

ENGINEERING INSTRUMENT SPECIFICATION

**067-0886-01 thru 05
TEST MODULATOR**

**FOR INTERNAL USE ONLY
TEKTRONIX, INC.**

June 11, 1980

ENGINEERING INSTRUMENT
SPECIFICATION

067-0886-01 thru 05

TEST MODULATOR

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TEKTRONIX, INC.



PREFACE

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

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 of this EIS are specifically classified for use in the Catalog and in sections 1 and 4 of the Instruction Manual.

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 data of the latest change appears at the bottom left hand 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.

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SECTION 1

INTRODUCTION

1-1 Scope

This document specifies the product performance of the Test Modulator, and is issued to support the Product Release for the Test Modulator. The product proposal "Test Modulator" by the Television Products Business Unit of Communications Division, is dated February, 1980.

1-2 Description

The Test Modulator is designed to drive a SYSTEM (Down Converter + Television Demodulator) or the Television Demodulator alone. There are five versions available. These modulator versions are described by CCIR Systems and visual if carrier frequencies. See Table 1-1.

Table 1-1 Test Modulator Versions

CCIR SYSTEM	VISUAL IF	AURAL IF	PART NUMBER
M	: 37 MHz	: 32.5 MHz	: 067-0886-01
M	: 38.9 MHz	: 34.4 MHz	: 067-0886-02
M	: 45.75 MHz	: 41.25 MHz	: 067-0886-03
B & G	: 38.9 MHz	: 33.4 MHz	: 067-0886-04
I	: 38.9 MHz	: 32.9 MHz	: 067-0886-05

The Test Modulator converts baseband video to a specified if or rf. The aural carrier is n* MHz below the visual carrier frequency at the if output, and n* MHz above the visual carrier frequency at the rf output (where n MHz = Aural Intercarrier Frequency). See Table 1-2.

The Test Modulator uses state of the art circuitry to achieve high stability. This stability means that very little maintenance or recalibration is required.

[01] * See Table 1-2.

Table 1-2 Aural Intercarrier Frequency

System M	4.5 MHz
System B	5.5 MHz
System G	5.5 MHz
System I	6.0 MHz

1-3 Front Panel Controls and Connectors (See Fig. 1-1)

1-3.1 Front Panel Controls

VISUAL IF SYSTEM

CARRIER Selects visual if carrier conditions; ON/OFF.

PRESET

ON In this position, the carrier switch selects a carrier level that can be set with a front-panel adjustment (MOD PRESET).

OFF In this position, the carrier switch selects a variable level that can be controlled with a front panel knob that varies modulation depth by varying the carrier level.

MOD PRESET A front-panel screwdriver adjustment that is used to set modulation level.

MODULATION LEVEL Varies the if carrier when (PRESET) OFF is selected.

QUADRATURE BALANCE Incidental phase modulation (ICPM) adjustment accessible from the front panel. It minimizes ICPM by nulling the quadrature carrier component.

VIDEO PROCESSING

PRECORRECTOR Applies delay (+90/-170 ns for System B and System G, +0/-0 ns for System I, and +0/-170 ns for System M) to the video input signal.

ON 'Group' delay is applied.

OFF 'Group' delay is not applied. That is, the precorrector is bypassed.

CLAMP The video input signal blanking level is held to 0 V +/-50 mV when the clamp is 'on'.

ON Video clamp is 'on'.

OFF Video clamp is 'off'. Video is dc-coupled to the if modulator.

1-3.1 Front Panel Controls (Cont'd)

AURAL IF SYSTEM	Aural IF Carrier is front panel-selectable from a crystal oscillator or from an inductor and capacitor (LC) oscillator.
CARRIER	Selects aural if carrier conditions; ON/OFF.
CRYSTAL REF	Selects a crystal oscillator output for aural carrier with no modulation capability.
MODULATOR	Selects the aural modulator output, providing aural carrier modulation by the incoming audio signal.
CENTER FREQ REF	A push momentary button switch that turns on the crystal oscillator when the aural modulator output is selected. It is used to calibrate the aural-carrier center frequency relative to the visual carrier frequency.
CENTER FREQ	Used to set the aural carrier center frequency.
CARRIER LEVEL	Varies aural carrier level with respect to visual carrier level.
AUDIO PROCESSING	
AUDIO	Selects audio conditions
ON	Allows the audio signal to pass through to the aural if modulator.
OFF	Inhibits the audio signal.
PRE-EMP IN	Selects pre-emphasis to the audio input to match the de-emphasis in the Television Demodulator.
PRE-EMP OUT	Selects no pre-emphasis.

1-3.2 Front Panel Connectors (See Fig. 1-1)

VIDEO IN	A bnc baseband video input connector.
AUDIO IN	A bnc connector audio input.
IF IN	A bnc if input connector accepts an if signal from the front panel IF OUTPUT or from an external if source, such as a down converter.
IF OUT	A bnc IF OUTPUT connector used to drive the the Test Modulator IF INPUT or a Television Demodulator.
LO IN	A sma input connector accepts an external LO signal (as from a crystal oscillator). The mixer product of this input and the if signal results in the rf output.
RF OUT	An n-type output connector for the rf output.

1-4 Accessories

1-4.1 Standard Accessories

QTY	ITEM	TEKTRONIX PART NO.
1	Instruction Manual	070-3530-00
1	Power Cable; 8 feet (2.44 m)	161-0066-00
1	Extender Circuit Board	670-6973-00
1	50 ohm Coaxial Cable with N type connectors; 42 in long (106.7 cm)	012-0114-01
1	50 ohm Coaxial Cable with bnc connectors; 6-13/16 in long (17.3 cm)	012-0751-00
1	50 ohm Coaxial Cable with sma connectors; 28-1/2 in long (72.4 cm)	012-0649-00
1	BNC-to-Square Pin Adapter Cable; 30 in long (76.2 cm)	175-2140-00
1	Right angle conhex female-to- conhex male adapter cable; 6 in long (15.2 cm)	175-0396-01
2	Conhex male-to-conhex male adapter	103-0146-00
1	Torx Screwdriver tip, magnetic	003-0814-00
1	0.5 A Slow Blow Fuse for 230 V Range	159-0032-00
1	0.25 A Slow Blow Fuse for 120 V Range	159-0044-00

1-4.2 Optional Accessories

QTY	ITEM	TEKTRONIX PART NO.
1	Half-Rack Adapter Kit (Two instruments side-by-side)	020-0633-00
1	Half Rack Adapter Kit (One instrument and a 'dummy' box side-by-side)	020-0634-00
1	Pair Rackmount Slide Guides	351-0104-03
1	Pair Rackmount Slides	351-0301-03

SECTION 2

PERFORMANCE SPECIFICATION

2-1 Performance Requirements

The Performance Requirements cited in this section are valid only within the following environmental limits. The Test Modulator must be turned 'on' at least 30 minutes prior to making any measurements.

2-2 Environmental Limits

The Test Set is Class III instrument as defined in Tektronix Standard 062-2853-00, Product Classification Environmental Summary.

2-2.1 Temperature

The Test Modulator storage-temperature performance requirement is -50 degrees C to +65 degrees C, Class III. Operating requirement is +10 degrees C to +40 degrees C.

2-2.2 Humidity

Conforms to Tektronix Standard 062-2853-00, Class III; 95 % to 97 % relative humidity.

2-2.3 Altitude

Conforms to Tektronix Standard 062-2853-00, Class III. See 2-6.2.2.

2-2.4 Vibration

Conforms to Tektronix Standard 062-2853-00, Class III; 0.015 in (10 - 55 Hz sine wave)

2-2.5 Shock

Conforms to Tektronix Standard 062-2853-00, Class III; 50 g's while operating.

2-2.6 Packaged Product Vibration and Shock

A packaged Test Modulator qualifies under the National Safe Transit Association's Pre-shipment Test Procedures, Project 1A-B-1. It also conforms to Tektronix Standard 062-2853-00, Class III.

2-3 Safety

The Test Modulator meets the Safety Standard for electrical Electrical and Electronic Measuring and Testing Equipment (UL1244 and CSA 556B).

2-4 Reliability and Maintenance

2-4.1 Mean Time Between Failure (MTBF)

The MTBF goal is 7,000 hours (calculated).

2-4.2 Mean Time to Repair (MTTR)

Projected MTTR is 2.5 hours.

2-5 Installation Requirements

No exceptional requirements are placed on the installation.

2-5.1 Heat Dissipation

Nominal heat dissipation is 10 Watts nominal.

Maximum heat dissipation is 15 Watts.

2-6 Specifications (Electrical, Environmental, and Physical)

2-6.1 Electrical Characteristics

Definitions of Column Headings

Characteristics

Distinguishing electrical, environmental, or physical features and properties of the product.

Performance Requirement

Statements that describe the primary characteristics of the product in terms of verifiable limits. Procedures should be provided in the manual to verify performance within these limits. However, it is possible that some items, that are performance requirements, cannot be checked by a simple Performance Check Procedure. Reason for this might be:

- a. Parameters that are fixed by the nature of their function.
- b. Characteristics that are digitally derived from a timing reference signal that is checked or controlled by a master clock in the system.
- c. Characteristics of a very stable nature that would require an extensive performance check procedure, and test equipment that is not commonly available in order to perform the check.

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 Instruction Manual.

Definitions of Column Headings (Cont'd)

Supplemental Information

This column may be used for two kinds of information:

a. Statements that are described as secondary characteristics in terms of verifiable limits. Procedures may be provided in the instruction manual to verify performance within these limits, but these procedures may be omitted if they require expensive or unique equipment, are complex or time-consuming, or are not necessary to assure that the product performs within limits.

b. Statements that describe characteristics in more general terms. No verifiable limits are given and procedures may not be provided in the instruction manual to verify these statements.

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.

Electrical Characteristics

CHARACTERISTICS	PERFORMANCE REQUIREMENT	SUPPLEMENTAL INFORMATION
Inputs		
VIDEO INput		
Zin and Connector		75 Ohm bnc
Return Loss	20 dB or greater	
Level		1 Vp-p with blanking at 0 V +-200 mV
AUDIO INput		
Zin and Connector		~600 Ohm bnc
Level Range	50 mVp-p/kHz peak +-5 % or 20 kHz/Vp-p	25 kHz peak deviation is equivalent to 1.25 Vp-p (0.442 Vrms), and 50 kHz peak deviation is equivalent to 2.5 Vp-p (0.884 Vrms).
IF INput		
		-24 dBm nominal (from Test Modulator or Down Converter IF OUTput)
Zin and Connector		50 ohm bnc
Return Loss	18 dB or greater	Across the if bandpass
Frequency		
Visual IF		See Table 2-1
Aural IF	Visual if minus Inter-carrier frequency	Dependant on CCIR System See table 2-1
LO INput		
Zin and Connector		50 ohm sma
Level	-5 dBm	0 to -6 dBm
Frequency		Visual rf carrier + Visual if carrier

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I	: 38.9 MHz	: 32.9 MHz	: 067-0886-05

Electrical Characteristics (Cont'd)

CHARACTERISTICS	PERFORMANCE REQUIREMENT	SUPPLEMENTAL INFORMATION

Outputs		
RF OUTPUT		
Zout and Connector		50 ohm n-type connector
Frequency Response	+/-0.1 dB (with VIDEO IN to RF OUT PRECORRECTOR 'OFF')	Across any single channel bandpass
Return Loss	16 dB or greater	
Level	-25 dBm +/-3 dB	Double Sideband
Frequency		LO INput - Visual if

IF OUTPUT		
Zout and Connector		50 ohm bnc
Frequency Response	+/-0.1 dB (with the VIDEO IN to IF OUT PRECORRECTOR 'OFF')	Across the if bandpass
Return Loss	20 dB or greater	
Level	-24 dBm +/-3 dB	Double Sideband
Frequency		
Visual	IF Carrier +/-0.01 %	See Table 2-1 Crystal-controlled
Aural	Visual if - Intercarrier frequency	Dependant on CCIR System See Table 2-1

VIDEO PROCESSING		
PRECORRECTOR ON	170 ns +/-10 ns See Table 2-2	At Fsc with PRECORRECTOR 'ON'
PRECORRECTOR OFF	+/-6 ns	0 to 6 MHz
CLAMP (Back Porch)	0 V +/-50 mV	With CLAMP 'ON'

Table 2-2 Envelope Delay vs. Baseband Frequency Response

System B and System G			System M		
FREQUENCY (MHz)	DELAY (ns)	TOLERANCE (ns)	FREQUENCY (MHz)	DELAY (ns)	TOLERANCE (ns)
0.25	+5	+/-6	0.50	0.0	+/-10
1.00	+53	+/-6	1.00	0.0	+/-10
2.00	+90	+/-6	2.50	0.0	+/-10
3.00	+75	+/-6	3.00	-25	+/-10
3.75	0.0	+/-6	3.58	-170	+/-10
4.43	-170	+/-10	4.00	-293	+/-20
4.80	-400	+/-45	4.18	-340	+/-40

Table 2-3 Pre-Emphasis Audio Frequency Reponse

50 us Time Constant Systems B, G, and I		75 us Time Constant System M	
FREQUENCY	ATTENUATION	FREQUENCY	ATTENUATION
10.00 Hz	0.00 dB	10.00 Hz	0.00 dB
1.000 kHz	+0.41 dB	1.000 kHz	+0.87 dB
2.000 kHz	+1.44 dB	2.000 kHz	+2.76 dB
3.000 kHz	+2.76 dB	2.122 kHz	+3.01 dB
3.183 kHz	+3.01 dB	3.000 kHz	+4.77 dB
4.000 kHz	+4.11 dB	4.000 kHz	+6.58 dB
5.000 kHz	+5.40 dB	5.000 kHz	+8.16 dB
6.000 kHz	+6.58 dB	6.000 kHz	+9.54 dB
7.000 kHz	+7.66 dB	7.000 kHz	+10.75 dB
8.000 kHz	+8.64 dB	8.000 kHz	+11.82 dB
9.000 kHz	+9.54 dB	9.000 kHz	+12.78 dB
10.000 kHz	+10.36 dB	10.000 kHz	+13.66 dB
11.000 kHz	+11.12 dB	11.000 kHz	+14.45 dB
12.000 kHz	+11.82 dB	12.000 kHz	+15.18 dB
13.000 kHz	+12.47 dB	13.000 kHz	+15.86 dB
14.000 kHz	+13.08 dB	14.000 kHz	+16.49 dB
15.000 kHz	+13.66 dB	15.000 kHz	+17.07 dB
16.000 kHz	+14.19 dB	16.000 kHz	+17.62 dB
17.000 kHz	+14.70 dB	17.000 kHz	+18.14 dB
18.000 kHz	+15.82 dB	18.000 kHz	+18.63 dB
19.000 kHz	+15.64 dB	19.000 kHz	+19.09 dB
20.000 kHz	+16.07 dB	20.000 kHz	+19.53 dB

Electrical Characteristics (Cont'd)

CHARACTERISTICS	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	TEST RATE
# VISUAL IF SYSTEM MODULATION PRESET	<u>100% ±10% of carrier</u>		
MODULATION LEVEL		Variable from 50% nominal to 100% of carrier.	
QUADrature BALance		Adjusts for ±3° of quad-rature modulation. Used to balance modulator.	
AUDIO PROCESSING			
PRE-EMPhasis	System B, G, & I = 50 μs System M = 75 μs ±0.25 dB	See Table 2-3.	
Total Harmonic Distortion	Less than 0.1% (-60 dB)		
Power Supply Character- istics			
Mains			
Power	15 Watts maximum	10 Watts nominal at 60 Hz High Line.	
Voltage Range			
100 V Low	90 V to 110 V		
115 V/120 V High	108 V to 132 V		
220 V Low	198 V to 242 V		
230 V/240 V High	216 V to 250 V		
Fuse Data			
115 V		0.5 A Slow-Blow.	
230 V		0.25 A Slow-Blow.	
Frequency	48 to 62 Hz		
Crest Factor		At least 1.3 (P-P rms).	

Electrical Characteristics (cont'd)

CHARACTERISTICS	PERFORMANCE REQUIREMENT	SUPPLEMENTAL INFORMATION
Power Supply Characteristics (Cont'd)		
Internal Supply		
Accuracy		
+15 V	+/-1%	0.390 A nominal (Current limit = 0.8 A)
-15 V	+/-0.5%	0.030 A nominal (Current limit = 0.09 A)
Ripple	1 mV or less	All supplies
Line Regulation	5 mV or less	All supplies
Safety		
Insulation Stress		
Primary Circuit	Withstands 1500V RMS	50 to 60 Hz for 10 secs
Grounding Circuit		
		0.1 Ohm maximum

2-6.2 Environmental Characteristics

Temperature	
Operating	+10 degrees C to +40 degrees C
Storage	-50 degrees C to +65 degrees C
Altitude	
Operating	To 4,572 m (15,000 feet)
Storage	To 15,240 m (50,000 feet)

2-6.3 Physical Characteristics

```
=====
Dimensions
  Height          19.49 cm (7.675 inches)
-----
  Width           21.40 cm (8.424 inches)
-----
  Length          49.72 cm (19.575 inches)
-----
Weight           9.53 kg (21 lb)
=====
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ENGINEERING INSTRUMENT SPECIFICATION CHANGE REQUEST

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