Sensor Workstation

Factory Automation

User Guide

Festo Didactic
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By the staff of Festo Didactic

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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 danger. Consult the relevant user documentation.
	Caution, risk of electric shock
	Caution, lifting hazard
	Caution, hot surface
	Caution, risk of fire
	Caution, risk of explosion
	Caution, belt drive entanglement hazard
	Caution, chain drive entanglement hazard
	Caution, gear entanglement hazard
	Caution, hand crushing hazard
	Static sensitive contents. Observe precautions for handling electrostatic discharge sensitive devices.
	Radio Equipment Directive (RED) geographical restrictions – consult the User Guide
	Notice, non-ionizing radiation
	Consult the relevant user documentation.

Symbol	Description
⎓	Direct current
∿	Alternating current
≂	Both direct and alternating current
3∿	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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1 About this Manual

The operator should familiarize himself/herself with the contents of this manual before installing and operating the equipment.

The Safety Symbols table at the beginning of this manual lists safety symbols that may be present in this manual or on the equipment.

This manual is freely available for download from the Festo Didactic website.

Upon request, printed copies of this manual are freely available. Contact your Festo Didactic sales representative.

Important. In this manual, “the equipment” and/or “the training system” specifically refers to the Sensor Workstation.

2 General Requirements for Operating the Equipment

General requirements for safe operation of electrical equipment:

- National regulations for operating electrical systems and equipment must be observed in commercial facilities.

- The laboratory or classroom must be overseen by a supervisor.
  - A supervisor is a qualified electrician or a person who has been trained in electrical engineering, knows the respective safety requirements and regulations, and whose training has been documented accordingly.

- Installation and commissioning of the equipment must be performed as directed in the accompanying documentation before any person can use the equipment for its intended purpose.

- Damaged or defective equipment must never be used.
  - Damaged devices must be barred from further use and removed from the laboratory or classroom.
  - Damaged connection cables and leads, pneumatic tubing, and hydraulic hoses represent a safety risk and must be removed from the laboratory or classroom.

Regulation in certain countries requires that the laboratory or classroom is equipped with the following devices:

- The ac power outlets in the laboratory or classroom must be protected by residual current devices (RCDs).
  - Electrical equipment (e.g., power supply units, compressors, hydraulic power units, etc.) may only be operated in training rooms which are equipped with residual current devices (RCDs).

- Type A or type B residual current circuit breakers with a residual current set in accordance with the local regulation (generally ≤ 30 mA) must be used to protect the ac power outlets in the laboratory or classroom.

- The ac power outlets in the laboratory or classroom must be protected by overcurrent protection devices.
  - Circuit breakers or fuses.

3 Use for Intended Purpose

The equipment may only be used:

- For its intended purpose in teaching and training applications.
- When its safety functions are in flawless condition.

The components of the equipment are designed in accordance with the latest technology and recognized safety rules. However, life and limb of the user and third parties may be endangered and the equipment may be impaired if it is used improperly.

The learning program from Festo Didactic has been developed and produced exclusively for an advanced training in the operating principles of the most common types of smart sensors. To ensure the safety of the trainees during their training, the training company and/or supervisors must make sure that all trainees use the equipment as directed in the accompanying Festo Didactic training manuals, and observe the safety instructions and precautions in the present manual.

3.1 Guarantee and Liability

Our “general terms and conditions of sale and delivery” are always applicable. These are made available to the operating company no later than on conclusion of the sales contract. Guarantee and liability claims resulting from personal injury and/or property damage are excluded if they can be traced back to one or more of the following causes:

- Use of the equipment for anything other than its intended purpose.
- Improper commissioning and/or operation of the equipment.
- Use of the equipment with defective safety equipment, or with improperly attached or non-functional safety and protective equipment.
- Non-compliance with instructions included in the core documentation with regard to commissioning and operation.
- Unauthorized modifications to the equipment.
- Improperly executed repairs.
- Disasters resulting from the influence of foreign bodies and acts of nature.

Festo Didactic hereby excludes any and all liability for damages suffered by trainees, the training company, and/or any third parties, which occur during use of the equipment in situations which serve any purpose other than training and/or vocational education, unless such damages have been caused by Festo Didactic due to malicious intent or gross negligence.

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4 For your Safety

4.1 Important information

Fundamental prerequisites for safe use and trouble-free operation of the equipment include knowledge of basic safety precautions and safety regulations. This manual includes important instructions for safe use of the equipment.

In particular, the safety precautions must be adhered to by all persons who work with the equipment. In addition, all pertinent accident prevention rules and regulations, which are applicable at the respective place of use, must be adhered to.

4.2 Obligations of the operating company

The operating company only permits those who meet the following qualification to work with the equipment:

- Persons that are familiar with the basic regulations regarding work safety and accident prevention, and have been trained in the use of the equipment.
- Persons that have read and understood the chapter concerning safety and the warnings in this manual.

Personnel should be tested at regular intervals for safety-conscious work habits.

4.3 Obligations of the trainees

All persons who have been entrusted to work with the equipment must complete the following steps before beginning work.

- Read the chapter concerning safety and the warnings in this manual.
- Familiarize themselves with the basic regulation regarding work safety and accident prevention.

5 Work and Safety Instructions

5.1 General

WARNING

Presence of dangerous voltage!

- The equipment conducts voltages which may be dangerous. Disregard of the warnings and/or non-observance of the safety instructions in this manual may result in life-threatening danger, severe injury, or major damage to property.

CAUTION

- Trainees should only work with the equipment under the supervision of a qualified supervisor.
- Always use the equipment as directed in the accompanying Festo Didactic training manuals.
- Observe the specifications included in the technical data for the individual components, and in particular, all safety instructions.

5.2 Electrical system

WARNING

- **Risk of death in case of missing or interrupted protective earthing conductor!**
  - Equipment with protective earthing terminals must always be earthed.
  - Protective earthing connections must always be established first (i.e., before establishment of connections to voltage sources) and removed last (i.e., after removal of all connections to voltage sources).
  - The protective earthing conductors (yellow-green) must not be interrupted, either inside or outside of any device.
  - The insulation of the protective conductors must never be damaged or removed.

- **Risk of death due to electric shocks!**
  - Contact voltages greater than 25 V AC or 60 V DC are not permissible.
  - Coming into contact with voltages greater than 33 V AC or 70 V DC may be fatal.
  - Use only cable or leads with adequate insulation and electric strength.
  - Switch all power supply units off before working on electrical circuits. Electrical connections may only be established or removed in the absence of voltage.

CAUTION

- Hazard-free operation of the equipment is no longer possible in the case of visible damage, malfunction, incorrect storage, or incorrect transport. In any of these situations, turn electric power off immediately and protect the equipment against inadvertent use.

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CAUTION

- When laying cables and leads, make sure that they are not kinked or pinched.
- Do not lay cables or leads over hot surfaces. Hot surfaces on the equipment are identified with the corresponding safety symbol.
- Always pull on the plug when disconnecting cables or leads. Never pull on the cable or lead itself.
- Make sure that connection cables and leads are not subjected to continuous tensile loads.
- Maximum permissible load currents for the devices and connection cables or leads must not be exceeded.
  - Always compare the current ratings of the device, the cables or leads, and the overcurrent protection (fuse or circuit breaker). If necessary, use an upstream fuse or circuit breaker to achieve proper overcurrent protection.

- Make sure that you use detachable mains supply cords with adequate rating.
- The equipment may generate high-frequency interference in residential areas, which may make it necessary to implement interference suppression measures.

6 Equipment Installation and Commissioning

6.1 Environmental requirements

The equipment is designed to be installed indoors and must be operated in the following environmental conditions to ensure user safety:

- an altitude up to 2000 m (6560 feet)
- a temperature between 5°C and 40°C (between 41°F and 104°F)
- a maximum relative humidity of 80% for temperatures up to 31°C (88°F), decreasing linearly to 50% relative humidity at 40°C (104°F)
- mains supply voltage fluctuations which do not exceed ±10% of the nominal voltage
- transient overvoltage up to the levels of overvoltage category II
- temporary overvoltage occurring on the mains supply: 2500 V
- a pollution degree of 2 in accordance with IEC 60664-1

The word pollution used above refers to any addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity.

Make sure that the location where you want to install the equipment meets the environmental requirements listed above, and then follow the directives given in the next sections to safely install and use the equipment.

Trainees must have basic electrical knowledge before using the equipment and a qualified instructor must supervise the training sessions.

6.2 Handling the workstation

Before handling the workstation, make sure of the following:

- You know where to install or move the workstation.
- No obstacle is in the way. The floor is not bumpy, obstructed, or slippery.
- You are strong enough to lift and carry the workstation to its intended location. Assess the workstation weight beforehand, if necessary.

When carrying the workstation, make sure of the following:

- Keep a good grip on the workstation.
- Keep the workstation as close as possible to the waist, with the shoulders level. Never hold the workstation at arm's length or away from the body.
- Move slowly while keeping the body and feet in a stable position.
- Turn by turning the feet, NOT the back.

7 Safety Precautions

7.1 Preliminary warning

Even though the equipment has been carefully designed to ensure trainees' safety, there are residual risks that cannot be reduced via technical solutions without impairing the learning process. The first and foremost safety measure that must be enforced at all times is the proper supervision of the trainees.

Nothing can replace the supervision and guidance of a qualified instructor. Trainees have an incomplete mastery of the subject. They can make mistakes and most certainly will. That is an essential part of the learning process.

The role of the instructor is to let trainees make mistakes that have no consequences on their safety, while protecting them from mistakes that can have unfortunate consequences.

⚠ CAUTION

Nothing can replace the supervision and guidance of a qualified instructor.

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7.2 General warnings

⚠ WARNING

- Before operating the equipment, make sure that the leads used to interconnect the protective earthing terminals of the modules form a protective earthing conductor that is not interrupted. Also, make sure that the insulation of each of these leads is not damaged or removed.
- Before making or modifying any connections on the equipment, always make sure that the power supply is turned off.

⚠ CAUTION

- Set the modules up so that activation of switches and disconnectors is not made difficult.

CAUTION

- The equipment is part of the EMC Class A (CISPR 11:2009) products. In a domestic environment, these products may cause radio interference, in which case the user may be required to take adequate measures.

7.3 Indication of conformity

The equipment is in conformity with the following directives and standards:

- Low Voltage Directive (LVD) 2014/35/EU
  - EN 61010-1:2010 - Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
- Electromagnetic Compatibility Directive (EMC) 2014/30/EU
  - IEC 61326-1:2012- Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
- Restriction of the use of certain Hazardous Substances Directives (RoHS) 2011/65/EU
  - EN 50581:2012-09 - Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

7.4 Degrees of ingress protection (IP)

The equipment is rated IP20.

CAUTION

The equipment is not protected against liquid infiltration or immersion. Keep it away from all types of liquids. Failure to do so could damage the equipment.

7.5 Personal protective equipment (PPE)

Even with all the safety features implemented on the equipment, there are still residual risks due to misuse or defective part(s). To further reduce the risks of injury, always follow the rules below when using the equipment:

- If equipment needs to be moved often from the storage room to the workstation or from one workstation to another, wear safety shoes.
- Clean the working area, it must be free of oil and water.

7.6 Equipment modification

Do not modify the equipment without prior written permission of Festo Didactic. The equipment uses complex industrial components and modifications could have undesired consequences on product integrity and safety.

8 Equipment Description

This section identifies the main components (connectors, controls, displays, indicators, etc.) on the equipment. It may also provide safety directives and/or operating instructions specific to certain pieces of equipment as well as instructions for the replacement of parts in the equipment.

8.1 Sensor Workstation

The Sensor Workstation (see the following figure) consists mainly of a slot plate for the installation and study of sensors, master devices, and measurement instrumentation. The front plate also includes the following elements:

- Power input: allows connection to an appropriate ac wall outlet.
- Multimeter: allows voltage and current measurements. A switch (-S1) allows the selection between voltage and current. The current (A) terminal is protected by a fuse (-F1). A connector (-X2) allows the configuration of the multimeter using a computer.
- Sensor outputs (via M12 connector or terminal block): allow the signals from a sensor to be accessible via 4 mm terminals. Sensors can be connected via either an M12 connector or wires on a terminal block.
- DC output: provides access to a 24 V dc power source that can be used for any purpose, such as powering sensors.

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Figure 1. Front view of the Sensor Workstation.

Number	Component name
1	Slot plate
2	Power input
3	Multimeter
4	Sensor output (via M12 connector)
5	Sensor output (via terminal block)
6	DC output
7	Protective earthing terminals PE+ (2)

Table 1. Description of the Sensor Workstation.

9 Equipment Maintenance

The equipment is designed to ensure user safety and long-term reliability. Nevertheless, care must be taken so that the equipment remains in good operating condition and thus safe to the user.

This section provides directives and guidelines for the maintenance of the equipment.

WARNING

Instructors and/or the personnel in charge of laboratory equipment should transmit the following directions and guidelines to students because they play an important role in maintaining the equipment in good operating condition.

9.1 General maintenance

The equipment does not require any particular maintenance. However, it is very important to perform a visual inspection of the equipment before each laboratory exercise. If a piece of equipment appears damaged or shows wear, it must be replaced to ensure user safety and prevent further damage to the equipment.

There are no user serviceable parts inside the equipment, other than certain parts that may need to be replaced, such as fuses, button cells, batteries, etc. Opening or removing the equipment housing to replace parts may expose you to dangerous voltages. Do not try to open the equipment housing to replace parts. Have a qualified technician replace parts in the equipment.

9.2 Consumables and replacement parts

It is possible to replace certain pieces of equipment that are consumable or that have been damaged. Use only Festo Didactic parts and accessories to ensure compatibility and sustainability of the equipment. Available replacements parts and accessories are listed below.

Part	Type	Rating	Order no.
Connection cable	IO-Link master cable	0.5 m	8112722
Connection cable	M8 male connector, straight RJ45 male connector, straight, 4-pin	0.5 m	8071261
Connection cable	M8x1, A coded to EN 61076-2-104 M12x1, A coded to EN 61076-2-101	0.5 m	8000209
Connection cable	Socket, 5-pin, M12 – plug, 5-pin, M12	0.5 m	8113451
Connection cable	Straight socket, M5x0.5, 4-pin Straight plug, M12x1, 4-pin	1 m	594983
Fuse	Time-lag, glass-body cartridge fuse	2 A	8111008
Power cord	YP-12/YC-12L, 1.83 m (6 ft)	120 V	582145
Power cord	YP-23/YC-12L, 1.83 m (6 ft)	230 V	582146

Table 2. List of consumable pieces and damageable equipment.

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9.3 Disposal

Do not discard the equipment with normal waste: it contains electrical and electronic components. A specialist must dismantle the product. Each component must be recycled or disposed of according to your local legislation.

It is the owner's responsibility to make provisions for the equipment recycling and safe disposal.

9.4 Cleaning

To clean the front panel(s) and housing(s) of the equipment, use a soft cloth and a mild solution of detergent and water. It is important not to apply the solution directly onto the surface of the module. Instead, apply the solution onto the soft cloth.

CAUTION

Unless specifically stated otherwise, do not use abrasive substances or solvents to clean any part of the equipment.

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