

SECTION 1. SPECIFICATION

Introduction

To effectively use the 7L5 Spectrum Analyzer, the operation and capabilities of the instrument must be known. This instruction manual covers general operating information about the instrument. Service information, such as circuit description and calibration are contained in the Service manual.

Description

The 7L5 is a 5 MHz spectrum analyzer with digital storage. Frequency stability is within 5 Hz/hr and center frequency (dot) can be read with six digit accuracy immediately after turn-on. There is no need to fine tune the display. Complex measurements and analysis can be made with relative ease. Built-in micro-processing circuits decode control settings, process frequency and reference level information, and optimize sweep time and resolution for the selected frequency span.

The 7L5 with 80 dB or more of spurious free dynamic range, provides the ability to measure wide relative amplitudes. Nanovolt sensitivity provides very low-level signal and noise measurements.

The 7L5 display is fully calibrated in dBm, dBV, or volts/div. The reference level can be accurately set to 1 dB increments. A front panel input buffer control increases front-end immunity to intermodulation distortion while maintaining a constant reference level. To accommodate a wide variety of impedance sources, the 7L5 uses quick disconnect plug-in input impedance modules of 50 Ω , 75 Ω , 600 Ω , 1 M Ω /28 pF and customized units to meet special requirements.

Digital storage allows any 7000-Series mainframe, with crt readout, to present clean, easy to photograph, displays. A smooth integrated display provides an accurate analysis of most displays. Two complete displays can be held in memory for comparison. Two modes select either the conventional peak display or a digitally averaged display.

ELECTRICAL CHARACTERISTICS

The following electrical characteristics apply when the 7L5 Spectrum Analyzer, in combination with a Plug-In Module, are normally installed in a 7000-Series oscilloscope and after a warm-up of ten minutes or more.

Frequency Characteristics

Range

Input Frequency: 10 Hz through 50 MHz.

Dot Frequency: 0 Hz through 4999.75 kHz.

Accuracy

20°C to 30°C: $+(5 \text{ Hz} + 2 \times 10^{-6} \text{ of dot readout})$.

0°C to 50°C: $\pm(20 \text{ Hz} + 10^{-5} \text{ of dot readout})$.

Drift

5 Hz/hour or less.

Residual (Incidental) FM

50 Hz/div to 2 kHz/div: 1 Hz (p-p) or less.

5 kHz/div to 500 kHz/div: 40 Hz (p-p) or less.

Resolution Bandwidth

Accuracy

30 kHz--30 Hz: Within 20% of selected resolution (6 dB down).

10 Hz: Within 100 Hz ± 20 Hz (70 dB down).

The COUPLED setting electronically selects the best resolution bandwidth for each setting of the FREQUENCY SPAN/DIV control.

Shape Factor

30 kHz-3 kHz 5:1 or better (60:6 dB ratio).

1 kHz-10 Hz: 10:1 or better (60:6 dB ratio).

Amplitude Deviation

30 kHz-100 Hz: 0.5 dB or less.

30 kHz-10 Hz: 2.0 dB or less.

Input Characteristics

CAUTION

The application of a dc voltage to the INPUT of the L1 or L2 Plug-In Modules may cause permanent damage to the mixer circuit.

Input Impedance (Nominal):

- L1 50 Ω
- L2 75 Ω
- L3 Selectable (50 Ω , 600 Ω , and 1 M Ω /28 pF).

Input Power (maximum Input level for reference levels of 0 dBm or greater):

- L1 21 dBm or 2.5 V rms
- L2 21 dBm or 3.07 V rms
- L3 21 dBm--input terminated 50 Ω or 600 Ω ; 100 V (peak ac + dc) Input 1 M Ω /28 pF.

Input Power (maximum input level for reference levels below 0 dBm):

- L1 +10 dBm
- L2 +10 dBm
- L3 +10 dBm--input terminated 50 Ω or 600 Ω , and 100 V (peak ac + dc) with input of 1 M Ω /28 pF.

Amplitude Characteristics

NOTE

If digital storage is used, an additional quantization error of 0.5% of full screen should be added to the amplitude characteristics.

Residual Response

Internally generated spurious signals are -130 dBm or less referred to the input (harmonics of the calibrator are -125 dB) with L1 or L2 plug-in module and -143 dBV with the L3 plug-in module.

Sensitivity

The following tabulation of equivalent input noise for each resolution bandwidth is measured with; the INPUT BUFFER off, the VIDEO PEAK/AVG at max cw, and the TIME/DIV set to 10 seconds.

| Resolution Bandwidth | Equivalent Input Noise (equal to or better than) | | |
|----------------------|---|----------|----------|
| | L1 | L2 | L3 |
| 10 Hz | -135 dBm | -135 dBm | -148 dBV |
| 30 Hz | -133 dBm | -133 dBm | -146 dBV |
| 100 Hz | -130 dBm | -130 dBm | -143 dBV |
| 300 Hz | -125 dBm | -125 dBm | -138 dBV |
| 1 kHz | -120 dBm | -120 dBm | -133 dBV |
| 3 kHz | -115 dBm | -115 dBm | -128 dBV |
| 10 kHz | -110 dBm | -110 dBm | -123 dBV |
| 30 kHz | -105 dBm | -105 dBm | -118 dBV |

NOTE

Sensitivity is degraded an additional 8 dB when the INPUT BUFFER is on; e.g., at 3 kHz, the equivalent input noise would be -107 dBm instead of -115 dBm. Noise level will increase by approximately 10 dB when operation is in video peak mode.

Intermodulation Distortion

Intermodulation products from two on-screen signals, within any frequency span are >75 dB down for third order products and at least 72 dB down for second order products.

Second and third order intermodulation products from two on-screen -53 dBV or less signals within any frequency span are at least 80 dB down.

With the INPUT BUFFER switch on, the second and third order intermodulation products, for any two onscreen signals, within any frequency span, are at least 80 dB down.

Display Flatness

Peak to peak deviation, over any selected frequency span: Quantization error must be added (see Note under Amplitude Characteristics) if digital storage is used.

- L1 0.5 dB;
- L2 0.5 dB;
- L3 0.5 dB

Reference Level

Refers to top graticule line in Log mode. Calibrated in 1 dB and 10 dB steps for the L1 and L2 modules and 1 dB/2 dB and 10 dB for L3 plug-in module.

| Range | L1 | L2 | L3 |
|-----------------|------------------------------------|--|--|
| Log 2 dB/Div | -128 dBm to +21 dBm | -128 dBm/ 139 dBV to +21 dBm/ +10 dBV | -128 dBm to +21 dBm (50 Ω), |
| | | | -139 dBm to +10dBm (600 Ω), |
| | | | -141 dBV to +8 dBV (Hi Z) |
| Log | -70 dBm 10 dB/Div to +21 dBm | -70 dBm/ -81 dBV to +21 dBm/ +10 dBV | -70 dBm to +21 dBm (50 Ω), |
| | | | -81 dBm to +10 dBm (600 Ω), |
| | | | -83 dBV to +8 dBV (Hi Z) |

Incremental Accuracy

When calibrated at -40 dBV in Log mode.

L1, L2 and L3: Within 0.2 dB/dB with cumulative error of 0.25 dB/10 dB.

Lin Mode Range: 20 nV/Div to 200 mV/Div within 5% in 1-2-5 sequence.

NOTE

A >sign is displayed adjacent to the reference level readout when the reference level is not calibrated due to an incompatible selection of controls.

Display Dynamic Range/Accuracy

Log 10 dB/DIV Mode: Dynamic window is 80 dB. Accuracy is within 0.05 dB/dB to 2 dB maximum.

Log 2 dB/DIV Mode: Dynamic window is 16 dB. Accuracy is within 0.1 dB/dB to 1 dB maximum.

Sweep Characteristics

Frequency Span

Provides calibrated frequency spans from 50 Hz/div to max (500 kHz/div), within 4%, in 1-2-5 sequence.

Horizontal linearity is within 4% over the entire 10 div display.

A 0-Hz/Div position is provided for time domain operation.

Sweep Rate

Time per div is selectable from 10 s/Div to 0.1 ms/Div in 1-2-5 sequence. An AUTO position permits automatic selection of optimum time/div for the selected resolution and span/div settings.

Sweep rate accuracy is within 5% of the rate selected.

Triggering

Provides two triggering sources, INT (internal) and LINE, in addition to a FREE-RUN position.

When INT is selected, ac coupled signal components from the mainframe Trigger Source (left or right vertical amplifiers) are used.

When LINE is selected, ac coupled sample of mainframe line voltage is used.

Three triggering modes are; NORM (normal), SGL SWP/READY (single sweep), and MNL SWEEP (manual sweep).

Trigger level is >1.0 div of internal signal for both NORM and SGL SWP modes over the approximate frequency range of 30 Hz to 500 kHz.

Output Connectors

Video Out

Front-panel pin jack connector supplies the video (vertical) output signal at an amplitude of 50 mV/div +5% (about the crt vertical center) with source impedance of 1 k Ω .

Horiz Out

A front-panel pin jack connector supplies horizontal output signal (negative-going sawtooth that varies from 0.0 V dc to approximately -6 V dc with a source impedance of 5 k Ω).

Calibrator

Front panel BNC connector supplies a calibrated 500 kHz squarewave output signal (derived from the analyzer's time base). Output amplitude is within +0.15 dB of -40 dBV into impedance of the plug-in module.

ENVIRONMENTAL CHARACTERISTICS

The 7L5 Spectrum Analyzer will meet the foregoing electrical characteristics within the environmental limits of a 7000-Series oscilloscope. Complete details on environmental test procedures including failure criteria etc., can be obtained from a local Tektronix Field Office or representative.

PHYSICAL CHARACTERISTICS

Net weight (instrument only), 8 pounds, 12 ounces.

ACCESSORIES AND OPTIONS

| Standard Accessories | Tektronix Part No. |
|------------------------------|---------------------------|
| Graticule, Spectrum Analyzer | 377-1159-02 (7000-Series) |
| Filter, light amber | 378-0684-00 |
| Manual, Operating | 070-1734-00 |
| Manual, Service | 070-2184-00 |

Optional Accessories

| | |
|----------------------------|-----------------------|
| Plug-in Module, | |
| 50 ohm | L1 |
| Plug-in Module, | |
| 75 ohm | L2 |
| Plug-in Module | |
| 50 Ω 600 Ω & | |
| 1 M Ω /28 pF | L3 |
| Probe (10X) | P6105 (see L3 Manual) |
| Attenuator, step. | |
| 50 ohm | 2701 |
| Attenuator, step, | |
| 75 ohm | 2703 |

OPTIONS

| |
|-------------------------------------|
| 7L5 Option 21 -(Log Display) |
| 7L5 Option 25--(Tracking Generator) |
| 7L5 Option 28--(Readout) |
| 7L5 Option 30-(Option 21/25) |
| 7L5 Option 31 -(Option 21/28) |
| 7L5 Option 32-(Option 25/28) |
| 7L5 Option 33--(Options 21/25/28) |