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May 1975

TECHNOLOGY UTILIZATION

ELECTRONIC COMPONENTS, SUBSYSTEMS, AND EQUIPMENT

A COMPILATION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Foreword

The National Aeronautics and Space Administration has established a Technology Utilization Program for the dissemination of information on technological developments which have potential utility outside the aerospace community. By encouraging applications of the results of its research and development, NASA earns for the public an increased return on the investment in aerospace research and development programs.

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SP-5971: Electronics – Components and Circuitry	SP-5976: Mechanics
SP-5972: Electronics Systems	SP-5977: Machinery
SP-5973: Physical Sciences	SP-5978: Fabrication Technology
SP-5974: Materials	SP-5979: Mathematics and Information Sciences
SP-5975: Life Sciences	

When the subject matter of a particular Compilation is more narrowly defined, its title describes the subject matter more specifically. Successive Compilations in each broad category above are identified by an issue number in parentheses: e.g., the (03) in SP-5972(03).

This document is one in a series intended to furnish such technological information. It is devoted to recent developments in electronic components, subsystems, and equipment. The Compilation has three sections: one discussing circuit components and techniques particularly applicable to printed circuits, another presenting descriptions of more general circuit components and techniques, and a third on cables and connectors.

Additional technical information on the items presented here can be requested by circling the appropriate number on the Reader Service Card included in this Compilation.

The latest patent information available at the final preparation of this Compilation is presented on the page following the last article in the text. For those innovations on which NASA has decided not to apply for a patent, a Patent Statement is not included. Potential users of items described herein should consult the cognizant organization for updated patent information at that time.

We appreciate comment by readers and welcome hearing about the relevance and utility of the information in this Compilation.

Jeffrey T. Hamilton, *Director*
Technology Utilization Office
National Aeronautics and Space Administration

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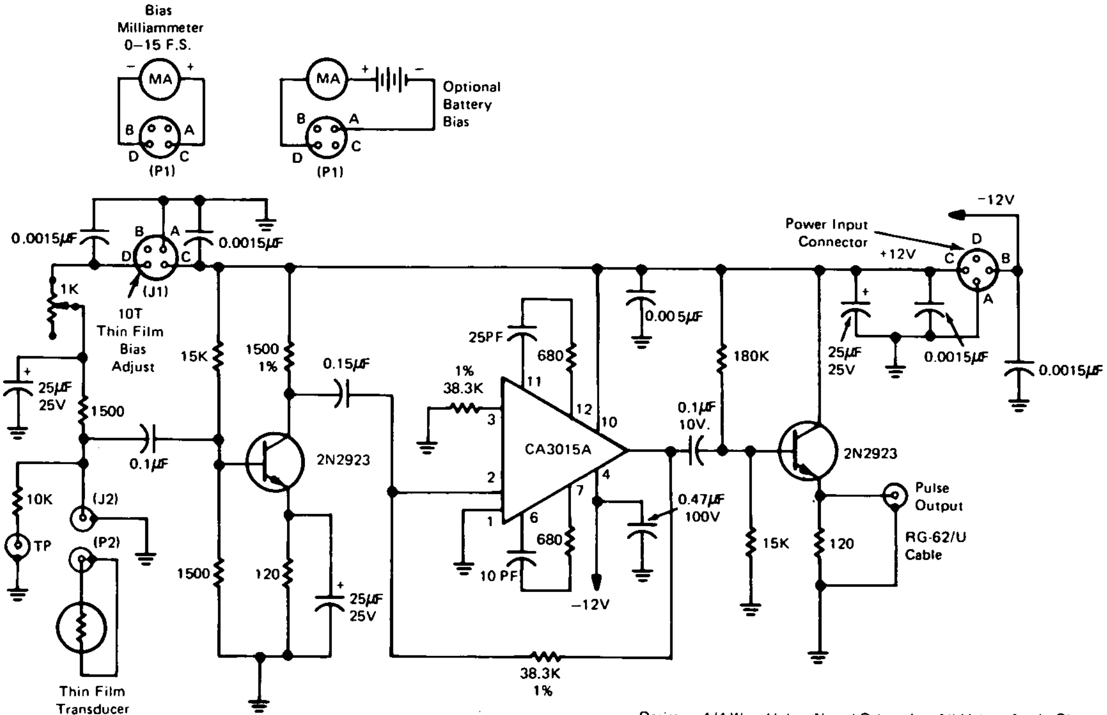
Contents

Section 1.
Integrated Circuit Components and Techniques

AMPLIFIER FOR SIGNAL FROM THIN FILM TRANSDUCER



Resistors 1/4 Watt Unless Noted Otherwise, All Values Are in Ohms

Electronic circuitry has been devised to raise the low level signal from a platinum film type transducer to a sufficient amplitude to trigger an oscilloscope or time interval counter. This amplifier has been used with shock tube apparatus to measure wave velocity between two or more points, and also to generate a timing signal to trigger an oscilloscope. The circuit could be used wherever it is necessary to raise the level of a low amplitude, low impedance positive polarity pulse to a 5 V or 6 V level.

The delicate construction of the thin platinum film transducer necessitates a low value of bias current, thereby limiting the available output signal. The circuit shown in the figure overcomes this problem and delivers the signal suitable for the shock tube measurements. The input circuit biases the transducer at one to ten milliamperes; this is adjustable and determined by the thin film characteristics. Power for biasing is normally drawn from the amplifier supply, but with the connections shown, an optional battery supply may be used.

The first stage is a buffer amplifier providing slight gain and signal polarity inversion. The next stage is an operational amplifier designed to differentiate the amplified pulse and restore the original signal polarity. This amplifier has a rise time of 0.5 microsecond and a voltage gain of about 3000. Short leads, adequate power supply bypassing, and grounding are important. The final stage is an emitter follower biased slightly less than cutoff to pass all positive polarity 6-V peak signals. The entire assembly was mounted in a 3 x 4 x 2 in. (7.6 x 10.2 x 5.1 cm) box installed directly on the transducer.

Source: K. A. Jensen
Lewis Research Center
(LEW-11494)

No further documentation is available.

IMPROVED FEEDBACK SHIFT REGISTER

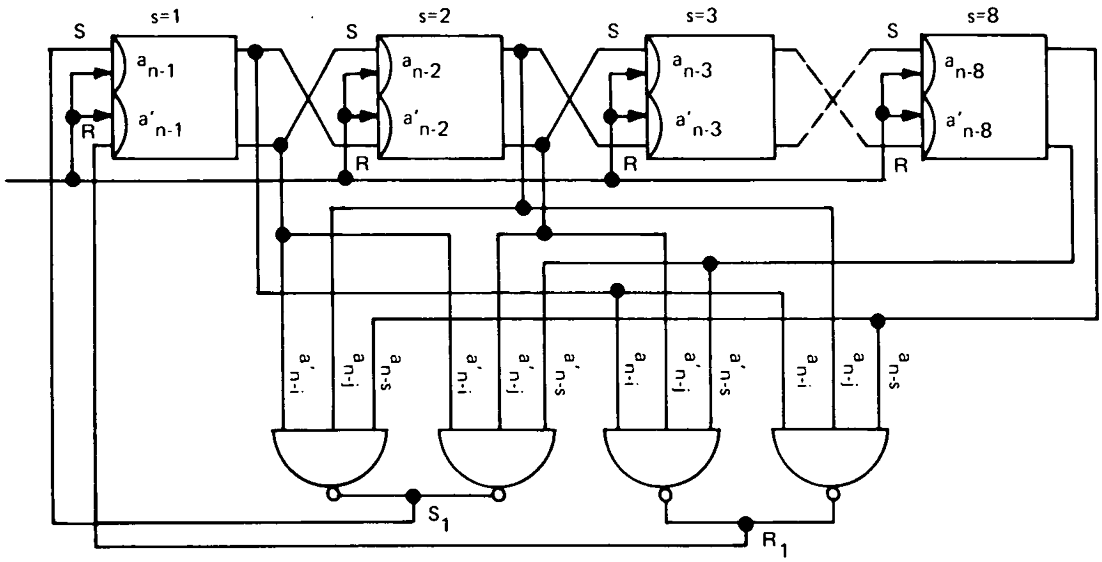


Figure 1. Three-Tap Feedback i=1

TABLE 1

s	i	j	2^s-2
4	1	2	14
5	1	3	30
6	1	2	62
7	1	5	126
8	1	2	254
9	2	6	510
10	2	3	1022
11	1	3	2046
12	2	7	4094
13	-	-	-
14	1	2	16382
15	3	5	32766
16	1	2	65534
17	1	11	131070
18	1	12	262142
19	1	7	524286
20	1	14	1048574

Currently feedback shift registers (FSR) of s stages, which use a two tap feedback decoding structure, cannot generate a maximal length sequence (2^s-1 states), when s takes on the value of certain integers. A design has been formulated which uses a three-tap feedback decoding scheme. The taps are selected from appropriate stages of the feedback register. This results in the generation of near maximal length sequences (2^s-2 or 2^s-4 states) for any integral value of s. These sequences will be either 1 or 3 increments shorter than a maximal length sequence. In addition the autocorrelation function of the three tap FSR shows a large negative correlation at 180° out of phase, in addition to the normal positive 0° phase. This is very useful in obtaining sequence synchronization patterns.

It has been found that for every integer value of s number of stages (except for s equal to 13 in the 2^s-2 case) up to relatively large values, at least one near maximal length sequence can be generated providing the three stages (designated as i, j, s) to be used in the feedback gating structure are properly selected. The last stage of the feedback register is always used. This is the s parameter. The i and j stages may vary depending on the sequence length. As shown in Figure 1, an 8 stage

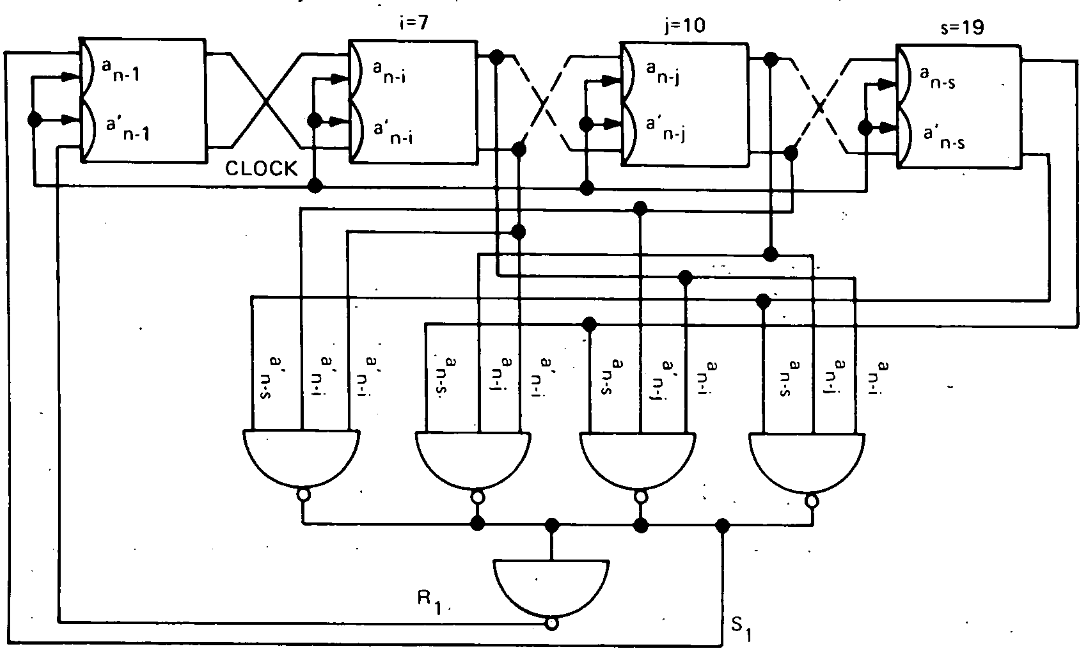


Figure 2. Three-Tap Feedback i≠1

TABLE 2

s	i	j	2^s-4
4	1	3	12
5	1	2	28
6	-	-	-
7	1	4	124
8	-	-	-
9	1	2	508
10	1	5	1020
11	1	4	2044
12	1	3	4092
13	1	2	8188
14	-	-	-
15	1	12	32764
16	1	7	65532
17	1	14	131068
18	5	9	262140
19	7	10	524284
20	5	7	1048572

feedback shift register with a three-tap structure is connected to provide a 254 counting (2^s–2) sequence. The selected feedback stages are i=1, j=2, and s=8. When i=1 (first stage) only four nand gates are required to implement the feedback logic.

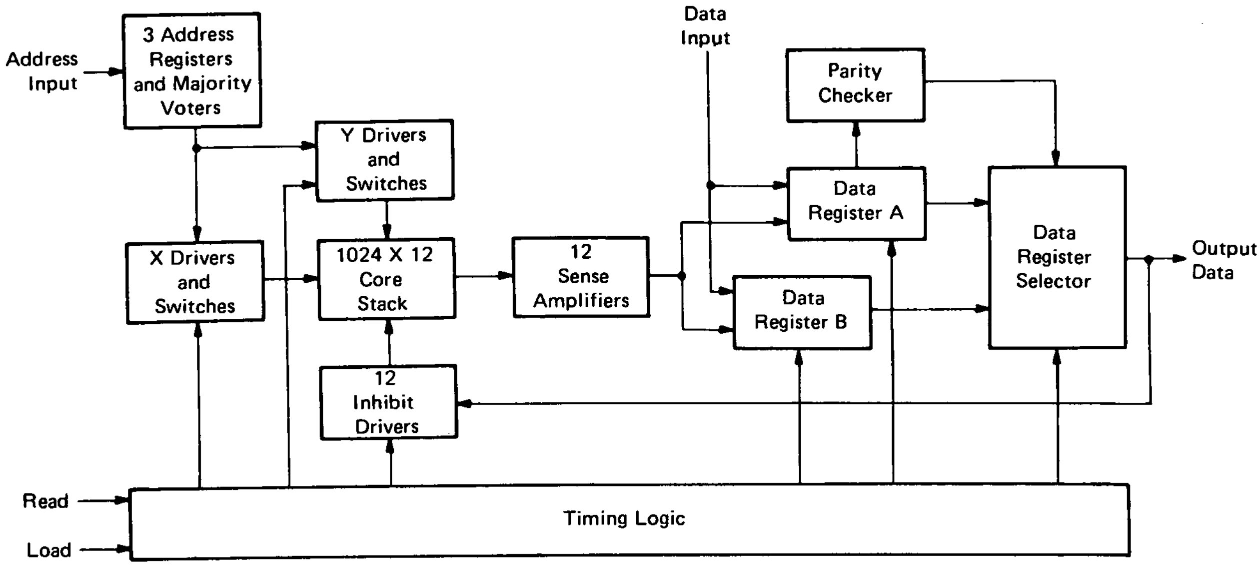
In Figure 2, the nineteen-stage three-tap feedback shift register is connected to provide a 52,484 counting (2^s–4) sequence. The selected feedback stages are 1=7, j=10, and s=19. Since i≠1, five nand gates are required for this implementation.

By utilizing the data shown in Tables 1 and 2 (which indicate the appropriate feedback stage selections) and connecting the feedback logic as shown in the figures, near maximal length cycles can be realized for each value of s for cycle lengths of 2^s–2 and 2^s–4.

Source: M. Perlman of
Caltech/JPL
under contract to
NASA Pasadena Office
(NPO-10351)

Circle 1 on Reader Service Card.

DUAL REDUNDANT CORE MEMORY SYSTEMS



A dual redundant core memory system prevents loss of memory data when a single drive circuit failure occurs. The system requires two address locations and a parity bit for each word. It incorporates series redundant drive switch circuits, triple redundant majority voted memory timing functions, and two data registers to provide functional dual redundancy. The signal flow through these circuits is shown in the figure.

To load a word into the memory the initial storage address is transferred into three address registers. A 12-bit data word (11 data bits and one parity bit which generates odd parity) is transferred into the two data storage registers A and B. A load signal is then transmitted to the timing section. This causes the following sequence of events to take place in the memory system.

1. The data in register A are loaded into the core stack at the address location designated by the address registers (an address from 0 to 511).
2. The three address registers and the data register B are complemented.
3. The data in register B are loaded into the core stack at the address location designated by the address registers (an address from 512 to 1023).
4. The three address registers are again complemented and then incremented by one.

The x and y drivers are arranged so that none of the drive circuits that load data from register A into the core memory will be used to also load the corresponding data from register B. The data word now stored in the memory is contained at two different address locations; one address between 0 and 511 and a second address between 512 and 1023. The numerical value of the second address is the binary bit complement of the first. The data word, stored in the second address location, is equal in value to the bit complement of the data word located in the corresponding first address.

Because the inhibit drivers are series redundant and cannot be turned on inadvertently, the only error that can be caused by a single failure is to load a logic "1" instead of a logic "0" in that bit position. Should this occur in one of the inhibit drivers, one of the two related addresses now loaded will still contain the correct data, the other will be incorrect by one bit (will have even parity). If an x or y driver or switch is open, one of the two words will still be correct and the other will have all "0's" (even parity). Additional words are loaded in a similar manner, except that a new initial address may not necessarily be transferred into the address registers. If not, loading is continued by loading sequential address locations.

To read data from the memory, the initial address from which data are to be read out of is transferred into the three address registers and a read signal is transmitted to the timing section. This causes the following sequence to take place in the memory system:

1. The data stored in the core stack at the address designated by the three address registers are read out into the data register A. They are then restored back into the same address location (an address between 0 and 511).
2. The three address registers are complemented.
3. The data stored in the stack at the address now designated by the three address registers are read out into data register B. They are then restored back into the same address location (an address between 512 and 1023).
4. Memory register B is complemented.
5. The parity bit, located in register A, is checked. If the parity is odd, the data selector transmits the data in register A to the output data lines. If the parity is even, the data selector transmits the data register B to the output data lines.
6. The three address registers are again complemented and incremented.

Additional words are read from the memory in a similar manner except that a new initial address may not necessarily be transferred into the address registers. If not, reading continues by reading sequential address locations.

Failure modes in a sense amplifier will either give a logic "1" output or logic "0" output regardless of the sense inputs. When reading a redundantly stored word, as described above, the output bit from the failed sense amplifier will be correct in one of the two data registers, and the register receiving the wrong output will have even parity.

Thus, regardless of any single failure in the memory system the resultant output data will be correct. Also, because the address registers, timing, x and y drive, and inhibit-sense-data register sections are independent of one another for redundancy considerations, many multiple failure modes may be tolerated without the loss of stored data.

This system may be of use where computer reliability requirements are critical.

Source: F. E. Hull
Martin Marietta Corp.
under contract to
Johnson Space Center
(MSC-13993)

No further documentation is available.

EMBEDDING CONDUCTORS IN MONOLITHIC FERRITE MEMORY ARRAYS

A new process for making conductors with controlled shrinkage, to match that of ferrite sheets fired at 1623 K (2462° F), consists of, first, forming sheets of the conductor material by doctor blading a paste of precious metal particles suspended in a vehicle composed of a binder and a solvent. The precious metal particles used are an alloy of Au, Pt, and Pd. The paste is doctor bladed with a blade height of 0.025 cm (0.010 in.). After drying, the sheets are 0.0076 to 0.0081 cm (0.0030 to 0.0032 in.) thick.

The dried conductor sheet is bisque fired at 1113 K (1544° F) between two flat alumina setter sheets, separated by spacers 0.0076 cm (0.003 in.) thicker than the conductor sheet. During the bisque firing, the conductor sheets sinter together, forming a metallic sheet having approximately 80 percent of its maximum fired density and a thickness of approximately 0.006 cm (0.003 in.). Conductors 10.16 by 0.0140 by 0.006 cm (4 by 0.0055 by 0.0025 in.) are formed by die-punching. These conductors are tested electrically for uniformity prior to use.

After embedding in ferrite sheets, the conductors shrink approximately 20 percent, matching the shrinkage of the ferrite, when final sintering occurs. The shrinkage of the conductors, to a first approximation, is then a function of the temperature to which they are fired during this operation. The shrinkage of the ferrite is a function of both temperature and time. This allows the conductors to shrink without setting up strains in the ferrite. The conductors are sufficiently strong, due to the sintering which occurs during bisque firing, so that they are not broken by the frictional forces that occur between the ferrite and the conductors during the final sintering.

The following documentation may be obtained from:
National Technical Information Service
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $2.25)

Reference: NASA CR-2152 (N73-13238), Development of a Monolithic Ferrite Memory Array

Source: C. H. Heckler, Jr., P. D. Baba, and N. C. Bhiwandker of Ampex Corp. under contract to Langley Research Center (LAR-10994)

SELF-ALINED, POLYSILICON FIELD SHIELD

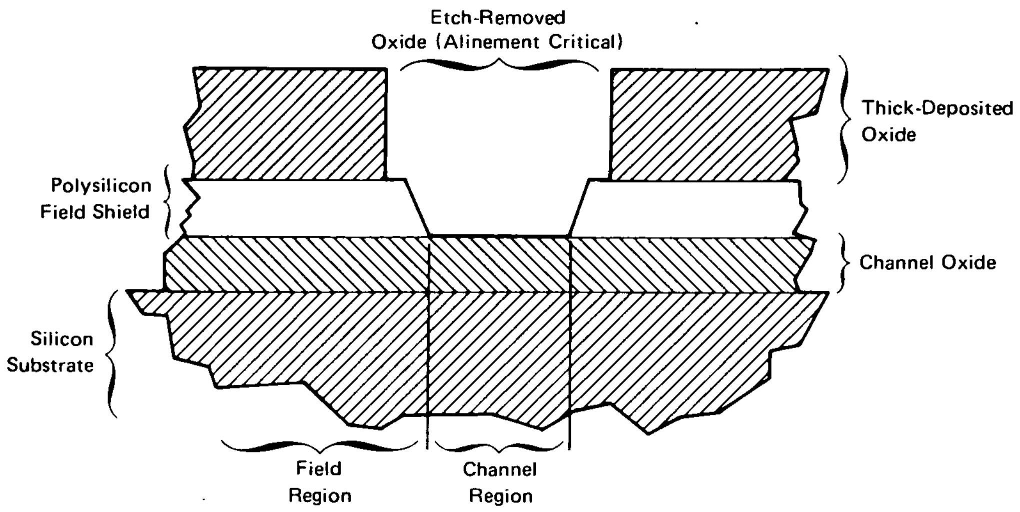


Figure 1. Standard Field-Shield Fabrication Sequence

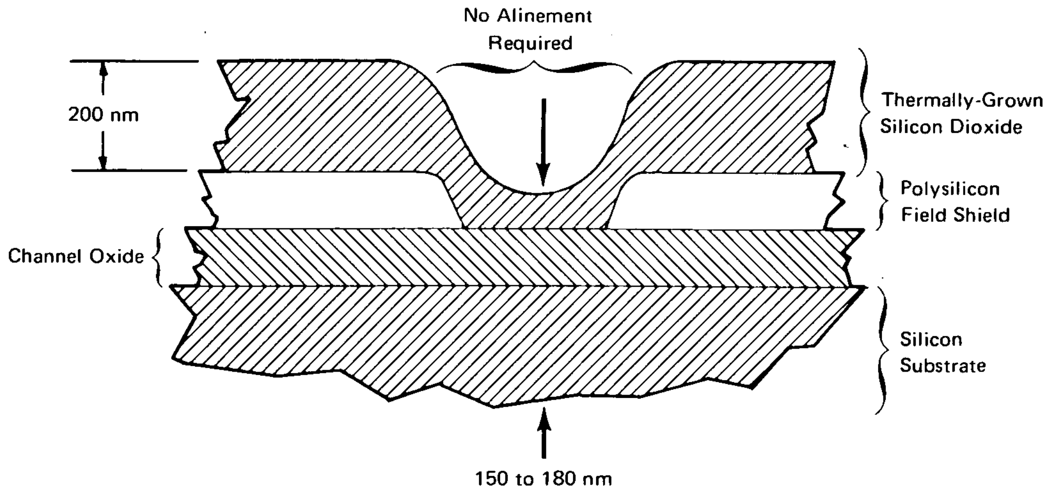


Figure 2. Self-Alined, Polysilicon Field Shield

A new, self-alining, field-shield technique, using polysilicon electrode material, simplifies the construction of MOS devices. Figure 1 shows the standard field-shield fabrication sequence. Selective etching of the thick-deposited oxide layer over the channel region requires precise and critical alinement.

The new self-alining method involves the deposition of a thermally-grown silicon dioxide layer, over the polysilicon field shield, after the channel regions have been etched. Critical alinement is not required because it is not necessary to etch this insulating layer. Figure 2 illustrates the new procedure. The total thickness of the channel oxide is increased during the polysilicon oxidation, typically from 100 nm to between 150 and 180 nm for a 200-nm layer of silicon oxide.

Source: W. F. Kosonocky and
J. E. Carnes of
RCA Corp.
under contract to
Langley Research Center
(LAR-11172)

No further documentation is available.

ELECTRICAL-COMPONENT FRAME ASSEMBLY: A CONCEPT

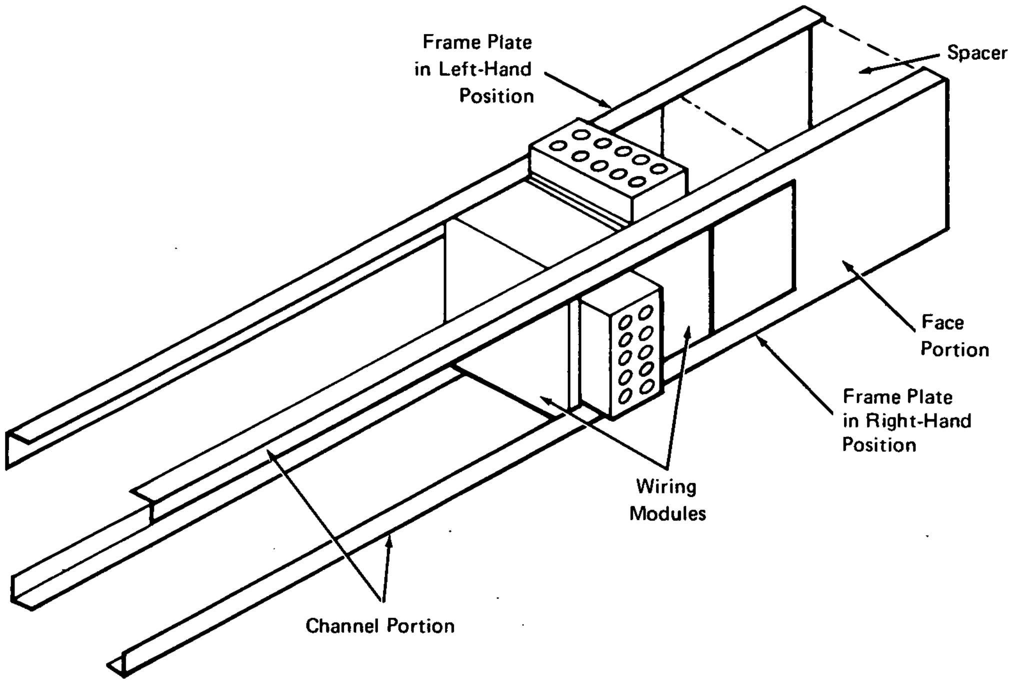


Figure 1. Frame Assembly

The stress-free, multidirectional organization of electrical connector blocks and associated wiring would be made possible by a special holding rack (Figure 1). Other assemblies allow the installation of modules in one direction only; a new method would facilitate four-directional orientation.

The design has two structural channels which are mounted on opposite faces of a spacer. Each channel has a rectangular window formed in its web, leaving, in combination with the original flange, a channel portion. Any two opposite channel portions form a window across the two structural channels. In this way, four windows become available for a four-directional positioning of terminal-junction modules. The device would be useful for interconnecting various test instruments, in repair shops, or for industrial-machine service and maintenance shops.

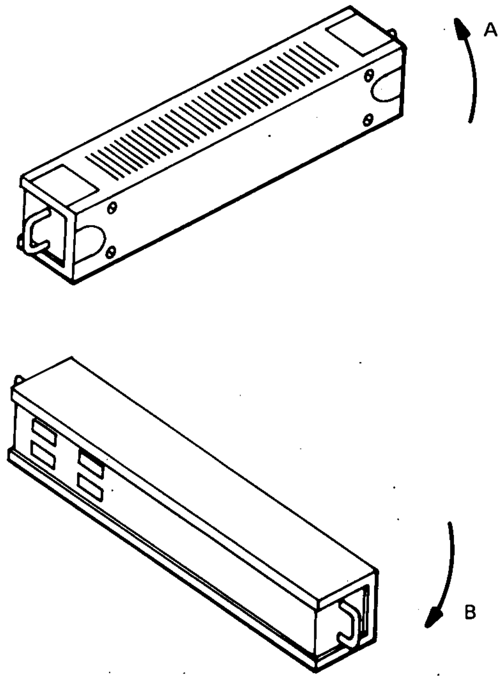


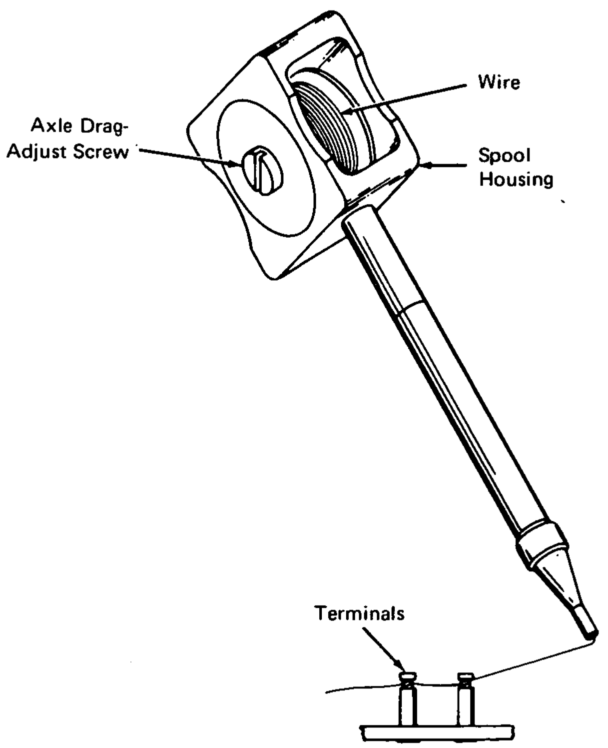
Figure 2. Present Method Requires Rotation of Entire Frame to Change Orientation

Figure 2 illustrates the limitation of the presently used method. Within one frame, modules must be oriented in the same direction (A or B). To change the orientation of one module, the entire frame must be rotated to the new orientation.

Source: R. Steiner of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-17250)

No further documentation is available.

MAGNET-WIRE WRAPPING TOOL FOR INTEGRATED CIRCUITS



A new tool wraps magnet wire around integrated-circuit terminals uniformly and securely without damaging the insulative coating on the wire. The wire-dispensing tool is similar to a mechanical pencil and (see figure) carries a supply of magnet wire on a spool. The wire passes through the hollow pencil-like stem and then through a tip of small diameter. The tool is manipulated easily inasmuch as it fits in the hand like a pencil; the tip is readily made to execute wire-wrapping movements. The tightness of the wire wrap is controlled by tension on the wire; the tension is controlled by restricting the unwinding of the wire from the spool by means of friction controlled by a screw on the axle supporting the spool.

Source: Ted H. Takahashi of
Caltech/JPL
under contract to
NASA Pasadena Office
(NPO-11815)

Circle 2 on Reader Service Card.

MATRIX FENCE FOR PRINTED WIRING BOARDS

High-density electronic packaging frequently requires more connections between components on printed wiring boards (PWB) than can be made on available surface areas. The matrix fence provides additional surfaces, perpendicular to the PWB planar surface for electrical connections (Figure 1). The conventional approach is to resort to multilayer board when the two sides of a PWB do not offer sufficient surface area. However, a multilayer board involves costly fabrication techniques, and connections between the surfaces are not as reliable as those for a double-sided board.

The matrix fence is shown in detail in Figure 2. The posts are soldered to the PWB printed circuits and provide electrical contact and mechanical support for the matrix fence. The posts are made from nickel wire 0.051 cm (0.020 in.) in diameter and may or may not be placed equidistantly. The spacing is predetermined by the design of the printed circuit. The rails are made of nickel ribbon 0.025 cm (0.010 in.) thick by 0.051 cm (0.020 in.) wide and are transverse to the posts, on the opposite side of a thin insulating strip.

The insulating strip is double-matted Mylar 0.018 cm (0.007 in.) thick. This insulating material is formed easily to the shape of the fence (Figure 1). Elongated apertures are predetermined and punched in the Mylar at each point of connection between a post and a rail. Posts and rails are resistive welded at each such aperture. The entire matrix fence assembly then may be placed within a U-shaped fiberglass channel and potted with epoxy for mechanical protection, or the assembly simply may be dipped in epoxy several times to achieve the desired rigidity.

The matrix fence illustrated in Figure 2 displays a true or balanced matrix: That is, the posts are spaced equally and extend entirely across one side of the insulating strip. The rails in a like manner are spaced equally and extend entirely across the opposite side of the strip, transverse to the posts. In actual practice, however, the matrix fence may be designed and constructed to suit a specific circuit (Figure 3). The use of such a modified matrix design minimizes time and cost in the construction of an assembly.

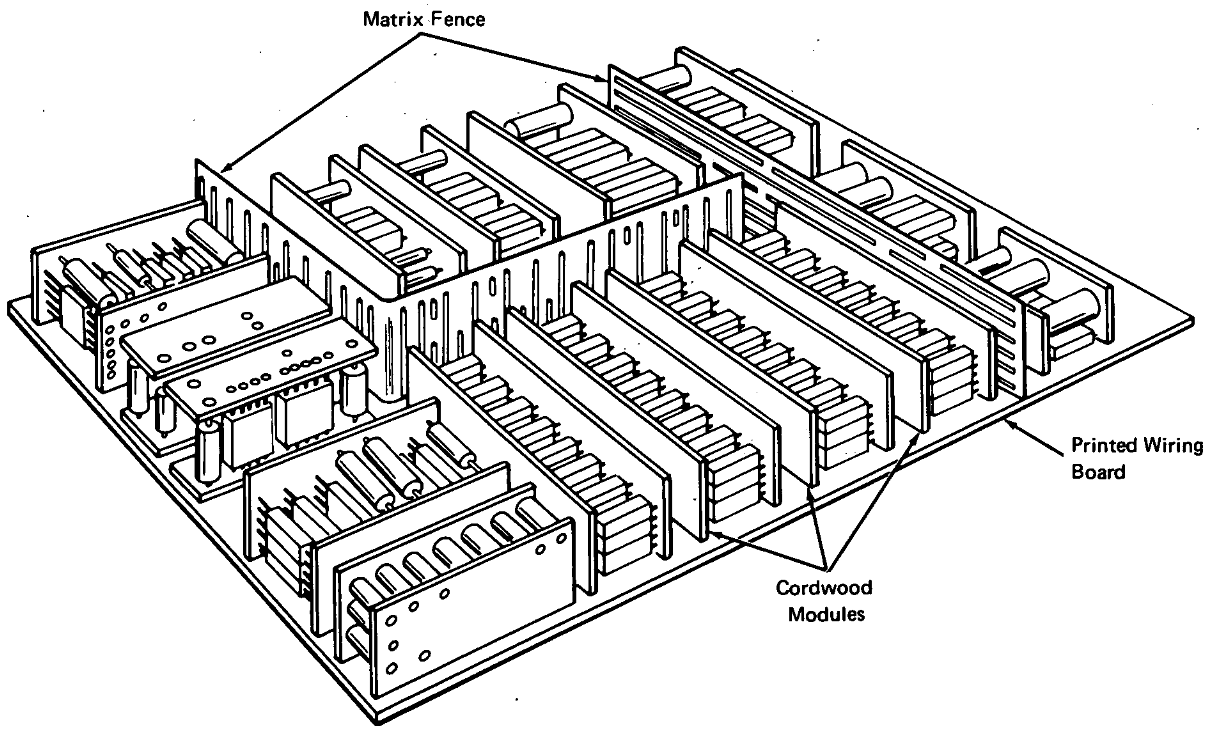


Figure 1. Parent Board With Modules and Matrix Fence

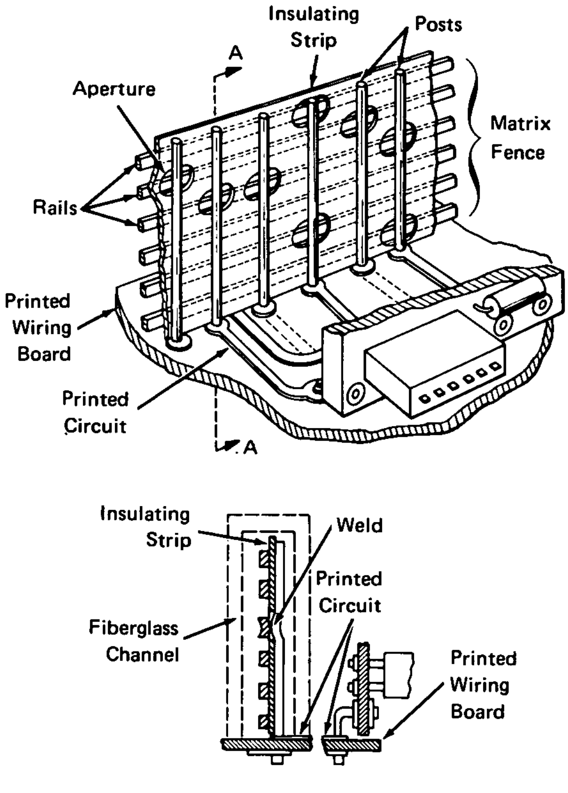


Figure 2. Balanced Matrix Fence

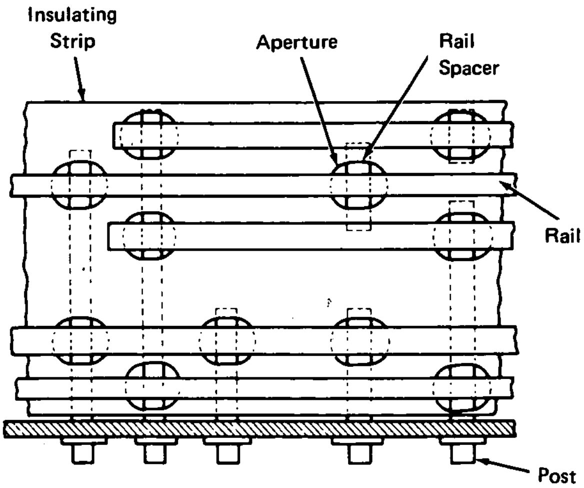


Figure 3. Unbalanced Matrix

The matrix fence assembly is designed preferably by computing the number of required connections between the modules making up the circuit. This is accomplished easily by displaying graphically the various modules in a row and a column, and by representing each connection by a mark such as a dot. Those modules requiring the largest number of interconnections may be determined and positioned efficiently, and the number of posts and rails as well as the number of PWB connections may be minimized. However, where distances between adjacent posts are large, short circuits between rails may occur. To prevent this a short piece of post material (Figure 3) is welded through an aperture to a rail on the opposite side of the insulating strip; the short piece thus serves as a rail spacer.

Source: C. J. Reed of
Ball Brothers Research Corp.
under contract to
Marshall Space Flight Center
(MFS-22628)

Circle 3 on Reader Service Card.

ELECTRICAL HARNESS-BOARD DECAL AIDS

Electrical harness boards define dimensional requirements and overall harness configurations. The boards are used primarily as manufacturing aids. They may also be used as inspection tools, against which completed harnesses may be checked for compliance with specifications.

Previously, orientation views and connector faces were drawn by hand directly on the boards, but these were not always sufficiently accurate. The decals, which are made of a standard transparent self-adhesive material, are affixed to the boards, and give accurate and clear views.

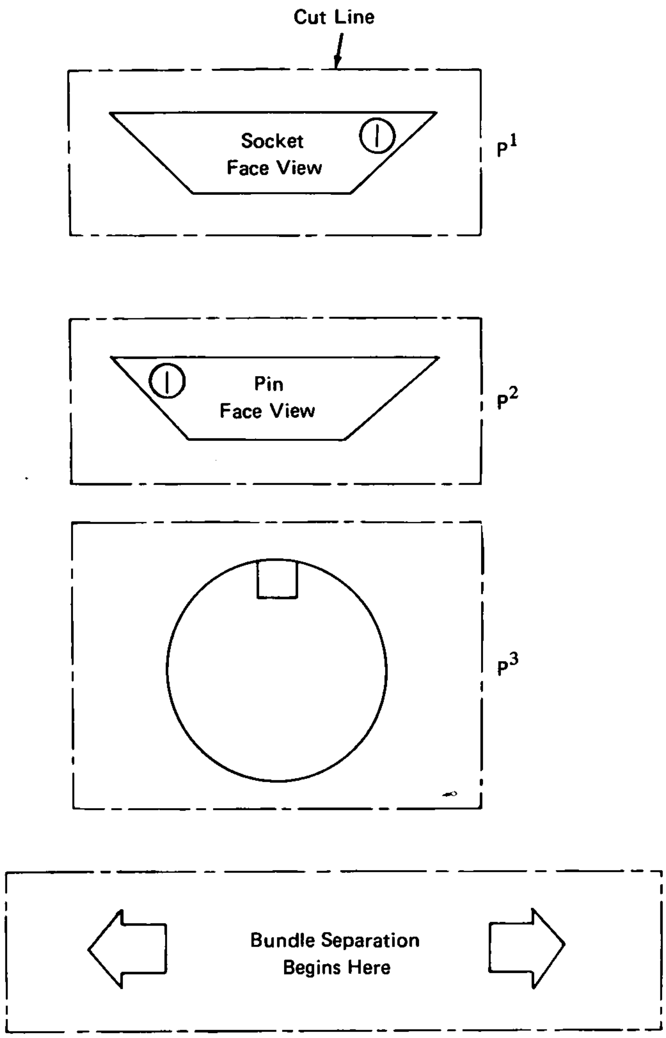


Figure 1. Harness-Board Decals

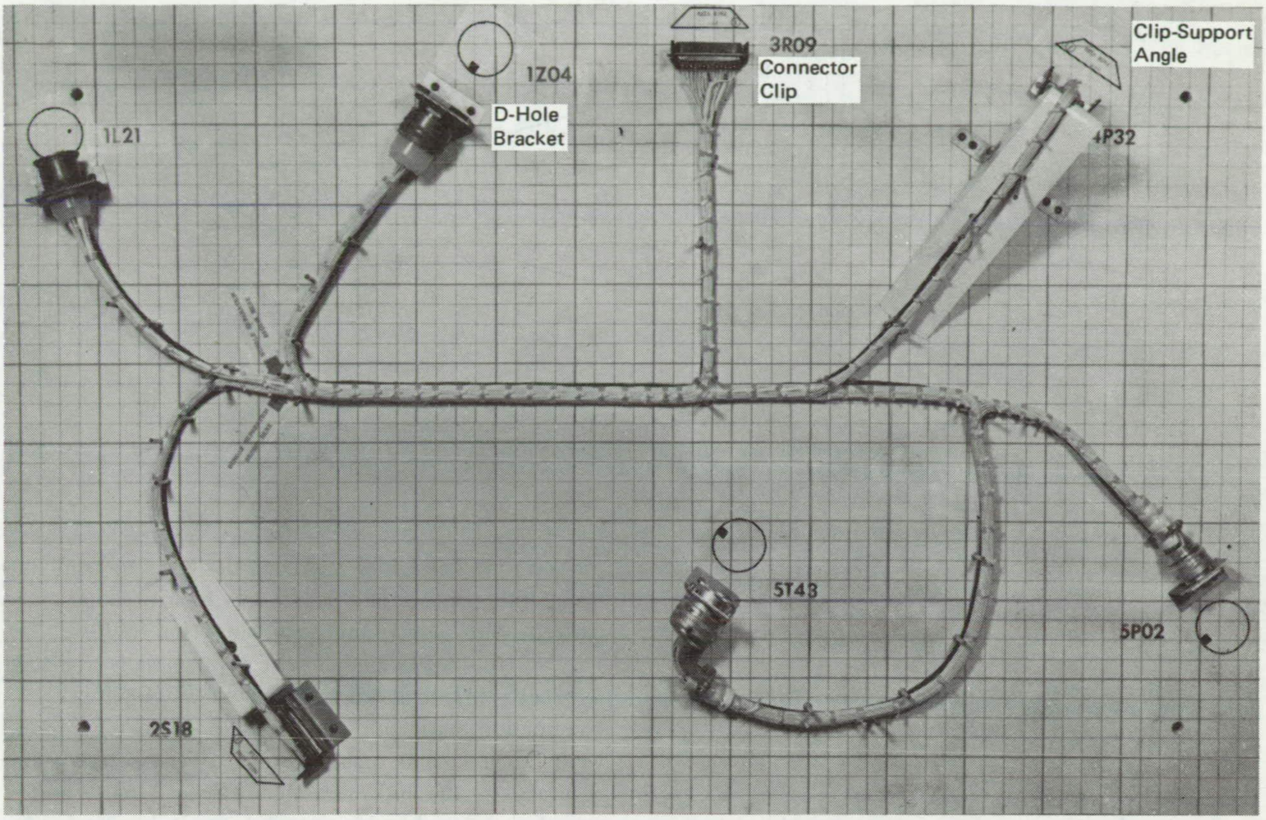


Figure 2. Harness Board with Completed Harness Affixed

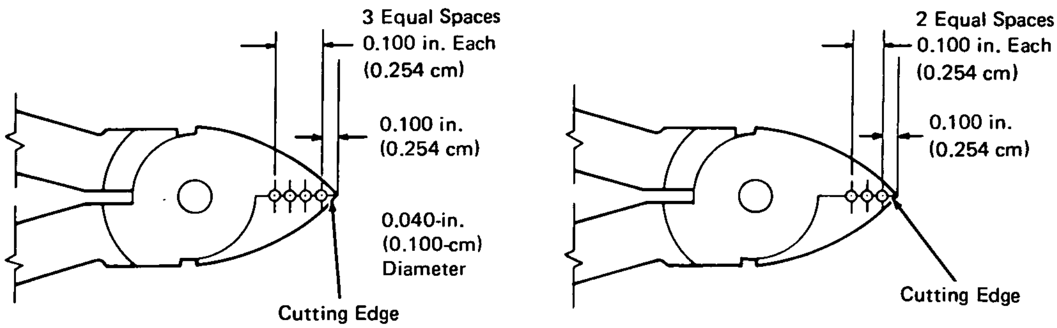
Figure 1 shows some specific decals, and Figure 2 shows a board in use. The advantages of the decals are:

a. The elimination of possible errors due to hand drawing,
b. Standardized connector views with proper information,
c. Easy layouts,
d. Easy visual inspection, and
e. Low cost.

Source: General Electric Co.
under contract to
Goddard Space Flight Center
(GSC-11136)

No further documentation is available.

INTEGRATED CIRCUIT LEAD-WIRE TRIMMING TOOL

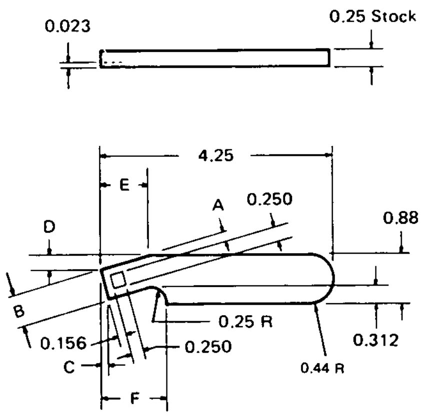


3-Wire Tool

4-Wire Tool

Note: Tool is used on one-half of a 14-wire flat conductor cable.
The wires not to be cut pass through the holes.

Figure 1. Lead-Wire Trimming Tool



All dimensions in inches.

	A	B	C	D	E	F
3-Wire Tool	0.100	0.440	0.116	0.300	1.120	1.119
4-Wire Tool	0.150	0.540	0.142	0.250	0.933	1.190

Figure 2. Trimming Guide

A simple hand tool has been designed to trim flat-pack, integrated circuit lead wires to a predetermined pattern with consistent accuracy. The tool was developed from a pair of standard, commercially-available, 4-in. (10-cm) diagonal cutting pliers (Figure 1). In conjunction with this tool, plastic guides (Figure 2) were designed and manufactured to ensure consistent accuracy of the predetermined wire-lead pattern. The use of these tools minimizes induced mechanical stress during lead-wire trimming.

Simplicity, low cost, and ease of operation make these tools ideal for nonproduction applications, and field repairs. Existing trimming devices are very expensive and are not practical for small-scale operations.

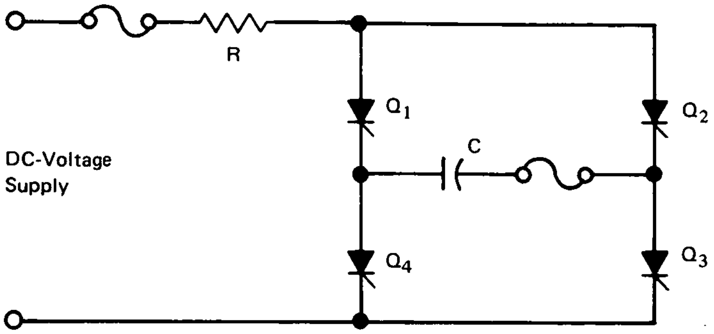
Source: L. E. Pack of
Lockheed Electronics Co.
under contract to
Goddard Space Flight Center
(GSC-10881)

No further documentation is available.

4-Wire Tool

Section 2. Circuit Components and Techniques

DC-TO-AC CONVERTER FOR CAPACITOR TESTING



Capacitor Test Circuit

The effects of ac operation on a capacitor can be approximated with tests using a bipolar square wave with a controlled, slow, rise time. Such a waveform can be obtained with a dc supply and a simple circuit, shown in the figure.

The controlled rectifiers (Q_1, Q_2, Q_3, and Q_4) are fired in conventional bridge sequence. Q_1 and Q_3 are fired simultaneously for one-half cycle, and Q_2 and Q_4 for the other half cycle. The repetition rate of this sequence is determined by the desired test frequency. The controlled rectifiers should be fired using pulses which are of no greater duration than needed to assure turnon.

After a pair of controlled rectifiers is fired, the current into capacitor C will rise at a rate limited by the inductance of the wiring. As it approaches full charge, before the end of the half cycle, the capacitor current will decay below the holding current of the controlled rectifiers. The rectifiers then turn off and recover their blocking ability, and the circuit is ready for the next half cycle. This mode of operation requires that the time constant of the circuit (RC) should be on the order of 10 percent of the time of a half period of the test frequency.

The rise time of the voltage across the capacitor is determined by the resistance, R, and the capacitance of the capacitor under test, C. Waveforms with longer rise times will have lower total harmonic content. Since the voltage across the capacitor also appears across the non-conducting controlled rectifiers, the rate of voltage rise must be kept below their dv/dt ratings. Also, some additional inductance may be necessary, in series with R, to limit the rate of current rise to a value below their di/dt ratings. Each controlled rectifier must withstand a voltage equal to the dc supply voltage and must be capable of carrying half the ac capacitor current.

Source: R. R. Secunde
Lewis Research Center and
W. C. Dysart of
Wyle Laboratories
under contract to
Lewis Research Center
(LEW-11616)

No further documentation is available.

ELECTROMAGNETIC RHEOMETER

An electromagnetic rheometer has been developed to measure the degree of structure of propellant gel systems. The rheometer determines the force required to pull free a small circular plate that has been imbedded in the gel liquid. For remote operation and for simplicity, the plate is pulled by an electromagnet.

The rheometer consists of a glass tube inside of which is a soft iron rod and perforated plate. The rheometer is mounted within two solenoids as indicated in the diagram; the magnets are used to pull the soft iron rod and plate through gels. Voltmeters attached to the input lines to the magnets are used to give an indication of the force exerted on the soft iron rod and plate. The entire apparatus can be heated or cooled as required; the upper limit stop can be used as an electrical contact to indicate when the iron rod has reached the limit of its upper travel.

The procedure for measuring the structure of a gel is as follows: The tube is filled with a gel and the return solenoid is energized to pull the inner rod down to the stop; then the solenoid current is interrupted. The upper solenoid is then energized in small step-wise increments until the magnetic field is just strong enough to start the soft iron rod moving through the gel. The voltage applied to the solenoid is recorded.

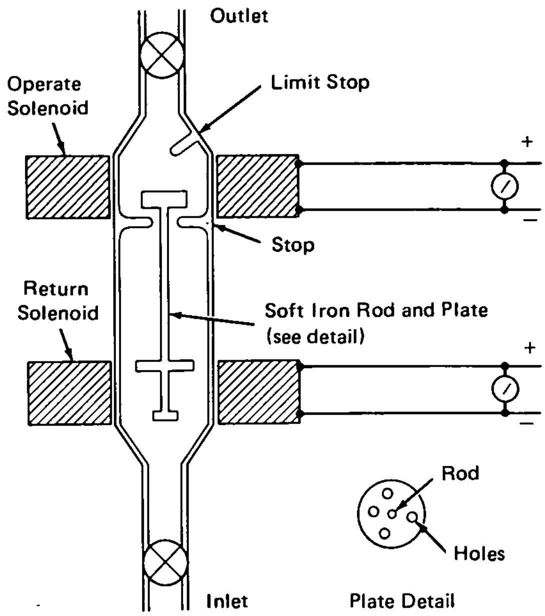
The structure index is computed as follows:

$$\text{Structure Index} = (G-N)\,(98.07)W/AE$$

where G = volts required to move the rod and plate in the gel,
N = volts required to move the rod and plate in neat liquid,
E = volts required to move the rod and plate in empty rheometer,
W = weight of the rod and plate in grams,
A = area of the rheometer plate, in m^2,

and the structure index is in newtons per square meter.

The following table shows correlation of the structure index obtained by a prototype electromagnetic rheometer and the sphere method; the data were obtained on a series of water gels.



Sample	Structure Index, N/m² Sphere Method	Structure Index, N/m² Electromagnetic Rheometer
A	110	95
B	150	155
C	175	190
D	190	205
E	250	255

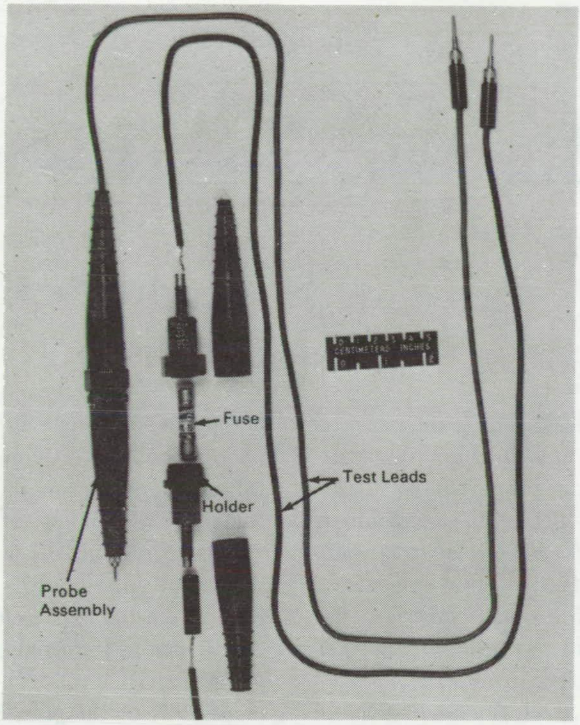
Although the values obtained with the electromagnetic rheometer are not absolute, they can be used as a relative indicator of gel structure.

NASA Tech Brief B72-10026 describes a similar rising-plate rheometer suitable for gel structure determinations.

Source: Robert H. Globus and Jackie A. Cabeal of Aerojet Liquid Rocket Company under contract to Ames Research Center (ARC-10525)

No further documentation is available.

NEW METER PROBES PROVIDE PROTECTION FROM HIGH CURRENT POWER SOURCES AT POTENTIALS UP TO 600 VOLTS



If a faulty test instrument or improper operational procedure is used in testing high current power sources, the test instrumentation can draw an extremely high current, resulting in an arc across the test lead tips. This arc can initiate ionization which can short-circuit the power source; the short-circuit can become self-propagating; and the high current can severely burn operating personnel. Though fuses are used on some conventional multitesters, they do not have the interruption rating required to limit the short-circuit current from the power source when high current is involved.

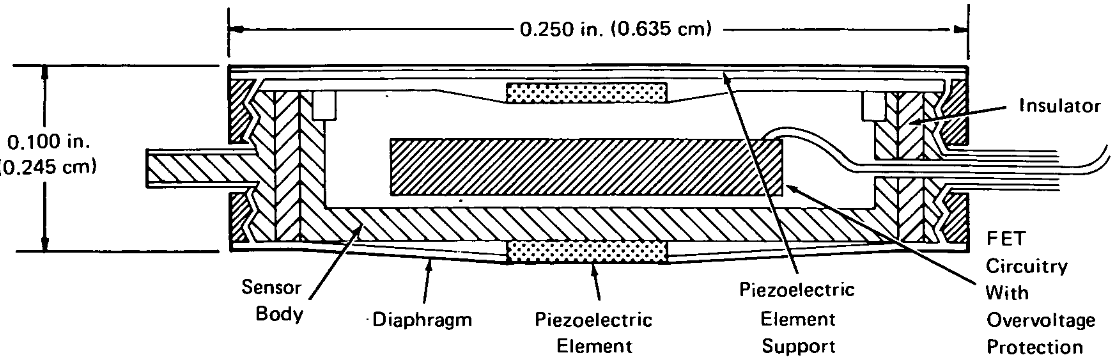
This problem can be overcome with meter probes which include fuses with an interruption rating that is high enough to open the meter circuit prior to ionization and before the short-circuit condition can occur.

The meter probes incorporate an integral fuse-holder which contains a limitation fuse of 600 V, 5A, with an interruption rating of 50,000 kVA. An analysis of test data on this probe indicates that it provides the required protection and minimizes the danger incurred by a defective or improperly operated meter. Meter accuracy is unaffected within the normal range of the instrument, but a current range of over 5A is not usable.

Source: H. Long and J. Getsug
Langley Research Center
(LAR-10804)

No further documentation is available.

SMALL, PIEZOELECTRIC, DIFFERENTIAL PRESSURE MICROPHONE



Differential Pressure Sensor

A new differential pressure sensor has a thickness of 0.25 cm (0.10 in.) and a diameter of 0.64 cm (0.25 in.). The sensor has two diaphragms supported by piezoelectric crystals, the output of which is fed to a common internal preamplifier that uses a FET circuit to convert the original high-impedance signal into a low-impedance signal. The polarization of the crystals is such that the sensor output is proportional to the difference, rather than to the sum, of the pressure (see figure).

The case material is stainless steel, for rigidity. Silver brazing of the 0.003-cm (0.001-in.) stainless steel diaphragms, with a maximum fillet diameter of 0.003 cm (0.001 in.), was accomplished with commonly employed techniques. Tight control of the braze was necessary to insure a uniform active area of the diaphragm. The piezoelectric elements were cut on an ultrasonic grinder to diameter tolerances of 0.0005 cm (0.0002 in.) to insure their roundness. The size of the elements is 0.127 cm (0.050 in.) in diameter by 0.025 cm (0.010 in.) thick. All components are cleaned ultrasonically after manufacture and again before assembly. Careful quality control and precise workmanship are necessary to maintain sensitivity uniform within ±1 dB.

Piezoelectric elements, which typically exhibit impedances of 10^{-12} ohms, make the sensor prone to random signals generated by lead motion. This fact makes an internal impedance-lowering circuit mandatory. A FET hybrid circuit with an output impedance of less than 1500 ohms is incorporated therefore into the transducer body. A bias resistor of 5×10^8 ohms is selected to give a lower rolloff frequency (50 Hz), eliminating any dc, or near dc (0 to 10 Hz), signals (caused, for example, by large temperature gradients or centrifugal loading).

The two sensing elements must be of opposite polarity to produce a different pressure signal. This, however, causes the vibration output to be in phase and thus leads to a doubling of the vibration sensitivity. The vibration output of one of the sensing elements is therefore shifted 180° to produce a reduction in vibration sensitivity, between 50 and 20,000 Hz, of about 20 dB below the original state. The phase shift of the vibration signal has to be accomplished without any phase shift of the pressure signal. Rearranging the spring mass ratios of one of the sensing elements provides the necessary results.

The high frequency data (20 kHz) required from this sensor eliminated the single-diaphragm type of differential sensor. Porting arrangements for a single-element sensor would not be adequate for the frequency requirements. The following values are representative:

Sensitivity	-115 ± 1 dB V/μbar
Vibration Sensitivity	Approximately 100 dB SPL/g (decibles of sound pressure level per unit of acceleration of gravity) between 50 and 20,000 Hz
Noise Floor	-100 dB V
Frequency Response	50 to 20,000 Hz
Temperature Sensitivity	±1 dB for $-50°$ to 1600° F (228 to 344 K)
Power Requirement	1 mA @ 9 Vdc
Output Impedance	Less than 1500 Ω

The following documentation may be obtained from:
National Technical Information Service
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $2.25)
Reference: NASA CR-2012 (N72-23991), The Role of Fluctuating Forces in the Generation of Compressor Noise

Source: Bolt Beranek and Newman, Inc.
under contract to
Langley Research Center
(LAR-11002)

ADVANCED ACTIVE DAMPER

An electrodynamic thruster has been developed that provides damping to aeroelastic models during wind tunnel testing. The damper can generate a precision dynamic force vector of variable orientation and magnitude in a given plane. The damper interface to the model has four attachments in one plane, whereas the stacked-type damper must have one attachment for each plane.

A damper system for launch vehicle models should have a force output in all azimuths, a large stroke capability, and a mounting method that does not interfere with model configuration requirements. Previously, two single-axis thrusters were mounted with the axes 90° apart, one above the other, on an inverted pendulum. This type of arrangement is limited by (a) a smaller shaker stroke, which affects shaker placement, (b) cross-axis coupling due to the vertical separation of the shaker axes, and (c) the size of the dampers with their mounting system, which affects configuration control.

The advanced active damper has two main components: the damper support assembly and the two-unit electromagnet assembly. The damper support assembly interfaces with the model by means of mounting lugs which are mounted on a circular ring. A system of tension springs, carried on the ring, is used to center the electromagnet assembly and to keep the bearing retainer on center.

Each electromagnet consists of a core piece, side and end plates, and a coil. The electromagnets are joined to each other by the support posts of the damper support assembly. The upper magnet carries the top race of the bearing assembly on its lower plate. The bearing races are contoured spherically, so that as the model bends there is no vertical or angular motion imparted to the electromagnet assembly.

In operation of the damper, the model response velocity is measured by two mutually perpendicular sensors. The outputs of these transducers drive two electromagnetic force generators that are oriented in the same directions as the corresponding sensors. The resultant force vector will coincide with the instantaneous velocity of the model. The magnitude of this force is proportional to the velocity, and the phase angle between the applied force and the velocity is 180°. The result is the addition of linear viscous damping to the model, and the damping coefficient is adjusted by adjusting the velocity signal-to-force gain.

Source: C. S. Chang of
Applied Dynamics Research Corp.
under contract to
Marshall Space Flight Center
(MFS-22042)

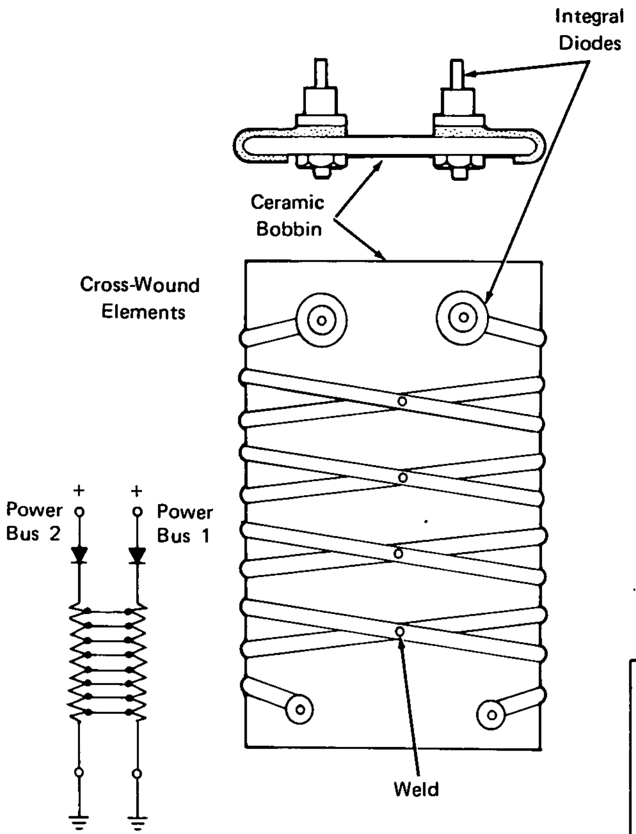
Circle 4 on Reader Service Card.

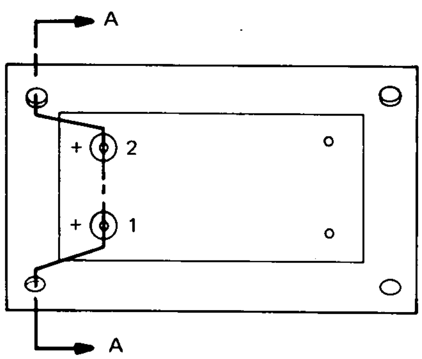
LOW-POWER, REDUNDANT, ELECTRIC-HEATER ELEMENT

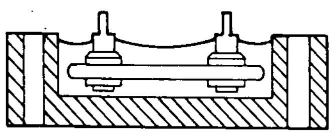
A reliable, low-power electrical heater eliminates the necessity for a backup system. It uses a redundancy technique similar to that applied in Christmas-tree lights, in which the failure of one bulb does not cause the entire string to fail.

The heater is constructed on a flat ceramic bobbin. The element is cross-wound and welded at each point of crossing. The heater operates from two power sources which are isolated by means of diodes placed so that their heat dissipation adds to the element heat.

If an element fails, a change in power dissipation of only 10 percent will occur. Power dissipation of the heater when fully operating, at 16° C (60° F), is 11.2 watts. With one element inoperative, dissipation is 10.2 watts. At 60° C (140° F), the fully operative heater dissipates 5.6 watts. The redundancy technique used in this innovation may have a wide range of applications wherever high reliability is desired in a series of electrical devices.







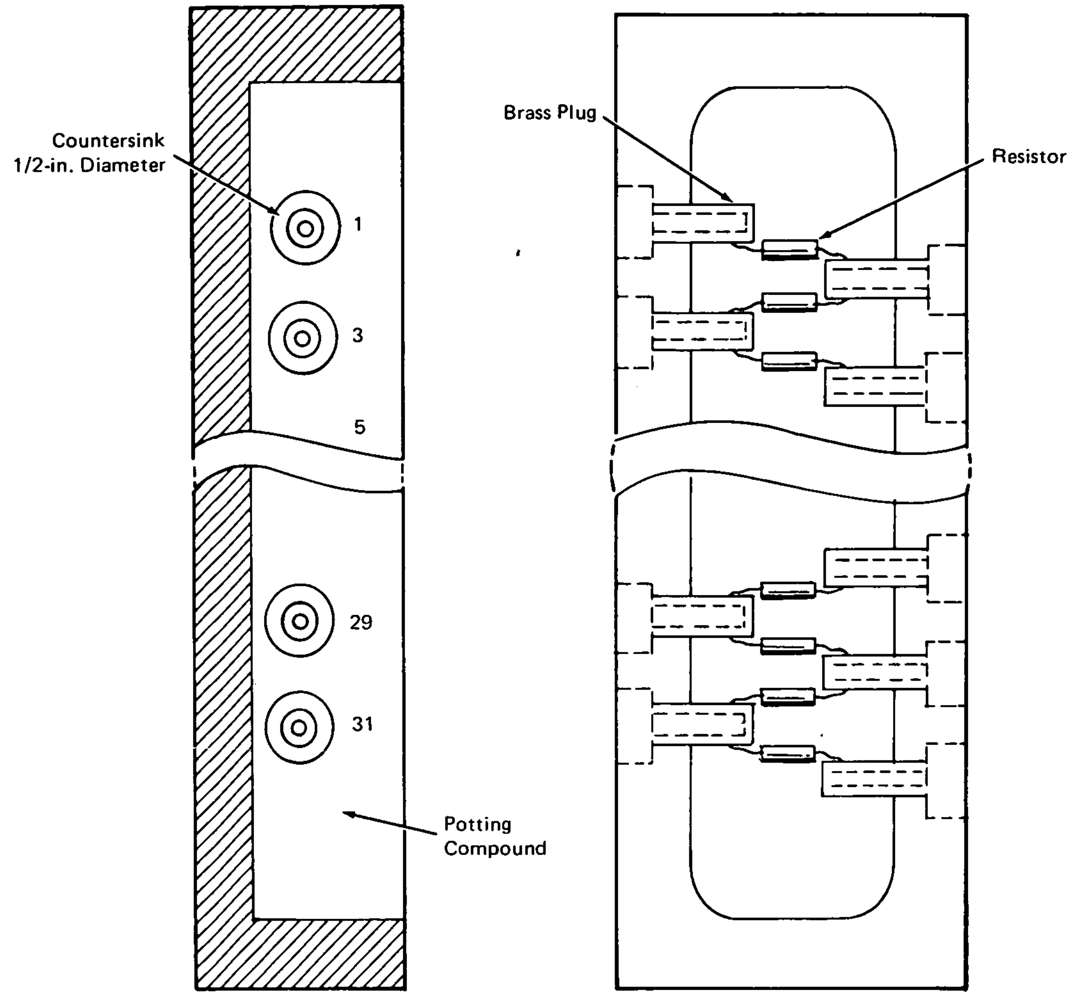
Section A-A

Electric-Heater Element

Source: B. H. Kernodle of
United Aircraft Corp.
under contract to
Marshall Space Flight Center
(MFS-21462)

Circle 5 on Reader Service Card.

HIGH-VOLTAGE RESISTOR DIVIDER



High-Voltage Resistor Divider

An improved voltage divider makes it feasible to measure small currents (0 to 50 μA) at high voltage (30 kV) in a vacuum chamber. Available commercial equipment does not provide similar performance.

The divider consists of a flat, rectangular, plastic shell, the walls of which are drilled to accommodate a series of brass plugs (see figure). By connecting an appropriate number of resistors between these plugs, in series, a wide range of resistance can be fabricated. To prevent damage to the plastic during the soldering operation, the brass plugs must be kept cool. After the soldering operation is complete, the shell is filled with epoxy. The epoxy is applied in thin layers to prevent cracking from overheating during the curing stage.

The plastic shell can be fabricated to any reasonable size. The mounting holes for the brass plugs are countersunk to reduce the possibility of voltage arc-over. The divider would be useful whenever various voltages are required for testing in an environmental or a vacuum chamber.

Source: J. C. Bryner and B. Marshall of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-11649)

No further documentation is available.

DIFFERENTIAL SPLIT-STATOR CAPACITOR

A modified piston rotor of predetermined shape is used in a new capacitor to achieve the simultaneous tuning (resonating) and balancing of push-pull RF tank circuits in RF amplifiers. The differential split-stator capacitor used (a) reduces to one the adjustments needed both to resonate and to balance a push-pull tank circuit, (b) reduces total circuit component count, and (c) reduces component bulk and space requirements. Previously, balanced, parallel-resonant RF circuits required that the inductor or the RF transformer be variable, to allow tuning to resonance. A differential capacitor (with parallel padding, fixed-capacitance added as needed) then would be adjusted to achieve balance. Alternatively, the inductor or the RF transformer would remain fixed (to keep mutual coupling and stray capacitances constant), while a variable or split-stator capacitor would be adjusted to achieve balance.

The differential capacitor is basically a variable, piston-type, split-stator, trimmer capacitor, which is readily available from many commercial sources. The piston rotor is modified to impart the novel differential action. A modified solid piston rotor is shown in Figure 1.

Material is removed from the piston rotor, in a plane essentially parallel to the long axis of the rotor, to produce a D-shaped cross section. The term "essentially parallel" is used because the angle of the cut plane (produced by removing material from the rotor), relative to the axis of rotation of the rotor (Figure 2), determines the percent of differential-capacitance action versus total capacitance. ($\%\Delta C/C_T$, where ΔC = change in C and C_T = total C.) The maximum positive angle,

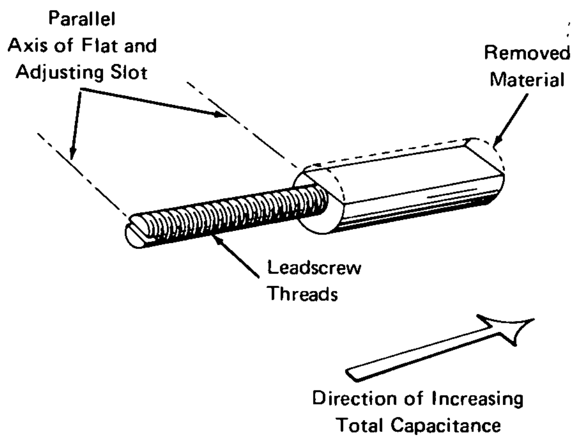


Figure 1. Modified Piston Rotor

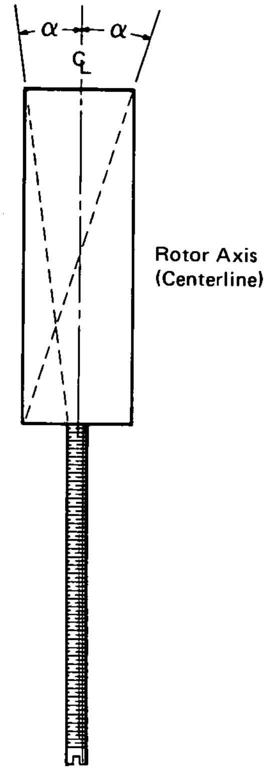


Figure 2. Cut-Plane Angle

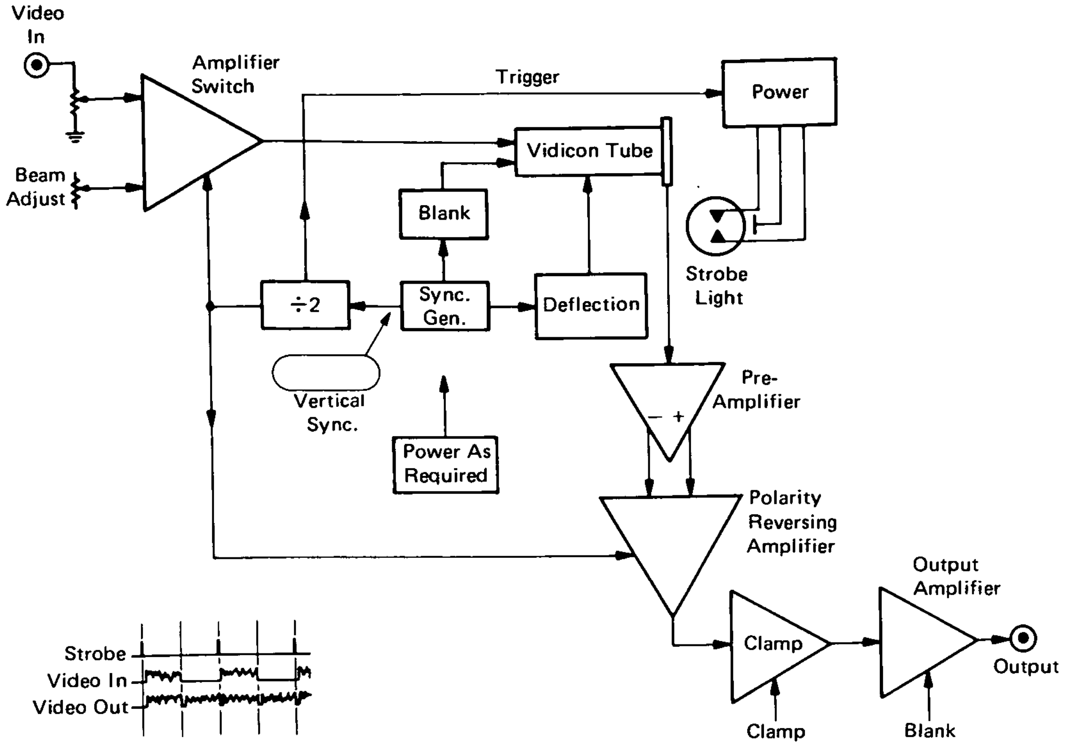
α, yields an increasing percentage differential-capacitance versus increasing total capacitance, while the maximum negative angle, $-\alpha$, yields the opposite result. Some intermediate value of α will produce a constant value.

The capacitance between the rotor and one of the stators will vary in a sinusoidal manner, while the total root-mean-square capacitance varies linearly with piston travel along the leadscrew axis. The small variation in the total capacitance for the other stator will vary in an inverse-sine manner. An appropriate mark is provided to indicate the relative position between the flat on the rotor and the median between the two stators. This procedure also may be applied to the hollow cylindrical type of piston rotor as well as to the multiple-coaxial cylinder type.

Source: E. C. Oakley of
Caltech/JPL
under contract to
NASA Pasadena Office
(NPO-10886)

Circle 6 on Reader Service Card.

VIDICON STORAGE TUBE ELECTRICAL INPUT/OUTPUT



Vidicon Storage Tube

An electrical data storage tube can be assembled from a standard vidicon tube using conventional amplification and control circuits. The vidicon storage tube is simple and inexpensive and has an erase and preparation time of less than 5 microseconds.

A conventional television camera is modified by removing the lens and adding (1) a synchronous strobe lamp, (2) an amplifier switch for modulating the tube during the input mode, (3) a polarity reversing amplifier to change the polarity signal when switching from input to output, and (4) a binary divide-by-two module for controlling the sequence. This system (shown in the diagram) is capable of short-term storage of analog television signals, FM modulated carrier, or any form of digital data.

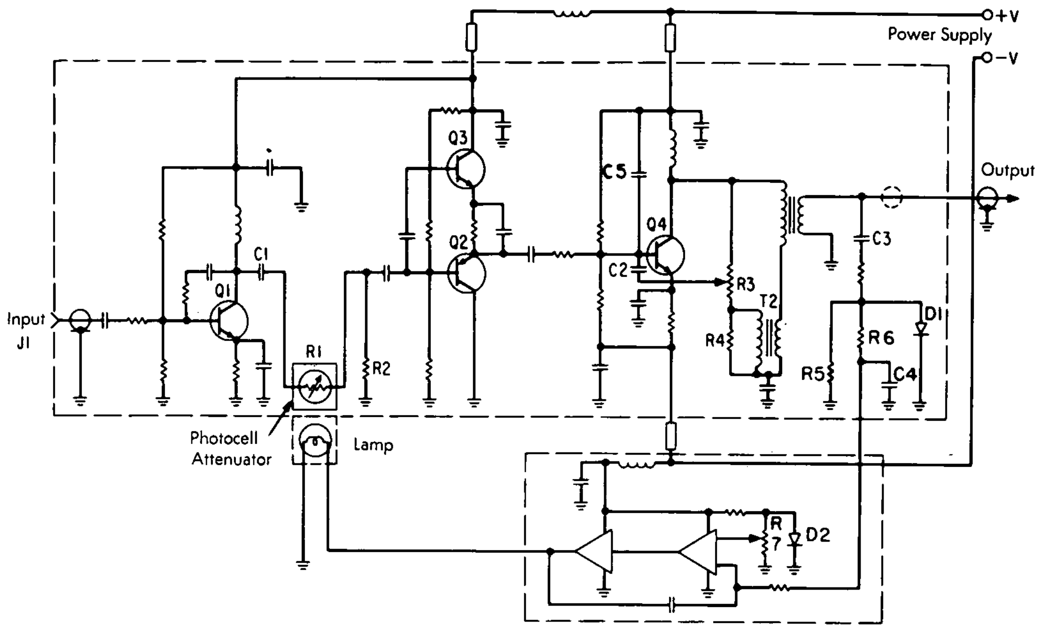
Normal scanning of the tube is required during the electrical input/output mode of operation. The flash of the strobe light charges the tube during vertical blanking. The input signal (information being stored) modulates the electron beam which proportionately discharges certain areas of the target. The storage cycle is complete when the entire target is scanned with a continuous beam current producing an output signal inversely proportional to that stored. The target is strobed to erase the previously stored information and the sequence repeated.

This technique may be useful for television scan conversion, data time-base conversion, serial-to-parallel color television conversion, and various types of digital memories.

Source: P. Lipoma of
Lockheed Electronics Corp.
under contract to
Johnson Space Center
(MSC-14053)

No further documentation is available.

BROADBAND RF-DISTRIBUTION AMPLIFIER



An RF-amplifier has been designed to distribute reference frequencies to various places in communication systems. It provides 10 dB of automatic gain control (AGC) with low phase distortion (+3 to +13 dbm input power). The output amplifier stage supplies 180 milliwatts into 50 ohms at an output impedance of 50 ohms resistive.

The amplifier utilizes a photocell in a variable attenuator configuration to obtain low phase shift with AGC; broadband transformers are used in a feedback network to obtain a variable output impedance with low power loss over a wide frequency range.

The first stage of the amplifier shown in the diagram consists of Q1 and associated components, and serves to isolate the photocell attenuator and the AGC lamp from the input; it also provides a 50-ohm input impedance at the input (J1). The first stage is followed by the variable attenuator which is a photocell in an L network consisting basically of C1, R1, and R2.

The second stage (Q2, Q3) is a simple amplifier that provides isolation between the attenuator R1 and the output stage Q4; this stage reduces the reactance at the output of the attenuator R1 and helps reduce phase shift as it is varied by the AGC power dissipated in the lamp.

The output stage Q4 is a power amplifier which supplies 180 milliwatts. Two types of feedback are provided by the transformer configuration at the output of Q4. The feedback from the collector of Q4 to its base, through R3 and C2, lowers the output impedance of Q4 while the feedback from the transformer T2 developed across R4 and coupled to the base raises the output impedance. The potentiometer (R3) between these two points can be used to provide a variety of adjustments between the two kinds of feedback. The output impedance can be varied from about 10 ohms to about 100 ohms, thus making it possible for the novel distribution amplifier to accommodate a wide range of loading. In the present application, the adjustment is made for 50 ±2 ohms. The capacitor C5 is in a lead network which cancels the reactive component on the output of the amplifier.

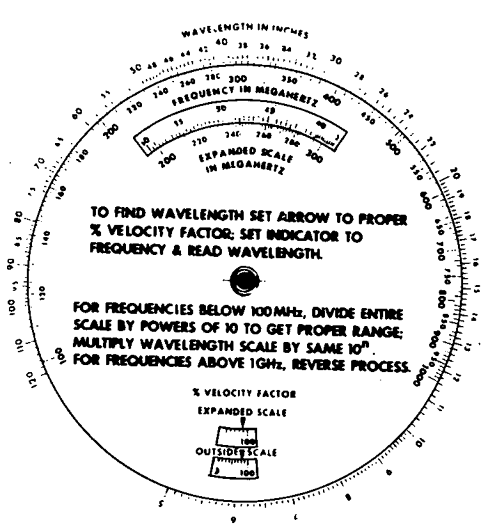
The RF output level also passes through C3 into a detector (R5, R6, C4, and D1) which generates a dc voltage proportional to the RF level. The dc voltage is compared to an adjustable reference voltage (D2; R7) and the difference is then amplified and phased properly to drive the lamp. The intensity of light falling on the photocell attenuator (R1) controls the input of the RF output; the desired output level is set by R7.

The amplifier was used to drive a passive hybrid power divider which split the power eight ways and provided eight outputs at 20 milliwatts (1 volt rms) each. Phase noise is so small that it cannot be measured accurately with instrumentation ordinarily available in development laboratories.

Source: George F. Lutes, Jr., of
Caltech/JPL
under contract to
NASA Pasadena Office
(NPO-11401)

Circle 7 on Reader Service Card.

FREQUENCY-WAVELENGTH CALCULATOR WITH TABLE OF DIELECTRIC PROPERTIES



PROPERTIES OF DIELECTRICS & RG/U COAX

NAME/NUMBER OF CABLE	% V.F.	Z_0*	LOSS**
AIR, VACUUM	100		
SEMI-SOLID POLYETHYLENE RG 114	88	185	26
RG 62, 71 210	84	93	18 5
RG 63 79	84	125	12
RG 115	70	50	13
TEFLON (TFE)	69 5		
RG 87, 116 225 227 143, 141 142, 178 188, 196	69 5	50	15 18; 26; 60; 85
RG 140; 179 187	69 5	75	26, 44
RG 180, 195	69 5	93	35
POLYETHYLENE (SOLID) POLYPROPYLENE	67 5		
RG 5, 212, 8, 10, 213; 9, 214, 14, 217	65.9	50	23; 16, 18; 12
RG 6; 11, 12, 13, 216 34, 35, 164; 74	65 9	75	23; 16.5; 16; 9 5; 12
RG 17, 18, 218, 219; 19 20, 220 221	65 9	50	9.5, 7.7
RG 21, 222 (NICHROME CENTER CONDUCTOR)	65 9	53	85
RG 55, 58, 223	65.9	50	30
RG 59, 149	65 9	75	25
POLYSTYRENE	63 2		
NYLON	59 8		VERY LOSSY
PAPER BASE PHENOLIC	53 5		VERY LOSSY
FUSED SILICA	51.3		
BERYLLIUM OXIDE, BOROSILICATE GLASS	50.0		
BORON NITRIDE	44 7		

*Z_0 - COAX CHARACTERISTIC IMPEDENCE IN OHMS
**ATTENUATION - dB/100 FT @ 3GHZ . DIVIDE BY 5 TO APPROX ATTN. @ 200MHZ

A frequency-wavelength calculator has been developed which rapidly and accurately calculates wavelength of a given frequency in a specific dielectric material. The unit fits into a shirt pocket and includes a table of dielectric properties and a one-step calculator.

Previous methods all entailed referencing a table of dielectric-velocity factors and then performing a multi-step calculation either by hand, a slide rule, or a desk calculator.

The new calculator, as shown in the figure, has a wheel which is free to rotate about its central mounting on a backing card. The wavelength and velocity-factor scales plus a table of properties for common dielectrics and coaxial cables are printed on the backing card. The wheel bears the frequency scale and has a window cutout with an arrow indicator which alines with the appropriate dielectric-velocity factor. In addition, a cursor rotates about the center of the wheel.

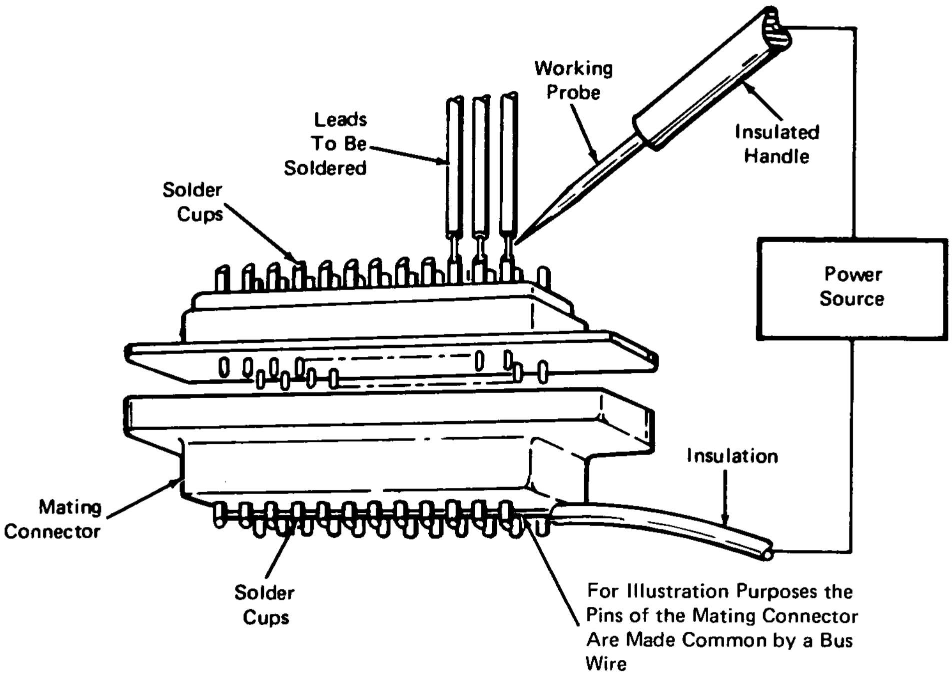
The arrow indicator is set to the proper velocity factor, as selected from the table. The wavelength and the frequency appear directly opposite each other and can be read using the hairline on the cursor.

The scales on the calculator are circular logarithmic and are designed to minimize interpolations of powers of 10 for a limited range of velocity factors which are satisfactory for most common materials. Other calculator designs can be larger in size, include all the possible velocity factors, and display wavelength in metric units.

Source: L. L. Thompson
Goddard Space Flight Center
(GSC-11200)

No further documentation is available.

A SIMPLE, EFFICIENT RESISTANCE SOLDERING APPARATUS



A wide variety of apparatus is available for soldering electric leads to multiple terminal connectors. Most of these are complex, bulky, and difficult to handle in soldering connectors with densely packed pins. Even a very common model which uses a pair of probe tips that conduct current to heat a junction of a lead and terminal solder cup has two inadequacies. First, it requires that both probe tips be in firm electrical contact with the solder cup, which is time consuming and inefficient. Second, the current flows perpendicular to the solder cup axis, causing uneven heat distribution along its length and hence a possibly poor solder connection containing voids or uneven solder distribution.

A resistance soldering apparatus was developed which is simple and provides fast, efficient soldering of leads to multiple terminal blocks. The apparatus (shown in the figure) uses a power source with one polarity connected to the working probe. The other polarity is attached to a connector that has all pins common, by using a shorting bus. This common connector completes the circuit to each connection that is to be soldered.

Each individual lead to be soldered is inserted into its own solder cup, on the back of the multiple terminal connector. Male and female connectors are mated. Each lead is then soldered to its cup connector by applying the working probe to that lead and cup.

With this technique, soldering is fast and efficient. Heating is uniform along the axes of the solder cups, so that joints are better and more reliable than those produced by other methods.

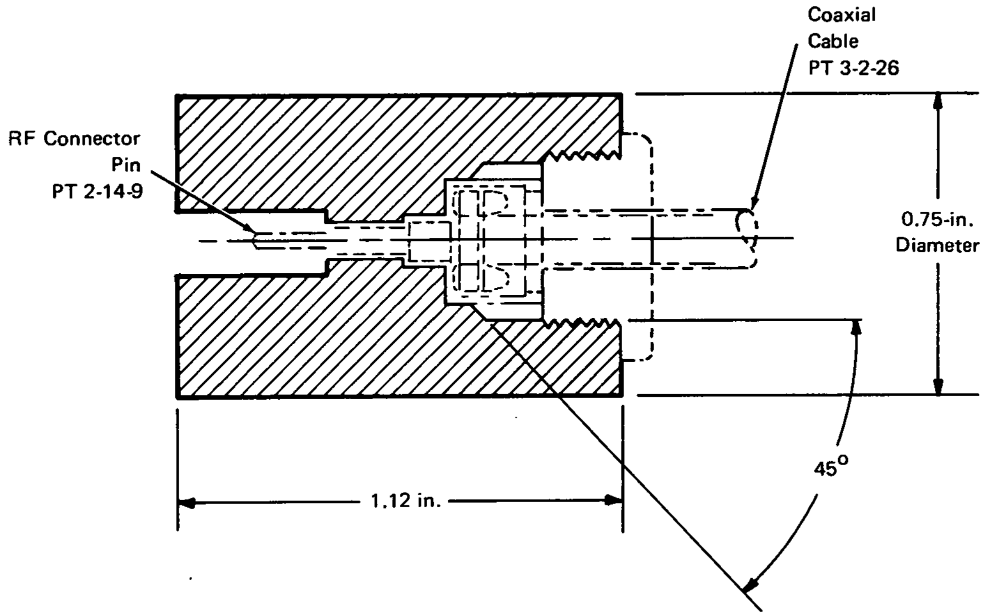
This technique provides fast and efficient soldering. Uniform heating along the axes of the solder cups results in better, more reliable solder joints than those produced by other methods.

Source: Clara M. Vermillion
Goddard Space Flight Center
(GSC-10913)

Circle 8 on Reader Service Card.

Section 3. Cables and Connectors

TRANSPARENT COAXIAL CABLE GAUGE



Coaxial Cable Termination Gauge

A new coaxial go/no-go gauge virtually eliminates malfunctions arising from poor dimensional control in the assembly of coaxial cable connectors. The gauge is designed for a particular cable and RF connector, but the dimensions can be modified for use with other connector-cable combinations. In the trimming of the coaxial cable prior to its insertion into the connector, it is vitally important to cut the central conductor properly and to trim the insulation, shield braiding, and outer jacket proportionately. In the past, if a suspected malfunction occurred after assembly, it was necessary to X-ray the connector to determine if the problem lay in the coaxial termination.

By using the new gauge (see figure), the trimmed condition of the coaxial cable can be checked visually. Also, because the gauge is machined carefully from Plexiglas, the diametrical dimensions of the cable can be checked with a certain degree of precision. The gauge can be used as part of the assembly process, during which time the cable is trimmed and inserted into its connector. It also has application as an inspection tool.

Source: B. R. Bergstrom of
TRW Systems Corp.
under contract to
Goddard Space Flight Center
(GSC-10454)

No further documentation is available.

FERRULE INSERTION TOOL FOR SHIELDED-CABLE TERMINATORS

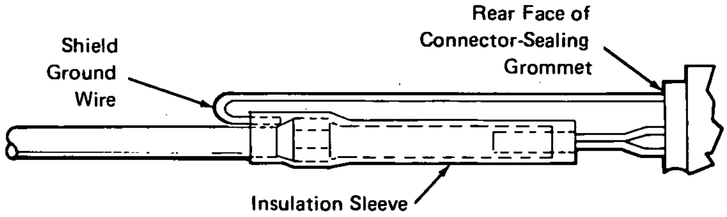


Figure 1. Shielded-Cable Termination

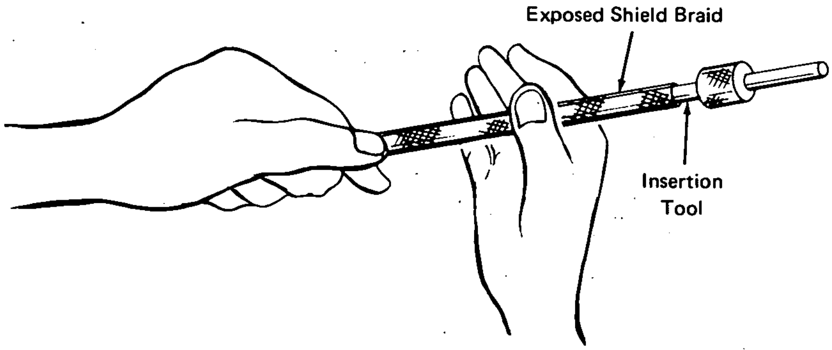


Figure 2. Insertion Tool Used to Expand Shield Braid

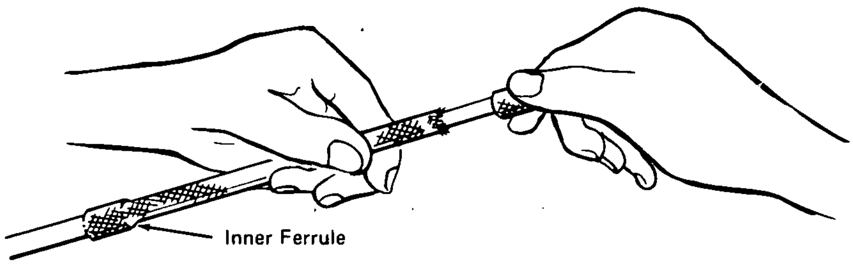


Figure 3. Insertion Tool Used to Install Inner Ferrule

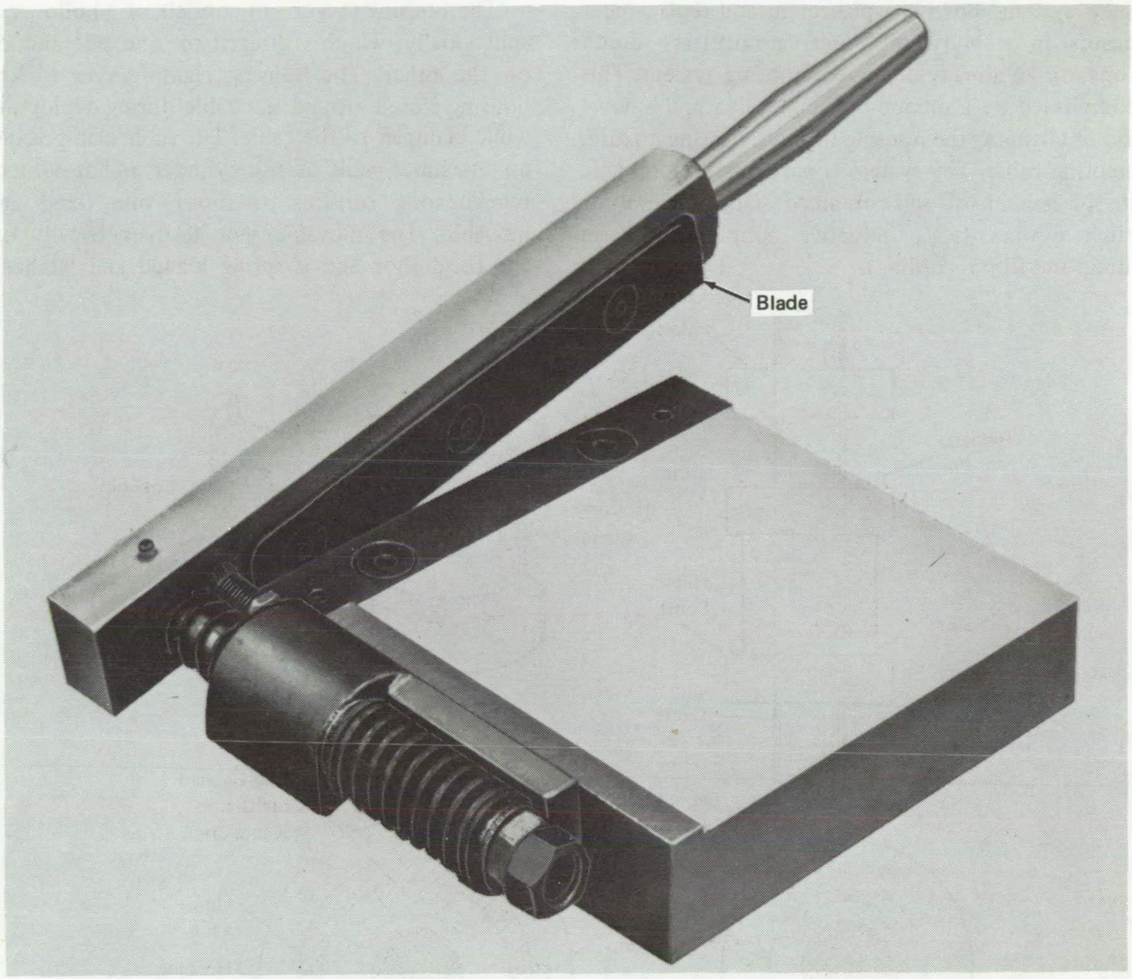
A new nylon insertion tool makes it possible to place inner ferrules deep under cable shields, even when the shield is braided tightly. The tool is designed to aid in the installation of a ground-wire connection to the braided shield. Figure 1 illustrates such a grounded terminator for a two-conductor shielded cable.

To install the terminator, the braided shield is loosened and pushed back, and the insertion tool is used to expand it, as shown in Figure 2. Any wrinkles in the shield are smoothed out over the tool, the shield is pushed back slightly, and the tool is removed. The inner ferrule then is pushed under the braid with the insertion tool, as shown in Figure 3. With the inner ferrule in place beneath the braid, the ground wire may be attached easily as shown in Figure 1.

Source: M. E. Ingles and E. J. Casey of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-17212)

Circle 9 on Reader Service Card.

FLAT-CONDUCTOR-CABLE CUTTER



Flat-Conductor-Cable Cutter

When flat conductor cable (FCC) is cut by hand, with the help of a straight edge and scissors, consistently-true square cuts are not possible. Consequently there is a variation in the lengths of the stripped conductors. The differing lengths interfere with positive mating in connectors.

A low-cost, portable cutter makes repeatable, straight, square cuts on FCC and trims properly. It is a miniature version of the conventional papercutter (see figure) with a special oil-hardened tool-steel blade. A heavy-duty blade-to-blade alinement and support assembly ensures precise and repeatable cuts. A pin and a heavy-duty spring secure the blade/handle assembly.

Source: R. M. Heisman of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-19416)

No further documentation is available.

OCEANOGRAPHIC SENSOR HOUSING AND CABLE CLAMP

A new system allows the placement and replacement of sensors in a body of water, at arbitrary depth locations, on an already-deployed mooring system. This is accomplished by a unique housing design and a novel method of clamping the housing to, and releasing it from, the mooring cable. The system is particularly adaptable to the placement of self-contained data retrieval or recording devices (e.g., inductive coupling, cassette recording, and film recording).

The housing (Figure 1) consists of a hollow cylinder, split axially, which is hinged on one side and clamped on the other. The housing clamp serves to keep the housing closed around the cable during deployment and while clamped to the cable. The cable clamp is mounted on the inner walls of the cylinder and is composed of two bearing surfaces or shoes, one fixed and one movable. The movable shoe is diametrically opposite the fixed shoe and is spring loaded and latched in the

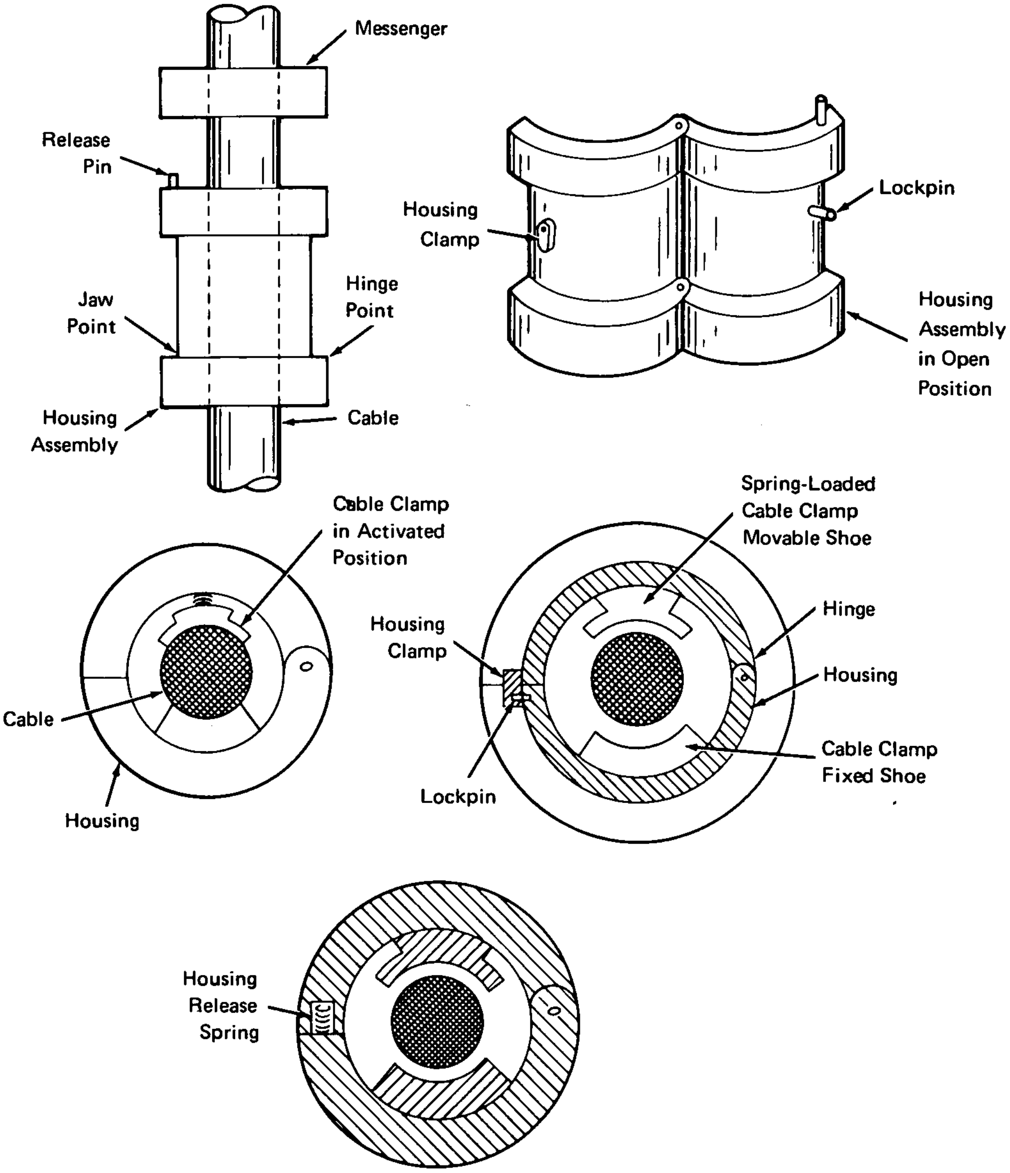


Figure 1. Housing Assembly

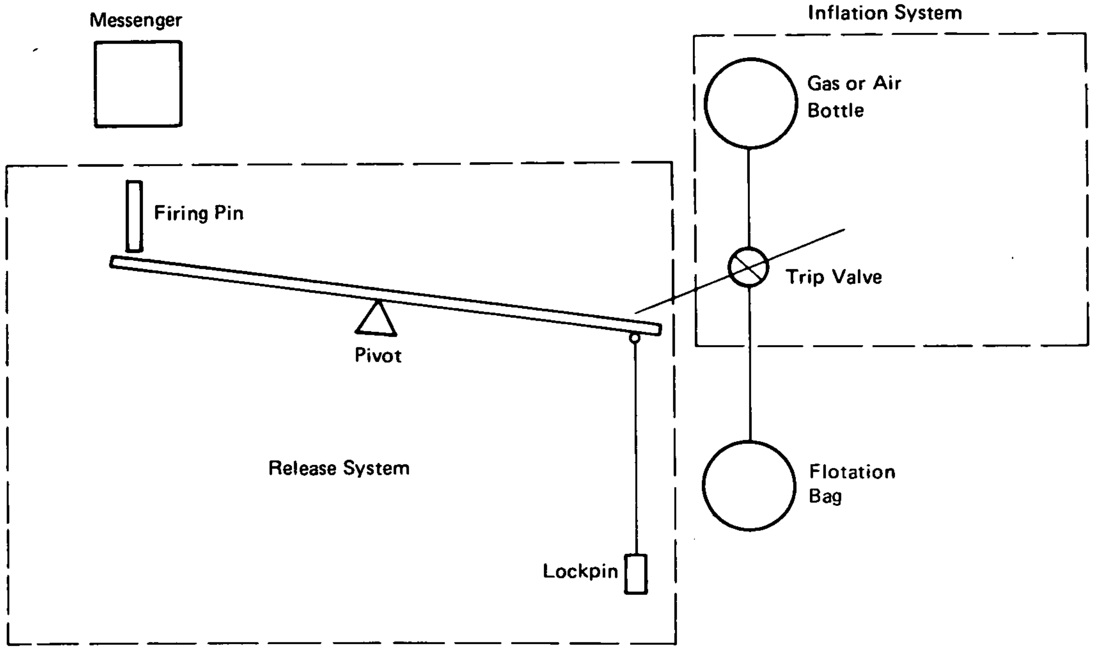


Figure 2. Schematic Diagram of Release and Inflation Systems

open position, until actuated by the hydrostatic pressure switch. An enlarged volume at the top is provided for clamping and release mechanisms, the inflation system, and the hydrostatic pressure sensor. An enlarged volume at the bottom provides for user sensors, electronics, and data coupling or recording devices.

The hydrostatic pressure switch is manually adjustable for any desired depth and actuates the cable clamp when the depth is reached. It should be noted that this operates solely on the vertical hydrostatic depth and is independent of any cable slope or catenary. The inflation system consists of a bottle of pressurized air or gas and a trip valve. When the valve is tripped open, the air/gas escapes into the flotation bag (Figure 2). The flotation bag is attached firmly to both halves of the cylinder; as it inflates it causes the halves to open wider, thus totally disengaging the cable clamp from the cable. When it has inflated sufficiently to overcome the weight of the housing and its contents, the whole package rises to the surface.

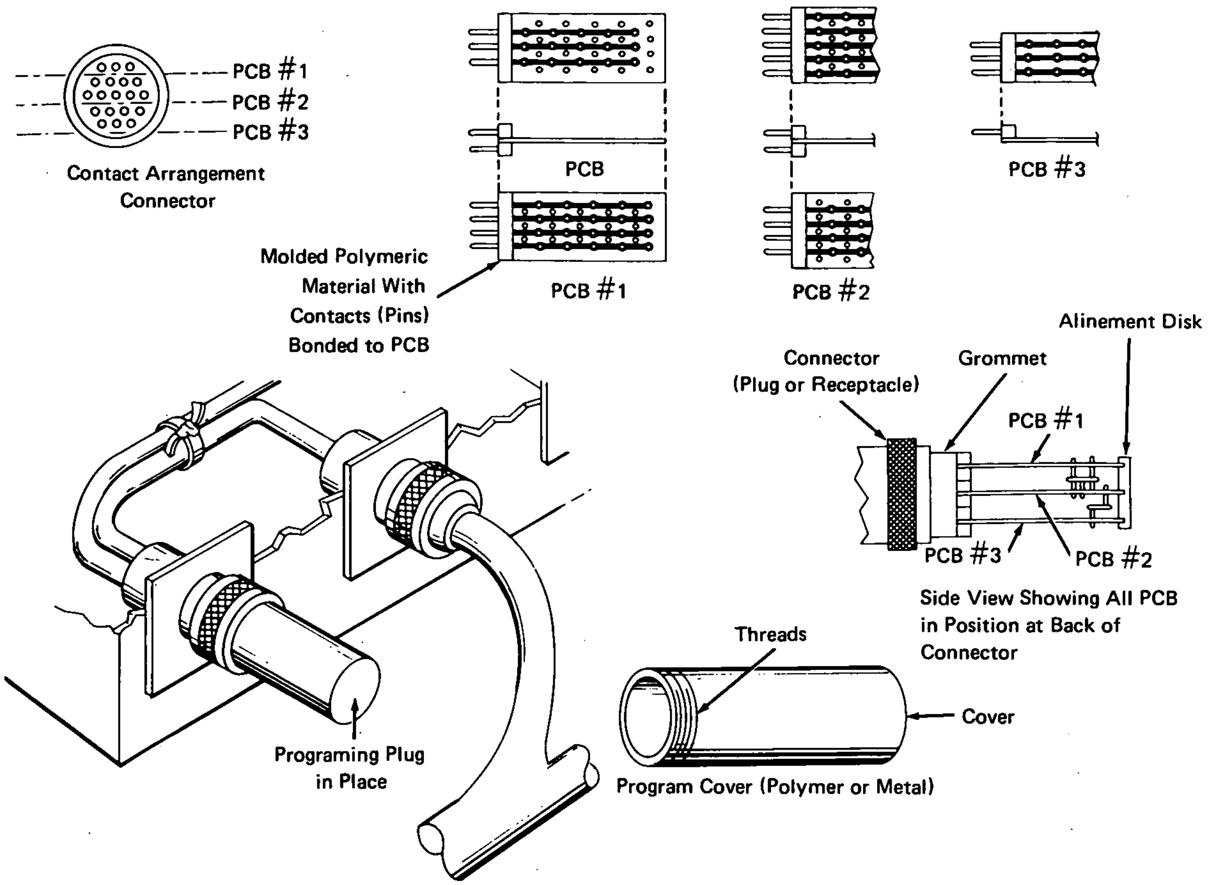
The messenger-activated release mechanism is triggered by the messenger striking the firing pin located in the top of the housing. This causes the lockpin to be withdrawn from the housing clamp and trips the inflation system trip valve. With the lockpin withdrawn from the housing clamp, the two half cylinders are separated by the housing release spring.

The system has three principal advantages over present methods: (1) packages may be deployed after the mooring line has been emplaced; (2) packages may be installed at any desired depth; and (3) packages may be retrieved without having to recover the entire mooring system.

Source: R. E. Werner of
Massachusetts Institute of Technology
under contract to
Johnson Space Center
(MSC-14272)

Circle 10 on Reader Service Card.

PROGRAMABLE CONNECTOR: A CONCEPT



Programable Connector

The convenience of small, replaceable, printed circuit board (PCB) assemblies, used to program or to monitor larger systems, can be enhanced by combining them with molded polymeric connector bases designed to unite with existing round connectors. Such an assembly is shown in the illustration. The width of each PCB is determined by the geometry of the connector with which it is mated. The length of each board and the size of the protective shell are determined by the design requirements. As seen in the illustration, posts of varying lengths can be used to interconnect two or more PCB's in the same module.

Alinement disks, slotted as required, maintain positive registration with the connection inserts, fitting over the PCB's at the ends opposite the connectors. These wafers can be designed and fabricated in many different configurations to provide a wide variety of programs or functions. Modules and connectors can be made waterproof and explosion proof when needed. The idea will afford ease of repair and maintenance, light weight, and increased flexibility.

Source: E. J. Stringer and J. D. Doyle of Rockwell International Corp. under contract to Marshall Space Flight Center (MFS-24248)

Circle 11 on Reader Service Card.

REPAIR OF DAMAGED FLAT CONDUCTOR CABLE

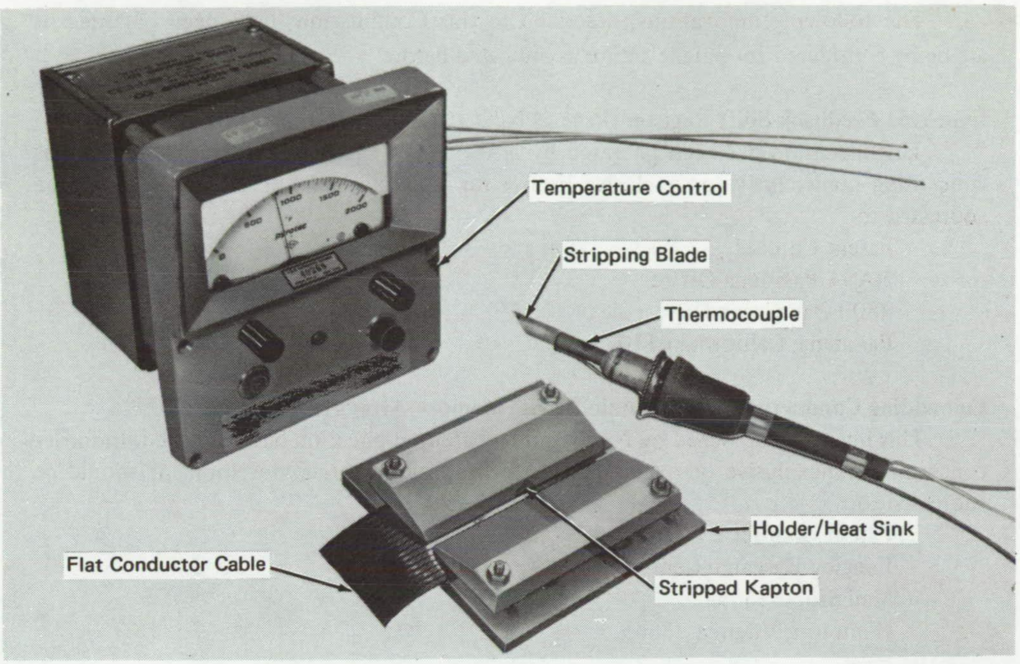


Figure 1. FCC Repair Apparatus

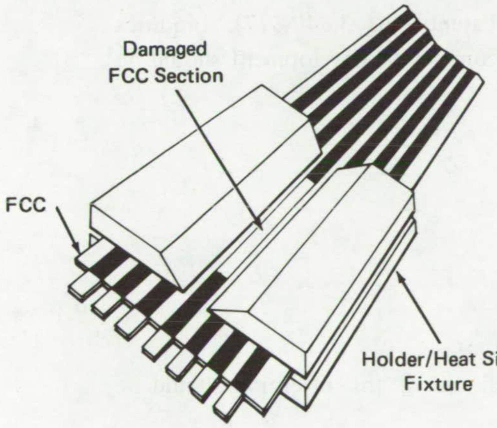


Figure 2. Holder/Heat Sink

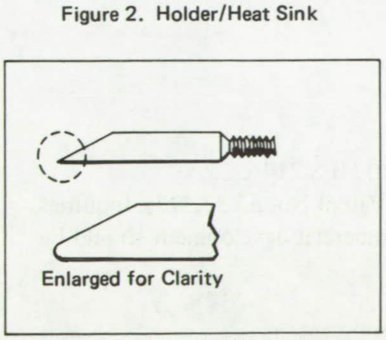


Figure 3. Stripping-Tool Blade

Users of flat conductor cables (FCC) will welcome a new method and apparatus that can remove a damaged segment of a multiple-conductor cable without damaging the remaining cable. A heated stripper blade is used. The temperature of the blade is controlled by an attached thermocouple, which provides feedback to a commercially-available temperature control device (Figure 1). A blade temperature of about 700 K (800° F) is maintained.

A specially fabricated jig, which serves as a heat sink, securely holds the FCC, exposing only the damaged section (Figure 2). Figure 3 shows details of the stripper blade. The tool is designed with a blunted edge, to allow removal of the Kapton insulation without damaging the wire.

Source: W. F. Iceland and
B. C. Blankenship, Jr., of
Rockwell International Corp.
under contract to
Johnson Space Center
(MSC-19109)

No further documentation is available.

Patent Information

The following innovations, described in this Compilation, have been patented or are being considered for patent action as indicated below:

Improved Feedback Shift Register (Page 2) NPO-10351

This invention has been patented by NASA (U.S. Patent No. 3,535,642). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

Patent Counsel
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103

Embedding Conductors in Monolithic Ferrite Memory Arrays (Page 6) LAR-10994

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

Patent Counsel
Langley Research Center
Mail Stop 313
Hampton, Virginia 23665

New Meter Probes Provide Protection From High Current Power Sources at Potentials Up to 600 Volts (Page 17) LAR-10804

This invention is owned by NASA (U.S. Patent No. 3,849,877). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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Hampton, Virginia 23665

Advanced Active Damper (Page 19) MFS-22042

and

Programable Connector: A Concept (Page 32) MFS-24248

Inquiries concerning rights for the commercial use of this invention should be addressed to:

Patent Counsel
Marshall Space Flight Center
Code CC01
Marshall Space Flight Center, Alabama 35812

Low-Power, Redundant, Electric-Heater Element (Page 20) MFS-21462

This invention has been patented by NASA (U.S. Patent No. 3,732,397). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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Marshall Space Flight Center, Alabama 35812

Vidicon Storage Tube Electrical Input/Output (Page 23) MSC-14053

Inquiries concerning rights for the commercial use of this invention should be addressed to:

Patent Counsel
Johnson Space Center
Code AM
Houston, Texas 77058

A Simple, Efficient Resistance Soldering Apparatus (Page 25) GSC-10913

This invention has been patented by NASA (U.S. Patent No. 3,621,194). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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