TEK Operator's Manual

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Product Group 21

751
BTSC AURAL MODULATION MONITOR/DECODER OPERATOR'S MANUAL

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For Firmware Version 2.0

Tektronix
COMMITTED TO EXCELLENCE

751 Operator's Manual
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Section 3 – Operating Instructions

Safety Summary

The general safety information in this part of the summary is for operating personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

Terms

In This Manual

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.

As Marked 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.

Safety Information

Use the Proper Power Source. This product is intended to operate from a power module connected to a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Ground the Product. This product is grounded through the grounding conductor of the power module power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power module power cord is essential for safe operation.

Danger May Arise From Loss of Ground. Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

Use the Proper Fuse. To avoid fire hazard, use only the fuse of correct type, voltage rating, and current rating as specified in the parts list for your product. Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres. To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

Do Not Operate Without Covers. To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.

Section 1 – Introduction

General Description

With the advent of stereo audio for television, an array of parameters previously nonexistent must be closely watched. The 751 displays modulation levels, injection levels, and processed audio levels of signals broadcast in the BTSC television stereo sound standard. This section briefly covers the uses and features of the 751. Details on this information is provided in Section 3 of this manual, Operating Instructions.

Baseband Inputs

The 751 is designed to be driven by the baseband signal from the Tektronix 1450-1 Deviation Output. A second input is provided for direct connection to a stereo generator or to pick off the baseband signal between the generator and the aural transmitter.

Modulation/Injection Level Indicators

Dynamic horizontal bars accurately display the modulation of the aural carrier due to the **Total** baseband signal, the **Main** channel (sum or mono), and **Stereo** (**Main** channel and stereo subchannel less 15.734 kHz pilot), as well as the modulation of the **SAP** and **PRO** subcarriers. Digital peak readouts accompany each bar for accurate measurements.

These indicators can be configured for either true peak or weighted peak indication. The 751 makes all modulation and injection level measurements prior to any front panel controlled processing.

Also shown on this screen are digital readouts of the injection levels of **Pilot**, **SAP** subcarrier, and **PRO** subcarrier, as well as the **Spurious** S/C (SubCarrier) level.

Constant Overmodulation Indication

An **Overmodulation** flag appears in the upper right-hand corner of the display when any dynamic bar on the **Peak Modulation** screen indicates overmodulation (except on the **Peak Modulation** screen).

Processed Audio Level Indicators

The dynamic bars on the **Processed Audio** screen indicate levels of **L+R**, **L–R**, **Left**, **Right**, **SAP**, and **PRO**. These bars represent audio levels after front panel controlled processing. These indicators are optimized for flat frequency response, and can be used in the FLAT (processing) mode to accurately measure steady-state test tones in their respective channels.

Switching between the **Peak Modulation** and **Processed Audio** screens is accomplished with the CHANGE SCREEN push button.

Peak Flashers

Each parameter displayed by the 751 provides visual indication when a peak limit is exceeded. The dynamic bars switch from a stippled texture to a solid, and the associated digital peak readout switches to reverse video. The solid outline of each bar, or "shadow bar," also displays the held peak values indicated by the digital peak readouts. The digital readouts across the bottom of the **Peak Modulation** screen also switch to reverse video when their limits are exceeded.

The peak flasher threshold is easily reset using the softkeys activated by the SET FLASHERS push button on the front panel.

Measurement Units

Units of measure are changed by pressing the CHANGE UNITS push button. This changes the units only for the screen displayed. On the **Peak Modulation** screen, the measurement units for the dynamic bars can be set to **kHz** or **%**. The **Spurious** S/C (SubCarrier) readout can be switched between **Hz** and **dB**, but the units for the injection levels are always **kHz**. The **Processed Audio** bars measurement units toggle between **dB** and **%**.

PROCESSING Controls

The 751's front panel PROCESSING controls provide all the options commonly needed. The BTSC selection for STEREO (Main channel and Stereo subchannel) gives you BTSC expansion for the Stereo subchannel and standard 75 µs de-emphasis for the Main channel. 75 µs de-emphasis is selected for both channels ("equivalent mode") when DE-EMP is selected, and no processing is used when FLAT is selected.

Processing selections for SAP are BTSC, DE-EMP (75 µs), and FLAT. The PRO channel processing choices are DE-EMP (150 µs) and FLAT.

MENU

The MENU provides quick access to essential functions that are not needed on a regular basis. The top level of the 751's MENU is:

- Display / Data Output options
- Installation and adjustment
- RMS Meter Enable
- BTSC Help
- Describe front panel buttons
- Select SAP and PRO display modes
- Change baseband input
- Self-test and service aids

Display Calibration

Automated display calibration ensures that the 751 remains accurate. Direct digital synthesis is used to generate the calibration signals which ensure very accurate deviation calibration. Connection to a wideband 1450-1 is strongly recommended, but is not necessary. Running the CALIBRATE sequence takes about two minutes and 15 seconds and requires only a few button pushes from the user.

TEST OUTPUT

The front and rear panel TEST OUTPUT BNC connectors are provided for additional measurements of the TOTAL baseband signal and the L+R, L–R, Left, Right, SAP and PRO processed audio signals. Output selection is made with the front panel TEST OUTPUT push buttons.

The Test Output is a voltage source with a 51Ω resistor in series with the output. This output is designed to drive high (≥100 kΩ) impedance devices such as voltmeters, spectrum analyzers, and distortion analyzers. The input impedance of the Tektronix AA 5001 distortion analyzer is 100 kΩ, and the input of the Tektronix 7L5 audio frequency spectrum analyzer can be set to 1 MΩ.

The Test Output will drive high impedance inputs with 10 V p-p at the 100% level of the corresponding processed audio bar, and can be used to perform any of the BTSC recommended measurements.

PHONES Output

The headphone output with VOLUME control can be set to monitor the STEREO output or the TEST OUTPUT with the SELECT push button.

REMOTE ALARMS Relay Contacts

The REMOTE ALARMS connector provides both normally open and normally closed contacts for the alarm conditions of **No Pilot**, **Pilot/Sync Unlock**, and (stereo) **Phase Inverted**.

AUDIO OUTPUTS

Decoded PRO, SAP, Left, and Right audio signals drive balanced line outputs on the 751's rear panel. When a processed audio level is 100% or 0 dB, the output level is +8 dBm into 600Ω.

About This Manual

Bold text in this manual (other than topic headings) indicates text found on the 751's display. Text that is all upper case indicates nomenclature found on the front or rear panel of the 751 or 1450-1.

Section 2 – Electrical Installation

Introduction

This section explains how to electrically install and configure the 751 for your particular application. Topics covered are:

— Power Requirements / Changing Line Voltage Range and Fuse

— Connecting Inputs and Outputs

— Wiring Remote Alarms Connector

— Wiring RS-232C Port

— Baseband Input Adjustments

— Pre-operation Calibration

Power Requirements

The 751 will operate with line frequencies from 47 to 63 kHz, over two line voltage ranges. The low voltage range nominal setting is 115 Vac. The high voltage range nominal setting is 230 Vac.

For your protection and to avoid damage to the instrument, shut the instrument power off before removing or replacing any circuit boards, connectors, or jumpers.

Changing Line Voltage Range and Fuse

The voltage range selection switch and fuse holder are located on the lower left corner of the 751's rear panel. See Figure 2-1.

The 751 is shipped from the factory set for 115 Vac operation. If this setting must be changed to 230 Vac, simply set the voltage range selection switch to the 230 position to operate in the high voltage range. The 4A fast-blow fuse provides the proper protection in the low voltage range and must be replaced with a 2A fast-blow fuse for operation in the high voltage range.

Connecting Inputs and Outputs

Connecting the 751 to your system is simple. The only connection to the 751 that requires anything but twisting on a BNC or plugging in an XLR is the REMOTE ALARMS connector and the RS-232C port, both covered later in this section.

Rear Panel

The following list tells you which connection to make at each input or output of the 751. Figure 2-1 is a diagram of typical 751 rear panel connections.

Stereo GEN INPUT (Z IN=100 kΩ)
— Accepts the baseband output of BTSC stereo generator (connect signal through supplied BNC "Tee" and terminate or pick off stereo generator signal). Use 50Ω cable.

1450-1 DEMOD INPUT (Z IN=75Ω)
— Primary baseband input from wideband version 1450-1 Deviation Output. Use 75Ω coaxial cable.

CALIBRATION SIGNAL
— Connects to the wideband version 1450-1 Aural Intercarrier Input. Use 50Ω coaxial cable.

TEST OUTPUT
— Connects to various high input impedance test equipment as required for additional BTSC tests (50Ω).

VIDEO OR H-SYNC LOOP-THROUGH
— Requires either a composite video or a composite sync signal with H-sync locked to the transmitted signal (75Ω).

AUDIO OUTPUTS
— Connect to your audio monitoring system as required.

Front Panel

TEST OUTPUT
— Same as rear panel connector.

PHONES
— Standard 1/4" headphone jack.

Remote Alarms Connector Wiring

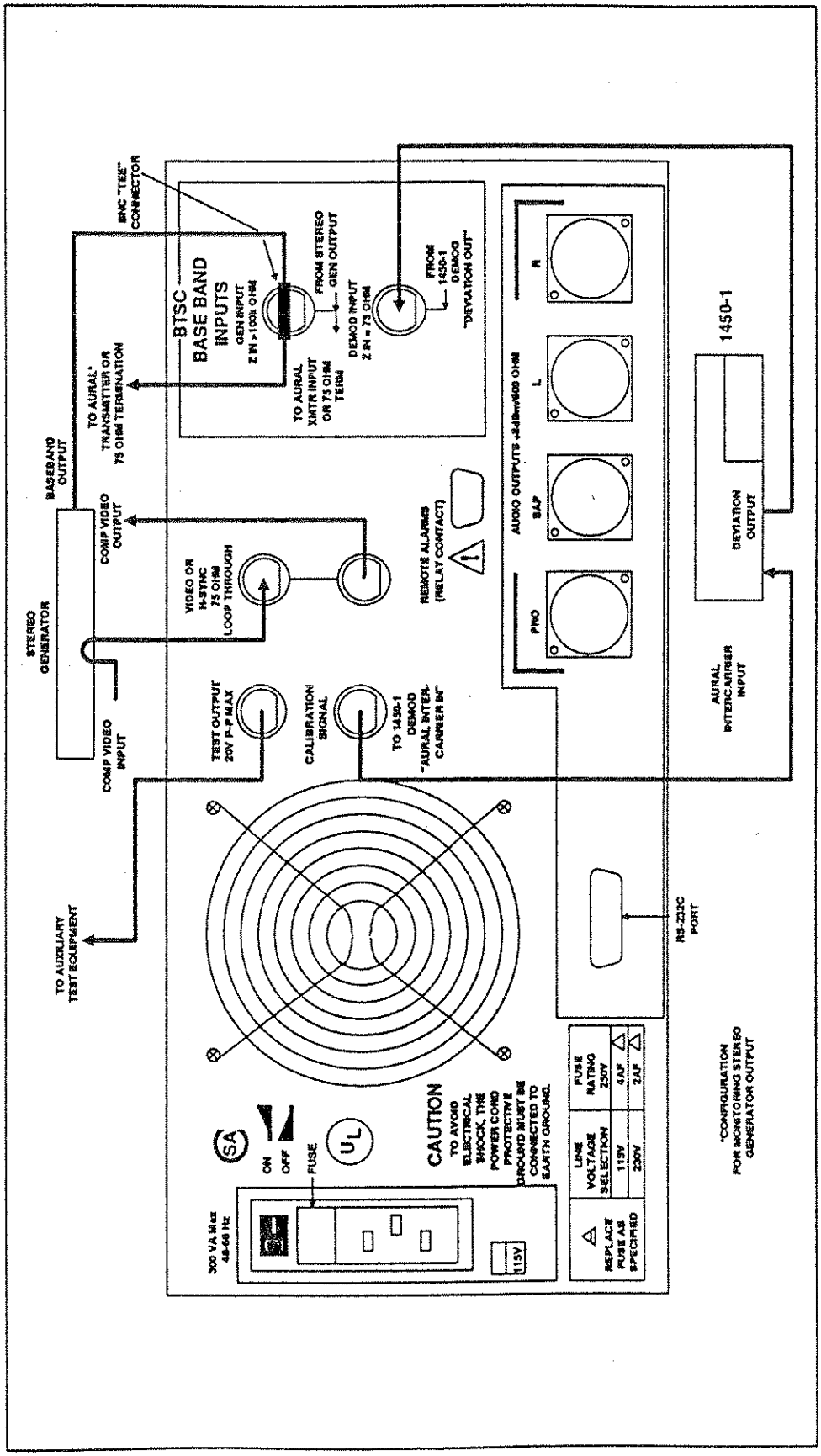
The REMOTE ALARMS Relay Contacts connector provides both normally open and normally closed contacts for No Pilot, (stereo) Phase Inverted, and Pilot/Sync Unlocked.

The following list describes how the 751's rear panel REMOTE ALARMS Relay Contacts are wired. A male 9-pin D subminiature connector is supplied as a standard accessory to wire for your system's needs.

No Pilot

Common	pin 6
Normally Open	pin 1
Normally Closed	pin 2

Figure 2-1
Typical 751 rear panel connections.



Phase Inverted

Common pin 3
Normally Open pin 7
Normally Closed pin 8

Pilot/Sync Unlock

Common pin 9
Normally Open pin 4
Normally Closed pin 5

RS-232C Port Connections

The 751's RS-232C port may be used to transmit data for a remote display of the Peak Modulation and Processed Audio screens or for remote data logging. Details on these two data formats are found in Section 3, Operating Instructions, of this manual.

The RS-232C port does no handshaking in either hardware or software. The 751 thinks it always has permission to send another character (it ignores CTS) and does not respond to any characters it receives. This means that the 751 will always transmit data, even if the remote device is busy with another task or has a full buffer.

Since the 751 does no handshaking, you need to connect only three wires from the 751 to the remote device (P.C., terminal, etc...). These are pin 1, chassis ground, pin 2, transmit data, and pin 7, signal ground.

If your remote device requires a high level on any other lines, the following lines are always high (≈+10 V) on the 751: pin 4, RTS (Ready To Send), and pin 20, DSR (Data Set Ready).

Baseband Input Adjustments

The 751 BASEBAND INPUTS must be adjusted to match the output of your 1450-1 (and the output of your stereo generator if it's connected) prior to running the automatic display-CALIBRATE sequence and beginning normal operation. The 751's BTSC expander circuitry requires precise input levels for proper expander tracking, which in turn ensures optimum channel separation.

Complete instructions for performing these adjustments are shown on the 751's display and are accessed through the **Installation and adjustment** option of the 751's main MENU. These adjustments are made through holes in the top cover of the 751, so you will need to extend the 751 in its rack slides to access these adjustments.

The instructions on the 751's display are quite clear and can be successfully followed without reading the remainder of the **Baseband Input Adjustments** topic. The following information is provided to explain in more detail what is happening during the installation adjustment procedure.

Demodulator Input Adjustment

Brief Description

When you select the **Demodulator** softkey from the **Installation and adjustment** menu, the 751 generates a 4.5 MHz carrier which is frequency-modulated by a precision BTSC encoded left-channel signal. The signal is routed to the 1450-1's Aural Intercarrier Input. The signal is then demodulated by the 1450-1 and fed back through the deviation output to the 751. Next, the 751 displays an RMS Right channel reading, prompting you to set the DEMOD INPUT GAIN adjustment to minimize this reading. Finally, the 751 performs an automatic display calibration, as though the CALIBRATE push button had been pressed.

Procedure

The following procedure describes in detail the steps necessary to calibrate the DEMOD INPUT circuitry:

— Press MENU to display the main menu, which is shown in Figure 2-2.

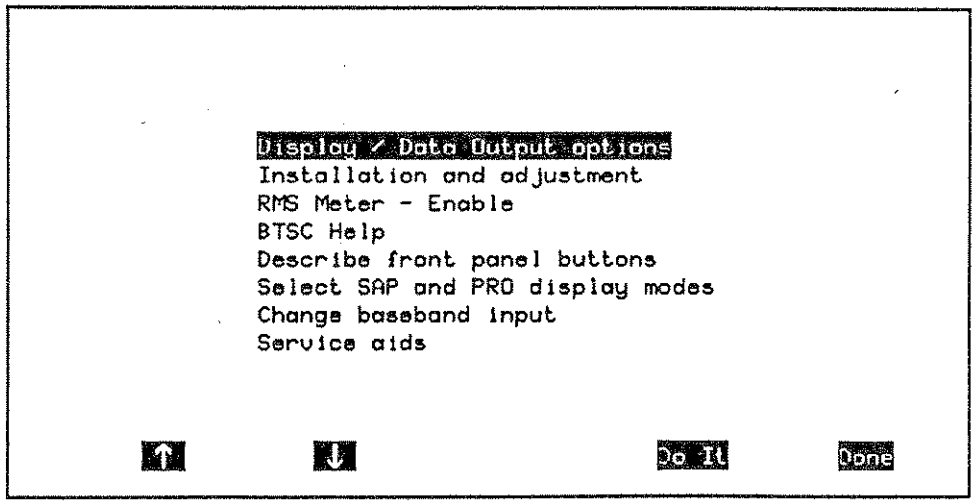
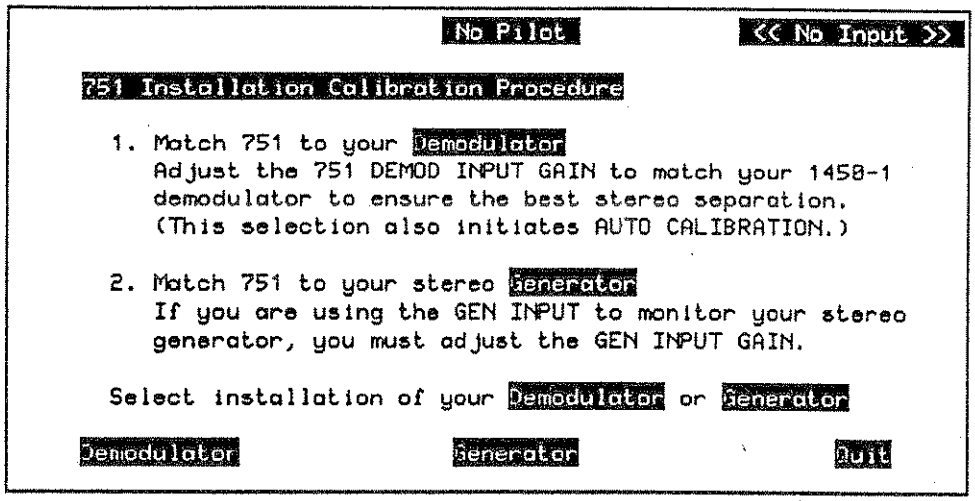


Figure 2-2
751 main menu.

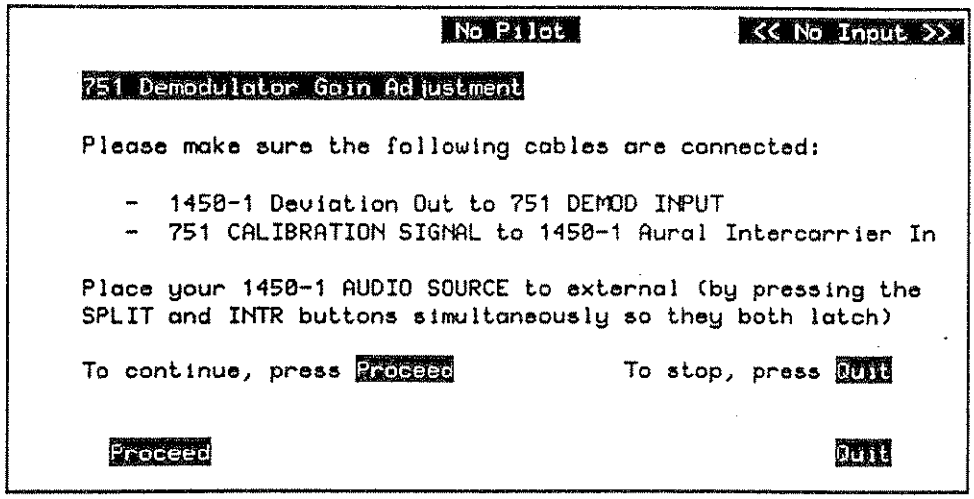
— Use the ↑ and ↓ softkeys to select **Installation and adjustment** and press **Do It**. This displays the **751 Installation Calibration Procedure** introduction screen, shown in Figure 2-3. This screen allows access to the **DEMODULATOR** and **GENERATOR** gain adjustment procedures.

Figure 2-3
751 Installation Calibration Procedure introduction screen.



— Press the **DEMODULATOR** softkey. This displays a screen with preliminary setup instructions for the demodulator gain adjustment, as shown in Figure 2-4. Failure to complete any one of the three instructions given on the display will make it impossible to perform the calibration.

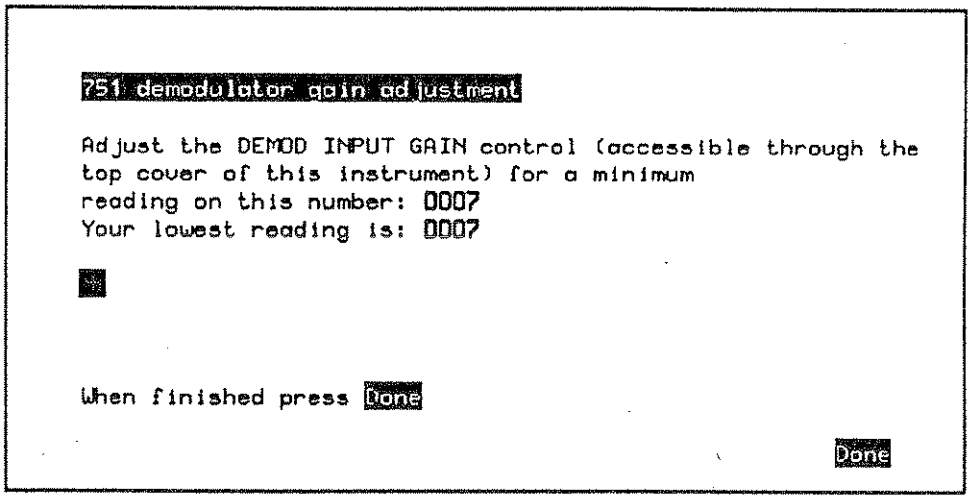
Figure 2-4
Preliminary setup instructions screen for 751 demodulator gain adjustments.



The three preliminary setup steps are as follows: (1) connect the 1450-1 DEVIATION OUT to the 751 DEMOD IN; (2) connect the 751 CALIBRATION SIGNAL to the 1450-1 AURAL INTERCARRIER IN; and (3) place the 1450-1 AUDIO SOURCE to external by pressing the SPLIT and INTR buttons simultaneously so they both latch. With this setup, the 1450-1 demodulates a precision calibration signal generated by the 751, then feeds the deviation signal back to the 751.

— Press the **Proceed** softkey. This displays the **751 demodulator gain adjustment** screen, shown in Figure 2-5.

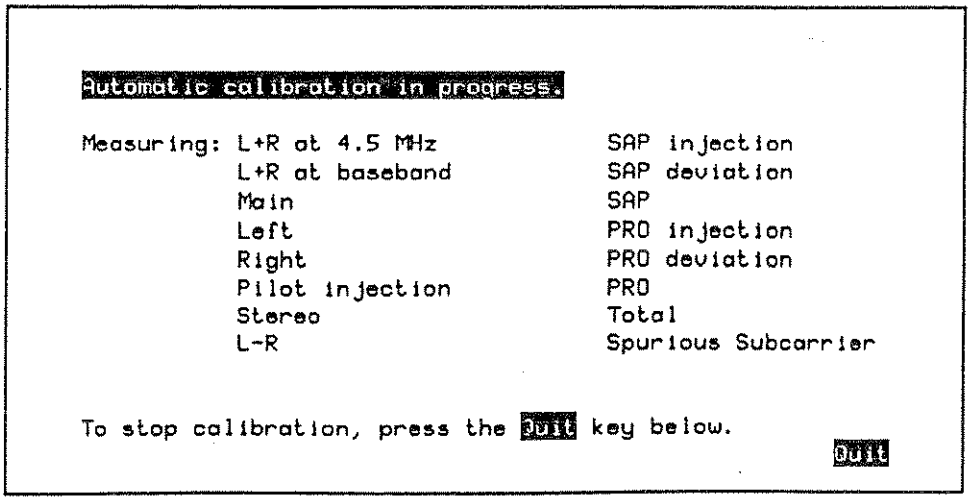
Figure 2-5
751 demodulator gain adjustment screen (properly adjusted).



— Adjust the DEMOD INPUT GAIN adjustment through the top cover of the 751 (the hole nearest the rear of the instrument) for a minimum reading and bar length on the 751 display. A reading of 30 or less indicates the instrument is operating properly. *If a reading of 30 or less can not be obtained, the instrument needs servicing.* Refer to the service manual.

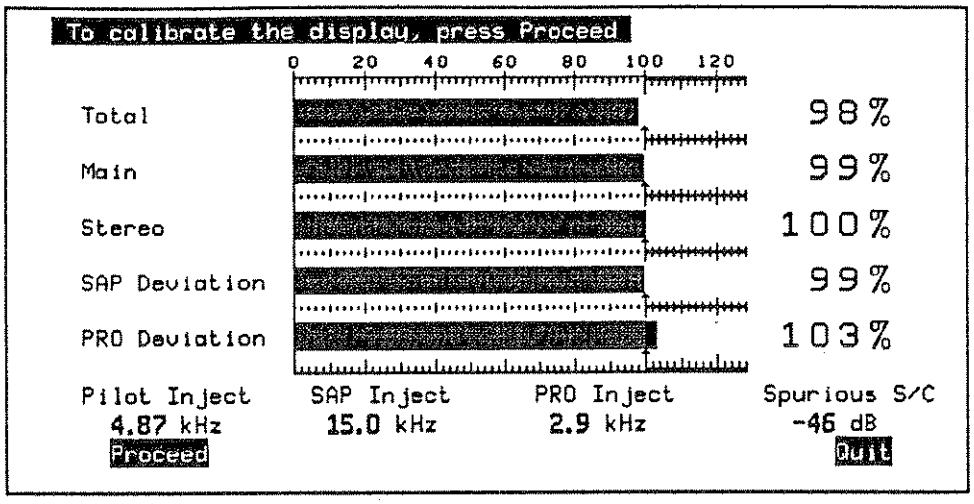
— After completing the input gain adjustment, press the **Done** softkey. This initiates an automatic calibration of the display, which takes about 2 minutes and 15 seconds. Figure 2-6 shows the 751 display while the calibration measurements are in progress. Also, pressing **Quit** stops the display calibration and displays the message **"Select your normal 1450 AUDIO SOURCE mode, (SPLIT, INTR, or Q-P), then press Done."** Pressing the **Done** softkey at this point displays the Peak Modulation screen.

Figure 2-6
751 display near end of automatic display calibration.



— When the calibration measurements are complete, the 751 will display the measured values of each component on the Peak Modulation screen, as shown in Figure 2-7.

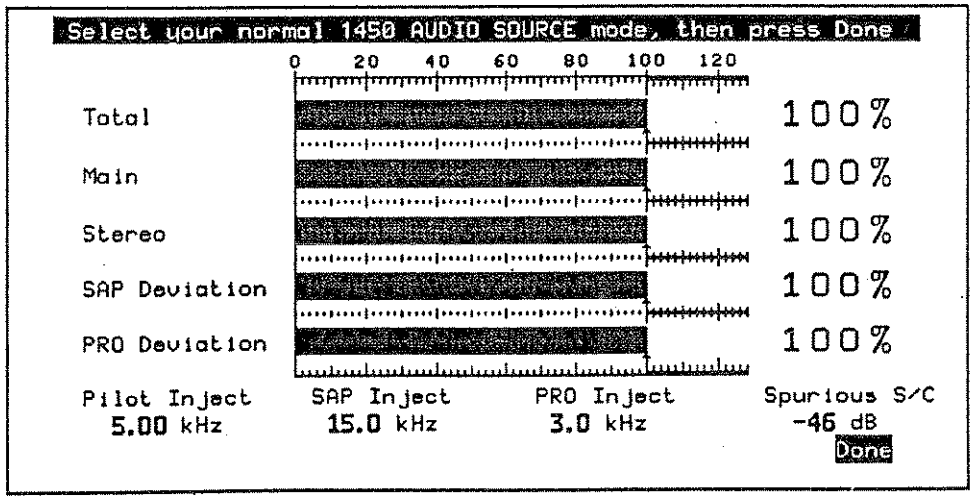
Figure 2-7
751 display upon completion of calibration measurements; calibration required.



— Press **Proceed** to store the calibration measurements, which are referred to as "calibration factors," or press **Quit** to stop the display calibration and display the message **"Select your normal 1450 AUDIO SOURCE mode, (SPLIT, INTR, or Q-P), then press Done"** (pressing the **Done** softkey at this point displays the **Peak Modulation** screen).

Pressing **Proceed** saves the calibration factors and displays the fully calibrated Peak Modulation screen, with all bars indicating 100% (or equivalent kHz readings) and all the digital readouts indicating their nominal values, as shown in Figure 2-8.

Figure 2-8
A fully calibrated 751 display.



— Reset the 1450-1 AUDIO SOURCE to its normal operating mode and press **Done** (the order of these two actions is not important). After pressing Done, the 751 will again remind you to reset the 1450-1 AUDIO SOURCE with the message "Select your normal 1450 AUDIO SOURCE mode, (SPLIT, INTR, or Q-P), then press Done." Pressing the **Done** softkey at this point displays the **Peak Modulation** screen.

— The 751 demodulator input gain is now properly adjusted and the display is calibrated.

Stereo Generator Input Adjustment

Brief Description

If you intend to monitor your stereo generator directly, the GEN INPUT GAIN adjustment must also be set to match your stereo generator. This process is begun by selecting the **Generator** softkey from the **Installation and adjustment** menu item. The GEN INPUT circuitry can be adjusted one of the two following ways: **method 1** — transmitting a test tone and receiving it with a 1450-1 is required; or **method 2** — neither transmitting a test signal nor a 1450-1 are required.

The advantage of **method 1** is that the specific level output by the stereo generator *is not* critical to the accuracy of the adjustment. With **method 2**, the level output by the stereo generator *is* critical to the accuracy of the adjustment. The advantage of **method 2** is the fact that transmitting a test signal is not required, as it is with **method 1**. The preferred method is **method 1**, and **method 2** should be used only if transmitting a test signal is not possible, or if no 1450-1 is available.

If you have a 1450-1 and can transmit a test tone (method 1):
You are prompted to transmit a tone with ≈25 kHz Main channel deviation. The exact deviation is not critical, nor is the frequency of the tone. The resulting deviation is measured by the 751 (through the 1450-1) and the value is stored. The 751 then switches to the GEN INPUT and displays a bar that represents the difference between the stored value and the direct measurement of the generator output and you are then prompted to set the GEN INPUT GAIN adjustment to eliminate the difference.

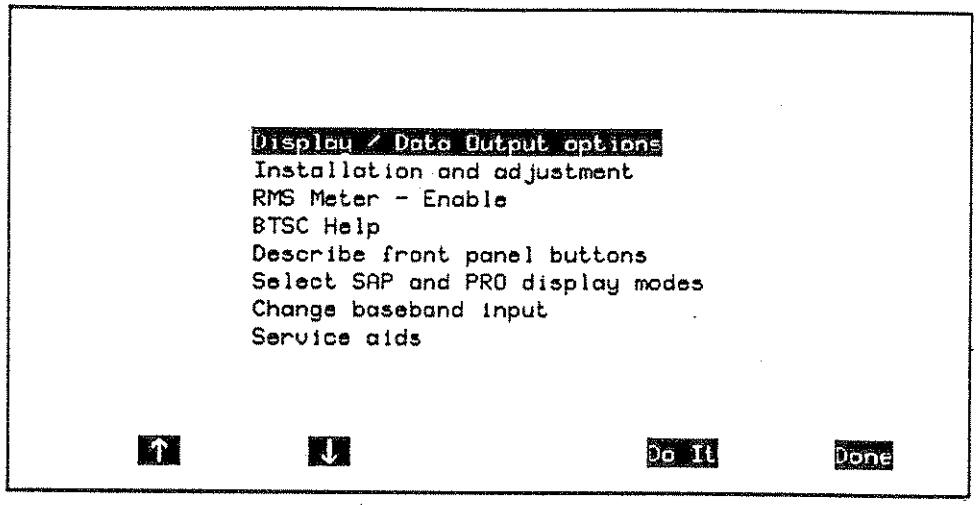
If you do not have a 1450-1 or can not transmit a test tone(method 2):
Your stereo generator must be capable of outputting a Main channel signal at the level used for Bessel Null calibration. The generator must be connected to its normal load and output either a 10.395 kHz signal representing 25 kHz deviation or a 7.867 kHz signal representing 18.92 kHz deviation.

Procedure

The following procedure describes the steps necessary to calibrate the GEN INPUT circuitry:

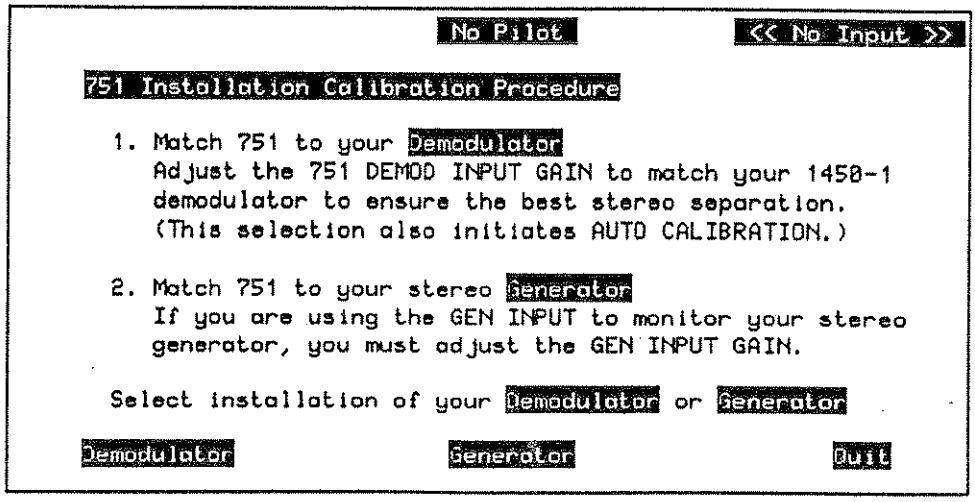
— Press MENU to display the main menu, which is shown in Figure 2-9.

Figure 2-9
751 main menu.



— Use the ↑ and ↓ softkeys to select **Installation and adjustment** and press **Do It**. This displays the **751 Installation Calibration Procedure** introduction screen, shown in Figure 2-10. This screen allows access to the DEMODULATOR and GENERATOR gain adjustment procedures.

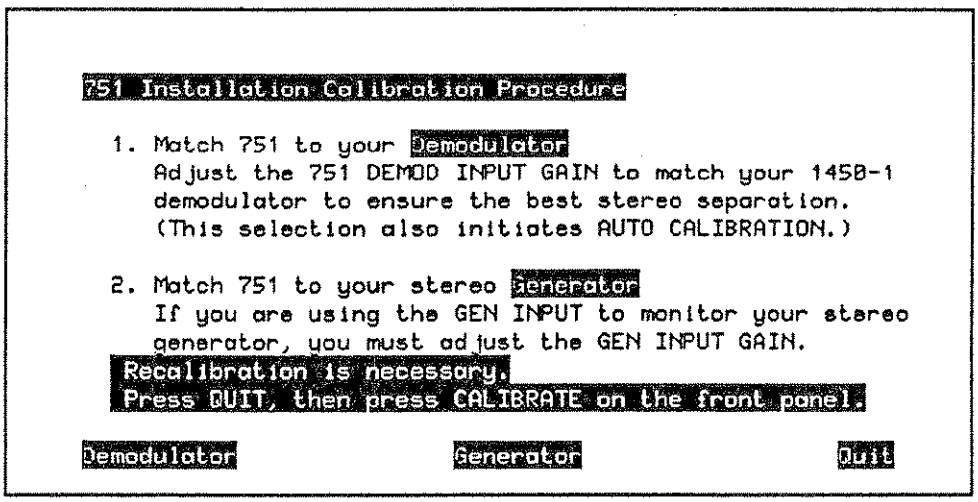
Figure 2-10
751 Installation Calibration Procedure introduction screen.



NOTE

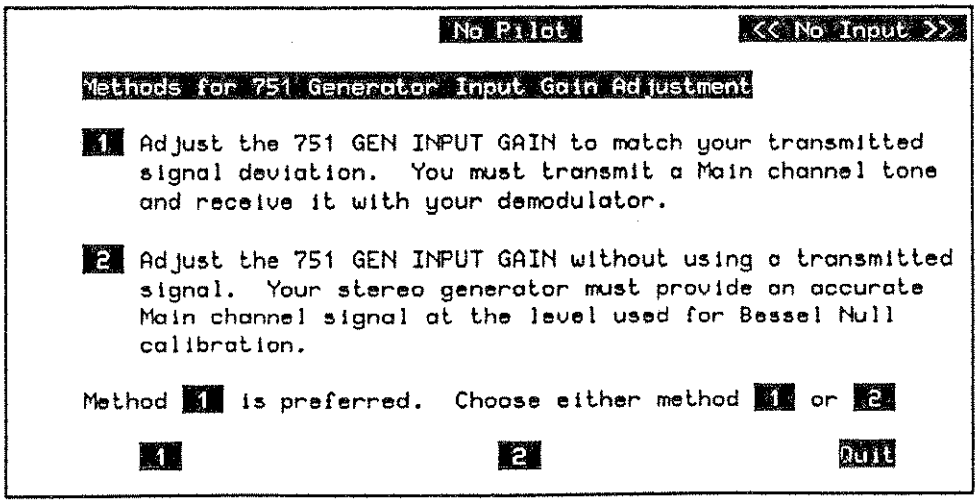
The demodulator must be installed (DEMOD INPUT GAIN adjusted) prior to installation of the generator, if both a demodulator and stereo generator will be used with the 751. Also, valid calibration factors must be stored in the 751 before a stereo generator can be installed. If the calibration factors generated at the factory somehow become corrupted, an automatic display calibration must be performed (press the CALIBRATE push button), either with or without (No Demod) a demodulator. If the calibration factors are invalid, the display shown in Figure 2-11 will appear, prompting you to recalibrate the display.

Figure 2-11
Screen displayed when Generator is pressed with invalid calibration factors present.



— Press the **Generator** softkey to display the screen shown in Figure 2-12. This screen presents the options of calibrating the GEN INPUT circuitry *with* (**method 1**, the preferred method) or *without* (**method 2**) transmitting a test tone.

Figure 2-12
GEN INPUT calibration options screen.



Method 1

— Press the 1 softkey to display the screen shown in Figure 2-13. This screen directs you to first connect the 1450-1 Deviation Output to the 751 DEMOD INPUT, and then connect the stereo generator's baseband output to the 751 GEN INPUT. Once these connections are made, you must transmit a main channel L=R signal of any audio frequency that causes approximately 25 kHz deviation of the aural carrier. Note that the transmitted signal must be received and demodulated by the 1450-1. The bar and digital readout on the screen shown in Figure 2-13 indicate kHz deviation of the main channel, to assist you in setting the generator to ≈25 kHz deviation.

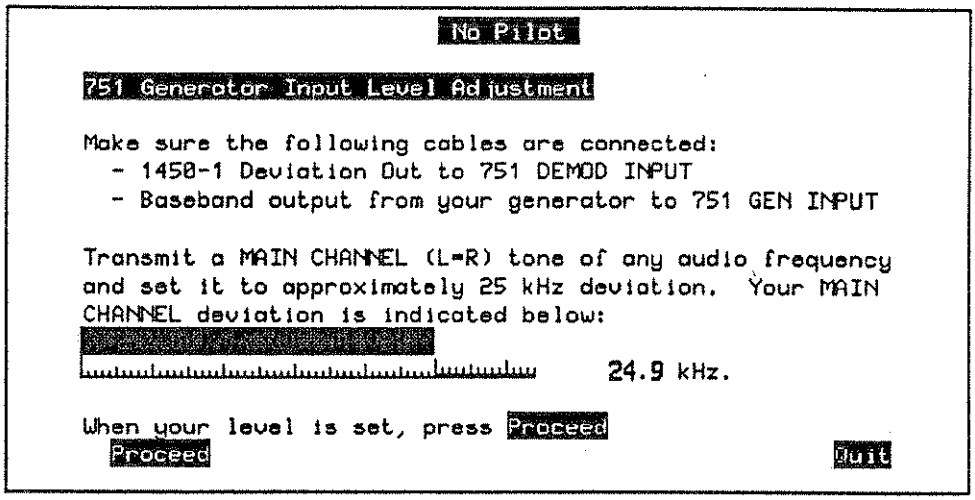


Figure 2-13
Generator gain calibration setup screen (preferred method).

— Press **Proceed** once your stereo generator is set for approximately 25 kHz deviation, as indicated on the 751's display. Pressing **Proceed** stores a value that corresponds to the measured deviation of your generator through the 1450-1, and displays the screen shown in Figure 2-14.

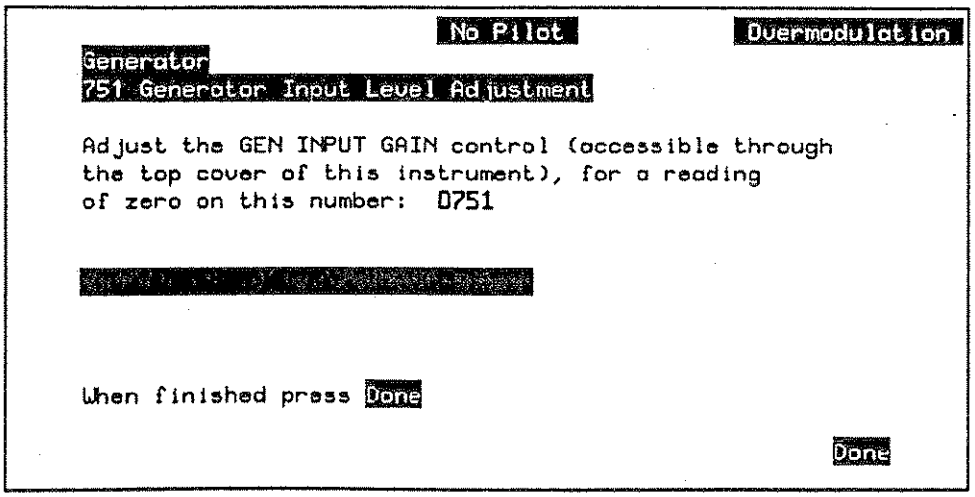


Figure 2-14
751 generator gain adjustment screen (needing adjustment).

— Set the GEN INPUT GAIN adjustment (through the hole in the top cover nearest the front of the instrument) for a reading of 0000 and a bar one pixel in length on the 751's display. This adjustment sets the GEN INPUT circuitry's gain to precisely match the gain through the accurately calibrated DEMOD INPUT circuitry. When the gain of the two circuits match, the reading is 0000.

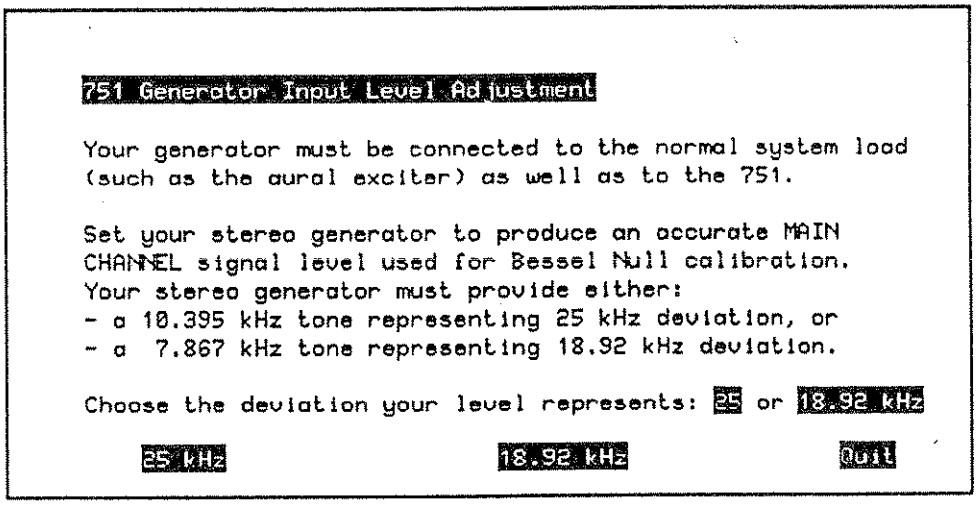
— The GEN INPUT circuitry is now properly calibrated.

— Press the **Done**, **Quit**, and **Done** softkeys to begin normal operation.

Method 2

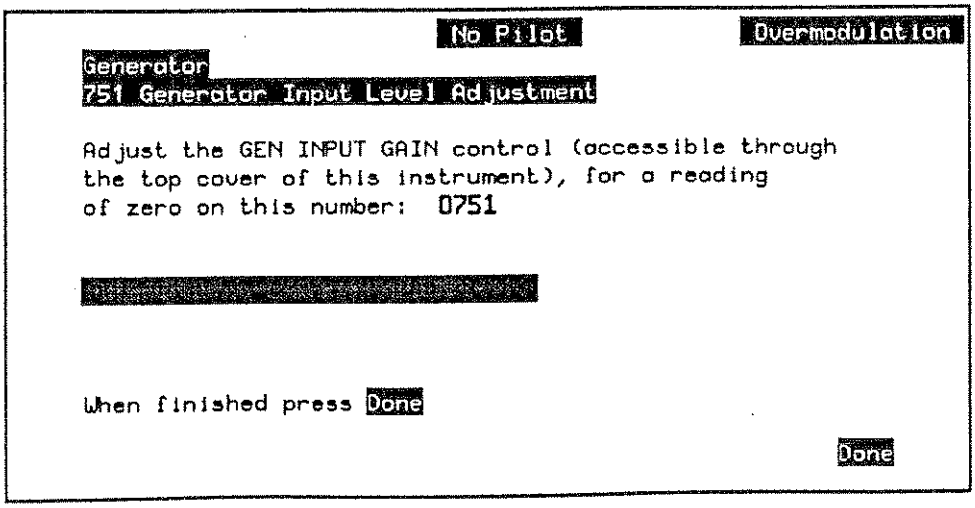
— Press the **2** softkey to display the screen shown in Figure 2-15. This screen instructs you to ensure that the stereo generator is connected to its normal load, typically the aural exciter, and to set the generator's output to a Bessel Null calibration signal. As the display indicates, the Bessel Null signal may be either **a 10.395 kHz tone representing 25 kHz deviation, or a 7.867 kHz tone representing 18.92 kHz deviation.**

Figure 2-15
Generator gain calibration setup screen (alternate method).



— Press **25 kHz** or **18.92 kHz**, depending on the output of your stereo generator. Pressing either softkey will display the screen shown in Figure 2-16.

Figure 2-16
751 generator gain adjustment screen (needing adjustment).



— Set the GEN INPUT GAIN adjustment (through the hole in the top cover nearest the front of the instrument) for a reading of 0000 and a bar one pixel in length on the 751's display. This adjustment sets the GEN INPUT circuitry's gain to precisely match a stored calibration factor. When the gain of the GEN INPUT circuit produces an internal level that matches the calibration factor, the reading is 0000.

— The GEN INPUT circuitry is now calibrated.

— Press the **Done**, **Quit**, and **Done** softkeys to begin normal operation.

Display Calibration

One step in preparing the 751 for normal operation is to run the automated CALIBRATE sequence. This operation measures precise internal calibration signals, and then computes and stores calibration factors for your 751 (and 1450-1 if you use one). The result is a precisely calibrated display. If you have already performed the demodulator input gain adjustment procedure, the display calibration was performed automatically, and need not be repeated. Also, if you have performed the generator input gain adjustment procedure, a display calibration has been performed.

A display calibration may be done periodically to ensure accurate display readings.

All the signals used by the 751 to perform the auto-CALIBRATE sequence can be monitored at the TEST OUTPUT, except the 4.5 MHz calibration signal #1. All signals are digitally synthesized, including the 4.5 MHz carrier.

The L+R channel of the 751 and the deviation sensitivity of the 1450-1 are calibrated using a 4.5 MHz signal that is frequency modulated to 25 kHz deviation by a 10.395 kHz sine wave (calibration signal #1, which yields a Bessel null). The 751 input is then switched to an internally generated baseband L+R signal representing 25 kHz deviation. The ratio of these measurements is used as a 1450-1 calibration factor. The remaining parameters are calibrated with appropriate baseband signals. Additionally, those parameters affected by the deviation sensitivity have the 1450-1 calibration factor applied to them.

Calibration factors are stored in non-volatile memory so you don't need to perform the auto-CALIBRATE routine every time you power-down.

Calibration Signals

Specific calibration signals used to calibrate each parameter are as follows:

L+R, Main, Left audio, Right audio - (calibration signal #2) 10.395 kHz sinusoid at 25 kHz equivalent modulation.

Pilot Injection, Stereo, L–R - (calibration signal #3) baseband composite consisting of a 3.934 kHz difference (L–R) signal amplitude modulating a $2f_H$ suppressed carrier at 50 kHz equivalent modulation, plus a Pilot carrier at f_H at 5 kHz equivalent injection level.

SAP deviation, SAP injection, SAP audio - (calibration signal #4) baseband SAP carrier at $5f_H$ and 15 kHz equivalent injection level frequency modulated by a 1748 Hz sinusoid at 10 kHz modulation.

PRO deviation, PRO injection, PRO audio - (calibration signal #5) baseband PRO carrier at $6.5f_H$ and 3 kHz equivalent injection level frequency modulated by a 1457 Hz sinusoid at 3 kHz modulation.

Total - (calibration signal #6) baseband 10 kHz signal at 73 kHz equivalent modulation.

Spurious Subcarrier - (calibration signal #7) baseband composite consisting of a Pilot carrier at f_H with 5 kHz equivalent injection level plus an unmodulated stereo difference carrier at $2f_H$ with 250 Hz equivalent injection level.

Procedure

— Press the CALIBRATE push button to begin the calibration sequence. This displays the screen shown in Figure 2-17. This screen offers the option of calibrating the display without a 1450-1. However, this option should be used *only if you have no 1450-1 available.* Maximum stereo separation is assured *only* when the 751 DEMOD INPUT circuitry and the display are calibrated using a 1450-1.

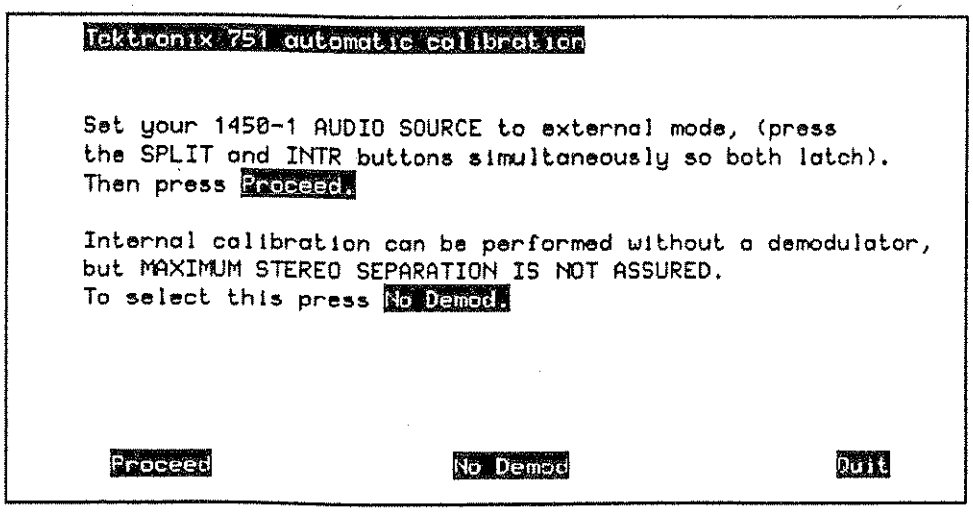


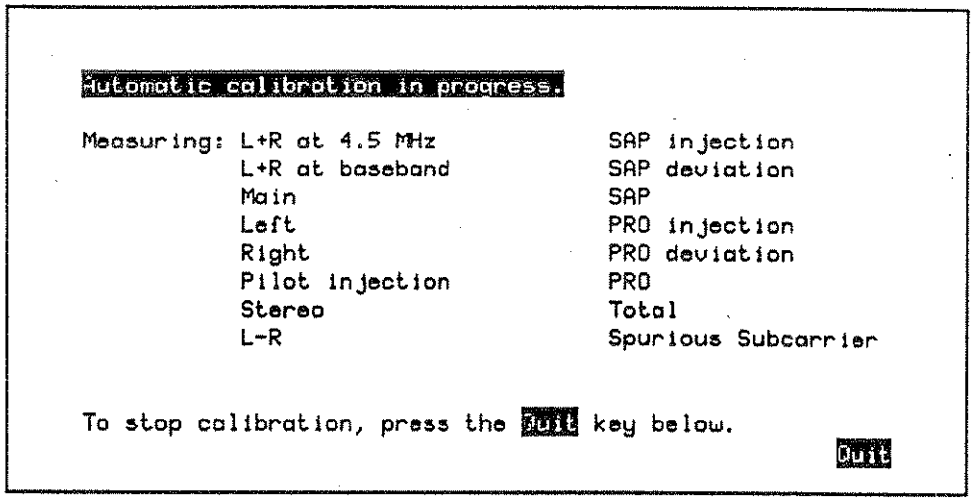
Figure 2-17
Display calibration options screen.

Display Calibration using a 1450-1

— The screen shown in Figure 2-17 prompts you top set the 1450-1 AUDIO SOURCE to external (press the SPLIT and INTR buttons simultaneously so both latch).

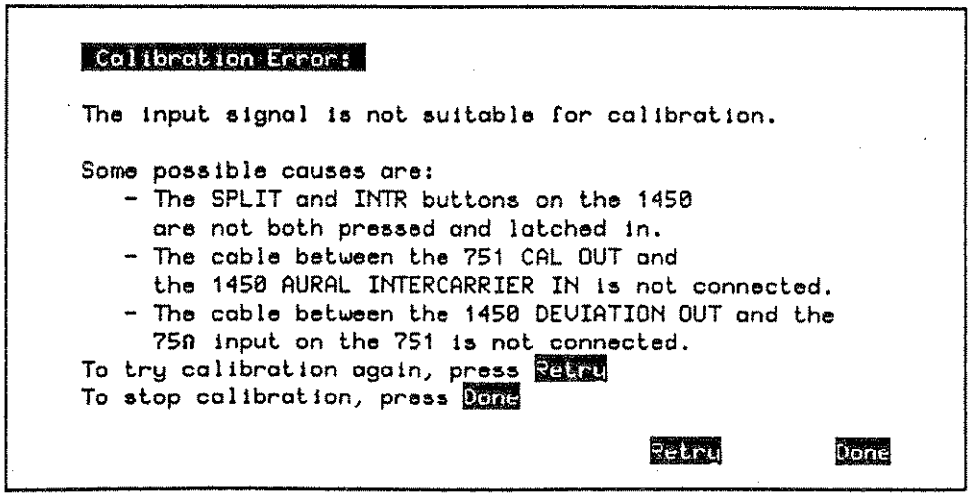
— Press **Proceed** to start the automatic display calibration. This initiates an automatic calibration of the display, which takes about 2 minutes and 15 seconds. Figure 2-18 shows the 751 display while the calibration measurements are in progress. Also, pressing **Quit** stops the display calibration and displays the message "Select your **normal 1450 AUDIO SOURCE mode, (SPLIT, INTR, or Q-P), then press Done.**" Pressing the **Done** softkey at this point would display the **Peak Modulation** screen.

Figure 2-18
751 display near end of automatic display calibration.



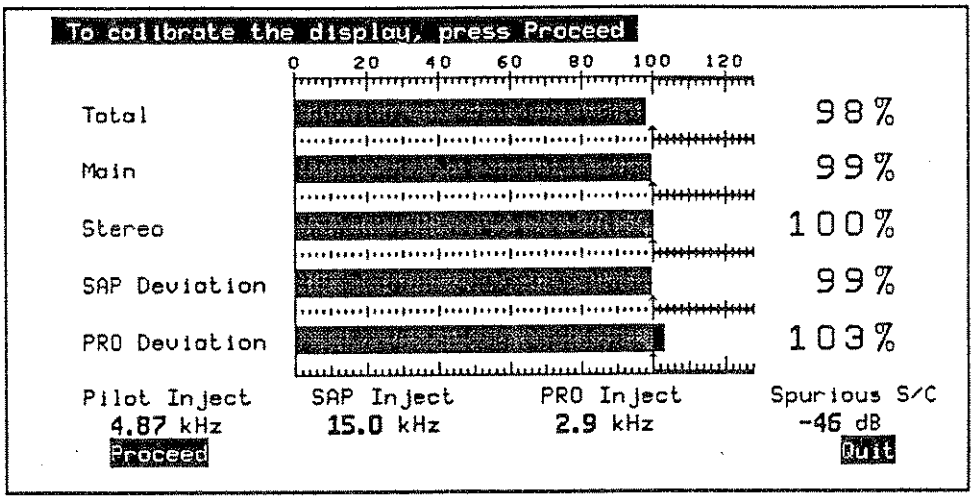
— If the 751 and 1450-1 are not properly connected or the 1450-1 AUDIO SOURCE is not set to external, the 751 will display the screen shown in Figure 2-19. This screen instructs you to recheck your equipment connections and settings. If the equipment connections are in order and the 1450-1 AUDIO SOURCE is set to external, press **Proceed** to try again.

Figure 2-19
Screen displayed by 751 when auto calibration fails.



— When the calibration measurements are complete, the 751 will display the measured values of each component on the **Peak Modulation** screen, as shown in Figure 2-20.

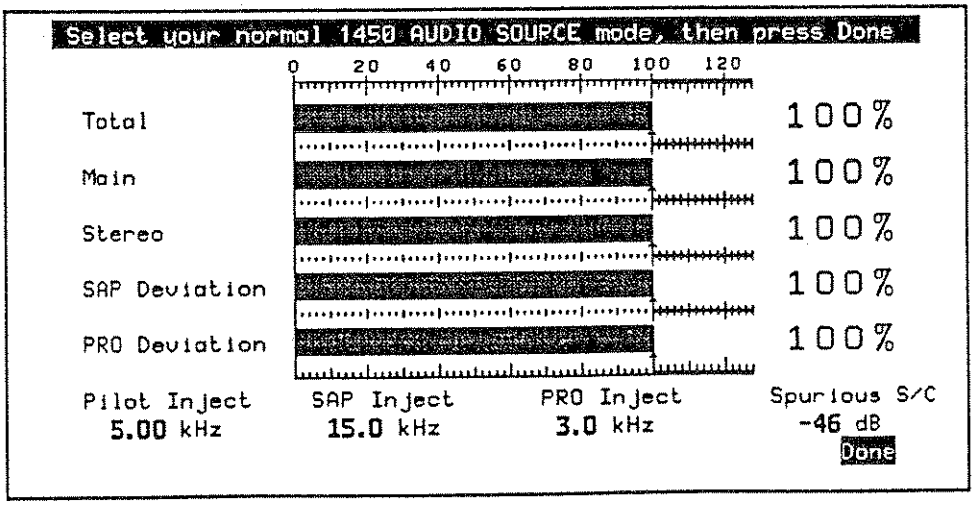
Figure 2-20
751 display upon completion of calibration measurements; calibration required.



— Press **Proceed** to store the calibration measurements, which are referred to as "calibration factors," or press **Quit** to stop the display calibration and display the message "**Select your normal 1450 AUDIO SOURCE mode, (SPLIT, INTR, or Q-P), then press Done**" (pressing the **Done** softkey at this point displays the **Peak Modulation** screen).

Pressing **Proceed** saves the calibration factors and displays the fully calibrated Peak Modulation screen, with all bars indicating 100% (or equivalent kHz readings) and all the digital readouts indicating their nominal values, as shown in Figure 2-21.

Figure 2-21
A fully calibrated 751 display.



— Reset the 1450-1 AUDIO SOURCE to its normal operating mode and press **Done** (the order of these two actions is not important). After pressing Done, the 751 will again remind you to reset the 1450-1 AUDIO SOURCE with the message "**Select your normal 1450 AUDIO SOURCE mode, (SPLIT, INTR, or Q-P), then press Done.**" Pressing the **Done** softkey at this point displays the **Peak Modulation** screen.

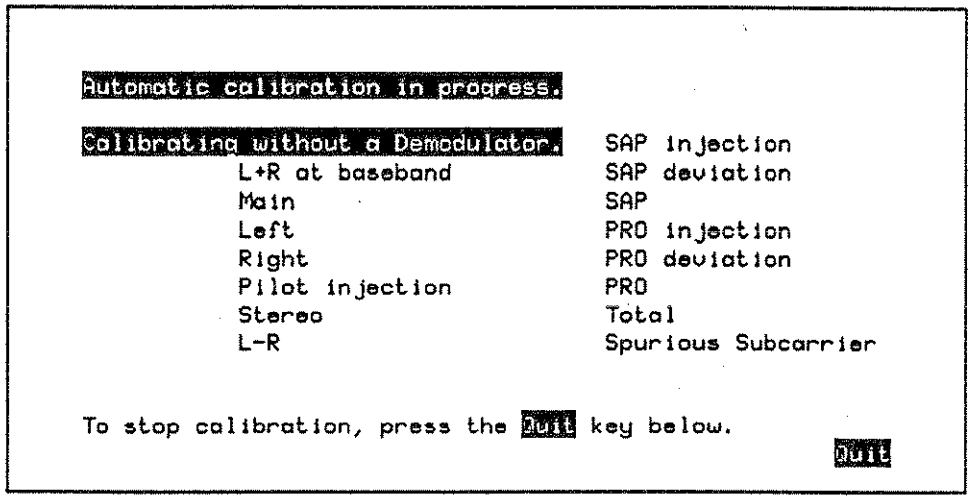
— The 751 display is now calibrated.

Display calibration without a 1450-1

— The screen shown in Figure 2-17 gives the option of calibrating the display without using a 1450-1. Again, this option should be selected only if there is no 1450-1 available.

— Pressing the **No Demod** softkey begins the automatic display calibration and displays the screen shown in Figure 2-22. Note difference between Figures 2-18 and 2-22. Figure 2-18 first says **Measuring: L+L at 4.5 MHz** where the **No Demod** calibration displays **Calibrating without a Demodulator** in reverse video.

Figure 2-22
751 display with "No Demod" display calibration in progress.



— The remainder of the automatic display calibration with **No Demod** is the same as when using the 1450-1, with one exception; because you are not using one, there is no prompt to return your 1450-1 to its normal operating mode when the calibration is completed.

Section 3 – Operating Instructions

Introduction

This section will familiarize you with the 751's display screens, controls, and operation. The features of the 751's display are covered first, followed by instructions on how to configure the 751's display to meet your requirements.

Display Features

The 751's display device is a 512 (horizontal) by 256 (vertical) pixel electroluminescent flat panel. Two screens of information, the **Peak Modulation** and **Processed Audio** screens, present all the monitoring and measurement information you'll need to routinely observe.

Peak Modulation Screen (True or Weighted Peaks)

On this screen, modulation levels are displayed as dynamic bars, with digital peak readouts accompanying each bar. Injection levels and the spurious subcarrier level are indicated by digital readouts across the bottom of the display. Figure 3-1 illustrates the **Peak Modulation** screen, while Table 3-1 describes the composition of each parameter displayed.

Figure 3-1
True Peak Modulation screen.

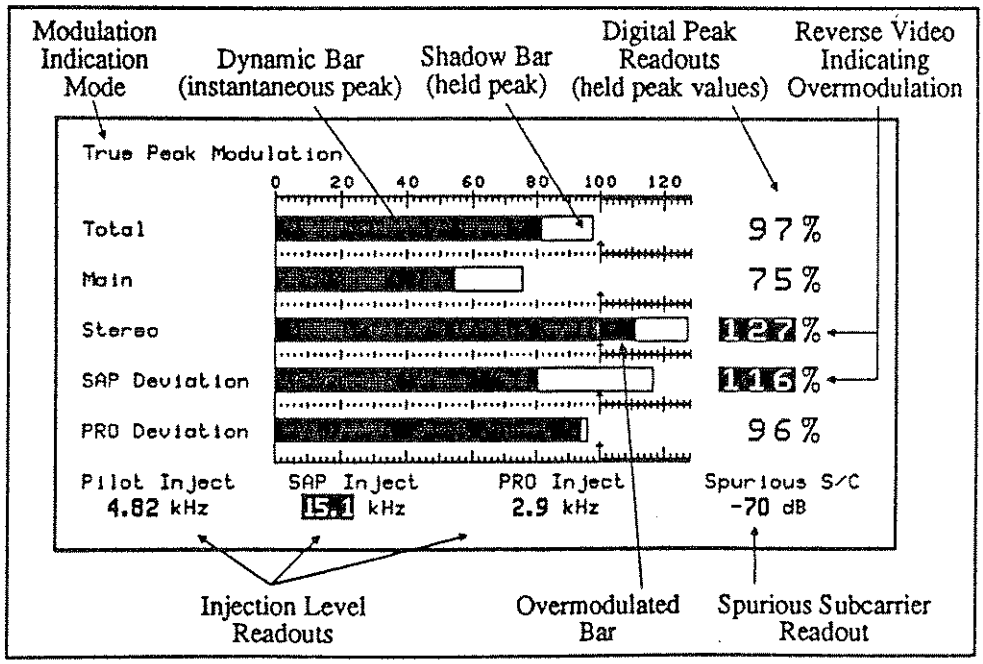


Table 3-1
Composition of parameters displayed on Peak Modulation screen.

Component Displayed	Definition	100% or Max	BTSC Rec. Practices[1]/ *OET 60A*[2]
Bars and Digital Peak Indicators Total	Total modulation of the aural carrier.	73 kHz[3]	3.2.2.e *D(b)(6)*
Main	Sum (L+R) channel (50 Hz to 15 kHz).	25 kHz	3.2.2.a *D(b)(1)*
Stereo	Combination of Main (L+R) and difference (L–R) channels (50 kHz to 46.468 kHz less 15.734 kHz Pilot).	50 kHz[4]	3.2.2.b *D(b)(2)*
SAP Deviation	Modulation of Second Audio Program subcarrier at 78.671 kHz.	10 kHz	3.2.2.c *B(b)(3)*
PRO Deviation	Modulation of PROfessional channel subcarrier at 102.273 kHz.	3 kHz	3.2.2.d
Digital Readouts Pilot Injection	Modulation of aural carrier by Pilot.	5 kHz ± 0.5	3.2.2.g *D(b)(3)*
SAP Injection	Modulation of aural carrier by Second Audio Program subcarrier.	15 kHz	3.2.2.f *D(b)(4)*
PRO Injection	Modulation of aural carrier by PROfessional channel subcarrier.	3 kHz	3.2.2.h *D(b)(5)*
Spurious S/C (SubCarrier)	The level of suppressed 31.468 kHz difference channel subcarrier.	250 Hz or -46 dB	3.2.4.11 *C(a)(5)*

Bars

The bars on the **Peak Modulation** screen indicate the instantaneous modulation level of the aural carrier due to the Total baseband BTSC signal, Main channel, Stereo (Main + Stereo subchannel without Pilot), and the instantaneous deviation level of the SAP and PRO subcarriers. Figure 3-2 illustrates the BTSC spectrum and what portions of the spectrum are represented by the Main and Stereo bars.

A solid line or "shadow bar" surrounds each bar. Each shadow bar holds a peak level until one of the two following events occur: (1) a user definable peak hold time elapses; or (2) the instantaneous value of the bar exceeds its held peak value, in which case the higher instantaneous value becomes the new held peak value. The digital peak readout to the right of each bar indicates the same held peak value as the shadow bar.

The portion of each bar that exceeds its peak limit switches from a stippled texture to solid. The digital peak readout for each bar will switch to reverse video at the same peak limit threshold. The arrow below each bar indicates the peak limit and will move along the scale as the peak limit is reset.

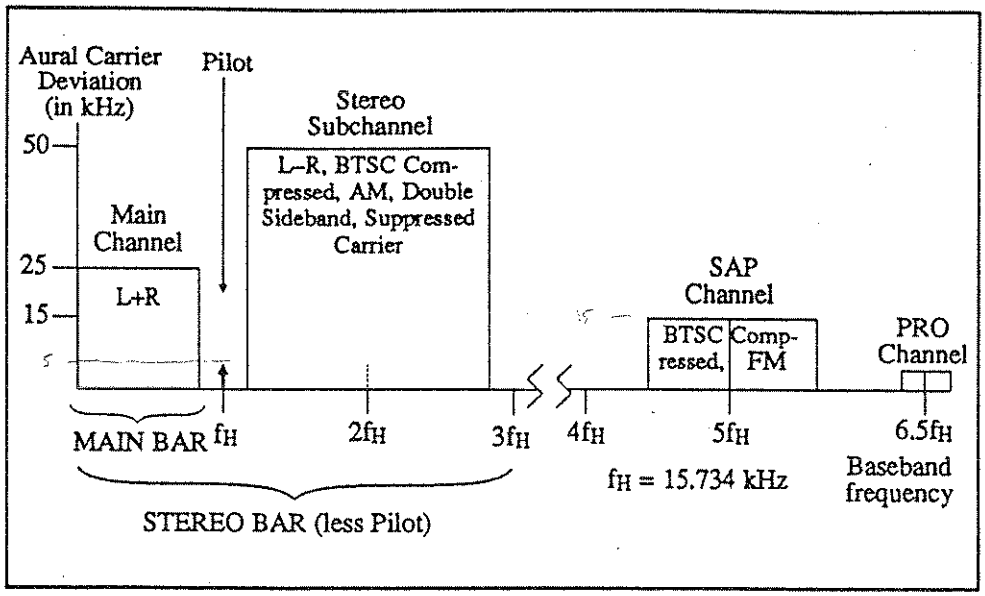
[1]EIA Television Systems Bulletin No. 5 on Multichannel Television Sound, BTSC System Recommended Practices, July, 1985.

[2]FCC Office of Engineering and Technology Bulletin #60 Rev. A.

[3]TOTAL bar 100% point can be rescaled to 70 kHz deviation if PRO is not present, 58 kHz if SAP is not present, or 55 kHz if neither SAP or PRO are present.

[4]Difference (L–R) channel need not be monitored separately. Operation within prescribed limits is assured by observing limits of Main channel and of combined Main and difference channels as per BTSC Rec. Practices 3.2.2 a-b and OET 60A D(b)(1-2).

Figure 3-2
BTSC spectrum.



The units of measure for each bar on this screen can be toggled between % and kHz. The display range of the bars on both screens is from 0% to 128% while the digital readouts indicate to ≈200%.

Digital Readouts

The digital readouts across the bottom of the display indicate injection levels of Pilot and the SAP and PRO subcarriers, as well as the spurious subcarrier level. These readouts also switch to reverse video when their respective limits are exceeded.

Processed Audio Screen

The **Processed Audio** screen displays audio levels after decoding and front panel selected processing, and will generally read substantially below 100% on program material when BTSC processing is selected. This does not indicate low modulation. If FLAT processing is selected, the **Processed Audio** bars will more closely agree with the **Peak Modulation** bars. The **Processed Audio** screen is shown in Figure 3-3.

Figure 3-3
Processed Audio screen.

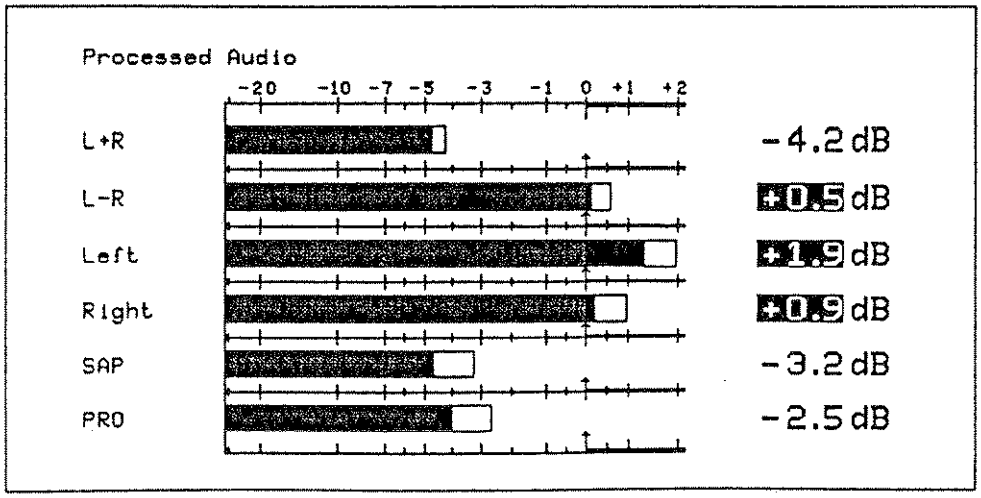


Table 3-2 describes the composition of each parameter displayed on the **Processed Audio** screen.

When FLAT processing is used with sinusoidal test signals, the relationship between the **Processed Audio** bars and the **Peak Modulation** bars is as noted in Table 3-2.

Table 3-2
Composition of parameters displayed on Processed Audio screen.

Component Displayed	Definition	100% or 0 dB Corresponds to[1]:
Bars and Digital Peak Indicators L+R	Main channel amplitude after front panel selected processing.	100% modulation of Main channel.
L–R	Difference channel amplitude after front panel selected processing.	100% modulation of Difference channel.
Left	Decoded Left channel after front panel selected processing.	100% modulation of Main channel by L=R.
Right	Decoded Right channel after front panel selected processing.	100% modulation of Main channel by L=R.
SAP	Second Audio Program after front panel selected processing.	100% modulation.
PRO	PROfessional channel after front panel selected processing.	100% modulation.

Bars

The **Processed Audio** screen displays the **L+R, L–R, Left, Right, SAP,** and **PRO** audio signals as dynamic bars. These bars and associated digital peak readouts have the same features as the bars and their associated readouts found on the **Peak Modulation** screen, with the exception of the attack time dynamics.

Bar Dynamics

Attack Times

The bars on the **Peak Modulation** screen can be set to provide **True Peak** or **Weighted Peak** indication. The type of peak indication desired is menu selected (in the **Display / Data Output options** sub-menu).

With **True Peak** indication selected, the 751 displays the true peak value of the input waveform without significant alteration of the wave shape and without introducing any false peaks. This mode is invaluable for setting up peak limiters.

The **Weighted Peak** indication response characteristics are shown in Figure 3-4. In this mode, bars and flashers on the **Peak Modulation** screen do not respond to the short duration, high frequency peaks that are inherent in the BTSC system. These peaks are caused by overshoot from the requisite sharp cut-off filters and the attack time of the BTSC compressor. Figure 3-4 shows the Weighted Peak mode response. This graph indicates the per cent of **True Peak Modulation** necessary to indicate 100% modulation

[1]With FLAT processing selected. In other processing modes, the displayed processed audio levels represent levels of audio inputs to an ideal stereo generator that has complimentary processing.

on the **Weighted Peak Modulation** screen for varying durations of a tone burst. For example, a 0.6 millisecond tone burst on the Main channel would have to actually modulate the aural carrier 180% on the **True Peak Modulation** screen to indicate 100% on the **Weighted Peak Modulation** screen, while a 1.0 millisecond tone burst would have to modulate the aural carrier only 120% on the **True Peak Modulation** screen to indicate 100% on the **Weighted Peak Modulation** screen.

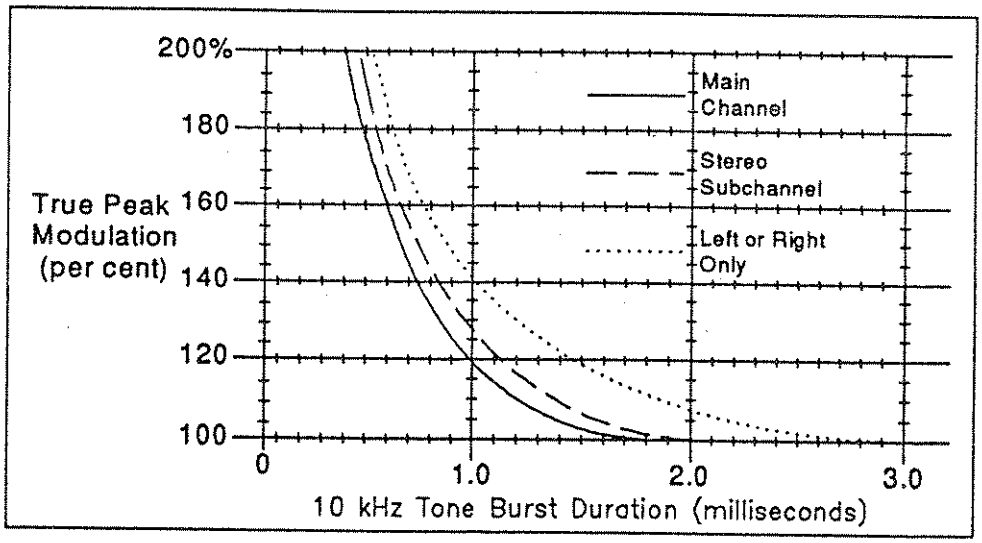


Figure 3-4
Typical time-weighting characteristic for Weighted Peak mode, showing what actual (True Peak) % modulation is required for a given length tone burst to indicate 100% with Weighted Peak indication selected.

BTSC processing in the stereo generator results in peak deviation that may be very different from what might be expected from a given audio input level. For the difference (L–R) channel, processing includes a level-dependent high frequency pre-emphasis that may exceed 40 dB at 15 kHz. This pre-emphasis combined with the finite attack time of the compressor causes modulation peaks to be much larger than program levels might indicate. Consequently, program levels to the stereo generator should be set while monitoring the **Weighted** or **True Peak Modulation** screen, not the **Processed Audio** screen.

The attack time for the **Processed Audio** bars is fixed. The audio bars reach 99% of their peak value within six millisecond.

Peak Hold and Decay Times

While the bars themselves indicate dynamic peak values, the shadow bars indicate held peak values for a menu selected time of 0, 0.5, 1, 2, 3, and 4 seconds. Bar decay rates can be set so the bars decay from 128% to 0% in either 0.5, 1, 2, 4, or 8 seconds. Note that the peak hold time and the decay rate selected applies to all the bars on both the **Peak Modulation** and **Processed Audio** screens.

Warning Flags

Several conditions will cause warning flags to appear across the top of the display on most screens. These flags appear for the conditions of **No Input**, **No Sync**, **Overmodulation**, and the REMOTE ALARMS conditions of **No Pilot**, **Phase Inverted**, and **Pilot/Sync Unlock**. These flags may appear on all screens except during the auto CALIBRATION routine. Also, the **Overmodulation** flag does not appear on the **Peak Modulation** screen. Figure 3-5 shows the warning flags on the 751 display.

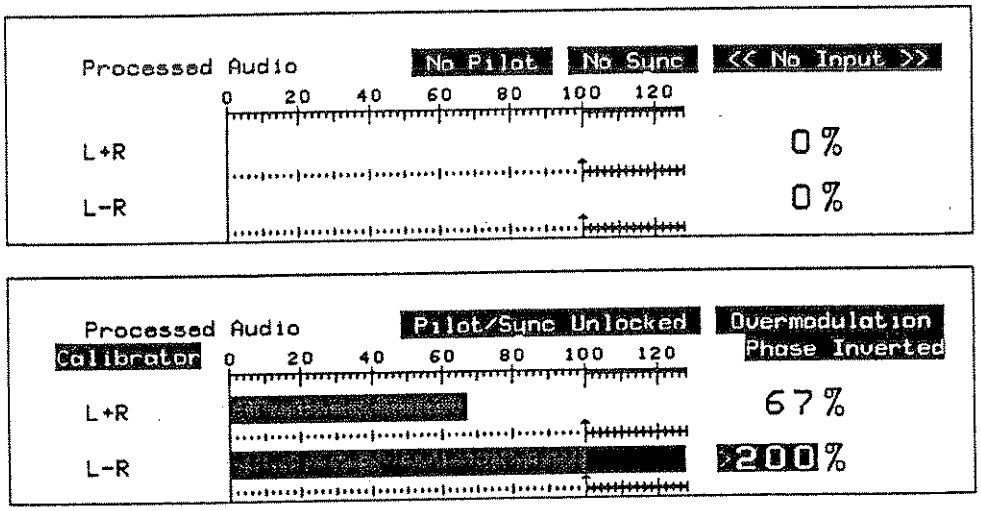


Figure 3-5
Warning flags.

Warning Flag Conditions

The following list describes the conditions that cause each warning flag to appear:

No Input indicates that there is no RF input signal to the 1450-1, which, in turn, outputs a large amplitude high frequency noise to the the 751's input.

No Sync is generated when the H sync amplitude of the comp sync, H sync, or comp video signal connected the 751's rear panel loop-through is below 143 mV for two consecutive cycles of Pilot.

Overmodulation flag is displayed when any of the bars (but not injection level readouts) on the **Peak Modulation** screen exceed their peak flasher limit. This flag does not appear on the **Peak Modulation** screen.

No Pilot is generated when the Pilot injection level is below ~500 Hz.

Phase Inverted is generated when the 751 is reasonably sure that a polarity reversal has occurred. The following criteria must simultaneously be met for at least three seconds:

- Front panel PROCESSING for STEREO must be set to BTSC.
- Pilot injection is great enough to prevent the No Pilot warning flag.
- The sum of decoded L+R and L–R signals is no smaller than ≈33 dB down from full scale.
- The L–R level is greater than twice the L+R level.

Pilot/Sync Unlock appears when pilot and sync are not frequency locked.

Configuring The 751's Display

This topic outlines how to configure the 751's display using the front panel controls and menus. Figure 3-6 illustrates the 751's front panel controls.

Changing Screens

The CHANGE SCREEN control alternates the 751 display between the **Peak Modulation** and the **Processed Audio** screens.

When in any level of the menu, pressing the CHANGE SCREEN push button returns you to either the **Peak Modulation** or **Processed Audio** screen (the alternate of the last screen displayed).

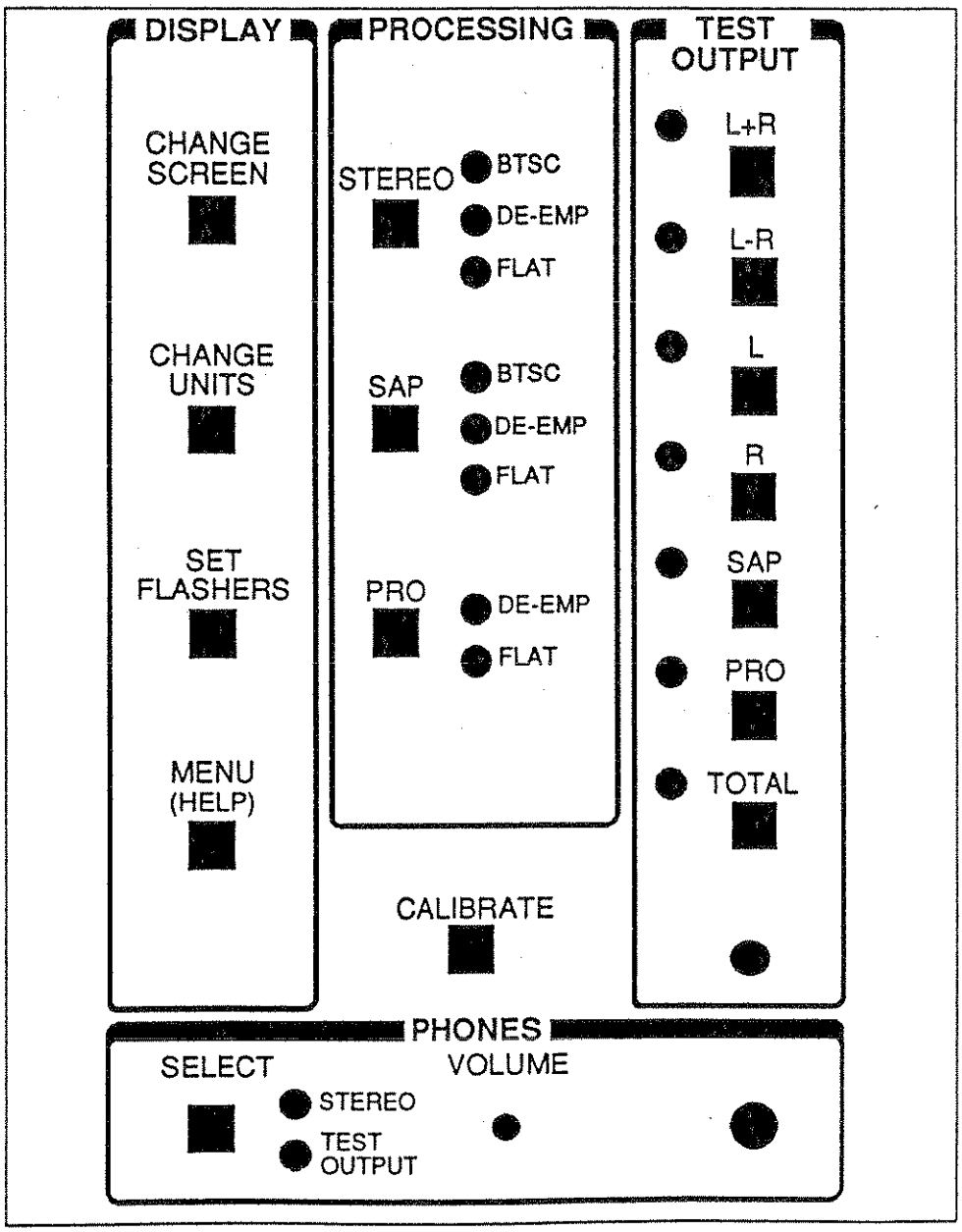


Figure 3-6
751 front panel controls.

Changing Units

The CHANGE UNITS push button toggles the units of measure for the displayed screen. The units of measure on the **Peak Modulation** screen are kHz and % for the bars and Hz and dB for the spurious subcarrier readout. The injection level units are always kHz. Units of measure for the **Processed Audio** screen are % and dB.

When in any level of the menu, pressing the CHANGE UNITS push button will return you to either the **Peak Modulation** or **Processed Audio** screen (whichever was last displayed), and change the units of measure.

Selecting SAP and PRO Display Modes

The installation procedure suggests you set the **Select SAP and PRO Display Modes** depending on how you use SAP and PRO.

You'll find this item in the top level of the MENU. **Select SAP and PRO display modes** allows you to select how and when the 751 displays the SAP and PRO modulation, injection and audio levels. Figure 3-7 shows the **Select SAP and PRO display modes** menu screen. Figure 3-8 shows the **Peak Modulation** screen with both SAP and PRO display modes set to **OFF**.

Figure 3-7
Select SAP and PRO display modes menu screen.

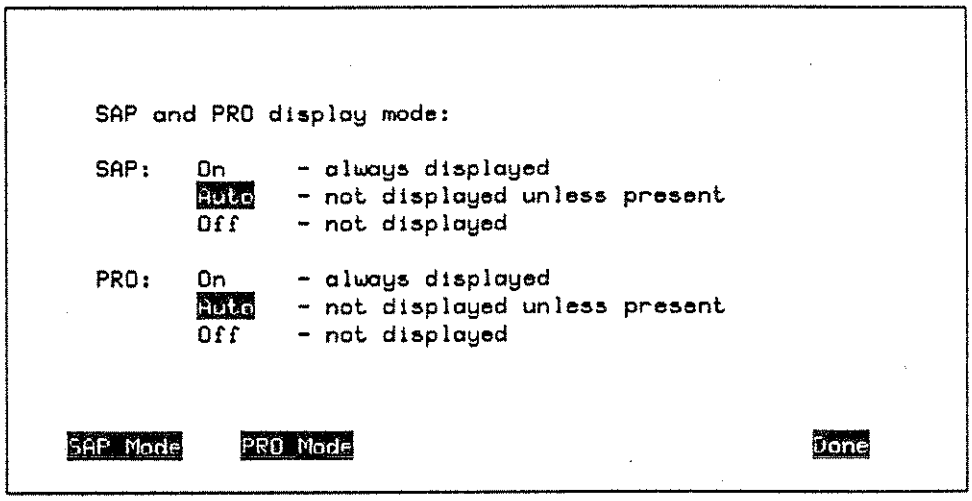


Figure 3-8
Peak Modulation screen with both SAP and PRO display modes set to OFF.