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| 1. Micro limit switches commonly have an amperage range of \_\_\_\_\_\_\_\_\_\_\_.

|  |  |  |
| --- | --- | --- |
|   | a.  | 1 to 3 amps |
|   | b.  | 1 to 7 amps |
|   | c.  | 1 to 10 amps |
|   | d.  | 1 to 20 amps |

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| 2. \_\_\_\_\_\_\_ are made up of a solid piece of material that manipulates the flow of electrons without any moving parts.

|  |  |  |
| --- | --- | --- |
|   | a.  | Limit switches |
|   | b.  | Solid-state devices |
|   | c.  | Optical encoders |
|   | d.  | Target flowmeters |

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| 3. You are setting up a system to detect if fluid is inside a carton so the robot can pick the empty cartons off the line. Which of the following would work for this task?

|  |  |  |
| --- | --- | --- |
|   | a.  | Inductive proximity switch |
|   | b.  | Capacitive proximity switch |
|   | c.  | Photoelectric proximity switch |
|   | d.  | Hall effect sensors |

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| 4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are devices activated by contact with an object that changes the state of its contacts when the object exerts a certain amount of force.

|  |  |  |
| --- | --- | --- |
|   | a.  | Limit switches |
|   | b.  | Inductive proximity switches |
|   | c.  | Photoelectric proximity switches |
|   | d.  | Hall effect sensors |

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| 5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_use an oscillating magnetic field to detect ferrous metal items.

|  |  |  |
| --- | --- | --- |
|   | a.  | Limit switches |
|   | b.  | Inductive proximity switches |
|   | c.  | Photoelectric proximity switches |
|   | d.  | Hall effect sensors |

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| 6. \_\_\_\_\_\_\_\_\_\_\_\_\_ photoelectric sensors separate the transmitter and receiver into different units, placed opposite each other.

|  |  |  |
| --- | --- | --- |
|   | a.  | Through-beam |
|   | b.  | Retroreflective |
|   | c.  | Diffuse |
|   | d.  | Light-level detection |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7. \_\_\_\_\_\_\_\_\_\_\_\_\_ photoelectric sensors place the transmitter and receiver in one assembly and often use something like a bicycle reflector to return the light.

|  |  |  |
| --- | --- | --- |
|   | a.  | Through-beam |
|   | b.  | Retroreflective |
|   | c.  | Diffuse |
|   | d.  | Light-level detection |

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| 8. When using the amperage draw of the motors to monitor for impact, which of the following statements is true?

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| --- | --- | --- |
|   | a.  | These systems are complex and require high-level math. |
|   | b.  | Noise in the system may cause a false shut down. |
|   | c.  | Excessive payload weight may cause the system to shut down. |
|   | d.  | All of these are correct. |

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| 9. \_\_\_\_\_\_\_\_\_\_ are based on the principle of a linear increase in resistance that occurs when a metal is exposed to heat.

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| --- | --- | --- |
|   | a.  | Thermocouples |
|   | b.  | RTDs |
|   | c.  | Thermistors |
|   | d.  | IR temperature sensors |

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| 10. \_\_\_\_\_\_\_\_\_\_ are temperature sensors that work off the principle of a small DC millivoltage generated when the junction of two dissimilar metals are heated.

|  |  |  |
| --- | --- | --- |
|   | a.  | Thermocouples |
|   | b.  | RTDs |
|   | c.  | Thermistors |
|   | d.  | IR temperature sensors |

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| 11. \_\_\_\_\_\_\_\_\_\_ place a disk or similar shape in the fluid and use the force of the fluid flow to deflect the disk and generate a signal.

|  |  |  |
| --- | --- | --- |
|   | a.  | Turbine flowmeters |
|   | b.  | Target flowmeters |
|   | c.  | Sail flowmeters |
|   | d.  | Magnetic flowmeters |

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| 12. \_\_\_\_\_\_\_\_\_\_ use a propeller-type assembly placed inside the fluid to generate a signal via a magnetic pickup sensor positioned nearby, but outside of the fluid.

|  |  |  |
| --- | --- | --- |
|   | a.  | Turbine flowmeters |
|   | b.  | Target flowmeters |
|   | c.  | Sail flowmeters |
|   | d.  | Magnetic flowmeters |

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| 13. \_\_\_\_\_\_\_\_\_\_\_\_\_ use a thin membrane, often made of metal in a capsule arrangement, to move the indicator assembly.

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| --- | --- | --- |
|   | a.  | Bourdon tube gauges |
|   | b.  | Bellows gauges |
|   | c.  | Diaphragm gauges |
|   | d.  | Pressure relief valves |

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| 14. \_\_\_\_\_\_\_\_\_\_\_\_\_ use a thin-walled, slightly elliptical, cross-sectioned tube bent in a C shape, which is tied directly to the system, to read pressure.

|  |  |  |
| --- | --- | --- |
|   | a.  | Bourdon tube gauges |
|   | b.  | Bellows gauges |
|   | c.  | Diaphragm gauges |
|   | d.  | Pressure relief valves |

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| 15. \_\_\_\_\_\_\_\_\_\_\_ are similar to photo eyes except that they emit and receive sound instead of light.

|  |  |  |
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|   | a.  | Sourcing signals |
|   | b.  | Sinking signals |
|   | c.  | Optical isolation |
|   | d.  | Ultrasonic sensors |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 16. \_\_\_\_\_\_\_\_\_\_\_ provide(s) the positive connection or DC voltage to the input module.

|  |  |  |
| --- | --- | --- |
|   | a.  | Sourcing signals |
|   | b.  | Sinking signals |
|   | c.  | Optical isolation |
|   | d.  | Ultrasonic sensors |

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| 17. What is the difference between a sourcing and a sinking signal? |

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| 18. How does an absolute encoder work? |

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| 19. How do thermocouples work? |

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| 20. What is the benefit of disengaging the axes as opposed to the E-stop method of stopping the robot when impact is detected? |

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| --- |
| 21. How do we commonly monitor impact today? |

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| --- |
| 22. What are the six main criteria for selecting a sensor? |