INSTRUCTION MANUAL

Serial Number _____

QUAD SIGNAL CHOPPER

015-0155-01

Tektronix, Inc. ● P. O. Box 500 ● Beaverton, Oregon 97005 ● Phone 644-0161 ● Cables: Tektronix

070-1083-00

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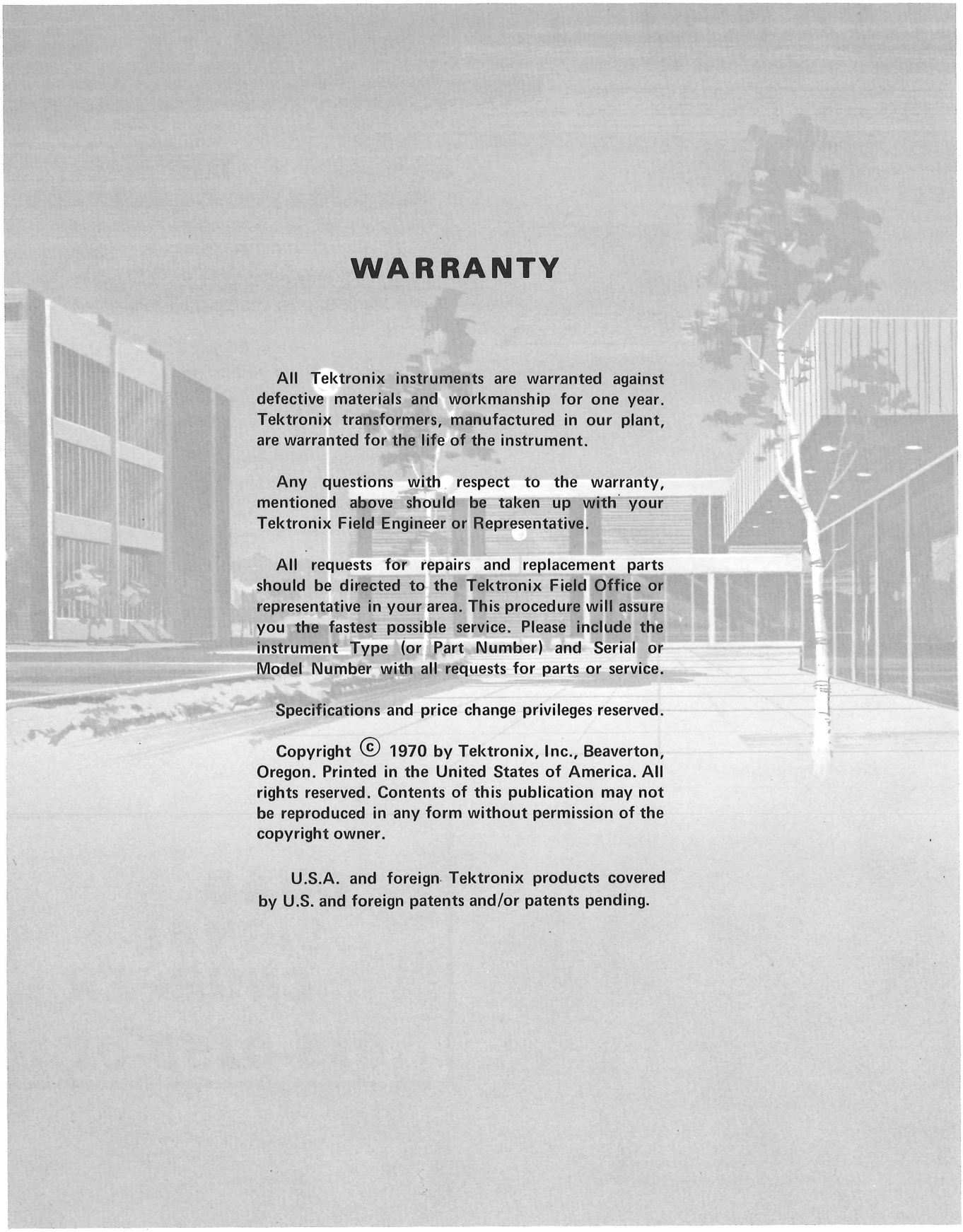

WARRANTY

All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our plant, are warranted for the life of the instrument.

Any questions with respect to the warranty, mentioned above should be taken up with your Tektronix Field Engineer or Representative.

All requests for repairs and replacement parts should be directed to the Tektronix Field Office or representative in your area. This procedure will assure you the fastest possible service. Please include the instrument Type (or Part Number) and Serial or Model Number with all requests for parts or service.

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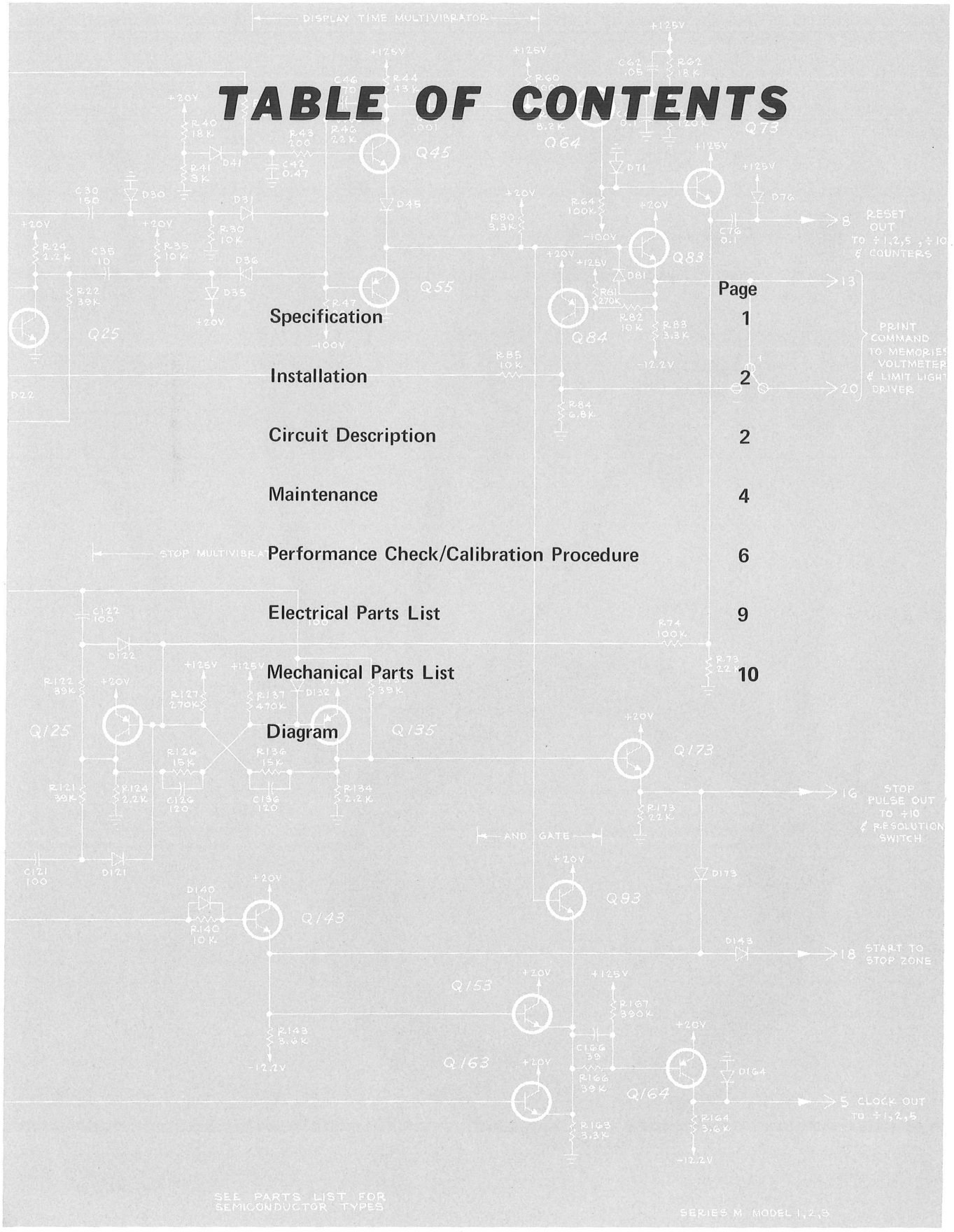


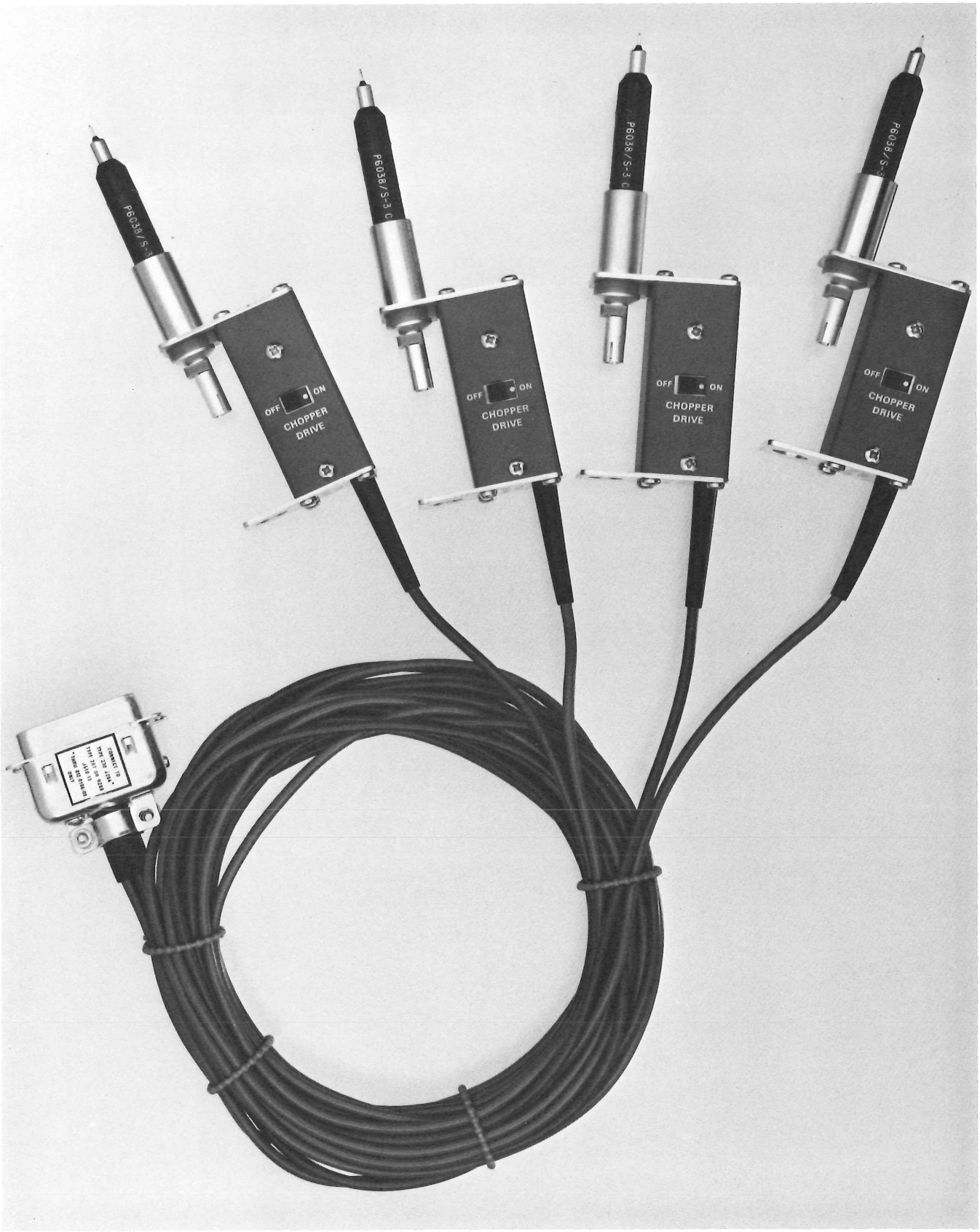


Fig. 1. Quad Signal Chopper, Tektronix Part No. 015-0155-01.

QUAD SIGNAL CHOPPER

(Tektronix Part No. 015-0155-01)

SPECIFICATION

General

The Quad Signal Chopper, Tektronix Part Number 015-0155-01, provides a switchable signal ground reference for making amplitude measurements with Tektronix Automated Measurement Systems, such as the Type S-3130 or S-3150. The instrument consists of four choppers labeled 0, 1, 2, and 3, connecting cables, and a 24-pin connector. A special 10X attenuator is furnished with each chopper. The attenuator connects the signal to the chopper and probe (Type S-3 Sampling Head probe).

The Quad Signal Chopper operating voltages and chopper drive signals are supplied via the 24-pin connector. Each chopper contains a two-position slide switch to turn the Chopper Drive Enable signal on and off when the choppers are used in the simpler systems. In the more complex system, the chopper enable function is programmed as needed, and the switch is not used. Two screwdriver adjustable controls allow the chopper drive and ground reference to be adjusted.

Compatibility

Chopper drive signal originates in the Type 230. In a Automated Measurement System, connections are made from the Type 230 to multiplex the chopper drive signal to the desired chopper and probe. The Quad Signal Chopper is compatible with the Type 286 Multiplex Unit, the Type 287 Multiplex Control Unit, and the Type R288 Multiplex Master Controller. One Quad Signal Chopper can be used for each Type 286 in the System.

Reed Switch Life

The reed switch (K11A) used in each chopper has an estimated life of 10 million contact closures. Therefore, the reed switches should only be operated when required by the System program or calibration.

Electrical Characteristics

The following electrical characteristics are applicable to the Quad Signal Chopper when calibrated with a Type S-3130 or S-3150 Automated Measurement System. The characteristics listed are those characteristics of the Type S-3 (given in the Type S-3 instruction manual) that are affected by the use of each chopper. The characteristics given require that the special 10X attenuator (Tektronix Part No. 010-0367-00) be used with each chopper, and that the choppers be calibrated with the Automated Measurement System at an ambient temperature between +20°C and +50°C, and after a 5 minute warmup time. The electrical characteristics apply over an operating temperature range from 0°C to +50°C and up to 15,000 feet altitude.

Electrical Characteristics

Type S-3 with each Chopper of 015-0155-01 Quad Signal Chopper

Characteristic	Performance Requirement
Attenuation	10X
Accuracy	Within 1%
Input Resistance	
Reed switch closed	900 kΩ within 1%
Reed switch open	1 MΩ within 1%
Input Capacitance	
Reed switch closed	2.5 pF within 10%
Reed switch open	2.4 pF within 10%
Step Response	
Risetime	0.5 ns or less with 25 Ω source

Environmental Characteristics

(Chopper Only)

Characteristic	Performance Requirement
Temperature	
Non-operating	−40°C to +65°C
Operating	0°C to +50°C
Altitude	
Non-operating	To 50,000 feet
Operating	To 15,000 feet

Physical Characteristics

(Chopper Only)

Characteristic	Description
Construction	Extruded Aluminum housing
Finish	Blue vinyl
Dimensions (each housing)	3 3/8 inches X 1 1/8 inches X 1 5/8 inches overall
Cable Length	10 feet
Weight (entire assembly)	12 ounces

INSTALLATION

Depending upon the Automated Measurement System used, the Quad Signal Chopper can be used with a chopper adapter cable and one Type 286, or connected directly to the appropriate matching connector on the Type 287 or Type R288.

In a System where signal chopping is desired for one to four probes, and only one Type 286 is used, an adapter cable is required (see Fig. 2). Plug the 24-pin connector of the Quad Signal Chopper into the mating connector of a three-connector adapter cable (Tektronix Part No. 012-0186-00). Connect one of the remaining connector plugs into J204 at the rear of the Type 230, and the remaining connector to the J204 cable from the Type 240 (or the Type 241 if used in your system).

In a system using more than one Type 286, plug the 24-pin connector of the Quad Signal Choppers into the appropriate connectors at the rear of the Type 287 or the Type R288.

Figure 3 shows the relationship between the Type 287 or R288 rear connectors and the Type 287 or R288 compartments. In addition, for the Type 286 installed in Compartment 0, the figure shows the relationship of each chopper and the sampling head compartment.

Connect the 10X attenuators, supplied with the Quad Signal Chopper, to each chopper being used (see Fig. 4). Connect each probe to the proper chopper. Be sure that the probes are connected to their respective choppers so the probes will operate in the System with the proper chopper. Each chopper with the 10X attenuator and probe assembled is now ready to be connected in the System or used for Performance Check/Calibration.

CIRCUIT DESCRIPTION

The Quad Signal Chopper consists of four choppers, labeled 0, 1, 2, and 3. Since the chopper circuits are identical, only one schematic is shown and described.

When the Type 230 is used without a Type 240 or Type 241, the CHOPPER DRIVE enable switch S11 (see the circuit diagram) enables the chopper drive circuit in the Type 230. The chopper drive signal from the Type 230, or from the Type 230 through the Type 287 or Type R288, acti-

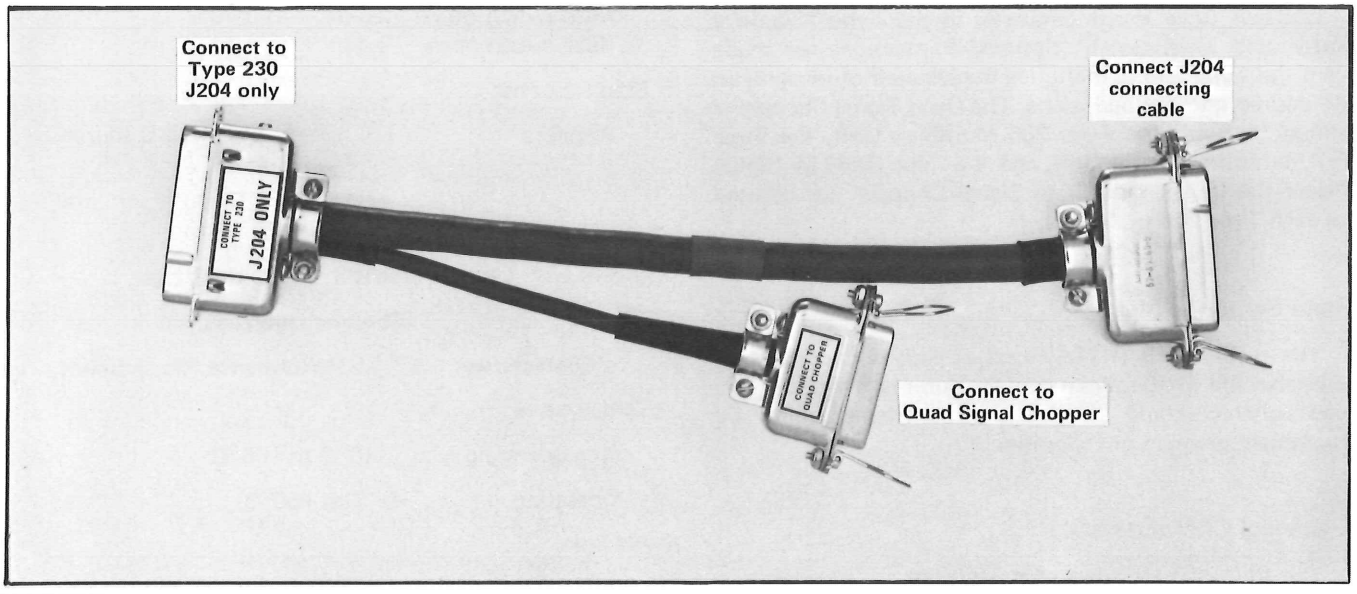


Fig. 2. Optional chopper adapter cable (Tektronix Part No. 012-0186-00) which is used in a System containing only one Type 286.

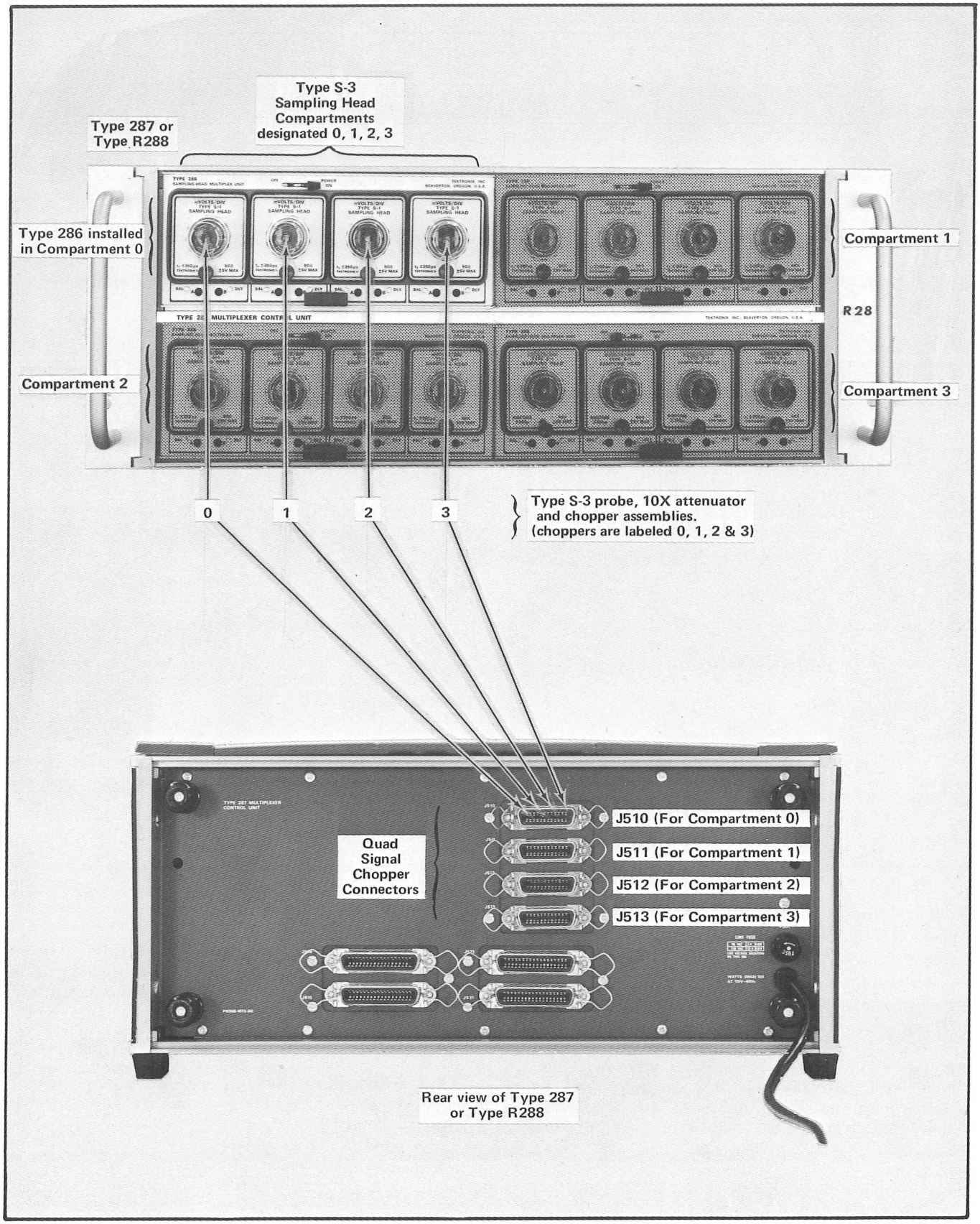


Fig. 3. Installation information using Type 287 or Type R288.

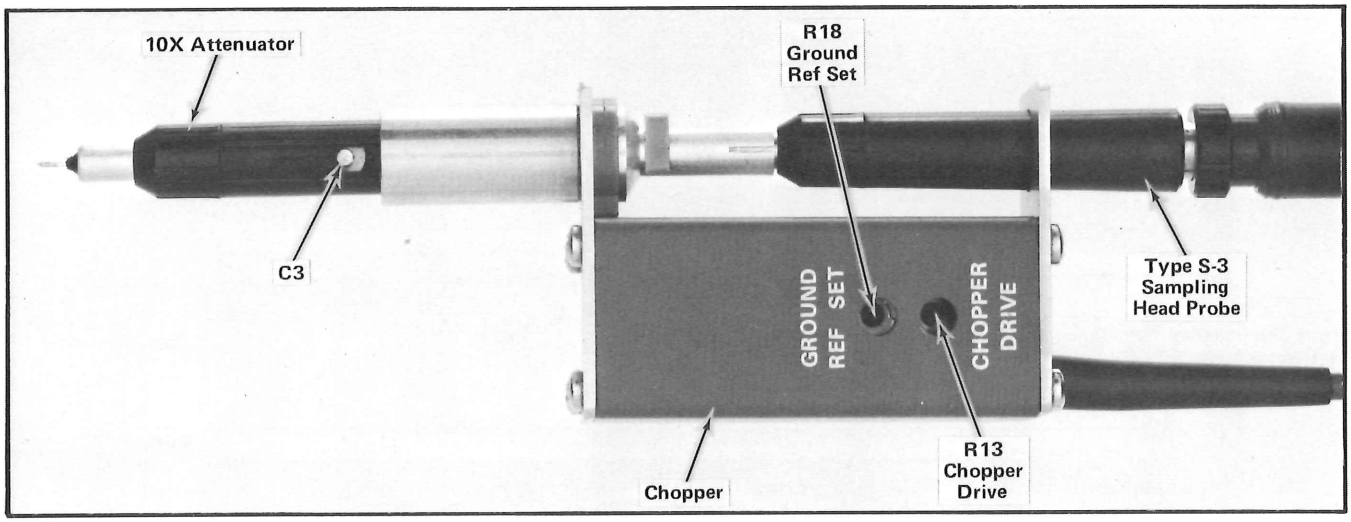


Fig. 4. Chopper with 10X attenuator and probe attached.

vates relay K11 in the chopper. When K11 is activated, reed switch K11A is closed and the input to the signal probe is grounded. When the activating signal is removed, K11A is opened and CR11 clamps off any inductive kick that might occur due to K11. Chopper Drive control R13 allows the current through K11 to be set for stable operation. Ground Ref Set control R18 allows the display no-signal trace to be set to ground when K11A is closed.

MAINTENANCE

Parts Replacement

The electrical and mechanical parts of the Signal Chopper are listed at the back of the manual. All parts used in the Quad Signal Chopper can be purchased directly through your Tektronix Field Office or Field Representative, however, some of the parts are common items and can be obtained locally. Consult the Parts Lists to determine the value, tolerance, and ratings required.

NOTE

When selecting replacement parts it is important to remember that the physical size and shape of a component may affect its performance at high frequencies. Parts orientation and lead dress should duplicate those of the original part, since many of the components are mounted in a particular way to reduce or control stray capacitance and inductance. After repair, the Signal Chopper may require calibration.

Circuit Board Replacement. If a circuit board is damaged and cannot be repaired, the circuit board or the entire assembly including all soldered-on components can be replaced. The part numbers are given in the Parts List. Each Chopper circuit board is removed as follows:

1. Remove the sleeve nut (item 1 on the mechanical diagram, Fig. 9) by rotating the sleeve counterclockwise.

2. Remove the 10 Phillips screws on the Chopper body.

3. Remove the front and rear plates (item 2 and 17).

4. Pull the Chopper body over the 4-conductor shielded cable to expose the circuit board.

5. Using a heat sink, carefully unsolder the tinned copper wire from the circuit board, freeing the assembly consisting of items 4 to 9, 10, and 11.

6. Unsolder the 4-conductor shielded cable, freeing the circuit board.

Reed Switch Replacement. Reed switch K11A is located inside relay coil K11 (see the circuit board photograph, Fig. 5). Carefully unsolder each end, using a heat sink, and remove the reed switch.

R11 Replacement. R11 is connected between item 6 and 7 on the mechanical diagram, Fig. 9. Remove as follows:

1. Remove the retaining clip (item 8).

2. Remove the retaining ring (item 11), using sharp pointed tweezers or a similar tool.

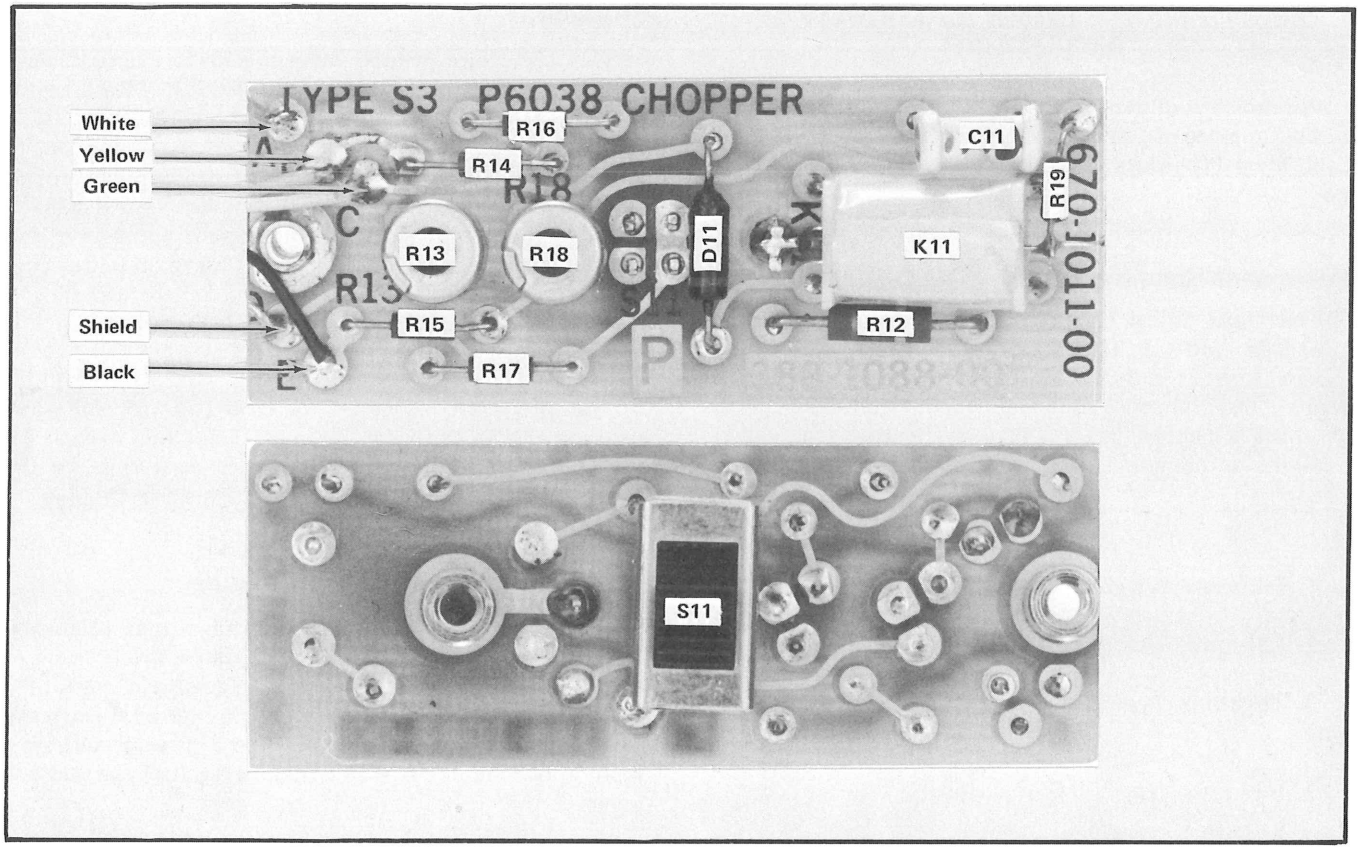


Fig. 5. Circuit board inside each chopper housing.

3. Carefully remove the tip assembly (item 4) and then the insulator half-bushing (one part of item 5).

4. Unsolder and remove R11, located inside the electrical connector shell (item 10), by carefully inserting the soldering iron tip into either side-port of item 10.

5. Unsolder and remove the wire-form male plug (item 6), and the attached tinned copper wire. In replacing R11, care should be taken to cut the resistor leads to the proper length (1/4 inch to item 6 and 3/32 inch to item 7) to maintain the proper spacing for assembly.

To assemble the Chopper, reverse this procedure.

Troubleshooting

The chopper makes an audible sound when it is activated by the Digital Unit. If the sound is not heard, check that the CHOPPER DRIVE switch is ON or that the chopper is enabled by the Type 240 or Type 241. Also check that the sampling sweep unit is producing a sweep. Since the Quad Signal Chopper is made up of four identical chopper circuits, the individual choppers may be interchanged if it is suspected that one chopper is defective.

If all four choppers are inoperative, determine if the operating voltages listed on the schematic diagram are available at the circuit boards. To check if the chopper drive signal is reaching the chopper, measure the chopper drive voltage on the circuit board (green wire connection point to ground). With a sweep repetition rate above 10 Hz, the voltage reading (with a 20,000 Ω/V meter) is about 10 volts. With no chopper drive signal the voltage reading will be 12 volts.

If the chopper drive signal is reaching the chopper, check reed switch K11A with an ohmmeter (connected directly across the switch).

CAUTION

To avoid damage to the reed switch when checking the switch with an ohmmeter, use an ohmmeter or ohmmeter scale which will limit the current to less than 10 mA. For example, with Triplett Model 630 NA, use X100 ohmmeter scale.

The reed switch operation can also be checked as outlined in the calibration procedure.

PERFORMANCE CHECK/CALIBRATION PROCEDURE

Performance of the Quad Signal Chopper can be checked without making any internal adjustments by completing the Calibration Procedure except for the "Adjust" part of the step.

Equipment Required

The Quad Signal Chopper is normally calibrated and operated with a Tektronix Automated Measurement System such as a S-3000 series containing a multiplexer system. The following equipment (or its equivalent), most of which is included in a S-3000 series System, is needed to perform a complete calibration of the Quad Signal Chopper.

1. Tektronix Type 568.

2. Tektronix Type 3S6 Programmable Sampling Unit.

3. Tektronix Type 3T6 Programmable Sampling Sweep Unit.

4. Tektronix Type 230 Digital Unit.

5. Tektronix Type 240 Program Control Unit or Type 241 Program Unit.

6. Type 286 Multiplex Unit.

7. Chopper Adapter Cable, Tektronix Part No. 012-0186-00, is required if only one Type 286 Multiplex Unit is used in the System; not required if a Type 287 or a Type R288 is used in the System.

8. Tektronix Type 191 Constant Amplitude Signal Generator. Alternate requirements: 5 MHz sine-wave output, amplitude 5 volts peak-to-peak into 50 Ω.

9. 50 Ω termination with GR to BNC connectors. Tektronix Part No. 017-0083-00 (supplied with the Type 191).

10. BNC to probe tip adapter. Tektronix Part No. 013-0084-00.

11. BNC T connector, Tektronix Part No. 103-0030-00.

12. Two 50 Ω coaxial cables, 42 inches long, with BNC connectors. Tektronix Part No. 012-0057-01.

13. BNC 50 Ω 10:1 attenuator, Tektronix Part No. 011-0059-00.

14. BNC female to BNC female adapter, Tektronix Part No. 103-0028-00.

Procedure

This procedure is used after the Performance Check/Calibration Procedure of the Automated Measurement System, including the multiplexer system. The Quad Signal Choppers, with their 10X attenuators, must also be installed in the System. If the Quad Signal Choppers are not installed, follow the Installation Instructions in this manual. (Be sure the sampling head compartment numbers match the numbers on the signal choppers.) Make all power connections. Turn on the power to all equipment and allow a 5-minute warmup time before proceeding.

This procedure is set up for calibration of one signal chopper of a Quad Signal Chopper. Calibration of each signal chopper can be accomplished for each step, or the entire procedure can be repeated for each signal chopper.

1. Check or Adjust 10X Attenuator

a. Connect the Type 568 Calibrator output (100 kHz, 5-volt) through a BNC coaxial cable, and a BNC female to female adapter, to a BNC to probe tip adapter. Connect the Calibrator + Pretrigger output signal through a 50 Ω coaxial cable (BNC connectors) to the Type 3T6 external trigger input connector J123. J123 is located on the Type 568 rear panel.

b. Set (or program) the Type 3S6 Mode switch to Ch A and the Channel A Units/Div switch to 100. (Be sure the Normal-Smooth switch is in the Normal position.)

c. Set (or program) the Type 3T6 Decade switch to 6, and the Multiplier switch to 5 for a 5 µs/div sweep rate.

d. Insert one of the signal chopper assemblies into the probe tip adapter.

e. Program the sampling head connected to the signal chopper and Calibrator for Channel A of the Type 3S6.

f. Set the Type 3T6 Trigger Sensitivity control for a stable, triggered display of the calibrator signal. Use the Type 3S6 DC Offset control to center the display if necessary.

g. **Check** for flat top and square corner on the display.

h. **Adjust** C3 (located on the 10X attenuator body) for best flat top and square corners on the display.

i. Remove the Calibrator connections.

2. Check or Adjust Ground Ref Set Control R18

a. Remove the signal chopper assembly from the probe tip adapter and ground the probe tip 10X attenuator.

b. Set (or program) the Type 3S6 Units/Div switch to 50. Set the Mode switch to Dual-Trace.

c. Set (or program) the Type 3T6 Decade switch to 7 and the Multiplier switch to 1 for a 100 ns/div sweep rate. Turn the Trigger Sensitivity control clockwise and obtain a free running sweep.

d. Program A Chop. Set the CHOPPER DRIVE switch on the signal chopped to OFF position. (If your test setup does not include a Type 240 or Type 241, the CHOPPER DRIVE switch must be in the ON position to enable the Chopper Drive circuit in the Type 230.)

e. Program the Type 230 Ch A and Ch B Reference Zones Position so the chopped portion of the input is shown on the CRT screen. Note that the ground reference shown in Fig. 6A and B lasts to the end of the first zone from the beginning of the trace.

NOTE

With a display similar to Fig. 6C, to determine if the display is chopped, remove the input ground momentarily. If the chopped display step does not appear, Chopper Drive control R13 may be out of adjustment. The chopper makes an audible noise when it is operating.

f. **Check** that the trace is chopped and the trace is a straight line (see Fig. 6C).

g. **Adjust** Ground Ref Set control R18 for a step on the display similar to either Fig. 6A or B. Then, adjust R18 until the step disappears and the trace becomes a straight line as in Fig. 6C.

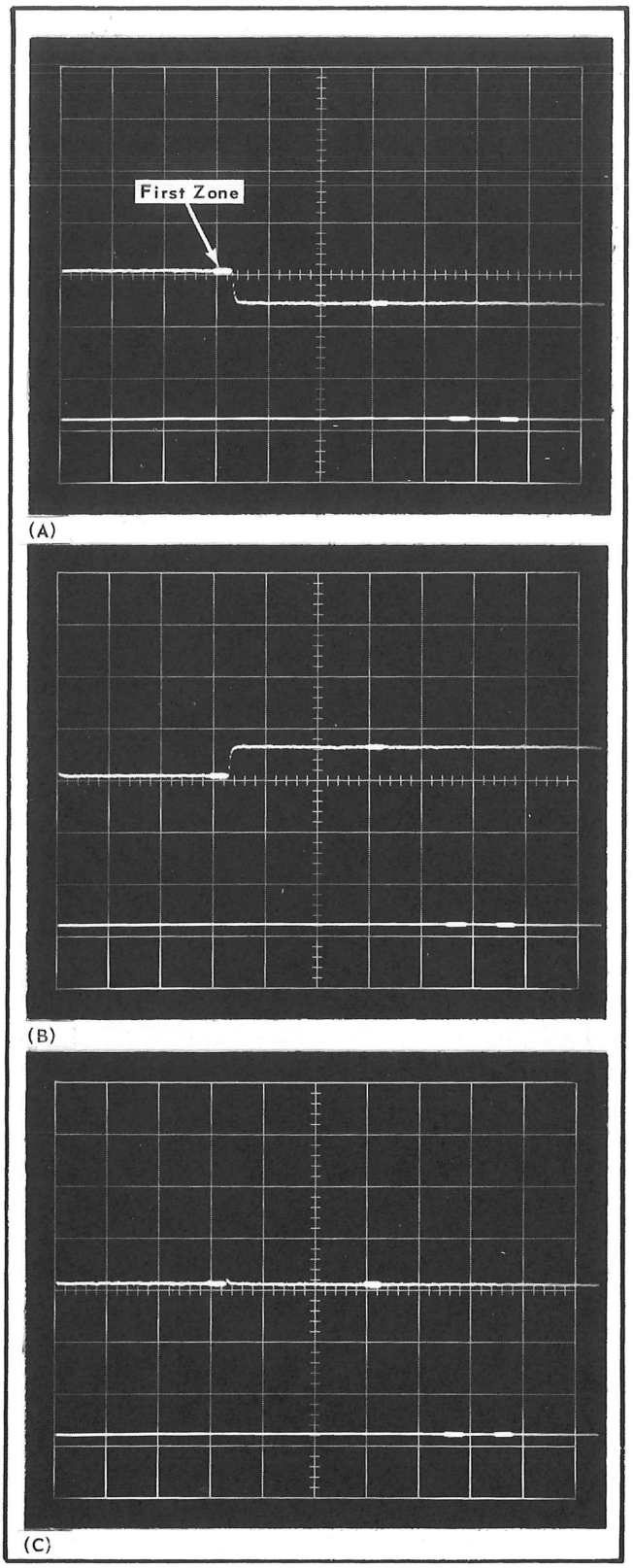


Fig. 6. Waveform for adjustment of Ground Ref Set control R18; (A) and (B) shows the step at the end of the first reference zone; (C) no step, proper adjustment.

3. Adjust Chopper Drive Control R13

a. Connect the equipment as shown in Fig. 7, or as follows:

Connect a 50 Ω GR to BNC termination and a T connector to the Type 191 Output connector. Connect the probe tip 10X attenuator to one arm of the T connector through a BNC to probe tip adapter. Connect the other arm of the T connector through a BNC Female to BNC Female adapter, a 10X attenuator and 50 Ω coaxial cable to the Type 3T6 external trigger input connector (J123).

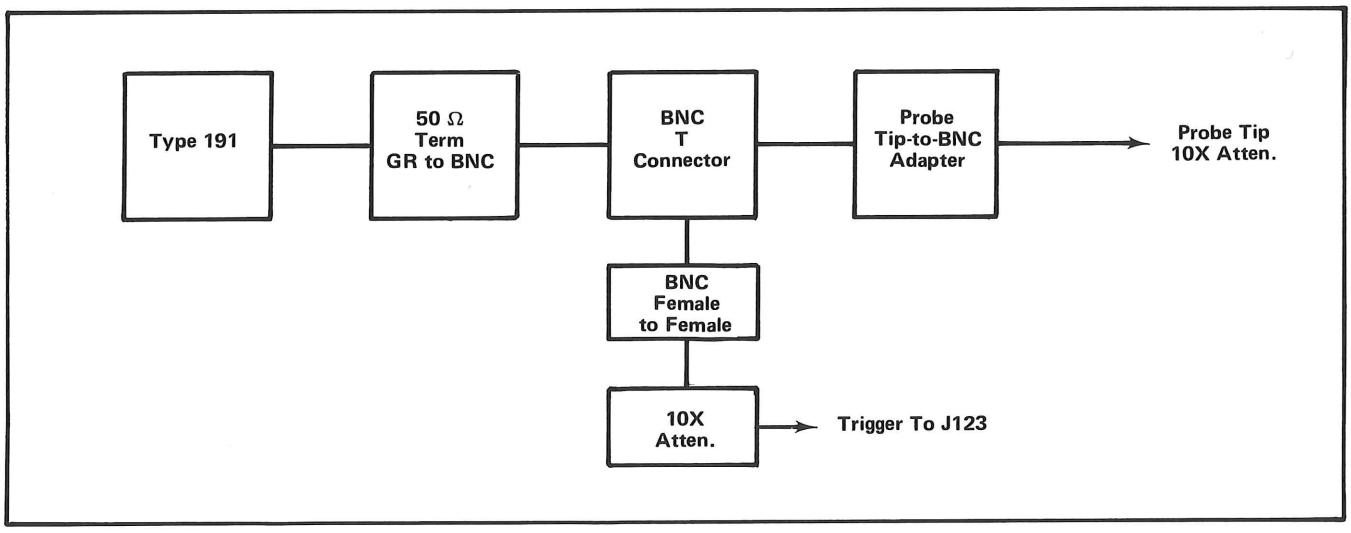


Fig. 7. Block diagram of equipment connections to adjust Chopper Drive control R13.

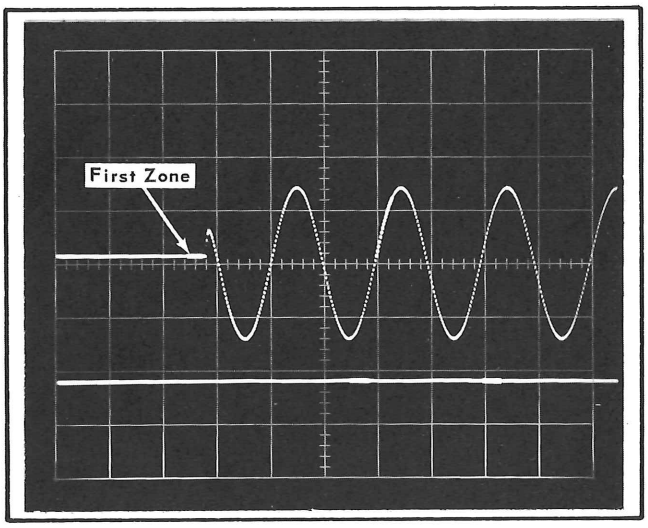


Fig. 8. Waveform for adjustment of Chopper Drive control R13.

b. Set (or program) the Type 3S6 Units/Div switch to 200.

c. Set the Type 191 for a 5 MHz, 5-volt peak to peak output signal.

d. Set the Type 3T6 Trigger Sensitivity control for a stable sine-wave display.

e. **Check** that the portion of the sweep preceding and during the first reference zone is chopped (see Fig. 8).

f. **Adjust** Chopper Drive control R13, by first turning it fully counterclockwise, then turing it back to a point about 15° beyond the point where the display of the sine wave begins to be chopped.

g. If misplaced dots occur at the beginning of the chopped trace, R13 may be adjusted farther clockwise to eliminate them. Further clockwise adjustment of R13, however, will shorten the life of reed switch K11A.

ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description	
			Capacitors		
Tolerance ±20% unless otherwise indicated.					
C11 (4)	281-0591-00		5600 pF	Cer	200 V
			Semiconductor Device, Diodes		
D11 (4)	*152-0107-00		Silicon	Replaceable by 1N647	
			Relays		
K11 (4)	*108-0499-00		Coil, Reed		
K11A (4)	260-1002-00		Reed		
			Connector		
P204	131-0325-00		24 pin, male		
			Resistors		
Resistors are fixed, composition, ±10% unless otherwise indicated.					
R11 (4)	315-0390-00		39 Ω	1/4 W	5%
R12 (4)	315-0151-00		150 Ω	1/4 W	5%
R13 (4)	311-0634-00		500 Ω, Var		
R14 (4)	317-0103-00		10 kΩ	1/8 W	5%
R15 (4)	317-0122-00		1.2 kΩ	1/8 W	5%
R16 (4)	317-0562-00		5.6 kΩ	1/8 W	5%
R17 (4)	317-0562-00		5.6 kΩ	1/8 W	5%
R18 (4)	311-0607-00		10 kΩ, Var		
R19 (4)	317-0106-00		10 MΩ	1/8 W	5%
			Switches		
Wired or Unwired					
SW11 (4)	260-0960-00		Slide	CHOPPER	

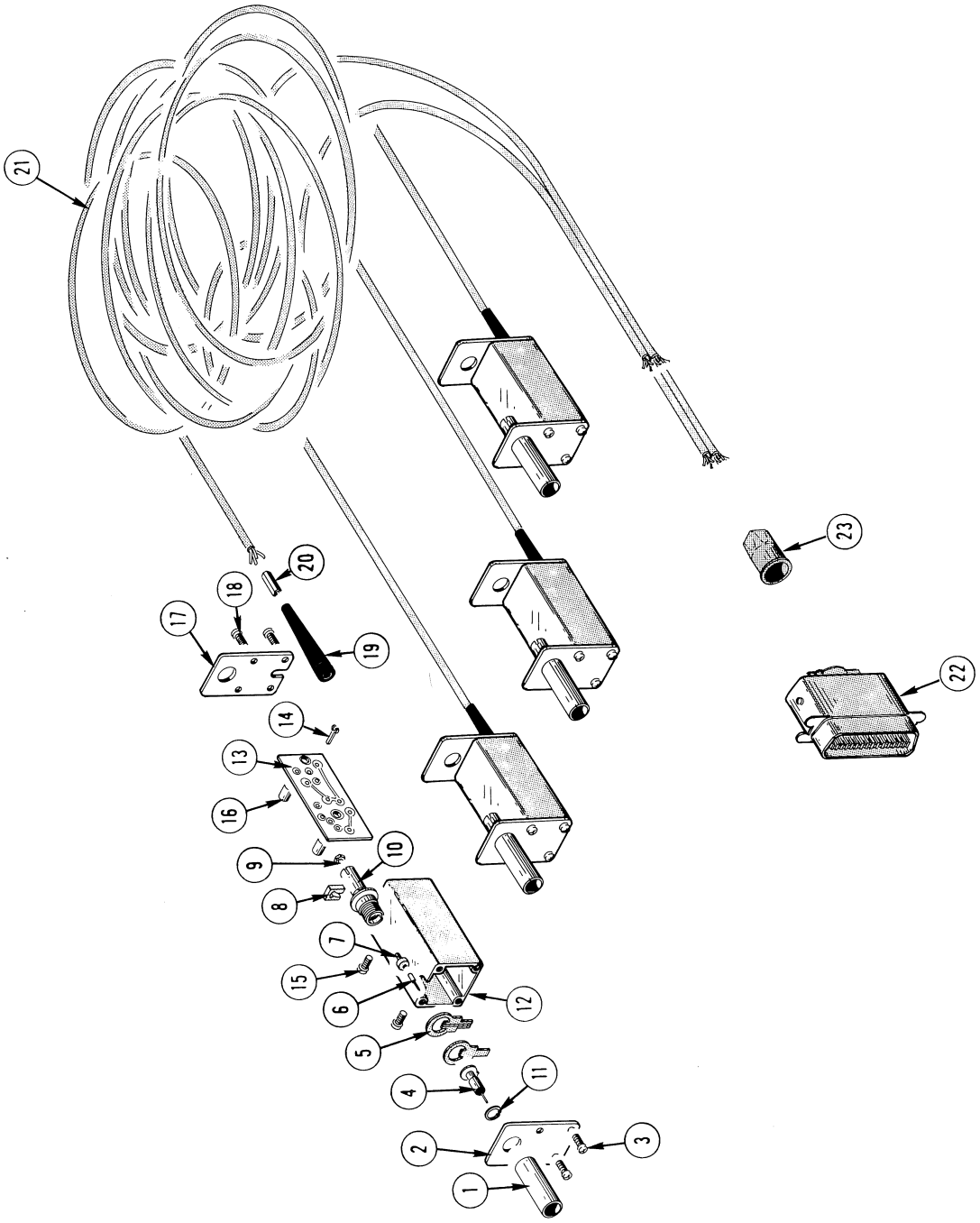
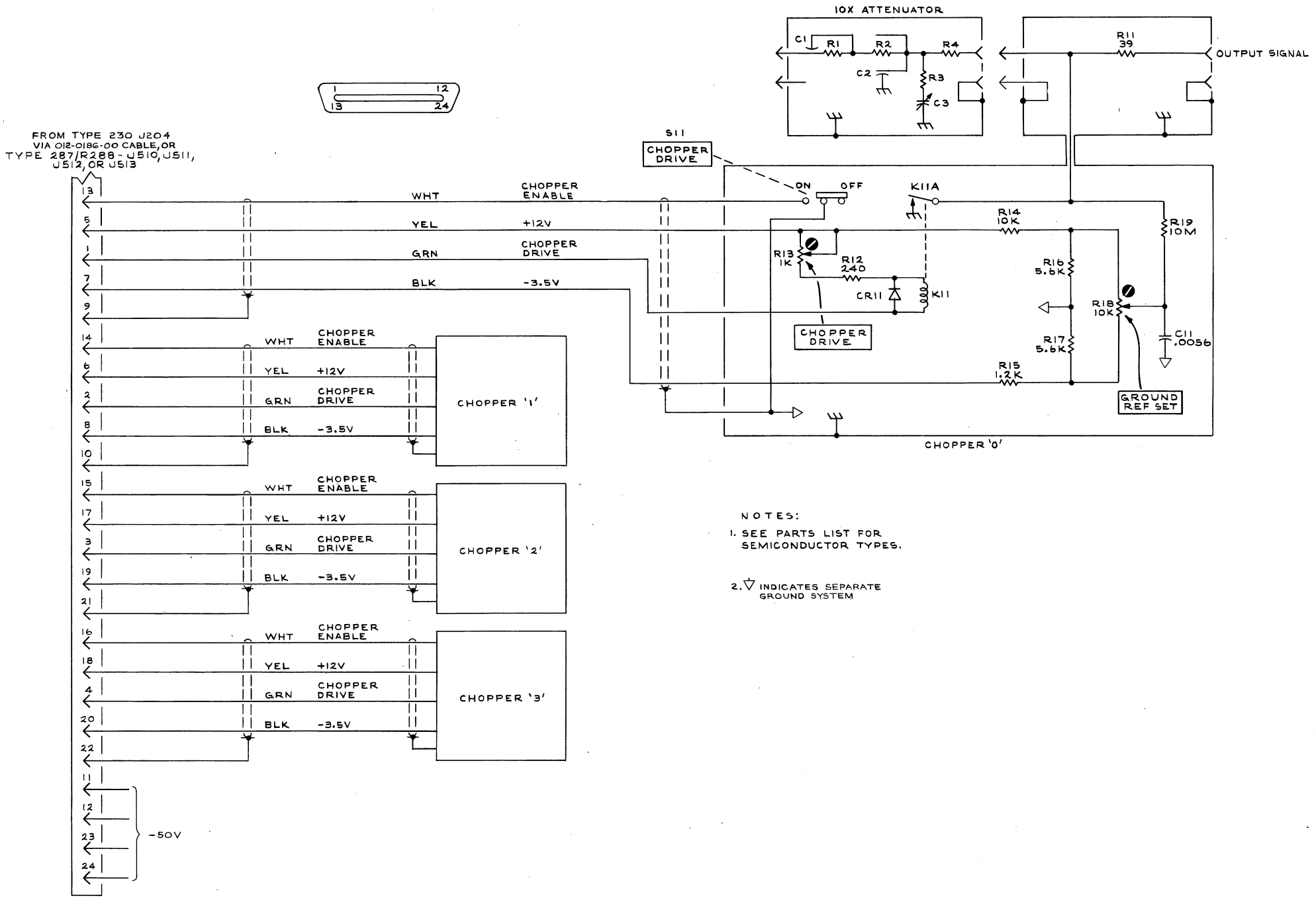


Fig. 9. Mechanical parts illustration.

MECHANICAL PARTS LIST

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty 1 2 3 4 5	Description
	015-0155-01			1	SIGNAL CHOPPER, w/accessories
	----------			-	signal chopper includes:
	015-0155-00			1	SIGNAL CHOPPER, quad
	----------			-	signal chopper includes:
1	166-0449-00			4	SLEEVE, attenuator support
2	386-1470-04			1	PLATE, front, silk screened 0
	386-1470-05			1	PLATE, front, silk screened 1
	386-1470-06			1	PLATE, front, silk screened 2
	386-1470-07			1	PLATE, front, silk screened 3
	----------			-	mounting hardware for each: (not included w/plate)
3	211-0065-00			4	SCREW, 4-40 X 0.188 inch, PHS
4	204-0375-00			4	BODY-TIP ASSEMBLY
5	214-1090-00			8	INSULATOR, bushing half
6	214-0592-00			4	CONTACT, wire form
7	131-0291-00			4	CONNECTOR, center assembly
8	344-0139-00			4	CLIP, retaining, U shape
9	377-0095-00			4	INSERT, pilot
10	205-0101-00			4	SHELL, electrical connector
	----------			-	mounting hardware for each: (not included w/shell)
11	354-0349-00			1	RING, retainer, C shape
12	204-0433-00			4	BODY, signal chopper
13	670-1011-00			4	CIRCUIT BOARD ASSEMBLY
	----------			-	each circuit board assembly includes:
	388-1088-00			1	CIRCUIT BOARD
	260-0960-00			1	SWITCH, slide (not shown)
14	214-0579-00			1	PIN, test point
	----------			-	mounting hardware for each: (not included w/
	----------			-	circuit board assembly)
15	211-0065-00			2	SCREW, 4-40 X 0.188 inch, PHS
16	129-0187-00			2	POST, metallic, 0.25 inch long
17	386-1513-00			4	PLATE, rear
	----------			-	mounting hardware for each: (not included w/plate)
18	211-0065-00			4	SCREW, 4-40 X 0.188 inch, PHS
19	200-0901-00			4	COVER, nipple, electrical, 1.625 inches long
20	166-0476-00			4	SLEEVE, ground, coaxial
21	175-0355-00			ft	CABLE ASSEMBLY, 4 conductor, w/jacket (60 feet)
22	131-0325-00			1	CONNECTOR, 24 pin, male
23	200-1119-00			1	CABLE NIPPLE, electrical, for 4
					STANDARD ACCESSORIES
	010-0367-00			4	ATTENUATION HEAD, 10X (not shown)
	070-1083-00			1	MANUAL, instruction (not shown)



NOTES:

1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

2. ▽ INDICATES SEPARATE GROUND SYSTEM

RMG
0570

QUAD SIGNAL CHOPPER CIRCUITS