Lab report on cathode ray oscilloscope

CRO-lab Report 2 Abstract This experiment aims to study cathode-beam oscillosce (CRO) and its applications in measuring voltage, frequency and phase transmission. In order to achieve this, it is crucial to understand the theoretical background of NGOs and some of its measured parameters, as discussed below. The cathode-beam Oscilloscope, also known as scope, is designed to measure and display waveforms, frequencies, magnitudes and phase ratios of electrical signals, i.e. currents and voltages with their inter-periodic variance time. Dio organisations can also be used to show non-erid or transient tensions. They effectively measure and display their measured parameters over a wide range, from millivolts to kilovolts and minutes to picoseconds. The structure of the Cathode Ray Oscilloscope is basically a cathode ray tube (CRT) consisting of three basic elements; Electron cannon, focus system and bending system included in the evacuated envelop. The electron gun produces a narrow set of ultra-fast electrons zoomed in on a phosphorus-coated florescent display to a single small point with the grid system that makes up the focus system. The centered bar is deviated from the screen on parallel plates, i.e. vertical and horizontal plates connected to the voltage supply that the application leads to horizontal and vertical deflectation. The CRO displays a trace of the variable electrical signal after the variable voltage has been confirmed and applied to its bending plates. For example, the tooth voltage of the saw, which is a type of tension that increases linearly over time, is displayed when used for horizontal bending plates. On application, it swipes an electronic beam over a ICTs raster at a steady speed. GOAL: Learn how to use a cathode-beam oscilloscope. EQUIPMENT: Cathode-beam oscilloscope, multimeter and oscillator. INTRODUCTION: The Cathode-Beam Oscilloscope (CRO) is a common laboratory device that provides accurate time and applause measurements of voltage signals over a wide frequency. Its reliability, stability and ease of use make it a suitable universal laboratory tool. The cro's heart is a cathode-beam tube that appears schemally in Figure 1. A cathode ray is an electron beam with a heated cathode (negative electrode) that accelerates towards the fluorescent display. The assembly of the cathode, the volume sling, the focusing sling and the accelerating anode (positive electrode) are called an electron gun. Its purpose is to produce an electron beam and control its intensity and focus heart rate. Between the electron gun and the fluorescent surface there are two pairs of metal plates - one oriented towards providing horizontal bending of the spotlight and one paired ot gives a vertical bent to the beam. These plates are thus called horizontal and vertical bending plates. Combination of the two allow the volume to extend to any part of the fluorescent display. Whenever an electron beam hits the screen, the phosphorus is excited and light emits light. This masking of electron energy in light allows us to write with dots or light lines on an otherwise darkened screen. For the most common use of the oscilloscope, first apply the signal to be studied and then apply to vertical (bend) plates to turn the radius vertically and, at the same time, linearly apply the horizontal (bend) plates to the increasing voltage over time, causing the radius to bend horizontally at a constant (constant >speed). Verical disks are subjected to a signal that appears on the screen as a function of time. The horizontal axis acts as a solid timescale. The linear bending or sweeping of the volume horizontally is achieved by using a sweep generator connected to the oscilloscope. The voltage power of such a generator is the voltage of the sawdust wave, as shown in Figure 2. The application of one cycle of this voltage difference, which increases linearly over time, causes the scales to bend linearly over time to the face of the tube. When the voltage suddenly drops to zero, as at points a) (b) (c) etc..., the head of each swipe - the radius flies back to its original position. The horizontal bending of the beam is repeated periodically, the frequency of this frequencies can be adjusted by external controls. In order to obtain a smooth mark on the pipe face, the internal amount of the unknown signal applied to vertical plates shall be connected to each cycle of the sweep generator. Thus, when the two bends are synchronized, the pattern on the tube face repeats itself and thus seems to stay in place. The preservation of vision in the human eye and the preservation of the glow of the fluorescent display help to produce a stationary pattern. In addition, the electron beam is cut off (emptied) during the flyback to avoid detecting the retrace sweep. CRO Operation: A simplified block diagram of a typical oscilloscope is shown in Figure 3. Usually the instrument is used as follows. The vertical amplifier amplifies the signal displayed and aligns with the crt's bloody bending plates. Part of the vertical amplifier signal is applied to the sweeping connector as a trigger signal. The swipe trigger then produces a pulse that coincides with the selected point in the trigger cycle. This pulse triggers a sweep generator that triggers the Sawrs waveform. The horizontal amplifier strengthens the saw tooth wave and is applied to horizontal bending plates. In general, an additional signal is made to provide an external launch signal or to utilize the 60 Hz line for launch. The sweep generator can also be bypassed and the external signal aligned directly Amplifier. CRO controls The controls available in most oscilloscopes offer a wide range of operating conditions and thus make the instrument particularly versatile. Since many of these controls are common for most oscilloscopes, a brief description of them follows. CATHODE-RAY TUBE Power and Scale Illumination: Switches on the instrument and controls gratcule lighting. Focus: Center the dot or trace on the screen. Intensity: Controls the brightness of a point or trace. VERTICAL AMPLIFIER PART Position: Controls the vertical position of the oscilloscope display. Sensitivity: Selects the sensitivity of the vertical amplifier in calibrated steps. Variable sensitivity: Provides continuous sensitivity between calibrated steps in the range. In general, sensitivity is calibrated only when the adjustable knob is fully clockwise. AC-DC-GND: Selects the desired switch (ac or dc) for an incoming signal applied to the vertical amplifier or justifies the amplifier input. When you select a DC feed directly for the amplifier; by selecting ac to transmit the signal through the capacitor before entering the amplifier, which blocks all standard components. HORIZONTAL SWEEP section Sweep time/cm: Selects the desired sweep speed from calibrated steps or awards an external signal to a horizontal amplifier. Sweep time/cm Variable: Provides continuously variable sweep speeds. The calibrated position is fully clockwise. Location: Controls the horizontal trace location on the screen. Horizontal variable: Control ext. Damping (reduction) of signals to the amplifier horizontal via Horiz. Connector. TRIGGER The trigger selects the timing of the start of the horizontal swipe. Slope: Selects whether to start in the increasing (+) or shrinking (-) part of the trigger signal. Connection: Selects whether the start-up will take place at a specific DC or AC level. Source: Selects the source of the trigger. INT - (internal) - signal in vertical amplifier EXT - (external) - external signal set to EXT. TRIG. Enter. LINE - 60 cycle triger Level: Selects the voltage point from the trigger where the sweep is triggered. It also allows automatic (automatic) start-up to allow you to swipe free (free driving). OSCILLOSCOPE Vertical Input Connections: A couple of connections connecting the examined signal to the Y (or vertical) amplifier. The lower jar is grounded. Horizontal input: Pair the connectors connecting the external signal to the horizontal amplifier. The lower terminal has been traced back to the oscilloscope housing. External tiger input: The input connector for the external trigger signal. Cal. Out: Provides amplitude-calibrated square waves of 25 and 500 millivolts for calibration of amplifiers reinforcements. Vertical bend resolution is + 3%. Sensitivity varies. Horizontal swipe must be within 3%. The sweep area is variable. Instructions for use: Before connecting the oscilloscope to the wall tank controls as follows: (a) Switch off the power switch (b) Full counterclockwise intensity (c) Vertical centre center center of the centre of the area (d) Horizontal centre centre centre (e) Vertical 0.2 f) Sweep times 1 Connect the cable to a standard AC wall recipe (nominally 118 V). Turn it on. Do not move the intensity adjustment forward. Allow the scope to warm up for about two minutes, then turn the intensity control until the radius is displayed. WARNING: Never take the intensity control to the point where too bright a point appears. Bright spots hint at the screen burning. A sharp concentrated high intensity point (high brightness) should never be allowed to stay attached to one position on the screen for a long time, as the screen can damage. Adjust horizontal and vertical centering controls. Adjust the alignment to give you a sharp print. Place the trigger on the inside, from level to automatic. Connect the gererator output to the vertical input of the oscilloscope. Position this input signal evenly in the affected area. Adjust (play) all the controls on the targeting and signal generator until you familiarise yourself with each one's operation. The purpose of such gaming is to give the student so much knowledge of the oscilloscope that it becomes an aid (tool) for measuring in other experiments and not as a huge obstacle. Note: If vertical validation is set too low, it may not be possible to get a steady mark. II. Voltage measurements: Consider circuit in Fig. 4(a). The signal generator is used to produce a 1,000-hert sine wave. The AC volt meter and oscilloscope vertage input wires are connected to the output of the generator. Adjusting the horizontal sweep time/cm and the trigger may show a smooth trace of the sine wave on the display. The imprint represents circuits of voltage and time in which the vertical tendency of the trace describing the CD line of symmetry is similar to the magnitude of the voltage in any moment. To determine the size of the voltage signal displayed in the connectors of the signal generator, these connectors are side by side with an AC volt meter (Fig. 4a). The AC volt meter is designed to read the steady power value of the voltage. This effect value is also called root mean square value (RMS). The peak or maximum voltage seen in the target plane (Fig. 4b) is Vm volts and is represented by the distance from the CD of the symmetry line to the maximum bend. The ratio between the peak voltage in the affected area and the effective voltage (VRMS) read on the AC volt meter is VRMS = 0,707 Vm (for the sine or cosine wave). Therefore, the voltage reading of the multimeter and the voltage reading of the oscilloscope are expected to be the same. Symmetrical wave (sine or cosine) The Vm can be considered a top 1/2 signal vpp top signal The adjustable signal can be used to adjust the display to fill the uniform area of the scope face. In this position, the trace is no longer calibrated so that the signal size cannot be read by simply calculating the number of shares and multiplying by a scale factor. However, you can find out what the new calibration is to use it, as long as the variable control remains unchanged. Warning: The mathematical formula given to RMS signals applies only to sine-shaped signals. The meter does not indicate the correct voltage when used to measure non-sine-shaped signals. III. Frequency measurements: When the horizontal sweep voltage is used, the vertical bending can still be measured at voltage. In addition, the signal is displayed as a function of time. If the time base (i.e. sweep) is calibrated, measurements such as pulse duration or signal sequence may be made. Frequencies can then be defined as reciprocal for periods. Set the oscillator to 1000 Hz. Show the signal in the CRO and measure the time of vibrations. Use a horizontal distance between two points, as shown in the C-D image. 4b. Set horizontal validation so that only one complete waveform appears. Reset the scale until 5 waves are visible. Keep the time base control in the calibrated position. Measure the distance (and therefore the time) for 5 complete cycles and calculate the frequency from this measurement. Compare the result with the value specified above. Repeat your measurements for other frequencies, which are 150 Hz, 5 kHz, 50 kHz as specified in the signal generator. IV. Lissajous numbers: When different frequency sine wave signals were entered into horizontal and vertical amplifiers, a fixed pattern is formed in the crt when the ratio of two frequencies is an intergral fraction, such as 1/2, 2/3, 4/3, 1/5, etc. These fixed patterns are known as Lissajous numbers and can be used to measure frequencies. Use two oscillators to create some simple Lissajous numbers, as shown in Figure 5. It is difficult to keep the Lissajous numbers in a fixed configuration because the two oscillators are not phase and frequency locked. Their frequencies and phase drift slowly cause two different signals to change slightly in relation to each other. A. Testing what you've learned: Your instructor will provide you with a small oscillator circuit. Use an oscilloscope to study the input and output of the circuit circuit circuit. Measure quantities such as signal voltage and frequency. Specify whether they are blue-shaped or with another wave sign. If square wave, measure the frequency of the wave. Also measure for square waves in time (when the voltage is high) and during leisure time (when low). Back

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