U.S.C.G. Merchant Marine Exam

Chief Engineer - Limited

Q604 Electrical - Electronic - Control Engineer

(Sample Examination)

Choose the best answer to the following Multiple Choice Questions:

1. In figure "B" of the illustrated circuit, if the resistance of R_1 is 10 ohms, R_2 is 10 ohms, and R_3 is 10 ohms, what is the total resistance? Illustration EL-0032

- (A) 15 ohms
- (B) 20 ohms
- (C) 25 ohms
- (D) 30 ohms

If choice A is selected set score to 1.

2. What is the maximum current allowed to be drawn from the secondary of a 2 kVA step-down transformer with a turns ratio of four to one if connected across a 440 volt line?

- (A) 1.1 amps
- (B) 4.5 amps
- (C) 18.1 amps
- (D) 22.7 amps

If choice C is selected set score to 1.

3. While troubleshooting a circuit in an engine room central control console, a resistor is suspected of being faulty. Which of the following precautions must be observed if an analog or digital multimeter set up as an ohmmeter is to be used to check its value?

- (A) The meter case must be grounded prior to attaching the leads.
- (B) The meter leads must not be twisted so as to cancel out the individual magnetic fields.
- (C) The correct polarity must be observed because reverse bias will damage the component.
- (D) The resistor's circuit must be de-energized and at least one end of the resistor isolated by disconnecting.

If choice D is selected set score to 1.

4. When measuring DC current flow using an analog or digital multimeter set up as a milliammeter, how is the meter connected?

- (A) in parallel with the power source and load
- (B) in series with the power source and load
- (C) insuring correct polarity
- (D) using the lowest range possible to prevent instrument damage

If choice B is selected set score to 1.

5. Prior to using an analog multimeter set up as an ohmmeter, the leads are purposely shorted together. Which of the following actions should be taken if, when adjusting to "zero" ohms, the indicating needle cannot be returned to "zero" on the scale?

- (A) The lead clips should be replaced.
- (B) The test reading should be added to each final reading.
- (C) The test reading should be subtracted from each final reading.
- (D) The batteries should be replaced.

If choice D is selected set score to 1.

6. In what situation would an electrical phase sequence indicator be useful?

- (A) connecting shore power lines to the ship
- (B) troubleshooting DC motors
- (C) preparing to parallel alternators
- (D) connecting lighting branch circuits

If choice A is selected set score to 1.

7. As shown in the illustration, what type of motor is controlled as depicted in both figure "A" and in figure "B"? Illustration EL-0144

- (A) single-phase wound rotor induction motor
- (B) three-phase wound rotor induction motor
- (C) three-phase squirrel cage induction motor
- (D) three-phase synchronous motor

If choice B is selected set score to 1.

8. As shown in the illustration, what type of motor and motor starter are featured? Illustration EL-0137

- (A) non-reversing squirrel cage induction motor with reduced voltage primary reactor starting
- (B) reversing squirrel cage induction motor with across-the-line starting
- (C) non-reversing squirrel cage induction motor with reduced voltage autotransformer starting
- (D) reversing squirrel cage induction motor with reduced voltage autotransformer starting

If choice C is selected set score to 1.

9. Which of the following describes the action when the handle is moved to the "start" position of a drum-type motor controller used with a compound wound DC motor?

- (A) Full line voltage is supplied to the shunt and series fields, and reduced voltage is supplied to the armature.
- (B) Reduced voltage is supplied to the shunt field, series field, and armature.
- (C) Full line voltage is supplied to the shunt field, and reduced voltage is supplied to the series field and the armature.
- (D) Full line voltage is supplied to the shunt field, series field, and armature.

If choice C is selected set score to 1.

10. By what means should motor controller contacts be routinely cleaned?

- (A) wiping with a clean dry cloth
- (B) dressing with crocus cloth
- (C) blowing with compressed air
- (D) filing with a bastard file

If choice A is selected set score to 1.

11. 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.

12. If a digital multimeter is set up as shown in figure "A" of the illustration to test an AC contactor coil, what would the display read if the coil is open-circuited? Illustration EL-0214

- (A) 0.03 ohms
- (B) 22 ohms
- (C) OL ohms
- (D) 110 V

If choice C is selected set score to 1.

13. If the contacts of a motor starter or controller fail to drop out when the 'stop' button is depressed, what could be the cause?

- (A) starter shading coil is loose
- (B) stop contacts have become welded together
- (C) starter shading coil is broken
- (D) stop contacts are carrying insufficient current

If choice B is selected set score to 1.

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

- (A) Allows the motor to come up to speed at reduced voltage before bypassing the starting resistors.
- (B) Ensures the motor cannot be started until the overload relays are reset.
- (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 A is selected set score to 1.

15. As shown in the illustration of a cycloconverter for an AC synchronous propulsion motor, what statement is true concerning the operating motor frequency? Illustration EL-0157

- (A) The operating motor frequency is generally limited to less than one-third of mains line frequency.
- (B) The operating motor frequency is generally not limited regardless of the mains line frequency.
- (C) The operating motor frequency is generally limited to three times the mains line frequency.
- (D) The operating motor frequency is generally limited to that equal to the mains line frequency.

If choice A is selected set score to 1.

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

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

If choice D is selected set score to 1.

17. Which of the following statements is true concerning a large polyphase synchronous main propulsion motor as used in an electric propulsion drive system?

- (A) The starting current is held below the rated current.
- (B) Resistance is gradually added to the rotor circuit.
- (C) The motor is started as an induction motor.
- (D) The field winding is energized for starting purposes only.

If choice C is selected set score to 1.

18. As shown in figure "B" of the illustration, what statement is true concerning "regenerating" operation? Illustration EL-0162

- (A) by applying torque in the same direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly speeds up the motor
- (B) by applying torque in the opposite direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly speeds up the motor
- (C) by applying torque in the opposite direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly slows down the motor
- (D) by applying torque in the same direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly slows down the motor

If choice C is selected set score to 1.

19. How is the direction of rotation of the main propulsion motor in a modern AC propulsion drive system reversed?

- (A) electronically changing the phase sequence of the voltages generated by the power converter
- (B) reversing the direction of current flow in the armature
- (C) changing the direction of current flow in the motor's field winding
- (D) power directional relays

If choice A is selected set score to 1.

20. How is the speed of the propeller shaft directly coupled to an AC synchronous drive motor changed when powered by either a dedicated or integrated constant frequency alternator in an AC diesel-electric drive system?

- (A) Varying the field strength of the generator
- (B) Varying the number of motor poles
- (C) Varying the generator speed
- (D) Varying the output frequency of the power converter

If choice D is selected set score to 1.

21. As shown in the illustrated electric propulsion control scheme for a twin screw vessel, when the two shaft speeds are within 5% of each other, the bridge may select "shaft synchro-phasing mode". What statement is true regarding the purpose of this operating mode? Illustration EL-0168

- (A) The respective shaft speed sensors alone are used to achieve identical shaft speeds without regard to propeller position to achieve even power development.
- (B) The respective shaft speed and shaft position sensors are used to achieve identical shaft speeds and propeller synchronization to minimize shaft vibration.
- (C) Cavitation sensors are used to achieve identical shaft speeds and propeller synchronization to minimize vibration.
- (D) Vibration sensors are used to achieve identical shaft speeds and propeller synchronization to minimize vibration.

If choice B is selected set score to 1.

22. 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.

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

If choice B is selected set score to 1.

24. What type of motor is generally used in DC propulsion drive systems?

- • (A) shunt wound
- ○ (B) permanent magnet
- ○ (C) differentially compounded
- ○ (D) series wound

If choice A is selected set score to 1.

25. How is reversal of a DC propulsion motor achieved?

- ○ (A) reversing the phase sequence of the incoming voltage
- • (B) reversing the direction of current flow in the motor field windings
- ○ (C) the use of a 12 pulse converter
- ○ (D) the use of a shunt field regulator

If choice B is selected set score to 1.

26. On DC diesel-electric drives, how is the speed of the DC propulsion motor primarily controlled?

- ○ (A) changing the polarity of the generator field
- • (B) changing the generator engine speed
- ○ (C) changing the generator field excitation current
- ○ (D) changing the motor field excitation current

If choice B is selected set score to 1.

27. What equipment for modern SCR rectified DC propulsion drive systems is usually included in the package?

- (A) propulsion generators which produce AC power that is converted to DC power for the shunt wound DC propulsion motor
- (B) propulsion generators which produce AC power that is directly delivered to the synchronous AC propulsion motor
- (C) propulsion generators which produce DC power that is converted to AC power for the propulsion motor
- (D) propulsion generators which produce DC power that is directly delivered to the series wound DC propulsion motor

If choice A is selected set score to 1.

28. 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 field winding of one of the propulsion motors is open-circuited.
- (B) The armature winding of one of the propulsion motors is open-circuited.
- (C) The field winding of one of the propulsion generators is open-circuited.
- (D) The armature winding of one of the propulsion generators is open-circuited.

If choice C is selected set score to 1.

29. As shown in the illustration of a DC diesel-electric propulsion drive system, what would be the set up contactor configurations if #1 M/E is to be secured, so that only #2 M/E diesel-generator is set up to supply both propulsion motors? Illustration EL-0141

- (A) contactors G2 and S2 dropped out; contactors G1 and S1 pulled in
- (B) contactors G2 and S1 pulled in; contactors G1 and S2 dropped out
- (C) contactors G2 and S1 dropped out; contactors G1 and S2 pulled in
- (D) contactors G2 and S2 pulled in; contactors G1 and S1 dropped out

If choice B is selected set score to 1.

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

If choice A is selected set score to 1.

31. As shown in figures "E" and "F" of the pictured high voltage rack mounted circuit breaker, which figure represents the circuit breaker position when in the open or tripped position? Illustration EL-0167

- (A) A
- (B) B
- (C) C
- (D) D

If choice C is selected set score to 1.

32. What is the greatest single cause of electrical failures?

- (A) the breakdown of insulation
- (B) overcurrent
- (C) high inductance
- (D) too frequent testing

If choice A is selected set score to 1.

33. What type of circuit is represented by the diagram shown in the illustration? Illustration EL-0058

- (A) uninterruptible power supply circuit
- (B) dual speed, 2-winding motor controller circuit
- (C) navigation running light circuit
- (D) common fluorescent lighting circuit

If choice C is selected set score to 1.

34. What are the operating characteristics of a step-down potential transformer in terms of the secondary load?

- (A) reduced voltage and increased current
- (B) reduced voltage and reduced current
- (C) reduced current and increased voltage
- (D) reduced power (kVA)

If choice A is selected set score to 1.

35. What is the purpose of the device labeled "Man-Auto Sw." in the illustrated switchboard? Illustration EL-0003

- (A) to enable the operator to read the field voltage on device "Volt. Reg. Adj. Pot." or device "Man. Volt. Adj. Rheo."
- (B) to shift from the automatic voltage regulator to manual voltage control or vice versa
- (C) to shift the governor control from manual to automatic/zero droop or vice versa
- (D) to supply regulated control power to the switchboard

If choice B is selected set score to 1.

36. As shown in figure "A" of the illustration, with respect to the common equipment grounding conductor, what statement is true? Illustration EL-0125

- (A) The common equipment grounding conductor is insulated from the source and this is the least common arrangement onboard merchant vessels.
- (B) The common equipment grounding conductor is solidly-grounded at the source and this is the least common arrangement onboard merchant vessels.
- (C) The common equipment grounding conductor is solidly-grounded at the source and this is the most common arrangement onboard merchant vessels.
- (D) The common equipment grounding conductor is insulated from the source and this is the most common arrangement onboard merchant vessels.

If choice D is selected set score to 1.

37. Why is it necessary to perform periodic testing of correctly rated and properly installed circuit breakers?

- (A) to insure they will continue to provide the original degree of protection
- (B) to insure they do not exceed their interrupting capacity
- (C) to insure they can trip faster as they increase in age
- (D) to insure they will be able to withstand at least 125% of applied voltage

If choice A is selected set score to 1.

38. Which of the following procedures should be used to maintain a large electric motor during periods of inactivity?

- (A) Spraying a solvent periodically to remove carbon dust.
- (B) Space heaters should be used to prevent condensation of moisture.
- (C) A thin layer of air-drying varnish should be applied on the windings.
- (D) Compressed air should be blown over areas where dust is deposited.

If choice B is selected set score to 1.

39. If a digital multimeter is set up as shown in figure "A" of the illustration, what would be displayed on the screen if the fuse being tested is blown? Illustration EL-0210

- (A) OL volts
- (B) 0.001 ohms
- (C) 470 ohms
- (D) OL ohms

If choice D is selected set score to 1.

40. To check the three line fuses protecting a three-phase motor using a multimeter set up as a voltmeter, what should be done FIRST?

- (A) place the starter in the "stop" position
- (B) place the leads across the bottom ends of the fuses
- (C) make sure the motor is operating at full load to guard against a false reading
- (D) place the leads across the "hot" ends of the fuses

If choice A is selected set score to 1.

41. In the lighting distribution circuit shown in the illustrated lighting panel L110 of the illustration, if all circuit breakers are closed and due to a problem with the relevant feeder circuit breaker, there is a loss of power on the incoming phase A, which of the following statements is true? Illustration EL-0013

- (A) All of the accommodation lighting circuits on the 01 deck, starboard side would lose power.
- (B) Half of the accommodation lighting circuits on the 01 deck, port side would lose power.
- (C) Half of the passageway lighting circuits on the 01 deck would lose power.
- (D) All of the receptacles in the laundry would lose power.

If choice B is selected set score to 1.

42. Which of the following expresses the relationship of the AC input frequency and DC ripple output frequency in a full wave rectifier?

- (A) The output ripple frequency is four times the input frequency.
- (B) The output ripple frequency is the same as input frequency.
- (C) The output ripple frequency is one-half the input frequency.
- (D) The output ripple frequency is twice the input frequency.

If choice D is selected set score to 1.

43. In a logic circuit, how does a NOT gate function?

- (A) it reverses the input logic condition
- (B) it serves to attenuate a given signal level
- (C) it serves to amplify a given signal level
- (D) it does not alter the input logic condition

If choice A is selected set score to 1.

44. What is the name of the digital logic gate represented by figure "1" of the illustration? Illustration EL-0035

- (A) Exclusive OR gate
- (B) OR gate
- (C) AND gate
- (D) NOR gate

If choice B is selected set score to 1.

45. In process control terminology, continuously variable values which change without distinct increments, such as temperature, pressure, or level are correctly referred to as what type of values?

- (A) binary values
- (B) digital values
- (C) bumpless values
- (D) analog values

If choice D is selected set score to 1.

46. As shown in figures "A", "B", and "C" of the illustration, what is the purpose of the differential amplifier segment of the 741 operational amplifier? Illustration EL-0111

- (A) detect and amplify the voltage difference between the inputs at pins 1 and 2
- (B) detect and amplify the voltage difference between the inputs at pins 1 and 5
- (C) detect and amplify the voltage difference between the inputs at pins 2 and 3
- (D) detect and amplify the voltage difference between the inputs at pins 3 and 5

If choice C is selected set score to 1.

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

- (A) when the anode is more negative than the cathode and when the gate is briefly pulsed with a voltage more positive than the cathode
- (B) when the anode is more positive 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 B is selected set score to 1.

48. What does the electronic symbol of figure "9" represent? Illustration EL-0065

- (A) diac trigger diode
- (B) triac thyristor
- (C) diode rectifier
- (D) zener diode

If choice B is selected set score to 1.

49. What does the circuit shown in the illustration represent? Illustration EL-0091

- ○ (A) voltage regulator
- ○ (B) oscillator
- • (C) electronic overload relay
- ○ (D) function generator

If choice C is selected set score to 1.

50. What would be the resistance tolerance of a carbon resistor which is color-coded as red, violet, brown, and silver in bands 1 thru 4 respectfully as shown in figure "A" of the illustration? Illustration EL-0103

- ○ (A) 1%
- ○ (B) 5%
- • (C) 10%
- ○ (D) 20%

If choice C is selected set score to 1.

51. If a digital multimeter is setup as shown in figures "A" and "B" of the illustration, what is the status of the silicon diode if the display reads 4.7 ohms when configured as in figure "A" and reads 490 ohms when configured as in figure "B"? Illustration EL-0211

- • (A) the diode is functioning properly
- ○ (B) the diode is intermittently open
- ○ (C) the diode is open
- ○ (D) the diode is shorted

If choice A is selected set score to 1.

52. When using an ohmmeter to test a semiconductor diode, you find a low resistance in both the forward and reverse bias directions. What condition does this indicate?

- ○ (A) good resistive quality
- ○ (B) good capacitive quality
- ○ (C) an open
- • (D) a short

If choice D is selected set score to 1.

53. In order to check the performance of a transistor removed from its circuit, what meter or tester should be used?

- ○ (A) voltmeter or transistor tester
- • (B) ohmmeter or transistor tester
- ○ (C) sensitive potentiometer
- ○ (D) impedance meter

If choice B is selected set score to 1.

54. What should be done with a capacitor that is obviously discolored due to excessive heat?

- (A) resoldered with care taken to ensure that the original cold solder joint is repaired
- (B) cooled with a spray can of refrigerant approved for this purpose
- (C) replaced and the reason for the overheating found
- (D) calibrated using a capacitance Wheatstone bridge

If choice C is selected set score to 1.

55. 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) Methodical substitution of components starting at one end of the board and working towards the opposite end.
- (B) Component substitution is not recommended as a troubleshooting technique.
- (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.

56. When troubleshooting a printed circuit board, one technique that can be used is swapping the suspected damaged board with a new board. When installing the new board which was stored in a specially manufactured antistatic bag, how may damage due to electrostatic discharge be prevented?

- (A) Before touching the board, you should discharge any static buildup on yourself by touching a conductive surface or use a grounding wrist strap, and the board should be handled by grasping trace solder surfaces.
- (B) Before touching the board, you should discharge any static buildup on yourself by touching a conductive surface or use a grounding wrist strap, and the board should be handled by its insulated edges only.
- (C) Before touching the board, you should discharge any static buildup on the board by touching the board to a conductive surface, and the board should be handled by grasping trace solder surfaces.
- (D) Before touching the board, you should discharge any static buildup on the board by touching the board to a conductive surface, and the board should be handled by its insulated edges only.

If choice B is selected set score to 1.

57. For the purposes of shipboard practice, voltages above what threshold would be considered high voltage?

- (A) 440 VAC
- (B) 1000 VAC
- (C) 4160 VAC
- (D) 6600 VAC

If choice B is selected set score to 1.

58. What is the most common and reliable type of circuit breaker used for high voltage practice aboard ship?

- (A) air-break
- (B) vacuum-break
- (C) gas-break
- (D) oil-break

If choice B is selected set score to 1.

59. In viewing the liquid crystal display for the illustrated depth sounder data display unit, what should be done if the graphic display of the ocean bottom is no longer visible on the screen? Illustration EL-0186

- (A) Increase the range adjustment.
- (B) Increase the gain adjustment.
- (C) Decrease the range adjustment.
- (D) Decrease the gain adjustment.

If choice A is selected set score to 1.

60. As shown in the illustrated digital gyrocompass functional block diagram and the associated communication protocols table, what would the rate of turn signal voltage be if the rate of turn is 30 degrees per minute to port? Assume that the rate of turn to port signal voltage is negative in polarity and that the rate of turn to starboard signal voltage 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.

61. As shown in the illustrated echo sounding display unit and control panel and pertinent operating characteristic tables, what situation would require increasing the unit gain? Illustration EL-0186

- (A) transitioning from a sand/mud seabed to a sand seabed
- (B) transitioning from a soft mud seabed to a mud/sand seabed
- (C) transitioning from a stone/rock seabed to a sand seabed
- (D) transitioning from a sand seabed to a stone/rock seabed

If choice C is selected set score to 1.

62. 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, assuming left rudder signals are negative and right 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.

63. If an 8-bit digital to analog converter (DAC) produces an analog output voltage with a range of 10 volts (0-9 volts), what is the smallest incremental step in voltage that can be generated at the output?

- (A) 0.03 volts
- (B) 0.04 volts
- (C) 0.625 volts
- (D) 1.25 volts

If choice B is selected set score to 1.

64. What statement is true concerning random access memory (RAM)?

- (A) RAM is non-volatile memory and the contents of RAM are lost when the power is removed.
- (B) RAM is volatile memory and the contents of RAM are not lost when the power is removed.
- (C) RAM is volatile memory and the contents of RAM are lost when the power is removed.
- (D) RAM is non-volatile memory and the contents of RAM are not lost when the power is removed.

If choice C is selected set score to 1.

65. If a computer display is flickering, how may this be remedied?

- (A) Increase the refresh rate
- (B) Decrease the refresh rate
- (C) Decrease the resolution bandwidth
- (D) Increase the resolution bandwidth

If choice A is selected set score to 1.

66. 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 from the command prompt screen by default by simply bringing up the command prompt.
- (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 typing "ipconfig/all".
- (D) It is run by clicking on the TCP/IP shortcut icon on the desktop.

If choice C is selected set score to 1.

67. In order for a live-line tester to be used to test and prove dead a high voltage circuit, what must be done to verify the ability of the tester to detect a voltage?

- (A) The live-line tester should be checked by connecting to a known high voltage source before and after the circuit to be worked upon is tested.
- (B) The live-line tester need not be checked prior to testing the circuit to be worked upon as long as it has not been declared inoperative.
- (C) The live-line tester should be checked by connecting to a known high voltage source only before testing the circuit to be worked upon.
- (D) The live-line tester should be checked by connecting to a known high voltage source only after testing the circuit to be worked upon.

If choice A is selected set score to 1.

68. 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 ten minutes to the insulation resistance taken at one minute.
- (B) The polarization index is the insulation resistance taken at ten minutes.
- (C) The polarization index is the ratio of the insulation resistance taken at one minute to the insulation resistance taken at ten minutes.
- (D) The polarization index is the ratio of the insulation resistance taken at thirty minutes to the insulation resistance taken at one minute.

If choice A is selected set score to 1.

69. Overheating is suspected in a high voltage bolted bus-bar joint. If the local continuity resistance is to be checked off-line after the necessary safety precautions have been taken, what instrument would be used for the resistance test?

- (A) A conventional ohmmeter.
- (B) A special high resistance tester (megohmmeter).
- (C) A special low resistance tester (microhmmeter).
- (D) Any of the above ohmmeters would be suitable.

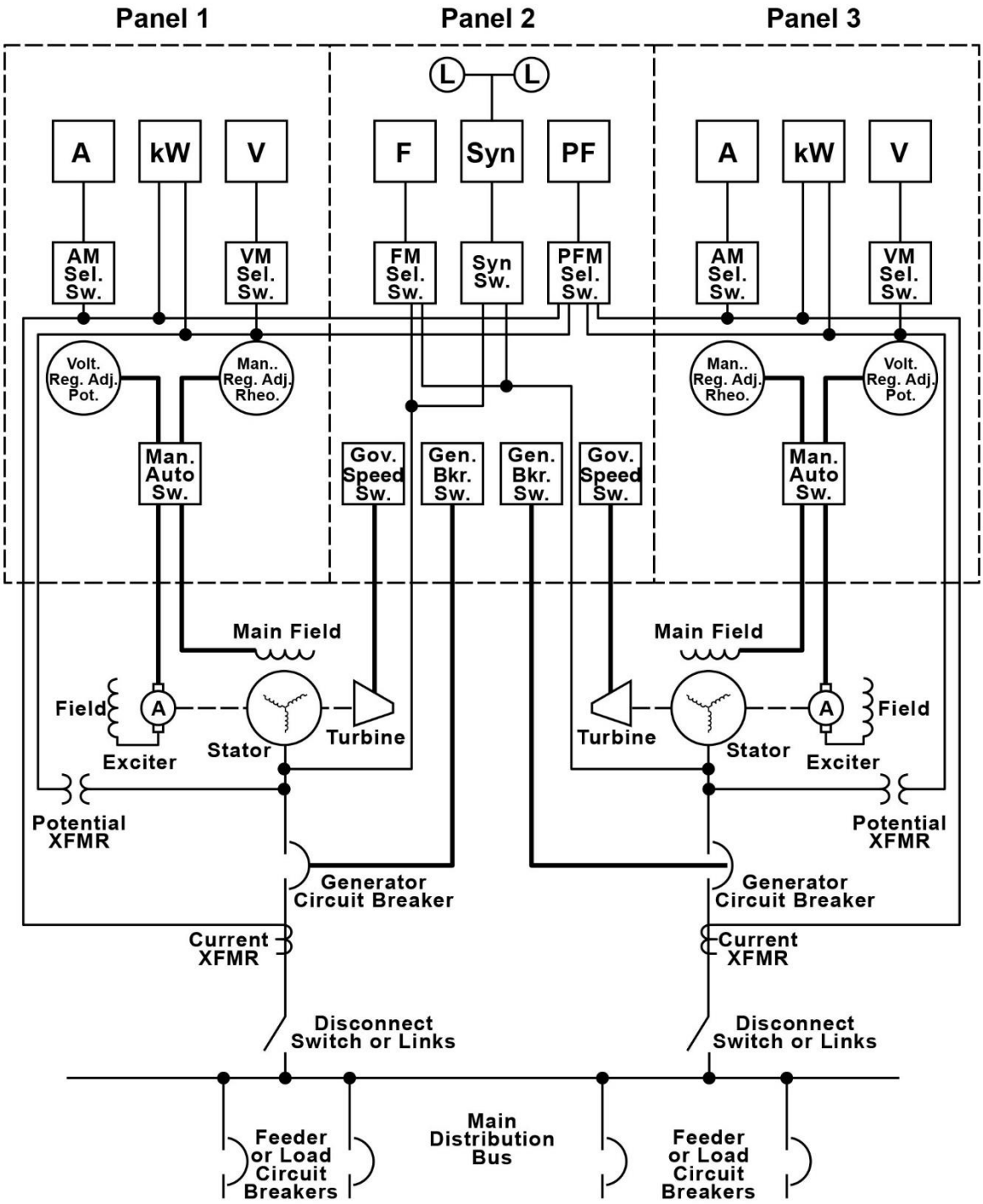
If choice C is selected set score to 1.

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

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

If choice B is selected set score to 1.

EL-0003



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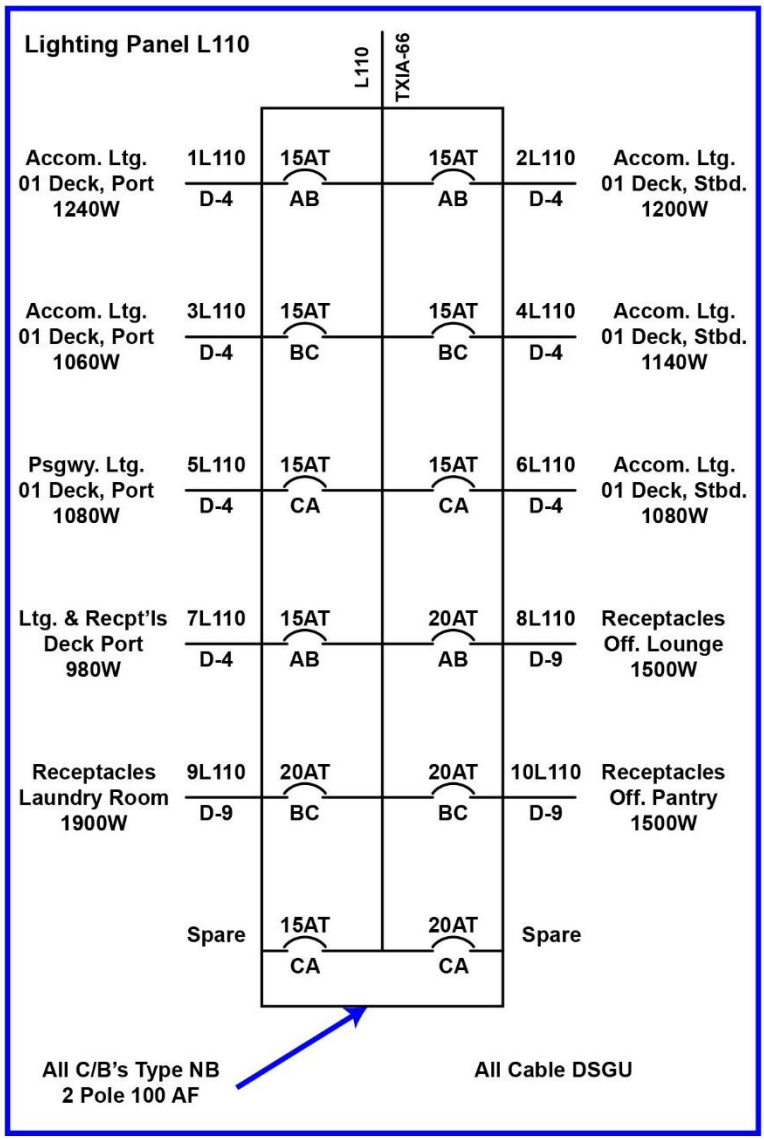

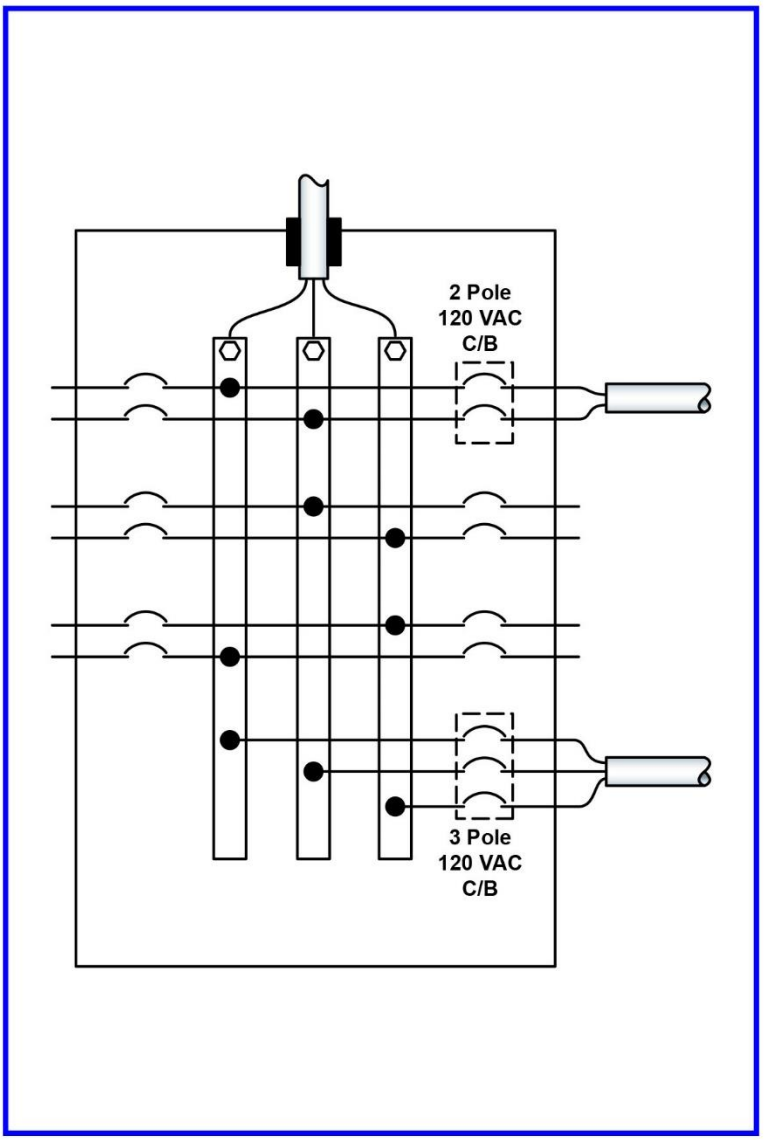

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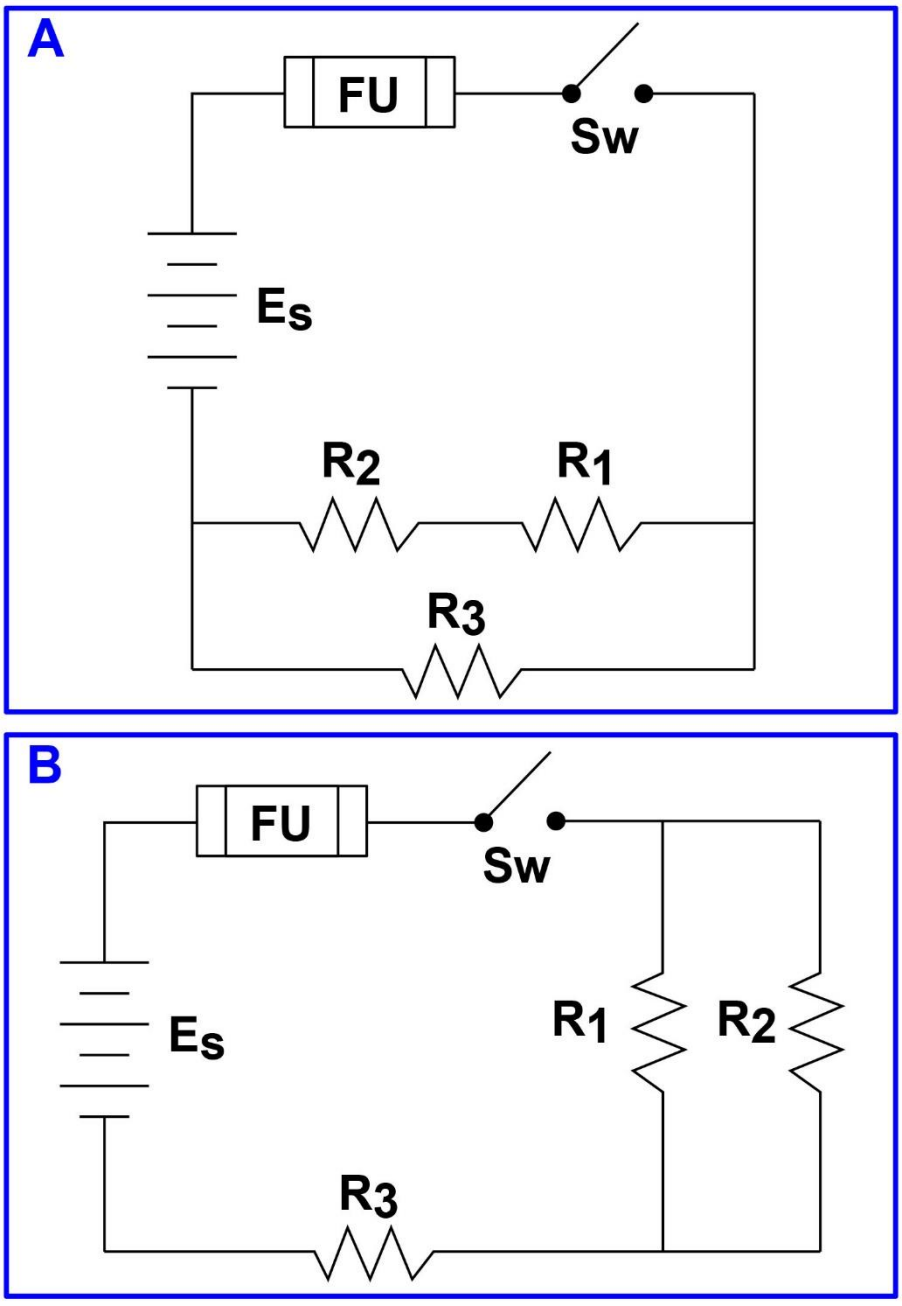

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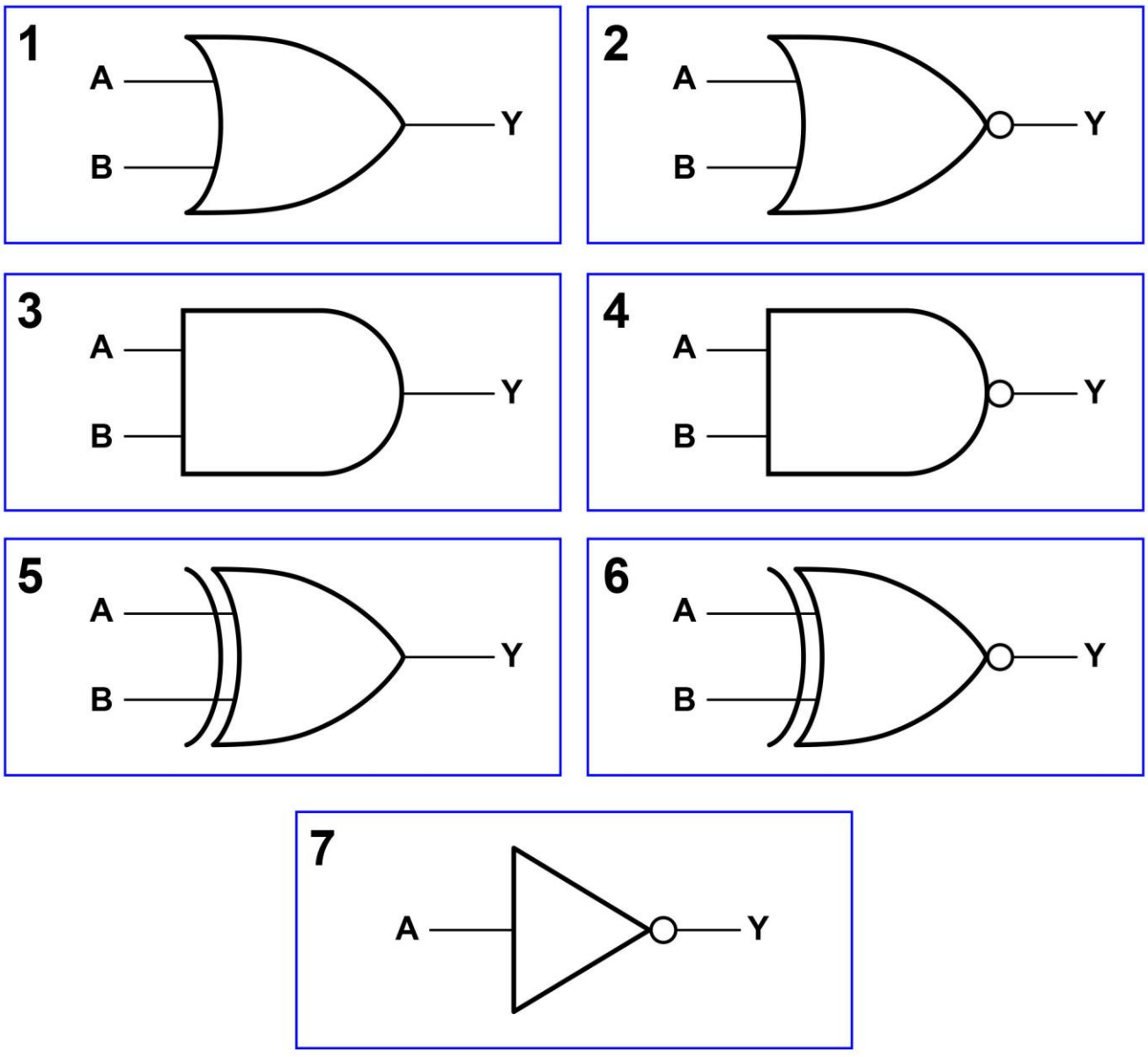

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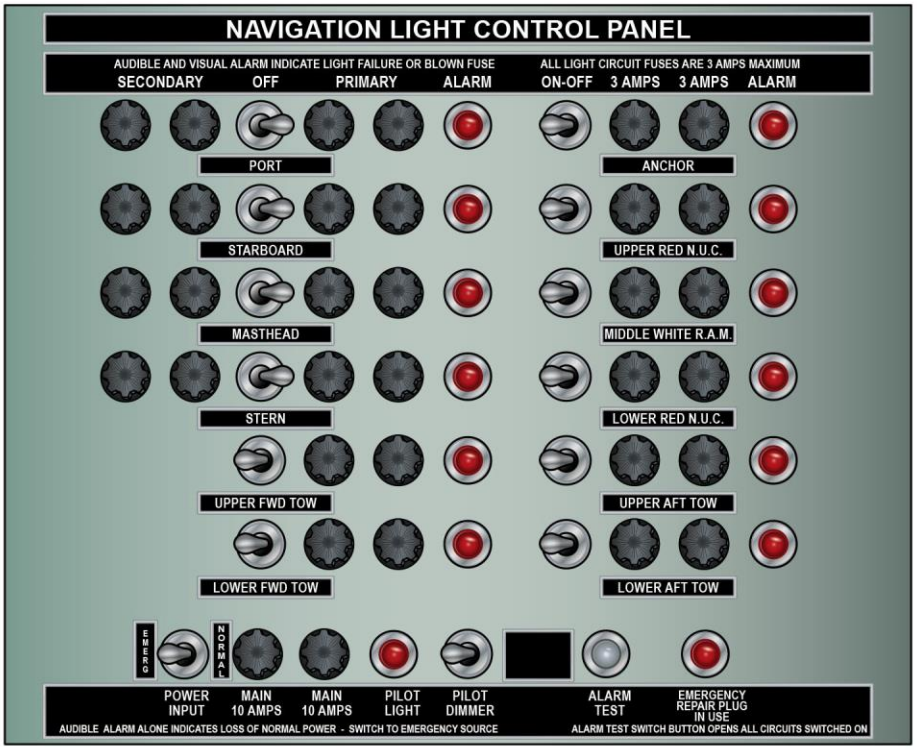

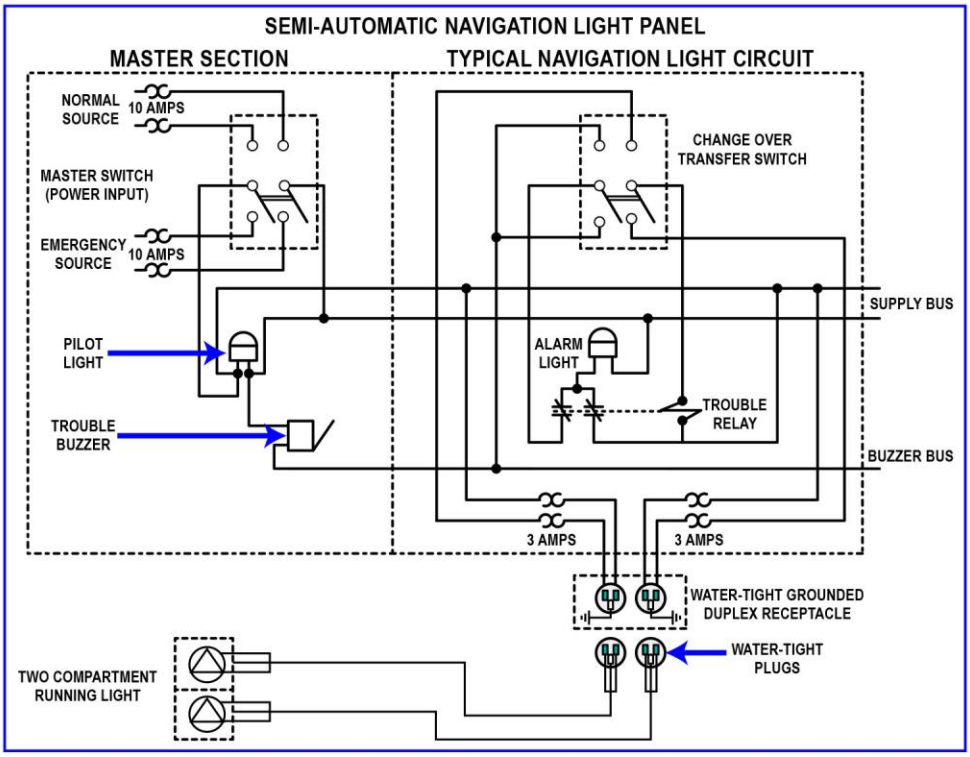

EL-0065

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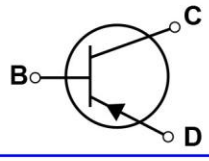

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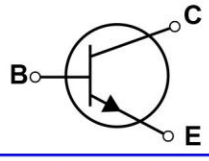

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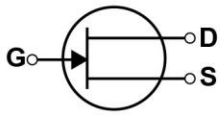

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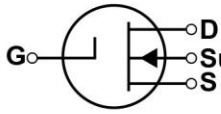

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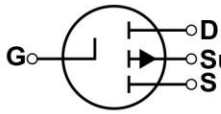

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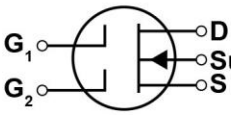

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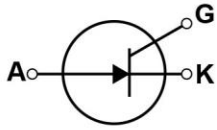

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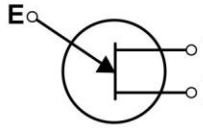

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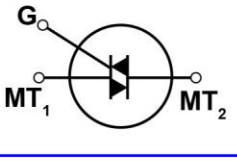

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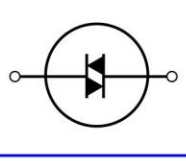

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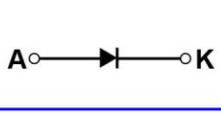

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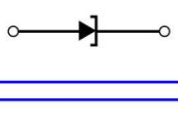

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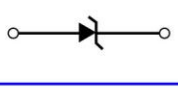

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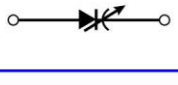

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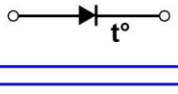

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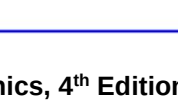
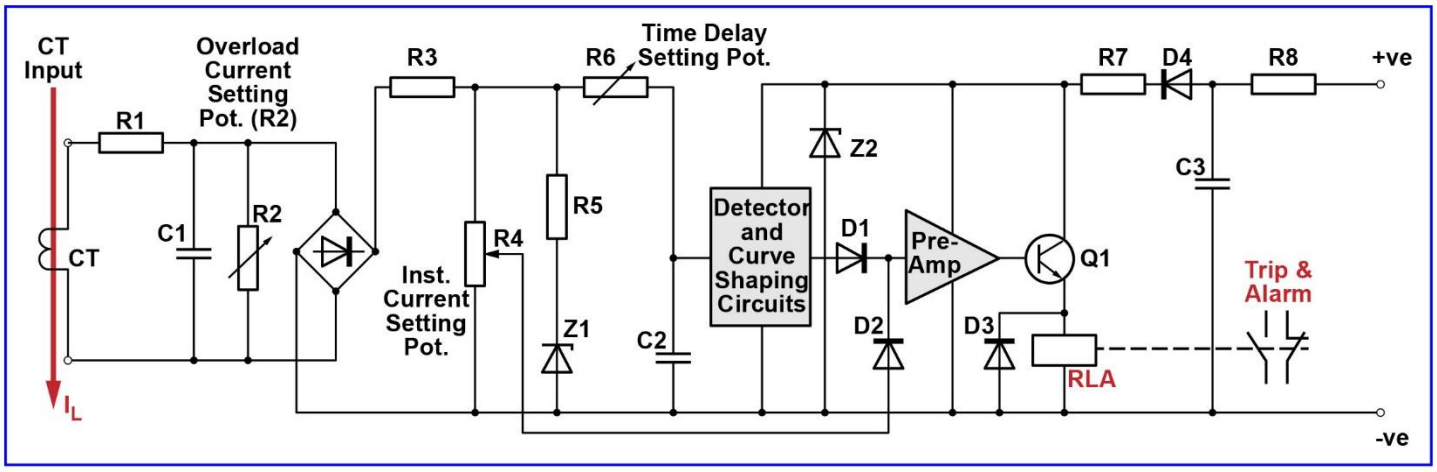


EL-0091



EL-0103

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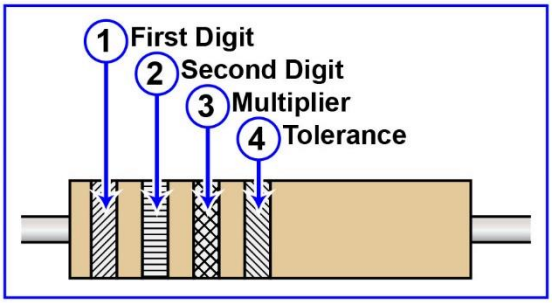
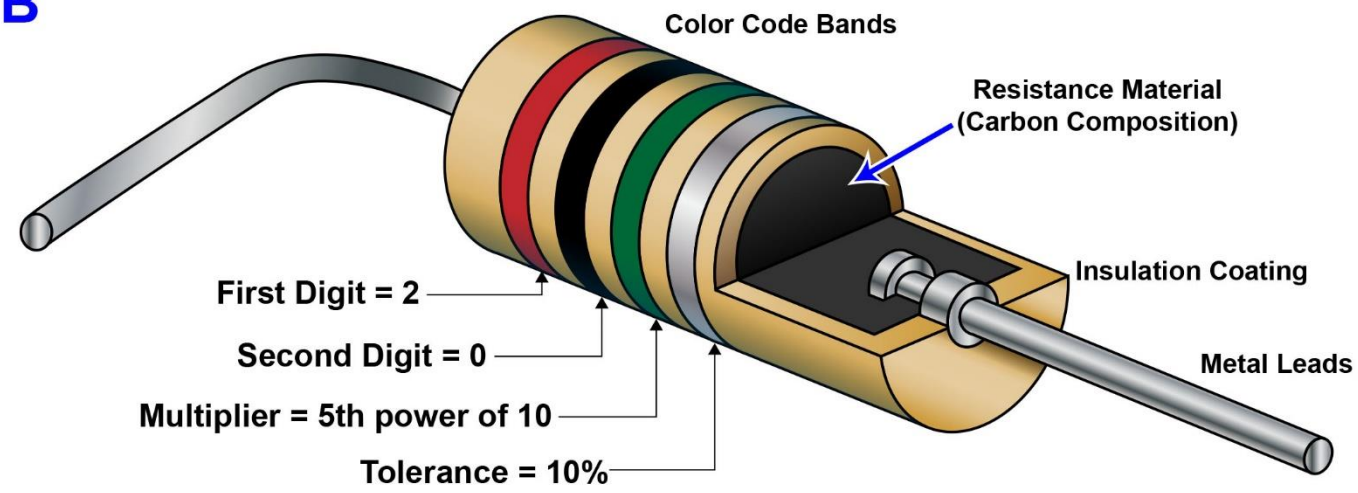


Color	1st Digit	2nd Digit	Multiplier	Tolerance (percent)
Black	0	0	1	
Brown	1	1	10	
Red	2	2	100	
Orange	3	3	1,000	
Yellow	4	4	10,000	
Green	5	5	100,000	
Blue	6	6	1,000,000	
Violet	7	7	10,000,000	
Gray	8	8	100,000,000	
White	9	9	1,000,000,000	
Gold			.1	5
Silver			.01	10
No Color				20

Resistors for military use may have a fifth band to indicate reliability in terms of failure rate as follows:

No Color:	No Test Made
Brown:	1.0 Percent Per 1000 Hours
Red:	0.1 Percent Per 1000 Hours
Orange:	0.01 Percent Per 1000 Hours
Yellow:	0.001 Percent Per 1000 Hours

B



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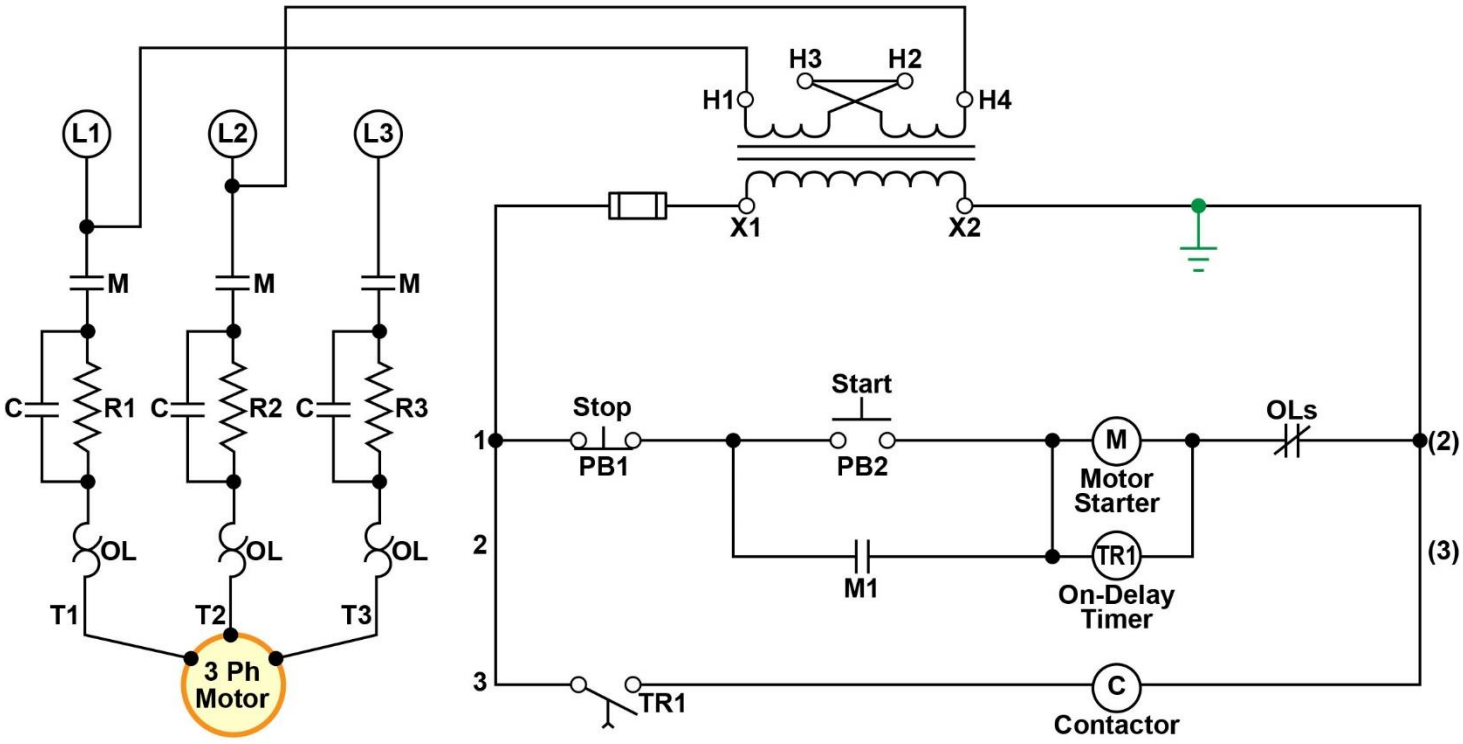
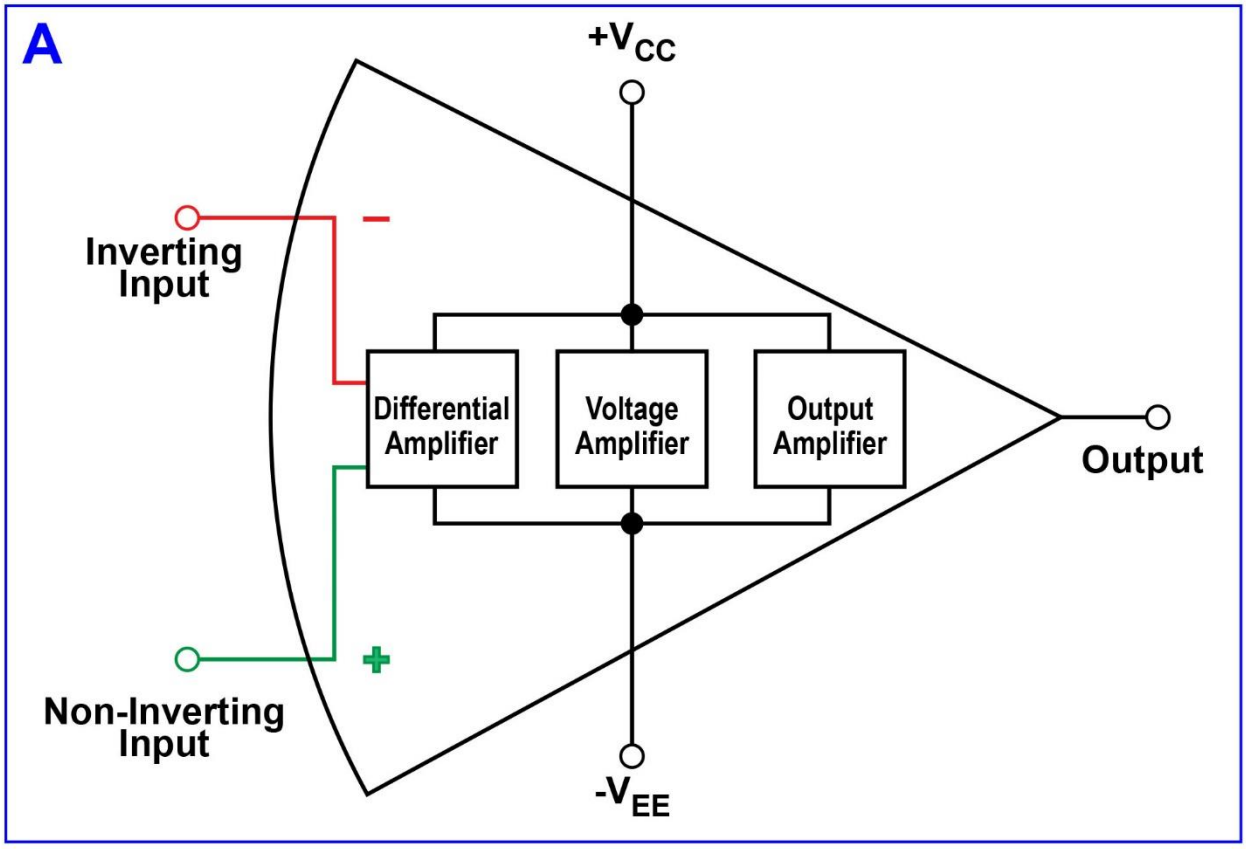
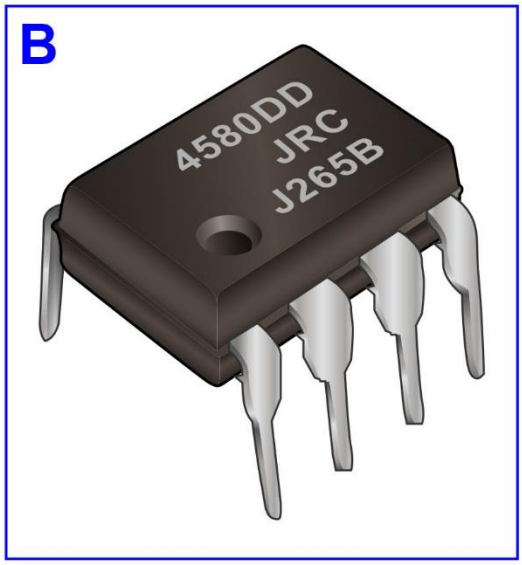
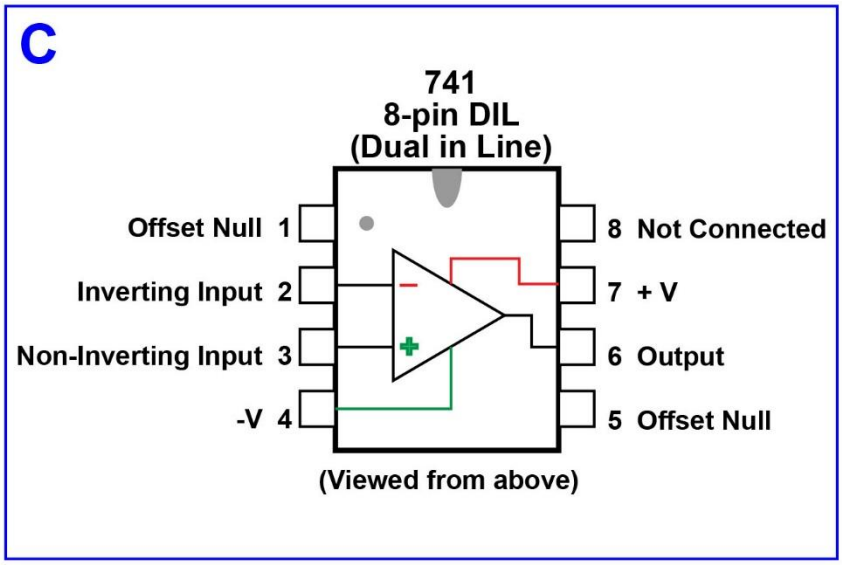


EL-0111

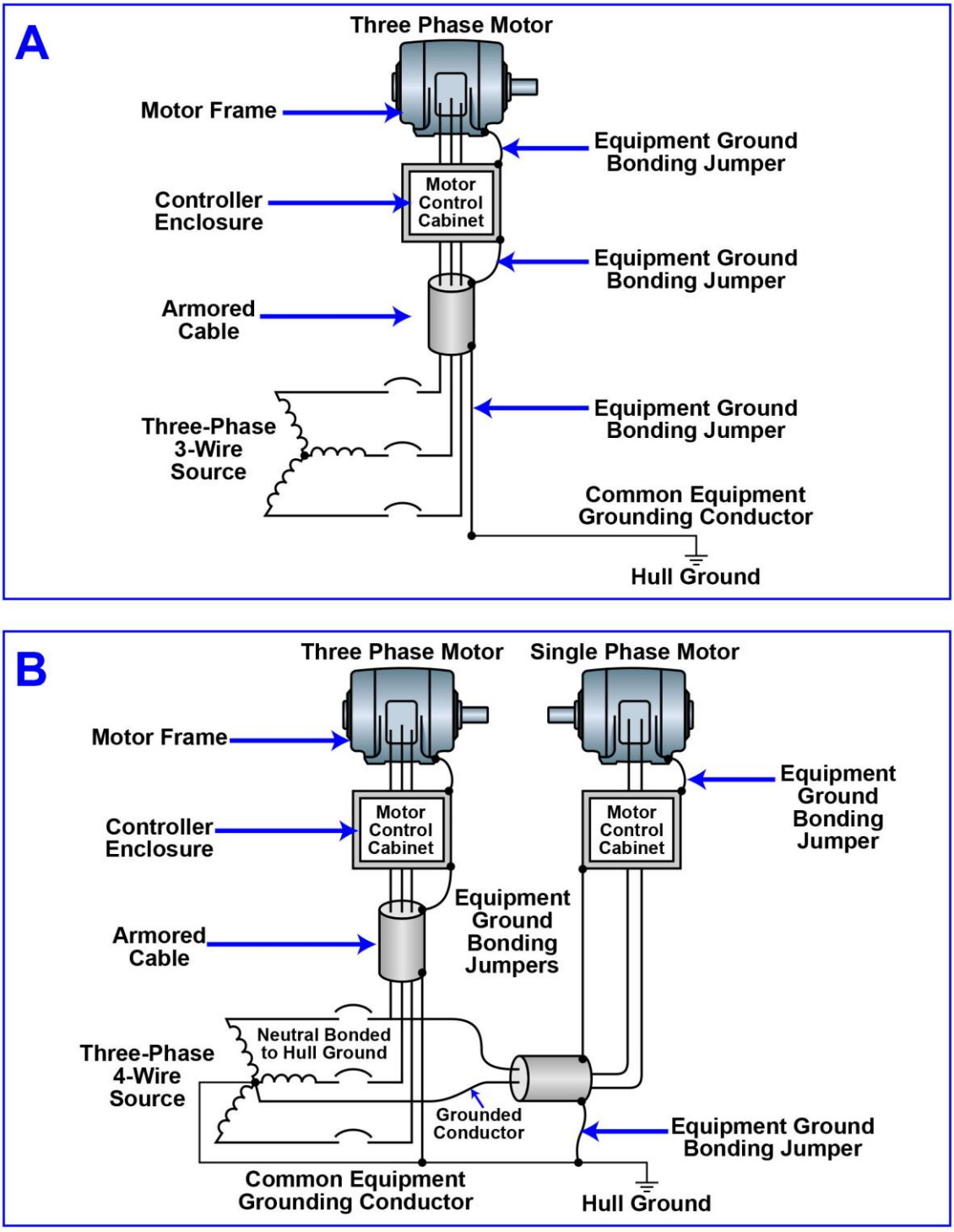






Adapted for testing purposes only from Introduction to Amplifiers,
Navy Electricity and Electronics Training Series, Module 8
NAVEDTRA 172-08-00-82

EL-0125



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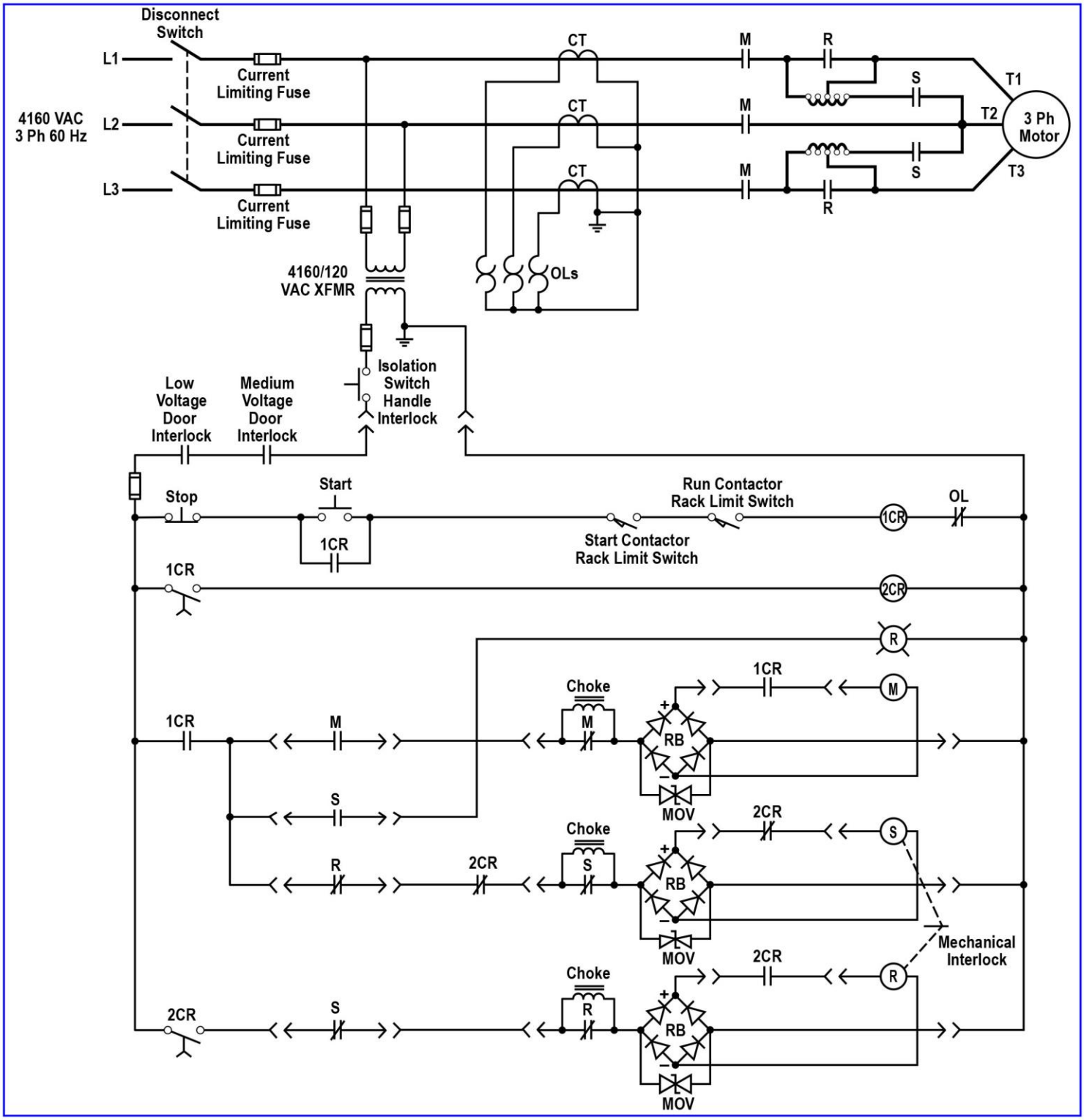

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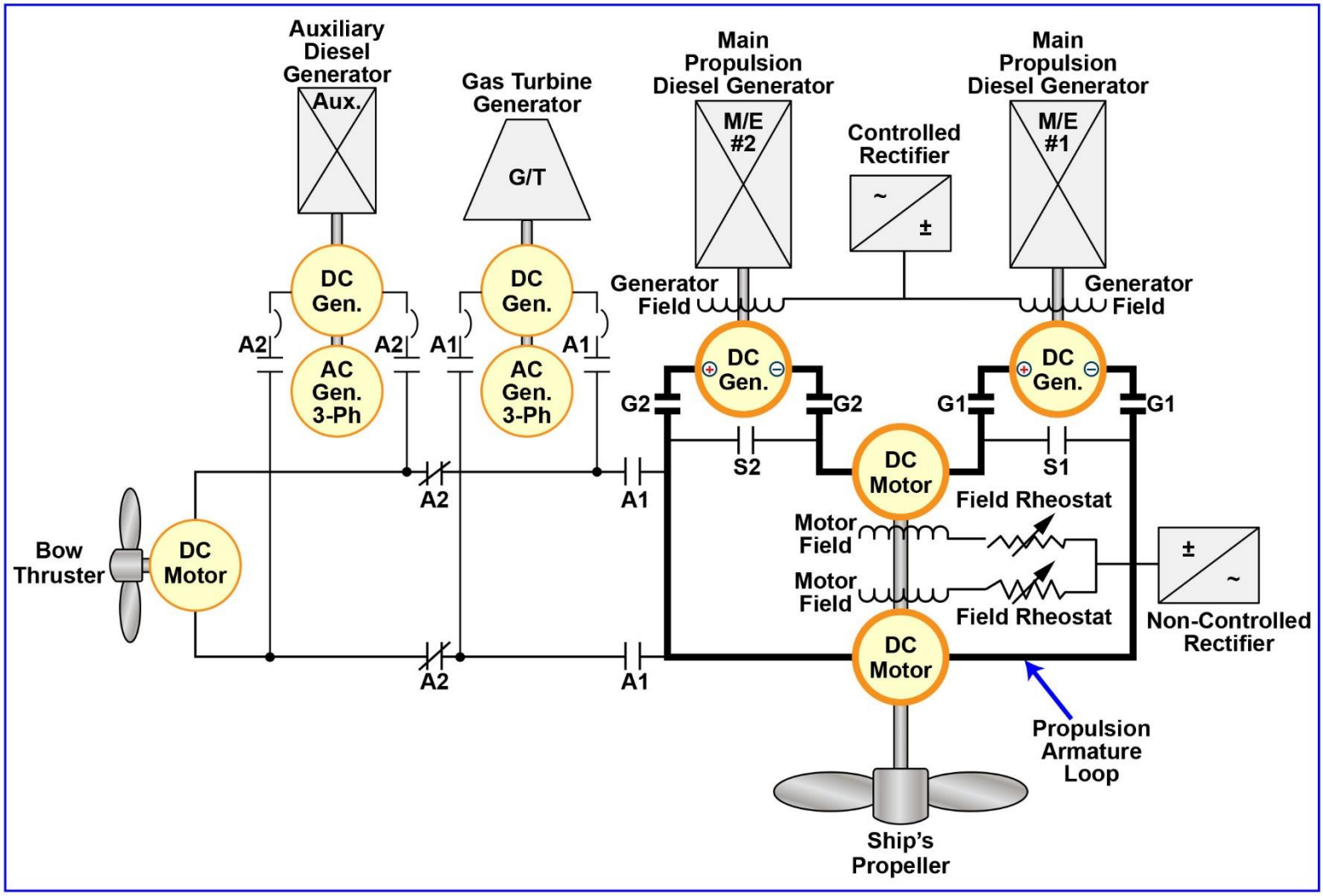

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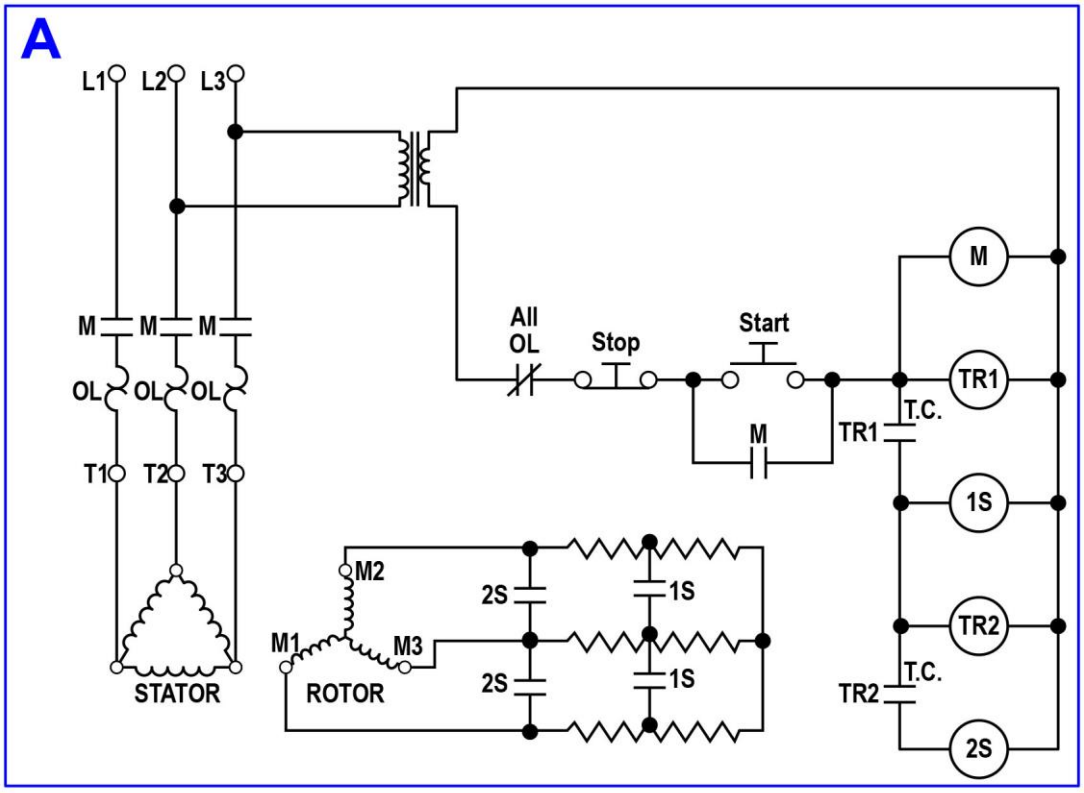

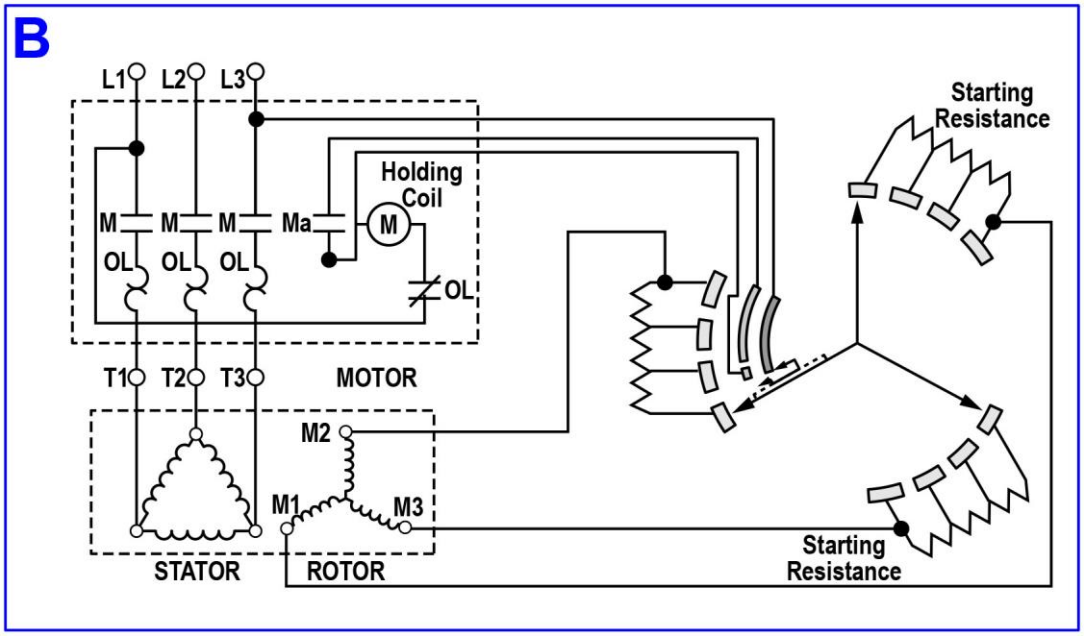

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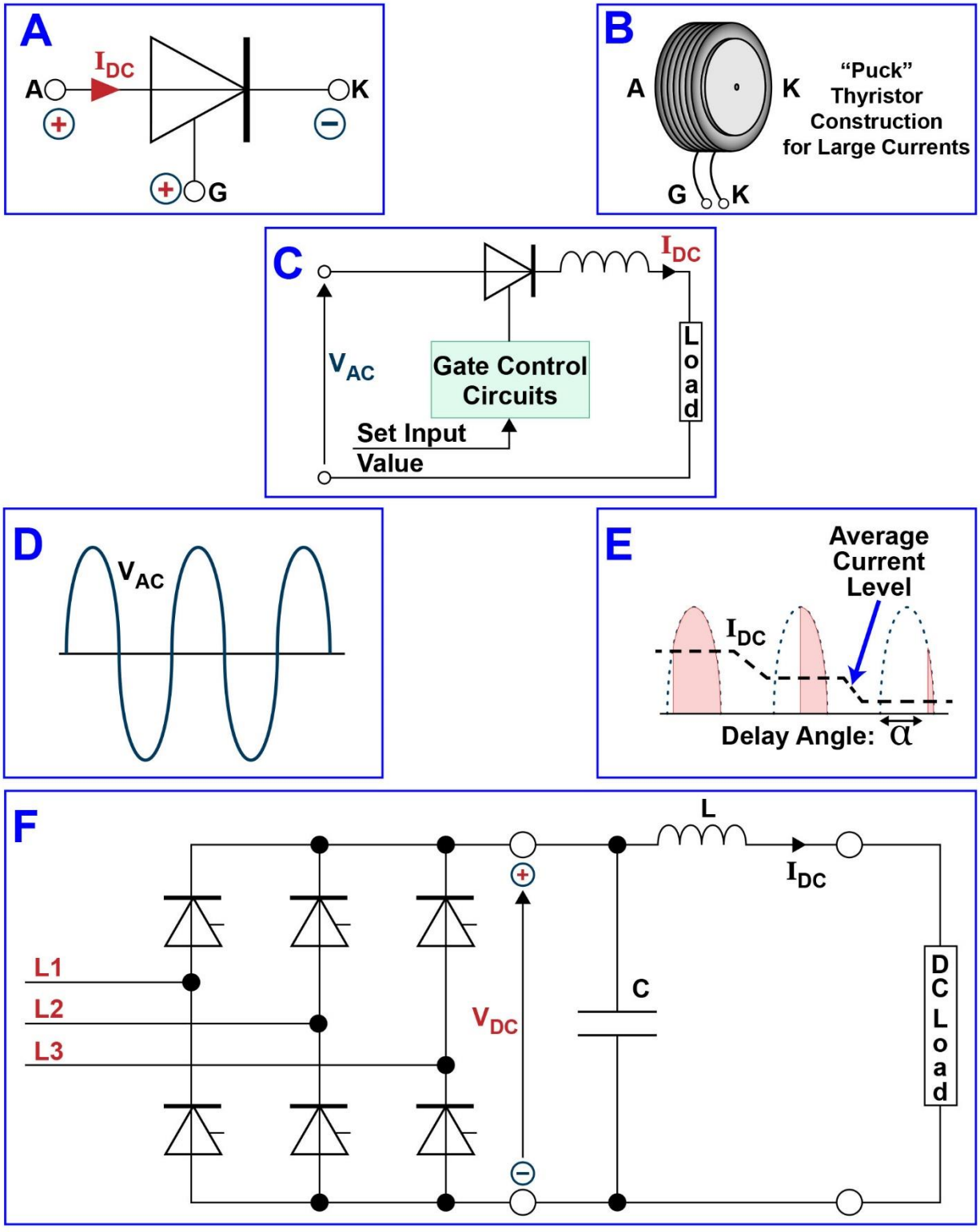

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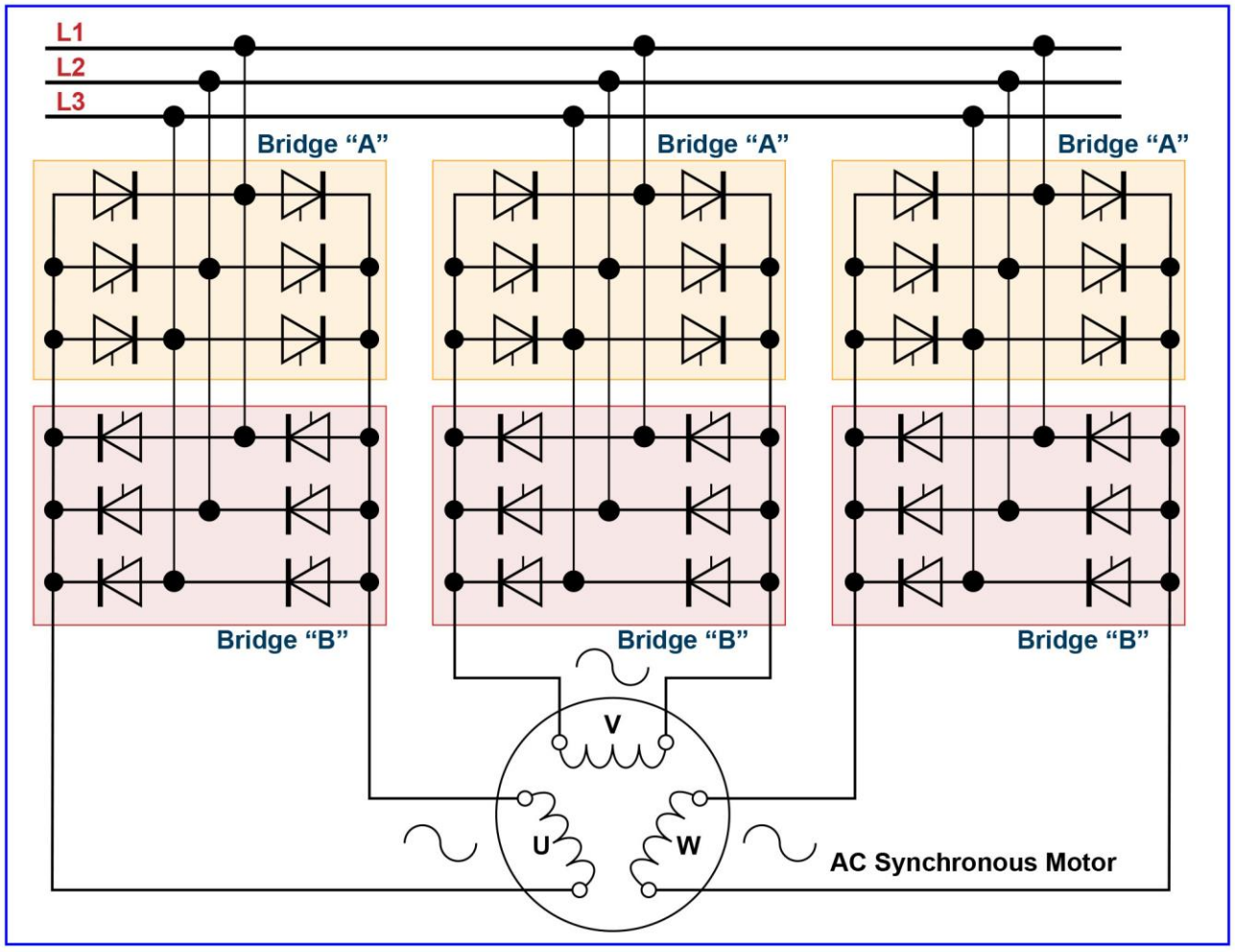

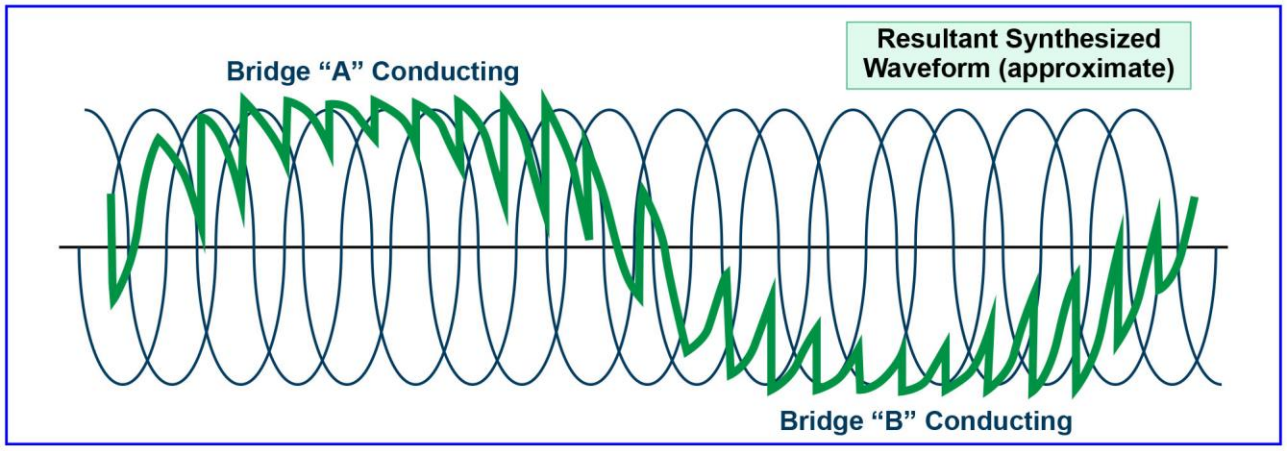

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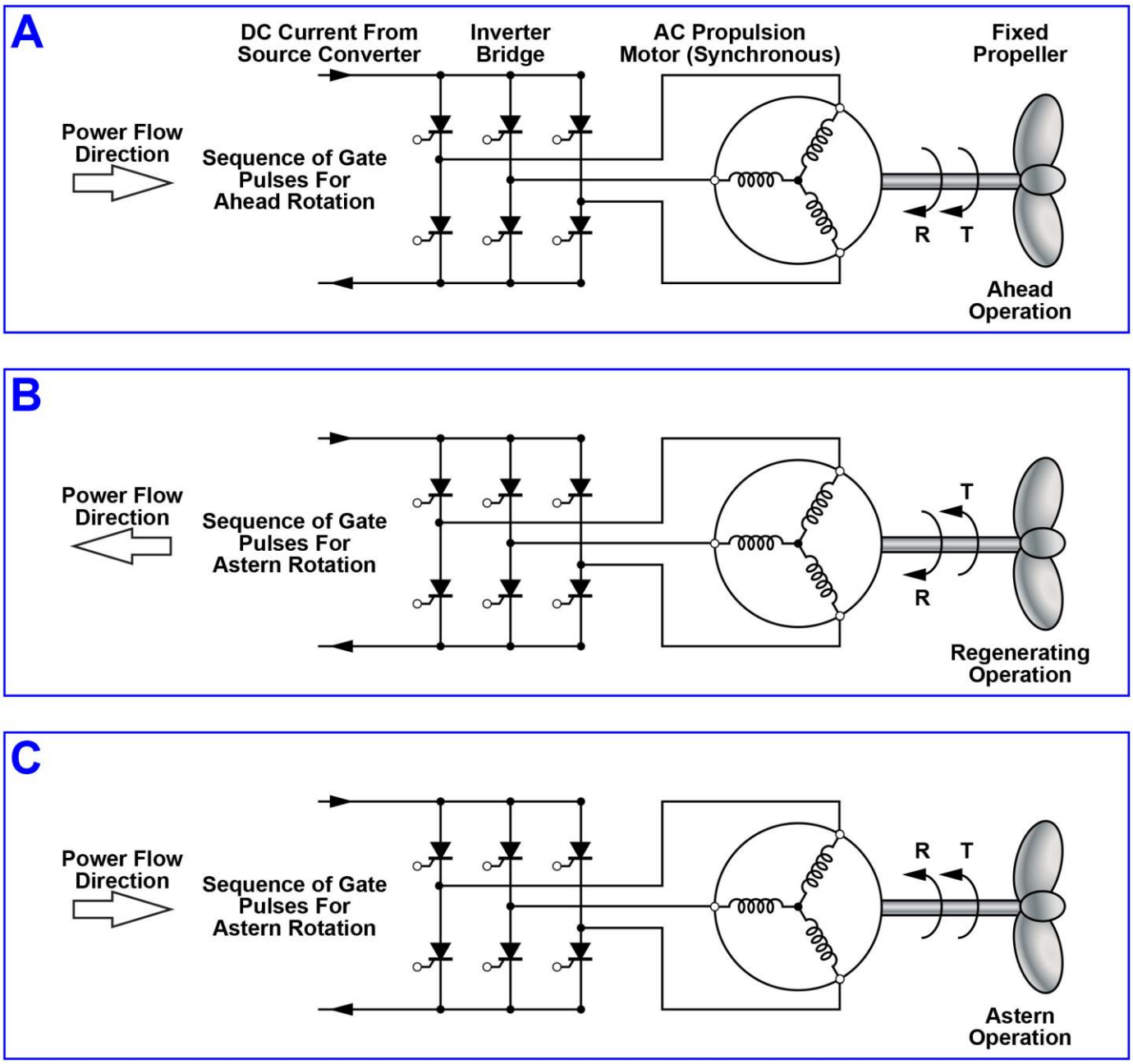
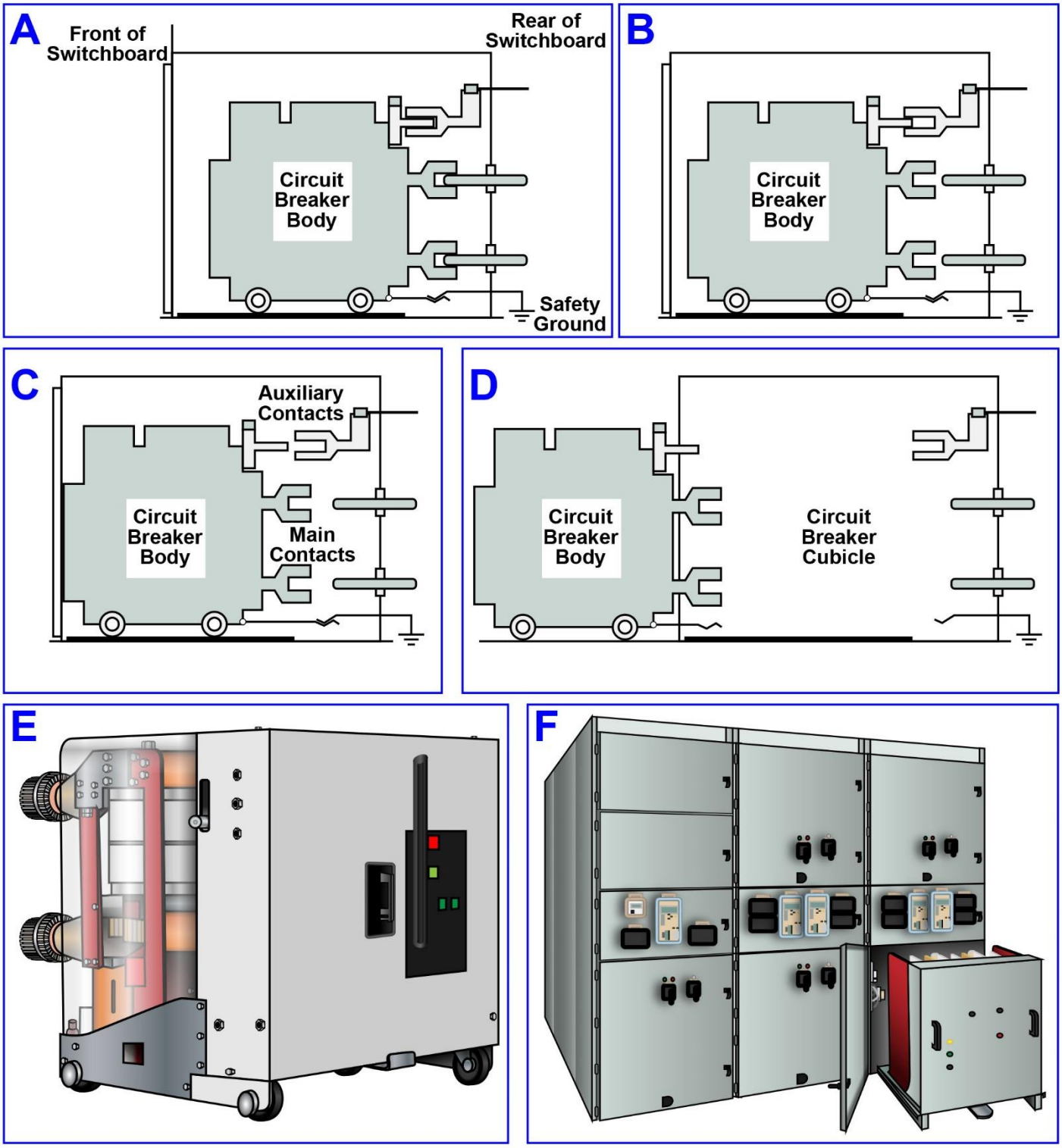
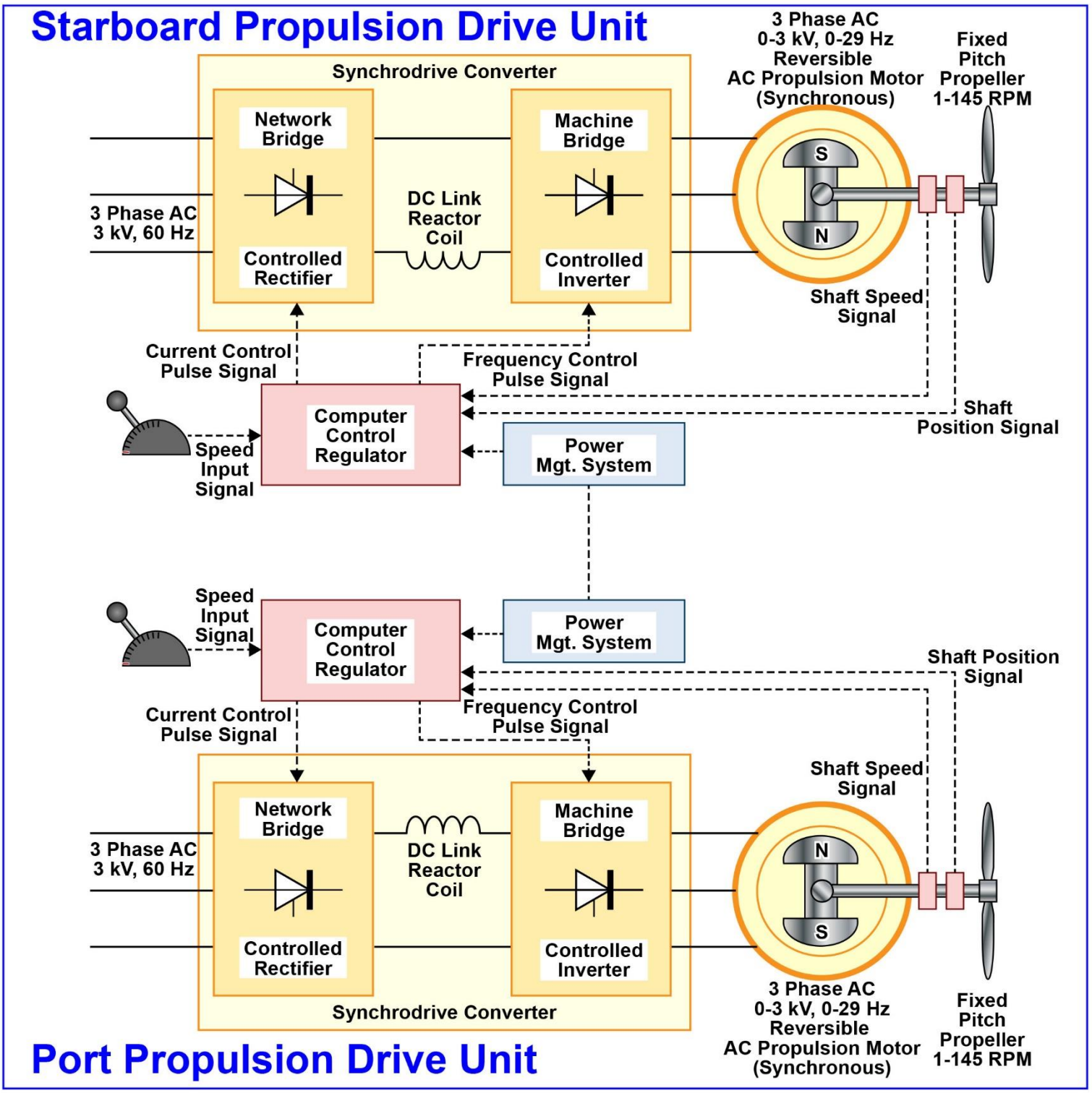


Where R = Direction of Actual Rotation
T = Direction of Applied Torque

EL-0167



EL-0168



EL-0180
Catalog Number Selection Chart

Example Catalog Number

A N 1 9 A N 0 A 5E 005

Device Type
A = Starter
C = Contactor

Standard
E = IEC
N = NEMA

Device Assembly Configurations
70 = Multi-speed
1 = Non-reversing
5 = Reversing

OLR Type
5 = Contactor only-no overload relay
6 = Starter w/C306 bi-metalic OLR
9 = Starter w/C440 electronic overload

Contactor Frame Size*

Suffix	NEMA Size	Continuous Amperes
A =	00	9
B =	0	18
D =	1	27
G =	2	45
K =	3	90
N =	4	135
S =	5	270
T =	6	540
U =	7	810
V =	8	1215

NEMA Enclosures
N = Open

For Starters
Starter Mounting Options
0 = Horizontal
V = Vertical

For Contactors Only
2 = Two-pole
3 = Three-pole
4 = Four-pole
5 = Five pole

C440 OLR Designation (FVNR and FVR only)
5E = Standard feature set
SEL Reset, SEL Class (10A, 10, 20, 30)
5G = Ground fault feature set
SEL Reset, SEL Class (10, 20)

AC Coil Suffix

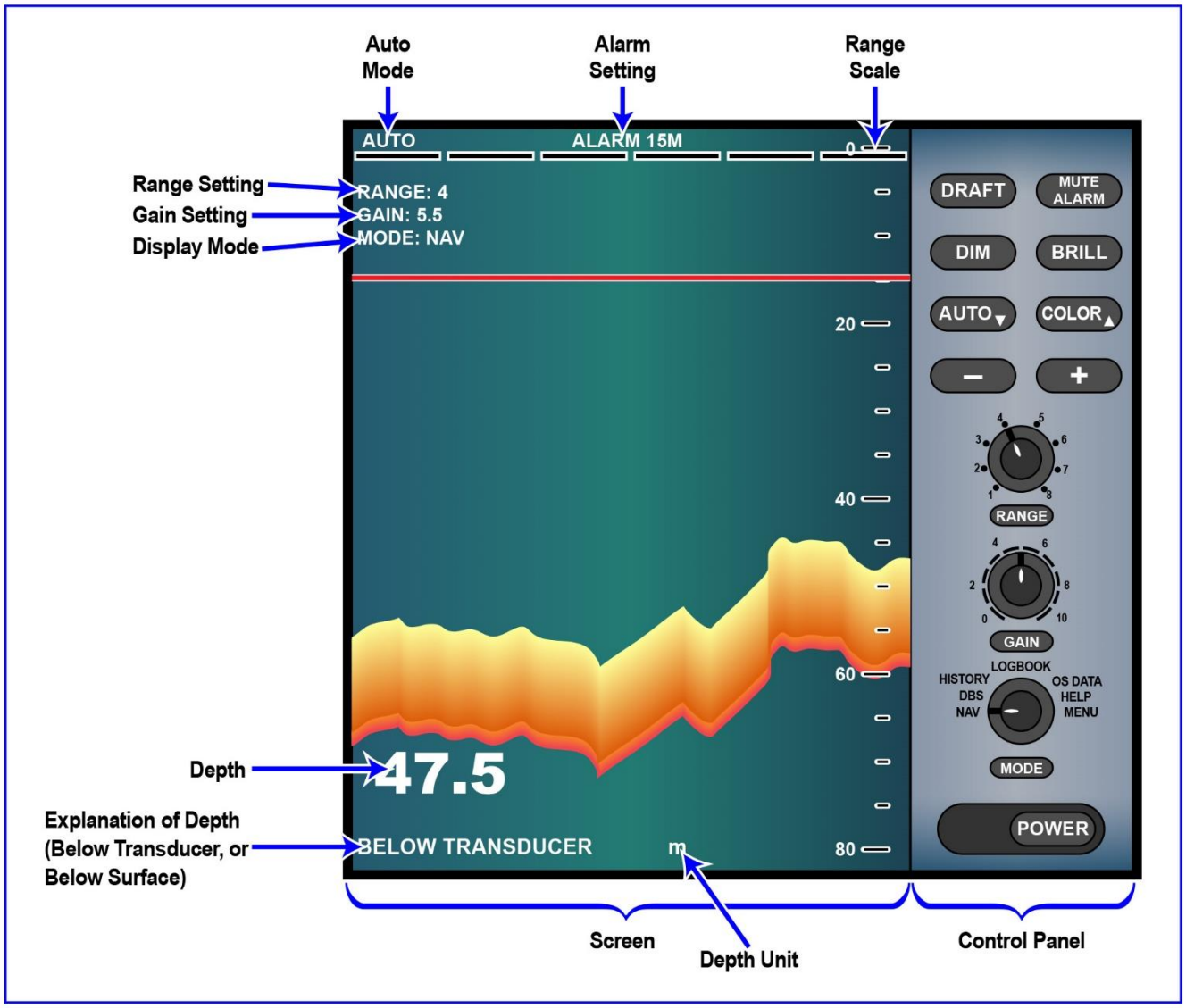
Suffix	Coil Volts and Hertz
A =	120/60 or 110/50
B =	240/60 or 220/50
C =	480/60 or 440/50
D =	600/60 or 550/50
E =	208/60
H =	277/60
J =	208-240/60 **
K =	240/50
L =	380-415/50
N =	550/50
T =	24/60, 24/50 ***
U =	24/50
V =	32/50
W =	48/60
Y =	48/50

C440 FLA Range (FVNR and FVR only)

NEMA Size 00
1P6 = 0.33 - 1.65A 005 = 1 - 5A 020 = 4 - 20A
NEMA Size 0
1P6 = 0.33 - 1.65A 005 = 1 - 5A 020 = 4 - 20A
NEMA Size 1
1P6 = 0.33 - 1.65A 005 = 1 - 5A 020 = 4 - 20A 045 = 9 - 45A
NEMA Size 2
005 = 1 - 5A 020 = 4 - 20A 045 = 9 - 45A
NEMA Size 3
100 = 20 - 100A ****
NEMA Size 4 **
300 = 60 - 300A ****
NEMA Size 5 **
300 = 60 - 300A ****

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 C440A2A 005SAX) with 60 - 300A CTs (ZEB-XCT300).

EL-0186



Echo Sounder Range vs. Pulse Length vs. PRF

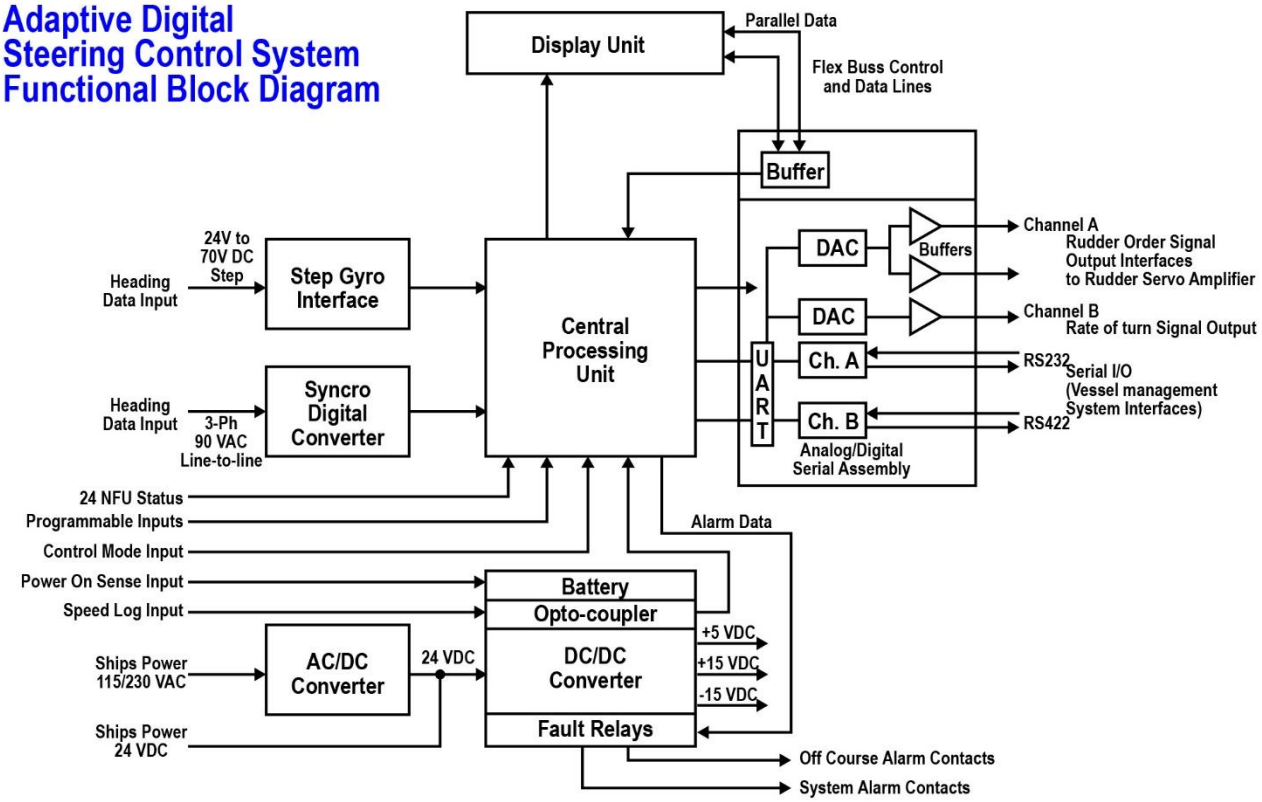
Depth (Meters)	Pulse Length (ms)	PRF (Pulses Per Minute)
5, 10 and 20	0.25	750
40	0.38	375
100	1.00	150
200	2.00	75
400 and 800	3.60	42

Sea Bed Consistency and Attenuation

Consistency	Attenuation (dB)
Soft mud	15
Mud / sand	9
Sand / mud	6
Sand	3
Stone / rock	1

EL-0191

Adaptive Digital Steering Control System Functional Block Diagram

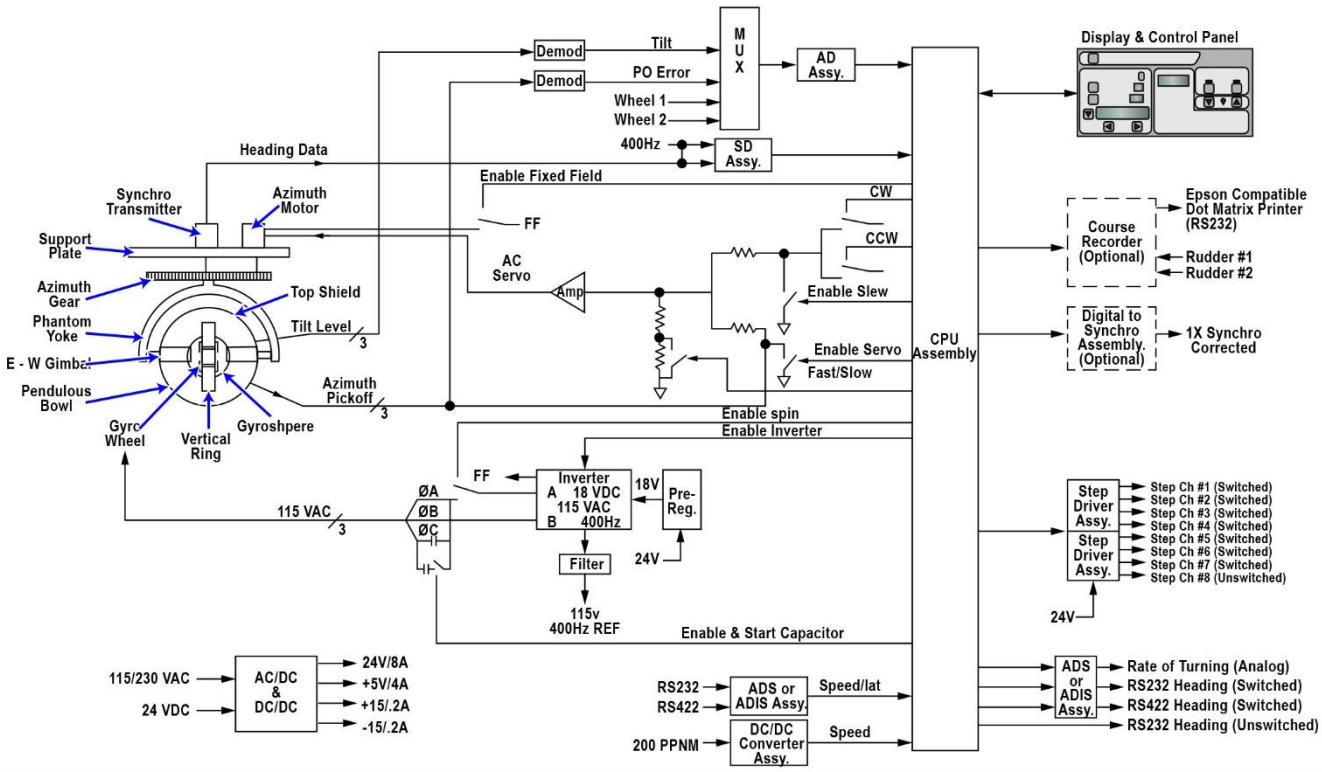


Adaptive Digital Steering System Interface Signals

Inputs	
Speed log input Pulsed Serial	 200 pulse nautical mile (PPNMI) format (contact closure) 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 Syncro	Positive or negative step data (24 or 70 V) 1X, 90X or 360X
Data Serial data	$HDT (on channels A, B or C)
Mode switch sense contact	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 ± 45° or rudder
Rate of turn interface	Bipolar analogue voltage proportional to a turn rate indicator. ± 4.5 V (Max) equal to ± 90° turn/min. Resolution equal to 0.5°/min.

EL-0194

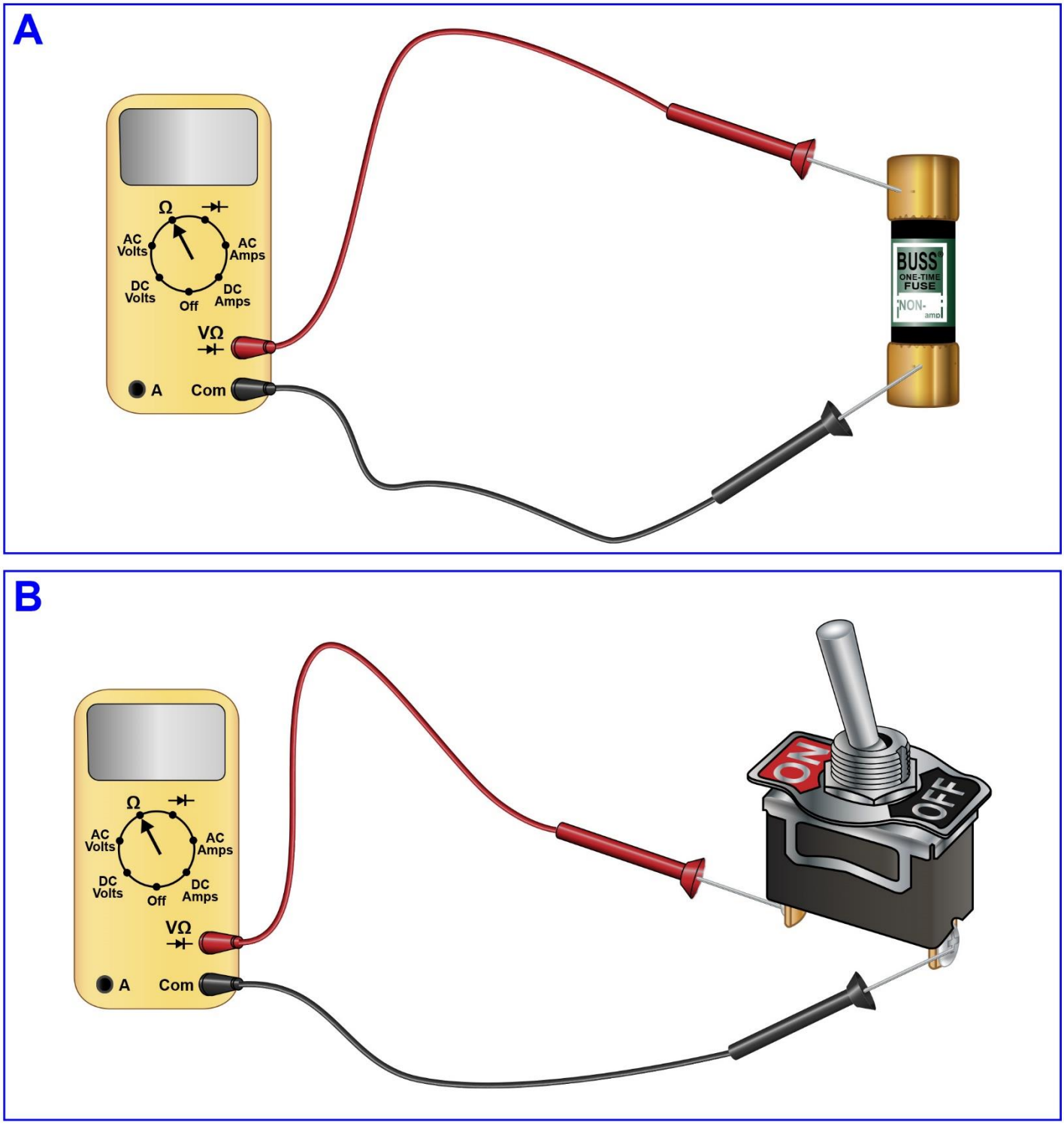
Digital Gyrocompass Functional Block Diagram



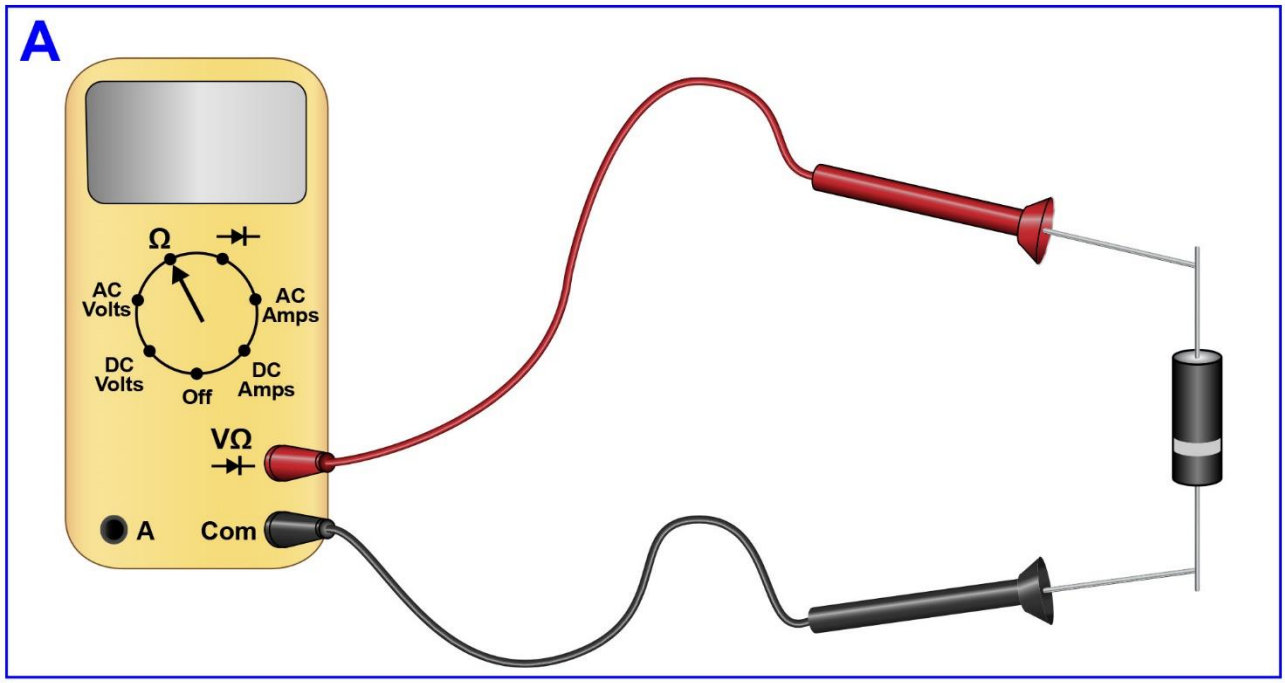
Digital Gyrocompass Communication Protocols

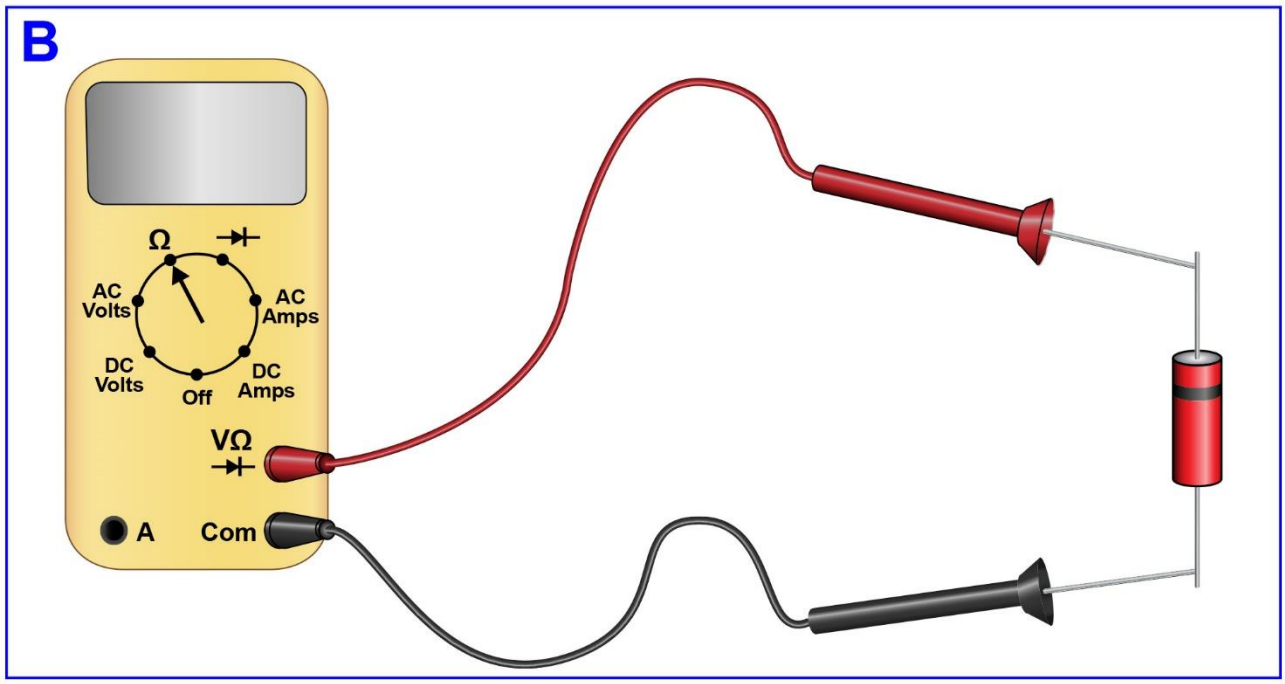
Inputs	
Speed: Pulsed Serial Manual	Automatic: 200 ppnm Automatic from digital sources, RS-232/422 in NMEA 0183 format $VBW, $VHW, $VTG Manually via the control panel
Latitude	Automatic from the GPS via RS-232/422 in NMEA format $GLL, $GGA Automatic from digital sources via RS-232/422 in NMEA 0183 format $GLL Manually via the control panel
Outputs	
Rate of Turn	50 mV per deg/min (± 4.5 VDC full scale = ± 90°/min) NMEA 0183 format $HEROT, X.XXXX, 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 $HEHDT, XXX.XXX, T*hh<CR><LF> Two RS-232, each capable of driving one load in NMEA 0183 format $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

EL-0210



EL-0211





EL-0214