VVM

VIDEO VOLT METER

INSTRUCTION BOOK
IB 6211-02

DESCRIPTION

The VVM digital Video Volt Meter measures the amplitude of standard NTSC or PAL television waveforms. The input to the VVM is high impedance with two BNC connectors in a loop-through configuration. This permits measurements to be made without "loading down" or altering the amplitude of the video signal when connecting the VVM into the video path. The VVM can be hand-held and is battery-operated with an automatic shut-off to avoid depleting the battery.

Six different measurements can be made on a video signal:

1. Sync amplitude in Volts peak-to-peak
2. Sync amplitude in I.R.E. units
3. Picture amplitude in Volts peak-to-peak
4. Picture amplitude in I.R.E. units
5. Composite video in Volts peak-to-peak
6. Composite video in I.R.E. units

A normal video signal would be 1 Volt peak-to-peak, or 140 IRE units. The VVM will read up to 1.99 Volts or 199 IRE units. The basic accuracy is 1% $\pm$0.01 Volt or 1 I.R.E. unit. The video signal must be sync-negative for the VVM to measure correctly.

HOW TO MEASURE VIDEO

The VVM is equipped with an IRE Luminance filter. Chrominance information is thus removed so that only the brightness (Luminance) component of the picture signal is measured. This is in accordance with standard video measurement practice. This may result in this meter reading a different Voltage than that observed on a wide-band oscilloscope unless that scope is also equipped with an IRE Luminance filter. Wide-band scope measurements can be as much as 10-20% too high because they also indicate the chrominance component of the video signal.

Two BNC coaxial connectors are provided, which are connected directly together inside the case. The input is not internally terminated and so it is a very high impedance. This assures that the video signal will not be reduced in amplitude when the meter is connected to the circuit to be measured. When the meter is turned on with no cable or termination connected to either coaxial connector, the meter may give an indication on some scales. This is a normal condition caused by Voltage-build-up on the very high input impedance. Placing a 75 Ohm termination on either connector will cause the meter to read zero ($\pm$1) on all scales.

Measurement is initiated by momentarily depressing the rocker-arm switch located below the rotary function switch. This turns on the meter. The meter will stay on for several minutes, then turn off to conserve the battery. Depressing the power switch again during a measurement will extend the on-time accordingly.

The output of a video source such as a satellite receiver may be measured by connecting a coaxial cable from that video source to one of the two BNC connectors, and terminating the other BNC connector with 75 Ohms.

The Voltage of the video signal may be monitored by "breaking" into the coaxial cable so that a cable leads from one connector to the video source, and another cable leads from the second connector to the input of the next video device in the transmission path. This measurement process requires a momentary break in the signal continuity while the meter is connected in.

A better method for measuring the video signal is to install the MMC Modulation Measurement Center. The video signal entering a TV modulator is looped through the MMC at the rear of the equipment rack and a monitoring BNC connector is at the front of the rack. In this way the VVM may be bridged onto the video line without breaking program continuity and the front panel video controls can be adjusted while viewing the meter. An alternate method to measure video without breaking video continuity is to install BNC "T" connectors in each video line. The VVM is then connected to the BNC "T" whenever a measurement is to be made.

If calibrated video routing switches are available, connect the VVM to an unused output and terminate the meter with 75 Ohms. The VVM is particularly well suited to calibrating video levels in routing switches due to the 1% accuracy of this meter.

Note that the VVM will read full white level even when video fades to black when a VIT (Vertical Interval Test) signal or VIR (Vertical Interval Reference) signal is present. This is a very desirable condition since the VIT and VIR signal represent 100% modulation and thus reduce need to interpret white amplitude. The internal peak and hold detector measures the brief VIT pulse and holds that reading until the next vertical interval.

The VVM reads the sync signal, picture signal and the composite peak-to-peak video signal in either Volts peak-to-peak, or I.R.E. units. In IRE units, a standard 100% modulated video signal consists of 40 IRE units of sync, and 100 IRE units of picture. The composite of sync and picture is thus 140 IRE units. In Volts peak-to-peak, a one Volt video signal would have .286 Volts of sync pulse and .714 Volts of picture. Since only two digits will show on the VVM below the decimal point, sync may register as .28 or .29 Volts and picture may register as .71 or .72 Volts.

A standard NTSC video signal must be sync negative, and only a sync negative signal will register correctly on the VVM. The VVM is intended to measure NTSC and European PAL standard video signals.

This VVM synchronizes to the video signal and measures the sync pulse from the "back porch" down to the tip of sync and measures the picture brightness from the "back porch" to the highest picture Voltage.

HOW TO SET VIDEOCIPHER SYNC TO WHITE RATIO

Proper operation of TV modulators, and particularly scrambling systems associated with them, requires that the correct ratio be established between the sync pulse amplitude and the peak white level while at the same time maintaining a one Volt peak-to-peak amplitude of the video signal. For non Videocipher signals, this ratio is carefully established at the source, therefore only the peak-to-peak Voltage needs to be set at the satellite receiver output. This measurement can be readily made as directed in the previous section. However, where the video signal has been encoded with Videocipher, the subsequent procedure should be followed.

1. Connect the VVM so as to measure the video signal at the composite output of the satellite receiver. Either loop the signal through the VVM to the Videocipher, or connect the satellite receiver output to the VVM and connect a 75 ohm termination to the other BNC connector. Measure on the COMPOSITE VOLTS setting. Adjust the satellite receiver output to read .7V. If no composite video adjustment control exists on the satellite receiver, then measure and record the composite video level for future reference. The reading should be between 0.6 and 1.0 Volts. Automatic correction in the Videocipher will occur if the video signal is in this range.

2. Now re-connect the satellite receiver to the Videocipher. Connect the VVM to the VIDEO connector on the MODULATION MEASUREMENT CENTER, or if the Head-end is not equipped with this test panel, connect the VVM to the output of the Videocipher (terminating the unused connector on the VVM), or looping through the VVM to the TV modulator. Now measure SYNC in I.R.E. units. Adjust the output level of the Videocipher to obtain 40 I.R.E. units of sync. Next measure WHITE in I.R.E. units without changing any connections. Adjust the ALC on the Videocipher to obtain a reading of 100 I.R.E. on the VVM. Re-check the SYNC level (40) and again the WHITE level (100). The sync-to-white ratio is now correct and the video signal will now also be 1.00 Volts peak-to-peak. No further adjustments should be made to the Videocipher.

HOW TO MEASURE CCTV CAMERA LEVEL

Manual Iris CCTV camera. Connect the camera video output to one BNC connector on the VVM with a short coaxial patch cord. Connect the coaxial cable linking the camera to the control center (the cable must be terminated with 75 Ohms at the control center) to the other BNC connector on the VVM or place a 75 Ohm termination onto the other BNC connector. NOTE: The camera must be terminated with 75 Ohms, either at the meter or at the far end of the coaxial cable to obtain a correct level measurement. Set the VVM dial to "SYNC" on the "IRE" scale and momentarily actuate the white rocker-arm switch. The VVM will display sync amplitude. The reading should be 40. If not between 39-41, adjust the video output level control on the camera to read 40. Move switch on the VVM to "WHITE" on the "IRE" scale and adjust the manual iris on the camera to read 100 with normal average illumination. Try to keep the reading between 85-115 with normal variations in scene illumination. If variations in illuminations are greater than this, an automatic iris camera should be considered for this application.

Automatic Iris CCTV camera. Connect the camera video output to one BNC connector on the VVM with a short coaxial patch cord. Connect the coaxial cable linking the camera to the control center (the cable must be terminated with 75 Ohms at the control center) to the other BNC connector on the VVM or place a 75 ohm termination onto the other BNC connector. NOTE: The camera must be terminated with 75 Ohms, either at the meter or at the far end of the coaxial cable to obtain a correct level measurement. Set the VVM dial to "SYNC" on the "IRE" scale and momentarily actuate the white rocker-arm switch. The VVM will display sync amplitude. The reading should be 40. If not between 39-41, adjust the video output level control on the camera to read 40. Move the switch on the VVM to "WHITE" on the "IRE" scale and adjust the automatic iris level control to read 100 under normal illumination level. Adjust lighting and/or camera angles to cover all reasonably possible illumination levels. The "WHITE" level reading should remain with 85-115 IRE units. If readings exceed this range at the high or low end, the manual iris (if provided) can be adjusted to keep the readings within the desired range or lighting levels could be adjusted as needed.

Multi-Camera, Switched Monitor Systems. Where two or more cameras are switched to a single monitor or video tape recorder, accurate video levels (both white and sync) are particularly important. Connect the VVM between the video switcher and the monitor or tape unit by looping the video signal through the VVM. Switch to each camera in turn and observe the sync level and the white level. The sync levels should be within 39-41 IRE Units to prevent "black bounce" during switching. The white levels should be within 85-115 IRE Units for consistent results. Adjust cameras as needed.

Multi-Camera Synchronization. Where multiple cameras are to be switched, it is desireable to prevent picture "rolling" due to the Vertical Interval of the video not being synchronized. Many CCTV cameras have provisions to synchronize the Vertical Interval to the power line frequency and have adjustments available on the camera to synchronize cameras together when the phase of the power line is not the same at all locations. A companion to the VVM, the VTM Video Timing Meter performs the function of synchronizing such CCTV cameras.

Note that a total of 140 IRE Units (40 sync plus 100 white) is also exactly 1.00 Volts peak-to-peak.

BATTERIES

One Alkaline 9V "transistor" battery is used. These batteries must not be used with the optional battery charger as the alkaline battery may leak and cause damage to the internal electronics. End of the battery life is indicated when no digital indication occurs when the power-on switch is depressed. Special circuitry prevents incorrect meter reading under low battery conditions by preventing instrument turn-on when the battery is discharged.

The battery is located in the case, under the digital meter, with access provided by a sliding plastic cover plate that has the word OPEN printed on it. Slide in the direction of the arrow to open. When replacing the cover, place it flat into the grooves so that both ends engage when closing.

CHARGER

An optional charger may be ordered. In this case, a "9 Volt" nickel-cadmium battery must be installed in the battery compartment. The initial charge of the nickel-cadmium battery requires 24 hours. Plug the charger into the 115V AC power source and connect the plug on the end of the 12 Volt cord into the connector on the side of the case to the left of the meter face. After the initial charge, operate the meter as needed until the meter reading ceases before re-charging. Re-charging after every use builds a "discharge memory" into the battery so that full use cannot be made of the full capacity of the battery.

The charging current is low so as to minimize over-charging. When re-charging is required, leave the charger on overnight, but do not charge day after day continuously. The VVM will not operate on the charger without the battery because the charger cannot supply current by itself. Always fully charge the battery, then remove the charging cord prior to starting measurements.

CARE AND MAINTENANCE

This VVM is a precision measuring instrument and should be treated accordingly. While it can withstand ordinary everyday indoor use, it should not be left outside in the rain or otherwise mistreated. It is not waterproof. The battery should be removed if it is placed into storage to prevent leakage of corrosive fluids from batteries as they discharge and age.

Replace non-rechargeable batteries at least once a year even if ordinary use does not discharge the battery because old batteries may leak and cause corrosion damage.

No routine maintenance or test procedures are required other than battery replacement. Attempts at field repair or adjustment will void the warranty.

If the VVM fails to operate even after battery replacement, or does not read a known video signal correctly, call the factory for a Return Authorization Number and return to the factory for repair.

AUXILIARY EQUIPMENT

The VVM Video Volt Meter can be used with the VMM Video Modulation Meter to set TV modulator video modulation levels very accurately. To adjust video depth of modulation, connect the VVM Video Volt Meter to measure the input video level and connect the VMM Video Modulation Meter to the 45.75 MHz video I.F. of the TV modulator. Adjust the video level until the VVM reads 1.00 Volts of Composite Video, then adjust the TV modulator video modulation control until the VMM reads 87.5%.