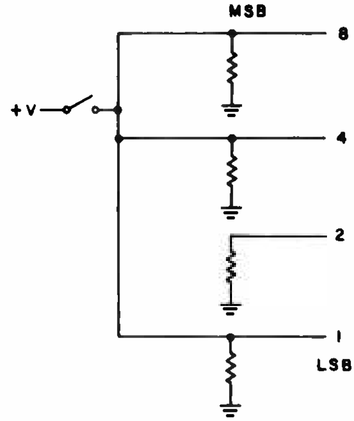
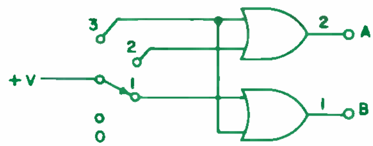


Fig. 7. A simple encoder.

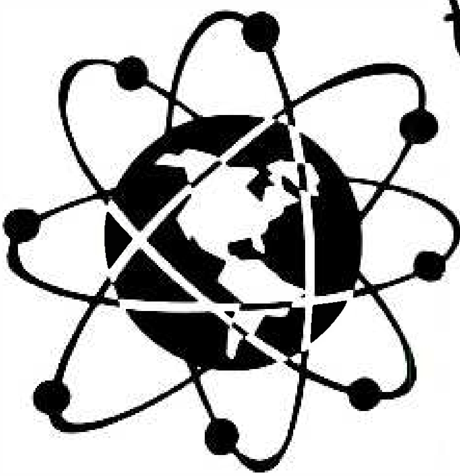
shown in Fig. 8. This circuit generates any one of four 2-bit output codes, depending upon the position of the switch. Since the switch is in position 1, a positive voltage (binary 1) is applied to gate 1 to produce outputs A = 0 and B = 1 (see table). Here the decimal numbers 0, 1, 2 and 3 are encoded as 2-bit numbers.



SW. POS.	CODE A	CODE B
0	0	0
1	0	1
2	1	0
3	1	1

Fig. 8. An encoder that generates four 2-bit codes.

These are only a few examples of how logic gates are used. In an upcoming issue, we'll get involved in more, including instances where we combine gates and storage circuits. Keep tuned.



Ham News

BY TED BEACH, K4MKX

Well, the FCC has been at it again. First of all they changed Form 610 (the form used by *all* amateurs for new, renewal and modified operator and station license). This one is dated April 1969 and is already out of date! The FCC made the mistake of printing the various filing fees on the second page. This is the second change they made—filing fees are ***up*** as of August 1, 1970, and the new Form 610 shows the old fees. A couple of other departures from old practice on the new form are that it can not be used as an application for a club or military recreation station license (use Form 610-B), and it now includes the code certification and request for examination papers of the volunteer examiner for the "mail order" licenses.

This is the procedure for obtaining Novice, Technician or Conditional licenses:

(1) Locate a qualified volunteer examiner
(2) Obtain a Form 610 from the FCC
(3) Take the code test
(4) Fill in Form 610, front side
(5) Examiner fills in side two and mails to:

FCC
Gettysburg
PA 17325

For Technician or Conditional, a check for the filing fee (made out to Federal Communications Commission) must accompany the application. There is still no fee for the Novice license. The rest of the procedure remains the same as before.

And now, here are the new fees:

New license, change of operator privileges, renewal of license or combination of modification and renewal . . . . $9.00 (was $4.00)
Modification without renewal . . . . $4.00 (was $2.00)
Special call sign request . . . . $25.00 (was $20.00)

And, just to let you guys see how ***lucky*** we are, check this one:

Class D Citizens Band license . . . . $20.00 (was $8.00)

I don't know, maybe the FCC is trying to tell the Ham operators on 11 meters something. It certainly is a lot less expensive (and more fun) to become and remain a ***real*** Ham!

Maybe the summer months kept everyone busy; we certainly didn't hear from many new NRI Hams this time—only 34 altogether for a two-month period. Several of these were not from new people, but simply notices of upgrading. This doesn't mean that we're not interested in hearing of these accomplishments—we certainly are! It's just that we also want to know everyone among our students and graduates who has a Ham ticket. At any rate, we're very pleased to note that 23 of the 34 people listed this time are enrolled in the Course for Amateur Licenses. Here they are:

Svend	WA1LWE	G	Shrewsbury, MA
Ken	WN2IBY	N	Watertown, NY
Alan	WN2PPG	N	Levittown, NY
Fred	WN4OQZ	N	Hampton, VA
Janet	WB4OUN	A	Mayfield, KY
Ken	WN4REW	N	Dizney, KY
B.M.	W5LKL	A	Odessa, TX
Bill	WA5SCN	G	Tulsa, OK
George	WA5VBW	A	Grand Prairie, TX
Jack	WN6BSC	N	Visalia, CA
Carl	WN6COW	N	Marysville, CA
Jim	WN6CXD	N	Los Osos, CA
Rich	WB6KSJ*	?	La Mesa, CA
Forrest	WN7NTI	N	Las Vegas, NV
Edwin	WN7PLZ	N	Phoenix, AZ
Edgar	WB8GGM*	G	Galion, OH
Gerald	WB9BFU*	G	Elkhart, IN
Tom	WB9DXK*	G	Racine, WI
Ray	WN9EXC	N	Danville, IL
Dennis	WN9EZS	N	Eau Claire, WI

Warren	WNØBXG	N	Bloomington, MN
Mauritz	WNØCHJ	N	Ft. Morgan, CO
Myrton	WP4DJW	N	Villamar, PR

* Just upgraded – congratulations!

WA1LWE reports that he was WN1LWE but has just passed the General test. Svend says that it is all because of his NRI course that he passed his exam with no difficulty. He also says he believes that he will be ready for the Advanced Amateur Course later this winter.

WN2IBY built his Conar Transmitter in four hours and it worked like a charm the first time he cranked it up. Ken hangs out on 3720, 3738 and 7191 using a trap dipole. Other equipment includes a homebrew transmatch, field strength meter and SWR bridge.

WN2PPG gives equal credit to NRI and the Royal Air Force for his new Novice ticket. Alan learned the International Morse Code during World War II and the basic theory from NRI. Now all we have to do is practice and keep at the books to get that next step!

WB4OUN almost got listed as WN4OUN, but before we went to press I got *three* communications from Janet, the last two indicating that she finally got her Advanced license. Congratulations! Janet says she was really up for the exam after studying only half the course and a couple of outside publications (which shall remain unnamed). Her interest in Ham radio goes back a few years when she was envying her older brother who had his license at 13. Now Janet has her Advanced and we are tickled pink for her.

WN4REW, another Kentuckian, has his Novice receiver kit finished (from the second Training Kit) and reports that it worked fine right away. Ken says he has WN8FLC on 80, WN8DCU on 40 and VE2DDM on 15 for DX so far. Both the 8's are in Michigan. That's swell, Ken, keep up the good work.

WB8GGM wrote a nice note thanking his instructors here at NRI for all the help they had given him in his study. Edgar seems to be doing quite well—Novice in March 1970 and General in July. No time wasted there.

WN9EZS writes to ask if there is going to be a club station or an NRI Alumni net formed in the future. Gee, Dennis, I wish I really knew. As far as I know, there has been very little response to the 40 CW net proposal; the 20 meter sideband net never really got off the ground either. We *still* don't have a club license here, but we're working on it (we *do* have a rig, though).

I was quite interested in seeing the Novice call WP4DJW as I never really knew how they worked calls for Novices in Puerto Rico. KP4 is the prefix for Puerto Rico, so it looks like Novices get a W instead of a K. How about that?

And that about wraps up the juicy news items from our Amateur Course students. Let us hear from you. Here is the current Rogue's Gallery of other students and graduates:

Franklin	WA3HIE/VP7	G	Andros Island, Bahamas
Franklin	WA3KSN/VP7	G	Andros Island, Bahamas
Frank	WB4OPF/VP7*	C	Andros Island, Bahamas
Howard	W4RYJ	T	Shelbyville, TN
Ed	W4VCY	T	Tarpon Springs, FL
Ralph	WB8EBG*	A	Spring Lake, MI
Charles	WN8HRI	N	Columbus, OH
Reid	W9JWT	A	Brookfield, WI
Richard	WNØAFA	N	Macon, MO
Michael	CP9AB		Bolivia, SA
Smitty	VE7ALU	A	Lillooet, BC

* Just upgraded – congratulations!

Notice the three /VP7 calls? How about those first names?! Frank, WB4OPF/VP7, wrote to let us know that he had changed the N to a B and that two other guys with him on Andros were not only Hams but also NRI students. He and the two Franklins have helped put together the AUTEC Amateur Radio Club at their Naval duty station. Frank also sent stats of his new Conditional ticket as well as the Bahamian "licence".

Howard, W4RYJ, sent us a copy of the Shelbyville Weekly Journal with a note to look at page 10. We did, and by golly there was a two-page spread about Howard and his Ham activities. Very impressive.

Reid, W9JWT, sent us a note at our home QTH which was returned to him marked "no such number" and "addressee unknown". It was correctly addressed, but we have moved. However, the Post Office knows where we went. Sorry.

Reid has been licensed since 1925 and specializes in QRP county and certificate hunting on 75, 40 and 20. He says it is really fascinating and he would be very happy to give anyone who is interested all the particulars. Send him a stamped, addressed envelope at: 200 So. Park Blvd., Brookfield, WI 53005

As a parting thought, Reid had a suggestion for the column which we won't have the room to include this time. What could it be? Hang in there and wait till the next time... Vy 73 Ted - K4MKX

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IT REALLY ISN'T CHRISTMAS WITHOUT THEM.

NRI honors program awards

For outstanding grades in their NRI course of study, the following July and August graduates received Certificates of Distinction along with their Electronics diplomas.

HIGHEST HONORS

Monte B. Botts, El Segundo, Calif.
Joseph L. Castagna, Glen Mills, Pa.
Ernest W. Chilton, Bowling Green, Va.
Robert Chris Day, Milton-Freewater, Ore.
George L. Douglass II, Dublin, Calif.
Farley E. Geddie, Cottondale, Ala.
Thomas R. Hoover, San Diego, Calif.
Kenneth R. Lytle, Bradford, Mass.
Eugene W. Maier, Yorktown Heights, N.Y.
Donald R. Muir, Crystal Lake, Ill.
Virginia M. Page, Phoenix, Ariz.
Duaine A. Reiff, Omaha, Neb.
Richard W. Reinert, Easton, Pa.
Albert Sizemore, Dayton, Ohio
Keith E. Smith, Bryans Road, Md.
Eugene R. Szymanski, Oxon Hill, Md.
Gerald E. Warner, Elkhart, Ind.
Charles Weissflog, Chicago, Ill.

HIGH HONORS

Leon Abramson, Portsmouth, Va.
William Alexander, Greenbelt, Md.
James P. Anderson, Nash, Texas
Joseph C. Ardinger, Fairfax, Va.
Edward Arledge, Vivian, La.
Richard E. Ashley, Greenland, N. H.
Raymond I. Beeman, Watertown, Conn.
Ronny E. Berry, Kingsley Field, Ore.
Harold R. Blevins, Huntsville, Ala.
Delbert J. Bohnert, Perryville, Mo.
Richard Bolton, Bloomfield, N.M.
Bruce A. Boomer, Nutter Fort, W. Va.
Robert Brick, Harwick, Pa.
Jim Carpenter, Stafford Springs, Conn.
Virginia Carter, Columbus, Ind.
Marvin L. Cherney, Franklin, Wis.
William G. Clark, Adamsville, Ala.
Ralph A. Collette, Malone, N.Y.
Walter G. Conway, Cincinnati, Ohio
Charles D. Crone, Berea, Ohio
Robert H. Culver, Nebraska City, Neb.
Gary Danielson, Cedar Rapids, Iowa
J. B. Delisle, Montreal, Quebec, Canada
Marlin M. Detwiler, West Chester, Pa.
Philip E. Domoney, Richmond, Va.
Dale A. Druck, Dover, Pa.
James Dunson, Cantonment, Fla.
Richard A. Esposito, Laredo, Tex.
Cesar A. Falconette, Paraiso, Canal Zone
Apolonio C. Garza, San Antonio, Tex.
Philip Gebhardt, Scarborough, Ont., Canada

NRI graduates climb to the top

Rene D. Ghersi, Lima, Peru
Glenn F. Golladay, Mount Jackson, Va.
Todd A. Greene, Lake Odessa, Mich.
John Gurz, Old Forge, Pa.
Dennis Hannan, Houlton, Me.
Svend A. Hansen, Shrewsbury, Mass.
Donald J. Hinz, Aberdeen, Md.
Edwin F. Hoffmeister, Rolla, Mo.
Marvin Hutto, Augusta, Ga.
M. R. Irion, Dallas, Texas
Wendell E. Jarvey, APO San Francisco
Donald L. Jaske, Dayton, Ohio
Wandel H. Johnson, Cleveland, Ohio
Wayne Kellogg, Hiawatha, Kan.
Emery W. Kleigleng, Newtown Square, Pa.
George H. Leonberger II, Midland, Tex.
Michael D. Lofano, San Antonio, Tex.
George W. Manthey, Lancaster, Calif.
William B. Martin, Charleston, S.C.
Joe W. Marx, Chilhowee, Mo.
Steven J. McElmeel, Lisbon, Iowa
Billy E. Mercer, Fayetteville, N.C.
Edward L. Modzelewski, Staten Island, N.Y.
Gilbert Mordsky, Ann Arbor, Mich.
Cecil F. Mott III, Gibson City, Ill.
Stanley J. Mueller, Appleton, Minn.
Charles R. Nicely, Goldsboro, N.C.
D.L. Osborn, Boise City, Okla.
Robert L. Osburn, Kent, Wash.
William S. Paulsen, South Bend, Ind.
Roger W. Peak, Yorktown, Va.
Curtis A. Perry, Brockton, Mass.
William A. Poist, Savage, Md.
Danny Potts, North Bend, Ore.
Sam L. Rainwater, APO New York
David M. Reichert, Hanover, Pa.
Alfred G. Richards, San Antonio, Tex.
Darrell H. Rohde, Concord, Calif.
Dieter Ruhstrat, Milwaukee, Wis.
W. F. Scheibe, Benton, Ill.
William B. Sharp, Jr., Charleston, S.C.
Chester L. Singleton, Livermore, Calif.
Fred E. Stevens, Fairfield, Ala.
Robert E. Stout, Clinton, Ill.
Cecil D. Swanson, Jamestown, N. Y.
Joseph L. Szumigala, Sedalia, Mo.
Eugene W. Tews, St. Petersburg, Fla.
Ronald B. Tyson, Marietta, Ga.
Richard Van Rennes, Jr., Riverside, Calif.
Roger V. Van Rheeden, Mt. Zion, Ill.

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C. W. Young, Dorval, Quebec, Canada

President—elect of the NRI Alumni Association for the 1971 term:

JIM WHEELER

Out of Verona, Pennsylvania comes the new NRIAA president Jim Wheeler. Jim, with the Pittsburgh chapter since 1952, has been elected to all of that chapter's official positions.

The making of this president began sixteen years ago, when NRI's TV course graduation list contained the name James L. Wheeler. Since then Jim has started his own radio and TV repair business. Grossing over $25,000 per year, Jim's repairs are keeping him truly active.

Here's hoping that the same prosperity follows Jim throughout his term as NRI Alumni Association president.

Congratulations, Jim!

Alumni News

Sam Stinebaugh	President
Br. Bernard Frey	Vice-Pres.
William Sames	Vice-Pres.
Graham Boyd	Vice-Pres.
Samuel Antman	Vice-Pres.
T. F. Nolan, Jr.	Exec. Sec.

PITTSBURGH Chapter Hosts Manufacturers' Representatives

William Pruzinowski, regional service representative for Admiral, presented a series of slides and gave a talk on the Admiral K-10 chassis at the August meeting. He indicated some of the common troubles with that chassis and the components most likely to be at fault.

Jim Cochran, President of the RTSA Independent Servicemen, discussed the state licensing bills which are before the State Senate. RTSA is against these bills because they think the bills could jeopardize the small-business serviceman.

RCA District Coordinator Justin Sanchez spoke in September about the Purchasers Satisfaction Program of RCA and the Solid State Color TV Chassis CTC44.

He explained the new dc controls, in which a direct current control is used instead of an ordinary potentiometer. This eliminates some of the noise usually associated with regular volume controls.

SAN ANTONIO Members Play "What's My Line?"

Ernie Geisondorff, Vice Chairman of the San Antonio chapter, explained at the June meeting how he constructed a "Heathkit" color TV.

Bob Bonge, chapter Chairman, brought a TV "dog" to the July meeting.

Bob assigned two men to work with the set and passed out copies of the schematic. The audience directed the work. (This is a possibility for group programs that other chapters might adopt.)

At the August meeting, Sam Stinebaugh, chapter Secretary, played host for an electronics version of "What's My Line?" The contestants were Color Difference Amplifier and Stacked B+ Power Supply.

Ragsdale Entertains SAN FRANCISCO Chapter

Instead of the regular August technical meeting, Mr. and Mrs. Arthur Ragsdale showed slides from their vacation abroad.

SPRINGFIELD, MASS. Chapter Starts Two Monthly Meetings

Good attendance has made the Springfield chapter decide to hold two meetings a month. Since September, they have met on the second Saturday of the month at Norm Charest's shop, and on the fourth Saturday at Chairman Al Dorman's shop in Simsbury, Connecticut.

At its last meeting, the chapter heard from John Parks, who had a sticky problem in the vertical section of a TV set: vertical shrinkage developed five or ten minutes after warmup. The culprit turned out to be a leaky capacitor in the wave-shaping network of the vertical oscillator.

Art Byron demonstrated a simple little gimmick attached to a scope which tested flybacks, transformers, etc. Viewing a damped wave shape, the members learned how to compare a good flyback transformer to a bad one.

Schedule of Local Chapter Visits by Executive Secretary of NRI Alumni Association for Fall-Winter 1970 and Spring 1971

SOUTHEASTERN MASSACHUSETTS	Thursday	September 24, 1970
FLINT-SAGINAW VALLEY	Wednesday	October 7, 1970
DETROIT	Thursday	October 8, 1970
CHAMBERSBURG (Cumberland Valley)	Thursday	November 19, 1970
PHILADELPHIA-CAMDEN	Monday	November 23, 1970
SPRINGFIELD (Mass.)	Wednesday	December 2, 1970
NEW YORK CITY	Thursday	December 3, 1970
SAN ANTONIO	Wednesday	March 17, 1971
NORTH JERSEY	Friday	April 23, 1971
PITTSBURGH	Thursday	May 6, 1971
SAN FRANCISCO	Thursday	June 10, 1971
LOS ANGELES	Saturday	June 12, 1971

DIRECTORY OF CHAPTERS

CHAMBERSBURG (CUMBERLAND VALLEY) CHAPTER meets 8 p.m. 2nd Tuesday of each month at Bob Erford's Radio-TV Service Shop, Chambersburg, Pa. Chairman: Gerald Strite, RR1, Chambersburg, Pa.

DETROIT CHAPTER meets 8 p.m., 2nd Friday of each month at St. Andrews Hall, 431 E. Congress St., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Mich. VI 1-4972.

FLINT (SAGINAW VALLEY) CHAPTER meets 7:30 p.m., 2nd Wednesday of each month at Andrew Jobbagy's shop, G-5507 S. Saginaw Rd., Flint, Mich. Chairman: Andrew Jobbagy, 694-6773.

LOS ANGELES CHAPTER meets 8 p.m., third Friday of each month at Graham D. Boyd's TV Shop, 1223 N. Vermont Ave., Los Angeles, Calif., NO-2-3759.

NEW ORLEANS CHAPTER meets 8 p.m., 2nd Tuesday of each month at Galjour's TV, 809 N. Broad St., New Orleans, La. Chairman: Herman Blackford, 5301 Tchoupitoulas St., New Orleans, La.

NEW YORK CITY CHAPTER meets 8:30 p.m. 1st and 3rd Thursday of each month at 264 E. 10th St., New York City. Chairman: Samuel Antman, 1669 45th St., Brooklyn, N.Y.

NORTH JERSEY CHAPTER meets 8 p.m., last Friday of each month at Midland Hardware, 155 Midland Ave., Kearney, N.J. Chairman: William Colton, 191 Prospect Ave., North Arlington, N.J.

PITTSBURGH CHAPTER meets 8 p.m., 1st Thursday of each month in the basement of the U.P. Church of Verona, Pa., corner of South Ave. & 2nd St. Chairman: Tom Schnader, RFD 3, Irwin, Pa.

SAN ANTONIO (ALAMO) CHAPTER meets 7 p.m., 4th Friday of each month at Alamo Heights Christian Church Scout House, 350 Primrose St., 6500 block of N. New Braunfels St. (3 blocks north of Austin Hwy.), San Antonio. Chairman: R. E. Bonge, 222 Amador Lane, San Antonio, Texas.

SAN FRANCISCO CHAPTER meets 8 p.m., 2nd Wednesday of each month at the home of J. Arthur Ragsdale, 1526 27th Ave., San Francisco. Chairman: Isaiah Randolph, 60 Santa Fe Ave., San Francisco, Calif.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8 p.m., last Wednesday of each month at the home of John Alves, 57 Allen Blvd., Swansea, Mass. Chairman: Oliva J. Laprise, 55 Tecumseh St., Fall River, Mass.

SPRINGFIELD (MASS.) CHAPTER meets 7 p.m., 2nd Saturday of each month at the shop of Norman Charest, 74 Redfern Dr., Springfield; and 4th Saturday at the shop of Chairman Al Dorman, 6 Forest Lane, Simsbury, Conn.

PHILADELPHIA-CAMDEN CHAPTER meets 8 p.m., 4th Monday of each month at K of C Hall, Tulip and Tyson Sts., Philadelphia. Chairman: Herbert Emrich, 2826 Garden Lane, Cornwell Heights, Pa.

There is no peace,
And yet ye cry
Peace, and peace!
And still they die —
Till in the fields
Where bloody gore
Ran rampant once
(And does no more?),
The shattered ghosts
Take up the cry,
If this be peace,
Why did we die?
Has our demise
Been not for good
And peace become
Mere interlude?

The wailing wind,
The list'ning hill
Reverberate
The echo still —
Peace, and peace
Incessantly.
It shall not cease
Till perfidy
Of all the vows
Sworn in the name
Of peace, arouse
The flick'ring flame
To white-hot heat
In every breast.
The restless shades
Sadly behest

Peace? And Peace?
And, languishing,
Know no release
From questioning.
The grass will grow,
Obliterate
The final trace
Of alien hate —
Yet think they rest
Beneath the sod,
Expectancy
Become — a clod?
Say what you will,
We have not won;
There is no peace
Till war is done.

JEREMIAH 6:14. They have healed also the hurt *of the daughter* of my people slightly, saying Peace, peace; when *there is* no peace.

Allene J. Magann
November, 1945
Harlingen, Texas

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