INSTRUCTION MANUAL

Serial Number _____

TYPE L20-L30

SPECTRUM ANALYZER
PLUG-IN UNITS

Tektronix, Inc.
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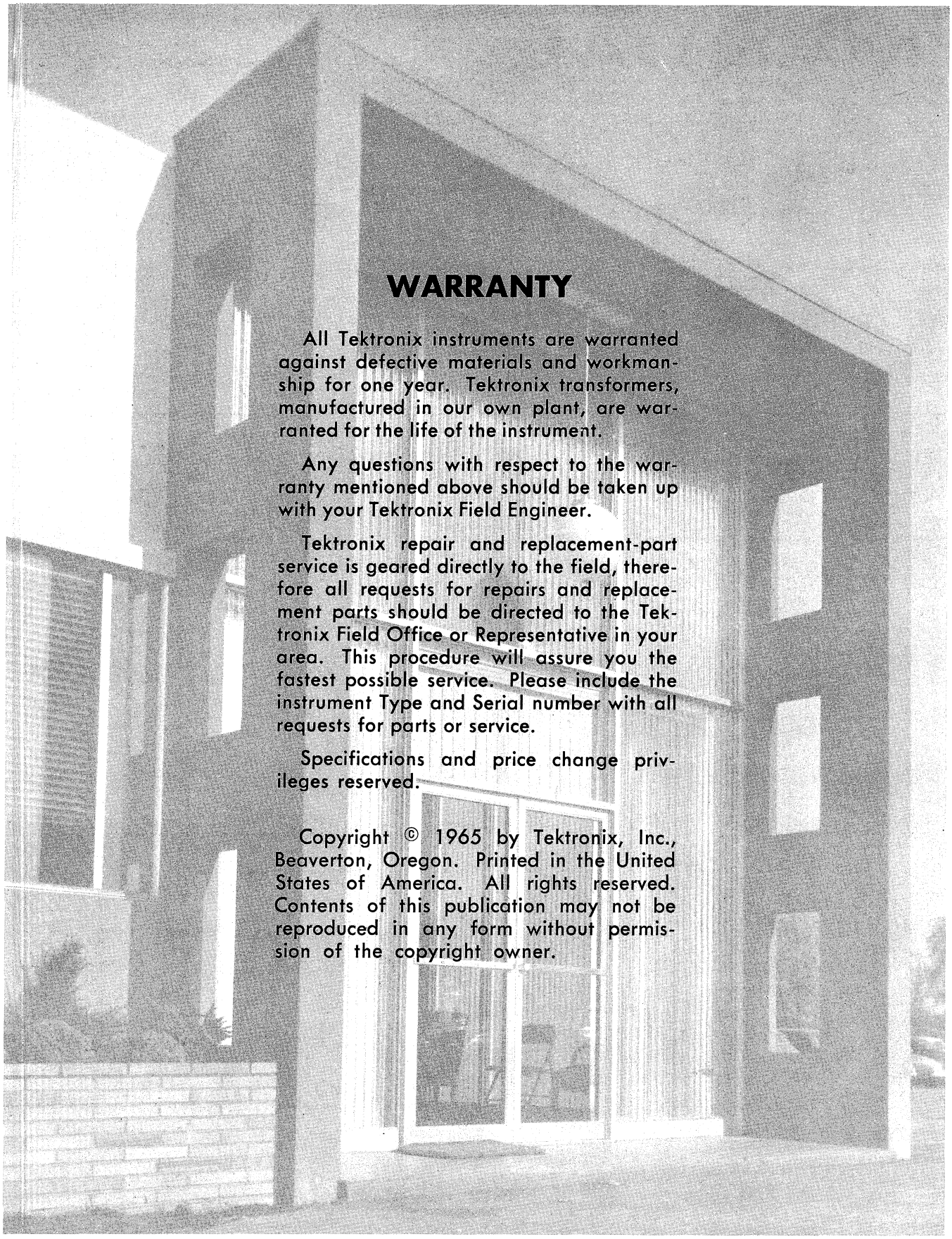
070-0474-00



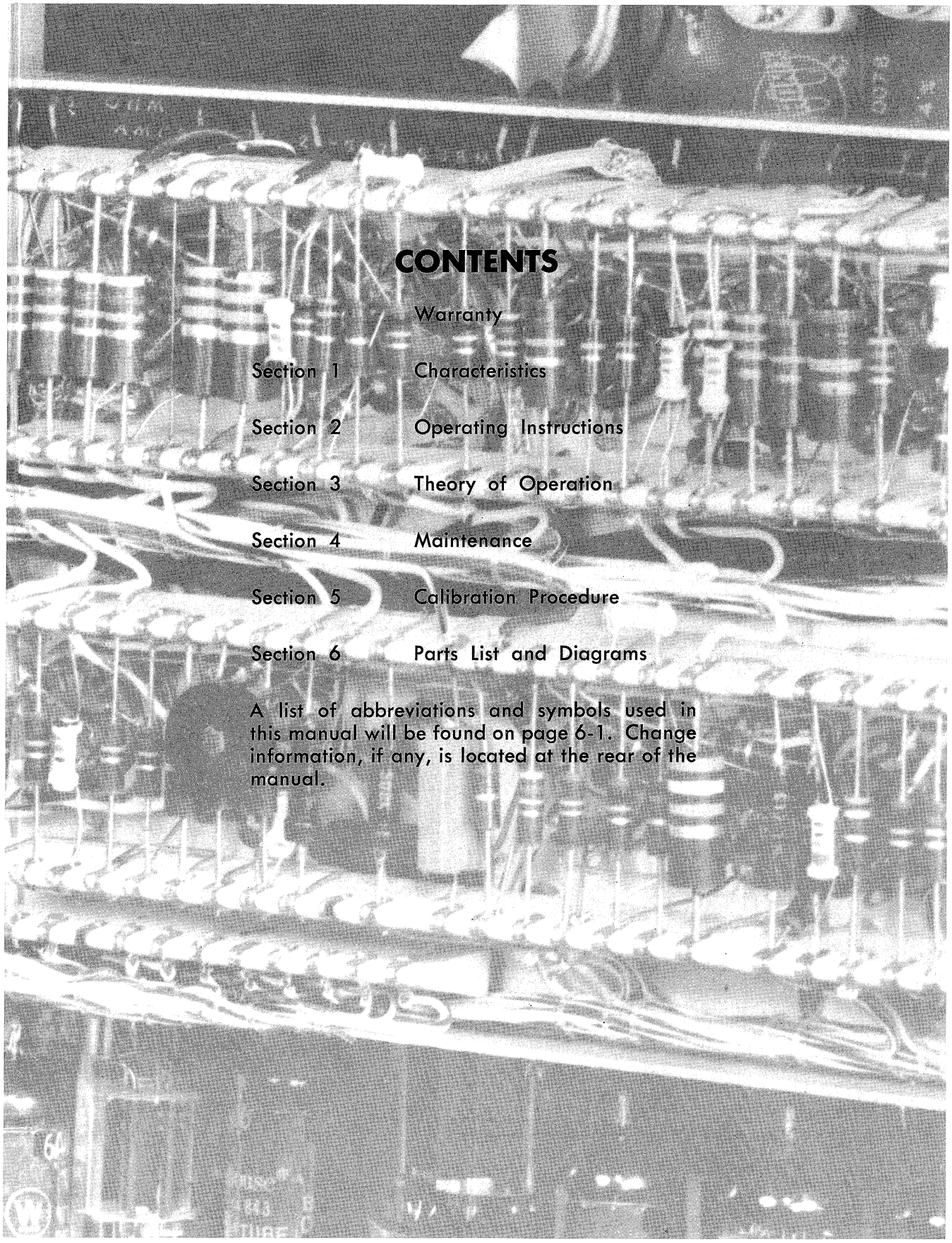
WARRANTY

All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our own 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.

Tektronix repair and replacement-part service is geared directly to the field, therefore 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 and Serial number with all requests for parts or service.

Specifications and price change privileges reserved.



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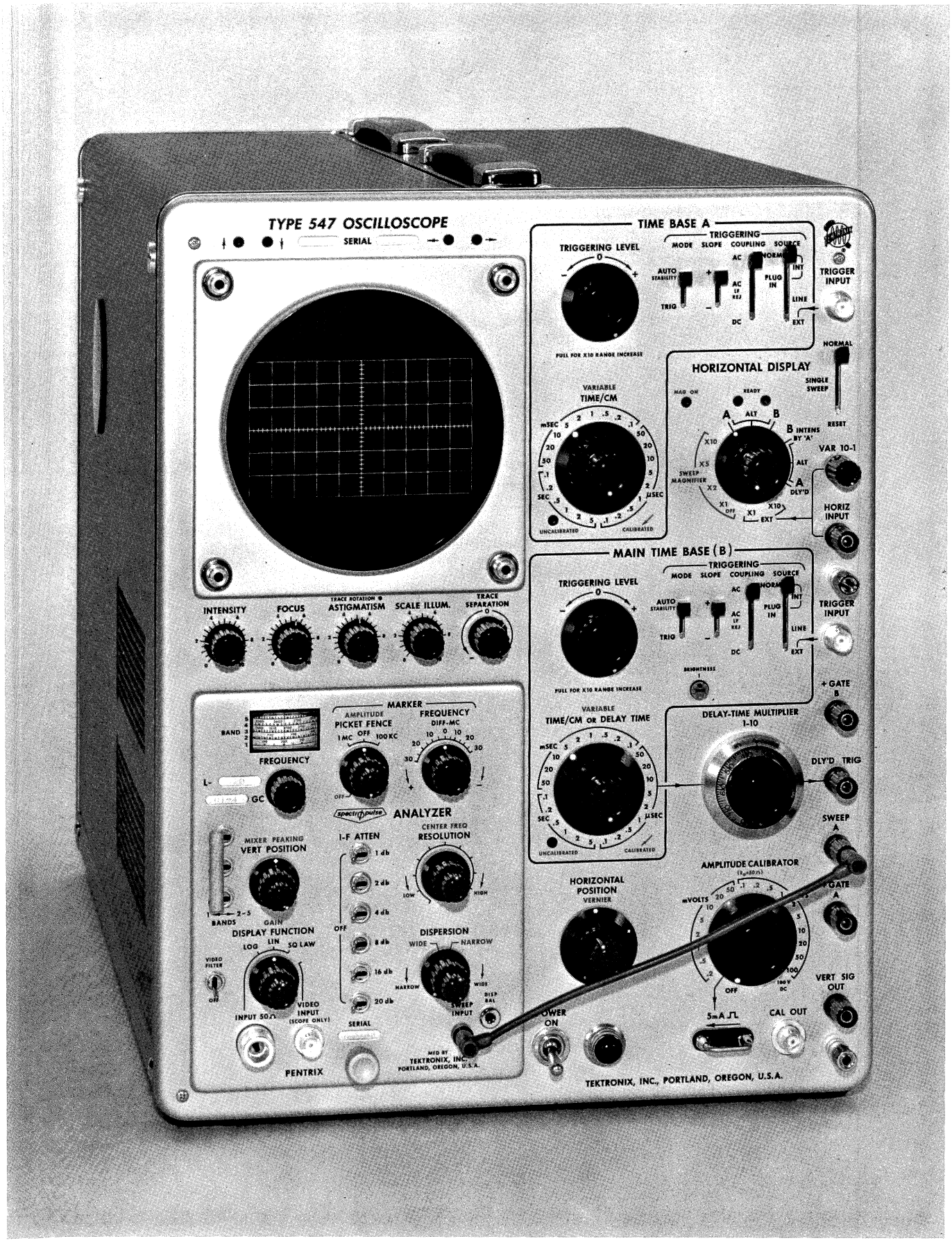
A list of abbreviations and symbols used in this manual will be found on page 6-1. Change information, if any, is located at the rear of the manual.



L-20 SPECTROPULSE Spectrum Analyzer

SECTION 1
CHARACTERISTICS

Introduction

This instruction manual applies to the Tektronix L-20 and L-30 SPECTROPULSE Spectrum Analyzers. The L-20 and L-30 Analyzers are designed for use in all Tektronix Type 530-, 540-, 550- and *580-Series Oscilloscopes.

The Type L-20 and L-30 differ primarily in their tunable frequency range. The Type L-20 is continously tunable over the frequency range of 10 mc to 4,000 mc. The Type L-30 is continuously tunable from 1,000 mc to 10,400 mc (see Table 1-1).

The SPECTROPULSE Spectrum Analyzer displays the frequency distribution of an applied signal spectrum along the horizontal axis of the oscilloscope and the signal energy is displayed on the vertical axis.

Specifications

Frequency Range — See Table 1-1.

Frequency Accuracy — 2 mc, ±1% of rf input frequency.

Frequency Linearity — ±3%.

Dispersion (frequency width of display) — Variable with the DISPERSION control from about 20 kc to **60 mc. Also, the dispersion may be narrowed further by the amount of sweep magnification used on the oscilloscope. For example, 5X magnification narrows the minimum dispersion figure to 4 kc.

Dispersion Linearity — Wide Dispersion: With 200 mc center frequency placed at the center graticule, linearity is within ±3% over 60 mc dispersion (+30 mc and —30 mc).
Narrow dispersion: with 200 mc center frequency at center graticule line, linearity is within ±5% over 5 mc (+2.5 mc and —2.5 mc). The Narrow Dispersion position is intended to give better control of dispersion between 5 mc and minimum, rather than providing a narrower range.

Display Flatness — ±3 db over width of the display.

Maximum rf Input Power (at 50 Ω INPUT Connector) — —30 dbm

Characteristic Input Impedance — Nominally 50 Ω

Resolution Bandwidth — Continuously adjustable, 1 kc to 100 kc.

Sweep Rate — Determined by oscilloscope TIME/CM switch. Typically from 5 sec/cm to 1 msec/cm, calibrated.

I.F. Attenuator — 51 db, ±0.1 db/db in 1 db steps.

I.F. GAIN Control — 50 db continuously variable, uncalibrated.

Vertical Display (with 6 cm screen) — LOG: 40 db
LIN: 26 db
SQ. LW: 13 db
VIDEO INPUT: about 0.1 v/cm, 10 cps to 10 mc. Input R of VIDEO INPUT connector is 100 Ω.

***A plug-in adapter must be used with 580-Series Oscilloscopes.**

****Band 1 of the Type L-20 is limited to a maximum dispersion usefulness of 5 mc due to a filter circuit. This filter is controlled by the bottom 2 toggle switches of the BAND switch. When observing frequency spectra above about 50 mc in band 1, the bar may be removed from the BAND switch and the filter network can be switched out of the circuit.**

Standard Accessories

1	012-031	Cord, Patch Banana Plug 18" Red
2	070-0474-00	Instruction Manuals

TABLE 1-1

TYPE L-20 (10-4,000 mc)			TYPE L-30 (1,000-10,400 mc)		
BAND	FREQUENCY RANGE (mc)	MINIMUM SENSITIVITY (—DBM)	BAND	FREQUENCY RANGE (mc)	MINIMUM SENSITIVITY (—DBM)
1	10-230	105	1	1,000-2,000	105
2	230-900	110	2	2,000-4,200	95
3	900-2,000	95	3	4,200-6,400	85
4	2,000-3,100	90	4	6,400-8,600	75
5	3,100-4,000	80	5	8,600-10,400	70

NOTES

SECTION 2

OPERATING INSTRUCTIONS

FUNCTION OF FRONT-PANEL CONTROLS AND CONNECTORS

FREQUENCY Control and Dial — Tunes the SPECTROPULSE Spectrum Analyzer to the frequencies to be displayed. The dial reading indicates the center frequency of the display when the display is centered.

PEAKING — Optimizes the conversion frequency of the first mixer circuit at the frequency under observation.

POSITION — Determines the vertical position of the display on the crt.

BANDS 1-2-5 (L-20 only) — Two-position switch that determines the frequency range of the FREQUENCY control.

GAIN — Controls i.f. amplification factor of the Spectrum Analyzer.

DISPLAY FUNCTION — The LOG, LIN, and SQ LW positions set the analyzer for different basic vertical displays. The VIDEO INPUT position permits a vertical input signal to be displayed on the oscilloscope for a conventional analog display of amplitude versus time. The vertical deflection factor in this case is 0.1 v/cm at frequencies from 10 cps to 10 mcs.

VID FIL — A two-position on-off switch that inserts a filter in the ON position. The filter restricts the bandwidth to prevent the occurrence of "zero beats" when resolving signals close to the minimum resolution of the unit.

INPUT 50 Ω — Connector for applying a signal for spectrum analysis when the DISPLAY FUNCTION switch is set to either LOG, LIN, or SQ LW.

MARKER

AMPLITUDE — Turns on the 200 mc marker oscillator and varies the amplitude of the marker.

PICKET FENCE — Three-position switch that puts a series of markers on the screen for frequency difference determination. In the 100 KC position, the markers are 100 kc apart and in the 1 MC position the markers are 1 mc apart. The MARKER AMPLITUDE varies the amplitude of the frequency markers.

FREQUENCY DIFF-MC — Control for varying the frequency of the 200-mc oscillator. The control has a frequency range of + and — 30 mc.

CENTER FREQ — A ten-turn control that determines the center frequency of the display.

RESOLUTION — Control that varies the resolution-bandwidth of the display from 1 kc (LOW) to 100 kc (HIGH).

IF ATTEN — Series of toggle switches that permit attenuation of the display from 1 to 51 db.

DISPERSION — A switch (red knob) and variable control (black knob) that varies the frequency width of the display.

*DISP BAL — Centers the display at 200 mc when the CENTER FREQ control is set properly.

SWEEP INPUT — Connector for applying the sawtooth voltage of the oscilloscope.

OPERATION

First-Time Operation

The following procedure provides a display with the SPECTROPULSE Spectrum Analyzer and demonstrates the function of various front-panel controls.

1. Before inserting the SPECTROPULSE Spectrum Analyzer into the oscilloscope, check the oscilloscope instruction manual to determine the nominal amplitude of the sweep or sawtooth output voltage—it will be either 100 or 150 volts. Then, on the rear of the plug-in unit, set the slide switch to 100 or 150, whichever is appropriate.

2. Insert the SPECTROPULSE Spectrum Analyzer into the oscilloscope, turn on the power and allow about 30 minutes for warm up.

3. Connect a patch cord between the oscilloscope Sawtooth Output connector and the SWEEP INPUT jack of the Spectrum Analyzer.

CAUTION

Be careful when making this connection since the sawtooth voltage can give a slight shock.

4. Set the Time/Cm of the oscilloscope to 2 mSec. (In actual practice the oscilloscope Time/Cm switch may be set to any desired setting from 5 Sec/Cm to 1 mSec/Cm.)

5. Set the front-panel controls of the SPECTROPULSE Spectrum Analyzer as follows:

POSITION	Midrange
PEAKING	Fully ccw
GAIN	Fully ccw
DISPLAY FUNCTION	LIN
VID FIL	OFF
MARKER AMPLITUDE	Fully cw

*Certain early instruments do not have this control.

PICKET FENCE	OFF
I-F ATTEN	All OFF
FREQUENCY DIFF-MC	0
CENTER FREQ	Midrange
RESOLUTION	Fully cw
DISPERSION	Red knob: WIDE Black knob: Fully cw
BAND (L-20 only)	2-5

6. Set the oscilloscope for a free-running sweep.

7. At this point there should be a trace displayed on the oscilloscope. If not, adjust the POSITION control of the Spectrum Analyzer along with the INTENSITY control of the oscilloscope. Also, check the setting of the HORIZONTAL DISPLAY or MODE switch of the oscilloscope. It should be set to 'A' or NORMAL.

8. Once a trace is obtained on the crt, set the FOCUS, ASTIGMATISM, and INTENSITY controls of the oscilloscope for a well-defined display.

9. Rotate the FREQUENCY DIFF-MC control back and forth while observing the screen. This will cause a spike or pip to move back and forth on the trace. It may be necessary to increase the gain with the GAIN control. This spike is the Marker generator signal. Return the FREQUENCY DIFF-MC control to exactly 0.

10. Set the HORIZONTAL POSITION control of the oscilloscope so that the trace starts on the first graticule line.

11. On the Spectrum Analyzer, set the FREQUENCY DIFF-MC control to the point where there is no horizontal shift of the displayed spike as the red DISPERSION knob is switched back and forth between WIDE and NARROW. Once this is completed, set the red DISPERSION knob to NARROW for the next step.

12. Slowly turn the black DISPERSION knob counterclockwise while adjusting the CENTER FREQ control to keep the displayed spike on the screen. Set the black DISPERSION knob to about midrange. Due to interaction, steps 11 and 12 should be repeated at least once.

*13. Set the DISP BAL (front panel screwdriver adjustment) to center the displayed signal on the graticule (make sure the start of the trace is positioned to the first graticule line with the Horizontal Position control of the oscilloscope). The setting of the DISP BAL control should be checked and reset, if necessary, occasionally during the regular use of the instrument.

14. Set the PICKET FENCE switch to 1 MC. This should cause the appearance of several smaller markers on each side of the main marker signal. These markers are 1 megacycle apart and are useful in determining the frequency at various points on the display or in determining the frequency width of the display (see Fig. 2-1).

15. Using the variable DISPERSION control (black knob), spread out the display so that about three picket-fence markers are displayed with the main center-frequency marker centered on the screen.

16. Turn the RESOLUTION control counterclockwise to the point where the displayed picket fence markers have the sharpest peak without appreciable loss of amplitude. This is the optimum setting of the RESOLUTION control for this setting of dispersion.

17. Set the PICKET FENCE switch to 100 KC. This should cause the appearance of several more closely spaced markers on both sides of the main marker.

18. Set the black DISPERSION control so the markers are spread across the screen.

19. With the RESOLUTION control, adjust for the best resolution between markers (see Fig. 2-2). The markers on the screen are 100 kilocycles apart. The higher frequency markers are to the left on the screen.

Applied Signal Precautions

Signals applied to the INPUT 50 Ω connector should be connected through a 50-ohm coaxial cable with a Type N male connector. Unshielded connections will tend to pick up stray unwanted signals and cause a confusing display. Before applying any signals to the INPUT 50 Ω connector, make sure the signal energy is —30 dbm (0 dbm = 1 mw) or less. Otherwise, the Spectrum Analyzer can be overdriven.

*Certain early instruments do not have this adjustment. With such instruments, skip this step and go on to step 14.

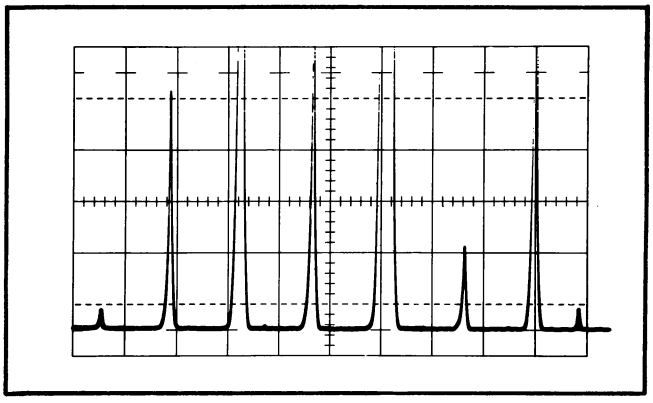


Fig. 2-1. Picket Fence display of 1 mc markers.

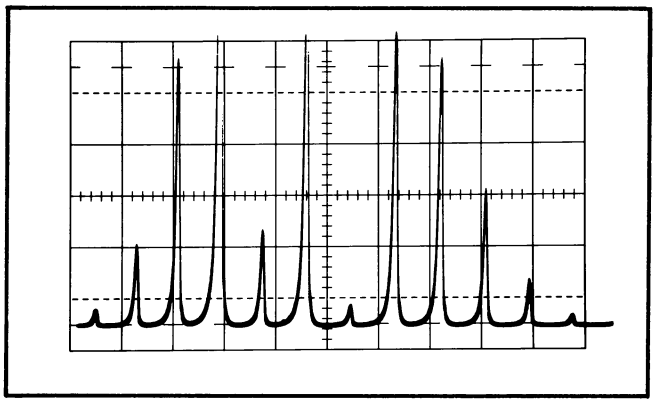


Fig. 2-2. Picket Fence display of 100 kc markers.

The characteristic input impedance (Z_o) at the INPUT 50 Ω connector is nominally 50 ohms. The dc input resistance of this connector is in the order of several hundred ohms. Proper matching between the device under test and the Spectrum Analyzer may be necessary to prevent adverse loading effects on the device under test.

Harmonic and Image Frequency Displays

Before making any measurements of a displayed signal (or signals), it must be determined that the signal is not a harmonic or an image frequency. To determine if the displayed signal is the signal indicated by the FREQUENCY dial, proceed as follows:

1. With the signal in question displayed on the screen, set the DISPERSION switch to WIDE and adjust the variable DISPERSION control so that the frequency width of the display is greater than 50 megacycles. (The frequency width of the display can be determined with the marker signal using the FREQUENCY DIFF-MC control. Move the marker signal to each end of the display with the FREQUENCY DIFF-MC control and note the reading at the two extremes—the difference between the two readings must exceed 50 megacycles.)

2. Turn the FREQUENCY dial in the direction of increasing frequency. The signal must move from the left side of the screen to the right. If not, the observed signal is an image frequency and the FREQUENCY dial must be set 400 mc (twice the I-F of the analyzer) above its present reading to observe the true signal.

3. To determine if the displayed signal is a harmonic, move the FREQUENCY dial so that the displayed signal is on the first graticule line on the left-hand side of the screen and note the reading of the FREQUENCY dial. Set the FREQUENCY dial to a setting exactly 50 megacycles above the noted setting. With the marker signal (FREQUENCY DIFF-MC control) check to see if the displayed signal moved 50 mc on the screen. If the signal moved 50 mc on the screen, the display is correct. If the signal moved more than 50 mc on the screen, then a lower dial frequency must be selected. If the signal moved less than 50 mc, then a higher dial frequency must be selected. See Fig. 2-3.

Obtaining Optimum Resolution

The resolution of the SPECTROPULSE Spectrum Analyzer is the measure of the capability of the instrument to separate individual signals. The resolution of the analyzer is a function of both the IF bandwidth and the sweep frequency rate.

To optimize resolution for CW signals with a given DISPERSION setting, set the RESOLUTION control for the maximum setting at which no loss of sensitivity is noticed. When examining two closely spaced CW signals, the RESOLUTION control is adjusted until two signals can be separated.

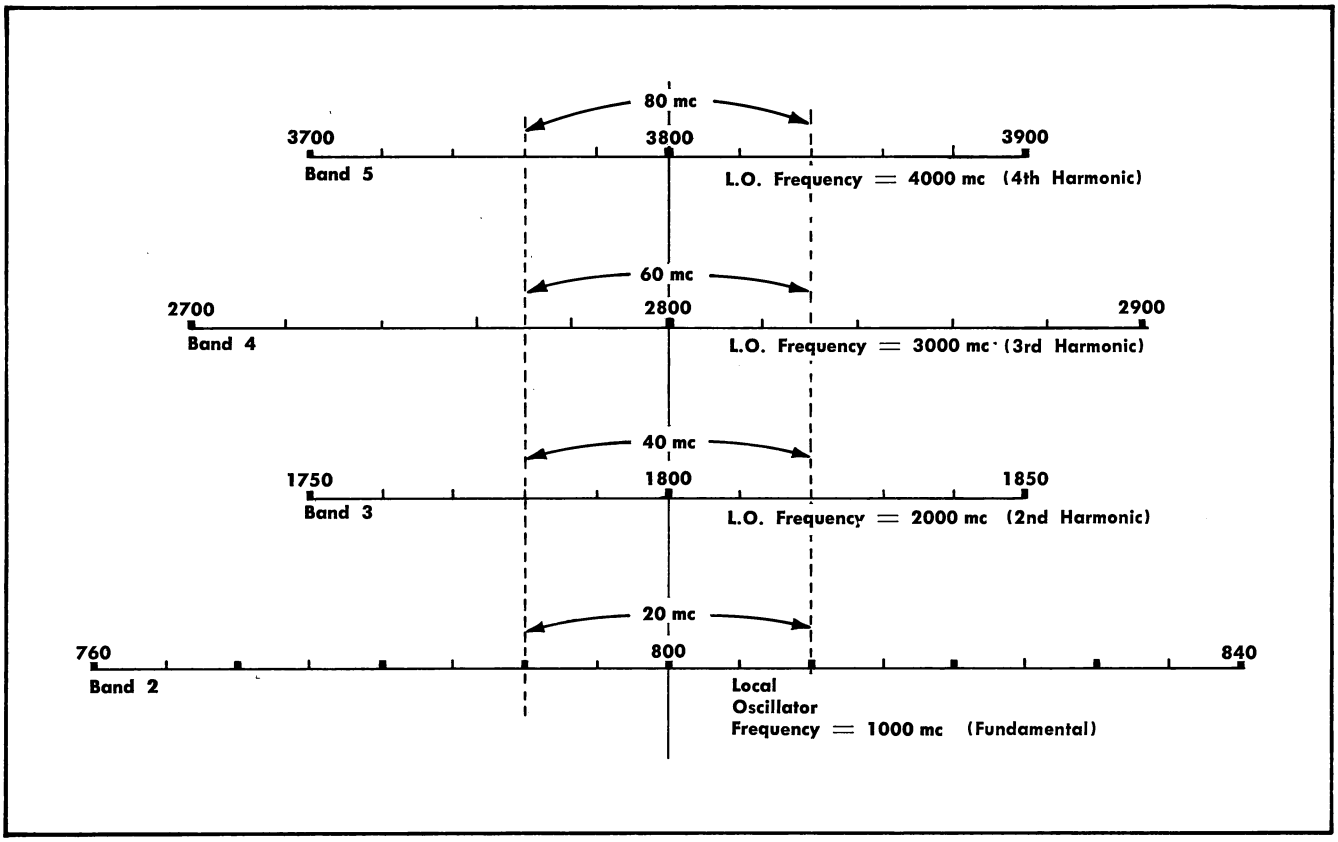


Fig. 2-3. Illustration of relationship between FREQUENCY dial reading, local oscillator frequency and applied signal frequency on bands 2-5 of a Model L-20.

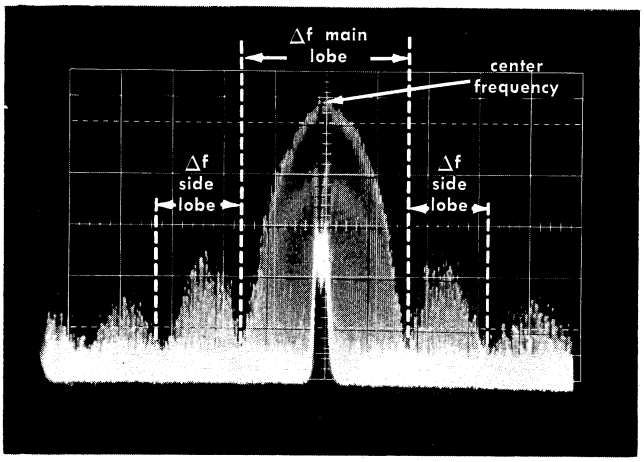


Fig. 2-4. Display of the frequency spectra of a pulsed c.w. signal.

Sensitivity of the Spectrum Analyzer to pulse signals is a function of the bandwidth of the instrument. However if the bandwidth is too large, the minima of the spectrum are no longer zero. The Spectrum Analyzer can be adjusted for best operation by first setting the oscilloscope sweep rate for a pulse repetition frequency of about 40 lines in the principal lobe of the spectrum. Then, adjust the RESOLUTION control for well-defined lobe zeros without ringing (see Fig. 2-4). This setting corresponds to a bandwidth-pulse width product of 0.1 or less.

Frequency Difference Measurements

The SPECTROPULSE Spectrum Analyzer is capable of making frequency difference measurements between two points on the display. Frequency difference measurements are made as follows:

1. Set the FREQUENCY dial so that the signals (or frequency lobes) of interest are centered in the display.

2. Set the DISPERSION control so that the signals of interest are spread apart as far as possible (up to 10 graticule divisions).

3. Rotate the FREQUENCY DIFF-MC control so that the marker signal is superimposed over one of the signals or frequency lobes. Note the reading of the FREQUENCY DIFF-MC control.

4. Rotate the FREQUENCY DIFF-MC control to superimpose the marker over the other signal or frequency lobe. Note the reading of the control.

5. Calculate the algebraic differences between the readings of steps 3 and 4. The result is the frequency difference in megacycles of the two signals measured.

Precision Frequency Difference Measurements

The Picket Fence provides for greater accuracy when making frequency measurements. The Picket Fence markers are spaced at equal frequency intervals on the display (see Figs. 2-1 and 2-2). The frequency spacing of the Picket Fence is determined by the setting of the PICKET FENCE switch; either 1 megacycle or 100 kilocycles. To measure the frequency difference between two points on the display with the Picket Fence marker, count the number of markers between the two points. The higher frequencies are to the left of the screen. Use the graticule divisions to interpolate frequencies between markers.

For higher resolution in frequency measurements, use the expanded sweep feature of the oscilloscope. This will increase the frequency resolution of the display by the amount of sweep expansion used.

Absolute Frequency Measurements

Absolute frequency measurements can be made from the FREQUENCY dial with a reasonable amount of accuracy (2 mc, ±1% of the frequency of the signal being measured). To measure the frequency of an applied signal, proceed as follows:

1. Set the variable DISPERSION control (black knob) fully clockwise.

2. Set the MARKER AMPLITUDE control fully clockwise and set the PICKET FENCE control to OFF.

3. With the marker signal displayed on the screen, alternately switch the DISPERSION range control (red knob) back and forth and, at the same time, set the FREQUENCY DIFF-MC control for minimum horizontal shift of the marker signal.

4. Slowly turn the variable DISPERSION control (black knob) counterclockwise and, at the same time, keep the marker signal on the screen with the CENTER FREQ control.

5. Set the variable DISPERSION control (black knob) to about midrange and repeat steps 3 and 4 until there is no further interaction.

6. With the HORIZONTAL POSITION control of the oscilloscope, position the marker signal to the centerline of the screen. All dial settings of the FREQUENCY dial now correspond to the center of the screen.

7. Turn the MARKER AMPLITUDE control to OFF.

8. Turn the FREQUENCY dial to the point where the signal of interest is positioned to the centerline of the graticule. The reading of the FREQUENCY dial now corresponds to the frequency of the signal being measured.

Frequency Spectra Measurements of Pulsed Signals

The main frequency lobe and side lobes of a pulse modulated signal can be displayed and measured with the SPECTROSCOPE Spectrum Analyzer as follows:

1. Adjust the DISPERSION control and FREQUENCY dial so that the main frequency lobe of the displayed signal is in the approximate center of the crt screen and the side lobes of interest are visible.

2. Turn on the marker signal and set the AMPLITUDE control so that the marker is clearly visible.

3. Set the FREQUENCY DIFF-MC control so that the marker is superimposed on the main lobe of the displayed signal.

4. Set the GAIN and I-F ATTEN so that the main lobe fills the screen vertically and the side lobes of interest are of sufficient amplitude for viewing.

5. Set the sweep rate of the oscilloscope so the spectrum is well defined (1/50 of the pulse repetition rate).

6. Set the RESOLUTION control so that the low points in the spectrum are easily discernible without excessive loss of sensitivity.

7. The equivalent pulse width of the modulating signal can be determined by measuring the frequency width of either the main lobe (Δf main) or a side lobe (Δf side) as per "Frequency Difference Measurements" of this section and calculating for pulse with (t) as follows:

$$t = \frac{2}{\Delta f \text{ main}}$$

or

$$t = \frac{1}{\Delta f \text{ side}}$$

Where: t = pulse width in microseconds

Δf main = frequency width of main lobe

Δf side = frequency width of side lobe

Repetition Rate Measurements of Pulsed Signals

The following instructions describe how to measure the repetition frequency of a pulsed signal:

1. With the signal of interest displayed on the screen, set the FREQUENCY dial so the signal appears at the center of the screen.

2. Set DISPERSION controls to minimum (DISPERSION range (Red Knob) in NARROW, variable DISPERSION control full ccw).

3. Set the sweep controls of the oscilloscope for + internal triggering and set the Stability and Triggering Level controls for a stable trace.

4. Set the Time/Cm switch of the oscillscope to display several frequency bursts of the applied signal.

5. Measure the distance between the frequency bursts, in graticule divisions, and multiply this distance times the setting of the Time/Cm switch. The reciprocal of this product is the repetition frequency, in cycles per second, of the pulsed signal.

NOTES

SECTION 3

THEORY OF OPERATION

General Description

The SPECTROPULSE Spectrum Analyzer is a superheterodyne receiver that is electronically swept over the portion of the frequency spectrum that is displayed on the screen of the oscilloscope. Horizontal deflection on the screen of the oscilloscope is proportional to frequency, with the higher frequencies displayed toward the left-hand side of the screen. Vertical deflection on the oscilloscope corresponds to signal power. The resulting display is of signal strength versus frequency.

Figs. 3-1 and 3-2 show block diagrams of the L-20 and L-30 Spectrum Analyzers. The block diagram of Fig. 3-2 is the common circuit for both types of analyzers. The differences between the two types of analyzers are shown in Fig. 3-1 (RF front-end sections).

R.F. Front-End Sections

Each of the rf sections shown in Fig. 3-1 are tunable over a given frequency range. The basic difference between the rf sections is their frequency range. The L-20 contains two oscillators for greater range while the L-30 rf section contains one oscillator circuit.

The rf sections contain a tuned cavity triode oscillator. Frequency of the cavity oscillator is controlled with the front-panel FREQUENCY control.

The rf sections contain a mixer circuit for mixing the applied frequency spectra with the tunable oscillator. Output of the mixer is coupled via the wide band filter to the Wide Band I.F. Amplifier circuit.

The remaining circuits of the SPECTROPULSE Spectrum Analyzers are the same for each type of unit.

Wideband I.F. Amplifier Chassis

The wideband amplifier chassis contains a two-stage i.f. amplifier, a mixer stage and a swept local oscillator. Fig. 3-3 shows a simplified schematic diagram of the circuits in the Wideband I.F. Amplifier chassis.

Output of the r.f. section is applied to the wideband i.f. amplifier through connector J101 (see Fig. 3-3). The two-stage i.f. amplifier is a conventional common-emitter tuned amplifier. The emitters of Q101 and Q102 are r.f. grounded through C105 and C124. Center frequency of the amplifier is 200 mc and the bandpass is ± 30 mc. L-C circuits L101-C101 and L111-C127 set the high and low frequency limits of the amplifier. Connector J102 is the input for the 200 mc marker signal.

The output of the i.f. stages is coupled to the base of the First Mixer (Q103). The output of the Sweep Local Oscillator is also coupled to the base of the First Mixer. The Swept Local Oscillator is swept in frequency from 229 mc to 289 mc or less but is centered around 259 mc when the CENTER FREQ control is set for center. The Swept Local Oscillator is driven by the sweep voltage of the oscilloscope. This sweep voltage is applied to a Varicap (D101) which changes in capacitance with changes in bias.

The First Mixer stage has an output frequency of 59 mc. A 59 mc trap at the base of Q103 keeps the stage from oscillating and also makes the stage less sensitive to 59 mc at its input. Resonant frequency of the mixer stage is set by C113.

The mixer stage produces an output signal only during the comparatively brief periods when the swept local oscillator frequency is 59 mc above any of the signal content of the i.f. amplifier output. Since the frequency change of the Swept Local Oscillator is coincident with the sweep voltage of the oscilloscope, a stable display will be produced of all repetitive signal spectra contained in the output of the i.f. amplifier. Output of the First Mixer is transformer coupled to the I.F. ATTEN and then to the Narrowband I.F. Amplifier. The I.F. Attenuator is a six-section pi attenuator. Each section may be switched in or out with the I.F. ATTEN switches. The attenuator maintains a constant 50 Ω input and output impedance regardless of the setting of the I.F. ATTEN switches.

Narrowband I.F. Amplifier Chassis

The Narrowband I.F. Amplifier chassis contains a two-stage, 59-mc i.f. amplifier, the second mixer, a crystal local oscillator and a single-stage 5-mc narrowband amplifier (see Fig. 3-4).

The two-stage 59 mc i.f. amplifier receives its input signal through J201 from the I.F. ATTEN. The two-stage amplifier is a conventional common-emitter, transformer coupled amplifier. Both stages are tuned to 59 mc with C204 in the first stage and C213 in the second stage. Gain of Q201 and Q202 stage is varied by changing the dc bias current with R207 (GAIN control). The 59-mc output signal of the i.f. amplifier is transformer coupled to the base of the second mixer stage (Q203).

Output of the 54-mc Crystal Local Oscillator (Q204) is also applied to the base of the second mixer stage (Q203). The Second Mixer stage amplifies the difference frequency of its two input signals of 54 mc and 59 mc. T203 of the mixer stage is tuned to 5 mc.

Output of the Second Mixer stage is transformer coupled to the base of the 5-mc Narrowband Amplifier stage (Q205). 5-mc peaking of the stage is accomplished by T204. The output of the 5-mc Narrowband Amplifier is transformer coupled to the 5-mc Variable Bandwidth Amplifier.

5-MC Variable Bandwidth Amplifier

This circuit provides variable resoultion in the display of the oscilloscope. The resolution is varied by changing the dc bias voltage on the 5-mc crystal Y601 with R611 (RESOLUTION control). Changing the dc bias voltage across the crystal changes the 'Q' of the crystal which, in turn, changes the selectivity (or bandwidth) of the tuned circuit.

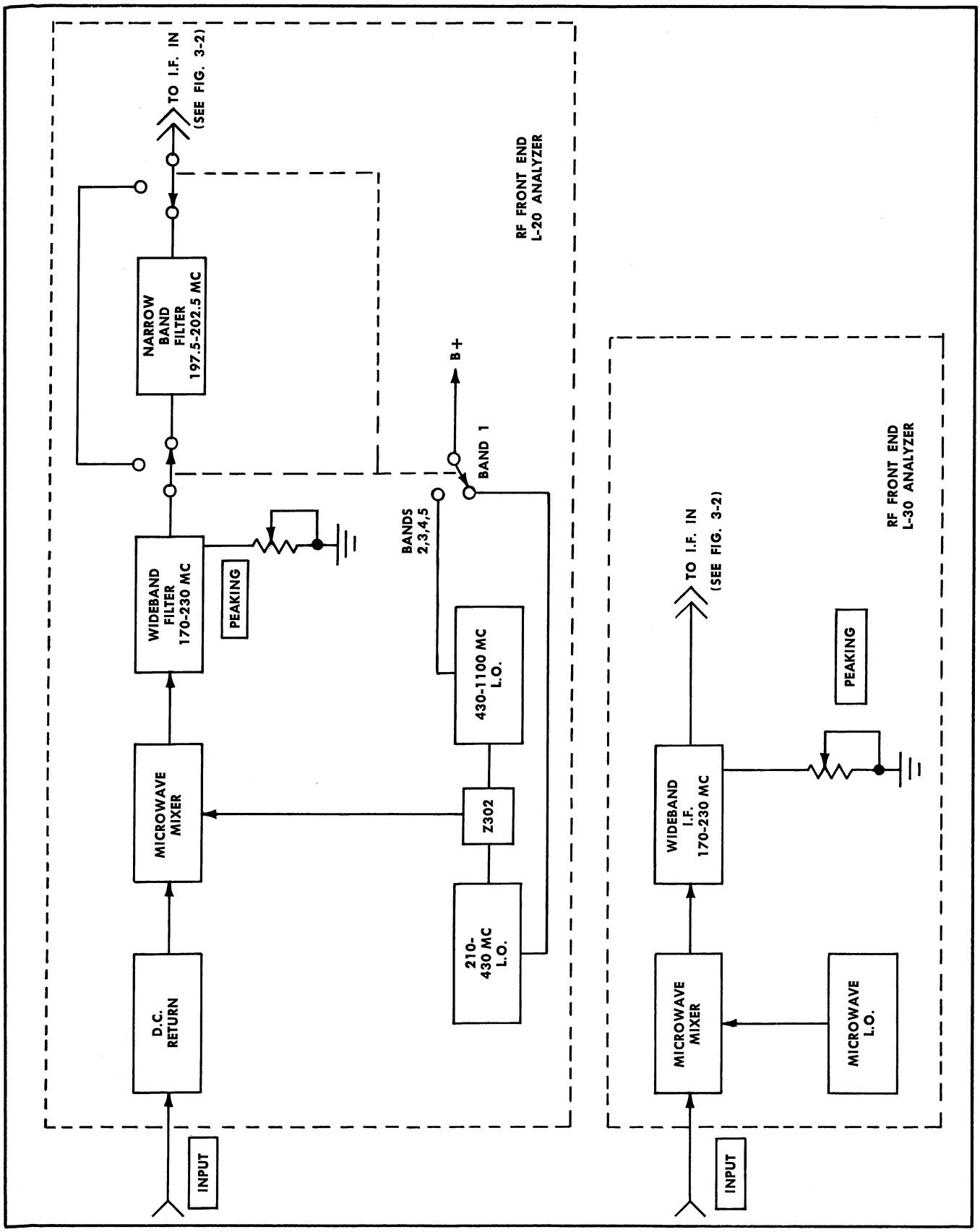


Fig. 3-1. Model L-20 and L-30 SPECTROPULSE Spectrum Analyzers, Block Diagrams of R.F. Sections.

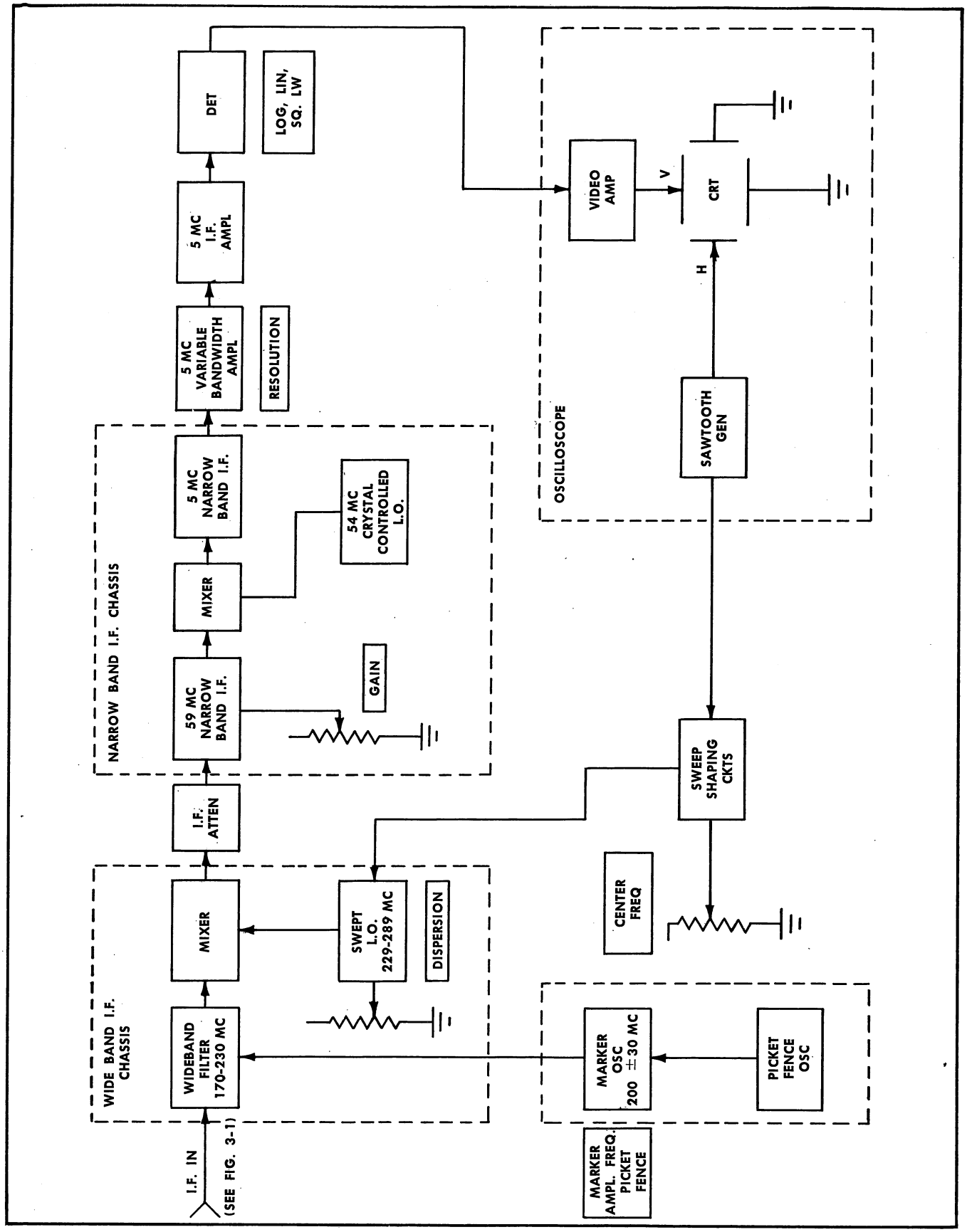


Fig. 3-2. I-F System Block Diagram.

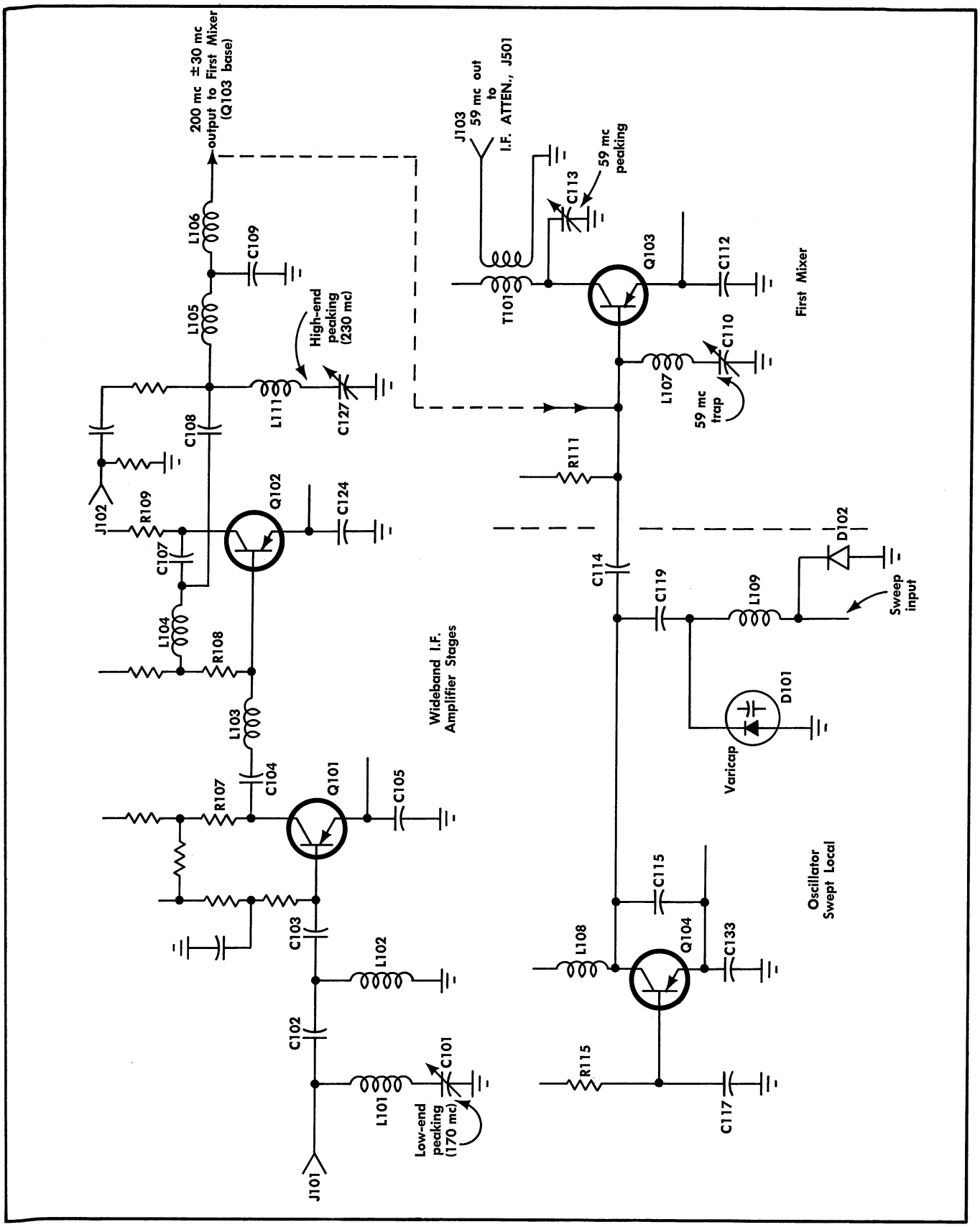


Fig. 3-3. Simplified schematic of the Wideband I.F. chassis circuitry.

Q601 and Q602 are broadband untuned amplifier stages. Signal path through the two stages is as follows: From the secondary of T602, the signal passes to the base of Q602. The amplified signal of Q602 appears at its collector and is capacitively coupled to the base of Q601 through C605. The output at the collector of Q601 passes through C608 and R608 to the DISPLAY FUNCTION switch SW301.

5-MC I.F. Amplifier and Detector

Before reaching the control grid of the 5-mc i.f. amplifier, the signal passes through a section of the DISPLAY FUNCTION switch. In the LOG position of the DISPLAY FUNCTION switch, the signal passes straight through to the control grid of V301. In the LIN position, the signal is attenuated approximately 3 times by the voltage divider R303 and R301. In the SQ LW (square law) position, small signals are attenuated more than large signals. This is due to non-linear characteristics of the diodes; with small signals (or with low forward bias voltage), a diode has higher impedance than it has with larger signals (or higher forward bias voltage). In the VIDEO INPUT position of the DISPLAY FUNCTION switch, the control grid of V301 if grounded and the 5-mc i.f. is blocked.

V301 is a tuned 5-mc amplifier. The tank circuit consists primarily of L301 and L302 in parallel, and C304 plus distributed capacity. The circuit is tuned with the variable inductor L301.

D302 is the detector diode. L303, C305 and C306 form a low pass filter to block any 5 mc signal remaining in the detected signal. The VID FIL switch inserts additional capacity across the output of the detector filter network and limits the high frequency response of the detector. The output of the detector circuit passes through another section of the DISPLAY FUNCTION switch to the vertical input of the oscilloscope when the switch is in the LIN and SQ LW positions. In the LOG position of the DISPLAY FUNCTION switch, the signal from the detector passes through a resistance network and diode D303. This network offers a lower series impedance to small amplitude signals and a low shunt impedance to high amplitude signals. This provides for a logarithmic response to higher amplitude signals. In the VIDEO INPUT position of the DISPLAY FUNCTION switch, the output of the detector circuit is disconnected and the signal from the VIDEO INPUT connector is connected to the vertical input of the oscilloscope. The GAIN control (R311) is a variable attenuator that provides the desired oscilloscope deflection factor (uncalibrated). The POSITION control varies the dc voltage on one vertical input of the oscilloscope and controls the vertical position of the display on the screen.

Sweep Shaping Circuit

The sweep shaping circuit provides the driving voltage for the Varicap D101 in the Swept Local Oscillator circuit. The DISPERSION control varies the amplitude of the driv-

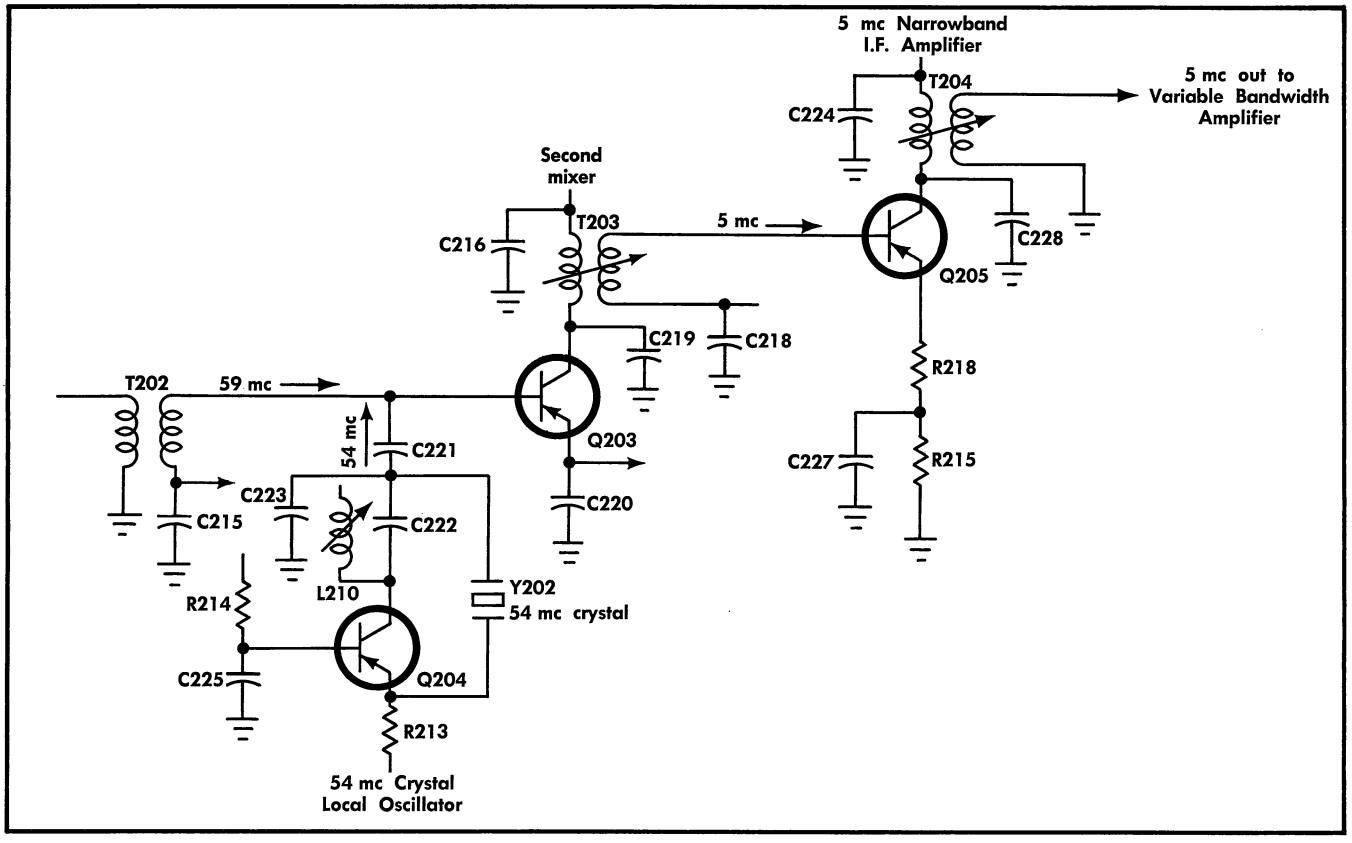


Fig. 3-4. Simplified schematic of the Narrowband I.F. chassis circuitry.

ing voltage and the CENTER FREQ control varies the average dc level of the driving voltage.

Since the capacitance change in the Varicap is not exactly proportional to the voltage change across it, the sweep shaping circuit forms a non-linear driving voltage. The non-linearity of the driving voltage is such that it offsets the non-linear capacitance change of the Varicap and makes the capacitance change in the Varicap linear in relation to time.

This shaping of the sweep is accomplished by placing three diode networks in the feedback path from the output of the shaping circuit (pin 6 of V303) to the control grid of V302. Each diode (D305, D306 and D307) is biased at a different dc level. D305 has a positive bias on its cathode, D306 is biased at ground, and D307 has a negative voltage on its cathode. As the sweep voltage across the diode circuits increases, the diodes come into conduction at various points on the rising sawtooth voltage. This causes a non linear voltage increase at the grid of V302 (pin 7). Since V302 is a comparator (difference amplifier), the voltage difference between its two control grids is amplified and is passed to the next stage (V303). V303 is also connected as a voltage comparator and further amplifies the difference between the linear and non linear sawtooth voltages. This non linearity is designed to match and cancel the non linear characteristics of the Varicap diode D101.

Marker Circuit

The Marker circuit is a 200 mc ±30 mc tunnel diode oscillator which can be frequency modulated with either 100 kc or 1 mc. The frequency output of the tunnel diode oscillator can be varied ±30 mc with the FREQUENCY DIFF-MC control C410.

The modulating oscillator (Q401) has selectable tank circuits in its collector that are switched in and out with the PICKET FENCE switch SW401.

The amplitude of the marker oscillator is varied with R414. The diode arrangement of D402, D403 and D404 help maintain a constant load on the oscillator as the AMPLITUDE control is varied by bypassing more or less signal to AC ground via C413, C414 and C415.

SECTION 4

MAINTENANCE

PREVENTIVE MAINTENANCE

Recalibration

To assure accurate measurements, check the calibration of this unit after each 500 hours of operation or every six months if used intermittently. Complete calibration instructions are given in Section 5.

Visual Inspection

The SPECTROPULSE Spectrum Analyzer should be inspected occasionally during routine maintenance for such defects as broken connections, broken or damaged ceramic strips, improperly seated tubes or transistors and heat-damaged parts.

The remedy for most visible defects is obvious; however, particular care must be taken if heat-damaged parts are located. Overheating is usually only a symptom of trouble. For this reason, it is essential to determine the actual cause of overheating before the heat-damaged parts are replaced; otherwise, the damage may be repeated.

Cleaning

The SPECTROPULSE Spectrum Analyzer should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket and prevents efficient heat dissipation. It also provides an electrical conduction path.

To clean the interior of the unit, blow off the accumulated dust with dry, low-pressure air. Remove any dirt which remains with a cloth dampened with a mild detergent and water solution or a soft paint brush. A cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning ceramic terminal strips.

The front panel of this unit can be cleaned with a soft cloth dampened with a mild solution of water and detergent. Do not use abrasive cleansers.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this unit. Avoid chemicals such as benzene, toluene, xylene, acetone, or similar solvents.

CORRECTIVE MAINTENANCE

Soldering

Ceramic Terminal Strips. A 40- to 75-watt soldering iron with a 1/8" wide chisel-shaped tip should be used when soldering to the ceramic terminal strips. The solder used should contain about 3% silver. Ordinary tin-lead solder can be used occasionally without damage to the ceramic terminal strips. If ordinary solder is used repeatedly or if excessive heat is applied, the solder-to-ceramic bond can be broken.

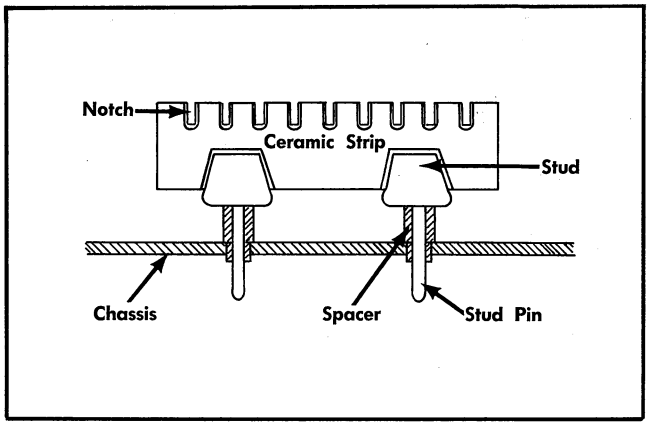


Fig. 4-1. Installation of a ceramic strip.

Solder containing 3% silver is generally available locally or it can be purchased from Tektronix in one-pound rolls; order by Tektronix Part Number 251-514.

The following precautions should be observed when soldering to ceramic terminal strips:

1. Use a hot iron for a short time. Apply only enough heat to make the solder flow freely.

2. Maintain a clean, properly tinned tip.

3. Avoid putting pressure on the ceramic terminal strip.

4. Do not attempt to fill the metal-strip notch with solder; use only enough solder to cover the wires adequately.

Metal Terminals. When soldering metal terminals (e.g., interconnecting plug pins, switch terminals, potentiometers, etc.), ordinary 60/40 solder can be used. The soldering iron should have a 40- to 75-watt rating with a 1/8" wide chisel-shaped tip.

Observe the following precautions when soldering metal terminals.

1. Apply only enough heat to make the solder flow freely.

2. If a wire extends beyond the solder joint, clip the excess close to the joint.

3. Apply only enough solder to form a solid connection. Excess solder may impair the function of the part.

Component Replacement

Certain parts in the instrument are easier to replace if a definite procedure is followed. The procedure for replacing these parts are outlined in the following paragraphs.

Many electrical components are mounted in a particular manner to reduce or control stray capacitance. Duplicate the original location and mounting when replacing components. When selecting replacement parts, remember that the physical nature of a component can affect its performance at high frequencies. After repair, check instrument calibration.

The shielded chassis must be removed from the unit for maintenance or repair. Special test setups are necessary for operational checks of these chassis when removed from the instrument. Therefore, it is recommended that the SPECTROPULSE Spectrum Analyzer be returned to a Tektronix Maintenance Center if trouble exists in any of the sealed units. Before returning the unit however, be sure that the trouble cannot be corrected by transistor or tube replacement or a calibration adjustment.

Repairs should not be attempted on the local oscillator (RF Front End).

NOTE

Turn off the indicator unit power before replacing any components.

Standard Parts

All electrical and mechanical part replacements for the SPECTROPULSE Spectrum Analyzer can be obtained through your local Tektronix Field Office or representative. However, since many of the electronic components are standard parts, they can generally be obtained locally in less time than is required to order them from the factory. Before purchasing replacement parts, consult the Parts List for values, tolerances, ratings and Tektronix Part Number.

Special Parts

In addition to the standard electronic components, some special parts are used in the production of the SPECTROPULSE Spectrum Analyzer. These parts are manufactured or selected by Tektronix to meet specific performance requirements, or are manufactured for Tektronix in accordance with our specifications. Most of the mechancial parts used in this instruments have been manufactured by Tektronix. These special parts are indicated in the Parts List by an asterisk preceding the part number. Order all special parts directly from your Tektronix Field Office or representative.

Ceramic Terminal Strip Replacement

A complete ceramic terminal strip assembly is shown in Fig. 4-1. Replacement strips (including studs) and spacers are supplied under separate part numbers. The old spacers may be reused unless they are damaged.

To replace a ceramic terminal strip, first unsolder all connections. Then the damaged strip can be pried loose from the chassis. If the spacers come out with the strip, remove them from the stud pins to be used for installation of the new strip.

After the damaged strip has been removed, place the undamaged spacers in the chassis holes. Then, carefully press the studs into the spacers until they are completely seated. If necessary, use a soft mallet and tap lightly, directly over the stud area of the strip.

Tubes and Transistors

Do not replace tubes or transistors unless they are actually defective. If tubes or transistors are removed during routine maintenance, return them to their original sockets.

Static tube- or transistor-testers are not recommended for locating a defective tube or transistor. These testers often indicate a defective component when it is operating satisfactorily in a circuit, or may fail to indicate a characteristic which affects circuit performance. Since dynamic testers check operation under simulated circuit conditions, they provide a better check of component operation. However, the best overall test of tube or transistor performance is to substitute a new component or one which has been previously checked.

If a tube or transistor performs satisfactorily, do not replace it. Unnecessary replacement of components may require recalibration of the instrument. If tubes or transistors are replaced, check the operation of the unit.

Tubes and transistors used in the SPECTROPULSE Spectrum Analyzer have been selected for the specific performance characteristics desired. Replacement tubes or transistors, even if of the same type, may not work properly if not selected to provide the desired performance. Therefore, order tubes and transistors from Tektronix by the part numbers listed in the Parts List.

Rotary Switches

Individaul wafers or mechanical parts of rotary switches are normally not replaced. If a switch is defective, replace the entire assembly. Replacement switches can be ordered either wired or unwired; refer to the Parts List for part numbers.

TROUBLESHOOTING

Introduction

The following information is provided to facilitate troubleshooting of the SPECTROPULSE Spectrum Analyzer if trouble develops. During troubleshooting, information contained in this section of the manual should be used along with information obtained from other sections (e.g., Diagrams, Operating Instructions, etc.).

Troubleshooting Aids

Circuit diagrams are given on pullout pages in Section 6. The circuit numbers for each electronic component in this unit along with important voltages and waveforms are shown on these diagrams.

Test Equipment

The following equipment will be useful in troubleshooting the SPECTROPULSE Spectrum Analyzer.

1. Dynamic Transistor Tester

Purpose: To test transistors and diodes used in this unit.

Description: Tektronix Type 575 Transistor-Curve Tracer or equivalent.

2. Dc Voltmeter

Purpose: To check operating voltages in the unit.

Description: 20,000 ohms/volt.

3. Test Oscilloscope

Purpose: To check circuit operation.

4. Flexible Plug-In Extension Cable

Purpose: Permits maximum accessibility to the unit while operating the unit outside of the plug-in compartment.

Description: 30", 24-pin. Tektronix Part Number 012-038.

Check Front-Panel Controls

Before proceeding with extensive troubleshooting, check the front-panel control settings. An incorrect control setting can produce an apparent trouble. If in doubt as to the proper setting of a control, see "First-Time Operation" in Section 2.

Check Oscilloscope

The oscilloscope can be checked for proper operation by substituting another plug-in unit which is known to be operating properly. If the trouble persists after substitution, the oscilloscope is defective.

Trouble Location

If the SPECTROSCOPE Spectrum Analyzer is definitely at fault, make a careful operational check of the unit. Note the effect that each front-panel control has on the symptom. Also check the effect of the calibration adjustments. The normal or abnormal operation of each control or adjustment may help isolate the trouble to the defective circuit.

After the trouble has been isolated to a particular circuit, perform a complete visual check of that circuit. Many troubles can be found most easily by visual means. If a visual check fails to detect the cause of trouble, check the tubes or transistors used in the circuit by replacing them with tubes or transistors known to be good (or check with a dynamic tester). Most of the troubles which occur result from tube or transistor failures. Be sure to return any tubes or transistors found to be good to their original sockets.

The following general troubleshooting procedure may aid in location of the defective component after the tubes or transistors have been found to be good.

1. Isolate the trouble to a portion of the circuit if possible.

2. Recheck the reaction of the front-panel controls and calibration adjustments of the affected circuit.

3. Check the voltages in the circuit. Typical operating voltages are given on the schematic diagrams.

4. Check waveforms in the circuit with a test oscilloscope. Typical waveforms are shown on the schematic diagrams.

5. Check the components in the circuit (i.e., check for faulty capacitors, off-tolerance resistors, etc.).

NOTES

SECTION 5

CALIBRATION

Introduction

Calibration of the SPECTROPULSE Spectrum Analyzer should be checked whenever parts are replaced. In order to reduce the amount of realignment required, realign only the stages that are directly associated with the replacement parts.

The following procedure is a complete alignment procedure for the Spectrum Analyzer. It is divided into sections that correspond to the subchassis.

Equipment Required

The following equipment, or the equivalent, is recommended for aligning the SPECTROPULSE Spectrum Analyzer:

1. Tektronix Type 530-, 540- or 550-Series Oscilloscope.

2. Flexible plug-in extension cable; Tektronix part number 012-038.

3. Sweep-frequency generator capable of sweeping the frequency from 170 mc to 230 mc. A Telonic Type HD3 or equivalent is recommended.

4. R.F. signal generator capable of 59 through 230 mc output frequencies with the frequency accuracy as high as practical. A Hewlett-Packard Model 608 or equivalent is recommended.

5. Special Alignment tools: Tektronix part numbers 003-394 and 003-399.

Preliminary Setup

Set the front-panel controls of the SPECTROPULSE Spectrum Analyzer as follows:

PICKET FENCE	OFF
AMPLITUDE	OFF
CENTER FREQ	Midrange (5 turns from either end)
RESOLUTION	Clockwise
DISPERSION (Both)	WIDE
I-F ATTEN	OFF
GAIN	Midrange
DISPLAY FUNCTION	LIN
POSITION	Midrange
VID FIL	OFF

Set the controls of the oscilloscope as follows:

NOTE

If the oscilloscope has two time bases (Time Base A and Time Base B for example) use the Time Base A controls in the following procedure.

STABILITY	Fully clockwise
TIME/CM	2 mSEC
SWEEP MAGNIFIER	OFF or NORMAL (X1)

Connect the SPECTROPULSE Spectrum Analyzer to the flexible plug-in extension cable (item 2 of the Equipment Required) and then connect the cable to the oscilloscope. Make a connection between the SWEEP INPUT of the Spectrum Analyzer and the sweep or sawtooth output of the oscilloscope.

In the following procedure, refer to Figs. 5-1 and 5-2 to locate test points and/or adjustments.

Wideband I.F. Amplifier Alignment

1. Set the sweep frequency generator (item 3 of Equipment Required) so that it sweeps in frequency from approximately 170 mc to 230 mc.

2. Apply the output of the sweep frequency generator to the I.F. input connector (J101) of the Wideband I.F. chassis.

3. Set the output amplitude of the sweep frequency generator and the GAIN control of the Spectrum Analyzer for 2-4 centimeters of vertical deflection.

4. Set the CENTER FREQ control of the Spectrum Analyzer so that the display produced by the sweep frequency generator is approximately centered on the screen.

5. Adjust C101 so that the displayed amplitude at 170 mc (the right-hand side of the signal display) is approximately 1 db lower in amplitude than the 200 mc point (the middle of the signal display).

NOTE

1 db is approximately 2 mm of CRT Display when the DISPLAY FUNCTION switch is set to the LOG position.

6. Adjust C127 so that the upper end (left side) of the displayed sweep frequency signal is approximately 1 db lower in amplitude than the 200 mc point on the display.

7. Disconnect the sweep frequency generator from J101 and apply a 59 mc signal from the signal generator (item 4 of Equipment Required) to J101.

8. Adjust the output amplitude of the signal generator for 2-4 divisions of vertical deflection.

9. Adjust C110 for minimum vertical deflection on the oscilloscope.

10. Adjust C113 for maximum vertical deflection on the oscilloscope.

11. Due to interaction between steps 9 and 10, they should be repeated to obtain their optimum settings.

12. Set the output frequency of the r.f. signal generator to 200 mc.

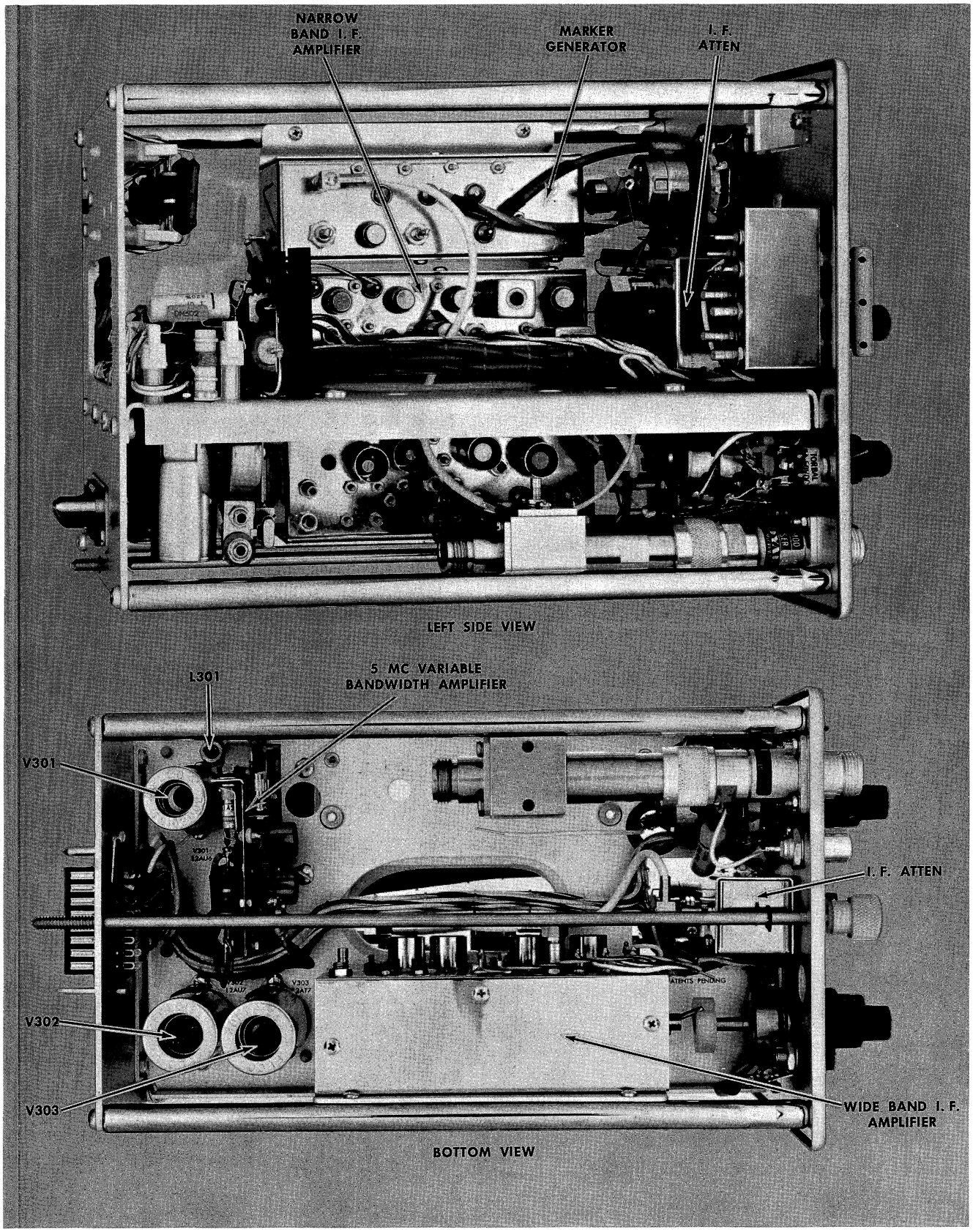


Fig. 5-1. Type L-20/30 Location of subassemblies and adjustments.

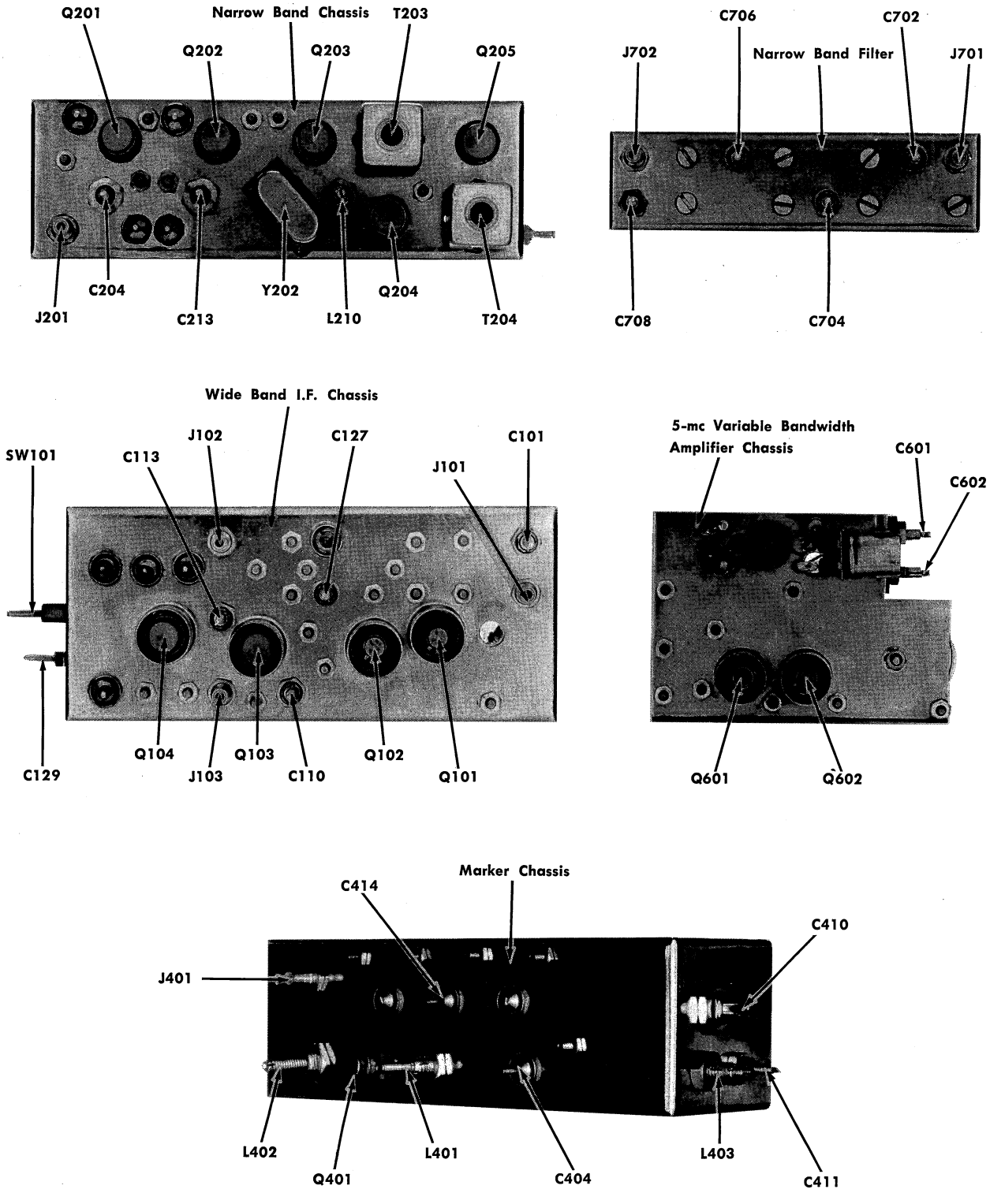


Fig. 5-2. Type L-20/30 Location of test points and adjustments.

13. Set the output amplitude of the generator for 2-4 divisions of vertical deflection.

14. With the CENTER FREQ control, move the signal to the center of the trace.

15. Set the two-position DISPERSION range switch (red knob) to NARROW.

16. Adjust C129 to center the signal on the trace. The signal should be in the same position on the trace as in step 14.

Narrowband I.F. Amplifier Alignment

With the equipment connected as in step 16 of Wideband I.F. Amplifier Alignment, proceed as follows:

1. Adjust C204 for maximum amplitude of the displayed 200 mc signal.

2. Adjust C213 for maximum amplitude of the displayed 200 mc signal.

3. Turn L210 clockwise just to the point where the 200-mc signal disappears. Turn L210 counterclockwise 1/4 to 1/2 way to the point where the 200-mc signal reappears and there is minimum noise displayed on the trace.

4. Adjust T203 for maximum amplitude of the displayed 200-mc signal.

5. Adjust T204 for maximum amplitude of the displayed 200-mc signal.

Detector Amplifier Alignment

With the equipment connected as in step 5 of Narrowband I.F. Amplifier Alignment, adjust L301 for maximum amplitude of the displayed 200-mc signal.

5-MC Variable Bandwidth Amplifier Adjustment

1. Set the RESOLUTION control fully clockwise.

2. Set the Marker AMPLITUDE control fully clockwise.

3. Set the FREQUENCY DIFF-MC control to position the 200-mc marker to the approximate center on the screen. Turn the PICKET FENCE switch to OFF.

4. Set the DISPERSION control so the base of the signal is about 3 cm wide and set the GAIN control so the signal is about 4 cm tall.

5. Adjust C601, C602, L301, T203, and T204 for a symmetrical waveform with a flat top (see Fig. 5-3). The dip shown in the middle of the waveform is not necessarily required and should not exceed 3 db below the top of the waveform.

Marker Alignment

With the equipment connected as in step 1 of Detector Amplifier Alignment, proceed as follows:

1. Set the red DISPERSION knob to WIDE.

2. Set the output frequency of the r.f. signal generator to 170 mc, 190 mc, 200 mc and 230 mc and, in turn, mark the screen of the oscilloscope with a grease pencil to note the positions of these frequencies.

3. Turn the marker AMPLITUDE control (red knob concentric with the PICKET FENCE control) fully clockwise.

4. Set the FREQUENCY DIFF-MC control to —30 and adjust L403 so that the marker signal on the screen corresponds to the 170-mc mark on the crt screen.

5. Set the FREQUENCY DIFF-MC control to +30 and adjust C411 so that the marker signal on the screen corresponds to the 230-mc mark on the crt screen.

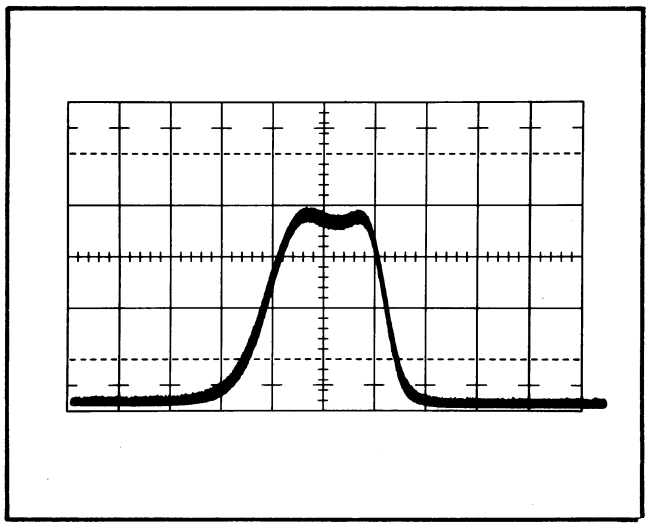


Fig. 5-3. I.F. Response waveform.

6. Due to the interaction between steps 4 and 5, they should be repeated until no further adjustment is necessary.

7. Set the PICKET FENCE switch at 1 MC.

8. With the FREQUENCY DIFF-MC control, move the Picket Fence signal between the 190 mc and 200 mc marks on the screen of the oscilloscope.

9. Adjust L401 for exactly 1 picket fence marker per cm (not counting the markers superimposed at the 190 mc and 200 mc marks.)

10. With the DISPERSION control and the r.f. signal generator, adjust the frequency width of the display so that a point on the right-hand side of the screen can be marked as a 199-mc point and the left-hand side of the screen can be marked as the 200-mc point.

11. Set the PICKET FENCE switch to 100 KC and set the FREQUENCY DIFF-MC control so that the markers are centered on the graticule.

12. Set the RESOLUTION control so that the individual Picket Fence markers are easily discernible.

13. Adjust L402 to obtain exactly 9 markers between the 199 mc and 200 mc points on the screen (not counting the markers at the 199 mc and 200 mc points on the screen).

Narrowband Filter (Model L-20 Only)

1. Set the output frequency of the r.f. signal generator to 12.5 mc and connect the output of the generator to the 50 Ω INPUT connector of the Model L-20 SPECTROPULSE Spectrum Analyzer.

2. Set the BAND switch of the Spectrum Analyzer to BAND 1.

3. Set the FREQUENCY dial to 10 mc.

4. Set the MARKER AMPLITUDE (red knob) control fully clockwise and set the PICKET FENCE control to 1 MC.

5. Set the FREQUENCY DIFF-MC control to 0.

6. With the DISPERSION controls, spread the markers so that 6 markers are displayed across the screen. (The first marker on the screen must correspond to the first graticule line and the sixth marker must correspond to the last graticule line.) Turn off the PICKET FENCE switch and set the 200 mc marker to the graticule center with the CENTER FREQ control.

7. Turn off the MARKER AMPLITUDE switch.

8. Set the GAIN control of the Spectrum Analyzer so that the r.f. signal generator has a displayed amplitude of 4 to 6 major divisions with the signal at the left hand edge of the screen. (Readjust generator frequency slightly if necessary.)

9. Adjust C706 for minimum spurious signal in the middle of the trace.

10. Adjust C708 for minimum spurious signal at the right-hand side of the trace.

11. With the FREQUENCY control of the Spectrum Analyzer, move the signal back and forth across the screen and check for flatness and the recurrence of spurious signals over the entire length of the trace. The displayed amplitude should not be down more than 3 db at the ends. Adjust C704 as required for best flatness on both ends.

12. Repeat steps 9 through 11 to see if further adjustment is required with C706 and C708.

13. Set the FREQUENCY dial of the L-20 to about 30 mc.

14. Adjust C702 for minimum spurious signal on the trace.

15. Due to interaction, recheck the settings of C708, C706, C704 and C702 and readjust as necessary.

Check of Mixer and R.F. Section

1. With a voltmeter, check for proper plate and filament voltages at the points shown in Fig. 5-4 or 5-5. Fig. 5-4 applies to the Model L-20 SPECTROPULSE Spectrum Analyzer and Fig. 5-5 applies to the Model L-30 SPECTROPULSE Spectrum Analyzer.

2. Connect a 0-16 milliammeter between the terminal on the Wideband Filter and ground. (The Wideband Filter has two coaxial connectors and a terminal and is located just below the R.F. Section.)

3. Turn the front-panel PEAKING control fully clockwise. The milliammeter should read between 80 μa and 12 ma for a Model L-30 throughout the range of the Frequency control. For a Model L-20 the current is not critical as long as there is measurable current and the instrument meets sensitivity requirements throughout all bands. Excessive current (well above 12 ma) or no current, with either the L-20 or L-30 indicates that the R.F. Section is faulty or out of adjustment.

4. If the current measurement in step 3 is too low or if the plug in unit does not meet sensitivity requirements, check the mixer diode before removing the R.F. Section for tube replacement. The Mixer is located just behind the 50 Ω INPUT connector and is held in place by a type N connector from the 50 Ω INPUT connector. Unscrew this connector, and one end of the mixer may be lifted out. By disconnecting the two cables, the mixer can be removed from the instrument. With a $\frac{5}{8}$" open-end wrench, remove the barrel portion of the mixer assembly. Once the barrel is removed from the Mixer, the mixer diode is accessible and may be unplugged. Remove the diode and check its forward and back resistance with a dc-ohmmeter. If this check does not indicate a shorted or open diode, assume that the diode is good and plug it back into the Mixer housing. Replace the barrel of the Mixer assembly. Reconnect the cables and the connector from the 50 Ω INPUT connector to the Mixer assembly.

NOTE

This completes the check of the R.F. Section and Mixer. If the proper indications were obtained in steps 1 through 4, the R.F. Section and Mixer may be assumed to be operating properly. Adjustment of the R.F. Section is not necessary unless it has been disassembled. If the R.F. Section was proven faulty by the previous steps, the tube in the R.F. Section should be replaced as per the following.

R.F. Section Oscillator or Tube Replacement

NOTE

Type L-20: In the event of a failure of the R.F. Section Oscillator of a Type L-20, it is recommended that the entire plug-in unit be sent to the nearest Tektronix maintenance center. If this is not possible, use the following procedure for replacing the defective local oscillator tube of the Type L-20.

Type L-30: Do not attempt to replace the oscillator tube in the R.F. Section of a Type L-30. If possible, send the entire plug-in unit to the nearest Tektronix maintenance center. If this is not possible, order a complete local oscillator assembly through your local Tektronix field engineer. Directions for removing and replacing the R.F. Section of a Type L-30 appear in this section under "Model L-30".

MODEL L-20

1. Remove the FREQUENCY knob with an Allen wrench and check to see if there is a retaining nut under the knob on the front panel. Remove the nut if present and proceed to step 2. Otherwise, remove the remaining front panel control knobs. Mark the original position of all the knobs so they may be returned to this position when they are replaced. Remove all retaining nuts from the toggle switches. Remove the bar from the three BANDS toggle switches. Lift off the front panel. On the front sub-panel, remove the two screws near the shaft of the FREQUENCY control.

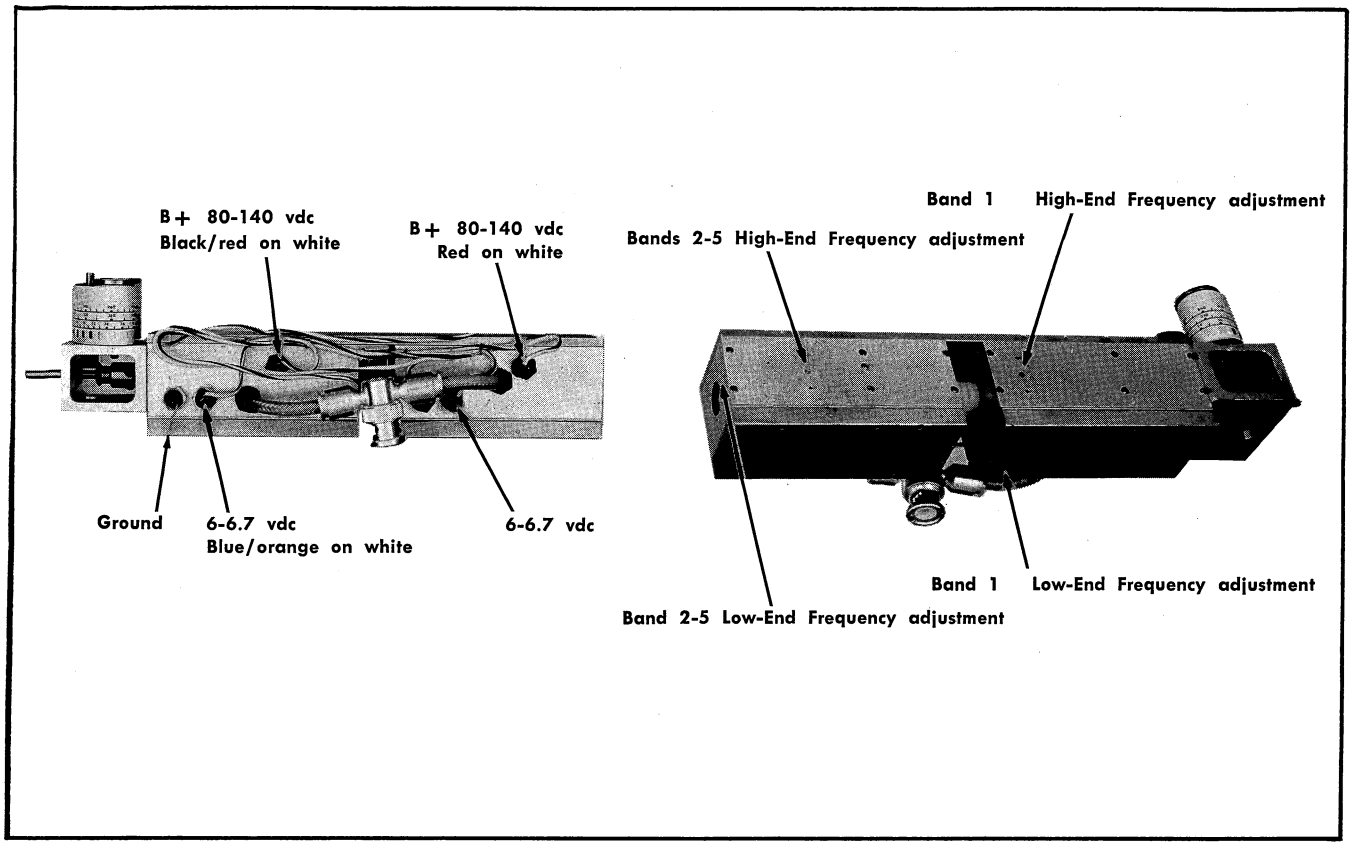


Fig. 5-4. L-20 R.F. Section illustrating test points and adjustments.

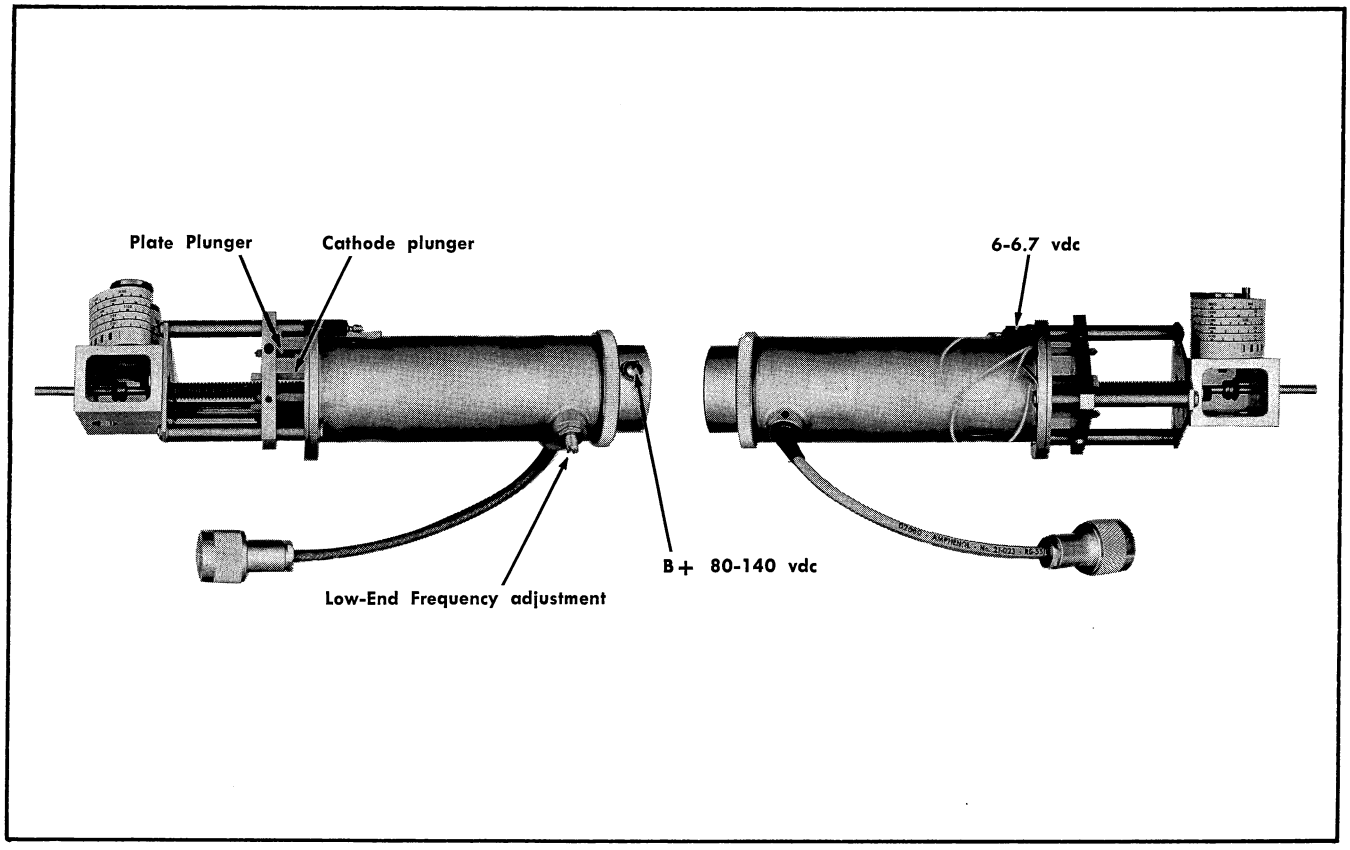


Fig. 5-5. L-30 R.F. Section illustrating test points and adjustments.

2. Unsolder the leads from the terminals and disconnect the cable on the R.F. Section.

3. Loosen the Allen screws in the rear mounting bracket.

4. Lift up the rear portion of the R.F. Section and pull towards the back panel to remove the section.

5. The front portion of the R.F. Section contains the Band 1 local oscillator and the rear portion contains the Bands 2-5 local oscillator. Remove the bottom plate from the faulty oscillator only.

6. Slide out the oscillator tube (it is held in place by clips) and replace with the new tube.

7. Replace the bottom plate of the oscillator and replace the R.F. Section in accordance with the reverse of the previous procedure.

8. Calibrate the R.F. Section of the instrument as per the applicable portion of "Calibration of R.F. Section".

9. In the event that replacing the tube and performing the calibration procedure does not repair the oscillator, remove the dial tape and gear assembly from the oscillator. Send the oscillator to the nearest Tektronix maintenance center.

MODEL L-30

1. Unsolder all connections to the R.F. Section.

2. Loosen the top Allen screw in the rear mounting bracket of the R.F. Section.

3. Remove all of the screws from the rear panel of the plug-in unit except the two screws holding the interconnecting plug.

4. On the front panel, remove the FREQUENCY knob with an Allen wrench and check to see if there is a retaining nut under the knob. Remove the nut if present and proceed to the next step. Otherwise, remove the remaining front-panel control knobs. Mark the original position of all the knobs so they can be returned to the same position when they are replaced. Remove all retaining nuts from the toggle switches. Lift off the front panel. On the front sub-panel, remove the two screws near the shaft of the FREQUENCY control.

5. Loosen the Allen screw at the point where the coaxial cable is held in the R.F. Section.

6. Lift out the R.F. Section from the rear of the plug-in unit (position the rear panel for adequate clearance).

7. Remove the two screws holding the dial tape and gear assembly to the oscillator. Slide off assembly and remove bevel gear from oscillator shaft and retain with tape assembly for installation on replacement oscillator.

8. Reinstall the new R.F. Section in accordance with the reverse of this procedure.

9. Calibrate the R.F. Section of the instrument as per the applicable portion of "Calibration of R.F. Section".

Calibration of R.F. Section

L-20

1. Set the front-panel controls of the Type L-20 as follows:

FREQUENCY	14
BAND	1
PEAKING	cw
POSITION	Midrange
DISPLAY FUNCTION	LIN
GAIN	ccw
VID FIL	OFF
IF ATTEN	All off
PICKET FENCE	OFF
MARKER AMPLITUDE	cw
FREQUENCY DIFF-MC	0
CENTER FREQ	Midrange
RESOLUTION	HIGH
Variable DISPERSION	Midrange
DISPERSION Range	WIDE

2. Connect the SAWTOOTH or SWEEP output of the oscilloscope to the SWEEP INPUT connector of the plug-in unit. Turn on the oscilloscope and allow approximately 30 minutes for warm up.

3. Set the CENTER FREQ control so that the 200-mc Marker signal is positioned to the center of the screen.

4. With the 200-mc Marker signal displayed on the screen, switch the DISPERSION range switch back and forth between WIDE and NARROW and set the FREQUENCY DIFF-MC control so there is no horizontal shift of the marker signal.

5. With the HORIZONTAL POSITION control of the oscilloscope, position the Marker to the vertical centerline of the graticule.

6. From an r.f. signal generator, apply a 14-mc signal to the 50 Ω INPUT connector of the SPECTROPULSE Spectrum Analyzer. The frequency accuracy of the signal generator should be 0.1% or better.

7. The signal of the r.f. generator should be superimposed on the Marker signal. If not, set the Band 1 Low-End Frequency adjustment of the plug-in unit so that the generator signal is superimposed on the Marker signal.

8. Set the FREQUENCY dial to 230 mc and apply a 230-mc signal to the INPUT of the SPECTROPULSE Spectrum Analyzer.

9. The 230-mc signal should be superimposed on the Marker signal. If not, set the Band 1 High-End Frequency adjustment to make the two signals beat against one another.

10. Due to interaction, steps 6 through 9 should be repeated until no further adjustment is necessary.

11. Set the BAND switch to BANDS 2-5 and the FREQUENCY dial to 226.

12. Apply a 226-mc signal from the signal generator and set the Bands 2-5 Low-End Frequency adjustment so that the internal marker signal and the 226-mc applied signal beat together.

13. Set the FREQUENCY dial to 890 and change the frequency of the signal generator to 890 mc.

14. Set the Bands 2-5 High-End Frequency adjustment so that the internal marker signal and the applied signal beat together.

15. Due to interaction, repeat steps 11 through 14 until no further adjustment is required.

L-30

1. Set the front-panel controls of the Model L-30 SPECTROPULSE Spectrum Analyzer as follows:

FREQUENCY	1500
PEAKING	Fully clockwise
POSITION	Midrange
DISPLAY FUNCTION	LIN
GAIN	Counterclockwise
VID FIL	OFF
IF ATTEN	All off
PICKET FENCE	OFF
MARKER AMPLITUDE	Fully clockwise
FREQUENCY DIFF-MC	0
CENTER FREQ	Midrange
RESOLUTION	HIGH
Variable DISPERSION	Midrange
DISPERSION	WIDE

2. Connect the SAWTOOTH or SWEEP output of the oscilloscope to the SWEEP INPUT connector of the plug-in unit. Turn on the oscilloscope and allow approximately 30 minutes for warm up.

3. Set the CENTER FREQ control so that the 200-mc internal Marker signal is positioned to the center of the screen.

4. With the 200-mc Marker signal displayed, switch the DISPERSION range switch back and forth between WIDE and NARROW and set the FREQUENCY DIFF-MC control so there is no horizontal shift of the Marker signal.

5. With the HORIZONTAL POSITION control of the oscilloscope, position the Marker signal to the centerline of the graticule.

6. From an r.f. signal generator, apply a 1500-mc signal to the 50 Ω INPUT connector of the plug-in unit. The frequency accuracy of the signal generator should be ±0.1% or better.

7. The signal of the r.f. generator should be superimposed on the internal Marker signal. If not, set the FREQUENCY control of the plug-in unit so the generator signal is superimposed on the Marker signal.

8. Set the scaled metal tape of the r.f. section so it reads exactly 1500-mc. The metal tape can be set by pushing forward on the tape at the two outer rollers that contain the tape. This slackens the tape and it may be set as desired. Be sure that once the tape is set to 1500, the sprocket is meshed with the sprocket holes in the metal tape.

9. Set the FREQUENCY dial to 1000 mc and apply a 1000-mc signal to the 50 Ω INPUT of the SPECTROPULSE Spectrum Analyzer.

10. The 1000-mc signal should be superimposed on the Marker signal. If not, set the Low-End Frequency adjustment on the R.F. Section to make the two signals beat against one another.

11. Set the FREQUENCY dial to 2000 mc and apply a 2000-mc signal to the 50 Ω INPUT of the SPECTROPULSE Spectrum Analyzer.

12. The internal marker and the applied signal should be superimposed on the screen or within ±1% of one another. This can be checked by setting the FREQUENCY control so the signals beat together. Next, check the setting of the FREQUENCY dial—the reading should be within ±1% of 2000 mc. If the dial reading is out of tolerance, return the FREQUENCY dial to 2000 and proceed to the next step. If the dial reading is within tolerance, this completes the procedure. If the dial reading is not within tolerance, complete the following steps.

13. Loosen the six Allen screws holding the Plate and Cathode Plungers.

NOTE

Make only slight adjustments with the plungers. The plungers have a total adjustment range of only a fraction of an inch. If either plunger is moved too far in one direction the travel of the FREQUENCY control will be restricted on one end.

14. Slide the Plate and Cathode Plungers in and out, one at a time to superimpose the internal Marker signal with the applied signal. Once this is done, tighten the six Allen screws that hold the plunger rods.

15. Recheck the Mixer current as per steps 2 and 3 of "check of Mixer and R.F. Section". If the current is out of tolerance, loosen the allen screws at the point where the coaxial cable enters the R.F. Section. Vary the position of the coaxial probe in and out and/or rotate and recheck the Mixer current. The position of the coax cable and the Plate and Cathode Plungers all affect the Mixer current. The plungers, however, have less effect on the Mixer current.

16. Due to the interaction between adjustments, the procedure should be repeated until no further adjustment is necessary.

SECTION 6
PARTS LIST and DIAGRAMS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix Field Office.

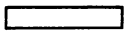
Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number including any suffix, instrument type, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix Field Office will contact you concerning any change in part number.

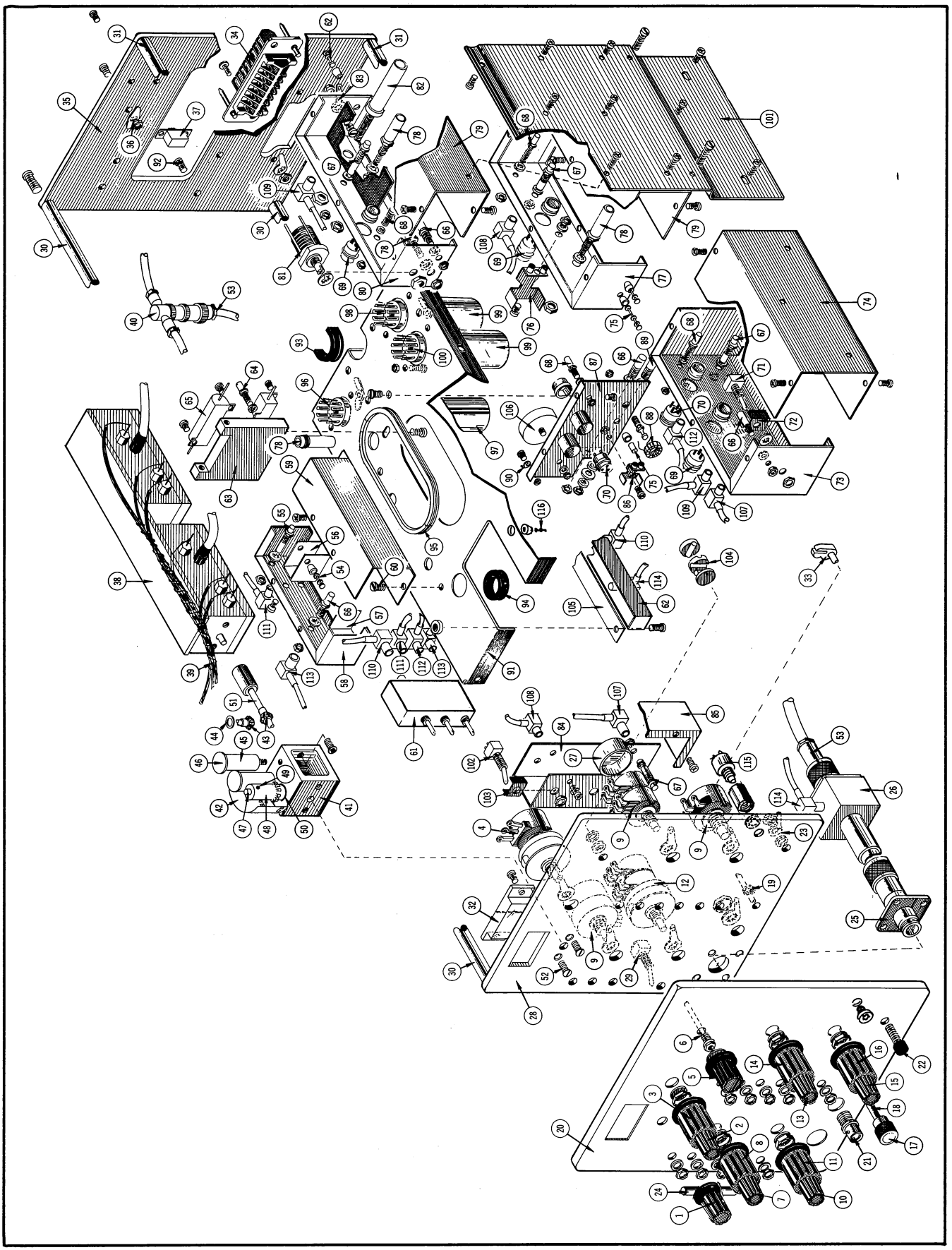
ABBREVIATIONS AND SYMBOLS

a or amp	amperes
BHS	binding head steel
C	carbon
cer	ceramic
cm	centimeter
comp	composition
cps	cycles per second
crt	cathode-ray tube
CSK	counter sunk
dia	diameter
div	division
EMC	electrolytic, metal cased
EMT	electroyltic, metal tubular
ext	external
f	farad
F & I	focus and intensity
FHS	flat head steel
Fil HS	fillister head steel
g or G	giga, or 10^9
Ge	germanium
GMV	guaranteed minimum value
h	henry
hex	hexagonal
HHS	hex head steel
HSS	hex socket steel
HV	high voltage
ID	inside diameter
incd	incandescent
int	internal
k or K	kilohms or kilo (10^3)
kc	kilocycle
m	milli, or 10^{-3}
mc	megacycle
mm	millimeter
meg or M	megohms or mega (10^6)
met.	metal
μ	micro, or 10^{-6}
n	nano, or 10^{-9}
Ω	ohm
OD	outside diameter
OHS	oval head steel
p	pico, or 10^{-12}
PHS	pan head steel
piv	peak inverse voltage
plstc	plastic
PMC	paper, metal cased
poly	polystyrene
Prec	precision
PT	paper tubular
PTM	paper or plastic, tubular, molded
RHS	round head steel
rms	root mean square
sec	second
Si	silicon
S/N	serial number
t or T	tera, or 10^{12}
TD	toroid
THS	truss head steel
tub.	tubular
v or V	volt
Var	variable
w	watt
w/	with
w/o	without
WW	wire-wound

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number.
000X	Part removed after this serial number.
*000-000	Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, or reworked or checked components.
Use 000-000	Part number indicated is direct replacement.
	Internal screwdriver adjustment.
	Front-panel adjustment or connector.

EXPLODED VIEW L-20



EXPLODED VIEW L-20

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
1	366-0284-00			1	KNOB, charcoal—FREQUENCY
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
2	366-0255-00			1	KNOB, red—AMPLITUDE
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
3	366-0249-00			1	KNOB, charcoal—PICKET FENCE
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
4	262-0681-00			1	SWITCH, wired—PICKET FENCE
	- - - - - -			-	mounting hardware: (not included w/switch)
	210-0413-00			1	NUT, hex, 3/8-32 x 1/2 inch
	210-0840-00			1	WASHER, .390 ID x 9/16 inch OD
	210-0012-00			1	LOCKWASHER, pot, internal, 3/8 x 1/2 inch
	210-0207-00			1	LUG, solder, pot
5	366-0285-00			1	KNOB, charcoal—FREQUENCY DIFF-MC
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
6	384-0329-00			1	ROD, shaft marker, assembly
7	366-0255-00			1	KNOB, red—PEAKING
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
8	366-0249-00			1	KNOB, charcoal—POSITION
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
9	- - - - - -			3	POT
	- - - - - -			-	mounting hardware for each: (not included w/pot)
	210-0413-00			1	NUT, hex, 3/8-32 x 1/2 inch
	210-0840-00			1	WASHER, .390 ID x 9/16 inch OD
	210-0012-00			1	LOCKWASHER, pot, internal, 3/8 x 1/2 inch
	210-0207-00			1	LUG, solder, pot
10	366-0255-00			1	KNOB, red—GAIN
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
11	366-0249-00			1	KNOB, charcoal—DISPLAY FUNCTION
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
12	262-0682-00			1	SWITCH, wired—DISPLAY FUNCTION
	- - - - - -			-	mounting hardware: (not included w/switch)
	210-0413-00			1	NUT, hex, 3/8-32 x 1/2 inch
	210-0840-00			1	WASHER, .390 ID x 9/16 inch OD
	210-0013-00			1	LOCKWASHER, pot, internal, 3/8 x 11/16 inch
	210-0207-00			1	LUG, solder, pot
13	366-0255-00			1	KNOB, red—CENTER FREQUENCY
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS

EXPLODED VIEW L-20 *(Cont'd)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
14	366-0249-00			1	KNOB, charcoal—RESOULTION
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
15	366-0255-00			1	KNOB, red—WIDE-NARROW
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
16	366-0249-00			1	KNOB, charcoal—DISPERSION
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
17	366-0125-00			1	KNOB, plug-in securing
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
18	384-0510-00			1	ROD, securing, 3/16 OD x 10 1/2 inches
	210-0894-00			1	WASHER, polyethylene, .190 ID x 7/16 inch OD (not shown)
19	354-0025-00			1	RING, retaining
20	333-0876-00	1001	1105	1	PANEL, front
	333-0893-00	1106		1	PANEL, front
21	131-0106-00			1	CONNECTOR, coaxial, BNC, VIDEO INPUT
	- - - - - -			-	mounting hardware: (not included w/connector)
	210-0255-00			1	LUG, solder
	210-0413-00			1	NUT, hex, 3/8-32 x 1/2 inch
22	136-0140-00			1	CONNECTOR, banana jack, SWEEP INPUT
	- - - - - -			-	mounting hardware: (not included w/connector)
23	210-0895-00			1	WASHER, insulating
	210-0223-00			1	LUG, solder, 1/4 inch hole
	210-0465-00			1	NUT, hex, 1/4-32 x 3/8 inch
24	376-0043-00			1	COUPLING, band switch
	- - - - - -			-	mounting hardware: (not included w/coupling)
	213-0140-00			3	SCREW, set, 2-56 x 3/32 inch, HSS
25	131-0376-00			1	CONNECTOR, pad attenuator, INPUT 50 Ω
	- - - - - -			-	mounting hardware: (not included w/connector)
	211-0025-00			4	SCREW, 4-40 x 3/8 inch, FHS
	210-0004-00			4	LOCKWASHER, internal, #4
	210-0406-00			4	NUT, hex, 4-40 x 3/16 inch
26	119-0041-00			1	MIXER, w/crystal
27	200-0263-00			1	COVER, dust, pot
28	386-0106-00	1001	1105	1	PLATE, front sub-panel
	386-0158-00	1106		1	PLATE, front sub-panel
29	260-0643-00			1	SWITCH, unwired—VID FIL
	- - - - - -			-	mounting hardware: (not included w/switch)
	210-0046-00			1	LOCKWASHER, internal, .400 OD x .261 inch ID
	210-0940-00			1	WASHER, 1/4 ID x 3/8 inch OD
	210-0562-00			2	NUT, hex, 1/4-40 x 5/16 inch

EXPLODED VIEW L-20 *(Cont'd)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
30	384-0631-00			2	ROD, spacer
	- - - - - -			-	mounting hardware for each: (not included w/rod)
	212-0043-00			1	SCREW, 8-32 x 1/2 inch, 100°, CSK, FHS, phillips
	212-0045-00			1	SCREW, 8-32 x 1/2 inch, THS phillips
31	384-0633-00			2	ROD, spacer
	- - - - - -			-	mounting hardware for each: (not included w/rod)
	212-0043-00			1	SCREW, 8-32 x 1/2 inch, 100°, CSK, FHS, phillips
	212-0045-00			1	SCREW, 8-32 x 1/2 inch, THS phillips
32	386-0115-00			1	PLATE, dial window
	- - - - - -			-	mounting hardware: (not included w/plate)
	213-0138-00			2	SCREW, thread forming, #4 x 3/16 inch, PHS phillips
33	214-0505-00			1	CAM, switch activator
	- - - - - -			-	cam includes:
	213-0022-00			1	SCREW, set, 4-40 x 3/16 inch, HSS
34	131-0017-00			1	CONNECTOR, 16 pin
	- - - - - -			-	mounting hardware: (not included w/connector)
	211-0008-00			2	SCREW, 4-40 x 1/4 inch, BHS
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0201-00			1	LUG, solder, SE #4
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
35	386-0104-00			1	PLATE, rear
36	210-0204-00			1	LUG, solder, DE #6
	- - - - - -			-	mounting hardware: (not included w/lug)
	211-0008-00			1	SCREW, 4-40 x 1/4 inch, BHS
	210-0406-00			1	NUT, hex, 4-40 x 3/16 inch
37	260-0583-00			1	SWITCH, unwired—100 V-150 V SAWTOOTH
	- - - - - -			-	mounting hardware: (not included w/switch)
	213-0088-00			2	SCREW, thread forming, #4 x 1/4 inch, PHS phillips
	632-0001-00	1001	1105	1	ASSEMBLY, OSCILLATOR (See Ref. #52)
	632-0005-00	1106		1	ASSEMBLY, OSCILLATOR (See Ref. #52)
	- - - - - -			-	assembly includes:
38	119-0039-00			1	OSCILLATOR
39	179-0959-00			1	CABLE HARNESS
40	131-0377-00			1	CONNECTOR, "T"
41	380-0070-00	1001	1105	1	HOUSING, dial assembly
	380-0076-00	1106		1	HOUSING, dial assembly
	- - - - - -			-	mounting hardware: (not included w/housing alone)
	211-0561-00	1001	1105	2	SCREW, 6-32 x 3/8 inch, hex, socket cap
	211-0595-00	1106		2	SCREW, 6-32 x 1/4 inch, hex, socket cap
	214-0564-00	X1106		1	PIN, roll (not shown)
42	331-0142-00			1	TAPE, dial
43	214-0522-00			2	GEAR
44	210-0991-00			1	WASHER, spring
45	214-0521-00			2	ROLLER, idler standoff
	- - - - - -			-	mounting hardware for each: (not included w/roller alone)
46	384-0639-00			1	ROD, idler standoff

EXPLODED VIEW L-20 *(Cont'd)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
47	384-0635-00			1	ROD, dial sprocket
48	214-0520-00			1	SPROCKET, dial
	- - - - - -			-	mounting hardware: (not included w/sprocket alone)
49	213-0075-00			1	SCREW, set, 4-40 x 3/32 inch, HSS
50	210-0992-00			1	WASHER, teflon
51	384-0634-00			1	ROD, shaft, drive
	- - - - - -			-	mounting hardware: (not included w/rod alone)
	213-0075-00			2	SCREW, set, 4-40 x 3/32 inch, HSS
52	- - - - - -			-	mounting hardware for assembly:
	211-0538-00			2	SCREW, 6-32 x 5/16 inch, 100°, CSK, FHS phillips (not included w/ assembly)
	358-0258-00	X1106		1	BUSHING (not shown) (included w/assembly)
53	175-0315-00			1	CABLE ASSEMBLY
	610-0138-00			1	ASSEMBLY, LOW PASS FILTER (See Ref. #60)
	- - - - - -			-	assembly includes:
54	131-0182-00			7	CONNECTOR, terminal feed through
	- - - - - -			-	mounting hardware for each: (not included w/connector alone)
	358-0135-00			1	BUSHING, teflon
55	131-0372-00			2	CONNECTOR, coaxial, w/hardware
56	337-0711-00			3	SHIELD, "U" shape
	- - - - - -			-	mounting hardware for each: (not included w/shield alone)
	213-0138-00			2	SCREW, thread forming, #4 x 3/16 inch, PHS phillips
57	337-0713-00			1	SHIELD, "L" shape
	- - - - - -			-	mounting hardware: (not included w/shield alone)
	213-0138-00			2	SCREW, thread forming, #4 x 3/16 inch, PHS phillips
58	441-0598-00			1	CHASSIS, low pass filter
59	337-0707-00			1	SHIELD, cover, narrow band filter
	- - - - - -			-	mounting hardware: (not included w/shield alone)
	213-0138-00			4	SCREW, thread forming, #4 x 3/16 inch, PHS phillips
60	- - - - - -			-	mounting hardware: (not included w/assembly)
	211-0504-00			2	SCREW, 6-32 x 1/4 inch, BHS
61	644-0010-00			1	ASSEMBLY, BAND SWITCH BOX
	- - - - - -			-	mounting hardware: (not included w/assembly)
	210-0940-00			3	WASHER, 1/4 ID x 3/8 inch OD
	210-0562-00			3	NUT, hex, 1/4-40 x 5/16 inch
62	610-0137-00			1	ASSEMBLY, WIDE BAND FILTER
63	407-0095-00			1	BRACKET, oscillator support
	- - - - - -			-	mounting hardware: (not included w/bracket)
	213-0022-00			2	SCREW, set, 4-40 x 3/16 inch, HSS
	211-0504-00			2	SCREW, 6-32 x 1/4 inch, BHS

EXPLODED VIEW L-20 *(Cont'd)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
64	- - - - - -			1	RESISTOR
	- - - - - -			-	mounting hardware: (not included w/resistor)
	131-0373-00			1	CONNECTOR, terminal standoff
	211-0001-00			1	SCREW, 2-56 x 1/4 inch, RHS
	210-0001-00			2	LOCKWASHER, internal, #2
65	- - - - - -			1	RESISTOR
	- - - - - -			-	mounting hardware: (not included w/resistor)
	211-0008-00			2	SCREW, 4-40 x 1/4 inch, BHS
66	- - - - - -			9	COIL, w/hardware
67	131-0372-00			7	CONNECTOR, coaxial, w/hardware
68	131-0373-00			38	CONNECTOR, terminal standoff
	- - - - - -			-	mounting hardware for each: (not included w/connector)
	210-0001-00			1	LOCKWASHER, internal, #2
	210-0405-00			1	NUT, hex, 2-56 x 3/16 inch
69	136-0150-00			8	SOCKET, transistor, 3 pin
	- - - - - -			-	mounting hardware for each: (not included w/socket)
	354-0180-00			1	RING, mounting
70	136-0209-00			3	SOCKET, transistor, 4 pin
	- - - - - -			-	mounting hardware for each: (not included w/socket)
	354-0180-00			1	RING, mounting
71	260-0642-00			1	SWITCH, toggle—WIDE-NARROW
	- - - - - -			-	mounting hardware: (not included w/switch)
	210-0046-00			1	LOCKWASHER, internal, .400 ID x .261 inch OD
	210-0562-00			1	NUT, hex, 1/4-40 x 5/16 inch
72	337-0702-00			1	SHIELD, switch
73	441-0590-00			1	CHASSIS, wide band I-F
74	337-0701-00			1	SHIELD, cover, wide band I-F
	- - - - - -			-	mounting hardware: (not included w/shield)
	213-0138-00			6	SCREW, thread forming, #4 x 3/16 inch, PHS phillips
75	131-0182-00			5	CONNECTOR, terminal feed through
	- - - - - -			-	mounting hardware for each: (not included w/connector)
	358-0135-00			1	BUSHING, teflon
76	136-0153-00			1	SOCKET, 2 pin, crystal, w/clamp
	- - - - - -			-	mounting hardware: (not included w/socket)
	211-0007-00			1	SCREW, 4-40 x 3/16 inch, BHS
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0406-00			1	NUT, hex, 4-40 x 3/16 inch
77	441-0591-00			1	CHASSIS, narrow band I-F
78	- - - - - -			4	COIL
	- - - - - -			-	mounting hardware for each: (not included w/coil)
	210-0010-00			1	LOCKWASHER, internal, #10
	210-0410-00			1	NUT, hex, 10-32 x 5/16 inch

EXPLODED VIEW L-20 *(Cont'd)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
79	337-0704-00			2	SHIELD, cover, narrow band & marker
	- - - - - -			-	mounting hardware for each: (not included w/shield)
	213-0138-00			6	SCREW, thread forming, #4 x 3/16 inch, PHS phillips
80	441-0593-00			1	CHASSIS, marker
81	- - - - - -			1	CAPACITOR
	- - - - - -			-	mounting hardware: (not included w/capacitor)
	210-0046-00			1	LOCKWASHER, internal, .400 OD x .261 inch ID
	210-0455-00			1	NUT, hex, 1/4-28 x 3/8 inch
82	- - - - - -			1	COIL
	- - - - - -			-	mounting hardware: (not included w/coil)
	210-0046-00			1	LOCKWASHER, internal, .400 OD x .261 inch ID
	210-0465-00			1	NUT, hex, 1/4-32 x 3/8 inch
83	210-0201-00			1	LUG, solder, #4
	- - - - - -			-	mounting hardware: (not included w/lug)
	211-0007-00			1	SCREW, 4-40 x 3/16 inch, BHS
	210-0406-00			1	NUT, hex, 4-40 x 3/16 inch
84	441-0594-00			1	CHASSIS, I-F attenuator
	- - - - - -			-	mounting hardware: (not included w/chassis)
	210-0940-00			6	WASHER, 1/4 ID x 3/8 inch OD
	210-0562-00			6	NUT, hex, 1/4-40 x 5/16 inch
85	337-0706-00			1	SHIELD, cover, I-F attenuator
	- - - - - -			-	mounting hardware: (not included w/shield)
	213-0138-00			4	SCREW, thread forming, 4-40 x 3/16 inch, PHS phillips
86	136-0208-00			1	SOCKET, crystal
	- - - - - -			-	mounting hardware: (not included w/socket)
	211-0022-00			1	SCREW, 2-56 x 3/16 inch, RHS
	210-0001-00			1	LOCKWASHER, internal, #2
	210-0405-00			1	NUT, hex, 2-56 x 3/16 inch
87	441-0596-00			1	CHASSIS, variable resolution
	- - - - - -			-	mounting hardware: (not included w/chassis)
	213-0138-00			2	SCREW, thread forming, #4 x 1/4 inch, PHS phillips
88	- - - - - -			1	TRANSFORMER
	- - - - - -			-	mounting hardware: (not included w/transformer)
	131-0373-00			1	CONNECTOR, terminal standoff
	210-0813-00			1	WASHER, fiber, #10, shouldered
	210-0405-00			1	NUT, hex, 2-56 x 3/16 inch
89	- - - - - -			1	COIL, w/lockwasher & nut
	- - - - - -			-	mounting hardware: (not included w/coil)
	210-0812-00			1	WASHER, fiber, #10
	210-0940-00			1	WASHER, 1/4 ID x 3/8 inch OD
	210-0813-00			1	WASHER, fiber, #10, shouldered

EXPLODED VIEW L-20 *(Cont'd)*

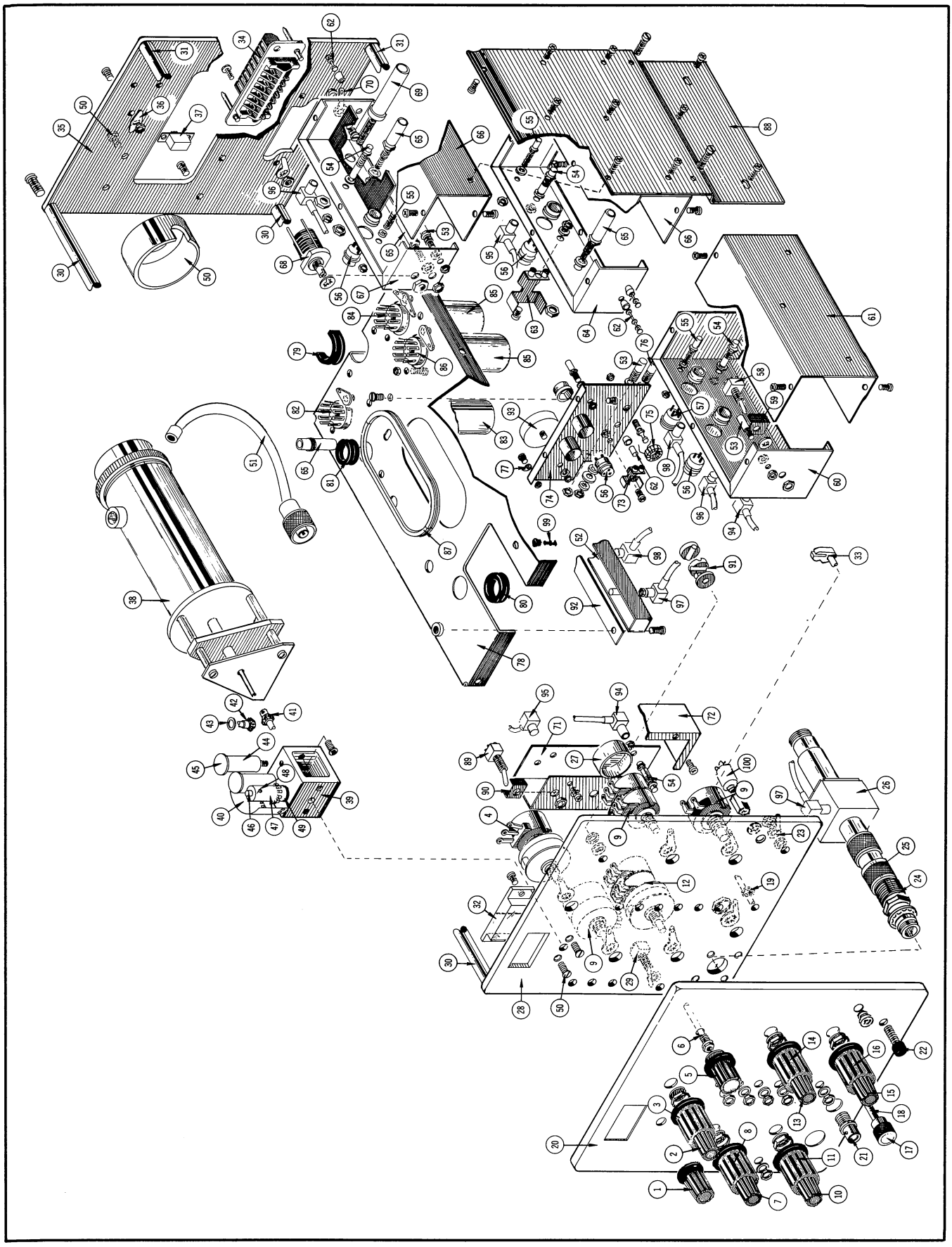
REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
90	210-0259-00			2	LUG, solder, #2
	- - - - - -			-	mounting hardware for each: (not included w/lug)
	211-0022-00			1	SCREW, 2-56 x 3/16 inch, RHS
	210-0405-00			1	NUT, hex, 2-56 x 3/16 inch
91	441-0603-00			1	CHASSIS, main
	- - - - - -			-	mounting hardware: (not included w/chassis)
92	211-0538-00			4	SCREW, 6-32 x 5/16 inch, 100°, CSK, FHS phillips
	211-0540-00			4	SCREW, 6-32 x 1/4 inch, BHS
	210-0006-00			3	LOCKWASHER, internal, #6
	210-0407-00			3	NUT, hex, 6-32 x 1/4 inch
93	358-0215-00			1	BUSHING, plastic
94	348-0012-00			1	GROMMET, rubber, 5/8 inch
95	252-0564-00			FT	CHANNEL, polyethylene (7 1/2 inches)
96	136-0010-00			1	SOCKET, 7 pin, w/o center pin
	- - - - - -			-	mounting hardware: (not included w/socket)
	211-0033-00			2	SCREW, 4-40 x 5/16 inch, PHS w/lockwasher
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0201-00			1	LUG, solder, SE #4
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
97	337-0007-00			1	SHIELD, tube, 7/8 inch ID w/spring
98	136-0022-00			1	SOCKET, STM9S
	- - - - - -			-	mounting hardware: (not included w/socket)
	211-0033-00			2	SCREW, 4-40 x 5/16 inch, PHS w/lockwasher
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0204-00			1	LUG, solder, SE #6
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
99	337-0008-00			2	SHIELD, tube, 1 1/32 inches ID w/spring
100	136-0022-00			1	SOCKET, STM9S
	- - - - - -			-	mounting hardware: (not included w/socket)
	211-0033-00			2	SCREW, 4-40 x 5/16 inch, PHS w/lockwasher
	210-0004-00			2	LOCKWASHER, internal, #4
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
101	407-0075-00			1	BRACKET, I-F chassis mounting
	- - - - - -			-	mounting hardware: (not included w/bracket)
	211-0504-00			2	SCREW, 6-32 x 1/4 inch, BHS
	213-0088-00			13	SCREW, thread forming, #4 x 3/16 inch, PHS phillips
102	260-0642-00			6	SWITCH, toggle—I-F ATTEN
	- - - - - -			-	mounting hardware for each: (not included w/switch)
103	337-0702-00			1	SHIELD, switch
	210-0562-00			1	NUT, hex, 1/4-40 x 5/16 inch

EXPLODED VIEW L-20 *(Cont'd)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
104	376-0041-00			1	COUPLING, shaft assembly
	- - - - - -			-	coupling includes:
	213-0022-00			2	SCREW, set, 4-40 x 3/16 inch, HSS
	213-0004-00			2	SCREW, set, 6-32 x 3/16 inch, HSS
105	337-0708-00			1	SHIELD, cover, wide band filter
	- - - - - -			-	mounting hardware: (not included w/shield)
	211-0504-00			2	SCREW, set, 6-32 x 1/4 inch, BHS
106	- - - - - -			1	TRANSFORMER
	- - - - - -			-	mounting hardware: (not included w/transformer)
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0406-00			1	NUT, hex, 4-40 x 3/16 inch
107	175-0308-00			1	CABLE ASSEMBLY (wide band I-F to attenuator)
108	175-0309-00			1	CABLE ASSEMBLY (narrow band I-F to attenuator)
109	175-0310-00			1	CABLE ASSEMBLY (marker to wide band I-F)
110	175-0313-00			1	CABLE ASSEMBLY (wide band filter to band switch)
111	175-0314-00			1	CABLE ASSEMBLY (band switch to narrow band filter)
112	175-0310-00			1	CABLE ASSEMBLY (band switch to wide band I-F)
113	175-0310-00			1	CABLE ASSEMBLY (band switch to narrow band)
114	175-0312-00			1	CABLE ASSEMBLY (wide band filter to mixer)
115	- - - - - -	X1106		1	POT
	- - - - - -			-	mounting hardware: (not included w/pot)
	210-0471-00			1	NUT, pot, hex, 1/4-32 x 5/16 inch
	210-0046-00			1	LOCKWASHER, .400 OD x .261 inch ID
	358-0054-00			1	BUSHING, banana jack
116	131-0181-00	X1106		1	CONNECTOR, terminal standoff
	- - - - - -			-	mounting hardware: (not included w/connector)
	358-0136-00			1	BUSHING, teflon

NOTES

EXPLODED VIEW L-30



EXPLODED VIEW L-30

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
1	366-0284-00			1	KNOB, charcoal—FREQUENCY
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
2	366-0255-00			1	KNOB, red—AMPLITUDE
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
3	366-0249-00			1	KNOB, charcoal—PICKET FENCE
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
4	262-0681-00			1	SWITCH, wired—MARKER
	- - - - - -			-	mounting hardware: (not included w/switch)
	210-0413-00			1	NUT, hex, 3/8-32 x 1/2 inch
	210-0840-00			1	WASHER, .390 ID x 9/16 inch OD
	210-0012-00			1	LOCKWASHER, pot, internal, 3/8 x 1/2 inch
	210-0207-00			1	LUG, solder, pot
5	366-0285-00			1	KNOB, charcoal—FREQUENCY DIFF-MC
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
6	384-0329-00			1	ROD, shaft marker assembly
7	366-0255-00			1	KNOB, red—PEAKING
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
8	366-0249-00			1	KNOB, charcoal—POSITION
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
9	- - - - - -			3	POT
	- - - - - -			-	mounting hardware for each: (not included w/pot)
	210-0413-00			1	NUT, hex, 3/8-32 x 1/2 inch
	210-0840-00			1	WASHER, .390 ID x 9/16 inch OD
	210-0012-00			1	LOCKWASHER, pot, internal, 3/8 x 1/2 inch
	210-0207-00			1	LUG, solder, pot
10	366-0255-00			1	KNOB, red—GAIN
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
11	366-0249-00			1	KNOB, charcoal—DISPLAY FUNCTION
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
12	262-0682-00			1	SWITCH, wired—DISPLAY FUNCTION
	- - - - - -			-	mounting hardware: (not included w/switch)
	210-0413-00			1	NUT, hex, 3/8-32 x 1/2 inch
	210-0840-00			1	WASHER, .390 ID x 9/16 inch OD
	210-0012-00			1	LOCKWASHER, pot, internal, 3/8 x 1/2 inch
	210-0207-00			1	LUG, solder, pot
13	366-0255-00			1	KNOB, red—CENTER FREQUENCY
	- - - - - -			-	knob includes:
	213-0020-00			1	SCREW, set, 6-32 x 1/8 inch, HSS
14	366-0249-00			1	KNOB, charcoal—RESOLUTION
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS

EXPLODED VIEW L-30 *(Cont'd)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
15	366-0255-00			1	KNOB, red—WIDE-NARROW
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
16	366-0249-00			1	KNOB, charcoal—DISPERSION
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
17	366-0125-00			1	KNOB, plug-in securing
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
18	384-0510-00			1	ROD, securing, 3/16 OD x 10 1/2 inches
	210-0894-00			1	WASHER, polyethylene, .190 ID x 7/16 inch OD (not shown)
19	354-0025-00			1	RING, retaining
20	333-0879-00	1001	1057	1	PANEL, front
	333-0894-00	1058		1	PANEL, front
21	131-0106-00			1	CONNECTOR, coaxial, BNC, VIDEO INPUT
	- - - - - -			-	mounting hardware: (not included w/connector)
	210-0255-00			1	LUG, solder
	210-0413-00			1	NUT, hex, 3/8-32 x 1/2 inch
22	136-0140-00			1	CONNECTOR, banana jack, SWEEP INPUT
	- - - - - -			-	mounting hardware: (not included w/connector)
23	210-0895-00			1	WASHER, insulating
	210-0223-00			1	LUG, solder, 1/4 inch hole
	210-0465-00			1	NUT, hex, 1/4-32 x 3/8 inch
24	131-0378-00			1	CONNECTOR, INPUT 50 Ω
25	131-0379-00			1	CONNECTOR
26	119-0042-00			1	MIXER, w/crystal
27	200-0263-00			1	COVER, dust, pot
28	386-0106-00	1001	1057	1	PLATE, front sub-panel
	386-0158-00	1058		1	PLATE, front sub-panel
29	260-0643-00			1	SWITCH, unwired—VID FIL
	- - - - - -			-	mounting hardware: (not included w/switch)
	210-0046-00			1	LOCKWASHER, internal, .400 OD x .261 inch ID
	210-0940-00			1	WASHER, 1/4 ID x 3/8 inch OD
	210-0562-00			2	NUT, hex, 1/4-40 x 5/16 inch
30	384-0631-00			2	ROD, spacer
	- - - - - -			-	mounting hardware for each: (not included w/rod)
	212-0043-00			1	SCREW, 8-32 x 1/2 inch, 100°, CSK, FHS phillips
	212-0045-00			1	SCREW, 8-32 x 1/2 inch, THS phillips
31	384-0633-00			2	ROD, spacer
	- - - - - -			-	mounting hardware for each: (not included w/rod)
	212-0043-00			1	SCREW, 8-32 x 1/2 inch, 100°, CSK, FHS phillips
	212-0045-00			1	SCREW, 8-32 x 1/2 inch, THS phillips
32	386-0115-00			1	PLATE, dial window
	- - - - - -			-	mounting hardware: (not included w/plate)
	213-0138-00			2	SCREW, thread forming, #4 x 3/16 inch, PHS phillips

EXPLODED VIEW L-30 *(Cont'd)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
33	214-0505-00			1	CAM, switch activator
	- - - - - -			-	cam includes:
	213-0022-00			1	SCREW, set, 4-40 x 3/16 inch, HSS
34	131-0017-00			1	CONNECTOR, 16 pin
	- - - - - -			-	mounting hardware: (not included w/connector)
	211-0008-00			2	SCREW, 4-40 x 1/4 inch, BHS
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0201-00			1	LUG, solder, SE #4
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
35	386-0104-00			1	PLATE, rear
36	210-0204-00			1	LUG, solder, DE #6
	- - - - - -			-	mounting hardware: (not included w/lug)
	211-0008-00			1	SCREW, 4-40 x 1/4 inch, BHS
	210-0406-00			1	NUT, hex, 4-40 x 3/16 inch
37	260-0583-00			1	SWITCH, unwired—100 V-150 V SAWTOOTH
	- - - - - -			-	mounting hardware: (not included w/switch)
	213-0088-00			2	SCREW, thread forming, #4 x 1/4 inch, PHS phillips
	632-0002-00	1001	1057	1	ASSEMBLY, OSCILLATOR (See Ref. #50)
	632-0006-00	1058		1	ASSEMBLY, OSCILLATOR (See Ref. #50)
	- - - - - -			-	assembly includes:
38	119-0040-00			1	OSCILLATOR
39	380-0070-00	1001	1057	1	HOUSING, dial assembly
	380-0076-00	1058		1	HOUSING, dial assembly
	- - - - - -			-	mounting hardware: (not included w/housing alone)
	211-0561-00	1001	1057	2	SCREW, 6-32 x 3/8 inch, hex, socket cap
	211-0595-00	1058		2	SCREW, 6-32 x 1/4 inch, hex, socket cap
	214-0258-00	X1058		1	PIN, roll (not shown)
40	331-0143-00			1	TAPE, dial
41	214-0535-00			1	GEAR
	- - - - - -			-	mounting hardware: (not included w/gear alone)
	213-0140-00			1	SCREW, set, 2-56 x 3/32 inch
42	214-0522-00			1	GEAR
43	210-0991-00			1	WASHER, spring
44	214-0521-00			2	ROLLER, idler standoff
	- - - - - -			-	mounting hardware for each: (not included w/roller alone)
45	384-0635-00	1001	1057	1	ROD, idler standoff
	384-0636-00	1058		1	ROD, idler standoff
46	384-0634-00	1001	1057	1	ROD, dial sprocket
	384-0635-00	1058		1	ROD, dial sprocket
47	214-0520-00			1	SPROCKET, dial
	- - - - - -			-	mounting hardware: (not included w/sprocket alone)
48	213-0075-00			1	SCREW, set, 4-40 x 3/32 inch, HSS
49	210-0992-00			1	WASHER, teflon
50	- - - - - -			-	mounting hardware for assembly:
	211-0538-00	1001	1057	2	SCREW, 6-32 x 5/16 inch, 100°, CSK, FHS phillips (not included w/assembly)
	358-0258-00	X1058		1	BUSHING (not shown) (included w/assembly)
	212-0001-00			2	SCREW, 8-32 x 1/4 inch, BHS (not included w/assembly)
	407-0112-00			1	BRACKET, oscillator mounting (not included w/assembly)

EXPLODED VIEW L-30 *(Cont'd)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
51	175-0317-00			1	CABLE ASSEMBLY (oscillator to mixer)
52	610-0137-00			1	ASSEMBLY, WIDE BAND FILTER
53	- - - - - -			9	COIL, w/hardware
54	131-0372-00			7	CONNECTOR, coaxial, w/hardware
55	131-0373-00			38	CONNECTOR, terminal standoff
	- - - - - -			-	mounting hardware for each: (not included w/connector)
	210-0001-00			1	LOCKWASHER, internal, #2
	210-0405-00			1	NUT, hex, 2-56 x 3/16 inch
56	136-0150-00			8	SOCKET, transistor, 3 pin
	- - - - - -			-	mounting hardware for each: (not included w/socket)
	354-0180-00			1	RING, mounting
57	136-0209-00			3	SOCKET, transistor, 4 pin
	- - - - - -			-	mounting hardware for each: (not included w/socket)
	354-0180-00			1	RING, mounting
58	260-0642-00			1	SWITCH, toggle—WIDE-NARROW
	- - - - - -			-	mounting hardware: (not included w/switch)
	210-0046-00			1	LOCKWASHER, internal, .400 ID x .261 inch OD
	210-0562-00			1	NUT, hex, 1/4-40 x 5/16 inch
59	337-0702-00			1	SHIELD, switch
60	441-0590-00			1	CHASSIS, wide band I-F
61	337-0701-00			1	SHIELD, cover, wide band I-F
	- - - - - -			-	mounting hardware: (not included w/shield)
	213-0138-00			6	SCREW, thread cutting, #4 x 3/16 inch, PHS phillips
62	131-0182-00			5	CONNECTOR, terminal feed through
	- - - - - -			-	mounting hardware for each: (not included w/connector)
	358-0135-00			1	BUSHING, teflon
63	136-0153-00			1	SOCKET, 2 pin, crystal, w/clamp
	- - - - - -			-	mounting hardware: (not included w/socket)
	211-0007-00			1	SCREW, 4-40 x 3/16 inch, BHS
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0406-00			1	NUT, hex, 4-40 x 3/16 inch
64	441-0591-00			1	CHASSIS, narrow band I-F
65	- - - - - -			4	COIL
	- - - - - -			-	mounting hardware for each: (not included w/coil)
	210-0010-00			1	LOCKWASHER, internal, #10
	210-0410-00			1	NUT, hex, 10-32 x 5/16 inch
66	337-0704-00			2	SHIELD, cover, narrow band I-F & marker
	- - - - - -			-	mounting hardware for each: (not included w/shield)
	213-0138-00			6	SCREW, thread forming, #4 x 3/16 inch, PHS phillips
67	441-0593-00			1	CHASSIS, marker
68	- - - - - -			1	CAPACITOR
	- - - - - -			-	mounting hardware: (not included w/capacitor)
	210-0046-00			1	LOCKWASHER, internal, .400 OD x .261 inch ID
	210-0455-00			1	NUT, hex, 1/4-28 x 3/8 inch

EXPLODED VIEW L-30 *(Cont'd)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
69	- - - - - -			1	COIL
	- - - - - -			-	mounting hardware: (not included w/coil)
	210-0046-00			1	LOCKWASHER, internal, .400 OD x .261 inch ID
	210-0465-00			1	NUT, hex, 1/4-32 x 3/8 inch
70	210-0201-00			1	LUG, solder, #4
	- - - - - -			-	mounting hardware: (not included w/lug)
	211-0007-00			1	SCREW, 4-40 x 3/16 inch, BHS
	210-0406-00			1	NUT, hex, 4-40 x 3/16 inch
71	441-0594-00			1	CHASSIS, I-F attenuator
	- - - - - -			-	mounting hardware: (not included w/chassis)
	210-0940-00			6	WASHER, 1/4 ID x 3/8 inch OD
	210-0562-00			6	NUT, hex, 1/4-40 x 5/16 inch
72	337-0706-00			1	SHIELD, cover, I-F attenuator
	- - - - - -			-	mounting hardware: (not included w/shield)
	213-0138-00			4	SCREW, thread forming, 4-40 x 3/16 inch, PHS phillips
73	136-0208-00			1	SOCKET, crystal
	- - - - - -			-	mounting hardware: (not included w/socket)
	211-0022-00			1	SCREW, 2-56 x 3/16 inch, RHS
	210-0001-00			1	LOCKWASHER, internal, #2
	210-0405-00			1	NUT, hex, 2-56 x 3/16 inch
74	441-0596-00			1	CHASSIS, variable resolution
	- - - - - -			-	mounting hardware: (not included w/chassis)
	213-0138-00			2	SCREW, thread forming, #4 x 1/4 inch, PHS phillips
75	- - - - - -			1	TRANSFORMER
	- - - - - -			-	mounting hardware: (not included w/transformer)
	131-0373-00			1	CONNECTOR, terminal standoff
	210-0813-00			1	WASHER, fiber, #10, shouldered
	210-0405-00			1	NUT, hex, 2-56 x 3/16 inch
76	- - - - - -			1	COIL, w/lockwasher & nut
	- - - - - -			-	mounting hardware: (not included w/coil)
	210-0812-00			1	WASHER, fiber, #10
	210-0940-00			1	WASHER, 1/4 ID x 3/8 inch OD
	210-0813-00			1	WASHER, fiber, #10, shouldered
77	210-0259-00			2	LUG, solder, #2
	- - - - - -			-	mounting hardware for each: (not included w/lug)
	211-0022-00			1	SCREW, 2-56 x 3/16 inch, RHS
	210-0405-00			1	NUT, hex, 2-56 x 3/16 inch
78	441-0603-00			1	CHASSIS, main
	- - - - - -			-	mounting hardware: (not included w/chassis)
	211-0538-00			4	SCREW, 6-32 x 5/16 inch, 100°, CSK, FHS phillips
	211-0504-00			4	SCREW, 6-32 x 1/4 inch, BHS
	210-0006-00			3	LOCKWASHER, internal, #6
	210-0407-00			3	NUT, hex, 6-32 x 1/4 inch

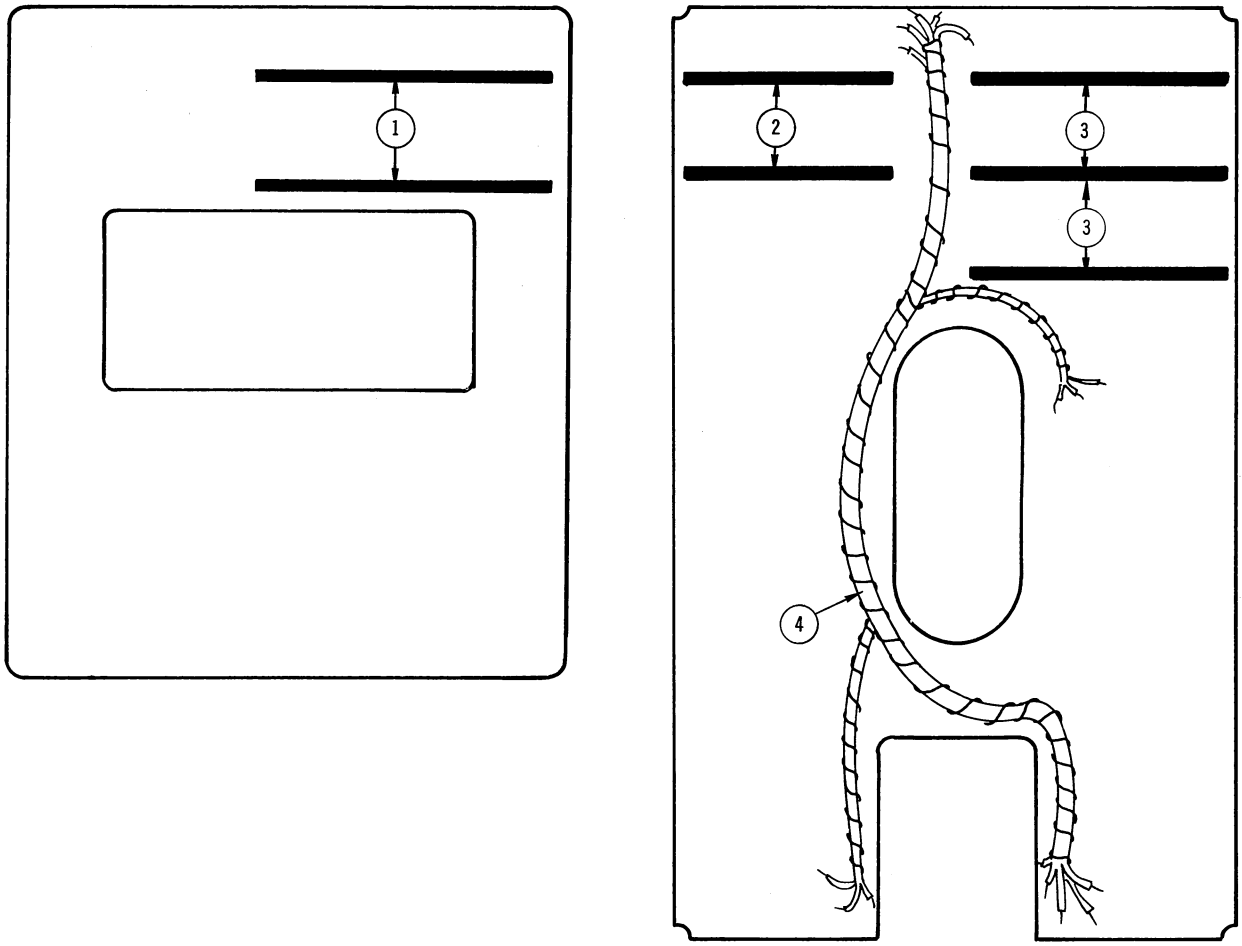
EXPLODED VIEW L-30 *(Cont'd)*

REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
79	358-0215-00			1	BUSHING, plastic
80	348-0012-00			1	GROMMET, rubber, 5/8 inch
81	348-0005-00			1	GROMMET, rubber, 1/2 inch
82	136-0010-00			1	SOCKET, 7 pin, w/o center pin
	- - - - - -			-	mounting hardware: (not included w/socket)
	211-0033-00			2	SCREW, 4-40 x 5/16 inch, PHS w/lockwasher
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0201-00			1	LUG, solder, SE #4
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
83	337-0007-00			1	SHIELD, tube, 7/8 inch ID w/spring
84	136-0022-00			1	SOCKET, STM9S
	- - - - - -			-	mounting hardware: (not included w/socket)
	211-0033-00			2	SCREW, 4-40 x 5/16 inch, PHS w/lockwasher
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0204-00			1	LUG, solder, DE #4
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
85	337-0008-00			2	SHIELD, tube, 1 1/32 inches ID w/spring
86	136-0022-00			1	SOCKET, STM9S
	- - - - - -			-	mounting hardware: (not included w/socket)
	211-0033-00			2	SCREW, 4-40 x 5/16 inch, PHS w/lockwasher
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0201-00			1	LUG, solder, SE #4
	210-0406-00			2	NUT, hex, 4-40 x 3/16 inch
87	252-0564-00			FT	CHANNEL, polyethylene (7 1/2 inches)
88	407-0075-00			1	BRACKET, I-F chassis mounting
	- - - - - -			-	mounting hardware: (not included w/bracket)
	211-0504-00			2	SCREW, 6-32 x 1/4 inch, BHS
	213-0088-00			13	SCREW, thread forming, #4 x 1/4 inch, PHS phillips
89	260-0642-00			6	SWITCH, unwired—I-F ATTEN
	- - - - - -			-	mounting hardware for each: (not included w/switch)
90	337-0702-00			1	SHIELD, switch
	210-0562-00			1	NUT, hex, 1/4-40 x 5/16 inch
91	376-0041-00			1	COUPLING, shaft assembly
	- - - - - -			-	coupling includes:
	213-0022-00			2	SCREW, set, 4-40 x 3/16 inch, HSS
	213-0004-00			2	SCREW, set, 6-32 x 3/16 inch, HSS
92	337-0708-00			1	SHIELD, cover, wide band filter
	- - - - - -			-	mounting hardware: (not included w/shield)
	211-0504-00			2	SCREW, 6-32 x 1/4 inch, BHS
93	- - - - - -			1	TRANSFORMER
	- - - - - -			-	mounting hardware: (not included w/transformer)
	210-0004-00			1	LOCKWASHER, internal, #4
	210-0406-00			1	NUT, hex, 4-40 x 3/16 inch

EXPLODED VIEW L-30 *(Cont'd)*

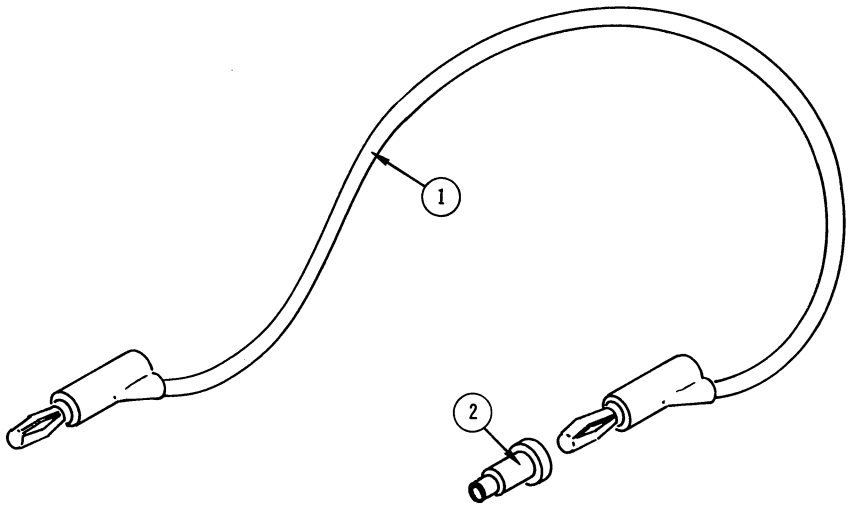
REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
94	175-0308-00			1	CABLE ASSEMBLY (wide band I-F to attenuator)
95	175-0309-00			1	CABLE ASSEMBLY (attenuator to narrow band I-F)
96	175-0310-00			1	CABLE ASSEMBLY (marker to wide band I-F)
97	175-0313-00			1	CABLE ASSEMBLY (wide band filter to mixer)
98	175-0314-00			1	CABLE ASSEMBLY (wide band filter to wide band I-F)
99	131-0181-00	X1058		1	CONNECTOR, terminal standoff
	- - - - - -			-	mounting hardware: (not included w/connector)
	358-0136-00			1	BUSHING, teflon
100	- - - - - -	X1058		1	POT
	- - - - - -			-	mounting hardware: (not included w/pot)
	210-0471-00			1	NUT, pot, hex, $\frac{1}{4}$-32 x $\frac{5}{16}$ inch
	210-0046-00			1	LOCKWASHER, .400 ID x .261 inch OD
	358-0054-00			1	BUSHING, banana jack

CABLE HARNESS & CERAMIC STRIPS L-20 & L-30



REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
1	124-0154-00			2	STRIP, ceramic, 20 notches, $^{7}/_{16}$ x 3 inches
	- - - - - -			-	each strip includes:
	355-0082-00			2	STUD, nylon
	- - - - - -			-	mounting hardware for each: (not included w/strip)
	361-0039-00			2	SPACER, nylon
2	124-0155-00			2	STRIP, ceramic, 13 notches, $^{7}/_{16}$ x 2 inches
	- - - - - -			-	each strip includes:
	355-0082-00			2	STUD, nylon
	- - - - - -			-	mounting hardware for each: (not included w/strip)
	361-0039-00			2	SPACER, nylon
3	124-0156-00			3	STRIP, ceramic, 16 notches, $^{7}/_{16}$ x 2$^{7}/_{16}$ inches
	- - - - - -			-	each strip includes:
	355-0082-00			2	STUD, nylon
	- - - - - -			-	mounting hardware for each: (not included w/strip)
	361-0039-00			2	SPACER, nylon
4	179-0958-00			1	CABLE HARNESS, chassis L-20
	179-0947-00			1	CABLE HARNESS, chassis L-30

ACCESSORIES L-20 & L-30



REF. NO.	PART NO.	SERIAL/MODEL NO. EFF.	SERIAL/MODEL NO. DISC.	QTY.	DESCRIPTION
1	012-0031-00			1	CORD, patch-banana plug
2	134-0076-00			1	PLUG, protector

NOTES

ELECTRICAL PARTS L-20

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Description				S/N Range
		Capacitors				
Tolerance ±20% unless otherwise indicated.						
C101	281-0105-00	0.8-8.5 pf	Cer	Var		
C102	281-0613-00	10 pf	Cer		200 v	10%
C103	281-0628-00	15 pf	Cer		600 v	5%
C104	283-0060-00	100 pf	Cer		200 v	5%
C105	283-0067-00	1000 pf	Cer		200 v	10%
C106	283-0060-00	100 pf	Cer		200 v	5%
C107	283-0060-00	100 pf	Cer		200 v	5%
C108	283-0060-00	100 pf	Cer		200 v	5%
C109	281-0613-00	10 pf	Cer		200 v	10%
C110	281-0105-00	0.8-8.5 pf	Cer	Var		
C111	283-0060-00	100 pf	Cer		200 v	5%
C112	283-0067-00	1000 pf	Cer		200 v	10%
C113	281-0105-00	0.8-8.5 pf	Cer	Var		
C114	281-0627-00	1 pf	Cer		600 v	
C115	281-0627-00	1 pf	Cer		600 v	
C116	283-0067-00	1000 pf	Cer		200 v	10%
C117	283-0067-00	1000 pf	Cer		200 v	10%
C118	283-0039-00	1000 pf	Cer		500 v	
C119	283-0067-00	1000 pf	Cer		200 v	10%
C120	283-0060-00	100 pf	Cer		200 v	5%
C121	283-0039-00	1000 pf	Cer		500 v	
C122	283-0039-00	1000 pf	Cer		500 v	
C123	283-0039-00	1000 pf	Cer		500 v	
C124	283-0067-00	1000 pf	Cer		200 v	10%
C125	283-0039-00	1000 pf	Cer		500 v	
C126	283-0060-00	100 pf	Cer		200 v	5%
C127	281-0105-00	0.8-8.5 pf	Cer	Var		
C128	281-0613-00	10 pf	Cer		200 v	10%
C129	281-0105-00	0.8-8.5 pf	Cer	Var		
C130	281-0628-00	15 pf	Cer		600 v	5%
C132	281-0628-00	15 pf	Cer		600 v	5%
C133	281-0572-00	6.8 pf	Cer		500 v	10%
C201	Use 283-0000-00	0.001 μf	Cer		500 v	
C203	Use 283-0000-00	0.001 μf	Cer		500 v	
C204	281-0105-00	0.8-8.5 pf	Cer	Var		
C206	Use 283-0000-00	0.001 μf	Cer		500 v	
C207	283-0039-00	1000 pf	Cer		500 v	
C208	283-0039-00	1000 pf	Cer		500 v	
C209	Use 283-0000-00	0.001 μf	Cer		500 v	
C210	Use 283-0000-00	0.001 μf	Cer		500 v	

Capacitors *(Cont'd)*

Ckt. No.	Tektronix Part No.	Description				S/N Range
C212	Use 283-0000-00	0.001 μf	Cer		500 v	
C213	281-0105-00	0.8-8.5 pf	Cer	Var		
C214	283-0039-00	1000 pf	Cer		500 v	
C215	Use 283-0000-00	0.001 μf	Cer		500 v	
C216	283-0110-00	5000 pf	Cer		150 v	
C218	283-0110-00	5000 pf	Cer		150 v	
C219	283-0609-00	100 pf	Mica		500 v	
C220	283-0110-00	5000 pf	Cer		150 v	
C221	281-0613-00	10 pf	Cer		200 v	10%
C222	283-0608-00	68 pf	Mica		500 v	
C223	283-0610-00	220 pf	Mica		500 v	
C224	283-0110-00	5000 pf	Cer		150 v	
C225	283-0110-00	5000 pf	Cer		150 v	
C226	Use 283-0000-00	0.001 μf	Cer		500 v	
C227	283-0110-00	5000 pf	Cer		150 v	
C228	283-0609-00	100 pf	Mica		500 v	
C229	283-0110-00	5000 pf	Cer		150 v	
C231	283-0039-00	1000 pf	Cer		500 v	
C235	Use 283-0000-00	0.001 μf	Cer		500 v	
C301	283-0110-00	5000 pf	Cer		150 v	
C302	283-0110-00	5000 pf	Cer		150 v	
C303	283-0110-00	5000 pf	Cer		150 v	
C304	283-0612-00	82 pf	Mica		500 v	
C305	283-0609-00	100 pf	Mica		500 v	
C306	283-0613-00	470 pf	Mica		500 v	
C307	285-0572-00	0.1 μf	PTM		200 v	
C308	281-0629-00	33 pf	Cer		600 v	5%
C309	283-0610-00	220 pf	Mica		500 v	
C310	281-0629-00	33 pf	Cer		600 v	5%
C311	281-0629-00	33 pf	Cer		600 v	5%
C312	283-0110-00	5000 pf	Cer		150 v	
C313	283-0614-00	47 pf	Mica		500 v	
C315	285-0572-00	0.1 μf	PTM		200 v	
C316	285-0673-00	5 μf	PTM		50 v	
C360[1]	283-0039-00	1000 pf	Cer		500 v	
C361[1]	283-0039-00	1000 pf	Cer		500 v	
C362[1]	283-0039-00	1000 pf	Cer		500 v	
C401	283-0110-00	5000 pf	Cer		150 v	
C402	285-0674-00	0.01 μf	PTM		100 v	
C403	285-0627-00	0.0033 μf	PTM		100 v	5%
C404	283-0611-00	1200 pf	Mica		500 v	
C405	283-0067-00	1000 pf	Cer		200 v	10%
C407	283-0039-00	1000 pf	Cer		500 v	
C409	283-0111-00	0.1 μf	Cer		50 v	
C410	281-0106-00	2.7-19.6 pf	Air	Var		FREQUENCY DIFF-MC

[1] Furnished with *644-0010-00. (Band Switch Box Assy.)

Capacitors *(Cont'd)*

Ckt. No.	Tektronix Part No.		Description				S/N Range
C411	281-0105-00	0.8-8.5 pf	Cer	Var			
C412	281-0627-00	1 pf	Cer		600 v		
C413	283-0039-00	1000 pf	Cer		500 v		
C414	283-0039-00	1000 pf	Cer		500 v		
C415	283-0039-00	1000 pf	Cer		500 v		
C420	281-0572-00	6.8 pf	Cer		500 v	10%	
C601	281-0105-00	0.8-8.5 pf	Cer	Var			
C602	281-0105-00	0.8-8.5 pf	Cer	Var			
C603	283-0110-00	5000 pf	Cer		150 v		
C604	283-0110-00	5000 pf	Cer		150 v		
C605	283-0067-00	1000 pf	Cer		200 v	10%	
C606	283-0067-00	1000 pf	Cer		200 v	10%	
C607	283-0110-00	5000 pf	Cer		150 v		
C608	283-0110-00	5000 pf	Cer		150 v		
C701	281-0629-00	33 pf	Cer		600 v	5%	
C702	281-0105-00	0.8-8.5 pf	Cer	Var			
C703	281-0617-00	15 pf	Cer		200 v		
C704	281-0105-00	0.8-8.5 pf	Cer	Var			
C705	281-0504-00	10 pf	Cer		500 v	10%	
C706	281-0105-00	0.8-8.5 pf	Cer	Var			
C708	281-0105-00	0.8-8.5 pf	Cer	Var			

Diodes

D101	152-0187-00	Varicap	PC-115	
D102	152-0186-00	Germanium	1N198	
D201	152-0186-00	Germanium	1N198	
D300	152-0194-00	Silicon	1N416D	
D301	152-0188-00	Germanium	1N64	
D302	152-0186-00	Germanium	1N198	
D303	152-0141-00	Silicon	1N3605	
D304	152-0188-00	Germanium	1N64	
D305	152-0141-00	Silicon	1N3605	
D306	152-0141-00	Silicon	1N3605	
D307	152-0141-00	Silicon	1N3605	
D401	152-0169-00	Tunnel	1N3712	1MA
D402	152-0188-00	Germanium	1N64	
D403	152-0188-00	Germanium	1N64	
D404	152-0188-00	Germanium	1N64	
D602	152-0062-00	Silicon	1N914	

Filters

FL301	*610-0137-00	L.P. Wide Band Filter Chassis (includes J801 and J802)
FL302	*610-0138-00	L.P. Narrow Band Filter Chassis

Connectors

Ckt. No.	Tektronix Part No.	Description	S/N Range
P11	131-0017-00	Connector, 16 contact, male	
J101	131-0372-00	Connector, Coax	
J102	131-0372-00	Connector, Coax	
J103	131-0372-00	Connector, Coax	
J201	131-0372-00	Connector, Coax	
J301	131-0106-00	Connector, BNC, 1 contact, female	
J303	*136-0140-00	Socket, Banana Jack Ass'y	
J401	131-0372-00	Connector, Coax	
J501	131-0372-00	Connector, Coax	
J502	131-0372-00	Connector, Coax	
J701	131-0372-00	Connector, Coax	
J702	131-0372-00	Connector, Coax	
J800[1]			
J801[2]			
J802[2]			
J803	131-0372-00	Connector, Coax	
J804[3]			
J805[4]			
J806[4]			
J807[4]			
J808[4]			
J810[5]			

Inductors

L101	*108-0319-00	0.08 μh		
L102	*108-0312-00	0.058 μh		
L103	108-0315-00	0.22 μh		
L104	108-0315-00	0.22 μh		
L105	*108-0310-00	0.09 μh		
L106	*108-0311-00	0.18 μh		
L107	*120-0353-00	Toroid, 8 turns		
L108	*108-0303-00	0.04 μh		
L109	108-0316-00	0.68 μh		
L110	*108-0314-00	Bare wire		
L111	*108-0313-00	0.05 μh		
L201	276-0507-00	Core, Ferramic Suppressor		
L202	276-0507-00	Core, Ferramic Suppressor		
L210	*114-0165-00	0.12-0.17 μh	Var	Core not available separately.
L301	*114-0169-00	24-45 μh	Var	Core not available separately.

[1] Furnished with Y301.

[2] Furnished with FL301.

[3] Furnished with Z302.

[4] Furnished with SW310.

[5] Furnished with Z301.

Inductors *(Cont'd)*

Ckt. No.	Tektronix Part No.	Description			S/N Range
L302	108-0317-00	15 μh			
L303	108-0318-00	100 μh			
L311	276-0507-00	Core, Ferramic Suppressor			
L312	276-0507-00	Core, Ferramic Suppressor			
L401	*114-0166-00	8-15 μh	Var	Core not available separately.	
L402	114-0168-00	850-1200 μh	Var	Core not available separately.	
L403	*114-0167-00	0.04-0.044 μh	Var	Core not available separately.	
L701	*108-0305-00	0.032 μh			
L702	*108-0322-00	0.04 μh			
L703	*108-0304-00	0.045 μh			
L704	*108-0304-00	0.045 μh			
L705	*108-0303-00	0.04 μh			
L706	*108-0302-00	0.12 μh			
L707	*108-0301-00	0.025 μh			
L708	*108-0300-00	0.2 μh			

Transistors

Q101	151-0143-00	2N2996			
Q102	151-0143-00	2N2996			
Q103	151-0144-00	2N1743			
Q104	151-0145-00	2N1744			
Q201	151-0146-00	2N1745			
Q202	151-0146-00	2N1745			
Q203	151-0146-00	2N1745			
Q204	151-0146-00	2N1745			
Q205	151-0147-00	2N1747			
Q401	151-0146-00	2N1745			
Q601	151-0143-00	2N2996			
Q602	151-0143-00	2N2996			

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

R101	316-0221-00	220 Ω	¼ w		
R102	316-0102-00	1 k	¼ w		
R103	316-0222-00	2.2 k	¼ w		
R104	310-0147-00	4.7 k	1 w	Prec	5%
R105	316-0222-00	2.2 k	¼ w		
R106	316-0102-00	1 k	¼ w		
R107	316-0102-00	1 k	¼ w		
R108	316-0221-00	220 Ω	¼ w		
R109	316-0102-00	1 k	¼ w		
R110	316-0222-00	2.2 k	¼ w		

Resistors *(Cont'd)*

Ckt. No.	Tektronix Part No.		Description			S/N Range
R111	316-0102-00	1 k	¼ w			
R112	316-0153-00	15 k	¼ w			
R113	316-0222-00	2.2 k	¼ w			
R114	316-0102-00	1 k	¼ w			
R115	316-0102-00	1 k	¼ w			
R116	316-0102-00	1 k	¼ w			
R117	316-0221-00	220 Ω	¼ w			
R118	316-0470-00	47 Ω	¼ w			
R119	304-0183-00	18 k	1 w			
R121	316-0470-00	47 Ω	¼ w			
R122	316-0332-00	3.3 k	¼ w			
R123	316-0682-00	6.8 k	¼ w			
R124	316-0471-00	470 Ω	¼ w			
R125	316-0471-00	470 Ω	¼ w			
R201	316-0331-00	330 Ω	¼ w			
R202	316-0331-00	330 Ω	¼ w			
R203	316-0180-00	18 Ω	¼ w			
R204	316-0683-00	68 k	¼ w			
R205	316-0222-00	2.2 k	¼ w			
R206	316-0102-00	1 k	¼ w			
R207[1]	311-0500-00	10 k		Var	GAIN	
R208	316-0102-00	1 k	¼ w			
R209	316-0222-00	2.2 k	¼ w			
R210	316-0222-00	2.2 k	¼ w			
R211	316-0222-00	2.2 k	¼ w			
R212	316-0102-00	1 k	¼ w			
R213	316-0102-00	1 k	¼ w			
R214	316-0102-00	1 k	¼ w			
R215	316-0102-00	1 k	¼ w			
R216	316-0471-00	470 Ω	¼ w			
R218	316-0470-00	47 Ω	¼ w			
R219	316-0472-00	4.7 k	¼ w			
R221	316-0222-00	2.2 k	¼ w			
R222	310-0146-00	8.2 k	1 w	Prec	5%	
R223	302-0102-00	1 k	½ w			
R301	316-0471-00	470 Ω	¼ w			
R302	316-0102-00	1 k	¼ w			
R303	316-0102-00	1 k	¼ w			
R304	316-0470-00	47 Ω	¼ w			
R305	316-0680-00	68 Ω	¼ w			
R306	316-0470-00	47 Ω	¼ w			
R307	316-0333-00	33 k	¼ w			
R308	316-0332-00	3.3 k	¼ w			
R309	Use 316-0124-00	120 k	¼ w			
R310	316-0104-00	100 k	¼ w			

[1] Furnished as a unit with R311 and SW301.

Resistors *(Cont'd)*

Ckt. No.	Tektronix Part No.	Description				S/N Range
R311[1]	311-0500-00	100 Ω	Var		GAIN	
R313	316-0102-00	1 k	¼ w			
R314	316-0102-00	1 k	¼ w			
R315	304-0472-00	4.7 k	1 w			
R316	302-0103-00	10 k	½ w			
R317	316-0101-00	100 Ω	¼ w			
R318	301-0512-00	5.1 k	½ w		5%	X1105-up
R319	305-0303-00	30 k	2 w		5%	1000-1104
R319	311-0448-00	20 k	Var		DISP CAL	1105-up
R320[2]	311-0502-00	10 k	Var		DISPERSION	1105-up
R321	316-0104-00	100 k	¼ w			
R322	316-0104-00	100 k	¼ w			
R323	316-0104-00	100 k	¼ w			
R324	316-0682-00	6.8 k	¼ w			
R325	316-0105-00	1 meg	¼ w			
R326	316-0105-00	1 meg	¼ w			
R327	316-0105-00	1 meg	¼ w			
R328	304-0154-00	150 k	1 w			
R329	305-0363-00	36 k	2 w		5%	1000-1104
R329	303-0243-00	24 k	1 w		5%	1105-up
R330	306-0273-00	27 k	2 w			
R331	316-0105-00	1 meg	¼ w			
R332	304-0333-00	33 k	1 w			
R333	316-0823-00	82 k	¼ w			
R334	308-0211-00	12 k	5 w	WW	5%	
R335	316-0103-00	10 k	¼ w			
R336	316-0333-00	33 k	¼ w		(Selected)	
R337	316-0823-00	82 k	¼ w		(Selected)	
R338	316-0682-00	6.8 k	¼ w			
R339	323-0385-00	100 k	½ w	Prec	1%	
R340	316-0471-00	470 Ω	¼ w		(Selected)	
R341	308-0334-00	7 k	3 w	WW	3%	
R342	308-0335-00	7 k	7 w	WW	5%	
R343[3]	311-0504-00	5 k	Var		CENTER FREQUENCY	
R344	316-0104-00	100 k	¼ w			
R345	304-0472-00	4.7 k	1 w			
R346	304-0153-00	15 k	1 w			1000-1104
R346	303-0103-00	10 k	1 w		5%	1105-up
R347	316-0472-00	4.7 k	¼ w			
R348	316-0682-00	6.8 k	¼ w			
R349	308-0333-00	3.5 k	3 w	WW	3%	
R350	316-0472-00	4.7 k	¼ w		(Selected)	
R352[4]	311-0501-00	10 k	Var		MIXER PEAKING	
R356	308-0341-00	4 k	3 w	WW	3%	
R357	308-0340-00	4.2 k	25 w	WW	3%	

[1] Furnished as a unit with R207 and SW301.

[2] Concentric with SW101.

[3] Furnished as a unit with R611.

[4] R352 and R372 furnished as a unit.

Resistors *(Cont'd)*

Ckt. No.	Tektronix Part No.		Description				S/N Range
R358	308-0339-00	15 k	10 w		WW	3%	
R360	308-0304-00	1.5 k	3 w		WW	1%	
R361	306-0123-00	12 k	2 w				
R362	308-0338-00	150 Ω	5 w		WW	5%	
R372[1]	311-0501-00	1 k		Var		VERT POSITION	
R401	316-0223-00	22 k	¼ w				
R402	316-0472-00	4.7 k	¼ w				
R403	316-0102-00	1 k	¼ w				
R404	316-0180-00	18 Ω	¼ w				1000-1113
R404[2]			¼ w			5%	1114-up
R405	316-0102-00	1 k	¼ w				
R406	308-0336-00	7 k	5 w		WW	5%	
R407	302-0683-00	68 k	½ w				
R408	316-0222-00	2.2 k	¼ w				
R409	316-0221-00	220 Ω	¼ w				
R410	316-0221-00	220 Ω	¼ w				
R411	316-0221-00	220 Ω	¼ w				
R412	316-0221-00	220 Ω	¼ w				
R413	316-0680-00	68 Ω	¼ w				
R414[3]	311-0499-00	10 k		Var		AMPLITUDE	
R415	304-0223-00	22 k	1 w				
R416	316-0152-00	1.5 k	¼ w				
R417	316-0101-00	100 Ω	¼ w				
R418	316-0101-00	100 Ω	¼ w				
R500	315-0470-00	47 Ω	¼ w			5%	
R501	315-0620-00	62 Ω	¼ w			5%	
R502	315-0241-00	240 Ω	¼ w			5%	
R503	315-0620-00	62 Ω	¼ w			5%	
R504	315-0680-00	68 Ω	¼ w			5%	
R505	315-0151-00	150 Ω	¼ w			5%	
R506	315-0680-00	68 Ω	¼ w			5%	
R507	315-0121-00	120 Ω	¼ w			5%	
R508	315-0510-00	51 Ω	¼ w			5%	
R509	315-0121-00	120 Ω	¼ w			5%	
R510	315-0221-00	220 Ω	¼ w			5%	
R511	315-0240-00	24 Ω	¼ w			5%	
D512	315-0221-00	220 Ω	¼ w			5%	
R513	315-0431-00	430 Ω	¼ w			5%	
R514	315-0120-00	12 Ω	¼ w			5%	
R515	315-0431-00	430 Ω	¼ w			5%	
R516	315-0911-00	910 Ω	¼ w			5%	
R517	307-0170-00	5.6 Ω	¼ w			5%	
R518	315-0911-00	910 Ω	¼ w			5%	
R519	316-0100-00	10 Ω	¼ w				
R601	316-0471-00	470 Ω	¼ w				
R602	304-0473-00	47 k	1 w				

[1] R352 and R372 furnished as a unit.

[2] Selected part ranging from 16 Ω to 27 Ω.

[3] Furnished as a unit with SW402.

Resistors *(Cont'd)*

Ckt. No.	Tektronix Part No.		Description		S/N Range
R603	316-0681-00	680 Ω	¼ w		
R604	316-0223-00	22 k	¼ w		
R605	316-0103-00	10 k	¼ w		
R606	316-0103-00	10 k	¼ w		
R607	304-0223-00	22 k	1 w		
R608	316-0102-00	1 k	¼ w		
R609	316-0102-00	1 k	¼ w		
R611[1]	311-0504-00	1 k		Var	RESOLUTION

Switches

	Unwired	Wired		
SW101[2]	260-0642-00		Toggle	WIDE-NARROW (Dispersion)
SW301[3]		*262-0682-00	Rotary	DISPLAY FUNCTION
SW305	260-0643-00		Toggle	VIDEO FILTER
SW310[4]			Toggle	
SW320	260-0583-00		Slide	100 V, 150 V SAWTOOTH
SW401		*262-0681-00	Rotary	PICKET FENCE
SW402[5]	311-0499-00		SPST	AMPLITUDE
SW501	260-0642-00		Toggle	20DB
SW502	260-0642-00		Toggle	16DB
SW503	260-0642-00		Toggle	8DB
SW504	260-0642-00		Toggle	4DB
SW505	260-0642-00		Toggle	2DB
SW506	260-0642-00		Toggle	1DB

Transformers

T101	*120-0352-00	Toroid	13 T
T201	*120-0354-00	Toroid	2 windings
T202	*120-0354-00	Toroid	2 windings
T203	120-0356-00	3.45 MC	
T204	120-0356-00	3.45 MC	
T601	*120-0358-00	Toroid	3 windings
T602	120-0357-00	Toroid	

[1] Furnished as a unit with R343.

[2] Concentric with R320.

[3] Furnished as a unit with R207 and R311.

[4] Furnished with *644-0010-00. (Band Switch Box Assy.) Includes J805, J806, J807, and J808.

[5] Furnished as a unit with R414.

Electron Tubes

Ckt. No.	Tektronix Part No.	Description	S/N Range
V301	154-0040-00	12AU6	
V302	154-0041-00	12AU7	
V303	154-0039-00	12AT7	
V304	154-0474-00	7486	
V305	154-0474-00	7486	

Crystals

Y202	158-0018-00	54 MC	
Y301	119-0041-00	Mixer w/Crystal (includes D300, J800 and J803)	
Y601	158-0019-00	5 MC	

Terminations, Input

Z301	131-0376-00	Connector, Pad Attenuator (includes J810)	
Z302	131-0377-00	Connector, "T" BNC to Cable (includes J804)	

Oscillator

	119-0039-00	Oscillator Assy	
Use	*632-0005-00	Oscillator and Dial Assy (includes Z302)	1000-1104
	and		
Use	*050-0234-00	Replacement Kit	1000-1104
	*632-0005-00	Oscillator and Dial Assy (includes Z302)	1105-up

ELECTRICAL PARTS L-30

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Description				S/N Range
		Capacitors				
Tolerance ±20% unless otherwise indicated.						
C101	281-0105-00	0.8-8.5 pf	Cer	Var		
C102	281-0613-00	10 pf	Cer		200 v	10%
C103	281-0628-00	15 pf	Cer		600 v	5%
C104	283-0060-00	100 pf	Cer		200 v	5%
C105	283-0067-00	1000 pf	Cer		200 v	10%
C106	283-0060-00	100 pf	Cer		200 v	5%
C107	283-0060-00	100 pf	Cer		200 v	5%
C108	283-0060-00	100 pf	Cer		200 v	5%
C109	281-0613-00	10 pf	Cer		200 v	10%
C110	281-0105-00	0.8-8.5 pf	Cer	Var		
C111	283-0060-00	100 pf	Cer		200 v	5%
C112	283-0067-00	1000 pf	Cer		200 v	10%
C113	281-0105-00	0.8-8.5 pf	Cer	Var		
C114	281-0627-00	1 pf	Cer		600 v	
C115	281-0627-00	1 pf	Cer		600 v	
C116	283-0067-00	1000 pf	Cer		200 v	10%
C117	283-0067-00	1000 pf	Cer		200 v	10%
C118	283-0039-00	1000 pf	Cer		500 v	
C119	283-0067-00	1000 pf	Cer		200 v	10%
C120	283-0060-00	100 pf	Cer		200 v	5%
C121	283-0039-00	1000 pf	Cer		500 v	
C122	283-0039-00	1000 pf	Cer		500 v	
C123	283-0039-00	1000 pf	Cer		500 v	
C124	283-0067-00	1000 pf	Cer		200 v	10%
C125	283-0039-00	1000 pf	Cer		500 v	
C126	283-0060-00	100 pf	Cer		200 v	5%
C127	281-0105-00	0.8-8.5 pf	Cer	Var		
C128	281-0613-00	10 pf	Cer		200 v	10%
C129	281-0105-00	0.8-8.5 pf	Cer	Var		
C130	281-0628-00	15 pf	Cer		600 v	5%
C132	281-0628-00	15 pf	Cer		600 v	5%
C133	281-0572-00	6.8 pf	Cer		500 v	10%
C201	Use 283-0000-00	0.001 μf	Cer		500 v	
C203	Use 283-0000-00	0.001 μf	Cer		500 v	
C204	281-0105-00	0.8-8.5.pf	Cer	Var		
C206	Use 283-0000-00	0.001 μf	Cer		500 v	
C207	283-0039-00	1000 pf	Cer		500 v	
C208	283-0039-00	1000 pf	Cer		500 v	
C209	Use 283-0000-00	0.001 μf	Cer		500 v	
C210	Use 283-0000-00	0.001 μf	Cer		500 v	

Capacitors *(Cont'd)*

Ckt. No.	Tektronix Part No.		Description			S/N Range
C212	Use 283-0000-00	0.001 μf	Cer	500 v		
C213	281-0105-00	0.8-8.5.pf	Cer	Var		
C214	283-0039-00	1000 pf	Cer	500 v		
C215	Use 283-0000-00	0.001 μf	Cer	500 v		
C216	283-0110-00	5000 pf	Cer	150 v		
C218	283-0110-00	5000 pf	Cer	150 v		
C219	283-0609-00	100 pf	Mica	500 v		
C220	283-0110-00	5000 pf	Cer	150 v		
C221	281-0613-00	10 pf	Cer	200 v	10%	
C222	283-0608-00	68 pf	Mica	500 v		
C223	283-0610-00	220 pf	Mica	500 v		
C224	283-0110-00	5000 pf	Cer	150 v		
C225	283-0110-00	5000 pf	Cer	150 v		
C226	Use 283-0000-00	0.001 μf	Cer	500 v		
C227	283-0110-00	5000 pf	Cer	150 v		
C228	283-0609-00	100 pf	Mica	500 v		
C229	283-0110-00	5000 pf	Cer	150 v		
C231	283-0039-00	1000 pf	Cer	500 v		
C235	Use 283-0000-00	0.001 μf	Cer	500 v		
C301	283-0110-00	5000 pf	Cer	150 v		
C302	283-0110-00	5000 pf	Cer	150 v		
C303	283-0110-00	5000 pf	Cer	150 v		
C304	283-0612-00	82 pf	Mica	500 v		
C305	283-0609-00	100 pf	Mica	500 v		
C306	283-0613-00	470 pf	Mica	500 v		
C307	285-0572-00	0.1 μf	PTM	200 v		
C308	281-0629-00	33 pf	Cer	600 v	5%	
C309	283-0610-00	220 pf	Mica	500 v		
C310	281-0629-00	33 pf	Cer	600 v	5%	
C311	281-0629-00	33 pf	Cer	600 v	5%	
C312	283-0110-00	5000 pf	Cer	150 v		
C313	283-0614-00	47 pf	Mica	500 v		
C315	285-0572-00	0.1 μf	PTM	200 v		
C316	285-0673-00	5 μf	PTM	50 v		
C401	283-0110-00	5000 pf	Cer	150 v		
C402	285-0674-00	0.01 μf	PTM	100 v		
C403	285-0627-00	0.0033 μf	PTM	100 v	5%	
C404	283-0611-00	1200 pf	Mica	500 v		
C405	283-0067-00	1000 pf	Cer	200 v	10%	
C407	283-0039-00	1000 pf	Cer	500 v		
C409	283-0111-00	0.1 μf	Cer	50 v		
C410	281-0106-00	2.7-19.6 pf	Air	Var		FREQUENCY DIFF-MC
C411	281-0105-00	0.8-8.5 pf	Cer	Var		
C412	281-0627-00	1 pf	Cer	600 v		
C413	283-0039-00	1000 pf	Cer	500 v		

Capacitors *(Cont'd)*

Ckt. No.	Tektronix Part No.	Description				S/N Range
C414	283-0039-00	1000 pf	Cer		500 v	
C415	283-0039-00	1000 pf	Cer		500 v	
C420	281-0572-00	6.8 pf	Cer		500 v	10%
C601	281-0105-00	0.8-8.5 pf	Cer	Var		
C602	281-0105-00	0.8-8.5 pf	Cer	Var		
C603	283-0110-00	5000 pf	Cer		150 v	
C604	283-0110-00	5000 pf	Cer		150 v	
C605	283-0067-00	1000 pf	Cer		200 v	10%
C606	283-0067-00	1000 pf	Cer		200 v	10%
C607	283-0110-00	5000 pf	Cer		150 v	
C608	283-0110-00	5000 pf	Cer		150 v	

Diodes

D101	152-0187-00	Varicap PC-115	
D102	152-0186-00	Germanium 1N198	
D201	152-0186-00	Germanium 1N198	
D300	152-0197-00	Silicon 1N415D	
D301	152-0188-00	Germanium 1N64	
D302	152-0186-00	Germanium 1N198	
D303	152-0141-00	Silicon 1N3605	
D304	152-0188-00	Germanium 1N64	
D305	152-0141-00	Silicon 1N3605	
D306	152-0141-00	Silicon 1N3605	
D307	152-0141-00	Silicon 1N3605	
D401	152-0169-00	Tunnel 1N3712	1MA
D402	152-0188-00	Germanium 1N64	
D403	152-0188-00	Germanium 1N64	
D404	152-0188-00	Germanium 1N64	
D602	152-0062-00	Silicon 1N914	

Filter

FL301	*610-0137-00	L.P. Wide Band Filter Chassis (includes J801 and J802)

Connectors

P11	131-0017-00	Connector, BNC, 1 contact, female
J101	131-0372-00	Connector, Coax
J102	131-0372-00	Connector, Coax
J103	131-0372-00	Connector, Coax
J201	131-0372-00	Connector, Coax
J301	131-0106-00	Connector, BNC, 1 contact, female
J303	*136-0140-00	Socket, Banana Jack Assy
J401	131-0372-00	Connector, Coax
J501	131-0372-00	Connector, Coax
J502	131-0372-00	Connector, Coax

Connectors *(Cont'd)*

Ckt. No.	Tektronix Part No.	Description			S/N Range
J800[1]					
J801[2]					
J802[2]					
J803	131-0732-00	Connector, Coax			
J810	131-0378-00	Connector, UG30C/U			

Inductors

L101	*108-0319-00	0.08 μh			
L102	*108-0312-00	0.058 μh			
L103	108-0315-00	0.22 μh			
L104	108-0315-00	0.22 μh			
L105	*108-0310-00	0.09 μh			
L106	*108-0311-00	0.18 μh			
L107	*120-0353-00	Toroid, 8 turns			
L108	*108-0303-00	0.04 μh			
L109	108-0316-00	0.68 μh			
L110	*108-0314-00	Bare Wire			
L111	*108-0313-00	0.05 μh			
L201	276-0507-00	Core, Ferramic Suppressor			
L202	276-0507-00	Core, Ferramic Suppressor			
L210	*114-0165-00	0.12-0.17 μh	Var	Core not available separately.	
L301	*114-0169-00	25-45 μh	Var	Core not available separately.	
L302	108-0317-00	15 μh			
L303	108-0318-00	100 μh			
L311	276-0507-00	Core, Ferramic Suppressor			
L312	276-0507-00	Core, Ferramic Suppressor			
L401	*114-0166-00	8-15 μh	Var	Core not available separately.	
L402	114-0168-00	850-1200 μh	Var	Core not available separately.	
L403	*114-0167-00	0.04-0.044 μh	Var	Core not available separately.	

Transistors

Q101	151-0143-00	2N2996
Q102	151-0143-00	2N2996
Q103	151-0144-00	2N1743
Q104	151-0145-00	2N1744
Q201	151-0146-00	2N1745
Q202	151-0146-00	2N1745
Q203	151-0146-00	2N1745
Q204	151-0146-00	2N1745
Q205	151-0147-00	2N1747
Q401	151-0146-00	2N1745
Q601	151-0143-00	2N2996
Q602	151-0143-00	2N2996

[1] Furnished with Y301.

[2] Furnished with FL301.

Resistors

Ckt. No.	Tektronix Part No.	Description			S/N Range
Resistors are fixed, composition, ±10% unless otherwise indicated.					
R101	316-0221-00	220 Ω	1/4 w		
R102	316-0102-00	1 k	1/4 w		
R103	316-0222-00	2.2 k	1/4 w		
R104	310-0147-00	4.7 k	1 w	Prec 5%	
R105	316-0222-00	2.2 k	1/4 w		
R106	316-0102-00	1 k	1/4 w		
R107	316-0102-00	1 k	1/4 w		
R108	316-0221-00	220 Ω	1/4 w		
R109	316-0102-00	1 k	1/4 w		
R110	316-0222-00	2.2 k	1/4 w		
R111	316-0102-00	1 k	1/4 w		
R112	316-0153-00	15 k	1/4 w		
R113	316-0222-00	2.2 k	1/4 w		
R114	316-0102-00	1 k	1/4 w		
R115	316-0102-00	1 k	1/4 w		
R116	316-0102-00	1 k	1/4 w		
R117	316-0221-00	220 Ω	1/4 w		
R118	316-0470-00	47 Ω	1/4 w		
R119	304-0183-00	18 k	1 w		
R121	316-0470-00	47 Ω	1/4 w		
R122	316-0332-00	3.3 k	1/4 w		
R123	316-0682-00	6.8 k	1/4 w		
R124	316-0471-00	470 Ω	1/4 w		
R125	316-0471-00	470 Ω	1/4 w		
R201	316-0331-00	330 Ω	1/4 w		
R202	316-0331-00	330 Ω	1/4 w		
R203	316-0180-00	18 Ω	1/4 w		
R204	316-0683-00	68 k	1/4 w		
R205	316-0222-00	2.2 k	1/4 w		
R206	316-0102-00	1 k	1/4 w		
R207[1]	311-0500-00	10 k		Var	GAIN
R208	316-0102-00	1 k	1/4 w		
R209	316-0222-00	2.2 k	1/4 w		
R210	316-0222-00	2.2 k	1/4 w		
R211	316-0222-00	2.2 k	1/4 w		
R212	316-0102-00	1 k	1/4 w		
R213	316-0102-00	1 k	1/4 w		
R214	316-0102-00	1 k	1/4 w		
R215	316-0102-00	1 k	1/4 w		
R216	316-0471-00	470 Ω	1/4 w		
R218	316-0470-00	47 Ω	1/4 w		
R219	316-0472-00	4.7 k	1/4 w		
R221	316-0222-00	2.2 k	1/4 w		
R222	310-0146-00	8.2 k	1 w	Prec 5%	
R223	302-0102-00	1 k	1/2 w		

[1] Furnished as a unit with R311 and SW301.

Resistors *(Cont'd)*

Ckt. No.	Tektronix Part No.		Description				S/N Range
R301	316-0471-00	470 Ω	1/4 w				
R302	316-0102-00	1 k	1/4 w				
R303	316-0102-00	1 k	1/4 w				
R304	316-0470-00	47 Ω	1/4 w				
R305	316-0680-00	68 Ω	1/4 w				
R306	316-0470-00	47 Ω	1/4 w				
R307	316-0333-00	33 k	1/4 w				
R308	316-0332-00	3.3 k	1/4 w				
R309	Use 316-0124-00	120 k	1/4 w				
R310	316-0104-00	100 k	1/4 w				
R311[1]	311-0500-00	100 Ω		Var			GAIN
R313	316-0102-00	1 k	1/4 w				
R314	316-0102-00	1 k	1/4 w				
R315	304-0472-00	4.7 k	1 w				
R316	302-0103-00	10 k	1/2 w				
R317	316-0101-00	100 Ω	1/4 w				
R318	301-0512-00	5.1 k	1/2 w			5%	X1057-up
R319	305-0303-00	30 k	2 w			5%	1000-1056
R319	311-0448-00	20 k		Var		DISP CAL	1057-up
R320[2]	311-0502-00	10 k		Var		DISPERSION	
R321	316-0104-00	100 k	1/4 w				
R322	316-0104-00	100 k	1/4 w				
R323	316-0104-00	100 k	1/4 w				
R324	316-0682-00	6.8 k	1/4 w				
R325	316-0105-00	1 meg	1/4 w				
R326	316-0105-00	1 meg	1/4 w				
R327	316-0105-00	1 meg	1/4 w				
R328	304-0154-00	150 k	1 w				
R329	305-0363-00	36 k	2 w			5%	1000-1056
R329	303-0243-00	24 k	1 w			5%	1057-up
R330	306-0273-00	27 k	2 w				
R331	316-0105-00	1 meg	1/4 w				
R332	304-0333-00	33 k	1 w				
R333	316-0823-00	82 k	1/4 w				
R334	308-0211-00	12 k	5 w		WW	5%	
R335	316-0103-00	10 k	1/4 w				
R336	316-0333-00	33 k	1/4 w			(Selected)	
R337	316-0823-00	82 k	1/4 w			(Selected)	
R338	316-0682-00	6.8 k	1/4 w				
R339	323-0385-00	100 k	1/2 w		Prec	1%	
R340	316-0471-00	470 Ω	1/4 w			(Selected)	
R341	308-0334-00	7 k	3 w		WW	3%	
R342	308-0335-00	7 k	7 w		WW	5%	
R343[3]	311-0504-00	5 k		Var		CENTER FREQUENCY	
R344	316-0104-00	100 k	1/4 w				
R345	304-0472-00	4.7 k	1 w				
R346	304-0153-00	15 k	1 w				1000-1056
R346	303-0103-00	10 k	1 w			5%	1057-up
R347	316-0472-00	4.7 k	1/4 w				

[1] Furnished as a unit with R207 and SW301.

[2] Concentric with SW101.

[3] Furnished as a unit with R611.

Resistors *(Cont'd)*

Ckt. No.	Tektronix Part No.		Description				S/N Range
R348	316-0682-00	6.8 k	1/4 w				
R349	308-0333-00	3.5 k	3 w		WW	3%	
R350	316-0472-00	4.7 k	1/4 w			(Selected)	
R352[1]	311-0501-00	10 k		Var		PEAKING	
R359	316-0471-00	470 Ω	1/4 w				
R360	308-0304-00	1.5 k	3 w		WW	1%	
R361	308-0062-00	3 k	5 w		WW	5%	
R362	308-0337-00	200 Ω	7 w		WW	5%	
R372[1]	311-0501-00	1 k		Var		POSITION	
R401	316-0223-00	22 k	1/4 w				
R402	316-0472-00	4.7 k	1/4 w				
R403	316-0102-00	1 k	1/4 w				
R404	316-0180-00	18 Ω	1/4 w				1000-1059
R404[2]			1/4 w			5%	1060-up
R405	316-0102-00	1 k	1/4 w				
R406	308-0336-00	7 k	5 w		WW	5%	
R407	302-0683-00	68 k	1/2 w				
R408	316-0222-00	2.2 k	1/4 w				
R409	316-0221-00	220 Ω	1/4 w				
R410	316-0221-00	220 Ω	1/4 w				
R411	316-0221-00	220 Ω	1/4 w				
R412	316-0221-00	220 Ω	1/4 w				
R413	316-0680-00	68 Ω	1/4 w				
R414[3]	311-0499-00	10 k		Var		AMPLITUDE	
R415	304-0223-00	22 k	1 w				
R416	316-0152-00	1.5 k	1/4 w				
R417	316-0101-00	100 Ω	1/4 w				
R418	316-0101-00	100 Ω	1/4 w				
R500	315-0470-00	47 Ω	1/4 w			5%	
R501	315-0620-00	62 Ω	1/4 w			5%	
R502	315-0241-00	240 Ω	1/4 w			5%	
R503	315-0620-00	62 Ω	1/4 w			5%	
R504	315-0680-00	68 Ω	1/4 w			5%	
R505	315-0151-00	150 Ω	1/4 w			5%	
R506	315-0680-00	68 Ω	1/4 w			5%	
R507	315-0121-00	120 Ω	1/4 w			5%	
R508	315-0510-00	51 Ω	1/4 w			5%	
R509	315-0121-00	120 Ω	1/4 w			5%	
R510	315-0221-00	220 Ω	1/4 w			5%	
R511	315-0240-00	24 Ω	1/4 w			5%	
R512	315-0221-00	220 Ω	1/4 w			5%	
R513	315-0431-00	430 Ω	1/4 w			5%	
R514	315-0120-00	12 Ω	1/4 w			5%	
R515	315-0431-00	430 Ω	1/4 w			5%	
R516	315-0911-00	910 Ω	1/4 w			5%	
R517	307-0107-00	5.6 Ω	1/4 w			5%	

[1] R352 and R372 furnished as a unit.

[2] Selected part ranging from 16 Ω to 27 Ω.

[3] Furnished as a unit with SW402.

Resistors *(Cont'd)*

Ckt. No.	Tektronix Part No.		Description		S/N Range
R518	315-0911-00	910 Ω	¼ w	5%	
R519	316-0100-00	10 Ω	¼ w		
R601	316-0471-00	470 Ω	¼ w		
R602	304-0473-00	47 k	1 w		
R603	316-0681-00	680 Ω	¼ w		
R604	316-0223-00	22 k	¼ w		
R605	316-0103-00	10 k	¼ w		
R606	316-0103-00	10 k	¼ w		
R607	304-0223-00	22 k	1 w		
R608	316-0102-00	1 k	¼ w		
R609	316-0102-00	1 k	¼ w		
R611[1]	311-0504-00	1 k	Var	RESOLUTION	

Switches

	Unwired	Wired		
SW101[2]	260-0642-00		Toggle	WIDE-NARROW (Dispersion)
SW301[3]		*262-0682-00	Rotary	DISPLAY FUNCTION
SW305	260-0643-00		Toggle	VIDEO FILTER
SW320	260-0583-00		Slide	100 V, 150 V SAWTOOTH
SW401		*262-0681-00	Rotary	PICKET FENCE
SW402[4]	311-0499-00		SPST	AMPLITUDE
SW501	260-0642-00		Toggle	20DB
SW502	260-0642-00		Toggle	16DB
SW503	260-0642-00		Toggle	8DB
SW504	260-0642-00		Toggle	4DB
SW505	260-0642-00		Toggle	2DB
SW506	260-0642-00		Toggle	1DB

Transformers

T101	*120-0352-00	Toroid 13T
T201	*120-0354-00	Toroid 2 windings
T202	*120-0354-00	Toroid 2 windings
T203	120-0356-00	3.45 MC
T204	120-0356-00	3.45 MC
T601	*120-0358-00	Toroid 3 windings
T602	120-0357-00	Toroid

[1] Furnished as a unit with R343.

[2] Concentric with R320.

[3] Furnished as a unit with R207 and R311.

[4] Furnished as a unit with R414.

Electron Tubes

Ckt. No.	Tektronix Part No.	Description	S/N Range
V301	154-0040-00	12AU6	
V302	154-0041-00	12AU7	
V303	154-0039-00	12AT7	
V304[1]			

Crystals

Y202	158-0018-00	54 MC	
Y301	119-0042-00	Mixer w/Crystal (includes D300, J800 and J803)	
Y601	158-0019-00	5 MC	

Oscillator

	119-0040-00	Oscillator Assy	
	Use *632-0006-00	Oscillator and Dial Assy	1000-1056
	and		
	Use *050-0234-00	Replacement Kit	1000-1056
	*632-0006-00	Oscillator and Dial Assy	1057-up

[1] For replacement contact your Tektronix field engineer.

IMPORTANT

VOLTAGE AND WAVEFORM CONDITIONS

Circuit voltages measured with 20,000 Ω/volt VOM. All readings in VOLTS.

Waveforms shown are actual waveform photographs taken with a Tektronix Oscilloscope Camera System using a Projected Graticule (Tektronix Part No. 016-204).

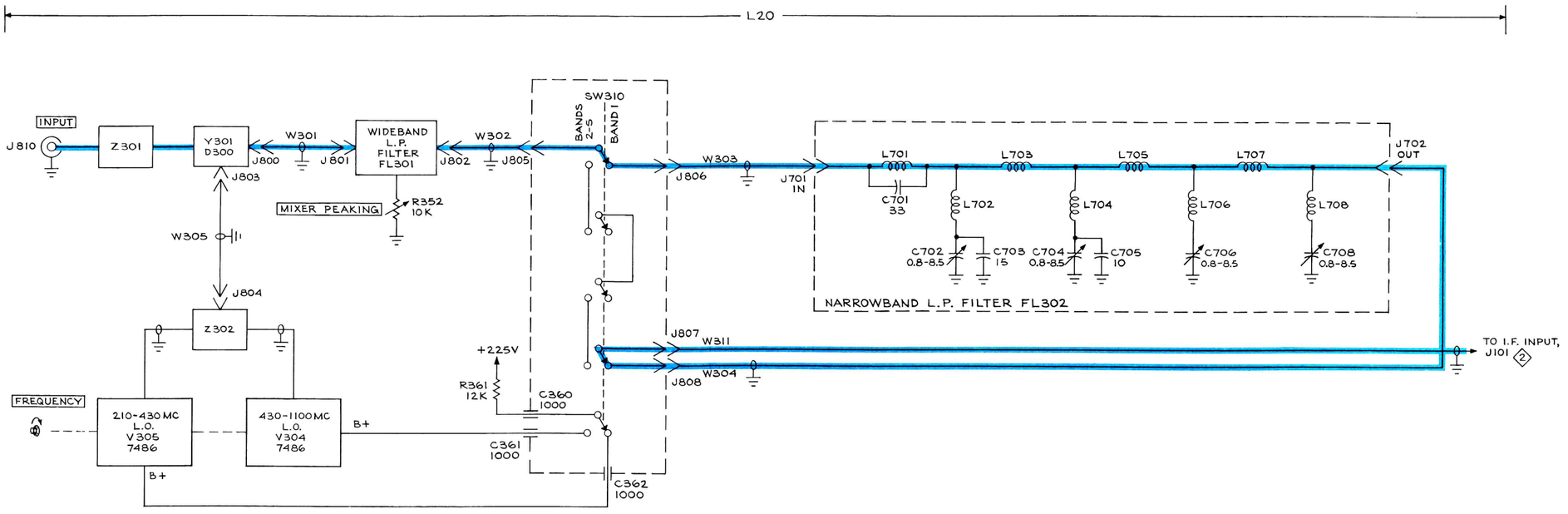
Voltage and waveform measurements are not absolute and may vary from unit to unit. For these measurements, a 30" flexible plug-in extension cable (Tektronix Part No. 012-038) was used to operate the SPECTROPULSE Spectrum Analyzer outside of the oscilloscope plug-in compartment.

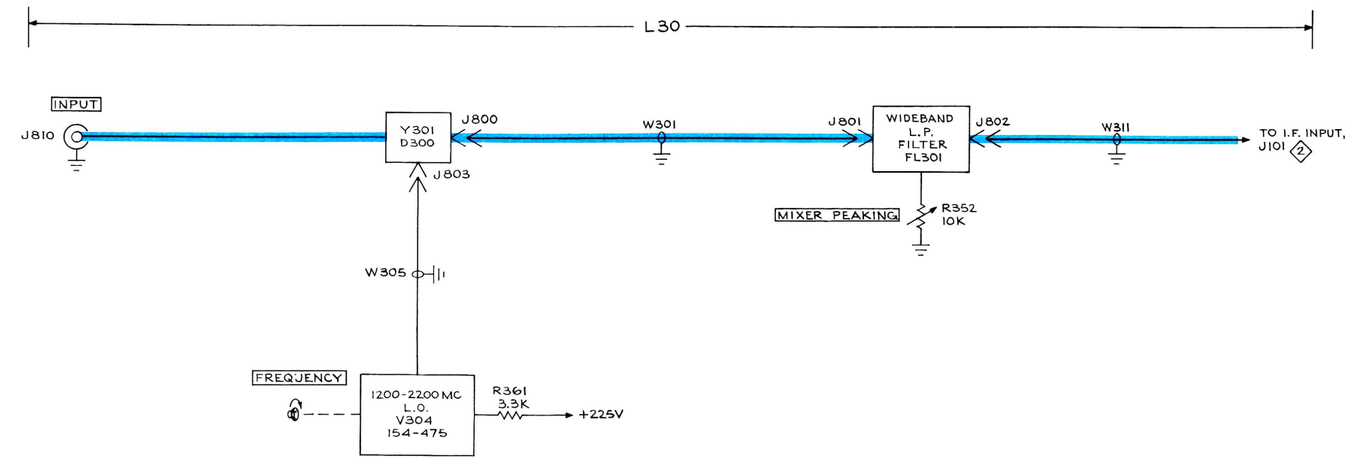
The oscilloscope time base was set for a free-running sweep at a 1 millisecond/centimeter rate.

Voltage readings were obtained under the following conditions:

FREQUENCY	Any Setting
MARKER	
PICKET FENCE	OFF
AMPLITUDE	Clockwise
FREQUENCY DIFF-MC	0
BANDS (L-20 only)	Band 1
POSITION	Trace positioned to bottom of graticule
PEAKING	Counterclockwise
I-F ATTEN	All switches OFF
RESOLUTION	HIGH
CENTER FREQ	Centered (5 turns from end of range)
VID FIL	OFF
DISPLAY FUNCTION	SQ LW
GAIN	Midrange
DISPERSION (Variable)	WIDE
INPUT 50 Ω Signal	None
VIDEO INPUT Signal	None
SWEEP INPUT Signal	Sawtooth from Oscilloscope
Sawtooth Selector (rear panel)	150 V SAWTOOTH

Signal path throughout the unit is shown by the blue lines.


L20
INPUT
J810
Z301
Y301
D300
J800
J803
W301
J801
WIDEBAND
L.P.
FILTER
FL301
J802
W302
J805
SW310
BANDS
2-5
BAND 1
W303
J806
J701
IN
L701
C701
33
L703
L705
L707
J702
OUT
L702
L704
L706
L708
C702
0.8-8.5
C703
15
C704
0.8-8.5
C705
10
C706
0.8-8.5
C708
0.8-8.5
NARROWBAND L.P. FILTER FL302
MIXER PEAKING
R352
10K
W305
J804
Z302
J807
W311
J808
W304
TO I.F. INPUT,
J101
2
+225V
R361
12K
C360
1000
C361
1000
C362
1000
FREQUENCY
210-430 MC
L.O.
V305
7486
430-1100 MC
L.O.
V304
7486
B+
B+


L30
INPUT
J810
Y301
D300
J800
J803
W301
J801
WIDEBAND
L.P.
FILTER
FL301
J802
W311
TO I.F. INPUT,
J101
2
MIXER PEAKING
R352
10K
W305
FREQUENCY
1200-2200 MC
L.O.
V304
154-475
R361
3.3K
+225V

WIDEBAND I-F AMPLIFIER — FIRST MIXER — SWEPT LOCAL OSCILLATOR

FROM R.F. OUTPUT ◇1

W314 J102 W311 J101

C127 0.8-8.5, L111 .05μh, C109 10, C126 100, R117 220, R118 47, C128 10, C101 0.8-8.5, L101 .08μh, L102 .058μh, C102 10, C103 15, L103 0.22, C108 100, L105 .09μh, L106 0.18μh, C110 0.8-8.5, C130 15, L107 8T

C106 100, R101 220, R102 1K, L104 0.22, R108 220, R106 1K, R105 2.2K, R110 2.2K, C114 1, R111 1K, R113 2.2K, R116 1K, R115 1K, C117 1000, C133 6.8, R114 1K, C122 1000 -42 TO C208 ◇3, C118 1000 -40 TO C214 ◇3

C125 1000, -150V, R104 4.7K, R107 1K, R103 2.2K, C104 100, C105 1000, R109 1K, C107 100, C124 1000, R119 18K, R125 470, C111 100, R112 15K, C113 0.8-8.5, T101 13T, C112 1000, R124 470, C116 1000, L108 .04μh, C115 1

Q101 2N2996 — Q102 2N2996 — Q103 2N1743 — Q104 2N1744

D101 PC115, D102, C119 1000, L109 0.68, C121 1000 +7

C120 100, L110, C132 15, C129 0.8-8.5, R121 47, SW101 CONCENTRIC WITH R320, R122 3.3K NARROW, R123 6.8K WIDE, C123 1000 -3.5

J103 — 59 MC OUT TO I.F. ATTEN. J501 ◇3

WIDEBAND I.F.

MARKER OSCILLATOR 200 MC ± 30MC — PICKET FENCE OSCILLATOR

+100V, R415 22K, MARKER AMPLITUDE, R414 10K GANGED WITH SW402, 0V

C415 1000, C414 1000, C413 1000, R418 100, R417 100, R412 220, D404, D403, D402, L403 0.40-0.44μh, C420 6.8, C411 0.8-8.5, C410 2.7-19.6, R404 22, C404 1200, C402 .01, R403 1K, J401, R413 68, R411 220, R410 220, R409 220, C412 1, FREQUENCY DIFF-MC, D401 1ma, R405 1K, R402 4.7K, C401 5000, C409 0.1, R401 22K, Q401 2N1745, C403 .0033, R408 2.2K, L401 8-15μh, L402 850-1200μh, C405 .001, MARKER, C407 1000 -11.5

SW402 OFF GANGED WITH R414, R416 1.5K, 1MC, OFF, 100KC, R407 68K, R406 7K, -150V, SW401 PICKET FENCE

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

SWEEP INPUT J303 — TO C123 — 150V SAWTOOTH — 100V SAWTOOTH — SW320 — R346 15K — TO R320 — R319 30K — R329 36K — -150V

L20 - S/N 1000 - 1104
L30 - S/N 1000 - 1056

SWEEP SHAPING CIRCUIT

SW320 — 150V SAWTOOTH — 100V SAWTOOTH — SWEEP INPUT J303 — R346 10K — R318 5.1K — DISP BAL R319 20K — R329 2.4K — -150V

CONCENTRIC WITH SW101 DISPERSION — R320 10K — +225V — R342 7K — R349 3.5K — C316 5μf — CENTER FREQ — R343 5K — R334 12K — R350 SEL. — -150V

+100V — R322 100K — C310 33 — R325 1M — R323 100K — R324 6.8K — C309 220 — R321 100K — C308 33 — R344 100K — R360 1.5K — R328 150K — -150V

V302 12AU7

R326 1M — C311 33 — R327 1M — V303 12AT7 — R330 27K — R331 1M — C313 — R333 82K

D305 — D306 — D307 — R335 10K — R336 SEL. — R337 SEL. — R340 SEL. — R339 100K — R338 6.8K

+47.5 — R345 4.7K — R341 7K

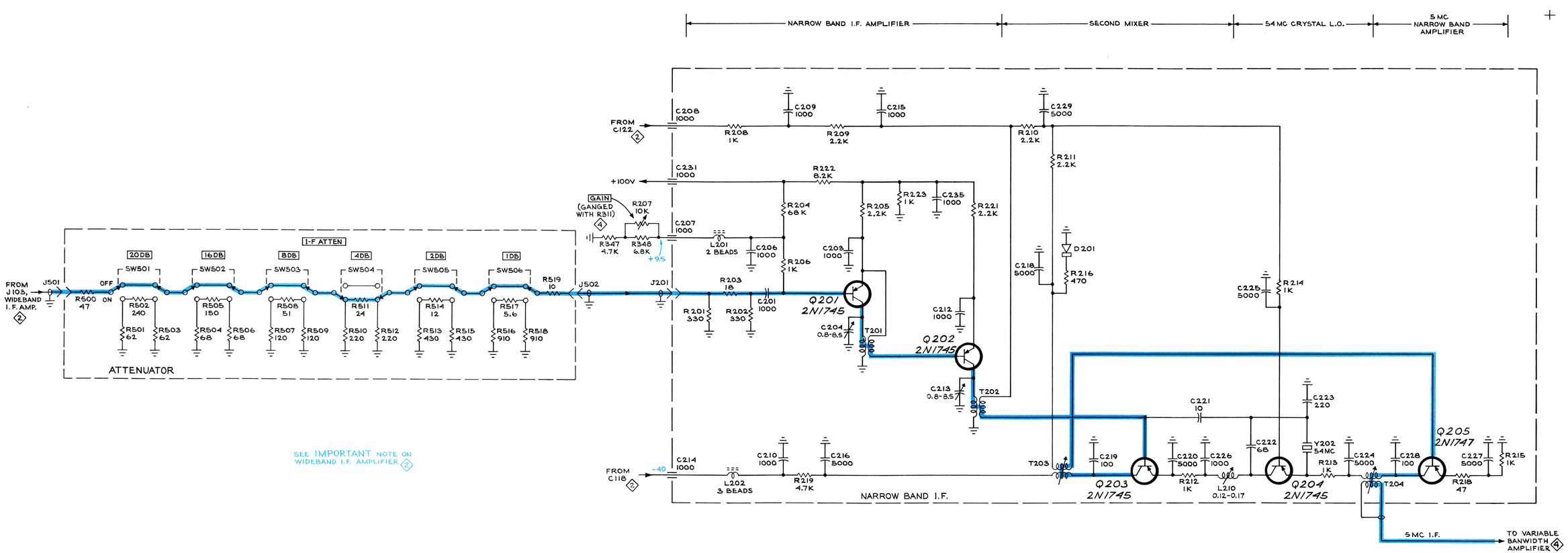
5V/DIV 2mSEC/DIV -50 — +35 — -52 — +100V +4 -51 — -53 — 10V/DIV +10 — -50

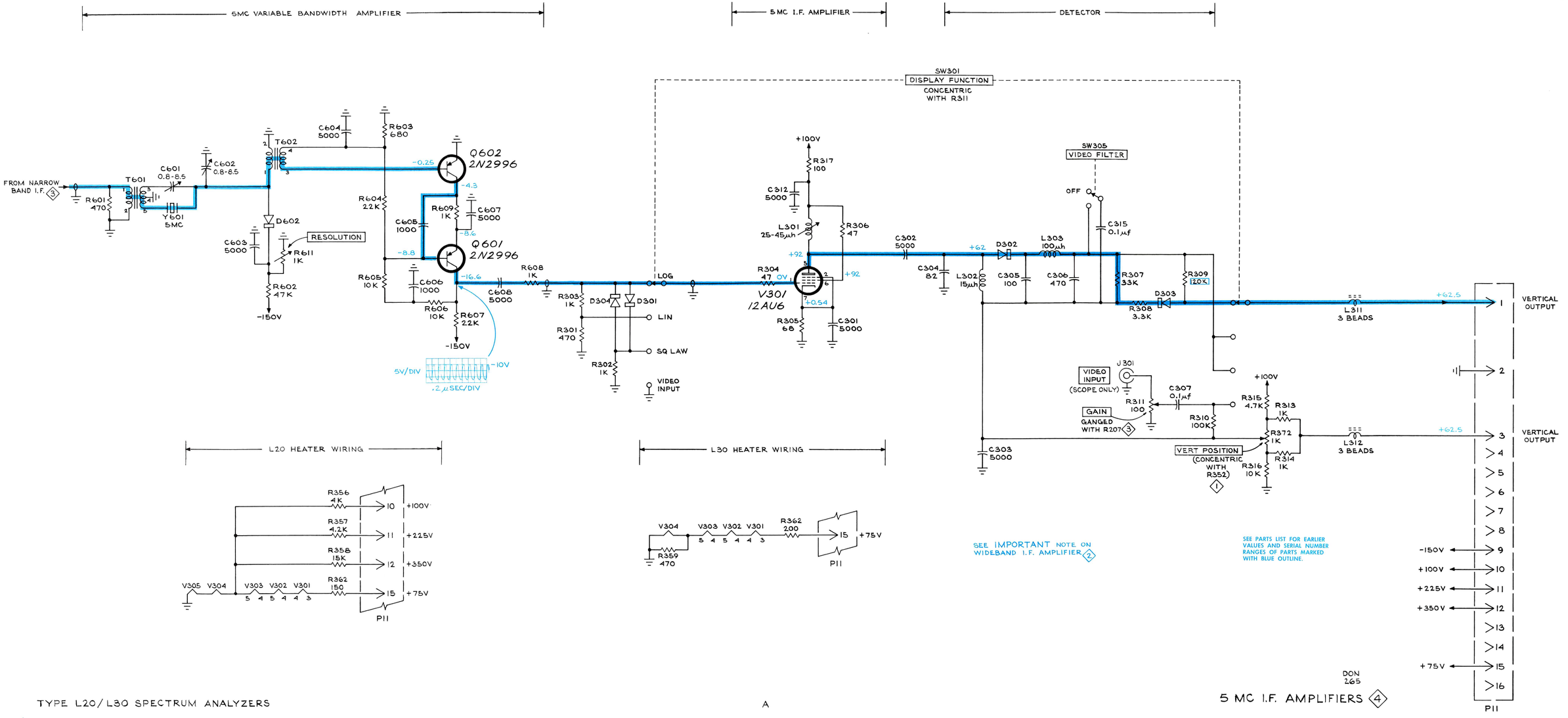
DON 265

TYPE L20/L30 SPECTRUM ANALYZERS

A

WIDEBAND I.F. AMPLIFIER ◇2


NARROW BAND I.F. AMPLIFIER
SECOND MIXER
54 MC CRYSTAL L.O.
5 MC NARROW BAND AMPLIFIER
FROM J103, WIDEBAND I. F. AMP. 2
J501
R500 47
I-F ATTEN
20DB
16DB
8DB
4DB
2DB
1DB
SW501
SW502
SW503
SW504
SW505
SW506
OFF
ON
R501 62
R502 240
R503 62
R504 68
R505 150
R506 68
R507 120
R508 51
R509 120
R510 220
R511 24
R512 220
R513 430
R514 12
R515 430
R516 910
R517 5.6
R518 910
R519 10
ATTENUATOR
J502
J201
SEE IMPORTANT NOTE ON WIDEBAND I.F. AMPLIFIER 2
FROM C122 2
C208 1000
R208 1K
C209 1000
R209 2.2K
C215 1000
C229 5000
R210 2.2K
R211 2.2K
+100V
C231 1000
R222 8.2K
GAIN (GANGED WITH R311) 4
R207 10K
R347 4.7K
R348 6.8K
+9.5
C207 1000
L201 2 BEADS
C206 1000
R204 68K
R206 1K
C208 1000
R205 2.2K
R223 1K
C235 1000
R221 2.2K
D201
R216 470
C218 5000
C225 5000
R214 1K
R203 18
R201 330
R202 330
C201 1000
Q201 2N1745
C204 0.8-8.5
T201
C212 1000
Q202 2N1745
C213 0.8-8.5
T202
C221 10
C223 220
FROM C118 2
-40
C214 1000
L202 3 BEADS
C210 1000
R219 4.7K
C216 5000
T203
C219 100
Q203 2N1745
C220 5000
R212 1K
C226 1000
L210 0.12-0.17
C222 68
Q204 2N1745
Y202 54MC
R213 1K
C224 5000
T204
C228 100
Q205 2N1747
C227 5000
R218 47
R215 1K
NARROW BAND I.F.
5 MC I.F.
TO VARIABLE BANWIDTH AMPLIFIER 4


5MC VARIABLE BANDWIDTH AMPLIFIER
5MC I.F. AMPLIFIER
DETECTOR
SW301
DISPLAY FUNCTION
CONCENTRIC WITH R311
FROM NARROW BAND I.F. 3
T601
T602
C601 0.8-8.5
C602 0.8-8.5
R601 470
Y601 5MC
C603 5000
C604 5000
R603 680
D602
RESOLUTION
R611 1K
R602 47K
-150V
Q602 2N2996
Q601 2N2996
-0.25
-4.3
-8.6
-8.8
-16.6
R604 22K
R605 10K
R609 1K
C607 5000
C605 1000
C606 1000
R606 10K
R607 22K
C608 5000
R608 1K
5V/DIV
.2 μSEC/DIV
-10V
R303 1K
D304
D301
LIN
SQ LAW
VIDEO INPUT
R301 470
R302 1K
LOG
+100V
R317 100
C312 5000
L301 25-45μh
R306 47
R304 47 OV
V301 12AU6
+92
+0.54
R305 68
C301 5000
C302 5000
+62
D302
C304 82
L302 15μh
C305 100
L303 100μh
C306 470
SW305
VIDEO FILTER
OFF
C315 0.1μf
R307 33K
R308 3.3K
D303
R309 (20K)
L311 3 BEADS
+62.5
VERTICAL OUTPUT
J301
VIDEO INPUT
(SCOPE ONLY)
GAIN
GANGED WITH R207 3
R311 100
C307 0.1μf
R315 4.7K
R313 1K
R310 100K
R372 1K
R314 1K
R316 10K
VERT POSITION
(CONCENTRIC WITH R352) 1
L312 3 BEADS
C303 5000
L20 HEATER WIRING
L30 HEATER WIRING
R356 4K
R357 4.2K
R358 15K
R362 150
V305 V304 V303 V302 V301
5 4 5 4 4 3
10 +100V
11 +225V
12 +350V
15 +75V
P11
V304
R359 470
R362 200
SEE IMPORTANT NOTE ON WIDEBAND I.F. AMPLIFIER 2
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
-150V
+100V
+225V
+350V
+75V
DON 265
5 MC I.F. AMPLIFIERS 4

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages. If it does not, your manual is correct as printed.

SECTION 1
CHARACTERISTICS

Page 1-2: Specifications

Add this specification to the list:

Sensitivity See Table 1-1

Change Table 1-1 as follows:

TABLE 1-1

TYPE L-20 (10-4,000 mc)			
BAND	FREQUENCY RANGE (mc)	MIN. SENSITIVITY * (-dbm) LOW RESOLUTION	MIN. SENSITIVITY * (-dbm) HIGH RESOLUTION
1	10-230	105	85
2	230-900	110	90
3	900-2000	100	80
4	2,000-3,100	95	75
5	3,100-4,000	90	70

TYPE L-30 (1,000-10,400 mc)			
BAND	FREQUENCY RANGE (mc)	MIN. SENSITIVITY * (-dbm) LOW RESOLUTION	MIN. SENSITIVITY * (-dbm) HIGH RESOLUTION
1	1,000-2,000	105	85
2	2,000-4,200	100	80
3	4,200-6,400	95	75
4	6,400-8,600	90	75
5	8,600-10,400	75	55

*Measured with controls set as follows:

DISPERSION	NARROW
MIXER PEAKING	Optimized
TIME/CM (Oscilloscope)	50 MSEC/CM

(Additional notes on the Sensitivity Specification as given above:

Sensitivity is the term that describes the minimum power level of a signal that can be successfully analyzed. This is a relative figure that must give consideration to the noise level in the system and is expressed as a ratio of 2:1 or, restated, "signal plus noise equals 2 times noise". This says that the sensitivity is noise limited.

Noise is a function of gain and amplifier bandwidth, so at any given GAIN setting, the system noise will be the limiting factor. Noise level

is a function of amplifier bandwidth, so at 100 kc bandwidth the noise level will be 20 DB greater than at 1 kc. This is a 1000:1 bandwidth difference and is equal to 20 DB difference in the signal/noise ratio. Therefore, the displayed 2:1 signal/noise ratio will be 20 DB greater at 1 kc than at 100 kc. This is reflected in the new figures given above for Table 1-1.

Sensitivity measurements are recommended at 100 kc bandwidth (high resolution) as it is less time consuming and puts less stringent requirements for stability on both the spectrum analyzer and the signal generator; stability characteristics being of little significance when measuring sensitivity.

Figure 1 (below) shows a typical signal/noise response:

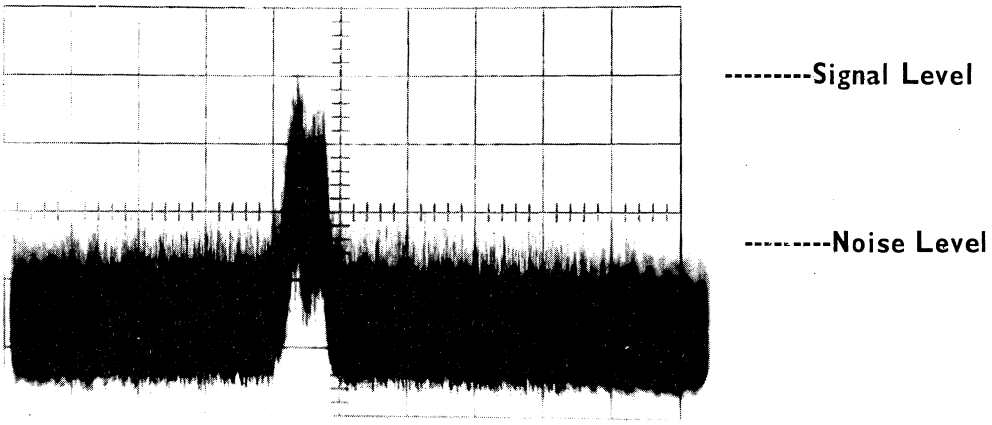


Figure 1. Typical signal/noise waveform

SECTION 2
OPERATING INSTRUCTIONS

Page 2-1: In left-hand column--change:

GAIN	Controls I.F. amplification factor of the Spectrum Analyzer.

To read:

GAIN	Controls VIDEO INPUT Gain and i.f. amplification factor of the Spectrum Analyzer.

In step 5 of "First Time Operation", change:

GAIN	Fully ccw

To read:

GAIN	Midrange

Page 2-3: Change the first paragraph to read:

The characteristic input impedance (Zo) at the INPUT 50Ω connector is nominally 50 ohms. Proper matching between the device under test and the Spectrum Analyzer may be necessary to prevent adverse loading effects on the device under test. The dc input resistance of this connector is approximately 400-500 ohms in the Type L-20; in the L-30 it is capacitively coupled.

Page 2-5: Change the fifth line of Step 7 to read:

...calculating for pulse <u>width</u> as follows:

SECTION 3
THEORY OF OPERATION

Page 3-2: In the block diagram of the L-30 RF FRONT END, change the block labeled "WIDEBAND I.F. to read "WIDEBAND FILTER".

Page 3-3: Change the block labeled "WIDEBAND FILTER" to read "WIDEBAND I.F."

SECTION 5
CALIBRATION

Page 5-5: Insert the following check after Step 15 of "Narrow Band Filter (Adjustment):

Resolution Check

1. Change the output controls of the rf generator for a -60 dbm 200 mc signal. Set the generator Mode Selector switch for a 1 kc modulation signal, and adjust the Modulation Level for 95% modulation.

2. Set all IF ATTEN switches to OFF and turn the GAIN full cw.

3. Turn the RESOLUTION and DISPERSION controls full ccw.

(Keep the signal on the screen by adjusting the generator Frequency controls; the signal is at the I.F. center frequency of 200 mc and will not be tuneable with the FREQUENCY control of the Analyzer, thereby increasing the display stability by eliminating the Local Oscillator.)

4. Set the rf generator for a signal 6 cm high. The display should resemble Figure 2. The dip between the carrier and the 1 kc sideband should be at least 3 db.

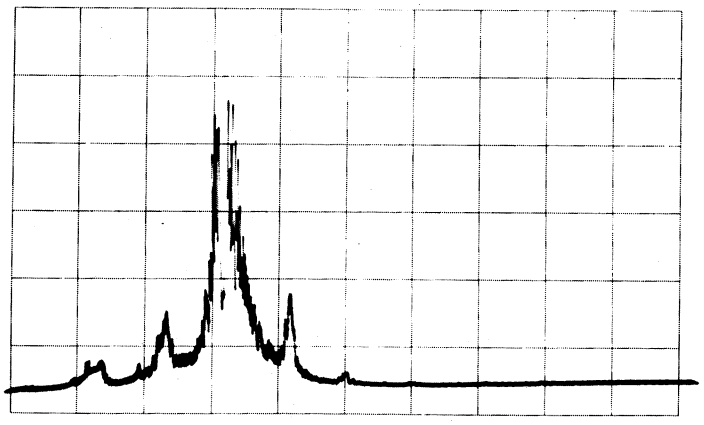


Fig. 2. Typical Resolution Check Waveform

SECTION 6
PARTS LISTS AND DIAGRAMS

Page 6-32: Add to: Electrical Parts--L-20

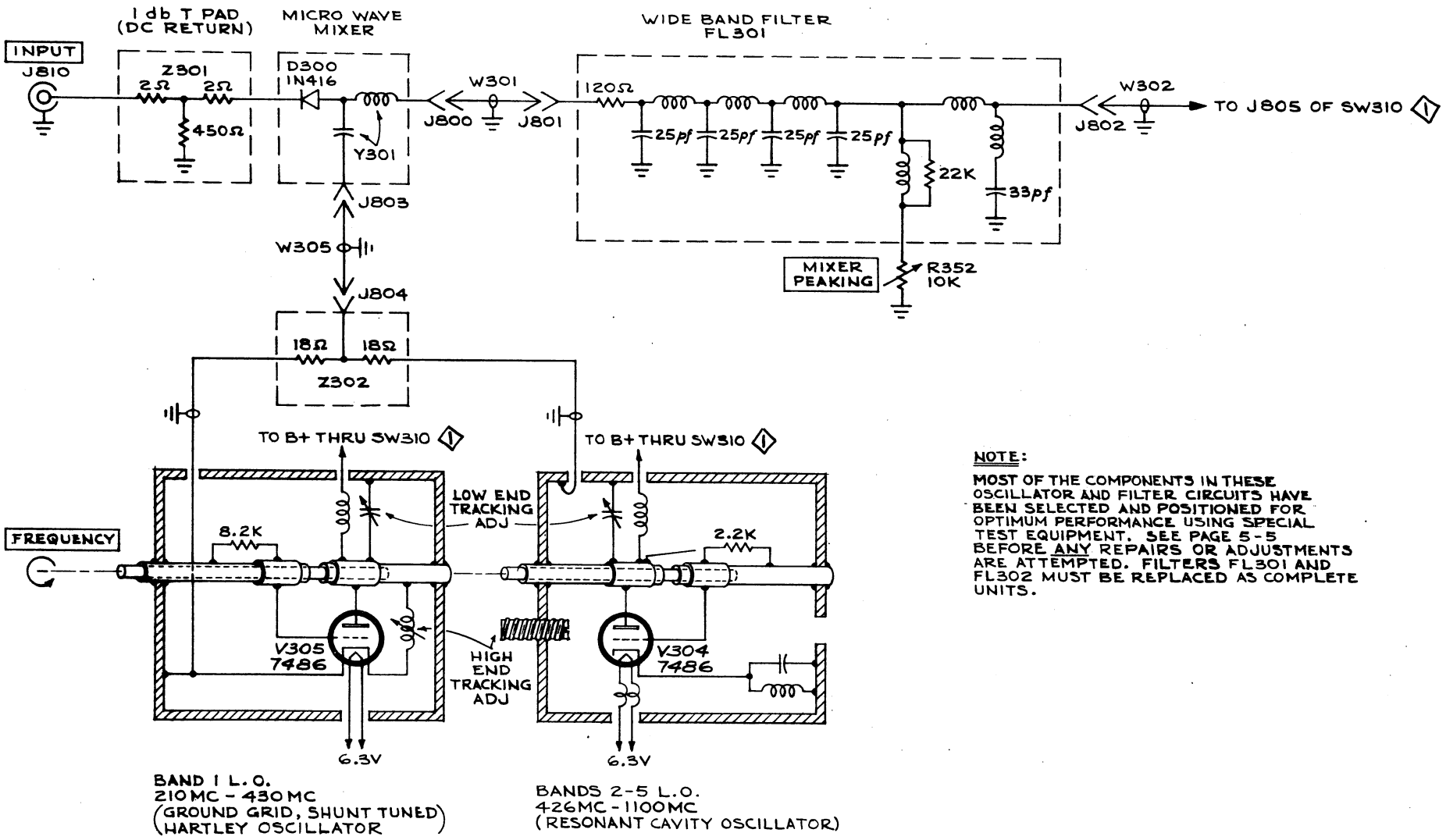
Coaxial Cable Assemblies

Ckt No.	Tek Part No.	Location
W301	175-0312-00	J800 (Mixer) to J801 Wideband LP Filter.
W302	175-0313-00	J802 (Wideband LP Filter) to J805 (Bandswitch)
W303	175-0310-00	J806 (Bandswitch) to J701 (Narrowband LP Filter)
W304	175-0314-00	J702 (Narrowband Filter) to J808 (Bandswitch)
W305	175-0315-00	J804 (Local Oscillator "tee") to J803 (Mixer)
W311	175-0310-00	J807 (Bandswitch) to J101 (Wideband IF)
W314	175-0310-00	J401 (Marker) to J102 (Wideband IF)
____	175-0308-00	J103 (Wideband IF) to J501 (IF Attenuator)
____	175-0309-00	J502 (IF Attenuator) to J201 (Narrowband IF)

Page 6-41 Add to Electrical Parts--L-30:

Coaxial Cable Assemblies

CKT. NO.	TEKTRONIX PART NO.	LOCATION
W301	175-0313-00	J800 (Mixer) to J801 (Wideband LP Filter)
W305	175-0315-00	(Local Oscillator) to J803 (Mixer)
W311	175-0314-00	J802 (Wideband LP Filter) to J101 (Wideband IF)
W314	175-0310-00	J401 (Marker) to J102 (Wideband IF)
-----	175-0308-00	J103 (Wideband IF) to J501 (IF Attenuator)
-----	175-0309-00	J502 (IF Attenuator) to J201 (Narrowband IF)

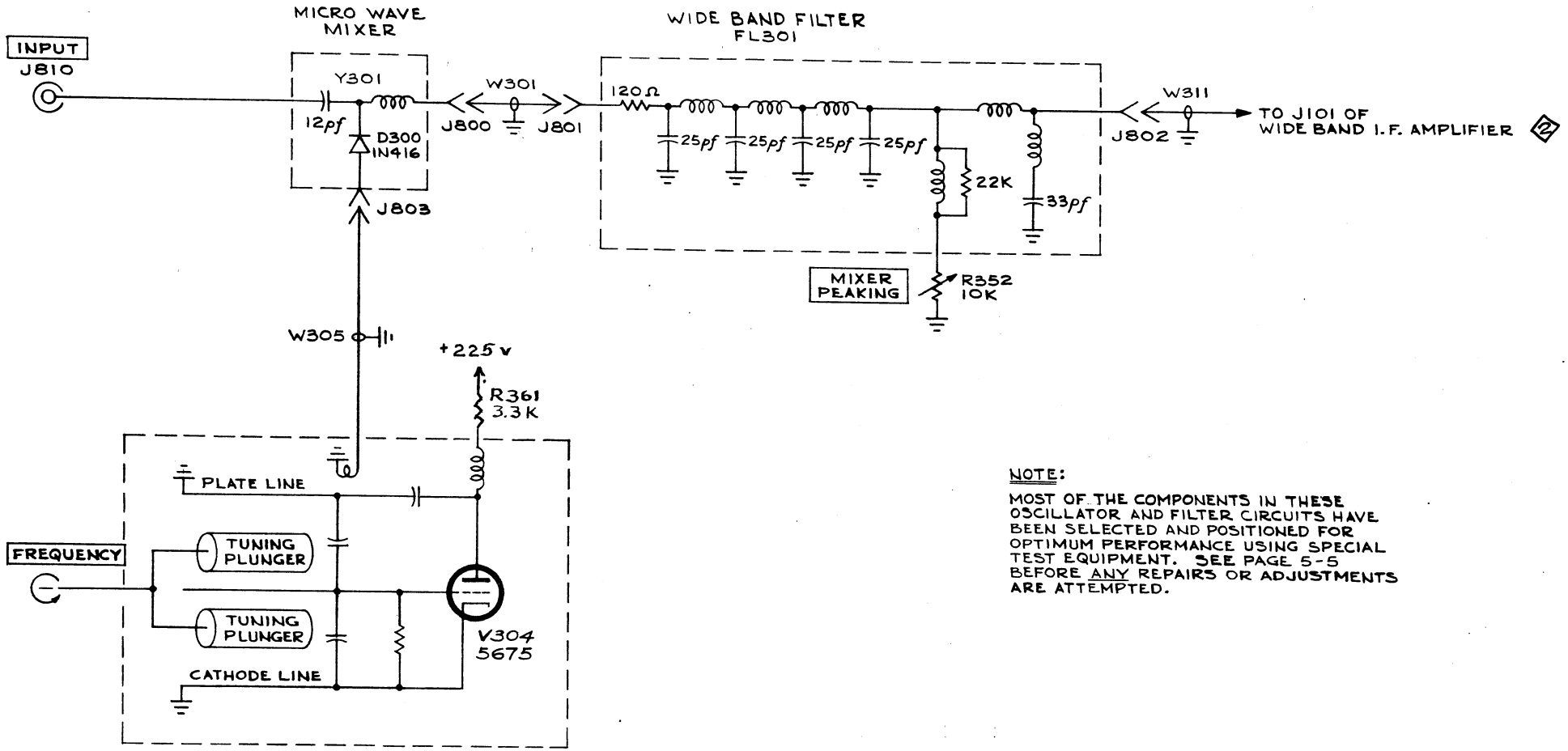


NOTE:

MOST OF THE COMPONENTS IN THESE OSCILLATOR AND FILTER CIRCUITS HAVE BEEN SELECTED AND POSITIONED FOR OPTIMUM PERFORMANCE USING SPECIAL TEST EQUIPMENT. SEE PAGE 5-5 BEFORE ANY REPAIRS OR ADJUSTMENTS ARE ATTEMPTED. FILTERS FL301 AND FL302 MUST BE REPLACED AS COMPLETE UNITS.

MRH
765

L-20 R.F. FRONT END CIRCUITS



L-30 L.O.
(CAVITY RESONATOR OSCILLATOR)

NOTE:

MOST OF THE COMPONENTS IN THESE OSCILLATOR AND FILTER CIRCUITS HAVE BEEN SELECTED AND POSITIONED FOR OPTIMUM PERFORMANCE USING SPECIAL TEST EQUIPMENT. SEE PAGE 5-5 BEFORE ANY REPAIRS OR ADJUSTMENTS ARE ATTEMPTED.

L-30 R.F. FRONT END CIRCUITS

The value of R335 is now selected during calibration for optimum performance. The value of R335 shown in the parts list is purely nominal and should not be taken as an absolute guide.

Type L20/L30

Type L199

Parts List Correction

Change To:

R335	Test selected	Nominal Value	10 K

TYPE L20 -- TENT S/N 1335

TYPE L30 -- TENT S/N 1134

PARTS LIST CORRECTION

CHANGE TO:

C201	283-0000-00	.001 µf	Cer	500V
C203	283-0000-00	.001 µf	Cer	500V
C206	283-0000-00	.001 µf	Cer	500V
C209	283-0000-00	.001 µf	Cer	500V
C210	283-0000-00	.001 µf	Cer	500V
C212	283-0000-00	.001 µf	Cer	500V
C215	283-0000-00	.001 µf	Cer	500V
C226	283-0000-00	.001 µf	Cer	500V
C235	283-0000-00	.001 µf	Cer	500V

M9884/1065