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- 1] To install and maintain a radar unit, you must have:
 - a) Permission of the master but no license.
 - b) A General Radiotelephone Operator License (GROL) with a Radar Endorsement or a GMDSS Radio Maintainer License (GMDSS/M) with a Radar Endorsement. @@
 - c) An Amateur Extra Class License.
 - d) A General Radiotelephone Operator License or a GMDSS Radio Maintainer License (GMDSS/M) only.

- 2] Who may replace fuses and receiving-type tubes and circuits in a radar unit?
 - a) An unlicensed person.
 - b) A holder of a GMDSS Radio Maintainer License (GMDSS/M).
 - c) A holder of a General Radiotelephone Operator License with a Radar Endorsement. @@
 - d) Any of these.

- 3] Under what circumstances can an unlicensed person operate a radar set?
 - a) Only if the transmitter is a non-tuneable type.
 - b) When the master of the ship designates him to operate it.
 - c) Never.
 - d) Only if the transmitter is a non-tuneable type and when the master of the ship designates him to operate it. @@

- 4] What radar maintenance work may be done by unlicensed workers?
 - a) None. @@
 - b) Replacement of magnetron and klystron tubes.
 - c) Replacement tubes and circuits.
 - d) Minor frequency adjustments only.

- 5] Who is permitted to operate a ship radar unit?
 - a) Only qualified FCC Licensed persons with a Radar Endorsement.
 - b) Only the engineer or someone under his or her direct supervision.
 - c) The master of the ship, or anyone designated by the master. @@
 - d) Anyone who is knowledgeable.

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6] What component of a radar receiver is represented by block 46 in Diagram EL8A?

- a) The ATR box.
- b) The TR box. @@
- c) The RF Attenuator.
- d) The Crystal Detector.

7] What component of a radar receiver is represented by block 47 in Diagram EL8A?

- a) The ATR box.
- b) The TR box.
- c) The RF Attenuator. @@
- d) The Crystal Detector.

8] What component of a radar receiver is represented by block 48 in Diagram EL8A?

- a) The Discriminator.
- b) The IF Amplifier.
- c) The Klystron. @@
- d) The Crystal Detector.

9] What component of a radar receiver is represented by block 49 in Diagram EL8A?

- a) The Discriminator.
- b) The IF Amplifier.
- c) The Klystron.
- d) The Crystal Detector. @@

10] What component is block 50 in Diagram EL8A?

- a) The Discriminator. @@
- b) The IF amplifier.
- c) The AFC amplifier.
- d) The Crystal detector.

11] The minimum range of a RADAR is primarily determined by?

- a) The pulse width and TR (TRL) cell recovery time@@

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- b) The ATR cell recovery time.
 - c) The overall height of the antenna.
 - d) The peak power output of the radar transmitter.
- 12] An RF mixer has what purpose in a radar system?
- a) It mixes the CW transmitter output to form pulsed waves.
 - b) It converts a low-level signal to a different frequency. @@
 - c) It prevents microwave oscillations from reaching the antenna.
 - d) It combines audio tones with RF to produce the radar signal.
- 13] Pulse transformers and pulse-forming networks are commonly used to shape the microwave energy burst radar transmitter. The switching devices most often used in such pulse forming circuits are:
- a) Power MOSFETS and Triacs.
 - b) Diacs and SCR's.
 - c) Thyratrons and BJT's.
 - d) SCR's and Thyratrons. @@
- 14] Good bearing resolution largely depends upon:
- a) A high transmitter output reading.
 - b) A high duty cycle.
 - c) A narrow antenna beam in the vertical plane.
 - d) A narrow antenna beam in the horizontal plane. @@
- 15] Bearing resolution is:
- a) The ability to distinguish two targets of different distances.
 - b) The ability to distinguish two targets of different elevations.
 - c) The ability to distinguish two adjacent targets of equal distance. @@
 - d) The ability to distinguish two targets of different size.
- 16] An artificial transmission line is used for:
- a) The transmission of radar pulses.
 - b) Testing the radar unit, when actual targets are not

available.

- c) Determining the shape and duration of pulses. @@
- d) Testing the delay time for artificial targets.

17] What device is located between the magnetron and the mixer and prevents received signals from entering the magnetron?

- a) The TR Box.
- b) The ATR Box. @@
- c) The RF Attenuator.
- d) A resonant cavity.

18] The ATR box:

- a) Protects the receiver from strong radar signals.
- b) Prevents the received signal from entering the transmitter. @@
- c) Turns off the receiver when the transmitter is on.
- d) All of these.

19] When a pulse radar is radiating, which elements in the TR box are energized?

- a) The TR tube only.
- b) The ATR tube only.
- c) Both the TR and ATR tubes. @@
- d) Neither the TR nor ATR tubes.

20] In the AFC system, the discriminator compares the frequencies of the:

- a) Magnetron and klystron. @@
- b) PRR generator and magnetron.
- c) Magnetron and crystal detector.
- d) Magnetron and video amplifier.

21] The purpose of the discriminator circuit in a radar set is to:

- a) Discriminate against nearby objects.
- b) Discriminate against two objects with very similar bearings.
- c) Generate a corrective voltage for controlling the frequency of the klystron local oscillator. @@

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- d) Demodulate or remove the intelligence from the FM signal.
- 22] Where is a RF attenuator used in a radar unit?
- a) Between the antenna and the receiver.
 - b) Between the magnetron and the antenna.
 - c) Between the magnetron and the AFC section of the receiver. @@
 - d) Between the AFC section and the klystron.
- 23] What frequency is the discriminator tuned to?
- a) The magnetron frequency.
 - b) The local oscillator frequency.
 - c) The 30 MHz or 60 MHz IF. @@
 - d) The pulse repetition frequency.
- 24] The usual intermediate frequency of a shipboard radar unit is:
- a) 455 kHz.
 - b) 10.7 MHz.
 - c) 30 or 60 MHz. @@
 - d) 120 MHz.
- 25] The error voltage from the discriminator is applied to:
- a) The repeller (reflector) of the klystron. @@
 - b) The grids of the IF amplifier.
 - c) The grids of the RF amplifiers.
 - d) The magnetron.
- 26] How may the frequency of the klystron be varied?
- a) Small changes can be made by adjusting the repeller voltage.
 - b) Large changes can be made by adjusting the size of the resonant cavity.
 - c) By changing the phasing of the buncher grids.
 - d) Small changes can be made by adjusting the repeller voltage and large changes can be made by adjusting the size of the resonant cavity. @@

27] Fine adjustments of a reflex klystron are accomplished by:

- a) Adjusting the flexible wall of the cavity.
- b) Varying the repeller voltage. @@
- c) Adjusting the AFC control system.
- d) Varying the cavity grid potential.

28] The pulse repetition rate (PRR) refers to:

- a) The reciprocal of the duty cycle.
- b) The pulse rate of the local oscillator tube.
- c) The pulse rate of the magnetron. @@
- d) The pulse rate of the klystron.

29] The timer circuit:

- a) Determines the pulse repetition rate (PRR).
- b) Determines range markers.
- c) Provides blanking and unblanking signals for the CRT.
- d) All of these. @@

30] On what frequency is radar expected to cause interference?

- a) On the pulse repetition frequency.
- b) On the klystron oscillator frequency.
- c) On the magnetron frequency.
- d) On most any communications frequency. @@

31] If the magnetron is allowed to operate without the magnetic field in place:

- a) Its output will be somewhat distorted.
- b) It will quickly destroy itself from excessive current flow. @@
- c) Its frequency will change slightly.
- d) Nothing serious will happen.

32] What radar circuit determines the pulse repetition rate (PRR)?

- a) The discriminator.
- b) The timer (synchronizer circuit). @@

- c) The artificial transmission line.
 - d) The pulse-rate-indicator circuit.
- 33] Range markers are determined by:
- a) The CRT.
 - b) The magnetron.
 - c) The timer. @@
 - d) The video amplifier.
- 34] The timer circuit:
- a) Determines the pulse repetition rate (PRR).
 - b) Determines range markers.
 - c) Provides blanking and unblanking signals for the CRT.
 - d) All of these. @@
- 35] Unblanking pulses are produced by the timer circuit. Where are they sent?
- a) To the IF amplifiers.
 - b) To the CRT. @@
 - c) To the mixer.
 - d) To the discriminator.
- 36] Accurate range markers must be developed using very narrow pulses. A circuit that could be used to provide these high quality pulses for the CRT is a:
- a) Ringing oscillator.
 - b) Blocking oscillator. @@
 - c) Monostable multivibrator.
 - d) Triggered bi-stable multivibrator.
- 37] What determines the maximum unambiguous range of a radar set?
- a) The duty cycle.
 - b) The peak power output.
 - c) The time between the transmitted pulses. @@
 - d) The sensitivity of the discriminator.

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38] The final stage of the sweep circuits of an electromagnetic CRT is usually a power amplifier. The reason for using a power amplifier rather than a voltage amplifier is:

- a) A voltage amplifier is likely to develop excessive sweep nonlinearity.
- b) To maintain a constant level of output current.
- c) To provide a relatively high output voltage to drive the deflection coils.
- d) To provide a relatively high output current to drive the deflection coils. @@

39] Using tuned circuits for selectivity, radar IF amplifier stages would normally be biased to operate:

- a) Class A amplifiers. @@
- b) Class B amplifiers.
- c) Class C amplifiers.
- d) Class AB amplifiers.

40] The AFC system is used to:

- a) Control the frequency of the magnetron.
- b) Control the frequency of the klystron. @@
- c) Control the receiver gain.
- d) Control the frequency of the incoming pulses.

41] The output of an AFC Discriminator is:

- a) A sine wave at the IF frequency.
- b) Zero volts if the IF is "on frequency". @@
- c) AC if "on frequency"; DC if "off frequency".
- d) Always filtered with a high-pass filter.

42] The primary operating frequency of a reflex klystron is controlled by the:

- a) Dimensions of the resonant cavity. @@
- b) Level of voltage on the control grid.
- c) Voltage applied to the cavity grids.
- d) Voltage applied to the repeller plate.

43] Electrons provide regeneration to oscillating cavities when they are:

- a) Accelerating.
- b) Decelerating. @@
- c) Entering the cavity.
- d) Oscillations involve electric and magnetic fields, so electrons have no control function.

44] Power losses in cavity resonators are very low because:

- a) Conducting surfaces are large. @@
- b) Cavities only require low operating currents.
- c) Heavy insulation is used for all interconnections.
- d) Only small conducting surfaces are used.

45] In a circular resonant cavity with flat ends, the E-field and the H-field form with specific relationships. The:

- a) E-lines are parallel to the top and bottom walls.
- b) E-lines are perpendicular to the end walls. @@
- c) H-lines are perpendicular to the side walls.
- d) H-lines are parallel to the end walls.

46] Practical radar operation requires the use of microwave frequencies so that:

- a) Stronger target echoes will be produced. @@
- b) Ground clutter interference will be minimized.
- c) Interference to other communication systems will be eliminated.
- d) Antennas will be more efficient for both transmitting and receiving.

47] Short range radars would most likely transmit:

- a) Narrow pulses at a fast rate. @@
- b) Narrow pulses at a slow rate.
- c) Wide pulses at a fast rate.
- d) Wide pulses at a slow rate.

48] The microwave energy developed by the radar transmitter and radiated into space:

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- a) May be refracted by the ionosphere.
- b) Can "see" targets beyond the horizon.
- c) Travels through space "line of sight" only. @@
- d) Is not usually reflected by the earth or the sea.

49] In comparing the overall operation of a pulse radar and a CW radar, it is determined that:

- a) The pulse radar provides more accurate long-range and short-range measurements. @@
- b) The CW radar produces spurious ground clutter on the display scope.
- c) The CW radar has better short-range detection capabilities.
- d) The CW radar develops a lower average output power.

50] The characteristic of the magnetron output pulse that relates to accurate range measurement is its:

- a) Amplitude.
- b) Decay time.
- c) Rise time. @@
- d) Duration.

51] Magnetrons may be frequency modulated by:

- a) Nutating the transmitter antenna.
- b) Varying the magnetron load impedance. @@
- c) Varying the power supply regulation.
- d) Varying the amplitude of the magnetron input pulses.

52] Some aircraft radars and avionics suites operate with a prime power line frequency of 400 Hz. What is the principle advantage of a higher line frequency?

- a) 400 Hz power supplies draw less current than 60 Hz supplies, allowing more current available for other systems on the aircraft.
- b) The magnetic devices in a 400 Hz power supply such as transformers, chokes and filters are smaller and lighter in weight than those used in 60 Hz power supplies. @@
- c) A 400 Hz power supply generates less heat and operates much more efficiently than a 60 Hz power supply.
- d) 400 Hz power supplies are much less expensive to produce than

power supplies with lower line frequencies.

53] When a radar signal is sent to an object, the Doppler effect is:

- a) Objects moving towards you reflect back a lower frequency.
- b) Objects moving away from you reflect back a higher frequency.
- c) Stationary objects reflect back a slightly lower frequency.
- d) Objects moving towards you reflect back a higher frequency. @@

54] Airport wind shear radars depend upon:

- a) The doppler effect to track rapid shifts in wind patterns. @@
- b) High resolution to track moisture content cells in the atmosphere.
- c) Phase measurements and FM & CW waveforms.
- d) Large, high-gain antenna systems.

55] Choose the most correct statement containing the parameters which control the size of the target echo.

- a) Transmitted power, antenna effective area, transmit and receive losses, radar cross section of the target, range to target. @@
- b) Height of antenna, power radiated, size of target, receiver gain, pulse width.
- c) Power radiated, antenna gain, size of target, shape of target, pulse width, receiver gain.
- d) Magnetron gain, antenna gain, size of target, range to target, waveguide loss.

56] Frequencies generally used for marine radar are in the ___ part of the radio spectrum.

- a) UHF.
- b) EHF.
- c) SHF. @@
- d) VHF.

57] The minimum range of a radar is determined by:

- a) The frequency of the radar transmitter.
- b) The pulse repetition rate.
- c) The transmitted pulse width. @@

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d) The pulse repetition frequency.

58] An S band radar operates in which frequency band?

- a) 1-2 GHz.
- b) 2-4 GHz. @@
- c) 4-8 GHz.
- d) 8-12 GHz.

59] An X band radar operates in which frequency band?

- a) 1-2 GHz.
- b) 2-4 GHz.
- c) 4-8 GHz.
- d) 8-12 GHz. @@

60] The major advantage of an S-band radar over an X-band radar is:

- a) It has greater bearing resolution.
- b) It is less affected by weather conditions. @@
- c) It is mechanically less complex.
- d) It has greater power output.

61] A major consideration for the use of a switching regulator power supply over a linear regulator is:

- a) The switching regulator has better regulation.
- b) The linear regulator does not require a transformer to step down AC line voltages to a usable level.
- c) The switching regulator can be used in nearly all applications requiring regulated voltage.
- d) The overall efficiency of a switching regulator is much higher than a linear power supply. @@

62] The major advantage of digitally processing a radar signal is:

- a) Digital readouts appear on the radar display.
- b) Enhancement of weak target returns. @@
- c) An improved operator interface.
- d) Rectangular display geometry is far easier to read on the

CRT.

63] In order to ensure that a practical filter is able to remove undesired components from the output of an analog to digital convertor, the sampling frequency should be:

- a) The same as the lowest component of the analog frequency.
- b) Two times the highest component of the analog frequency.
- c) Greater than two times the highest component of the sampled frequency. @@
- d) The same as the highest component of the sampled frequency.

64] Which of the following is the most practical means of increasing the range of a ship radar installation?

- a) Increase the height of the radar antenna and the height of the target.
- b) Increase the height of the target and use a corner reflector.
- c) Use a metallic corner reflector and increase pulse width.
- d) Increase transmitter power, increase pulse width, and increase the time between transmitted pulses. @@

65] A shipboard radar uses a PFN driving a magnetron cathode through a step up transformer. This results in which type of modulation?

- a) Frequency modulation.
- b) Amplitude modulation.
- c) Continuous Wave (CW) modulation.
- d) Pulse modulation. @@

66] In a solid-state radar modulator, the duration of the transmitted pulse is determined by:

- a) The thyatron.
- b) The magnetron voltage.
- c) The pulse forming network. @@
- d) The trigger pulse.

67] What device is used as a transmitter in a marine radar system?

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- a) A Klystron.
- b) A beam-powered pentode.
- c) A Magnetron. @@
- d) A Thyatron.

68] What device(s) could be used as the local oscillator in a radar receiver?

- a) A Thyatron.
- b) A Klystron.
- c) A Klystron and a Gunn Diode. @@
- d) A Gunn diode.

69] The klystron local oscillator is constantly kept on frequency by:

- a) Constant manual adjustments.
- b) The Automatic Frequency Control circuit. @@
- c) A feedback loop from the crystal detector.
- d) A feedback loop from the TR box.

70] What device(s) may act as the modulator of a radar system?

- a) A magnetron.
- b) A thyatron.
- c) A silicon-controlled rectifier (SCR).
- d) A thyatron and a silicon-controlled rectifier. @@

71] A circuit used to develop AFC voltage in a radar receiver is called the:

- a) Peak detector.
- b) Crystal mixer.
- c) Second detector.
- d) Discriminator. @@

72] The TR box:

- a) Prevents the received signal from entering the transmitter.
- b) Protects the receiver from the strong radar pulses.

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- c) Turns off the receiver when the transmitter is on.
- d) Protects the receiver from the strong radar pulses and turns off the receiver when the transmitter is on. @@

73] A DC keep-alive potential:

- a) Is applied to a TR tube to make it more sensitive.
- b) Partially ionizes the gas in a TR tube, making it very sensitive to transmitter pulses.
- c) Fully ionizes the gas in a TR tube.
- d) Is applied to a TR tube to make it more sensitive and partially ionizes the gas in a TR tube, making it very sensitive to transmitter pulses. @@

74] What determines the minimum range of a radar set?

- a) The duty cycle.
- b) The average power.
- c) The peak power.
- d) The transmitted pulse width and the T/R cell recovery time. @@

75] The ARPA term CPA refers to:

- a) The closest point a ship or target will approach your own ship. @@
- b) The furthest point a ship or target will get to your own ship's bow.
- c) Direction of target relative to your own ship's direction.
- d) The combined detection and processing of targets.

76] What is the purpose or function of the "Trial Mode" used in most ARPA equipment?

- a) It selects trial data for targets' recent past positions.
- b) It is used to display target position and your own ship's data such as TCPA, CPA, etc.
- c) It is used to allow results of proposed maneuvers to be assessed. @@
- d) None of these.

77] On most ARPA equipment, this is a line on the PPI display which indicates a target's position. The speed of the target is shown by the length of the line. The course of the target is shown by the direction of the line. This statement best

describes a/an:

- a) Vector. @@
- b) Electronic Bearing Line.
- c) Range Marker.
- d) Heading Marker.

78] Raster-scan displays are frequently used in the newer and the more sophisticated radars. These displays are most like those found in:

- a) Television sets. @@
- b) A-scan Radars.
- c) B-scan Radars.
- d) PPI displays.

79] Voltages used in CRT anode-circuits are in what range of value?

- a) 0.5-10 mV.
- b) 20-50 mV.
- c) 200-1000 V.
- d) 10-50 kV. @@

80] In older radar sets, how far from the waveguides are the spark gaps located?

- a) One quarter wavelength. @@
- b) One half wavelength.
- c) One wavelength.
- d) Two wavelengths.

81] The echo box is used for:

- a) Testing and tuning of the radar unit by providing artificial targets. @@
- b) Testing the wavelength of the incoming echo signal.
- c) Amplification of the echo signal.
- d) Detection of the echo pulses.

82] The heading flash is a momentary intensification of the sweep line on the PPI presentation. Its function is to:

- a) Alert the operator when a target is within range.
- b) Alert the operator when shallow water is near.
- c) Inform the operator of the dead-ahead position on the PPI scope. @@
- d) Inform the operator when the antenna is pointed to the rear of the ship.

83] The magnetron is:

- a) A type of diode that requires an internal magnetic field.
- b) A triode that requires an external magnetic field.
- c) A type of diode that requires an external magnetic field. @@
- d) Used as the local oscillator in the radar unit.

84] In a radar unit, the local oscillator is:

- a) A hydrogen thyratron.
- b) A klystron. @@
- c) A pentagrid converter tube.
- d) A reactance tube modulator.

85] What type of video output tube is used in most marine radar units?

- a) A standard CRT.
- b) A plan position indicator (PPI). @@
- c) An oscilloscope.
- d) None of these.

86] How are ranges changed so that range markers represent different distances?

- a) By changing the electrical potential on the video amplifier.
- b) By changing the PPI screen.
- c) By changing the oscillating frequency of the ringing oscillator. @@
- d) By changing the peak power.

87] Sea return is:

- a) Sea water that gets into the antenna system.
- b) The return echo from a target at sea.

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- c} The reflection of radar signals from nearby waves. @@
- d} None of these.

88] The sensitivity-time control (STC) circuit:

- a} Increases the sensitivity of the receiver for close objects.
- b} Increases the sensitivity of the receiver for distant objects.
- c} Decreases the sensitivity of the receiver for close objects. @@
- d} Decreases the sensitivity of the transmitter for close objects.

89] The primary tube used in the STC circuit is:

- a} A pentode.
- b} A triode.
- c} A diode.
- d} A hydrogen thyratron. @@

90] In a radar unit, the mixer uses:

- a} A silicon crystal or PIN diode. @@
- b} A pentagrid converter tube.
- c} A field-effect transistor.
- d} A microwave transistor.

91] Why is hydrogen gas used in thyratron tubes?

- a} It ionizes and deionizes slowly.
- b} It ionizes and deionizes quickly. @@
- c} Because it is much lighter than other gases.
- d} Because it does not ionize at all.

92] In video amplifiers, compensation for the input and output stage capacitances must be accomplished to prevent distorting the video pulses. This compensation is normally accomplished by:

- a} Connecting inductors in parallel with both the input and output capacitances.
- b} Connecting resistances in parallel with both the input and output capacitances.

c) Connecting an inductor in parallel with the input capacitance and an inductor in series with the output capacitance.

d) Connecting an inductor in series with the input capacitance and an inductor in parallel with the output capacitance. @@

93] The video (second) detector in a pulse modulated radar system would most likely use a (an):

a) Discriminator detector.

b) Diode detector. @@

c) Ratio detector.

d) Infinite impedance detector.

94] In the receive mode, frequency conversion is generally accomplished by a:

a) Tunable waveguide section.

b) Pentagrid converter.

c) Crystal diode. @@

d) Ferrite device.

95] When the receiver employs an MTI circuit:

a) The receiver gain increases with time.

b) Only moving targets will be displayed. @@

c) The receiver AGC circuits are disabled.

d) Ground clutter will be free of "rabbits".

96] Video amplifiers in pulse radar receivers must have a broad bandwidth because:

a) Weak pulses must be amplified. @@

b) High frequency sinewaves must be amplified.

c) The radars operate at PRFs above 100.

d) The pulses produced are normally too wide for video amplification.

97] To minimize video display saturation caused by RF energy from external sources, such as jamming, a receiver might employ:

a) STC circuits.

b) GTC circuits.

c) FTC circuits. @@

d) AGC circuits.

98] A magnetron has a cathode-anode potential of 20 kilovolts. Electrons emitted by the cathode:

- a) Never reach the anode.
- b) Enter the cavities to sustain oscillations.
- c) Travel to the anode in straight line paths.
- d) Sustain oscillation by their cycloidal paths. @@

99] How many active elements are contained in a magnetron?

- a) 2. @@
- b) 3.
- c) 4.
- d) 5.

100] The shape and duration of the high voltage pulse delivered to the magnetron is established by:

- a) An RC network in the keyer stage.
- b) The duration of the modulator input trigger.
- c) An artificial delay line. @@
- d) The time required to saturate the pulse transformer.

101] The pulse developed by the modulator may have an amplitude greater than the supply voltage. This is possible by:

- a) Using a voltage multiplier circuit.
- b) Employing a resonant charging choke. @@
- c) Discharging a capacitor through an inductor.
- d) Discharging two capacitors in series and combining their charges.

102] To minimize video display saturation caused by RF energy from external sources, such as jamming, a receiver might employ:

- a) STC circuits.
- b) GTC circuits.
- c) FTC circuits. @@
- d) AGC circuits.

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103] An advantage of resonant charging is that it:

- a) Eliminates the need for a reverse current diode.
- b) Guarantees perfectly square output pulses.
- c) Reduces the high voltage power supply requirements. @@
- d) Maintains a constant magnetron output frequency.

104] Pulse radars require precise timing for their operation. Which type circuit below might best be used to provide these accurate timing pulses?

- a) A single-swing blocking oscillator. @@
- b) An AFC controlled sine wave oscillator.
- c) A non-symmetrical astable multivibrator.
- d) A triggered flip-flop type multivibrator.

105] Standard vacuum tubes are not used at radar frequencies because:

- a) Their interelectrode capacitance is too small.
- b) Transit time is so short that oscillation may result.
- c) Pentode gain is too high and reduces sensitivity.
- d) The inductance of the leads is excessive. @@

106] Transit time might be defined as the time required for:

- a) RF energy to travel through the waveguide.
- b) A pulse to travel a wavelength inside a waveguide.
- c) One cycle of operation to be completed.
- d) Electrons to travel from cathode to anode. @@

107] A CW radar may be used to determine the rate of travel of a target and whether it is moving toward or away from the radar position. To make this determination:

- a) The carrier must be frequency modulated.
- b) The AFC control circuits must be disabled.
- c) The carrier must be pulse modulated.
- d) The principles of doppler effect are employed. @@

108] A CW radar is being frequency modulated with a low frequency sine wave to provide range measurements. To develop a

range indication, the receiver would most likely use a:

- a) Diode detector, tuned to the IF.
- b) Diode detector, tuned to the modulating frequency.
- c) Phase comparator, tuned to the IF.
- d) Phase comparator, tuned to the modulating frequency. @@

109] To obtain an indication of target movement using the doppler principle, a CW radar receiver would most likely employ a:

- a) Discriminator, tuned to the IF. @@
- b) Discriminator, tuned to the transmitter frequency.
- c) Discriminator, tuned to an audio frequency.
- d) Slope detector, tuned slightly above the IF.

110] A negative voltage is commonly applied to the magnetron cathode rather than a positive voltage to the magnetron anode because:

- a) The cathode must be made negative to force electrons into the drift area.
- b) A positive voltage would tend to nullify or weaken the magnetic field.
- c) The anode can be operated at ground potential for safety reasons. @@
- d) The cavities might not be shock-excited into oscillation by a positive voltage.

111] Solid state microwave amplifier devices operating at C-Band and above are typically made from:

- a) Germanium.
- b) Silicon Dioxide.
- c) Silicon Carbide.
- d) Gallium Arsenide. @@

112] The SSR subsystem of an Airport Surveillance Radar System uses:

- a) Multiple waveforms to resolve range and doppler ambiguities.
- b) A much higher frequency than the PSR subsystem.
- c) Coded response information from aircraft transponders. @@
- d) A high azimuth scan rate and peak transmitter power.

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113] What is the transmit frequency of an aircraft transponder?

- a) 5250 MHz.
- b) 1.09 GHz. @@
- c) 1030 MHz.
- d) 2950 MHz.

114] What is the receive frequency of an aircraft transponder?

- a) 5250 MHz.
- b) 1.09 GHz.
- c) 1030 MHz. @@
- d) 2950 MHz.

115] Choose the most correct statement with respect to component damage from electrostatic discharge:

- a) ESD damage occurs primarily in passive components which are easily identified and replaced.
- b) ESD damage occurs primarily in active components which are easily identified and replaced.
- c) The technician will feel a small static shock and recognize that ESD damage has occurred to the circuit.
- d) ESD damage may cause immediate circuit failures, but may also cause failures much later at times when the radar set is critically needed. @@

116] The display of a 2-D Airport Surveillance radar typically provides:

- a) Range, elevation, and target speed.
- b) Range and azimuth only.
- c) Range, azimuth, and elevation.
- d) Range, azimuth, and SSR responses. @@

117] In a conventional PPI display, the electron beam is scanned:

- a) From the center of the display to the outer edges.
- b) From the center of the display to the outer edges and in a rotating pattern which follows the antenna position. @@
- c) In a rotating pattern which follows the antenna position.

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d) From one specified X-Y coordinate to the next.

118] What does the term ARPA/CAS refer to?

a) The basic radar system in operation.

b) The device which displays the optional U.S. Coast Guard Acquisition and Search radar information on a CRT display.

c) The device which acquires and tracks targets which are displayed on the radar indicator's CRT. @@

d) The device which allows the ship to automatically steer around potential hazards.

119] The characteristics of a Field Effect Transistor (FET) used in a modern radar switching power supply can be compared as follows:

a) "On" state compares to a bipolar transistor. "Off" state compares to a 1 Mega-ohm resistor.

b) "On" state compares to a pure resistor. "Off" state compares to a mechanical relay. @@

c) "On" state compares to an low resistance inductor. "Off" state compares to a 10 Megohm resistor.

d) "On" state compares to a resistor. "Off" state compares to a capacitor.

120] Which of the following characteristics are true of a power MOSFET used in a radar switching supply?

a) Low input impedance; failure mode can be gate punch-through.

b) High input impedance; failure mode can be gate punch-through. @@

c) High input impedance; failure mode can be thermal runaway.

d) Low input impedance; failure mode can be gate breakdown.

121] On a basic syncro system, the angular information is carried on:

a) The DC feedback signal.

b) The stator lines. @@

c) The deflection coils.

d) The rotor lines.

122] In a fixed-frequency switching power supply, the pulse width of the switching circuit will increase when:

- a) The load current decreases.
- b) The output voltage increases.
- c) The input voltage increases.
- d) The load impedance decreases. @@

123] The output of an RC integrator, when driven by a square wave with a period of much less than one time constant is?

- a) A Sawtooth wave.
- b) A Sine wave.
- c) A series of narrow spikes.
- d) A Triangle wave. @@

124] A pulse width modulator in a switching power supply is used to:

- a) Provide the reference voltage for the regulator.
- b) Vary the frequency of the switching regulator to control the output voltage.
- c) Vary the duty cycle of the regulator switch to control the output voltage. @@
- d) Compare the reference voltage with the output voltage sample and produce an error voltage.

125] In video amplifiers, compensation for the input and output stage capacitances must be accomplished to prevent distorting the video pulses. This compensation is normally accomplished by:

- a) Connecting inductors in parallel with both the input and output capacitances.
- b) Connecting resistances in parallel with both the input and output capacitances.
- c) Connecting an inductor in parallel with the input capacitance and an inductor in series with the output capacitance.
- d) Connecting an inductor in series with the input capacitance and an inductor in parallel with the output capacitance. @@

126] When comparing TTL and CMOS logic families, which of the following is true:

- a) CMOS logic requires a supply voltage of 5 volts +/- 20%, whereas TTL logic requires 5 volts +/- 5%.
- b) Unused inputs should be tied high or low as necessary only in the CMOS family.
- c) At higher operating frequencies, CMOS circuits consume almost

as much power as TTL circuits. @@

d) When a CMOS input is held low, it sources current into whatever it drives.

127] When comparing a TTL and a CMOS NAND gate:

a) Both have active pull-up characteristics. @@

b) Both have three output states.

c) Both have comparable input power sourcing.

d) Both employ Schmitt diodes for increased speed capabilities.

128] A basic sample-and-hold circuit contains:

a) An analog switch and an amplifier.

b) An analog switch, a capacitor, and an amplifier.

c) An analog multiplexer and a capacitor.

d) An analog switch, a capacitor, amplifiers and input and output buffers. @@

129] Which of the following is not a method of analog to digital conversion?

a) Delta-sigma conversion.

b) Dynamic-range conversion. @@

c) Switched-capacitor conversion.

d) Dual-slope integration.

130] Some handshaking signals you might find on a EIA-232-D interface are:

a) NRFD and NDAC.

b) ACKNLG and DATA STROBE.

c) PIO and LIFO.

d) RTS and CTS. @@

131] In standard CMOS logic IC databooks, the parameter tTLH is considered to be:

a) Negligible in CMOS logic.

b) Measured from the leading edge to the trailing edge.

c) Measured from the 10% to 90% points of the leading edge. @@

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d) Measured at the 50% point of the leading edge.

132] Which of the following would not be considered an input to the computer of a collision avoidance system?

- a) Own ship's exact position from navigation satellite receiver.
- b) Own ship's gyrocompass heading.
- c) Own ship's speed from Doppler log.
- d) Own ship's wind velocity from an anemometer. @@

133] High voltage is applied to what element of the magnetron?

- a) The waveguide.
- b) The anode.
- c) The plate cap.
- d) The cathode. @@

134] An ion discharge (TR) cell is used to:

- a) Protect the transmitter from high SWRs.
- b) Lower the noise figure of the receiver.
- c) Protect the receiver mixer during the transmit pulse. @@
- d) Tune the local oscillator of the radar receiver.

135] In a radar unit, the mixer uses:

- a) PIN diodes and silicon crystals. @@
- b) PIN diodes.
- c) Boettcher crystals.
- d) Silicon crystals.

136] An AFC system keeps the receiver tuned to the transmitted signal by varying the frequency of:

- a) The magnetron.
- b) The IF amplifier stage.
- c) The local oscillator. @@
- d) The cavity duplexer.

137] A Gunn diode oscillator takes advantage of what effect?

- a) Negative resistance.
- b) Avalanche transit time.
- c) Bulk-effect.
- d) Negative resistance and bulk-effect. @@

138] The basic frequency determining element in a Gunn oscillator is:

- a) The power supply voltage.
- b) The type of semiconductor used.
- c) The resonant cavity. @@
- d) The loading of the oscillator by the mixer.

139] A logarithmic IF amplifier is preferable to a linear IF amplifier in a radar receiver because:

- a) It has higher gain.
- b) It is more easily aligned.
- c) It has a lower noise figure.
- d) It has a greater dynamic range. @@

140] Silicon crystals:

- a) Are very sensitive to static electric charges.
- b) Should be wrapped in lead foil for storage.
- c) Tolerate very low currents.
- d) All of these. @@

141] The TWT (traveling wave tube) is:

- a) A type of waveguide.
- b) Not really a vacuum tube but a semiconductor device.
- c) A microwave amplifier tube. @@
- d) A microwave tube that requires a very strong external magnetic field for proper operation.

142] The input signal to a TWT is inserted at:

- a) The anode end of the helix.

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- b) The grid end of the helix.
- c) The collector end of the helix.
- d) The cathode end of the helix. @@

143] Which is typical current for a silicon crystal used in a radar mixer or detector circuit?

- a) 3 mA. @@
- b) 15 mA.
- c) 50 mA.
- d) 100 mA.

144] Oscillations in a klystron local oscillator tube are maintained by:

- a) The grid-feedback loop.
- b) Bunches of electrons passing the cavity grids. @@
- c) The circulation of electrons.
- d) The LC circuit.

145] The STC circuit:

- a) Increases the sensitivity of the receiver for close targets.
- b) Decreases sea return on the PPI scope. @@
- c) Helps to increase the bearing resolution of targets.
- d) Increases sea return on the PPI scope.

146] In a radar receiver, the RF power amplifier:

- a) Is high gain.
- b) Is low gain.
- c) Requires a wide bandwidth.
- d) Does not exist. @@

147] What is the average range of a ship's surface search radar unit?

- a) 20 miles.
- b) 40 miles. @@
- c) 80 miles.

d} 100 miles.

148] The anode of a magnetron is normally maintained at ground potential:

- a} Because it operates more efficiently that way.
- b} For safety purposes. @@
- c} Never. It must be highly positive to attract the electrons.
- d} Because greater peak-power ratings can be achieved.

149] A keep-alive voltage is applied to:

- a} The crystal detector.
- b} The ATR tube.
- c} The TR tube. @@
- d} The magnetron.

150] How does a TWT amplify?

- a} Through a positive feedback circuit.
- b} Through a negative feedback circuit.
- c} Through a capacitive feedback circuit.
- d} By transfer of energy from the signal to the electron beam. @@

151] A wavelength is equal to how many degrees of a sine wave?

- a} 360. @@
- b} 180.
- c} 90.
- d} 45.

152] A raster scan radar display maintains the display presentation on the CRT face by the use of:

- a} Long-persistence phosphors in the CRT face.
- b} Analog to digital conversion.
- c} Fast sweeping of the radar video.
- d} Video RAM. @@

153] In a raster-type display, the electron beam is scanned:

- a) From the center of the display to the outer edges.
- b) Horizontally and vertically across the CRT face. @@
- c) In a rotating pattern which follows the antenna position.
- d) From one specified X-Y coordinate to the next.

154] The position of the PPI scope sweep must indicate the position of the antenna. The sweep and antenna positions are frequently kept in synchronism by the use of:

- a) Servosystems.
- b) Synchro systems. @@
- c) DC positioning motors.
- d) Differential amplifiers.

155] What is the main difference between an analog and a digital receiver?

- a) Special amplification circuitry.
- b) The presence of decision circuitry to distinguish between "on" and "off" signal levels. @@
- c) The two cannot be compared.
- d) Digital receivers produce no distortion.

156] The purpose of the aquadag coating on the CRT is:

- a) To protect the electrons from strong electric fields.
- b) To act as a second anode.
- c) To attract secondary emissions from the CRT screen.
- d) All of these. @@

157] When you examine the RADAR you notice that there is no target video in the center of the CRT. The blank spot gets smaller in diameter as you increase the range scale. What operator front panel control could be misadjusted?

- a) TUNE.
- b) Sensitivity Time Control (STC). @@
- c) Anti-Clutter Rain (ACR).
- d) False Target Elimination (FTE).

158] When you examine the RADAR you notice that there is no target video in the center of the CRT. The blank spot gets

smaller in diameter as you increase the range scale. If all of the front panel controls are properly adjusted, what would be the most probable faulty circuit?

- a) The local oscillator is misadjusted.
- b) Video amplifier circuit.
- c) The IF amplifier circuit.
- d) The TR (TRL) Cell. @@

159] While examining the shipboard radar sets, you notice on a particular indicator that the video representing the pier is distorted closest to the center of the PPI. (The video appears to bend in a concave fashion.) This is a primary indication of what?

- a) The deflection coils need adjusting.
- b) The centering magnets at the CRT neck need adjusting.
- c) The waveguide compensation delay line needs adjusting. @@
- d) The CRT filaments are weakening.

160] How do you eliminate stationary objects such as trees, buildings, bridges, etc., from the PPI presentation?

- a) Remove the discriminator from the unit.
- b) Use a discriminator as a second detector. @@
- c) Calibrate the IF circuit.
- d) Calibrate the local oscillator.

161] The radar service person should take the following precautions to ensure that the magnet of the magnetron is not weakened:

- a) Keep metal tools away from the magnet.
- b) Do not subject it to excessive heat.
- c) Do not subject it to shocks or blows.
- d) All of these. @@

162] While making repairs or adjustments to radar units:

- a) Wear fire-retardant clothing.
- b) Discharge all high-voltage capacitors to ground. @@
- c) Maintain the filament voltage.
- d) Reduce the magnetron voltage.

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163] While removing a CRT from its operating casing, it is a good idea to:

- a) Discharge the first anode.
- b) Test the second anode with your fingertip.
- c) Wear gloves and goggles. @@
- d) Set it down on a hard surface.

164] In a marine radar set, a high VSWR is indicated at the magnetron output. The waveguide and rotary joint appear to be functioning properly. What component may be malfunctioning?

- a) The magnetron.
- b) The waveform generator.
- c) The STC circuit.
- d) The waveguide array termination. @@

165] The VSWR of a microwave transmission line device might be measured using:

- a) A dual directional coupler and a power meter.
- b) A Network Analyzer.
- c) A Spectrum Analyzer.
- d) A dual directional coupler, a power meter, and a Network Analyzer. @@

166] Prior to removing, servicing or making measurements on any solid state circuit boards from the radar set, the operator should ensure that:

- a) The waveguide is detached from the antenna to prevent radiation.
- b) The magnetic field is present to prevent over-current damage or overheating from occurring in the magnetron.
- c) The proper work surfaces and ESD grounding straps are in place to prevent damage to the boards from electrostatic discharge. @@
- d) Only non-conductors and devices are used.

167] Before removing either a primary or secondary airport surveillance radar from service for maintenance or repair, the operator must:

- a) Notify the pilots of all planes in the area.
- b) Ensure that the area is relatively clear of air traffic.

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c) Notify Air Traffic Control. @@

d) Record the operating conditions of the radar in the proper maintenance log.

168] Before ground testing of an aircraft radar, the operator should:

a) Ensure that the area in front of the antenna is clear of other maintenance personnel to avoid radiation hazards. @@

b) Be sure that the receiver has been properly shielded and grounded.

c) First test the transmitter connected to a matched load.

d) Measure power supply voltages to prevent circuit damage.

169] The azimuth encoder of an airport surveillance radar appears to be malfunctioning. What must the operator do before performing maintenance on the unit?

a) Inform Air Traffic Control that the azimuth information is unreliable until maintenance is performed. Continue operation until scheduled maintenance can be accomplished.

b) Notify Air Traffic Control and cease operation immediately.

c) Notify Air Traffic Control that the PSR will be removed from service to avoid radiation hazard to maintenance personnel. Then, and only then, you may remove and replace the malfunctioning unit.

d) The redundant unit is automatically switched into service and operates independently. You may remove and replace the malfunctioning unit without affecting normal operation. @@

170] It is reported that the radar is not receiving small targets. The most likely causes are:

a) Magnetron, IF amplifier, or receiver tuning. @@

b) PFN, crystals, or processor memory.

c) Crystals, Local oscillator tuning, or power supply.

d) Fuse blown, IF amp, or video processor.

171] The radar display has sectors of solid video (spoking). What would be the first thing to check?

a) Antenna information circuits failure.

b) Frequency of raster scan.

c) For interference from nearby ships. @@

d) Constant velocity of antenna rotation.

172] When replacing components of a radar transmitter, what safety precautions should be taken?

- a) All of these. @@
- b) De-energize equipment and turn off associated ship's power circuit breakers whenever possible.
- c) Adhere to safety notices appearing in the equipment's service manual.
- d) Ensure someone else is nearby.

173] Targets displayed on the radar display are not on the same bearing as their visual bearing. What should you first suspect?

- a) A bad reed relay in the antenna pedestal.
- b) A sweep length misadjustment.
- c) One phase of the yoke assembly is open.
- d) Incorrect antenna position information. @@

174] Range rings on the PPI indicator are oval in shape. Which circuit would you suspect is faulty?

- a) Timing circuit.
- b) Video amplifier circuit.
- c) Range marker circuit.
- d) Sweep generation circuit. @@

175] On a vessel with two radars, one has a different range indication on a specific target than the other. How would you determine which radar is incorrect?

- a) Triangulate target using the GPS and visual bearings.
- b) Check the sweep and timing circuits of both indicators for correct readings. @@
- c) Check antenna parallelism.
- d) Use the average of the two indications and adjust both for that amount.

176] Sea clutter on the radar scope cannot be effectively reduced using front panel controls. What circuit would you suspect is faulty?

- a) The Sensitivity Time Control (STC) circuit. @@
- b) The False Target Eliminator (FTE) circuit.

- c) The Fast Time Constant (FTC) circuit.
- d) The Intermediate Frequency (IF) circuit.

177] When monitoring the gate voltage of a power MOSFET in the switching power supply of a modern radar, you would expect to see the gate voltage change from "low" to "high" by how much?

- a) 1 Volt to 2 Volts.
- b) 300 microVolts to 700 microVolts.
- c) Greater than 2 Volts. @@
- d) 1.0 Volt to 20.0 Volts.

178] Prior to making "power-on" measurements on a switching power supply, you should be familiar with the supply because of the following:

- a) You need to know where the filter capacitors are so they can be discharged.
- b) If it does not use a line isolation transformer you may destroy the supply with grounded test equipment. @@
- c) It is not possible to cause a component failure by using ungrounded test equipment.
- d) So that measurements can be made without referring to the schematic.

179] In a radar using digital video processing, a bright, wide ring appears at a fixed distance from the center of the display on all digital ranges. The transmitter is operating normally. What receiver circuit would you suspect is causing the problem?

- a) VRM circuit.
- b) Range ring generator.
- c) Video storage RAM or shift register. @@
- d) EBL circuit.

180] The raster scan radar display has missing video in a rectangular block on the screen. Where is the most likely problem area?

- a) Horizontal sweep circuit.
- b) Power supply.
- c) Memory area failure. @@
- d) Vertical blanking pulse.

181] The ship's speed indication on the ARPA display can be set

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manually, but does not change with changes in the vessel's speed. What other indication would point to a related equipment failure?

- a) "GYRO OUT" is displayed on the ARPA indicator.
- b) "LOG OUT" is displayed on the ARPA indicator. @@
- c) "TARGET LOST" is displayed on the ARPA indicator.
- d) "NORTH UP" is displayed on the ARPA indicator.

182] The ship's heading flash on a gyro-stabilized indicator tracks in the opposite direction of the ship's turn. What would be the most likely cause?

- a) No gyro information to the indicator.
- b) Two of the phases of the gyrocompass signal to the indicator are reversed. @@
- c) The reed switch in the antenna pedestal is broken.
- d) The compass drive circuits in the indicator are faulty.

183] While troubleshooting a memory problem in a raster scan radar, you discover that the "REFRESH" cycle is not operating correctly. What type of memory circuit are you working on?

- a) DRAM. @@
- b) SRAM.
- c) ROM.
- d) PROM.

184] Small targets in an area of very heavy swell are frequently being lost and reacquired by a collision avoidance radar. Each time a target is acquired, the antenna rotates several times before the target's course and speed can be displayed. What is the most likely cause of the delay?

- a) An intermittent connection in the CAS computer.
- b) The antenna sweep rate is affected by the sea conditions.
- c) The CAS computations require several sweeps of the antenna. @@
- d) The targets are moving between sweeps.

185] An increase in the deflection on the magnetron current meter could likely be caused by:

- a) Insufficient pulse amplitude from the modulator.
- b) Too high a B+ level on the magnetron.
- c) A decrease of the magnetic field strength. @@

d) A lower duty cycle, as from 0.0003 to 0.0002.

186] An increase in magnetron current which coincides with a decrease in power output is an indication of what?

- a) The pulse length decreasing.
- b) A high SWR.
- c) A high magnetron heater voltage.
- d) The external magnet weakening. @@

187] Low or no mixer current could be caused by:

- a) A local oscillator frequency misadjustment.
- b) All of these. @@
- c) A TR cell failure.
- d) Mixer diode degradation.

188] Silicon crystals are used in radar mixer and detector stages. Using an ohmmeter, how might a crystal be checked to determine if it is functional?

- a) Its resistance should be the same in both directions.
- b) Its resistance should be low in one direction and high in the opposite direction. @@
- c) Its resistance cannot be checked with a dc ohmmeter because the crystal acts as a rectifier.
- d) It would be more appropriate to use a VTVM and measure the voltage drop across the crystal.

189] In a radar unit, if the crystal mixer becomes defective, replace the:

- a) Crystal only.
- b) The crystal and the ATR tube.
- c) The crystal and the TR tube. @@
- d) The crystal and the klystron.

190] Radar interference on a communications receiver appears as:

- a) A varying tone.
- b) Static.
- c) A steady tone. @@

d) A hissing tone.

191] Radar interference to a communications receiver is eliminated by:

- a) Not operating other devices when radar is in use.
- b) Properly grounding, bonding, and shielding all units. @@
- c) Using a high pass filter on the power line.
- d) Using a link coupling.

192] A defective crystal in the AFC section will cause:

- a) No serious problems.
- b) Bright flashing pie sections on the PPI. @@
- c) Spiking on the PPI.
- d) Vertical spikes that constantly move across the screen.

193] Before testing a radar transmitter, it would be a good idea to:

- a) Make sure no one is on the deck.
- b) Make sure the magnetron's magnetic field is far away from the magnetron.
- c) Make sure there are no explosives or flammable cargo being loaded. @@
- d) Make sure the Coast Guard has been notified.

194] How can a CRT be damaged?

- a) By operating it at a high intensity.
- b) By operating it at a lower-than-normal intensity.
- c) By leaving a stationary high-intensity image on the screen. @@
- d) By operating it beyond its frequency limit.

195] If a CRT is dropped:

- a) Most likely nothing will happen because they are built with durability in mind.
- b) It might go out of calibration.
- c) It might implode, causing damage to workers and equipment. @@
- d) The phosphor might break loose.

196] A high magnetron current indicates:

- a) A defective AFC crystal.
- b) A defective external magnetic field. @@
- c) An increase in duty cycle.
- d) A high standing wave ratio (SWR).

197] If the TR box malfunctions:

- a) The transmitter might be damaged.
- b) The receiver might be damaged. @@
- c) The klystron might be damaged.
- d) Magnetron current will increase.

198] How would you prolong the life of a spark gap?

- a) By applying only low voltages to the unit.
- b) By periodically reversing the polarity. @@
- c) By applying extremely high voltages to it from time to time.
- d) It does not matter because spark gaps are not used anymore.

199] If long-length transmission lines are not properly shielded and terminated:

- a) The silicon crystals can be damaged.
- b) Communications receiver interference might result. @@
- c) Overmodulation might result.
- d) Excessive RF loss can result.

200] You are troubleshooting a component on a printed circuit board in a RADAR system while referencing the following Truth Table in Diagram EL8B. What kind of integrated circuit is the component?

- a) D-Type Flip-Flop, 3-State, Inverting. @@
- b) Q-type Flip-Flop, Non-Inverting.
- c) Q-type Directional Shift Register, Dual.
- d) D to Q Convertor, 2-State.

201] A circuit card in a radar system has just been replaced with a spare card. You notice the voltage level at point E in Diagram EL8C is negative 4.75 volts when the inputs are all at 5 volts. The problem is:

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- a) The 25 K resistor is open.
- b) The 100 K resistor has been mistakenly replaced with a 50 K resistor.
- c) The op amp is at the rail voltage.
- d) The 50 K resistor has been mistakenly replaced with a 25 K resistor. @@

202] In the circuit contained in Diagram EL8C, there are five volts present at points B and C, and there is zero volts present at points A and D. What is the voltage at point E?

- a) 3.75 Volts
- b) -3.75 Volts
- c) -1.5 Volts. @@
- d) 4.5 Volts

203] What does the schematic in Diagram EL8D represent?

- a) A magnetron circuit.
- b) A klystron oscillator.
- c) An STC circuit. @@
- d) An audio oscillator.

204] The circuit shown in Diagram EL8E is being used as a time base generator for a CRT. How can this circuit be changed to produce the desired waveform shown?

- a) Increase the resistance of R4.
- b) Increase the resistance of R2. @@
- c) Increase the capacitance of C3.
- d) Decrease the resistance of R2.

205] It is desired to modify the circuit in Diagram EL8E to produce trapezoidal sweep voltages for an electromagnetic CRT. This can be accomplished by:

- a) Increasing the resistance of R4.
- b) Increasing the resistance of R3.
- c) Connecting a resistor between C3 and ground. @@
- d) Connecting another capacitor in series with C3.

206] The two sinewaves in the Diagram EL8F are being applied to

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the vertical and horizontal CRT deflection plates as shown. The display on the CRT screen will be:

- a) A straight line, inclined to the right.
- b) A straight line, inclined to the left.
- c) An ellipse.
- d) A circle. @@

207] The diagram in Diagram EL8G shows a simplified radar mixer circuit using a crystal diode as the first detector. What is the output of the circuit when no echoes are being received?

- a) 60 MHz CW.
- b) 4095 MHz CW.
- c) 4155 MHz CW.
- d) No output is developed. @@

208] In the circuit shown in Diagram EL8H, the diode current is limited by:

- a) Power supply.
- b) R38. @@
- c) R37.
- d) The transistor.

209] The circuit shown in Diagram EL8I is the output of a switching power supply. Measuring from the junction of CR6 and L1 to AGND with an oscilloscope, what waveform would you expect to see?

- a) Filtered DC.
- b) Pulsating DC at line frequency.
- c) AC at line frequency.
- d) Pulsating DC much higher than line frequency. @@

210] With regard to the comparator shown in Diagram EL8J, the input is a sinusoid. Nominal high level output of the comparator is 4.5 volts. Choose the most correct statement regarding the input and output.

- a) The rising edge of the output waveform trails the positive zero crossing of the input waveform by 45 degrees.
- b) The rising edge of the output waveform trails the negative zero crossing of the input waveform by 45 degrees.

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- c) The rising edge of the output waveform trails the positive peak of the input waveform by 45 degrees.
- d) The leading edge of the output waveform occurs 180 degrees after positive zero crossing of the input waveform. @@

211] The nominal output high of the comparator shown in Diagram EL8J is 4.5 volts. Choose the most correct statement which describes the trip points.

- a) Upper trip point is 4.5 Volts. Lower trip point is approximately 0 Volts.
- b) Upper trip point is 2.5 Volts. Lower trip point is approximately 2.0 Volts.
- c) Upper trip point is 900 microVolts. Lower trip point is approximately 0 Volts.
- d) Upper trip point is 750 microVolts. Lower trip point is approximately 0 Volts. @@

212] In the circuit shown in Diagram EL8K, what will be the output of the circuit?

- a) \overline{ABC}
- b) $\overline{AB}+CB$
- c) $AB+C$
- d) $ABC + \overline{BC}$ @@

213] In the circuit shown in Diagram EL8L, U5 pins 1 and 4 are high and both are in the reset state. Assume one clock cycle occurs of Clk A followed by one cycle of Clk B. What are the output states of the two 'D' type flip flops?

- a) Pin 5 low, Pin 9 low.
- b) Pin 5 high, Pin 9 low.
- c) Pin 5 low, Pin 9 high.
- d) Pin 5 high, Pin 9 high. @@

214] Choose the selection from the truth table which is correct for the circuit shown in Diagram EL8M.

- | | P | Q | R | S |
|----|---|---|---|-------|
| a) | 0 | 1 | 0 | 1. |
| b) | 0 | 1 | 1 | 1. @@ |
| c) | 1 | 0 | 0 | 1. |
| d) | 1 | 1 | 1 | 1. |

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215] In the circuit shown in Diagram EL8N, which of the following is true?

- a) With A and B high, Q1 is saturated and Q2 is off.
- b) With either A or B low, Q1 is saturated and Q2 is off. @@
- c) With A and B low, Q2 is on and Q4 is off.
- d) With either A or B low, Q1 is off and Q2 is on.

216] The block diagram of a typical radar system microprocessor is shown in Diagram EL80. Choose the most correct statement regarding this system.

- a) The ALU is used for address decoding.
- b) General registers are used for arithmetic manipulations.
- c) The control unit executes arithmetic manipulations.
- d) Address pointers are contained in the general registers. @@

217] The block diagram of a typical radar system microprocessor is shown in Diagram EL80. Choose the most correct statement regarding this system.

- a) The ALU is used for address decoding.
- b) General registers are used for arithmetic manipulations.
- c) The ALU executes arithmetic manipulations. @@
- d) Address pointers are contained in the control unit.

218] The block diagram of a typical radar system microprocessor is shown in Diagram EL80. Choose the most correct statement regarding this system.

- a) The ALU is used for address decoding.
- b) The Memory and I/O communicate with peripherals. @@
- c) The control unit executes arithmetic manipulations.
- d) The internal bus is used simultaneously by all units.

219] In this Line-Driver/Coax/Line-receiver circuit shown in Diagram EL8P, what component is represented by the blank box?

- a) 25 ohm resistor.
- b) 51 ohm resistor. @@
- c) 10 microhm inductor.
- d) 20 microhm inductor.

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220] With reference to the schematic shown in Diagram EL8Q, choose the most correct statement.

- a) This is a low voltage circuit.
- b) The anode of V201 carries high voltage.
- c) The filament of V201 carries dangerous voltages. @@
- d) This is a video amplifier.

221] If more light strikes the photodiode in Diagram EL8R, there will be:

- a) More diode current. @@
- b) Less diode current.
- c) No change in diode current.
- d) There is wrong polarity on the diode.

222] What is the correct value of R_s in Diagram EL8S, if the voltage across the LED is 1.9 Volts with 5 Volts applied and $I_{f \max}$ equals 40 milliamps?

- a) 75 ohms. @@
- b) 4700 ohms.
- c) 155 ohms.
- d) 10000 ohms.

223] Visible light is measured between:

- a) 100 and 1000 nanometers. @@
- b) 10 and 100 nanometers.
- c) 0.1 and 10 nanometers.
- d) 1 and 10 nanometers.

224] What is a typical forward bias voltage across an LED when it is emitting light?

- a) 0.3 volts.
- b) 0.7 volts.
- c) 1.2 volts.
- d) 1.7 volts. @@

225] Laser light is produced by:

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- a) Stimulated emission. @@
- b) Spontaneous emission.
- c) Black magic.
- d) Electricity.

226] What is the primary purpose of an optical coupler?

- a) To equalize voltage levels.
- b) To reduce power consumption.
- c) To provide voltage isolation. @@
- d) To couple optical signals.

227] The voltage drop across a LED rated at 1300 nm is:

- a) 1 volt. @@
- b) 0 volts.
- c) 1.5 volts.
- d) 3 volts.

228] Optical fibers used to carry radar signals are made of:

- a) Glass coated with plastic.
- b) Ultrapure glass.
- c) Plastic.
- d) All of these. @@

229] Light emissions from an LED are modulated by:

- a) Voltages applied across the diode.
- b) Current passing through the diode. @@
- c) Illumination of the diode.
- d) An indirect voltage surge.

230] Which wavelengths are standard for attenuation measurements in fiber optic cable?

- a) 850 nm
- b) 1300 nm
- c) 1550 nm

d) All of these. @@

231] The response time of a fiber optic system, (like those used to carry radar signal information), is:

- a) The square root of the sum of the squares of the response times of its individual components. @@
- b) The sum of the response times of its individual components.
- c) The average response time of its individual components.
- d) Not directly dependent upon individual response times.

232] What is the usual modulation method for fiber optic transmitters used to carry radar signal information?

- a) Intensity modulation. @@
- b) Frequency modulation.
- c) Wavelength modulation.
- d) Voltage modulation.

233] If the rise time of a radar system's fiber optic signal transmitter is 1 nanosecond, what is its theoretical bandwidth?

- a) 1 MHz.
- b) 100 MHz.
- c) 350 MHz. @@
- d) 350 kHz.

234] What circuit element receives the drive voltage in a radar system's fiber optic signal transmitter?

- a) A filter capacitor.
- b) A load-limiting resistor.
- c) A temperature sensor.
- d) A transistor. @@

235] What is the special advantage of using plenum fiber optic cables to carry radar signal information aboard maritime vessels?

- a) They are small in diameter and easily fit through wire-ways.
- b) They meet stringent fire codes for running through wire-ways. @@
- c) They are crush-resistant and can withstand 10,000 pounds per square inch of pressure.

d) They have special armor coatings that keep rodents from damaging them.

236] Which of the following is not a type of multiplexing used in radar receiver signal transmitters sent through optical fibers?

a) Wavelength-division multiplexing, with pulses transmitted at different wavelengths.

b) Time-division multiplexing, with pulses transmitted at different times.

c) Space-division multiplexing, with pulses transmitted at different positions in the fiber. @@

d) Frequency-division multiplexing, with analog signals transmitted at different frequencies.

237] A radio wave will travel a distance of three nautical miles in:

a) 6.17 microseconds.

b) 18.51 microseconds. @@

c) 37.0 microseconds.

d) 22.76 microseconds.

238] One radar mile is how many microseconds?

a) 6.2.

b) 12.34. @@

c) 528.0.

d) .186.

239] If a target is 5 miles away, how long does it take for the radar echo to be received back at the antenna?

a) 51.4 microseconds.

b) 61.7 microseconds. @@

c) 123 microseconds.

d) 30.75 microseconds.

240] How long would it take for a radar pulse to travel to a target 10 nautical miles away and return to the radar receiver?

a) 123.4 microseconds. @@

b) 12.34 microseconds.

- c) 1.234 microseconds.
- d) 10 microseconds.

241] What is the distance in nautical miles to a target if it takes 308.5 microseconds for the radar pulse to travel from the radar antenna to the target and back.

- a) 12.5 nautical miles.
- b) 25 nautical miles. @@
- c) 50 nautical miles.
- d) 2.5 nautical miles.

242] If the PRF is 2500 Hz, what is the PRI?

- a) 40 microseconds.
- b) 400 microseconds. @@
- c) 250 microseconds.
- d) 800 microseconds.

243] If the pulse repetition frequency (PRF) is 2000 Hz, what is the pulse repetition interval (PRI)?

- a) 0.05 seconds.
- b) 0.005 seconds.
- c) 0.0005 seconds. @@
- d) 0.00005 seconds.

244] If the radar unit has a pulse repetition frequency (PRF) of 2000 Hz and a pulse width of 0.05 microseconds, what is the duty cycle?

- a) 0.0005.
- b) 0.0001. @@
- c) 0.05.
- d) 0.001.

245] A shipboard radar transmitter has a pulse repetition frequency (PRF) of 1,000 Hz, a pulse width of 0.5 microseconds, peak power of 150 KW, and a minimum range of 75 meters. Its duty cycle is:

- a) 0.05.
- b) 0.005.

- c) 0.0005. @@
- d) 0.00005.

246] A pulse radar has a pulse repetition frequency (PRF) of 400 Hz, a pulse width of 1 microsecond, and a peak power of 100 kilowatts. The average power of the radar transmitter is:

- a) 25 watts.
- b) 40 watts. @@
- c) 250 watts.
- d) 400 watts.

247] A pulse radar transmits a 0.5 microsecond RF pulse with a peak power of 100 kilowatts every 1600 microseconds. This radar has:

- a) An average power of 31.25 watts. @@
- b) A PRF of 3200.
- c) A maximum range of 480 kilometers.
- d) A duty cycle of 3.125 percent.

248] If a radar transmitter has a pulse repetition frequency (PRF) of 900 Hz, a pulse width of 0.5 microseconds and a peak power of 15 kilowatts, what is its average power output?

- a) 15 kilowatts.
- b) 13.5 watts.
- c) 6.75 watts. @@
- d) 166.67 watts.

249] What is the average power if the radar set has a PRF of 1000 Hz, a pulse width of 1 microsecond, and a peak power rating of 100 kilowatts?

- a) 10 watts.
- b) 100 watts. @@
- c) 1000 watts.
- d) None of these.

250] A search radar has a pulse width of 1.0 microsecond, a pulse repetition frequency (PRF) of 900 Hz, and an average power of 18 watts. The unit's peak power is:

- a) 200 kilowatts.

- b) 180 kilowatts.
- c) 20 kilowatts. @@
- d) 2 kilowatts.

251] For a range of 10 nautical miles, the radar pulse repetition frequency (PRF) should be:

- a) Approximately 8.1 kHz or less. @@
- b) 900 Hz.
- c) 18.1 kHz or more.
- d) 120.3 microseconds.

252] For a range of 30 nautical miles, the radar pulse repetition frequency should be:

- a) .27 kHz or less.
- b) 27 kHz or more.
- c) 2.7 kHz or less. @@
- d) 2.7 Hz or more.

253] For a range of 5 nautical miles, the radar pulse repetition frequency should be:

- a) 16.2 Hz or more.
- b) 16.2 MHz or less.
- c) 1.62 kHz or more.
- d) 16.2 kHz or less. @@

254] For a range of 100 nautical miles, the radar pulse repetition frequency should be:

- a) 8.1 kHz or less.
- b) 810 Hz or less. @@
- c) .81 MHz or more.
- d) 810 kHz or more.

255] U.S. Regulations limit exposure to microwave energy to a power density of 5 mW/centimeters squared. What is the average energy density transmitted by a radar across a one square foot surface area with the following pulse parameters: 1000 pulses per second, 55 kilowatts peak power, and a 3 microsecond pulse width? (Assume all the RF is focused on the 1 square foot surface).

- a) 55 watts/centimeters squared.

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- b) 178 milliwatts/centimeters squared. @@
- c) The answer cannot be estimated.
- d) 5 milliwatts/centimeters squared.

256] You are asked to determine if it is safe for maintenance personnel to work immediately in front of the antenna of an air traffic control SSR while it is operating. The radar transmits at a frequency of 1030 MHz with a peak power of 3 KW, a pulse width of 2.0 microseconds and a pulse repetition rate (PRR) of 250 Hz with an antenna whose dimensions are 1.5 meters high and 8.54 meters wide. What is the average power density immediately in front of the antenna?

- a) 2.05 milliwatts/centimeters squared.
- b) .012 milliwatts/centimeters squared. @@
- c) 2.05 watts/centimeters squared.
- d) .73 milliwatts/centimeters squared.

257] A radar operating at a frequency of 3.5 GHz has a wavelength of approximately:

- a) 0.86 centimeters.
- b) 8.6 centimeters. @@
- c) 0.8 meters.
- d) 0.86 meters.

258] A radar transmitting at 6 GHz has a wavelength of:

- a) 0.5 cm.
- b) 5 cm. @@
- c) 50 cm.
- d) 500 cm.

259] How long is a half wavelength at 5400 MHz?

- a) 5.5 cm.
- b) 2.7 cm. @@
- c) 11 cm.
- d) 55 cm.

260] At the operating frequency of 3000 MHz, what is the distance between the waveguide and the receiver in Diagram EL8T?

- a) 10 cm.
- b) 5 cm. @@
- c) 2.5 cm.
- d) 1.25 cm.

261] At the operating frequency of 3000 MHz, what is the distance between the waveguide and the ATR spark gap in Diagram EL8T?

- a) 10 cm.
- b) 5 cm.
- c) 2.5 cm. @@
- d) 1.25 cm.

262] If the operating radar frequency is 3000 MHz, what is the distance between the waveguide and the spark gaps in older radar units?

- a) 10 cm.
- b) 5 cm.
- c) 2.5 cm. @@
- d) 20 cm.

263] The wide dimension of a rectangular waveguide for a given frequency band is:

- a) Approximately 1/4 wavelength.
- b) Approximately 1/2 wavelength. @@
- c) Dependent on pulse width.
- d) Not dependent upon the frequency band in use.

264] A CW radar is operating on 1.5 GHz. If this radar uses rectangular waveguide, the wide dimension of the waveguide will measure:

- a) 10 cm. @@
- b) 20 cm.
- c) 30 cm.
- d) 40 cm.

265] Which of these conditions would require a waveguide with the smallest physical dimensions?

- a) A frequency of 5 GHz. @@
- b) A frequency of 3500 MHz.
- c) A wavelength of 10 cm.
- d) A wavelength of 0.08 meters.

266] A shipboard raster scan radar has a CRT with the following characteristics: 70 pixels per character, 80 characters per line, 25 lines per screen and it scans 100 screens per second. What is the minimum required bandwidth for the electron beam control signal?

- a) 210 MHz.
- b) .21 MHz.
- c) 2.1 MHz.
- d) 21 MHz. @@

267] A shipboard raster scan radar has a CRT with the following characteristics: 70 pixels per character, 80 characters per line, 25 lines per screen and it scans 60 screens per second. What is the minimum required bandwidth for the electron beam control signal?

- a) 4.2 MHz.
- b) 6.8 MHz.
- c) 8.8 MHz.
- d) 12.6 MHz. @@

268] A shipboard raster scan radar has a CRT with the following characteristics: 100 pixels per character, 100 characters per line, 30 lines per screen and it scans 60 screens per second. What is the minimum required bandwidth for the electron beam control signal?

- a) 26.5 MHz. @@
- b) 8.8 MHz.
- c) 12.6 MHz.
- d) 30.2 MHz.

269] A shipboard raster scan radar has a CRT with the following characteristics: 100 pixels per character, 100 characters per line, 60 lines per screen and it scans 100 screens per second. What is the minimum required bandwidth for the electron beam control signal?

- a) 26.5 MHz.
- b) 30 MHz.

- c) 90 MHz. @@
- d) 8.8 MHz.

270] Radar range is measured by the constant:

- a) 150 meters per microsecond. @@
- b) 150 yards per microsecond.
- c) 300 yards per microsecond.
- d) 18.6 miles per microsecond.

271] A Continuous Wave radar is frequency modulated with a 50 Hz sine wave. At the output of the receiver phase detector, a phase delay of 18 degrees is measured. This indicates a target range of:

- a) 15 kilometers.
- b) 75 kilometers.
- c) 150 kilometers. @@
- d) 300 kilometers.

272] A Continuous Wave radar is frequency modulated with a 50 Hz sine wave. At the output of the receiver phase detector, a phase delay of 36 degrees is measured. This indicates a target range of:

- a) 15 kilometers.
- b) 75 kilometers.
- c) 150 kilometers.
- d) 300 kilometers. @@

273] A Continuous Wave radar is frequency modulated with a 100 Hz sine wave. At the output of the receiver phase detector, a phase delay of 18 degrees is measured. This indicates a target range of:

- a) 15 kilometers.
- b) 75 kilometers. @@
- c) 150 kilometers.
- d) 300 kilometers.

274] A Continuous Wave radar is frequency modulated with a 100 Hz sine wave. At the output of the receiver phase detector, a phase delay of 36 degrees is measured. This indicates a target range of:

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- a) 15 kilometers.
- b) 75 kilometers.
- c) 150 kilometers. @@
- d) 300 kilometers.

275] A Continuous Wave radar is frequency modulated with a 25 Hz sine wave. At the output of the receiver phase detector, a phase delay of 18 degrees is measured. This indicates a target range of:

- a) 15 kilometers.
- b) 75 kilometers.
- c) 150 kilometers.
- d) 300 kilometers. @@

276] A Continuous Wave radar is frequency modulated with a 25 Hz sine wave. At the output of the receiver phase detector, a phase delay of 36 degrees is measured. This indicates a target range of:

- a) 15 kilometers.
- b) 150 kilometers.
- c) 300 kilometers.
- d) 600 kilometers. @@

277] A target pulse appears on the CRT 100 microseconds after the transmitted pulse. The target slant range is:

- a) 30 kilometers.
- b) 93 miles.
- c) 15 kilometers. @@
- d) 15,000 yards.

278] A gated LC oscillator, operating at 12.5 kHz, is being used to develop range markers. If each cycle is converted to a range mark, the range between markers will be:

- a) 120 kilometers.
- b) 12 kilometers. @@
- c) 1.2 kilometers.
- d) None of these.

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279] On an "A" scope presentation, range markers are displayed at 200 microsecond intervals. A target pulse appears exactly half-way between the third and fourth range marks. The target slant range is:

- a) 75 kilometers.
- b) 105 kilometers. @@
- c) 150 kilometers.
- d) 210 kilometers.

280] On an "A" scope presentation, range markers are displayed at 200 microsecond intervals. A target pulse appears exactly half-way between the third and fourth range marks. The range marks are being developed using a ringing oscillator. The operating frequency of the ringing oscillator must be:

- a) 500 Hz.
- b) 5,000 Hz. @@
- c) 10,000 Hz.
- d) 15,000 Hz.

281] A radar transmitter is operating on 2.5 GHz and the reflex klystron local oscillator, operating at 2.56 GHz, develops a 60 MHz IF. If the magnetron drifts higher in frequency, the AFC system must cause the klystron repeller plate to become:

- a) More positive.
- b) More negative. @@
- c) Less positive.
- d) Less negative.

282] A radar magnetron develops a transmission frequency of 1250 MHz. To develop an IF of 60 MHz, the local oscillator must operate at:

- a) 1.031 GHz.
- b) 1.265 GHz.
- c) 1.31 GHz. @@
- d) 13.10 GHz.

283] The impedance total (Z_o) of a transmission line can be calculated by $Z_o = \omega L/C$ when inductance L and capacitance C are known. When a section of transmission line contains 250 microhenries of inductance and 1000 picofarads of capacitance, its impedance total (Z_o) will be:

- a) 50 ohms.

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- b) 250 ohms.
- c) 500 ohms. @@
- d) 1,000 ohms.

284] A certain length of transmission line has a characteristic impedance of 72 ohms. If the line is cut at its center, each half of the transmission line will have a Z_0 of:

- a) 36 ohms.
- b) 72 ohms. @@
- c) 144 ohms.
- d) The exact length must be known to determine Z_0 .

285] Energy travels down a section of transmission line at a rate of $T = \sqrt{LC}$. If a section of line has 100 microhenries of inductance and 1,000 picofarads of capacitance, how long will it take the leading edge of a pulse to travel the length of the line?

- a) 100 microseconds.
- b) 0.01 microseconds.
- c) 316 nanoseconds. @@
- d) 31.6 nanoseconds.

286] A basic constant frequency switching power supply regulator with an input voltage of 165 volts DC, and a switching frequency of 20 kHz, has an "ON" time of 27 microseconds when supplying 1 ampere to its load. What is the output voltage across the load?

- a) It cannot be determined with the information given.
- b) 305.55 volts DC.
- c) 89.1 volts DC. @@
- d) 165 volts DC.

287] A directional coupler has an attenuation of -30 db. A measurement of 100 microwatts at the coupler indicates the power of the line is:

- a) 10 watts.
- b) 100 watts. @@
- c) 1,000 watts.
- d) 10,000 watts.

288] The high gain IF amplifiers in a radar receiver may amplify a 2 microvolt input signal to an output level of 2 volts. This amount of amplification represents a gain of:

- a) 60 db.
- b) 100 db.
- c) 120 db. @@
- d) 1,000 db.

289] Given a square wave with a frequency of 1,000 hertz to be converted to trigger pulses by an RC network, which combination of R and C will provide the sharpest pulses?

- a) R = 10 kilohms, C = 0.01 microfarad.
- b) R = 20 kilohms, C = 0.005 microfarads.
- c) R = 51 kilohms, C = 0.001 microfarad. @@
- d) R = 100 kilohms, C = 0.002 microfarads.

290] What is the most common type of radar antenna used aboard commercial maritime vessels?

- a) Parabolic.
- b) Truncated parabolic.
- c) Slotted array. @@
- d) Multi-element Yagi array.

291] A circulator provides what function in the RF section of a radar system?

- a) It cools the magnetron by forcing a flow of circulating air.
- b) It replaces the TR cell and functions as a duplexer. @@
- c) It permits tests to be made to the thyristors while in use.
- d) It transmits antenna position to the indicator during operation.

292] Why is coaxial cable often used for S-band installations instead of a waveguide?

- a) Losses can be kept reasonable at S-band frequencies and the installation cost is lower. @@
- b) A waveguide will not support the power density required for modern S-band radar transmitters.
- c) S-band waveguide flanges show too much leakage and are unsafe for use near personnel.

d) Dimensions for S-band waveguide do not permit a rugged enough installation for use by ships-at-sea.

293] Radar antenna direction must be sent to the display in all ARPA's or radar systems. How is this accomplished?

- a) 3-phase synchros.
- b) 2-phase resolvers.
- c) Optical encoders.
- d) Any of these. @@

294] A thick layer of rust and corrosion on the surface of the parabolic dish will have what effect?

- a) No noticeable effect.
- b) Scatter and absorption of radar waves.
- c) Decrease in performance, especially for weak targets. @@
- d) Slightly out of focus PPI scope.

295] A shipboard acquisition or surface-search type of radar would have an antenna in the form of a:

- a) Vertical orange peel.
- b) Horizontal orange peel. @@
- c) Parabolic dish.
- d) Dipole with reflector and directors.

296] To insert RF energy or extract RF energy from a waveguide, which of the following would not be used?

- a) A current loop.
- b) A coupling capacitance. @@
- c) An aperture window.
- d) A voltage probe.

297] Slotted waveguide arrays, when fed from one end exhibit:

- a) Frequency scan. @@
- b) High VSWR.
- c) Poor performance in rain.
- d) A narrow elevation beam.

298] A microwave transmission line constructed of a center conductor suspended between parallel conductive ground planes is called:

- a) Microstrip.
- b) Coax.
- c) Stripline. @@
- d) Waveguide.

299] What device(s) might be used to allow electronic scanning in an array antenna?

- a) PIN diode phase shifters. @@
- b) Solid state T/R switching.
- c) Ferrite circulators.
- d) A two-axis gimbal.

300] The radome of an aircraft radar must be kept clean in order to prevent:

- a) Loss of range performance.
- b) Reflected power from affecting the transmitter.
- c) Changes to the beam shape of the antenna which might reduce accuracy.
- d) All of these. @@

301] A ferrite circulator is most commonly used in what portion of a radar system?

- a) The antenna.
- b) The modulator.
- c) The duplexer. @@
- d) The receiver.

302] Choose the most correct statement:

- a) Radar antennas do not have side lobes.
- b) X Band radar gives a larger target return than S Band radar.
- c) X Band radar requires more power for a given range than S Band radar.
- d) For a given antenna, as frequency increases, beamwidth decreases. @@

303] Proportionally, a very narrow beamwidth for a radar antenna indicates:

- a) Proportionally higher frequencies are being transmitted and received. @@
- b) Proportionally lower frequencies are being transmitted and received.
- c) A narrow beamwidth does not coincide with frequency increases or decreases.
- d) Proportionally narrow beamwidths indicate a pulse-type radar is being employed.

304] Marine radar is dependent upon antenna beamwidth for:

- a) Range resolution.
- b) Bearing resolution. @@
- c) Maximum receiver sensitivity.
- d) Increased power output.

305] The ferrite material in a circulator is used as a(an):

- a) Electric switch.
- b) Saturated reactor.
- c) Loading element.
- d) Phase shifter. @@

306] A waveguide is used at radar microwave frequencies because:

- a) It is easier to install than other feedline types.
- b) It is more rugged than other feedline types.
- c) It has lower transmission losses than other feedline types. @@
- d) It is less expensive than other feedline types.

307] Why should long horizontal runs of waveguide be avoided?

- a) They must be insulated to prevent electric shock.
- b) To prevent accumulation of condensation. @@
- c) To prevent damage from shipboard personnel.
- d) To minimize reception of horizontally polarized returns.

308] Loss of distant targets during and immediately after wet weather indicates:

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- a) High atmospheric absorption.
- b) Dirt or soot on the rotary joint.
- c) High humidity in the transmitter causing power supply loading.
- d) A leak in waveguide or rotary joint. @@

309] A right angle bend in an X-band waveguide must have a radius greater than:

- a) Three inches.
- b) Six inches.
- c) Two inches. @@
- d) One inch.

310] A rotary joint is used to:

- a) Couple two waveguides together at right angles.
- b) Act as a switch between two waveguide runs.
- c) Connect a stationary waveguide to the antenna array. @@
- d) Maintain pressurization at the end of the waveguide.

311] A typical shipboard radar antenna is a:

- a) Rotary parabolic transducer.
- b) Slotted waveguide array. @@
- c) Phased planar array.
- d) Dipole.

312] At microwave frequencies, waveguides are used instead of conventional coaxial transmission lines because:

- a) They are smaller and easier to handle.
- b) They have considerably less loss. @@
- c) They are lighter since they have hollow centers.
- d) Moisture is never a problem with them.

313] Long horizontal sections of waveguides are not desirable because:

- a) The waveguide can sag, causing loss of signal.
- b) Moisture can accumulate in the waveguide. @@

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- c) Excessive standing waves can occur.
- d) The polarization of the signal might shift.

314] How is the signal removed from a waveguide or magnetron?

- a) With a thin wire called a T-hook.
- b) With a thin wire called a J-Hook. @@
- c) With a coaxial connector.
- d) With a waveguide flange joint.

315] What should be done to the interior surface of a waveguide in order to minimize signal loss?

- a) Fill it with nitrogen gas.
- b) Paint it with nonconductive paint to prevent rust.
- c) Keep it as clean as possible. @@
- d) Fill it with a high-grade electrical oil.

316] The following is true concerning waveguides:

- a) Conduction is accomplished by the polarization of electromagnetic and electrostatic fields.
- b) The magnetic field is strongest at the edges of the waveguide. @@
- c) Ancillary deflexion is employed.
- d) The magnetic field is strongest at the center of the waveguide.

317] The polarization of the radiated electromagnetic energy through a waveguide is determined by:

- a) Both E and H fields.
- b) The vector sum of the E and H fields.
- c) The H field alone.
- d) The E field alone. @@

318] Which of these transmission line statements is not true?

- a) Incident waves travel toward the load.
- b) E and I are in phase on a flat line.
- c) Standing waves travel down the line. @@

d) Reflected waves travel toward the source.

319] Standing waves on a transmission line may be an indication that:

- a) All energy is being delivered to the load.
- b) Source and surge impedances are equal to Z_0 and Z_L .
- c) The line is terminated in impedance equal to Z_0 .
- d) Some of the energy is not absorbed by the load. @@

320] What is the purpose or function of the RADAR duplexer/circulator?

- a) A coupling device that is used in the transition from a rectangular waveguide to a circular waveguide.
- b) An electronic switch that allows the use of one antenna for both transmission and reception. @@
- c) A modified length of waveguide that is used to sample a portion of the transmitted energy for testing purposes.
- d) A dual section coupling device that allows the use of a magnetron as a transmitter.

321] Resistive losses in a waveguide are very small because:

- a) The inner surface of the waveguide is large. @@
- b) The inner surface of the waveguide is small.
- c) The waveguide does not require a ground connection.
- d) The heat remains in the waveguide and cannot dissipate.

Fig. EL8A

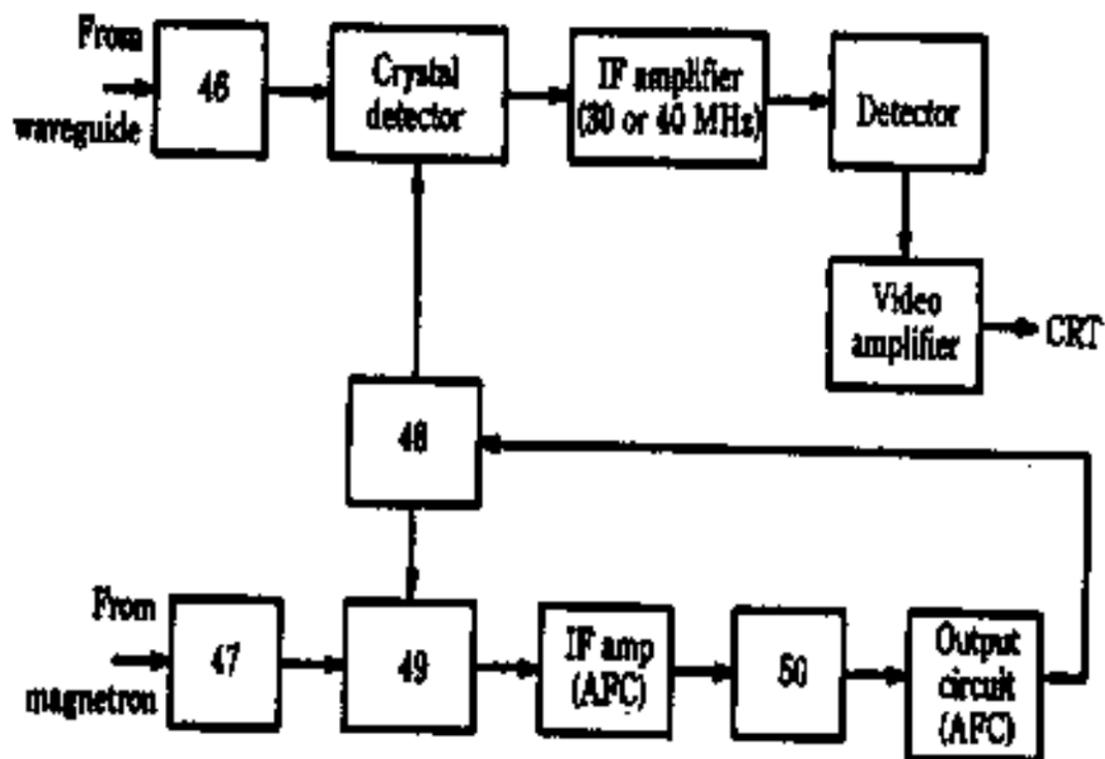


Fig. EL8B

TRUTH TABLE

Inputs			Output
\overline{OE}	CP	Dn	\overline{Qn}
L		H	L
L		L	H
L	L	X	No Change
H	X	X	Z

Note:

X=Don't care

Z=High impedance state

=Low-to-High transition

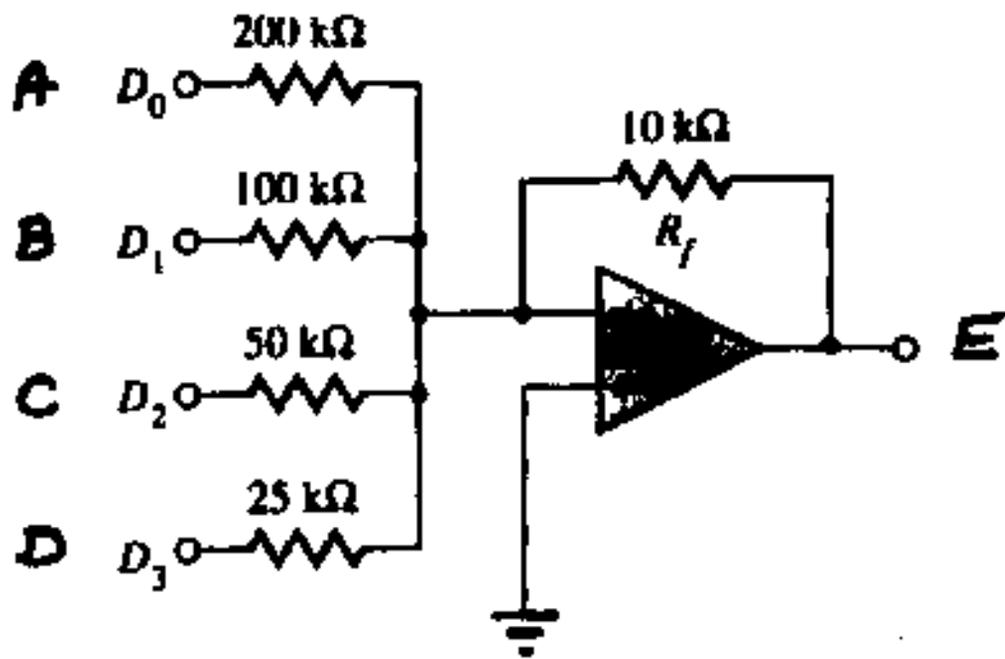


Fig. EL8C

Fig. EL8D

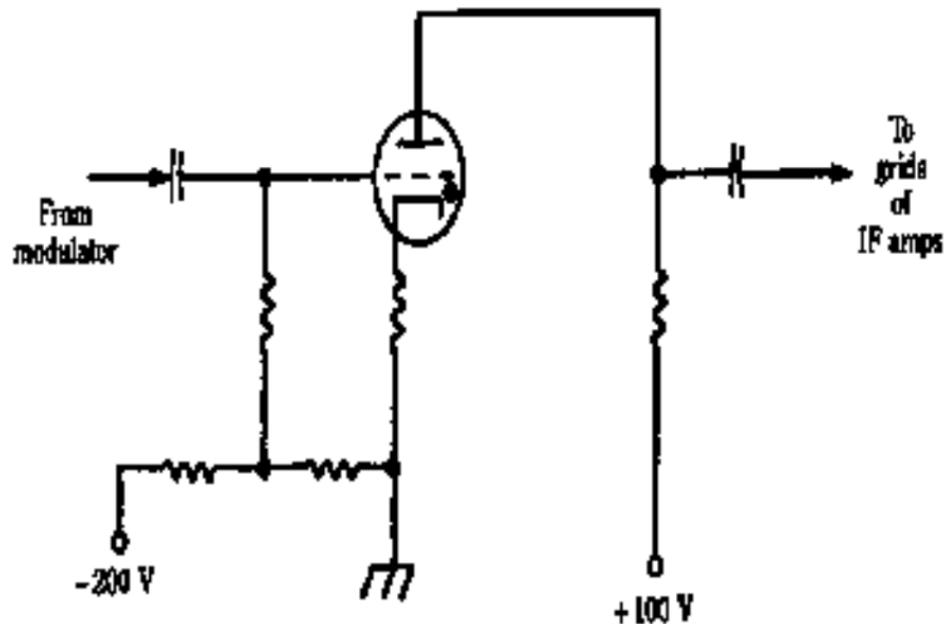


Fig. EL8E

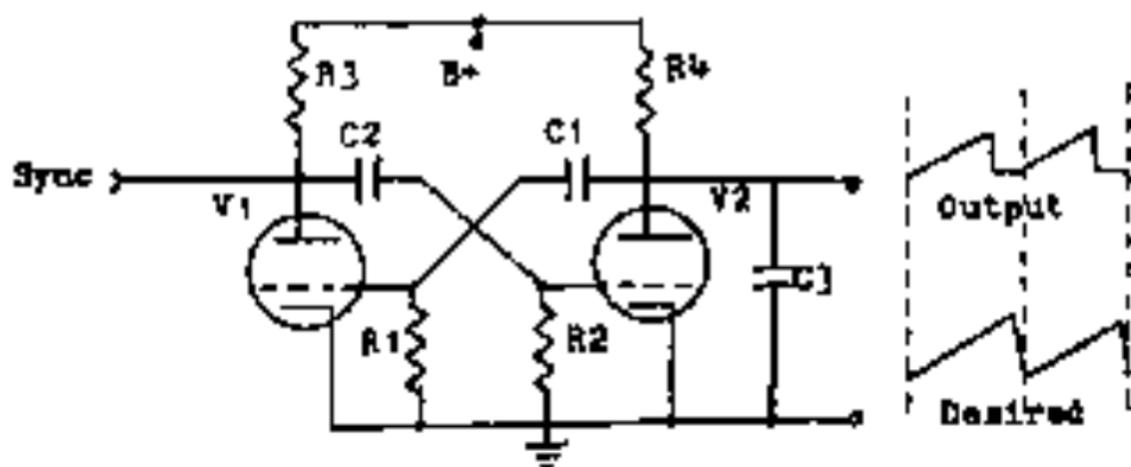


Fig. EL8F

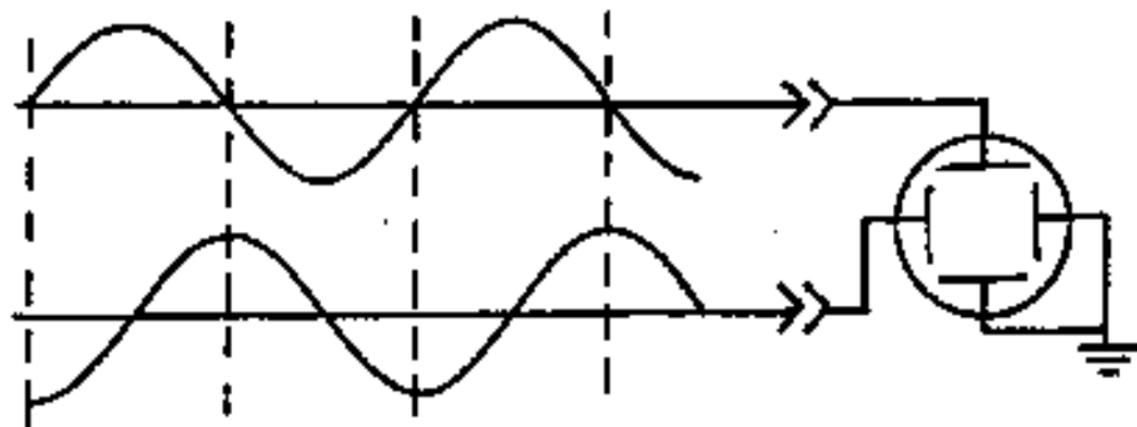


Fig. E186

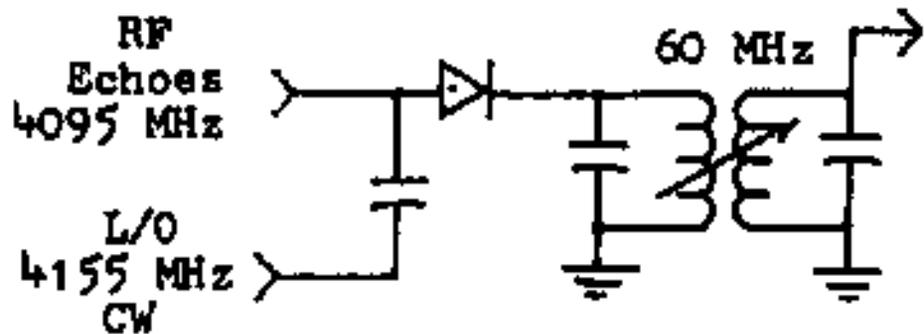


Fig. EL8H

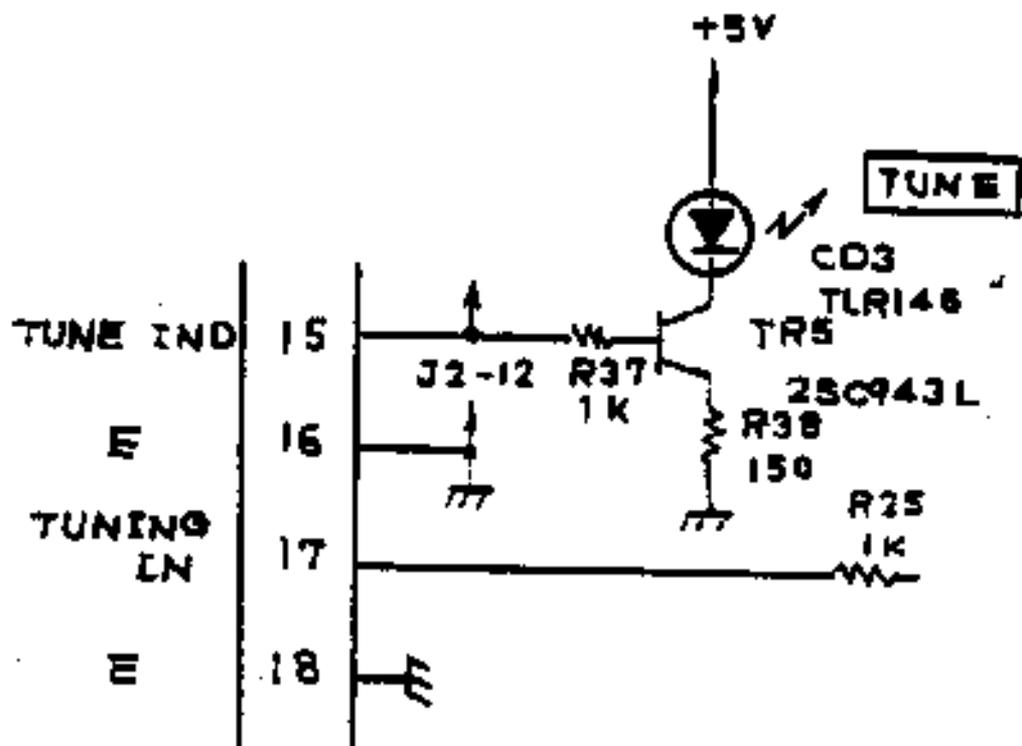


Fig. EL8I

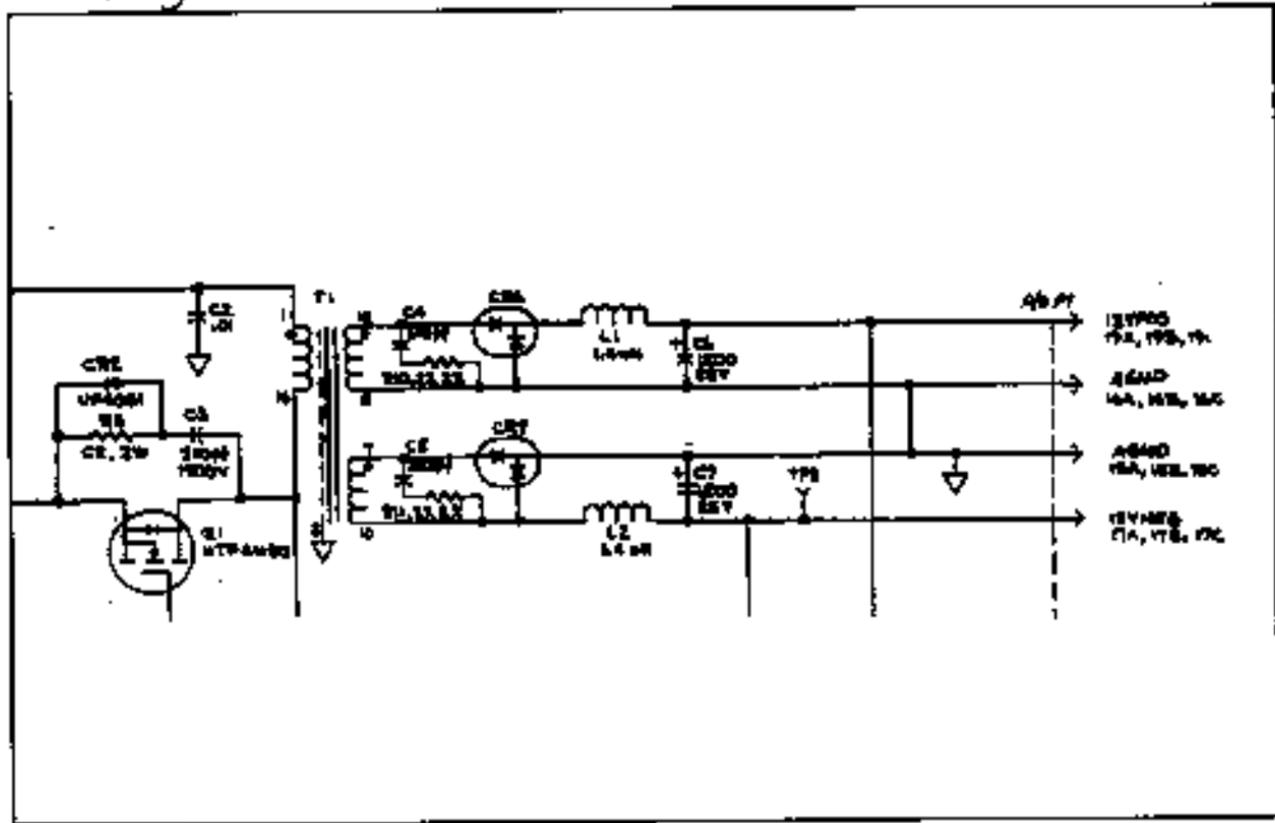


Fig. EL8J

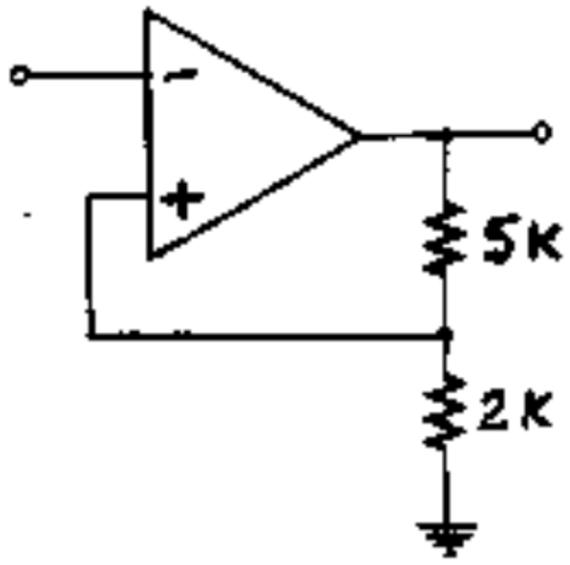


Fig. EL8K

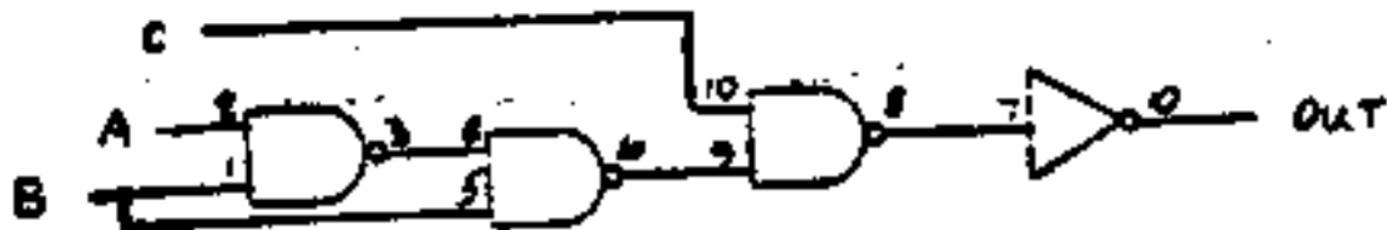


Fig. EL8L

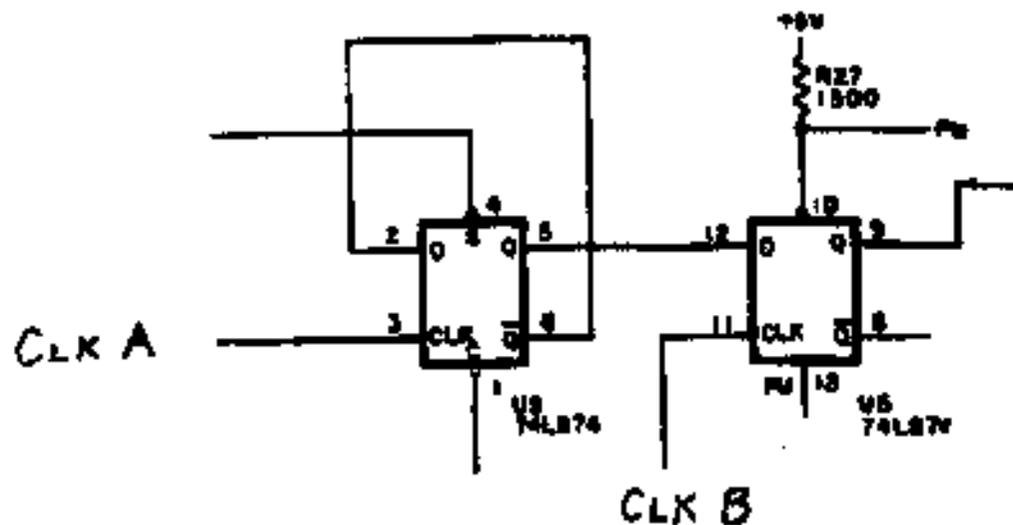


Fig. EL8M

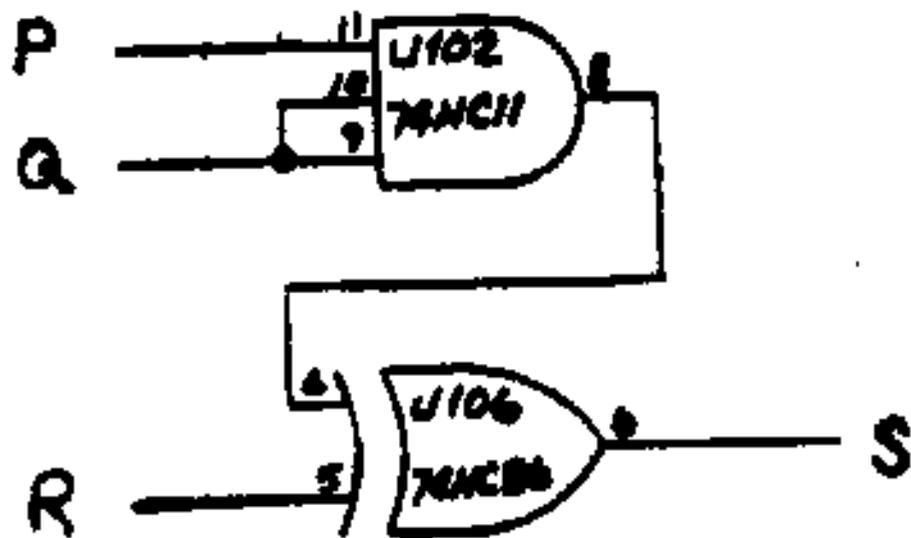


Fig. EL8N

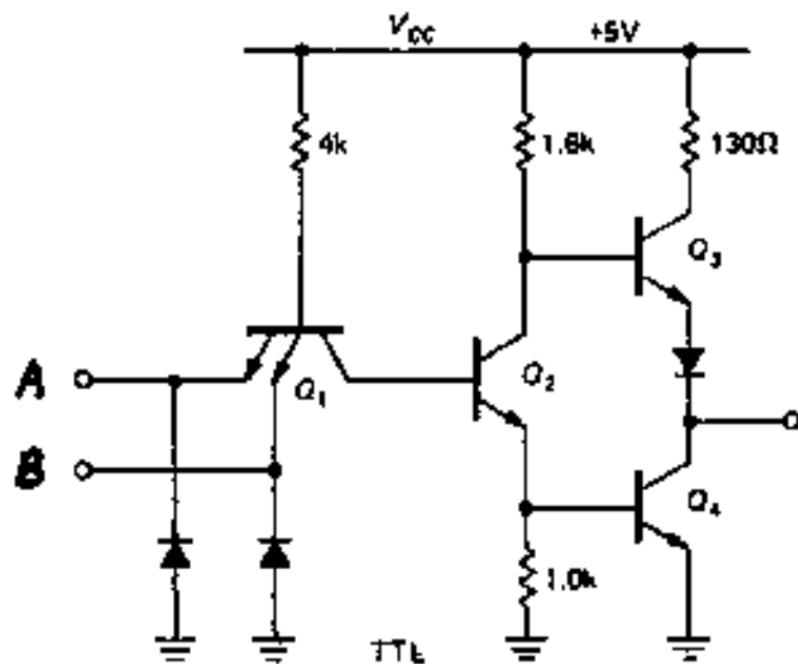


Fig. EL80

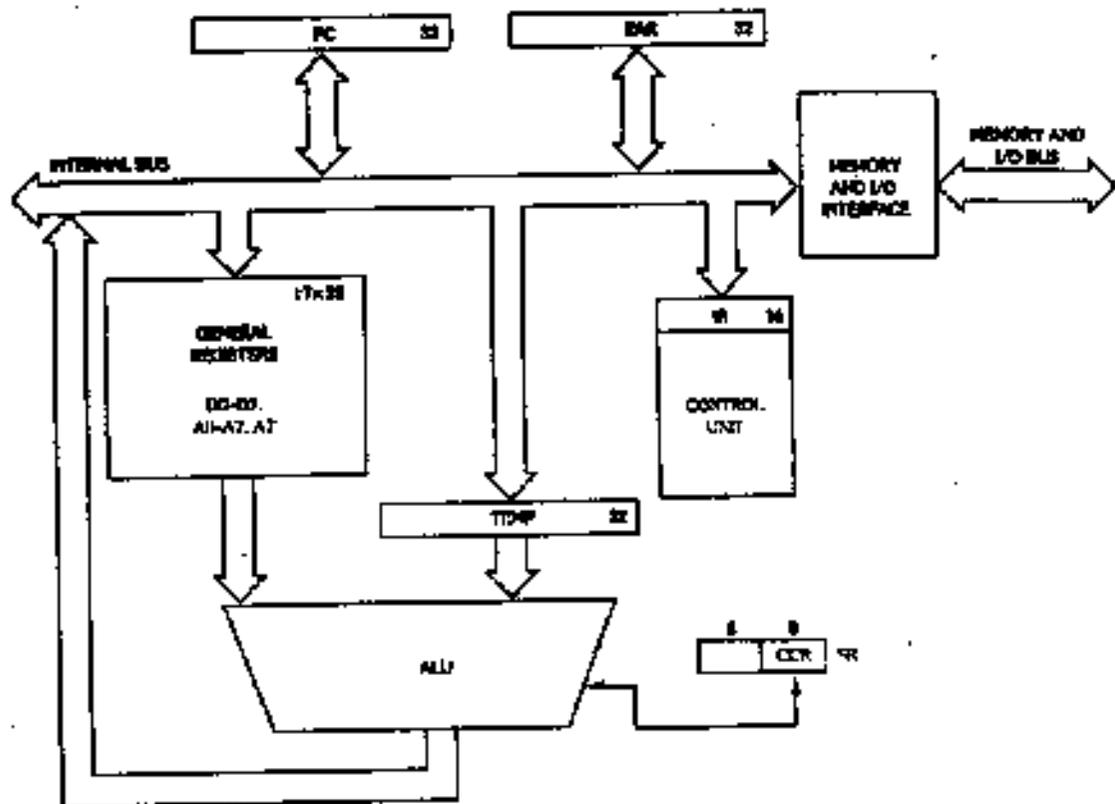


Fig. ELBP

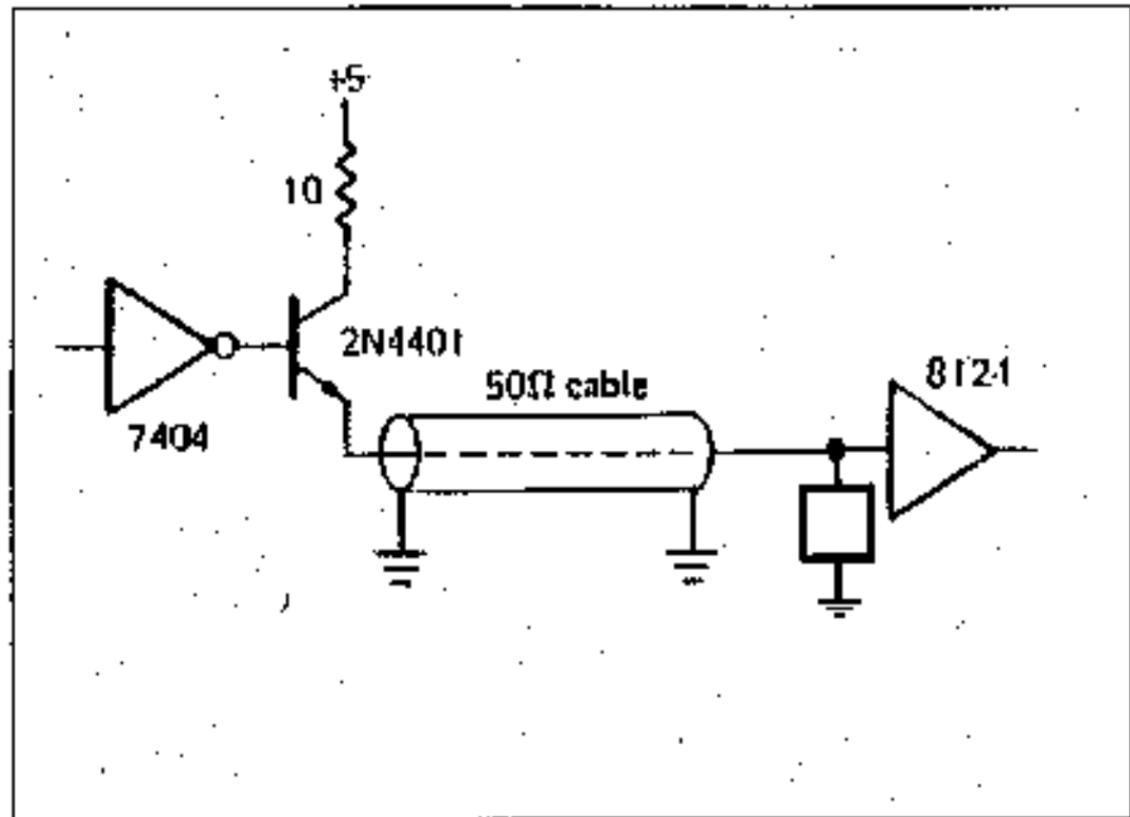


Fig. EL8Q

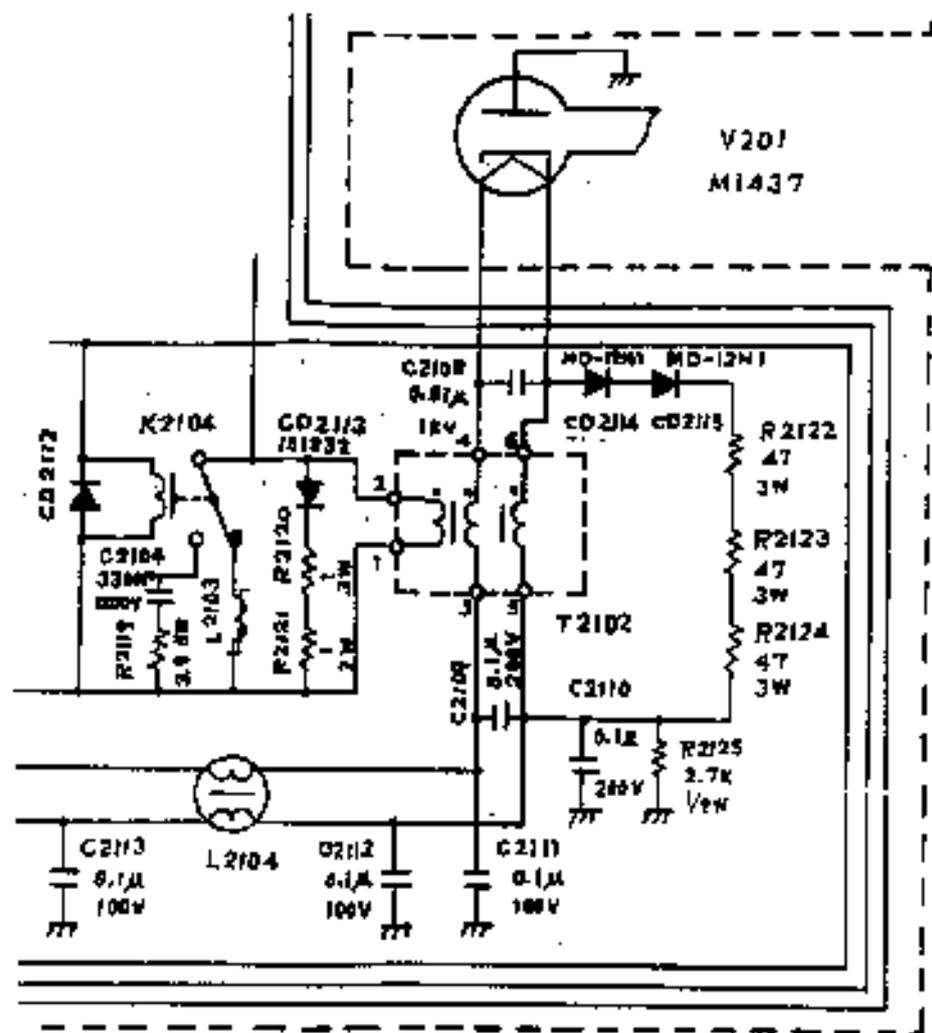


Fig. EL8R

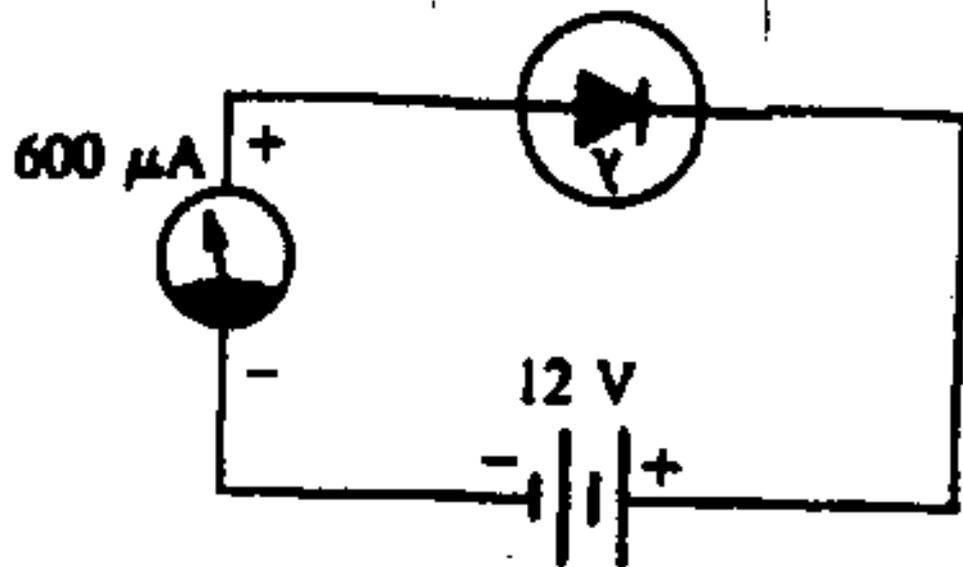
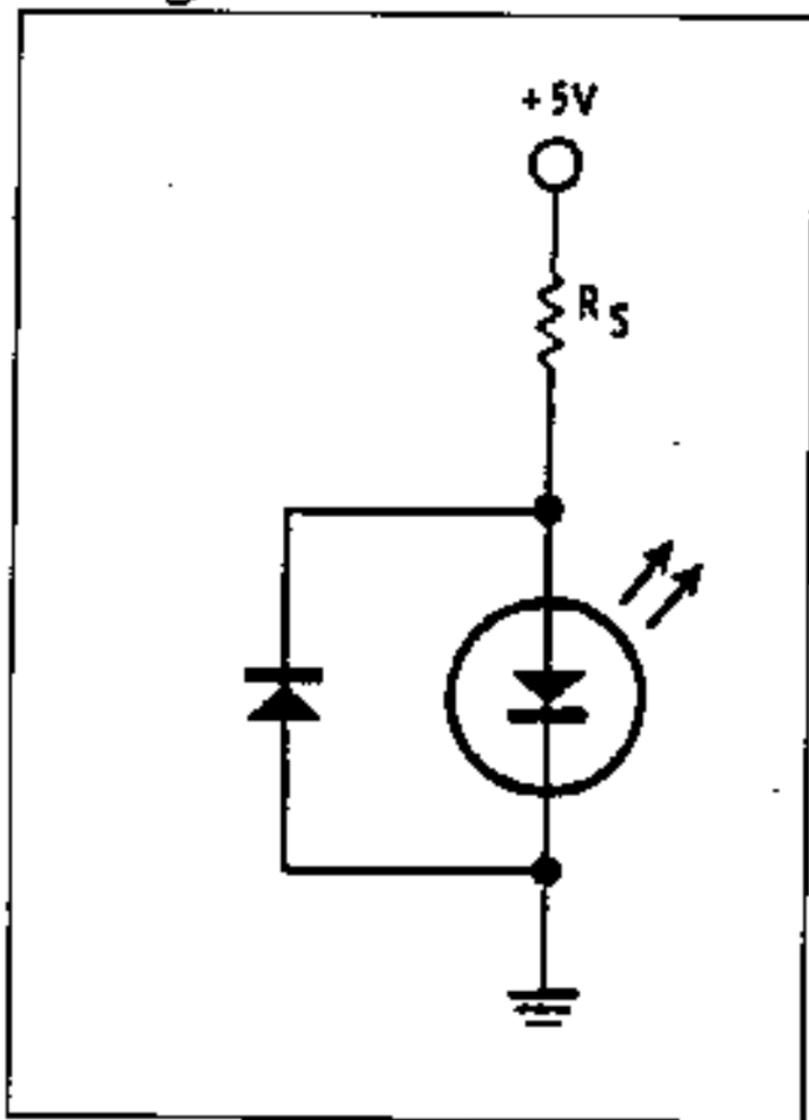


Fig. EL85



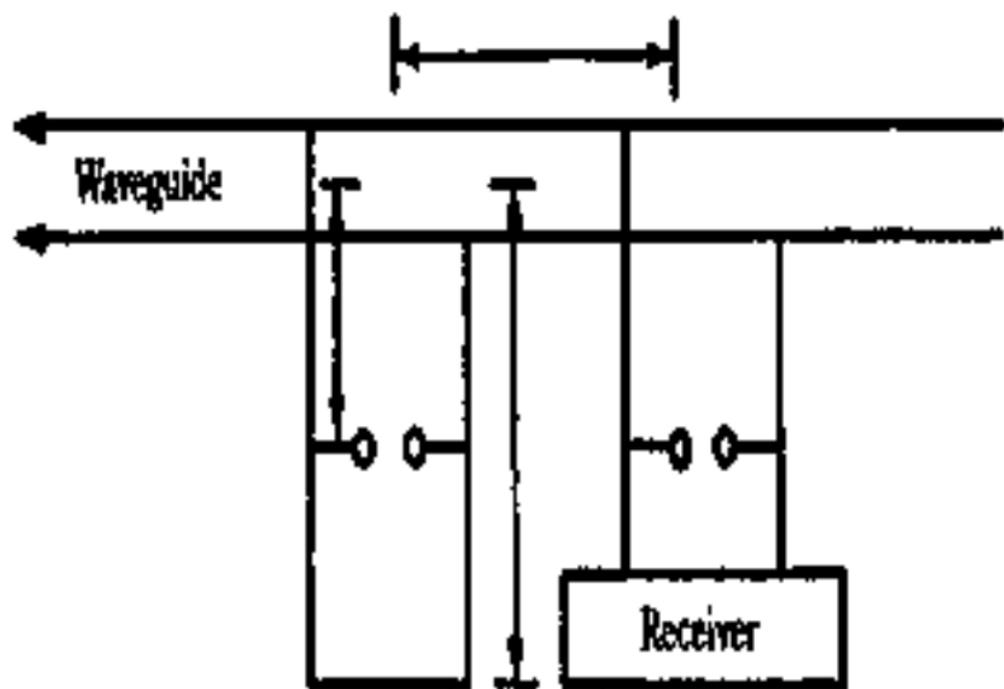


Fig. EL8T