CM-1V

CAMERA MASTER

VIDEO VOLT READING METER

OPERATOR MANUAL

IB 6276-01

CM-1
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DESCRIPTION

The CM-1 Camera Master measures five attributes of a camera video signal:

1. SYNC measures the amplitude of the video synchronizing pulse and thus can be used to establish correct video level, coaxial cable continuity and correct termination impedance.

2. LUMINANCE measures the "white level" of video, thus is used to adjust the camera IRIS to the correct setting for the existing lighting conditions.

3. COMPOSITE measures the overall amplitude of the video signal (the peak to peak level).

4. COLOR BURST measures the Color Burst amplitude of a Color Camera and is used to correctly slope equalize coaxial cable runs for best transmission of detail and color.

5. FOCUS is used to set the Focus ring on the camera for the sharpest picture.

The SYNC, LUMINANCE, COMPOSITE, and COLOR BURST measurements are displayed in Volts peak to peak in which the Sync should measure (0.29 Volts peak to peak). The Luminance should measure (0.71 Volts peak to peak). The Composite should measure(1.000 Volt peak to peak), and the Color Burst should measure(0.29 Volts peak to peak).

The Focus is an open-ended numeric scale where the maximum reading also correlates to the most maximum focus setting for the camera. It can also be used to set the " Back Focus " adjustment.

HOW TO MEASURE VIDEO SIGNALS

The CM-1 is equipped with an I.R.E. Luminance filter, Chrominance information is removed so that only the brightness (Luminance) component of the picture signal is measured per (IEEE) standards. 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 I.R.E. Luminance filter. Wide-band scope measurements can be as much as 10 to 20% too high because they also indicate the chrominance component of a color video signal.

HOW TO MEASURE VIDEO SIGNALS (cont.)

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 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 (+/-1) on all scales.

Measurement is initiated by momentarily depressing the push button 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 video camera 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 or by connecting the coaxial cable leading to the TV monitors that are terminated with 75 Ohms.

Connecting the actual load termination (monitor, multiplexer or DVR) is refered to as LOOP THROUGH operation and is the recommended for the most accurate readings.

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

The standard NTSC or PAL video signal must be sync negative, only a sync negative signal will register correctly on the CM-1. Negative sync is standard with both NTSC and PAL video signals. All video used in the CCTV industry is sync negative.

HOW TO MEASURE CCTV CAMERA LEVELS

Manual Iris CCTV Camera. Connect the camera video output to one BNC connector on the CM-1 with a short coaxial patch cord. Connect the coaxial cable linking the camera to the control center to the other BNC connector, 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 CM-1 dial to "SYNC" and momentarily actuate the push button switch. The CM-1 will display sync amplitude. The reading should be 0.29 volts P/P. If the reading is twice that level then the end of line 75 Ohm termination resistor is not in the circuit. Go to the monitor equipment and switch it on. If the Sync reading is half the expected reading then there are two end of line terminations in place. Go to the monitor location and remove one of the terminations. Next move the switch on the CM-1 to "LUMINANCE" and adjust the manual iris on the camera to read 0.71 Volts P/P with normal average illumination. Try to keep the reading between 0.84 and 0.60 with normal variations in scene illumination. If variations in illumination 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 CM-1 with a short coaxial patch cord. Connect the coaxial cable linking the camera to the control center to the other BNC connector 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 CM-1 dial to "SYNC" and momentarily actuate the push button switch. The CM-1 will display sync amplitude. The reading should be 0.29 Volts P/P. If the reading is not close to 0.29 Volts P/P then check the end of line termination. Move the switch on the CM-1 to LUMINANCE and adjust the automatic iris level control to read 0.71 Volts P/P under normal illumination level. Adjust lighting and or camera angles to cover all reasonably possible illumination levels. The "LUMINANCE" or WHITE level reading should remain within 0.60 Volts P/P to 0.84 Volts P/P. If readings exceed this range at the high or low end, the Automatic iris should be adjusted to keep the readings within the desired range or lighting levels should 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 Luminance and Sync) are particularly important. Connect the CM-1 between the video switcher and the monitor or tape unit by looping the video signal through the CM-1. Switch to each camera in turn and observe the sync level and the white level. The sync levels should be maintained correctly to prevent "Black Bounce" during switching.

HOW TO MEASURE CCTV CAMERA LEVEL (cont.)

Coaxial Cable Continuity Measurement. The Camera Master can be used to identify cabling trouble conditions such as shorts, opens and double terminations at the Monitor Station. This is done by cabling the CM-1 between the Camera and the coaxial cable leading to the Monitor location. Measure the Sync amplitude and observe for the following conditions:

SYNC	CONDITION
.27-.31	Cable is connected to Monitor or Switcher with standard 75 Ohm termination. (Optimum level is .29).
.0-.10	Partial or complete short circuit between center conductor and shield on the coaxial cable, connector, or Monitor equipment.
.12-.15	Indicates double termination at the Monitor equipment (two 75 Ohm terminations inadvertently connected to one cable, or more equipments, each with a termination of it's own, connected to one cable).
.50-.64	Open circuit on coaxial cable or connectors, or non-terminated Monitor equipment.

NOTE THAT THE CORRECT READING FOR STANDARD SYNC. AMPLITUDE IS .29 Volts P/P FOR A PROPERLY TERMINATED VIDEO SIGNAL.

HOW TO SET BACK FOCUS

The "Back Focus" adjustment on a camera is best set on a test bench after the lens that is to be used has been installed. Place the camera a known distance from a test pattern card or other picture that contains high contrast and detailed image. Make sure that the card fills the camera field of view and is perpendicular to the pointing direction of the camera. Adjust the lens focus ring to the measured distance between the camera and the test card. Connect the Camera Master to the Camera to be adjusted and set the CM-1 selector switch to the FOCUS position. Adjust the Back Focus control to the highest reading on the CM-1. "Rock" the focus ring back and forth to be sure the highest reading on the CM-1 has been attained. Observe that the focus ring setting reads the same distance as that between the camera and the test pattern card.

CABLE SLOPE EQUALIZATION MEASUREMENT

The CM-1 can measure cable slope loss and cable slope equalization. This is the excess loss produced at high frequencies on long coaxial cable runs. This is also referred to as Luminance-to-Chrominance level inequality. This measurement is obtained by comparing the Sync amplitude (low frequency) and the Color Burst (high frequency) amplitude. A correctly equalized cable will read .29 Volts on both the Sync Pulse and the Color Burst. The slope loss of a coaxial cable can be corrected by a cable slope equalizer combined with a video amplifier that corrects for the loss induced by the cable and equalizer. The CM-1 measures these levels at the TV Monitor location, not at the Camera. Connect the cable coming from the Color Camera to the equalizer, then in tandem to the Video Amplifier. Connect the CM-1 to the output of the Video Amplifier and either terminate with the precision 75 Ohm termination or connect the other BNC connector on the CM-1 to the (properly terminated) Monitor Equipment. Adjust the Equalizer until the Sync and Color Burst readings are equal (even though not necessarily .29 Volts, then adjust the gain of the Video Amplifier to bring the reading to exactly .29 Volts. The coaxial cable run is now correctly equalized for slope loss.

NOTE THAT CORRECT CABLE SLOPE EQUALIZATION WILL ALSO IMPROVE THE PICTURE DETAIL RECORDED FROM BLACK AND WHITE CAMERAS.

To slope equalize a cable run from a monochrome (Black and White) camera, temporarily replace it with a color camera (to provide the color burst signal that the CM-1 measures). Complete the adjustment of the equalizer and video amplifier as in the previous paragraph, then replace the color camera with the monochrome camera while leaving the equalizer in place. This process can restore the detail and contrast lost by long cable runs.

CARE AND MAINTENANCE

This CM-1 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.

CARE AND MAINTENANCE (cont.)

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

If the CM-1 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.

BATTERIES

One alkaline 9 Volt "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 by the LCD display flashing when the meter is turned on. Readings should not be taken if LCD display is flashing, the battery must be replaced by a fresh 9 Volt battery. 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 115 Volt 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 LCD display begins to flash 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 CM-1 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.

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AUXILIARY EQUIPMENT

The VTM Video Timing Meter is used to bring CCTV cameras into synchronism so that monitors and or recorders can be switched among cameras without causing "rolling" of the picture. The camera synchronizing control is adjusted to cause the VTM to read zero, indicating that both cameras have their vertical sync interval at the same time, insuring that switching during the vertical interval can occur without picture rolling.

The VTG Video Timing Generator provides up to ten video sync signals with which to synchronize CCTV cameras in the field. The VTG is intended to be used with the VTM Video Timing Meter to establish accurate timing of multiple CCTV cameras.

The VVMTERM is a precision 75 Ohm termination that can be used to compare with terminations in Monitors and Video Switches to determine whether Monitor and Video Switcher terminations are in fact present and are within allowed limits.

The MC1, MC2, and MC3 are Protective Carry Cases to house and protect the Camera Master, Video Timing Meter, and the Video Timing Generator while being transported. These are very rugged ABS cases with foam lined interiors suitable for transporting one, two, or all three instruments respectively.

CCTV INSTALLATION TIPS

Someone once said "Knowledge is the key to success". This rule also applies to the installation and maintenance of CCTV camera equipment. Have you ever installed a CCTV camera system and then had to go back to solve a problem that was overlooked? A basic understanding of CCTV video signals, can save you hundreds of man hours, improve customer relations and increase job profitability all at the same time. This section will discuss problems and solutions for CCTV camera installations.

To discuss video let's start with the unit of measure, the I.R.E. unit. I.R.E. stands for Institute of Radio Engineers, this regulating body set the standards of measure for the video industry. This standard has been adopted by all industries in the United States and other parts of the world. 140 I.R.E. units is equal to 1 Volt Peak to Peak. I.R.E. units are easier to use because they divide into a video signal evenly.

For example proper Sync on a camera is 40 I.R.E. units, the Voltage equivalent would be 0.2857143 Volts. Unfortunately this voltage cannot be measured on the Volt Ohm Milliamp Meter that you use for checking contacts.

SYNC PULSE AMPLITUDE, HOW IT EFFECTS CCTV INSTALLATIONS.

A CCTV video camera creates synchronization pulses to lock the viewing monitor on the picture. These pulses occur at a rate of 15,750 times a second. There is one synchronization pulse or (sync pulse) for each line in the picture frame. The sync pulse tells the video monitor to start drawing a video line across the picture screen. When it gets to the end of the screen another sync pulse begins the next line, and so forth until the screen has been filled with lines. It take 262 and a half lines to form a frame, and two frames to form the video picture we see on the monitor.

The proper level for sync is 40 I.R.E. units. If the sync signal from the camera is too small in amplitude the picture will break up or roll. If the sync pulse is too big, any black portion of the picture will be more gray and the dynamic range of the picture will be degraded. Peak white level will also be compressed causing a blooming effect (loss of picture definition).

WHITE LEVEL IRIS SETTING, HOW MUCH IS ENOUGH?

There is a standard for Iris setting, or white level and it is 100 I.R.E. units. When setting a manual iris, or an automatic iris the level should be the same, 100 I.R.E. units. If you set the iris below 100 I.R.E. units, the picture will be dim with less than desired dynamic range and the white picture elements will not be pure white. If you set the iris for more than 100 I.R.E. units, the picture can be washed out causing loss of picture definition.

Some cameras can be set to 120 I.R.E. units, but it should be noted that the standard is 100 I.R.E. units and in any case all camera's in the system should be set to the same level of white. This will ensure that the white portion of the picture will be the same brightness when a monitor is switched between them.

PEAK TO PEAK MEASUREMENT OF THE CCTV SIGNAL.

A quick measurement of the peak to peak video signal will re-assure you that the CCTV camera is putting out the right level. The standard level is 140 I.R.E. units.

COLOR CAMERA'S AND WHAT IS COLOR BURST ANYWAY?

More color camera's are being used in CCTV installations. The color camera adds a chromanance component (color information) to the signal, also known as Chroma. This Chroma signal operates at 3.58 Mega-Hertz. The standard level for the Chroma is 40 I.R.E. units. When the chroma level is low, the colors will be dull.

If this level is too low, the color monitor will turn its color receiver off causing a Black and White only picture. This condition also indicates a loss of picture detail. You can see this effect on long cable runs.

The solution is to install a video equalizer GB-60 in the line and adjust the color burst back to 40 I.R.E. units. If the Chroma signal is too high the picture will display color flaring and reduction of detail at the edge of the color flare.

VERTICAL INTERVAL, ITS MANY USES

The Vertical Interval (V.I.) is the part of the video signal that tells the monitor to start drawing a new screen. It is made up of special SYNC pulses with no picture elements. The standard level for these SYNC pulses are 40 I.R.E. units. All video SYNC pulses should be 40 I.R.E. units. The Vertical Interval is a very useful place to put alarm and control signals. Some manufacturers make equipment for pan and tilt camera control, alarm contact information, and data transmission that is inserted into the V.I. signal and sent up or down the cable.

TERMINATION, THE END OF THE LINE.

A termination for video is a 75 Ohm resistor placed at the end of any video cable to prevent signal reflections that cause ghosting or multiple images on the monitor. Some CCTV equipment have built-in terminations some of which are switchable. If you are using this equipment in series, you must switch off all terminations except the termination at the last piece of equipment in the cable run. Proper termination can be checked by measuring the SYNC pulse amplitude anywhere in the video cable. It should read 40 I.R.E. with the termination ON, and 80 I.R.E. with the termination OFF. If the SYNC level does not change when you remove the termination, the camera or video source is not standard 75 Ohms and should be serviced or replaced. Problems with V.I. control systems can result if the level does not double when you remove the termination.

THE BASIC THREE

To check performance of any CCTV camera installation make sure the SYNC level is 40 I.R.E. units +/- 5 I.R.E.. WHITE level should be 100 I.R.E. units +/- 5 I.R.E.. Remember if you want to run high white level say 120 I.R.E., be sure that all camera's in the system have the same level of I.R.E +/- 5 I.R.E. Color burst level should be 40 I.R.E. units +/- 5 I.R.E.. SYNC, WHITE, and COLOR BURST are the three basic measurements to make to insure proper operation of your CCTV system.