## Tektronix

## 1910

Digital Generator
Operator Manual
070-4466-01

Please check for change information at the rear of this manual.


Fig. 1-1. The 1910 Digital Generator.

## SPECIFICATION

## INTRODUCTION

## Reference Documentation

The following documents were used as references in the preparation of this Operators Manual.

UL 1244-Standard for Electrical and Electronics Measuring and Testing Equipment.

FCC Rules and Regulations, Section 73.676 (f) and Figures 13, 14, and 15 of Section 73.699 for Remote Control Monitoring of Television Broadcast Transmitters.

RS-170A-Color Television Studio Picture Line Amplifier Output.

RS-189 EIA STANDARD-Encoded Color Bar Signals.
RS-232-C EIA STANDARD-Interface Between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange.

Proposed SMPTE Standard for a Composite Parallel Digital Video Interface.

ANSI Y1.1—1972, Abbreviations.

## Product Description

The TEKTRONIX 1910 DIGITAL GENERATOR (see Fig. $1-1$ ) is a high quality test instrument capable of providing a variety of test signals useful for testing NTSC video systems or discrete parts of the systems. The test signals generated are available from the FULL FIELD OUTPUT as field information. Also, most of the test signals are available as Vertical Interval Test Signals (VITS) inserted on the incoming Program Line Signal.

A non-volatile memory maintains selected VITS and Full Field Signals after a power-line interruption. There is a provision for insertion of up to four external VITS for such services as Teletext and closed captioning. If external VITS is not needed, this provision can be replaced with a Pulse Output board that provides four signals: H Drive, V Drive, Comp Blanking. and Burst Flag.

The test signals generated by the 1910 are derived from information stored in sets of PROMs. This provides several advantages. Test signal format changes are accomplished by replacing the appropriate test signal memory. No recalibration is required and changing industry test signal standards will not cause absolescence. The other advantage is the exceptional stability of the test signals. This stability means that very little maintenance and recalibration is required.

The 1910 test signals may be genlocked ${ }^{1}$ to the incoming Program Signal or to a Black Burst master generator, thus assuring accurate timing and phasing of the output signal. In the absence of burst, the 1910 locks to the leading edge of sync. A front-panel light will illuminate upon loss of sync, indicating a free-running state of the instrument's oscillator. In the free-running state the 1910 oscillator is controlled by a crystal in a constant-temperature oven.

The signals generated by the 1910 are programmed to be SCH (subcarrier-to-horizontal sync) phase referenced. Because of this it is not recommended to genlock the 1910 with a signal where sync and burst are non-synchronous.

The 1910 Digital Generator has remote-control capabilities for some of its functions. The remote-control capabilities may be utilized by either the REMOTE CONTROL interface or the RS-232 CONTROL interface on the rear panel. The 1910 is compatible with other instruments that have RS-232 interface; some examples are: TEKTRONIX 4006 Computer Display Terminal, TEKTRONIX 4010 Computer Display Terminal, TEKTRONIX 4052 Desktop Computer, and TEKTRONIX 1980 ANSWER. (Some hand-held computers and personal or home computers may be compatible with the 1910 RS-232 CONTROL port.)

The 1910 will also accept digital information from an external source through the DIGITAL INPUT connector to generate test signals. A DIGITAL OUTPUT connector provides access to the 10 -bit words that are being used to generate the Full Field Signals.

[^0]
## SPECIFICATION

The performance requirements listed here apply over an ambient temperature range of $0^{\circ} \mathrm{C}$ to $+50^{\circ} \mathrm{C}$ after a warmup time of 20 minutes. The rated accuracies are valid when this instrument is calibrated at $+20^{\circ} \mathrm{C}$ to $+30^{\circ} \mathrm{C}$ after a warm-up time of ten minutes minimum.

Test equipment used in verifying performance requirements must be calibrated and working within the limits specified under Table 3-1, Recommended Test Equipment, provided in Section 3, Performance Check Procedure, of the Service Manual.

Items listed in the Performance Requirements column of the Electrical Characteristics tables are verified by completing the Performance Check in Section 3 of the Service Manual, unless specifically stated otherwise. Items listed in the Supplemental Information column may not be verified in either manual; they are either explanatory notes or performance characteristics for which no limits are specified.

The Performance Check Step No. column lists the specific step number of the Performance Check procedure in Section 3 of the Service Manual that checks the appropriate Performance Requirement items.

Table 1-1
PROGRAM SIGNAL PATH/VITS INSERTER

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| Program Line Input Input Level |  | $1 \mathrm{~V}(0.7$ to 1.4 V$)$ |  |
| Input Impedance | $75 \Omega$ nominal |  | 53 |
| Return Loss <br> Power On | At least 46 dB to 5 MHz |  | 53 |
| Power Off/Bypass | At least 40 dB to 5 MHz |  | 53 |
| Program Line Out Program Monitor Out Impedance | $75 \Omega$ nominal |  | 53 |
| Return Loss | At least 36 dB to 5 MHz |  | 53 |
| Hum Rejection | At least 10 dB . <br> Referenced to 1 V hum. | Jumper selectable to 20 dB . Requires unique test equipment capable of inserting 1 V hum on the program line. | 15 |
| Keyboard (no noise) | Less than 0.25 IRE |  | 9 |
| Video Gain | Unity Gain $\pm 0.5 \%$ |  | 1 |
| DC Blanking Output Level | $0 \mathrm{~V} \pm 100 \mathrm{mV}$ |  | 8 |
| VITS Pedestal Offset from Blanking <br> $0 \vee$ Hum | 2 mV or less |  | 10 |
| 1 V Hum | 10 mV or less | Requires unique test equipment capable of inserting 1 V hum on the program line. |  |

Table 1-1 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| Isolation <br> Program Line to Program Monitor | At least 40 dB to 5 MHz | Referenced to 1 V | 2 |
| Pulse-to-Bar Ratio T/2 | 100\% $\pm 2 \%$ |  | 3 |
| T | 100\% $\pm 0.5 \%$ |  | 3 |
| $2 T$ | 100\% $\pm 0.25 \%$ |  | 3 |
| Pulse and Bar Aberrations T/2 | 2\% or less |  | 4 |
| T | 0.5\% or less |  | 4 |
| 2 T | 0.25\% or less |  | 4 |
| Waveform Tilt <br> Field Tilt <br> (Field Rate Square Wave) | 0.5\% or less |  | 5 |
| $\begin{aligned} & \text { Bar Tiitt } \\ & (25 \mu \mathrm{~s} \text { Bar }) \end{aligned}$ | 0.5\% or less |  | 5 |
| Differential Phase (10-90 APL) | $0.15^{\circ}$ or less |  | 22 |
| Differential Gain (10-90 APL) | 0.2\% or less |  | 23 |
| Inserted VITS <br> Differential Phase | $0.4{ }^{\circ}$ or less |  |  |
| Differential Gain | 0.7\% or less |  |  |
| Amplitude Nonlinearity | 0.25\% or less |  | 6 |
| Frequency Response | $\begin{aligned} & \pm 0.5 \% \text { to } 5 \mathrm{MHz} \\ & \pm 1 \% \text { to } 10 \mathrm{MHz} \\ & \pm 3 \% \text { to } 15 \mathrm{MHz} \end{aligned}$ |  | 11 |
| Random Noise Output | At least 75 dB (rms) down | Referenced to 1 V . <br> 5 MHz low-pass filter and a noise weighting filter into a rms meter. | 18 |
| Residual Subcarrier | At least 60 dB down | Referenced to 1 V . <br> 5 MHz low-pass filter into an oscilloscope. | 12 |
| Hum | At least 60 dB down | Referenced to 1 V . <br> 5 MHz low-pass filter into an oscilloscope. | 16 |

Table 1-1 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| Spurious Signals During Blanking <br> Up to 5 MHz | At least 40 dB down ( 10 mV or less) | Insertion transient | 17 |
| Above 5 MHz | At least 46 dB down ( 5 mV or less) | Clock noise | 17 |
| Delete Mode Signal Attenuation <br> 2T Pulse | At least 70 dB down | Referenced to 0.714 V | 14 |
| Subcarrier | At least 60 dB down | Referenced to 0.714 V | 14 |
| Crosstalk (Internal to Program Line) $2 T$ | At least 70 dB down | Referenced to 0.714 V | 13 |
| Subcarrier | At least 60 dB down | Referenced to 0.714 V | 13 |
| Insert Delay Range | $\pm 8 \mu \mathrm{~s}$, (16 $\mu \mathrm{s}$ total) | In 70 ns increments (internal DIP switch) | 19 |
| INSERT SUBCARRIER PHASE ADJUST RANGE | Minimum $10^{\circ}$ total | Continuously adjustable over 70 ns (internally) | 21 |
| Instrument Delay |  | 25 ns typical. Input to output delay. |  |
| Insertion Width | $9.8 \mu \mathrm{~s} \pm 100 \mathrm{~ns}$ to $10.9 \mu \mathrm{~s} \pm 100 \mathrm{~ns}$ | Front Porch (jumper selectable): $1.6 \mu \mathrm{~s}$ to $1.32 \mu \mathrm{~s}$ nominal. <br> Back Porch (jumper selectable): $8.46 \mu \mathrm{~s}, 8.74 \mu \mathrm{~s}$, $9.02 \mu \mathrm{~s}$, or $9.3 \mu \mathrm{~s}$ nominal. | 20 |

Table 1-2 GENLOCK FUNCTION

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step No. |
| :---: | :---: | :---: | :---: |
| Genlock Input (via PROGRAM IN or BLACK BURST $\operatorname{IN})$ |  |  |  |
| Burst Amplitude | 40 IRE $\pm 6 \mathrm{~dB}$ |  | 25 |
| Phase Change with APL |  | For $1^{\circ}$ or less phase change over $10 \%$ to $90 \%$ APL. |  |
| Sync Amplitude | 40 IRE $\pm 6 \mathrm{~dB}$ |  | 25 |
| Return Loss BLACK BURST IN | At least 46 dB to 5 MHz |  | 53 |
| Genlock Performance Burst Lock | $3.579545 \mathrm{MHz} \pm 20 \mathrm{~Hz}$ | 0.00056\% |  |
| If Burst Not Present | Clock is referenced to leading edge of sync. |  |  |
| Sync Lock | $15.73426 \mathrm{kHz} \pm 0.079 \mathrm{~Hz}$ | Requires unique test equipment capable of measuring 0.079 Hz sync frequency offset. |  |
| If Sync and Burst Not Present |  | Clock is referenced to temperature-controlled crystal oscillator. |  |
| Oscillator (Free Running) <br> Subcarrier Frequency | $3.579545 \mathrm{MHz} \pm 10 \mathrm{~Hz}$ | Digitally derived from 14.3 MHz clock. | 26 |
| Sync Frequency | $15.73426 \mathrm{kHz} \pm 0.04 \mathrm{~Hz}$ | Digitally derived from 14.3 MHz clock. Locked to subcarrier by 455/2 ratio. |  |
| Jitter | 5 ns or less |  | 27 |

Table 1-3
EXTERNAL VITS INPUT

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step No. |
| :---: | :---: | :---: | :---: |
| Maximum Input | $\pm 1 \mathrm{~V}$ peak | Ac plus dc. |  |
| Input Impedance | $75 \Omega$ nominal |  |  |
| Return Loss | At least 40 dB to 5 MHz | Power on and off. | 53 |
| Insertion Level | $\pm 5 \mathrm{mV}$ | Referenced to External VITS In blanking level. | 42 |
| Insertion Gain | Unity $\pm 1 \%$ |  | 43 |
| Frequency Response | Flat within $1 \%$ to 5 MHz | -3 dB at 8 MHz | 44 |
| Pulse-to-Bar Ratio $2 T$ | 100\% $\pm 1 \%$ |  | 45 |
| T | $100 \pm 2 \%$ |  | 45 |
| Pulse and Bar Aberration $2 \mathrm{~T}$ | Less than 0.5\% |  | 45 |
| $T$ | Less than 1\% |  | 45 |
| Differential Phase | $0.5^{\circ}$ or less | 10 to $90 \%$ APL. Blanking at 0 Vdc . | 48 |
| Differential Gain | 0.5\% or less | 10 to $90 \%$ APL. Blanking at 0 Vdc . | 49 |
| Amplitude Non-linearity | 0.5\% or less |  | 47 |
| Line-Time Tilt | 1\% or less |  | 46 |
| External Input Isolation | Greater than 60 dB to 5 MHz |  | 50 |
| Switching Transients | Less than 10 mV p-p to 5 MHz | (Switching transient at insertion time.) | 51 |
|  | Less than 5 mV above 5 MHz | (Generator clock noise.) | 51 |

Table 1-4
TEST SIGNALS-FULL FIELD \& VITS

| Characteristics | Performance Requirements |  | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: | :---: |
| AC bOUNCE | 0 to 100 IRE on 4 out of 5 lines |  | Refer to FIELD SQ WAVE Amplitude specification. | 7 |
| Bounce Frequency | Adjustable from approximately 1 Hz to greater than $1 / 30 \mathrm{~Hz}$. |  |  | 7 |
| BOUNCE \& APL |  |  | Selected full-field signal on one line with the Bounce or APL signal on the next four lines. |  |
| Amplitude | 100 IRE $\pm 0.7$ IRE |  |  | 28 |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |  |
| Line Timing | See Fig. 1-2A. |  |  |  |
| FIELD SQ WAVE | Lines 72 to 202 |  |  |  |
| Field Timing |  |  |  |  |
| Lines (White) |  |  |  |  |
| Lines at Blanking |  |  | All remaining active lines. |  |
| Field Tilt | $0.5 \%$ maximum |  |  | 34 |
| Line Tilt | 0.5\% maximum |  |  | 33 |
| Amplitude | 100 IRE $\pm 0.7$ IRE |  |  | 28 |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |  |
| Line Timing | See Fig. 1-2A. |  |  |  |
| WINDOW/FIELD BAR | 100 IRE $\pm 0.7$ IRE |  |  |  |
| White Bar Amplitude |  |  |  |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |  |
| Field Tilt | 0.5\% maximum |  |  |  |
| Line Tilt | 0.5\% maximum |  |  |  |
| Field Timing | Lines 72 to 202 |  | Window only |  |
| Line Timing | See Fig. 1-2B. |  |  |  |
| FCC MULTIBURST/ MULTIBURST 100 | 100 IRE $\pm 0.7$ IRE |  |  |  |
| White Reference Bar Amplitude |  |  |  |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |  |
| Multiburst Packets <br> Amplitude | FCC MB | MB 100 |  |  |
|  | $\begin{aligned} & 60 \text { IRE, } \pm 1 \text { IRE, } \\ & \text { p-p } \end{aligned}$ | 100 IRE $\pm 2$ IRE, p-p |  |  |
| Average Level | 40 IRE $\pm 1$ IRE | 50 IRE $\pm 1$ IRE |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements |  | Supplemental Information | Perf. Ck. Step. No. |
| :---: | :---: | :---: | :---: | :---: |
| Frequencies | 500 kHz <br> 1.25 MHz <br> 2.0 MHz <br> 3.0 MHz <br> 3.58 MHz <br> 4.1 MHz |  | Digitally derived from 14.3 MHz clock. |  |
| Packet Rise Time $500 \mathrm{kHz}$ | $140 \mathrm{~ns} \pm 14 \mathrm{~ns}$ |  | The packets are envelope shaped. |  |
| The Remaining | $400 \mathrm{~ns} \pm 40 \mathrm{~ns}$ |  |  |  |
| Harmonic Content | At least 40 dB down |  |  |  |
| Line Timing | See Fig. 1-2C. |  |  |  |
| MULTIPULSE 70/100 $70$ | 70 IRE $\pm 0.7$ IRE white reference bar. 10 IRE $\pm 0.5$ IRE pedestal level. |  |  |  |
| 100 | 100 IRE $=0.7$ IRE white reference bar. No pedestal. |  |  |  |
| 70 and 100 <br> Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |  |
| Puise-to-Bar Ratio | 100\% $\pm 1 \%$ |  |  |  |
| Pulse Half Amplitude Duration <br> 2 T HAD | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |  |
| 25T HAD | $3.14 \mu \mathrm{~S} \pm 0.3 \mu \mathrm{~S}$ |  |  |  |
| 12.5T HAD | $1.57 \mu \mathrm{~s} \pm 150 \mathrm{~ns}$ |  |  |  |
| Modulated Puise Frequencies | MP 70 | MP 100 | The first pulse HAD is 25 T , and the remaining pulse HADs are 12.5 T . <br> All pulses are digitally derived |  |
| 1st Pulse | 1.25 MHz | 1.0 MHz |  |  |
| 2nd Pulse | 2 MHz | 2 MHz |  |  |
| 3rd Pulse | 3 MHz | 3 MHz |  |  |
| 4th Pulse | 3.58 MHz | 3.58 MHz |  |  |
| 5th Pulse | 4.1 MHz | 4.2 MHz |  |  |
| Group Delay | 10 ns or less |  |  | 31 |
| Other Perturbations on Baseline | 0.5 IRE or less. |  |  |  |
| Line Timing | See Figs. 1-2D and 1-2E. |  |  |  |

Table 1-4 (cont)

| Characteristics | Performance <br> Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| COLOR MULTIPULSE |  |  |  |
| White Reference Bar |  |  |  |
| Amplitude | 100 IRE $\pm 0.7$ IRE |  |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Pulse-to-Bar Ratio | $1: 1 \pm 1 \%$ |  |  |
| Pulse Half Amplitude Duration |  |  |  |
| 2 THAD | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| 12.5T HAD | $1.57 \mu \mathrm{~s} \pm 150 \mathrm{~ns}$ |  |  |
| Modulated Pulse |  |  |  |
| Frequencies |  |  |  |
| 1st | 2.379545 MHz |  |  |
| 2nd | 2.679545 MHz |  |  |
| 3 rd | 2.979545 MHz | HAD for all modulated pulses |  |
| 4th | 3.279545 MHz |  |  |
| 5th | 3.579545 MHz | All pulses digitally derived |  |
| 6th | 3.879545 MHz |  |  |
| 7th | 4.179545 MHz | Phase of the 5th pulse |  |
| 8th | 4.479545 MHz | is |  |
| 9th | 4.779545 MHz |  |  |
| Group Delay | 10 ns or less |  | 31 |
| Other Baseline Perturbations | 0.5 IRE or less |  |  |
| Line Timing | See Fig. 1-2F. |  |  |
| SPECIAL MULTIPULSE <br> White Reference Bar Amplitude | 100 IRE $\pm 0.7$ IRE | This signal occupies two adjacent television lines. |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Pulse-to-Bar Ratio | $1: 1 \pm 1 \%$ for pulses to 5 MHz |  | 30 |

Table $1-4$ (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| 5.5 MHz |  | Typically -3\%. |  |
| 6.0 MHz |  | Typically $-7.5 \%$. |  |
| Pulse Half Amplitude Duration <br> 2 THAD | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| 12.5T HAD | $1.5 \mu \mathrm{~s} \pm 150 \mathrm{~ns}$ |  |  |
| 25 T HAD | $3.14 \mu \mathrm{~s} \pm 0.3 \mu \mathrm{~S}$ |  |  |
| Modulated Pulse Frequencies <br> First Line | 1.0 MHz 1.5 MHz 2.0 MHz 2.5 MHz 3.0 MHz | First two pulses are 25T HAD. <br> Last three pulses are 12.5T HAD. <br> All pulses are digitally derived from 14.3 MHz clock. |  |
| Second Line | 3.5 MHz 4.0 MHz 4.5 MHz 5.0 MHz 5.5 MHz 6.0 MHz | All pulses are 12.5T HAD and digitally derived. |  |
| Group Delay | 10 ns or less for puises of 5 MHz or less. |  | 31 |
| 5.5 MHz Pulse |  | 20 ns typical. |  |
| 6.0 MHz Pulse |  | 100 ns typical. |  |
| Line Timing | See Fig. 1-3A. |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements |  |  | Supplemental Information | Perf. Ck. Step. No. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| COLOR BARS <br> Luminance and Chrominance | Absolute amplitudes of luminance signal, setup, and sync are within $1 \%$ or 1.5 mV , whichever is greater, with respect to blanking. <br> Chrominance amplitudes are within $1 \%$ of their given value. |  |  |  |  |
| 75\% Amplitude, 7.5\% Setup | $\begin{aligned} & \text { LUM } \\ & (\mathrm{mV}) \end{aligned}$ | CHROMA P-P ( mV ) | Phase (degrees) |  |  |
| Full Field \& SMPTE BARS | 714.3 | 1.0 or less |  |  |  |
| Gray | 549.1 | 1.0 or less |  |  |  |
| Yellow | 494.6 | 444.2 | 167.1 |  |  |
| Cyan | 400.4 | 630.1 | 283.4 |  |  |
| Green | 345.9 | 588.5 | 240.8 |  |  |
| Magenta | 256.7 | 588.5 | 60.8 |  |  |
| Red | 202.2 | 630.1 | 103.4 |  |  |
| Blue | 108.1 | 444.2 | 347.1 |  |  |
| Full Field Black | 53.6 | 1.0 or less |  |  |  |
| IYQB -1 | 53.6 | 285.7 | 303.0 |  |  |
| IYQB White Ref | 714.3 | 1.0 or less |  |  |  |
| IYQB $\quad$ Q | 53.6 | 285.7 | 33.0 |  |  |
| IYQB + Pluge | 82.1 |  |  |  |  |
| IYQB - Pluge | 25.0 |  |  |  |  |
| Luminance Rise Time <br> Full Field | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |  |  |
| SMPTE | $140 \mathrm{~ns} \pm 15 \mathrm{~ns}$ |  |  |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| Chrominance Rise Time $-1$ | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Q | $833 \mathrm{~ns} \pm 80 \mathrm{~ns}$ |  |  |
| All Others | $400 \mathrm{~ns} \pm 40 \mathrm{~ns}$ |  |  |
| Bar Duration Full Field |  | $6.5 \mu \mathrm{~s} / \mathrm{bar}$ (8 bars). |  |
| SMPTE |  | $7.5 \mu \mathrm{~s} / \mathrm{bar}$ ( 7 bars). |  |
| Time Difference Between Luminance and Chrominance | 20 ns or less |  |  |
| Residual Subcarrier | At least 52 dB below 1 V White, Black |  | 40 |
| Spurious Subcarrier | At least 52 dB below 1 V |  |  |
| Other Spurious Outputs | At least 52 dB below 1 V , except 40 dB for 2nd harmonic |  | 41 |
| Field Timing <br> FULL FIELD COLOR BARS |  | 241 lines per field. |  |
| BARS/Y (Full Field Color Bars) |  | Modulated bars first 181 active lines per field; unmodulated bars last 60 lines of the field. |  |
| BARS/RED (Full Field Color Bars) |  | Same as for BARS/Y except last 60 lines of the field are red. |  |
| SMPTE BARS |  | EIA Color Bars first 161 active lines per field; Reverse Blue Bars for 20 lines; and IYQB with Pluge for the last 60 lines of field. |  |
| Line Timing <br> FULL FIELD COLOR BARS | See Fig. 1-3B. |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| Color Bars for SMPTE BARS or EIA COLOR BARS | See Fig. 1-3C. |  |  |
| IYQB | See Fig. 1-3D. |  |  |
| REVERSE BLUE BARS | See Fig. 1-3E. |  |  |
| RED FIELD <br> Luminance <br> Amplitude | $202.2 \mathrm{mV}, \pm 1 \% \text { or } 1.5 \mathrm{mV}$ whichever is greater, with respect to blanking. | NOTE: These electrical characteristics are the same as for red color bar. |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Chrominance <br> Amplitude | $630.1 \mathrm{mV} \pm 1 \%$ |  |  |
| Phase | $103.4^{\circ} \pm 0.3^{\circ}$ |  |  |
| Rise Time | $400 \mathrm{~ns} \pm 40 \mathrm{~ns}$ |  |  |
| Duration | $51.9 \mu \mathrm{~s}$ |  |  |
| Line Timing | See Fig. 1-4A. |  |  |
| FCC/NTC 7 COMPOSITE <br> Modulated 5-step <br> Staircase |  |  |  |
| Luminance <br> Amplitude <br> FCC | 80.4 IRE $\pm 0.7$ IRE |  |  |
| NTC 7 | 90.2 IRE $\pm 0.7$ IRE |  |  |
| Riser Amplitude | 1/5 of 5 -step amplitude $\pm 0.5 \%$ |  |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| Chrominance |  |  |  |
| Phase | Same as burst $=0.3^{\circ}$ |  |  |
| Amplitude | $40 \mathrm{IRE} \pm 0.5 \mathrm{IRE}(3.6 \mathrm{mV})$ |  |  |
| Inherent Diff Gain | 0.6\% or less |  | 38 |
| Inherent Diff Phase | $0.3^{\circ}$ or less |  | 37 |
| Envelope Rise Time FCC | $375 \mathrm{~ns} \pm 37.5 \mathrm{~ns}$ |  |  |
| NTC 7 | $400 \mathrm{~ns} \pm 40 \mathrm{~ns}$ |  |  |
| 2T Pulse |  |  |  |
| Pulse-to-Bar Ratio | 100\% $\pm 0.5 \%$ |  | 30 |
| Half Amplitude Duration (HAD) | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Ringing | 1.0 IRE or less |  | 36 |
| Modulated SineSquared Pulse |  |  |  |
| Pulse-to-Bar <br> Peak Amplitude | 100\% $\pm 0.5 \%$ |  |  |
| Half Amplitude Duration (HAD) | $1.563 \mu \mathrm{~s} \pm 150 \mathrm{~ns}$ |  |  |
| Chrominance-toLuminance Delay | 10 ns or less |  |  |
| Chrominance-toLuminance Gain Inequality (RCL) | $\pm 0.5 \mathrm{IRE}( \pm 1 \%)$ |  |  |
| Other Perturbations on Baseline | 0.5 IRE or less |  |  |
| Harmonic Distortion of Subcarrier | At least 40 dB down |  | 41 |
| Phase | $60.8^{\circ} \pm 1^{\circ}$ |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. Step. No. |
| :---: | :---: | :---: | :---: |
| Bar |  |  |  |
| Amplitude | 100 IRE $\pm 0.7$ IRE |  |  |
| Rise Time |  |  |  |
| FCC | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| NTC 7 | $125 \mathrm{~ns} \pm 15 \mathrm{~ns}$ |  |  |
| Line Timing |  |  |  |
| FCC | See Fig. 1-4B. |  |  |
| NTC 7 | See Fig. 1-4C. |  |  |
| MODULATED BAR |  |  |  |
| White Reference Bar |  |  |  |
| Amplitude | 100 IRE $\pm 0.7$ IRE |  |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Pulse-to-Bar | $1: 1 \pm 1 \%$ |  |  |
| Pulse Half Amplitude Duration |  |  |  |
| 12.5 HAD | $1.57 \mu \mathrm{~S} \pm 180 \mathrm{~ns}$ |  |  |
| 2 THAD | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| 12.5 Modulated Puise |  |  |  |
| Frequency | 3.579545 MHz | Digitally derived from 14.3 MHz clock. |  |
| Phase | $327^{\circ} \pm 1^{\circ}$ |  |  |
| Modulated Bar Chrominance |  |  |  |
| Amplitude | 100 IRE $\pm 1$ IRE |  |  |
| Rise Time | $1.56 \mu \mathrm{~s} \pm 100 \mathrm{~ns}$ |  |  |
| Frequency | 3.579545 MHz | Digitally derived from 14.3 MHz clock. |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. Step. No. |
| :---: | :---: | :---: | :---: |
| Phase | $33^{\circ} \pm 1^{\circ}$ |  |  |
| Luminance Amplitude | $50 \mathrm{IRE} \pm 0.5 \mathrm{IRE}$ |  |  |
| Group Delay | Equal to or less than 10 ns |  |  |
| Baseline Perturbations | 0.5 IRE or less |  |  |
| Line Timing | See Fig. 1-4D. |  |  |
| INVERTED PULSE \& BAR <br> Reference Bar <br> Amplitude | 100 IRE $\pm 0.7$ IRE |  |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Pulse-to-Bar Ratio | 1:1 $\pm 1 \%$ |  |  |
| 2 P Pulse HAD | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Baseline Perturbations | 0.5 IRE or less |  |  |
| Timing | See Fig. 1-4E. |  |  |
| VIRS (Vertical Interval Reference Signal) <br> Chrominance <br> Reference <br> Amplitude | 40 IRE $\pm 0.4$ IRE |  |  |
| Phase | Same as burst $\pm 0.3^{\circ}$ |  |  |
| Envelope Rise Time Time (Sine-squared shaped) | $1 \mu \mathrm{~s} \pm 100 \mathrm{~ns}$ |  |  |
| Average Level of Chrominance Signal | 70 IRE $\pm 0.7$ IRE |  |  |
| Luminance Reference <br> 50 IRE Level | 50 IRE $\pm 0.5$ IRE |  |  |
| Black Reference | 7.5 IRE $\pm 0.5$ IRE |  |  |
| Line Timing | See Fig. 1-4F. |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| VICR (Vertical Internal Color Reference) <br> Chrominance Reference <br> Amplitude | 100 IRE $\pm 1$ IRE | Removed S/N B023197. |  |
| Phase | Same as burst within $\pm 0.3^{\circ}$ |  |  |
| Envelope Rise Time | $1 \mu \mathrm{~s} \pm 100 \mathrm{~ns}$ | Sine-squared shape |  |
| Average Level Chrominance Signal | 50 IRE $\pm 0.5$ IRE |  |  |
| Luminance Reference 100 IRE Level | 100 IRE $\pm 0.7$ IRE |  |  |
| Black Reference | 7.5 IRE $\pm 0.5$ IRE |  |  |
| Line Timing | See Fig. 1-5A. |  |  |
| BLACK BURST, 10/25i 50/100 IRE PED Pedestal Amplitudes BLACK | 7.5 IRE $\pm 0.5$ IRE |  |  |
| 10 IRE | 10 IRE $\pm 0.5$ IRE |  |  |
| 25 IRE | 25 IRE $\pm 0.5$ IRE | Removed S/N B023197. |  |
| 50 IRE | 50 IRE $\pm 0.5$ IRE |  |  |
| 100 IRE | 100 IRE $\pm 0.5$ IRE |  |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Tilt | 0.5\% or less |  |  |
| Line Timing | See Fig. 1-5B. |  |  |
| GCR Positive (Ghost Cancellation Reference, Positive) Pedestal Amplitude. | 30 IRE $\pm 0.5 \mathrm{IRE}$ | Added S/N B023197. |  |
| Chrominance Amplitude | 80 IRE $\pm 1$ IRE |  |  |
| Spectrum | Flat to $4.1 \mathrm{MHz} .-3 \mathrm{~dB}$ at 4.3 MHz |  |  |
| Line Timing | See Fig. 1-6D. |  |  |
| GCR Negative(Ghost Cancellation Reference, Negative) |  | Added S/N B023197. |  |
| Pedestal Amplitude | 30 IRE $\pm 0.5$ IRE |  |  |
| Chrominance Amplitude | 80 IRE $\pm 1$ IRE |  |  |
| Spectrum | Flat to 4.1 MHz. -3 dB at 4.3 MHz |  |  |
| Line Timing | See Fig. 1-6E. |  |  |
| GCR (Ghost Cancellation Reference) for Options | See individual Appendix sections. |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| MOD PED (Modulated Pedestal) <br> Pedestal <br> Amplitude | 50 IRE $\pm 0.5$ IRE |  |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Tilt | 0.5\% or less |  |  |
| Chrominance <br> Amplitudes <br> 20 IRE | 20.01 IRE p-p, $\pm 0.5$ IRE |  |  |
| 40 IRE | 40.02 IRE p-p, $\pm 0.5$ IRE |  |  |
| 80 IRE | 80.04 IRE p-p, $\pm 0.5$ IRE |  |  |
| Phase <br> Relative to Burst | $90^{\circ}$ within $0.3^{\circ}$ |  |  |
| Relative to the Other Two | $0^{\circ}$ within $0.5^{\circ}$ |  |  |
| Harmonic Distortion | At least 40 dB down |  |  |
| Rise Time | $400 \mathrm{~ns} \pm 40 \mathrm{~ns}$ |  |  |
| Line Timing | See Fig. 1-5C. |  |  |
| 5-STEP STAIRCASE, MODULATED 5 STEP <br> Luminance <br> Amplitude | 100 IRE $\pm 0.7$ IRE |  |  |
| Linearity | $\pm 0.5 \%$ of total amplitude | Any step amplitude will match any other by 0.5 IRE. | 29 |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Chrominance <br> 5-STEP STAIRCASE | No modulation |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. Step. No. |
| :---: | :---: | :---: | :---: |
| MODULATED 5 STEP (each step) |  |  |  |
| Amplitude | 40 IRE $\pm 0.5$ IRE |  |  |
| Rise Time | $400 \mathrm{~ns} \pm 40 \mathrm{~ns}$ |  |  |
| Phase | $180^{\circ}$ |  |  |
| Line Timing | See Fig. 1-5D. |  |  |
| 10-STEP STAIRCASE, MODULATED 10 STEP |  |  |  |
| Luminance |  |  |  |
| Amplitude | 100 IRE $\pm 0.7$ IRE |  |  |
| Linearity | $1 / 10$ of 10 -step amplitude $\pm 0.5 \%$ |  |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Chrominance 10-STEP STAIRCASE | No modulation |  |  |
| MODULATED 10 STEP <br> (Each Step) <br> Amplitude | 40 IRE $\pm 0.5$ IRE |  |  |
| Rise Time | $400 \mathrm{~ns} \pm 40 \mathrm{~ns}$ |  |  |
| Phase | Same as burst |  |  |
| Line Timing | See Fig. 1-5E. |  |  |
| $\frac{\operatorname{Sin} x}{x}$ <br> Spectrum | Flat within $\pm 0.2 \mathrm{~dB}$ to 4.5 MHz . -3 dB at 4.75 MHz . |  |  |
| Main Pulse Zero Crossing | $210 \mathrm{~ns} \pm 21 \mathrm{~ns}$ |  |  |
| Small Lobe Zero Crossing | $105 \mathrm{~ns} \pm 15 \mathrm{~ns}$ |  |  |
| Bar Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Line Timing | See Fig. 1-5F. |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| MOD RAMP 80/100, <br> Y RAMP 100 |  |  |  |
| Luminance Amplitudes MOD RAMP 80 | 0 to 80 IRE $\pm 0.7$ IRE |  |  |
| MOD RAMP 100, <br> Y RAMP 100 | 0 to 100 IRE $\pm 0.7$ IRE |  |  |
| Slope | 1:1 | LSB:Sample |  |
| Linearity | Within 1\% |  |  |
| Chrominance |  |  |  |
| Amplitude | $40 \mathrm{IRE} \pm 0.5 \mathrm{IRE}$ |  |  |
| Inherent Diff Gain | 0.6\% or less |  | 38 |
| Inherent Diff Phase | $0.3^{\circ}$ or less |  | 37 |
| Envelope Rise Time | $400 \mathrm{~ns} \pm 40 \mathrm{~ns}$ |  |  |
| Phase | Same as burst within $\pm 0.3^{\circ}$ |  |  |
| Line Timing | See Figs. 1-6A \& 1-6B. |  |  |
| NTC 7 COMBINATION |  |  |  |
| Multiburst White Reference Bar <br> Amplitude | 100 IRE $\pm 0.7$ IRE |  |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Overshoot | 1\% or less |  |  |
| Tilt | 0.5\% or less |  |  |
| Multiburst Packets <br> Amplitude | 50 IRE $\pm 0.5$ IRE p-p |  |  |
| Average Level | $50 \mathrm{IRE}=0.5 \mathrm{IRE}$ |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| Frequencies | 500 kHz <br> 1.0 MHz <br> 2.0 MHz <br> 3.0 MHz <br> 3.58 MHz <br> 4.2 MHz | Digitally determined from 14.3 MHz. |  |
| Packets Rise Time $\begin{aligned} & 500 \mathrm{kHz}, \\ & 1 \mathrm{MHz} \end{aligned}$ | $140 \mathrm{~ns} \pm 14 \mathrm{~ns}$ | The packets are envelope shaped as indicated. |  |
| Remaining Packets | $400 \mathrm{~ns} \pm 40 \mathrm{~ns}$ |  |  |
| Harmonic Content | 40 dB down |  |  |
| Modulated Pedestal <br> Pedestal <br> Amplitude | 50 IRE $\pm 0.5$ IRE |  |  |
| Rise Time | $250 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Tilt | 0.5\% or less |  |  |
| Chrominance <br> Amplitude $20 \text { IRE }$ | 20.01 IRE $\pm 0.5$ IRE |  |  |
| 40 IRE | 40.02 IRE $\pm 0.5$ IRE |  |  |
| 80 IRE | 80.04 IRE $\pm 0.6$ IRE |  |  |
| Phase | $90^{\circ} \pm 0.5^{\circ}$ |  |  |
| Relative to the Other Two Levels | $0^{\circ} \pm 0.3^{\circ}$ |  |  |
| Harmonic Distortion | At least 40 dB down |  |  |
| Rise Time | $400 \mathrm{~ns} \pm 40 \mathrm{~ns}$ |  |  |
| Line Timing | See Fig. 1-6C. |  |  |

Table 1-4 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| CONVERGENCE |  |  |  |
| Crosshatch Vertical Lines |  |  |  |
| Pulse Polarity | Positive |  |  |
| Line Puise HAD | $225 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  |  |
| Dot Pulse HAD | $350 \mathrm{~ns} \pm 35 \mathrm{~ns}$ |  |  |
| Crosshatch Horizontal Lines <br> Number of Unblanked Pulses | 14 per frame |  |  |
| Pulse Polarity | Positive |  |  |
| Line Pulse Rise Time | $140 \mathrm{~ns} \pm 15 \mathrm{~ns}$ |  |  |
| Line Pulse Duration | 2 lines (1 line on each field) |  |  |
| Dot Pulse | 3 lines ( 1 line on one field and 2 lines on the other field) |  |  |
| EYE TEST PATTERN <br> Amplitude | 68 IRE | This signal occupies two adjacent television lines. The second line is of opposite phase. <br> High $=70$ IRE, Low $=2 \operatorname{IRE}$ |  |
| Rise \& Fall Times | $100 \mathrm{~ns} \pm 25 \mathrm{~ns}$ | Sine-squared shape. |  |
| Bit Period | 174.6 ns/bit | 5.727272 MHz bit rate. |  |
| Bit Sequence | 16 cycles at 2.86 MHz 8 cycles at 1.43 MHz 5 cycles at 954 kHz 4 cycles at 716 kHz 4 cycles at 573 kHz 3 cycles at 477 kHz 2 cycles at 409 kHz 2 cycles at 358 kHz 1 cycle at 716 kHz 1 cycle at 954 kHz 2 cycles at 1.43 MHz 2 cycles at 2.86 MHz |  |  |

Table 1-4 (cont)

| Characteristics | Performance <br> Requirements |  | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: | :---: |
| EYE PATTERN REFERENCE SIGNAL <br> Amplitude | 68 IRE |  | This signal occupies two adjacent TV lines. The second line is of opposite phase. <br> High $=70$ IRE, Low $=2$ IRE |  |
| Rise \& Fall Times | $100 \mathrm{~ns} \pm 25 \mathrm{~ns}$ |  | Sine-squared shape. |  |
| Bit Period | $174.6 \mathrm{~ns} / \mathrm{bit}$ |  | 5.727272 MHz bit rate. |  |
| Bit Sequence | 144 cycles at 2.86 MHz |  |  |  |
| MATRIX 1 | Signal | Lines | Customer definable. |  |
|  | MOD 10 STEP COLOR BARS RED FIELD | 21-103 <br> 104-182 <br> 183-262 |  |  |
| MATRIX 2 | MOD RAMP 100 EIA BAR <br> REV. BLUE BAR <br> MULTIPULSE 100 | $\begin{gathered} 21-87 \\ 88-151 \\ 152-202 \\ 203-262 \end{gathered}$ | Customer definable. |  |
| MATRIX 3 | CONVERGENCE EIA BAR <br> REV. BLUE BAR CONVERGENCE IYQB CONVERGENCE | $\begin{gathered} 21-54 \\ 55-87 \\ 88-103 \\ 104-151 \\ 152-214 \\ 215-262 \end{gathered}$ | Customer definable. |  |




Fig. 1-3. Test Signals With Amplitude and Timing Details.


Fig. 1-4. Test Signals With Amplitude and Timing Details.


Fig. 1-5. Test Signals With Amplitude and Timing Details.


Fig. 1-6. Test Signals With Amplitude and Timing Details.

Table 1-5
TEST SIGNALS—FULL FIELD OUTPUT
(Sync \& Burst)

| Characteristics | Performance <br> Requirements | Supplemental information | Perf. Ck. Step. No. |
| :---: | :---: | :---: | :---: |
| Amplitude | 1.2 V maximum p-p into $75 \Omega$ |  |  |
| Sync | $285.7 \mathrm{mV} \pm 2 \mathrm{mV}$ |  |  |
| Peak Level | $714.3 \mathrm{mV} \pm 5 \mathrm{mV}$ |  | 28 |
| Blanking Level DAC DC Restorer On | $0 \mathrm{~V} \pm 2 \mathrm{mV}$ |  | 40 |
| DAC DC Restorer Off | $0 \mathrm{~V} \pm 50 \mathrm{mV}$ |  | 40 |
| Field Period | 16.68 ms | Digitally determined from 14.3 MHz. |  |
| Line Period | $63.56 \mu \mathrm{~s}$ |  |  |
| Sync Rise \& Fall Time | $140 \mathrm{~ns} \pm 15 \mathrm{~ns}$ | 10\% to 90\% amplitude. |  |
| Sync Timing | See Fig. 1-7. |  |  |
| Front Porch | $1.7 \mu \mathrm{~s} \pm 100 \mathrm{~ns}$ using a 100 IRE pedestal | Digitally determined from 14.3 MHz. |  |
| Line Blanking Interval | $11.28 \mu \mathrm{~s} \pm 100$ ns at 20 IRE points using a 100 IRE Pedestal |  |  |
| Breezeway | $0.6 \mu \mathrm{~s}, \pm 50 \mathrm{~ns}$, at $50 \%$ of sync to $50 \%$ of burst amplitude |  |  |
| Back Porch Duration | $4.83 \mu \mathrm{~s}, \pm 50 \mathrm{~ns}$, at $50 \%$ of sync to 20 IRE using a 100 IRE pedestal |  |  |
| Line Sync | $4.7 \mu \mathrm{~s}, \pm 50 \mathrm{~ns}$, at $50 \%$ amplitude point |  |  |
| Vertical Serration | See Fig. 1-8. |  |  |

Table 1-5 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. Nc |
| :---: | :---: | :---: | :---: |
| Duration | $4.7 \mu \mathrm{~s}, \pm 50 \mathrm{~ns}$, at $50 \%$ amplitude point |  |  |
| Sequence |  | Three lines. |  |
| Period | 262.5 lines | Digitally determined from 14.3 MHz. |  |
| Equalizing Pulse <br> Duration | $2.33 \mu \mathrm{~s}, \pm 50 \mathrm{~ns}$, at $50 \%$ amplitude point |  |  |
| Sequence |  | Three lines. |  |
| Burst <br> Rise \& Fall Time | $400 \mathrm{~ns} \pm 40 \mathrm{~ns}$ |  |  |
| Delay from Line | $5.308 \mu \mathrm{~s} \pm 35 \mathrm{~ns}$ | 19 cycles of subcarrier. |  |
| Half-Amplitude Duration of Envelope | $2.51 \mu \mathrm{~s} \pm 100 \mathrm{~ns}$ | 9 cycles of subcarrier. |  |
| Amplitude | $285.7 \mathrm{mV} \pm 8.57 \mathrm{mV}$ |  |  |
| Residual Subcarrier (Luminance \& Blanking) | At least 52 dB below $1 \mathrm{~V}(2.5 \mathrm{mV})$ | As viewed on a 1480 Waveform Monitor | 40 |
| Spurious Subcarrier on Outputs | At least 52 dB below $1 \mathrm{~V}(2.5 \mathrm{mV})$ |  | 40 |
| Chrominance Subcarrier Frequency |  |  |  |
| Locked Mode |  | Locked to incoming burst; locked to the leading edge of sync if burst is not present. |  |
| Output Impedance | $75 \Omega$ nominal |  |  |
| Return Loss | At least -36 dB to 5 MHz |  | 53 |
| Isolation (Front- \& Rear-Panel Outputs) | At least -40 dB |  | 35 |



Fig. 1-7. Horizontal Blanking Details.


Fig. 1-8. Composite Sync Details.

Table 1-6
SYNC \& SUBCARRIER

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| COMPOSITE SYNC <br> Amplitude | $4 \mathrm{~V} \pm 10 \% \mathrm{p}-\mathrm{p}$, negative going, into $75 \Omega$ |  |  |
| Rise \& Fall Times | $140 \mathrm{~ns} \pm 20 \mathrm{~ns}$ | Measured from $10 \%$ to $90 \%$ amplitude points. |  |
| Return Loss | At least 30 dB to 3.58 MHz |  | 53 |
| Line Period |  | $\begin{array}{r} \text { Nominal }(H)=63.556 \mu \mathrm{~s} \\ \frac{1}{455} \end{array}$ |  |
| Line Sync Duration | $4.7 \mu \mathrm{~s} \pm 50 \mathrm{~ns}$ | Measured at 50\% amplitude point. |  |
| Equalizer Pulse <br> Duration | $2.3 \mu \mathrm{~s} \pm 50 \mathrm{~ns}$ | Measured at 50\% amplitude point. |  |
| Sequence Duration |  | Three lines each. |  |
| Vertical Sync Pulse <br> Serration | $4.7 \mu \mathrm{~s} \pm 50 \mathrm{~ns}$ |  |  |
| Sequence Duration |  | Three lines. |  |
| Field Period | 262.5 H Lines | 16.6835 ms nominal. |  |
| SUBCARRIER <br> Amplitude | 2 V p-p $\pm 10 \%$ | into $75 \Omega$. |  |
| Return Loss | At least 30 dB into 5 MHz |  | 53 |
| Frequency |  | Locked to incoming burst. If burst is not present, locked to leading edge of incoming sync. If sync is not present, determined by an internal oven-controlled oscillator. | 25 |

Table 1-6 (cont)

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| Pulse Outputs ${ }^{\text {a }}$ <br> Amplitude | H DRIVE, $V$ DRIVE, BURST FLAG, \& COMP BLANKING <br> $4 \mathrm{~V} \pm 10 \% \mathrm{p}-\mathrm{p}$, negative going, into $75 \Omega$ |  |  |
| Rise \& Fall Times | $140 \mathrm{~ns} \pm 20 \mathrm{~ns}$ | Measured from $10 \%$ to $90 \%$ amplitude points. |  |
| Return Loss | At least 30 dB to 5 MHz |  |  |
| Timing <br> H DRIVE Duration | Start of line blanking to end of line sync $\pm 100 \mathrm{~ns}$ |  | 52 |
| $V$ DRIVE Duration | Nine lines | Coincident with beginning of field. Blanking extends nine lines. | 52 |
| BURST FLAG <br> Delay from Line Sync | $5.3 \mu \mathrm{~s} \pm 100 \mathrm{~ns}$ |  | 52 |
| Duration | $2.5 \mu \mathrm{~S}$ | 9 cycles of subcarrier. | 52 |
| COMP BLANKING <br> Line Blanking Duration | $11.1 \mu \mathrm{~S} \pm 100 \mathrm{~ns}$ |  | 52 |
| Front Porch | $1.5 \mu \mathrm{~s}=100 \mathrm{~ns}$ | Leading edge of comp sync to end of line blanking is $9.6 \mu \mathrm{~s} \pm 100 \mathrm{~ns}$. | 52 |
| Field Blanking Duration |  | Field $1=21$ lines <br> Field $2=21$ lines <br> Start: $1.5 \mu \mathrm{~S} \pm 100 \mathrm{~ns}$ before leading edge of first equalizing pulse. | 52 |

[^1]Table 1-7
RS-232 CONTROL PORT INTERFACE

| Characteristics | Performance <br> Requirements | Supplemental <br> Information |  |
| :--- | :--- | :--- | :--- |
| Interface ${ }^{\text {a }}$ |  | Supports EIA Standard RS-232-C <br> format to the extent shown below. |  |
| Baud | $300,1200,2400$, and 4800 bits/sec | Selectable through the RS-232 <br> port. |  |
| Input | Serial Asynchronous Data | Full duplex input and output. |  |
| Output | Serial Asynchronous Data | ASCII | Eleven bits per character, including a <br> start and two stop bits. |
| Data Code |  | No parity is required; and, if |  |
| Character Length |  |  |  |
| Parity | No parity is sent. |  |  |
| Input |  | See Section 5 of this manual. |  |
| Output |  |  |  |

${ }^{\text {a }}$ The control lines used in the 1910 are listed below:

| Pin | Function | Input or Output |
| :---: | :--- | :---: |
| 1 | Protective Ground |  |
| 2 | Receive Data | Input |
| 3 | Transmit Data | Output |
| 4 | Request to Send | Input |
| 5 | Clear to Send | Output |
| 6 | Data Set Ready | Output |
| 7 | Signal Ground |  |
| 8 | Received Line Signal Detector | Output |
|  | (Data Carrier Detect) |  |
| 20 | Data Terminal Ready | Input |

Table 1-8
DIGITAL INPUT INTERFACE

| Characteristics | Performance <br> Requirements | Supplemental <br> Information | Perf. Ck. <br> Step. No. |
| :--- | :--- | :--- | :--- |
| Digital Format |  | Parallel, 12 balanced signal pairs <br> consisting of 10 data bits per <br> sample, a clock, and a timing <br> reference signal. |  |
| Encoding Format | Positive binary <br> Sampling Frequency <br> times color subcarrier. Nominally <br> Sampling Phase Angle |  | Referenced to I and Q axis. |

Table 1-9
DIGITAL OUTPUT INTERFACE

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. <br> Step. No. |
| :---: | :---: | :---: | :---: |
| Digital Format |  | Parallel, 12 balanced signal pairs consisting of 10 data bits per sample, a clock, and a timing reference signal. |  |
| Timing Reference Signal |  | See Fig. 1-9. |  |
| Encoding Format | Positive Binary |  |  |
| Sampling Frequency | 4 times color subcarrier nominal ( 14.31818 MHz ) |  |  |
| Sampling Phase Angle |  | Referenced to I and Q axis. |  |
| Output Logic Levels | 10K ECL compatible. <br> High: -0.96 to -0.81 V <br> Low: -1.85 to -1.65 V | At $25^{\circ} \mathrm{C}$. |  |
| Dynamic Range 10 bits/sample | Blanking level (OIRE) is at digital word 240. <br> Reference white ( 100 IRE) is at digital word 800 ( 5.6 LSB/IRE). |  |  |
| Clock Timing | The $50 \%$ point of the leading edge of the clock pulse precedes the data by $5 \mathrm{~ns} \pm 5 \mathrm{~ns}$. |  |  |

## TIMING REFERENCE SIGNAL



This signal occurs once every $63.56 \mu$ s. Field and Frame information change at line number $1 .{ }^{*}$
Bit 1 of Word 0 occurs 91 Clock cycles after the nominal $50 \%$ point of the leading edge of the Horizontal Sync pulse.

WORD 0
Bit 0 - Always High.
Bits 1 through 9 are always Low.
WORD 1
Bit 0 - Always High.
Bit 1 - High for Color Frame $\mathrm{B}^{*}$
Bit 2 - High for Fields 2 and $4^{* *}$
Bit $3-2^{*}(M S B)$
Bit $4-2^{\text {i }} \quad$ Horizontal Line Count ${ }^{*}$
Bit $5-2^{*} \quad$ (straight binary sequence)
Bit $6-2^{5}$
Bit $7-2^{\text {a }}$
Bit 8 - Odd Parity for Word 1.
(Odd parity gives the word, including parity, an odd number of high states.)

WORD 2

```
Bit 0 - Always High
Bit \(1-2^{3}\)
Bit \(2-2^{2} \quad\) Horizontal Line Count \({ }^{*}\)
Bit \(\left.3-2^{\prime} \quad\right\}\) (straight binary sequence)
Bit 4-20 (LSB)
Bit 5 - High when the preceding Frame, Field or Line Count is invalid.
Bit 6 - High for lines with Color Burst.
Bit 7 - High when reference subcarrier is positive-going."
Bit 8 - Odd Parity for Word 2.
                    (Odd parity gives the word, including parity.
                    an odd number of high states.)
```

The remaining time of the Timing Reference Signal is High.
*The clocks repetition rate ( $t_{\text {clk }}$ ) is equivalent to $1 / 14.31818 \mathrm{MHz}$.
"*As defined in the EIA Tentative Standard RS 170A for Color Television Studio Picture Line Amplifier Output.

Fig. 1-9. Timing Reference Signal Details.

Table 1-10
POWER SUPPLY

| Characteristics | Performance Requirements | Supplemental Information | Perf. Ck. Step. No. |
| :---: | :---: | :---: | :---: |
| Supply Accuracy |  |  |  |
| $+15 \mathrm{~V}$ |  | $15 \mathrm{~V}=50 \mathrm{mV}$ |  |
| +5V Analog |  | $5 \mathrm{~V} \pm 50 \mathrm{mV}$ |  |
| +5V Digital |  | $5 \mathrm{~V} \pm 50 \mathrm{mV}$ |  |
| -5.2 V ECL |  | $-5.2 \mathrm{~V} \pm 50 \mathrm{mV}$ |  |
| -15V |  | $-15 \mathrm{~V} \pm 25 \mathrm{mV}$ |  |
| Current Limit |  | Nominal |  |
| $+15 \mathrm{~V}$ |  | 0.7 A |  |
| +5 V Anaiog |  | 0.5 A |  |
| -5V Digital |  | 6.5 A |  |
| -5.2 V ECL |  | 2 A |  |
| -15V |  | 0.8 A |  |
| Supply Ripple |  | Typical |  |
| +15V |  | 5 mV |  |
| +5 V Analog |  | 5 mV |  |
| $+5 \vee$ Digital |  | 5 mV |  |
| -5.2 V ECL |  | 5 mV |  |
| $-15 \mathrm{~V}$ |  | 5 mV |  |
| Line Voltage Range |  |  |  |
| 100 Vac | 90 Vac to 110 Vac |  |  |
| 110 Vac | 99 Vac to 121 Vac |  |  |
| 120 Vac | 108 Vac to 132 Vac |  |  |
| 200 Vac | 180 Vac to 220 Vac |  |  |
| 220 Vac | 198 Vac to 242 Vac |  |  |
| 240 Vac | 216 Vac to 250 Vac |  |  |
| Crest Factor |  | At least 1.35 |  |
| Fuse Data |  |  |  |
| 100/120 Vac |  | 1.6 A Slow-Blow |  |
| 200/240 Vac |  | 0.8 A Slow-Blow |  |
| Maximum Power Consumption |  | 130 W |  |
| Maximum Current at $120 \mathrm{Vac}, 60 \mathrm{~Hz}$ |  | 1.08 A |  |
| Line Frequency |  | 47 Hz to 63 Hz |  |

Table 1-11
PHYSICAL CHARACTERISTICS

| Characteristics | Information |
| :---: | :---: |
| Dimensions <br> Rackmount <br> Height | See Fig. 1-10. <br> 88 mm (3.470 inches) |
| Width | 486 mm (19.134 inches) |
| Length | 525 mm (20.650 inches) |
| Cabinet <br> Height | 96 mm ( 3.770 inches) |
| Width | 442 mm (17.399 inches) |
| Length | 525 mm (20.650 inches) |
| Net Weight Rackmount | 12.2 kg (27 lbs) |
| Cabinet | 11.6 kg ( 25.5 lbs ) |
| Shipping Weight | 16.7 kg ( 37 lbs ) |

Table 1-12
ENVIRONMENTAL CHARACTERISTICS

| Characteristics | Information |
| :--- | :--- |
| Temperature | $-40^{\circ} \mathrm{C}$ to $+65^{\circ} \mathrm{C}$. |
| Non-Operating | $0^{\circ} \mathrm{C}$ to $+50^{\circ} \mathrm{C}$. |
| Operating | To 50,000 feet. |
| Altitude | To 15,000 feet. |
| Non-Operating | 15 minutes each axis at 0.015 inch, frequency varied from 10-50-10 c/s in 1-minute cycles with <br> instrument secured to vibration platform. Three minutes each axis at any resonant point or at 50 <br> C/s. |
| Vibration | 30 g's, 1/2 sine, 11 ms duration, 2 guillotine-type shocks per axis. |
| Shock | Qualified under NTSC Test Procedure 1A, Category II (24-inch drop). |
| Non-Operating |  |



Fig. 1-10. Dimensional Illustrations for the 1910.


[^0]:    ${ }^{1}$ Synchronization of signal in both frequency and phase.

[^1]:    ${ }^{\text {a }}$ Available when the Pulse Output board, A15 (a standard accessory), is installed in place of the External VITS board, A17.

