

U.S.C.G. Merchant Marine Exam
First Assistant Engineer, Unlimited
Q517 Electrical-Electronic-Control Engineering
(Sample Examination)

Choose the best answer to the following Multiple Choice Questions.

1. What problem with a printed circuit board may resolve itself once a board is removed from its edge card connector and then reinstalled?
- (A) Leaking components
 - (B) Corroded pin connectors
 - (C) Open traces or broken connections
 - (D) Discolored or darkened components

If choice B is selected set score to 1.

2. Which of the listed conditions describes the effect on intrinsic semiconductor operation as a result of a temperature increase?
- (A) Inductive reactance will decrease
 - (B) Resistivity will increase
 - (C) Capacitive reactance will decrease
 - (D) Conductivity will increase

If choice D is selected set score to 1.

3. Why are transformer cores laminated?
- (A) to reduce secondary flux
 - (B) to reduce eddy currents
 - (C) to reduce leakage flux
 - (D) to reduce hysteresis

If choice B is selected set score to 1.

4. When troubleshooting a printed circuit board, one technique that can be used is component substitution. Upon what basis would a suspected defective component be substituted with a known good component?
- (A) Component substitution is not recommended as a troubleshooting technique.
 - (B) Methodical substitution of components starting at one end of the board and working towards the opposite end.
 - (C) Random substitution of components in no particular pattern.
 - (D) Visual inspection of components or the use of live signal tracing with test instruments.

If choice D is selected set score to 1.

5. The greatest cause of electrical failures is the breakdown of insulation. What factors would you use to determine the frequency of cleaning of electrical apparatus to avoid future failures?
- (A) Visual determination of accumulated dirt on the windings.
 - (B) Increasing insulation measurements.
 - (C) Decreasing operating temperature of the motor.
 - (D) Based solely on a fixed number of days between cleaning.

If choice A is selected set score to 1.

6. As shown in figure "B" of the illustrated function block for a PLC PID controller, to what input is the actual analog signal of the measured value delivered? Illustration EL-0251
- (A) KP
 - (B) PV
 - (C) SP
 - (D) XO

If choice B is selected set score to 1.

7. Without the benefit of a specially designed enclosure window for thermo graphic analysis, what must be done to obtain accurate, but safe readings using infrared thermo graphic techniques?
- (A) The infrared camera recording is taken after waiting a suitable period of time after de-energizing and isolating in accordance with safety procedures.
 - (B) The infrared camera recording is taken before de-energizing and isolating in accordance with safety procedures.
 - (C) The infrared camera recording is taken immediately after de-energizing and isolating in accordance with safety procedures.
 - (D) The infrared camera recording is taken while energized with the enclosure door open in accordance with safety procedures.

If choice C is selected set score to 1.

8. In addition to short circuits and sustained overloads, in what other situation are fuses likely to blow?
- (A) low fuse holder clip to fuse contact resistance
 - (B) oversized fuses in terms of amp rating
 - (C) low ambient temperatures
 - (D) loose fuse holder clips

If choice D is selected set score to 1.

9. An electric propulsion drive system in which the propulsion generator only supplies power to the propulsion motor is referred to as what type of system?

- (A) a dedicated system
- (B) a composite system
- (C) a multi-purpose system
- (D) an integrated system

If choice A is selected set score to 1.

10. Why are external shunts sometimes used with ammeters?

- (A) to increase meter sensitivity
- (B) to permit shunts with larger resistances to be utilized
- (C) to prevent damage to the meter movement from heat generated by the internal shunt
- (D) to reduce reactive power factor error

If choice C is selected set score to 1.

11. Which of the following statements is true concerning the cleaning of electrical contacts?

- (A) Magnetic brushes should be used to remove metallic dust.
- (B) The contact surfaces should be greased to increase contact resistance.
- (C) Compressed air should be used to blow out metallic dust.
- (D) Delicate parts should be cleaned with a brush and an approved safety solvent.

If choice D is selected set score to 1.

12. When a transformer is used to step down voltage, what statement is true?

- (A) The low voltage winding is part of the core.
- (B) The low voltage winding is the secondary coil.
- (C) The low voltage winding is the primary coil.
- (D) The low voltage winding is not insulated.

If choice B is selected set score to 1.

13. Which of the listed statements is correct when using a digital multimeter set up as an ohmmeter?

- (A) With the test leads shorted together, a reading of 'zero' ohms will be displayed.
- (B) With the test leads apart insulated from each other, a reading of 'zero' ohms will be displayed.
- (C) With the test leads shorted together, a reading of 'OL' ohms will be displayed.
- (D) It is usually not possible for a digital multimeter to be set up as an ohmmeter.

If choice A is selected set score to 1.

- 14.** When a high voltage system insulation test value is suspect or recorded during an annual survey, a polarization index test is performed. What is the polarization index?
- (A) The polarization index is the ratio of the insulation resistance taken at one minute to the insulation resistance taken at ten minutes.
 - (B) The polarization index is the ratio of the insulation resistance taken at thirty minutes to the insulation resistance taken at one minute.
 - (C) The polarization index is the insulation resistance taken at ten minutes.
 - (D) The polarization index is the ratio of the insulation resistance taken at ten minutes to the insulation resistance taken at one minute.

If choice D is selected set score to 1.

- 15.** What would be considered the first line of defense in trying to prevent the build-up of dust on printed circuit boards associated with computer network devices?
- (A) Removal of access panels, followed by vacuuming out the equipment with a vacuum cleaner.
 - (B) Periodically cleaning or replacing any equipment enclosure air filters.
 - (C) Removal of access panels, followed by blowing out the equipment with compressed air.
 - (D) Periodically flushing out the equipment enclosure with an approved solvent.

If choice B is selected set score to 1.

- 16.** What statement is true concerning temporary protective grounds used to establish an equipotential zone for the purposes of eliminating the electric shock hazard?
- (A) A shock hazard exists only when there is a difference in potential between conductors.
 - (B) A shock hazard exists only when there is a difference in potential between a conductor and hull ground.
 - (C) A shock hazard exists when there is no difference in potential between conductors or a conductor and hull ground.
 - (D) A shock hazard exists when there is a difference in potential between conductors or a conductor and hull ground.

If choice D is selected set score to 1.

- 17.** Using the trouble analysis chart and faults table provided in the illustration, if the gyrocompass was malfunctioning, but no fault codes are present on the display unit, what is most likely the problem if the DC/DC converter LED status indicator is functioning properly, but the CPU LED status indicator is not blinking? Illustration EL-0195
- (A) The DC/DC converter is malfunctioning.
 - (B) The AC/DC power supply is malfunctioning.
 - (C) The CPU assembly is malfunctioning.
 - (D) Ship's power is not available.

If choice C is selected set score to 1.

18. Which of the following electrical schematic symbols represents a normally closed flow switch?
Illustration EL-0059

- (A) 6
- (B) 7
- (C) 11
- (D) 14

If choice A is selected set score to 1.

19. How should the shunt used in an ammeter be connected?

- (A) in parallel with the load and in series with the meter movement
- (B) in series with the load and in series with the meter movement
- (C) in series with the load and in parallel with the meter movement
- (D) in parallel with the load and in parallel with the meter movement

If choice C is selected set score to 1.

20. What is the functional purpose of a heat sink, as frequently used with transistors?

- (A) to increase the reverse current
- (B) to compensate for excessive doping
- (C) to prevent excessive temperature rise
- (D) to decrease the forward current

If choice C is selected set score to 1.

21. For troubleshooting purposes, the key indicator to the safety and general condition of high voltage circuitry is insulation resistance. For a 6.6 kV high voltage system, what would be the recommended minimum insulation resistance value?

- (A) 1 megohm
- (B) 5.6 megohms
- (C) 6.6 megohms
- (D) 7.6 megohms

If choice D is selected set score to 1.

22. Under what circumstance would a hand-held portable phase sequence indicator be used should the main switchboard mounted fixed phase sequence indicator be inoperative?

- (A) preparing to make the shore power connection
- (B) installing a new synchroscope
- (C) replacing a defective solenoid
- (D) paralleling alternators

If choice A is selected set score to 1.

23. Before work may safely commence on a high voltage system, what must first be done after disconnection and isolation?

- (A) The circuit must be grounded first, then tested and proved dead with an off-line tester.
- (B) The circuit must be grounded first, then tested and proved dead with a live-line tester.
- (C) The circuit must be tested and proved dead first with a live-line tester, then grounded.
- (D) The circuit must be tested and proved dead first with an off-line tester, then grounded.

If choice C is selected set score to 1.

24. What will be the resulting current when a voltage of 12 VDC is applied to a capacitance of 470 microfarads in figure "C" of the illustrated circuit after the capacitor has had ample time to fully charge? Illustration EL-0018

- (A) 0.0 amps
- (B) 0.0255 amps
- (C) 5.64 amps
- (D) 25.5 amps

If choice A is selected set score to 1.

25. An AC diesel-electric drive ship with synchronous propulsion motors has the capability for power factor correction. If the power factor associated with the main power distribution including all motors is 0.7 leading, what statement is true?

- (A) The synchronous propulsion motors are under-excited.
- (B) The excitation status of the synchronous motor cannot be determined.
- (C) The synchronous propulsion motors are over-excited.
- (D) The synchronous propulsion motors are normally excited.

If choice C is selected set score to 1.

26. As shown in the illustrated digital gyrocompass functional block diagram and the associated communications protocols table, what would the rate of turn signal voltage be if the rate of turn is 30 degrees per minute to port, assuming that rate of turn to port is negative and rate of turn to starboard is positive in polarity? Illustration EL-0194

- (A) -0.5 VDC
- (B) -1.0 VDC
- (C) -1.5 VDC
- (D) +1.5 VDC

If choice C is selected set score to 1.

27. An AC diesel-electric drive ship with synchronous propulsion motors has the capability for power factor correction. If the power factor associated with the main power distribution including all motors is 0.7 lagging, what statement is true?

- (A) The synchronous propulsion motors are under-excited.
- (B) The excitation status of the synchronous motor cannot be determined.
- (C) The synchronous propulsion motors are over-excited.
- (D) The synchronous propulsion motors are normally excited.

If choice A is selected set score to 1.

28. As shown in the illustrated adaptive digital steering control system functional block diagram and listed system interface signals table, what would the rudder order signal output voltage to the rudder servo amplifier be for a rudder order of 20 degrees left rudder? Assume that left rudder order signals are negative in polarity and that right rudder order signals are positive in polarity. Illustration EL-0191

- (A) - 2.25 VDC
- (B) - 4.0 VDC
- (C) - 5.0 VDC
- (D) + 5.0 VDC

If choice C is selected set score to 1.

29. As shown in the illustration, what is the purpose of the Time Delay (TR) coil in the circuit?
Illustration EL-0104

- (A) Ensures the motor cannot be started until the overload relays are reset.
- (B) Allows the motor to come up to speed at reduced voltage before bypassing the starting resistors.
- (C) Ensures the motor cannot be started until the accelerating coil is energized.
- (D) Allows the motor to come up to speed before placing the starting resistors in the circuit.

If choice B is selected set score to 1.

30. Modern ships use multiple computers arranged in a client/server network to perform various shipboard functions. What type of computer network would most likely be used aboard ship?

- (A) Wired local area network
- (B) Wireless local area network
- (C) Wireless wide area network
- (D) Wired wide area network

If choice A is selected set score to 1.

31. What will be the resulting total current if a voltage of 125 VDC is applied to the loads of the circuit in figure "A" of the illustration where the resistance of R_1 is 12 ohms, and R_2 is 115 ohms? Illustration EL-0019

- (A) 11.5 amps
- (B) 12.5 amps
- (C) 115 amps
- (D) 125 amps

If choice A is selected set score to 1.

32. A vessel is equipped with two ship's service generators. Generator No.1 is rated at 900 kW and generator No.2 is rated at 600 kW. During parallel operation, with a hotel load of 1,000 kW, what should be the kW load on generator No.2 if the load is shared proportionately?

- (A) 100 kW
- (B) 400 kW
- (C) 500 kW
- (D) 600 kW

If choice B is selected set score to 1.

33. What Ethernet cabling technology supports the greatest data transfer speeds?

- (A) Gigabit Ethernet
- (B) Fast Ethernet
- (C) Thick Ethernet
- (D) Thin Ethernet

If choice A is selected set score to 1.

34. As shown in the illustrated one-line diagram of a two-tiered emergency power system for a passenger ship, what statement is true? Illustration EL-0166

- (A) On a loss of normal ship's power, the final emergency loads power source is battery (from AC/DC UPS "A"), whereas the temporary emergency loads power source is the emergency generator.
- (B) On a loss of normal ship's power, the temporary emergency loads power source is battery (from AC/DC UPS "B"), whereas the final emergency loads power source is the emergency generator.
- (C) On a loss of normal ship's power, the final emergency loads power source is battery (from AC/DC UPS "B"), whereas the temporary emergency loads power source is the emergency generator.
- (D) On a loss of normal ship's power, the temporary emergency loads power source is battery (from AC/DC UPS "A"), whereas the final emergency loads power source is the emergency generator.

If choice B is selected set score to 1.

- 35.** Suppose it is desired to determine the integrity of the insulation of a 4160 VAC motor. What type of insulation resistance tester (megger) would be suitable?
- (A) 500 V megger
 - (B) 1000 V megger
 - (C) 2500 V megger
 - (D) 5000 V megger

If choice D is selected set score to 1.

- 36.** A very useful Windows utility for discovering or verifying IP addressing information of a network is "ipconfig". How is this utility program launched?
- (A) It is run by clicking on the TCP/IP shortcut icon on the desktop.
 - (B) It is run by clicking on the "ipconfig" icon in start menu or under programs.
 - (C) It is run from the command prompt screen by default by simply bringing up the command prompt.
 - (D) It is run from the command prompt screen by typing "ipconfig/all".

If choice D is selected set score to 1.

- 37.** Under unusual circumstances, it may be required to operate a ship's service generator above its rated kVA. What supplemental casualty control action will be required?
- (A) While maintaining the rated system voltage, lower the operating frequency to at least 5% below the rated system frequency.
 - (B) Increase the cooling water flow, while maintaining air temperatures below the dew point for increased cooling effect.
 - (C) Increase the cooling water flow, while maintaining air temperatures above the dew point to avoid any condensation.
 - (D) While maintaining the rated system frequency, lower the operating voltage to at least 5% below the rated system voltage.

If choice C is selected set score to 1.

- 38.** If a digital multimeter is set up as shown in figure "B" of the illustration to test a capacitor, what would the display read if the capacitor was functioning properly? Illustration EL-0213
- (A) initially a very low ohmic value will be displayed, followed by a gradual rise in resistance until a very high value is displayed (OL ohms)
 - (B) initially a very high ohmic value will be displayed (OL ohms), followed by a gradual drop in resistance until a very low value is displayed
 - (C) the charging voltage would be displayed which will initially be low and gradually rise to the internal battery voltage
 - (D) the actual capacitance value of the capacitor will be displayed which should be within the tolerance range of the capacitor

If choice D is selected set score to 1.

39. What statement is TRUE concerning the Azipod propulsion system?

- (A) It is an electric drive system in which the motor drives a controllable-pitch propeller (CPP).
- (B) It is an electric drive system where the propulsion motor is installed in a submerged housing capable of swiveling.
- (C) It is an electric drive system that incorporates a DC motor.
- (D) It is an electric drive system using water jets.

If choice B is selected set score to 1.

40. If a mechanical mouse of a computer workstation is operating erratically, what maintenance should be performed?

- (A) Remove the plastic surround on the underside of the mouse, and after removing the ball, mechanically clean the limit switches.
- (B) Solvent should be sprayed onto the underside of the mouse.
- (C) Compressed air should be directed onto the underside of the mouse.
- (D) Remove the plastic surround on the underside of the mouse, and after removing the ball, mechanically clean the two wheels.

If choice D is selected set score to 1.

41. As shown in the illustrated block diagram for a digitized echo sounding system, what statement is true concerning the function of the transducer? Illustration EL-0185

- (A) The transducer converts audio frequency (AF) electromagnetic energy to acoustic energy while transmitting and converts the reflected acoustic energy back into AF electromagnetic energy while receiving.
- (B) The transducer converts radio frequency (RF) electromagnetic energy to acoustic energy while transmitting and converts the reflected acoustic energy back into RF electromagnetic energy while receiving.
- (C) The transducer converts radio frequency (RF) electromagnetic energy to acoustic energy while receiving and converts the reflected acoustic energy back into RF electromagnetic energy while transmitting.
- (D) The transducer converts audio frequency (AF) electromagnetic energy to acoustic energy while receiving and converts the reflected acoustic energy back into AF electromagnetic energy while transmitting.

If choice B is selected set score to 1.

42. In the illustration what is the component labeled "C"? Illustration EL-0033

- (A) trip bar
- (B) connection terminal
- (C) moving contact
- (D) fixed contact

If choice D is selected set score to 1.

43. Which of the procedures or conditions listed could result in damaging a transistor beyond repair?

- (A) Providing incorrect polarity to the collector circuit.
- (B) Installing a transistor whose current rating exceeds the design circuit current.
- (C) Providing insufficient voltage to the input circuit.
- (D) Applying silicone grease between the heat sink and the transistor mounting.

If choice A is selected set score to 1.

44. As shown in the illustration, which of the following pieces of equipment is supplied with a circuit breaker providing both overload and short-circuit protection? Illustration EL-0165

- (A) Cargo Oil Transfer Pump No.1
- (B) Lube Oil Service Pump No.1
- (C) S.W. Cooling Circ. Pump No.1
- (D) Sewage Treatment Plant

If choice D is selected set score to 1.

45. As shown in the illustrated adaptive digital steering control system functional block diagram and listed system interface signals table, what would the rudder order signal output voltage to the rudder servo amplifier be for a rudder order of 15 degrees right rudder? Assume that left rudder order signals are negative in polarity and that right rudder order signals are positive in polarity. Illustration EL-0191

- (A) -1.33 VDC
- (B) -3.75 VDC
- (C) +3.75 VDC
- (D) +5.0 VDC

If choice C is selected set score to 1.

46. Why are motor controllers seldom troubled by grounds?

- (A) shock mounts on controller panels greatly reduce vibration
- (B) cabinet heaters always keep internal components dry
- (C) special insulation is used on wire for vital circuits
- (D) contactors and relays are mounted on non-conducting panels

If choice D is selected set score to 1.

- 47.** What equipment for modern SCR rectified DC propulsion drive systems is usually included in the package?
- (A) propulsion generators which produce DC power that is directly delivered to the series wound DC propulsion motor
 - (B) propulsion generators which produce AC power that is converted to DC power for the shunt wound DC propulsion motor
 - (C) propulsion generators which produce AC power that is directly delivered to the synchronous AC propulsion motor
 - (D) propulsion generators which produce DC power that is converted to AC power for the propulsion motor

If choice B is selected set score to 1.

- 48.** In order to definitively determine whether or not fuse "1", shown in the illustration is blown using an on-line testing technique, across what points would you connect the voltmeter leads? Illustration EL-0062
- (A) from the top of fuse "1" and the top of either fuse "2" or fuse "3"
 - (B) from the bottom of fuse "1" and the bottom of either fuse "2" or fuse "3"
 - (C) from the top of fuse "1" and the bottom of either fuse "2" or fuse "3"
 - (D) from the bottom of fuse "1" and the top of either fuse "2" or fuse "3"

If choice D is selected set score to 1.

- 49.** Propulsion AC generators creating 4160 VAC use transformers to provide nominally 120 VAC to the automatic voltage regulator. What is the turns ratio of this step-down transformer?
- (A) 1:4
 - (B) 4:1
 - (C) 35:1
 - (D) 40:1

If choice C is selected set score to 1.

- 50.** The timer element of a reverse power relay cannot be energized unless what condition is met?
- (A) one generator is fully motorized
 - (B) the power flow is the opposite to the tripping direction
 - (C) the movement of the disk is damped by a permanent magnet
 - (D) the power flow is the same as the tripping direction

If choice D is selected set score to 1.

51. When completing repairs on a high voltage circuit where portable grounding straps were used for increased operator safety and confidence, what is the proper procedure for disconnecting these grounding straps?

- (A) The common to hull ground connection and the phase connections to common can all be disconnected in any sequence.
- (B) Disconnect the phase connections to common first, and then disconnect the common connection to hull ground.
- (C) The common to hull ground and the phase connections to common should all be disconnected simultaneously.
- (D) Disconnect the common connection to hull ground first, and then disconnect the phase connections to common.

If choice B is selected set score to 1.

52. With what kind of starting equipment are most three-phase induction motors of five horsepower or less started?

- (A) autotransformer starters
- (B) resistor starters
- (C) reactor starters
- (D) across-the-line starters

If choice D is selected set score to 1.

53. How are fuses usually rated?

- (A) watts only
- (B) amps only
- (C) volts and amps only
- (D) volts, amps, and interrupting capacity

If choice D is selected set score to 1.

54. As shown in the illustrated switchboard, what is the function of the switch labeled "PFM Sel. Sw."?
Illustration EL-0003

- (A) to determine bus frequency
- (B) to determine reactive volt amperes of the bus
- (C) to determine frequency of either generator
- (D) to determine power factor of either generator

If choice D is selected set score to 1.

- 55.** The conversion of constant frequency power into adjustable frequency power in a modern AC propulsion drive system is commonly achieved through the use of what electronic system components?
- (A) transformers and resistors
 - (B) potentiometers and diodes
 - (C) rectifiers and thyristors
 - (D) rheostats and resistors

If choice C is selected set score to 1.

- 56.** Refer to the two-generator, two-motor, DC diesel-electric drive propulsion system simplified schematic shown in the illustration. While in two-generator, two-motor operation, which of the following conditions would cause the propulsion shaft speed to be approximately one-half the desired speed? Illustration EL-0141
- (A) The armature winding of one of the propulsion generators is open-circuited.
 - (B) The field winding of one of the propulsion generators is open-circuited.
 - (C) The field winding of one of the propulsion motors is open-circuited.
 - (D) The armature winding of one of the propulsion motors is open-circuited.

If choice B is selected set score to 1.

- 57.** With an AC synchronous electric propulsion motor driving a fixed-pitch propeller, whenever there is a direction reversal ordered from the bridge, there is a process of regenerative braking that is used to slow the motor down before the shaft actually reverses. Where is the energy associated with the inertia of rotation dissipated before reversal occurs?
- (A) The energy is dissipated at a dynamic braking resistor bank used for this purpose only.
 - (B) The energy is dissipated at the AC synchronous electric propulsion motor itself.
 - (C) The energy is dissipated by transferring the energy back to the electrical source.
 - (D) The energy is dissipated at the load converter GTO controlled thyristors.

If choice C is selected set score to 1.

- 58.** What is the minimum threshold voltage which requires electrical workers to be insulated from energized conductors or circuit parts by wearing the appropriate PPE while working in open enclosures?
- (A) 24 V
 - (B) 50 V
 - (C) 120 V
 - (D) 480 V

If choice B is selected set score to 1.

59. What should be done when performing maintenance of circuit breaker contacts?

- (A) inspect for wear and misalignment of main contacts
- (B) use a metallic oxide abrasive cloth to dress contacts
- (C) smooth roughened contact surfaces with a file
- (D) apply a thin film of oil on contact surfaces

If choice A is selected set score to 1.

60. As shown in figure "A" of the illustration, under what conditions will the thyristor conduct?
Illustration EL-0154

- (A) when the anode is more positive than the cathode and when the gate is briefly pulsed with a voltage more positive than the cathode
- (B) when the anode is more negative than the cathode and when the gate is briefly pulsed with a voltage more positive than the cathode
- (C) when the anode is more positive than the cathode and when the gate is briefly pulsed with a voltage more negative than the cathode
- (D) when the anode is more negative than the cathode and when the gate is briefly pulsed with a voltage more negative than the cathode

If choice A is selected set score to 1.

61. Which of the following statements is TRUE concerning Azipod propulsion systems?

- (A) The system integrates propulsion and steering into one function.
- (B) The system requires the use of a controllable-pitch propeller.
- (C) The system requires the need for a separate rudder.
- (D) The pod assembly swivels on a horizontal axis.

If choice A is selected set score to 1.

62. As shown in figure "A" of the illustration, what type of converter unit is represented? Illustration EL-0240

- (A) de-multiplexer
- (B) digital to analog converter
- (C) analog to digital converter
- (D) multiplexer

If choice C is selected set score to 1.

- 63.** While standing "at sea watch" onboard a modern rectified DC diesel-electric drive ship you notice the transformer core temperature slowly rising. What should be your FIRST action?
- (A) reduce load by tripping lighting circuits
 - (B) check the transformer ventilation fans for proper operation
 - (C) notify the bridge that you need to slow down
 - (D) send the oiler to look for fires in the transformer

If choice B is selected set score to 1.

- 64.** As shown in the illustration, by what means are all the "MS" contacts opened and closed?
Illustration EL-0073
- (A) manual operation of the master switches
 - (B) solenoid switches
 - (C) magnets
 - (D) operating coils

If choice A is selected set score to 1.

- 65.** The conversion of the throttle command voltage to the signal necessary to achieve the desired shaft RPM is accomplished by what circuit?
- (A) feedback resistor of the summing amplifier circuit
 - (B) ahead or astern function generator of the throttle control circuit
 - (C) operational amplifiers in the autorotation circuit
 - (D) long time constant amplifier circuit

If choice B is selected set score to 1.

- 66.** Using the catalog selection chart shown in Illustration EL-0180, determine the correct catalog number for a motor starter that meets the following criteria:

NEMA	Open enclosure
3-pole	Rated at 45 continuous amperes
Vertically mounted	Electronic overload relay-Ground fault feature set
Reversing starter	Operating coil rated at 24 VAC/60 Hz

- (A) AE19GNVB5G045
- (B) AN19AN0A5E005
- (C) AN59GNVT5G045
- (D) CN16GNVT5G045

If choice C is selected set score to 1.

67. What can a typical common analog or digital multimeter be used to measure?

- (A) voltage, power, and current
- (B) frequency, current, and resistance
- (C) voltage, resistance, and current
- (D) voltage, frequency, and current

If choice C is selected set score to 1.

68. Due to the operating characteristics of the system, time lag fuses (or dual-element fuses) are necessary for use in what types of circuits?

- (A) main lighting circuits
- (B) general alarm circuits
- (C) motor starting circuits
- (D) emergency lighting circuits

If choice C is selected set score to 1.

69. When troubleshooting the modems, network interface cards, hubs, switches, and routers of a network, what technique represents the most logical first step?

- (A) Replacing suspected faulty network devices with known good devices.
- (B) Testing the network cabling with an appropriate network analyzer.
- (C) Running a network utility diagnostic program and generating a report.
- (D) Observing the status indicator lights of the suspected faulty network device.

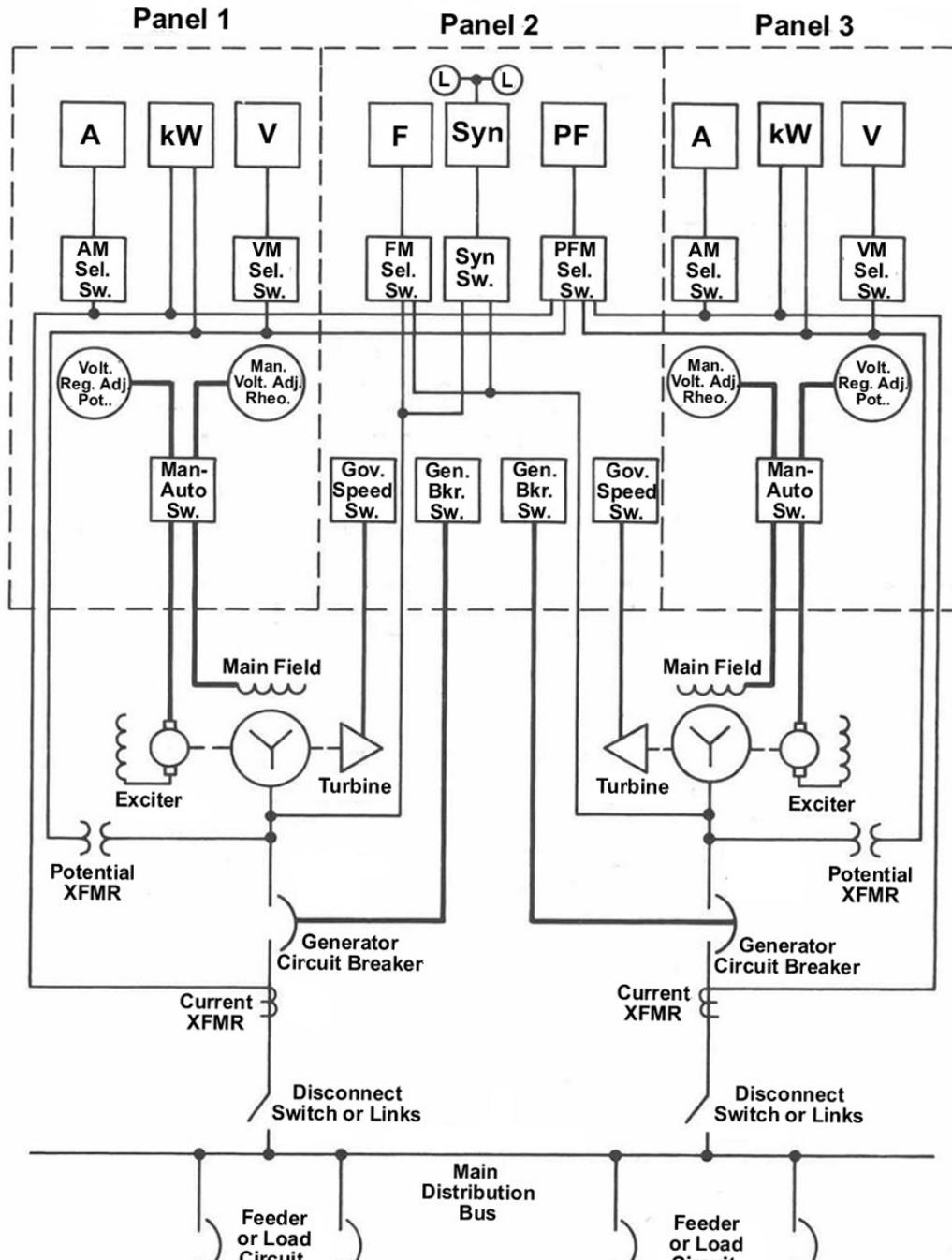
If choice D is selected set score to 1.

70. Which figure represents the schematic symbol shown in figure "2"? Illustration EL-0034

- (A) figure "A"
- (B) figure "B"
- (C) figure "C"
- (D) figure "D"

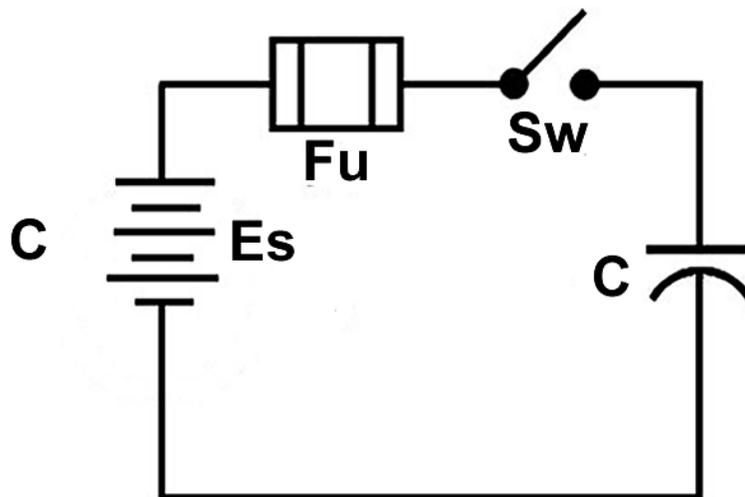
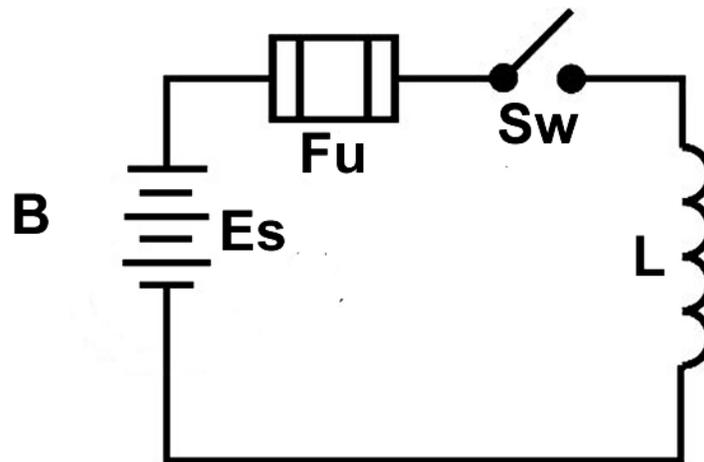
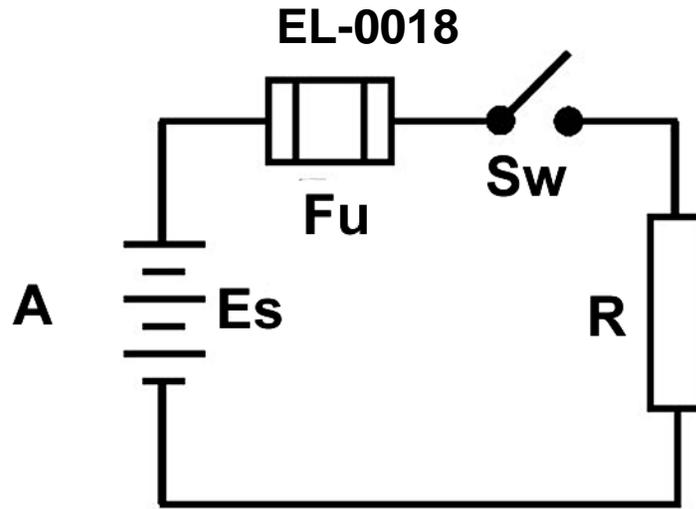
If choice B is selected set score to 1.

EL-0003



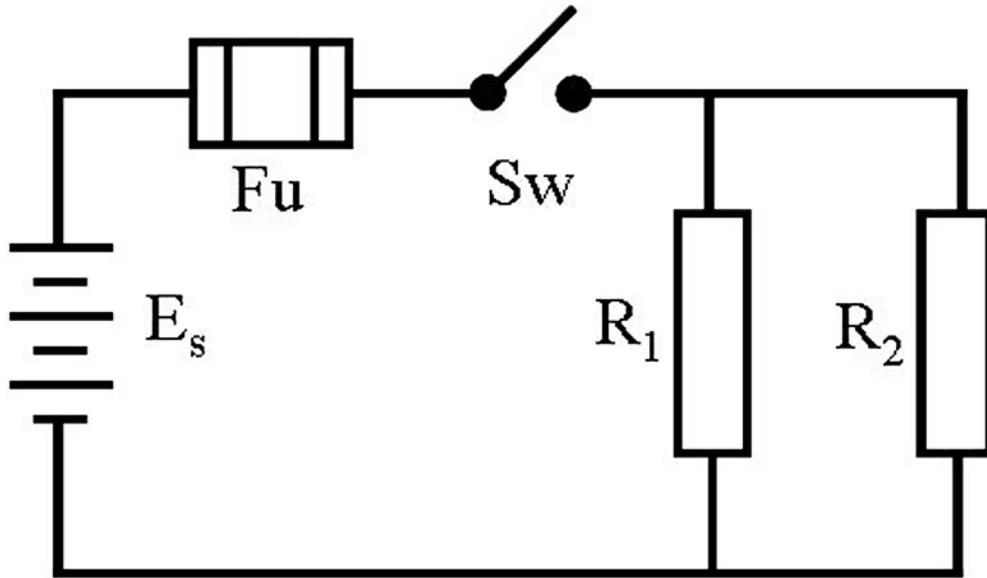
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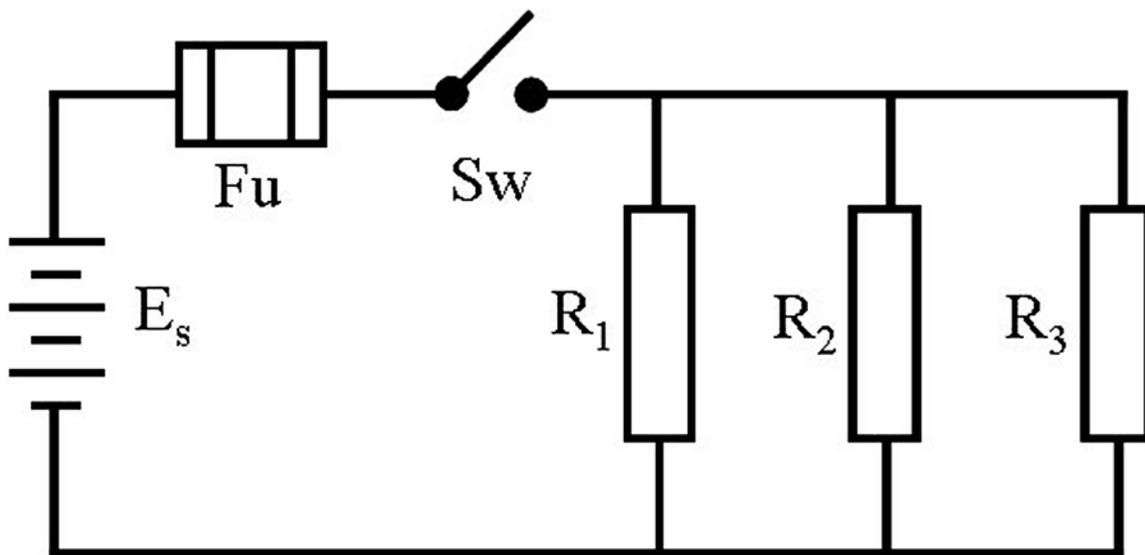


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EL-0019



A



B

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EL-0033



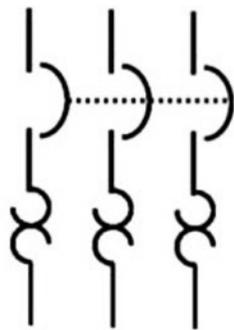
A



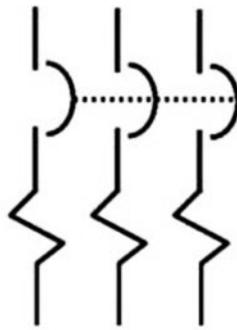
B



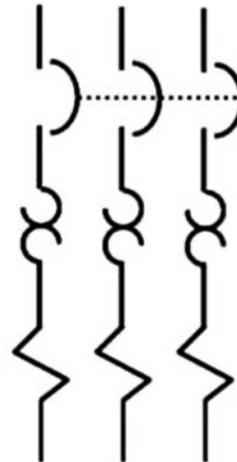
C



1



2



3

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EL-0034



A



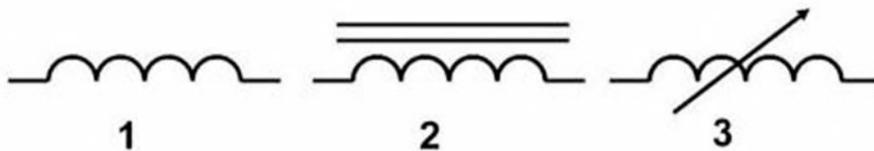
B



C



D



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EL-0059



A



B



C



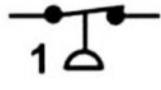
D



E



F



1



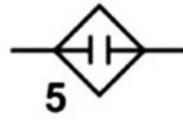
2



3



4



5



6



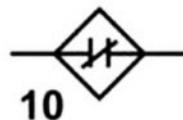
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8



9



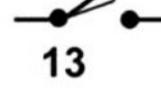
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11



12



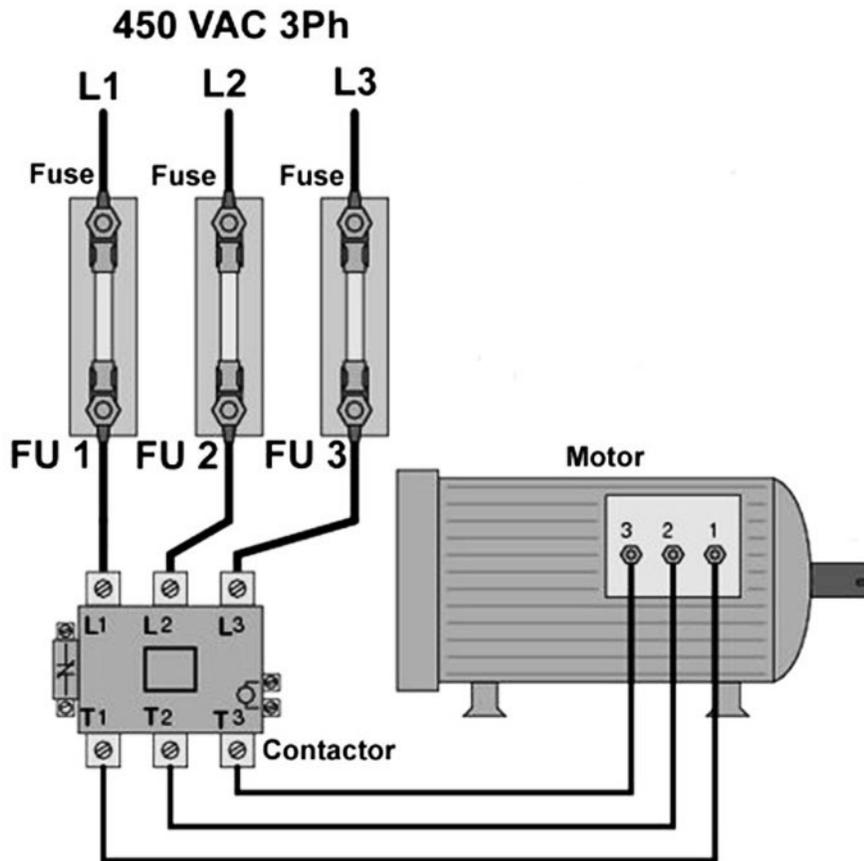
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14

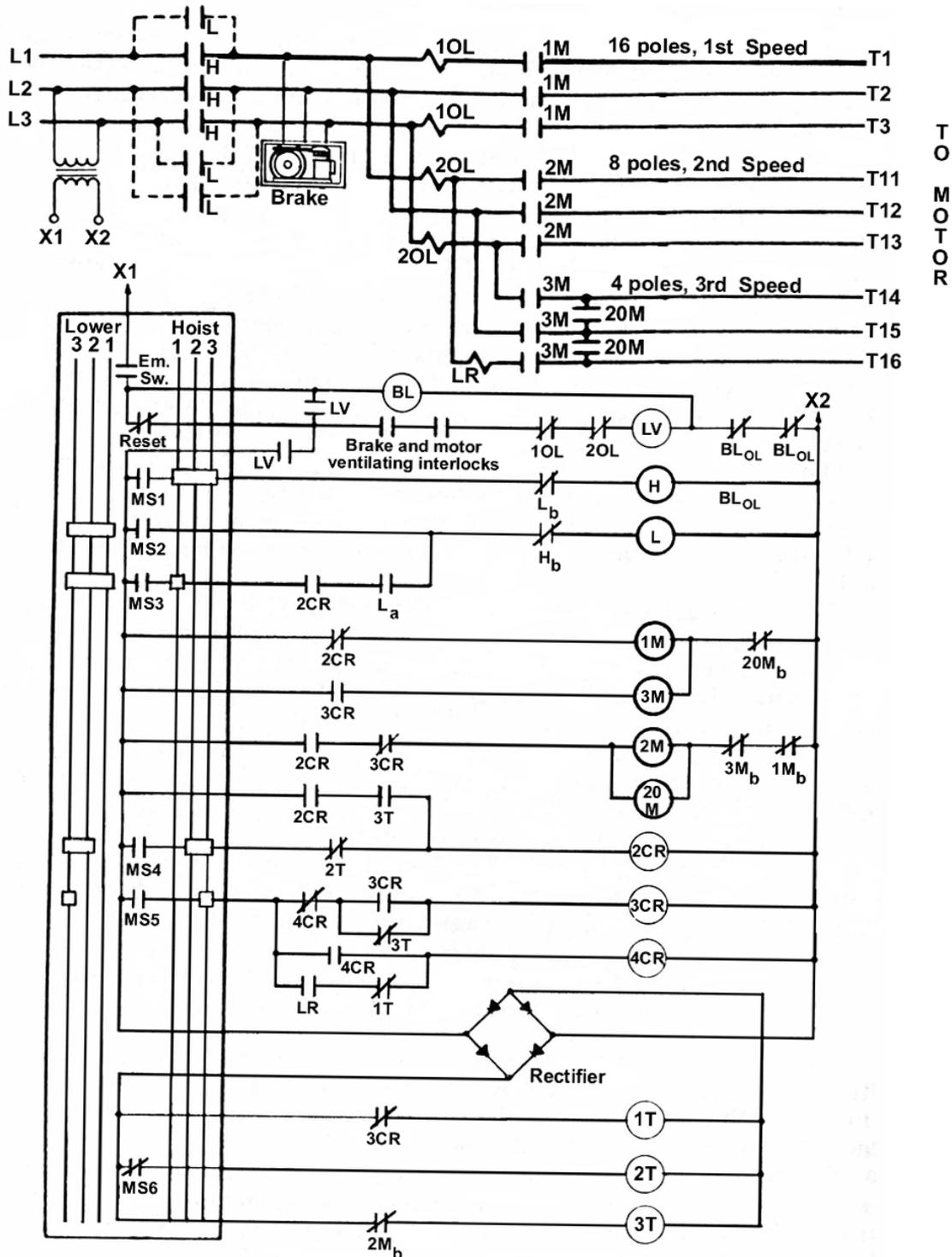
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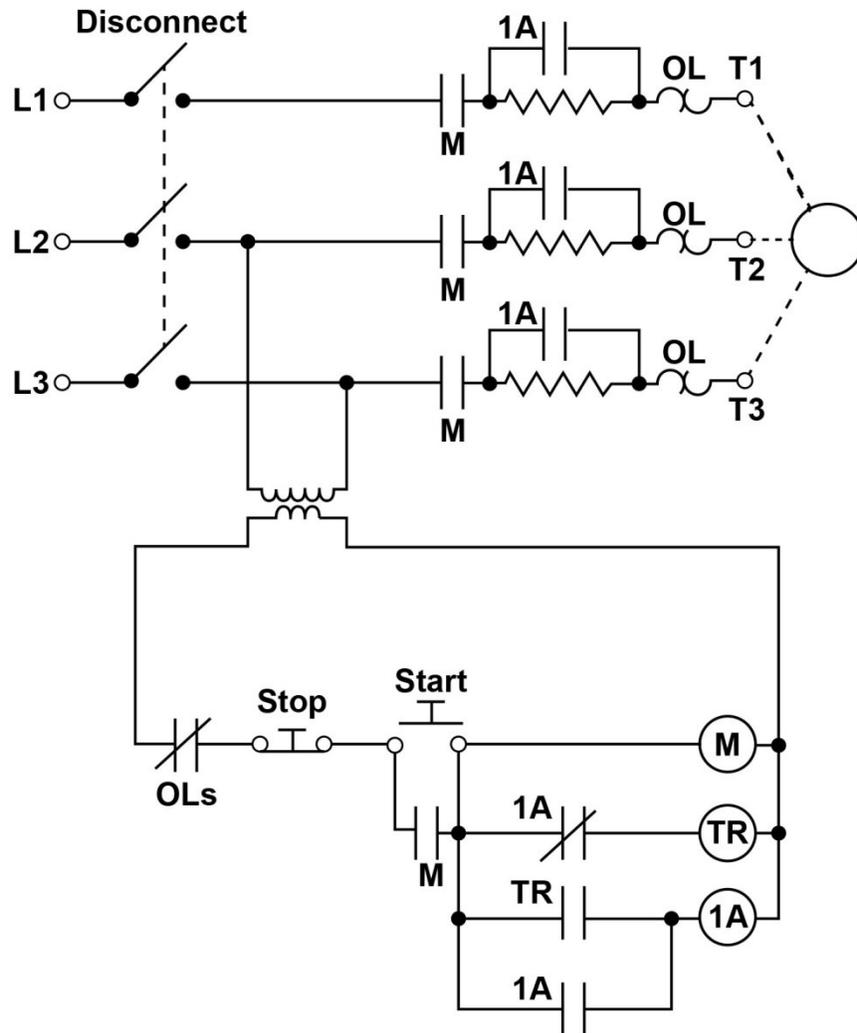
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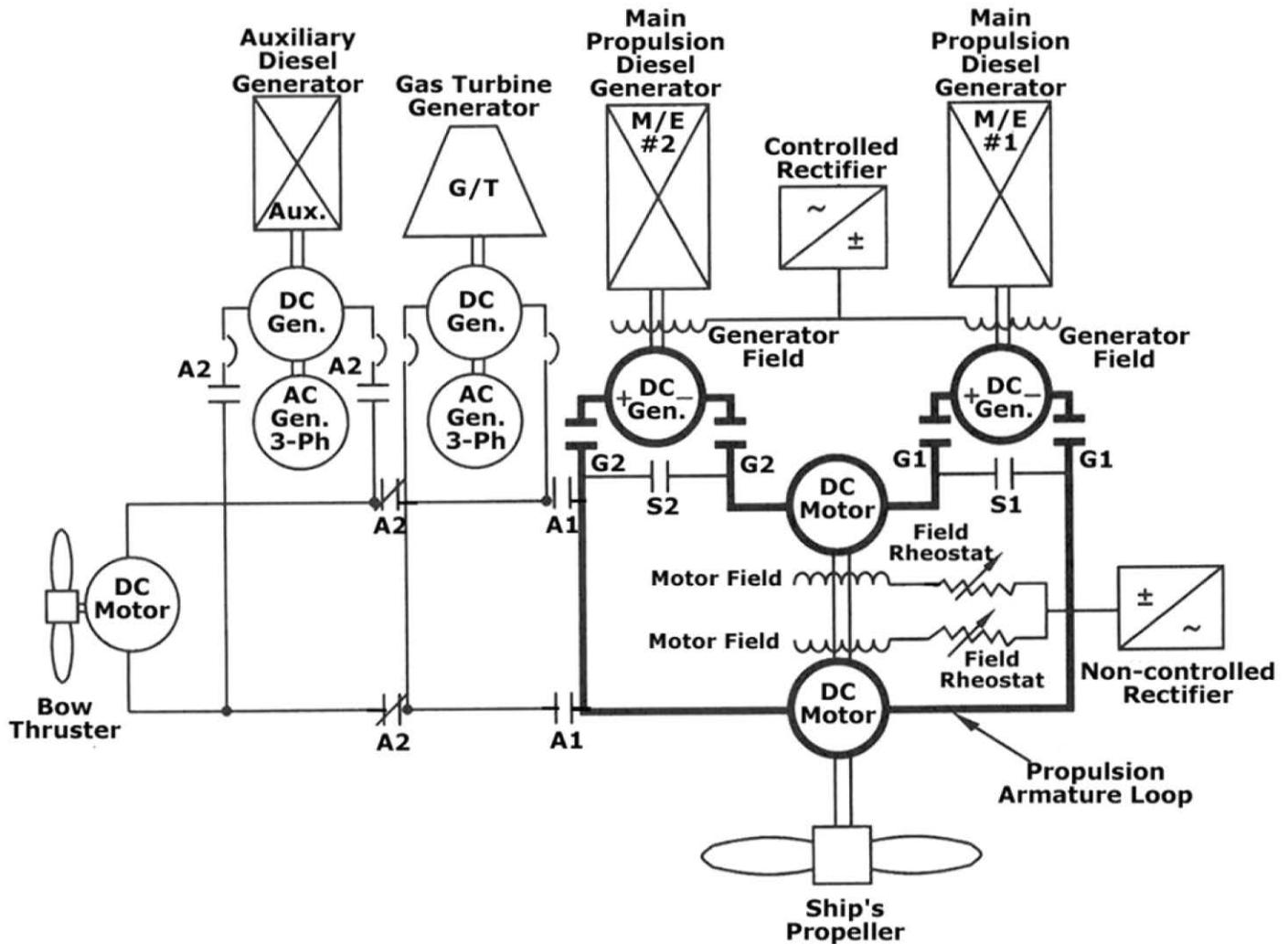
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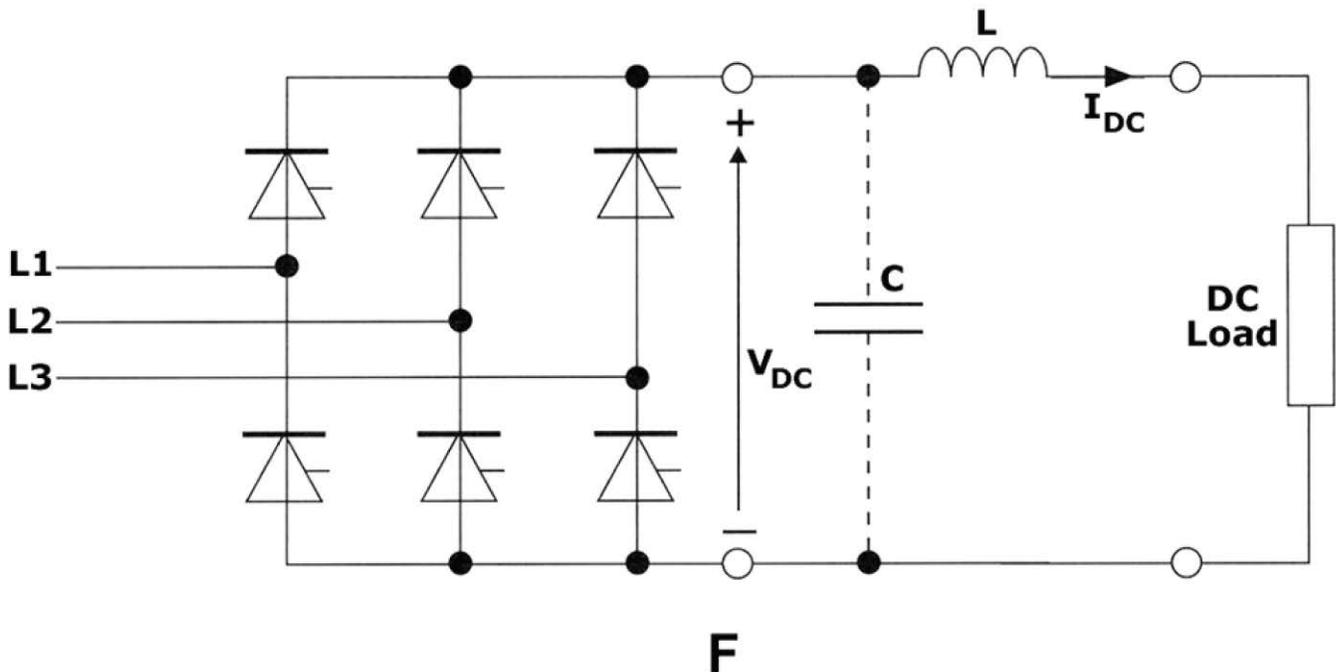
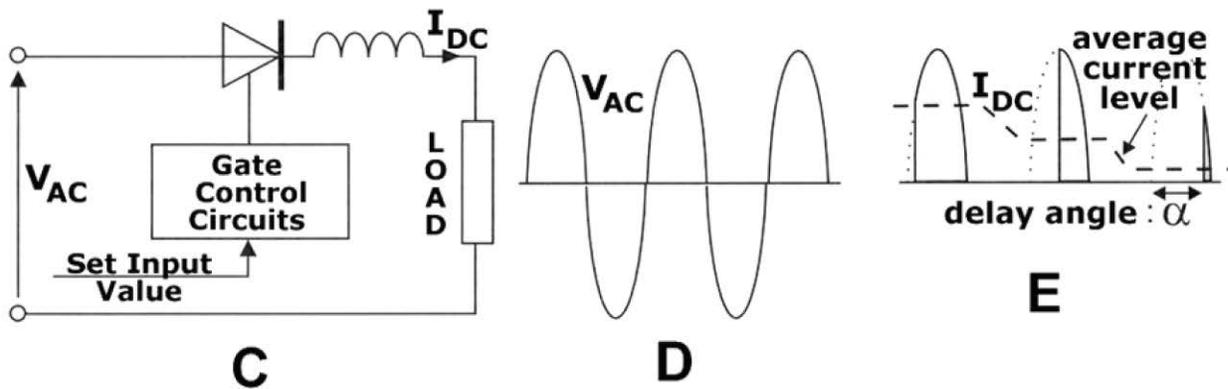
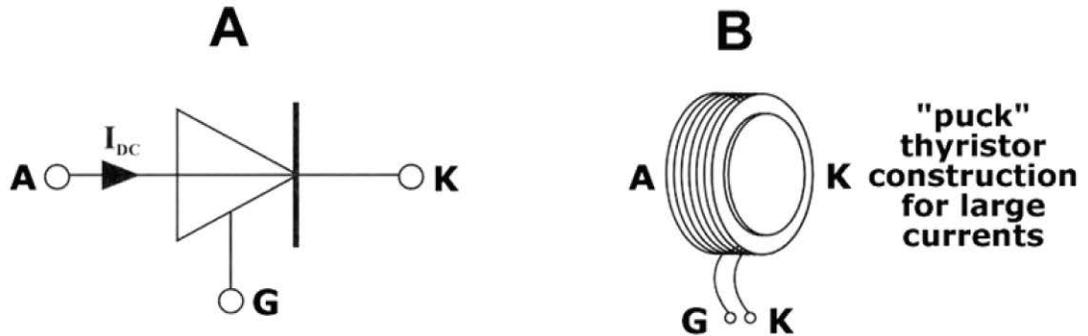
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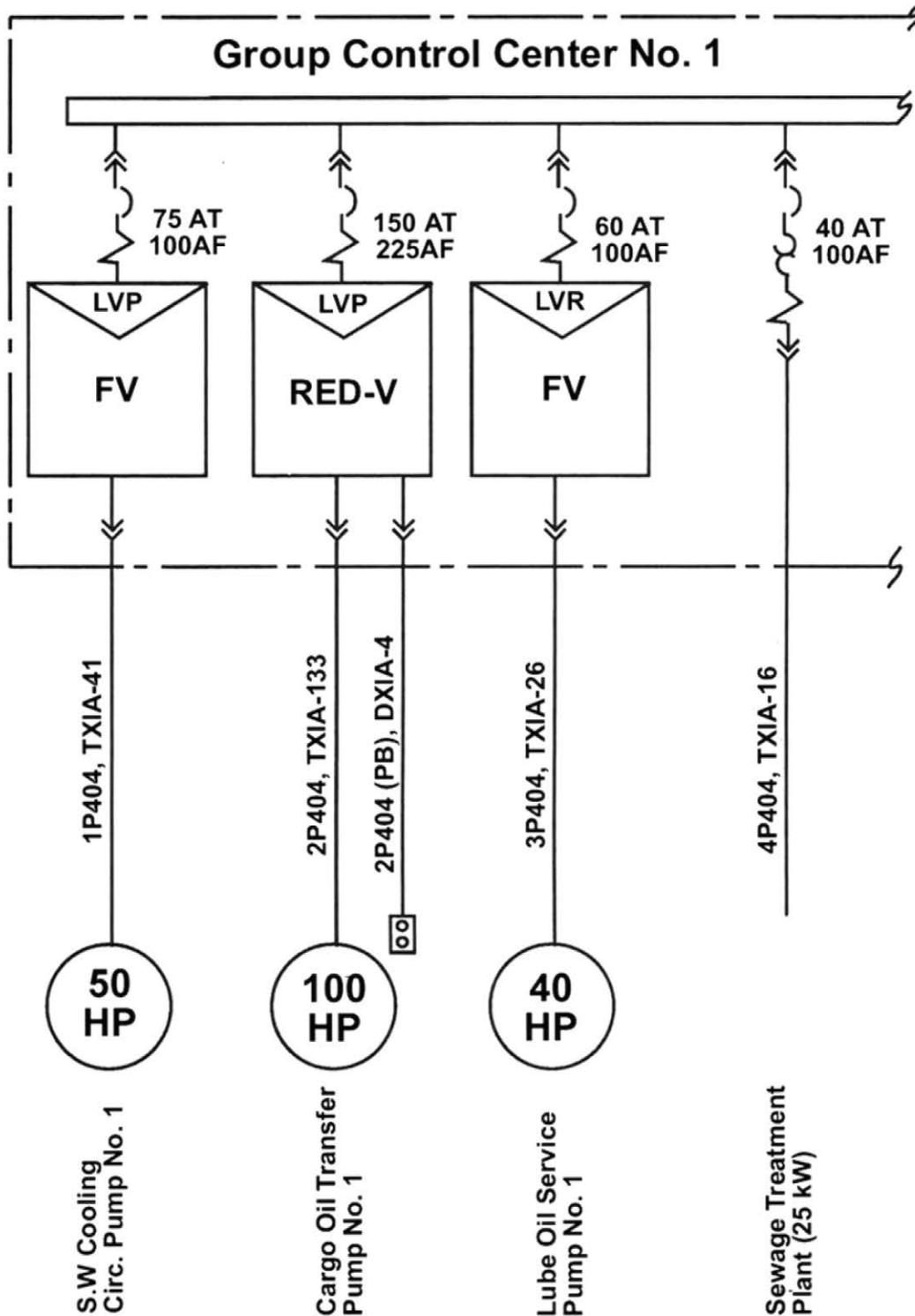
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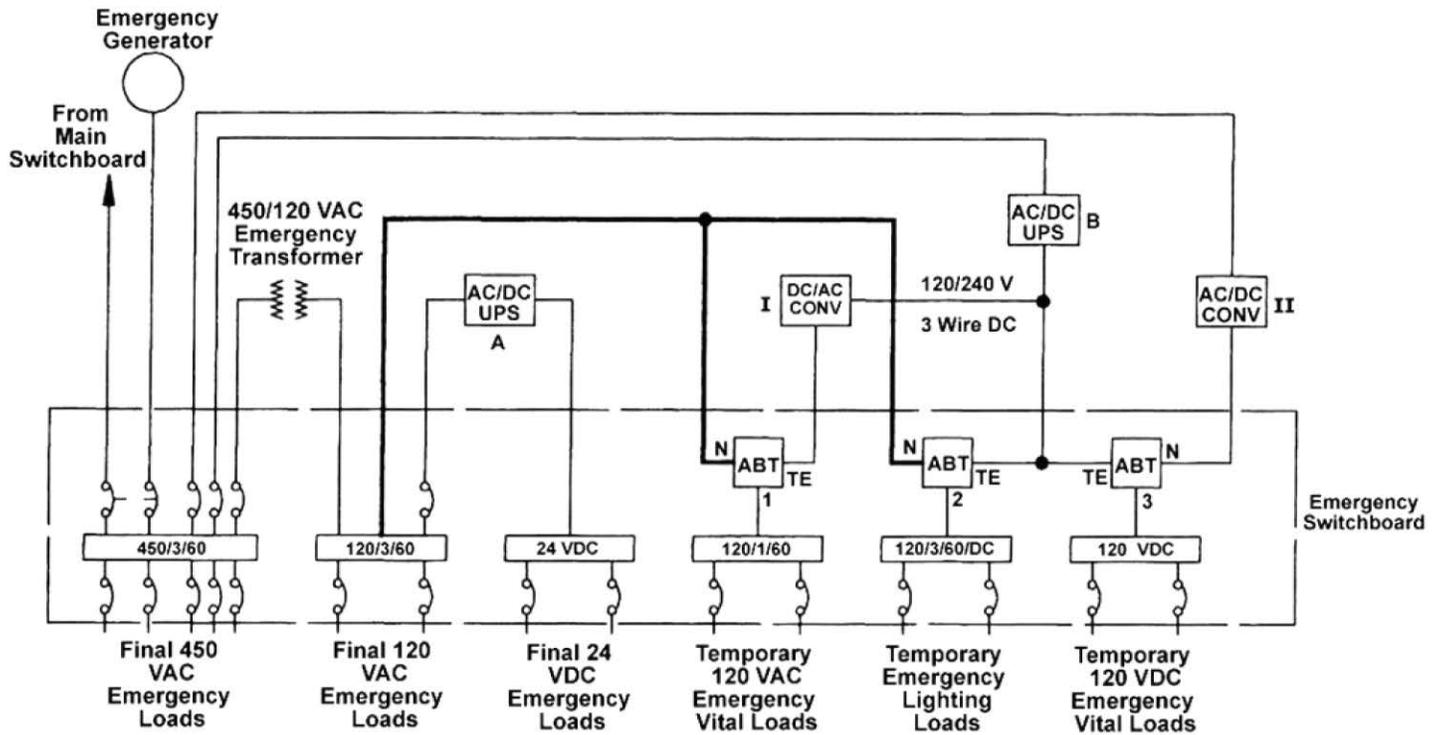
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Legend:

UPS: Uninterruptible Power Supply (Including Battery)

A - 120 VAC to 24 VDC

B - 450 VAC to 120/240 VDC

ABT: Automatic Bus Transfer Switch

1 - Transfers Vital AC Loads to UPS (B) via DC/AC Converter (I)

2 - Transfers Temporary Emergency Lighting to UPS (B)

3 - Transfers Vital DC Loads to UPS (B)

CONV: Converters

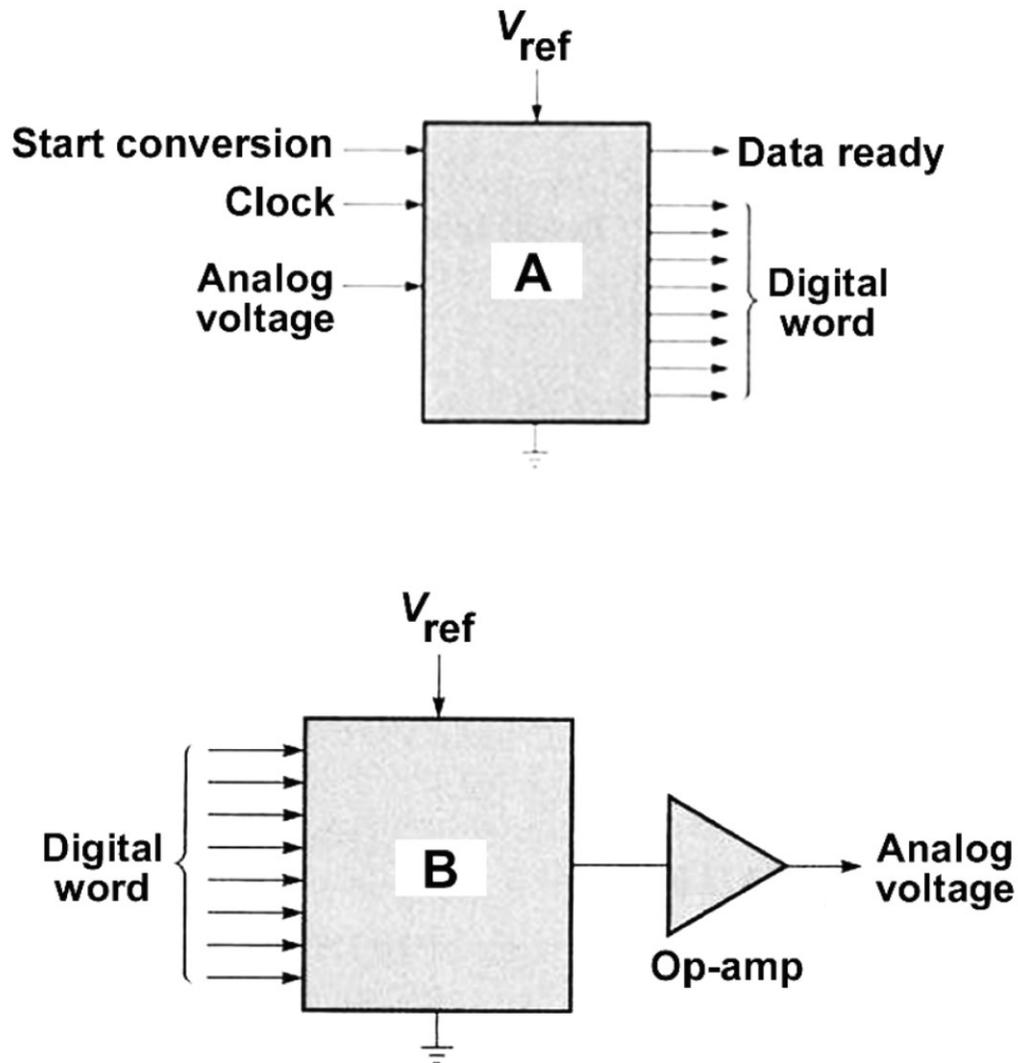
I - 240 VDC to 120 VAC

II - 450 VAC to 120VDC

N - Normal & Final Emergency Power Source

TE - Temporary Emergency Power Source

EL-0240



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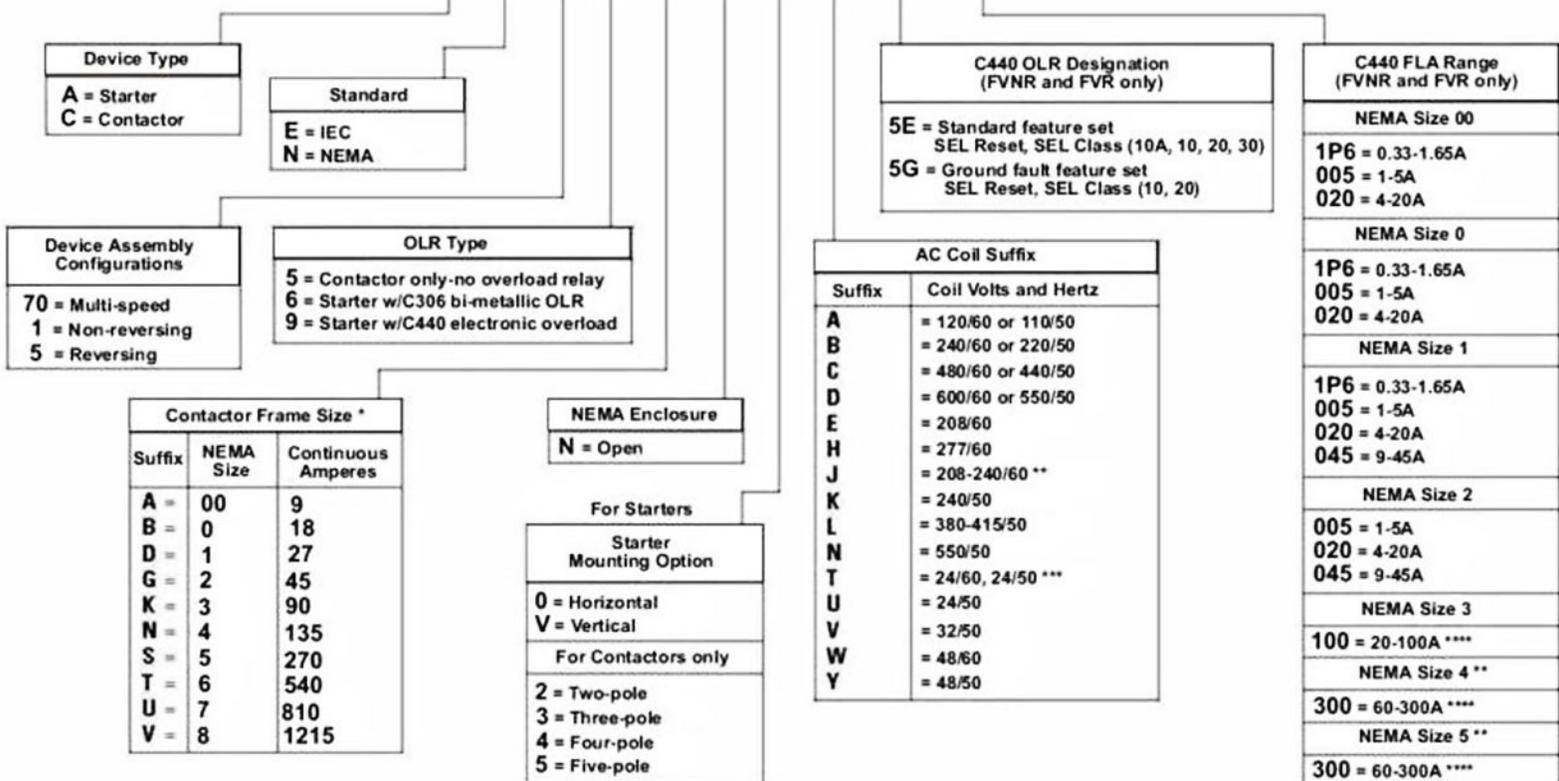
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EL-0180

Catalog Number Selection Chart

Example Catalog Number

A N 1 9 A N 0 A 5E 005



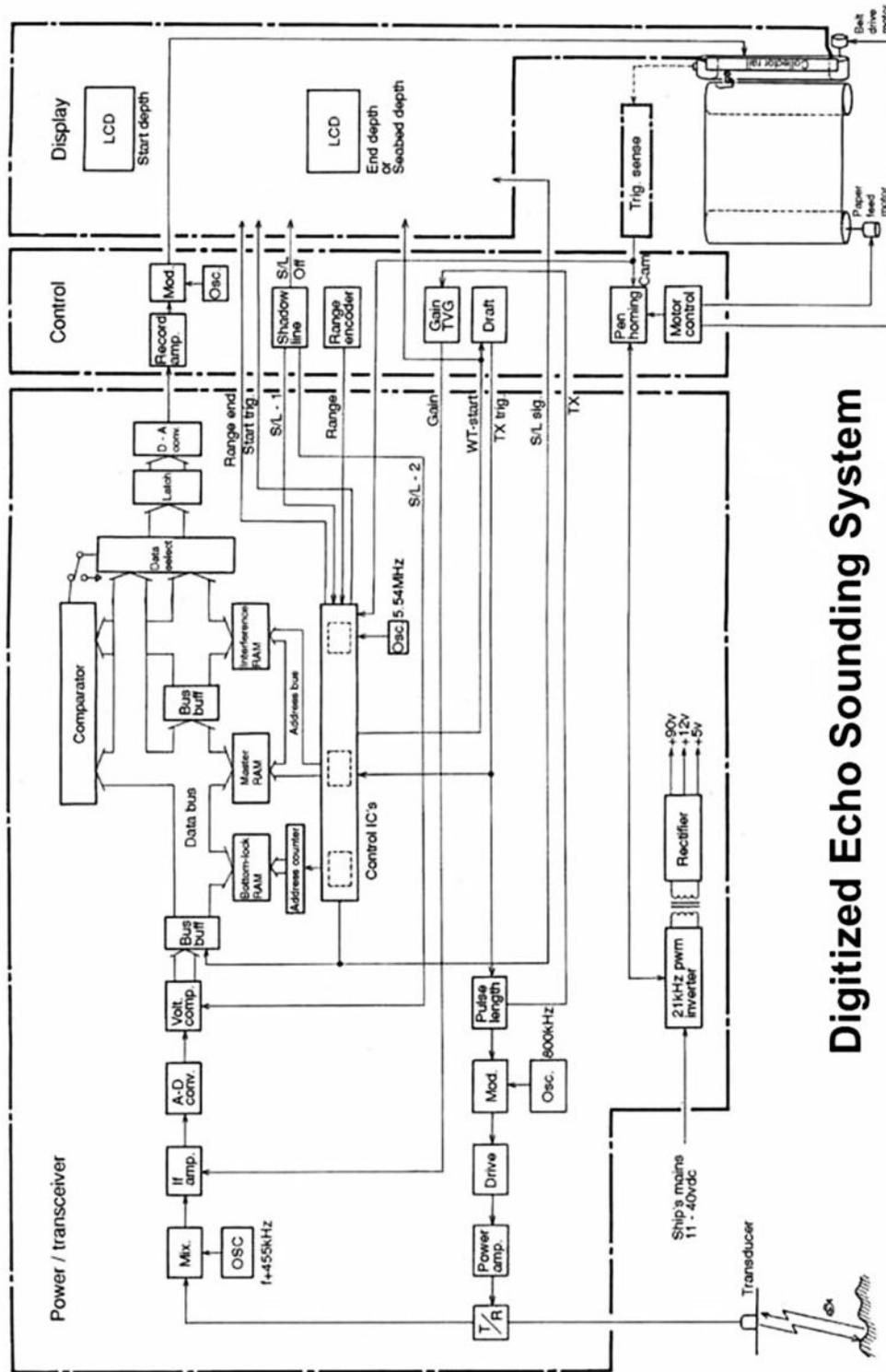
Notes:

- * For contactor only orders, add B to end of catalog number if NEMA size 00-2, 6.
- ** NEMA sizes 00 and 0 only.
- *** NEMA sizes 00 and 0 only. Sizes 1-8 are 24/60 only.
- **** NEMA sizes 4 and 5 require the use of CTs with 1-5A OL relay. Size 4 starters are not shipped as assembled units. Order CN15NN01 contactor 1-5A OL (C440A1A005SAX or C440A2A005SAX) with 60-300A CTs (ZEB-XCT300).

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EL-0185

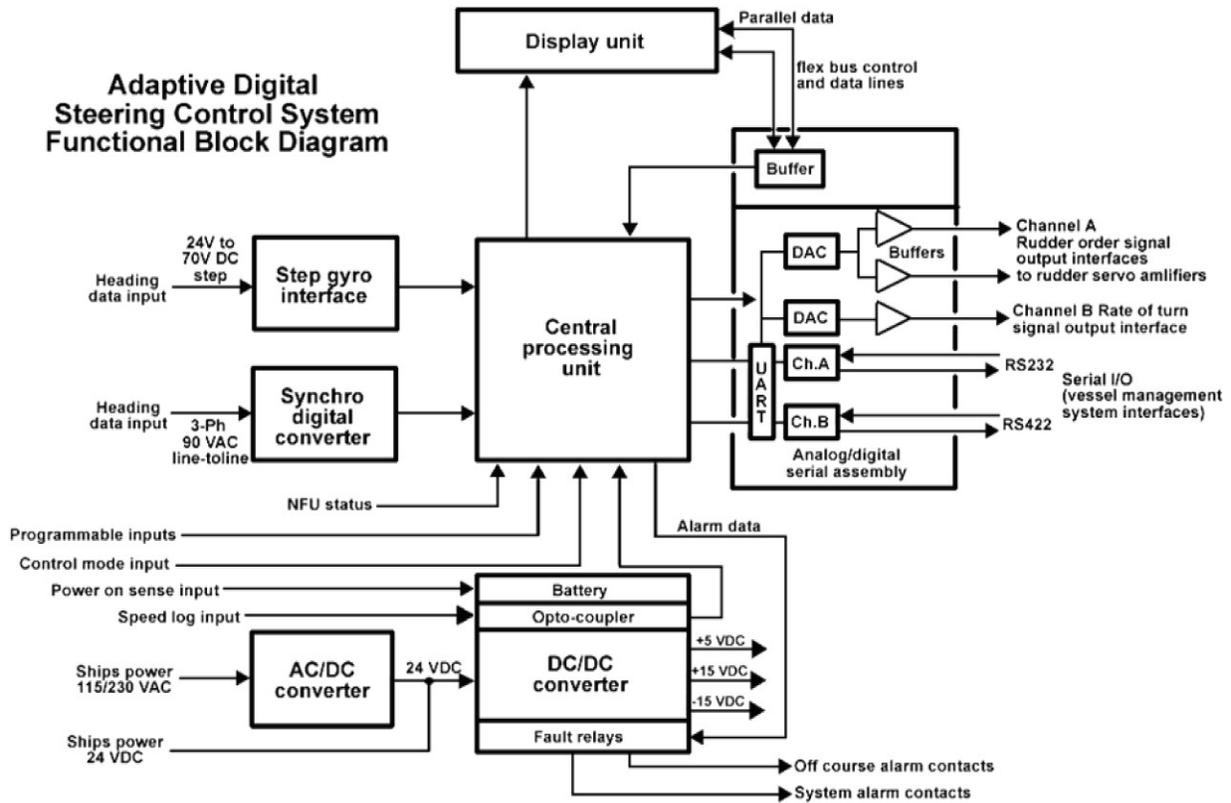


Digitized Echo Sounding System

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EL-0191

Adaptive Digital Steering Control System Functional Block Diagram

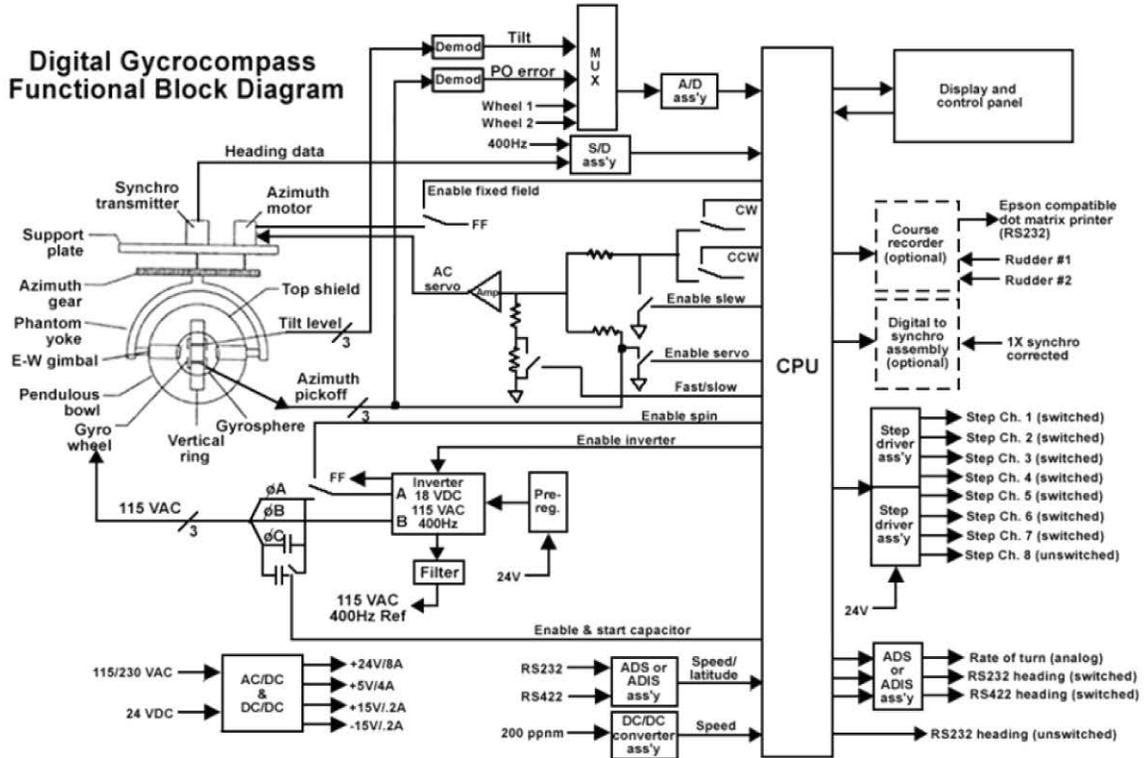


Adaptive Digital Steering System Interface Signals	
Inputs	
Speed log input	
Pulsed	200 pulse/nautical mile (PPNMI) format (contact closure)
Serial	RS-232 (channel A or C) or RS-422 (channel B) communications in NMEA 0183 format, \$VBW, \$VHW
Navigator (vessel management system) input	Serial data for heading order, rate order, and cross track error information in RS-232 or RS-422 communication on channel A, B or C. in NMEA format \$APB, \$HSC, \$HTR, \$HTC or \$XTE.
Compass	
Step data	Positive or negative step data (24 or 70 V)
Synchro	1X, 90X or 360X
Data	\$HDT (on channels A, B or C)
Serial data	
Mode switch sense contacts	External switched opened or closed to inform autopilot to change from Standby mode to an automatic mode
NFU sense contacts	External contacts to indicate when the NFU controller is active
Power failure circuits	Closed contacts on external power switch to activate power failure alarm
Outputs	
Interface to external rudder servo control amplifiers	Bipolar analogue voltage proportional to the rudder order. ± 11.25 V (maximum limit) equal to $\pm 45^\circ$ or rudder
Rate of turn interface	Bipolar analogue voltage proportional to a turn rate indicator. ± 4.5 V (max) equal to $\pm 90^\circ$ turn/min. Resolution equal to 0.5° /min.

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EL-0194



Digital Gyrocompass Communication Protocols

Inputs

Speed:	Pulsed	Automatic, 200 ppm
	Serial	Automatic from digital sources, RS-232/422 in NMEA 0183 format \$V _{BW} , \$V _{HW} , \$V _{TG}
	Manual	Manually via the control panel
Latitude		Automatic from GPS via RS-232/422 in NMEA format \$G _{LL} , \$G _{GA} Automatic from digital sources via RS-232/422 in NMEA 0183 format \$G _{LL} Manually via the control panel

Outputs

Rate of Turn	50 mV per deg.min (+/- 4.5 VDC full scale = +/- 90 /min) NMEA 0183 format \$S _{HEROT} , X.XXX, A*hh<CR><LF> 1 Hz, 4800 baud
Step Repeaters	Eight 24 VDC step data outputs. (An additional 12-step data output at 35 VDC or 70 VDC from the optional transmission unit) 7 - switched, 1 - unswitched
Heading Data	One RS-422, capable of driving up to 10 loads in NMEA 0183 format \$S _{HEHDT} , XXX.XXX, T*hh<CR><LF> Two RS-232, each capable of driving one load in NMEA format \$S _{HEHDT} , XXX.XXX, T*hh<CR><LF> 10 Hz, 4800 baud 1 - 232 switched, 1 - 232 unswitched, 1 - 422 switched
Alarm Outputs	A relay and a battery-powered circuit activates a fault indicator and audible alarm during a power loss. Compass alarm - NO/NC contacts. Power alarm - NO/NC contacts
Course Recorder	(if fitted) RS-232 to dot matrix printer
Synchro Output	(if fitted) 90 V line-to-line with a 115 VAC 400 Hz reference. Can be switched or unswitched.

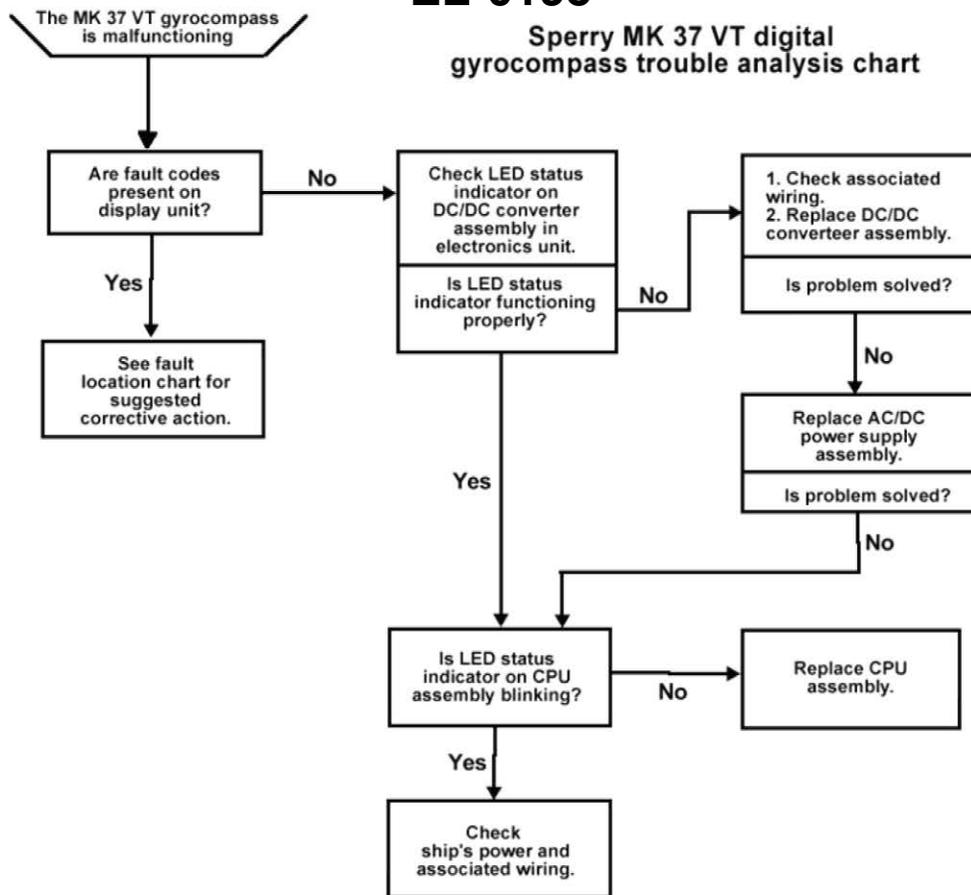
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Sperry MK 37 VT digital gyrocompass trouble analysis chart



Partial list of Sperry MK 37 VT digital gyrocompass faults

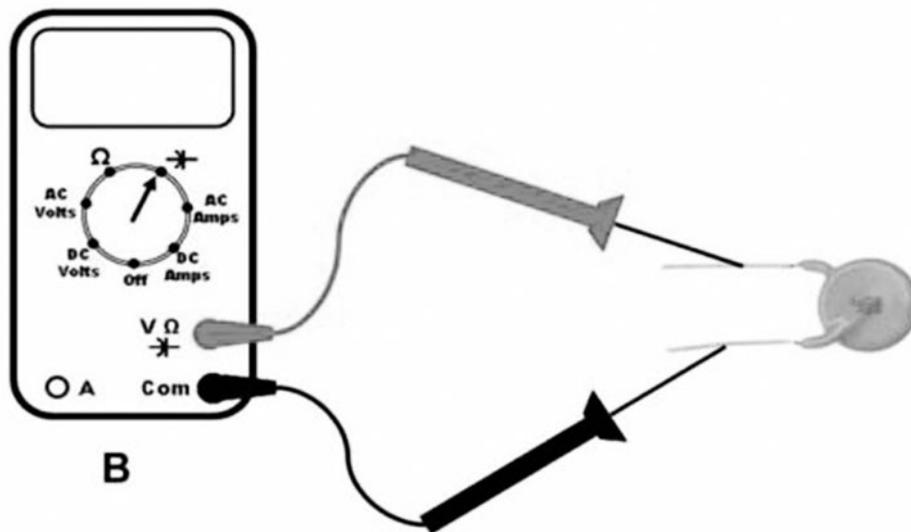
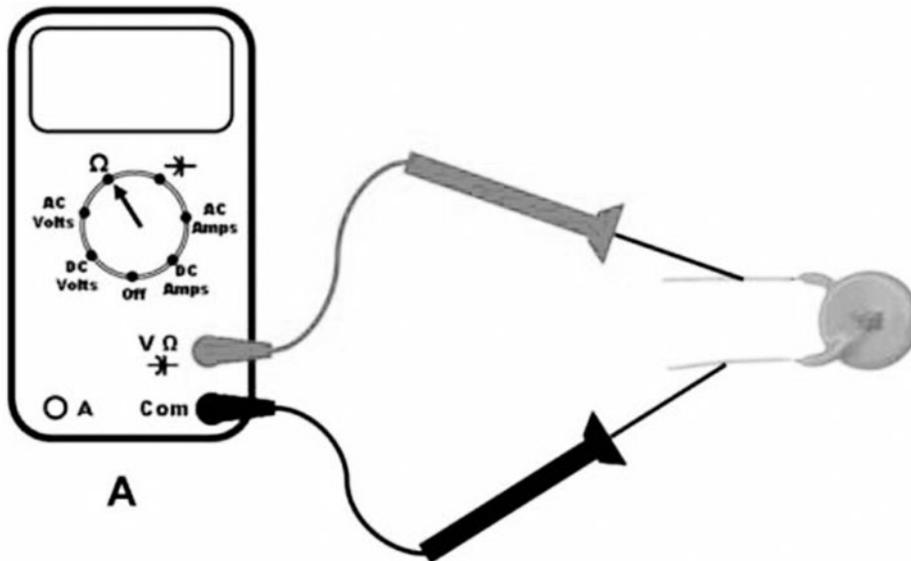
Symptom	Probable cause	Remedy
Course recorder leaves a blank page every 8-10 inches or has paper feed problems	Printer paper-release lever not in the middle, push-tractor position	Place level in the middle position for push-tractor installation
Repeater does not follow MK 37 VT heading	Repeater channel may not be on or not synchronized to the MK 37 VT heading	Check repeater switch on step driver assembly. Make sure repeater is synchronized to the MK VT gyrocompass
Speed value does not change	Speed selection may not be in Auto	Verify that speed menu selection is in Auto. Check for faults on serial channel
Latitude value does not change	Latitude selection may not be in Auto	Verify that latitude menu selection is in Auto. Check for faults on serial channel
Manual transfer (dual system) does not occur	Other system may not be powered, attached, or may have a critical fault. Manual transfer must be initiated from the primary compass only	Verify that other system is powered, attached, and does not have a critical fault
Unit makes buzzing sound for at least 15 min. after being switched on	If sound persists longer than 15 min., the AC/DC power supply assembly relay is bad	Replace the AC/DC power assembly

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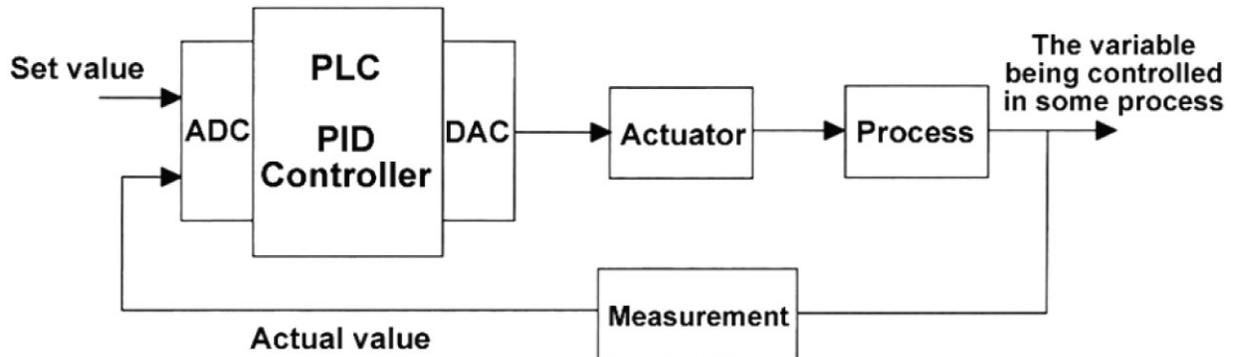
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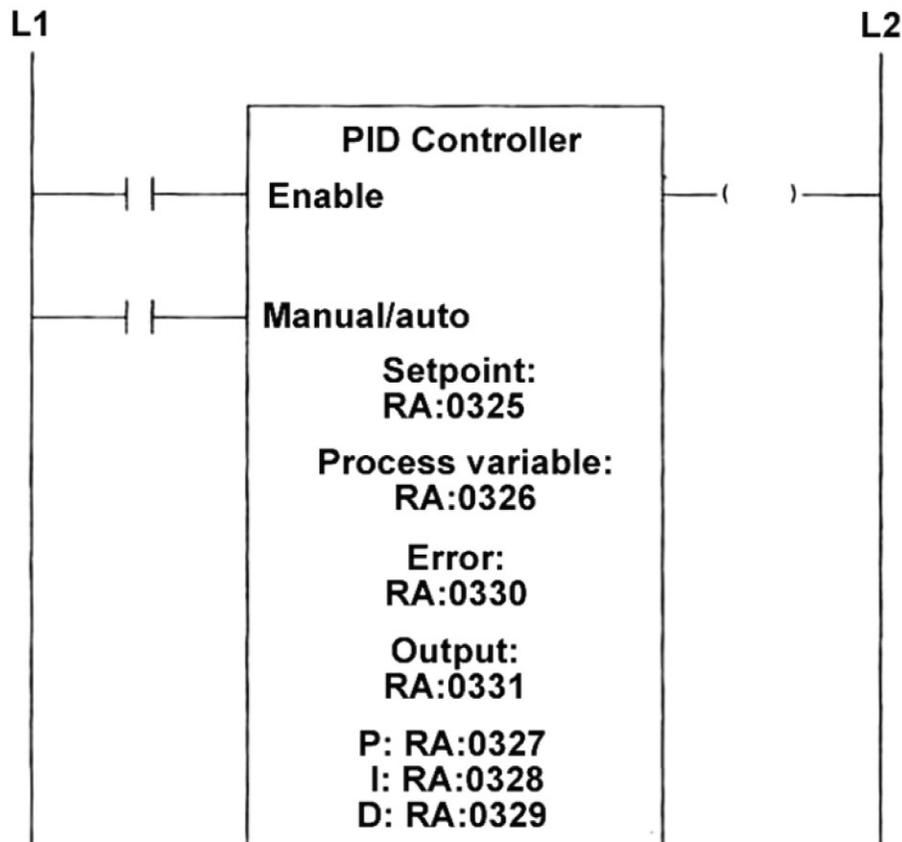
EL-0213



EL-0251



A



B

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