Industrial Maintenance

Conventional Fire Alarm System

Course Sample

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Safety and Common Symbols

The following safety and common symbols may be used in this course and on the equipment:

Symbol	Description
⚠ DANGER	**DANGER** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
⚠ WARNING	**WARNING** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
⚠ CAUTION	**CAUTION** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
CAUTION	**CAUTION** used without the *Caution, risk of danger* sign ⚠, indicates a hazard with a potentially hazardous situation which, if not avoided, may result in property damage.
	Caution, risk of electric shock
	Caution, hot surface
	Caution, risk of danger. Consult the relevant user documentation.
	Caution, lifting hazard
	Caution, belt drive entanglement hazard
	Caution, chain drive entanglement hazard
	Caution, gear entanglement hazard
	Caution, hand crushing hazard
	Notice, non-ionizing radiation
	Consult the relevant user documentation.

Safety and Common Symbols

Symbol	Description
	Direct current
	Alternating current
	Both direct and alternating current
	Three-phase alternating current
	Earth (ground) terminal
	Protective conductor terminal
	Frame or chassis terminal
	Equipotentiality
	On (supply)
	Off (supply)
	Equipment protected throughout by double insulation or reinforced insulation
	In position of a bi-stable push control
	Out position of a bi-stable push control

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Preface

The Conventional Fire Alarm System reproduces an environment where you will develop your skills in the installation and wiring initiating devices and notification appliances.

You will learn and use a practical method to calculate the number of wires required to connect the components of a circuit. You will also familiarize yourself with the programming of a fire alarm control panel.

We hope that your learning experience with the training system will be the first step of a successful career.

We invite readers to send us their tips, feedback, and suggestions for improving the course.

Please send these to did@de.festo.com.

The authors and Festo Didactic look forward to your comments.

About This Course

The work orders in this manual provide a systematic and realistic means of learning how to install and program a fire alarm system.

Safety considerations

Safety symbols that may be used in this course and on the equipment are listed in the Safety and Common Symbols table at the beginning of this document.

Safety procedures related to the tasks that you will be asked to perform are indicated in each exercise.

Make sure that you are wearing appropriate protective equipment when performing the tasks. You should never perform a task if you have any reason to think that a manipulation could be dangerous for you or your teammates.

Reference material

Refer to the *Fire Shield – Technical Reference Manual* as reference on how to use the fire alarm control panel.

Systems of units

Units are expressed using the International System of Units (SI) followed by units expressed in the U.S. customary system of units (between parentheses).

To the Instructor

You will find in this Instructor Guide all the elements included in the Student Manual together with the answers to all questions, results of measurements, graphs, explanations, suggestions, and, in some cases, instructions to help you guide the students through their learning process. All the information that applies to you is placed between markers and appears in red.

Accuracy of measurements

The numerical results of the hands-on exercises may differ from one student to another. For this reason, the results and answers given in this course should be considered as a guide. Students who correctly perform the exercises should expect to demonstrate the principles involved and make observations and measurements similar to those given as answers.

Considerations

- Before a student begins a work order, ensure that the equipment is in good condition and does not represent any risk when used.
- This guide provides you with the answers to questions. Your evaluation, however, must also relate to the quality of the accomplished work. Make sure that the programming requirements described in the work orders are met.
- Make sure that the students understand the objectives of the job to do.
- Make sure that the students do not unplug the fire alarm control panel from the power outlet while programming. This would cause permanent damage to the panel.

Sample

Extracted from

Work Orders - Instructor

Schematic Diagram and Wiring

Wire identification method

The wire identification method described in this work order is used to determine the number of wires required to connect the components of an electrical circuit. It refers to the schematic diagram of the electrical circuit and to the physical arrangement of the components.

Schematic diagram

Figure 1 shows the schematic diagram of a circuit made of a power source (PS) and a single pole switch (S) controlling a lamp (L).

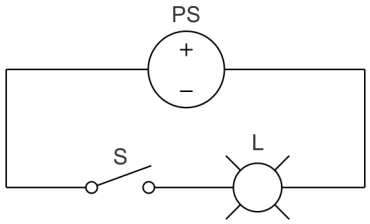


Figure 1. Schematic diagram of a circuit made of a power source and a switch controlling a lamp.

Wire identification rules

- In the schematic diagram, identify the wires that connect to the first component with a number. Numbers 1 and 2 are used to identify the wires that connect to the power source (PS) in the example shown in Figure 2.
- Identify the wire that connects to the next component in the line with the corresponding number.
- When you go through a component, increase the number by one.
- Follow the same logic to identify all the wires that connect to the components.

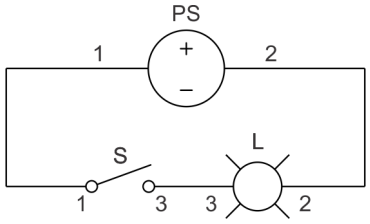


Figure 2. Component identification.

Field wiring

For convenience, each component is mounted in an electrical box and is interconnected by wires installed into the conduits going from one electrical box to another. Figure 3 shows a typical arrangement of the electrical boxes of the circuit.

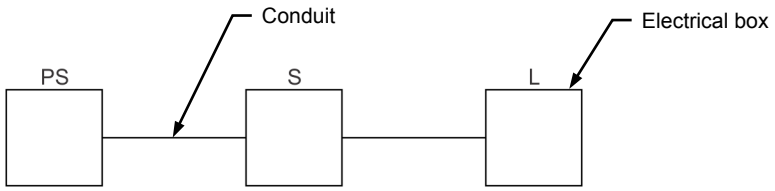


Figure 3. Component identification.

- Transfer the wire numbers from the schematic diagram, in Figure 2, to the boxes showing the physical location of the components. Indicate the numbers below the electrical boxes as shown in Figure 4.
- Starting from the number 1 on the first component, determine the path to link this number 1 to any other number 1.
- In the process, each time you go through a path, write a mark on the path (conduit) and note the corresponding number.
- Repeat the process until all wires have been identified. Each numbered mark, on a given path, corresponds to a wire going from one location to the other.

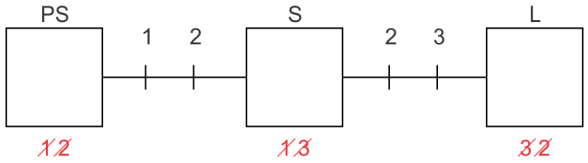


Figure 4. Transfer the wire numbers from the schematic diagram to the electrical box showing the physical location of the component.

With this training system, it is fairly easy to identify the wires. But if we consider that two adjacent boxes on the training system could be installed in the field in different rooms or at a great distance, we would need a method to identify the wires. We suggest that you proceed as follows to identify each wire:

- Use the steel pipe as a wire.
- At one end of a wire, make an electrical contact with the pipe.
- Go to the next box and look for a continuity between the pipe and a wire.
- Once the continuity is established, identify each end of the wire with the desired number.

The continuity test can be performed using an ohmmeter. In some cases a circuit using a buzzer and a battery are used to make the continuity test.

When the boxes are in different rooms or at a great distance, two persons could work at the identification of the wires. The first person will pick a wire and will make an electrical contact with the pipe while the second person at the other end will look for a continuity between the pipe and the wire under the search. When the continuity is established, they communicate with each other and affix the desired wire number.

Schematic Diagram and Wiring (1)

OBJECTIVE

- To draw a schematic diagram, and to determine the number of wires required to connect the components.

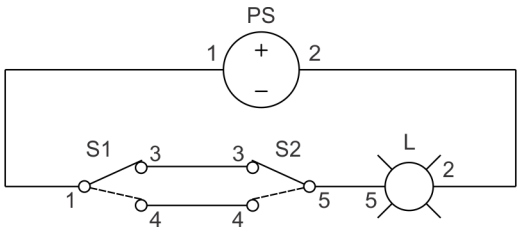
PROCEDURE

Schematic diagram and wiring

1. Draw the schematic diagram of a circuit made of a power source (PS) and two three-way switches (S1 and S2) controlling a lamp (L) in Figure 5.

Figure 5. Schematic diagram of a circuit made of a power source and two three-way switches controlling a lamp.

The schematic diagram to draw is shown below.



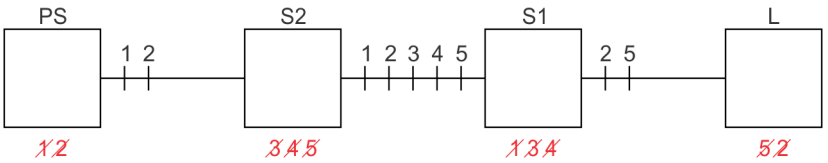
Schematic diagram of a circuit made of a power source and two three-way switches controlling a lamp.

2. Number the wires that connect to each component in Figure 5.

3. Determine the number of wires required to connect the components in an arrangement as shown in Figure 6. Identify the wires in Figure 6.

Figure 6. Component arrangement.

The component arrangement is shown below.



Component arrangement.

4. Ask your instructor to check your work.

Name: _____ Date: _____

Instructor's approval: _____