FACTORY CALIBRATION PROCEDURE

CONTENTS:

This is the guide for calibrating new instruments in Product Manufacturing. The procedure consists of 4 sections:

This procedure is company confidential

520 PAL

September 1968
For all serial numbers.

<u>Equipment Required</u>

<u>Factory Test Limits</u> - Factory Test Limits are limits an instrument must meet before leaving Manufacturing. These limits are often more stringent than advertised performance requirements. This is to insure that the instrument will meet advertised requirements after shipment, allows for individual differences in test equipment used, and (or) allows for changes in environmental conditions.

<u>Short Form Procedure</u> - The Short Form Procedure has the same sequence of steps and the same limits on checks or adjustments as the Main Procedure.

<u>Main Procedure</u> - The Main Procedure gives more detailed instructions for the calibration of the instrument. This procedure may require that some checks and adjustments be made so that performance is better than that required by the Factory Test Limits. This insures the Factory Test Limits will be met when side panels are added, permits some normal variation in test equipment and plug-in scopes, etc.

Abbreviations in this procedure will be found listed in TEKTRONIX STANDARD A-100. Definitions of terms used in this procedure may be found in TEKTRONIX STANDARD A-101.

In this procedure, all front panel control labels and Tektronix instrument names are in capital letters (VOLT/DIV, etc). Internal adjustment labels are capitalized only (Gain Adj, etc).

CHANGE INFORMATION:

This procedure has been prepared by Product Manufacturing Staff Engineering. For information on changes made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact PMSE, 39-307. (NC)

EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

a. TEKTRONIX Instruments

1 TYPE 540 series OSCILLOSCOPE
1 TYPE 1A1 DUAL TRACE PLUG-IN UNIT
1 TYPE 106 SQUARE WAVE GENERATOR
1 TYPE 191 CONSTANT AMPLITUDE SIGNAL GENERATOR
1 TYPE P6006 10X Passive Probe
2 TYPE P6023 10X Probe
1 TYPE 76TU LINE-VOLTAGE CONTROL UNIT
1 TYPE 141 PAL SIGNAL GENERATOR

b. Test Fixture and Accessories

1 DC Voltage Bridge (with corrected reading for -3900V ±1.0%) (067-0543-99)
1 Standard Amplitude Calibrator (SAC) (067-0502-00)
1 Vector Scope Test Unit (067-0570-00)
1 Dual Input Coupler (067-0525-00)
2 75Ω Termination (011-0023-00)
1 BNC to Dual Binding Post adapter (103-0035-00)
1 50Ω to 75Ω Min Loss Attenuator (011-0057-00)
1 75Ω Variable Attenuator (PMIE Dwg #2018-A)
1 Ramp and Sine Wave adder (067-0565-00)
3 75Ω Cable (012-0002-00)

c. Other Equipment

1 20,000Ω/VDC Multimeter
1 Video Generator capable of producing the following
signals: H sync
4.43MHz cw (≥2.5V P-P)
multiburst

d. Equipment for Sample Checks

1 20T $\sin^2$ pulse generator

Substitute test equipment may be used. The Plant Staff Engineer must approve any substitutions. All equipment listed must perform within its manufacturer's specifications, unless otherwise stated.

FACTORY TEST LIMITS

QUALIFICATION

Factory Test Limits are qualified by the conditions specified in the main body of the Factory Calibration Procedure. The numbers and letters to the left of the limits correspond to the procedure steps where the check or adjustment is made. Steps without Factory Test Limits (set-ups, presets, etc.) are not listed. Instruments may not meet Factory Test Limits if calibration or checkout methods and test equipment differ substantially from those in this procedure.

1. PRELIMINARY

f. SCR Oven: quick heat turns off within 3 min

g. Graticule Lights: vector graticule illuminated with VECTOR PAL and VECTOR NTSC buttons depressed; luminance graticule illuminated with Y, R, G, B, V, U and DIFF GAIN buttons depressed; neither graticule illuminated with DIFF PHASE button depressed.

2. POWER SUPPLIES

a. -15 Volts: -15V ±0.5%

b. Power Supply Accuracy:
- +3.6V ±7%
- +10V ±3.5%
- +100V ±3.5%
- +275V ±6%

c. Power Supply Ripple:
- -15V <10mV
- +3.6V ≤100mV
- +10V ≤10mV
- +100V ≤20mV
- +275V ≤500mV

e. High Voltage: accuracy; -3900V ±3%
regulation; ≤20V change

6. CRT

c. BEAM ROTATE/Vert Geometry: BEAM ROTATE: +3°, -3° range
Vert Geometry: ≤0.05cm bowing

d. Horiz Geometry: ≤0.05cm bowing

8. CLAMPS

c. Vector Position Clamp: Range: +0.25div, -0.25div from graticule center, total of 2div; Stability: ≤0.25div center shift with phase rotation or line volts change

9. LUMINANCE CALIBRATOR

b. Luminance Cal Amplitude: 1V ±0.5%

10 VIDEO AMP GAIN

d. CH A to CH B Phase Difference: ≤1°

e. Variable Range (CH A & CH B): ≤0.5:1 to ≥1.4:1

f. 100% Gain: 100% gain = 0.75 (75% gain) ±2%

12. SUBCARRIER REGENERATOR

f. BURST FLAG TIMING Range: + and - 0.5μs

g. SCR Pull-in: Range: + and - 20Hz
Time: ≤15s
Ø shift vs freq: ≤0.6°

14. SUBCARRIER PROCESSING

b. Demod Balance: ≤0.25div shift

c. Quadrature Phase: +2°, -2° range; circle overlay within 0.032"

15. OUTPUT GAIN

a. Vertical Gain (luminance): cal signal = 100% ±0.125div

b. LUMINANCE Gain Range: 0.7:1 to 1.4:1

d. Vertical Gain Range: 200V to 250V

g. Horizontal Gain Range: 200V to 250V

h. TCO Amplitude: 699mV ±1%

i. Sweep Length: 5 to 6.5cm

j. POSITION Range: Horiz: must position either end of sweep to within 0.3cm of graticule center
Vert: Must position trace +0.40 and -0.10div from 0% (bottom) graticule line (Y, R, G and B)

16. TRANSIENT RESPONSE

b. Vertical Amp Transient Response (luminance): ≤0.25div

17. BANDWIDTH

a. Luminance Bandwidth:
   Flag = 10div (set)
   0.5MHz = 7.6- 8.6div
   1.5MHz = 3.5-4.6div
b. Chrominance Bandwidth:
   Fsc = 4.433619MHz
   lower -3db = Fsc -(750 to 1250kHz)
   upper -3db = Fsc +(750 to 1250kHz)

18. DIFFERENTIAL GAIN/DIFFERENTIAL PHASE

b. Diff Gain Deflection Factor: 2.8mV/1.0div ±5%
c. Diff Gain: ≤0.5% last 90% of trace.
d. Diff Phase: Ext: ≤0.1° last 90% of trace
   Burst: ≤0.2% last 80% of trace
   Resolution: 0.1° ≥0.1div
   Noise: ≤0.2° in 10s

19. PHASING

b. X-Y Phase Accuracy: ≤1° error between marker and graticule; 0.5° error in any 10° segment
e. CALIBRATED PHASE Accuracy: within 10% per degree or 0.5° whichever is smaller; incremental accuracy within 10% per degree segment, 0.5° max

20. SYNC AND EXT Ø REF RANGE

b. Composite Video Input Range: 0.7V to 1.4V internal and external
c. External Composite Sync Range: 3.5V to 7.5V
d. External Ø Reference Range: 1.5V to 2.5V

21. VIT

c. VIT Selector (VITS I & VITS II): selects line 17 or 18 of field 1 or field 2

22. GONIOMETERS/DISPLAY SWITCH

a. PHASE Controls: AØ, BØ and AØ/BØ ALT selects A PHASE, B PHASE and A PHASE and B PHASE time shared
b. DISPLAY Switch: selects + V, -V or both

23. COLOR BAR DECODING

b. Color Bar Decoding Accuracy: within ±3%

24. U AND V: Demodulation axis within 2° of burst

SAMPLE CHECKS

[THE FOLLOWING CHECKS ARE NOT MADE ON 100% OF THE INSTRUMENTS BUT ARE DONE ON A SAMPLE BASIS]

25. DIFF GAIN/DIFF PHASE (10%-90% APL)

a. Differential Gain: 1% or less last 90% of trace
b. Differential Phase: Burst: ≤0.3° last 80% of trace Ext: ≤0.15° last 90% of trace

26. Y DISPLAY SHIFT (10%-90% APL): ≤0.25div

27. LUMINANCE TO CHROMINANCE DELAY: ≤100ns

THE END

SHORT FORM PROCEDURE

Factory TEST LIMITS are limits an instrument must meet before it leaves Manufacturing; therefore, it must be possible to inspect to these limits. Because of normal variations in test equipment and plug-in scopes, addition of side panels, etc, it is necessary to set up some circuits so their performance is better than required by Factory Test Limits. Therefore, the instructions given in the Factory Calibration Procedure may call for checks or adjustments which result in less error than that allowed by the Factory Test Limits.

1. PRELIMINARY

a. Check Fuses:

F1500	1.6A	slo blo
F1501	0.8A	slo blo
F1502	1/8A	
F1532	0.2A	
F1562	1.5A	

b. Align CRT
c. Align Gratiucle Lights
d. Preset Controls
e. Make Resistance Checks
f. Check SCR Oven: Quick heat turns off within 3 min
g. Check SCALE ILLUM and Graticule Lights

2. POWER SUPPLY

a. Adjust -15 Volts (R1588): adjust for -15 volts
b. Check Power Supply Accuracies:

3.6V	±5%	(0.18V)
10V	±3%	(0.3V)
100V	±3%	(3V)
275V	±6%	(16.5V)

c. Check Power Supply Ripple:

-15V	10mV
3.6V	100mV
10V	10mV
100V	20mV
275V	500mV

d. Check 220V Operation
e. Check High Voltage:
Accuracy: -3900V ±3%
Regulation: $\leq$20V change

3. TEST CIRCLE OSCILLATOR

b. Adjust T.C.O. Resonance (L46): max DC level at TP41
c. Adjust T.C.O. Amplitude (Rough set, R45): 0.7V P-P at TP49

4. INPUT COMPENSATION

b. Adjust CH A Input Compensation (C2): unity gain between TP85 and junction of C1 and C2
c. Adjust CH B Input Compensation (C52): unity gain between TP85 and TP95

5. DC BALANCE

a. Adjust Vert DC Bal (R625): 0V at TP630
b. Adjust Horiz DC Bal (R644): 0V at TP650
c. Adjust Lum Bal (R672): +0.5V at TP680

6. CRT

a. Adjust GEOM: set for average deflection plate voltage
b. Adjust FOCUS and ASTIG: optimum focus
c. Adjust BEAM ROTATE/Check Vert Geometry: +3°, -3° range; $\leq$0.05cm bowing
d. Adjust ORTH/Check Horiz Geometry: $\leq$0.05cm bowing
e. Adjust UNBLANK BIAS (R1478): uniform intensity of test circle

7. COMMON MODE LEVEL

b. Adjust Horiz and Vert Common Mode (R985, R875): 5.6V between gnd and TP980 and TP870

8. CLAMPS

b. Adjust Clamp Pulse Timing (R905): adjust gate pulse for 8V
c. Check Vector Position Clamp: Range: +0.25div, -0.25div from graticule center, 2div total; $\leq$0.25div shift with PHASE rotation or line voltage change

9. LUMINANCE CALIBRATOR

b. Adjust Luminance Cal (R583): set for 1 volt P-P at TP583

10. VIDEO AMP GAIN

b. Adjust A CAL (R402): unity gain between TP583 and TP450
c. Match CH B to CH A (R412, C52): adjust R412 to match CH A luminance gain, adjust C52 to match CH A chrominance gain
d. Adjust CH A to CH B phase difference (C401, C411) adjust for 0 phase difference.
e. Check Variable Range: $\leq$0.5:1 to $\geq$1.4:1.
f. Check 100% Gain: 100% gain = 0.75 (75% gain) ±2%.
g. Adjust Max Gain (C430, C434; C439, & C442): Adjust for 5X gain and minimum phase shift.

11. OUTPUT GAIN (Preset)/LUMINANCE FILTER

b. Adjust Luminance Filter (L610-L616): Adjust for optimum transient
c. Preset Output Gain (R848, R626, & R968)

12. SUBCARRIER REGENERATOR

b. Adjust Input Filters (L220, L221): Min burst at TP220, max burst at TP222
c. Check Gated Burst: ≈10V at TP230
d. Adjust Varicap Bias (R250, R243): No voltage change at TP225 with CH A, A CAL and A CAL, B CAL.
e. Adjust Output Coils (L272, L279): max amplitude at TP275
f. Check BURST FLAG TIMING Range: at least + and - 0.5μs
g. Check SCR Pull-in: Range: +20Hz, -20Hz; TIME: $\leq$15s; Ø shift vs frequency: $\leq$0.6°

13. SUBCARRIER HARMONIC TRAP

b. Adjust Harmonic Traps (C454, C453): min amplitude at 13.3MHz and 22MHz

14. SUBCARRIER PROCESSING

a. Adjust Subcarrier Filter (L545, L547): max amplitude at TP502
b. Adjust Demod Balance (R501, C593, C503): $\leq$0.25div shift in V, U and DIFF PHASE
c. Adjust Quadrature Phase (C586): at least +2°, -2° range; circle overlay within 0.032"
d. Adjust dA Pos Bal (R498): adjust diff gain display to 0% diff graticule line

15. OUTPUT GAIN

a. Adjust Vertical Output Amp Gain (R848): 100% luminance cal signal
b. Check LUMINANCE GAIN Range: $\leq$0.7:1 to $\geq$1.4:1
c. Adjust Vertical Driver Amp Gain (R626): 699mV Circle overlays graticule circle at the intersection of vertical axis
d. Check Vertical Gain Range (R848): $\leq$200V to $\geq$250V
e. Adjust Horizontal Output Amp Gain (R968): trace length equals circle diameter
f. Adjust Horizontal Driver Amp Gain (R646): 699mV circle overlays graticule circle at intersection of horizontal axis
g. Check Horizontal Gain Range (R968): $\leq$200V to $\geq$250V
h. Adjust T.C.O. Amplitude C18, C66): adjust to match 699mV signal from 067-0570-00

i. Check Sweep Length: 5 to 6.5cm

j. Check Position Range:
Horiz: must position either end of trace to within 0.3cm of graticule center
Vert: must position trace +0.40 and -0.10 div from 0% graticule line.

16. TRANSIENT RESPONSE

b. Adjust Vertical Amp Transient Response (R849, C848, L838, L858): $\leq$0.25div aberrations

c. Adjust Horizontal Amp Transient Response (R969, C968, C958, L958, L978):

17. BANDWIDTH

a. Check Luminance Bandwidth:

Flag	10div
0.5MHz	7.6-8.6div
1.5MHz	3.5-4.6div

b. Adjust Chrominance Bandwidth:
Fsc= 4.433619MHz
lower -3db = Fsc -(750 to 1250kHz)
upper -3db = Fsc +(750 to 1250kHz)

18. DIFFERENTIAL GAIN/DIFFERENTIAL PHASE

b. Check DIFF GAIN Deflection Factor: 2.8mV/1.0div ±5%

c. Check DIFF GAIN: $\leq$0.5% last 90% of trace

d. Check DIFF PHASE:
Ext: $\leq 0.1°$ last 90% of trace
Resolution: $0.1°$ $\geq$0.1div
Burst: $\leq 0.2°$ last 80% of trace
Noise: $\leq 0.2°$ in 10s

19. PHASING

b. Check (X-Y) Phase Accuracy: $\leq 1°$ error; $\leq 0.5°$ error in any $10°$ segment

c. Adjust CALIBRATED PHASE (rough set L331, L332, R335)

d. Adjust CALIBRATED PHASE (fine adjust): $-14°$ to $+14°$ = $28° \pm 0.5°$

e. Check CALIBRATED PHASE Accuracy: within 10% per degree segment, $0.5°$ max

f. Adjust CALIBRATED PHASE (alternate method)

g. Check CALIBRATED PHASE (alternate method)

20. SYNC AND EXT Ø REF RANGE

b. Check Composite Video Input Range: 0.7V to 1.4V int and ext

c. Check External Composite Sync Range: 3.5V to 7.5V

d. Check External Ø Reference Range: 1.5V to 2.5V

21. VIT

b. Adjust VIT Intens (R1227): max intensity without defocusing

c. Check VITS Selectors: selects line 17 or 18 of field 1 or field 2

22. GONIOMETERS/DISPLAY SWITCH

a. Check PHASE Controls: AØ, BØ and AØ/BØ ALT selects A PHASE, B PHASE or A PHASE and B PHASE time shared

b. Check DISPLAY Switch: selects +V, -V or both

23. COLOR BAR DECODING

b. Check Color Bar Decoding Accuracy: ±3%

24. U AND V: demodulation axis
within 2° of burst

[THE FOLLOWING CHECKS ARE NOT MADE ON 100% OF THE INSTRUMENTS BUT ARE DONE ON A SAMPLE BASIS]

25. DIFF GAIN/DIFF PHASE (10%-90% APL)

a. Check Differential Gain: 1% or less last 90% of trace
b. Check Differential Phase:
Burst: $\leq 0.3°$ last 80% of trace;
Ext: $\leq 0.15°$ last 90% of trace

26. Y DISPLAY SHIFT (10%-90% APL):
≤ 0.25div shift

27. LUMINANCE TO CHROMINANCE DELAY:
100ns or less

THE END

1. PRELIMINARY

a. Check Fuses

Check all fuses for correct value:

F 1500	1.6A slo blo
F 1501	0.8A slo blo
F 1502	1/8A
F 1532	0.2A
F 1562	1.5A

b. Align CRT

Align the CRT so the implosion shield is flush with the front panel at all points. Rotate the CRT so the X axis on the vector graticule is parallel to the IRE lines on the luminance graticule. Tighten the CRT clamp. Check the CRT neck pin connectors for tightness. Check for face plate and phosphor defects (see notes.)

Do not reject a CRT without consulting a trained CRT Checker or referring to the Cathode Ray Tube Check Out Procedure.

c. Align Graticule Lights

Adjust the vector graticule lights so they just touch the bottom of the hole in the light guide. Adjust the luminance graticule lights so the filament in the light bulb is adjacent to the edge of the luminance graticule.

d. Preset Controls

Preset all front and rear panel screw driver adjustments to midr. Preset all internal adjustments to midr. Preset front panel controls as follows:

CHANNEL A GAIN	75%, CAL
CHANNEL B GAIN	75%, CAL
ØREF	Burst
INTENSITY	ccw
SCALE ILLUM	ccw
LUMINANCE GAIN	cal
DISPLAY	Both
FOCUS	ccw
BURST FLAG TIMING	midr
FIELD	1
SYNC	INT
VERT POSITION	midr
HORIZ POSITION	midr

Depress the following front panel buttons: FULL FIELD, AØ/BØ ALT, VECTOR PAL

1. (cont'd)

e. Make Resistance Checks

Check for the specified resistance between gnd and the following test points. (Use the indicated meter scale)

Test Point	Approx Resistance (neg meter lead gnd)	Approx Resistance (pos meter lead gnd)
-15V	140Ω (X100 scale)	140Ω (X100 scale)
10V	190Ω (X100 scale)	190Ω (X100 scale)
100V	1600Ω (X100 scale)	250Ω (X100 scale)
275V	18kΩ (X1k scale)	6kΩ (X1k scale)

f. Check SCR Oven: quick heat turns off within 3 min

Apply power to the TYPE 520 via a TYPE 76TU LINE VOLTAGE CONTROL UNIT. Set the line voltage to 115VAC. Monitor the voltage at TP295 with the VOM. Voltage should read approx -15 volts. (Indicates Q295 is turned on and extra heat from R299 is speeding up oven temperature).

Check that the voltage at TP295 changes to approx +20 volts within 3 minutes after initial turn on. (Indicates Q295 is turned off).

g. Check SCALE ILLUM and Graticule Lights

With VECTOR PAL button depressed; check that the vector (internal) graticule illumination increases smoothly as the SCALE ILLUM is rotated cw.

Check that only the vector graticule is illuminated when the VECTOR PAL and VECTOR NTSC buttons are depressed. Check that only the luminance graticule is illuminated when; Y, R, G, B, V, U and DIFF GAIN buttons are depressed. Check that neither graticule is illuminated when the DIFF PHASE button is depressed.

2. POWER SUPPLY

a. Adjust -15 Volts (R1588) to -15V

Connect the DCVB between gnd and the -15 volt supply. Set the DCVB to read -15V and adjust R1588 for a null indication on the DCVB.

b. Check Power Supply Accuracies
+3.6 ±5%
+10V ±3%
+100V ±3%
+275V ±6%

Connect the DCVB between gnd and the appropriate power supply and check for the specified voltages.

Power Supply	Voltage
+3.6V	3.42 -3.78V
+10V	9.7 -10.3V
+100V	97 -103V
+275V	258.5 -291.5V

c. Check Power Supply Ripple:

-15V	*10mV P-P*
+3.6V	*100mV P-P*
+10V	*10mV P-P*
+100V	*20mV P-P*
+275V	*500mV P-P*

Connect a coaxial cable from the DCVB RIPPLE OUTPUT to the test scope vertical input. Connect the DCVB between gnd and the appropriate supply and check for the specified maximum ripple while varying the line voltage from 104VAC to 126VAC

Power Supply	Max Ripple
+275V	500mV P-P
+100V	20mV P-P
+10V	10mV P-P
+3.6V	100mV P-P
-15V	10mV P-P

Change the Line Voltage Range (rear panel) to Hi and repeat the ripple check while varying the line voltage from 112 VAC to 136 VAC.

2. (cont'd)

Change the Line Voltage Range to Lo and repeat the ripple check while varying the line voltage from 90 VAC to 110 VAC. Return the Line Voltage Range to M and return the line voltage to 115 VAC.

d. Check 220V Operation

Connect the VOM across pins 17 and 18 on the power transformer. Note the voltage reading. Change the Line Voltage Range to 220V operation. The voltage across pins 17 and 18 should be one-half the previously noted voltage.

Return the Line Voltage Range to 115V operation.

e. Check High Voltage
accuracy: -3900V ±3%
regulation: ≤20V change

Connect the DCVB between gnd and the CRT Cathode (pin 2 on CRT socket). The voltages must read between 3783V and 4017V. Check for no more than 20 volts change in the high voltage as the INTENSITY control is varied from full cw to full ccw.

3. TEST CIRCLE OSCILLATOR

a. Setup

Set the front panel controls as follows:

CHANNEL A GAIN	75%, CAL
CHANNEL B GAIN	75%, CAL
Ø REF	BURST
LUMINANCE GAIN	CAL
SYNC	INT

Depress A CAL, FULL FIELD, AØ and VECTOR PAL buttons.

b. Adjust T.C.O. Resonance (L46)

Connect a DC coupled 10X probe from the test scope to TP41. Adjust L46 for maximum voltage (≃-0.42).

3. (cont'd)

c. Adjust T.C.O. Amplitude (rough set) (R45)

Connect a 10X probe from the test scope to TP49. Adjust R45 for 0.7 volts T.C.O. amplitude.

4. INPUT COMPENSATION

a. Setup

Connect a 1 volt color bar signal from the Pal Signal Generator TYPE 141 to CH A INPUT, loop through to CH B INPUT and terminate with 75Ω terminator.

Connect P6023 probes to the TYPE 1A1 INPUT 1 and INPUT 2. Set the TYPE 1A1 MODE to ALT and both VOLTS/CM to .02, and invert CH 1.

Through out this procedure, use 75Ω cable to make all connections from the video generator or the vector scope test unit to the TYPE 520 inputs.

Balance the P6023 probes by connecting both probes to a common signal source, invert one channel, and adjust the probes for optimum signal cancellation.

b. Adjust CH A Input Compensation (C2)

Connect the balanced P6023 probes between TP85 and the junction of C1 and C2 (pin A on INPUT board). Depress the CH A front panel button. Adjust C2 for equal gain of the Chrominance signals as viewed on the test scope.

Return INVERT to normal

c. Adjust CH B Input Compensation (C52)

Connect the balanced P6023 probes between TP85 and TP95. Adjust C52 for equal gain of the chrominance signals as viewed on the test scope.

Preset L279 for maximum burst amplitude at TP275 before proceeding beyond step 6.

Remove Probes.

5. DC BALANCE

a. Adjust Vert DC Bal (R624)

Set CH A, A CAL and CH B, B CAL buttons to neutral. Connect the VOM between gnd and TP630. Adjust Vert DC Bal (R624) for 0V at TP630.

5. (cont'd)

b. Adjust Horiz DC Bal (R644)

Connect the VOM between gnd and TP650. Adjust Horiz DC Bal (R644) for 0V at TP650.

c. Adjust Lum Bal (R672)

Connect the VOM between gnd and TP680. Adjust Lum DC Bal (R672) for plus 0.5V at TP680.

6. CRT

a. Adjust GEOM

Depress the VECTOR and FULL FIELD buttons. Adjust the VERTICAL and HORIZONTAL POSITION CLAMP to center the dot on the vector graticule. Connect a VOM between gnd and one of the deflection plates. Note the voltage. Connect the VOM between gnd and the geometry (9-3) lead on the CRT, adjust GEOM (R1472) for the same voltage that was noted at the deflection plate.

The GEOM will be readjusted for best circularity in step 14c. In most instruments the geometry voltage will end up about 20 volts below the average deflection plate voltage.

b. Adjust FOCUS and ASTIG

Depress the A CAL and Y buttons. Adjust the FOCUS and ASTIG controls for the best focused display.

c. Adjust BEAM ROTATE/ Check Vert Geom +3°, -3° range; ≤0.05cm bowing

Depress the VECTOR PAL button. Disconnect the horizontal (B-Y) driver amp (pin AB). A vertical trace should be displayed. Rotate the BEAM ROTATE control from end to end and check that the trace will rotate at least +3° and -3° from a vertical line. (Position trace as necessary with the VECTOR HORIZ POS CLAMP). Adjust the BEAM ROTATE so the trace is parallel to the vertical graticule line.

Trace bowing must not exceed 0.05cm. Reconnect the horizontal driver amp.

6. (cont'd)

d. Adjust ORTH/Check Horiz Geom ≤0.05cm bowing

Disconnect the output (pin AD) of the vertical (R-Y) driver amp. A single horizontal line should be displayed. If necessary adjust the CHANNEL A GAIN for a full screen display. Adjust ORTH (R1474) so the trace is parallel to the horizontal graticule line. (Position trace as necessary with the VERT POS CLAMP). Trace bowing must not exceed 0.05cm. Reconnect the vertical driver amp.

There is interaction between steps C and D, repeat the steps as necessary.

e. Adjust UNBLANK BIAS (R1478)

With the test circle displayed, adjust UNBLANK BIAS (R1478) for uniform intensity around the displayed test circle.

7. COMMON MODE LEVEL

a. Setup

Set CH A, A CAL and CH B B CAL buttons to neutral. Depress the FULL FIELD and VECTOR buttons. Adjust the HORIZ and VERT POSITION CLAMP to center the dot on the vector graticule.

b. Adjust Horiz and Vert Common Mode (R985, R875)

Connect the VOM between gnd and TP980. Adjust Horiz Common Mode Lev (R985) for 5.6 volts.

Connect the VOM between gnd and TP870. Adjust Vert Common Mode Lev (R875) for 5.6 volts.

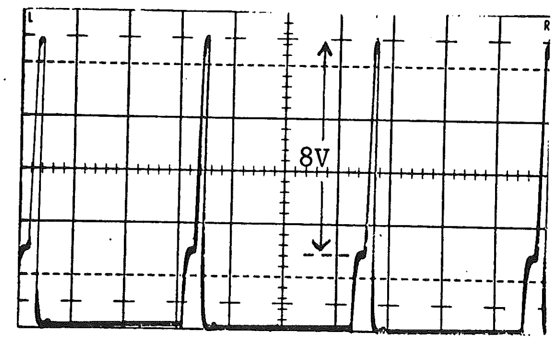
8. CLAMP

a. Setup

Connect a 10X probe from the TYPE 1A1 CH1 to TP905. Connect another 10X probe from the TYPE 1A1 CH2 to TP805. Set the 1A1 MODE to ALT and both VOLTS/CM to .2 and INPUT SELECTORS to AC. Set CH A and CH B to neutral.

b. Adjust Clamp Pulse Timing (R905)

Adjust Clamp Pulse Timing (R905) so the lowest amplitude gate pulse has an amplitude of 8 volts (see picture).



c. Check Vector Position Clamp Range: +0.25 div, -0.25 div from graticule center, total of 2 div Stability: ≤0.25div shift with phase rotation or line voltage change

Rotate the VERT POSITION CLAMP from end to end and check that the vector origin dot will position at least 0.25div above and below the center of the vector graticule. Total range of adjustment must be 2div or more.

Rotate the HORIZ POSITION CLAMP from end to end and check that the vector origin dot will position at least 0.25div to the left and right of the center of the vector graticule. Total range of adjustment must be 2div or more.

Connect the color bar signal from the Pal Signal Generator to CH A INPUT and depress the CH A button.

Adjust the HORIZ and VERT POSITION CLAMP to position the origin dot to the center of the vector graticule.

Rotate the CHANNEL A PHASE control through 360° rotation. Check that the origin dot does not shift more than 0.25div from the graticule center.

Check that there is no more than 0.25 div shift as the line voltage is varied from 104VAC to 126VAC. Return line voltage to 115VAC.

9. LUMINANCE CALIBRATOR

a. Setup

Set the B CAL, CH B buttons to neutral and depress the A CAL and Y buttons. Connect the DCVB between gnd and TP583 on the Demodulator EC board. Set the DCVB RANGE to 1.1V.

b. Adjust Luminance Cal (R583) adjust for 1 volt P-P

Remove Q 570 and note the voltage at TP583 (≃ -5mV). Replace Q 570 and remove Q 571 and adjust the DCVB to read exactly 1 volt more positive than the previously noted voltage. Adjust R853 for a null indication on the DCVB. Remove the DCVB and replace Q571.

10. VIDEO AMP GAIN

a. Setup

Connect the Pal Signal Generator color bar signal through a dual input coupler (067-0525-00) to both CH A and CH B inputs. Terminate both inputs with 75Ω. Connect the balanced P6023 probes (see notes step 4a) between TP583 on demod board and TP450. invert one channel in the TYPE 1A1.

b. Adjust A CAL (R402)

Depress the A CAL and Y buttons and adjust A CAL (R402) for optimum signal cancellation as viewed on the test scope.

c. Match CH B to CH A (R412, C52) adjust CH B to match CH A in luminance and chromanance

Depress A CAL, B CAL and Y buttons. Adjust B CAL (R412) so CH B luminance calibrator signal overlays the CH A luminance calibrator signal. Depress CH A and CH B buttons. Check that the CH A and CH B luminance video signals are overlayed.

10c(cont'd)

Depress the VECTOR PAL and AØ/BØ ALT buttons. Adjust C52 so the CH B vector length matches the CH A vector length (adjust A and B PHASE controls as necessary for correct phase relationship).

d. *Adjust CH A to CH B Phase Difference (C401, C411) adjust for 0 phase difference*

Depress the AØ button. Set C401 to minimum capacitance and adjust C411 for zero phase difference between CH A and CH B vectors. If the phase difference increases with the adjustment of C411; set C411 to minimum capacitance and adjust C401 for zero phase difference.

e. *Check Variable Range ≤0.5:1 to ≥1.4:1*

Depress the B CAL and VECTOR buttons and set CH A, A CAL buttons to neutral. Set the GAIN to 75% and CAL. Adjust the test scope for a 3cm display. Rotate the CHANNEL B variable gain control through out its range. The signal amplitude must vary from 6cm or more to 2.1cm or less. Return the variable control to the CAL detent.

Set the CH B and B CAL buttons to neutral. Depress the A CAL button and repeat the check for CHANNEL A variable gain. Return the variable control to the CAL detent.

f. *Check 100% Gain*
100% = 0.75 (75% gain) ±2%

Depress the A CAL button and set CH B, B CAL to neutral. Monitor the test circle signal at TP450 with the test scope. Adjust the test scope vertical deflection factor to display exactly 5cm. Change the CHANNEL A GAIN to 100%. The displayed signal amplitude on the test scope must change to 3.75cm ±2%.

Set the CH A and A CAL buttons to neutral, depress the B CAL button and repeat the check for CHANNEL B 100% gain.

10. (cont'd)

g. Adjust Max Gain (C430, C434, C439, & C442)

Adjust the test scope vertical deflection factor to display 1cm of burst. Adjust the PHASE control to align the bursts on the horizontal axis. A dim dot should be visible (4.43MHz from VIT stairstep) on the horizontal (180°) axis. Change the CHANNEL B GAIN sw to MAX GAIN. Adjust C439 and C442 for 5cm burst amplitude (test scope display) while keeping the dim dot aligned on the horizontal axis.

Set the CH B, B CAL buttons to neutral and depress the CH A button. Repeat the adjustment for CH A MAX GAIN, adjust C430 & C434.

Due to interaction between steps d and g, it may be necessary to repeat the adjustments.

Remove the dual input coupler and the video signal.

11. OUTPUT GAIN (Preset)/LUMINANCE FILTER

a. Setup

Connect the TYPE 106 HI AMPLITUDE output...50 to 75Ω min loss atten... CH A IN (J1)...75Ω terminator (J2). Connect a 1X probe from the TYPE 106 SYNC INPUT to TP1205. Depress CH A FULL FIELD and Y buttons. Set the TYPE 106 frequency to ≈15kHz (slight frequency adjustment will be necessary to sync display) and adjust the amplitude for 0% to 100% vertical deflection. Adjust the VERT POSITION so the bottom of the display is on the 0% graticule line. Connect a compensated 10X probe from the test scope to TP680.

b. Adjust Luminance Filter

Adjust L610 through L616 for optimum square corner and minimum aberrations as viewed on the test scope.

11. (Cont'd)

c. Preset Gains (R848, R626, R968)

Depress the Y, FULL FIELD and A CAL buttons. Adjust Vert Gain (R848) for 100% luminance cal signal. Depress the VECTOR PAL button and adjust the R-Y Gain (R626) so the test circle overlays the graticule circle at the R-Y axis. Adjust the Output GAIN (R968) so the test circle overlays the graticule circle at the B-Y axis.

12. SUBCARRIER REGENERATOR

a. Setup

Connect the Pal Signal Generator color bar signal to CH A IN (J1) and terminate with 75Ω (J2). Depress the CH A, FULL FIELD and VECTOR PAL buttons. Externally trigger the test scope with H sync from TP900 on output amplifier EC board.

b. Adjust Input Filter (L220, L221)

Connect a 10X probe from the test scope vertical input to TP220. Adjust L220 for minimum 4.43 (burst) amplitude. Connect the 10X probe to TP222 and adjust L221 for maximum 4.43 (burst) amplitude. L220 and L221 interact repeat adjustments as necessary.

c. Check Gated Burst

Connect the test scope probe to TP 230. Adjust BURST FLAG TIMING (see notes) and check for a gated burst packet of ≈10 volts P-P.

d. Adjust Varicap Bias

Depress CH A and CH B buttons. Connect a DC coupled 10X probe to TP255. Set R243 to midr. If the vector is not locked in, slowly adjust DC Bal (R250) until the vector display locks in. The voltage at TP255 will be ≈0.5V.

12c. Correct adjustment of BURST FLAG TIMING can be done by depressing the V button and adjusting the PHASE control for maximum amplitude of burst envelope. Reduce the INTENSITY so only the start of sweep is visible and adjust the BURST FLAG TIMING so the intensified portion of the sweep is evenly distributed on the burst envelope.

12d. (cont'd)

Note the voltage at TP255 when vector is locked-in. Depress the A CAL and B CAL front panel buttons. Readjust R250 so the voltage at TP255 is the same as noted previously. Circuit reaction is slow and it will be necessary to observe the voltage at TP255 for several seconds before the final voltage is reached. Depress the A CAL and B CAL buttons. Adjust R243 to obtain the same DC level.

Final adjust of R250 and R243 should be set so there is no voltage change at TP255 when CH A and A CAL or A CAL and B CAL buttons are alternately depressed.

e. *Adjust Output Coils (L272, L279) (initial adjustment)*

Connect a 10X probe from the test scope to TP275. Adjust L272 and L279 for maximum signal amplitude. Signal amplitude will be ≈4 volts.

12e.

In most instruments L279 can be set so the top of the slug is flush with the top of the coil form.

f. *Check BURST FLAG TIMING Range at least + and - 0.5μs*

Connect a 10X probe from the test scope vertical to TP205. Trigger the test scope, externally, with H pulses from TP1120. Set the BURST FLAG TIMING to optimum (see 12c notes).

Set the test scope TIME/CM to 1μSEC and depress the Y button. Check that the luminance display will remain clamped while varying the BURST FLAG TIMING + and - 0.5μs from the optimum setting. Select R694 as required to make the specified range.

g. *Check SCR Pull-in*
Range: +20Hz, -20Hz
Time: ≤15s
Ø shift vs freq: ≤0.6°

Remove the color bar signal and connect the VARIABLE OFFSET SUBCARRIER signal from the Vector Scope Test Unit (067-0570-00) to CH A IN (J1), terminate with 75Ω (J2). Connect the 4.433619MHz SUBCARRIER signal to CH B IN (J50) and terminate with 75Ω.

12g. (cont'd)

Depress the CH B button and set CH A and A CAL buttons to neutral. The display must be locked in on the CH B signal.

Set the variable frequency from the Vector Scope Test Unit to 4.433619MHz +20Hz. Depress the CH A button. The display must lock in on the CH A signal within 15s.

Set the CH A and A CAL buttons to neutral and change the variable frequency to 4.433619MHz -20Hz. Depress the CH A button. The channel A vector display must lock-in within 15s.

Check that the Channel A vector display does not shift more than 0.6° as the frequency is slowly varied -20Hz to +20Hz from 4.433619MHz.

13. SUBCARRIER HARMONIC TRAP

a. Setup

Connect the TYPE 191 output through a 50Ω to 75Ω min loss attenuator to CH A input. Terminate with 75Ω. Depress the CH A, FULL FIELD and LINE SWEEP buttons.

b. Adjust Harmonic Traps (C454, C453)

Set the TYPE 191 frequency to 13.3 MHz and output amplitude to 1 volt. Adjust C454 for minimum amplitude. Change the TYPE 191 frequency to 22MHz and adjust C453 for minimum amplitude.

Remove the TYPE 191 signal.

14. SUBCARRIER PROCESSING

a. Adjust Subcarrier Filter (L545, L547)

Adjust L545 and L547 for maximum subcarrier amplitude at TP502.

b. Adjust Demod Balance (R501, C593, C503) ≤ 0.25div shift

Set the CH A, A CAL and CH B, B CAL buttons to neutral. Recheck vertical and horizontal DC Balance, step 5a and 5b.

In some instruments it may be necessary to misadjust R501 slightly to obtain optimum circle overlay and circularity.

Depress the VECTOR NTSC button and adjust C503 and C593 so the center dots are superimposed. Adjust R501 for minimum display shift while alternately depressing the V and DIFF PHASE buttons.

R501, C503 and C593 interact, repeat the adjustments as necessary.

Check for no more than 0.25 div shift when V, U and DIFF PHASE buttons are depressed. If necessary readjust R644 to bring the shift within test limits when the U button is depressed.

c. Adjust Quadrature Phase (C586)
QUAD PHASE Range: at least +2°, -2°
Circle Overlay: within 0.032"

Connect a color bar signal from the Pal Signal Generator to CH A in and terminate loop through with 75Ω. Depress the CH A, B CAL and VECTOR PAL buttons. Rotate the QUAD PHASE control from end to end, and note the total degrees of vector rotation. Total vector rotation must be at least 4°. Set the QUAD PHASE to electrical midr. (Equal amount of vector rotation when control is rotated cw and ccw).

With QUAD PHASE set to electrical midr adjust C586 for optimum overlay of test circles. If necessary readjust C503, C593, R501 and GEOM (R1472) for optimum circle overlay and circularity. Separation between test

If readjustment of R501 is necessary recheck demod balance (step 14b).

14c. (cont'd)

circles must not exceed 0.032". NOTE: 0.032" is equal to 1/3 the length of the two degree graticule marks.

If GEOM is readjusted, readjust ORTH (R1474) and FOCUS for optimum focus. (A fine degree of focus resolution may be obtained by misadjusting the QUAD PHASE so there is a slight separation between the test circles).

d. Adjust dA Pos Bal (R498)

Depress VITS I and Y buttons. Adjust the VERT POSITION to position the back porch level to the 30% graticule line. Depress the DIFF GAIN button and change the CHANNEL A GAIN to MAX GAIN. Adjust R498 to position the display to the Diff Gain 0% graticule line.

Return the CHANNEL A GAIN to 75%.

15. OUTPUT GAIN

a. Adjust Vertical Output Amp Gain (R848)

Depress the Y, FULL FIELD and A Cal buttons. Adjust Vert Gain (R848) for exactly 100% luminance Cal signal.

b. Check LUMINANCE GAIN Range 0.7:1 to 1.4:1

Adjust the CHANNEL A variable GAIN for 70% luminance cal signal. Check that the LUMINANCE GAIN variable control has sufficient range to vary the luminance cal signal from 49% or less to 98% or more.

Return the CHANNEL A variable and the LUMINANCE GAIN variable to the CAL detent.

c. Adjust Vertical Driver Amp Gain (R626)

Connect the 4.421303MHz SIDEBAND VIDEO signal from the VECTOR SCOPE TEST UNIT through a 75Ω cable to CH A IN (J1) and terminate with 75Ω (J2). Depress the VECTOR PAL, FULL FIELD and CH A buttons.

15c. (cont'd)

Adjust R-Y Gain (R626) so the circle overlays the graticule circle at the intersection of the vertical axis.

d. *Check Vertical Gain Range ≤200V to ≥250V*

Use the test scope to measure the differential amplitude of the signal at the vertical deflection plates. Rotate R848 full cw and full ccw. The signal amplitude must vary from 200V P-P or less to 250V P-P or more.

Reset R848 so the circle overlays the graticule circle at the intersection of the vertical axis.

e. *Adjust Horizontal Output Amp Gain (R968)*

Disconnect the outputs of the vertical and horizontal driver amps. Connect the output of the vertical driver amp to the input of the horizontal output amp. Adjust Horiz Gain (R968) so the length of the horizontal trace is exactly equal to the diameter of the graticule circle.

f. *Adjust Horizontal Driver Amp Gain (R646)*

Reconnect the vertical and horizontal driver amps to the vertical and horizontal output amps. Set GAIN BAL to midr. Adjust B-Y Gain (R646) so the circle overlays the graticule circle at the intersection of the horizontal axis.

g. *Check Horizontal Gain Range (R968) ≤200V to ≥250V*

Use the test scope to measure the differential amplitude of the signal at the horizontal deflection plates. Rotate R968 from full cw to full ccw. The signal amplitude must vary from 200V P-P or less to 250V P-P or more. Reset R968 so the circle overlays the graticule circle at the intersection of the horizontal axis.

15. (cont'd)

h. Adjust T.C.O. Amplitude (C18, C66)

Depress the A CAL button and adjust C18 so the test circle overlays the graticule circle at the intersection of the vertical and horizontal axis.

Depress the B CAL button and adjust C66 so the test circle overlays the graticule circle at the intersection of the vertical and horizontal axis.

i. Check Sweep Length 5 to 6.5cm

Set CH A and CH B buttons to neutral and depress the Y button. Adjust the HORIZ POSITION control to position the start of the sweep to the left edge of the luminance graticule. Check for a sweep length of 5cm to 6.5cm.

The horizontal lines on the luminance graticule are 6cm long.

j. Check POSITION Range
HORIZ: Must position either end of trace to within at least 0.3cm of graticule center
VERT: Must position trace +0.40 and -0.10div from 0% graticule line

Rotate the HORIZ POSITION control full cw. The start of the sweep must position to within at least 0.3cm of graticule center. Rotate the HORIZ POSITION Control full ccw. The end of the trace must position to within at least 0.3cm of graticule center.

Rotate the VERT POSITION Control full cw. The trace must position at least 0.40div above the 0% (bottom) graticule line. Rotate the VERT POSITION Control full ccw. The trace must position at least 0.10div below the 0% graticule line.

16. TRANSIENT RESPONSE

a. Setup

Connect the TYPE 106 HI AMPLITUDE output...50 to 75Ω min loss atten...CH A IN (J1)...75Ω terminator (J2).

16a. (Cont'd)

Connect a 1X probe from the TYPE 106 SYNC INPUT to TP1205. Depress CH A FULL FIELD and Y buttons. Set the TYPE 106 frequency to ≈15kHz (slight frequency adjustment will be necessary to sync display) and adjust the amplitude for 70% vertical deflection. Adjust the VERT POSITION so the bottom of the display is on the 30% graticule line.

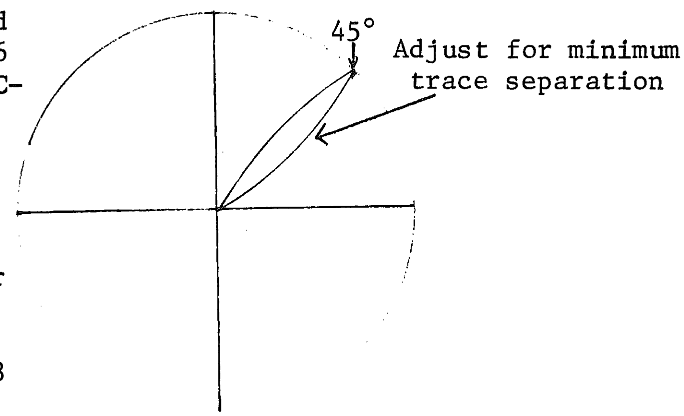
b. Adjust Vertical Amp Transient Response *≤0.25div aberrations*

Adjust R849, C848, L838 and L858 for optimum transient response as viewed on TYPE 520. Aberrations must not exceed 0.25 div.

c. Adjust Horizontal Amp Transient Response

Remove the leads from pins AD and AB on the Driver Amp EC board. Connect the TYPE 106 HI AMPLITUDE output through a 50Ω terminator and a BNC to clip lead adapter to the leads that were removed from pins AD and AB. Set the TYPE 106 frequency to 30kHz and depress the VECTOR PAL button. Adjust the TYPE 106 amplitude so the length of the vector display is equal to the radius of the vector graticule. Adjust the HORIZ and VERT POSITION CLAMP so the origin of the vector display is at the center of the vector graticule.

16c.



Adjust R969, C968, C958, L958 and L978 for the best 45° vector display with minimum trace separation.

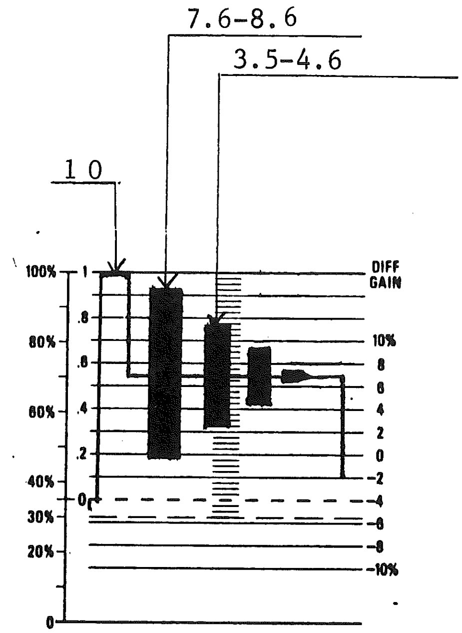
Remove the TYPE 106 signal and reconnect the leads to pin AD and AB.

17. BANDWIDTH

a. Check Luminance Bandwidth

Connect the NTSC multiburst to CH A INPUT and terminate loop-through with 75Ω. Depress the CH A, FULL FIELD and Y buttons. Adjust the multiburst amplitude for 10div of flag amplitude. Check the amplitude of the 0.5MHz, and 1.5MHz. The respective amplitude (in div) must be 7.6 -8.6 and 3.5 - 4.6.

Remove the multiburst signal.



b. Adjust Chromanance Bandwidth
(R-Y and B-Y filters)
Fsc = 4.433619MHz
lower -3db = Fsc - (750 to 1250kHz)
upper -3db = Fsc + (750 to 1250kHz)

Connect the TYPE 191 OUTPUT through a 50Ω to 75Ω min loss attenuator to CH A INPUT and terminate loop-through with 75Ω. Connect a 10X probe from the test scope to the output of the R-Y amplifier (pin AD on Horiz/Vert Driver EC board).

Set the test scope TIME/CM to 1μsec. (Verify the 1μsec/cm timing accuracy with a TYPE 184.) Depress the CH A, FULL FIELD and V buttons. Set the DISPLAY sw to + V.

Set the TYPE 191 frequency to 4.43MHz and adjust the amplitude for 0 to 100% vertical deflection on the 520. Increase TYPE 191 frequency to 10 cycles on test scope. Adjust L600, L601 and L602 for 70% amplitude on the 520. Decrease the TYPE 191 frequency (from 4.43MHz) until the amplitude reduces to 70%. The frequency on the test scope must be between 3.693MHz and 3.193MHz (7.5 to 12.5 cycles on test scope). If bandwidth is out of limits at the lower end, it may be necessary to repeat the adjustments of L600, L601 and L602 for equal frequencies on both sides of the center frequency.

Depress the U button and adjust L605, L606 and L607 same as above.

Remove the TYPE 191 signal.

18. DIFFERENTIAL GAIN/DIFFERENTIAL PHASE

a. Setup

Connect the Ramp and Sine Wave Adder (067-0565-00) to CH A IN (J1) and terminate with 75Ω (J2). Connect the sawtooth out from the test scope to the Ramp-in jack. Connect the 4.433619MHz subcarrier from the Vector Scope Test Unit to the EXT ∅ REF (J310) and jumper to the INPUT jack on the Ramp and Sine wave Adder. Externally trigger the test scope with -H pulses from TP1205. Depress CH A, A∅, FULL FIELD and Y button. Set the test scope TIME/CM to 2μSEC. Adjust the TIME/CM variable so there is one complete ramp waveform displayed on the TYPE 520. Set the 90%/100% switch on the Ramp and Sine wave Adder to 100%. Adjust the Ramp Amp pot on the Ramp and Sine wave Adder so the displayed sawtooth has an amplitude of 100%. Set the CHANNEL A GAIN to MAX. Depress the VECTOR PAL button, adjust the Subcarrier Amp pot and PHASE control so the subcarrier vector overlays the graticule circle.

b. Check DIFF GAIN Deflection Factor 2.8mV/1div ±5%

Depress the DIFF GAIN button and change the CHANNEL A GAIN to MAX. Adjust the VERT POSITION to position the display to the 0.5div graticule line. Change the 100%/90% switch on Ramp and Sine wave Adder to 90%. The display must shift down by 5div ±0.25div.

Return the switch to 100%.

18 (cont'd

c. Check DIFF GAIN ≤0.5%

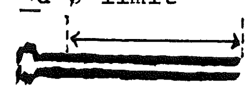
Tilt ≤0.25div

Position the display to the DIFF GAIN 0% graticule line. The display must not deviate from a straight horizontal line by more than 0.25div. Exclude the first 10% of the trace.

d. Check Diff Phase
External: ≤0.1° last 90% of trace
Resolution: 0.1°≥0.1div
Burst: ≤0.2° last 80% of trace
Noise: ≤0.2° in 10s

Depress the DIFF PHASE button set the ∅ REF to BURST and set the CALIBRATED PHASE to 0. Adjust the CHANNEL A PHASE control to bring the two lines close together at mid screen. Adjust L279 for the best straight line display)slight adjustment of L272 may also be necessary). Change the ∅ REF to EXT. Adjust the CALIBRATED PHASE so the two lines just touch at the point of minimum separation (exclude the first 10% of the trace) note the dial reading. Turn the CALIBRATED PHASE so the two lines just touch at the point of maximum separation. Note the dial reading. The difference between the two dial readings must be 0.1° or less.

Δ separation
≤d ∅ limit



Rotate the CALIBRATED PHASE through 0.5°. Check for at least 5 IRE Units change in trace separation.

Change the ∅ REF switch to BURST and repeat the check. The differential phase must not exceed 0.2° in last 80% of trace. The displayed noise (jitter) must not exceed 0.2° in a 10s period.

19. PHASING

a. Setup

Connect the VECTOR SCOPE TEST UNIT (067-0570-00) to the TYPE 520 as follows:

VECTOR SCOPE T.U.

PHASE MARK PULSE OUTPUT...X1 Probe... pin BT on Sweep EC board
4.433619MHz SUBCARRIER...75Ω coax... EXT Ø REF (J10)
4.421303MHz SIDEBAND VIDEO...75Ω coax... CH A (J1)
H-SYNC...............75Ω coax... EXT SYNC

Terminate CH A, CH B and EXT Ø REF with 75Ω. Depress the CH A, CH B, FULL FIELD, A Ø and VECTOR buttons. Set Ø REF BURST to EXT. Set the PHASE-MARK GENERATOR (Vector Scope T.U.) to 10°, POS.

Adjust the vector clamps to position the center dot to graticule center. Adjust CHANNEL A GAIN so the dots are displayed on the vector graticule inscribed circle. Reduce the intensity so only the dots are visible.

b. Check (X-Y) Phase Accuracy ≤1° error between marker and graticule ≤0.5° in any 10° segment

Adjust the CH A PHASE control for best linear distribution of the 10° vector dots. Check that all dots are within 1° of their respective graticule marks. (If necessary, readjust QUAD PHASE for optimum overlay of test circles). Check for no more than 0.5° error in any 10° segment.

c. Adjust CALIBRATED PHASE (rough set)

Connect a 10X Probe from the TYPE 1A1 (test scope) CH 1 INPUT to TP345. Set CH 1 VOLTS/CM to .005 and input coupling to AC. Adjust the POSITION controls to display the top of the signal on the test scope.

c. (continued)

Set the CALIBRATED PHASE dial full ccw (C335 A shorted out). Set R335 to minimum resistance (full cw). Adjust L332 for minimum amplitude at TP345. Set the CALIBRATED PHASE dial to 0 and adjust L331 for maximum amplitude at TP345.

Adjust the CHANNEL A PHASE control so one of the dots lies on a 0 reference mark on the graticule. (eg. horizontal or vertical axis). Turn the CALIBRATED PHASE dial to read -14°. Adjust L331 so the dot that was on the 0 reference mark is on the -14° graticule mark. RE-turn the CALIBRATED PHASE to 0 and if necessary readjust the CHANNEL A PHASE control to reset the dot to the 0 reference graticule mark. Turn the CALIBRATED PHASE dial to read +14° and adjust R335 so the dot that was on the 0 graticule mark is on the +14° graticule mark. R335 and L331 interact, repeat adjustments several times.

d. Adjust CALIBRATED PHASE (fine adjust) -14° to +14° = 28° ±0.5°

Connect the H-SYNC from the Vector Scope Test Unit to the EXT SYNC (J120). Set the SYNC switch to EXT and depress the U button. Change the VECTOR SCOPE TEST UNIT VECTOR switch to 2°.

With the CALIBRATED PHASE set to 0, adjust the CHANNEL A PHASE control so two rows of the marker dots are superimposed. Slowly rotate the CALIBRATED PHASE toward -14°. Each time a row of dots cross (superimpose) indicates a 1° phase shift. Note the dots that represent 14° phase shift and set the CALIBRATED PHASE to -14°. Adjust L332 so the dots representing 14° phase shift are superimposed.

Return the CALIBRATED PHASE to 0 and re-adjust the CHANNEL A PHASE so two rows of dots are superimposed. Slowly rotate the CALIBRATED PHASE toward +14° until there is 14° phase shift. Note the dots that represent 14° phase shift and set the

19d. (cont'd)

CALIBRATED PHASE to +14°. Adjust R335 so the dots representing 14° phase shift are superimposed. Repeat the adjustment of R335 and L332 until interaction is minimized.

e. *Check CALIBRATED PHASE Accuracy*
Dial accuracy: within 10% per degree segment, 0.5° max
Incremental accuracy: 10% per one degree or 0.5° whichever is smaller

Set the CALIBRATED PHASE dial to -14°. Adjust the CHANNEL A PHASE control to superimpose two rows of dots. Turn the CALIBRATED PHASE toward +14°. Check the dial reading after every two degrees of phase shift. The difference between any two dial readings must be within 0.2° of 2°. Set the CALIBRATED PHASE dial to +14° and adjust the CHANNEL A PHASE control to superimpose two of the dots. Rotate the CALIBRATED PHASE toward -14°. Check the dial reading after every two degrees of phase shift. For the first five degrees of phase shift the dial accuracy must be within 10% per degree of phase shift. After the first five degrees of phase shift the dial must read within 0.5° of the actual phase shift.

f. *Adjust CALIBRATED PHASE (alternate method)* .

Connect the 4.433619MHz SUBCARRIER signal from the Vector Scope Test Unit to the EXT Ø REF (J310). Connect the external phase reference signal through a 75Ω variable attenuator to CH A IN. Depress CH A, CH B, A Ø. FULL FIELD and VECTOR PAL buttons. Terminate CH B INPUT with 75Ω. Set the Ø REF switch to EXT. Adjust the variable attenuator so the vector falls on the degree markings of the vector graticule. Adjust the VECTOR CLAMPS to set the center dot to graticule center.

Monitor TP345 with the test scope. Turn the CALIBRATED PHASE dial full ccw until C335 A is shorted out. Set R335 to minimum resistance (full cw). Adjust L332 for minimum amplitude at TP345. Set the CALIBRATED PHASE dial to 0 and adjust L331 for maximum amplitude at TP345.

19f. (cont'd)

Adjust the CHANNEL A PHASE control to position the vector to a 0° reference graticule mark (eg horizontal or vertical axis). Turn the CALIBRATED PHASE to read -14°. Adjust L331 so the vector is exactly -14° from the 0° reference mark. Turn the CALIBRATED PHASE to +14° and adjust R335 so the vector is exactly +14° from the 0° reference mark. R335 and L331 interact, repeat adjustments several times.

g. *Check CALIBRATED PHASE Accuracy (alternate method) Dial Accuracy: 10% per degree or 0.5° whichever is smaller; Incremental Accuracy: within 10% per one degree segment, 0.5° max*

Set the CALIBRATED PHASE to read -14° and adjust the CHANNEL A PHASE control so the vector is exactly -14° from the 0° reference mark. Turn the CALIBRATED PHASE toward +14°. Check the dial reading after every 2° of vector rotation. The dial accuracy must be within 10% per degree of vector rotation. After five degrees of vector rotation the dial accuracy must be within 0.5°.

Set the CALIBRATED PHASE to read +14° and adjust the CHANNEL A PHASE control to position the vector exactly +14° from the 0° reference mark. Turn the CALIBRATED PHASE toward -14° and check the dial reading after every 2° of vector rotation. The difference between any two dial readings must be 2° ±0.2°.

20. SYNC AND EXT Ø REF RANGE

a. *Setup*

Connect the stairstep signal through a 75Ω variable attenuator to CH A IN (J1), loop through to EXT SYNC IN (J120).

20. (cont'd)

b. Check Composite Video Input Range INT: 0.7V to 1.4V EXT: 0.7V to 1.4V

Depress CH A, FULL FIELD and Y buttons. Check that the display remains stable as the amplitude of the stairstep signal is varied from 0.7 volts to 1.4 volts P-P. (0.7 volts is equal to 70% with GAIN in 75%, 1.4 volts is equal to 100% with GAIN in 100%).

Change the SYNC switch to EXT and repeat the check (see notes).

Connect the 9-2-0 lead from the EXT SYNC IN jack to pin D on the Input Sync EC board when making external composite video (0.7 to 1.4 volts) checks.

c. Check External Composite Sync Range 3.5V to 7.5V

Remove the stairstep signal from the EXT SYNC IN jack and terminate the stairstep signal at CH A IN (J2). Connect the composite sync signal through a 75Ω variable attenuator to EXT SYNC IN (J120). (see notes) Monitor the composite sync signal at J120 with the test scope. Check that the display remains stable as the composite sync amplitude is varied from 3.5 volts to 7.5 volts.

Connect the 9-2-0 lead from the EXT SYNC IN jack to pin E on the Input EC board when making external composite sync (3.5 to 7.5 volts) checks.

Return the SYNC switch to INT and remove the composite sync signal.

d. Check External Ø Reference Range 1.5V to 2.5V

Connect the 4.43MHz Subcarrier through a 75Ω variable attenuator to the EXT Ø REF IN (J310). Monitor the subcarrier amplitude with the test scope. Change Ø REF switch to EXT. Depress the B CAL button. Check that the vector display remains locked in and the test circles do not change amplitude as the subcarrier signal is varied from 1.5V to 2.5V.

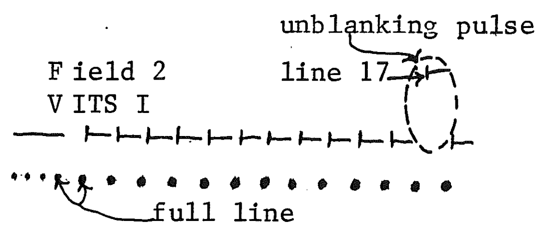
21. VIT

a. Setup

Connect the Pal Signal Generator color bar signal to CH A INPUT. Connect a 10X probe from CHANNEL 1 of the TYPE 1A1 to the video signal at CH A INPUT. Connect another 10X probe from CHANNEL 2 to the unblanking pulse at pin BT on the Sweep EC board. Set CHANNEL 2 VOLTS/CM to .05, CHANNEL 2 VOLTS/CM to 5 and MODE to ADD. Trigger the test scope, externally, with field, pulses from TP1289. Set the test scope TIME/CM to 2mSEC and MAG to X10.

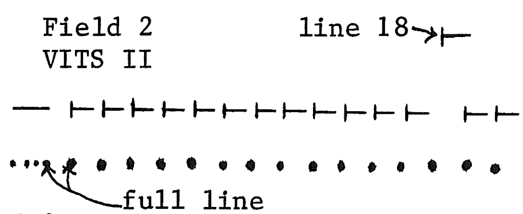
b. Adjust VIT Intens (R1227)
max intensity without defocusing

Set the FIELD sw to 1 and depress the VITS I and Y buttons. The VIT stair-step signal should be displayed. Adjust the VIT Intens (R1227) for maximum intensity without defocusing the display. Check that the intensity can be turned off with the INTENSITY control; if not, readjust R1227 for a lower level.

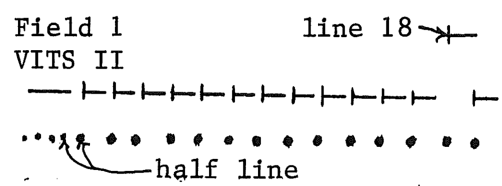


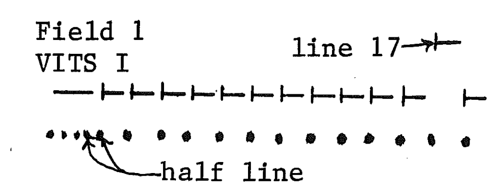
c. Check VIT Selector selects line
17 or 18 of field 1 or field 2

Set the FIELD sw to 1 and depress the VITS I button. Check that the unblanking pulse is superimposed only on line 17 of field 1. Depress the VITS II button and check that the unblanking pulse is superimposed only on line 18 of field 1.



Change the FIELD sw to 2 and check that the unblanking pulse is superimposed on line 18 of field 2. Depress the VITS I button and check that the unblanking pulse is superimposed on line 17 of field 2.





22. GONIOMETERS/DISPLAY SWITCH

a. Check PHASE Controls

Set the DISPLAY sw to +V. Depress the FULL FIELD, AØ and VECTOR NTSC buttons. Set the CH B and B CAL buttons to neutral. Check that the CHANNEL A PHASE control will rotate the vectors smoothly through 360°. Check that the CHANNEL B PHASE control does not affect the display.

Depress the AØ/BØ ALT button. Check that the CHANNEL A and CHANNEL B PHASE controls will rotate their respective vector displays.

Depress the BØ button. Check that the CHANNEL B PHASE control will rotate the vectors smoothly through 360°. Check that the CHANNEL A PHASE control does not affect the display.

Depress AØ/BØ ALT, CH A and CH B buttons (no signal applied to CH B). Check that only A PHASE will rotate the vector display.

b. Check DISPLAY Switch

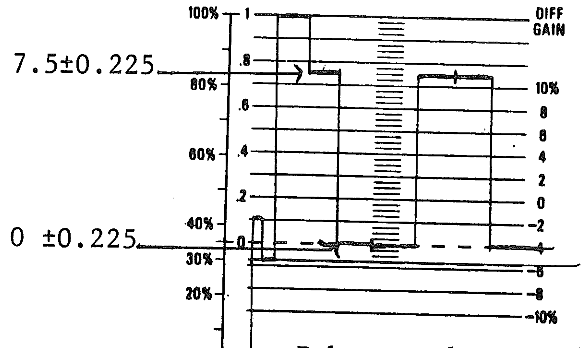
Depress the VECTOR PAL and AØ buttons. Set the DISPLAY sw to BOTH and adjust the A PHASE control to align the burst vectors to the subcarrier axis on the graticule (135° and 225° graticule lines).

Change the DISPLAY sw to +V. Only the color bar vectors relating to the burst on the 135° axis should be displayed. Change the SYNC sw from INT to EXT several times and check that the vectors lock-on in the correct phase each time.

Change the DISPLAY sw to -V. Only the color bar vectors relating to the burst on the 225° axis should be displayed. Change the SYNC sw from INT to EXT several times and check that the vectors lock-on in the correct phase each time.

22b. (cont'd)

Set the DISPLAY sw to BOTH and depress the VECTOR NTSC button. Both vectors should be displayed with burst on the 135° graticule line.

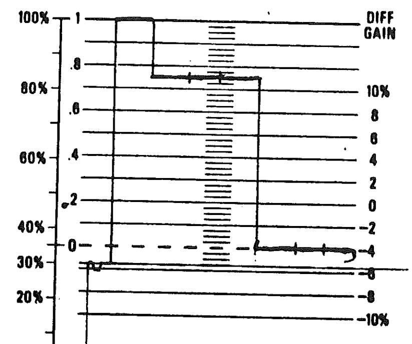


R button depressed

23. COLOR BAR DECODING

a. Setup

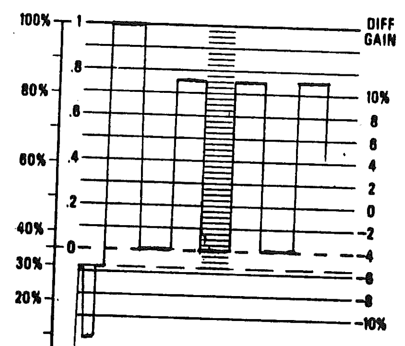
Set the DISPLAY sw to + V and depress the VECTOR PAL button. Adjust the CHANNEL A variable gain and PHASE control to align the color bars to their respective boxes. Depress the Y button and adjust the LUMINANCE GAIN and VERT POSITION to set the back porch level on the 30% graticule line and the peak white bar on the 100% graticule line.



G button depressed

b. Check Color Bar Decoding Accuracy ±3%

Depress the R button. Check that the color bars are within 3% of 75% saturated level. (See pictures). Repeat the check with G and B buttons depressed.



B button depressed

24. U AND V

Set the DISPLAY sw to +V and depress the VECTOR PAL button. Adjust the PHASE control to position the burst vector to one of the horizontal axis. Depress the V button. The burst must be nulled within 2° (check with CALIBRATED PHASE). Adjust the PHASE control to position the burst vector to the other horizontal axis and repeat the check.

24. (cont'd)

Depress the VECTOR PAL button and adjust the PHASE control to position the burst vector to one of the vertical axis. Depress the U button. The burst must be nulled within 2°. Repeat the check with the burst aligned to the other vertical axis.

[THE FOLLOWING CHECKS ARE NOT DONE ON 100% OF THE INSTRUMENTS BUT ARE DONE ON A SAMPLE BASIS]

25. DIFF GAIN/DIFF PHASE (10%-90% APL)

a. *Check Differential Gain*
1% or less last 90% of trace

Connect the Pal Signal Generator signal to CH A INPUT. Set the Pal Signal Generator to VAR/APL and AVERAGE PICTURE LEVEL sw to 10%. Depress the CH A, FULL FIELD and DIFF GAIN buttons. Set the CH A GAIN sw to MAX GAIN. Measure the differential gain at 10% APL. Change the AVERAGE PICTURE LEVEL sw to 90%. The difference in differential gain at 10% APL and 90% APL must be 1% less.

b. *Check Differential Phase*
Burst: ≤0.3° last 80% of trace
Ext: ≤0.15° last 90% of trace

Return the CHANNEL A GAIN sw to 75% and depress the DIFF PHASE button. Connect the 4.43361875MHz subcarrier from the back of the Pal Signal Generator to the EXT Ø REF jack. Set the Ø REF sw to BURST. Measure the differential phase with 10% and 90% APL, the difference in differential phase must not exceed 0.3°. Change the Ø REF sw to EXT and repeat the check. The difference in differential phase, with 10% and 90% APL, must not exceed 0.15°.

26. Y DISPLAY SHIFT (10%-90% APL)

$\leq$0.25 div

Depress the Y button. With the stairstep signal displayed vary the APL from 10% to 90%. The back porch level of the stairstep must not shift by more than 0.25 div.

27. LUMINANCE TO CHROMINANCE DELAY

100ns or less

Connect the output of the 20T $\sin^2$ pulse generator to the CH A INPUT. Trigger the pulse generator, externally, with -H from TP1205. Connect a 10X probe from the TYPE 1A1 CH 1 TRIGGER OUT and set the TYPE 1A1 MODE to ALT. The time difference between the half amplitude points of the CH 1 and CH 2 waveforms must be 100ns or less.

THE END