Service Scope

USEFUL INFORMATION FOR USERS OF TEKTRONIX INSTRUMENTS

NUMBER 9 PRINTED IN U.S.A AUGUST 1961

ADVANTAGES OF INSTRUMENT CYCLING AND A DESIGN FOR A CYCLING UNIT

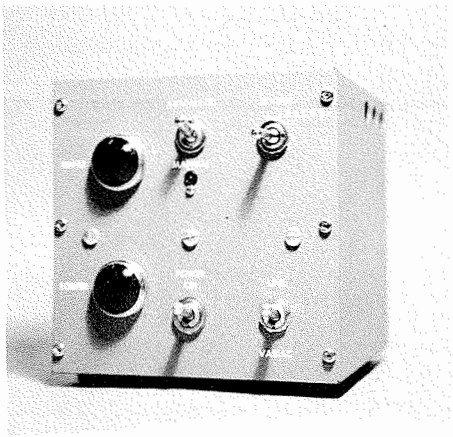


Figure 1—Instrument Cycling Unit.

The cycling of an instrument after repair invites incipient failure from any cause before placing the instrument in service. Periodic switching of the instrument on and off over a span of from 16 to 24 hours can precipitate tube failure (opens or shorts), electrolytic breakdown, transformer breakdown or failure of components in marginal condition. Cycling will also accomplish the gradual aging of any new tubes installed in the repair process.

Changes in original characteristics of tubes and other newly installed components will most likely occur during the cycling period. For this reason, cycled instruments require a recheck of calibration before returning to service.

Typical check points are:

Vertical balance and gain

Plug-in gain and D.C. balance

Sweep timing (sweep cal. at 1 msec/cm)

Complete check and final adjustment of trigger operation.

Les Hurlock of the Tektronix Field Training staff has designed a unit to control the cycling of repaired instruments. It provides simplicity of operation with reliability and at the same time incorporates sufficient versatility to cover most anticipated cycling conditions.

The unit cycles a maximum of four instruments at a time—two on at a time and two off at a time. This arrangement limits the current drawn through the wall outlet and associated breakers.

The unit offers a normal duty cycle of 15 minutes on and 15 minutes off. However, by turning the REVERSE-RACKS switch, you can leave a particular instrument on or off for a longer period of time. Under these conditions, a MANUAL-WARNING neon indicates that the instrument will not cycle unless done so manually. Apart from providing manual operation, the REVERSE-RACKS switch facilitates initial setting up when adding an instrument to or removing an instrument from the racks.

By applying the output of a variable autotransformer to the AUTOTRANSFORMER-IN connector and switching the LINE-AUTOTRANSFORMER control to AUTOTRANSFORMER you can cycle an instrument at a voltage other than that supplied by the line.

Note: Some means of monitoring the auto-transformer voltage should be employed.

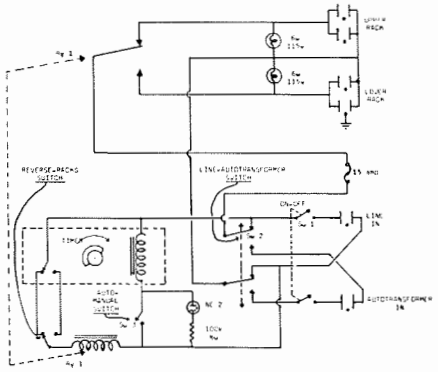


Figure 2 shows the circuit design used in this cycling unit. Notice the 15 amp fuse in the common supply to the upper and lower racks. This fuse prevents excessive current drain in the event of short circuits in the unit or the instruments under-going cycling.

CYCLE UNIT PARTS LIST

QTY.	PART
	SWITCHES
1	DPST 25 amp (Sw. 1)
1	DPDT 25 amp (Sw. 2)
1	SPST (Sw. 3)
1	DPDT (Sw. 4)
	RELAY
1	Ryl-Power* DPDT 25 amp
	TIMER
1	Haydon HR026* 2R.P.M.-standard 15 min. on 15 min. off
	OR
	Haydon HR027* 1R.P.M.-optional 30 min. on 30 min. off
	INDICATOR LIGHTS
1	Socket for candelabra bulb-red jewel (Upper)
1	Socket for candelabra bulb-green jewel (Lower)
2	56 115V-6W bulbs
1	Neon bulb socket
1	NE15 neon bulb
	CONNECTORS
2	3 pin recessed, male (Line-In and Autotransformer-In)
4	3 pin, female (2 for Upper Rack and 2 for Lower Rack)
	MISCELLANEOUS
1	Fuse holder
1	15 amp fuse
1	100 K 5W comp. resistor
1	Metal Cabinet Budd AU1039-HG*

* or equivalent

Figure 3 shows a chart of the parts required to build the cycling unit.

SERIAL NUMBERS OF INSTRUMENTS MODIFIED TO PROTECT THE DISTRIBUTED AMPLIFIER

The February 1961 issue of SERVICE SCOPE carried an article warning of possible damage to the distributed amplifiers of Type 540A and 550 Series Oscilloscopes. At that time we promised to announce the serial numbers at which a corrective modification became effective.

Here is that information. For the:

Type 541A s/n 21701 RM41A s/n 1271
Type 543A s/n 3151 RM43A s/n 101
Type 545A s/n 29162 RM45A s/n 2191
Type 551 s/n 3180
Type 555 s/n 1683

ALL respective instruments above these serial numbers have the modification. Also; many, many instruments with serial numbers below those listed were modified out of sequence. Visually check the distributed amplifier of your instrument to determine its status. If, after this examination, you are still confused as to your instruments status, contact your Tektronix Field Engineer. He has a complete list of modified instrument serial numbers.

MISSING OSCILLOSCOPES

Through our Chicago Field Office we have learned of the loss of a Type 310 Oscilloscope, serial number 2241 by the G. E. X-Ray, 1061 Jackson Boulevard, Chicago, Illinois. This instrument disappeared from a car parked in front of the G. E. X-Ray office on June 19th, 1961. Please contact these people at the above address if you have any information on this oscilloscope.

From our Long Island Field Office comes word of the disappearance of three Type 310 Oscilloscopes from the Royal-McBee Corporation at 2 Park Avenue, New York City, New York. Serial numbers of these missing instruments are 11496, 4510 and 4511. If you see any of these instruments or have any information regarding them, please contact the Royal-McBee Corporation or your nearest Tektronix Field Office.

Seems that the Type 310's handy size and convenient portability make it a highly desirable item for those who purchase on a "midnight requisition".

A Type 545A Oscilloscope, serial number 22088, and a Type L Plug-In Pre-

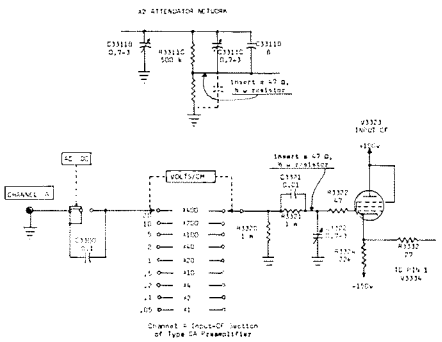
amplifier Unit, serial number 6696, are missing from the Osborne Electronic Corporation, 712 S.E. Hawthorne Boulevard in Portland, Oregon. These instruments were apparently taken from the premises of the Osborne Electronic Corporation by unauthorized persons on the night of March 31, 1961. Please call the Osborne people if you have any information on these instruments. Their telephone number is BE 2-0161.

TYPE 53/54C AND TYPE C-A PARASITIC OSCILLATIONS

On some Type 53/54C and Type C-A Plug-In Units a parasitic oscillation occurs when the attenuator switch is in the .1 VOLTS/CM position and the input is grounded or connected to a low impedance source through a patch cord.

Where these oscillations are only an occasional problem the solution may be to use short ground straps or alligator clips to ground the input instead of patch cords, and use coaxial cables or shielded leads to couple the input to a low impedance source. If this is an impractical solution or the oscillations are a continuing problem, modification of the plug-in unit is recommended.

Type C-A units with serial numbers above 25730 will have this modification incorporated at the factory. For all other Type C-A or Type 53/54C units here's how you install the modification:



Shown in Figure 1 are the two portions of the channel A schematic affected by this modification. The two corresponding portions of the Channel B schematic are identical except for identifying component numbers. Whereas; identifying numbers for components in Channel A are in the 3300 range those of Channel B are in the 4300 range. Bear this in mind as you follow the ensuing instructions.

Channel A—

( ) 1. Locate C3322 (C3023*), a variable tubular-capacitor mounted on the chassis under the Channel A VOLTS/CM switch. From this capacitor, unsolder the 1 meg, ½ w, 10%, composition resistor paralleled by a 0.01 discap.

( ) 2. Solder one lead of a 47 Ω, ¼ w, 10%, composition resistor to the lead of the resistor-capacitor combination unsoldered in step 1. Solder the other lead to the variable tubular-capacitor C3322 (C3023*).

( ) 3. On the dielectric mounting board situated beside the Channel A VOLTS/CM switch locate the variable tubular-capacitor C3311C (C4823*). From this capacitor a bare wire runs to a contact on the second-from-the-front ceramic wafer of the Channel A VOLTS/CM switch. Replace this bare wire with a 47 Ω, ½ w, 10%, composition resistor.

Channel B—

( ) 4. Locate C4322 (C4823C*), a variable tubular-capacitor mounted on the chassis under the Channel B VOLTS/CM switch. Unsolder from this capacitor the 1 meg, ½ w, 10%, composition resistor paralleled by a 0.01 discap.

( ) 5. Solder one lead of a 47 Ω, ¼ w, 10%, composition resistor to the lead of the resistor-capacitor combination unsoldered in step 4. Solder the other lead to the variable tubular-capacitor C4322 (C4023*).

( ) 6. On the dielectric mounting board situated beside the Channel B VOLTS/CM switch, locate the variable tubular-capacitor C4311C (C4923C*). From this capacitor, a bare wire runs to a contact on the second-from-the-front ceramic wafer of the Channel B VOLTS/CM switch. Replace this bare wire with a 47 Ω, ½ w, 10%, composition resistor. This step completes the modification.

*53/54C Unit symbol numbers

TWO NEW SILICON- RECTIFIER MODIFICATION KITS AVAILABLE

Because they offer better reliability and longer life, the relatively new silicon rectifiers are generally preferred over selenium rectifiers.

You can enjoy the advantages of these new rectifiers in your Type 517 or Type 517A Oscilloscopes by installing a Type 517 Silicon Rectifier Mod Kit, Tek number 040-210. Each kit contains a prewired chassis with silicons mounted, schematic, parts list and step-by-step instructions. Type 517 or Type 517A instruments with serial numbers 101 through 1900 will accept this modification—instruments with serial numbers above 1900 come equipped with silicon rectifiers. Price of the Mod Kit is $50.00.

Users of Type 524D or Type 524AD Oscilloscopes can also enjoy the benefits of silicon rectifiers by the installation of a Type 524 Silicon Rectifier Mod Kit, Tek number 040-236. Price $32.00. All but the following Type 524D and Type 524AD instruments will accept this modification:

1. Those with serial numbers 941, 989, 991, 994, 996-998, 1000, 1002, 1006-1008, 1039-1044, 1046-1049, 1051-1053, 1055, 1057, 1058.
2. Those instruments that have had Mod Kit 040-055 or 040-056 installed (selenium stack relocated in line with the fan).

For instruments in the above categories, or for instruments with serial numbers above 1069 which do not have silicon rectifiers, we suggest Type 524 Silicon Rectifier Mod Kit, Tek number 040-177. Price $22.00.

Both the 040-177 and the 040-236 mod kits contain a completely wired chassis with silicons mounted, schematic, parts list and step-by-step installation instrutions.

Order these kits from your Tektronix Field Engineer or Field Office. Be sure to include the serial number of the instrument you intend to modify.

CRYSTAL-OVEN MOD KIT FOR TYPE 180 TIME MARK GENERATOR

The installation of a Type 180 Crystal-Oven Mod Kit in a Type 180 Time Mark Generator will improve the frequency stability of this instrument. The modification replaces the original one megacycle crystal-controlled oscillator with a one megacycle crystal-controlled oscillator mounted in a temperature-stabilized oven. A trimmer capacitor provides a means of adjusting the crystal frequency to zero beat with W.W.V. The modification gives to the Type 180 a stability comparable to that of its successor instrument, the Type 180A.

In addition to the crystal oven with crystal, the kit contains: other necessary components, schematics, parts list, and step-by-step installation instructions that include photographs.

Order from your Tektronix Field Engineer or Field Office. Ask for Type 180 Crystal Oven Mod Kit, Tek number 040-252. Price is $35.00.

SERVICING HINT

Should you find it necessary to replace a precision resistor in the sweep timing circuits of Tektronix oscilloscopes, from stock you have on hand or purchased locally, we suggest you contact your local Field Engineer. One brand we have supplied in the past year has not proved to be as stable as most.

USED INSTRUMENTS WANTED

1 Type 502	Ralph Wiese 674 Sweetbriar Milford, Michigan
1 Type 515	Larry Rhoades Systems Research Labs. 500 Woods Drive Dayton 32, Ohio

1 each Type A, B, C, G, H, K, & L Plug-In Units	Jim Wright 2319 E. Indianola Phoenix 16, Arizona
1 Type 511, Type 513 or Type 514	John Padalino 35 Gail Road Morris Plains, N. J. Phone: JE 9-3918

USED INSTRUMENTS FOR SALE

1 Type R Plug-In Unit, s/n 342. Price $225.00	Bill Crouch Plug-In Instruments, Inc. 1416 Lebanon Road Nashville, Tenn.
1 Type 524, s/n 1161	Jack Bennet, Engineer C.B.S. Electronics 100 Endicott Street Danvers, Mass.
1 Type 127	William H. Read Continental Leasing Co. 5215 Hollywood Blvd. Los Angeles 27, Calif. Phone: HO 9-5371
1 Type 524AD, s/n 1813 1 Scopemobile Price for both $850.00	Monty Studio City Television 12504 Moorpark Street Studio City, California Phone: PO 6-4555 TR 7-1441

QUESTIONS FROM THE FIELD

1. Q: We are having difficulty with noise coming through our 115-v ac line; this noise is being generated by rf oscillations in a nearby department. Do you have any information regarding toroid filters that may help correct the situation?
   A: Toroid cores with an OD of 1", ID of ½" and a thickness of ¼" placed on the instruments power cord should help in filtering out the unwanted signal. It will probably be best to make up a special power cord. Remove the plug or "cap" from the power cord and thread the cord through the core repeatedly until the core center is tightly loaded. Use two or more cores if necessary. If you are unable to obtain the cores locally, you can order them through your Tektronix Field Engineer. Ask him for Tek part number 276-519. Price is 60 cents each.
2. Q: It looks as if the Type 81 Plug-In Adapter's plate dropping resistor R532 (4.7 k, ½ w, 10%, composition) for the output cathode follower might be a bit low on the wattage rating. A check of several adapters reveals this resistor to be blackened around its center. Could we replace this resistor with a 2 watt resistor of otherwise equal value and rating?
   A: Your tip is correct. Our check reveals that R532 is dissipating approximately 1.3 watts of power; that's a little too much. A modification has been submitted to clear up this problem on production instruments. On instruments in the field, this resistor should be replaced with a 2 watt resistor if it shows indication of overheating or burning.
3. Q: What is an easy way to check 6DK6's for cathode interface.
   A: Feed a signal from a Tektronix Type 105 or Type 107 Square Wave Generator into the oscilloscope. Contrive to shift (via a Variac, Powerstat or some similar instrument) the line voltage supplying power to the oscilloscope. If the overshoot in the response changes with line voltage you have it! (cathode interface). Interface will increase as you decrease line voltage.
   Editor's note: We refer you to the August 1960 issue of SERVICE SCOPE. An article in that issue dealt at some length on the problem of cathode interface. The title of the article—"Does the Square Wave Response of Your Scope Look Like This".
4. Q: Let us assume that by miscalculation a very high potential is applied to the signal input of the Type 507 Oscilloscope. Does the Type 507 have any protection for the operating personnel under these circumstances?
   A: We trust a good deal to the operator's judgment in using any oscilscope. However, included as an accessory with every Type 507 is a heavy copper buss. Mounted in this buss are three coaxial connectors and a ground post. In operation of the instrument, the connectors on the buss are attached to the connectors on the rear of the Type 507. The grounded side of the coaxial fittings provide connection between the oscilloscope, ground, and the ground post at the test setup. It is essential, and should be mandatory, that the observation-shack ground be tied to the oscilloscope also. This should be done by means of the ground post on the buss mentioned above.
5. Q: Is there a way of synchronizing the oscillators of a number of Q Units?
   A: Yes. Connect pin 5 of T5779 in the first Q Unit to pin 1 of V5770 in the second Q Unit through a 50 pf capacitor. Connect the second Q Unit to the third Q Unit in this same manner, etc. This injects enough signal from the first unit into the second, from the second into the third, etc., to bring the oscillators of the several units into synchronization. However, for this method to work the oscillators of the several Q Units must all be adjusted to operate at or very near the same frequency. Adjustment of oscillator frequency is explained on page 6-2 of the Q Unit Instruction Manual.

   The need for oscillator synchronism arises when long input leads to the Q Units are laid closely together or when the leads are not adequately shielded. Under these conditions, capacitive coupling of signals will occur and cause erroneous readings at the output of the Q Units.

DOUBLE PULSER OUTPUT FEATURE

The Tektronix Type 535, 545, 535A, 545A, 555 and 585 Oscilloscopes contain a double pulse generator. When these instruments are set up to provide the "superposition of waveform" feature, the +GATE A (+GATE MAIN SWEEP)* provides a double pulse output with the following variables:

a) The width of the pulse is variable via the Time Base A TIME/CM (Main Sweep TIME/CM)* switch and is variable with the concentric variable control.

b) The time of occurrence relative to the pulse is variable by way of the DELAY-TIME MULTIPLIER control.

c) The point of the double pulsing action can be varied by way of the Time Base B TIME/CM or DELAY TIME (Delaying Sweep TIME/CM or DELAY TIME)* switch and the concentric LENGTH control.

Here's how you set up the oscilloscope to provide the "superposition of waveform" feature:

1. Connect the VERT. SIG. OUT connector to the Time Base B TRIGGER INPUT (Delaying Sweep TRIGGER OR EXT. SWEEP IN)* connector. Connect a capacitor of about 100 $\mu\mu$f capacitance between the +GATE B (+GATE DEL'G SWEEP) * connector and the DEL'D TRIG. (DEL'D TRIG. FROM MAIN OR DEL'G SWEEP)* connector.

2. Set the HORIZONTAL DISPLAY switch to 'B' INTENSIFIED BY 'A' (DELAYING SWEEP)*. Connect the source of the wave train to the INPUT or CHANNEL connector of the plug-in preamplifier. Adjust the controls to obtain a delayed sweep. Turn the DELAY-TIME MULTIPLIER control to a setting in the upper part of its range. Adjust the Time Base B TIME/CM OR DELAY TIME (Delaying Sweep TIME/CM OR DELAY TIME)* control so that the desired number of waveforms is displayed.

3. You should now observe two brightened portions of the display—one at the start of the display at the left-hand end of the graticule, and the other at a later point along the graticule. Set the Time Base A TIME/CM (Main Sweep TIME/CM and MULTIPLIER)* control so

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that the left-hand brightened portion includes the first waveform in the train. With the DELAY-TIME MULTIPLIER, move the second brightened area so that it includes the waveform you want to compare with the first waveform in the train.

4. Set the HORIZONTAL DISPLAY switch to 'A' DEL'D BY 'B' (MAIN SWEEP DELAYED)*. The display should now present both the first waveform in the train and the other waveform that was brightened in the preceding step. You can now use the DELAY-TIME MULTIPLIER to superimpose these two waveforms for precise comparison. The resulting reading of the DELAY-TIME MULTIPLIER, multiplied by the TIME/CM OR DELAY TIME setting indicates the delay time between the waveforms being compared. You can also now observe any jitter in the second waveform with respect to the first.

* Captions in parenthesis refer to the Type 535 and Type 545 instruments.

FUNDAMENTALS OF SELECTING AND USING OSCILLOSCOPES

Two authoritative articles covering the fundamentals of selecting and using oscilloscopes are now available in a single booklet. These articles originally appeared in ELECTRICAL DESIGN NEWS; the first one, "Factors Affecting the Validity of Oscilloscope Measurements", in the November 1960 issue and the second, "Appraising Oscilloscope Specifications and Performance", in the February 1961 issue.

Author of the articles is John Mulvey. John has been with Tektronix since 1952. He has worked in Test and Calibration, in Engineering and in Marketing. In addition, he has had nearly six years experience in the Philadelphia and Los Angeles areas as a Field Engineer. At present he is manager of the Field Information Group supporting Field Office activities. His wide experience enables John to write clearly and interestingly about his subjects. We believe you will find the booklet informative and helpful.

A copy of this booklet may be obtained through your Tektronix Field Engineer or the nearest Tektronix Field Office. A current list of Tektronix Field Offices appeared on page four of the JUNE 1961 issue of SERVICE SCOPE.

DC RELAY FIELD MODIFICATION KIT FOR "A" SERIES 530/540 OSCILLOSCOPES

Magnetic flux leaking from the ac relays will cause ripple on the crt trace of some 530/540 "A" Series instruments. Rack mounted instruments seem to be most susceptible to this difficulty because the crt shield is oriented differently with respect to relay location.

A way to tell how much, if any, ripple is caused by the relay is:

1. Short the vertical-deflection plates together and rapidly rotate the horizontal position control back and forth while looking for vertical ripple.
2. Short the horizontal-deflection plates together and rapidly rotate the vertical-position control back and forth while looking for horizontal ripple.

A Field Modification Kit that replaces the ac relay with a dc relay in the 530/540 "A" Series Oscilloscopes is now available. This modification will eliminate the ripple stemming from the ac relay in these instruments. It will also improve the relay and power supply reliability by eliminating the relay chatter.

The kit contains a complete set of components including; a new time-delay relay and power-supply relay, parts list, schematic and step-by-step instructions. Ask for DC Relay Field Modification Kit, Tek. No. 040-258. Price is $8.00.

We earnestly recommend you consult your Tektronix Field Engineer before ordering this modification kit. It is always to your advantage to avail yourself of his help when ordering Tektronix instruments, replacement parts or modification kits. It may be particularly so in this instance.

THE CORRECT TOOL

The correct tool makes a difficult job easier. It may also point to a successful solution for a seemingly impossible task. Conversely, the selection of an incorrect tool will result in costly delays and bitter disappointment.

The purchase of an accurate, reliable, high-quality oscilloscope involves a substantial sum of money. In these days of tight schedules and even tighter budgets, it is of prime importance that the instrument selected do the job as efficiently, as easily and as quickly as possible. It is to this end that a great measure of the Tektronix Field Engineer's training is directed.

There are many types of oscilloscopes, each designed for a specific application area...from the broad general-purpose oscilloscope to the highly specialized instrument. Your Tektronix Field Engineer can help you make the best possible investment by recommending the oscilloscope best suited to your present and future needs. He will be happy to back up his recommendation with an actual demonstration of the instrument in your application. But he will not hesitate to recommend some other method of attacking the problem if it appears to meet your requirements more efficiently. Try him. A no-pressure consultation with him can help you select the correct tool for your work.

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.