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USEFUL INFORMATION FOR USERS OF TEKTRONIX INSTRUMENTS

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CRT-Design Review

Mesh and Frame-Grid Characteristics

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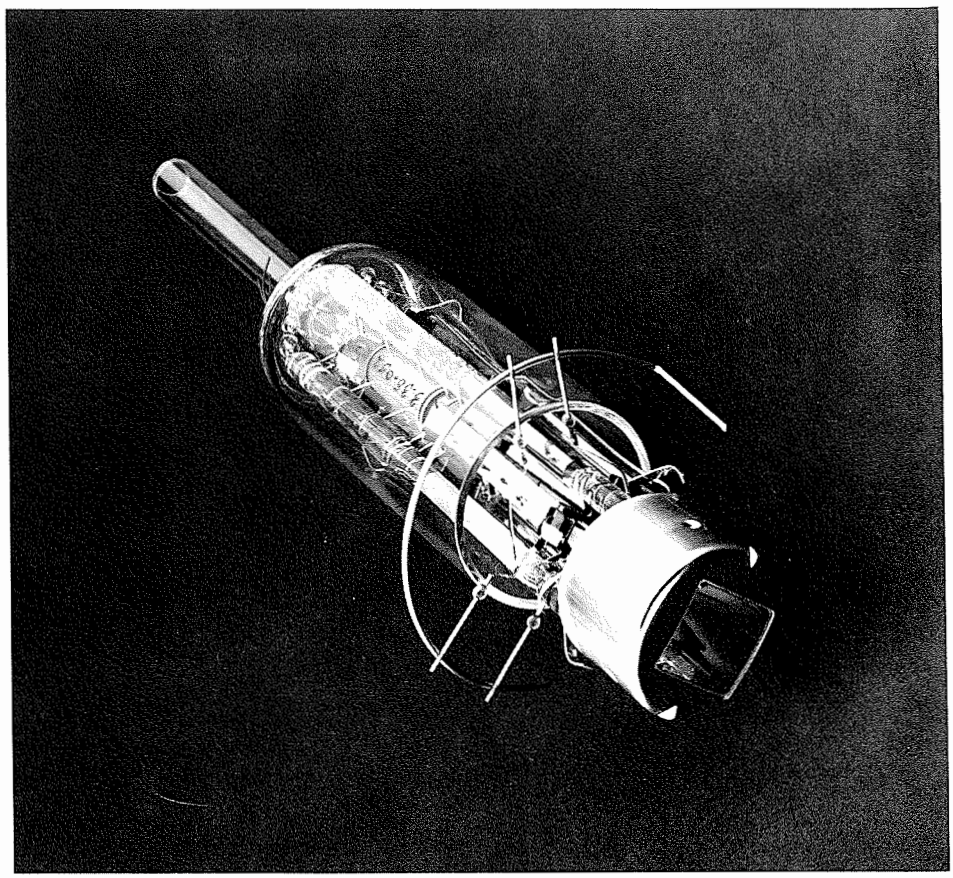

FRAME-GRID GUN ASSEMBLY READY FOR SEALING INTO THE CRT ENVELOPE

Mesh and frame-grid crt's have come into fairly wide usage in the oscilloscope industry in the last few years. The author outlines the theory of their operation and the advantages and disadvantages from the oscilloscope user's point of view.

The idea of interposing an electrostatic shield between the post-deflection accelerator and the deflection plates of a crt has been around for sometime, as a means of increasing deflection sensitivity of a high-accelerating-potential crt. The British were among the earliest users of "mesh" crt's in general-purpose laboratory oscilloscopes. One manufacturer (Marconi) has employed mesh tubes for several years now, producing instruments with 10 kv acceleration, yet having deflection amplifiers no more complex than might be required for a 4 kv conventional pda (post-deflection-accelerator) crt.

In the past two years, several American manufacturers also have begun to use mesh design— particularly in crt's for wideband instruments where amplifier gain and voltage swing are at a premium. The recently introduced Tektronix Type 647 Oscilloscope uses a highly-developed frame-grid design crt. This crt, housed in a very-compact and rugged instrument, provides 50 Mc performance with 14 kv acceleration.

The mesh or frame-grid is not, however, a magic cure-all for oscilloscope bandwidth, sensitivity, and scan (picture size) problems. Its use in any given situation depends on the particular instrument-performance compromises that are allowable.

In general, the bad effects of the mesh are larger spot-size, lower writing rate, and a shadow-pattern that can be seen on the phosphor when the spot is defocused. The

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good effects are high sensitivity (for a given tube length and accelerating potential), less edge-defocus, and the possibility of using post-deflection acceleration in a rectangular crt — which has not as yet become practical in the conventional tube types. The mesh also allows the designer to obtain a fairly high level of performance in a relatively *short* crt, making for instrument compactness.

How it Works

The mesh or frame-grid is an electrostatic shield, just beyond the deflection plates in a crt, which performs two functions: It acts as a shield to prevent the post-deflection accelerating fields from reaching into the deflection plate structure and compressing the deflection (Figure 1), and it also acts as a field-*forming* electrode to give a positive curvature to the accelerating fields (Figure 2), which may be used to cause an effective *expansion* or *magnification* of the deflection. The first of these effects results in a sensitivity increased by a factor of about two with a 10 kv tube, since the compression effect in the conventional tube is of this order. The expansion effect is determined by the curvature and placement of the mesh and the shaping of the accelerating field between the mesh and the phosphor. Achievement of 10% to 40% deflection magnification is possible from this latter effect.

The entire concept is quite simple (in theory). An electron beam will always be accelerated in the direction of the highest potential *gradient*. In the conventional pda crt, the accelerating field of the post accelerator (helix) reaches down well into the deflection structure; if the equipotential contours are plotted, it becomes immediately apparent that, because of the deformation of the field by the presence of the deflection plates, the highest gradient (shortest distance between equipotential lines) for a deflected beam is not in the direction of the original deflection, but at an angle tending back toward the center of the screen.

Near the deflection plates, where the beam has low energy, it is most easily bent by the curvature of the accelerating field. Out near the phosphor, where — because the voltage gradient of the helix stops about an inch short of the phosphor — the contours are bent in a way to have a magnifying effect on the beam, the beam already has so much energy that the incremental magnifying effect is negligible. The net effect in the conventional tube is *compression* — a linear compression if the tube is properly constructed, not the nonlinear sort of compression for which a tube would be rejected.

In the mesh-type crt, the mesh serves to *shape* the accelerating field so that the greatest accelerating potential gradient beyond the mesh is pretty much in line with the angle of deflection. Thus, the beam is accelerated in the same direction as it has been deflected. If the field lines just outside the mesh have a radius of curvature shorter than the distance from the mesh to the effective center of deflection in a given plane, the deflection will be magnified in that plane. If the radius of curvature is longer, there will be compression, though not as much as in a conventional tube.

It is possible to shape the mesh and helix in such a way that the post-deflection accelerating field has almost no effect on deflection sensitivity, the deflected beam entering the acceleration field at nearly a right angle to the equipotential lines for all angles of deflection. In a case like this a scope could be equipped with a front panel "+Hi volts" knob, and the post accelerator varied at will. However, there are other problems outlined below which make this less than practical.

Since to obtain optimum performance a very high-gradient accelerating field must be used with a mesh-type tube, it is possible to compress the accelerating helix into a very short distance . . . such as the round portion of the neck of a rectangular-faceplate crt, leaving the forward rectangular portion of the crt a "free-fall" area, where there is no further acceleration (the faceplate and interior of the crt are maintained at the maximum acceleration voltage).

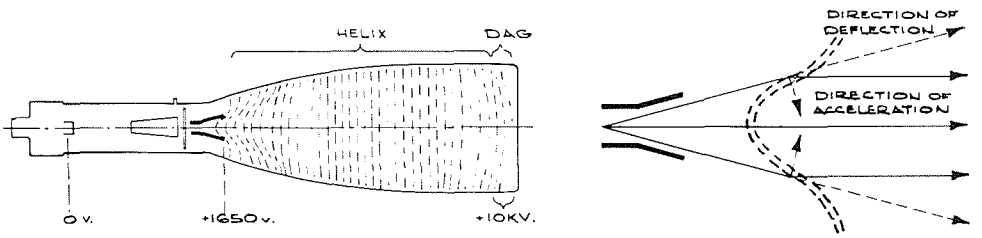


FIGURE 1. CONVENTIONAL PDA CRT.

Curvature of equipotential lines of accelerating field near deflection structure reduces effective deflection by refracting beam. Beam tends to cross equipotential line at 90° angle. Actual refraction effect depends on energy (acceleration) of the beam before it reaches the "line". Thus, the "positive" curvature at the phosphor (caused by the "fringing" of the helix field here) has little magnifying effect; curvature at plates has large compression effect.

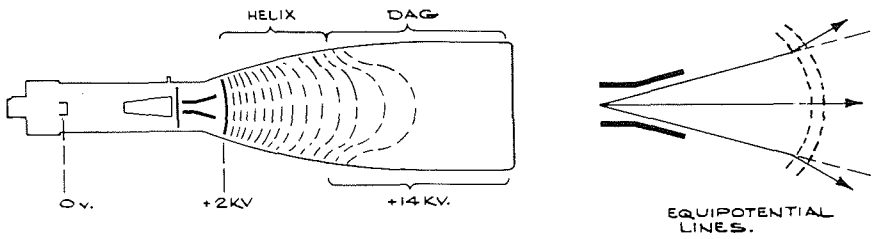


FIGURE 2. MESH-TYPE CRT.

Very strong accelerating field gradient may be used, since mesh prevents accelerating field from penetrating deflection area. Depending on radius of mesh and equipotential line curvature, magnification of deflection may be obtained. Magnification occurs when radius of mesh and field curvature is less than distance from mesh to center of deflection.

Mesh versus Frame-Grid

The post-acceleration screen may be made by either of two techniques, known as mesh and frame grid.

The mesh — though it is more often an electro-formed foil structure than an actual wire gauze — has conductors running in both planes. Its chief advantage is that it may be curved in both planes, spherically or with unequal curvature as described, to obtain the desired acceleration field curvature. It also is capable of dissipating more readily the heat generated by interception of the beam. Its chief disadvantage is that it does intercept more (40 to 50% in a typical 500 lines/inch structure) of the beam current, and it defocuses the spot in both the X and Y axes.

The frame-grid has conductors running in one direction only. Its chief advantage is substantially less beam intercept for a given spacing (around 15% in a typical 500 lines/inch structure) and spot defocusing in one axis only. Its chief disadvantage is that it can be curved in one plane only, requiring special techniques to obtain optimum deflection sensitivity in both planes.

Limitations

As mentioned before, the mesh idea is not a cure-all. For all of its advantages in gaining deflection amplifier simplicity and low power for wide-band, wide-scan, high-performance scopes, the mesh tube suffers from some basic limitations which require accepting some fairly serious compromises in its use. Primarily, the limitations relate to spot size and writing rate.

The chief purpose (other than the psychological one) in providing a high-potential post-deflection accelerator is to put beam *power* into the spot. To the extent that the tube designer can increase beam power (kv x μa) faster than he increases spot size (area), he increases both visual and photographic writing rate . . . at least over a nominal range.

The mesh not only intercepts 15 to 50 percent of the available beam current, as

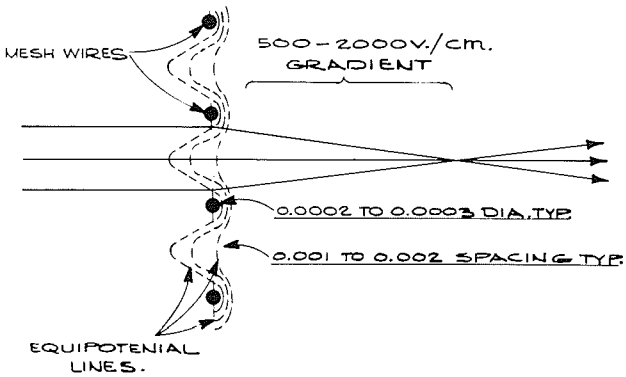


FIGURE 3. ACCELERATION FIELD OF THE MESH STRUCTURE.

Small beam-defocusing lenses form at each mesh aperture. The larger the aperture or the higher the field grodient, the worse the defocusing. The effect is exaggerated and simplified here; typicolly, beam moy cover 15-20 apertures; spot size will increase by a factor of 2 in perhaps 8" throw. Frame-grid couses this type of defocusing in one axis only.

mentioned above, but it also provides a larger spot (under the same general conditions) than the conventional pda tube, for two reasons:

(1) Lack of compression: The same compressing effect the post-accelerator field had on the deflection, it also had on the spot size. Reduce this compression effect, and the spot grows larger*.

(2) Accelerating fields penetrating the mesh: The spacing of the wires or conductors of the mesh is made very close, for two reasons: (a) The mesh itself tends to throw a shadow pattern on the screen, so this pattern should be made as fine as possible; and (b) the larger the holes in the mesh, the deeper the accelerating fields may penetrate through the mesh into the deflection area. The effect of this penetration (Figure 3) is defocusing of the spot by accelerating different parts of the beam in different directions. The closer the spacing of the conductors of the mesh, the less penetration a given gradient field will have, and hence the less defocusing of the spot. Unfortunately, at just the point where the spacing is correct for 0% defocusing, the beam intercept by the mesh is 100%, and there's no spot. So some compromise between beam intercept, mesh spacing, and accelerating field gradient must be arrived at which will provide usable spot size and writing rate.

Compromise operating conditions: Because of the spot size and writing rate problems, it is pointless simply to add a mesh to an existing crt design so as to be able to advertise a high accelerating potential. With all other parameters held equal, adding a mesh to a crt, increasing its deflection sensitivity by a factor of (say) 3, will cause on the order of a 4 times increase in spot size and an even greater reduction in writing rate.

To recover the original desirable crt characteristics, it is generally necessary to do three things:

(1) Increase gun voltage (cathode-to-deflection-plates) for a better "original" spot size.

(2) Increase cathode "'loading" (milliamperes per cm^2 of usable cathode area) by increasing the effective G_m or changing the cutoff voltage of the crt, so that more beam current is available.

(3) Increase the post acceleration potential, to increase the number of watts per cm^2 delivered to the spot on the phosphor.

By the optimum utilization of these three techniques together, a mesh crt design with overall performance comparable to that of a conventional design can be obtained, together with the mesh tube's advantages of possible short length, high sensitivity, and adaptability to rectangular (space-saving) format. But none of the mesh tube's apparent advantages can be individually maximized without severe sacrifices in one or more of the normally desirable characteristics of writing rate, spot size, good geometry, and low power supply (heater and accelerator) requirements.

Miscellaneous Characteristics

Flare: Deflection-plate bounce in a mesh-type crt produces much more *even* illumination of the phosphor than in a conventional tube, because of the scattering effect the mesh has on electrons arriving from odd angles. The flare characteristics is sometimes useful for pre-fogging the phosphor and film for photography.

Shadow Pattern: Figure 3 shows how the mesh tends to defocus the spot by producing a convergence and crossover short of the screen. This applies, of course, to a spot which is properly focused. By changing focus, the beam can be caused to enter the mesh at the diverging angle which will just compensate for the lens effect of the mesh apertures, putting the convergence out to the plane of the phosphor. The result is a large, defocused spot containing a fairly well-focused image of the mesh.

* To this extent, adding the mesh has about the same effect as *lengthening* the crt in the area beyond the deflection plates. A "long-throw" crt has greater effective deflection sensitivity, a larger spot, and poorer writing rate than a "short-throw" crt, other parameters held equal. Most of both the good *and* bad effects, then, of a mesh tube can be achieved in a long-throw crt, provided that length is no problem.

ANALYZING SYSTEM MECHANICS AND IMPROVING MECHANICAL DESIGN WITH **CATHODE-RAY OSCILLOSCOPES**

"Oscilloscopes are versatile engineering tools for shock and vibration analysis, bearing and lubrication studies, and virtually every other area of mechanical research and development. They are basically electronic graph-drawing instruments capable of handling and displaying events or signals one billion times too fast for display on meters, recorders and similar mechanical devices.

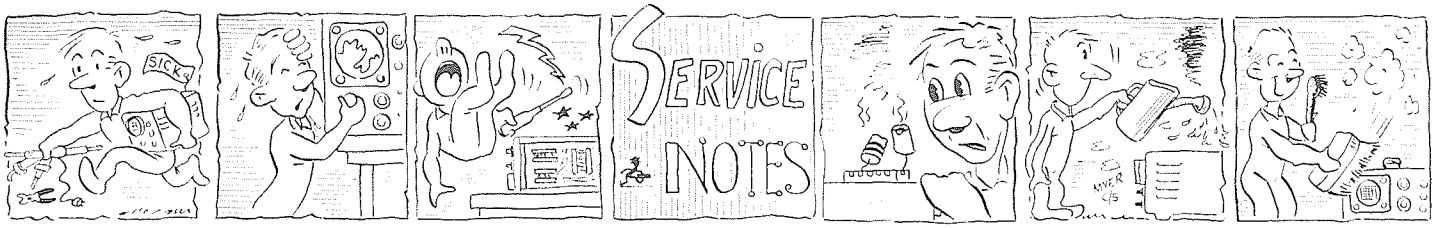
The commercial availability of transducers for conversion of mechanical, thermal, optical and chemical phenomena into electrical signals has extended the utility of the oscilloscope well beyond the electrical industry. This article analyzes the relationship between an incident and a system response in terms of mechanical engineering problems, the available measuring tools, the information needed for planning and evaluating data, and gives an indication of system costs and some practical examples of oscilloscope measurements".

In this manner, Will Marsh, Tektronix Staff Engineer and author of the article "Analyzing System Mechanics and Improving Mechanical Design with Cathode-Ray Oscilloscopes" introduces his subject to readers of "Machine Design". The article appeared in the June 6, 1963 issue of that magazine.

People in the mechanical industry are becoming increasingly aware of the possibilities of an oscilloscope as a means of obtaining precise (and sometimes otherwise unobtainable) information. For such forward thinking people, Will's article carries a special appeal.

Reprints are available from your Tektronix Field Engineer of local Field Office (see list of Tektronix Field Offices on page 7 of this Service Scope).

(REPRINT AVAILABLE)



TYPE 3A74 FOUR-TRACE AMPLIFIER UNIT — GRID-TO-PLATE SHORT

A grid-to-plate short can develop in V533B (a 6DJ8 tube) in the Type 3A74 Unit and cause considerable damage to the unit by taking out several diodes, resistors and transistors. Replacing R593, a 1 k, ½ w, 10% resistor (in the plate circuit of V533B) with a 10 k, ½ w, 10% resistor will limit the average plate current to 30 ma.

This information applies to all Type 3A74 units presently in the field. Serial number of the unit in which the factory-installed mod became effective will be announced later.

TYPE 561 and RM561 OSCILLOSCOPES — INTERMITTENT INTENSITY MODULATION

Some Type 561 and Type RM561 Oscilloscopes can develop an intermittent-intensity-modulation problem. The problem stems from R842, a 12 meg, 2 w, precision resistor in the crt high-voltage-divider string. When R842 goes out completely, the operator will have no control over the intensity; the beam will be full on. R842 is rated at 2 kv. At turn-on time the voltage across R842 goes up to 2.5 kv and some of these resistors just can't stand it. Replacing R842 with a Pyrofilm, 12 meg, 2 w, precision resistor will overcome this problem. The Pyrofilms carry the same Tektronix part number (310-568) as the originally installed resistor, but are rated at 5 kv.

This information applies to Type 561's below s/n 1165 and Type RM561's below s/n 230.

WELWYN RESISTORS — Handle With Care

Welwyn precision resistors can be easily damaged if they are handled with pliers. Puncture of the moisture-resistant lacquer and pressure on the resistance element and ceramic substrate from holding the resistor body with pliers have been identified as the cause of a number of failures. It's a good idea to avoid holding any brand of carbon film resistors by the body with pliers.

TYPE 3S76 DUAL-TRACE SAMPLING UNIT

The 0.1 μf, 200 volt discap used in four locations (C1073, C2073, C2277 and C2279) in early Type 3S76 Dual-Trace Sampling Units has developed a reliability problem. These discaps show a tendency to short out. When they do, damage to the high-voltage supplies can occur — sometimes to a considerable extent.

None of the other presently available discaps of this value and rating will fit physically, so we've changed the values. C1073 and C2073 now use a 0.02 μf, 500 volt discap (Tektronix part number 283-006); C2277 and C2279 now use a 0.001 μf, 200 volt discap (Tektronix part number 283-067).

This information applies to Type 3S76 Units with s/n's below 409 with some exceptions. A physical check of C1073, C2073, C2277 and C2279 will help to determine if your instrument is one of these exceptions.

LOW-FREQUENCY COMPENSATION — DON'T OVERDO IT!

A slight misadjustment of the low-frequency compensation in a Type L, Type ML or Type B Plug-In Unit or a Type 310, Type 310A, Type 316 or Type 317 Oscilloscope may cause a low-frequency *boost* of as much as 3 db at about 5 cps when a probe is used.

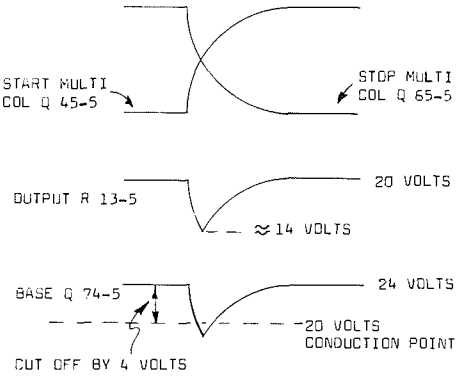
The problem is this: There are *two* capacitors in the circuit — the input coupling capacitor and the preamplifier coupling capacitor. The LF Comp. or LF Adj. controls are intended to compensate only for the second (preamplifier) time constant so the response will be substantially the same as in the regular AC-coupled positions. If the compensation is adjusted so as to partially correct the *input* time constant as well, the use of a probe (which increases the input time constant) will result in low-frequency boost. A good procedure is to use a strap to short out the input-coupling capacitor while adjusting the LF compensation. Then remove the strap and double-check the result by observing a 50 cps square wave using a 10X probe. Set the VOLTS/DIV. control in the most sensitive position and the INPUT control in the AC position. There should be no upward tilt to the waveform, though the flat-top may be somewhat bowed. This bowing represents a small, but not critical, boost at low frequencies. Those interested in accurate low-frequency measurements should be careful to verify the exact roll-off and LF boost characteristics of the particular oscilloscope used, if AC coupling is required.

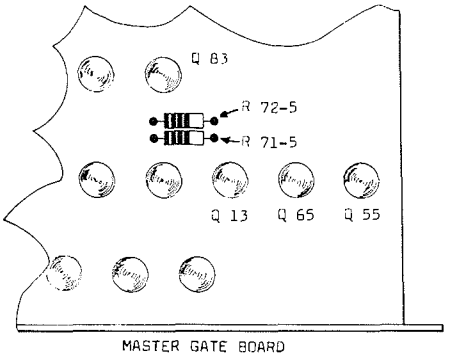
The square-wave adjustment as outlined is probably the best approach; however, we still experience a rise at approximately 5 cps when doing it this way. Those interested in low-frequency sine-wave response, may want to adjust accordingly.

The two plate-load decoupling electrolytics (LF boost circuit) in the X10 amplifier also act to complicate the multiplier time constant.

Many persons prefer the simplicity of using a 10X probe in the first place. This is all right, but the "straight-in" (no probe) operation should be double-checked afterwards.

TYPE 6R1 DIGITAL UNIT —SPURIOUS COUNT





Type 6R1's employing a Model 2A, Series 5, Master Gate circuit board will produce a spurious (one extra) count during the reset phase of the Start and Stop multivibrators. This shows up when making voltage measurements with either a Type 3S76 Dual-Trace Sampling Unit or a Type 3S3 Sampling-Probe Dual-Trace Unit in the vertical plug-in compartment of the Type 567 Digital Readout Oscilloscope. It is most apparent when the MV/DIV control of these units is in any (except the most sensitive) "5" position.

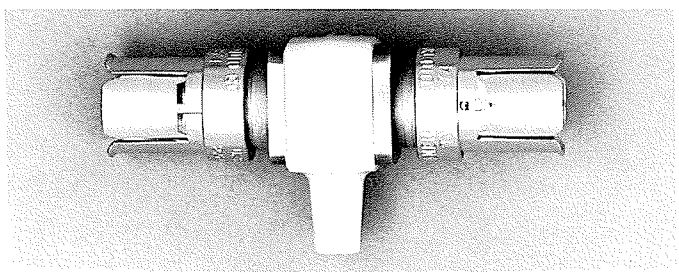
To check for this problem, apply a waveform to the A or the B INPUT of the Type 3S76 (or Type 3S3) unit in the Type 567 and set the unit's MV/DIV control to a "5" position. Set the RESOLUTION control of the 6R1 to AVERAGE OF 10 SWEEPS — HI. Depending upon the INPUT (A or B) to which you applied the waveform, reverse the polarity of the A VOLTAGE or the B VOLTAGE switch of

the 6R1. The Nixie tubes should then read 0000 — if they do not, the Master Gate is producing a spurious count.

To correct this condition, — and we suggest here that you refer to the Master Gate schematic in the Type 6R1 manual — replace R72, a 1 meg, ½ w, 5% resistor with a 470 k, ½ w, 5% resistor (Tektronix part number 301-474).

This problem stems from the fact that the Start multivibrator does not completely reset before the Stop multivibrator and produces a 6 volt negative pulse across the R13 resistor. The transistor Q74 is reverse biased by about 4 volts which is not enough to stop the 6 volt pulse. Changing the R72 resistor from 1 meg to 470 k raises the bias of Q74 to 9 volts enabling it to effectively block the 6 volt pulse and thus overcome the problem.

VP-1 50-OHM PICKOFF "T"



The VP-1 is a 50-ohm coaxial tee with GR fittings on each end and a plastic center collar. The collar is formed to provide a branch for insertion of P6034 10X or P6035 100X low-capacity, miniature passive probes.

The VP-1 is designed for use with a Type 4S1, Type 4S2 or Type 3S76 Pulse-Sampling Plug-In Unit as a means of access to a 50-ohm system with minimum disturbance of the 50-ohm environment. The reflection coefficient with either probe in use is less than 2% (capacitive) and without a probe, 2 to 3% (inductive) as seen on a Type 4S1.

Some of the more obvious uses of the VP-1 are as a trigger takeoff and inspection of signals within a 50-ohm system.

SC-87 DRI-FILM EFFECTIVE IN RETARDING METAL-ION MIGRATION

Recent tests indicate that treatment of (new) ceramic strips with General Electric SC-87 Dri-Film will retard metal-ion migration by a factor of 6 or more under conditions of high humidity and atmospheric contamination such as some customers must contend with in their laboratories.

Our Manufacturing Staff Engineers evaluated sample strips in a high humidity atmosphere containing hydrogen sulfide, using no treatment (control group), using silicone grease, and using SC-87. Only one failure was noted in 18 days in five 11-notch strips using SC-87. Three failures (e.g., 1/16 amp fuses blown at 360 v) occurred in the three silicone-grease treated samples; five failures in the five untreated samples, in the first seven days. The one failure on the 18th day in the SC-87 group was easily cured by wiping off a track of black sulfide between notches with a dry cotton swab. The dramatic success of the SC-87 was demonstrated by the fact that the average notch-to-notch resistance of the SC-87 treated strips was significantly higher after the test than that of the untreated strips *before* the test.

Accordingly, we suggest that a customer planning to use a new instrument in a corrosive atmosphere under high humidity, treat the strips with SC-87 prior to use.

There are some precautions to observe:

(1) SC-87 forms its protective film by combining with atmospheric moisture and changing its chemical composition. During this process, it gives off hydrochloric acid. Therefore, the work area where it's applied should be well ventilated, and the treated instrument should be allowed to sit for about 24 hours before turning on. This allows the reaction to complete itself. Precautions should be taken *not* to get SC-87 or its fumes on the skin or in the eyes.

(2) The treatment will be most effective only on a *new* instrument. Where metal-ion migration has already attacked an instrument, the affected area between strip notches can be cleaned in many cases using soap and water (e.g., tooth paste) abrasive, if rinsed well. The strips should be clean and dry before application of the Dri-Film.

(3) The SC-87 should not be allowed to flow onto or into pots, variable capacitors, or switches.

To treat a scope, simply brush the SC-87 along the tops of the ceramic strips. It will flow down between the notches to form a quite durable film after the reaction is complete. The reaction will tend to discolor the tinning of the ceramic strip notches, but will have no other deleterious effects.

SC-87 is available through General Electric Silicone Products Department distribution offices in most major cities.

NEW FIELD MODIFICATION KITS

TYPE 132 and TYPE 133 PLUG-IN UNIT POWER SUPPLIES — SPLIT-PHASE FAN MOTORS

This modification will reduce ac noise apparent when using these power supplies with Type Q Plug-In Units. It replaces the original induction-type fan motor with a split-phase (capacitor start-run) fan motor. The modification applies to Type 132's with serial numbers 101 to 940 and Type 133's with serial numbers 101 to 440.

Order through your Tektronix Field Engineer or local Field Office. Specify Tektronix part number 040-310. Price $13.15.

TYPE Z PLUG-IN UNIT — HOOK REDUCTION

This modification reduces "hook" distortion of the signal and improves turret-attenuator reliability. It replaces the AC-DC switches, PUSH-TO-DISCONNECT SIGNAL switches and the input-tube sockets with components made of material with less tendency to impart hook to the signal. It also replaces plastic tubing with Teflon tubing, adds ground springs to ground the turret-attenuator contacts on each side of the contacts in use and provides a different type of turret-attenuator switching contact.

The modification applies to Type Z units with serial numbers 101 to 3563.

Order through your Tektronix Field Engineer or local Field Office. Specify Tektronix part number 040-313. Price $29.00.

TYPE 581 AND TYPE 585 OSCILLOSCOPES* — IMPROVED TUNNEL DIODE TRIGGER

This modification extends the triggering range of these instruments out to 100 Mc or more. It installs an improved tunnel diode circuit and TRIGGERING SOURCE switch. The new switch incorporates three new (for the Type 580 Series) triggering modes — INT and EXT HY SYNC and INT AC LF REJ. The INT and EXT HF SYNC modes accept and trigger stably on signals above approximately 100 Mc. The INT AC LF REJ mode affords stable triggering on signals above 15 kc that contain low-frequency noise or line-frequency pickup. It also prevents trace dimming when operating multi-trace plug-ins in the ALTERNATE mode.

Order through your Tektronix Field Engineer or local Field Office. Specify Tektronix part number 040-322. Price: $65.00.

*NOTE: This modification replaces Tunnel Diode Modification Kits, Tektronix part numbers 040-242 and 040-270. It applies to Type 581 instruments, serial numbers 101 to 510 and Type 585 instruments, serial numbers 101 to 1070, that have *not* — we repeat, have *not* — previously been modified by the installation of kits 040-242 or 040-270.

If your instrument is in these respective serial-number ranges (and has had modification kit 040-242 or 040-270 installed), you may update it by installing a Triggering Source Switch and Improved TD Trigger Modification Kit, Tektronix part number 040-323, which is described elsewhere in this column.

TYPE 581 AND TYPE 585 OSCILLOSCOPES — IMPROVED VERTICAL OUTPUT TUBES

This modification will decrease compression in the vertical-amplifier output stage. It replaces V1284, a dual-tetrode 7699 tube, with two single-pentode 7788 tubes. It also replaces the crt support-bracket assembly.

The modification applies to Type 581's with Serial numbers 101 to 1500 and Type 585's with serial numbers 101 to 5000. However, on the following instruments, a Vertical Amplifier Standardization modification kit, Tektronix part number 040-275, must first be installed: Type 581, serial numbers 101 to 949 and Type 585, serial numbers 101 to 2584.

Order through your Tektronix Field Engineer or local Field Office, Specify Tektronix part number 040-324. Price $64.05.

TYPE 581 AND TYPE 585 OSCILLOSCOPES — TRIGGERING SOURCE SWITCH AND IMPROVED TD TRIGGER

The benefits and changes offered by this modification kit are the same as those described above for the Improved Tunnel Diode Trigger Modification Kit.

It was designed for Type 581 Oscilloscopes with serial numbers 510 to 1500 and for Type 585 Oscilloscopes with serial numbers 1071 to 5000. These instruments will not accept the Improved Tunnel Diode Trigger Modification Kit.

The Triggering-Source-Switch-and-Improved-TD-Trigger modification kit is intended also for Type 581's, s/n's 101 to 510 and Type 585's, s/n's 101 to 1070 that have had either the 050-242 or the 040-270 Tunnel Diode modification kit installed.

Order through your Tektronix Field Engineer or local Field Office. Specify Tektronix part number 040-323. Price: $60.00.

TYPE 5T1 TIMING UNIT — TIME EXPANDER AND GENERAL IMPROVEMENTS

This modification improves the Type 5T1, serial numbers 101 to 996, so as to nearly correspond to the performance of the more recent 5T1A. It does this by replacing the Fast Ramp board with a new one which provides improved linearity of the Fast Ramp waveform, and, by the addition of several new features which are: a TIME EXPANDER control, two new positions ("1000" and "TIMED") for the SAMPLES/CM control, a front-panel screwdriver-adjusted potentiometer and a TIMED POSITION control.

The TIME EXPANDER control is incorporated into a switch assembly in which it is concentric with the SWEEP MODE control. The TIME EXPANDER supplies X1, X10, X20, X50 and X100 "magnification" which does not affect the number of samples per centimeter.

The SAMPLES/CM control with its two added positions, "1000" and "TIMED", is incorporated into a new switch assembly in which it is concentric with the new TIMED POSITION control. This new assembly replaces the old assembly in which the SAMPLES/CM control was concentric with the TIME DELAY (N SEC) control — now obsolete. The "1000" of the SAMPLES/CM control provides greater display resolution. The "TIMED" position provides slow scan for use with Y-T recorders, and, the new front-panel screwdriver-adjusted potentiometer supplies a means of adjusting the TIMED scan speed between the approximate limits of 5 to 8 sec/cm.

The new TIME POSITION control provides the variable time delay for time positioning the signal display when the TIME EXPANDER control is in the X1 position. In the other expanded positions, the TIME POSITION control moves the time "window" anywhere within the original range displayed in the X1 position.

Order through your Tektronix Field Engineer or local Field Office. Specify Tektronix part number 040-311. Price: $152.00.

Three Type D High-Gain DC Differential Units, s/n's 19681, 19682, and 19683, shipped by Tektronix, Inc., Beaverton, Oregon, apparently never arrived at their destination. They were new instruments destined for the George C. Marshall Space Flight Center in Huntsville, Alabama. The Receiving Department at the Flight Center has no record of their arrival.

Tektronix, Inc. would appreciate hearing from anyone with information on the whereabouts of these instruments. Information can be reported to any Tektronix Field Office or to Jim Leep, Customer Service Department, Tektronix, Inc., P. O. Box 500, Beaverton, Oregon. Telephone: MItchell 4-0161.

The Electronic Industries Association reports the loss of a Type Z Plug-In Unit, serial number 374. This instrument was lost in a shipment and Mr. G. F. Hohn, Manager of EIA in Newark, New Jersey asks that any information regarding its present location be directed to him. The street address is 32 Green Street. Telephone: MArket 3-7245.

Two Type 503 Oscilloscopes, serial numbers 1467 and 1882, were reported stolen from the International Rectifier Corporation in Los Angeles, California.

Anyone with information on the whereabouts of these instruments should contact Detective Hotchkiss of the West Los Angeles Detective Bureau, Los Angeles Police Department, Los Angeles, California. The Police Report number is 63-507176.

A Type 310A Oscilloscope, serial number 014069, IBM number 892740, disappeared from Clarkson College in Potsdam, New York. This instrument, which disappeared sometime in April of this year, may show up in the Albany, New York area.

Mr. Harry Mang of the International Business Machine Corporation at 1512 Genesee Street in Utica, New York, would appreciate hearing from anyone with information on the whereabouts of this instrument.

Here is another Type 310 Oscilloscope reported as stolen. This one by the International Business Machine Corporation in New Orleans. Serial number of this instrument is 3098. It disappeared from the automobile of one of their Engineers on July 12, 1963. The supposed theft occurred in the New Orleans area.

Information regarding the location of this instrument should be passed on to Mr. Lou Russell, IBM Corporation, 2640 Canal Street, New Orleans, Louisiana. Telephone: 504-523-2011.

The convenient portability of the Type 310 makes this oscilloscope the preferred choice of many legitimate operators. It apparently also offers an irresistable appeal to those unwelcome human parasites who "borrow" or appropriate an oscilloscope without the owner's consent.

At any rate, still another Type 310A, serial number 013632, has come up missing. This one disappeared from the Naval Air Station at North Island. Any information regarding this instrument should be forwarded to the O & R Security Officer, Naval Air Station, North Island, San Diego 35, California. Telephone: 714-435-6611.

USED INSTRUMENTS FOR SALE

1 Type 561A, s/n 6255, 1 Type 67 Time Base Unit, s/n 2932, 1 Type 3A1 Dual-Trace Unit, s/n 1218 and 2 probes. Total price: $800.00. Equipment has seen 661 hours of service. Mr. Jenkins, Don Lee Electronics, Vallejo, California. Telephone: MI 2-8983.

1 Type 533 Oscilloscope, s/n 1783 and 1 Type 53C/54C Plug-In Unit, s/n 20259. Williams and Associates, 4971 Jackson Street, Denver, Colorado.

1 Type 503 Oscilloscope, s/n 478. Howell Runion, 2525 North Pershing Avenue, Stockton, California. Telephone: HO 2-8808.

1 Type 561 Oscilloscope, s/n 648; 1 Type 63 Differential Amplifier Unit, s/n 508; 1 Type 75 Amplifier Unit, s/n 355; 1 Type 67 Time-Base Unit, s/n 988 and 1 Type 203 Scope-Mobile® Cart. Original price of this complete outfit was $1004.50. Will sell for 10% off original price. Mr. Ben Ambrosio, BFA Products, 5711 Melvin Ave., Tarzana, California. Phone: DI 3-3346.

USED INSTRUMENTS WANTED

1 Type 531, Type 533, Type 515, or Type 316 Oscilloscope. Harvey Minsk, Southeastern Engineering Service, 1356 Carolyn Drive, N. E., Atlanta 6, Georgia.

1 Type 515 or Type 516 Oscilloscope. Ray Dakin, Correlated Data Systems, 1007 Airway, Glendale 1, California.

1 Type 121 Wide Band Preamplifier. Responses to this ad should be directed to George Lodge, Tektronix, Inc., 3601 South Dixie Drive, Dayton 39, Ohio.

1 Type 575 Transistor Curve-Tracer Oscilloscope. Tennelec Instrument Company, Inc., Box 964 Oak Ridge, Tennessee.

1 Type 531 or Type 533 Oscilloscope and a CA Plug-In Unit or,
1 Type 516 Oscilloscope. Contact Dick Martin, P. O. Box 5824, Tucson, Arizona.

Tektronix, Inc.
P. O. Box 500
Beaverton, Oregon

Service Scope

USEFUL INFORMATION FOR

USERS OF TEKTRONIX INSTRUMENTS