TEK 11000 SERIES PLUG-INS

THE 11T5H

MULTISTANDARD VIDEO TRIGGER

Service Reference

Tektronix®
COMMITTED TO EXCELLENCE

Part No. 070-7962-00
Product Group 47

THE 11T5H

MULTISTANDARD VIDEO TRIGGER

Service Reference

WARNING

The following servicing instructions are for use by qualified service personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to the Safety Summary prior to performing any service.

Please check for CHANGE INFORMATION at the rear of this manual.

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Instrument Serial Numbers

Each instrument manufactured by Tektronix has a serial number on a panel insert or tag, or stamped on the chassis. The first letter in the serial number designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B010000	Tektronix, Inc., Beaverton, Oregon, USA
E200000	Tektronix United Kingdom, Ltd., London
J300000	Sony/Tektronix, Japan
H700000	Tektronix Holland, NV, Heerenveen, The Netherlands

Instruments manufactured for Tektronix by external vendors outside the United States are assigned a two digit alpha code to identify the country of manufacture (e.g., JP for Japan, HK for Hong Kong, etc.).

Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077

Printed in U.S.A.

Contents

Theory of Operation

Replaceable Parts

Change Information

List of Illustrations

List of Tables

General Information

This reference provides service information and test procedures for the 11T5H Multistandard Video Trigger. It contains information necessary for qualified service personnel to check, adjust, troubleshoot and correct the 11T5H.

Checking the 11T5H involves performing a sequence of check and adjustment procedures. These procedures allow you to check, then adjust if necessary, the specifications of the 11T5H. If a faulty Field Replaceable Unit (FRU) is identified, you can correct the problem by removing and replacing the FRU. This manual also describes the theory of operation for the 11T5H, including general block diagrams, functional descriptions of the major circuitry blocks, and descriptions of unique video trigger circuitry.

The 11T5H triggers on a variety of video signal formats including NTSC, PAL, and HDTV. It can trigger on line rates up to 1280 lines per field and can accommodate the tri-level sync of HDTV signals. To prevent display bounce of changing video images, the 11T5H has the capability of vertically clamping a video signal.

The 11T5H is designed to operate in Digitizing Mainframes (that accept plug-in units) only. When inserted in the rightmost compartment, it can receive trigger signals from its companion plug-in, the 11A34V High Bandwidth Video Amplifier. The front panel provides an easy to use interface to all the 11T5H functions.

This reference contains the following sections:

- **General Information** – discusses information that you should know about the 11T5H before you service it, such as safety information, installation and removal, available options and packaging suggestions.
- **Checks and Adjustments** – describes the procedures for examining and adjusting several measurement limits and electrical specifications of the 11T5H.
- **Maintenance** – contains information for performing preventive maintenance, diagnosing faulty field replaceable units (FRUs), or corrective maintenance on the 11T5H.
- **Theory of Operation** – discusses the general operation and signal path of the 11T5H. Descriptions of unique circuitry are also provided.
- **Replaceable Parts** – provides you with a complete list of replaceable parts found on the 11T5H.

Safety Summary

This general safety information is directed to operators and service personnel. Specific warnings and cautions will be found throughout the manual, but may not appear in this summary.

Terms in Manuals

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

Terms on Equipment

CAUTION warns you of possible hazards to the equipment or yourself (but you are not exposed as you read the marking).

DANGER indicates that you are exposed to a personal injury hazard as you read the marking.

Symbols in Manuals

Static Sensitive Devices

Symbols on Equipment

DANGER High Voltage

Protective ground (earth) terminal

ATTENTION Refer to manual

Grounding the 11T5H

The 11T5H is grounded through the grounding conductor of the mainframe power cord. To avoid electric shock, plug the mainframe power cord into a properly wired receptacle before installing the 11T5H. A protective ground connection, through of the grounding conductor in the mainframe power cord, is essential for safe operation.

Danger Arising from Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulators), can render an electrical shock.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an atmosphere of explosive gasses.

Do Not Service Alone

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

Use Care When Servicing with Power On

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections or components while the power is on.

Disconnect the power before removing protective panels, or replacing components.

Installing and Removing an 11T5H

Install the 11T5H in a Digitizing Mainframe as follows:

☐ Step 1: Set the mainframe's ON/STANDBY switch to STANDBY.

CAUTION

If the green indicator light remains on when the STANDBY position is selected, then the switch was internally disabled when the power supply was serviced. To enable the ON/STANDBY switch, refer to the Corrective Maintenance section of the Service Reference manual for your mainframe.

☐ Step 2: Align the grooves in the top and bottom of the 11T5H with the guides in the mainframe plug-in compartment.

☐ Step 3: Insert the plug-in into the compartment until the front panel of the 11T5H is flush with the front panel of the mainframe.

Remove the 11T5H from the mainframe as follows:

☐ Step 1: Set the mainframe's ON/STANDBY switch to STANDBY.

☐ Step 2: Pull the release latch (see Fig. 1-1) to disengage the 11T5H from the mainframe.

☐ Step 3: Slide the 11T5H straight out of the plug-in compartment.

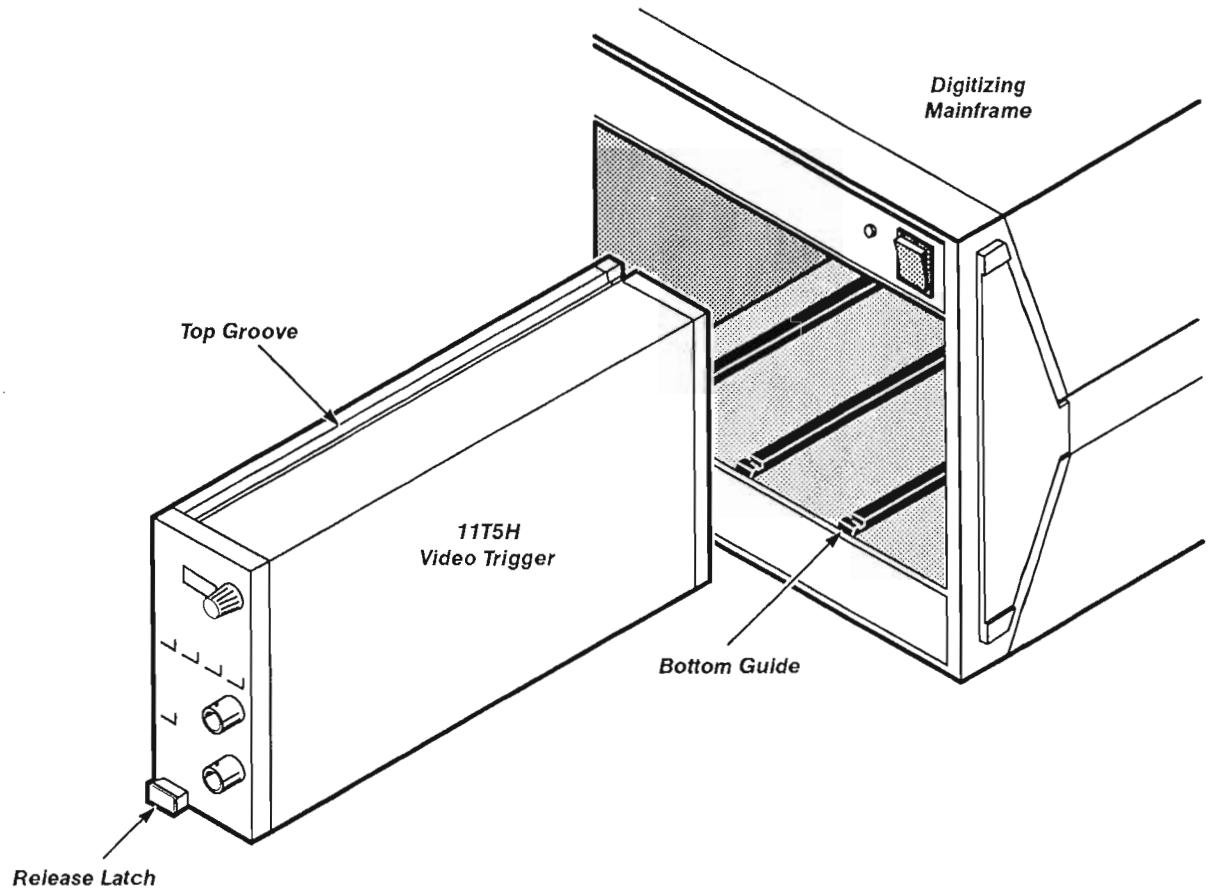


***Figure 1-1** — Installing the 11T5H in a Mainframe*

Power Supply Information

The 11T5H is intended to operate in a mainframe connected to a power source that does not apply more than 250 V rms between the supply conductors or between a supply conductor and ground. A protective ground connection, through the grounding conductor in the mainframe power cord, is essential for safe system operation.

Memory Backup Power for the 11T5H

The nonvolatile RAM (NVRAM) within the 11T5H allows the data in memory to be retained when the 11T5H is removed. The NVRAM stores system-configuration data such as the 11T5H, mainframe, and probe identification numbers as well as the calibration constants. The data that the NVRAM stores enables the 11T5H to resume Enhanced Accuracy performance from a powered-off condition without performing a full calibration (Enhanced Accuracy) operation. The rated lifetime of the NVRAM's internal power source is ten years. If the 11T5H habitually loses Enhanced Accuracy status without a system configuration change (that is, the 11T5H remains plugged into the same slot in the same mainframe), then you may need to replace the NVRAM.

Operating Environment

To ensure proper functioning and extended operation of the 11T5H, operate and store the 11T5H within the following environments:

- Operate the 11T5H in an mainframe where the ambient air temperature is between 0° and +50°C.
- Store the 11T5H in ambient temperatures from −40° to +75°C.
- After storing the 11T5H at temperatures outside the operating limits, allow the 11T5H to reach the safe operating temperature before applying power.

Enhanced system accuracy is available after a 20-minute warmup period. If the mainframe is in the Enhanced Accuracy state and the internal temperature of the mainframe changes ±5°C, the mainframe reverts to normal accuracy.

Packaging for Shipment

If shipping the 11T5H to your local Tektronix service center for repair, attach a tag to it with the following information:

- Name and address of the plug-in owner.
- Name of a person at your firm who can be contacted about the plug-in.
- Plug-in type and serial number.
- Description of the service required.

Save and reuse the original carton and packaging when shipping the 11T5H by commercial transportation. Be sure to package and ship the 11T5H and mainframe separately. If the original package is not available or is not reusable, package the 11T5H as follows:

1. Obtain a corrugated cardboard carton with dimensions at least six inches (15 cm) greater than the 11T5H dimensions. Use a carton with a bursting test strength of at least 200 pounds per square-inch.
2. Fully wrap the 11T5H with anti-static sheeting to protect its finish.

3. Tightly pack 3 inches of dunnage or urethane foam between the carton and the 11T5H to cushion it.
4. Seal the carton with shipping tape or with industrial staples.
5. Mark the address of the Tektronix service center and your return address on the carton in one or more prominent places.

Checks and Adjustments

This section contains procedures that allow you to examine measurement limits and electrical specifications of the 11T5H Multistandard Video Trigger. Adjustment Procedures 1 to 4 (see Table 2-1) are intended to return the 11T5H Video Amplifier to proper operation following repair, or as a part of a routine maintenance program.

To ensure accurate operation, check the electrical adjustment after each 2,000 hours of operation; or every 24 months if you use the 11T5H infrequently. Refer to the *11T5H User Reference* for more information about advertised specifications and operation.

To verify that the instrument is functioning, perform the procedures which have an indication (✓) in the Functional Test column of Table 2-1.

***Table 2-1** — Measurement Limits, Specifications, Adjustments, and Functional Test*

Procedure and Description	**Measurement Limits *(Examine)***	**Specifications *(Check)***	**Adjustments *(Adjust)***	**Functional Test**
Procedure 1 Initial Setup	none	none	none	✓
Procedure 2 Enhanced Accuracy	none	successful execution	none	✓
Procedure 3 Line Select/Mode Test	none	Verify operation.	none	✓
Procedure 4 Display Clamp/ Trigger Source Test	none	Verify operation.	see Adjustment Procedure 4	✓
Procedure 5 Jitter Test	Jitter	≤10 ns	none	✓
Adjustment Procedure 1 Gain, Flatness, Offset, and Front Corner	Gain Flatness Offset Front Corner	±5% ±3% ±50 mV ±6%	R925 C1020 R723 R922, C922	
Adjustment Procedure 2 Loop Gain	Loop Gain	(See procedure)	R5608	
Adjustment Procedure 3 Back Porch Clamp Timing	Back Porch Clamp Timing	(See procedure)	R5710	
Adjustment Procedure 4 Back Porch Clamp Reference	Back Porch Clamp Reference	(See procedure)	(See procedure)	

Table 2-2, Test Equipment, lists equipment recommended for use with the procedures in this manual. The Functional Test column of Table 2-2 indicates, with a check mark (✓), the test equipment that is recommended if you are only performing a functional test. Procedure steps are based on the test equipment examples given, but other equipment with similar specifications may be substituted. Test results, setup information, and related connectors and adapters may be different if you use different equipment.

***Table 2-2** — Test Equipment*

Description	Minimum Specification	Examples of Recommended Test Equipment	Functional Test
Mainframe that accommodates plug-in units	Tektronix Digitizing Mainframe	TEKTRONIX 11401 Digitizing oscilloscope 11402 Digitizing oscilloscope 11402A Digitizing oscilloscope 11403 Digitizing oscilloscope 11403A Digitizing oscilloscope CSA 404 Communications Signal Analyzer DSA 600 Series Digitizing Signal Analyzer with firmware version 2.0 or above	✓
TV Signal Generator	NTSC white field with burst	TEKTRONIX TSG 100 or TSG 1001	✓
11A34V High Bandwidth Video Amplifier (one or two, as available)	11A34V High Bandwidth Video Amplifier	TEKTRONIX 11A34V High Bandwidth Video Amplifier	✓
Power Module	Tektronix four-compartment power module	TEKTRONIX TM 504 Power Module	✓
11K Plug-in Extender		Tektronix Part 067-1261-00	
Calibration Generator	Period, 0.1 ms Amplitude, −60 V Square wave output, 0.25% accuracy, 1-2-5 amplitude selection from 200 μV p-p to 100 V p-p, ~1 ms period, fast rise <1 ns	TEKTRONIX PG 506A Calibration Generator with a TM 500-Series Power Module	✓
Coaxial Cable, 42-inch (2 required)	75 Ω, 36-inch male BNC connectors	Tektronix Part 012-0074-00	✓
75 Ω Termination	Impedance: 75 Ω; Accuracy, within 2%; connectors, BNC	Tektronix Part 011-0055-01	✓
DC Block		Tektronix Part 015-0221-00	✓

Table 2-2 — Test Equipment (cont)

Description	Minimum Specification	Examples of Recommended Test Equipment	Functional Test
Alignment Tool (insulated slot)	Insulated slot	Tektronix Part 003-0675-01	
Magnetic Screwdriver	Holder for Torx tips	Tektronix Part 003-0293-00	
Torx Screwdriver Tips	#6 tip #7 tip #8 tip #10 tip #10 tip narrow shank #15 tip	Tektronix Part 003-1415-00 Tektronix Part 003-1293-00 Tektronix Part 003-0964-00 Tektronix Part 003-0814-00 Tektronix Part 003-0815-00 Tektronix Part 003-0966-00	
Needle-nose pliers			
Tweezers			

Using These Procedures

The first-time user should become familiar with the above information prior to performing the procedures.

At the beginning of each procedure a short narrative describes the purpose of the procedure. Following this description is a list of the steps required to check the Multistandard Video Trigger's specification.

Conventions in this Manual

In these procedures, the following conventions are used:

- CAPITAL letters within the body of text identify front panel controls, indicators, and connectors (for example, MEASURE) on the mainframe and amplifier.
- **Bold** letters identify menu labels, display messages, and commands typed in from a terminal or controller.
- Initial Capital letters identify connectors, controls, and indicators (for example, Position) on associated test equipment. Initial Capital letters also identify adjustments inside the amplifier (for example Vert Pos).
- In some steps, the first word is italicized to identify a step that contains a performance verification and/or an adjustment instruction. For example, if *Check* is the first word in the title of a step, an electrical specification is checked. If *Adjust* appears in the title, the step involves an electrical adjustment. If *Examine* is the first word in the title, the step involves measurement limits that are used as calibration guides; these limits are not to be interpreted as electrical specifications.

Initializing Mainframe Settings

At the beginning of most steps, you are instructed to **Initialize** the instrument as part of the setup. The **Initialize** feature, available through the UTILITY menu, presets all mainframe controls and functions to known values. Initializing the instrument at the beginning of a step eliminates the possibility of settings from previous steps causing erroneous or confusing results. For more information on initialization, refer to the mainframe *User Reference*.

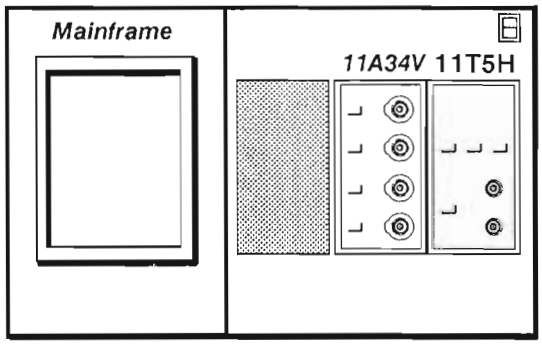
Menu Selections and Measurement Techniques

Details on measurement techniques and instructions for making menu selections are generally not included in this procedure. Comprehensive descriptions of menus and instrument features are located in the mainframe *User Reference*.

Procedure 1 Initial Setup

Perform Checks and Adjustment procedures within an ambient temperature range of +18° to +28°C, to ensure proper mainframe and amplifier operation.

Initial Setup



CAUTION

To avoid damage to any of the equipment, set the mainframe ON/STANDBY switch to STANDBY before installing or removing amplifiers.

Turning the mainframe power off during probe calibration, self-calibration, Extended Diagnostics, or other intense system activity may result in some internal data being corrupted. If corruption occurs, refer to Restoring Calibration Data in your mainframe Service Reference.

☐ Step 1: Power on the following test equipment, so that it is warmed up with the mainframe and amplifiers to be tested:

Power supply
Calibration generator

☐ Step 2: With the ON/STANDBY switch set to STANDBY, connect the mainframe to a suitable power source.

☐ Step 3: Install the 11T5H in the right plug-in compartment.

☐ Step 4: Install an 11A34V in the center plug-in compartment. If two 11A34V amplifiers are available, install a second in the left plug-in compartment.

☐ Step 5: Set the front panel ON/STANDBY switch to ON.

☐ Step 6: Allow the equipment to warm up for 20 minutes before continuing.

Procedure 2 Enhanced Accuracy

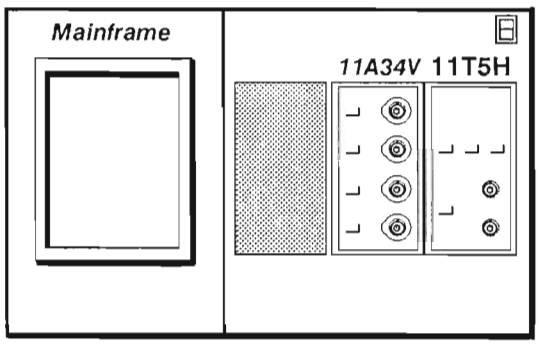
When displayed, the Enhanced Accuracy symbol (**EA**) indicates that the instrument is at its highest Accuracy state. The mainframe saves the time of calibration and ambient temperature for use in maintaining the Enhanced Accuracy state.

For more information about the Enhanced Accuracy state, see the mainframe *User Reference* manual.

Specification

When invoked, the self-calibration activity executes successfully.

Setup to Check Enhanced Accuracy



Procedure to Check Enhanced Accuracy

☐ Step 1: With the mainframe set to STANDBY, install an 11A34V Video Amplifier in the center plug-in compartment.

☐ Step 2: **Initialize** the mainframe's settings.

Right plug-in (11T5H) . . . . . no setting changes
Center plug-in (11A34V) . . . . . no setting changes
Mainframe . . . . . no setting changes

☐ Step 3: Twenty minutes after power-on, the mainframe must recalibrate itself to achieve the Enhanced Accuracy state. Press the ENHANCED ACCURACY button. A prompt then appears on the display. Press the ENHANCED ACCURACY button again. Enhanced Accuracy is achieved after a couple of minutes.

CAUTION

Turning the mainframe's power off during Enhanced Accuracy testing may result in losing some of the non-volatile RAM data. This could cause diagnostic errors at the next power-up, and cause the mainframe to operate unpredictably. If this event occurs, refer to Restoring Calibration Data in your mainframe's Service Reference.

☐ Step 4: *Check* that the message, **Enhanced Accuracy in Progress** (indicating that the mainframe is attempting to achieve Enhanced Accuracy) appears.

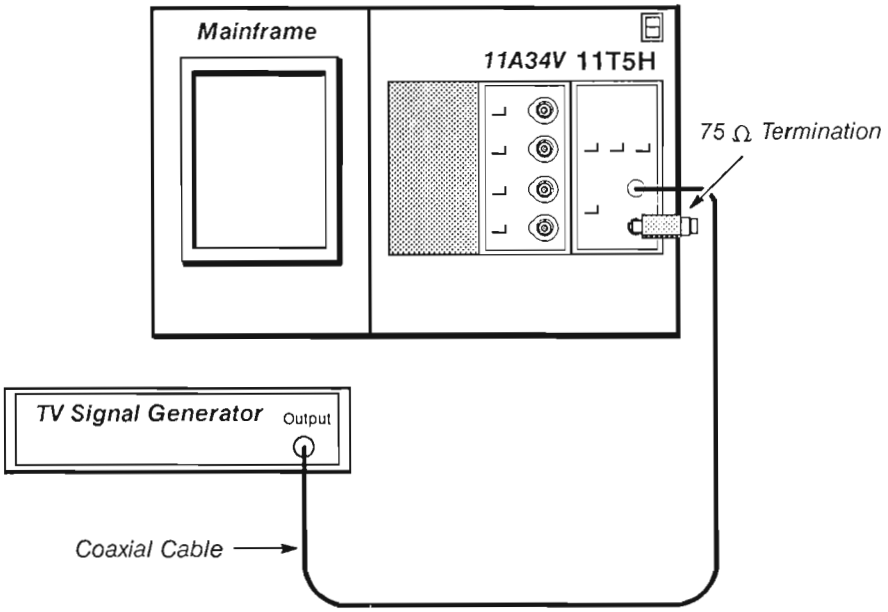
☐ Step 5: *Check* that the message, **Enhanced Accuracy completed and passed** or **Self calibration completed successfully** (indicating that the Enhanced Accuracy state has been achieved) appears. The **EA** indicator appears on the display when Enhanced Accuracy is completed.

Procedure 3 Line Select/Mode Test

This procedure tests the line select and mode functions of the 11T5H. Line select should be able to select from 1 to the maximum number of lines for each video format (up to a maximum of 1280). The following modes should be operational: FIELD 1, FIELD 2, ALL LINES, and ACTIVE LINES.

Setup to Check Line Select and Mode Test

The 11T5H should be in the rightmost plug-in compartment.



Procedure to Check Line Select and Mode Test

☐ Step 1: Initialize the mainframe's settings.

☐ Step 2: Connect a 75 Ω termination to the OUTPUT BNC of the 11T5H.

☐ Step 3: Connect a 75 Ω cable from the TV generator's output to the INPUT BNC of the 11T5H.

☐ Step 4: Set the TV generator to output an NTSC white (flat) field.

☐ Step 5: Press EXT 1 on the front panel of the 11T5H. A stable waveform should appear on the mainframe's display. If the waveform is not stable, check to make sure VIDEO POLARITY is set to **NORM** on the 11T5H.

☐ Step 6: Use Main Pos on the mainframe to position the trigger arrow close to the second graticule line (from the left) as shown in Figure 2-1.

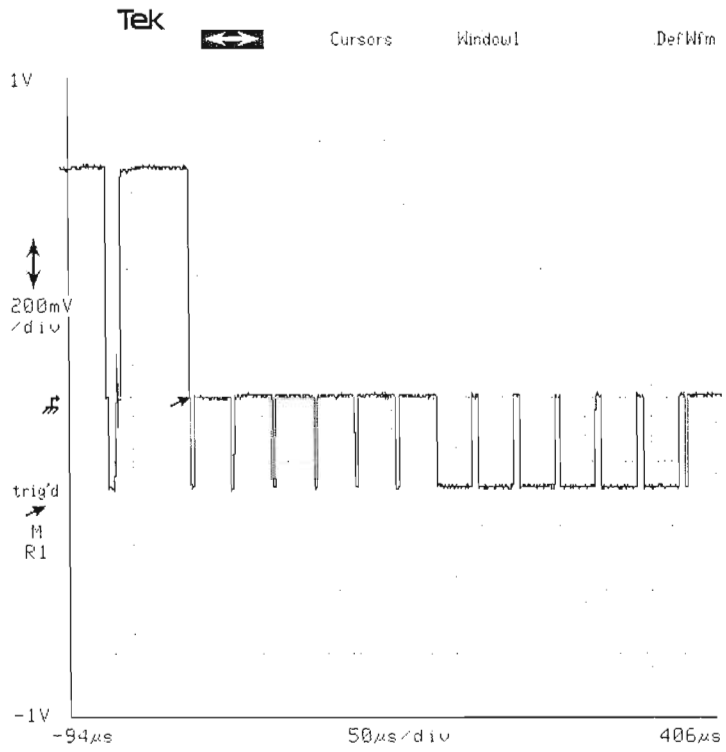


***Figure 2-1** — A Displayed Video Waveform*

☐ Step 7: Select FIELDS: FRAME on the front panel of the 11T5H. Use the knob on the 11T5H to set the fields per frame to **2:1**.

☐ Step 8: Select LINE SELECT on the front panel of the 11T5H. The 11T5H display should contain a **1**. Turn the knob one click clockwise and observe that the 11T5H display now contains a **2**. Turn the knob two clicks counterclockwise and observe that the 11T5H display now contains **525**. Note: FIELD 2, in the MODE section, will light.

☐ Step 9: If an HDTV source is available, repeat the above steps for each source. For HDTV 1050 the 11T5H will display a line select range of 1 to 1050. For HDTV 1250/50 the 11T5H will display a line select range of 1 to 1250.

Note: *The maximum line count for the 11T5H is 1280 lines.*

The following steps test the mode functions of the 11T5H:

☐ Step 10: Set the TV generator to output an NTSC white (flat) field.

☐ Step 11: Use Main Size on the mainframe to set the horizontal size to 10 µs/div.

☐ Step 12: While the MODE is FIELD 1 on the 11T5H, select LINE SELECT. Use the knob on the 11T5H to set the line select to **1**.

☐ Step 13: On the 11T5H, press the MODE button to select FIELD 2. The LINE SELECT should change to **264**.

☐ Step 14: On the 11T5H, press the MODE button to select ALL LINES. The LINE SELECT should display ----. (No line select is available in this mode.) The mainframe display will continue to display a stable waveform, but you may also see what appears to be a drifting trace moving across the screen.

☐ Step 15: On the 11T5H, press the MODE button to select ACTIVE LINES. The LINE SELECT should display ----. (No line select is available in this mode.) The mainframe display will display a stable waveform.

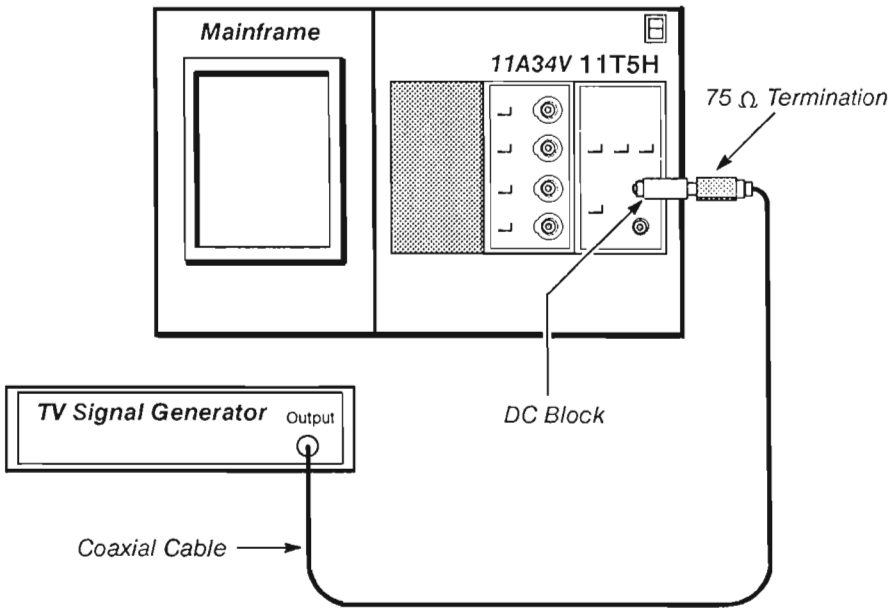
Procedure 4 Display Clamp/ Trigger Source Test

This procedure shows the setup and lists the procedure to check the display clamp function. Display clamp and trigger should function for EXT 1 on the 11T5H, and channels 1 and 2 of an 11A34V in the center and/or left plug-in compartment.

Setup to Check Display Clamp/Trigger Source

The 11T5H should be in the rightmost plug-in compartment and an 11A34V in the center plug-in compartment of the test mainframe. Two 11A34V's can be used so all signal paths can be checked without having to move one 11A34V from the center to the left plug-in compartment during the test. Remove the TV Generator cable from the front panel of the 11T5H. Remove the 75 Ω termination from the front panel of the 11T5H and attach it to the cable coming from the TV generator. Attach a DC Block to the 75 Ω termination that is on the cable.

Note: *Always set the mainframe's ON/STANDBY switch to STANDBY whenever installing or removing plug-in units.*



Procedure to Check Display Clamp/Trigger Source

- ☐ Step 1: Attach the blocked, terminated cable to EXT 1 INPUT of the 11T5H.
- ☐ Step 2: Initialize the mainframe.
- ☐ Step 3: Set the TV generator to output an NTSC white (flat) field.

☐ Step 4: Press EXT 1 on the front panel of the 11T5H. A stable waveform should appear on the mainframe's display. This verifies the trigger is working. If the waveform is not stable, check to make sure VIDEO POLARITY is set to **NORM** on the 11T5H.

☐ Step 5: Use Main Pos on the mainframe to position the trigger arrow close to the second graticule line (from the left). The mainframe display should appear as shown in Figure 2-2.

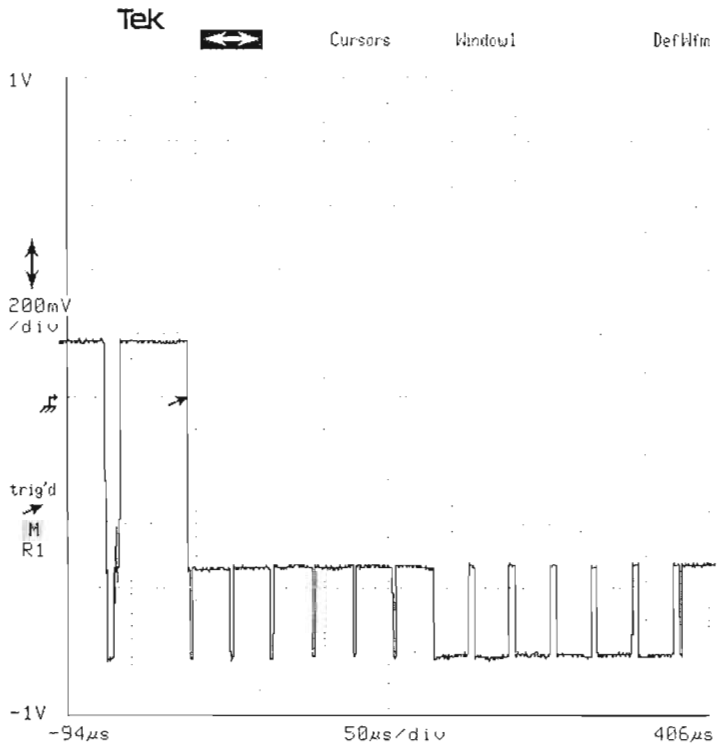


***Figure 2-2** — Blocked Video Waveform*

☐ Step 6: Select DISPLAY CLAMP on the front panel of the 11T5H. Use the knob on the 11T5H to set the clamp to **EXT1**. The portions of the waveform that are at the black level should return to within one half division of the zero reference on the mainframe display as shown in Figure 2-3. This verifies that the clamp is working.

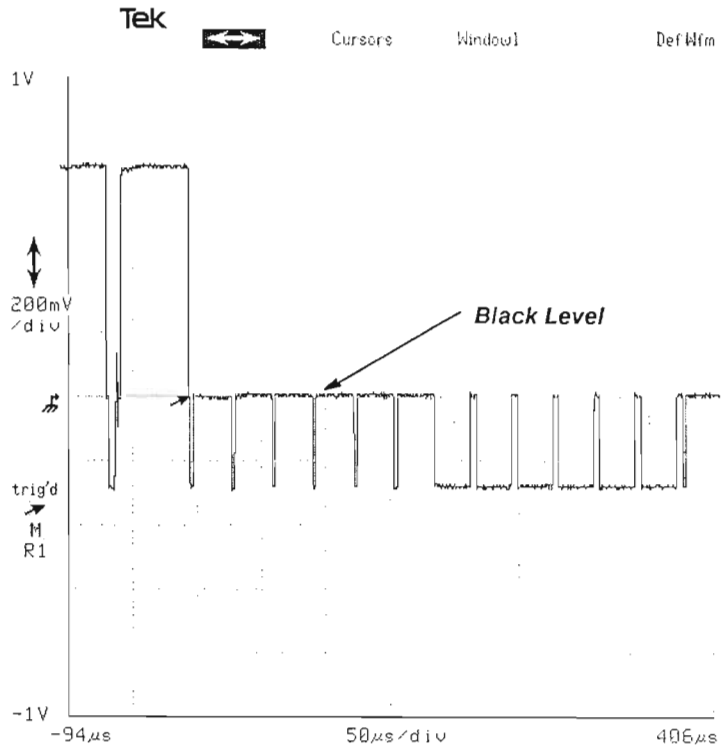


***Figure 2-3** — A Clamped Video Waveform*

☐ Step 7: To check the 11A34V channels, disconect the cable from the 11T5H. Disconnect the block and termination from the cable (neither the block nor the termination are needed to test the 11A34Vs), and connect the cable to channel 1 on the center plug-in.

☐ Step 8: On the 11T5H front panel, select TRIGGER SOURCE. Use the knob on the 11T5H to set the trigger source to **C1**.

☐ Step 9: Press CH 1 on the front panel of the 11A34V. A stable waveform should appear. On the mainframe set the sensitivity to **200 mV/div**.

☐ Step 10: On the mainframe set the impedance for C1 to **75** Ω and set coupling to **AC**.

☐ Step 11: Select DISPLAY CLAMP on the front panel of the 11T5H. Use the knob on the 11T5H to set the clamp to **C1**. The portions of the waveform that are at the black level should return to within one half of a division of the zero reference on the mainframe display. This verifies that the clamp is working for this channel.

☐ Step 12: Repeat the steps 8 through 11 substituting C2, L1, and L2 for C1 until each channel has been tested.

Note: *Channels 3 and 4 on the 11A34V are not available as trigger sources or for clamping.*

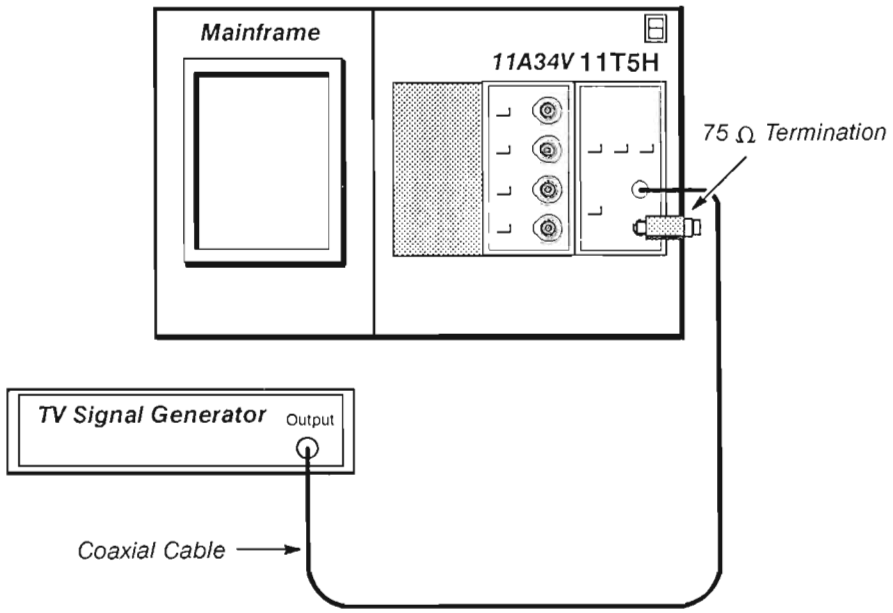
Note: *To adjust the display clamp level, see Adjustment Procedure 4.*

Procedure 5 Jitter Test

This procedure shows the setup and lists the procedure to test jitter. Jitter should be less than or equal to ten nanoseconds for an HDTV source.

Setup to Check Jitter

The 11T5H should be in the rightmost plug-in compartment of the mainframe.



Procedure to Check Jitter

- ☐ Step 1: Initialize the mainframe's settings.
- ☐ Step 2: Connect a 75 Ω termination to the OUTPUT BNC of the 11T5H.
- ☐ Step 3: Connect a 75 Ω cable from the TV generator's output to the INPUT BNC of the 11T5H.
- ☐ Step 4: Set the TV generator to output an HDTV white (flat) field. If NTSC is used, double the jitter specification to 20 ns/div.
- ☐ Step 5: Press EXT 1 on the front panel of the 11T5H. A stable waveform should appear on the mainframe's display. If the waveform is not stable, check to make sure VIDEO POLARITY is set to **NORM** on the 11T5H.
- ☐ Step 6: Use Main Pos on the mainframe to position the trigger arrow close to the second graticule line (from the left).
- ☐ Step 7: Define a second waveform as R1 + 0. (Press DefWfm, R1 + 0, Enter Desc.)

☐ Step 8: Using Main Pos and Main Size on the mainframe, position the horizontal sync pulse at the trigger arrow in the center of the screen at 100 ns/div.

☐ Step 9: Using Vertical Pos on the mainframe, move the waveform vertically to center screen, then set Vertical Mag to 10 mV/div.

☐ Step 10: Select Pan/Zoom on the mainframe and use Horizontal Magnify and Position to center the waveform at 10 ns/div. The mainframe display should appear as shown in Figure 2-4.

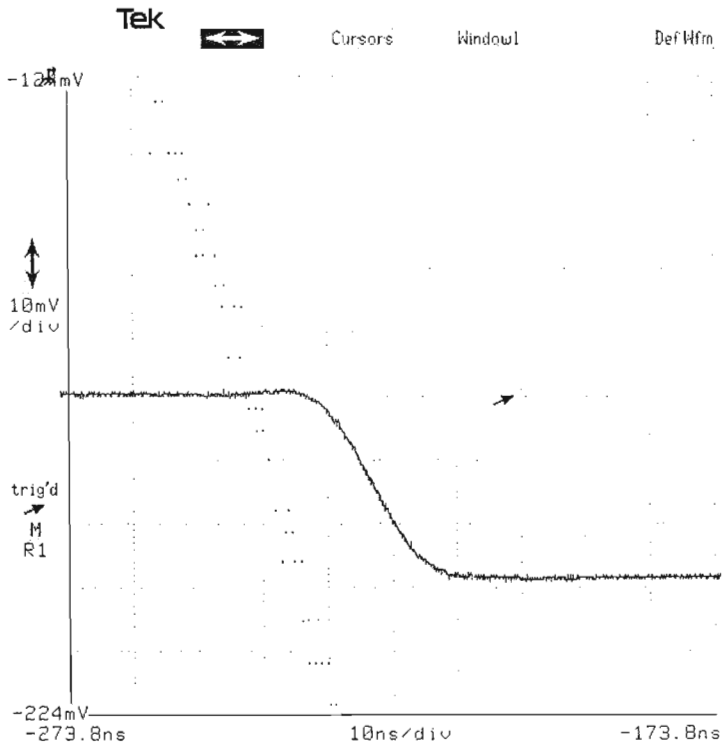


***Figure 2-4** — Jitter*

☐ Step 11: Check for less than 10 ns/div of jitter.

Adjustment Procedures

Adjustment Procedures are used to restore optimum performance or to return the 11T5H Multistandard Video Trigger to conformance with its Performance Requirements.

Adjustment of the instrument must be done at an ambient temperature between +20°C and +30°C, and the instrument must have had a warm-up period of at least 20 minutes. Performing this procedure while the temperature is drifting or before the Digitizing Mainframe is calibrated may cause erroneous calibration settings.

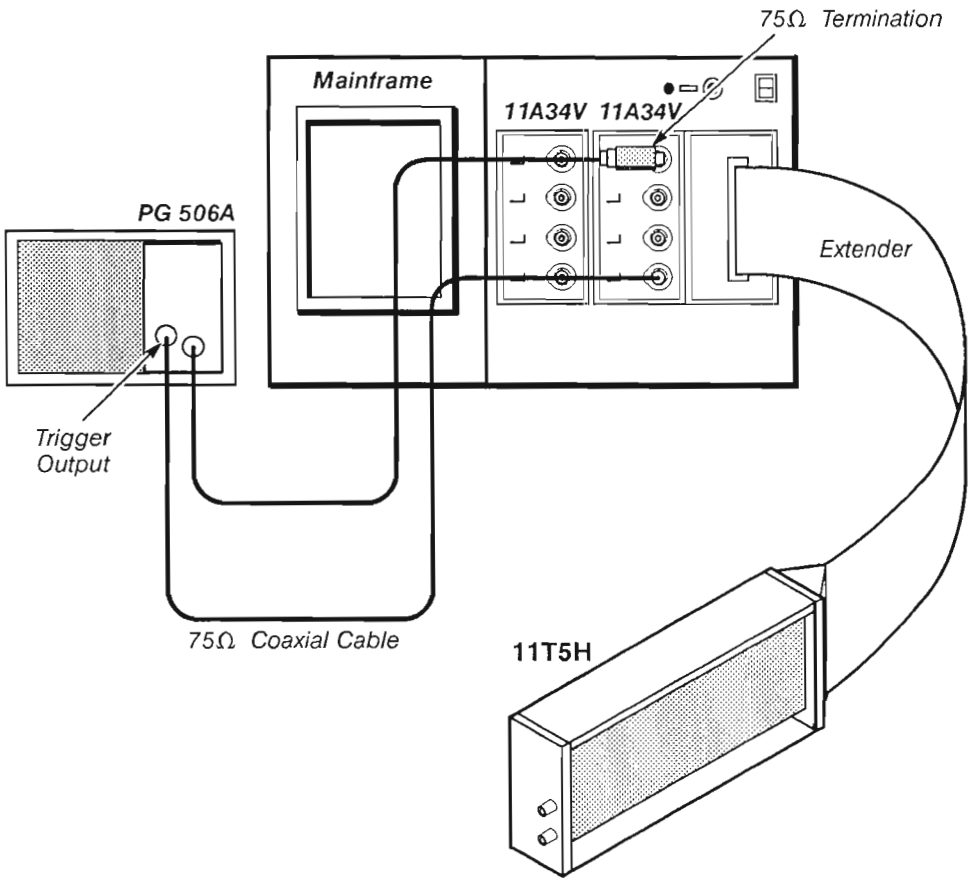
Adjustment Procedure 1 Gain, Flatness, Offset, and Front Corner

This procedure describes how to adjust gain, flatness, offset, and front corner. All adjustments are made on the Main Board of the 11T5H. Refer to Figure 2-5 for resistor and capacitor locations.

Equipment Required:
Digitizing Mainframe
11T5H
11A34V
Calibration Generator
Precision 75 Ω Cables
75 Ω Termination
Alignment tool

Setup to Adjust Gain, Flatness, Offset, and Front Corner

Insert an 11A34V in the center compartment of the mainframe. Use an extender to connect the 11T5H to the right compartment of the mainframe. Remove the side panels of the 11T5H. (See the Maintenance section).



Procedure to Adjust Gain, Flatness, Offset, and Front Corner

- ☐ Step 1: Initialize the mainframe's settings.
- ☐ Step 2: Set up the PG 506A Calibration Generator to generate a 1 V, 0.1 ms period, fast positive edge square wave.
- ☐ Step 3: Connect a 75 Ω cable to the trigger output of the PG 506A. Connect the cable to the CH 4 on the front panel of the 11A34V.
- ☐ Step 4: Press the CH 4 button on the front panel of the 11A34V.
- ☐ Step 5: On the mainframe, set the CH 4 impedance to 75 Ω.
- ☐ Step 6: Press AUTOSET on the front panel of the mainframe.

Steps 7 through 10 are used to adjust the output from the PG 506A.

☐ Step 7: Connect a 75 Ω cable to the PG 506A positive edge (⌐) output. Connect a 75 Ω Termination to the end of the cable. Connect the cable to CH 1 on the front panel of the 11A34V.

☐ Step 8: Press the CH 1 button on the front panel of the 11A34V.

☐ Step 9: Press AUTOSET on the front panel of the mainframe.

☐ Step 10: Use Vertical Size to adjust the Volts per division to **200 mV/div**. Average eight waveforms (turn averaging **ON**; Average N should be **8**). Use the Peak-Peak measurement to set the waveform to 1 V ± 20 mV. Adjust the PG 506A as needed and record the actual Peak-Peak measurement reading.

☐ Step 11: Disconnect the cable from CH 1 on the front panel of the 11A34V. Remove the 75 Ω Termination from the cable. Connect the output of the PG 506A Calibration Generator to the INPUT connector of the 11T5H.

☐ Step 12: Connect the 75 Ω Termination to the external OUTPUT BNC of the 11T5H.

☐ Step 13: Press the EXT 1 button on the front panel of the 11T5H. A waveform will appear.

☐ Step 14: Turn on waveform averaging for this waveform. Average N should be **8**.

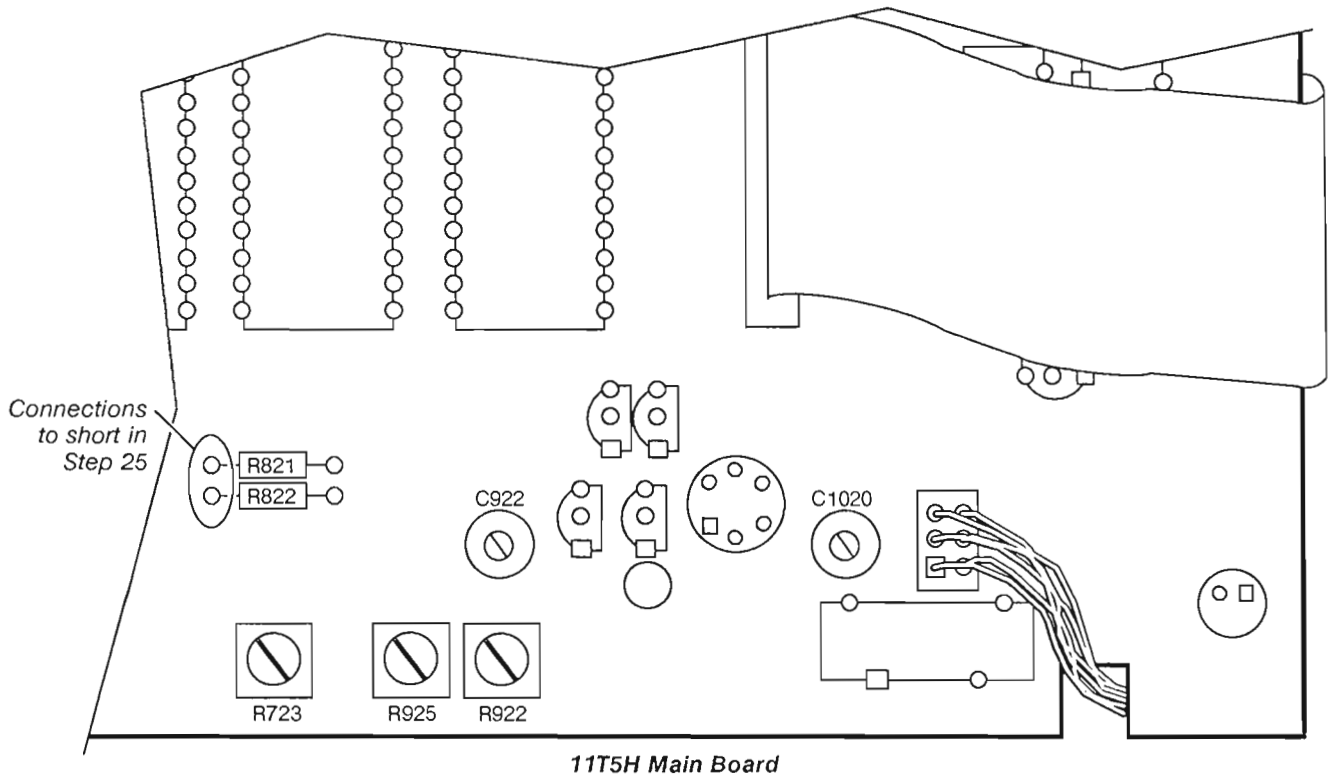


***Figure 2-5** — Lower Right Corner of the 11T5H Main Board*

☐ Step 15: Press CH 1 and CH 4 on the on the front panel of the 11A34V to remove the traces. Note: CH 4 is still the trigger channel.

☐ Step 16: Set the Main Size to **10 µs/div**.

☐ Step 17: Use R723 (refer to Fig. 2-5 for resistor and capacitor locations) on the main board of the 11T5H to move the waveform up a quarter of a division.

☐ Step 18: Use the Peak-Peak measurement to measure the voltage. (Touch Peak-Peak twice in the major menu area so measurement annotation lines appear.)

For Gain use 067-0916-00 CHR 2-D

☐ Step 19: If the Peak-Peak measurement is not 1.00 V ±50 mV, set the Gain with R925 to within ±20 mV of the reading recorded in Step 10 as shown in Figure 2-6.

☐ Step 20: If the flatness needs to be adjusted use C1020 (note that flatness affects the voltage measurement). Figure 2-6 shows the correct flatness adjustment.

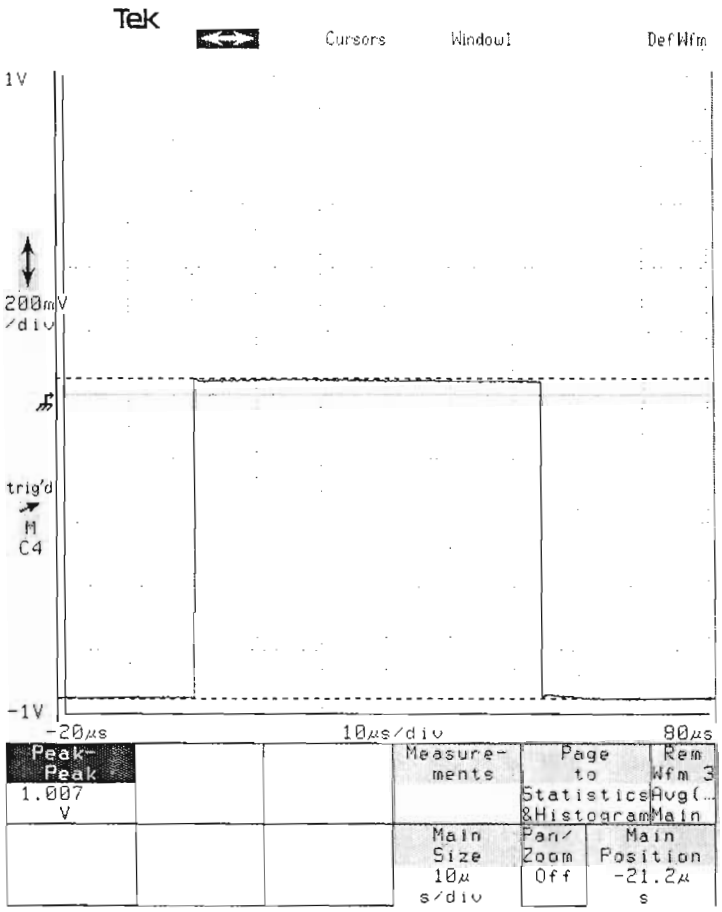


***Figure 2-6** — Correct Gain and Flatness*

☐ Step 21: Turn off waveform averaging.

☐ Step 22: Increase Main Size to **10 ns/div**.

☐ Step 23: Check for ±6% ringing or aberrations in the front corner.

☐ Step 24: Adjust the front corner using C922 and R922. Level out the waveform using C922 which adjusts the overall tilt. Minimize the amount of ringing by adjusting R922. (See Fig. 2-7.)

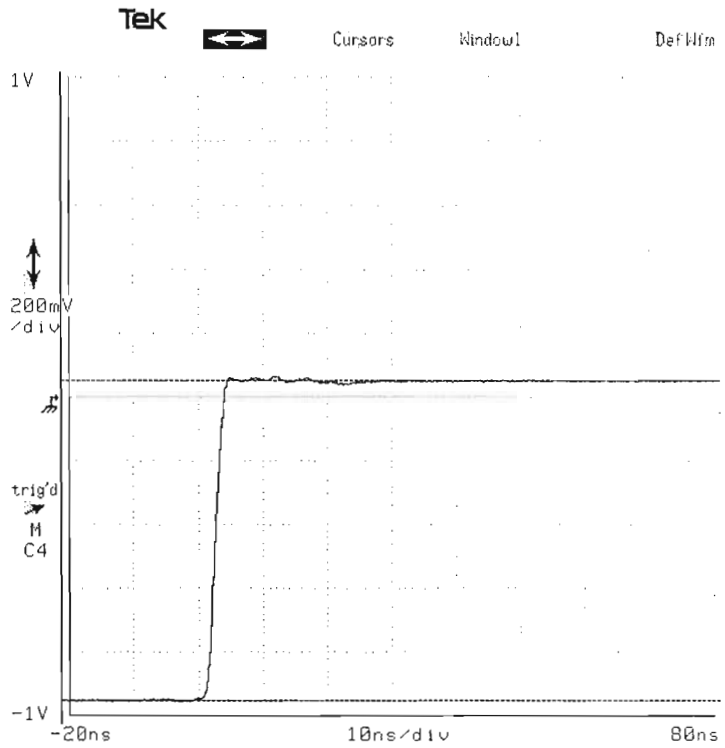


***Figure 2-7** — Correct Front Corner Adjustment*

☐ Step 25: Adjust the offset to the zero level at the center of the screen with R723. Obtain a zero reference level by alternately shorting the plus and minus display signal paths together at R821 and R822 (the plug-in interface connector ends; see Fig. 2-5 for location). Use the metal blade in the adjustment tool for shorting.

Adjustment Procedure 2 Loop Gain (R5608)

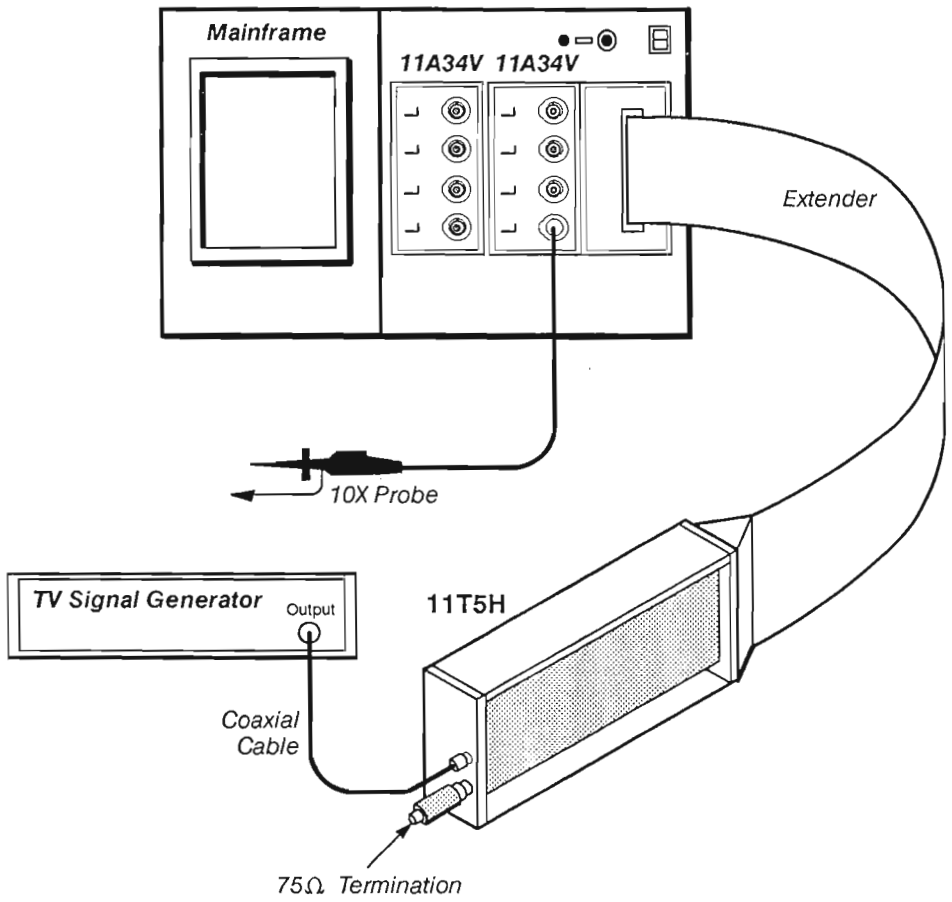
The following procedure explains how to adjust the Loop Gain. The adjustment is made on the HDTV board. Refer to Figure 2-10 for component locations.

Note: *This adjustment is factory set and requires re-adjustment only if one of the functional tests fail.*

Equipment Required: Digitizing Mainframe
11T5H
11A34V
TV Signal Generator
10X Probe
75 Ω Cable
75 Ω Termination

Setup to Adjust Loop Gain

Insert an 11A34V in the center plug-in compartment of the mainframe. Use an extender to connect the 11T5H to the right compartment of the mainframe. Remove the side panels of the 11T5H. (See the Maintenance section).



Procedure to Adjust Loop Gain

☐ Step 1: Initialize the mainframe's settings.

☐ Step 2: Set the TV Signal to generate an NTSC white field with burst.

☐ Step 3: Press the MODE button on the front panel of the 11T5H until **ACTIVE LINES** is highlighted. Make sure VIDEO POLARITY is set to **NORM** and LINE1 LOCATION is set to **AUTO**.

☐ Step 4: Connect the output from the TV Signal Generator to the external INPUT of the 11T5H. Connect a 75 Ω Termination to the external OUTPUT of the 11T5H.

☐ Step 5: Press the EXT 1 button on the front panel of the 11T5H.

☐ Step 6: Set the Main Size to **2 μs/div**. Use Main Pos to place the trigger arrow on the second graticule division. The display should appear stable.

☐ Step 7: Attach a 10X probe to channel 4 of the 11A34V. Press the CH 4 button on the front panel of the 11A34V. Set the Vertical Size to **1 V/div** and the Vertical Offset to **2.25 V**. Set the bandwidth limit to **20 MHz**.

☐ Step 8: Press EXT 1 to remove the trace.

☐ Step 9: Touch the probe tip to TP5008 (see Fig. 2-10 for component locations). An improperly adjusted waveform can appear as shown in Figure 2-8.

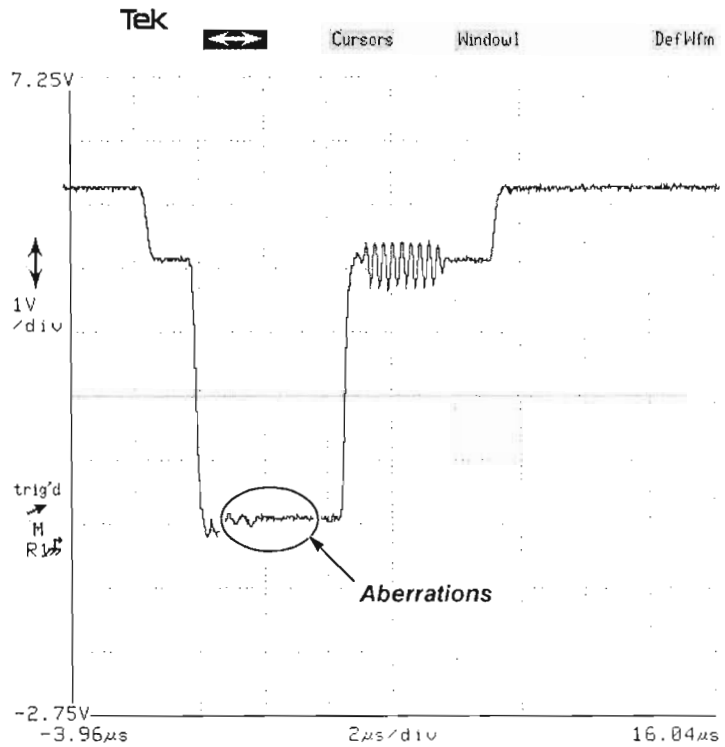


***Figure 2-8** — Waveform with R5608 Set Too Far Clockwise (Vert Size is 1 V/div)*

☐ Step 10: While watching the displayed waveform, turn R5608 counterclockwise and observe that aberrations in the bottom of the sync pulse decrease. R5608 should be adjusted to the point where the bottom of the pulse just starts to move down and the aberrations just disappear, as shown in Figure 2-9. If you continue to turn R5608, the bottom of the sync pulse will flatten out completely. This indicates an over-driven condition. Typically, R5608 is properly adjusted when its pointer is at 11 o'clock.

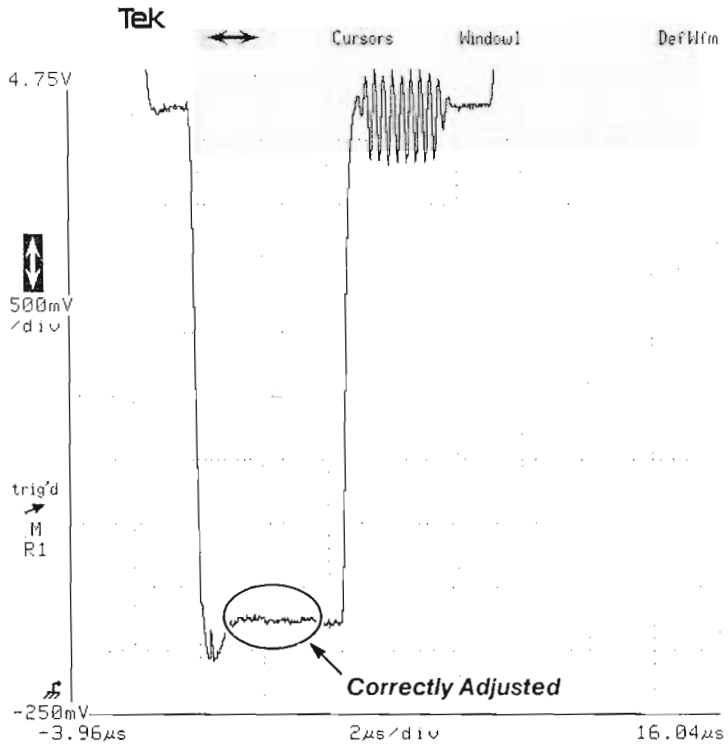


***Figure 2-9** — Waveform After Loop Gain Adjustment (Vert Size is 500 mV/div)*

Adjustment Procedure 3 Back Porch Clamp Timing (R5710)

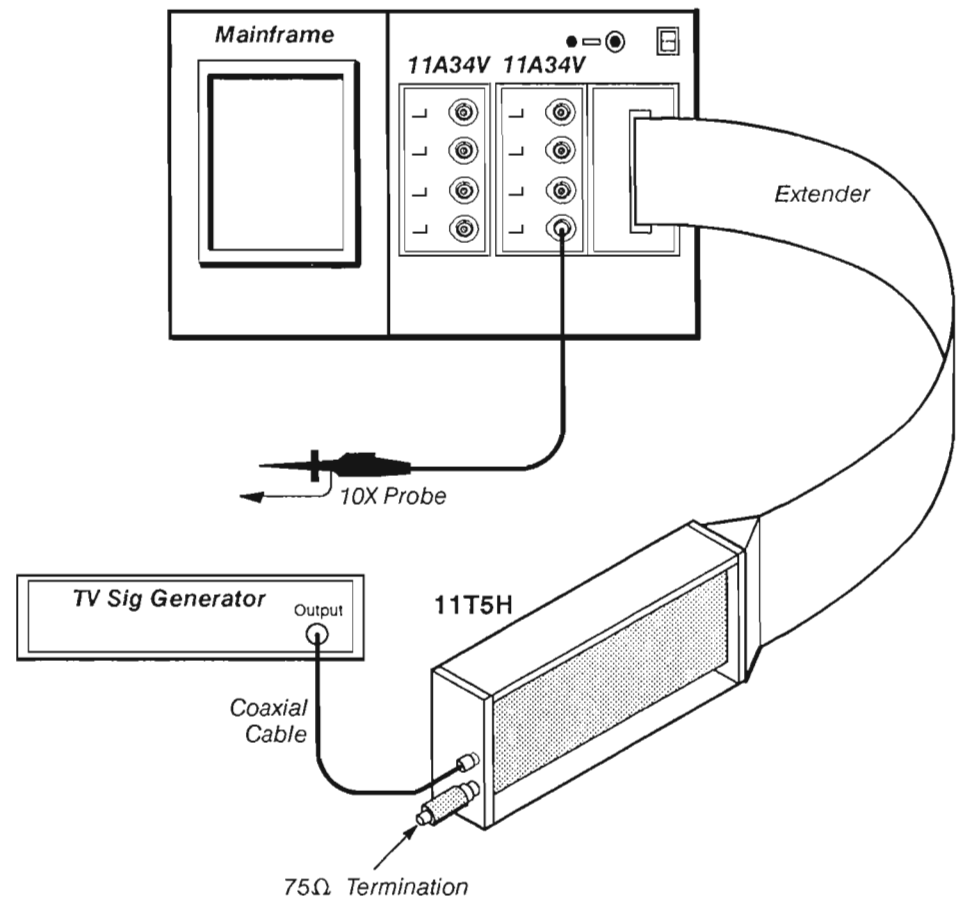
The following procedure explains how to adjust the back porch clamp timing. The adjustment is made on the HDTV board. Refer to Figure 2-10 for component locations.

Note: *This adjustment is factory set and requires readjustment only if a functional test fails.*

Equipment Required: Digitizing Mainframe
11T5H
11A34V
TV Signal Generator
10X Probe
75 Ω Cable
75 Ω Termination

Setup to Adjust Back Porch Clamp Timing

Insert an 11A34V in the center plug-in compartment of the mainframe. Use an extender to connect the 11T5H to the right compartment of the mainframe. Remove the side panels of the 11T5H. (See the Maintenance section).



Procedure to Adjust Back Porch Clamp Timing

☐ Step 1: Initialize the mainframe's settings.

☐ Step 2: Set the TV Signal to generate an NTSC white field with burst.

☐ Step 3: Connect the output from the TV Signal Generator to the external INPUT of the 11T5H. Connect a 75 Ω Termination to the external OUTPUT of the 11T5H.

☐ Step 4: Press the MODE button on the front panel of the 11T5H until **ACTIVE LINES** is highlighted. Make sure VIDEO POLARITY is set to **NORM** and LINE 1 LOCATION is set to AUTO.

☐ Step 5: Press the EXT 1 button on the front panel of the 11T5H.

☐ Step 6: Set the Main Size to 1 μs/div.

☐ Step 7: Attach a 10X probe to channel 4 of the center 11A34V. Press CH 4 on the front panel of the 11A34V. Set the Vertical Size to **2 V/div**.

☐ Step 8: Touch the probe tip to pin 8 of U5890 (see Fig. 2-10 for component locations).

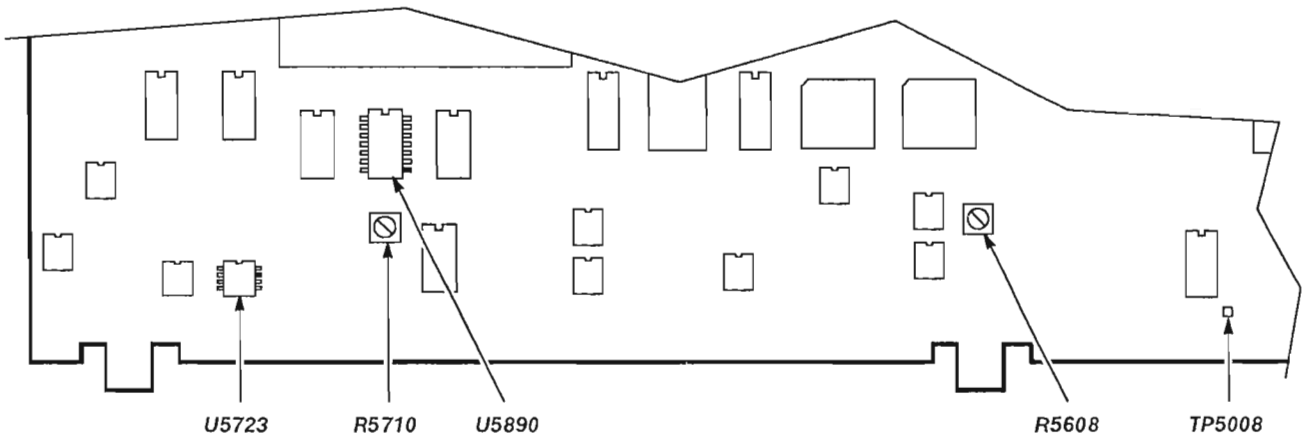


***Figure 2-10** — Lower Left Corner of the 11T5H HDTV Board*

☐ Step 9: Use Main Pos to align the falling edge of the pulse from pin 8 U5890 to the second vertical graticule line as shown in Figure 2-11. (For more accuracy, use the fine knob resolution.)

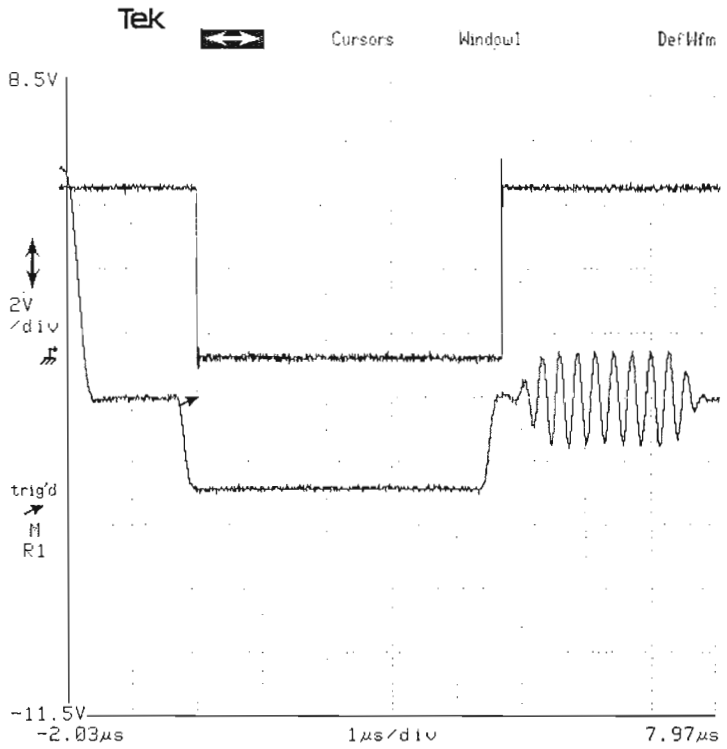


***Figure 2-11** — Centered Waveform and Signal from U5890*

☐ Step 10: Move the probe tip to pin 7 of U5723.

☐ Step 11: While watching the displayed waveform from pin 7 U5723, adjust R5710 to the point at which the rising edge on the waveform coincides with the fifth vertical graticule line. The correct adjustment is illustrated in Figure 2-12.

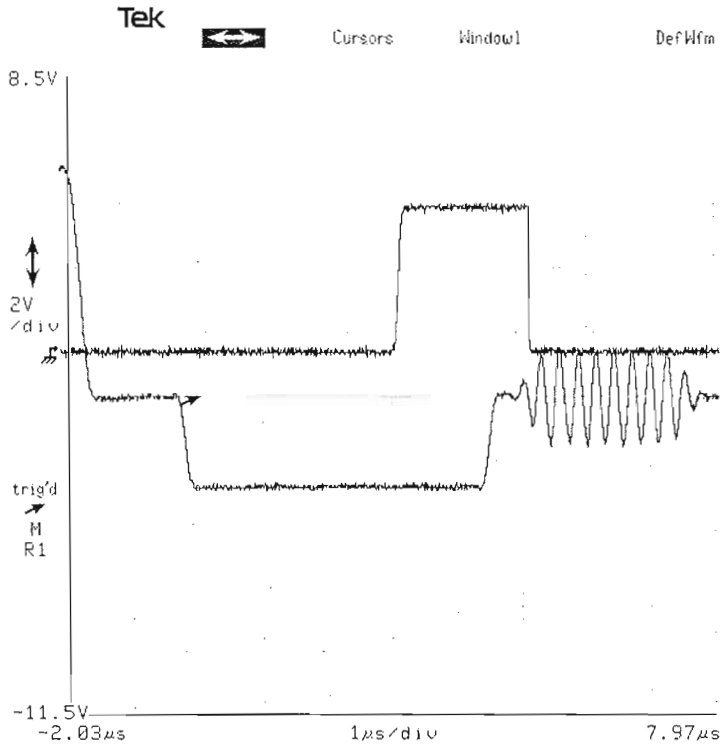


Figure 2-12 *— Back Porch Clamp Timing Adjustment*

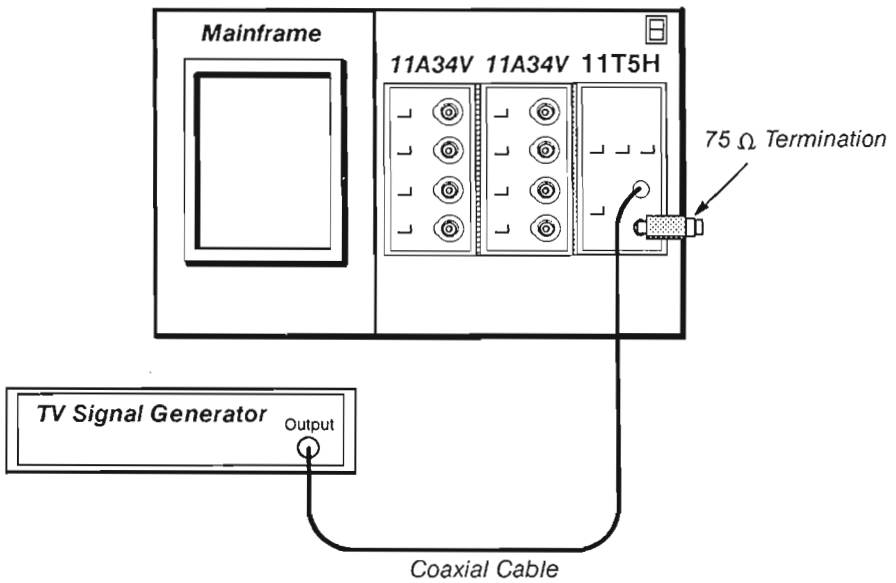
Adjustment Procedure 4 Back Porch Clamp Reference

The following procedure explains how to adjust the back porch clamp reference. All adjustments are made on the HDTV board. Refer to Figure 2-10 for component locations.

Equipment Required: Digitizing Mainframe
11T5H
11A34V
TV Signal Generator
10X Probe
75 Ω Cable
75 Ω Termination

Setup to Adjust the Back Porch Clamp Reference

Insert two 11A34V plug-in amplifiers in the center and the left plug-in compartments of the mainframe. Insert the 11T5H in the right compartment of the mainframe. Run Enhanced Accuracy. If two 11A34Vs are not available, move the 11A34V from the center to the left compartment during the second part of this adjustment. Run Enhanced Accuracy after you move the 11A34V.



Procedure to Adjust the Back Porch Clamp Reference

☐ Step 1: Initialize the mainframe's settings.

☐ Step 2: Set the TV Signal to generate an NTSC white field with burst.

☐ Step 3: Connect the output from the TV Signal Generator to the external INPUT of the 11T5H. Connect a 75 Ω Termination to the external OUTPUT of the 11T5H.

☐ Step 4: Press the EXT 1 button on the front panel of the 11T5H. A stable trace should appear.

☐ Step 5: Set the Main Size to **50 μs/div**. Use Main Pos to move the trigger arrow to the second graticule division.

☐ Step 6: Select DISPLAY CLAMP on the front panel of the 11T5H. Note the position of the trace with clamp off. While watching the trace, use the knob on the 11T5H to set the clamp to **EXT1**. *Check* if the trace shifts more than ½ division. If so, then the back porch clamp reference should be adjusted. Note: The TV signal generator must be DC coupled during this test, so that the black level will be the ground reference.

☐ Step 7: To adjust the back porch clamp, press all three setup buttons on the 11T5H at one time. A number will appear on the 11T5H display. Use the knob on the 11T5H to align the trace to the same vertical position it was at when clamp was off.

☐ Step 8: Select DISPLAY CLAMP (touching any single setup button returns the 11T5H to standard operation) and set it to OFF.

☐ Step 9: To verify the back porch clamp reference for L1, L2, C1, and C2 using the 11A34Vs, attach the TV signal generator output to CH 1 of the center 11A34V. Select TRIGGER SOURCE on the 11T5H and set it to **C1**.

☐ Step 10: Press CH 1 on the 11A34V. On the mainframe, set the 11A34V sensitivity to **200 mV/div**. Set the Impedance to **75 Ω**. *Check* that the mainframe trigger is set to **R1**.

☐ Step 11: Select DISPLAY CLAMP on the front panel of the 11T5H. Note the position of the trace with clamp off. While watching the trace, use the knob on the 11T5H to set the clamp to **C1**. *Check* if the trace shifts more than ½ division. If so, then the back porch clamp reference should be adjusted.

☐ Step 12: To adjust the back porch clamp, press all three setup buttons on the 11T5H at one time. A number will appear on the 11T5H display. Use the knob on the 11T5H to optimize the setting for the least vertical shift while alternately changing the sensitivity between 500 mV/div and 100 mV/div.

☐ Step 13: Select DISPLAY CLAMP (touching any single setup button returns the 11T5H to standard operation) and set it to OFF.

☐ Step 14: In the same manner, verify operation of the display clamp for C2, L1, and L2 with the 11A34V. If two 11A34Vs are not available, move the 11A34V from the center to the left compartment. Run Enhanced Accuracy after you move the 11A34V.

Maintenance

This section provides you with preventive maintenance, troubleshooting, ordering information, static-sensitive component information, and techniques to remove/replace the FRU (field-replaceable units) of the 11T5H Multistandard Video Trigger. Preventive Maintenance provides simple cleaning techniques that may extend the life of the 11T5H. Diagnostic Troubleshooting describes the software diagnostics that are available and describes procedures for checking suspect FRUs. Corrective Maintenance is limited to the replacement of FRUs or modules. Service beyond this level must be done at a Tektronix Service Center.

Preventive Maintenance

Preventive maintenance can prevent the 11T5H from failing and increases its reliability. Preventive maintenance entails cleaning and visual inspection of the 11T5H.

To clean or inspect the internal boards of the11T5H you must remove its side shields.

11T5H Side Shield Removal/Installation

The side shields, top and bottom frames, and front panel reduce radiation of electromagnetic interference (EMI) from the 11T5H. They also reduce the amount of dust reaching the interior. Therefore, when not maintaining the 11T5H, keep the side shields in place.

Remove a side shield as follows:

- ☐ Step 1: Gently pry the side shield from the rear of the 11T5H.
- ☐ Step 2: Lift up on the shield.
- ☐ Step 3: Remove the shield from the grooves in the frame and front panel.

Install a side shield as follows:

- ☐ Step 1: Position the shield over the frame grooves.
- ☐ Step 2: Slide the front lip of the side shield under the front panel.
- ☐ Step 3: Press down on the shield until it snaps into place. (Pressure must be applied along the full length of the frames to secure the shield.)

Note that the 11T5H will not slide into the mainframe if the side shields are not fully seated in the frames.

Cleaning

The 11T5H should be cleaned as often as operating conditions require. Dirt on a component acts as an insulating blanket and prevents efficient heat dissipation. Dirt also provides an electrical conduction path, which may cause the 11T5H to fail.

CAUTION

Use anti-static protection when working on the 11T5H to prevent static damage to components.

Exterior—dust can be removed with a soft cloth or small brush. A brush is particularly useful for dislodging dirt in and around the side shield ventilation holes and front panel switches. Remove the side shields before cleaning.

Interior—cleaning of the 11T5H is seldom required. If the interior of the 11T5H accumulates dust or dirt clean with dry, low-velocity air. Remove stubborn dirt with a soft brush or a cloth dampened with a mild detergent and water solution. (A cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning delicate components.) Finally, remove any cleaning residue by wiping with a damp washcloth.

CAUTION

To prevent damage from electrical shorts, the boards and components must be dry before applying power.

Visual Inspection

The 11T5H should be inspected occasionally for loosely-seated or heat-damaged components. The corrective procedure for most visible defects is replacement; however, particular care must be taken if heat-damaged parts are found. Since overheating usually indicates other problems with the 11T5H, correcting the cause of overheating is important to prevent the damage from recurring.

Diagnostic Troubleshooting

The mainframe automatically performs a series of diagnostic tests when it is powered on and the microprocessor unit (MPU) is reset. Extended diagnostics (see your mainframe service reference) allow you to further diagnose faulty FRUs on the 11T5H.

CAUTION

Turning the mainframe power off during the execution of the diagnostic tests may result in losing some or all of the nonvolatile RAM (NVRAM) data (for example, stored settings and calibration constants). This loss of data may cause the mainframe to operate unpredictably. If this occurs, refer to Restoring Calibration Data later in this section.

Extended Diagnostics

The mainframe will check the major memory devices of the 11T5H. Refer to your mainframe's *Service Reference* for more information on Extended Diagnostics or Extended Test menus and operation. Table 3-1 lists the FRUs that Extended Diagnostics will check, and the suspect 11T5H board.

Table 3-1 — 11T5H Extended Diagnostics

Suspect Module	*Suspect Board*
EPROM	Main Board
RAM	Main Board
NVRAM	Main Board

Conventional Troubleshooting

This section lists faulty FRUs and symptoms that Extended Diagnostics cannot detect. After determining the suspect FRU, refer to the Corrective Maintenance section for instructions on removing and replacing it.

Troubleshooting the PALs—The 11T5H main board uses three programmable array logic chips (PALs). These chips provide GPIB and mainframe/plug-in communication control.

The CONV. PAL converts Intel communication (bus) standards into Motorola (on-board) communication standards. If communication between the terminal and the mainframe is lost when using plug-in specific commands, the CONV. PAL chip may be faulty.

The RPAL is the reception controller for the 11T5H. If the 11T5H fails to respond to commands from the mainframe, the RPAL may be faulty.

The TPAL is the transmission controller for the 11T5H. If the mainframe fails to respond to front panel settings of the 11T5H, the TPAL may be faulty.

These PALs are not FRUs, so failure of any one of them should be corrected by replacing the main board.

Field Replaceable Unit (FRU) Guide

This section lists board FRUs, and component/module FRUs. The tables list the hybrid, integrated circuit (IC), module, or board FRU suspected of causing a diagnostic error. The FRU in each category is listed in order of most-to-least probable cause (assuming only one error is indicated). If any errors occur, inspect the suspect FRU for loose connections and components and then repeat the diagnostic test. If any errors recur, then replace the suspect FRU with a good FRU. Verify that the new FRU is a correct replacement for the old FRU. If the old FRU contains firmware, be sure that the new firmware version is either the same or updated.

Abbreviations of Component Names—Table 3-2, Component Location, lists the location designator for the FRUs.

Table 3-2 *— Component Location*

Name	*Location Designator*
EPROM	U710
RAM	U810
NVRAM	U711

If the corrective maintenance procedures do not restore normal operation, contact a Tektronix Service Center.

Ordering Parts

If you find that it is necessary to replace an FRU or an FRU IC, it can be ordered from a Tektronix Service Center. When ordering replacement parts, include the following information:

- Plug-in type
- Plug-in serial number
- Description of the part (if electrical, include the circuit number)
- Tektronix part number

If a part you order has been replaced with a different or improved part, your local Tektronix Service Center or representative will contact you concerning any changes.

Static-Sensitive Device Classification

Static discharge can damage semiconductors in the 11T5H.

The 11T5H contains electrical components that are susceptible to damage from static discharge. Refer to Table 3-3, Relative Susceptibility to Damage from Static Discharge, for the relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Observe the following precautions to avoid damage:

- Minimize handling of static-sensitive components.
- Transport and store static-sensitive components or assemblies in their original containers, either on a metal surface or conductive foam. Label any package that contains static-sensitive assemblies or components.
- Wear a wrist strap while handling these components to discharge the static voltage from your body. Servicing static-sensitive assemblies or components should be performed only at a static-free work station. The use of the static control mat is recommended.

- Clear anything from the work station surface that is capable of generating or holding static charge.
- Keep component leads shorted together whenever possible.
- Pick up components by the body, never by the leads.
- Do not slide components over any surface.
- Avoid handling components in areas that have a floor or a work surface that is capable of generating static charge.

Table 3-3 *— Relative Susceptibility to Damage from Static Discharge*

Semiconductor Classes	**Relative Susceptibility Levels**[1]
MOS or CMOS microcircuits, and discrete or linear microcircuits with MOS inputs (most sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFETs	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (least sensitive)	9

[1]*Voltage equivalent for levels.*

1 = 100 to 500 V
2 = 200 to 500 V
3 = 250 V
4 = 500 V
5 = 400 to 600 V
6 = 600 to 800 V
7 = 400 to 1000 V (est.)
8 = 900 V
9 = 1200 V

(The voltage equivalent is the voltage discharged from a 100 pF capacitor through a resistance of 100 Ω.)

Removing/Replacing FRUs

Once you have determined the suspect FRU remove the 11T5H side shields as discussed in the Preventive Maintenance section, find the FRU in Table 3-4, to find the removal/replacement procedure(s).

CAUTION

To avoid damage to the 11T5H, set the mainframe ON/STANDBY switch to STANDBY, and remove the 11T5H from the mainframe before removing or replacing FRUs. If the mainframe's green indicator light remains lit when the ON/STANDBY switch is in the STANDBY position, then the switch was internally disabled after the servicing of the Power Supply module. To enable the ON/STANDBY switch, refer to Corrective Maintenance in the Service Reference *for your mainframe.*

***Table 3-4** — FRU Removal/Replacement Procedure Cross Reference*

FRU to be Removed/ Replaced	Technique(s) to Reference During Removal/Replacement	Page
EPROM	Removing/Replacing an FRU IC	3-13
Front Panel	Removing/Replacing a Front Panel	3-7
Front Panel Board	Removing/Replacing a Front Panel Removing/Replacing a Multi-pin Connector Removing/Replacing a Front Panel Board	3-7 3-12 3-10
HDTV Board	Removing/Replacing a Multi-Pin Connector Removing/Replacing a HDTV Board	3-12 3-12
Main Board	Removing/Replacing a Multi-Pin Connector Removing/Replacing a Main Board Programming the Unit Identification	3-12 3-10 3-14
NVRAM	Removing/Replacing an FRU IC Programming the Unit Identification	3-13 3-14
RAM	Removing/Replacing an FRU IC	3-13

Procedures to Remove/Replace FRUs

This section provides procedures to remove and/or replace Field Replaceable Units. These procedures are in no particular order so you should refer to Table 3-4, FRU Removal/Replacement Procedure Cross Reference, to determine which procedure(s) to do.

Removing/Replacing Front Panel Connections—See Figures 3-3 and 3-5 for connector locations.

Remove the connector assembly as follows:

- ☐ Step 1: Disconnect the co-pin cable connecting the 2 BNC connectors to the Main Board assembly. Thread the connector through the slot on the bottom of the Main Board.
- ☐ Step 2: Disconnect the grey multi-pin ribbon connector that connects the Front Panel Board to the Main Board.
- ☐ Step 3: Disconnect the multi-pin connector that connects the Knob to the Main Board.
- ☐ Step 4: Remove the front panel (See Removing/Replacing the Front Panel).

Removing/Replacing the Front Panel—See Figures 3-1 and 3-2 for connector and screw locations.

Remove the front panel as follows:

- ☐ Step 1: Unhook the return spring, located on the bottom of the 11T5H, from the release bar (retain this return spring).
- ☐ Step 2: Remove the four Torx drive screws (two on the bottom and two on the top of the front panel) that secure the front subpanel to the top and bottom frames.
- ☐ Step 3: Use an allen wrench to remove the knob on the front panel.
- ☐ Step 4: Carefully separate the front panel from the subpanel by pushing on the front panel tabs. (Do not bend the front panel.)

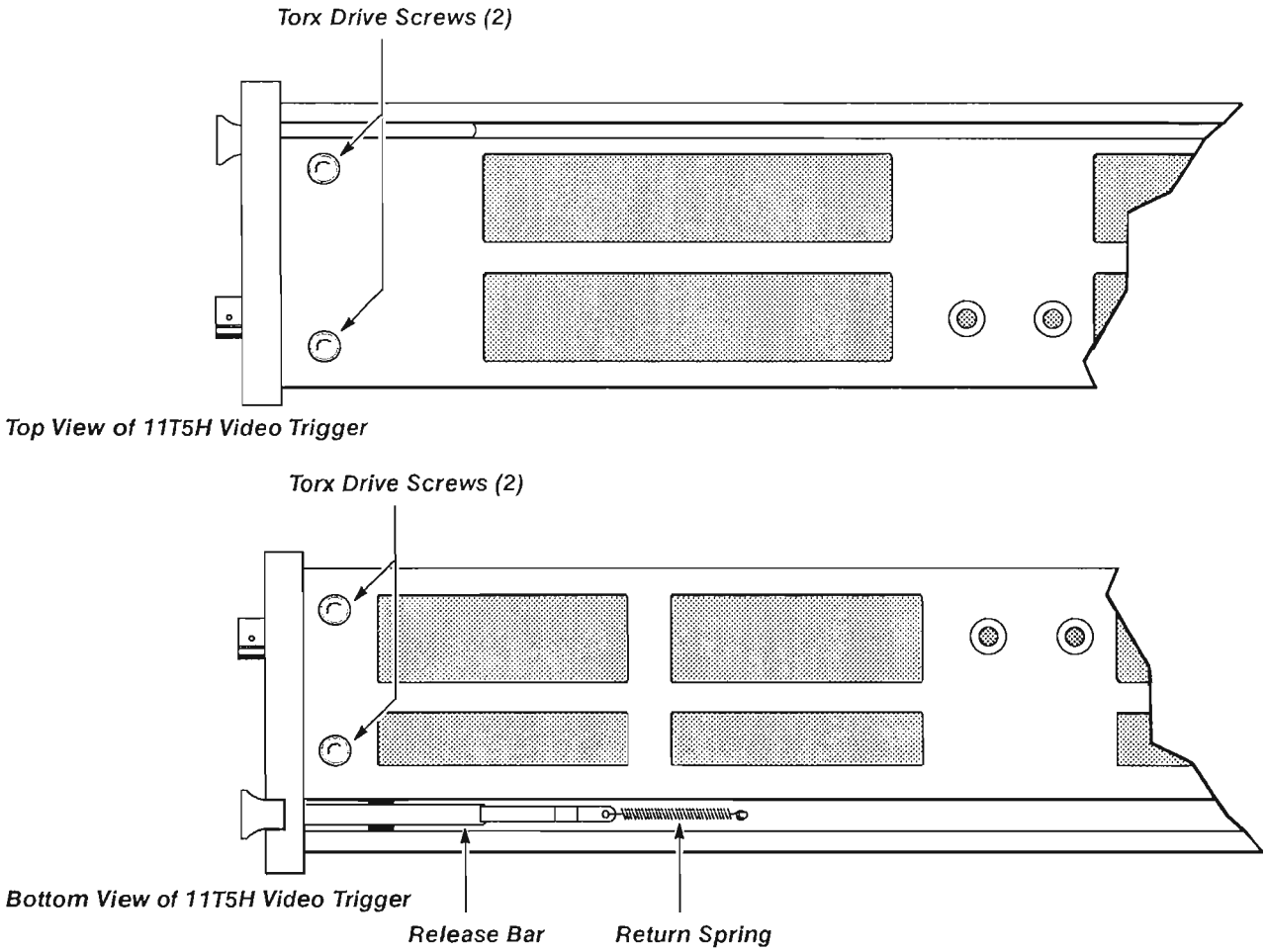


Figure 3-1 *— Removing/Replacing the Front Panel*

Replace the front panel as follows:

- ☐ Step 1: Ensure that the four screws that secure the front subpanel to the top and bottom frames are removed.
- ☐ Step 2: Ensure that the release bar return spring is removed.
- ☐ Step 3: Position the amplifier on its side, with the front panel facing toward you.
- ☐ Step 4: Pull the release bar out of the 11T5H as far as possible, and then leave the release bar in this position.
- ☐ Step 5: Position the front panel so that the notch in the bottom fits over the release bar rod, then carefully insert the four front-panel tabs into the slots in the front subpanel. (You may need to pull the top and bottom frames away from the subpanel to allow the front panel tabs to fit between the casting and the frames.)
- ☐ Step 6: Carefully snap the edges of the front panel into place around the input connectors and the outer edges of the front panel.

☐ Step 7: Replace the four Torx drive screws that secure the front subpanel to the top and bottom frames.

☐ Step 8: Replace the knob.

☐ Step 9: Replace the release bar return spring; orienting the spring so that its loop fits over the frame hook, flat against the frame section.

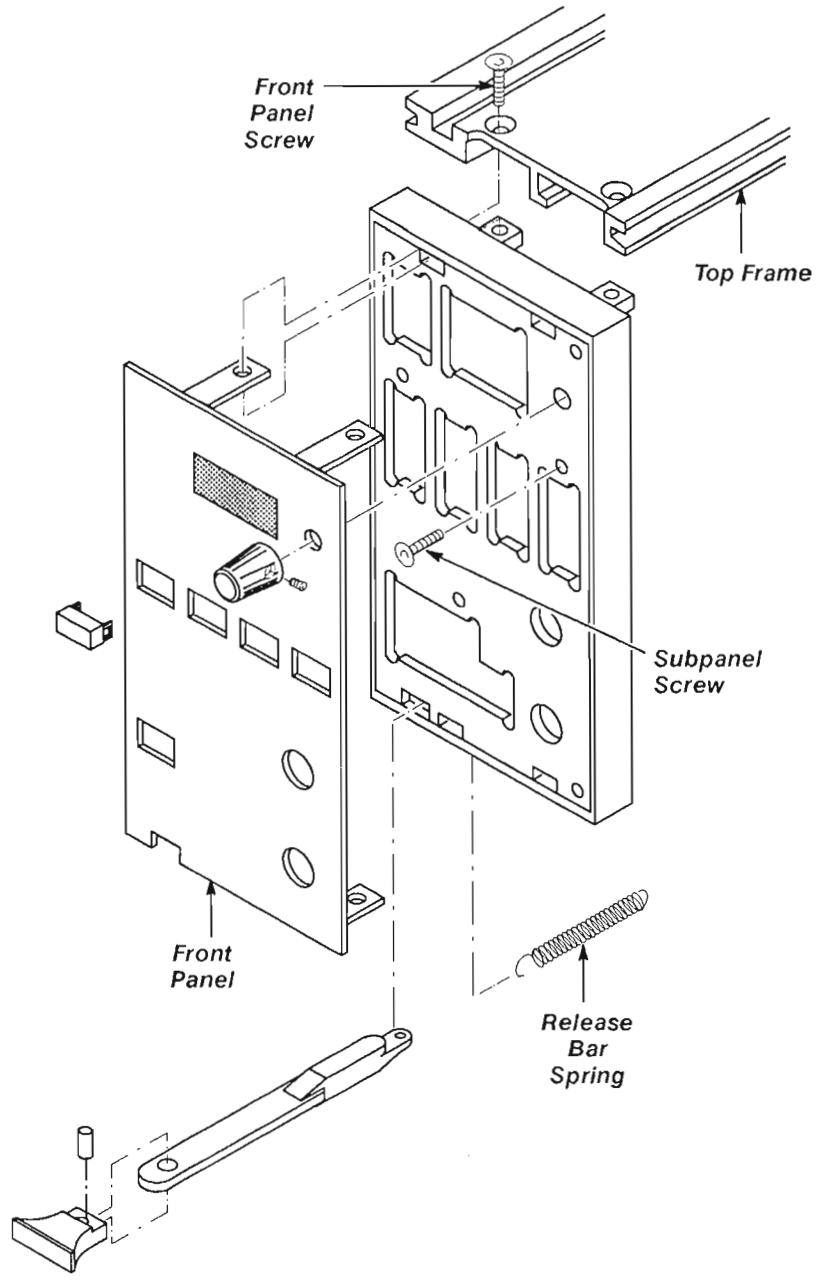


Figure 3-2 — *Removing/Replacing the Front Panel*

Removing/Replacing the Front Panel Board—See Figures 3-2, 3-1, and 3-5 for connector, screw, and index locations.

Remove and replace the Front Panel Board as follows:

- ☐ Step 1: Remove the front panel.
- ☐ Step 2: Remove the three Torx drive screws that secure the Front Panel Board to the front subpanel.
- ☐ Step 3: Remove the Front Panel Board.

To replace the Front Panel Board, perform the previous steps in the reverse order.

Removing/Replacing the Main Board—See Figures 3-3, 3-4, and 3-5 for connector, screw, and index locations.

Remove the Main Board as follows:

- ☐ Step 1: Disconnect the three multi-pin connectors that connect the Front Panel Board to the Main Board.
- ☐ Step 2: Remove the four Torx drive screws that secure the plastic rear panel to the top and bottom frames.
- ☐ Step 3: Push up on the side of the rear panel that has the locator pin, until the locator pops out of the Main Board. Remove the rear panel from the Main Board.
- ☐ Step 4: Remove the six Torx drive screws and nut blocks that secure the Main Board to the top and bottom frames.
- ☐ Step 5: Carefully withdraw the Main Board between the frames.

To replace the Main Board, perform the previous steps in the reverse order.

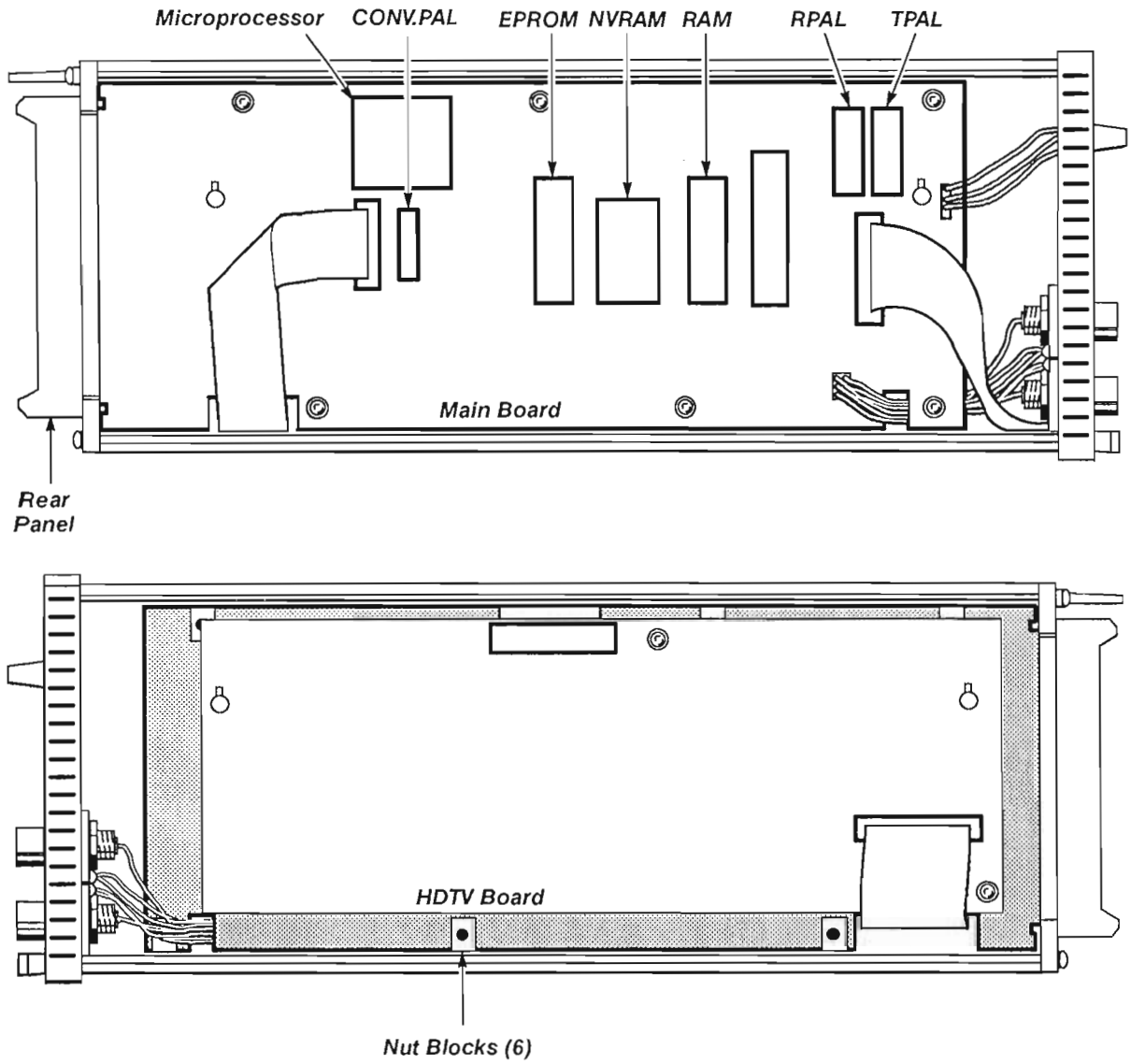


Figure 3-3 — Removing/Replacing the Main Board

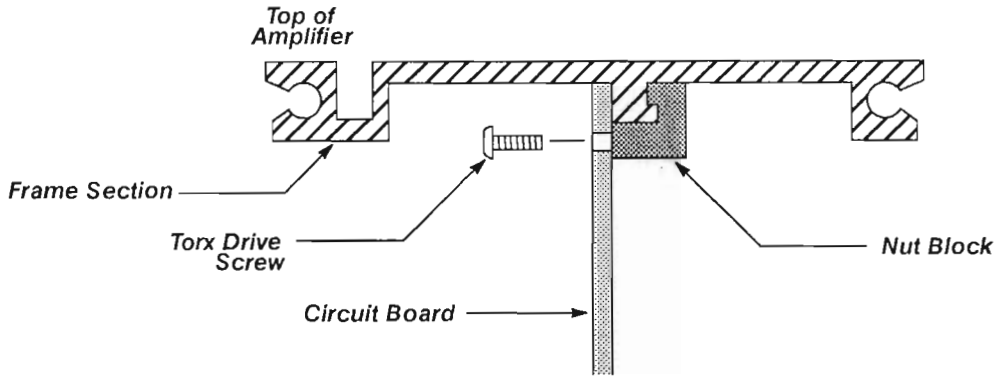


Figure 3-4 — Torx Drive Screw and Nut Block Orientation

Removing/Replacing the HDTV Board – See Figures 3-5 for connector and screw locations.

Remove the HDTV Board as follows:

- ☐ Step 1: Disconnect the gray multi-pin ribbon connector (J4232) that connects the HDTV Board to the Main Board. Slide off the ribbon connector that is underneath it (J4234).
- ☐ Step 2: Disconnect the multi-pin connector on the Main Board (J3).
- ☐ Step 3: Remove the two Torx drive screws that secure the HDTV Board to the Main Board.
- ☐ Step 4: Release the two board spacers that secure the HDTV Board to the Main Board.
- ☐ Step 5: Push back the two clips that hold the bottom of the board in place and carefully withdraw the HDTV Board between the frames.

To replace the HDTV Board, perform the previous steps in the reverse order.

Removing/Replacing Multi-Pin Connectors – This section describes the multi-pin connectors found on the 11T5H Amplifier. Pin 1 on a multi-pin connector is designated with a triangle (or arrowhead) on the holder. A square pad on the board denotes pin 1. When a connection is made to a board, the square pad determines the indexing of the symbol on the multi-pin holder.

A gap between the pin 1 and 3 positions in the holder keys a multi-pin connector. There is a corresponding gap between pins 1 and 3 on the board. (A small plastic plug covers the pin 2 position on the end of the holder.)

Align the plastic plug of the holder with the gap between the board pins (see Fig. 3-5).

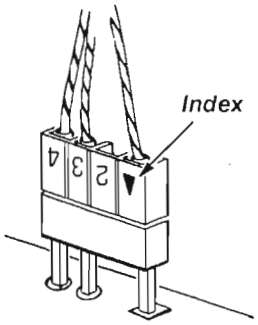


Figure 3-5 *— Multi-Pin Connector Orientation*

Removing/Replacing a Pin Jumper – The jumper on pins 2 and 3 at J720 on the Main Board is installed in the amplifier for normal operation.

If the jumper at J720 is installed over pins 1 and 2, the microprocessor will be reset. While pins 1 and 2 are jumped, the 11T5H will not operate.

Removing/Replacing an FRU IC – The Main Board has two socketed ICs that are replaceable in the field: the microprocessor (U501) and the EPROM (U710).

CAUTION

Observe all the special precautions mentioned under Static-Sensitive Device Classification earlier in this section. Avoid touching the IC or the socket contacts with your fingers since finger oils can lessen reliability.

Do not remove the label affixed to the top of any EPROM. Removing this label will allow light into the IC which may erase data.

The RAM and NVRAM ICs are soldered in. If you are required to desolder an IC from the Main Board it is suggested that you install an IC socket. A socket saves wear and tear on the Main Board when removing/replacing ICs.

Remove an FRU IC as follows:

☐ Step 1: Use IC insertion-extraction pliers to remove the IC.

☐ Step 2: Position the pliers around the outside of the IC. Squeeze the handles to grasp the IC, and slowly pull the IC from the socket.

CAUTION

Avoid touching the removed IC pins or socket contacts with your fingers. Finger oils can lessen contact reliability.

Replace an FRU IC as follows:

☐ Step 1: Grasp the IC with the IC insertion-extraction pliers; ensuring that all the pins of the IC are straight and evenly spaced. Do not use the IC label as an index; instead locate the index on the body of the IC.

☐ Step 2: Align the IC index slot with that of the socket underneath it. (Fig. 3-6 gives an illustration of this indexing.)

☐ Step 3: Align the pins with their respective socket contacts.

☐ Step 4: Press the IC slowly and evenly into its socket.

CAUTION

Avoid touching the IC or the socket contacts with your fingers. Finger oils can lessen reliability.

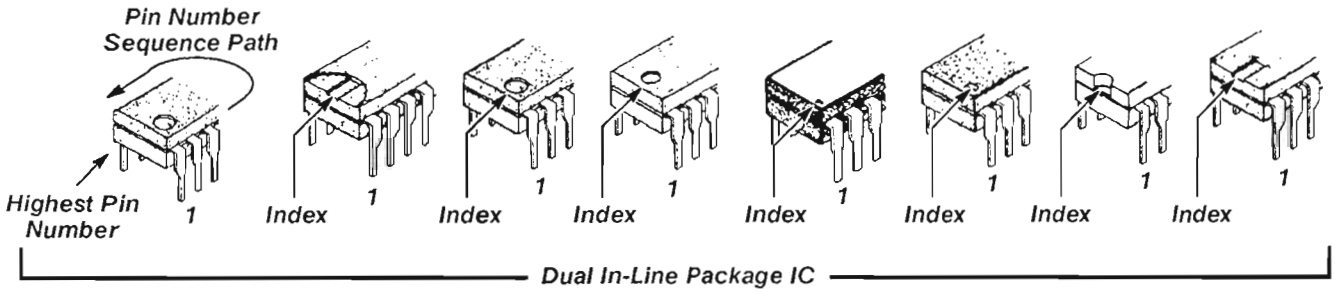


***Figure 3-6** — Semiconductor Indexing Diagram*

Programming the Unit Identification—This section discusses the procedure to enter the Unit Identification (UID) into the amplifier nonvolatile RAM (NVRAM). The UID is identical to the serial number of the amplifier, and is stored in NVRAM. You will need to enter this number if the Main Board is replaced or if data in NVRAM becomes corrupted.

Note: *The Cal Lock jumper must be installed on the mainframe before the UID write function will work. Refer to the Service Reference for your mainframe for information on installing this jumper.*

Enter the UID as follows:

☐ Step 1: Connect your terminal to the RS-232-C port of the mainframe. (Refer to the *User Reference* manual of your mainframe for instructions on setting up the RS-232-C parameters.)

☐ Step 2: Place the amplifier in any compartment.

☐ Step 3: Set the ON/STANDBY switch to ON.

☐ Step 4: Wait until the diagnostics checks are completed.

☐ Step 5: On your terminal, type the command:

UID [Left|Center|Right]:"<Serial Number>**"**

Left|Center|Right refers to the compartment in which the amplifier resides. For example, UID RIGHT:"B000001"

☐ Step 6: On the terminal, type the query:

UID? [Left|Center|Right]

Observe that the correct UID is reported.

☐ Step 7: Set the ON/STANDBY switch to STANDBY.

☐ Step 8: Remove the amplifier.

Theory of Operation

System Functional Overview

This section describes and illustrates the major functional blocks of the 11T5H Video Trigger.

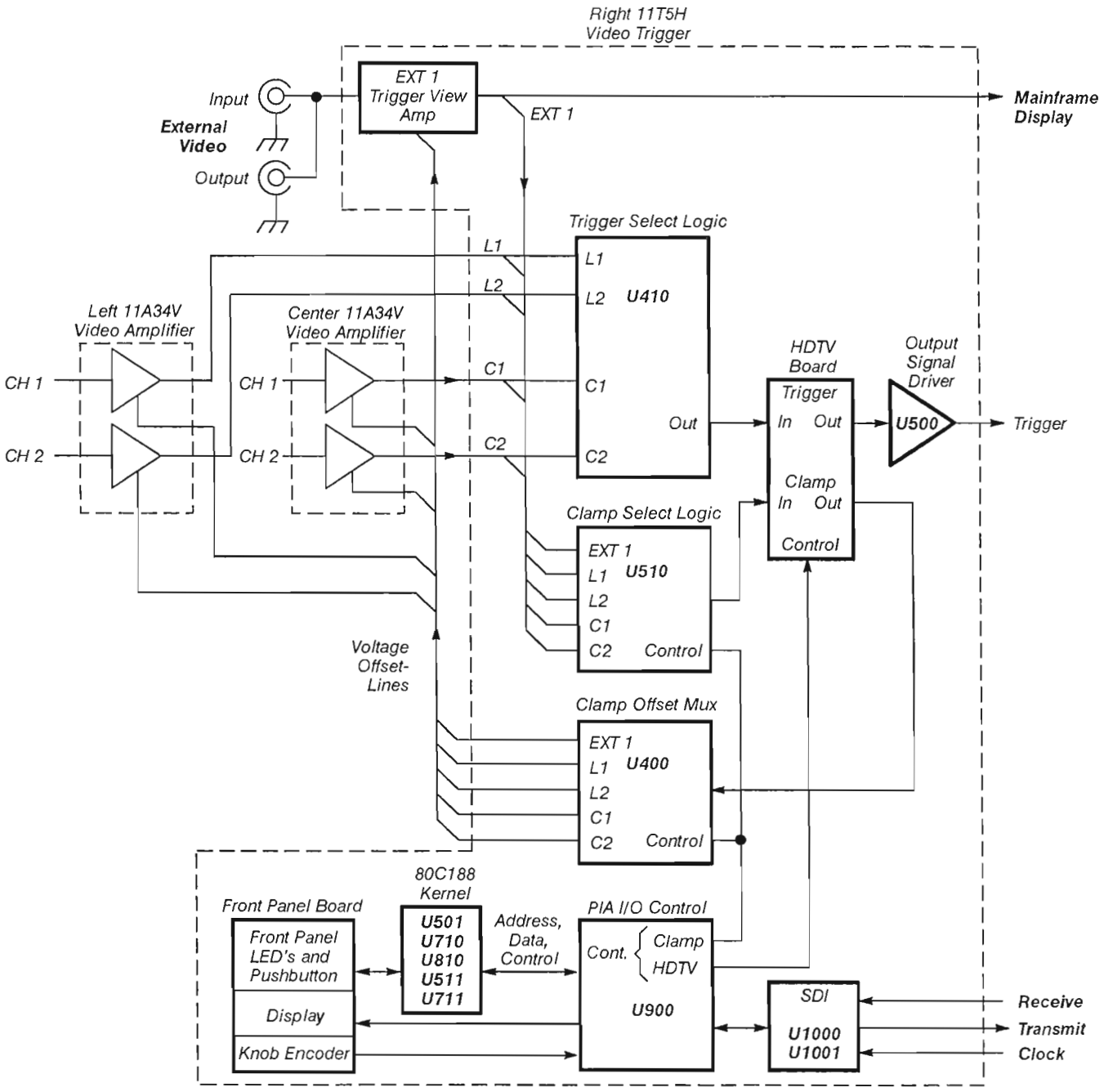


Figure 4-1 *— 11T5H Video Trigger System Functional Block Diagram*

External Trigger View Amplifier

This 1 MΩ input amplifier is used to trigger on and view a standard composite video signal supplied by the External Video Input (EXT1). It is DC coupled and its sensitivity is fixed at 200 mV/div. If the video signal is AC coupled or has a "hum" component, EXT clamp may be used to eliminate waveform tilt and prevent level changes in the average picture level (APL). The amplifier "clamps" the video signal by using a correction voltage that originates from the HDTV Board.

Clamp Select Logic

This logic block uses a demultiplexer (U510) to select the source of the video signal that is to be clamped. These video signals can originate from the External Video Input (EXT1) or CH1/CH2 of an optional 11A34V Video Amplifier plug-in. C1 and C2 correspond to Channels 1 and 2 of the center compartment and L1 and L2 correspond to Channels 1 and 2 of the left compartment.

Clamp Offset Multiplexer

This multiplexer (U400) channels clamp offset voltages generated by the HDTV Board to the selected 11A34V Amplifier plug-in.

HDTV Board

The HDTV Board obtains and generates the trigger. It determines the type of video waveform that is being received and synchronizes on it. The HDTV Board also provides vertical clamp. See the detailed block diagram (Fig. 4-2).

Output Signal Driver

This driver is used to interface the video trigger to a mainframe. It is a voltage comparator (U500) that converts a single ended trigger signal generated by the HDTV Board, into a 600 mV differential signal. At 50 mV/div this is equivalent to 12 divisions of signal to trigger the mainframe.

Trigger Select Logic

This logic block uses an analog multiplexer (U410) to route video signals from the vertical inputs to the HDTV Board. Video signals may originate from the External Video Input or CH1/CH2 of an 11A34V Amplifier plug-in.

Kernel Block

The Kernel block uses an 80C188 8-bit microprocessor (U501) and other ICs to provide the following functions:

- Control the Clamp Select Logic (U510), the Clamp Offset Multiplexer (U400), the Trigger Select Logic (U410), and the Peripheral Interface Adapter (U900).
- Convert Intel bus timing signals to Motorola bus timing signals.
- Control the Front Panel interface and Serial Data Interface.

Front Panel Board

The front panel display, push buttons, and knob encoder provide user interface functions for the 11T5H.

Serial Data Interface (SDI) I/O Block

This SDI block provides a transmission and reception block that allows communication between the 11T5H and Digitizing Mainframes. The transmission logic sends data serially, in bytes, to the mainframe. A transmit PAL (U1001) controls the handshaking with the mainframe and shifting out of the data stored in the shift register (U1111). A receive PAL (U1000) and its associated shift register (U1200) accept incoming data from the MF_TO_PI line. At power up, the SDI I/O Block is brought to an idle state by the momentary assertion of the /RES signal from U720.

Front Panel I/O

The front panel display, pushbuttons, and knob encoder are interfaced to the Kernel Block via a Peripheral Interface Adapter (PIA) (U900). The front panel LEDs are activated by writing a byte into U110, U210, or U310. The byte originating from U140 gives an image of the current pushbutton settings. Table 4-1 shows the address and its associated function.

Table 4-1 *— Front Panel I/O Addresses and Functions*

PCS3 + Address Offset	Read/Write	Function
4	Write U110	LED Drive
5	Write U210	LED Drive
6	Write U310	LED Drive
7	Read U140	Pushbutton image

Typical Signal Processing Cycle

This description of how the video trigger processes a signal is based on the following mainframe system configuration:

- Mainframe: 11400 Series, DSA 600 Series, or CSA 404.
- Left plug-in compartment: 11A34V Video Amplifier.
- Right plug-in compartment: 11T5H Multistandard Video Trigger.
- Connector: 75 Ω Coaxial Cable (connected to CH 1 input of the Video Amplifier).
- Signal Input: 1 V peak to peak Composite Video Signal.
- Input Impedance: 75 Ω.
- Video Trigger Source: L1.
- Mainframe trigger: R1

The following sequence of steps is a brief overview of how the video trigger acquires and processes a signal:

☐ Step 1: The composite TV signal is processed and passed through the Video Amplifier plug-in.

☐ Step 2: The TV signal is passed to the mainframe display path where the signal appears as a trace on the Display. The same signal is passed to the Video Trigger plug-in through the AUX Trigger Lines on the plug-in interface board.

☐ Step 3: The Video Trigger splits the differential input signal into single-ended, positive and negative polarity signals.

☐ Step 4: The negative polarity signal is passed to the HDTV Board through the Trigger Selection Multiplexer (U410).

☐ Step 5: The HDTV Board processes the signal then generates a trigger on the line that the Video Trigger has currently selected.

☐ Step 6: The trigger signal is then passed to the Main Board's Signal Output Driver (U500) where it is converted back to a differential signal.

☐ Step 7: The Signal Output Driver passes the signal to the Mainframe.

Detailed Block Diagram Descriptions

This section describes and illustrates in detail the HDTV Board of the 11T5H Video Trigger (see Fig. 4-2).

The analog section contains the composite video signal processing circuitry. It includes signal amplification, automatic gain control, back-porch clamping, sync pickoff and sync separation circuitry. Clocks at the horizontal (line) rate and a field indicator are sent to the digital section.

The digital section contains the microprocessor interface and circuitry that triggers the mainframe's sweep generator. The trigger is generated when the selected horizontal sync pulse (line) occurs.

Analog Circuitry

The HDTV Board analog circuitry processes the composite video signal. The following discussion describes the function of each major block.

Variable Gain Amplifier—Differential amplifier U5436 amplifies the input composite video signal. It contains two pairs of switching transistors that provide signal inversion when desired. The Sync Tip Clamp and Automatic Gain Control circuitry control the channel resistance of Q5530, which in parallel with R5530 determines the gain of the amplifier. The gain is automatically adjusted to maintain proper sync-tip level. With no input signal, the gain is maximum.

Fixed Gain Amplifier with Back Porch—The second stage amplifier circuitry provides additional gain to the video signal from the Variable Gain Amplifier.

Sync Pickoff Comparator—The comparator, composed of Q5515 and Q5512, is switched by the sync pulse. The switching threshold is set to 0.

Sync-Tip Clamp and Automatic Gain Control—Transconductance operational amplifier U5410 acts as a sync-tip clamp and controls the gain of U5436 by altering the channel resistance of Q5530.

Back-Porch Clamp—Transconductance operational amplifier (U5310) acts as a back-porch clamp to control the level of the video during the back-porch period.

Vertical Back-Porch Clamp—The Vertical Back-Porch Clamp clamps the back-porch level of the displayed signal to approximately zero volts.

Back-Porch Clamp Switching—The Back-Porch Clamp Switching circuitry determines when the Vertical Back-Porch Clamp is active and which of its level comparators is used.

Auto Baseline Generator—The Auto Baseline Generator producers the horizontal clock signal used in generating triggers.

Phase Locked Loop—The Phase Locked Loop (PLL) generates signals used in identifying individual fields in interlaced scan systems.

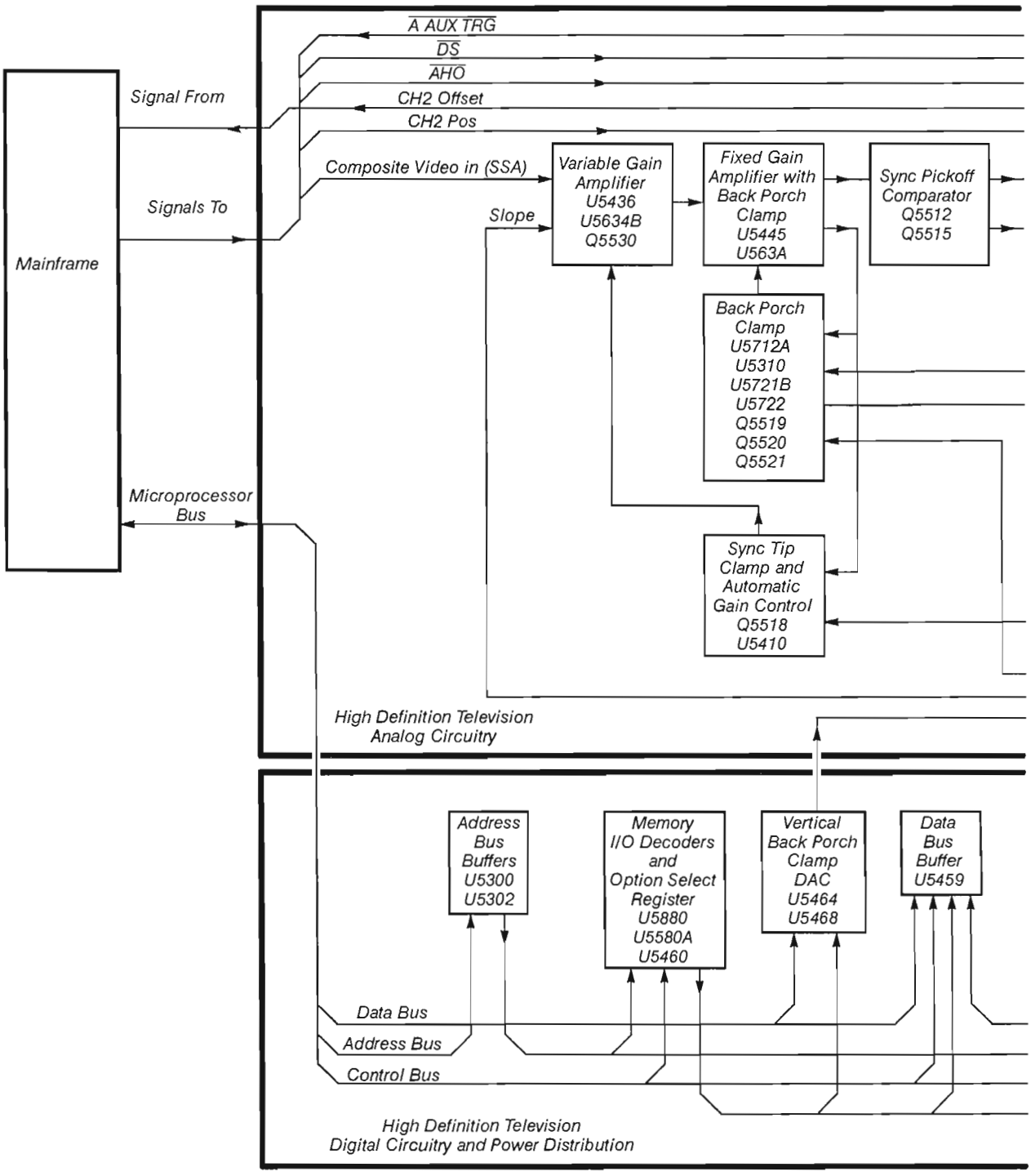


Figure 4-2A *— HDTV Board Detailed Block Diagram*

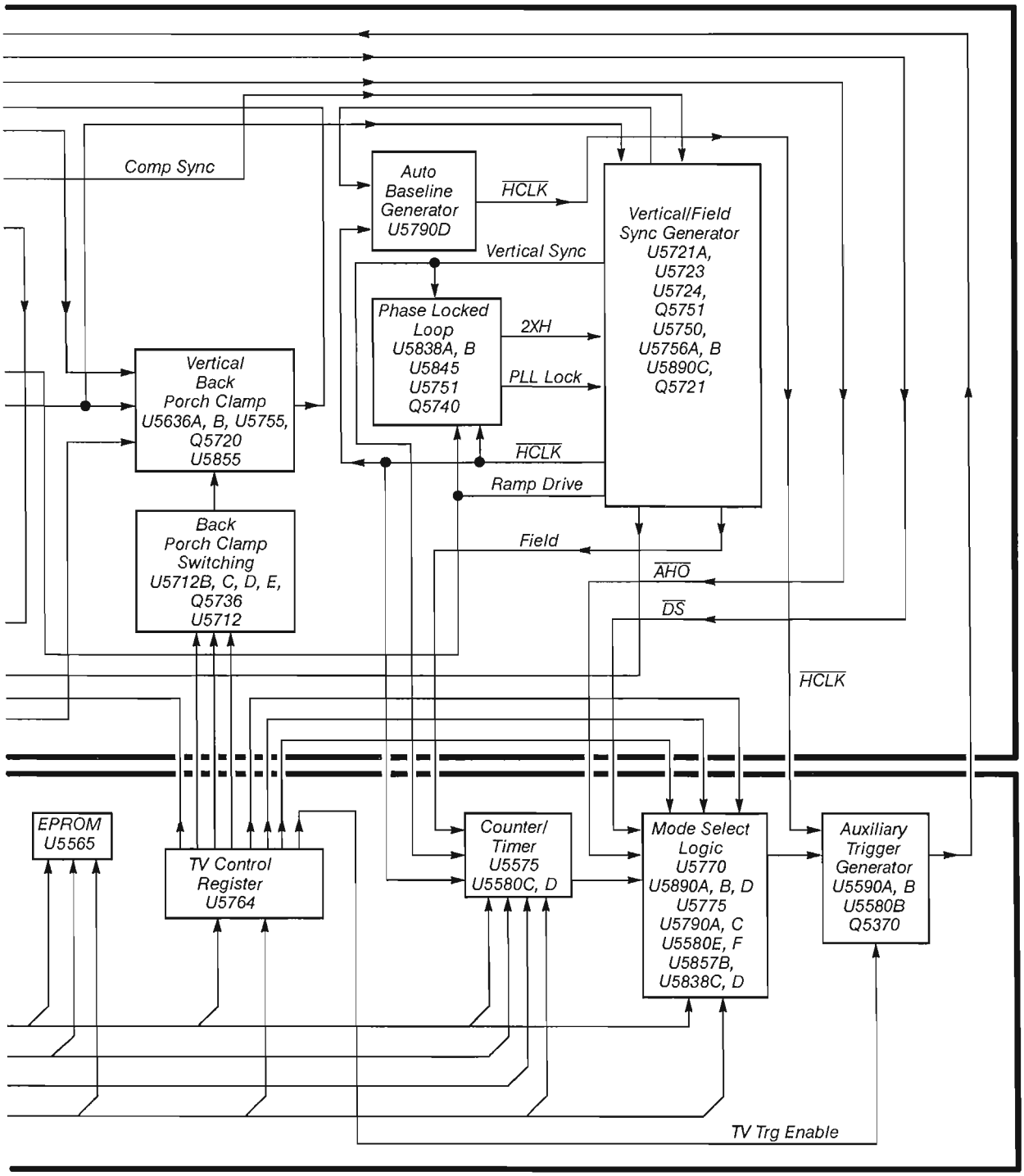


Figure 4-2B *— HDTV Board Detailed Block Diagram*

Vertical/Field Sync Generator—The Field Sync Generator circuitry (U5750 and U5756) generates the FIELD ID and VERT SYNC signals used by the counters in the digital section. The FIELD ID signal selects either the Field 1 or Field 2 line counter. The VERT SYNC signal is used by the vertical sync line counter. (For interlaced scan signals it identifies the field, while for noninterlaced scan signals it identifies vertical sync only.)

Digital Circuitry

The HDTV Digital circuitry provides an interface to the microprocessor and generates a trigger signal.

Memory and I/O Decoders—This circuitry decodes the address bus, generating enabling signals and strobes that allow the microprocessor to control the various circuit functions and devices.

Data Bus Buffer—The data bus is buffered by bidirectional buffer U5459.

EPROM—The EPROM U5565 is enabled by BVMA, $\overline{BE}$, the Option Select register, and one of its addresses being selected through programmable logic device U5880.

TV Control Register—The microprocessor writes to the TV Control register to:

- Control the polarity (SLOPE) of the sync tips of the composite video used in the analog section of the circuitry.
- Control the back-porch clamp circuitry.
- Enable the Auxiliary Trigger generator.
- Set the Mode Select Logic.

When the microprocessor writes to the register, the register's address is decoded by U5880 and U5460.

Counter/Timer—Counter/Timer U5575 contains three programmable counters used to determine the maximum number of lines in a given field and to produce a variable delay. The delay is varied to select any specific line in the selected field as the trigger point.

Auxiliary Trigger Generator—The Auxiliary Trigger generator produces the trigger signal when the appropriate horizontal line is reached.

Mode Select Logic—The Mode Select Logic selects the signal used to arm the Auxiliary Trigger generator.

Vertical Back Porch Clamp DAC—Provides the comparison signal for the Vertical Back Porch Clamp.

Replaceable Parts

This section contains a list of the components that are replaceable for the 11T5H Multistandard Video Trigger. As described below, use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available from or through your local Tektronix, Inc., service center or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest circuit improvements. Therefore, when ordering parts, it is important to include the following information in your order:

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If a part you order has been replaced with a different or improved part, your local Tektronix service center or representative will contact you concerning any change in the part number.

Module Replacement

The 11T5H Multistandard Video Trigger is serviced by module replacement; there are three options you should consider:

- **Module Exchange.** In some cases you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-TEKWIDE, ext. BVJ5799.
- **Module Repair.** You may ship your module to us for repair, after which we will return it to you.
- **New Modules.** You may purchase new replacement modules in the same way as other replacement parts.

Using the Replaceable Parts List

The tabular information in the Replaceable Parts List is arranged for quick retrieval. Understanding the structure and features of the list will help you find the all the information you need for ordering replacement parts.

Item Names

In the Replaceable Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, U.S. Federal Cataloging Handbook H6-1 can be used where possible.

Indentation System

This parts list is indented to show the relationship between items. The following example is of the indentation system used in the Description column:

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
(END ATTACHING PARTS)
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
(END ATTACHING PARTS)
Parts of Detail Part
Attaching parts for Parts of Detail Part
(END ATTACHING PARTS)

Attaching parts always appear at the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. Attaching parts must be purchased separately, unless otherwise specified.

Abbreviations

Abbreviations conform to American National Standards Institute (ANSI) standard Y1.1

CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
TK0032	POWELL ELECTRONICS	411 FAIRCHILD DR	MT VIEW CA 94040
TK1163	POLYCAST INC	9898 SW TIGARD ST	TIGARD OR 97223
TK1326	NORTHWEST FOURSLIDE INC	18224 SW 100TH CT	TUALATIN OR 97062
TK1465	BEAVERTON PARTS MFG CO	1800 NW 216TH AVE	HILLSBORO OR 97124-6629
TK1547	MOORE ELECTRONICS INC (DIST)	19500 SW 90TH COURT PO BOX 1030	TUALATIN OR 97062
TK1967	SYNDETEK	3915 E MAIN	SPOKANE WA 99202
0B0A9	DALLAS SEMICONDUCTOR CORP	4350 BELTWOOD PKWY SOUTH	DALLAS TX 75244
0JR05	TRIQUEST CORP	3000 LEWIS AND CLARK HWY	VANCOUVER WA 98661-2999
12697	CLAROSTAT MFG CO INC	LOWER WASHINGTON ST	DOVER NH 03820
22599	AMERACE CORP ESNA DIV	15201 BURBANK BLVD SUITE C	VAN NUYS CA 91411-3532
34649	INTEL CORP SALES OFFICE /ST4-2/	3065 BOWERS AVE	SANTA CLARA CA 95051
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
8X345	NORTHWEST SPRING & MFG CO	5858 WILLOW LANE	LAKE OSWEGO OR 97034-5343
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
83385	MICRODOT MFG INC GREER-CENTRAL DIV	3221 W BIG BEAVER RD	TROY MI 48098
92101	SCHULZE MFG	50 INGOLD RD	BURLINGAME CA 94010-2206
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108-5181

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1 -1	366-0600-00			5	PUSH BUTTON:0.269 X 0.409,ABS	TK1163	ORDER BY DESC
-2	366-1708-03			1	KNOB:SIL GY,0.127 ID X 0.5 OD X 0.531 H	0JR05	ORDER BY DESC
-3	366-1058-00			1	KNOB:GRAY,0.625 X 0.255 X 0.485 (ATTACHING PARTS)	0JR05	ORDER BY DESC
-4	214-1095-00			1	PIN,SPRING:0.187 L X 0.094 OD,STL (END ATTACHING PARTS	22599	52-022-094-0187
-5	105-0076-04			1	RELEASE BAR,LCH:PLUG-IN UNIT	0JR05	ORDER BY DESC
-6	214-1280-00			1	SPRING,HLCPS:0.14 OD X 1.126 L	8X345	ORDER BY DESC
-7	214-1054-00			1	SPRING,FLAT:0.825 X 0.322,SST	TK1326	ORDER BY DESC
-8	105-0075-00			1	BOLT,LATCH:7A & 7B SER PL-IN	80009	105007500
-9	333-3896-00			1	PANEL,FRONT:11T05 (ATTACHING PARTS)	80009	333389600
-10	211-0392-00			4	SCREW,MACHINE:4-40 X 0.25,FLH,STL (END ATTACHING PARTS)	93907	ORDER BY DESC
-11	348-0235-00			2	SHLD GSKT,ELEK:FINGER TYPE,4.734 L	92101	ORDER BY DESC
-12	386-6136-00			1	SUBPANEL,FRONT:11T5H	TK1465	ORDER BY DESC
-13	671-1790-00			1	CIRCUIT BD ASSY:FRONT PANEL (SEE A2, EXCHANGE ITEM) (ATTACHING PARTS)	80009	671179000
-14	211-0390-00			3	SCREW,MACHINE:2-56 X 0.188,FH,STL (END ATTACHING PARTS	93907	ORDER BY DESC
-15	311-2481-00			1	ENCODER,MECH BA:DIGITAL 2 BIT GREY (ATTACHING PARTS)	12697	CM46578
-16	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS	73743	2X-20319-402
-17	210-0046-00			1	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS)	78189	1214-05-00-0541
-18	174-2311-00			1	CA ASSY,SP,ELEC:3,26 AWG,4.25 L,RIBBON	TK1967	ORDER BY DESC
-19	386-5296-00			1	PANEL,REAR:POLYCARBONATE (ATTACHING PARTS)	TK1163	ORDER BY DESC
-20	213-0904-00			4	SCREW,TPG,TR:6-32 X 0.5,PNH,STL (END ATTACHING PARTS)	83385	ORDER BY DESC
-21	426-2061-00			1	FR SECT,PLUG-IN:LOWER,ALUMINUM	TK1465	ORDER BY DESC
-22	426-2060-00			1	FR SECT,PLUG-IN:UPPER,ALUMINUMN	TK1465	ORDER BY DESC
-23	214-1061-00			1	CONTACT,ELEC:GROUNDING,CU BE	80009	214106100
-24	337-1064-11			2	SHIELD,ELEC:PLUG-IN SIDE	80009	ORDER BY DESC
-25	671-1794-01			1	CIRCUIT BD ASSY:HDTV (SEE A3, EXCHANGE ITEM)	80009	671179401
-26	174-2314-00			1	CA ASSY,SP,ELEC:20,28 AWG,6.0 L,FLAT	TK1547	ORDER BY DESC
-27	671-1791-00			1	CIRCUIT BD ASSY:VIDEO TRIGGER,MAIN (SEE A1, EXCHANGE ITEM)	80009	671179100
-28	175-2353-00			1	CA ASSY,SP,ELEC:40,28 AWG,3.5 L,RIBBON	TK0032	ORDER BY DESC
-29	156-5866-00			1	MICROCKT,DGTL:CMOS,16-BIT MICROPROC (A3U501)	34649	N80C188
-30	160-7333-00			1	MICROCKT,DGTL:CMOS,EPROM,23K X 8 (A3U710)	80009	160733300
-31	156-2671-00			1	IC,MEMORY:CMOS,NVRAM;2K X 8 (A3U711)	0B0A9	DS1220Y
-32	361-1578-00			2	SPACER,WASHER:0.010 X 0.180 X 0.498,STEEL	80009	361157800
-33	344-0131-00			2	CLIP,SPR TNSN:CKT BD MT,ACETAL BLK (ATTACHING PARTS)	80009	344013100
-34	211-0409-00			2	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL (END ATTACHING PARTS)	93907	829-06888-024
-35	220-0022-00			6	NUT BLOCK:0.4 X 0.25 X 0.33,4-40 THRU,NI (ATTACHING PARTS)	80009	220-0022-00
-36	211-0409-00			6	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL (END ATTACHING PARTS)	93907	829-06888-024
-37	361-0041-00			2	SPACER,POST:0.375 L W/4-40 THRU,AL (ATTACHING PARTS)	80009	361004100

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Serial No. Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1 -38	211-0408-00			4	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX (END ATTACHING PARTS)	93907	829-06815-024
					STANDARD ACCESSORIES		
	070-7961-00			1	MANUAL,TECH:USERS REF,11T5H,HDTV	80009	070796100
	070-7962-00			1	MANUAL,TECH:SERVICE REF,11T5H,HDTV	80009	070796200