

Figure 28. Signal Level Measurements (Oscilloscope)

more than one cycle. In this manual, both phase shift and time delay are measured in the same way.

Use a Tektronix oscilloscope with a dual channel amplifier. Connect one amplifier input to the reference or input terminals and the other to the delayed or output terminals. Adjust the oscilloscope time-centimeter and positioning controls to position the two pulses as shown in Figure 29. Find the time delay in milliseconds or microseconds by dividing the time scale indicated on the time/cm dial by the number of centimeters between the input and output pulse.

Current Measurement

Current measurements are useful in troubleshooting totally inoperative machines or troubles that are widespread. They often take less time than more complex troubleshooting methods.

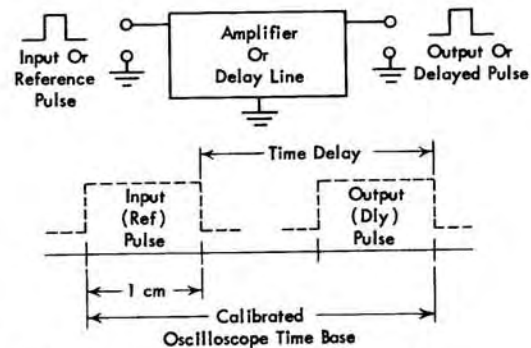
CAUTION: Remove power when connecting ammeters in circuit or when changing connections to the laminar bus.

Before measuring current, make sure that voltages are within specified tolerances. Then measure total current drain from the power supply to the machine for each voltage bus. If current drain is excessive on any voltage bus, remove the jumpers from the laminar bus to the card rows, one at a time, until the current indication is about normal. When the trouble is isolated to one card row, remove all power from the machine, and use resistance measurements to locate the defective component.

If the current drain for any one voltage bus is so excessive that power supply fuses blow as soon as they are replaced, remove all jumper wires from the laminar

bus to the card rows and replace them one at a time until the shorted card row is discovered.

Alternating current, 60 cycles or 400 cycles, may be measured with a meter as follows: Connect a one-ohm, high wattage resistor in series with the load and measure the voltage drop across it. Because $I = E/R$ and $R = 1$, the current will equal the voltage indicated on the meter. Error introduced by the current limiting effect of the one-ohm resistor in series with the load may be disregarded.



* The leading edge, trailing edge or pulse center can be used as a reference point for measuring time delay.

$$\text{Time/cm} = 10 \mu\text{sec/cm} \quad \text{Time Delay} = \frac{10 \mu\text{sec/cm}}{2 \text{ cm}} = 5 \mu\text{sec}$$

Figure 29. Phase Shift and Time Delay Measurement