

Instructions

Tektronix

013-0278-00
Video Display Clamp
070-8762-00

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In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the respective warranty period and make suitable arrangements for the performance of service. Tektronix will provide such service at Customer's site without charge during the warranty period, if the service is performed within the normal on-site service area. Tektronix will provide on-site service outside the normal on-site service area only upon prior agreement and subject to payment of all travel expenses by Customer. When or where on-site service is not available, Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

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Safety Summary

Please take a moment to review these safety precautions. They are provided for your protection and to prevent damage to the 013-0278-00 Video Display Clamp. This safety information applies to all operators and service personnel.

Symbols and Terms

These two terms appear in manuals:

-  statements identify conditions or practices that could result in damage to the equipment or other property.
-  statements identify conditions or practices that could result in personal injury or loss of life.

These two terms appear on equipment:

- *CAUTION* indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.
- *DANGER* indicates a personal injury hazard immediately accessible as one reads the marking.

This symbol appears in manuals:



Static-Sensitive Devices

These symbols appear on equipment:



DANGER
High Voltage



Protective ground
(earth) terminal



ATTENTION
Refer to
manual

Specific Precautions

Observe all of the following precautions to ensure your personal safety and to prevent damage to either the 013-0278-00 Video Display Clamp or the equipment connected to it.

Power Source The 013-0278-00 Video Display Clamp is intended to operate from a TEK-PROBE™ LEVEL 2 interface. Therefore, power for the Video Display Clamp is supplied by the oscilloscope when connected to the front panel BNC.

Do Not Remove Covers or Panels To avoid personal injury, do not operate the 013-0278-00 Video Display Clamp without the covers.

Do Not Operate in Explosive Atmospheres The 013-0278-00 Video Display Clamp provide no explosion protection from static discharges or arcing components. Do not operate the 013-0278-00 Video Display Clamp in an atmosphere of explosive gasses.

Electric Overload Never apply a voltage to a connector on the 013-0278-00 Video Display Clamp that is outside the range specified for that connector.

The Video Display Clamp

Product Description

The Tektronix 013-0278-00 Video Display Clamp is an active signal processor designed to increase your ability to monitor video signals.

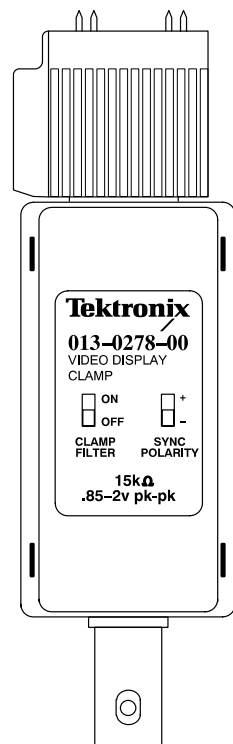
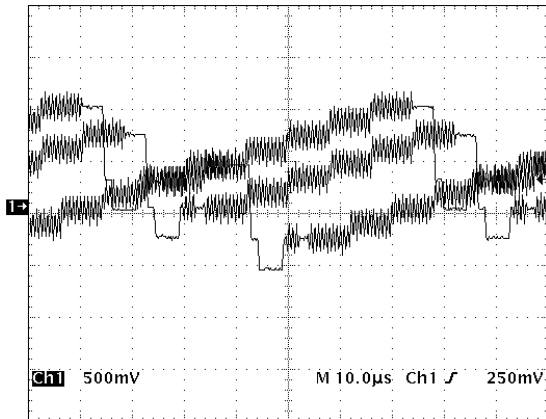


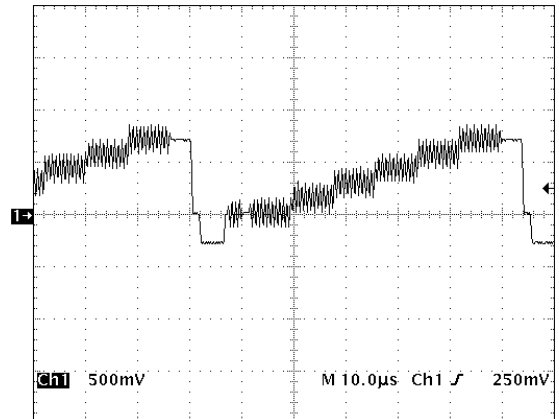
Figure 1: The Video Display Clamp

Video signals containing a 60 Hz ripple or a DC offset make it difficult to view the video signal with an oscilloscope. The Video Display Clamp provides a stable signal to the oscilloscope by clamping the back porch of the video signal to ground reference. This does not affect the signal source.

Figure 2 gives an example of how a 60 Hz hum disrupts the capability to view the video signal. Figure 2 also shows the same signal stabilized by using the Video Display Clamp. You can see how this enhances your ability to take measurements of the video signal.



Video Signal Disrupted with 60 Hz Hum



Video Signal Stabilized using the Video Display Clamp

Figure 2: Video Waveform Disrupted by 60 Hz Hum

The Video Display Clamp receives its power from the host instrument. The host instrument must have a TEKPROBE™ Level 2 interface (such as the Tektronix TDS 400, TDS 500, and TDS 600 Series Oscilloscopes).

The Video Display Clamp works with most popular signal formats including the following:

- NTSC
- PAL
- HDTV (component and composite)

Features

Features of the Video Display Clamp (other than setting the back porch to ground reference) include the following items.

CLAMP FILTER. When **ON**, the Video Display Clamp ignores the presence of a color burst signal. This helps ensure a ground level for the back porch. The filter does not remove the color burst signal from the video waveform.

SYNC POLARITY. Select **+** to match sync pulses having a positive leading edge. Select **-** to match sync pulses having a negative leading edge.

Using the Video Display Clamp

Signals passing through cables often pick up stray 60 Hz hum (from the line voltage) or a small DC offset might be generated by the video equipment. Although these signals may not affect the quality of the information contained in

the signal, it makes it nearly impossible to obtain a viewable display of the video information.

Use the Video Display Clamp to reduce or eliminate this type of interference to view the video signal.

Viewing the video signals can be accomplished with several methods.

- Connect a video signal directly to the Video Display Clamp (see Figure 3).
- Tap into a video signal line with a T-connector to monitor the signal without causing loading interference to the signal (see Figure 4).
- Connect a 1X probe directly to the Video Display Clamp to probe video circuits (see Figure 5). The bandwidth of the Video Display Clamp may be compromised due to the probes characteristics.

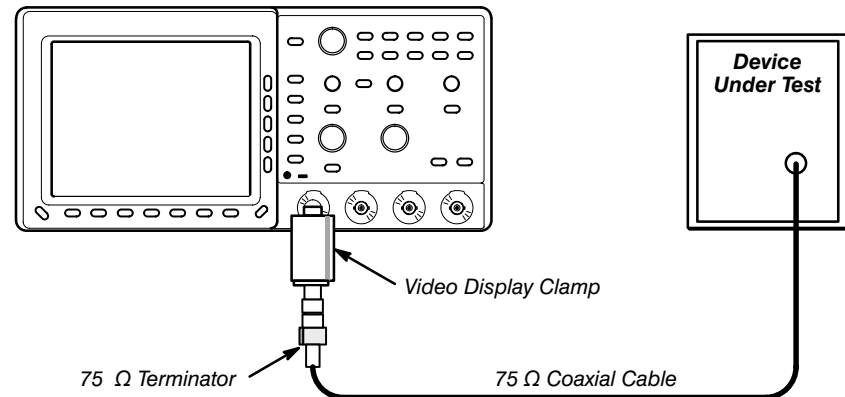


Figure 3: Viewing a Video Signal Directly with the Video Display Clamp

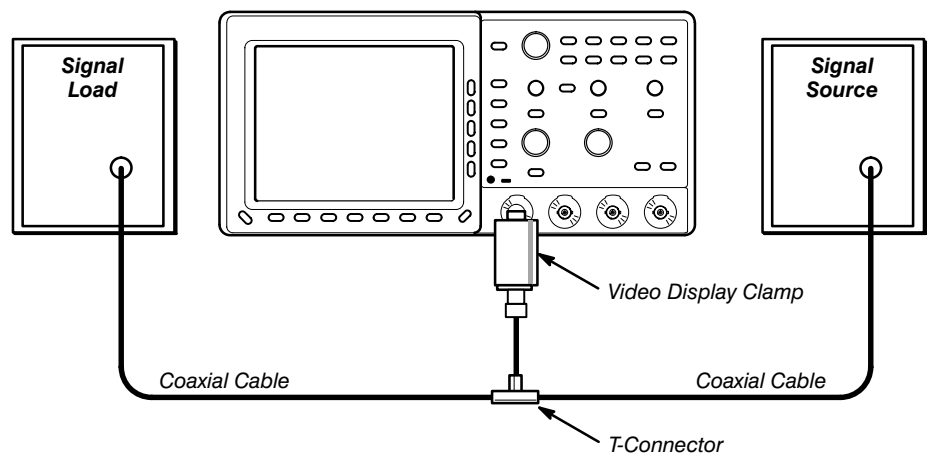


Figure 4: Monitoring a Video Signal with the Video Display Clamp

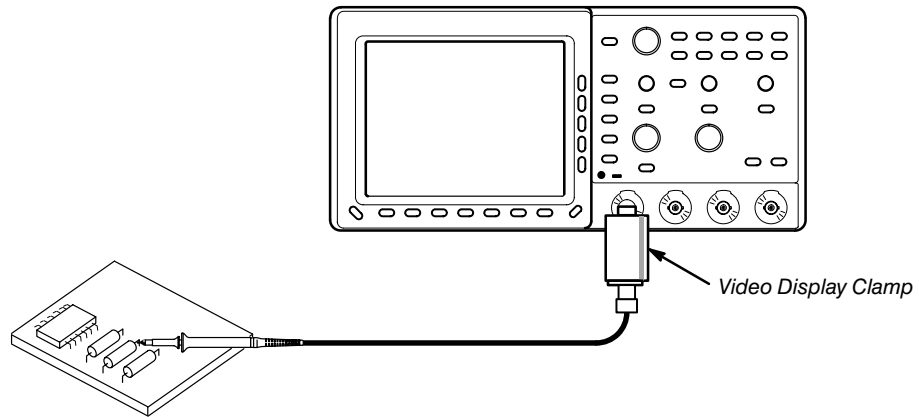


Figure 5: Probing Circuits with the Video Display Clamp

Procedure Use the following short procedure to install and use the Video Display Clamp. Attaching the Video Display Clamp to an oscilloscope with a TEKPROBE™ Level 2 interface automatically turns on the Video Display Clamp.

STOP. The use of this clamp requires that the test oscilloscope has a TEK-PROBE™ Level 2 interface and the vertical input impedance is 1 M Ω .

1. Attach the Video Display Clamp to the input of the oscilloscope and apply the test signal to the input of the Video Display Clamp. See the examples provided in Figures 3 through 5.
2. Set the input impedance of the oscilloscope to 1 M Ω .
3. Set the **SYNC POLARITY** of the Video Display Clamp to match the polarity of the signal source.
 - Set to – for video signals with negative sync pulses.
 - Set to + for video signals with positive sync pulses.
4. Set the **CLAMP FILTER** of the Video Display Clamp.
 - Set to **OFF** for video signals without a color burst signal.
 - Set to **ON** for video signals with a color burst signal.
5. Set the controls of the test oscilloscope as you normally would to view the signal.

Specifications

The electrical characteristics found in these tables of warranted characteristics apply when operating at an ambient temperature between 0° C and +50° C.

Table 1: Warranted Characteristics — Signal Pass Through (Insertion Characteristics)

Name	Description
Bandwidth The bandwidth of the video clamp signal path with the oscilloscope input coupling set to 1 M Ω and the input of the clamp is terminated into 75 Ω .	-3 dB at 70 MHz (100 MHz typical), ± 1 dB out to 30 MHz (60 MHz typical).
Gain Error Error does not include the vertical error of the oscilloscope or the error in the terminator.	$\pm 2.5\%$.

Table 2: Warranted Characteristics — Signal Input Impedance (Return Characteristics)

Name	Description
Input Resistance Only applies when the video display clamp is operating.	≥ 15 k Ω .

Table 3: Warranted Characteristics — Video Display Clamp

Name	Description
60 Hz Rejection Measured with 1 V _{p-p} NTSC video signal with 1 V _{p-p} 60 Hz interference signal.	21 dB (NTSC or PAL, typical) worst case. Faster speed standards have better rejection.
60 Hz Modulation The maximum amount of 60 Hz interference that the clamp functions under.	1 V _{p-p} (NTSC and PAL). 0.5 V _{p-p} (HDTV).
Video Input Amplitude	240 mV to 570 mV sync tip height (measured from the top of the sync tip to the back porch). If the video information does not extend below the back porch, these limits translate to approximately 0.85 V _{p-p} to 2 V _{p-p} of video signal amplitude.
Back Porch Correction The maximum voltage between the back porch and ground the video clamp can correct.	± 1 V.

Table 3: Warranted Characteristics — Video Display Clamp (Cont.)

Name	Description										
Crosstalk The maximum crosstalk interference created on the back porch.	10 mV _{p-p} .										
Line Rates/Standards The video display clamp works with any bi-level sync pulse standard that has a back porch at least 3 μs long. The clamp works with any tri-level sync pulse standard as long as the sync tip is shorter than 1.8 μs and the back porch is at least 1 μs long.	<table> <tr> <td>525/59.94/2:1</td> <td>1050/59.94/2:1</td> </tr> <tr> <td>525/59.94/1:1</td> <td>1050/59.94/1:1</td> </tr> <tr> <td>625/50/2:1</td> <td>1250/50/2:1</td> </tr> <tr> <td>625/50/1:1</td> <td>1250/50/1:1</td> </tr> <tr> <td>787/59.94/1:1</td> <td></td> </tr> </table>	525/59.94/2:1	1050/59.94/2:1	525/59.94/1:1	1050/59.94/1:1	625/50/2:1	1250/50/2:1	625/50/1:1	1250/50/1:1	787/59.94/1:1	
525/59.94/2:1	1050/59.94/2:1										
525/59.94/1:1	1050/59.94/1:1										
625/50/2:1	1250/50/2:1										
625/50/1:1	1250/50/1:1										
787/59.94/1:1											
Offset Error The difference between the back porch and ground.	±16 mV. Offset error may increase up to 40 mV for certain standards (such as 787/59.94/1:1) due to timing considerations of the vertical interval sync pulses. This increase is resolved by the fourth line.										

Table 4: Warranted Characteristics — Environmental and Safety

Name	Description
Operating Temperature	0° C to +50° C.
Operating Temperature	-55° C to +75° C.
Humidity	90% +5% -0% humidity, 60° C non-operating, 50° C operating.
Packaged Product Vibration and Shock	The packaged product qualifies under the Distribution Cycle 1 Assurance Level II for packaged products 0 — 20 lbs. Test 2 for Warehouse and Vehicle Stacking (Compression) is omitted.
Electrostatic Immunity	IEC 801-2.
Certification	UL 1244.

Table 5: Typical Characteristics — Video Display Clamp

Name	Description
Maximum Input Voltage The maximum input voltage allowed for proper operation.	±3 V.

Table 6: Nominal Traits — Mechanical

Name	Description
Weight	500 grams.

Performance Verification

This *Performance Verification* subsection confirms the performance of the 013-0278-00 Video Display Clamp to its warranted specifications.

General Instructions

These *General Instructions* describe the conventions used in the test procedures and provides a list of the required test equipment.

Conventions

The procedures in this section provide the following information:

- title of test
- equipment required (if applicable)
- procedure

The procedures check all the characteristics designated as checked in the *Specifications* subsection. (The checked characteristics appear in **boldface** type.)

Equipment Required

These procedures use external, traceable signal sources to directly check warranted characteristics. Table 7 lists the required test equipment.

Table 7: Test Equipment

Item Number and Description	Minimum Requirements	Example	Purpose
1. Oscilloscope	TEKPROBE™ Level 2 interface, 100 MHz bandwidth.	Tektronix TDS 460.	Signal display
2. Cable, Precision Coaxial	50 Ω , 36 in, male to male BNC connectors.	Tektronix part number 012-0482-00	Signal interconnection
3. Termination, 50 Ω	Impedance 50 Ω ; connectors: female BNC input, male BNC output.	Tektronix part number 011-0049-01	Signal interconnection
4. Attenuator, 2.5X	Ratio: 2.5X; impedance 50 Ω ; connectors: female BNC input, male BNC output.	Tektronix part number 011-0076-02	Signal attenuation
5. Coupler, Dual-input (two required)	Female BNC to dual male BNC.	Tektronix part number 067-0525-02	Signal interconnection
6. Generator, Leveled Sine Wave	30 MHz; Variable amplitude from 5 mV to 4 V _{p-p} into 50 Ω .	TEKTRONIX SG 503 Leveled Sine Wave Generator ¹	Bandwidth check

Table 7: Test Equipment (Cont.)

Item Number and Description	Minimum Requirements	Example	Purpose
7. Generator, Leveled Sine Wave	60 Hz; Variable amplitude from 5 mV to 4 V _{p-p} into 50 Ω.	TEKTRONIX SG 502 Leveled Sine Wave Generator ¹	60 Hz rejection check
8. Generator, Pulse	0 to 3 V, 15 kHz pulses with independent controls of the top and bottom pulse levels; Variable pulse duration and pulse period; Normal output and its complement.	TEKTRONIX PG 502 Pulse Generator ¹	Back porch correction and gain accuracy checks

¹ Requires a TM 500 or TM 5000 Series Power Module Mainframe.

Procedures

These procedures check the characteristics of the Video Display Clamp listed as checked under *Warranted Characteristics* in the *Specifications* section.

Back Porch Correction Check

These procedures check those characteristics that relate to the back porch correction capability of the Video Display Clamp listed as checked under *Warranted Characteristics* in the *Specifications* section.

Equipment Required: One test oscilloscope (Item 1), one pulse generator (Item 8), one 2.5X attenuator (Item 4), one 50 Ω terminator (Item 3), one dual-input coupler (Item 5), and one precision coaxial cable (Item 2).

1. Set the test oscilloscope as follows:
 - set the sec/div scale to 10 μs
 - set the channel 1 volts/div scale to 100 mV, DC coupled
 - set the channel 2 volts/div scale to 500 mV, DC coupled
 - position both channel 1 and 2 traces to center screen
 - display channel 2 (channel 1 off)
2. Connect the output of the pulse generator to the test oscilloscope as shown in Figure 6.

NOTE. This test setup provides a display of the test signal on channel 2 and a clamped test signal on channel 1.

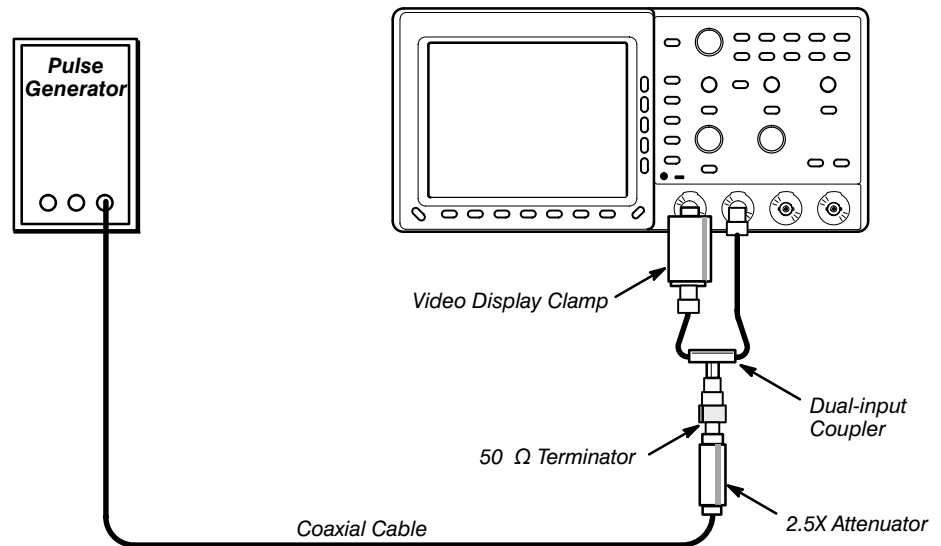


Figure 6: Back Porch Test Setup

3. Set the pulse generator as follows (viewed with channel 2):
 - set the compliment to –
 - adjust the period to 15 kHz
 - adjust the pulse duration to 5 μ s
 - set the high level to 1.0 volts
 - set the low level to 0.75 volts
4. Set the Video Display Clamp as follows:
 - **Polarity** to – (negative)
 - **Filter** to **Off**
5. Set the test oscilloscope to display channel 1 (channel 2 off).
6. Verify that the positive portion of the pulse is within ± 14 mV of the ground reference (see Figure 7).

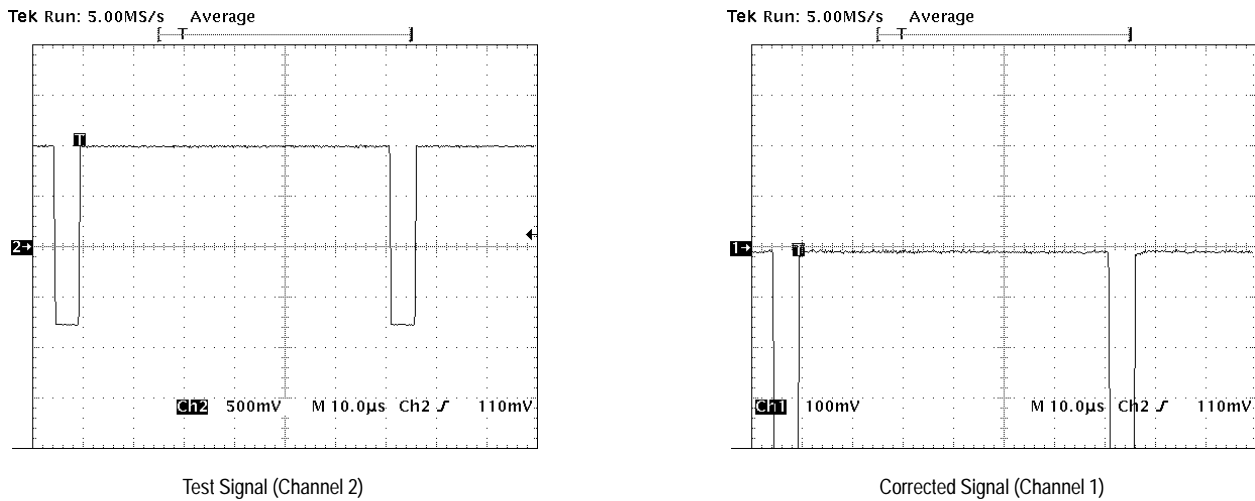


Figure 7: Back Porch Correction Check (Negative)

7. Set the test oscilloscope to display channel 2 (channel 1 off).
8. Set the pulse generator as follows:
 - set the high level to -0.8 volts
 - set the low level to -1.0 volts
 - set the compliment to +
9. Set the Video Display Clamp **Polarity** to + (positive).
10. Set the test oscilloscope to display channel 1 (channel 2 off).
11. Verify that the negative portion of the pulse is within ± 14 mV of the ground reference (see Figure 8).

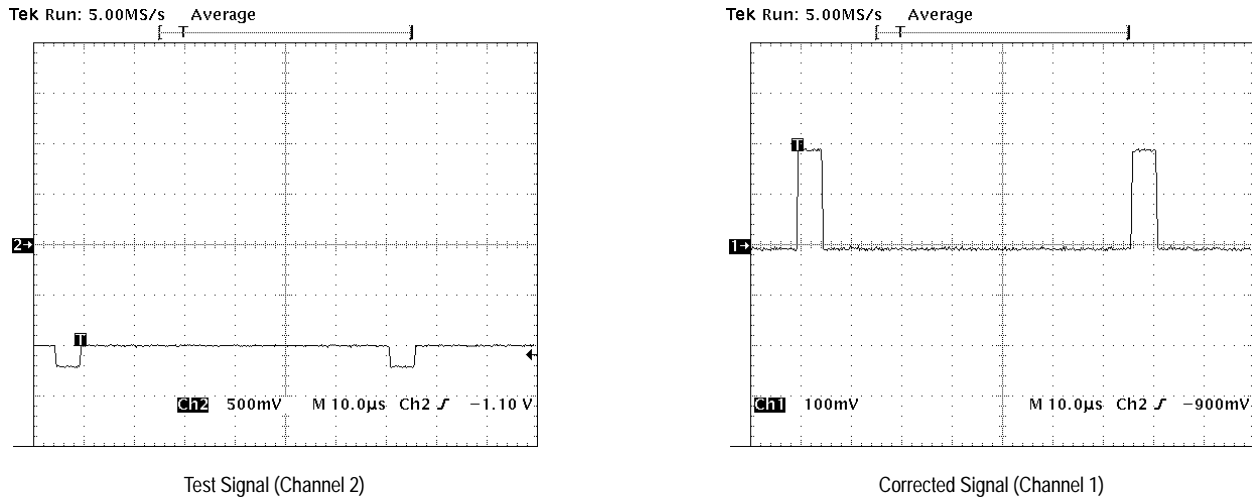


Figure 8: Back Porch Correction Test (Positive)

Gain Error Check

These procedures check those characteristics that relate to the gain error of the Video Display Clamp listed as checked under *Warranted Characteristics* in the *Specifications* section.

Equipment Required: One test oscilloscope (Item 1), one pulse generator (Item 8), one precision coaxial cable (Item 2), one 2.5X attenuator (Item 4), one 50 Ω terminator (Item 3), and one dual-input coupler (Item 5).

1. Set the test oscilloscope as follows:
 - set the sec/div scale to 10 μ s
 - set the channel 1 volts/div scale to 200 mV, DC coupled
 - set the channel 2 volts/div scale to 500 mV, DC coupled
 - position both channel 1 and 2 traces to center screen
 - display channel 2 (channel 1 off)
2. Connect the output of the pulse generator to the test oscilloscope as shown in Figure 9.

NOTE. This test setup provides a display of the test signal on channel 2 and a clamped test signal on channel 1.

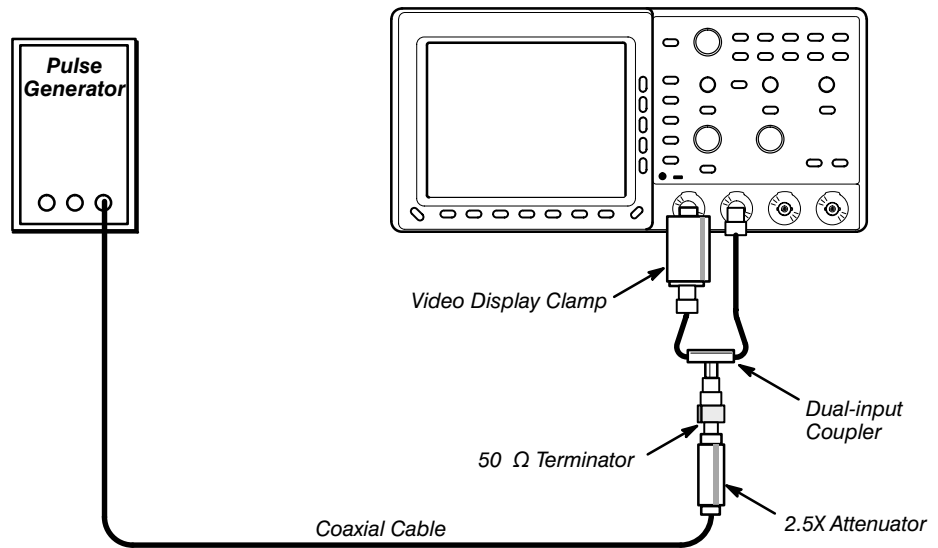


Figure 9: Gain Error Test Setup

3. Set the pulse generator as follows:
 - set the compliment to –
 - adjust the period to 15 kHz
 - adjust the pulse duration to 5 μ s
 - set the high level to 500 mV
 - set the low level to –500 mV
4. Set the Video Display Clamp as follows:
 - **Polarity** to – (negative)
 - **Filter** to **Off**
5. Set the test oscilloscope to display channel 1 (channel 2 off).
6. Vertically position the channel 1 display to view the entire signal.
7. Verify that the pulse amplitude is between 975 mV_{p-p} and 1.025 V_{p-p} (see Figure 10).

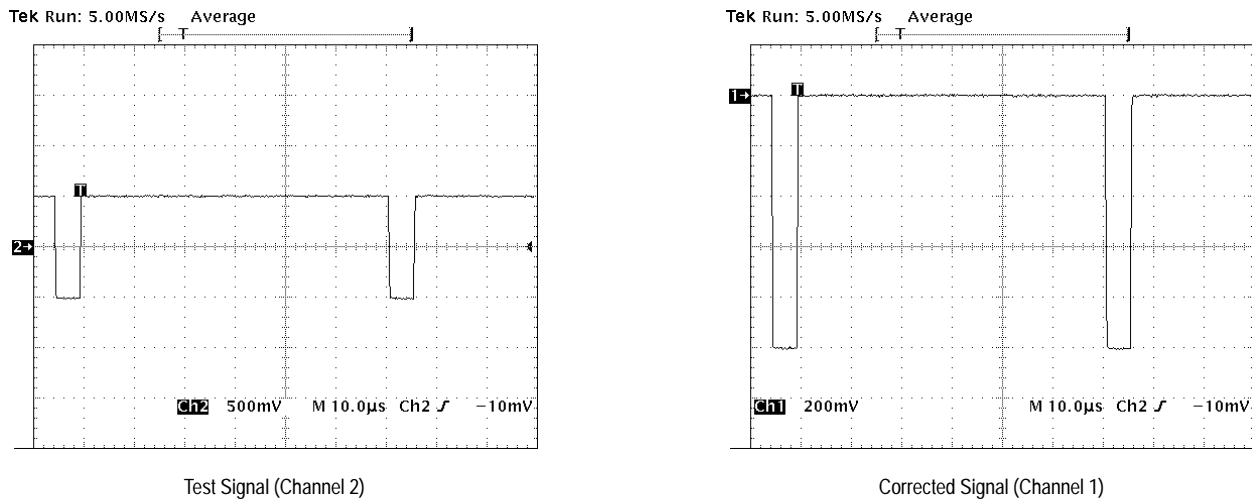


Figure 10: Gain Check

Crosstalk and Timing Checks

These procedures check those characteristics that relate to crosstalk interference and timing of the Video Display Clamp listed as checked under *Warranted Characteristics* in the *Specifications* section.

Equipment Required: One test oscilloscope (Item 1), one pulse generator (Item 8), one precision coaxial cable (Item 2), one 2.5X attenuator (Item 4), and one 50 Ω terminator (Item 3), and one dual-input coupler (Item 5).

1. Set the test oscilloscope as follows:
 - set the sec/div scale to 10 μ s
 - set the channel 1 volts/div scale to 5 mV, DC coupled
 - set the channel 2 volts/div scale to 100 mV, DC coupled
 - position both channel 1 and channel 2 traces to center screen
 - display channel 2 (channel 1 off)
2. Connect the output of the pulse generator to the test oscilloscope as shown in Figure 11.

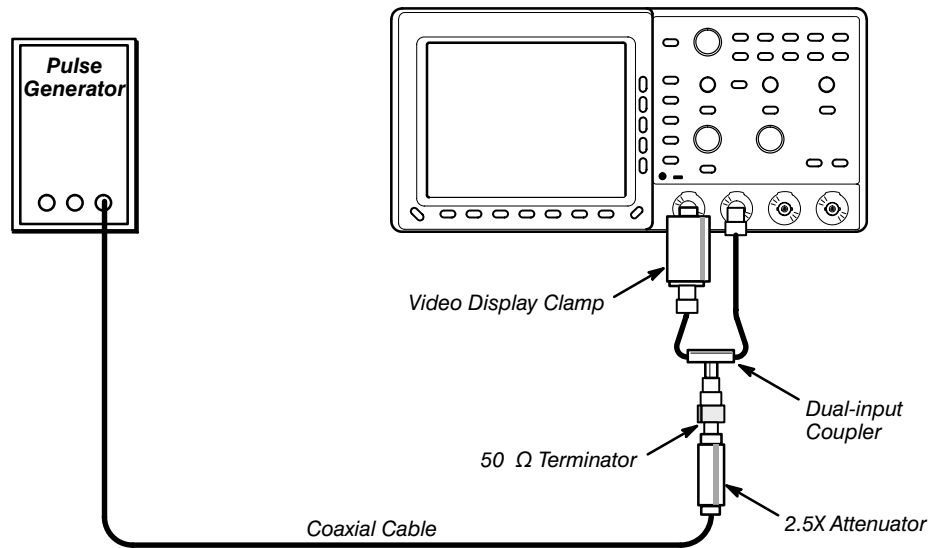


Figure 11: Crosstalk Test Setup

3. Set the pulse generator as follows:
 - set the compliment to –
 - adjust the period to 15 kHz
 - adjust the pulse duration to 5 μ s
 - set the high level to 0 V
 - set the low level to –300 mV
4. Set the Video Display Clamp as follows:
 - **Polarity** to – (negative)
 - **Filter** to **Off**
5. Set the test oscilloscope to display channel 1 (channel 2 off).
6. Verify that any interference on the high level of the pulse is <math><10\text{ mV}_{\text{p-p}}</math> (see Figure 12).

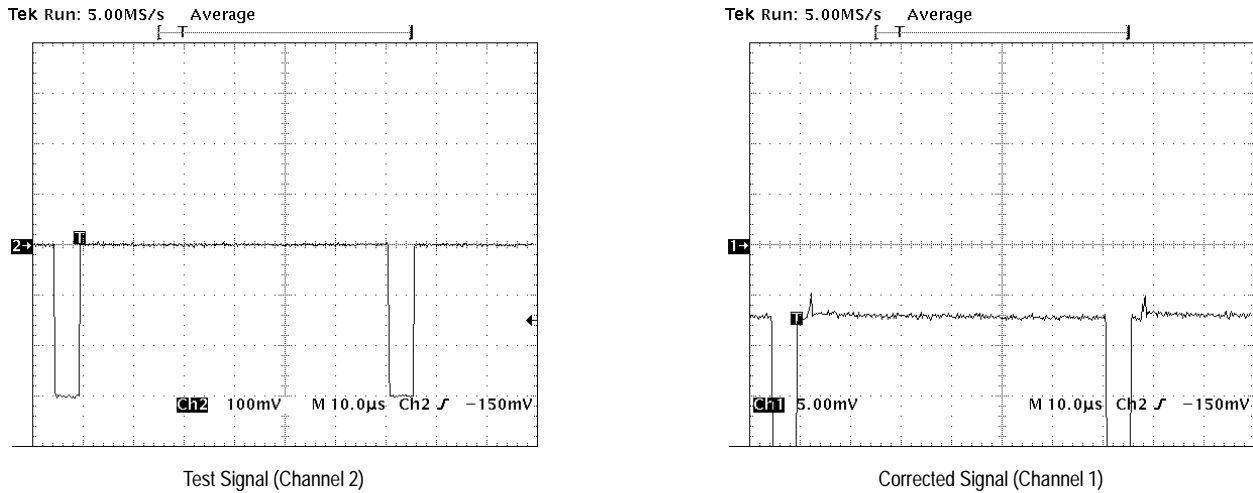


Figure 12: Measuring Interference

7. Switch the Video Display Clamp **Polarity** to + (positive) then back to – (negative).
8. Verify that the pulse display returns to its original position within ± 1 mV.
9. Set the test oscilloscope sec/div scale to 500 ns.
10. Using Figure 13 as a reference, measure the time intervals marked A and B.
 - Verify that interval A is between 2.08 μ s and 2.28 μ s.
 - Verify that interval B is between 600 ns and 700 ns.

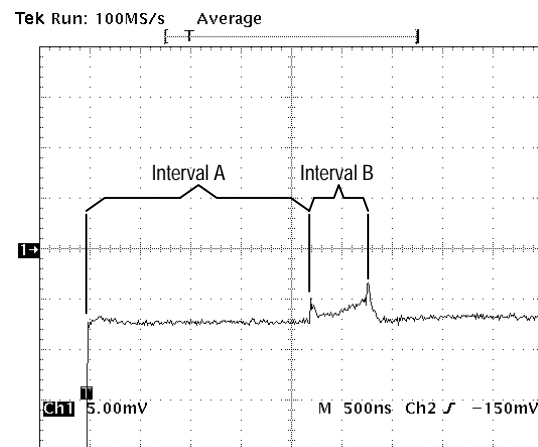


Figure 13: Measuring Timing Intervals

Bandwidth Check

These procedures check those characteristics that relate to the bandwidth of the Video Display Clamp listed as checked under *Warranted Characteristics* in the *Specifications* section.

Equipment Required: One sinewave generator (Item 6), one precision coaxial cable (Item 2), one 50 Ω terminator (Item 3), and one dual-input coupler (Item 5).

1. Set the test oscilloscope as follows:
 - set the sec/div scale to 10 ns
 - set the channel 1 and channel 2 volts/div scales to 200 mV, AC coupled
 - position both the channel 1 and channel 2 traces to center screen
 - display channel 2 (channel 1 off)
2. Connect the output of the sinewave generator to the test oscilloscope as shown in Figure 14.

NOTE. This test setup provides a display of the test signal on channel 2 and a clamped test signal on channel 1.

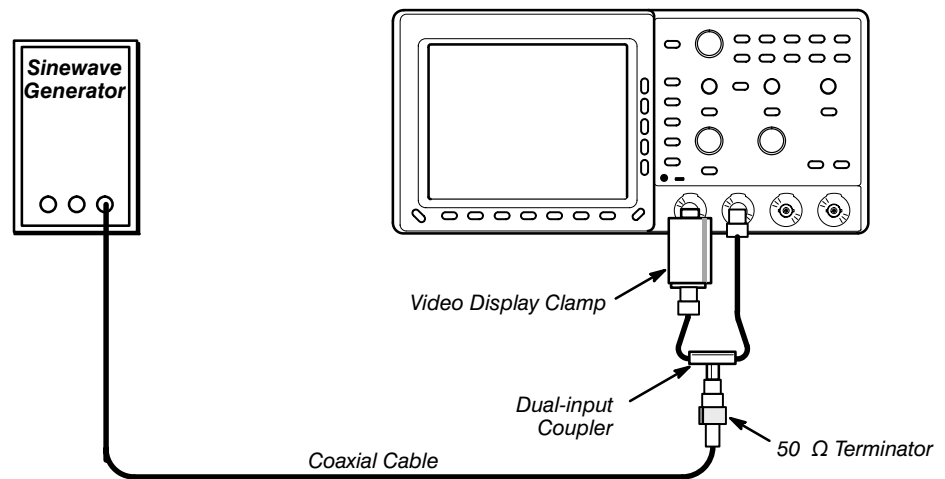


Figure 14: Bandwidth Test Setup

3. Set the sinewave generator as follows:
 - adjust the frequency to 30 MHz
 - adjust the amplitude for a 1 V_{p-p} display.

4. Set the Video Display Clamp as follows:
 - **Polarity** to – (negative)
 - **Filter** to **Off**
5. Set the test oscilloscope to display channel 1 (channel 2 off).
6. Verify that the signal display amplitude is greater than 892 mV_{p-p}.

60 Hz Rejection Check

These procedures check those characteristics that relate to the 60 Hz rejection capability of the Video Display Clamp listed as checked under *Warranted Characteristics* in the *Specifications* section.

Equipment Required: One test oscilloscope (Item 1), one pulse generator (Item 8), one sinewave generator (Item 7), one 2.5X attenuator (Item 4), two dual-input couplers (Item 5), and one precision coaxial cable (Item 2).

1. Set the test oscilloscope as follows:
 - set the sec/div scale to 10 μ s
 - set both channel 1 and channel 2 volts/div scales to 200 mV, DC coupled.
 - position both channel 1 and 2 traces to center screen
 - display channel 2 (channel 1 off)
2. Connect the output of the pulse generator and the sinewave generator to the test oscilloscope as shown in Figure 15.

NOTE. *This test setup provides a display of the test signal on channel 2 and a clamped test signal on channel 1.*

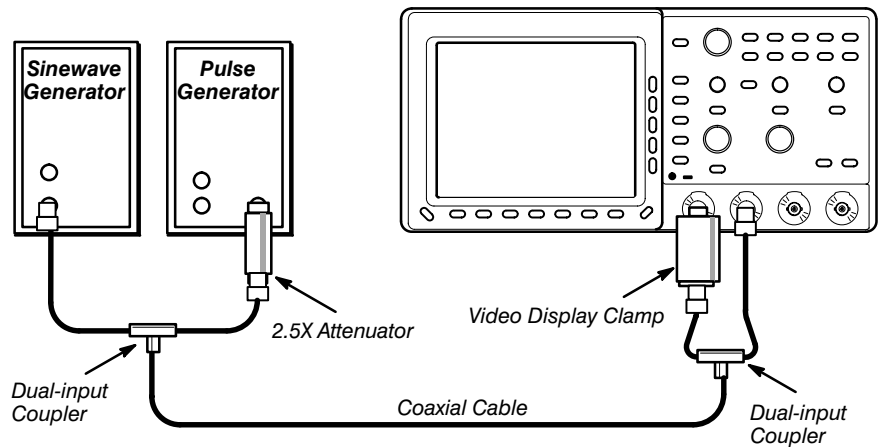


Figure 15: 60 Hz Rejection Test Setup

3. Set the Video Display Clamp as follows:
 - **Polarity** to – (negative)
 - **Filter** to **Off**
4. Set the sinewave generator as follows:
 - set the frequency to 60 Hz
 - adjust the amplitude to 0 V
5. Set the pulse generator as follows:
 - set the compliment to –
 - adjust the period to 15 kHz
 - adjust the pulse duration to 5 μ s
 - set the high level to 150 mV
 - set the low level to –420 mV
6. Set the test oscilloscope sec/div to 2 ms.
7. Set the sinewave generator amplitude to create a 1 V_{p-p} display of the 60 Hz sinewave.
8. Set the test oscilloscope to display channel 1 (channel 2 off).
9. Verify that the amplitude of the 60 Hz sinewave component of the waveform is $\leq 70 mV_{p-p}$ (see Figure 16).

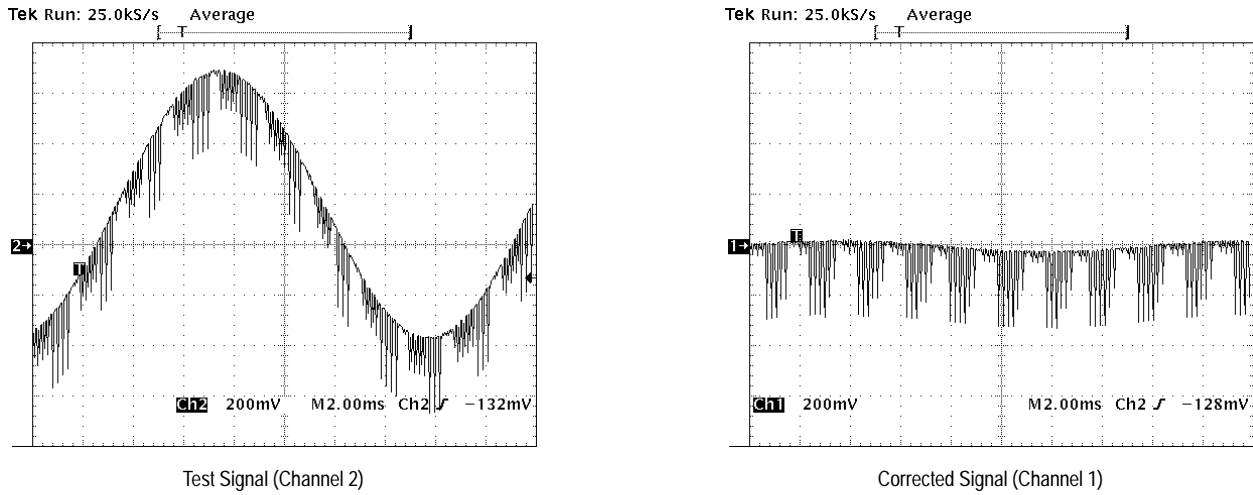


Figure 16: 60 Hz Rejection Check (Negative)

10. Set the compliment of the pulse generator to +.
11. Set the Video Display Clamp **Polarity** to + (positive).
12. Verify that the amplitude of the 60 Hz sinewave component of the waveform is $\leq 70 \text{ mV}_{\text{p-p}}$ (see Figure 17).

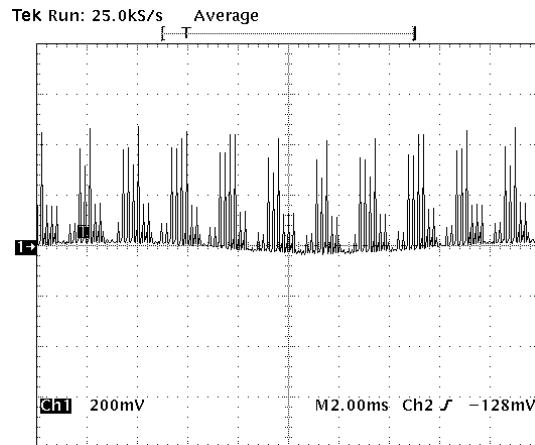


Figure 17: 60 Hz Rejection Check (Positive)

Maintenance

This subsection provides you with the service information for the Video Display Clamp.

Service Information

There are no user serviceable parts inside the case of the Video Display Clamp. The TEKPROBE™ interface contact pins are the only replaceable part of the Video Display Clamp.

Replacing the Contact Pins

If the contact pins become damaged, obtain replacement pins through your nearest Tektronix Field Office or representative. Use the following procedure to replace a damaged contact pin.

1. Using a pair of needle-nosed pliers, grasp the damaged pin and pull the pin straight out of the assembly (see Figure 18). Note the location of the removed pin.
2. Using the needle-nosed pliers, grasp the replacement pin and carefully insert the pin into the assembly. Use care to avoid crushing or bending the new pin during installation.
3. Verify that the new pin is installed to the same depth as the other pins.

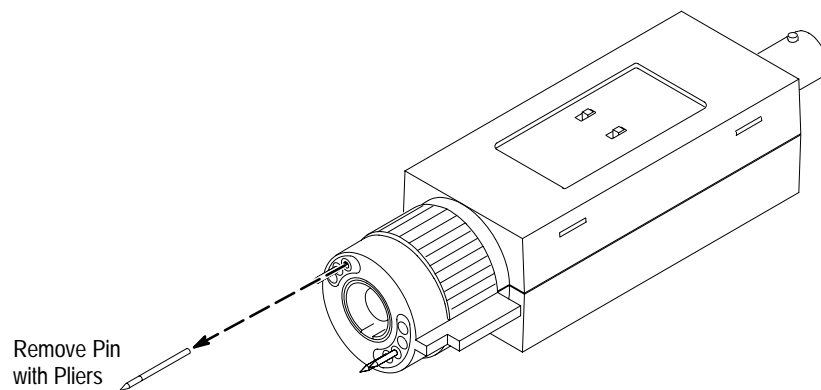


Figure 18: Replacing the Contact Pins

