

10 kHz to 512 MHz



Contact: mike@kl6m.com



CONTENTS

Section	Page No.
I INTRODUCTION	
1.1 Scope of Manual	1-1
1.2 Purpose and Use of Equipment	1-1
1.2.1 Signal Generator Operation	1-1
1.2.2 Frequency Meter Operation	1-1
1.2.3 Amplitude Modulation Meter Operation	1-2
1.2.4 Swept-Frequency Generator Operation	1-2
1.2.5 Spectrum Monitor Operation	1-2
1.2.6 Audio Tone Generator Operation	1-2
1.2.7 Oscilloscope Operation	1-2
1.3 General Description	1-2
1.4 Supplies Accessories	1-3
II SPECIFICATIONS	
2.1 Introduction	2-1
2.2 Specifications	2-1
III CONTROLS, INDICATORS AND RECEPTACLES	
3.1 Introduction	3-1
IV INSTALLATION INSTRUCTIONS	
4.1 Introduction	4-1
4.2 Equipment Setup	4-1
4.3 240 V Operation	4-1
V OPERATING INSTRUCTIONS	
5.1 Introduction	5-1
5.2 Generate Mode	5-1
5.2.1 CW Frequency Generation	5-1
5.2.2 Manually-Swept Frequency Generation	5-1
5.2.3 Internally-Swept Frequency Generation and Display	5-1
5.2.4 Internally-Modulated AM Signal Generation	5-2
5.2.5 Externally-Modulated AM Signal Generation	5-3
5.2.6 Externally-Modulated FM Signal Generation	5-3
5.2.7 Audio Test Tone Generation	5-4
5.3 Measure Mode	5-4
5.3.1 Signal Level Requirements	5-4
5.3.2 Signal Coupling	5-4
5.3.3 Operating Notes	5-4
5.3.4 CW Frequency Measurement and Manual Search Mode	5-5
5.3.5 AM Measurement	5-5
5.3.6 Spectrum Monitor Mode	5-6
5.4 General Purpose Oscilloscope Functions	5-6
5.4.1 General Purpose Oscilloscope Using Internal Horizontal Sweep	5-6
5.4.2 General Purpose Oscilloscope Using External Horizontal Signals	5-8

VI APPLICATION NOTES

6-1	Frequency Accuracy Verification	6-1
6-2	Techniques for Increased Frequency Accuracy	6-1

ILLUSTRATIONS

Figure		Page No.
1-1	Communications Service Monitor, Model CSM-1	1-1
1-2	Model CSM-1 Accessories	1-4
3-1	Controls, Indicators, and Receptacles, Model CSM-1	3-0
5-1	Direct Connection, Measuring Mode	5-5

TABLES

Table		Page No.
1-1	Supplied Accessories	1-3
2-1	Specifications for the Generate Function	2-1
2-2	Specifications for Measure Function	2-3
2-3	Specifications for Oscilloscope Function	2-4
2-4	Miscellaneous Specifications	2-5
3-1	Controls, Indicators and Receptacles	3-1
5-1	Sweep Ranges	5-2
5-2	Peak Deviation and 0 - 100 Hz Frequency Control Ranges	5-3
5-3	Conversion from dBm to Volts for a 50 ohm System	5-7

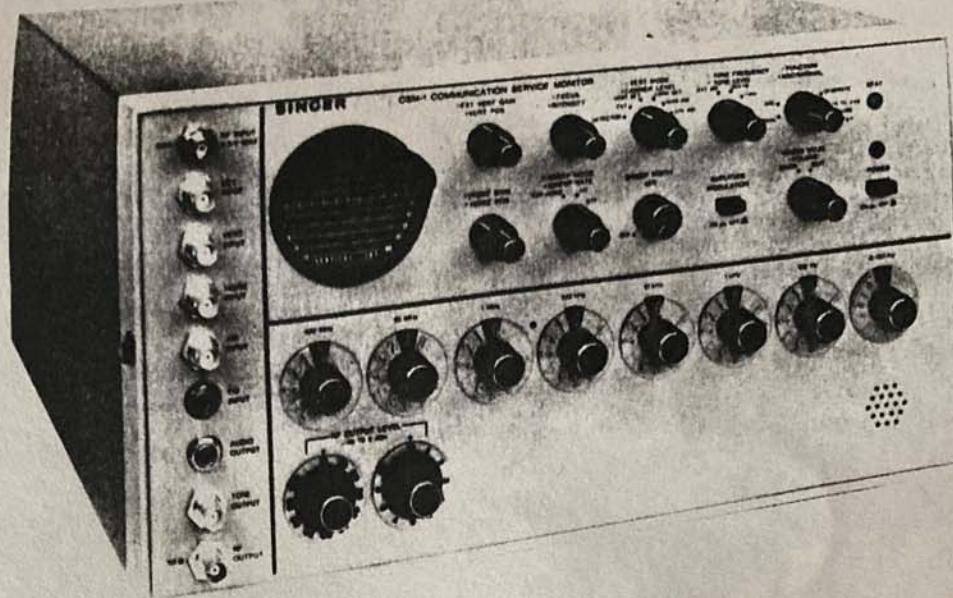


Figure 1-1. Communications Service Monitor, Model CSM-1

Section I

INTRODUCTION

1.1 SCOPE OF MANUAL

This manual is designed to provide information for the operation of the Communications Service Monitor, Model CSM-1. (See Figure 1-1). The manual is divided into five sections, containing an introduction; specifications; controls, indicators and receptacles; installation instructions; and operating instructions.

1.2 PURPOSE AND USE OF EQUIPMENT

The major capabilities of the Model CSM-1 may be described as the equivalent of three conventional instruments: an AM/CW signal generator, a frequency meter, and an amplitude modulation meter.

In addition, the Model CSM-1 provides other useful capabilities, such as a swept-frequency generator, a swept-frequency response curve display, a spectrum monitor, FM signal generator, a source of 400 Hz or 1 kHz audio tones and a general purpose oscilloscope.

1.2.1 Signal Generator Operation

As a signal generator, the Model CSM-1 provides CW, essentially free of spurious outputs, with 1 ppm direct

synthesized frequency accuracy and stability, from 50 kHz to 512 MHz, with calibrated output levels in 1 dB steps from -110 dBm to 0 dBm (0.7 μ V to 224 mV rms).

As an AM generator, amplitude modulation of up to 95%, as indicated on an integral CRT display, may be produced from an internal 400 Hz or 1 kHz source or from an external source.

As a sweep generator, a sweep width of up to 1 MHz may be achieved at repetition frequencies ranging from less than 10 Hz to greater than 100 Hz from an internal sawtooth generator.

As an FM generator, a peak deviation of up to 100 kHz and beyond, may be achieved with external modulating frequencies from less than 5 Hz up to greater than 3 kHz, or by the internal 400 Hz or 1 kHz source by means of a patch cable.

1.2.2 Frequency Meter Operation

As a frequency meter, the Model CSM-1 is capable of measuring the frequency of a received signal at a level as low as 2 μ V, either via antenna or direct connection, at an accuracy of ± 1 ppm ($\pm 0.0001\%$).

The frequency error between the received signal and the Model CSM-1 selected frequency is indicated by an audible beat tone for error frequencies less than 10 kHz and by a visual beat indicator (a light-emitting diode) for error frequencies less than 25 Hz, providing resolution within 1 Hz.

1.2.3 Amplitude Modulation Meter Operation

As an amplitude modulation meter, the Model CSM-1 is capable of measuring the percentage of amplitude modulation of received signals in two ranges: 0 to 30% and 0 to 100%, to within an accuracy of $\pm 8\%$ of full-scale deflection, with the recovered audio waveform displayed on a three-inch CRT. The percentage of amplitude modulation is indicated directly on a calibrated graticule.

1.2.4 Swept-Frequency Generator Operation

As a swept-frequency generator, the Model CSM-1 includes an internal saw-tooth generator, which provides a sweep width variable from 0 to greater than 1 MHz, and provides sweep rates variable from less than 10 Hz to greater than 100 Hz.

1.2.5 Spectrum Monitor Operation

As a spectrum monitor, the Model CSM-1 uses the combination of the internal swept-frequency capability and the AM measurement capability, to provide an amplitude versus frequency display on the CRT. A typical application is the monitoring of multi-channel activity in a communications band.

1.2.6 Audio Tone Generator Operation

As an audio tone generator, the Model CSM-1 provides a variable level 400 Hz or 1 kHz low distortion audio signal output for general purpose audio testing. In a typical application, the audio tone may be used to modulate a transmitter while simultaneously measuring amplitude modulation or frequency of the transmitter's output with the Model CSM-1.

1.2.7 Oscilloscope Operation

As an oscilloscope, the Model CSM-1 provides a 3-inch CRT display, vertical and horizontal controls, intensity and focus controls, provision for external vertical input from dc to greater than 30 kHz (3 dB bandwidth) and a choice of external horizontal input from 5 Hz to 30 kHz or an internal horizontal recurrent sweep at rates from 10 Hz to 5 kHz automatically synchronized to the vertical input signal.

1.3 GENERAL DESCRIPTION

The direct synthesizer method of frequency generation has been selected in the Model CSM-1 because of its superior overall stability and accuracy and its inherent calibration reliability. The direct synthesizer generates the selected output frequency by multiplying, dividing, adding, or subtracting several signals derived from a standard frequency 10 MHz temperature compensated crystal oscillator (TCXO) with a ± 1 ppm accuracy.

The output frequency accuracy is therefore always equal to the accuracy of the standard frequency. Because there are no phase-locked loops with their inherent settling time, the desired output frequency is produced accurately at the instant that the frequency is selected (less than 1 millisecond). Since the fully synthesized mode produces only fixed frequencies, a variable frequency oscillator is also incorporated to provide continuous frequency coverage. The variable frequency oscillator in the Model CSM-1 operates in the megahertz range. However, its influence on the output frequency is selectable in five different ranges, depending upon which decade frequency switch is placed at the V position. This combination of a direct synthesizer and a variable oscillator provides a simple and fast method for measuring a transmitter frequency.

When the Model CSM-1 is used as a frequency meter, the unknown signal is received via the antenna or an input cable and heterodyned with the synthesized local oscillator (LO) frequency of the Model CSM-1 to provide a first intermediate frequency (IF) of 11 MHz which is further converted to 1 MHz and mixed with a 1 MHz synthesized frequency to produce an audio beat tone. By varying the frequency switches and 0 - 100 Hz control of the Model CSM-1, a zero beat will result when the two frequencies are exactly the same. The unknown signal frequency will then be indicated directly on the front panel frequency switches and the 0 - 100 Hz control. An automatic frequency offset system, located within the circuitry of the frequency switches, maintains the synthesized LO frequency 11 MHz above the indicated frequency of the measured signal.

The instrument is designed to operate from a power source of 120 V rms $\pm 10\%$ (108 V to 132 V rms) or 240 V rms $\pm 10\%$ (216 V to 264 V rms) at a frequency of 60 Hz ± 3 Hz and consumes approximately 51 watts.

The side of the Model CSM-1 is equipped with a carrying handle located at the plane of the center of gravity. The back of the Model CSM-1 contains a power input receptacle that includes a fuse holder, 120 V or 240 V provisions, ac cord storage, and the power supply regulator heat sink.

A protective front cover is provided. Attached to the inside of the cover is a vinyl pouch which may be used to store accessories.