



Service Scope

USEFUL INFORMATION FOR USERS OF TEKTRONIX INSTRUMENTS

NUMBER 13

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APRIL 1962

FAN-VIBRATION PROBLEMS: SOME CAUSES AND CURES

In Tektronix instruments employing forced-air ventilation, fan vibration is not normally a problem. Fan-vibration problems, when they do occur, generally stem from one of two sources—the fan motor or the fan-blade assembly (fins, spider and hub).

In most of our forced-air-ventilation instruments, the fan motors operate at relatively slow speeds. The fan motors used in these instruments are typically in proper balance as we receive them from the suppliers. In instruments where the rotation speed of the fan motor might conceivably cause a problem we shock mount the fan motor as a precautionary measure.

The fan-blade assemblies are fabricated by techniques designed to produce assemblies in balance both statically and dynamically. The fins in a properly balanced assembly are all aligned to operate in the same plane and all have the same pitch or angle relative to the axis of the fan-motor shaft. Troublesome fan vibration is most often caused by an unbalanced fan-blade assembly. Instruments undergo a check, before they leave our factory, to assure that they have a minimum of fan vibration.

However, any rough handling of the instrument can upset the balance of the fan-blade assembly by altering either the pitch or rotation plane (or both) of one or more of the fins.

Often you can restore the fins to their proper plane and degree of angle by the following procedure:

1. Check all fins to make sure they turn in the same plane by referencing a gauge bar (screw driver tip, pencil or etc.) within $\frac{1}{8}$ " of one of the side edges of the fins. While maintaining a slight axial pressure toward the fan motor, slowly rotate the fan-blade assembly and note the clearance between the gauge bar and the fin edges. If the fins are all turning in the same plane, the clearance will be the same for each fin. Correct any difference by grasping the tip of the offending fin between a thumb and forefinger and bending in the required direction.
2. Compare the pitch of all fins by checking both sides of the fin edges as in step 1. Twist and bend the fins with thumb and forefinger as necessary to make each side of each fin run in its proper plane. Correctly done, this should establish the same degree of pitch for each fin.

If vibration still persists, remove the fan-blade assembly from the motor shaft and

run the motor. If the fan motor is the culprit, vibration will still be present but, most likely, considerably reduced. This will indicate that the fan motor, through wear, has developed excessive bearing play. More rarely, it may indicate a defective motor. In either case, the motor should be replaced.

Absence of vibration will indicate that the fan-blade assembly is too badly out of alignment to be corrected by the means described here. Under these circumstances you will no doubt find it most expedient to replace the old fan-blade assembly with a new one.

SERVICE HINTS

TYPE 551 DUAL-BEAM OSCILLOSCOPES

Filament wiring change to increase power supply reliability—s/n's 101 to 2357.

You can considerably reduce the possibility of heater-cathode breakdown in V734 (6AU6 error-amplifier tube in ± 500 v power supply regulator) by changing the heater of this tube from a grounded supply to an elevated supply. Type 551 'scopes, serial numbers 2358 and up incorporate this modification.

To modify instruments in the field, remove the bare wires connecting the filaments of V734 (pins 3 and 4) to pin 7 (grounded) of V657 and the 6.3 v filament buss at pin 8 of V687.

Also, unsolder from pin 4 of V734, the bare wire coming from pin 9 of V616 and resolder it to pin 1 (grounded) of V619.

Wire the filaments of V734, in parallel with those of V747. For proper access, you will probably find it necessary to unsolder one or two of the components mounted above the V747 socket. Unsolder these components at one end only and bend them up out of the way. If you find it necessary to remove the PTM capacitor C744 (0.01 μ f), unsolder it at both ends and temporarily remove it.

Use insulated or sleeved wire to connect pin 4 of V734 to pin 4 of V747. If you pay careful attention to lead dress, you may use bare wire when connecting pin 3 of V734 to pin 3 of V747.

After carefully checking the wiring and lead dress, replace and resolder any components unsoldered for access.

A resistance check should now show: Pin 3 or 4, V734 to ± 350 v supply buss, approximately 100 k. Pin 3 or 4, V734 to ground, 110 k or more.

Correct the instruction manual (power supply diagram) for the modified instru-

ment to show the filament V734 connected to the elevated (± 350 v) filament supply.

TYPE 535A, TYPE 545A, TYPE RM35A, AND TYPE RM54A OSCILLOSCOPES

When operating the above instruments and using Time Base B triggered in the DC mode, tube V94 may go into oscillation. The problem can be overcome by tube selection. However, a very simple modification will give a more satisfactory solution and eliminate the necessity to select tubes.

To make the modification, locate R90, a 1.2 meg, 1 w, 10% resistor. You will find this resistor connected between the 4th and 8th notches (counting from the front of the oscilloscope) of the ceramic strip located almost directly over tubes V74 and V95. These tubes are in turn located on the swing-out chassis containing the Time-Base B Trigger and Generator, Delay Pickoff, and External Horizontal Amplifier circuitry. Replace this resistor with a 2.2 meg, $\frac{1}{2}$ w, 10% resistor. Correct the instruction manual (Time-Base B diagram) to show the new value for R90.

This modification applies to instruments with serial numbers below the following:

Instrument	Serial Number
Type 535A	27860
Type RM35A	2550
Type 545A	33015
Type RM45A	2760

Respective instruments bearing serial numbers above those listed here have this modification incorporated at the factory.

TYPES (53/54) A, B, C-A, G, AND H PLUG-IN PREAMPLIFIERS—TRANSCONDUCTANCE AND GAIN CHECK.

It is sometimes difficult to determine in a low-level, low-gain, video amplifier stage, whether transconductance and gain are adequate or whether the tubes should be replaced.

Here's a trick that works well in Tektronix Plug-In Preamplifiers Types (53/54) A, B, and C-A for checking the in-circuit transconductance of the input-amplifier stages, and in Types G and H for checking the output-amplifier stage, using a display of the calibrator waveform or other convenient signal.

The trick is simply to rotate the VARIABLE VOLTS/CM control over its full range with the GAIN ADJ control fully clockwise. If the range of the variable volts/cm changes display amplitude by $2\frac{1}{2}$ -to-1 or more, the transconductance of the tubes in the affected stage is adequate. If the control range is less than $2\frac{1}{2}$ -to-1, the tubes are probably weak and should be changed.

This method will also work with the Type K and L Plug-Ins (input amplifier check). In these instruments, however, the range of the variable volts/cm change in the display amplitude will be 2-to-1 ($2\frac{1}{2}$ -to-1 with new 360° , continuous rotation, potentiometer).

To determine the actual value of transconductance, set the VARIABLE VOLTS/CM control for exactly $\frac{1}{2}$ maximum deflection. Turn off the scope, remove the plug-in and (after allowing several seconds for the tubes to cool), measure the resistance across the VARIABLE VOLTS/CM potentiometer terminals. Dividing this value of ohms into 2 will give you the average in-circuit transconductance (in mhos) of the two tubes whose cathodes are connected to the pot. To convert to micro-mhos, move the decimal point 6 places to the right.

This transconductance is set by the GAIN ADJUST control, which varies the tubes' cathode current. In instruments where the main amplifier gain has been set too high (and the preamp GAIN ADJUST set too low to obtain calibrated deflection), a full $2\frac{1}{2}$ -to-1 (2-to-1, or $2\frac{1}{2}$ -to-1, in the case of the Type K and L Plug-Ins) var-volts/cm range may not be obtainable at the normal GAIN ADJUST setting. The solution, of course, is to reset the oscilloscope main-amplifier gain to the standard 100 mv/cm, using the Type TU-1 or TU-2 Test Plug-In, or a Type EP-53A Gain Adjust Adapter and then increase the preamp GAIN ADJ setting to obtain a calibrated deflection.

REMINING YOU —

... that blue vinyl touch-up paint for Tektronix instruments (with the smooth textured—not cracked finish) is available in 12 ounce pressurized spray cans (Tek no. 252-092). Price is \$2.00.

... that in high-speed pulse measurement and observation techniques, impedance mismatching in coupling the oscilloscope to the signal source through coaxial systems must be avoided. Such a mismatch can have an extremely important effect on the accuracy of the information obtained.

6DJ8 CONVERSION

Type 6DJ8 tubes are improved versions of Type 6BQ7A tubes. They offer better performance, more reliability and characteristics more consistent from tube to tube and between sections of one tube. You can use 6DJ8's as direct replacements for 6BQ7A's in most Tektronix instruments including those using aged and checked 6BQ7A's.

In most cases you won't have to change any circuits. Minor adjustments are, however, often necessary. They usually amount to no more than routine calibration for the circuits in which you replaced the tubes. Your instruction manual describes how to make these adjustments.

A premium version of the 6DJ8 tube is available as the Type 6922 tube. We recommend its use where optimum reliability is

imperative. Tektronix part numbers for these tubes:

- (154-187) tube, electron Type 6DJ8 \$2.75
- (154-195) tube, electron Type 6922 \$7.35

Circuit changes necessary:

Type 53C Plug-In Preamplifier, all serial numbers:

Reduce the gain of the first amplifier stage by changing R3553, R3573, R4553 and R4573 from 680 or 820 Ω resistors to 470 Ω $\frac{1}{2}$ w, 10% composition resistors (Tek no. 302-471).

Type 315D Oscilloscope, all serial numbers:

Install a NE-2 neon bulb (Tek no. 150-002) between pins 7 and 8 of tube V2. This reduces the possibility of a grid-to-cathode short in V2 when the instrument is first turned on.

The MAG CENTERING control (R306) in the time-base amplifier may not have enough range when using 6DJ8's. If it doesn't, change R300 from 200 or 220 k to 250 k, $\frac{1}{2}$ w, 1% precision resistor (Tek no. 309-109). Also, you may run into trouble using 6DJ8's in the time-base generator. If you can't calibrate this circuit with 6DJ8's installed, change back to 6BQ7A's.

Type 524D and Type 524AD Oscilloscopes:

These instruments, depending on the serial number, will require several of the following changes:

All serial numbers:

1. Decouple the plate of V15B by adding a 47 Ω , $\frac{1}{2}$ w, 10% composition resistor (Tek no. 302-470) and a 0.005 μ f, 500 v discap (Tek no. 283-001) as shown in Figure 1. This prevents the line-indicating video-output circuit from oscillating when V15 is a 6DJ8 and a 52 Ω load is used.

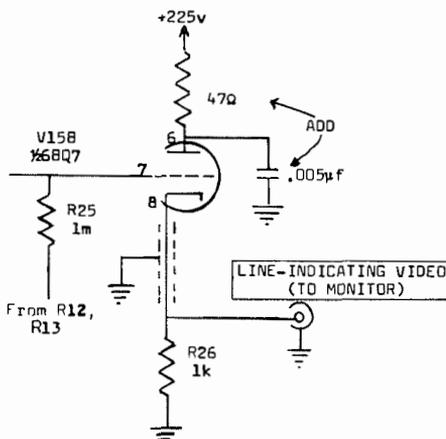


Figure 1. Type 524D/524AD Vertical Amplifier and Delay Line (partial schematic).

2. Shunt C28 and C31, 9-180 or 7-45 pf, variable capacitors in the vertical amplifier, with 82 pf, 500 v, 10% ceramic capacitors (Tek no. 281-528).

Serial numbers 1842 and below:

1. Refer to Figure 2. Decouple the 120 v plate supply of V601B by adding a 1.5 k, 1 w, 10% composition resistor (Tek no. 304-152) and a 0.02 μ f, 600 v discap (Tek no. 283-006) as shown in Figure 2.

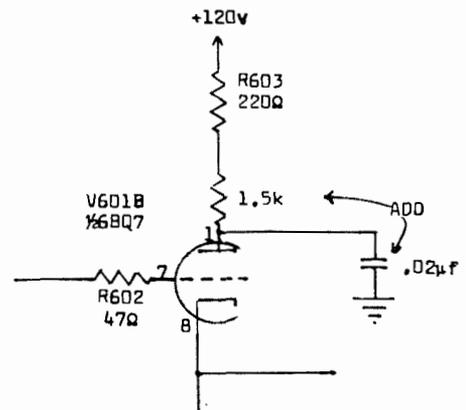


Figure 2. Type 524D/524AD Time-Mark Generator for serial numbers 1842 and below (partial schematic).

2. Refer to Figure 3. Decouple the 120 v plate supply of V601A by adding a 1.8 k, 1 w, 10% composition resistor (Tek no. 304-182) and a 0.1 μ f, 500 v discap (Tek no. 283-008) as shown in Figure 3.

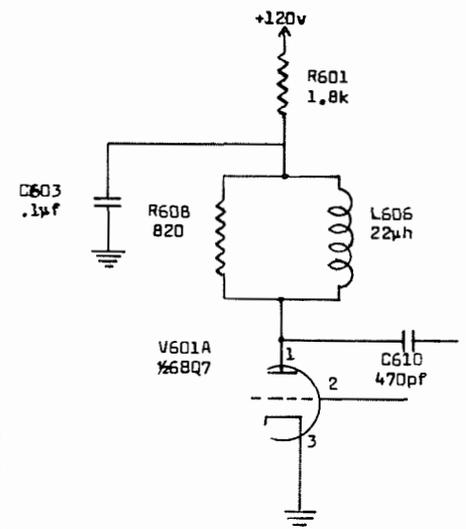


Figure 3. Type 524D/524AD Time-Mark Generator for serial numbers 1842 and below (partial schematic).

Serial numbers 1843 and up:

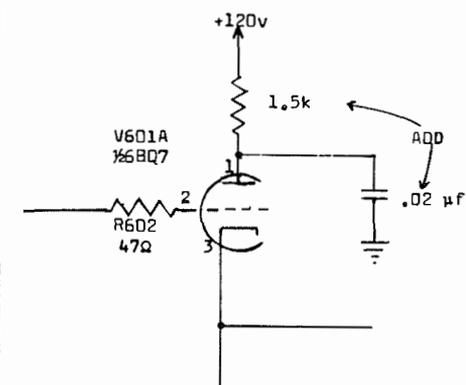


Figure 4. Type 524D/524AD Time-Mark Generator for serial numbers 1843 and up (partial schematic).

1. Refer to Figure 4. Decouple the 120 v plate supply of V601A by adding a 1.5k, 1w, 10% composition resistor (Tek no. 304-152) and a 0.02 μ f, 600 v discap (Tek no. 283-006) as shown in Figure 4.
2. Refer to Figure 5. Decouple the 120 v plate supply of V601B by adding a 1.8k, 1w, 10% composition resistor (Tek no. 304-182) and a 0.1 μ f, 500 v discap (Tek no. 283-008) as shown in Figure 5.

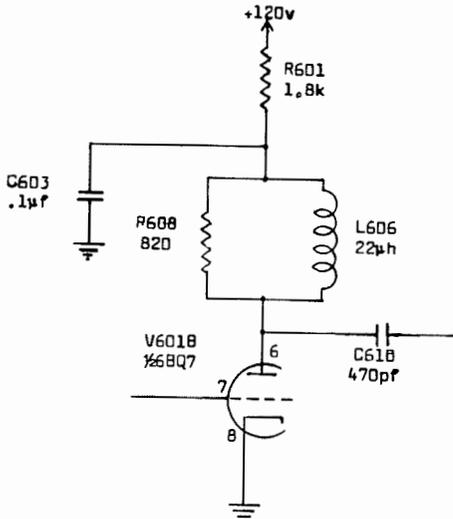


Figure 5. Type 524D/524AD Time-Mark Generator for serial numbers 1843 and up (partial schematic).

Serial numbers 101 through 2154:

Change C28 and C31 in the vertical amplifier from 7-45 pf to 9-180 pf variable capacitors (Tek no. 281-023.) Shunt each with an 82 pf, 500 v, 10% ceramic capacitor (Tek no. 281-574).

Serial numbers 101 through 5341:

Install two neon bulbs, NE-2 (Tek no. 150-002); one between pins 2 and 3 and one between pins 7 and 8 of V222. This helps to prevent grid-to-cathode shorts in this tube when the 524 is first turned on.

Serial numbers 101 through 5899:

Install two neon bulbs, NE-2 (Tek no. 150-002); one between pins 7 and 8 of V23 and one between pins 7 and 8 of V24. This helps to prevent grid-to-cathode shorts in these tubes when the 524 is first turned on.

Serial numbers 6650 and up:

Change R601 from a 1.2k to 1.8k, 1w, 10% composition resistor (Tek no. 302-182).

Serial numbers 101 through 6649:

Refer to Figure 6. Shunt V412 by adding a 3k, 10w, 5% wire-wound resistor (Tek no. 308-020) as shown in Figure 6. This limits the power dissipation of V412 and V601.

Type 525, serial numbers 590 and below:

1. Change R19 in the calibrator circuit from a 2.7 meg, to a 2.2 meg, $\frac{1}{2}$ w, 10% composition resistor (Tek no. 302-225). Readjust the CAL ADJ by referring to your instruction manual.
2. Change all 6BQ7A's in the sweep circuit to 6DJ8's at the same time.

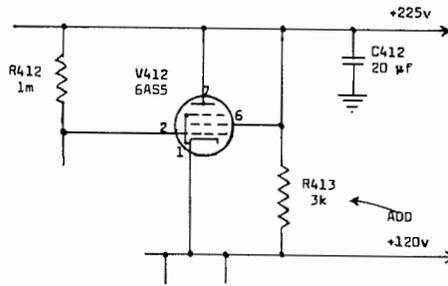


Figure 6. Type 524D/524AD Low-Voltage Power Supply all serial numbers (partial schematic).

3. Change R353 from 10k to 12k, $\frac{1}{2}$ w, 10% composition resistor (Tek no. 302-123).
4. Change R354 from 15k to 18k, $\frac{1}{2}$ w, 10% composition resistor (Tek no. 301-183).
5. Change R365 from 150k to 120k, $\frac{1}{2}$ w, 10% composition resistor (Tek no. 301-124).
6. Change R366 from 150k to 120k, $\frac{1}{2}$ w, 10% composition resistor (Tek no. 301-124).
7. Change wiring in the sweep as shown in Figure 7.

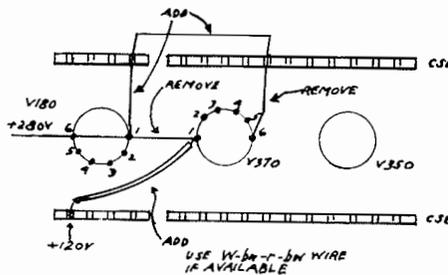


Figure 7.

Readjustments are necessary if you install 6DJ8's in the horizontal or vertical circuits. Refer to your instruction manual. No readjustments are necessary if you install 6DJ8's in the sync separator and trigger amplifier circuit.

Type 531, serial numbers 593 and below:

Type 535, serial numbers 1056 and below:

Reduce the gain of the vertical amplifier by changing the cathode circuits of the delay-line driver stage:

1. Check R503, located between pin 8 of V508 and pin 8 of V509. If it is 3.9 Ω or 5.6 Ω , remove it and the 0.047 μ f capacitor, C503, connected in parallel with it. In place of this parallel combination put a series combination consisting of a 1.2k, $\frac{1}{2}$ w, 10% composition resistor (Tek no. 302-122) and a 100 pf, 500 v capacitor (Tek no. 281-530). Shunt this series combination with another 100 pf, 500 v capacitor (Tek no. 281-530).
2. Change the 10 Ω resistors connected between pin 3 of V508 and V509 and the ceramic strip with 39 Ω , $\frac{1}{2}$ w, 10% composition resistors (Tek no. 302-390).

Type 531A, serial numbers 5969 and below:
 Type 535A, serial numbers 6321 and below:
 There is a possibility of vertical amplifier parasitic oscillations. This appears as a step on the leading edge on an input squarewave (calibrator waveform for instance). Prevent this by adding C560, a 0.01 μ f, 500 v, discap (Tek no. 283-002), between pin 1 and V558 and ground. This is a desirable change even if 6DJ8's are not used in the vertical amplifier.

Type 541A, serial numbers 6475 to 7078:

Type RM41, serial numbers 149 and below:

Type 543, serial numbers 318 and below:

Type 545A, serial numbers 9292 to 11904:

Type RM45, serial numbers 208 and below:

Type 551, serial numbers 596 and below:

In the vertical amplifier (upper-beam vertical amplifier of Type 551) change R1033 from 1.5k to 2.5k, 5w, wire wound resistor (Tek no. 308-127) and R1223 from 2.7k to 4.7k, 2w, 10% composition resistor (Tek no. 306-472).

In the Type 551 lower-beam vertical amplifier, also change R2033 and R2223 to the new values.

Readjust the vertical amplifier and delay line according to your instruction manual. (This SERVICE SCOPE article supersedes FMR 157 - 3/24/61).

MISSING INSTRUMENTS

Tektronix Field Engineer John Griffin of our Stamford Field Office experienced a bit of bad luck recently. A Type 502 Oscilloscope, s/n 5070, and a Type C-12 Camera, s/n 348, with a Shutter Actuator, Model 1 disappeared from his car. John did not authorize anyone to remove these instruments from his car so we presume they have been stolen.

If you have any information regarding these instruments, please get in touch with the Stamford Field Office. Their address is 1122 Main Street, Stamford, Connecticut. Phone number—DAvis 5-3817. Or, if you prefer, contact your local Tektronix Field Engineer.

The Oklahoma State University reports that a Type 561 Oscilloscope, s/n 409, along with a Type 72 Dual-Trace Plug-In Unit, s/n 397, and a Type 67 Time-Base Plug-In Unit, s/n 433, is missing from the Electrical Engineering Department and is thought to be stolen.

Persons with information regarding the whereabouts of these instruments should contact: Gerald Stotts, Head Lab Technician, School of Electrical Engineering, Oklahoma State University, Stillwater, Oklahoma. The telephone number is FRontier 2-6211, Ext. 322.

Our Cleveland Field Office notifies us of a missing Type 321, s/n 883. This instrument disappeared from the Worden Road Plant of the Bailey Meter Company in Wickliffe, Ohio.

Mr. V. S. Rutherford of the Bailey Meter Company would like to hear from anyone who has information on the whereabouts of this instrument. Address information to: V. S. Rutherford, Bailey Meter Company, Worden Road Plant, Wickliffe, Ohio.

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

USERS OF TEKTRONIX INSTRUMENTS

USEFUL INFORMATION FOR

Service Scope

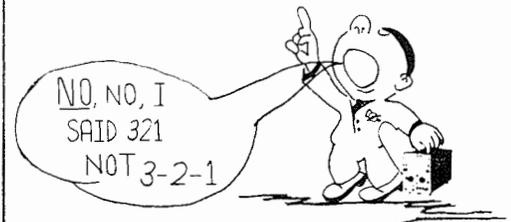
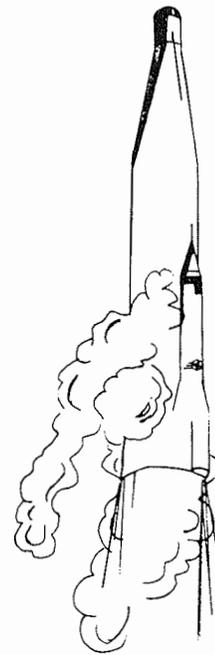


USED INSTRUMENTS WANTED

- 1 3" or 5" Tektronix scope. John J. Arragnost
DeVry Technical Inst.
4141 West Belmont St.
Chicago, Illinois
- Several Type 511, James Palmer
Type 512 and Engineering Department
Type 513 Oscilloscopes. Gannon College
Perry Square
Erie, Pennsylvania
- Several general Bob Jones
purpose 10 to 15 2406 Eastern Avenue
MC Oscilloscopes, Wesleyville, Pa.
3" or 5".
- 1 Type 524 Ed Shinholt
Radio Corporation of
America
3301 South Adams St.
Marion, Indiana
- 1 Type 310 or Thomas A. Barr
Type 310A WAFG TV
1000 S. E. Monte Sano
Blvd.
Huntsville, Alabama
- 1 Type 502 or Joe Posten
Type 503 309 Benton Drive
Indianapolis, Indiana
Phone: TU 1-9771
- 1 Type 514D or M. Perez & Sons
Type 310 Television Service Labs.
6475 Main Street
Long Hill, Connecticut
Phone: AM 8-3766
- 1 Type 310 or Al Willis
Type 315 70 Pilgrim Lane
Westbury, Long Island
Phone: ED 4-5604

USED INSTRUMENTS FOR SALE

- 1 Type 524AD, Jerry A. Richards
s/n 6347 Chief Engineer
WGTE-TV
Toledo, Ohio
Phone: 531-1451,
Ext. 348
- 1 Type 502, Col. Hoxie
s/n 1477 Lind Industries
2294 Mora Drive
Mountain View, Calif.
Phone: Yorkshire
8-0083
- 1 Type 514D, Pete Pappas
s/n 2812. Electronic Development
Price \$675.00 Laboratories
4307 23rd Avenue
1 Type 524D, Long Island, New York
s/n 1665. Phone: RA 8-7116
Price \$775.00
- Seller says both scopes in better than average condition.
- 1 Type 575, s/n Travis Howell
2103. Has had RAWCO Instruments
very little use. 1400 Riverside Drive
Fort Worth, Texas
- 1 Type 551, Dr. Verner J. Wulff
s/n 2011 Masonic Medical
2 Type CA Plug- Research Laboratory
Ins, s/n's 13443 Utica 2, New York
and 13444 Phone: RE 5-2217
- 1 Type R Plug- Bob Billings
In Unit Eldorado Electronics
2821 Tenth Street
Berkeley, California
- 1 Type 533A, Mr. Blair
s/n 3039 Eastern Specialty
3617 North Eighth St.
Philadelphia 40, Penn.
Phone: BA 8-0500



Tektronix Field Engineer Bob Browning with a Type 321 Oscilloscope calls at Cape Canaveral.

Tektronix Instrument-Repair Facilities: There is a fully-equipped and properly-staffed Tektronix Instrument Repair Station near you. Ask your Field Engineer about Tektronix Instrument-Repair facilities.