BOMA Instrumentation & Controls Practice Test (Sample)

Study Guide

Everything you need from our exam experts!

Questions

1. What type of electrical component consists of two or more conductive surfaces separated by an insulator?

A. Diode

B. Capacitor

C. Resistor

D. Transformer

2. What is the purpose of an actuator in an instrumentation system?

A. To monitor system performance

B. To input data into the system

C. To move or control a mechanism or system

D. To measure external variables

3. What type of sensor measures temperature?

A. Photodiode

B. Thermocouple or thermistor

C. Magnetometer

D. Barometer

4. The speed of air through a duct is measured in:

A. Feet per hour

B. Feet per second

C. Feet per minute

D. Inches per minute

5. What is the typical output range for a Voltage sensor?

A. 0 - 5 V

B. 0 - 15 V

C. 0 - 10 V

D. 0 - 20 V

6. Which of the following instruments requires careful filtration of compressed air?

- **A. Temperature Transmitter**
- **B. Pneumatic Instrumentation**
- **C. Water Level Sensor**
- **D. Electrical Control Relay**

7. Compressors are most efficient when the intake air is:

- **A. Warm**
- **B. Cool**
- **C. Dry**
- **D. Moist**

8. Why is redundancy important in critical building control systems?

- **A. To ensure continuous operation in case of a failure in one component**
- **B. To reduce the overall cost of building management systems**
- **C. To simplify the configuration of the systems**
- **D. To limit the number of devices used in the system**

9. What is a minimum code requirement for a compressed air receiver?

- **A. Must have a safety valve only**
- **B. Must have a pressure gauge and bottom drain only**
- **C. Vessel must have a pressure gauge, safety valve, bottom drain**
- **D. Must have a bottom drain only**

10. What type of device can provide feedback for a control loop?

- **A. A sensor or transducer**
- **B. A microprocessor**
- **C. A relay switch**
- **D. An actuator**

Answers

1. B
2. C
3. B
4. C
5. C
6. B
7. B
8. A
9. C
10. A

Explanations

1. What type of electrical component consists of two or more conductive surfaces separated by an insulator?

A. Diode

B. Capacitor

C. Resistor

D. Transformer

The component that consists of two or more conductive surfaces separated by an insulator is a capacitor. Capacitors are essential in electrical circuits as they store electrical energy in an electric field. When voltage is applied across the conductive plates, an electric field forms between them, enabling the capacitor to store energy. This property is crucial in various applications such as filtering, timing circuits, and energy storage. The conductive surfaces, usually made of metal, are plated on either side of an insulator, typically a dielectric material. The configuration allows capacitors to maintain charge separation, which is fundamental to their operation. This characteristic is what defines a capacitor among various electrical components, making it distinct from devices like diodes, resistors, or transformers, which operate on different principles.

2. What is the purpose of an actuator in an instrumentation system?

A. To monitor system performance

B. To input data into the system

C. To move or control a mechanism or system

D. To measure external variables

An actuator is a critical component in an instrumentation system, responsible for moving or controlling a mechanism or system. It converts energy into motion, allowing for the physical movement of parts in response to signals received from a control system. This function is essential in applications where precise manipulation is required, such as in HVAC systems, industrial machinery, or automated processes. Actuators can control valves, dampers, motors, and other devices, making them integral to the operation and efficiency of various systems. Monitoring system performance, inputting data, or measuring external variables are functions typically associated with other components such as sensors or controllers, rather than the actuator itself. Thus, while those functions are important for the overall operation of an instrumentation system, they do not define the primary role of an actuator.

3. What type of sensor measures temperature?

A. Photodiode

B. Thermocouple or thermistor

C. Magnetometer

D. Barometer

The type of sensor that measures temperature includes a thermocouple or thermistor. A thermocouple consists of two different metals joined together at one end, and when the junction experiences a change in temperature, it produces a voltage that can be correlated to temperature changes. This makes thermocouples versatile and commonly used in various applications, from industrial to household thermometers. On the other hand, a thermistor is a type of resistor whose resistance varies significantly with temperature changes. Thermistors are usually made of ceramic materials and are very sensitive, making them ideal for precise temperature measurement in various applications, such as in HVAC systems, automotive sensors, and consumer electronics. Both of these sensors are widely recognized and used for their effectiveness and reliability in measuring temperature across numerous settings. This unique capability distinguishes them from the other options listed, which are intended for different measurement purposes.

4. The speed of air through a duct is measured in:

A. Feet per hour

B. Feet per second

C. Feet per minute

D. Inches per minute

The measurement of air speed in a duct is typically expressed in feet per minute. This unit is practical for assessing airflow rates in HVAC systems, where understanding the velocity of the air helps to determine system efficiency, comfort levels in occupied spaces, and overall performance. Feet per minute allows for a direct comparison with air volume measurements and is commonly used in engineering and design practices related to heating, ventilation, and air conditioning. Other units like feet per hour or inches per minute may be relevant in specific contexts but do not provide the same level of granularity for air velocity in typical duct applications. Feet per second is less common for ductwork measurements, as it is more often used in situations where very rapid airflow is being discussed. The use of feet per minute strikes a balance that facilitates practical calculations and system design in the context of typical building ventilation systems.

5. What is the typical output range for a Voltage sensor?

A. 0 - 5 V

B. 0 - 15 V

C. 0 - 10 V

D. 0 - 20 V

The typical output range for a voltage sensor is commonly set at 0 - 10 V. This range is widely used in various building automation and control systems because it provides a standard, easily manageable signal that can be utilized by controllers and other equipment in the system. The 0 - 10 V output allows for accurate measurement of voltage levels and can accommodate a variety of applications, including the monitoring of lighting, HVAC systems, and other electrical devices. Using a voltage range that extends to 10 V allows for sufficient resolution to discern changes in the system being monitored while minimizing the complexity of signal processing. This balance is crucial for systems that require reliable and consistent performance in their monitoring and control functions.

6. Which of the following instruments requires careful filtration of compressed air?

A. Temperature Transmitter

B. Pneumatic Instrumentation

C. Water Level Sensor

D. Electrical Control Relay

The correct choice pertains to pneumatic instrumentation, which relies on compressed air as a medium for signal transmission. This type of instrumentation often operates with precise and sensitive mechanical components that can be adversely affected by contaminants present in the compressed air, such as dust, moisture, or oil. Filtration is essential because any particles or droplets in the air can interfere with the instrument's performance, leading to inaccurate measurements or potential failure of the system. By ensuring that the compressed air is thoroughly filtered, the reliability and accuracy of pneumatic instruments can be maintained, providing consistent performance in critical applications. While other instruments may have their own requirements for function and performance, they do not share the same direct dependence on clean and filtered compressed air as pneumatic instrumentation does. For instance, temperature transmitters and electrical control relays generally do not utilize pneumatic signals and therefore are less susceptible to issues arising from contaminated air supply.

7. Compressors are most efficient when the intake air is:

A. Warm

B. Cool

C. Dry

D. Moist

Compressors are designed to optimize performance based on various factors, one of which is the temperature of the intake air. When the intake air is cool, it has a higher density compared to warm air. This denser air allows the compressor to take in more mass flow of air per cycle, which translates to increased efficiency in the compression process. Additionally, compressing cooler air requires less energy than compressing warmer air, as cooler air naturally has lower thermal energy. This reduction in energy consumption contributes significantly to the overall efficiency of the compressor. Therefore, operating at cooler intake temperatures helps the compressor work more effectively, making this choice the most efficient for compressor operation. In contrast, warm air is less dense, resulting in lower mass flow into the compressor and requiring more energy to achieve the same output. Moist air can also have a lower efficiency due to the potential of water vapor causing issues within the system such as corrosion or liquid carryover. Dry air may enhance performance over moist air but still does not offer the benefits of cool intake conditions.

8. Why is redundancy important in critical building control systems?

A. To ensure continuous operation in case of a failure in one component

B. To reduce the overall cost of building management systems

C. To simplify the configuration of the systems

D. To limit the number of devices used in the system

Redundancy in critical building control systems is vital for maintaining operations without interruption. By providing backup components or systems that can take over if the primary system fails, redundancy ensures that the building can continue its essential functions, such as climate control, lighting, and security, without significant downtime. This capability is particularly crucial in environments where consistent operational reliability is expected, such as hospitals or data centers, where even brief outages can have severe consequences. The other options do not accurately reflect the primary purpose of redundancy. Reducing the overall cost of building management systems could be a consideration but is not the primary goal of implementing redundancy. Similarly, simplifying the system configuration or limiting the number of devices used in the system is not aligned with the concept of redundancy, which often involves adding extra components or systems to enhance reliability. Thus, ensuring continuous operation in the face of potential failure is the key aspect that underscores the importance of redundancy.

9. What is a minimum code requirement for a compressed air receiver?

A. Must have a safety valve only

B. Must have a pressure gauge and bottom drain only

C. Vessel must have a pressure gauge, safety valve, bottom drain

D. Must have a bottom drain only

The minimum code requirement for a compressed air receiver mandates that the vessel must be equipped with a pressure gauge, safety valve, and bottom drain. The pressure gauge is crucial as it allows operators to monitor the pressure within the receiver, helping prevent over-pressurization and ensuring safe operation. The safety valve is a critical safety feature that automatically releases pressure if it exceeds a predetermined threshold, hence protecting the vessel and maintaining safety standards. The bottom drain is necessary for the removal of accumulated moisture and condensate that can negatively impact the performance and longevity of the compressed air system. Together, these components ensure that the compressed air receiver operates safely, efficiently, and in compliance with safety codes. Each element plays a significant role in maintaining the integrity and functionality of the system, which is why having all three is considered the minimum requirement.

10. What type of device can provide feedback for a control loop?

A. A sensor or transducer

B. A microprocessor

C. A relay switch

D. An actuator

A sensor or transducer is essential for providing feedback in a control loop because it measures the output variable of the system, such as temperature, pressure, or flow. This measurement is crucial for the control system to determine how closely the actual output aligns with the desired setpoint. When the sensor detects a change in the condition being measured, it converts that physical change into an electrical signal that can be processed by the control system. This feedback mechanism allows the controller to make adjustments as necessary to maintain the desired performance of the system. By continuously monitoring the output, the sensor or transducer ensures that the system can respond dynamically to any fluctuations or disturbances, thereby enhancing the overall stability and efficiency of the control loop. Other devices mentioned, such as microprocessors, relay switches, and actuators, play important roles within a control system but do not directly provide feedback in the same way. Microprocessors process data and execute control algorithms, relay switches operate on and off signals to control power to various components, while actuators are responsible for physically moving or controlling a mechanism within the system based on the decisions made by the processing unit. Thus, a sensor or transducer is uniquely positioned to fulfill the feedback requirement effectively in a control loop.