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Specification 858  
December 3, 1979

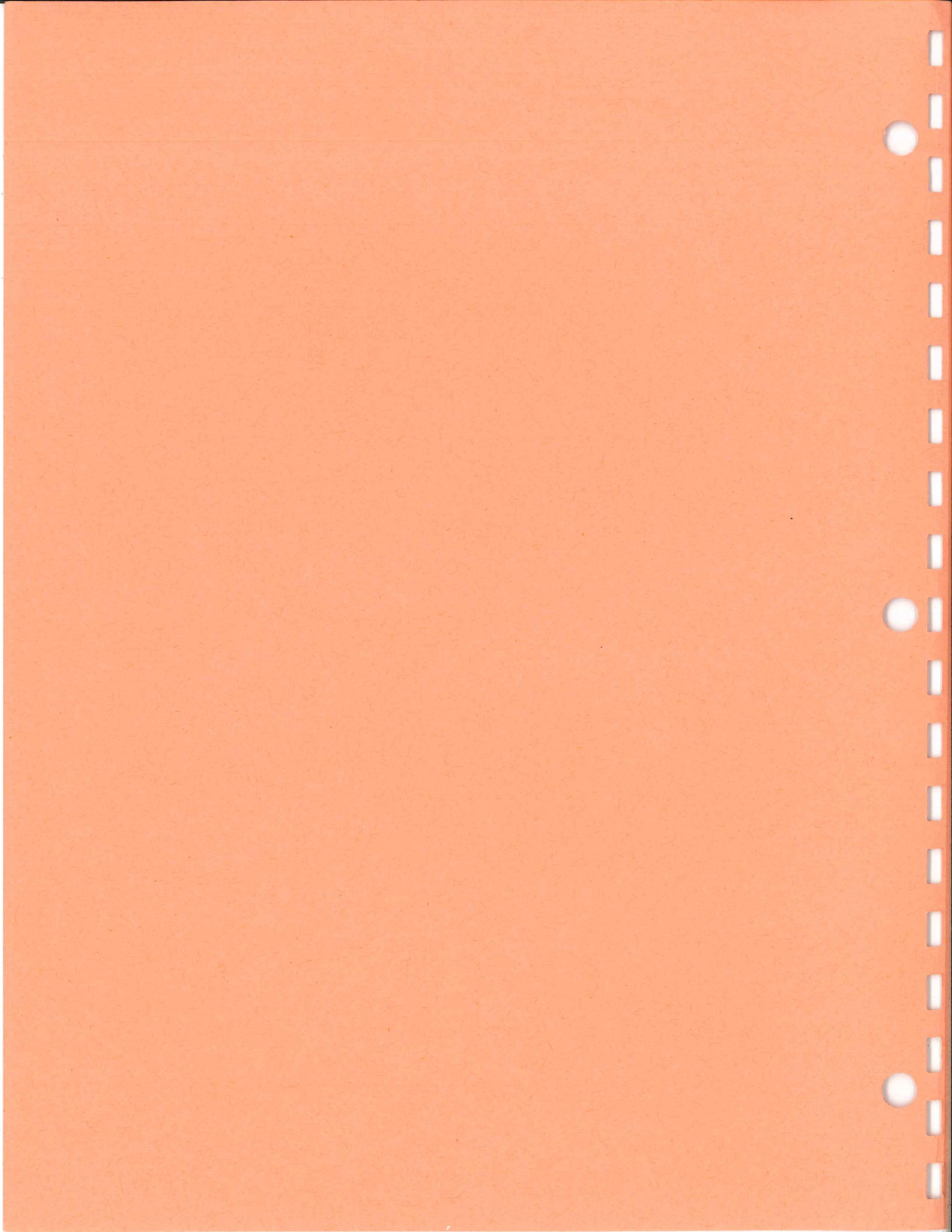
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# ENGINEERING INSTRUMENT SPECIFICATION

## SG 505 OSCILLATOR

FOR INTERNAL USE ONLY  
TEKTRONIX, INC.



December 3, 1979

## ENGINEERING INSTRUMENT

## SPECIFICATION

SG 505

OSCILLATOR

Approved by:

Program Manager	<u>R. Michael Johnson</u>	R. Michael Johnson
Project Manager	<u>Bruce E Hofer</u>	Bruce Hofer
Project Engineer, Design Engineer Electrical	<u>Rush Hood</u>	Rush Hood
Project Manager, Mechanical	<u>Bud Deibele S.R.H.</u>	Bud Deibele
Project Engineer, Mechanical	<u>Bob Brown</u>	Bob Brown
Evaluation Engineer	<u>Eric D Smith</u>	Eric Smith
Marketing Specialist	<u>Norb Luersen</u>	Norb Luersen
Product Safety Specialist	<u>Dale McDaniel</u>	Dale McDaniel
Manufacturing Staff	<u>Ralph G Sawyer</u>	Ralph Sawyer
NPI Staff Engineering	<u>Tom Honma</u>	Tom Honma

Prepared by:

Manual Writer	<u>Sandra Wohlfarth</u>	Sandra Wohlfarth
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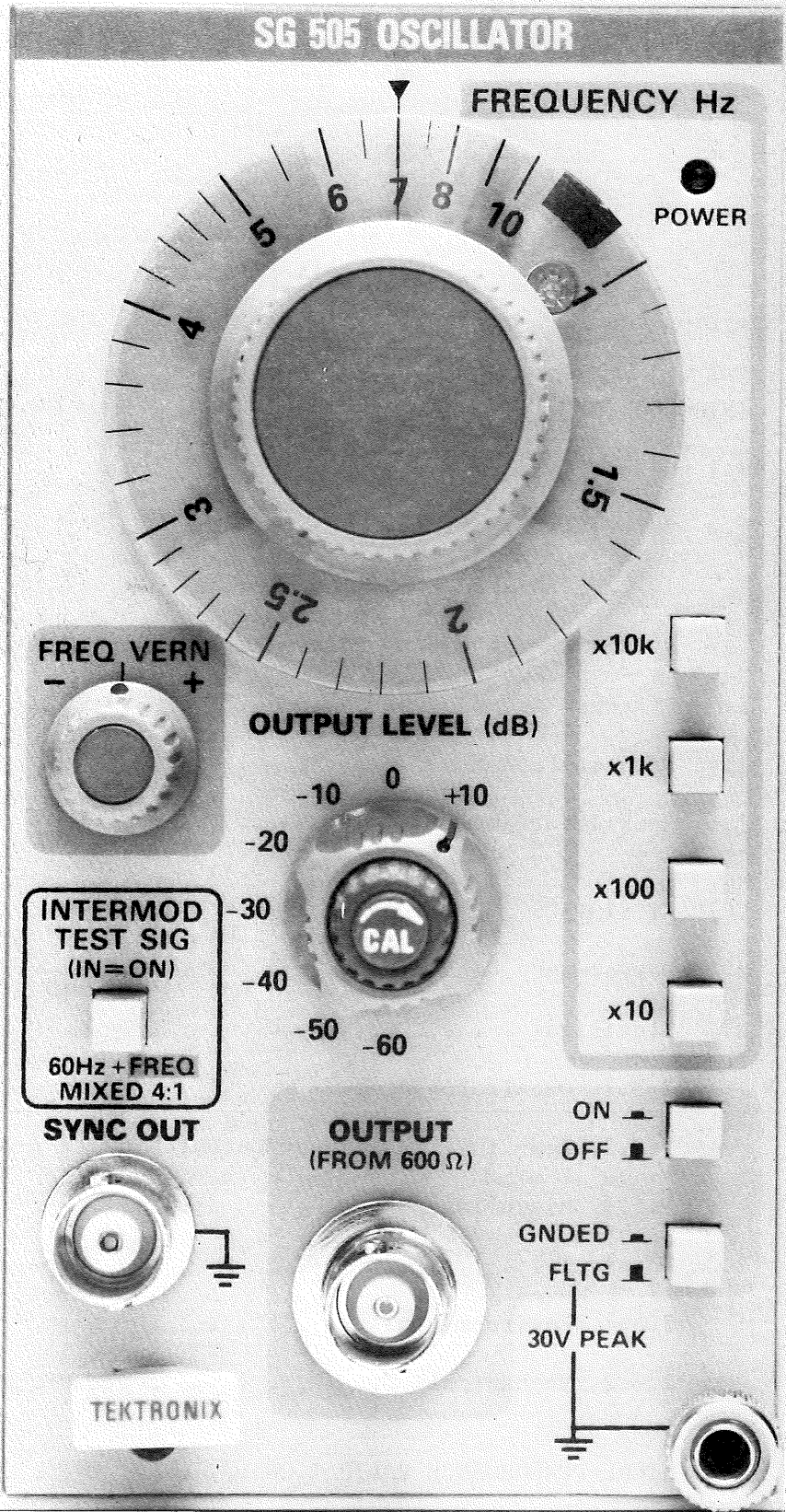
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THIS IS A PHOTO OF AN  
ENGINEERING MODEL AND  
MAY DIFFER FROM THE  
PRODUCTION INSTRUMENT.

PREFACE

This Engineering Instrument Specification (EIS) is the reference document for company activities concerned with the electrical environmental and physical characteristics of the subject product.

The information in this document is generally intended for use in customer-oriented publications such as the Catalog and Instruction Manual. However, performance characteristics in Section 2 are specifically classified for use in the Catalog and in certain sections of the Instruction Manual (see page 2-1 for further information concerning the tabular data).

A copy of this EIS appears in Product Reference Book with additional copies available from Product Specifications in the Manuals department.

Changes to the EIS may be made only via the Change Request form of which 3 are included at the back of this document (contact Product Specifications for additional copies).

Approved changes are issued in the form of replacement pages slit-punched for easy insertion in the EIS. Changed information appears in italicized print with a cross-hatch symbol in the left margin opposite the latest change. The date of the latest change appears at the bottom left corner of the page.

The following publications contain reference information relative to this document:

Abbreviations and Symbols, Tektronix Part No. 062-1737-00.

Glossary of Technical Terms, Tektronix Standard No. A-101

Manuals Production  
April 1, 1976

CHANGE INFORMATION LOG

This page is used as a guide to insure that all change pages have been inserted. When change pages are received, log them on this page, then insert the change pages in their appropriate place. Change numbers (located in upper right corner of Change Notice form) are assigned in sequence. Absence of a number from the sequence indicates a change which has not been inserted.

CHANGE NOTICE NUMBER	EFFECTIVE DATE OF CHANGE	DESCRIPTION



## SECTION 1

## INTRODUCTION

## 1.1 Description

The SG 505 Oscillator generates an ultra-low-distortion sine-wave over the frequency range of 10 Hz to 100 kHz in four overlapping bands selected by four decade pushbuttons. A FREQUENCY Hz dial provides frequency adjustment within each band. A FREQ VERNIER control permits extremely fine frequency adjustment over a  $\pm 1\%$  range from the dial setting. Distortion is less than or equal to 0.0008% over the 20 Hz to 20 kHz range.

An OUTPUT LEVEL switch, calibrated in dBm with a 600  $\Omega$  load, selects eight level steps from +10 dBm to -60 dBm at the OUTPUT connector. A variable control concentric within the OUTPUT LEVEL switch permits continuous adjustment above and below the calibrated output level steps. A GNDED/FLTG pushbutton connects or disconnects the common conductor of the OUTPUT connector from chassis ground, allowing either ground-referenced or floating operation. An ON/OFF pushbutton connects or disconnects the signal at the OUTPUT connector.

The SYNC OUT connector provides approximately 200 mV rms fixed amplitude and ground-referenced sine-wave signal at the frequency selected for the OUTPUT signal. Versions of both the OUTPUT signal and SYNC OUT signal are provided at the rear interface connector.

An Option 01 instrument adds an inter-modulation test function. The INTERMOD TEST SIG pushbutton mixes an internally selectable 60 Hz or 250 Hz sinewave with the normally selected frequency in a 4:1 amplitude ratio. The composite peak-to-peak amplitude is calibrated to be identical with the peak-to-peak amplitude of the OUTPUT signal in the normal oscillator mode. In the INTERMOD TEST SIG mode the SYNC OUT connector provides only the LF (60 Hz or 250 Hz) component.

An LED on the front panel indicates when power is applied to the instrument. The SG 505 operates in one compartment of a TM 500 series power module.

1.2 Safety Information

Use of the following information in manuals and advertising literature should be cleared through Product Safety Engineering.

1.2.1 Product Safety Information

The SG 505 has been designed and tested in accordance with the intent of UL Standard 1244, "Safety Requirements for Electrical and Electronic Measuring and Testing Equipment". The front and rear panel, and internal safety markings are controlled by Product Safety Engineering. Contact Product Safety Engineering before modifying these markings.

1.2.2 Manual Safety Information

The manuals for the product include warnings and information appropriate for safety purposes to ensure that the manuals conform to safety standards. These items may include an Operators Safety Summary, a Service Safety Summary, and appropriate cautions and warnings. Such warnings and information are developed in collaboration with Product Safety Engineering. Contact Product Safety Engineering before modifying these items. Where Product Safety Engineering provides a text for such manuals material, either such text or an equivalent will suffice.

1.3 Standard Accessories Included

1 Instruction Manual                      070-2823-00

1.4 The following people are involved in the project:

Manual Writer	Sandra Wohlfarth
TM 500 Engineering Manager	R. Michael Johnson
Project Manager	Bruce Hofer
Project Leader/Design Engineer	Rush Hood
Mechanical Engineering Manager	Bud Deibele
Mechanical Design Engineer	Bob Brown
Evaluation Manager	George Malin
Evaluation Engineer	Eric Smith
Marketing Specialist	Norb Luersen
Product Safety Specialist	Dale McDaniel
Manufacturing Staff Engineer	Ralph Sawyer
Etched Circuit Board Designer	Linda Boylen
Prototype Support	Lorna Goedel
NPI Staff Engineering	Tom Honma

1.5 INPUT-OUTPUT ASSIGNMENTS FOR PLUG-IN REAR INTERFACE CONNECTOR

Output or Input	Pin B		Pin A	Output or Input	
Sync Common	28	SG Barrier Slot	28		
Sync Output	27		27		
	26		26	Buffered Main Output Common	
	25		25	Buffered Main Output	
	24		24		
	23		23		
	22		22		
	21		21		
	20		20		
	19		19		
	18		18		
	17		17		
	16		16		
	15		15		
	14	14			
	13	13			
	12	12			
Collector lead of PNP Series-Pass	11	TM 500 Barrier Slot	11	Base lead of PNP Series-Pass	
	10		10	Emitter lead of PNP Series-Pass	
33.5 V Common	9		9	-33.5 V Common	
	8		8	-33.5 V dc	
Collector Lead of NPN Series-Pass	7		7	Emitter lead of NPN Series-Pass	
	6		Rear View of Plug-in	6	Base lead of NPN Series-Pass
	5			5	
+11.5 V Common	4			4	+11.5 V Common
+11.5 V Common	3			3	+11.5 V Common
	2			2	+11.5 V filtered DC
25 V ac	1			1	25 V ac
	B			A	

Assignments listed for pins 1A—13A and 1B—13B are available in all power modules; however, only those pins marked with an asterisk (\*) are used by the SG 505.



**SECTION 2**

**CHARACTERISTICS**

**COLUMN HEAD DEFINITIONS**

**CHARACTERISTICS:** Primary and secondary attributes of the product. They include the electrical, environmental, and mechanical features that can be described in terms of qualitative or quantitative limits (boundaries).

**PERFORMANCE REQUIREMENTS:** Statements that describe the primary characteristics of the product in terms of verifiable limits. Performance Check procedures must be provided in the manual to verify performance within these limits. Statements in this column are considered a commitment to the customer and are intended for use in advertising, in the catalog, and as specifications in the product manual(s).

**SUPPLEMENTAL INFORMATION:** This column may be used for two kinds of information:  
1) Statements that describe the primary or secondary characteristics in more general terms. No verifiable limits are given and procedures may not be provided in the manuals to verify these statements.  
2) Statements that describe secondary characteristics in terms of verifiable limits. Procedures may be provided in the manual to verify performance within these limits, but these procedures may be omitted if they require unique, expensive test equipment, are mathematically complex or time-consuming, or are not necessary to assure that the product performs within the stated limits.  
Statements in this column are not considered a commitment to the customer but are intended for use in advertising, in the catalog, and as supplementary specifications in the product manual(s).

**ENGINEERING REFERENCE INFORMATION:** Statements that describe characteristics essential to support information in the Performance Requirements and Supplemental Information columns or to record product-design criteria. Verifiable limits may be included for use in the calibration procedures in the manual(s), manufacturing, or verification of the product design. Statements in this column are COMPANY CONFIDENTIAL and are NOT intended for use in advertising, in the catalog, or as specifications in the product manual(s), except under special authorized circumstances.

**TEST RATE:** Suggested percentage of units that should be tested during manufacture to assure product quality for the indicated characteristic. Test rates are COMPANY CONFIDENTIAL.

**DESCRIPTION:** Statements that describe characteristics of the product not measurable in the usual sense or where verifiable limits cannot be assigned. This is part of an alternate form with two columns, Characteristics and Description. Statements in this column are intended for use in advertising, in the catalog, and as specifications in the product manual(s).

2.1 PERFORMANCE CONDITIONS

The performance limits in this specification are valid with the following conditions:

Each instrument must have been calibrated at an ambient temperature of +20°C to +30°C.

Each instrument must be in an environment whose limits are described in Section 2.3.1.

Allow thirty minutes warm-up time for operation to specified accuracy. (Sixty minutes after storage in high humidity environment.)

Any conditions that are unique to a particular characteristic are expressly stated as part of that characteristic.

The electrical and environmental performance limits together with their related validation procedures comprise a complete statement of the electrical and environmental performance of a calibrated instrument.

2.2 ELECTRICAL		2.2.1 Oscillator		COMPANY CONFIDENTIAL	
CHARACTERISTICS	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	ENGINEERING REFERENCE INFORMATION	TEST RATE	
<p>FREQUENCY</p> <p>Range</p> <p>Vernier Range</p> <p>Dial Accuracy</p> <p>Drift</p>	<p>10 Hz to 100 kHz in four overlapping bands.</p> <p><math>\geq \pm 1\%</math> of frequency setting.</p> <p><math>\pm 3\%</math> of setting with vernier at center.</p>	<p>Typically 9 Hz to 110 kHz. Nominal range of each band is 0.90 to 11.0.</p>	<p>+10 dBm = 2.4495 V rms into 600 <math>\Omega</math>. Derate 0 dBm accuracy to <math>\pm 0.3</math> dB for class 3.</p>		
<p>OUTPUT LEVEL</p> <p>Calibrated Steps</p> <p>Step Accuracy</p> <p>Stability</p> <p>Variable Range</p> <p>Maximum Output</p>	<p>+10 dBm to -60 dBm into 600 <math>\Omega</math> in eight 10 dB steps, <math>\pm 0.2</math> dB at 0 dBm and 1 kHz.</p> <p><math>\pm 0.1</math> dB/10 dB step.</p> <p><math>\geq +2.2</math> dB to <math>&lt; -10</math> dB from calibrated position.</p> <p><math>\geq 10</math> dBV (<math>+12.2</math> dBm) or 3.16 V rms into 600 <math>\Omega</math>.</p>	<p>Typically less than 0.01%/°C and 0.03%/hour.</p> <p>Typically better than 0.01 dB/°C and 0.03 dB/hour.</p> <p><math>\geq 6</math> V rms unloaded.</p>			

2.2 ELECTRICAL		COMPANY CONFIDENTIAL	
2.2.1 Oscillator (cont)	CHARACTERISTICS	PERFORMANCE REQUIREMENTS	ENGINEERING REFERENCE INFORMATION
		SUPPLEMENTAL INFORMATION	TEST RATE
OUTPUT LEVEL (cont)	Settling Time	<p>&lt; 5 seconds to 0.2 dB of final value, 20 Hz-100 kHz, typically &lt; 3 seconds above 100 Hz. Worst case transient overshoot is &lt; 3 dB.</p>	
LEVEL FLATNESS (1 kHz ref)	10 Hz-20 kHz	±0.1 dB	
	20 kHz - 100 kHz	±0.2 dB (Exclude -60 dB OUTPUT LEVEL attenuator range.)	On -60 dB range flatness is ±0.3 dB to 50 kHz, ±1 dB to 100 kHz.
DISTORTION ( $R_L \geq 600 \Omega$ )	20 Hz-20kHz	≤ 0.0008% (-102 dB) THD.	Derate to following values for class 3:
	10 Hz-20 Hz, 20 kHz-50 kHz.	≤ 0.0018% (-95 dB) THD.	≤ 0.001% (-100 dB) THD
	50 kHz-100 kHz	≤ 0.0032% (-90 dB) THD.	≤ 0.0025% (-92 dB) THD
OUTPUT	Impedance	600 Ω ±2%.	≤ 0.0050% (-86 dB) THD
		Refer to Buffered Main Output load impedance limitation in Section 2.2.2. <p>Typically ≤ 0.0003%.</p> <p>Floating or grounded through approximately 30 Ω. Output impedance does not change with OUTPUT ON/OFF selection.</p>	



2.2 ELECTRICAL		COMPANY CONFIDENTIAL	
2.2.1 Oscillator (cont)		ENGINEERING REFERENCE INFORMATION	
CHARACTERISTICS	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	TEST RATE
OUTPUT (cont)			
Dc Offset		<p><math>\leq 1\%</math> of output ac rms voltage.</p> <p><math>\pm 30</math> V peak. (0.01 <math>\mu</math>F between output common and chassis ground in floating mode.)</p> <p>Typically <math>&lt; 50</math> mV rms into an open circuit.</p>	
Maximum Floating Voltage			
Line Related Common Mode Output Voltage In Floating Mode			
SYNC OUTPUT			
Signal	<p>200 mV rms <math>\pm 20\%</math> sine wave.</p> <p><i>① Sine wave with same freq as output 200 mV RMS <math>\pm 20\%</math> - 20 KHZ - AT LEAST 120 mV @ 100 KHZ.</i></p> <p><i>② Sine wave with same freq as output 200 mV RMS <math>\pm 20\%</math> to 20 KHZ, at least 120 mV RMS @ 100 KHZ.</i></p>	<p>THD is typically <math>\leq 3\%</math> and phase shift from OUTPUT is typically <math>\leq 5^\circ</math>, 20 Hz to 20 kHz.</p> <p>1 k<math>\Omega</math>, <math>\pm 10\%</math>, ground referenced and isolated from main output.</p>	<p>Instrument can be custom modified for phase shifts of <math>90^\circ</math> or <math>180^\circ</math>.</p>
Impedance			
INTERMOD TEST SIGNAL (Optional)			
Signal	<p>LF sinewave mixed with normal oscillator output in a 4 (<math>\pm 0.1</math>) to 1 amplitude ratio.</p>	<p>SYNC OUT signal is LF component only.</p>	<p>With oscillator set for 7 kHz test signal conforms with SMPTE recommendation.</p>
LF Frequency	<p>Internally selectable 60 Hz (<math>\pm 1</math> Hz) or 250 Hz (<math>\pm 3</math> Hz).</p>		<p>Instrument can be custom modified for any LF frequency between 60 Hz and 400 Hz.</p>

2.2 ELECTRICAL		COMPANY CONFIDENTIAL		
2.2.1 Oscillator (cont)	CHARACTERISTICS	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	
			ENGINEERING REFERENCE INFORMATION	
			TEST RATE	
INTERMOD TEST SIGNAL (Optional) (cont)	Level	Composite peak-to-peak output is within $\pm 0.2$ dB of the normal oscillator mode sinewave output.	Typically $< 0.0005\%$ from 2.5 kHz to 10 kHz and $< 0.001\%$ from 10 kHz to 20 kHz.	
Residual IND				

<p>2.2 ELECTRICAL</p>		<p>COMPANY CONFIDENTIAL</p>	
<p>2.2.1 Rear Interface Input/Output Signals</p>	<p>CHARACTERISTICS</p>	<p>PERFORMANCE REQUIREMENTS</p>	<p>ENGINEERING REFERENCE INFORMATION</p>
<p>Buffered Main Output</p>	<p>Supplemental Information</p>	<p>TEST RATE</p>	<p>Pins 25A and 26A (common). Unity gain buffered version of the actual output signal from front panel connector. Pin 26A is electrically connected to front panel OUTPUT common. To prevent possible instrument damage, do not float output in excess of ±30 V peak. Output impedance is approximately 600 Ω. To prevent degradation in oscillator distortion at the front panel, the rear interface load impedance must be &gt;1 kΩ. This output is intended to provide an AC signal level reference for gain measurements. THD is typically ≤ 0.03%.</p> <p>Pins 27B and 28B (ground). Approximately 200 mV rms sine-wave identical to front panel SYNC output signal. Output impedance is approximately 50 Ω and always ground referenced.</p>
<p>Sync Output</p>			

<p>2.2 ELECTRICAL</p>				
<p>2.2.3 Miscellaneous</p>				<p style="text-align: center;">COMPANY CONFIDENTIAL</p>
<p>CHARACTERISTICS</p>	<p>PERFORMANCE REQUIREMENTS</p>	<p>SUPPLEMENTAL INFORMATION</p>	<p>ENGINEERING REFERENCE INFORMATION</p>	
<p>Power Consumption                  MTBF (Calculated)                  Calibration Interval                  Warm-up time</p>		<p>6 VA or less.                  18,000 hours.                  1000 hours or 6 months.                  30 minutes.</p>		<p>TEST RATE</p>

<p>2.3 PHYSICAL</p> <p>2.3.1 Environmental<sup>a</sup></p>	<p><b>CHARACTERISTICS</b></p>	<p><b>DESCRIPTION</b></p>
<p>Temperature</p> <p>Operating</p> <p>Non-operating</p> <p>Humidity</p> <p>Altitude</p> <p>Operating</p> <p>Non-operating</p> <p>Vibration</p> <p>Shock</p>	<p>0°C to +50°C</p> <p>-55°C to +75°C</p> <p>90-95% RH for 5 days cycled to 50°C.</p> <p>4.6 km (15,000 ft).</p> <p>15 km (50,000 ft).</p> <p>0.38 mm (0.015") 10 Hz to 55 Hz, 75 minutes.<sup>b</sup></p> <p>30 g's (½ sine), 11 ms, 18 shocks.<sup>c</sup></p>	<p>Meets MIL-T-28800B, class 5. (Engineering Note: Test to Tektronix Standard 062-2847-00, class 5. Additionally test at -15°C and +55°C MIL-T-28800B, class 3 limits, with electrical performance derations, exceptions, or other observations noted in respective Engineering Reference columns.)</p> <p>Exceeds MIL-T-28800B, class 5. (Engineering Note: Test to Tektronix Standard 062-2847-00, class 5.)</p> <p>Exceeds MIL-T-28800B, class 3. (Engineering Note: Test to Tektronix Standard 062-2847-00, class 3.)</p> <p>Meets or exceeds MIL-T-28800B, class 5, b with exception in certain power modules. (Engineering Note: Test to Tektronix Standard 062-2858-00, class 3, 0.025" 10 Hz to 55 Hz, operating on flexible extender outside of power module.)</p> <p>Meets or exceeds MIL-T-28800B, class 5 with exception in certain power modules.<sup>c</sup> (Engineering Note: Test to Tektronix Standard 062-2858-00, class 3, 50 g's (½ sine), 11 ms, 18 shocks without power module.)</p>
<p><sup>a</sup>With power module except where noted.</p> <p><sup>b</sup>0.26 mm (0.010") 10 Hz to 55 Hz in TM 501, TM 503, TM 504, TM 506.</p> <p><sup>c</sup>20 g's (½ sine), 11 ms, 18 shocks in TM 501, TM 503, TM 504, TM 506.</p>		

<p>2.3 PHYSICAL</p>	<p>2.3.1 Environmental<sup>a</sup> (cont)</p>	
<p><b>CHARACTERISTICS</b></p>	<p><b>DESCRIPTION</b></p>	
<p>Bench Handling</p> <p>E. M. C.</p> <p>Electrical Discharge</p> <p>Transportation<sup>d</sup></p> <p>Vibration</p> <p>Package Drop</p>	<p>45° or 4" or equilibrium, whichever occurs first.</p> <p>MIL-STD 461A/462.</p> <p>20 kV maximum.</p> <p>25 mm (1") at 270 rpm for 1 hour.</p> <p>10 drops from 91 cm (3 ft).</p>	<p>Meets MIL-T-28800B, class 3. (Engineering Note: Test to Tektronix Standard 062-2858-00, class 3.)</p> <p>Meets MIL-T-28800B, class 3. (Engineering Note: Test to Tektronix Standard 062-2866-00 with all power module compartments filled.)</p> <p>Charge applied to each protruding area of the product under test except the output terminals. (Engineering Note: Test to Tektronix Standard 062-2862-00.)</p> <p>Qualified under National Safe Transit Association Preshipment Test Procedures 1A-B-1 and 1A-B-2. (Engineering Note: Test to Tektronix Standard 062-2858-00.)</p>
<p><sup>a</sup>With power module except where noted.</p> <p><sup>d</sup>Without power module.</p>		

2.3 PHYSICAL

2.3.2 Mechanical

**CHARACTERISTICS**

**DESCRIPTION**

Finish

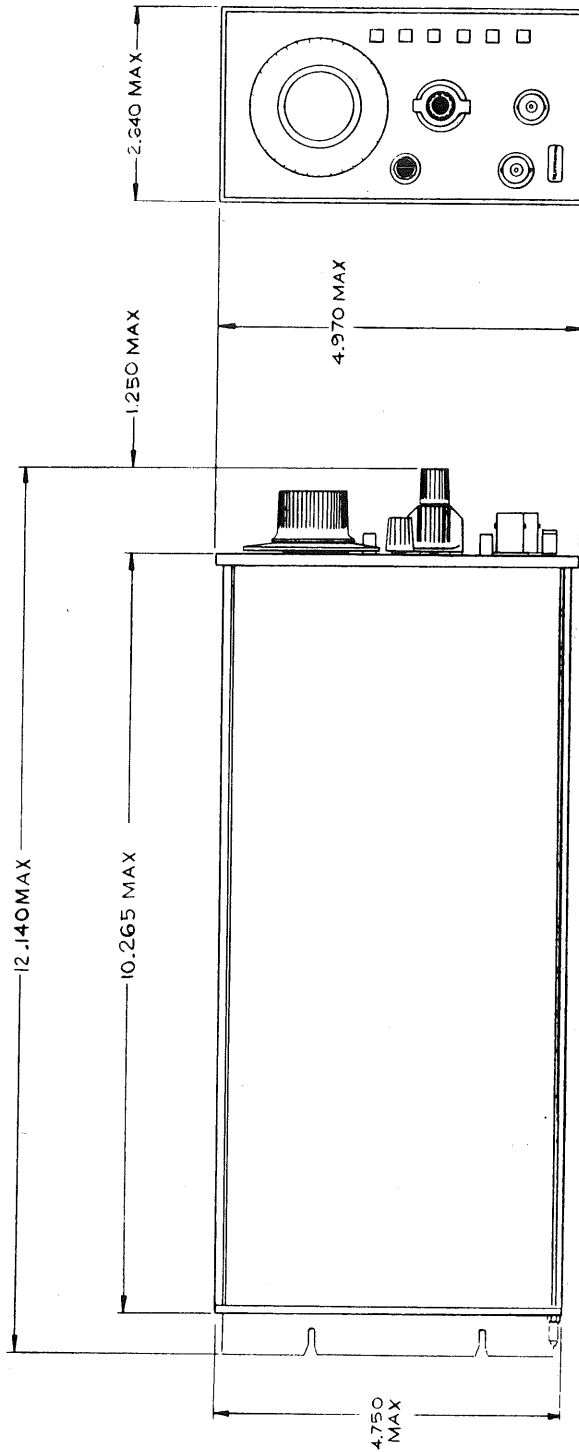
Plastic/aluminum laminate front panel.

Net Weight

1.13 kg (2.49 lbs.)

Overall Dimensions

METRIC EQUIVALENCY TABLE						
DECIMAL (IN.)	1.250	2.540	4.750	4.970	10.265	12.140
METRIC (MM)	31.75	67.06	120.65	126.24	260.73	308.36



SG 505 SINGLE WIDE PLUG-IN

SECTION 3

ELECTRICAL PERFORMANCE VALIDATION

See Performance Check procedure in the Calibration Section of the manual.



SECTION 4

ENVIRONMENTAL PERFORMANCE VALIDATION

See applicable Tektronix standards for verification procedures.



ENGINEERING INSTRUMENT SPECIFICATION  
**CHANGE REQUEST**

This form is a worksheet used to make changes in an Engineering Instrument Specification (EIS) or (for the case when an EIS does not exist) in performance claims quoted in other publications.

Return completed form to Product Specifications 76-165 for action and distribution.

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Product: \_\_\_\_\_

Publication affected: \_\_\_\_\_ No. \_\_\_\_\_ Dated \_\_\_\_\_

Requested by: \_\_\_\_\_ Dept. \_\_\_\_\_ Date \_\_\_\_\_

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Approve						
Reject						

Date Received in Product Spec's \_\_\_\_\_ by: \_\_\_\_\_



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Approve						
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Publication affected: \_\_\_\_\_ No. \_\_\_\_\_ Dated \_\_\_\_\_

Requested by: \_\_\_\_\_ Dept. \_\_\_\_\_ Date \_\_\_\_\_

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Recommended Action	Prog. Mgr.	Proj. Eng.	Eval. Mgr.	Eval. Eng.	CRT Eng.	Manual Writer
Approve						
Reject						

Date Received in Product Spec's \_\_\_\_\_ by: \_\_\_\_\_

