

FACTORY CALIBRATION PROCEDURE

CONTENTS:

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

Equipment Required

Factory Test Limits - 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.

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

Main Procedure - 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)

*This procedure is
company confidential*

067-0546-00

March 1968
For all serial
numbers.



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
- 2 TYPE P6006 10X Passive Probe
- 1 TYPE P6028 1X Passive Probe
- 1 TYPE 76TU LINE-VOLTAGE CONTROL UNIT

b. Test Fixtures and Accessories

- 1 75 Ω Terminator (feed through type) (011-0046-00)
- 1 75 Ω Cable (012-0002-00)
- 1 Standard Amplitude Calibrator (SAC) (067-0502-00)
- 1 P-P Voltmeter Model 36MC75 (PE Elec Stds. special)
- 1 286mV adapter for SAC (PMPE Dwg #1500B)
- 1 DC Voltage Bridge (067-0543-99)

c. Other Equipment

- 1 20,000 Ω /VDC Multimeter
- 1 Frequency Counter (HP model 5246L or equivalent)

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.

2. POWER SUPPLY

- a. Power Supply Accuracy: 3.6V ± 0.3 V
-15V ± 2 V
- b. Power Supply Ripple and Regulation:
 ≤ 10 mV ripple
 92 to 138VAC regulation range

3. SUBCARRIER

- c. Frequency: 3.579545MHz ± 2 Hz
- d. Amplitude: 2V $\pm 3\%$
- e. External Subcarrier Drive: 1.5 to
 2.5V range

4. SIDEBAND OSCILLATOR

- c. Frequency: 3.589488MHz ± 3 Hz
- d. Amplitude: 707mV $\pm 0.5\%$

5. PHASE MARK GENERATOR

- b. Phase Marker Amplitude and Frequency:
 Amplitude: ≥ 15 V pos
 ≥ 7 V neg
 Frequency: $2^\circ = 1.7897725$ MHz ± 2 Hz
 $10^\circ = 0.3579545$ MHz ± 1 Hz

6. VARIABLE OFFSET SUBCARRIER

- c. Amplitude: 286mV ± 5 mV

7. METER

- a. 100Hz Range Accuracy: $\pm 3\%$ of full scale
- b. 250Hz Range Accuracy: $\pm 3\%$ of full scale
- c. 1000Hz Range Accuracy: $\pm 3\%$ of full scale

8. H-SYNC

- a. H Lock: Locked to subcarrier
- b. H-Sync:
 Amplitude: > 1 V into 75 Ω
 Width: 4 μ s $\pm 10\%$

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. Preset Controls/Check Fuse:
0.4 A slo blo
- b. Check Power Supply Resistance:
3.6V \approx 230 Ω
-15V \approx 270 Ω

2. POWER SUPPLY

- a. Adjust/Check Power Supply:
3.6V: +10%, -10% range, adjust to
3.6V; -15V: \pm 2V accuracy
- b. Check Ripple and Regulation:
ripple: \leq 10mV
regulation: 92 to 138VAC
- c. Check 115/230 Switch

3. SUBCARRIER OSCILLATOR

- a. Preset Output Resonance and Amplitude (L35, R25)
- b. Adjust Feedback Resonance (L22): max voltage at Q24 emitter
- c. Adjust Frequency (C12): 3.579545MHz
- d. Adjust Amplitude (R25): 2V P-P
- e. Check External Subcarrier Drive:
1.5 to 2.5V

4. SIDEBAND OSCILLATOR

- a. Preset Output Resonance and Amplitude (L75, R65)
- b. Adjust Feedback Resonance (L67):
max voltage at Q54 collector
- c. Preset Frequency (R45): 3.589488MHz
- d. Adjust Amplitude (R65): 707mV

5. PHASE MARK GENERATOR

- a. Adjust Sideband Frequency (R45):
3.589488MHz \pm 3Hz.
- b. Check Phase Marker Amplitude, Polarity and Frequency:
Amplitude: \geq 15V pos
 \geq 7V neg
Frequency: $2^\circ = 1.7897725\text{MHz} \pm 2\text{Hz}$
 $10^\circ = 0.3579545\text{MHz} \pm 1\text{Hz}$

6. VARIABLE OFFSET SUBCARRIER

- a. Adjust Feedback Resonance (L227):
max voltage at TP224
- b. Adjust Frequency (C209): at least
+1000Hz, -1000Hz
- c. Adjust Amplitude (R225): 286mV

7. METER

- a. Adjust 100Hz Range (R292): \pm 2%
of full scale accuracy
- b. Adjust 250Hz Range (R295): \pm 2% of
full scale accuracy
- c. Adjust 1000Hz Range (R290): \pm 2% of
full scale accuracy

8. H-SYNC

- a. Adjust H Lock (R305): Lock to
subcarrier
- b. Check H-Sync:
Amplitude: \geq 1 volt into 75 Ω
Width: 4 μ s \pm 10%

THE END

1. PRELIMINARY*a. Preset Controls/Check Fuse*

Preset front and rear panel controls as follows:

OFFSET FREQUENCY	midr
METER RANGE	1000
PHASE-MARK GENERATOR	OFF
115/230V sw (rear panel)	115

Preset all internal adjustments to midr. Check fuse for correct value: 0.4A slo blo.

b. Check Power Supply Resistance

Remove B419 (power on light) and check for the specified resistance to gnd on the 3.6V and -15V supplies. Connect negative meter lead to gnd and use X100 scale.

<u>Supply</u>	<u>approx resistance</u>
3.6V	230 Ω
-15V	270 Ω

Replace B419.

2. POWER SUPPLY

- a. Adjust/Check Power Supply (R435)*
 3.6V: + & - 10% range, adjust to 3.6V
 -15V: $\pm 2V$ accuracy

Apply power to the 067-0546-00 via a TYPE 76TU LINE-VOLTAGE CONTROL UNIT. Set the line voltage to 115V.

Use the VOM to check the 3.6V supply. Vary the +3.6 Volts adjustment (R435) from end to end and check that the 3.6 volts will vary from 3.2V to 4.0 volts. Set the 3.6 volts to optimum. Check the -15 volt supply for -15 volts $\pm 2V$.

2. (cont'd)

*b. Check Ripple and Regulation**ripple: $\leq 10\text{mV}$ P-P**regulation: 92VAC to 138VAC*

Connect a 1X probe from the test scope to the appropriate power supply. Check for no more than 10mV P-P 120 ν ripple, on each supply, while varying the line voltage from 92VAC to 138VAC.

c. Check 115/230 Switch

Measure the AC voltage across pins 6&7 on the power transformer. Change the 115/230 switch (rear panel) to 230. The voltage across pins 6&7 should reduce to one half. Return the sw to 115.

3. SUBCARRIER OSCILLATOR*a. Preset Output Resonance and Amplitude (L35, R25)*

Connect the output of the 3.579545MHz SUBCARRIER through a 75 Ω cable and a 75 Ω termination to the test scope vertical input. Adjust L35 for maximum output amplitude. Adjust R25 for 2 volts P-P amplitude.

*b. Adjust Feedback Resonance (L27)
max voltage at Q24 emitter*

Connect a DC coupled 10X probe to the emitter of Q24. Adjust L27 for max DC level.

c. Adjust Frequency (C12) 3.579545MHz

Connect the 3.579545MHz SUBCARRIER through a 75 Ω cable and a 75 Ω termination to the Frequency Counter. Adjust C12 for a frequency of 3.579545MHz.

d. Adjust Amplitude (R25) 2V P-P

Verify the TYPE 1A1 .5 VOLTS/CM accuracy with a 2 volt square-wave from the SAC. Connect the 3.579545MHz SUBCARRIER through a 75 Ω cable and a 75 Ω termination to the test scope input (volts 1cm set to .5). Adjust R25 for exactly 2 volts (4cm) P-P amplitude.

Recheck the adjustments of L27, L35 and C12.

3. (cont'd)

*e. Check External Subcarrier Drive
1.5V to 2.5V*

Remove the subcarrier crystal (Y-8) and apply a 3.579545MHz subcarrier from an external source to the external subcarrier in jack. Monitor the subcarrier output at J35 with the test scope. Vary the amplitude of the external subcarrier from 1.5 to 2.5 volts while checking that the output of the subcarrier remains stable with no change in amplitude.

4. SIDEBAND OSCILLATOR*a. Preset Output Resonance and Amplitude
(L75, R65)*

Connect the output of the 3.589488MHz SIDEBAND VIDEO through a 75 Ω cable and a 75 Ω termination to the test scope vertical input. Adjust L75 for maximum output amplitude. Adjust R65 for as close to 707mV as possible.

*b. Adjust Feedback Resonance (L67)
max voltage at Q54 collector*

Connect a DC coupled 10X probe from the test scope to Q54 collector. Adjust L67 for maximum DC level.

c. Preset Frequency (R45) 3.589488MHz

Connect the 3.589488MHz SIDEBAND VIDEO through a 75 Ω cable and a 75 Ω termination to the Frequency Counter. Adjust R45 for a frequency as close as possible to 3.589488MHz.

Recheck the adjustments of L75, R65 and L67.

d. Adjust Amplitude (R65) 707mV P-P

Connect the P-P Voltmeter (special model 36MC75) to the SIDEBAND VIDEO output. Connect the DC Voltage Bridge to the P-P Voltmeter output. Adjust R65 for exactly 707mV P-P (see notes).

The DC voltage corresponding to 707mV P-P will vary with individual P-P Voltmeters. The correct DC voltage reading for 707mV P-P is indicated on the P-P voltmeter.

5. PHASE MARK GENERATOR

- a. *Adjust Sideband Frequency (R45)*
 3.589488MHz within 3Hz

Connect a 10X probe from the TYPE 1A1 INPUT 1 to the junction of C124 and C125. Connect another 10X probe from INPUT 2 to one of the outputs of the divider (pin A or B on Divider EC board). Set the TYPE 1A1 MODE to ALT and externally trigger the test scope with the CH 1 TRIGGER OUT signal. Set the TIME/CM to 20μSEC. Vary R45 and check that the CH 2 square-wave display will remain stable over a range of about 30° rotation of R45. Set R45 to the center of the stable range.

Check the SIDEBAND VIDEO signal for a frequency of 3589488Hz ±3Hz.

- b. *Check Phase Marker Amplitude, Polarity and Frequency*
- amplitude: >15V pos
 >7V neg
- frequency: 2° = 1.7897725MHz ±2Hz
 10° = 0.3579545MHz ±1Hz

Connect a 10kΩ resistor between gnd and the center conductor of the PHASE-MARK PULSE OUTPUT jack. Connect a 10X probe from the test scope vertical input to the PHASE-MARK PULSE OUTPUT jack.

Set the PHASE-MARK GENERATOR sw to 2° POS and check for positive marks of 15 volts or more. Change the polarity sw to NEG and check for negative going marks of 7 volts or more.

Check the amplitude of the positive and negative going 10° phase markers for 15 volts or more and 7 volts or more respectively.

Disconnect the 10k resistor and connect the phase-marker output to the Frequency Counter. Check the 2° marker frequency for 1.7897725MHz ±2Hz. Check the 10° marker frequency for 0.3579545MHz ±1Hz.

6. VARIABLE OFFSET SUBCARRIER

- a. *Adjust Feedback Resonance (L227)*
max voltage at TP 224

Set OFFSET FREQUENCY to midr. Adjust L227 for maximum DC voltage at TP 224.

- b. *Adjust Frequency (C209)*
+ and - 1000 ~

Set Amplitude (R225) for maximum amplitude (full cw). Set the METER RANGE to 1000Hz. Set OFFSET FREQUENCY full cw (-15 volt end). Connect the VARIABLE OFFSET SUBCARRIER through a 75 Ω cable and a 75 Ω termination to the Frequency Counter.

Adjust C209 for at least +1000 ~ from 3579545Hz (+1100 ~ is normal). Note: If set for more the +1500 ~ the crystal may go into a spurious mode of oscillation. Set the OFFSET FREQUENCY ccw (+3.6 volt end). Check for at least -1000 ~ from 3579545Hz.

- c. *Adjust Amplitude (R225)* 286mV

Connect the VARIABLE OFFSET SUBCARRIER through a 75 Ω cable and a 75 Ω termination to the TYPE 1A1 INPUT 1. Connect a 286mV square-wave from the SAC (use special 286mV adapter) to INPUT 2. Set both VOLTS/CM to .01, MODE to ADD and invert one channel.

Adjust Amplitude (R225) for no error signal as viewed on the test scope.

7. METER

- a. *Adjust 100Hz Range (R292)*
accuracy: $\pm 2\%$ of full scale

Connect the VARIABLE OFFSET SUBCARRIER through a 75 Ω cable and a 75 Ω termination to the Frequency Counter. Set the METER RANGE sw to 100Hz. Adjust the OFFSET FREQUENCY for a frequency reading of 3579625Hz (3579545 + 80Hz). Adjust R292 for a meter reading of 80Hz on the upper scale.

7a. (cont'd)

Check + and - frequency readings at 10Hz, 50Hz and 100Hz (meter readings). The frequency as read on the counter must be within 2Hz of the meter indication.

b. Adjust 250Hz Range (R295)
accuracy: $\pm 2\%$ of full scale

Change the METER RANGE sw to 250Hz.
Adjust the OFFSET FREQUENCY for 3579745Hz (3579545 + 200Hz). Adjust R295 for a meter reading of 200Hz on the lower scale.

Check + and - frequency readings at 50Hz, 125Hz and 250Hz (meter readings). The frequency as read on the counter must be within 5Hz of the meter indication.

c. Adjust 1000Hz Range (R290)
accuracy: $\pm 2\%$ of full scale

Change the METER RANGE sw to 1000Hz. Adjust the OFFSET FREQUENCY for 3580345Hz (3579545 + 800Hz). Adjust R290 for a meter reading of 800Hz on the upper scale.

Check + and - frequency readings at 100Hz, 500Hz and 1000Hz (meter readings). The frequency as read on the counter must be within 20Hz of the meter indication.

8. H SYNC

a. Adjust H Lock (R305)
Lock to subcarrier

Monitor the 3.579545MHz with the test scope. Trigger the test scope externally with the H-SYNC. Adjust H-Lock (R305) for a stable 3.579545MHz subcarrier display. Turn the power sw on and off several times and check that the H-SYNC remains locked to the subcarrier.

b. Check H Sync
amplitude: $> 1.0V$ into 75Ω
width: $4\mu s \pm 10\%$

Connect the output of the H-SYNC through a 75Ω cable and a 75Ω termination to the test scope input. Check for negative going sync pulses of at least 1.0 volt in amplitude and width of $4\mu s \pm 0.4\mu s$.

THE END