User Manual

Tektronix

**VM700T Video Measurement Set
Option 22 Video Wander Measurements**

071-0038-00

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Contacting Tektronix

Product Support	For application-oriented questions about a Tektronix measurement product, call toll free in North America: 1-800-TEK-WIDE (1-800-835-9433 ext. 2400) 6:00 a.m. – 5:00 p.m. Pacific time
	Or, contact us by e-mail: tm_app_supp@tek.com
	For product support outside of North America, contact your local Tektronix distributor or sales office.
Service Support	Contact your local Tektronix distributor or sales office. Or, visit our web site for a listing of worldwide service locations.
	http://www.tek.com
For other information	In North America: 1-800-TEK-WIDE (1-800-835-9433) An operator will direct your call.
To write us	Tektronix, Inc. P.O. Box 1000 Wilsonville, OR 97070-1000

Getting Started

This section provides a product description and instructions for configuring Option 22.

Product Description

Option 22 is a VM700T Video Measurement Set application designed to measure the horizontal-sync timing wander characteristics (also referred to as frequency offset and drift) of a video signal that has been transported over a SONET or SDH digital distribution network.

Sync-timing wander is a common problem with contribution-quality video that has been transported over SONET or SDH distribution networks. Since sync-timing wander is often misunderstood, the problem is frequently undiagnosed. Contribution-quality video transport requires a higher level of network timing control than does voice or data transport. Option 22 provides a simple and efficient method for the verification of horizontal-sync frequency timing stability for contribution-quality video applications.

Digital distribution networks, which are synchronized to an external timing source, buffer their data and use pointers to indicate the start of the next part of the payload. At each step where data is multiplexed, the network may add or drop a few bytes of buffered data (pointer adjustments) in order to maintain the average payload bit-rate. However, pointer adjustments cause a phase variation in the network.

A portion, if not all, of this phase variation (horizontal-sync wander) is transferred to the video signal that is recovered at the output of the Codec. If this happens, a composite video signal can exhibit subtle shifts in color hue or variations in sync phase when viewed on a waveform or vector monitor. Excessive pointer adjustments in the network can cause levels of video wander to accumulate, producing more severe problems including loss of synchronizing lock-up.

Option 22 requires no special test signals, measures standard composite-video signals, and provides the following two measurement methods for verification of video horizontal-sync frequency:

- Frequency Offset measures the absolute horizontal-sync frequency error.

- Drift Rate measures the rate of horizontal-sync timing changes.

Configuration

> *NOTE. Configuration of Option 22 is only necessary if you need to change the value of the displayed default-limit markers. There are no special test signals or measurement locations required to operate Option 22.*

Configuring the Option 22 Video Wander Measurements option is similar to configuring the other video functions of the VM700T Video Measurement Set. When you install Option 22, a default measurement-limits file and wander directory are provided which contain the parameters that the measurement set uses to perform the wander measurements.

If the parameters provided in the System Default file are acceptable, you do not need to change the configuration files. If your specific measurement application requires parameters other than the default parameters supplied with Option 22, you can reconfigure the configuration files to suit your testing requirements.

To reconfigure and use new measurement parameters for Option 22, you must perform these tasks:

- Create your own Wander configuration file (for example, Wander_Limits) and configure it with your own parameter values.

- Create your own Video Source file (for example, Wander_Source) and select the Wander_Limits file as the limits file to be used.

- Configure the Source_Selection Video file to select the Wander_Source file as a source file for one or all of the channels (A, B, or C), as needed for your measurements.

Creating and Editing a Configuration File

Perform the following procedure to create a new Wander configuration file and to edit a configuration file:

1. Create a new Wander-measurement configuration file. You only need to create a new configuration file if you do not already have a user-created configuration file, or you want to create a new configuration file.

    a. Press the front-panel **Configure** button to enable the measurement set Configuration mode. See Figure 1.

    b. Touch the **Configure Files** soft key. The screen now displays a series of soft key options in a window.

    c. Use the front-panel knob to scroll through the window to locate the Wander configuration file soft key.

    d. Touch the **Wander** soft key. The screen displays the System Default file and any user-created files that have been created. See Figure 2.

Non volatile memory: used 52416 bytes, free 995904 bytes

used
5%

free
95%

VM700T Video Measurement Set xxxxxx-xxxx

```
Option 01 NTSC      Version  2.10
Option 11 PAL       Version   2.10
Option 40 Audio     Version  1.05
Option 30 Component    Version  1.01.01
Option 20 Teletext    Version  1.01.01
Option 1G Echo/Rounding Version  1.00.01
Option 21 Camera Testing Version  1.02.01
Option 22 Wander       Version  1.00
```

Time	Configure Files	Function Keys	Option Key
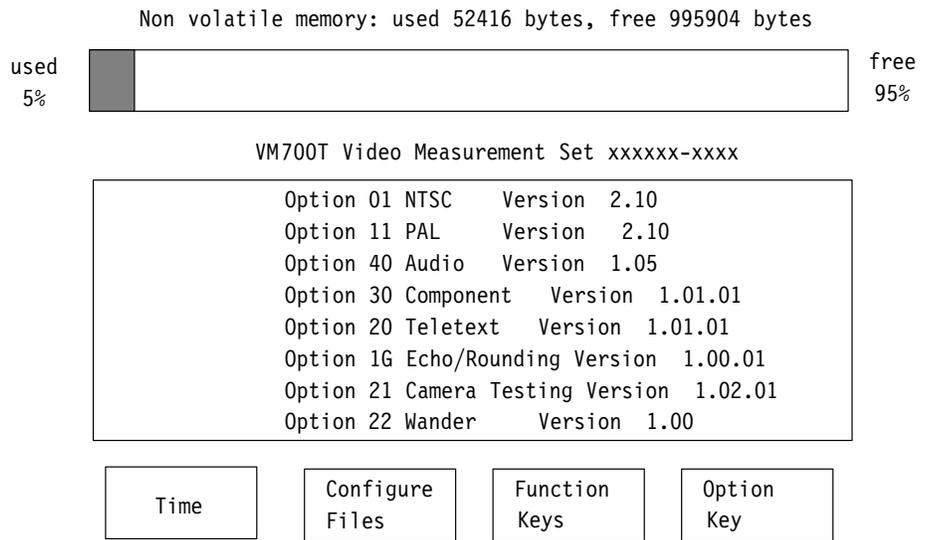
Figure 1: Typical Configure menu

System
Default

In /nvram0/ConfigFiles/Wander_Limits/NTSC

NTSC files

| Delete	Switch NTSC/PAL	Create File	Rename	Print File	Leave Directory
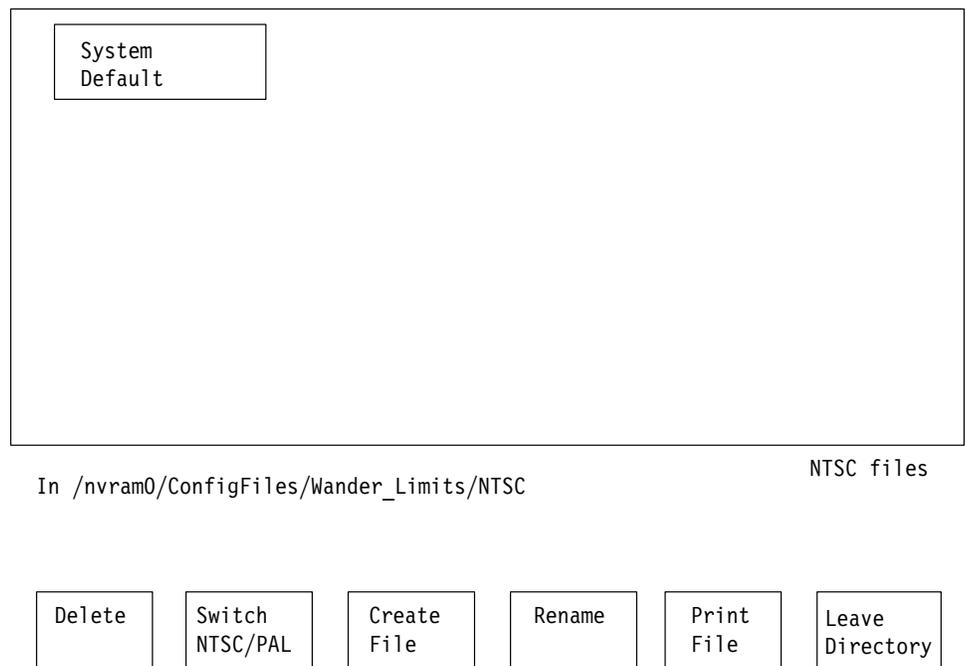
Figure 2: Typical configuration file display

    e. Touch the **Create File** soft key. The query line (the top line of the display) asks you to select a file to use as a template for your new file.

   f. Touch the soft key of the file you want to use as a template (for example, System Default). The screen displays a keyboard that you can use to type a name for your new file. See Figure 3.

   g. Type the new file name, for example Wander_Limits, observing the following rules and noting the special uses of some characters and keys:

- Spaces are not allowed in file or directory names; use an underline (_) or dot (.) character to separate words in a name.

- Forward slash (/) and reverse slash (\) characters are not permitted in the file name.

- When neither Set1 nor Set2 is highlighted, you can type lowercase and uppercase English alphabet characters. The lowercase Set1 character set allows you to enter numerals and punctuation characters. The uppercase Set1 and the Set2 character set allow you to enter various special or accented characters for use in nonEnglish language file names.

  The Set1, Set2, and Shift soft keys lock when they are selected. Set1 and Set2 are unlocked by touching the same key again or touching the unselected key of the pair. Shift is unlocked by touching Shift again.

- A maximum of 31 characters are allowed in a file or directory name.

```
            Please enter file name (max 31 characters)

                  ┌──────────────────────────┐
                  │ NewLimits█                │
                  │                           │
                  └──────────────────────────┘


  [q]  [w]  [e]  [r]  [t]  [y]  [u]  [i]  [o]  [p]

    [a]  [s]  [d]  [f]  [g]  [h]  [j]  [k]  [l]  [Back
                                                 Space]

      [z]  [x]  [c]  [v]  [b]  [n]  [m]  [Return]

  [Cancel] [Set1] [Set2] [    Space    ] [Shift] [Done]
```
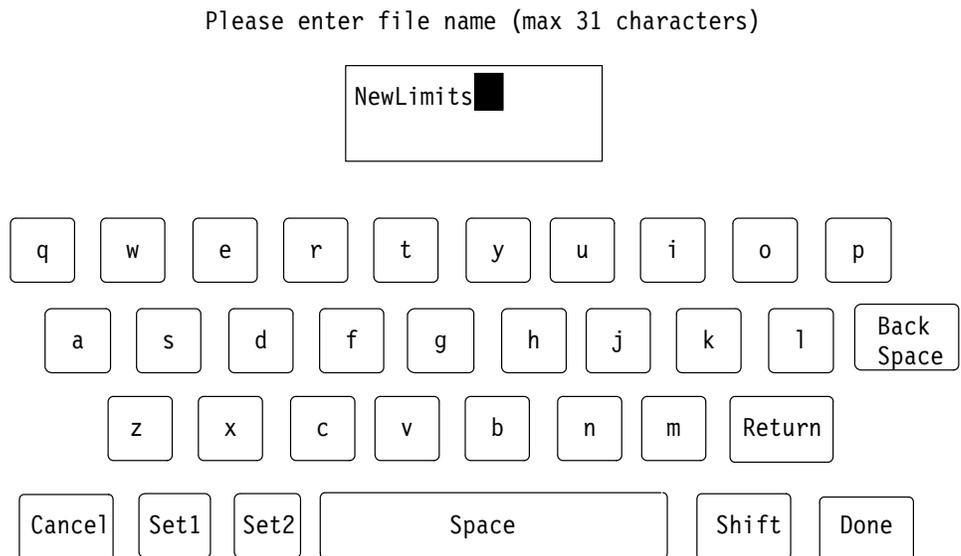
Figure 3: File naming keyboard

■ Use only uppercase and lowercase letters, numbers, and the following punctuation characters in names: (_) underline, (.) dot, (–) minus sign, (+) plus sign, (:) colon, and (~) tilde. Avoid using punctuation characters other than those mentioned above in a directory or file name.

■ Multiline directories and file names can be entered using the Return key. Touch Return on the touch-screen keyboard to get to the second line.

■ When the VM700T Video Measurement Set is in Remote mode, the return character becomes a tilde (~) character for purposes of file name reference. Thus, a directory name that is displayed as:

```
JOHN
SMITH
```

becomes JOHN~SMITH in a remote operation.

h. Touch the **Done** soft key when you finish naming the file. (If you do not want to create the new file, touch the **Cancel** key to quit the process.)

After you touch the Done soft key, the measurement set displays the contents of the new Wander-measurement configuration file (the configuration data from the template file you selected). You can now modify the parameters in the configuration file as described in step 2.

2. Modify your Wander-measurement configuration file.

NOTE. You can view the parameters in any configuration file. However, to modify the parameters of the System Default file, you must create a copy of the System Default file, and then edit the copy. Refer to the previous step for instructions.

a. If you just completed step 1, and the measurement set is displaying your new Wander configuration file, proceed to step 2c.

b. Open the Wander-measurement configuration file you want to edit. To locate your existing Wander-measurement configuration file(s), first press the front-panel **Configure** button to enable the measurement set Configuration mode. See Figure 1.

Touch the **Configure Files** soft key, then use the front-panel knob to scroll through the window to locate the Wander soft key. Touch the **Wander** soft key to display the Wander-measurement System Default configuration file and any other Wander-measurement configuration files that have been created. See Figure 2.

Touch the soft key of the configuration file you want to edit.

     c. Select the parameter you want to change by rotating the front-panel knob to highlight the line on the display containing the parameter, and then touch the parameter. (This includes the title line in the configuration file.) Table 1 shows the editable fields in a user-created Wander-measurements limit file.

     d. Rotate the front-panel knob to increase or decrease the value of the selected parameter.

     e. Touch the **Accept Input** soft key to accept the change.

NOTE. If you change a parameter and then decide that you do not want to keep the change, touch the No Change & Exit soft key. The measurement set verifies that you want to exit without changing anything by asking you to touch the No Change & Exit soft key again.

To return to the file you created, touch the soft key on the display (the file you created now appears there).

If you are making extensive changes to the file, you can avoid losing all your changes by pressing the Update & Exit soft key after each change and then re-entering the file. That way, if you make a mistake and must exit the file, your earlier work is retained while the most recent change (or mistake) is eliminated.

---

     f. Touch the **Update & Exit** soft key, and then touch **Leave Directory** to return to the main level of the Configuration mode. See Figure 2.

3. Perform this step only if you need to delete an existing configuration file.

     a. In the Wander-measurement configuration files directory, touch the **Delete** soft key. See Figure 2. The query line (the top line of the display) asks you to select a file to be deleted.

NOTE. You can halt file deletion by pressing the Cancel soft key (in the same position as the Delete soft key before the deletion process started). You can also halt file deletion by touching the screen image of the file. A file is not deleted when you halt the deletion process.

---

     b. Select the file to be deleted by touching its soft key. The measurement set begins the deletion process.

Table 1: Editable fields in the Wander-measurement configuration file

Editable Item	Choices
Wander Option Configuration defaults	Name of file identification line can be changed for the measurement reports. This does not change the file name.
NTSC Limits	Select any value between the upper and lower limits.
Drift Rate peak (ppb/s)	Upper: +999.0 (Factory default value: +28.0) Lower: −999.0 (Factory default value: −28.0)
Frequency Offset peak (ppb)	Upper: +99990.0 (Factory default value: +2800.0) Lower: −99990.0 (Factory default value: −2800.0)
PAL Limits	Select any value between the upper and lower limits.
Drift Rate peak (ppb/s)	Upper: +999.0 (Factory default value: +22.6) Lower: −999.0 (Factory default value: −22.6)
Frequency Offset peak (ppb)	Upper: +9999.0 (Factory default value: +226.0) Lower: −9999.0 (Factory default value:−226.0)

Creating and Editing a Video Source File

Perform the following procedure to create a new Video Source file and to edit a Video Source file:

1. Create a new Wander-measurement video source file. You only need to create a new video source file if you do not already have a user-created video source file, or you want to create a new video source file.

   a. Press the front-panel **Configure** button to enable the measurement set Configuration mode. See Figure 1.

   b. Touch the **Configure Files** soft key. The screen now displays a series of soft key options in a window.

   c. Use the front-panel knob to scroll through the window to locate the Video_Source Files soft key.

   d. Touch the **Video_Source Files** soft key to enter the Video Source Files directory. The screen displays the System Default file and any user-created files that have been created. See Figure 4.

   e. Touch the **Create File** soft key. The query line (the top line of the display) asks you to select a file to use as a template for your new file.

   f. Touch the soft key of the file that you want to use as a template (for example, System Default). The screen displays a keyboard that you can use to type a name for your new file. See Figure 3.

   g. Type the new file name, for example Wander_Source, observing the rules and notes given on page 4.

```
┌─────────────────────────────────────────────────────────────────────────┐
│  ┌───────────────────────┐      ┌───────────────────────┐                 │
│  │  Wander_Source        │      │  System               │                 │
│  │                       │      │  Default              │                 │
│  └───────────────────────┘      └───────────────────────┘                 │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
│                                                                           │
└─────────────────────────────────────────────────────────────────────────┘
```

In /nvram0/ConfigFiles/Video_Source~Files/NTSC   NTSC Files

```
┌──────────┐ ┌──────────┐ ┌──────────┐ ┌──────────┐ ┌──────────┐ ┌──────────┐
│  Delete  │ │  Switch  │ │  Create  │ │  Rename  │ │  Print   │ │  Leave   │
│          │ │ NTSC/PAL │ │  File    │ │          │ │  File    │ │ Directory│
└──────────┘ └──────────┘ └──────────┘ └──────────┘ └──────────┘ └──────────┘
```
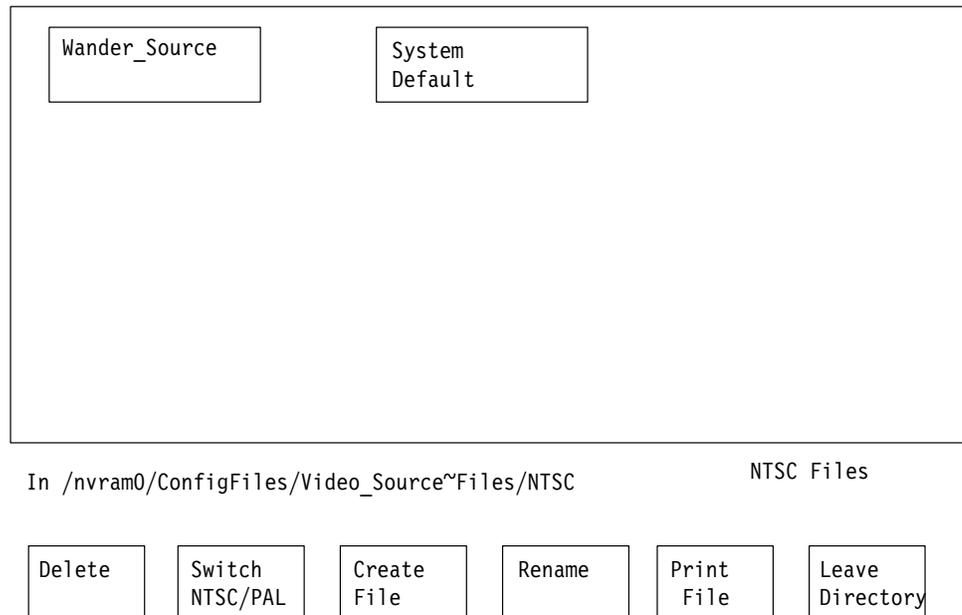
Figure 4: Typical Video Source file display

    h. Touch the **Done** soft key when you have finished naming the file. (If you do not want to create the new file, touch the **Cancel** key to quit the process.)

        After you touch the Done soft key, the measurement set displays the contents of the new Wander-measurement video source file (the source data from the template file you selected). You can now modify the video source file as described in step 2.

2. Modify your Wander-measurement video source file.

NOTE. You can view the parameters in any video source file. However, to modify the parameters of the System Default file, you must create a copy of the System Default file and edit the copy.

---

    a. If you just completed step 1, and the measurement set is displaying your new Wander video-source file, proceed to step 2c.

    b. Open the Wander-measurement video source file you want to edit. To locate your existing Wander-measurement video source file(s), first press the front-panel **Configure** button to enable the measurement set Configuration mode. See Figure 1.

        Touch the **Configure Files** soft key, then use the front-panel knob to scroll through the window to locate the Video_Source Files soft key.

Touch the **Video_Source Files** soft key to display the Wander-measurement System Default video source file and any other Wander-measurement video source files that have been created. See Figure 4.

Touch the soft key of the video source file you want to edit.

c. Select the parameter you want to change by rotating the front-panel knob to highlight the line on the display containing the parameter, and then touch the parameter.

d. Rotate the front-panel knob to select the name of the new Wander_Limits configuration file you created.

e. Touch the **Accept Input** soft key to accept the change.

NOTE. If you change a parameter and then decide that you do not want to keep the change, touch the No Change & Exit soft key. The measurement set verifies that you want to exit without changing anything by asking you to touch the No Change & Exit soft key again.

To return to the file you created, touch the soft key on the display (the file you created now appears there).

If you are making extensive changes to the file, you can avoid losing all your changes by pressing the Update & Exit soft key after each change and then re-entering the file. That way, if you make a mistake and must exit the file, your earlier work is retained while the most recent change (or mistake) is eliminated.

f. Touch the **Update & Exit** soft key, and then touch **Leave Directory** to return to the main level of the Configuration mode. See Figure 2.

3. Perform this step only if you need to delete an existing video source file.

a. In the Video_Source Files directory, touch the **Delete** soft key. See Figure 4. The query line (the top line of the display) asks you to select a file to be deleted.

NOTE. You can halt file deletion by pressing the Cancel soft key (in the same position as the Delete soft key before the deletion process started). You can also halt file deletion by touching the screen image of the file. Nothing happens to a file whose deletion process is halted.

b. Select the file to be deleted by touching its soft key. The measurement set begins the deletion process.

For more information about the other selections in the Video Source file, refer to the *VM700T Option 01 (NTSC) & Option 11 (PAL) User Manual*.

Configuring the Video Source Selection

The configuration files used by the measurement set for video-wander measurements are configured in the Wander configuration directory and specified in the Video Source Files directory. Likewise, the video-source files are configured in the Video Source Files directory and specified in the Source Selection Video directory.

In the Source Selection Video file you can select a source file (if you want to use a video-source file other than the System Default file) for each of the three channel input sources.

To specify a Video Source file, perform the following procedure:

1. Press the front-panel **Configure** button to enable the measurement set Configuration mode. See Figure 1.

2. Touch the **Configure Files** soft key. The screen now displays a series of soft key options in a window.

3. Use the front-panel knob to scroll through the window to locate the Source_Selection Video soft key.

4. Touch the **Source_Selection Video** soft key.

5. Rotate the front-panel knob to highlight the source for which you are specifying a video source file (source A, B or C).

6. Touch the highlighted source file to select it.

7. Rotate the front-panel knob to change the Video Source file selection.

8. When you have selected a Video Source file, touch the **Accept Input** soft key.

9. If the change is correct, touch the **Update & Exit** soft key. If the change is not correct, touch the **No Change & Exit** soft key and attempt the change again.

NOTE. If you change the video source file and then decide to exit the directory and cancel the change, press the Accept Input soft key, followed by the No Change & Exit soft key. The measurement set verifies that you want to exit the Source Selection Video directory and cancel any changes by asking you to touch the No Change & Exit soft key again.

Operating Basics

This section contains a measurement theory discussion, instructions for performing each of the video-wander measurements, and a description of the menu selections within each measurement window display.

Measurement Theory

Since video-signal paths are usually self-synchronized by phase tracking the input video signal, it is not advantageous to limit the very low-frequency spectral components to a fixed peak value. Therefore, the measurement set processes these slow-phase variations in terms of Frequency Offset and Drift Rate, which are more directly related to a video-systems phase tracking ability.

The plot of the time error versus frequency accommodation in Figure 5 illustrates the effect of the LP Corner menu selections of 0.2 Hz, 0.5 Hz, and 1.0 Hz. These LP Corner drift-rate bandwidth values select the upper-frequency limit of the Drift Rate measurement. For example, if a 10 ns peak jitter is considered acceptable, it is not advantageous to restrict the peak drift-rate to 28 ppb/s above 0.2 Hz since, as long as the peak jitter is below 10 ns, the drift-rate value is of no concern and can have any value.
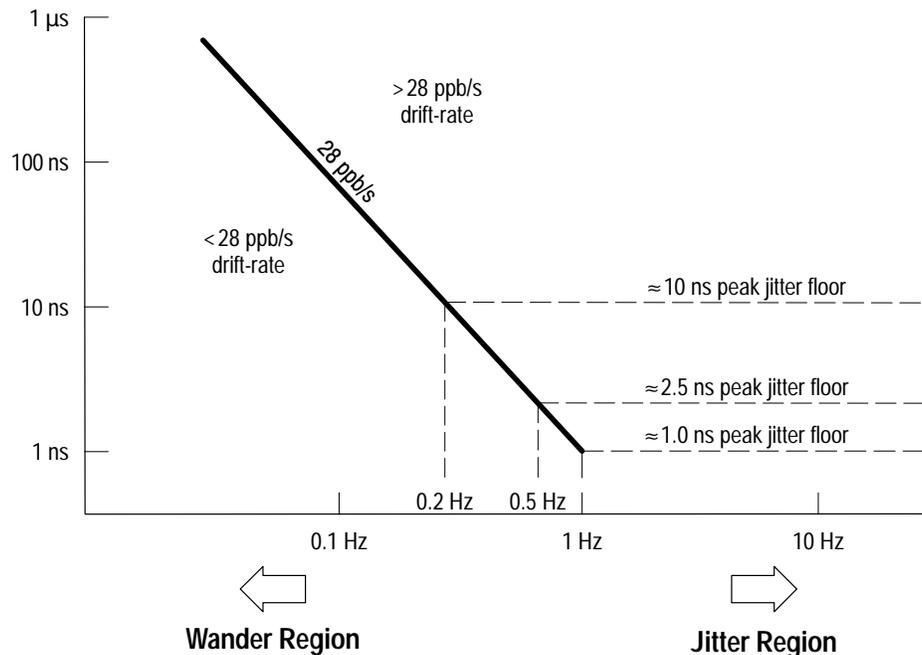

Figure 5: Plot of time error versus frequency accommodation

To better understand this concept, consider the typical contribution-quality video signal. These signals typically have broad-band jitter and wander that is composed of many spectral components, but may have large low-frequency jitter or wander due to digital buffering and reclocking.

Contribution-quality video is not well defined, but a jitter limit of 2.5 ns peak (since no other limit currently exists) and a drift-rate limit of 28 ppb/s would be only slightly worse than a studio black-burst reference signal such as SMPTE RP-154-1994.

Therefore, it is advantageous to only measure the jitter spectral components below 0.5 Hz in terms of drift-rate, and measure jitter above 0.5 Hz in terms of its peak or peak-to-peak time value. For final distribution-quality video, 10 ns peak jitter may be acceptable. In this case, the drift-rate should only be measured below 0.2 Hz. The general concept is that large acceptable jitter floors imply using a low LP Corner value.

Frequency Offset Measurement

Frequency Offset is a frequency-accuracy measurement of the absolute frequency error of a video signal as compared to a reference video signal. When the measurement set is warmed up, you can make accurate measurements of the input video-signal frequency to within 100 ppb of the reference-signal frequency.

Display limit-markers indicate peak frequency offset in ppm and Hz @ Fsc over the past 17 seconds. Default limit-markers of ± 2.8 ppm (± 10 Hz) for NTSC and ± 0.226 ppm (± 0.1 Hz) for PAL may be reprogrammed to any value.

Normalization. The internal frequency reference of the measurement set drifts over time, which can affect the Frequency Offset measurement accuracy. To maintain measurement accuracy, periodically normalize the measurement set to a stable frequency reference to zero out any drift that has accumulated over time. Normalization is performed by using the Zero Offset function while measuring a reference video signal.

Since the measurement accuracy is based on the accuracy of the reference signal, use a reference signal with stability drift typically better than 100 ppb/hr. A suggested reference signal is a black burst signal from a Tektronix SPG422 Component Digital Master Sync Generator. (You can lock the SPG422 generator to an Rb or Ce clock source for optimum accuracy.)

If the VM700T Video Measurement Set is in a stable temperature environment, normalization should be done every half hour. To maintain optimum measurement accuracy, periodically normalize the measurement set at intervals of less than half an hour.

Performing the Measurement

Perform the following procedure to measure the amount of frequency offset in your composite-video signal:

NOTE. *To maintain optimum measurement accuracy, periodically normalize the measurement set at intervals of less than half an hour. Refer to* Normalization *on page 12.*

---

1. Normalize the Frequency Offset application of the measurement set.

   a. Connect a composite-video reference signal to a channel input of the VM700T Video Measurement Set.

   b. Press the **Measure** button on the front panel, and then touch the **Video Options** soft key on the display.

   c. Touch the **Wander** soft key to enable the Option 22 applications.

   d. Press the front-panel **Menu** button to display the application soft keys.

   e. Use the **Frequency Offset** application to measure the video reference source on the channel input.

   f. Use front-panel **Source** buttons to select the input channel connected to the reference signal. (This is only necessary if you have more than one signal connected to the measurement set.)

   g. Touch the **Zero Offset** soft key to normalize the measurement set to the video reference signal.

2. Measure the frequency offset of the video signal you want to test. Figure 6 illustrates the Frequency Offset measurement display.

   a. Connect the composite-video signal that you want to test to a channel input of the VM700T Video Measurement Set.

   b. Press the **Measure** button on the front panel, and then touch the **Video Options** soft key on the display.

   c. Touch the **Wander** soft key to enable the Option 22 Video Wander measurements.

   d. Touch the **Frequency Offset** soft key (if necessary) to display Frequency Offset application window.

   e. Press the front-panel **Menu** button to display the application soft keys.

   f. Use the application soft keys to perform the measurement you need.
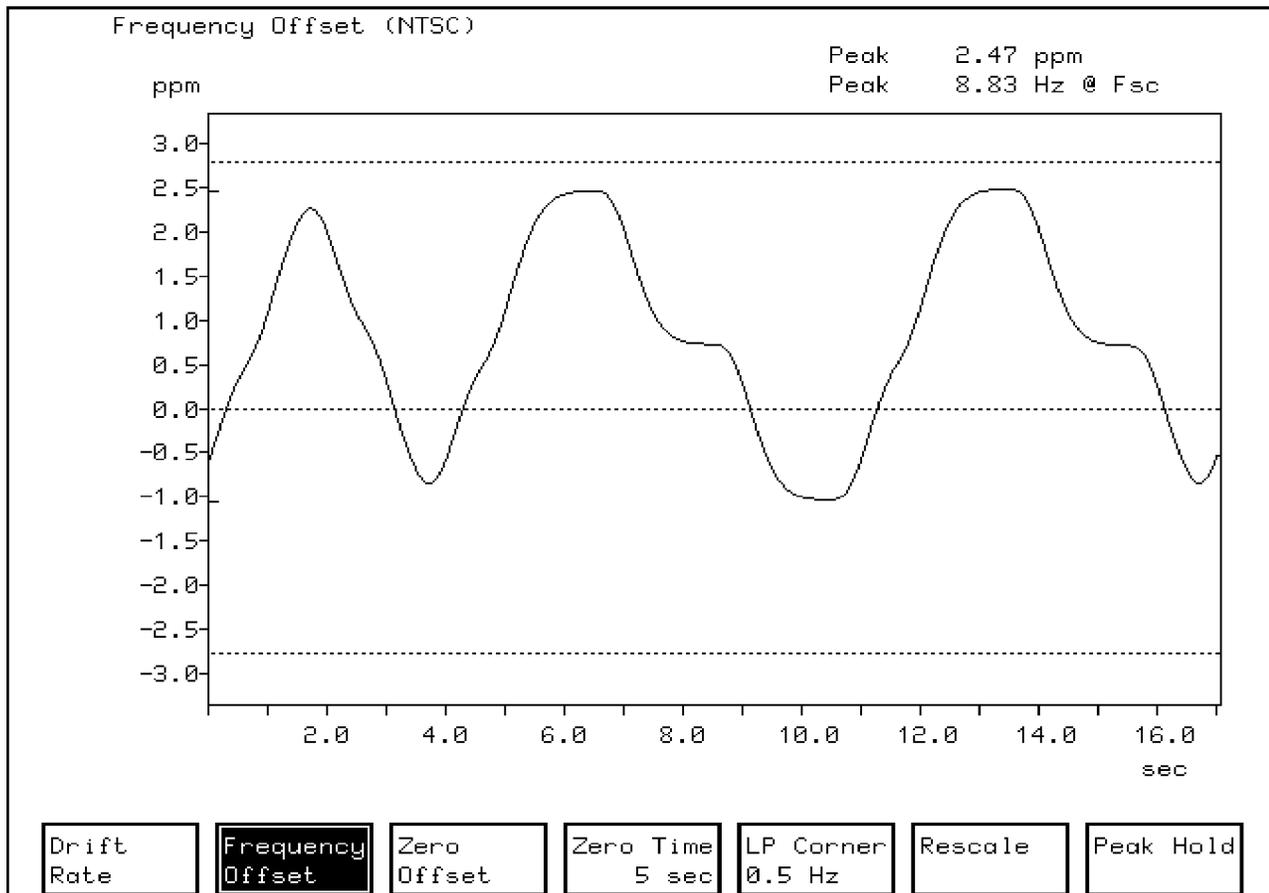
Figure 6: Frequency Offset measurement display

Frequency Offset Soft Keys

Drift Rate. Touch this soft key to toggle to the Drift Rate application display.

Frequency Offset. Touch this soft key to toggle to the Frequency Offset application display.

Zero Offset. Touch this soft key to zero the frequency offset measurement to the frequency offset of the measured video signal.

Zero Time "n" sec. Touch this soft key to select the total number of seconds to average the external frequency reference.

LP Corner "n" Hz. Use this soft key to select from the following measurement bandwidths:

1 Hz   1 ns maximum peak jitter (studio quality)

0.5 Hz   2.5 ns maximum peak jitter (contribution quality)

0.2 Hz   10 ns maximum peak jitter (distribution quality)

Rescale. Touch this soft key to automatically rescale the display for optimum viewing.

Peak Hold. Touch this soft key to detect and hold the peak timing variations over the prior 17 seconds.

Drift Rate Measurement

The constantly-updated Drift Rate application calculates the rate of frequency drift of the horizontal-synchronizing pulse frequency. The rate of horizontal-sync frequency drift has the greatest effect on studio-quality recording and post-processing equipment. Therefore, measuring the drift rate is of primary concern for users of such equipment.

Drift rate limit-markers of 0.028 ppm/s for NTSC and 0.0226 ppm/s for PAL are marked and can be reprogrammed to any value you desire. Display limit-markers indicate the drift-rate peaks in ppm/s and Hz/s @ Fsc over the past 17 seconds.

Performing the Measurement

Figure 7 illustrates the Drift Rate measurement display. Perform the following procedure to measure the drift rate of your composite-video signal:

1. Connect a composite-video signal to a channel input of the VM700T Video Measurement Set.

2. Press the **Measure** button on the front panel, and then touch the **Video Options** soft key on the display.

3. Touch the **Wander** soft key to enable the Option 22 applications.

4. Press the front-panel **Menu** button to display the application soft keys.

5. Touch the **Drift Rate** soft key (if necessary) to display Frequency Offset application display.

6. Use the soft keys listed below to perform the measurement you need.
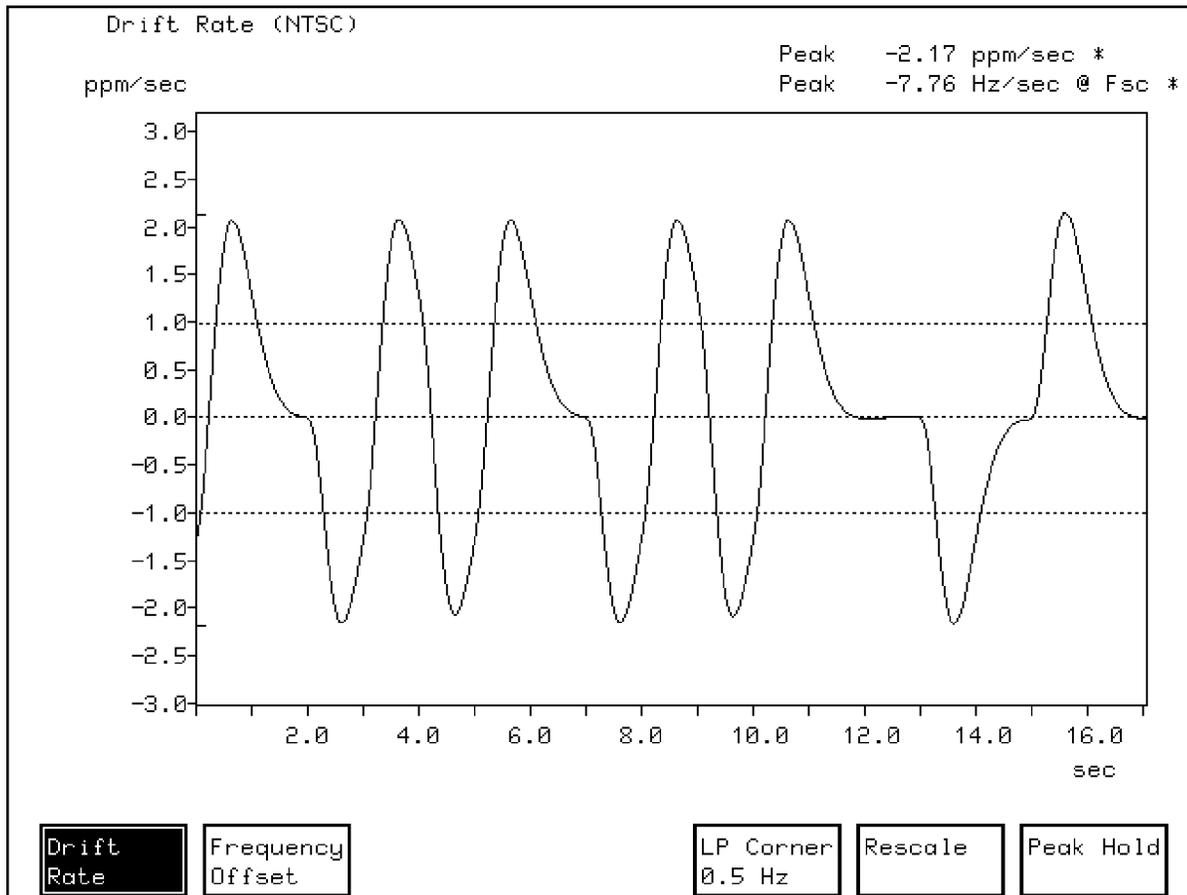
Figure 7: Drift Rate measurement display

Drift Rate Soft Keys

Drift Rate. Touch this soft key to toggle to the Drift Rate application display.

Frequency Offset. Touch this soft key to toggle to the Frequency Offset application display.

LP Corner "n" Hz. Use this soft key to select the measurement bandwidth.

   1 Hz   1 ns maximum peak jitter (studio quality)

   0.5 Hz   2.5 ns maximum peak jitter (contribution quality)

   0.2 Hz   10 ns maximum peak jitter (distribution quality)

Rescale. Touch this soft key to automatically rescale the display for optimum viewing.

Peak Hold. Touch this soft key to detect and hold the peak timing variations over the prior 17 seconds.

Appendix A: Specifications

Table A–1 lists the specifications for the VM700T Video Measurement Set Option 22. All specifications listed here are guaranteed unless labeled "typical" in the Characteristics column. Typical specifications are provided for your convenience, but are not guaranteed.

Option 22 Specifications

Table A–1: Option 22 specifications

Characteristics	Description
Frequency Offset measurement	
Measurement range	90 ppm$_{p\text{-}p}$
Measurement accuracy	Accuracy determined by reference source
Stability drift, typical	≤ 100 ppb/hr
Drift Rate measurement	
Measurement range	90 ppm/s$_{p\text{-}p}$
Measurement accuracy	Resolution and accuracy better than ± 10 ppb/s

Appendix B: Remote Control

This section contains general information on how to connect the VM700T Video Measurement Set for remote control and the specific remote commands and keywords required to operate the Option 22 functions via remote control.

Option 22 can be controlled remotely either through the standard RS-232C interface or through the optional GPIB remote interface. Control of the Option 22 application involves sending the appropriate *softkey*, *softpress*, or *softrelease* command followed by the desired soft key name in the application.

Remote Control Setup

Like other VM700T Video Measurement Set functions, remote control of the Video Wander measurements is performed via the serial (RS-232C) or parallel (GPIB, Option 48) ports on the measurement set rear panel. Capabilities available while operating the measurement set from a remote location include:

- ■ Make a specific manual measurement or an Auto mode series of measurements

- ■ Execute and interrupt a function (Function Key)

- ■ Temporarily change the configuration of a channel

To use the RS-232C remote-control functions, you must connect a terminal or computer to the measurement set RS-232C serial port. If you use a computer, you must also have a suitable terminal program to operate the measurement set.

Tektronix offers a software package called *VMT Remote Control Software* for serial communication. This software package provides a choice of using either menu selection or command-line entry of VM700T Video Measurement Set remote commands.

To use the GPIB remote-control functions, you must have Option 48 (GPIB) installed in your measurement set. You will then connect a GPIB controller with appropriate controller programming to the measurement set parallel connector.

More Information

For information about configuring the measurement set serial ports for remote operation and typical cable-wiring configurations, refer to the *VM700T RS-232 Interface Programmer Manual*. For information about using the GPIB (Option 48) parallel port, refer to the *VM700T Option 48 GPIB Interface Programmer Manual*.

Remote Commands and Keywords

The VM700T Video Measurement Set remote commands use this form:

```
command [argument(s)]
```

Variable values in the command are shown in *italics*. Optional arguments are enclosed with [ ]. A description of command usage and arguments follows the command header.

NOTE. In the following descriptions, **VM700T>** *is a prompt (which you can edit), not a required input.*

"N" Group Keywords (NTSC Only)

"N" group keywords are for NTSC only Option 22 Video Wander measurements. The keywords report on or set the values of the Drift Rate and Frequency Offset application configuration parameters.

The Get commands used with the "N" keywords have this form:

```
get <keyword> <channel letter>
```

Shown below is an example of the commands required to change the Drift Rate limit values for NTSC.

```
VM700T> get NDRT A
-5.00 5.00
VM700T> set NDRT A -20 20
VM700T> get NDRT
-20 20
VM700T>
```

NDRT and NFRO are the available keywords for the "N" group.

NDRT. NDRT specifies the lower and upper limits in ppb/s for the NTSC Drift Rate measurement. The set command takes two arguments after the channel letter, representing the values of the lower and upper limits, respectively. Valid values for the limit numbers are between –999.0 and 999.0 ppb/s.

NFRO. NFRO specifies the lower and upper limits in ppb for the NTSC Frequency Offset measurement. The set command takes two arguments after the channel letter, representing the values of the lower and upper limits, respectively. Valid values for the limit numbers are between –99990.0 and 99990.0 ppb.

"O" Group Keywords (PAL Only)

"O" group keywords are for PAL only Option 22 Video Wander measurements. The keywords report on or set the values of the Drift Rate and Frequency Offset application configuration parameters.

The Get commands used with the "O" keywords have this form:

```
get <keyword> <channel letter>
```

Shown below is an example of the commands required to change the Drift Rate limit values for PAL.

```
VM700T> get ODRT A
-5.00 5.00
VM700T> set ODRT A -20 20
VM700T> get ODRT
-20 20
VM700T>
```

ODRT and OFRO are the available keywords for the "O" group.

ODRT. ODRT specifies the lower and upper limits in ppb/s for the PAL Drift Rate measurement. The set command takes two arguments after the channel letter, representing the values of the lower and upper limits, respectively. Valid values for the limit numbers are between –999.0 and 999.0 ppb/s.

OFRO. OFRO specifies the lower and upper limits in ppb for the PAL Frequency Offset measurement. The set command takes two arguments after the channel letter, representing the values of the lower and upper limits, respectively. Valid values for the limit numbers are between –9999.0 and 9999.0 ppb.

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