Electrical Motor Controls

Chapter 5 (4th Edition)

Chapter 5 (5th Edition)

1. How many loads should be placed in any one circuit line between L1 and L2?
2. If more than one load is controlled by the same circuit how is the second load connected?
3. What is a load and where is it connected in the diagram?
4. Where are NC overload contacts typically placed?
5. Where are control devices placed on a line diagram?
6. How are two control devices connected in the circuit if either one is required to pass current to a device?
7. What is indicated by the numbers in parenthesis to the right of L2?
8. How is a NC contact indicated in the numbers to the right of L2?
9. What is the purpose of circling wire reference numbers?
10. What are two methods of indicating that contacts on different lines of the diagram belong to the same control switch?
11. What are the three basic sections of control circuits?
12. What devices are found in the signal section of a control circuit?
13. How is the decision determined in the decision section of a control circuit?
14. What is an example of an indirect action in the action section?
15. Which logic function is shown when three NO pushbuttons are connected in series to control a load?
16. Which logic function is shown when three NO pushbuttons are connected in parallel to control a load?
17. What are three logic functions that utilize NC contacts?
18. Where are “Memory” contacts connected into a pushbutton circuit?
19. What logic function is provided by a NC stop pushbutton in a motor circuit?

20. What logic function is used for multiple stop pushbuttons?

21. What logic function is used for multiple start pushbuttons?

22. What is the meaning of the term “Cascade Control” or “Sequence Control”?

23. Which part of a control circuit is disabled when a selector switch is set to jog instead of run?

24. What is the “Tie-down” method of troubleshooting a control circuit?

25. What is the voltage across the terminals of a good switch that is open?

26. What is the voltage across the terminals of a good switch that is closed?

27. What precaution must be taken before testing a circuit using a continuity tester?

28. What is a “short circuit” or “dead short”?

29. What are some indications of the source of a short circuit?

Chapter 14 (4th Edition)

Chapter 16 (5th Edition)

1. What are the four major categories of timers?

2. What is a programmable logic relay?

3. How is the travel time of the piston adjusted with a dashpot timer?

4. Which timer would be affected most by temperature? (Think about it)

5. Why are synchronous clock motors accurate?

6. What are some advantages of solid-state timers?

7. What is a retentive timer?

8. What happens to preset values in a non retentive timer when there is a power failure?

9. What is the term used to describe the amount of time a timer counts before performing an action?

10. What are the three things that must be programmed into a PLR timer?
11. What are some of the modes for a PLR timer?
12. What is the value of a preset of 743 with a time base of .1 sec?
13. What is the value of a preset of 298 with a time base of .01 sec?
14. What is the value of a preset of 1298 with a time base of .001 sec?
15. What is the 12 hour clock equivalent of 21:00 hours on the 24 hour clock?
16. What is the 12 hour clock equivalent of 16:00 hours on the 24 hour clock?
17. What are the three standard timer instructions used with PLCs?
18. Which timer has a preset time period that must pass after it is energized before any action occurs on the timer contacts?
19. Which timer has starts a timing function when the power is removed from the timer?
20. Which type of timer would be used to make sure a projector bulb is cooled after use before the fan stops?
21. Which type of timer has contacts that change immediately when energized and remain changed for a set period of time before returning to the original position?
22. Which type of timer opens and closes repeatedly once the timer receives power until the power is removed?
23. What is an asymmetrical recycle timer?
24. How are multi-function timers typically programmed for different functions?
25. What feature of the newer solid-state switches allows for a great deal more flexibility?
26. What is the main disadvantage of supply-voltage controlled timers?
27. Where is the voltage supply for the control switch circuit in a contact-controlled timer?
28. What is the typical voltage rating of the control circuit in a contact-controlled timer?
29. What precaution must be taken when connecting wires to a contact-controlled timer?
30. Which timer is typically used with proximity sensors and photoelectric sensors?
31. Loads connected to a multiple contact timer may utilize both the immediate and delayed contacts of the timer?
32. What is typically the best timer where circuits don’t change function or time range?
33. Which timer would be used to monitor a patient's breathing and sound an alarm if he stopped for a period of time?

34. How could an off-delay timer be used in an emergency shower?

35. What timer would be used to apply heat to an item for a set period of time when it moves into an area?

36. Which timer would be used to mix a batch of product for 2 minutes in every 20?

37. What are the four steps to troubleshooting timing circuits?

38. What is the term used to describe a counter that displays a number but does not initiate an action?

39. What are the two types of counters?

40. How is a counter with only one input reset?

41. What is one application of an up/down counter?

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Chapters 8 & 25 (5th Edition)

1. What is the maximum load controlled by most relays?

2. Which electronic component most closely resembles a relay?

3. What is an electromechanical relay?

4. What is a solid-state relay (SSR)?

5. What are the three types of EMRs?

6. What is the term used to describe a hermetically sealed, single-pole, single-throw, switch with NO contacts?

7. What is the typical amperage rating of a reed switch?

8. Why is DC typically used for the magnetism of a reed switch circuit?

9. In a bias arrangement for a reed switch how many magnets are required?
10. What are some advantages of a general-purpose relay?

11. What is the typical voltage rating for general-purpose relays?

12. What is the most common form for general-purpose relays? What contacts are found on this type?

13. What type of switch is a 3PDT-DB?

14. What is the main difference between general-purpose and machine control relays?

15. What are some other names for machine-control relays?

16. What are some of the accessories that may be added to machine-control relays?

17. What is the typical contact life for EMRs?

18. What is the typical mechanical life of EMRs?

19. Which loads when switched shorten the contact life?

20. What are three types of contact protection circuits?

21. What metal is the best conductor of electricity?

22. How is sulfidation minimized with silver contacts?

23. Where are gold-flashed silver contacts used?

24. Where are tungsten contacts used?

25. Why does switching incandescent lamps require relay contacts rated higher than the wattage of the lamp?

“Go to Chapter 25 if 5th Edition!”

26. What are some reasons for industrial control markets moving to solid-state relays?

27. Which solid-state relay turns a load on or off as the current crosses the horizontal axis?

28. Which SSR switching method turns a load on when the control voltage is present at any point in the sine wave and turns it off when the load current crosses the horizontal axis?

29. Why is peak switching preferred when voltage and current are around 90° out of phase?

30. Which SSR switching method is best suited to switching transformers and large motors?

31. Which SSR switching method starts the load voltage at a low level and increases over a period of time?
32. Which SSR switching methods turn off when the control voltage is removed and the current in the load crosses zero?

33. What are the three parts of a SSR circuit?

34. What is the typical input voltage range for a SSR?

35. Which circuit of an SSR determines when the output is energized or de-energized?

36. What type of SSR output is typically used to switch high current DC loads?

37. What type of SSR output is typically used to switch low current DC loads?

38. What type of SSR output is typically used to switch high current AC loads?

39. What type of SSR output is typically used to switch low current AC loads?

40. What electronic device is used to switch a load with a momentary pushbutton when “Memory” is required after the pushbutton is released?

41. How is the gate current limited when using an SCR in the control circuit of an SSR?

42. Where is the pushbutton connected into the control circuit when simulating a NC contact for a SSR?

43. How is a three-phase load controlled when a multi-contact SSR is not available?

44. How does temperature affect fail rates in SSRs?

45. What is the term used to describe the ability of a device to impede the flow of heat?

46. What is the relationship between ability to dissipate and the thermal resistance number?

47. What material has the highest thermal conductivity?

48. What material has good thermal conductivity and is the most cost effective?

49. How is maximum heat transfer ensured between the heat sink and the solid-state device?

50. How are SSRs typically protected from overcurrent damage?

51. What device is used to protect SSR output circuits from transient voltage spikes?

52. What determines how much heat is produced in a SSR?

53. How much power in watts is generated when 15 A current is flowing through a SSR relay with a 2 V drop?

54. Which type of relay would typically have a longer life?
55. How do EMRs and SSRs compare for response time?

56. What types of device are sometimes affected by leakage current through an SSR?

**Skip to “Troubleshooting Relays” on Page 460 (4th Edition)**

57. What is the first check for electromechanical relays?

58. What is the proper voltage across the contacts of an EMR when they are open?

59. What is the proper voltage across the contacts of an EMR when they are closed?

60. What is evidence of problems with contacts?

61. What precaution should be taken when manually operating a relay to test?

62. Which circuit is bypassed when you manually operate a relay?

63. What is the cause of a reading of system voltage across a contact of a relay when it is energized or not?

64. What is the cause of a reading of 0 Volts across a contact of a relay when it is energized or not?

65. What has been determined when a reading of 3 V is present across the control relay contacts in an EMR?

66. What are the two methods of troubleshooting SSRs?

67. What are the three improper relay operations?

68. What are some of the more common causes of a SSR not turning load off?

69. Current drawn by the load should be a maximum of what percentage of the SSR rating?

70. What are the most likely causes of an SSR failing and not turning a load on?

71. What is the most likely problem if a SSR input voltage is good and the output voltage is not?

72. What are the three types of mechanical problems that can cause a SSR to operate erratically?

73. Why should control circuit wires be isolated from input or output circuit wires?