WAVEFORM MONITOR AUXILIARY PANEL PA1M/529

Introduction

The PA1M/529 accepts up to three video signals and provides a range of facilities for use with general-purpose waveform monitors or oscilloscopes, to adapt them for television measurement. The facilities provided consist of:

(a) A range of triggering pulses which permit the examination of any part of a video signal, on the 405-, 525-or 625-line standards.
An auxiliary output of the waveform from which the trigger pulses are derived is provided for feeding to a picture monitor. This output carries a white marker pulse to indicate the position of the delayed-strobe trigger.

(b) An accurate calibration waveform which can be used for aligning the Y-amplifiers of oscilloscopes or for measuring Y-amplifier gain.

(c) A Difference Amplifier by means of which R, G and B colour television circuits with a source impedance of 75 ohms can be aligned. The Difference Amplifier can also be used to measure nominally standard video signals which come from a 75-ohm source which are within $\pm$ 1 dB of one of the calibration voltages (1 volt, 0·7 volt, 0·3 volt) provided. For source impedances in the range 70 to 80 ohms the accuracy of this measurement is within $\pm$ 0·1 dB.

(d) A Clamp Unit to restore the d.c. component of the applied waveform, if the oscilloscope has direct coupling.

If required, the gain of the equipment can be increased from 0 dB to 6 dB by means of a 6-dB Video Distribution Amplifier.

A block diagram of a PA1M/529 which shows the signal paths and the switching arrangements is given in Fig. 1. The panel consists of the follow-

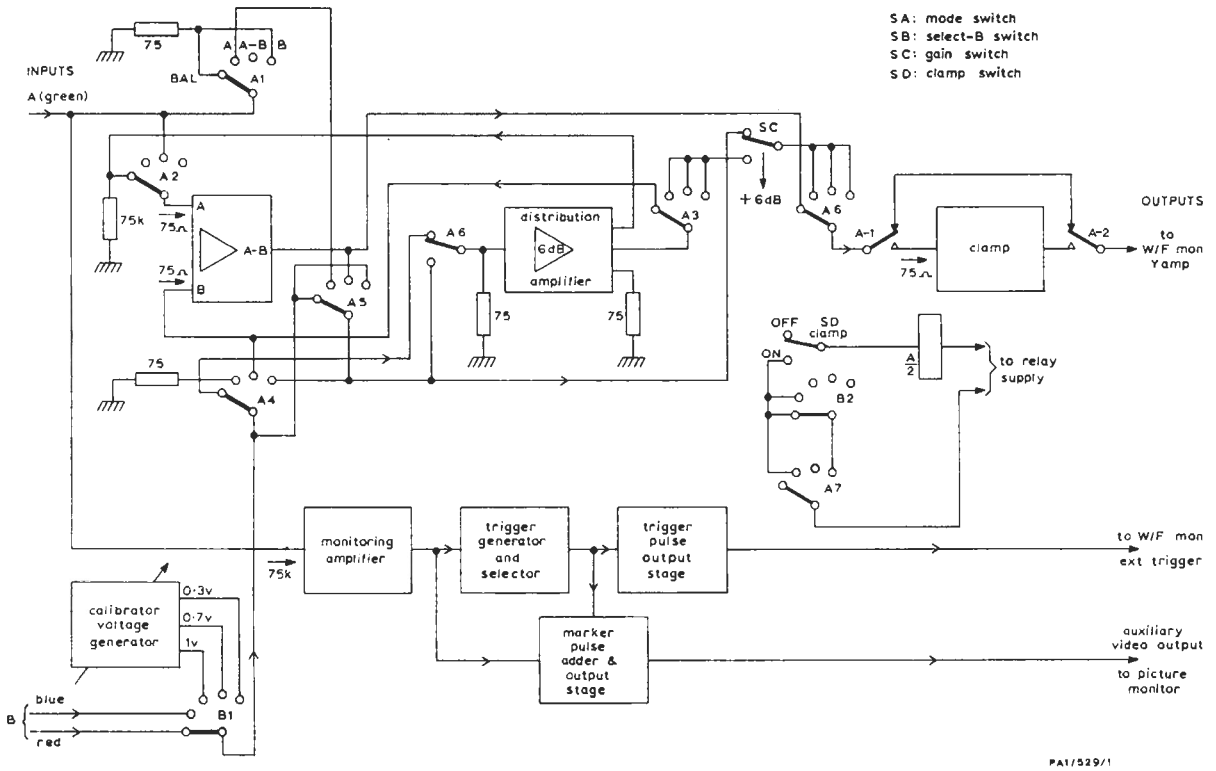

Fig. 1 Block Diagram of the PA1/529

ing sub-units mounted on a PN3/23 chassis:
Video Distribution Amplifier AM4/513
Difference Amplifier AM1/541
Clamp Unit UN13/502
Trigger Unit UN1/558

The PN3/23 chassis carries also a fixed panel which contains a mains switch, mains fuses and a neon indicator. Power consumption is about 27 watts from 240-volt 50-Hz mains. The ambient temperature of the panel must not exceed 45 °C.

Inputs and Outputs

Input A (On Difference Amplifier)

This is the main signal input. When the panel is used for R, G, B alignment this input takes the Green signal. When the panel is used for measurement it takes the signal to be measured. The signal applied to this input is fed at all times to the trigger unit for the generation of trigger pulses.

Inputs Blue and Red (On Difference Amplifier)

These inputs are classified as B inputs. As such they are subtracted from the A input when selected in the (A-B) mode. For R, G, B alignment they take the Blue and Red signals.

Main Output (On Difference Amplifier)

This output feeds the Y-input of the associated oscilloscope which, to obtain a reasonably accurate calibration voltage, must be terminated in 75 ohms ±1%.

Trigger Output (On Trigger Unit)

This output is fed to the external trigger terminal on the associated oscilloscope; it does not need to be terminated. The trigger output, when unterminated, consists of a 4-volt negative-going capacitively-coupled pulse with a fast leading edge and a duration of 1 μs.

Auxiliary Video Output (On Trigger Unit)

This output is for feeding a picture monitor. It consists of the Input A signal with the addition of a white marker-pulse to indicate the strobe-trigger position. The output impedance is nominally 75 ohms and, provided the *Main Output* is terminated in 75 ohms, the output signal has about the same amplitude as the A-input signal.

Front Panel Controls

On/Off/Remote Switch (On Clamp Unit)

For all normal applications this switch should be left in the *Remote* position; the clamp is then controlled from the Difference Amplifier.

Mode Switch (On Difference Amplifier)

This switch is used for selecting the signal that appears at the main output of the unit and for checking the balance of the difference amplifier. The signal selections available are: the A input, the B input or (in the *A-B* position) the difference between the A and B signals. When the switch is in the *Bal* position the B signal is fed, via the distribution amplifier, to both inputs of the difference amplifier.

Balance Control (On Difference Amplifier)

This variable resistor is used to adjust the low-frequency balance of the difference amplifier. It must not be touched unless the *Mode* switch is at *Bal* and a visible signal is observed at the output of the unit. (High-frequency balance is set by applying a 625-line pulse-and-bar signal to the two inputs of the difference amplifier and adjusting C13 for minimum amplitude of the T pulse.)

Select B Switch (On Difference Amplifier)

This five-position switch is used to select the required B signal from the *Red* input, the *Blue* input or one of the calibration signals.

Calibrator Level Control (On Difference Amplifier)

This control, which is attached to the calibrator dial, is used to adjust the peak-to-peak amplitude of the calibration waveform. The level of the calibrator voltage at any instant is indicated by the dial setting in dB relative to the calibration voltage selected on the *Select B* switch. The accuracy of this control for an ambient temperature range 10—35 °C is ±0·1 dB. Because the dial moves instead of the pointer, the gradations to the left of the 0-dB point are positive; this maintains the clockwise-to-increase convention.

Gain Switch (On Difference Amplifier)

When set to the *+6 dB* position this switch inserts the distribution amplifier into the main signal path and so increases the *Main Output* level by 6 dB. The switch is not effective when the *Mode* switch is at *Bal* (i.e. the gain can not be reduced to 0 dB).

Clamp Switch (On Difference Amplifier)

This switch provides remote control for the clamp unit; the associated star indicator operates when the clamp is in circuit. Interlocks are provided to prevent the clamp from attempting to clamp unsuitable signals. Thus the clamp will not operate when the *Mode* switch is set to *Bal* or

to *A-B*, or when a calibration waveform is selected to appear at the output of the unit.

Red and Blue Delay Controls (On Trigger Unit)
These controls are used to adjust the timings of some of the trigger pulses. Clockwise rotation of either control causes the pulse affected to occur earlier in time, and the waveform displayed on the oscilloscope to move to the right.

Trigger Selection Switch (On Trigger Unit)
This ten-position continuously-rotatable switch selects one of ten different triggers, or combinations of triggers, for application to the Y-input of the associated oscilloscope. All the trigger pulses are derived from the A-input signal. For details of the triggers available see Instruction UN1/558.

Change Field Switch (On Trigger Unit)
This switch is operated to change the field selected for strobing. Each time the switch is operated the field is changed but, because its initial setting depends on the field conditions pertaining at the moment of switching on, the switch does not have specific odd-field and even-field positions.

405 and 525/625 Switch (On Trigger Unit)
This switch changes the timings of the multivibrators in the trigger unit to suit the different line standards.

Operating Instructions

To Set Up the Equipment for Use
1. Connect the signal to be measured to *Input A*.
2. Connect the Main Output to the Y-input of the oscilloscope and terminate in 75 ohms ±1%.
3. Connect the Trigger Output to the external trigger input of the oscilloscope.
4. Set the oscilloscope Y-gain control to a range of about 0·5 volt/cm and, if possible, switch the oscilloscope to d.c. input.
5. Adjust the oscilloscope trigger controls so that the oscilloscope will accept negative-going externally-generated trigger pulses.
6. Apply mains to the panel and switch on.
7. Check that the On/Off/Remote switch on the clamp unit is set to *Remote*.
8. Select the appropriate line standard.

To Observe a Waveform
1. Set the *Mode* switch to *A*.
2. Select suitable trigger pulses. (If the waveform to be observed is not a composite positive-going video waveform, then set the trigger selector to *Line*; this will give trigger pulses corresponding to negative edges at the lower part of the waveform. Alternatively, set the oscilloscope to internal trigger.)
3. Adjust the time base of the oscilloscope as appropriate.
4. The signal should now be seen as a steady trace on the oscilloscope and may be clamped and/or increased in gain by 6 dB, as required.

To Observe Any Selected Period of Time per Picture
1. Set the *Mode* switch to *A*.
2. Switch the trigger selector to *Strobe Delayed*.
3. Connect the auxiliary video output to a picture monitor.
4. Observe the position of the white marker pulse on the picture monitor and adjust its position both horizontally and vertically, by means of the Red and Blue delay controls, until it occurs at the beginning of the desired interval of time. Note that the range of control available in the vertical direction is a whole field, beginning about halfway through a field; thus it will sometimes be necessary to move the marker pulse through the field-blanking interval.
5. Adjust the oscilloscope sweep-rate to suit the required time interval.
6. To observe the adjacent field, operate the *Change Field* switch.
7. If the trigger pulse is required to correspond to a line-sync pulse, move the trigger selector anticlockwise by one position to *Strobe*. The marker pulse on the picture monitor will remain unmoved, but the line selected will be the one preceding (in time) the marked line.

To Measure the Amplitude of a Composite Video Signal
1. Set the *Mode* switch to *A-B*.
2. Set the *Select B* switch to *1V Cal*.
3. Select a suitable trigger, usually *Line* or *Field*.
4. Observe the dual waveform displayed on the oscilloscope and adjust the *Calibrator Level* control until the bottom of the upper waveform is level with the top of the lower waveform. The calibrator dial reading now gives the error of the input signal with respect to the calibration signal.
5. Similarly, by setting the *Select B* switch to *0·7 V* or to *0·3 V*, the picture or sync components of the signal can be measured separately.

To Compare the Relative Amplitudes of Red, Green and Blue Colour Television Signals

1. Set the *Mode* switch to *A-B.*
2. Set the trigger selector to *Line.*
3. Apply the three colour signals to the appropriate inputs of the panel.
4. Set the *Select B* switch to *Red.* The oscilloscope display will consist of Green minus Red.
5. Set the *Select B* switch to *Blue.* The oscilloscope display will consist of Green minus Blue.

To Check and Measure Oscilloscope Y-Gain

1. Set the *Mode* switch to *B.*
2. Set the *Select B* switch to *1V Cal* and set the *Calibrator Level* control to 0 dB.
3. Trigger the oscilloscope either internally or externally.
4. The two horizontal lines appearing on the oscilloscope should be separated by a distance corresponding to 1 volt.
   Note that the accuracy of this measurement depends on the use of a close-tolerance terminating resistor.
   If the measured voltage is not 1 volt, carry out step 5.
5. Adjust the *Calibrator Level* control to make the calibration voltage equal to the nominal oscilloscope deflection for 1 volt; e.g. 2 cm, if the Y-gain control is set to 0·5 V/cm. The setting of the *Calibrator Level* control now indicates the true value of the applied calibration voltage and so this figure, with the sign reversed, gives the error introduced by the Y amplifier of the oscilloscope.

To Check the Balance of the Difference Amplifier

1. Set the *Mode* switch to *Bal.*
2. Set the *Select B* switch to *0·7 V Cal.* (This applies a 1·4-volt peak-to-peak calibration signal, via the distribution amplifier, to both inputs of the difference amplifier. Alternatively, an external signal can be used by selecting it from a B-input.)
   Note: the A and B inputs must not be connected together when checking balance.
3. Check that a video signal is present at the A input to provide trigger pulses.
4. Increase the Y-gain of the oscilloscope to at least 0·05 V/cm.
5. Observe the oscilloscope. The display should consist of a single horizontal line. If two lines are seen, or if the single line appears unduly thick, adjust the *Bal* control on the front panel of the difference amplifier to obtain a single trace of minimum thickness.

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