

SECTION 3

TABLE OF SPECIFICATIONS

The performance requirements listed here apply over an ambient temperature range of 0°C to +50°C after a warmup time of 20 minutes. The rated accuracies are valid when this instrument is calibrated at +20°C to +30°C.

Test equipment used in verifying performance requirements must be calibrated and working within the limits specified under Table 5-1 of this manual.

Table 3-1
Digital Video Output Interface

Characteristics	Performance Requirement	Supplemental Information
Connector		25 pin subminiature "D" type, female contacts.
Digital Format		Parallel, 11 balanced signal pairs consisting of 10 data bits per sample, and a clock.
Output Logic Levels		10K ECL compatible.
Receiver Termination Required		$110\Omega \pm 10\Omega$.
Encoding Format	Positive Binary.	Linear PCM.
Sampling Frequency	Four times color subcarrier nominal (14.31818 MHz).	
Sampling Phase Angle		Referenced to I and Q axes.
Dynamic Range 10 bits/sample	Blanking level (0 IRE) is at digital word 240. Reference white (100 IRE) is at digital word 800 (5.6 LSB/IRE).	
Clock Timing	The 50% point of the rising edge of the clock pulse follows the data by $35\text{ ns} \pm 5\text{ ns}$.	
Resolution	10 bits.	Jumper selectable to 8 bits.
SCH Phase		0° .

Table 3-2
Test Signal Generator — General Test Signal Characteristics

Characteristics	Performance Requirement	Supplemental Information
Luminance Amplitude Accuracy	$\pm 1\%$.	Measured at 100 IRE.
Chrominance-to-Luminance Gain	$\pm 1\%$.	Measured at 500 kHz and 3.58 MHz.
Chrominance to Luminance Delay	≤ 10 ns.	
Blanking Level	0 Vdc \pm 50 mV.	
Luminance Rise Time	250 ns \pm 25 ns.	Except where specified otherwise.
Chrominance Rise Time	400 ns \pm 40 ns.	
Burst Amplitude	285.7 mV (40 IRE) \pm 2%.	
Burst Rise Time	400 ns \pm 40 ns.	
Sync Amplitude	285.7 mV \pm 1%.	
Sync Rise Time	140 ns \pm 20 ns.	
Line Timing	See Figs. 3-1 through 3-16.	
Front Porch Duration	1.5 μ s \pm 0.1 μ s.	
Line Blanking Interval Wide Blanking	10.9 μ s \pm 0.2 μ s.	Beginning at 20 IRE point of active video.
Breezeway Duration	600 ns \pm 50 ns.	
Line Sync Duration	4.7 μ s \pm 50 ns.	50% amplitude point.
Vertical Serration Duration	4.7 μ s \pm 50 ns.	50% amplitude point.
Equalizing Pulse Duration	2.35 μ s \pm 50 ns.	50% amplitude point.
Burst Delay from Sync	5.308 μ s \pm 35 ns.	19 cycles of subcarrier.
Burst Duration	2.51 μ s \pm 0.1 μ s.	9 cycles of subcarrier.
Output Impedance	75 Ω .	
Return Loss	≥ 36 dB to 4.2 MHz.	
Residual Subcarrier	≥ 60 dB down.	
SCH Phasing	0° \pm 5°.	
Phase Match between Test Signal and Black Burst	Within 5°.	

Table 3-3
Test Signal Generator — Test Signals

Characteristics	Performance Requirement	Supplemental Information
COLOR BARS	SMPTE Bars.	
CONVERGENCE Amplitude Pattern Pulse HAD	549.1 mV (76.9 IRE). 250 ns \pm 50 ns.	Crosshatch — 14 horizontal lines and 17 vertical lines per field.
PULSE & BAR WITH WINDOW 2T Pulse HAD 12.5T Mod Pulse White Bar Amplitude Field Tilt Line Tilt Field Timing Pulse-to-Bar Ratio Ringing	250 ns \pm 25 ns, 100 IRE 1.5625 μ s \pm 25 ns, 100 IRE, 60.84°. 100 IRE. \leq 0.5%. \leq 0.5%. Lines 72 to 202. 1:1 \pm 1%. \leq 1% peak.	
MULTIBURST White Reference Bar Amplitude Packet Amplitudes Pedestal Burst Frequencies Packet Rise Time 500 kHz Other Packets	500 mV (70 IRE). 428.6 mV (60 IRE) p-p. 285.7 mV (40 IRE). 500 kHz, 1.0 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz, and 4.2 MHz.	140 ns typical (sine-squared shaped packets). 400 ns typical (sine-squared shaped packets).
5-STEP STAIRCASE Amplitude Linearity Error	714.3 mV (100 IRE). \leq 1%.	Relative step matching.
LUMINANCE RAMP Luminance Amplitude	0 to 714.3 mV (100 IRE).	

Table 3-3 (cont.)
Test Signal Generator — Test Signals (cont.)

Characteristics	Performance Requirement	Supplemental Information
Linearity Error	$\leq 1\%$.	
MODULATED RAMP Luminance Amplitude and Linearity Chrominance Amplitude Diff Gain Diff Phase	Same as LUMINANCE RAMP. 285.7 mV (40 IRE). 0.6% maximum. 0.3° maximum.	
APL	1 line full field signal and 4 lines 0 or 100 IRE flat field.	
AC BOUNCE Bounce Rate	1 second high, 1 second low.	
FLAT FIELDS Amplitudes	71.4 mV (10 IRE). 714.3 mV (100 IRE).	
RED FIELD Luminance Pedestal Chrominance Amplitude	153.6 mV (21.5 IRE). 714.3 mV (100 IRE).	
MULTIBARS	Color bars and multiburst.	
NTC 7 COMPOSITE	100 IRE bar; 2T and 12.5T mod pulse; 90 IRE 5-step staircase, modulated with 40 IRE subcarrier.	
LINE SWEEP	714.3 mV p-p. Linear sweep from 500 kHz to 5 MHz.	Markers at 1, 2, 3, and 4 MHz.
MULTIPULSE Amplitude Frequencies	714.3 mV. 1.0 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz, and 4.2 MHz.	
SYSTEM TEST MATRIX	Multibars and Composite.	
MONITOR SETUP MATRIX	Convergence, Color Bars, Reverse Bars, Convergence, IWQB, and Convergence.	
DAC TEST 1	Split field: 500 kHz (140 IRE p-p) followed by 3.58 MHz (140 IRE) p-p.	Non-composite signal. Available only in Diagnostic mode.

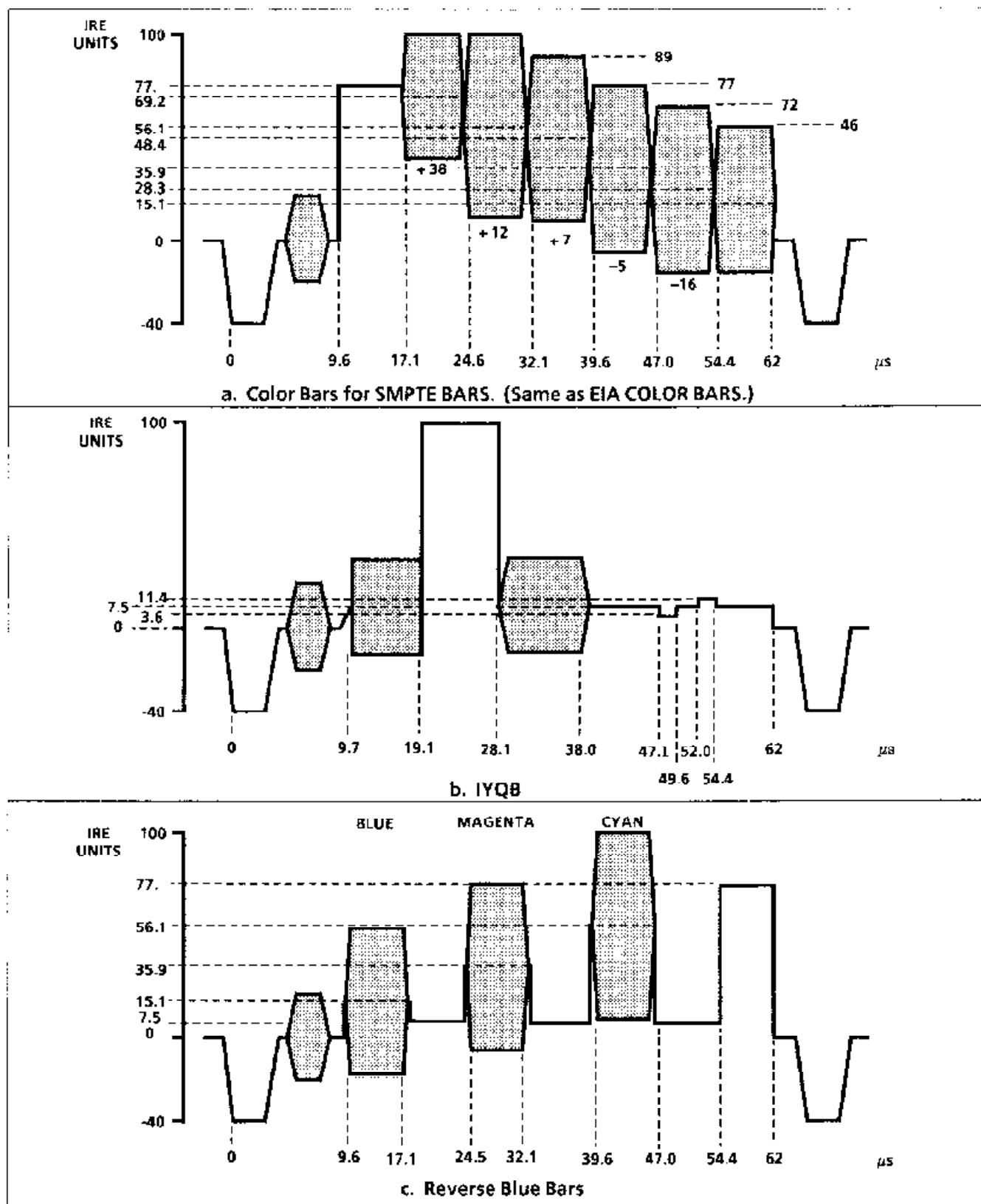


Fig. 3-1. Color Bar signal components.

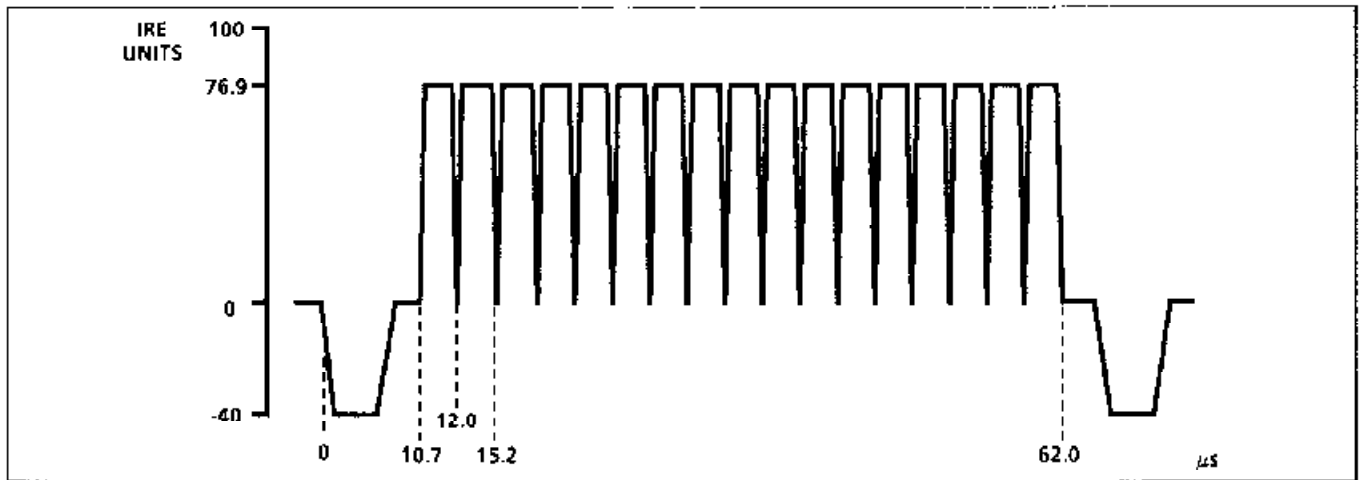


Fig. 3-2a. Horizontal component of Convergence test signal.

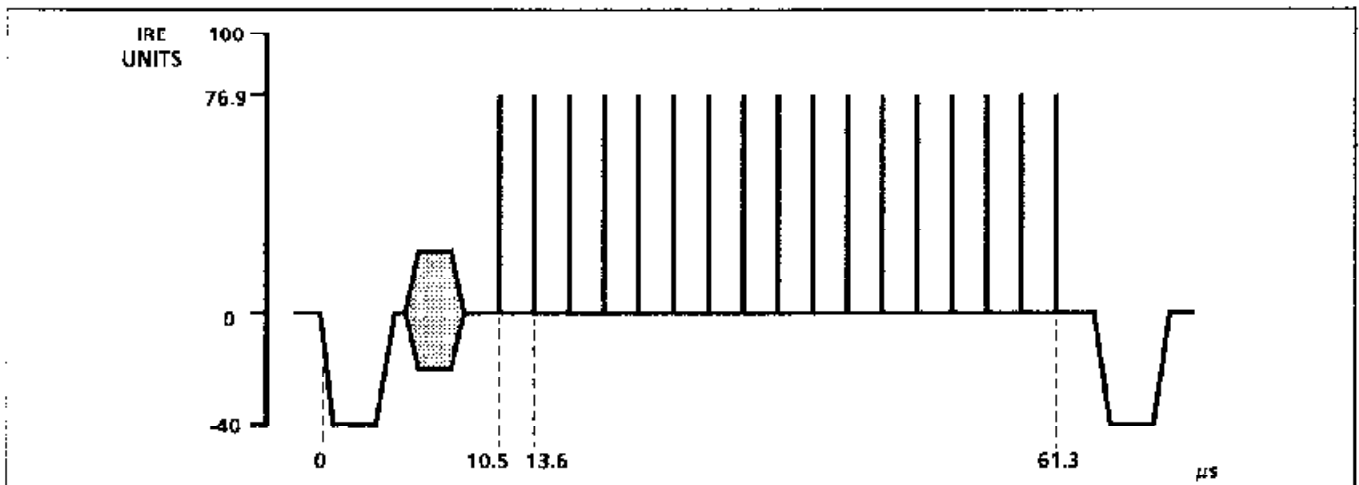


Fig. 3-2b. Vertical component of Convergence test signal.

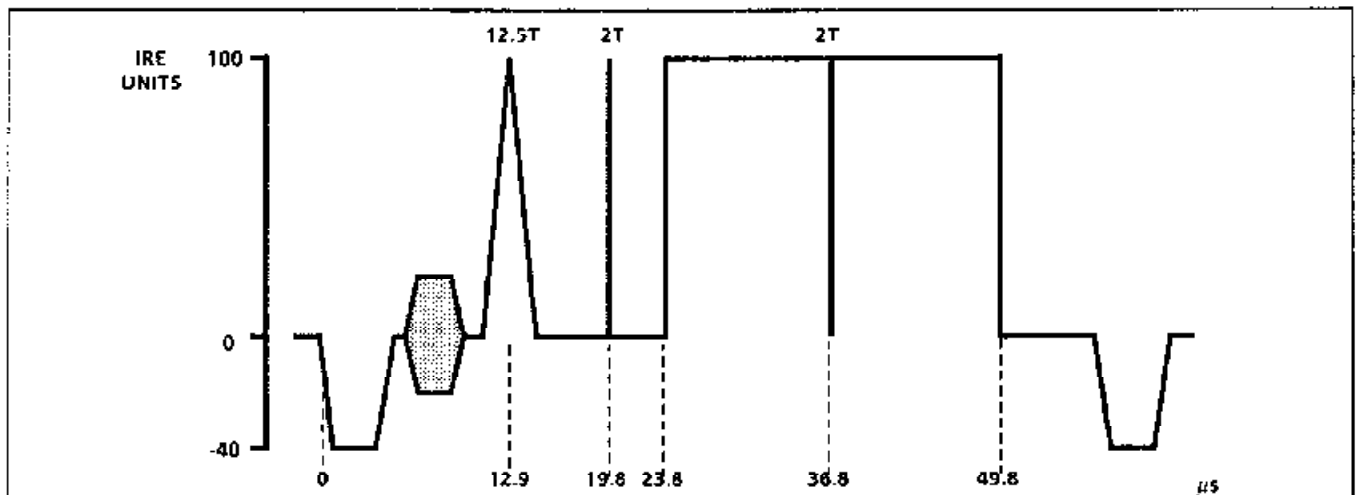


Fig. 3-3. Mod Pulse and Bar.

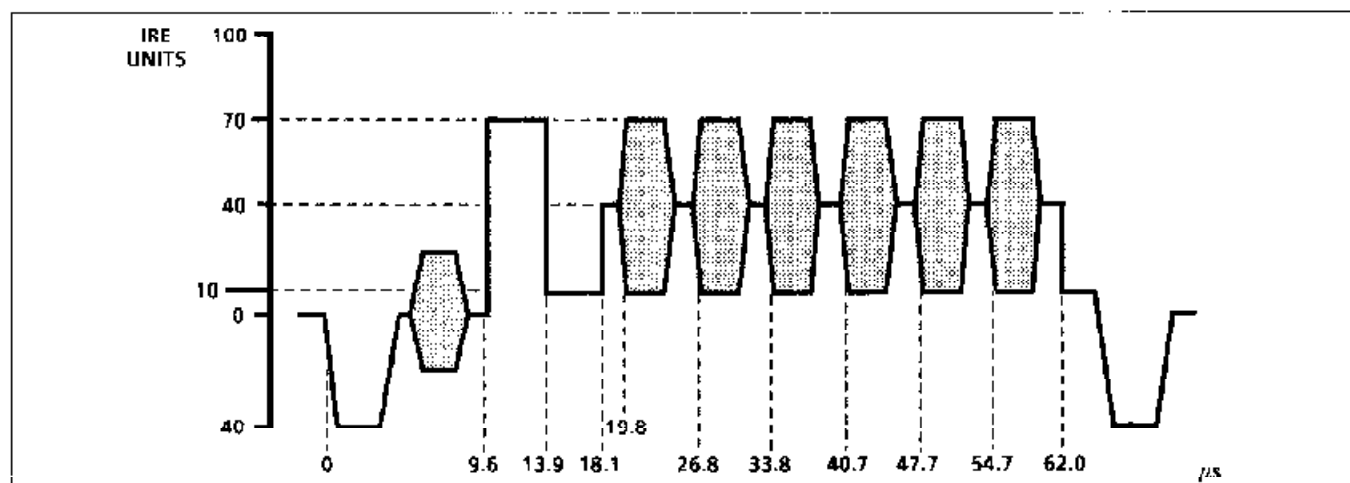


Fig. 3-4. Multiburst.

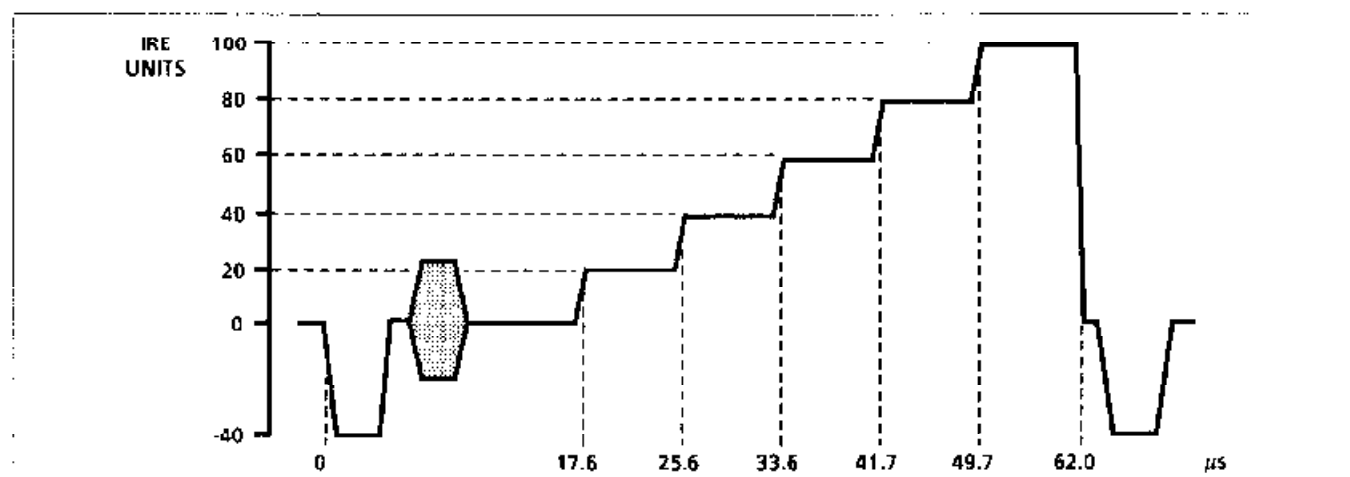


Fig. 3-5. 5-Step Staircase.

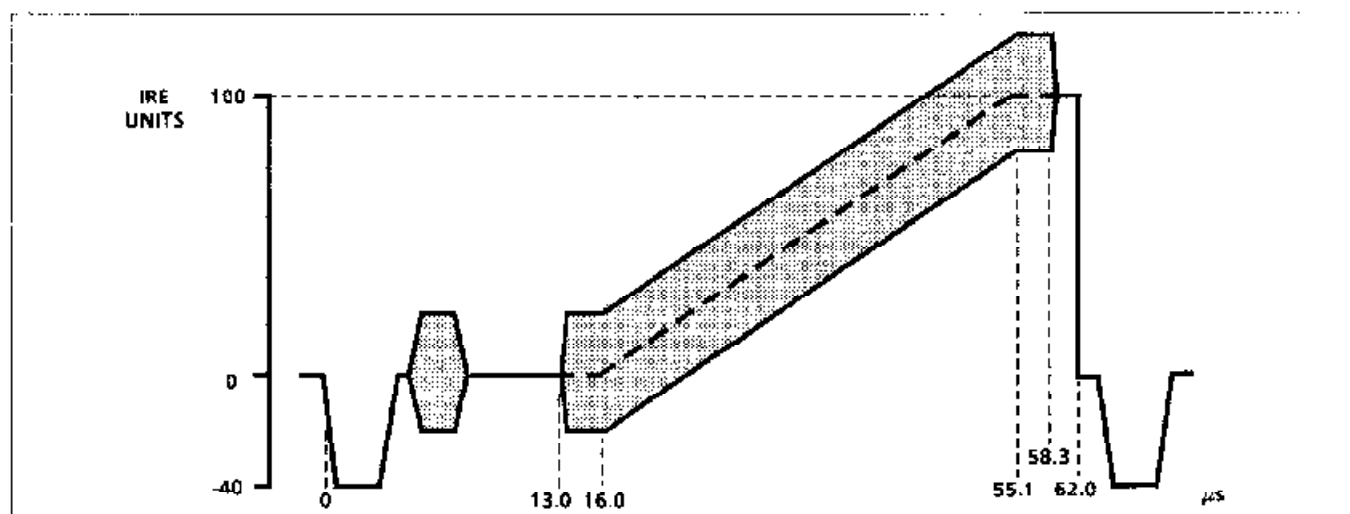


Fig. 3-6. Mod/Luminance Ramp.

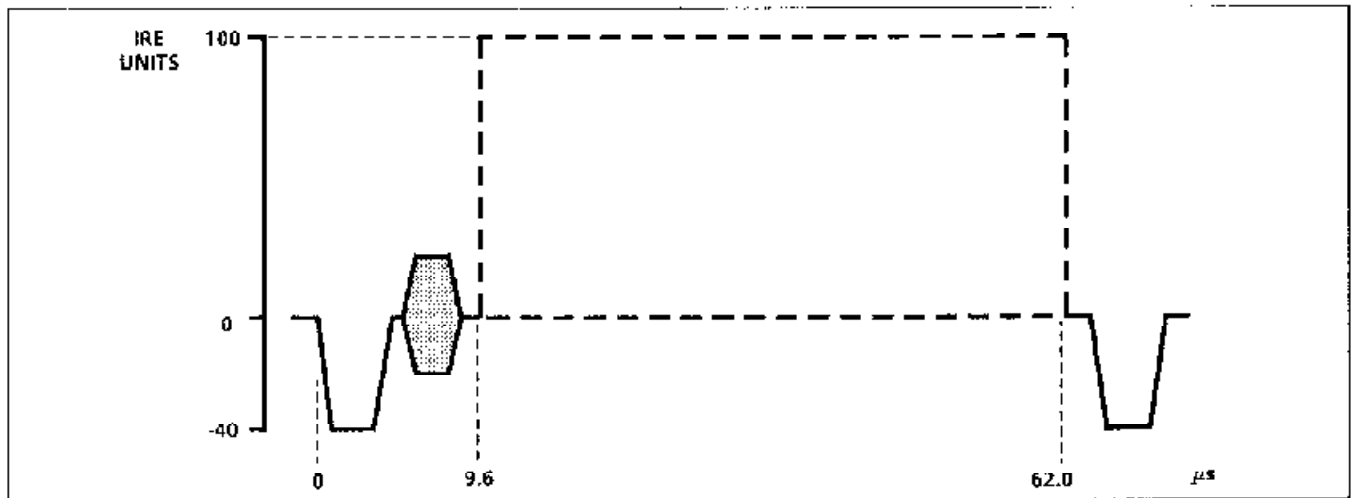


Fig. 3-7. APL and Bounce.

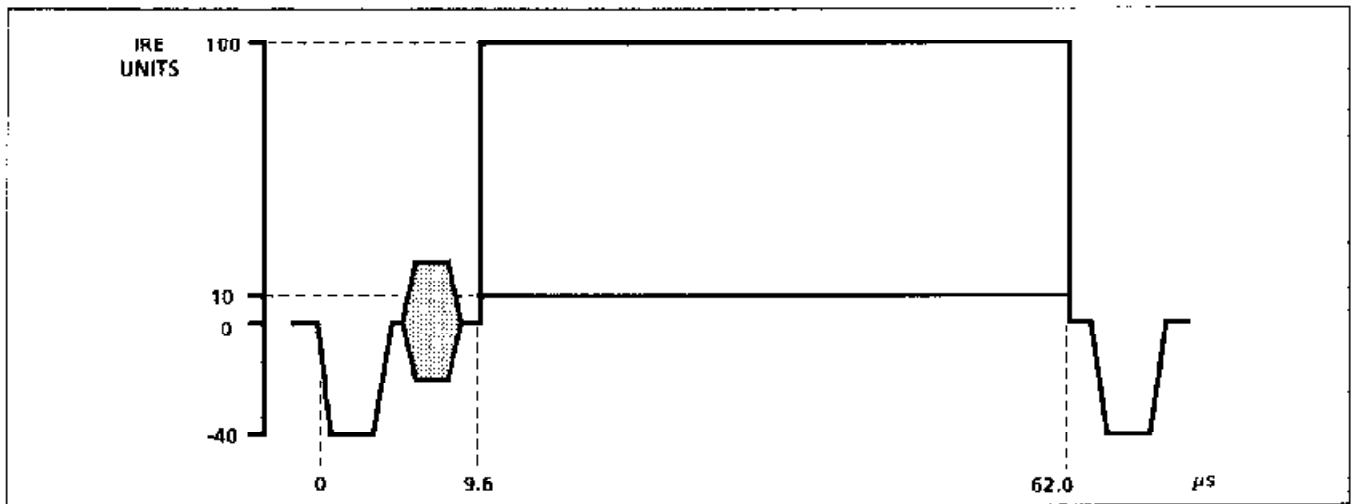


Fig. 3-8. 100/10 IRE Flat Fields.

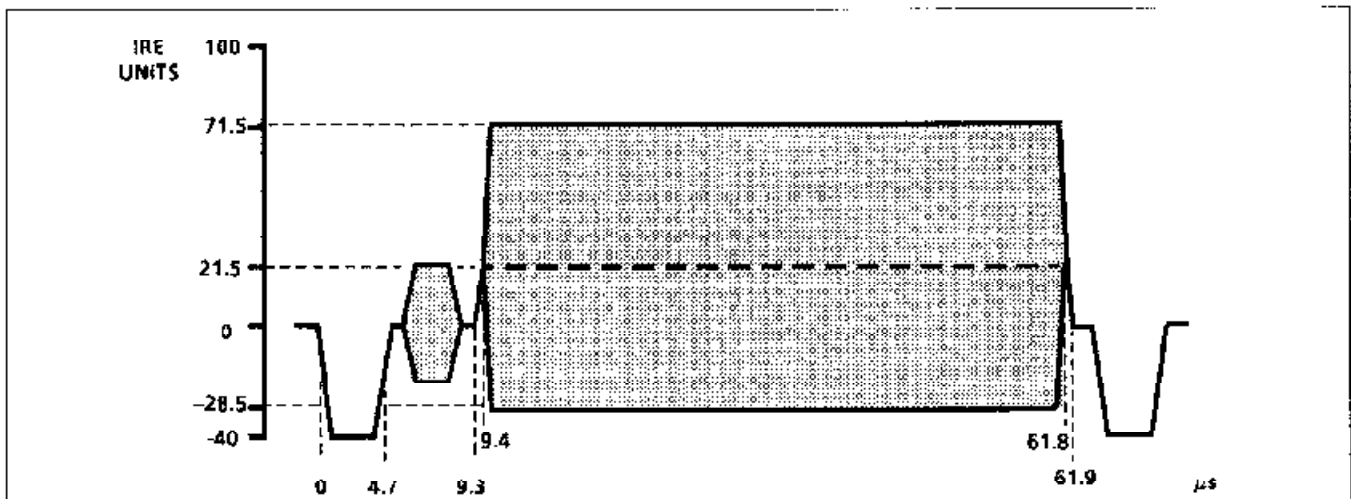


Fig. 3-9. Red Field.

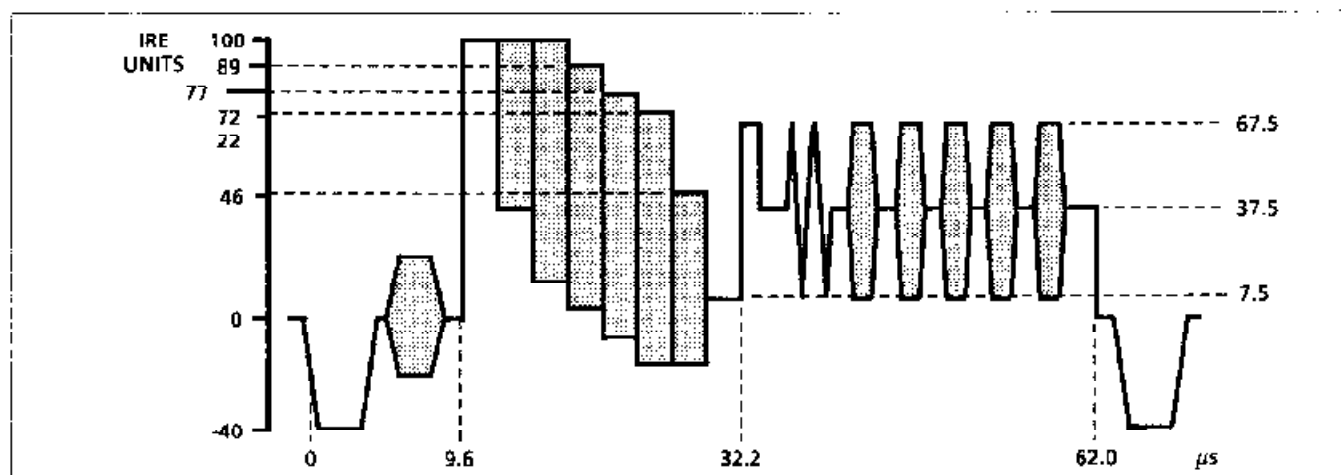


Fig. 3-10. Multibars.

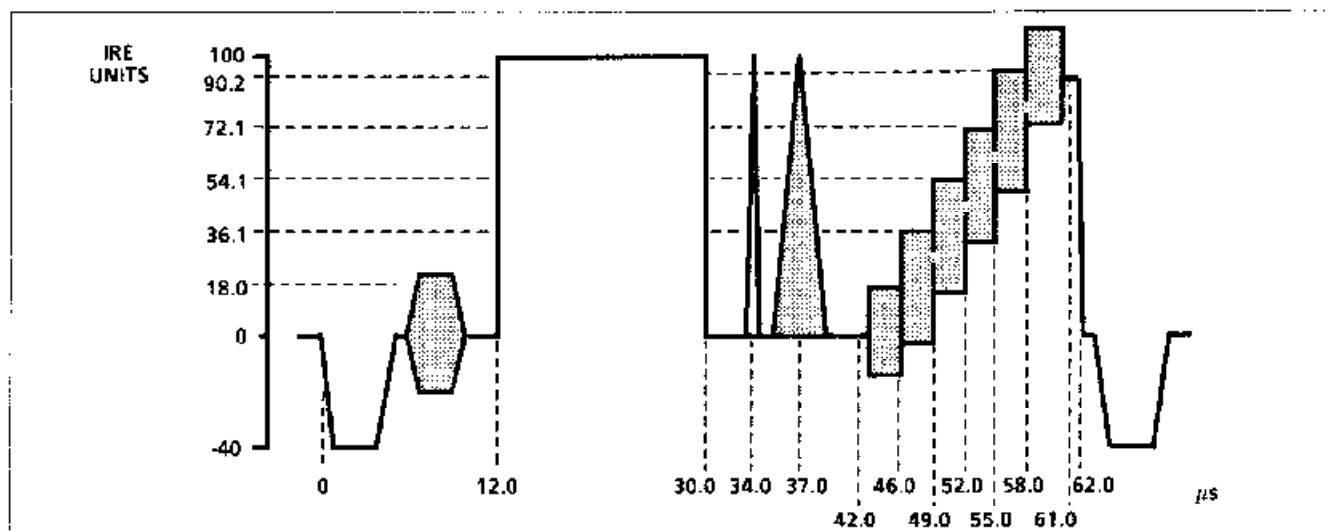


Fig. 3-11. NTC7 Composite.

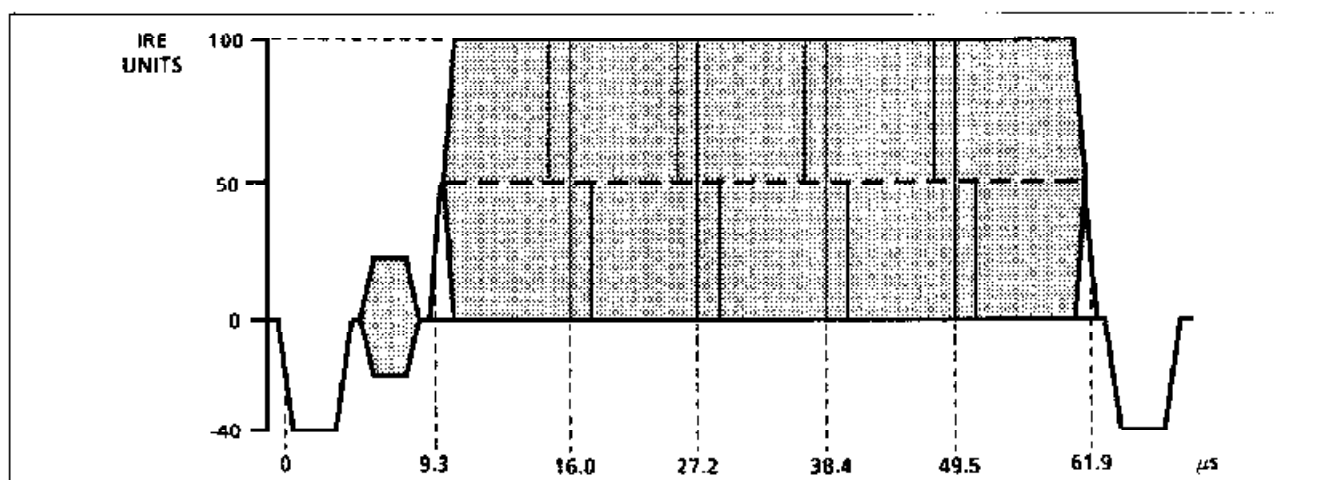


Fig. 3-12. Line Sweep with Markers.

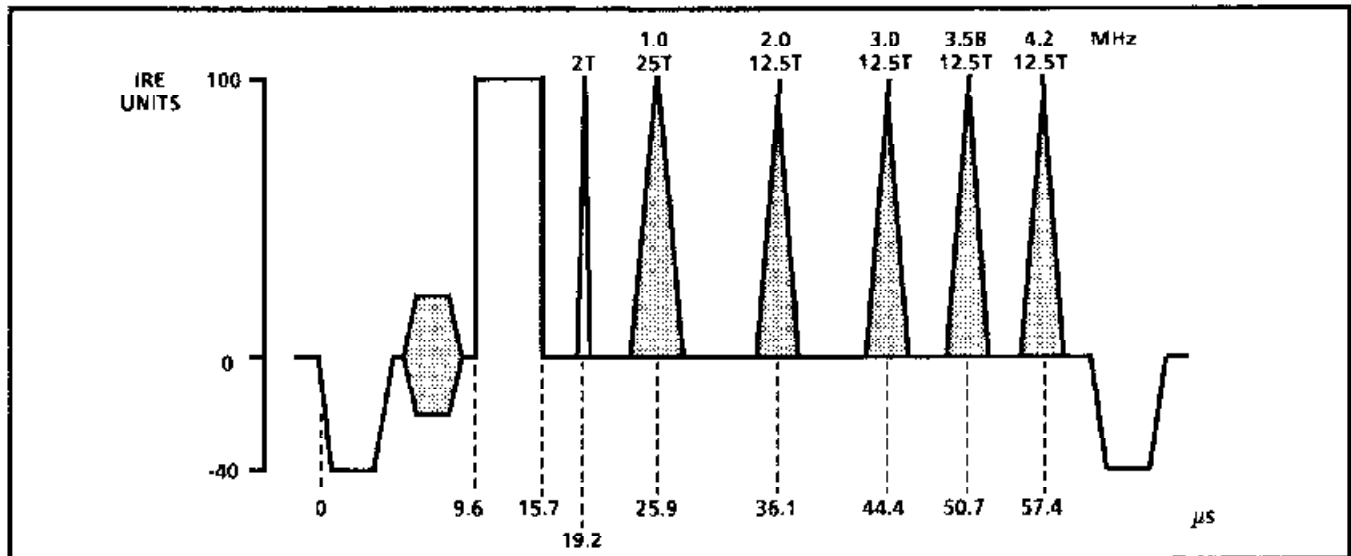


Fig. 3-13. Multipulse.

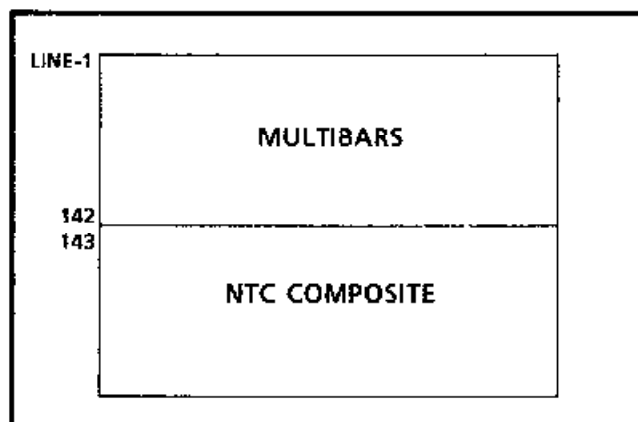


Fig. 3-14. System test matrix.

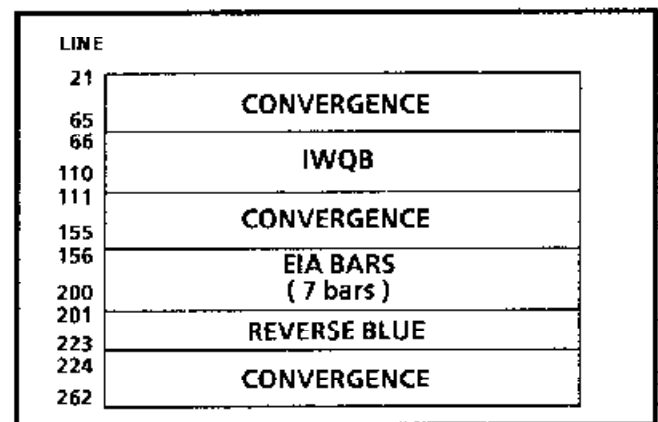


Fig. 3-15. Monitor setup matrix.

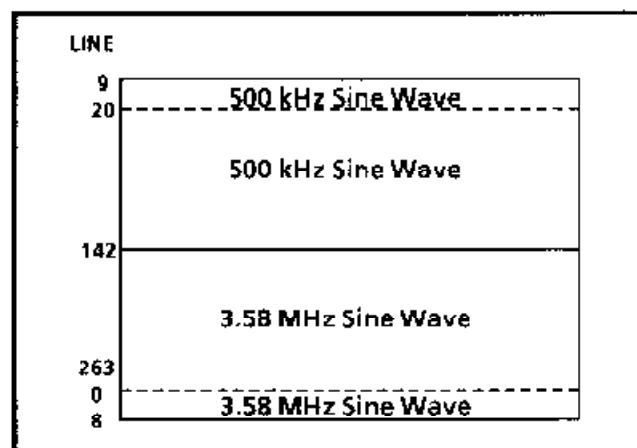


Fig. 3-16. DAC test signal.

Table 3-4
Test Signal Generator — Black Burst Output

Characteristics	Performance Requirement	Supplemental Information
Black Amplitude	7.5 IRE \pm 1 IRE.	Adjustable to 0 IRE.
Blanking Width	10.2 μ s \pm 0.2 μ s.	
Sync Timing	See Fig. 3-17.	

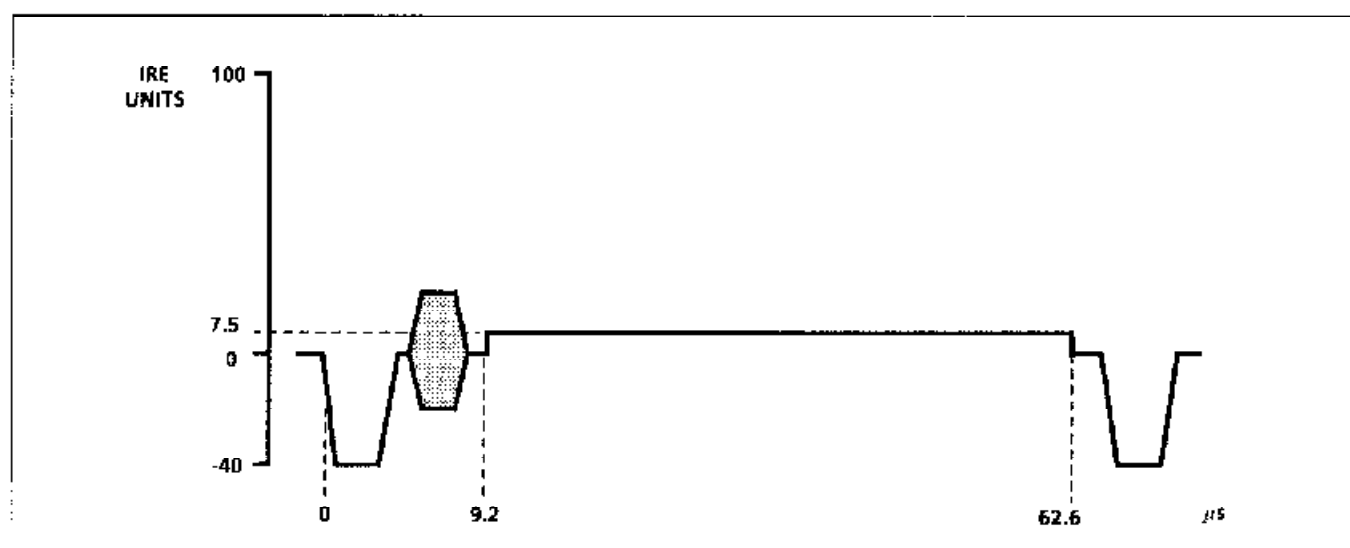


Fig. 3-17. Black Burst.

Table 3-5
Genlock Function

Characteristics	Performance Requirement	Supplemental Information
Input Configuration	75 Ω loop-through.	
Return Loss (GENLOCK INPUT)	At least 40 dB to 4.2 MHz.	
Genlock Phase Change with Input Burst Amplitude	286 mV +1 to -6 dB.	$\leq 1^\circ$ phase shift (burst lock).
Genlock Phase Change with Input Sync Amplitude	286 mV +3 to -6 dB.	$\leq 10^\circ$ phase shift (sync lock).
Genlock Phase Change with Input Signal APL	$\leq 1^\circ$ burst phase change over 10% to 90% APL.	
Burst Lock Frequency Dependence	$\leq 1^\circ$ burst phase change for ± 20 Hz change in incoming subcarrier.	
Horizontal Genlock Timing Range	At least 8 μ s advance and delay relative to Genlock Input.	Front-panel control (resolution: 0.2 $^\circ$ steps).
Vertical Timing Range	0, 1, or 2 lines advance. 1 line delay.	
Burst Lock Range	3.579545 MHz \pm 20 Hz.	
Color Framing Decisions Hysteresis Angle of Decision		<p>120$^\circ$. See Fig. 3-18.</p> <p>Initially, genlock circuit chooses field 1 if SCH Phase angle is $< 90^\circ$ or $> 270^\circ$. Chooses field 3 if angle is $> 90^\circ$ or $< 270^\circ$.</p> <p>Maintains field 1 decision from $0^\circ \pm 120^\circ$.</p> <p>Maintains field 3 decision from $180^\circ \pm 120^\circ$.</p>
Phase Resolution (Burst)	$\leq 0.5^\circ$.	
Jitter Burst Lock Sync Lock	$\leq 0.5^\circ$. < 2 ns.	
Continuous Wave Input Specs Genlock Phase Change with Input CW Amplitude Change CW Lock Range Jitter	$\leq 1^\circ$ burst phase change for input CW amplitude range of 2 V +1, -6 dB. 3.578545 MHz \pm 20 Hz. $\leq 0.5^\circ$.	

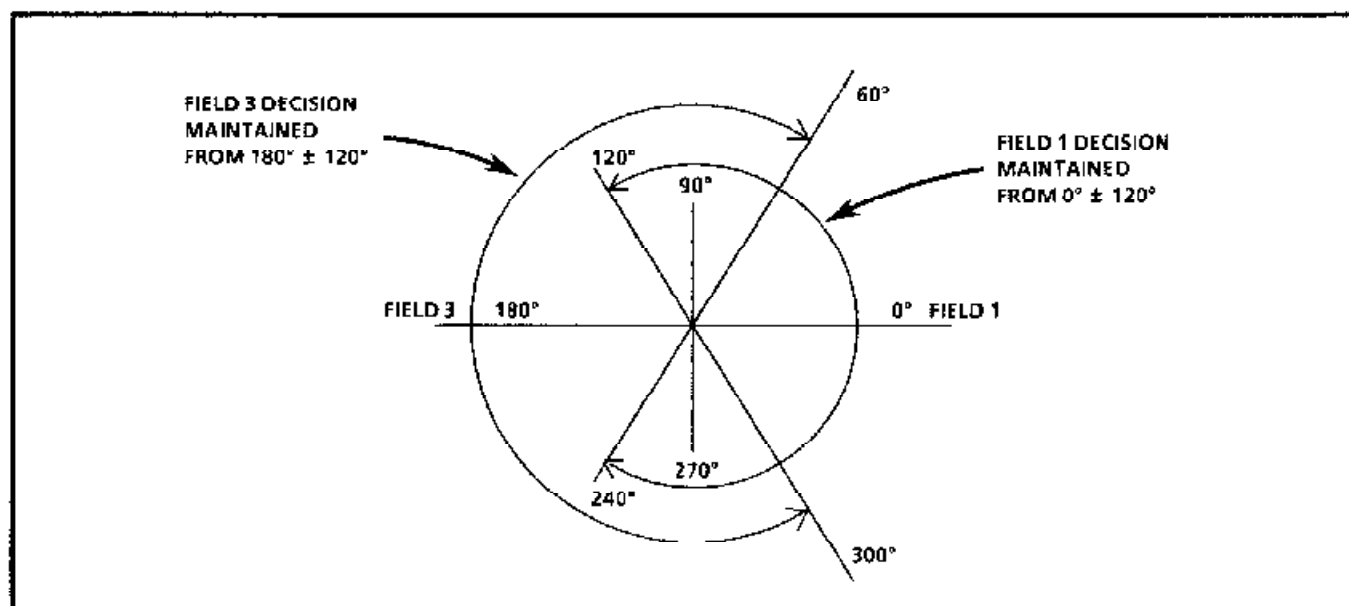


Fig. 3-18. Color framing decision angles.

Table 3-6
Parallel Digital Audio Output Interface

Characteristics	Performance Requirement	Supplemental Information
Output Connector		25 pin subminiature "D" type, female contacts.
Digital Format		Parallel, 11 balanced signal pairs consisting of 8 data bits per sample, a clock, a frame sync signal, and a spare.
Output Logic Levels		10K ECL compatible.
Receiver Termination		$110\Omega \pm 10\Omega$.
Encoding Format		Two's Complement Binary, Linear PCM.
Output Clock Rate		768 kHz, nominal.
Output Clock Jitter	<100 ns peak-to-peak.	
Audio Sampling Frequency		48 kHz, nominal.
Number of Audio Channels		4.
Quantized Resolution		20 bits.
Clock Timing	The 50% point of the rising edge of the clock pulse follows the data by 650 ns ± 100 ns.	
Tone Frequency		800 Hz*, jumper selectable for 1 kHz.
Tone Amplitude		Positive peaks 0CCD0 hex* Negative peaks F3330 hex*
Pre-Emphasis		None*

*Specified by SMPTE RP-4.40X Appendix 1

Table 3-7
Serial Digital Audio Output Interface

Characteristics	Performance Requirement	Supplemental Information
Output Connector		3 pin XLR, male contacts.
Digital Format		Serial, balanced signal pair and a ground.
Digital Code		Bi-phase mark.
Output Level	3–10 volts.	Measured differentially across 110Ω.
Receiver Termination		110Ω ± 10Ω.
Encoding Format		Two's Complement Binary, Linear PCM.
Audio Sampling Frequency		48 kHz, nominal.
Number of Audio Channels		2.
Quantized Resolution		24 bits.
Tone Frequency		800 hz*, jumper selectable for 1 kHz.
Tone Amplitude		Positive peaks: 0CCD00 hex* Negative peaks: F33300 hex*
Pre-Emphasis		None*.

*Specified by SMPTE RP-4.40X Appendix 1

Table 3-8
Analog Audio Output Interface

Characteristics	Performance Requirement	Supplemental Information
Output Connector		3 pin XLR, male contacts.
Output Level	0–8 dBu [†] , adjustable.	Low impedance to drive 150Ω or 600Ω.
Tone Frequency		800 Hz, jumper selectable for 1 kHz.

[†]0 dBu is the voltage that would deliver 1 mW to a load of 600Ω.

Table 3-9
Identification

Characteristics	Performance Requirement	Supplemental Information
IDENTIFICATION	12 characters, 7 x 9 matrix.	

Table 3-10
Power Supply

Characteristics	Performance Requirement	Supplemental Information
Supply Accuracy +12 V +5 V -5.2 V -12 V		12 V \pm 300 mV. 5 V \pm 100 mV. -5.2 V \pm 300 mV. -12 V \pm 300 mV.
Current Limit +12 V +5 V -5.2 V -12 V		Total power limited to 75W
Hum +12 V +5 V -5.2 V -12 V		Typical 10 mV. 10 mV. 20 mV. 10 mV.
Noise +12 V -12 V +5 V -5.2 V		\leq 50 mV (5 MHz bandwidth). \leq 50 mV (5 MHz bandwidth). \leq 50 mV (5 MHz bandwidth). \leq 50 mV (5 MHz bandwidth).
Line Voltage Range 110 Vac 220 Vac	90 - 132 Vac. 180 - 250 Vac.	
Crest Factor		\geq 1.35.
Fuse Data 115 V Setting 230 V Setting		2 A Med-Blow. 1A Med-Blow.
Power Consumption Maximum		60 W.
Line Frequency		48 Hz to 62 Hz.

Table 3-11
Physical Characteristics

Characteristics	Information
Dimensions	
Rackmount	
Height	1.734 inches (4.4 cm).
Width	19.0 inches (48.3 cm).
Length	22.1 inches (56.1 cm).
Net Weight	13.5 lbs (6.14 kg).
Shipping Weight	22 lbs, 14 oz (10.4 kg).

Table 3-12
Environmental Characteristics

Characteristics	Information
Temperature	
Non Operating	-40°C to +65°C.
Operating	0°C to +50°C.
Altitude	
Non-Operating	To 50,000 feet.
Operating	To 15,000 feet.
Vibration (Operating)	15 minutes each axis at 0.025 inch, frequency varied from 10-55-10 c/s in 4-minute cycles with instrument secured to vibration platform. Ten minutes each axis at any resonant point or at 55 c/s.
Shock	50 g's, 1/2 sine, 11 ms duration, 3 guillotine type shocks per side.
Transportation	Qualified under NTSC Test Procedure 1A, Category II (24-inch drop).

Table 3-13: Certifications and compliances

Category	Standards or description
EC Declaration of Conformity – EMC ¹	<p>Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Union:</p> <p>EN 55011 Class A Radiated and Conducted Emissions</p> <p>EN 50082-1 Immunity:</p> <p>IEC 801-2 Electrostatic Discharge Immunity</p> <p>IEC 801-3 RF Electromagnetic Field Immunity</p> <p>IEC 801-4 Electrical Fast Transient/Burst Immunity</p> <p>IEC 801-5 Power Line Surge Immunity</p> <p>¹ High-quality shielded cables must be used to ensure compliance to the above listed standards.</p>
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits.
Installation (Overvoltage) Category	<p>Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:</p> <p>CAT III Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location.</p> <p>CAT II Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected.</p> <p>CAT I Secondary (signal level) or battery operated circuits of electronic equipment.</p>
Pollution Degree	<p>A measure of the contaminants that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.</p> <p>Pollution Degree 1 No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.</p> <p>Pollution Degree 2 Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.</p> <p>Pollution Degree 3 Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.</p> <p>Pollution Degree 4 Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.</p>
Safety Standards	
U.S. Nationally Recognized Testing Laboratory Listing	<p>UL1244 Standard for electrical and electronic measuring and test equipment.</p>
Canadian Certification	CAN/CSA C22.2 No. 231 CSA safety requirements for electrical and electronic measuring and test equipment.

TSG-170D — Specifications

Table 3-13: Certifications and compliances (cont.)

Category	Standards or description	
European Union Compliance	Low Voltage Directive 73/23/EEC, amended by 93/69/EEC	
	EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Additional Compliance	IEC 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Safety Certification Compliance		
Temperature, operating	+5 to +40° C	
Altitude (maximum operating)	2000 meters	
Equipment Type	Test and measuring	
Safety Class	Class 1 (as defined in IEC 1010-1, Annex H) – grounded product	
Overvoltage Category	Overvoltage Category II (as defined in IEC 1010-1, Annex J)	
Pollution Degree	Pollution Degree 2 (as defined in IEC 1010-1). Note: Rated for indoor use only.	