Service Scope

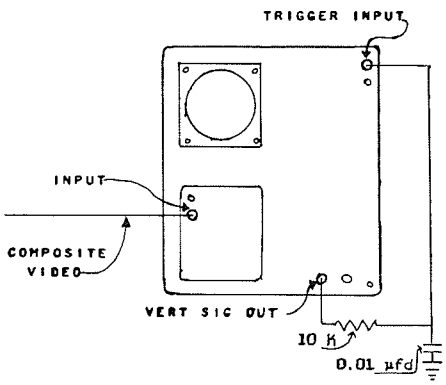
USEFUL INFORMATION FOR USERS OF TEKTRONIX INSTRUMENTS

NUMBER 7 PRINTED IN U.S.A APRIL 1961

TYPE 530/540 OR TYPE 530A/540A SERIES OSCILLOSCOPES AND COMPOSITE VIDEO SIGNALS

Part 2

Fig. 1, which appeared with Part 1 of this article in the February issue of SERVICE SCOPE, was incorrectly drawn. The circuit as shown was not an integrator circuit. Notice that in the corrected drawing (fig. 1 below) the 10 k resistor precedes the 0.01 μfd capacitor in the circuit from the VERT. SIG. OUT to the TRIGGER INPUT.



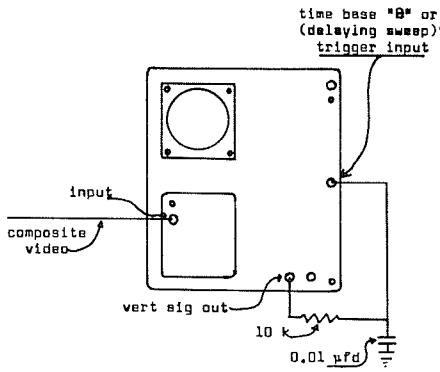
Instructions in Part 1 of this article dealt with the Type 531, 532, 533, 541, 543, 531A and 541A instruments. Part 2 will deal with the Type 535, 535A, 545 and 545A oscilloscopes.

These more sophisticated oscilloscopes provide the Tektronix unique Delaying Sweep feature and can also display either field or line presentations. In addition, the Delaying Sweep feature permits the operator to select the line presented. Also, once the instrument is set up, the operator can switch from line to field presentation by simply turning the HORIZONTAL DISPLAY switch.

Here's how you set it up:

Step 1. Use a wide-band Plug-In Preamplifier in the oscilloscope and apply the composite video signal to the INPUT. Adjust the VOLTS/CM to give 3 or 4 centimeters of deflection.

Step 2. Couple the VERT SIG OUT to the TIME BASE B (DELAYING SWEEP) TRIGGER-IN with an integrator circuit consisting of a 10 k resistor and a 0.01 μfd capacitor. See fig. 2



(Note: If available, Field sync pulses are preferable for triggering the Delaying Sweep.)

Step 3. Set the HORIZONTAL DISPLAY switch to the 'B' INTENSIFIED BY 'A' (DELAYING SWEEP)* position. Turn the TIME BASE B (DELAYING SWEEP)* STABILITY and TRIGGERING LEVEL controls full right. Set the TIME BASE B (DELAYING SWEEP)* TIME/CM switch to 5 MILLISEC and the LENGTH control for 9 to 10 centimeters of sweep. For displaying positive-going video signals, turn the TIME BASE B (DELAYING SWEEP)* TRIGGER SLOPE switch to +EXT (+)* and the TIME BASE B TRIGGERING MODE switch to AC (Type 535 and Type 545 instruments do not have a triggering mode switch on the DELAYING SWEEP section of their front panel), for negative-going signals, switch the TRIGGER SLOPE to −EXT (−)*. Turn the TIME BASE B (DELAYING SWEEP)* STABILITY control to the left until the sweep ceases to operate. Continue turning the control several more degrees to the left. Now turn the TIME BASE B (DELAYING SWEEP)* TRIGGERING LEVEL control to the left until a stable display is obtained. This should occur when the index mark is at or near the straight up position.

Step 4. Set the HORIZONTAL DISPLAY switch to the 'A' DEL'D BY 'B' (MAIN SWEEP DELAYED)* position. Set the TIME BASE A (MAIN SWEEP)* TIME/CM switch to display any desired number of lines. Trigger the 'A' DEL'D BY 'B' (MAIN SWEEP DELAYED)* from the first line sync pulse after the delayed trigger by turning the TIME BASE A (MAIN SWEEP)* STABILITY and TRIGGERING LEVEL controls full right and then turning the STABILITY control to the left until the sweep ceases to operate. Continue turning the STABILITY control to the left for several more degrees.

If you are displaying video signals of positive-going polarity, switch the TIME BASE A (MAIN SWEEP)* TRIGGER SLOPE control to +INT: if you have negative-going signals, switch TIME BASE A (MAIN SWEEP)* TRIGGER SLOPE control to −INT. Turn the TIME BASE A (MAIN SWEEP)* TRIGGERING LEVEL control to the left until a stable display is obtained.

The display will now be similar to the display obtained when using the Type 524 Oscilloscope; the line presentation will jump from one line to the next as the DELAY TIME MULTIPLIER is turned through its range.

Step 5. By switching the HORIZONTAL DISPLAY control from 'A' DEL'D BY 'B' (MAIN SWEEP DELAYED)* position to the 'B' INTENSIFIED BY 'A' (DELAYING SWEEP)* position, you can have either line or field presentation. The TIME BASE A (MAIN SWEEP)* brightening on the TIME BASE B (DELAYING SWEEP)* will indicate the horizontal lines being observed with reference to the entire frame. +GATE A (+GATE MAIN SWEEP)* could be used to modulate the 'Z' axis of a monitor kinescope.

Step 6. If dual trace operation with a Type 53/54C, 53C, or CA Plug-IN is desired, the trigger must be derived from an external source rather then the VERT

SIG OUT, due to the switching signals present. TIME BASE A (DELAYING SWEEP)* sweep rates and length should be adjusted to give proper presentation of interlaced pairs of lines.

The above method will give usable results, but for specific applications most engineers will prefer a Type 524AD Oscilloscope with its carefully designed sync-separator circuits.

* (Captions in parenthesis apply to the Type 535 and Type 545 instruments.)

SERVICE HINTS

Tektronix Field Maintenance Engineer Jack Banister finds a pressure can of contact cleaner a handy service tool. The use of this cleaner has usually been with tube sockets in jittery vertical amplifiers. He squirts the cleaner into the vertical-amplifier tube sockets. Several times this operation has cleared up the trouble just fine. Indications of faulty pin contacts can generally be made apparent by wiggling a tube in its socket.

The brand name of the contact cleaner Jack uses is "Injectoral". There are probably other good contact cleaners in pressure cans on the market, but this is the only one Jack has had experience with.

Occasionally, when a Type 530/540 Series Chopping-Transient-Blanking Mod Kit (Tek. No. 040-200) is installed in an instrument, the unblanking-spike phasing occurs too early and does not cover the switching transient.

Increasing the blanking period should correct this condition. To do this, change the resistor on the grid (pin 5) of V78 from 270 k to 390 k.

The 390 k resistor will generally increase the blanking period enough to cover the switching transient and enable the modification to work correctly. However, isolated cases may require a resistor of an even higher value. Tektronix Maintenance Engineer Udo Lindenmeyer found one instrument that required a 560 k resistor to give correct results.

SOLVING POWER LINE PROBLEMS FOR BETTER SCOPE PERFORMANCE

Problems arising from excessively high or low line voltage continue to plague users of Tektronix oscilloscopes in some areas. Tektronix oscilloscopes are designed to accommodate line-voltage variations up to roughly ±10% from design center without loss of stability or accuracy; however, variation beyond these limits (105-125 volts for most instruments wired for domestic use) causes loss of accuracy and often, severe instability.

The problems reported seem to fall into three main categories: (1) continuously high or low line voltage; (2) fluctuation between high and low line voltage; and (3) serious waveform distortion, giving the effect of low line voltage. Some suggested solutions to these problems are:

(1) The first problem is easily solved for the owner of a Type 310(A), 316, 317, 502 or 516 Oscilloscope. These instruments are equipped with multi-tap power transformers, for use at various "high" or "low" line-voltage ranges. For other instruments, it is necessary to provide some external step-up or step-down transformer to provide the necessary operating voltage to the scope. A variable autotransformer of the "Variac" or "Powerstat" type is particularly useful in accomodating a wide range of input voltages. An inexpensive filament transformer may also be used as an autotransformer in cases where the line voltage is consistently high or low. Reconnected as shown in Figure a, the transformer's

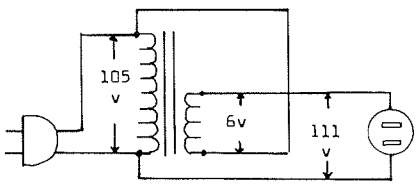


Figure A. Low-cost line-voltage boost or drop circuit, using a filament transformer. Connect as shown for 6 v boost; reverse secondary connections for 6 v drop. Filament winding must have minimum rating indicated in Figure B.

secondary voltage is added to or subtracted from the incoming line voltage to bring it within range. Be sure the filament-winding current rating is adequate to carry the oscilloscope load (Fig. B).

Scope Type	Max. Power Consumption	Recommended Transformer Rating (Min)
310(A)	175 W	2 Amp
315	375 W	4 Amp
316	260 W	3 Amp
317	260 W	3 Amp
321	20 W	¼ Amp*
502	280 W	3 Amp
503	107 W	1 Amp
504	93 W	1 Amp
507	600 W	8 Amp
511(A)	240 W	3 Amp
512	280 W	3 Amp
513	475 W	6 Amp
514(A)	375 W	4 Amp
515(A)	300 W	3 Amp
516	300 W	3 Amp
517(A)	1250 W	15 Amp
519	660 W	7 Amp
524(A)	500 W	5 Amp
525	380 W	4 Amp
526	340 W	4 Amp
527	240 W	3 Amp
531(A)	455 W	5 Amp
532	475 W	5 Amp
533	500 W	6 Amp
535(A)	550 W	6 Amp
536	650 W	7 Amp
541(A)	520 W	6 Amp
543	530 W	6 Amp
545(A)	600 W	6 Amp
551	900 W	10 Amp
555	1050 W	12 Amp
561	175 W	2 Amp
570	400 W	5 Amp
575	410 W	5 Amp
581	640 W	7 Amp
585	725 W	8 Amp

*Power-line regulation not required if batteries are in place and line voltage does not exceed 125 v.

Figure B. Chart of Tektronix oscilloscope power requirements.

(2) The second problem is a little more difficult. Although slow periodic fluctuations in power-line voltage can be conveniently handled with a variable autotransformer, as above, there are many areas where wide line-voltage variations are so frequent that a constant-voltage-transformer type of regulator appears to be the only solution. However, for proper operation of the oscilloscope power supplies, it is extremely important that the regulator does not cause waveform distortion. The electronically-regulated power supplies in Tektronix oscilloscopes require not so much a certain rms voltage on which to operate, as a certain minimum peak-to-peak voltage. Many regulating transformers of the saturable-reactance type regulate primarily by limiting the peaks of the incoming sine waves. Either an rms or average-reading AC voltmeter (most voltmeters are of the latter type) may indicate the proper rms voltage for scope operation. However, the actual peak-to-peak voltage supplied by most of the common "constant-voltage" transformers is insufficient for proper operation of the scope's power supplies. Under these circumstances excessive ripple, jitter, and instability will result. Therefore, it is important to use only a low-distortion type of regulator — one having less than, say 5% distortion at the highest expected incoming line voltage under full oscilloscope load conditions. Regulators of this type are available through commercial channels, though at some increase in cost over the models without waveform correction.

The third problem — serious waveform distortion, giving the effect of low line voltage — will be discussed in Part 2 of this article which will appear in the June issue of SERVICE SCOPE. The discussion will include methods of determining whether waveform distortion will seriously affect the performance of your instrument and suggested solutions for the problem.

USED INSTRUMENTS WANTED

1 Type 515	Gene Pulaski 200 Maple Ave. Graterford, Penn.
1 Type 514 or Type 515 for cash or will trade Waterman USM-24C Pulsescope	J. L. Hartke Elec. Eng. Res. Lab. University of Illinois Urbana, Illinois
1 Type 310	Carl C. Rosen Ray Jefferson, Inc. 4000 N. W. 28th Street Miami 42, Florida

1 Type RM16	Herb Evans, Chief Eng. WTHS-TV 1410 N. E. 2nd Avenue Miami 32, Florida
1 General Purpose DC to 1 or 5 mc scope 5" crt	Robert W. Blair, M.D. 3761 Stocker Street Los Angeles 8, Calif. Phone: AX 5-4347
1 Type 575	Roger Hill Electronic Systems of America, Inc. 624 High Street Racine, Wisconsin Phone: ME 4-7747
1 DC-to-10 mc or better scope. 5" crt	Phil Adelman 6332 W. 85th Place Los Angeles 45, Calif. Phone: OR 4-3504
1 Type 121 Amplifier	Stevens P. Tucker Physics Department Oregon State College Corvallis, Oregon
1 Type 512 or Type 513 or Type 514	Art Humphery Digitrols, Inc. 8 Industry Lane Cockeysville, Maryland
1 Type 531A or Type 533 1 Type 53/54C or CA Plug-In Unit	William Bowin 54-D Oak Grove Drive Baltimore 20, Md.

USED INSTRUMENTS FOR SALE

1 Type 53/54C Plug-In s/n 7414 — $125 or best offer	Ken Mollenauer Argonaut Underwriters 250 Middlefield Road Menlo Park, Calif.
1 Type 514D	Gene Phelps KPTV P. O. Box 3401 Portland, Oregon
1 Type 524AD s/n 2710	Seymor Schatz Rainbow TV Sales & Ser. 6302 Fifth Avenue Brooklyn 20, N. Y. Phone: HY 2-6662
1 Type G Plug-In Unit	R. L. Arntz The Hartman Electrical Mfg., Co. 175 N. Diamond Street Mansfield, Ohio
1 Type 543 with Type CA Plug-In	Mr. MacDonald Sports Network 36 West 44th Street New York 36, N. Y. Phone: MU 2-0117
1 Type 513D s/n 1887 Asking $495	Ronald Knight Pulse Engineering, Inc. 560 Robert Avenue Santa Clara, Calif. Phone: CH 8-6040

BEWARE OF MISLEADING INSTRUCTIONS

The instructions for installing the Type 502 Horizontal Beam Registration Field Modification Kit (Tek #040-234) contain an error. On page 4, step 13 should read as follows:

( ) 13. Solder the white-blue wire to the #1 wafer, #4 position.

The possibility exists that there are Type 502 instruments in use with this mod installed with the white-blue wire going to the wrong (#3 position) contact. Under these conditions, one of the horizontal deflection plates will be left "hanging" or unconnected. The noticeable effect of this error is that with the HORIZ. DEF. PLATE SELECTOR switch in the UPPER BEAM AMP. position, the POSITION control on the UPPER BEAM section of the front panel will have only 5 cm of horizontal range (using normal intensity).

To correct the error, place the Type 502 on the bench with the left side facing you and remove the side panel. On the #1 wafer of the HORIZ. DEF. PLATE SELECTOR switch, locate the contact with two white-blue wires (Note: the #1 wafer is the one nearest the mounting bracket). Unsolder, from this switch contact, the white-blue wire that is dressed through one of the grommets on the bottom of the switch bracket (Caution: do not unsolder the white-blue wire running to the neck of the crt). Move the unsoldered wire one contact to the right and resolder (this contact will have a bare wire going to the #2 wafer of the switch). With this correction the instrument should operate properly.

TYPE 580 SERIES OSCILLOSCOPE TRIGGER CIRCUIT MODIFICATION

Installation of a Type 581/585 Tunnel-Diode Trigger Circuit Modification Kit will extend the reliable triggering capabilities of these instruments out to a full 100 mc. The modification will not impair the instrument's ability to trigger reliably on signals of low amplitude or pulses of very short duration.

Time required by a trained technician to install this modification is about six hours. Tentative triggering specifications of the instrument will then be as follows:

	Frequency	Amplitude
Internal Triggering	DC to 10 mc	2 mm
	10 mc to 30 mc	1 cm
	30 mc to 50 mc	2 cm
	50 mc to 100 mc	3 cm
	DC to 10 mc	0.2 v
External Triggering	10 mc to 50 mc	0.5 v
	50 mc to 100 mc	1.0 v

This modification applies to all Type 581 instruments below serial number 511 and all Type 585 instruments below serial number 1071. Please consult your Tektronix Field Engineer to order this modification.

TYPE 570 CHARACTERISTIC CURVE TRACER WILL SAVE THIS CUSTOMER MONEY

Tektronix Field Engineer Francis Frost reports that one of his customers had need of 19 matched tubes. This customer ordered the tubes from a supplier and the charges amounted to $800.00. The raw stock price of these tubes was $1.95 each. Based on this experience, the customer felt he could more than justify the purchase of a Type 570 Characteristic-Curve Tracer. By matching his own tubes, it would take only a couple of situations like the one described above to realize savings that would more than cover the purchase price of a Type 570 instrument. An extra bonus would be that the Type 570 would be readily available to the design engineers in tailoring circuits to fit the operating characteristics of available tubes. Also, tubes could be selected faster and more accurately for circuits requiring other than average electron-tube characteristics.

PREFIXES AND SYMBOLS

Reproduced in the chart below are the prefixes and symbols of electrical units as adopted by The National Bureau of Standards.

Your Tektronix Field Engineer has a supply of these charts in two sizes; a 4¾" x 7" card suitable for posting near your desk or in your work area, and a handy wallet-sized card convenient to carry with you as a quick and ready reference.

He offers these charts to you with his compliments and suggests you contact him if you have not received yours or if you require additional charts.

Tektronix, Inc.
P. O. Box 500 • Beaverton, Oregon
Phone Mitchell 4-0161 • TWX—BEAV 311 • Cable: TEKTRONIX

PREFIXES and SYMBOLS
of Electrical Units as Adopted by
The National Bureau of Standards

UNIT	PREFIX	SYMBOL
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10	deka	dk
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Compliments of your Tektronix Field Engineer

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

Service Scope

USEFUL INFORMATION FOR
USERS OF TEKTRONIX INSTRUMENTS

MISSING INSTRUMENTS

Our Chicago Field Office sends word that a Type 310A oscilloscope, s/n 13069 is missing and may have been stolen from the Toledo Scale Company, 2033 South Michigan, Chicago, Illinois.

If you have any information regarding this instrument, please wire or call the Toledo Scale Company collect. The telephone number is CA 5-7143.

TYPE 81 PLUG-IN ADAPTER PARASITIC OSCILLATIONS

Parasitic oscillations can occur on the trace of Type 581 and Type 585 Oscilloscopes when using the Type 81 Plug-In Adapter. These oscillations appear at a frequency of approximately 200 mc and have an amplitude of from two to four mm.

A simple modification of the Type 81 will eliminate these oscillations. This modification consists of 0.01 μf, 150 volt discap added in parallel to R549, a 3k, 5w, wire wound resistor.

To install this modification, remove the Type 81 from the oscilloscope and place it on the bench bottom side up. Locate contacts 14 and 16 on the male amphenol connector. Trace back from these connectors to where R 547 and R 548; two 93 Ω, ½ w, precision resistors, join R 549, a 3 k, 5 w, wire wound resistor. Solder one end of an 0.01 μf, 150 volt discap to this connection and solder the other end to the ground lug located on the female amphenol connector.

This modification applies to all Type 81 Plug-In Adapters except the following:

105	232	279	646
107	236	502	649
136	237	590	652
140	250	600	653
143	264	641	654
152	266	642	655
154	268	644	656
188	272	645	664

These instruments were modified out of sequence at the factory.

REACTIVATING THE CATHODES OF STORED CATHODE-RAY TUBES

A cathode-ray tube that has been in storage for some time should be "reactivated" before being placed in service. To reactivate the cathode, operate the CRT with 8 volts on the heater (other operating conditions normal) for about one hour, and follow with 24 hours of operation at normal heater voltage. During the reactivation period the beam should be positioned off the face of the CRT.

TEKTRONIX OPENS IN MONTREAL, MARCH 15

Opening the 36th Field Office provides more immediate attention to the needs of Tektronix customers in Quebec, Nova Scotia, Prince Edward Island, New Brunswick, and Newfoundland. These areas were formerly served from our Toronto Field Office.

CHECK YOUR SERVICE SCOPE ADDRESS!

Please, if you wish uninterrupted delivery of your copy of Service Scope, advise us of **any** change in your address immediately.

After every mailing of this publication, our returned mail contains a large number of copies marked "undeliverable". Investigation discloses that an addressee may have moved only from one room to another within the same building, however, Service Scope delivered to his old address may not reach him. The reason for their non-delivery seems to stem from the rapid expansion, both in size and activity, that many companies and military installations are experiencing. Apparently, the people responsible for internal distribution of mail at these organizations find it difficult to keep abreast of the many moves and changes of personnel resulting from this expansion.

As an aid in insuring the delivery of mail under these conditions, we would like to offer the following suggestions: Determine through the people responsible for distribution of mail within your organization, the address information required to assure delivery of mail intended for you. Advise your correspondents of this information. Notify them as quickly as possible when changes occur in this information.

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.