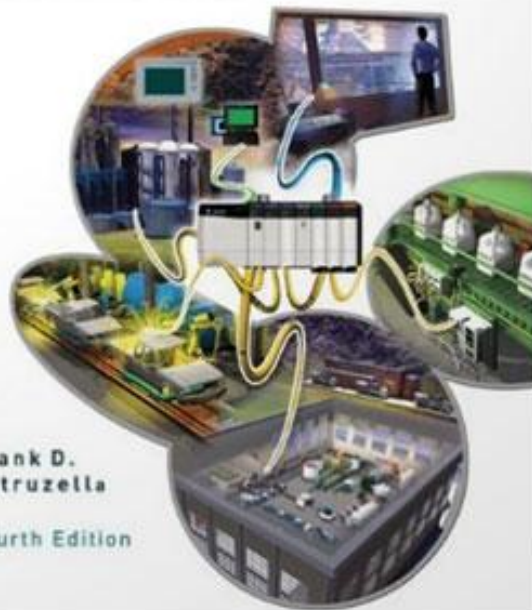


SOLUTIONS MANUAL

PROGRAMMABLE LOGIC CONTROLLERS



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Answers to Chapter 2 Review Questions

1. To accept signals from the machine or process devices and to convert them into signals that can be used by the controller
2. To convert controller signals into external signals that are used to control the machine or process
3. An I/O addressing unit that uses 8 words in the input image table and 8 words in the output image table
4. a) A rack that is located away from the processor module near the field devices
b) To minimize the amount of wiring required
5. By its address
6. Type refers to an input or output
Slot refers to the physical location of the I/O module
Word and bit refers to the actual module terminal connection
7. Bit level addressing specifies a discrete device that is connected to a specific terminal. Word level addressing specifies an analog device connected to a module that uses a word of information.
8. In tag-based addressing you use a tag (alphanumeric name) to address data (variables). In rack/slot-based addressing a fixed numeric format is used to identify the address data.
9. An input/output PC interface card
10. Combination I/O modules
11. Connections for the power supply
12. For ease of wiring and replacing modules
13. The advantage with the high-density module is that it is possible to install up to 64 inputs or outputs in one slot for greater space savings. The disadvantage is that the high-density output modules cannot handle as much current per output.
14. ON/OFF devices such as selector switches, pushbuttons and limit switches
15. ON/OFF devices such as lights, solenoids and motor starters
16. The backplane supplies current and voltage for the modules from the power supply

17. An optical isolator is used to provide electrical isolation between the field wiring and the PLC backplane internal circuitry.
18. Power and Logic sections
19. Senses when a signal is received
 - Converts the input signal to the correct voltage level
 - Isolates the PLC from the input voltage or current
 - Sends a signal to the processor indicating which sensor originated the signal
20. Triac
21. a) 1 amp per point
 - b) A control relay is connected to the output module. The contacts of the control relay are then used to control the larger load.
22. Transistor
23. A discrete relay-type module uses an electromechanical relay element for switching which allow it to work for AC or DC applications.
24. a) Sinking and sourcing are terms used to describe a current signal flow relationship between field input and output devices in a control system and their power supply.
 - b) Sourcing
25. Discrete I/O modules allow only ON/OFF devices to be connected. Analog I/O modules allow analog or varying voltage or current devices to be connected.
26. Used to convert analog signals to an equivalent digital value
27. Used to convert digital signals to an equivalent analog value
28. Voltage sensing and current sensing
29. Temperature, speed, level, flow, weight, pressure, and position
30. A twisted shielded pair cable is used in wiring the circuit to reduce unwanted electrical noise signals that can be induced in the conductors from other wiring
31. Unipolar modules can accept an input signal that varies in the positive direction only. Bipolar signals swing between a maximum negative value and a maximum positive value.
32. The analog input channel is capable of sensing voltages down to 0.3V increments.

33. The loop power may be supplied by the sensor or may be provided by the analog output module
34. Control valves, chart recorder, electronic drives
35. a) Used to count pulses such as motor encoders that occur at very high speeds
b) Allows the use of thumbwheel switches for feeding information to a PLC
c) Allows the transmitting and receiving of TTL signals for communication with the PLC's processor
d) Used to monitor the output of incremental or absolute encoders
e) Allows the transmitting and receiving of ASCII files
f) Provides pulse trains to a stepper-motor translator, which enables control of a stepper motor
g) Enables a PLC to operate devices that require BCD-coded signals
36. a) Used to maintain a process variable such as temperature, flow, level, or speed within set limits of a specified set point.
b) Used in applications involving accurate high-speed machining and packaging operations
c) Used to establish point-to-point connections with other intelligent devices for the exchange of data
37. a) Specifies the magnitude and type of voltage signal that will be accepted by the input
b) Specifies a minimum ON-state voltage that is the minimum voltage at which logic 1 is recognized as absolutely ON; and a maximum OFF-state voltage which is the voltage at which logic 0 is recognized as absolutely OFF
c) Specifies the minimum input current that the input devices must be capable of driving to operate the input circuit
d) Specifies what the maximum temperature of the air surrounding the I/O modules should be for best operating conditions
e) Specifies the maximum time duration required by an input module's circuitry to recognize that a field device has switched ON (input ON-delay) or switched OFF (input OFF-delay)
f) Specifies the magnitude and type of user supply voltage at which a discrete output module is designed to operate
g) Specifies the maximum current that a single output and the module as a whole can safely carry under load (at rated voltage)
h) Specifies the maximum inrush current and duration for which an output circuit can exceed its maximum continuous current rating
i) This specification will designate whether the particular module's design has individual protection for each circuit or if fuse protection is provided for groups (e.g. 4 or 8) of outputs
j) Specifies the amount of current still conducting through an output circuit even after the output has been turned off
k) Rates the module's capacity for sustaining an excessive voltage at its input or output terminal
l) This specification defines the number of field inputs or outputs that can be connected to a single module

- m) This value indicates the amount of current the module requires from the backplane
38. a) Specifies the number of analog channels that can be connected to the module
- b) The voltage or current signal ranges that an analog input module is designed to accept
 - c) This specification defines the current or voltage signal ranges that a particular analog output module is designed to output under program control
 - d) Analog input circuits are usually protected against accidentally connecting a voltage that exceeds the specified input voltage range
 - e) This specification determines the smallest measurable unit of current or voltage the module can measure
 - f) For analog I/Os, these values must be matched to the external device connected to the module
 - g) Refers to an analog module's ability to prevent noise from interfering with data integrity on a single channel and from channel to channel on the module
39. The CPU section executes the program and makes the decisions needed by the PLC to operate and communicate with other modules. The memory section electronically stores the PLC program along with other retrievable digital information
40. a) The power supply converts 115 VAC or 230 VAC into the usable DC voltage required by the CPU, memory, and I/O electronic circuitry
- b) the length of time a PLC can tolerate a power loss
41. Allows transfer of control to the second processor in the event of a processor fault
42. Run mode, program mode, and remote mode
43. Timing, counting, latching, comparing, motion control and complex math functions
44. Ground yourself by touching a conductive surface before handling static-sensitive components
- Wear a wrist strap that provides a path to bleed off any charge that may build up during work
 - Be careful not to touch the backplane connector or connector pins of the PLC system (always handle the circuit cards by the edge if possible)
 - Be careful not to touch other circuit components in a module when you configure or replace its internal components
 - When not in use, store modules in its static-shield bag.
45. a) Data are stored in memory locations by a process called *writing*
- b) Data are retrieved from memory by what is referred to as *reading*
 - c) Individual piece of memory in the form of 1's or 0's
 - d) Memory *location* refers to an address in the CPU's memory where a binary word can be stored
 - e) Memory *utilization* refers to the number of memory locations required to store each type of instruction

- 46. a) The status of all input and output devices
 - b) 1
 - c) 0
 - d) 1
 - e) 0

- 47. To be sure that the PLC memory has not been corrupted

- 48. Volatile: Loses all its stored information if all operating power is lost or removed. Memory is easily altered and usually supported by a battery backup power supply
Nonvolatile: Retains stored information when the power is accidentally or intentionally removed. Memory is generally unalterable.

- 49. ROM is normally used to store the programs and data that define the capabilities of the PLC.

- 50. RAM is used as a temporary storage area of data that may need to be quickly changed

- 51. An EEPROM memory module is used to store, back up, or transfer PLC programs

- 52. They are extremely fast at saving and retrieving files

- 53. Allows the user to enter, change or monitor a PLC program

- 54. Handheld programmers are compact, inexpensive, and easy to use but they have limited display capabilities.

- 55. Appropriate programming software

- 56. Typical capabilities of the programming software include on-line and off-line program editing, on-line program monitoring, program documentation, diagnosing malfunctions in the PLC and troubleshooting the controlled system

- 57. One

- 58. Replace hard-wired pushbuttons and pilot lights with realistic-looking icons
Show operations in graphic format
Allow the operator to change timer and counter presets
Show alarms, complete with time of occurrence and locations
Display variables as they change over time