

Electric Vehicle AC Charging Station

FESTO

Electric Power Technology

User Guide



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Electric Vehicle AC Charging Station

User Guide

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By the staff of Festo Didactic

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Internet: www.festo.com

e-mail: services.didactic@festo.com

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Document Preliminaries

About this document

The operator should be familiar with the content of this document before installing and operating the equipment.

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

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

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



Important. In this document, "the equipment" and/or "the learning system" specifically refers to the Electric Vehicle AC Charging Station learning equipment.

This document contains the information required to set up, commission, and carry out maintenance on the equipment. However, for specific instructions or information, refer to the documents listed in the following table. These documents form the core of the documentation for the equipment.













Table 1: Documents important to the operation of the Electric Vehicle AC Charging Station.














Document	Part number
Electric Vehicle AC Charging Stations (workbook)	8239012 (IEC) 8239010 (ANSI)
Electric Vehicle AC Charging Stations (workbook for instructors)	8239011 (IEC) 8239009 (ANSI)
Electric Vehicle AC Charging Stations (user guide)	8242207/8242208





Safety Symbols and Procedures

The following table lists the safety and common symbols that may be used in this document and on the equipment. Before performing procedures with the equipment, you should read all sections regarding safety in the User Guide accompanying the equipment. Additional safety procedures are given before any task requiring specific safety precautions.

Symbol	Description
	DANGER indicates a hazard with a high level of risk, which, if not avoided, will result in death or serious injury.
	WARNING indicates a hazard with a medium level of risk, which, if not avoided, could result in death or serious injury.

Symbol	Description
	<p>CAUTION indicates a hazard with a low level of risk, which, if not avoided, could result in minor or moderate injury.</p>
	<p>NOTICE indicates a hazard with a potentially hazardous situation, which, if not avoided, may result in property damage.</p>
	<p>Caution, risk of danger. Consult the relevant user documentation.</p>
	<p>Caution, risk of electric shock.</p>
	<p>Caution, lifting hazard.</p>
	<p>Caution, hot surface.</p>
	<p>Caution, risk of fire.</p>
	<p>Caution, risk of explosion.</p>
	<p>Caution, belt drive entanglement hazard.</p>
	<p>Caution, chain drive entanglement hazard.</p>
	<p>Caution, gear entanglement hazard.</p>
	<p>Caution, hand crushing hazard.</p>

Symbol	Description
	Static sensitive contents. Observe precautions for handling electrostatic discharge sensitive devices.
	Notice, non-ionizing radiation.
	Consult the relevant user documentation.
	Radio Equipment Directive (RED) geographical restrictions – consult the relevant user documentation.
	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).

Symbol	Description
	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.

General Requirements for Operating the Equipment

To safely operate electrical equipment in commercial or training environments, the following requirements apply:

- **Follow national regulations** that govern electrical systems and equipment in commercial or industrial facilities.
- **Ensure supervision.** A qualified supervisor (electrician or trained electrical engineer with documented training) must oversee the laboratory or classroom.
- **Perform correct setup.** Install and commission the equipment strictly according to the accompanying documentation before use.
- **Remove damaged equipment.** Immediately block off and remove damaged or defective devices, cables, leads, pneumatic tubing, or hydraulic hoses from the lab or classroom.
- **Ensure the room is equipped with all required safety devices.** Where local regulations apply, the room must include:
 - DC-sensitive residual current devices (RCDs), type B, ≤ 30 mA.
 - Overcurrent protection (circuit breakers or fuses).
 - One or more emergency-off devices to cut power either for the entire room or individual workstations.
 - Security features (e.g., lockable power-on switches or on-off valves) to prevent unauthorized activation of voltage or compressed air.



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 equipment components are designed with the latest technology and adhere to recognized safety standards. However, improper use can endanger the user and others, and may damage the equipment.

The Festo Didactic learning program is designed solely for training. To keep trainees safe, the training company or supervisors must ensure that all trainees use the equipment as instructed in the Festo Didactic courses and follow the safety guidelines in this document.

	 WARNING
	<p>Risk of danger from using the equipment in a way other than prescribed by Festo Didactic!</p> <ul style="list-style-type: none"> • Using the equipment in a way other than directed in the accompanying Festo Didactic courses, or using the equipment with equipment from other manufacturers, may increase the risk of injuries or property damage. • To minimize the risk of danger, always respect the specifications marked on the equipment as well as the specifications in the Festo Didactic data sheet of the equipment. • If the equipment includes a third-party component, consult the manufacturer's official documentation for that component—available from the manufacturer or online—to ensure safe use and compliance with all specifications and directives.

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 about 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.

Work and Safety Instructions





Safety responsibilities

Responsibilities are divided by role as shown in the following table.

Table 2: Responsibilities by role.

Role	Responsibilities
Operating company	<ul style="list-style-type: none"> ● Allow only qualified personnel to work with the equipment. ● Ensure personnel are trained in safety regulations and have read the safety information in this document. ● Periodically evaluate personnel for safe working practices.
Instructor	<ul style="list-style-type: none"> ● Supervise trainees at all times. ● Permit only harmless mistakes and prevent actions that could cause injury or damage.
Trainees	<ul style="list-style-type: none"> ● Read the safety chapter and warnings before use. ● Follow all applicable work-safety and accident-prevention rules. ● Work only under the supervision of a qualified person.

General operational safety

	 CAUTION
	<p>Ignoring basic operational safety rules may lead to accidents, injuries, or equipment damage.</p> <ul style="list-style-type: none"> • Trainees must be supervised by an instructor at all times when working with the equipment. • Use the equipment only as instructed in Festo Didactic documentation. • Keep switches, buttons, and disconnectors unobstructed and easy to reach. • Repair or secure faulty equipment immediately. • Wear suitable personal protective equipment (PPE), such as safety glasses and safety shoes. • Avoid wearing loose clothing or accessories that could become entangled in equipment. • Secure long hair to prevent it from interfering with moving parts or obstructing vision. • Keep the work area clean, dry, and free of substances that could cause slips or interfere with equipment operation.
	 CAUTION
	<p>Improper handling of heavy equipment may cause personal injury or equipment damage.</p> <ul style="list-style-type: none"> • Use proper lifting techniques or assistance when moving heavy components marked with the lifting-hazard symbol.

Personal protective equipment (PPE)

Despite built-in safety features, residual risks remain due to misuse or faulty components. To reduce injury risk, always follow these PPE guidelines:

- Wear **safety shoes** when frequently moving equipment between storage and workstations.
- Wear **safety glasses** when working with polarized capacitors, which may explode unexpectedly.
- Wear **hearing protection** when using noisy equipment such as rotating machines.

- Wear **insulating gloves** when handling live electrical components.
- Wear **safety gloves** for mechanical handling (e.g., sharp edges, heavy parts, hot surfaces).

Equipment handling and layout

NOTICE

Cable handling

- Lay out cables without bends, pinches, or contact with hot surfaces (clearly marked if applicable).
- Always unplug by pulling the plug itself—never pull on the cable.
- Prevent continuous tension on cables to avoid damage and disconnection.

NOTICE

Ventilation and heat management



- Keep all ventilation slots unobstructed. Place equipment only on hard, flame-resistant surfaces to allow proper airflow.
- Do not install heat-generating equipment near or underneath temperature-sensitive components.

NOTICE

Workstation setup

- Check the maximum load capacity of the workstation and ensure it is not exceeded.

Electrical safety

	 WARNING
	<p>Risk of electric shock due to dangerous voltage</p> <p>The equipment contains hazardous voltage that can cause death, serious injury, or major property damage if safety instructions are ignored.</p> <p>Protective earth (PE)</p> <ul style="list-style-type: none"> • Always earth equipment fitted with a PE terminal. • Connect the PE first and disconnect it last. • Do not break or damage yellow-green PE conductors. • Equipment with high leakage current needs a separate PE lead on its extra PE terminal. <p>Prohibited practices</p> <ul style="list-style-type: none"> • Never connect power sources in series. • Never connect multiple power supplies to a single ac power wall outlet, as this can cause higher leakage currents. • Do not exceed the input voltage or current rating of any device, as this can lead to heating, shocks, and fires. <p>Safe voltage limits</p> <ul style="list-style-type: none"> • Contact with > 30 V ac rms or > 60 V dc can be fatal. • Shield power source outputs and leads from touch; use shrouded safety leads rated CAT II or higher. • Switch off all power sources and de-energize circuits before wiring changes. • Only use detachable mains supply cords, cables, and connection leads with adequate ratings. <p>Capacitors</p> <ul style="list-style-type: none"> • Large capacitors may stay charged after power-off. Wait several minutes before opening housings. <p>Low-voltage circuits</p> <ul style="list-style-type: none"> • Power low-voltage circuits only with Class II SELV or double-insulated supplies (e.g., Festo Didactic power sources).

Cyber security

Festo Didactic provides products with security functions that support the safe operation of plants, systems, machines, and networks. Protecting these assets from cyber threats, however, requires a comprehensive and regularly updated security concept. Festo's products and services form only part of such a strategy.

The customer is responsible for preventing unauthorized access to equipment and networks. Connections to company networks or the Internet should be made only when necessary and only with appropriate security measures, such as firewalls, network segmentation, defense-in-depth strategies, etc.

Without these measures, connecting products to a network can expose vulnerabilities that allow unauthorized remote access, potentially affecting the entire system. This access can be exploited for data theft, manipulation, or sabotage. Common threats include Denial-of-Service attacks, remote code execution, privilege escalation, ransomware, and other malicious activities. In industrial environments, such attacks can create unsafe conditions, endangering both people and equipment.

Customers should follow Festo's security guidelines and keep their products up to date. Festo continuously improves its products for greater security and strongly recommends installing updates promptly. Using outdated or unsupported versions increases exposure to cyber threats.

Report security issues to the Festo Product Security Incident Response Team (PSIRT) in German or English by email at psirt@festo.com or through the online form at <https://www.festo.com/psirt>.

WARNING

Unsecure operating conditions due to software tampering

- Software tampering (e.g., viruses, Trojans, malware, worms) can cause unsafe system conditions, potentially leading to serious injury or property damage.
- Keep all software up to date.
- Integrate all automation and actuator components into a comprehensive industrial security concept aligned with current technological standards.
- Ensure all installed products are included in your security concept.
- Use protective tools, such as antivirus software, to scan files on removable storage media for malware.



WARNING

Firmware Update Security

This warning applies only to products with updatable firmware. To protect the security and integrity of your system, follow these guidelines during the firmware update process:

- **Download source.** Obtain firmware updates only from the official manufacturer's website.
- **Do not tamper.** Do not modify or interfere with the firmware update process.
- **Update process.** Strictly follow the firmware update instructions provided in the user guide.

Equipment Installation and Commissioning

Environmental requirements

The equipment is designed to be installed and stored indoors and operated in the following environmental conditions:

- An altitude up to 2000 m (6560 ft).
- A temperature between 5°C and 40°C (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 $\pm 10\%$ of the nominal voltage.
- Transient overvoltages up to the levels of overvoltage category II (1500 V for 120 V mains and 2500 V for 230 V mains).
- Temporary overvoltage occurring on the mains supply.
- A pollution degree of 2 (dry, non-conductive pollution).



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.



Equipment handling

Before handling equipment, ensure the following:

- You know where to install or relocate the equipment.
- The path is clear—no obstacles, bumps, or slippery surfaces.
- You can safely lift and carry the equipment. Check its weight beforehand if needed.

While carrying equipment, make sure to:

- Maintain a firm grip.
- Hold the equipment close to your waist, with level shoulders. Do not extend your arms.
- Move slowly and maintain stable footing.
- Turn by moving your feet, not by twisting your back.

	 CAUTION
	<p>Physical stress likely to occur when handling heavy equipment.</p> <ul style="list-style-type: none">• Take extra care when lifting or moving heavy equipment.• Equipment heavier than 5 kg (10 lb) are marked with a lifting hazard symbol where not otherwise obvious.

Equipment installation in an A4 workstation

The equipment is designed either for tabletop use or for installation in an A4 workstation. The following safety guidelines apply when equipment is installed in an A4 workstation.

To install equipment in an A4 workstation, first place the equipment between the lower and upper rails of a workstation row. Then, insert the top edge of the equipment in the upper rail of the workstation row. Finally, insert the bottom edge of the equipment in the lower rails so that the equipment is up straight. Once properly installed, the equipment can slide on the rails.

Always respect the following recommendations when installing equipment in an A4 workstation.

- If the A4 workstation comprises more than one row, equipment that dissipates heat should be installed in the top row. Heat-dissipating equipment are recognized by a hot surface caution sign cut in the top surface of the equipment.
- The manufacturer gives the maximum load limit of the rails of the A4 workstation. It is important to consult the document on the A4 workstation before installing the equipment in order to avoid overloading the rails.



Festo Didactic A4 workstations 8153360 and 8158409 are rated for 50 kg (110 lb) per row.

Protective earthing instructions

Before using equipment provided solely by Festo Didactic, always perform the protective earthing procedure described in the present section.

Protective earthing of the equipment is achieved via the power supply modules, including:

- Split Phase Power Supply
- 3AC Power Supply and Safety Unit

These power supply modules have protective earthing (PE) terminals. These PE terminals are maintained at earth potential when the power supply module is connected to an ac power outlet.

As for the power supply modules, each other module in the equipment has two PE terminals. These PE terminals must be inter-connected using the provided protective earthing leads, forming strings of modules. Strings of up to twenty series-connected modules are allowed. Each string of modules must then be connected to the PE terminal of a power supply module.

NOTICE

If you use protective earthing leads other than those provided with the equipment, they must have a cross-section of at least 4.0 mm², according to EN60204-1.

The PE terminals of the power supply module(s) and training modules must be interconnected to achieve effective protective earthing. The strings of training modules must be connected to the PE terminals available on the power supply module as shown in the following figure.

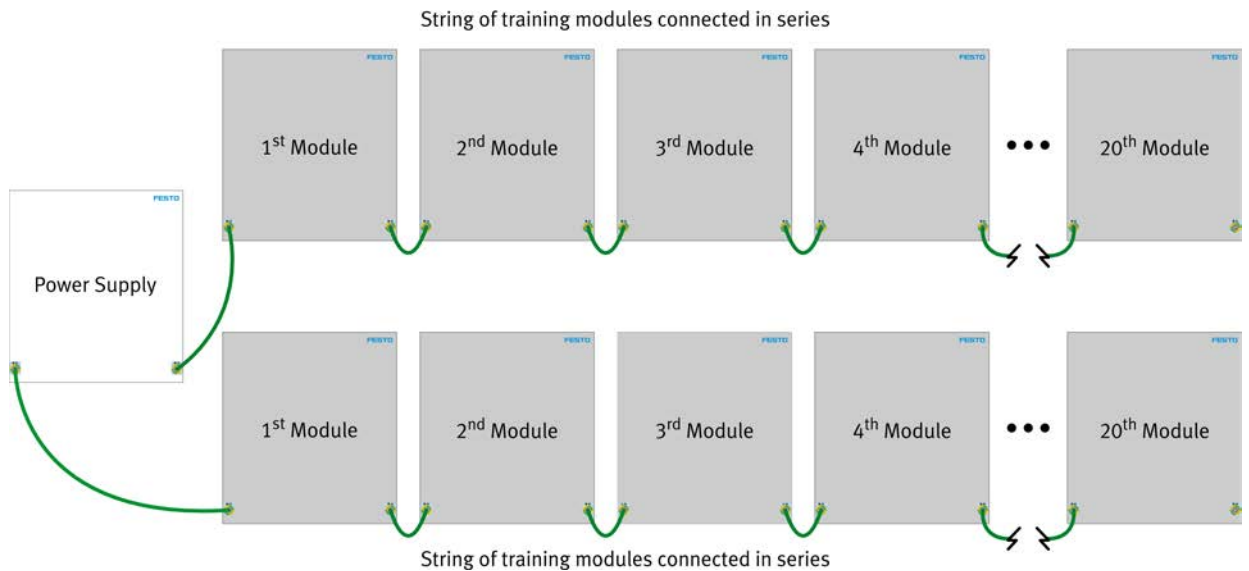


Figure 1: Protective earthing in a setup containing a single power supply module.

When two sets of charging station modules are used, each are connected individually. There is no need to connect the PE terminals of the first power supply to the terminals of the second. However, the strings of training modules must be connected to the PE terminals of their respective power supply modules as shown in the following figure.

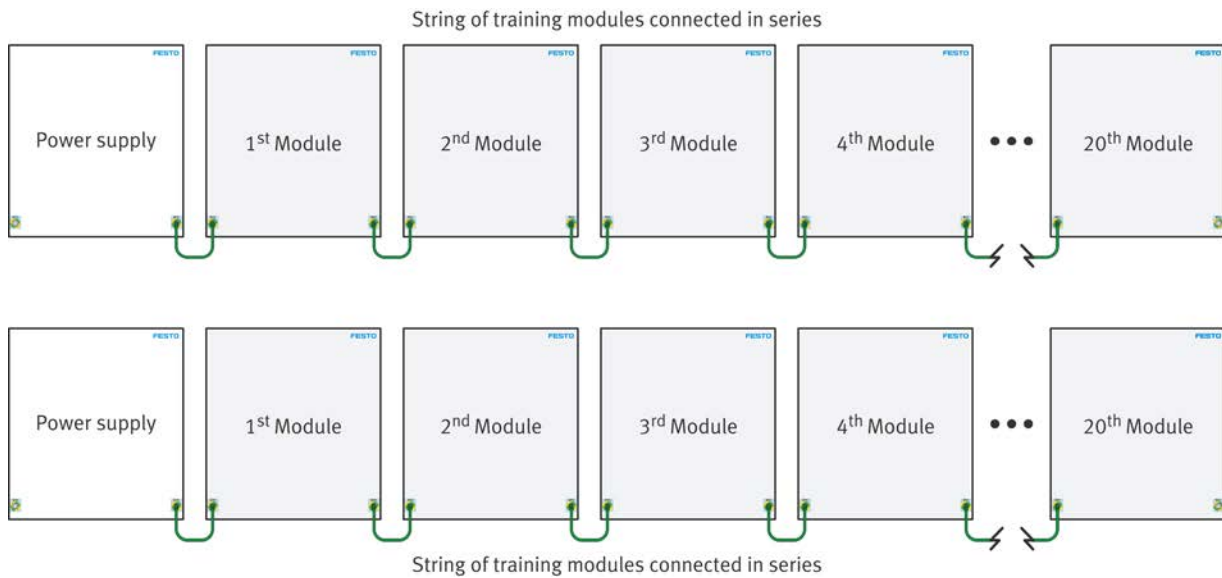


Figure 2: Protective earthing of the training modules in two equipment setups containing each one power supply module.

For your safety and the safety of the equipment, follow this checklist before completing hands-on exercises.

- Make sure that the equipment is in a secure location (accessible, with no tripping hazards, notably).
- Make sure that the equipment is stable on a flat working surface or secured in its racking.
- Inspect the charging station for any visible damage or wear (e.g., cracks, loose components).
- Ensure all cables and connectors are in good condition, without frays or exposed wires.
- Ensure the charge connector is clean and free from debris.
- Verify that the emergency stop button is disengaged. If engaged, it can be reset by turning the key counterclockwise.
- Verify that all fault switches are disengaged. They should be at the 0 position, flipped toward the front of the unit.
- Validate that all electrical connections are secured and accurate to the provided circuit diagram.
- Validate that grounding connections are secured.



Validate your setup with your instructor before powering up the charging station.

Notify your instructor if you notice any damage or defect on the charging station.

Via the USB-C interface

To communicate between the Electric Vehicle AC Charging Station and the computer, it is recommended to use the USB-C interface to avoid Ethernet network restrictions. Administrator rights on your computer are required.

For more information, refer to the manufacturer's documentation (Phoenix Contact, CHARX SEC-3xxx controller).

1. Download an RNDIS driver for your computer by typing the following URL into your browser:

catalog.update.microsoft.com

2. In the search bar of the Microsoft Update Catalog, type the following exactly as shown (do not include spaces):

USB\VID_0525&PID_A4A2

If you copy this line from the document, make sure the "&" symbol is not replaced by "&" or other characters.

Alternatively, search for "RNDIS Gadget".

Select the driver compatible with your operating system.

3. Download the driver to your computer. The file is compressed and approximately 21 KB in size.

Extract the file to a directory such as **c:\rndis-driver**.

4. Open the Device Manager from the Control Panel or by using the Search bar.

Connect the controller to the computer with a USB-C or USB/USB-C cable.

A new device appears when the EVSE controller is connected and disappears when disconnected. This is the interface for the EVSE controller. Depending on the operating system, it may appear as "USB Device" or a similar name.

Double-click the device.

5. In the new window, select Driver and then Driver Update.

Browse to the directory containing the extracted driver files.

6. After installation, the device appears under the Network category as "USB Ethernet/RNDIS Gadget" or a similar entry.

Access the web interface by entering the IP address **192.168.5.1** in your browser.



If access remains unavailable despite correct installation, check the following:

- Your computer may be attempting to connect via an Ethernet or WLAN interface. Disable these interfaces temporarily.
- The driver may not be assigned to the correct interface. Identify which interface appears or disappears when connecting or disconnecting the module.

Via an Ethernet cable

If it is not possible to install the driver for the USB-C interface, it is possible to use an Ethernet cable to connect the controller to a computer. The IP address of the computer must be reassigned, which requires administrator rights to your computer.

7. Connect the controller to your computer using an Ethernet (RJ-45) cable through the ETH0 port.
8. On your computer, in Settings, go to Network & Internet.
Go to the Ethernet menu on the left.
9. Click Change adapter options.
Right-click on the Ethernet connection used to connect to the controller, click Properties.
10. Select "Internet Protocol Version 4 (TCP/IPv4)" and click Properties.
Set the IP address of your computer to 192.168.1.30.
Set the Subnet mask to 255.255.255.0.
Click OK.
11. Once the charging station is turned on and has finished booting (about 3 minutes), you will be able to access the web interface through your browser.
In the address bar of the browser, type 192.168.1.10 and press Enter.





Figure 3: To remove the Ethernet cable, you may need to use a small screwdriver to push on the tab.

Setup and quick start

Setting up the equipment

1. Make sure that the main circuit breaker on the power supply is set to the OFF (O) position.
Connect the modules as shown in the following figures.
2. Complete the inspection of the charging station by following the Inspection checklist of the charging station.
3. Set the On-board charger on the Electric Vehicle (EV) module to 16 A (one phase).

	 WARNING
	<p>The protective earth (PE) terminal of each module must be connected, either directly or through another module, to a PE terminal on the power supply. If necessary, check with the instructor to ensure that the connections you have made provide proper earthing of the equipment.</p>

Connection instructions

- Connect the Power Supply module to the Electric Vehicle Supply Equipment (EVSE) module.
- Connect the Power Supply module power cord to a suitable power outlet.
- Connect the charging cable to the front terminals of the EVSE.

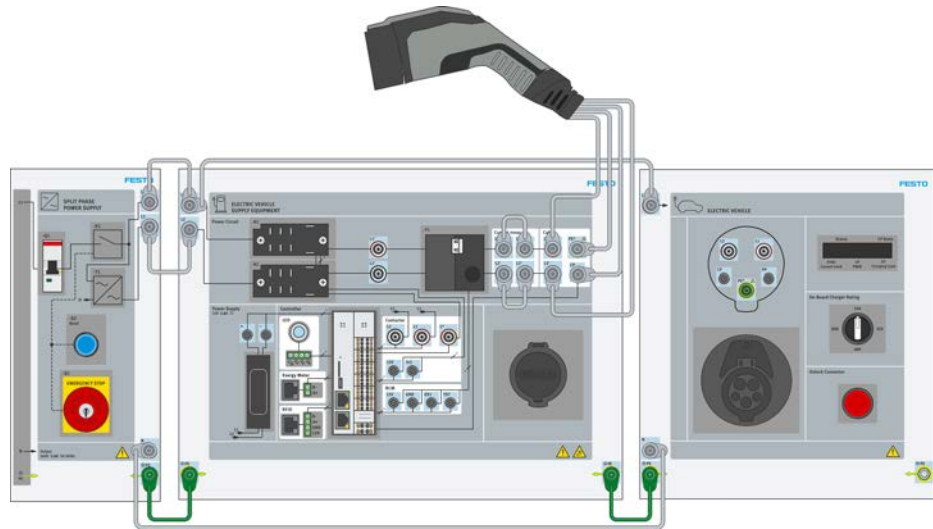


Figure 4: Connection diagram for the charging station (Type 1).

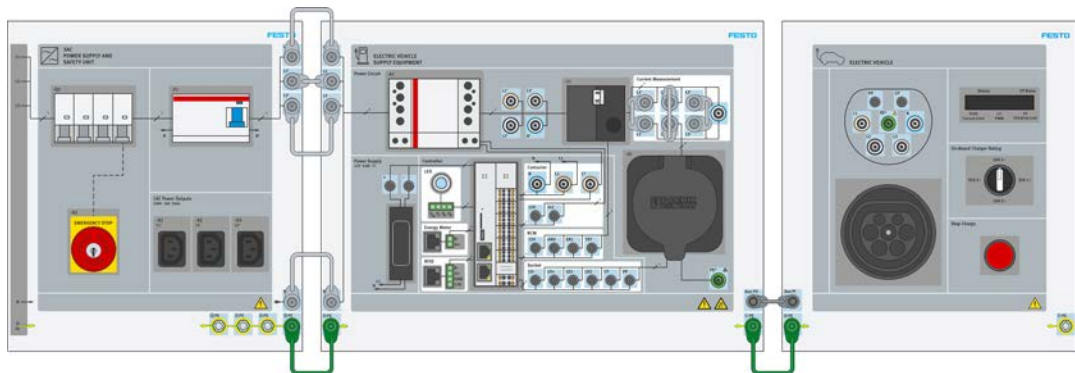


Figure 5: Connection diagram for the charging station (Type 2).

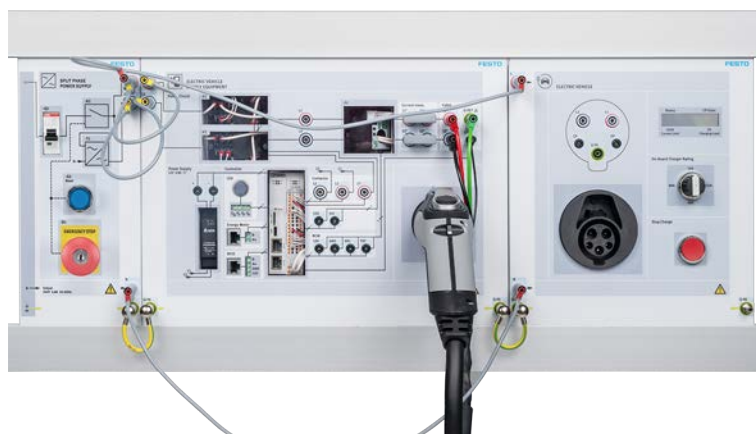


Figure 6: Setup example T1 without M&A.



Figure 7: Setup example T2 without M&A.

When using the Metering and Authentication (M&A) module, connections to the energy meter and RFID reader are required. Complete the connections as shown in the following figures.

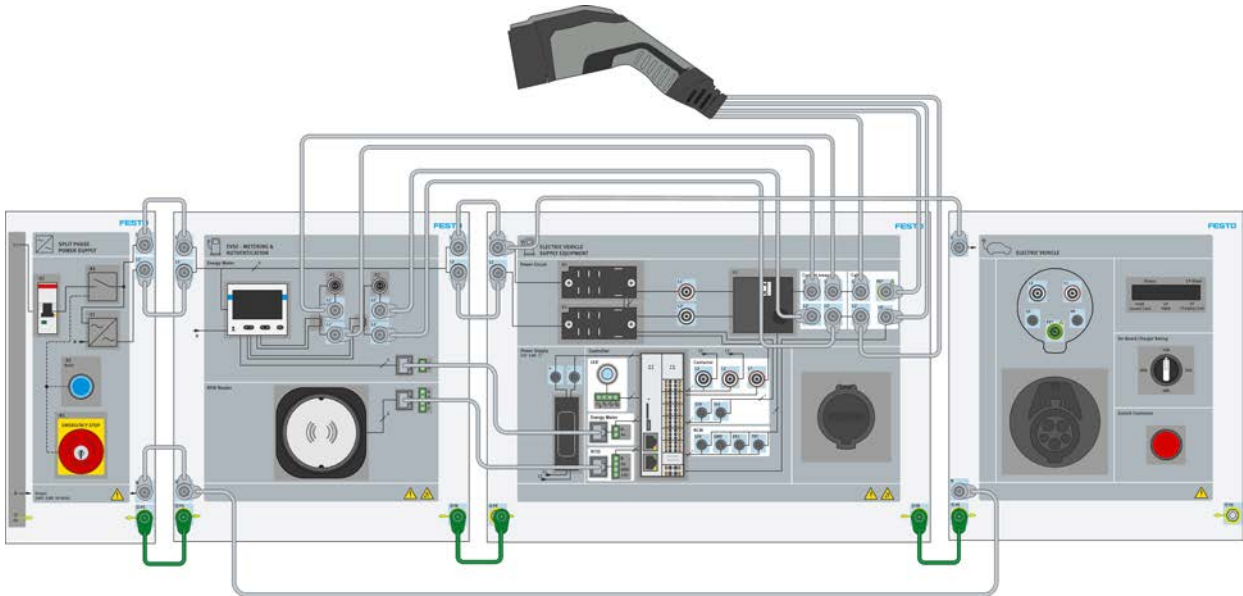


Figure 8: Connection diagram for the charging station (Type 1).

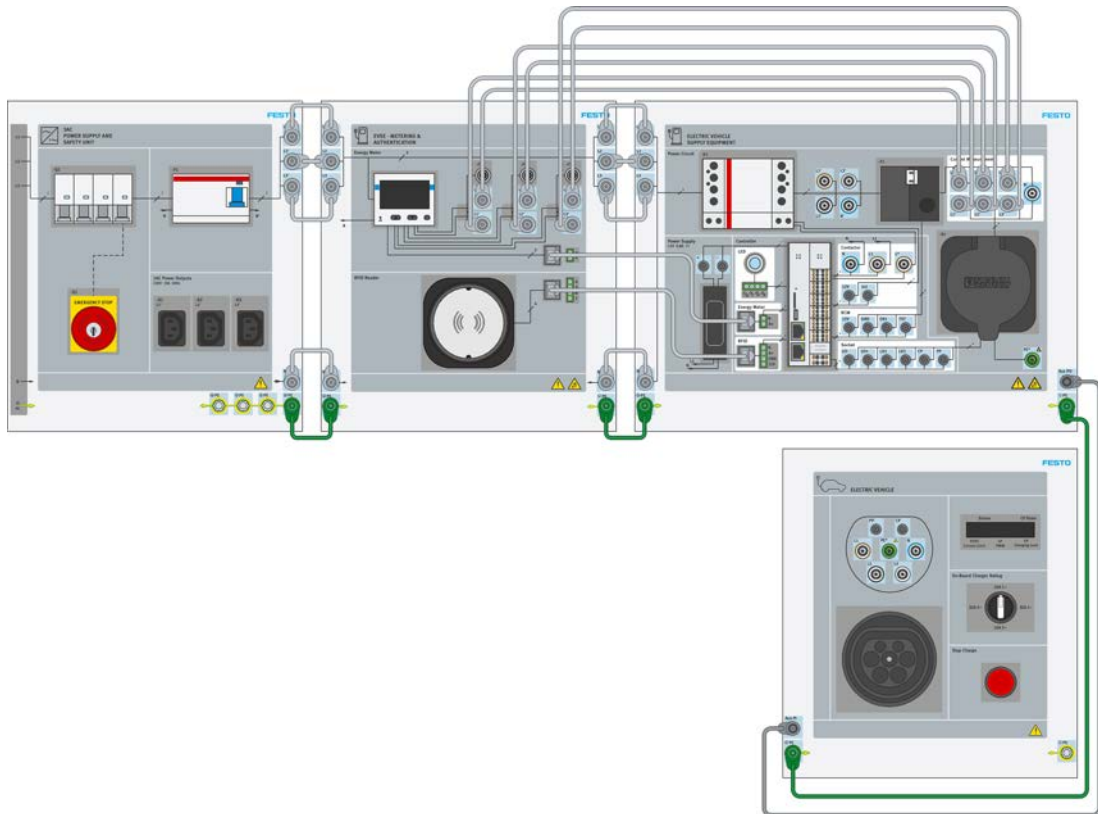


Figure 9: Connection diagram for the charging station (Type 2).

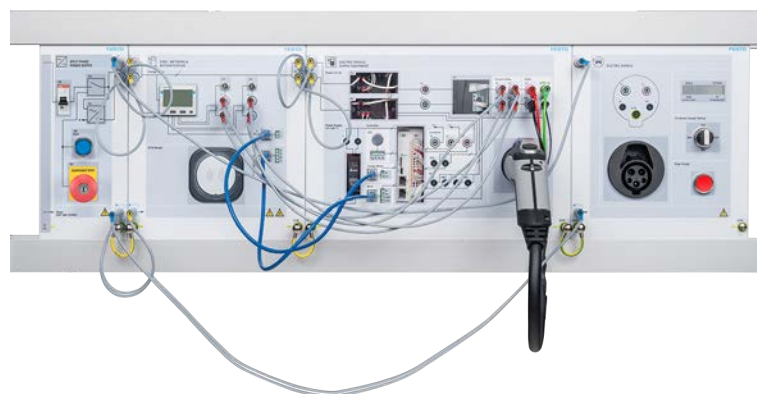


Figure 10: Setup example T1 with M&A.

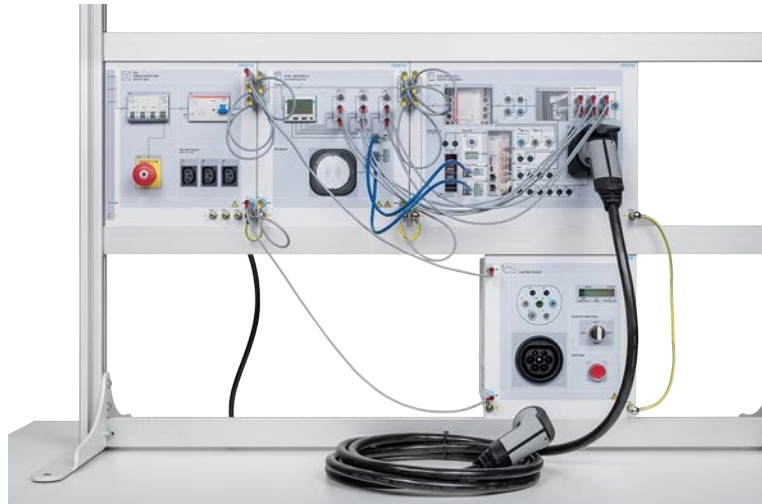


Figure 11: Setup example T2 with M&A.

Turning on the equipment

4. Turn on the charging station with the Power Supply circuit breaker.

Press the blue Reset button (Split Phase Power Supply 8234496 only).

The charging station takes about 3 minutes to boot. After that wait time, it is ready to be operable.

Here are the visual indicators that the system is booting up correctly:

- LED indicator lights up blue.
- Lights on the EVSE controller flash green as the system boots up, then light green and blue.
- EV module display lights up, shows the firmware version before getting to the normal view: Status Disconnected, CP status A1, EVSE current limit 0 A, Duty cycle 0%, EV charging load 0 A.
- (If using the M&A module) RFID reader beeps on startup and lights up green. Energy meter display lights up, shows a charge rate of 0 kW and an energy total in kWh.

Initiating a charging session

5. Plug the charging cable in the EV module. Make sure it is pushed all the way in.

Here are the visual indicators that the charging session is running correctly:

- LED indicator flashes blue (State B), then flashes green as the charging session starts (State C).
 - Contactor clicks.
 - An actuator audibly locks the cable outlet in place.
 - On the EV module display, the status goes from Connected B1 to Connected B2, to Charging C2. The EV charging load is at 16 A, with a duty cycle of 95%.
 - (If using the M&A module) Energy meter display shows a charge rate of 4.17 kW and an energy total in kWh.
6. The charging rate setpoint can be adjusted using the On-board charger selector on the EV module.

Stopping the charge

7. Stop the charge:

Press the Unlock connector or Stop charge button on the EV module. Remove the cable from the EV module.

Here are the visual indicators that the charging session has been stopped correctly:

- An actuator audibly unlocks the cable outlet. Then, as the cable is pulled off:
- Contactor clicks.
- LED indicator turns blue as the charging session stops.
- On the EV module display, the status returns to Disconnected A1. The EV charging load is 0 A and the duty cycle is at 0%.
- Energy meter display shows a charge rate of 0 kW and an energy total in kWh.

Fault insertion

The following table lists all faults that can be inserted on the Electric Vehicle AC Charging Station for the troubleshooting exercise.

They should be inserted before starting up a charging session, except for fault switch 3 (see below).

To insert a fault with a fault switch


Fault switches are located on the sides of the modules and may be covered by a sliding panel.

A fault is deactivated when the switch is in position O, flipped toward the user. To activate the fault, set the switch to position I, flipped toward the back of the module.



Figure 12: Fault switches on the side of a module.

Table 3: Fault insertion.

Fault	Insertion method
Electric Vehicle Supply Equipment module faults	
Disconnection of RCM TST Pin from EVSE controller	Fault switch 1 on EVSE module
Disconnection of contactor coil from EVSE controller	Fault switch 2 on EVSE module
Leakage ground current fault This fault is differently implemented according to the version of the module, see note below.	Fault switch 3 on EVSE module
Contactor welded contact: input and output short circuited (auxiliary contact short circuited)	Fault switch 4 on EVSE module
Disconnection of ground/PE from outlet/cable (CP = 12V)  See Warning below this table.	Fault switch 5 on EVSE module
Pilot state is Status E (CP = 0V, CP and PE short circuited)	Fault switch 6 on EVSE module
Disconnection of proximity pilot from outlet Type 2 version only	Fault switch 7 on EVSE module
Disconnection of interlocking signal feedback from outlet Type 2 version only	Fault switch 8 on EVSE module
Pilot state is Status F (Configuration / Software)	Click "Disable charging point" from the Dashboard or the EVSE Status menu on the web interface.
EV faults	
Simulated drawn current higher than PWM setpoint*	Fault switch 1 on EV module*
Disconnection of Proximity pilot from socket	Fault switch 2 on EV module



Fault	Insertion method
State C disabled	Fault switch 3 on EV module
Diode by-pass	Fault switch 4 on EV module
Metering faults	
Disconnection of RS485 (+) pin to EVSE controller	Fault switch 1 on Metering & Authentication module
RFID faults	
Disconnection of V+ pin to EVSE controller	Fault switch 2 on Metering & Authentication module

*: For this fault to be effective, the EVSE Charge Current Maximum must not exceed 70 A. Set this value on the web interface by navigating to **Charging Stations > EVSE #1 > Configuration**, then scrolling down to the Energy section. Also, set the On-Board Charger Rating to 80 A (Type 1) or 32 A (Type 2).



The leakage ground current fault (EVSE Fault switch 3) differs slightly from the others.

In the Type 2 version (EU, P/N 8218283), the simulation of the ground current leak operates differently. The fault is activated immediately when the fault switch is turned on. Therefore, it is recommended to insert this fault during the charging session so the student can observe the associated symptoms.

	 WARNING
	<ul style="list-style-type: none"> Risk of death due to an electric shock when using the ground/PE terminal linked to the outlet/charging cable for earthing of other modules! This terminal is intended for functional/demonstrative purposes only, it can be disconnected using a fault switch which would subsequently interrupt the protective earthing of other modules in the string. The absence of a protective earth symbol and yellow background around this terminal indicates that it is not meant to serve safety purposes. Only use the PE terminals at the bottom corners of the modules for protective earthing purposes. Refer to the Protective earthing instructions section of the User Guide for instructions relative to adequate earthing of modules.

Equipment Description

The Electric Vehicle AC Charging Station contains four modules:

- Power supply module
- Metering & Authentication (M&A) module
- Electric Vehicle Supply Equipment (EVSE) module
- Electric Vehicle (EV) module

The modules are connected together to complete the hands-on activities. The EVSE, M&A, and EV modules have to be powered by the power supply to operate and require protective earth connection for grounding.

All modules are designed to be placed in a standard A4 racking. They also have rubber feet, so they can be securely placed on a table.

The EVSE, M&A, and EV modules include small switches used in troubleshooting exercises. These fault switches are hidden behind a panel on the sides of the modules. They introduce faults representative of common issues encountered with charging stations.

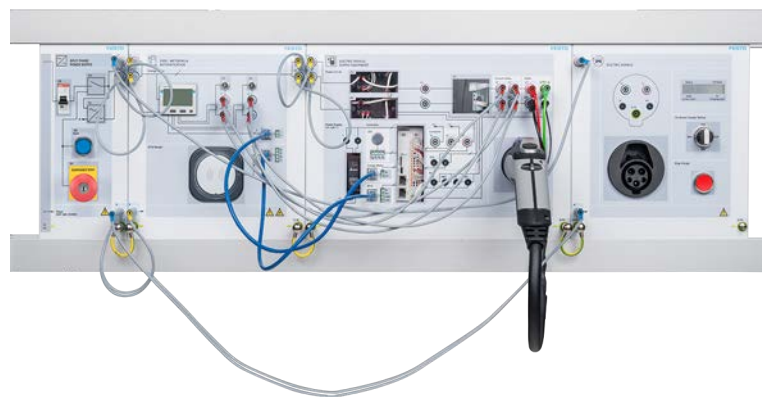


Figure 13: Electric Vehicle AC Charging Station (Type 1) with all modules connected.

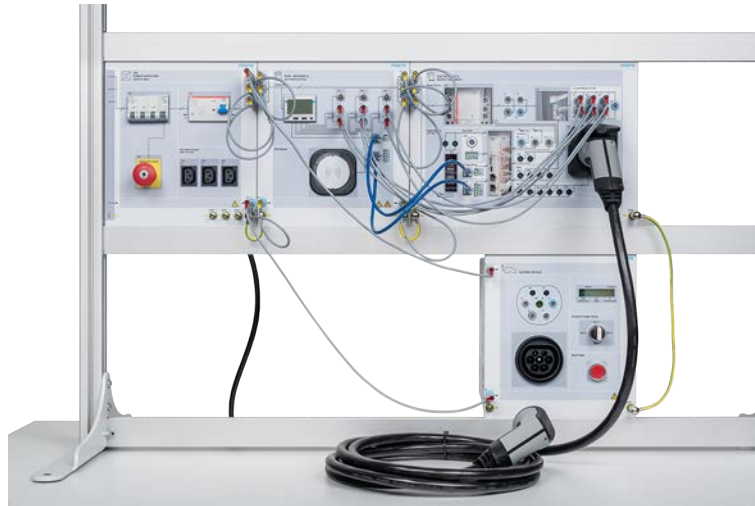


Figure 14: Electric Vehicle AC Charging Station (Type 2) with all modules connected.

EVSE module

The Electric Vehicle Supply Equipment (EVSE) module is the main component of the charging station. It is centered around the EVSE controller, which is the brain of the station, visible through a transparent panel. The other components of this module, visible on the front panel, include:

- The contactors, which allow or block the current used for the charge.
- The RCM (Residual Current Monitor), a safety component.
- The 12 V power supply.
- The indicator LED, denoting to the user the charge status.
- Either a holder (Type 1) or a socket (Type 2) for the charging cable.

Jack terminals allow the user to connect the different components of the charging station together with standard 4 mm leads. Those, along with 2 mm leads, also allow to take measurements on the components of the station.

Jack terminals of the EVSE module

- Electrical supply (L1 and L2 for Type 1; L1, L2, L3, N for Type 2), that are connected to the power supply module.
- Test points (L1' and L2' for Type 1; L1', L2', L3', N' for Type 2), between the contactor and the RCM.
- Current measurement (L1' and L2' for Type 1; L1', L2', L3', N' for Type 2), between the RCM and the charging cable.
- 12 V power supply outlets (+ and -).
- Contactor test points (L2, L1, L* for Type 1; N, L1, L* for Type 2; 12V and In2 for both types)
- RCM test points (12V, GND, ER1, TST)
- Charging cable test points (L1', L2', CP, PE* for Type1; LO+, LO-, LD1, LD2, CP, PP, PE* for Type 2)

Two Ethernet ports are used to connect the controller to the Metering & Authentication module. A USB-C port on the EVSE controller is used to connect it to a computer. Alternatively, the ETH0 port of the controller can be used for this purpose.

The protective earth (PE) jack terminal linked to the charging cable on this module should not be used for protective earthing purposes. This terminal is only used for demonstration, as it can be disconnected with a fault switch. For more details, see the warning in this section: Fault Insertion.

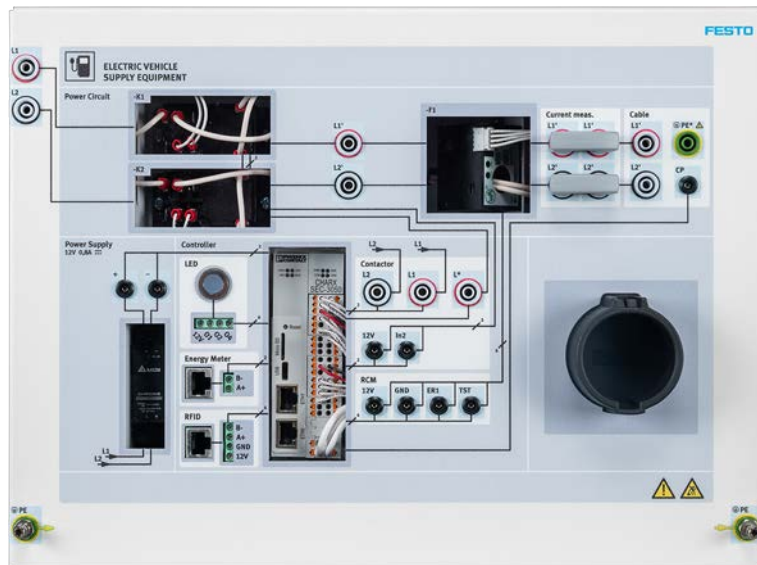


Figure 15: EVSE module Type 1 front panel.

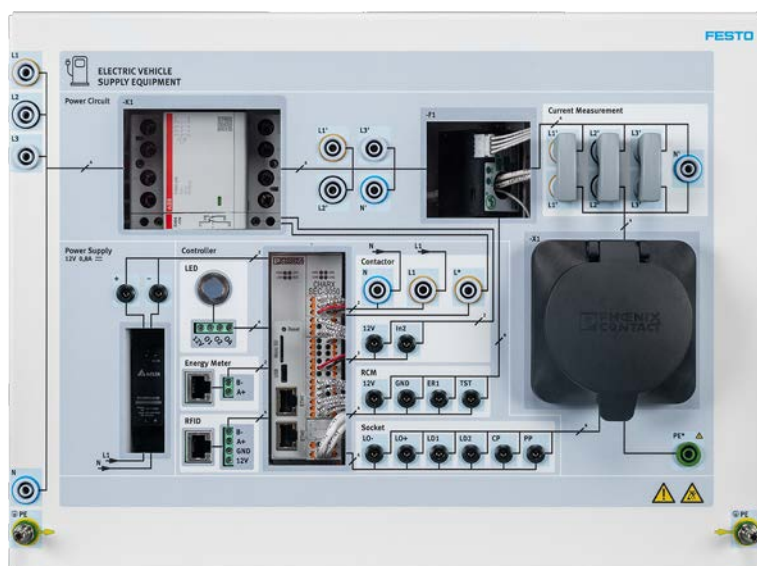


Figure 16: EVSE module Type 2 front panel.

Table 4: Specifications of the EVSE module Type 1 (8218281).

Parameter	Rating
AC power network voltage and frequency	240 V – 60 Hz
Maximum charging current	0.3 A
Electrical installation	2 phases line-to-line provided by Split Phase Power Supply, derived from single phase network, including line, neutral, and earth wires, protected by a circuit breaker in accordance with local regulations.
Maximum control circuit input	0.24 A, 240 V, split phase
Installation location	Tabletop or A4 workstation
Ingress protection rating	IP20
Dimensions (H × W × D)	300 × 400 × 140 mm (12 × 16.3 × 5.7")
Weight	4.9 kg (10.8 lb)

Table 5: Specifications of the EVSE module Type 2 (8218283).

Parameter	Rating
AC power network voltage and frequency	230/400 V – 50 Hz
Maximum charging current	0.3 A
Electrical installation	3 phases, star (wye) configuration, including line, neutral, and earth wires, provided by a compatible power supply module and protected by a circuit breaker in accordance with local regulations.
Maximum control circuit input	0.4 A, 230 V, single phase
Installation location	Tabletop or A4 workstation
Ingress protection rating	IP20

Parameter	Rating
Electromagnetic compatibility	Group 1, Class A (industrial environment, EN 55011)
Dimensions (H × W × D)	300 × 400 × 140 mm (12 × 16.3 × 5.7")
Weight	6.2 kg (13.4 lb)
CE and UKCA markings	<ul style="list-style-type: none"> ● Low-Voltage Directive ● EMC Directive ● RoHS Directive

Power supply module

The power supply module provides power to the charging station at the adequate voltage and phase configuration. It is the only module that needs to be plugged into a power outlet. Your system includes one of two versions of this module:

- Type 1 uses the **Split Phase Power Supply**.
- Type 2 uses a **3AC Power Supply and Safety Unit** or an equivalent one approved by your instructor.

Both modules include on their front panel 4 mm jack terminals to supply power to the other modules, protective earth terminals, circuit breakers, and an emergency stop button. This emergency stop button can be reset using a key, which must be kept away from the button, in a secure location.

The Split Phase Power Supply (P/N 8234496) includes a blue Reset button. As the blue Reset light is on when powering the learning system, you will need to reset it by pressing the Reset button on the module.

The 3AC Power Supply and Safety Unit also includes three power outlets on its front panel, which are not used within the scope of this course.

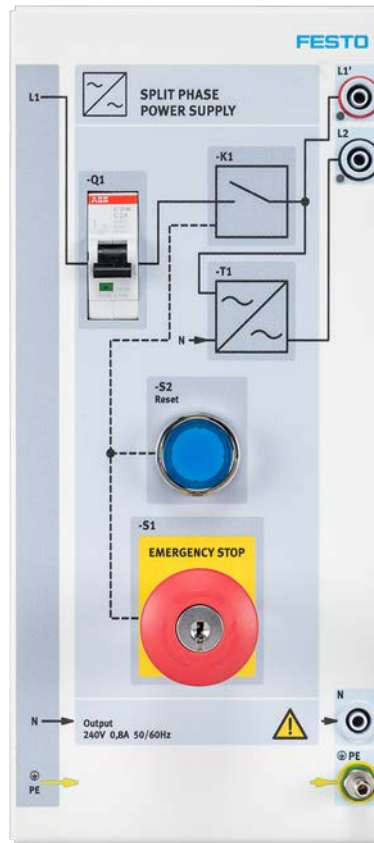


Figure 17: Split Phase Power Supply (8234496) front panel.

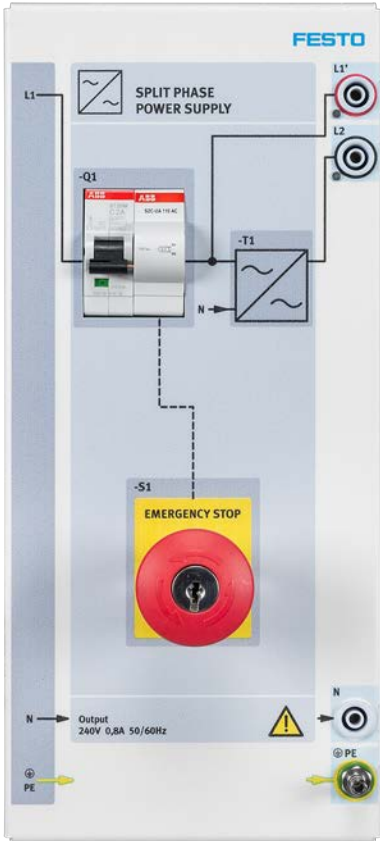


Figure 18: Split Phase Power Supply (8218279) front panel.

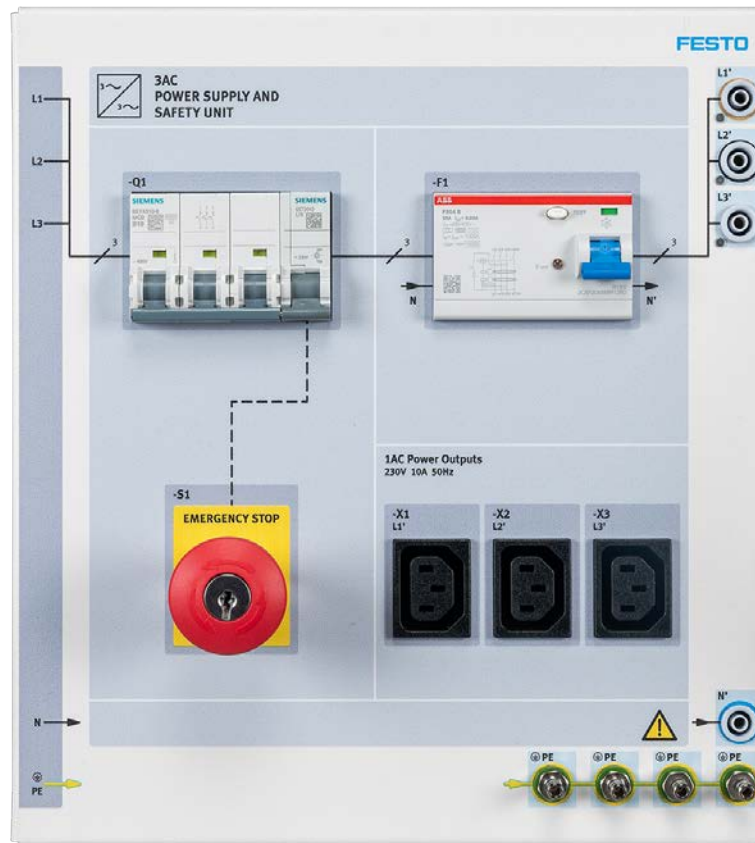


Figure 19: 3AC Power Supply and Safety Unit front panel.

Table 6: Specifications of the Split Phase Power Supply (8218279 and 8234496).

Parameter	Rating
AC power network voltage and frequency	120 V – 60 Hz
Maximum current	1.6 A
Electrical installation	1 phase, including line, neutral, and earth wires, protected by a circuit breaker in accordance with local regulations.
Maximum output	0.8 A, 240 V, split phase
Installation location	Tabletop or A4 workstation
Ingress protection rating	IP20
Dimensions (H × W × D)	300 × 130 × 140 mm (12 × 5.3 × 5.7")
Weight	3.8 kg (8.4 lb)

Table 7: Specifications of the Power Supply and Safety Unit modules (8162950, 594826, and 8143155).

Parameter	Rating
AC power network voltage and frequency	230/400 V – 50 Hz
Maximum current	10 A
Electrical installation	3 phases, star (wye) configuration, including line, neutral, and earth wires, protected by a circuit breaker in accordance with local regulations.
Maximum output	10 A, 230 V, three phases
Installation location	Tabletop or A4 workstation
Ingress protection rating	IP20
Electromagnetic compatibility	Group 1, Class A (industrial environment, EN 55011)
Dimensions (H × W × D)	300 × 265 × 140 mm (12 × 10.8 × 5.7")

Parameter	Rating
Weight	8162950: 6.20 kg (13.7 lb) 594826: 4.60 kg (10.1 lb) 8143155: 5.50 kg (12.1 lb)
CE and UKCA markings	<ul style="list-style-type: none"> • Low-Voltage Directive • EMC Directive • RoHS Directive

EVSE - Metering & Authentication module

This module includes an energy meter used to measure the total current and power sent to the vehicle during a charging session.

Below it, an RFID reader allows the charging station to read RFID cards.

Both components connect to the EVSE controller via Ethernet cables. The energy meter connects to the EVSE module's Current Measurement section using 4 mm leads. The energy meter circuitry is protected with small circuit breakers.

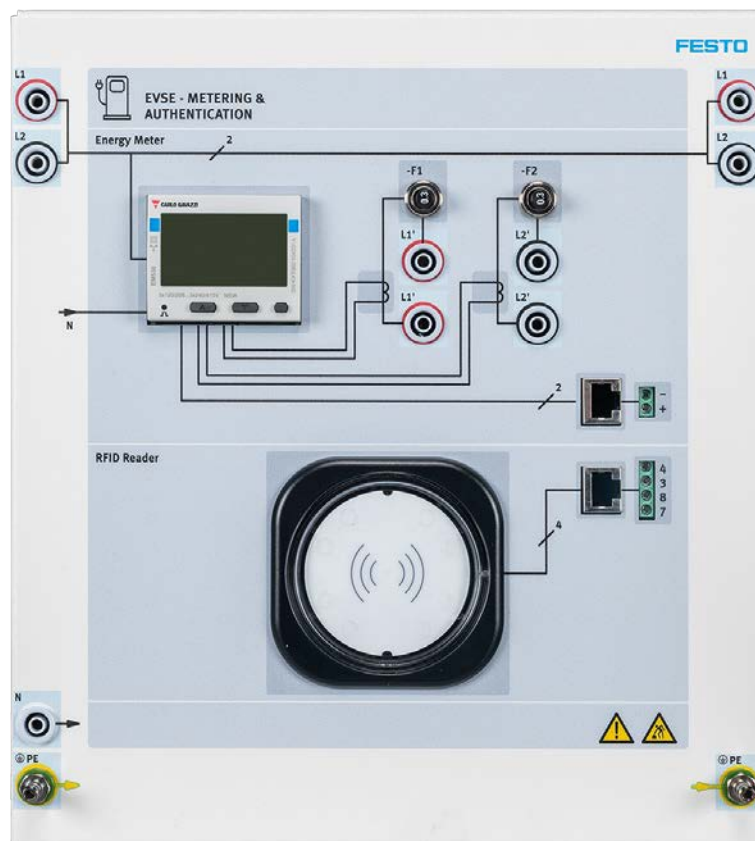


Figure 20: M&A module Type 1 front panel.



Figure 21: M&A module Type 2 front panel.

Table 8: Specifications of the M&A module Type 1 (8218285).

Parameter	Rating
AC power network voltage and frequency	120/240 V – 60 Hz
Maximum current	0.3 A
Electrical installation	2 phases circuit provided by Split Phase Power Supply, derived from single phase network including line, neutral, and earth wires, protected by a circuit breaker in accordance with local regulations.
RFID frequencies	125 kHz (LF) / 13.56 MHz (HF)
RFID transmission power	125 kHz: ≤ -13.95 dB μ A/m 13.56 MHz: ≤ -7.17 dB μ A/m (field strength at 10 meters, standard max value)

Parameter	Rating
Installation location	Tabletop or A4 workstation
Ingress protection rating	IP20
Dimensions (H × W × D)	300 × 265 × 140 mm (12 × 10.8 × 5.7")
Weight	5.4 kg (11.9 lb)

Table 9: Specifications of the M&A module Type 2 (8218286).

Parameter	Rating
AC power network voltage and frequency	230/400 V – 50 Hz
Maximum current	0.3 A
Electrical installation	3 phases, star (wye) configuration, including line, neutral, and earth wires, provided by a compatible power supply module and protected by a circuit breaker in accordance with local regulations.
RFID frequencies	125 kHz (LF) / 13.56 MHz (HF)
RFID transmission power	125 kHz: ≤ -13.95 dBμA/m 13.56 MHz: ≤ -7.17 dBμA/m (field strength at 10 meters, standard max value)
Installation location	Tabletop or A4 workstation
Ingress protection rating	IP20
Electromagnetic compatibility	Group 2, Class A (industrial environment, EN 55011)
Dimensions (H × W × D)	300 × 265 × 140 mm (12 × 10.8 × 5.7")
Weight	6.6 kg (14.5 lb)
CE and UKCA markings	<ul style="list-style-type: none"> ● Radio Equipment Directive ● RoHS Directive

NOTICE

The EVSE - Metering & Authentication module contains an RFID module, model TWN4 Palon Compact M Light from ELATEC GmbH:

elatec-rfid.com/int/product-detail/twn4-palon-compact-m-light

FCC ID: WP5TWN4F10

IC: 7948A-TWN4F10

Complies with Radio Equipment Directive 2014/53/EU.

To comply with the applicable RF exposure requirements, the RFID module should be installed and operated with a minimum distance of 20 cm to any user's/nearby person's body at all times.

Operators of the equipment should familiarize themselves with the safety instructions of the RFID device. The user manual of the TWN4 Palon Compact family can be accessed at the Technical Documentation page of ELATEC's website: elatec-rfid.com/int/technical-documentation

Refer to the Compliance statements section of Learning Unit 8 for additional regulatory information.

EV module

The Electric Vehicle (EV) module simulates an electric vehicle when plugged into the charging station. The main feature on its front panel is the socket for the charging cable, including 4 and 2 mm jack terminals to allow measurements.

Jack terminals of the EV module

- Type 1: L1, L2, CP, PP, PE*.
- Type 2 : L1, L2, L3, N, CP, PP, PE*.

It also includes a small LCD screen that displays information about the charge:

- Charge status
- Control Pilot (CP) state
- Current limit of the EVSE
- CP PWM (% Duty cycle)
- EV charging load

A selector, the On-Board Charger Rating, allows the user to choose the charge setpoint of the vehicle:

- On Type 1 modules, the setpoint can be adjusted between 16, 32, 48, and 80 A.
- On Type 2 modules, the setpoint can be adjusted between 16 and 32 A, either single-phase or three-phase current.

A red button on the front panel is there to allow the user to unplug the cable and stop the charge. Labelled "Unlock connector" (on Type 1) or "Stop charge" (on Type 2), it deactivates the electric actuator that locks the charging cable when plugged in.



Figure 22: EV module Type 1 front panel.



Figure 23: EV module Type 2 front panel.

Table 10: Specifications of the EV module Type 1 (8218288).

Parameter	Rating
AC power network voltage and frequency	120/240 V – 60 Hz
Maximum charging current	0.14 A
Electrical installation	Power provided by Split Phase Power Supply, derived from single phase network including line, neutral, and earth wires, protected by a circuit breaker in accordance with local regulations. Charging circuit: 2 phases line-to-line Control circuit: 1 phase line-to-neutral
Control circuit	20 mA, 120 V, single phase
Installation location	Tabletop or A4 workstation
Ingress protection rating	IP20
Dimensions (H × W × D)	300 × 265 × 140 mm (12 × 10.8 × 5.7")
Weight	3.9 kg (8.6 lb)

Table 11: Specifications of the EV module Type 2 (8218289).

Parameter	Rating
AC power network voltage and frequency	230/400 V – 50 Hz
Maximum charging current	0.12 A
Electrical installation	3 phases, star (wye) configuration, including line, neutral, and earth wires, provided by a compatible power supply module and protected by a circuit breaker in accordance with local regulations.
Auxiliary input	0.3 A, 12 VDC
Installation location	Tabletop or A4 workstation
Ingress protection rating	IP20

Parameter	Rating
Electromagnetic compatibility	Group 1, Class A (industrial environment, EN 55011)
Dimensions (H × W × D)	300 × 265 × 140 mm (12 × 10.8 × 5.7")
Weight	4.2 kg (9.3 lb)
CE and UKCA markings	<ul style="list-style-type: none"> ● Low-Voltage Directive ● EMC Directive ● RoHS Directive



Equipment Maintenance

The equipment is designed to ensure user safety, reliability, and effective learning outcomes. To maintain safety and performance, it is important to keep the equipment in good condition.

The learning system needs regular maintenance. Students will perform some tasks as part of their training, while qualified personnel must handle other periodic maintenance.

Since trainees may not yet detect issues, a technician or instructor should inspect the system before and after each use.

Replace defective or missing components immediately. Contact our service department for replacement parts and instructions.

	 CAUTION
	<ul style="list-style-type: none"> • Instructors and laboratory personnel must communicate these directions and guidelines to students, as they are essential for maintaining the equipment's safety and functionality. • Do not operate the equipment with missing or damaged parts.

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.

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. Most parts and accessories used for the Electric Vehicle AC Charging Station are part of component kits and come with a packing document listing all included parts and their corresponding part numbers. We highly recommend keeping these lists for reference. Should you need replacement parts or kits, contact your Festo Didactic representative.

Equipment modification

Do not modify the equipment without prior written permission of Festo Didactic. The equipment was designed in accordance with various regulations (safety, electromagnetic compatibility, etc.). Modifications could have undesired consequences on product integrity and safety.

The use or installation of spare parts by unqualified persons, as well as any repair or modifications not complying with the product's original specifications and manufacturing methods, can cause material damage, serious injury, or even death. It may also void any warranty or product approval.

Equipment 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.

Waste from Electrical and Electronic Equipment (WEEE) directive:

- In accordance with European regulations, used electrical and electronics devices cannot be disposed of in unsorted municipal waste. The symbol of the waste bin on wheels indicates the necessity for separate collection. For environmental protection, make sure the equipment is disposed of in the waste sorting processes designed for this purpose. DIRECTIVE 2012/19/EU of the EUROPEAN PARLIAMENT AND OF the COUNCIL of 4 July 2012 on waste electrical and electronic equipment (WEEE).



The presence of this symbol on the equipment indicates the necessity of separate collection.

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 equipment. Instead, apply the solution onto the soft cloth.

NOTICE

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

Indications of conformity

Directives and declarations of conformity

The directives applicable to each piece of equipment in the learning system are specified in the corresponding Equipment Description section.

You can download declarations of conformity for all available equipment using the following link:

1. Enter your equipment name in the search field.
2. Click the "Didactic Products" tab.
3. Select your equipment from the search results.
4. Open the "Downloads" tab.
5. Go to the "Certificates" section.
6. Download the required documents.



Festo website.

<https://www.festo.com>

Electromagnetic compatibility (EMC)

The following table outlines international electromagnetic compatibility (EMC) compliance requirements, specifying applicable standards, equipment classifications, and usage limitations.

Table 12: Electromagnetic compatibility (EMC) compliance.


International	<p>EN IEC 61326-1: Basic Electromagnetic Environment CISPR 11: Group 1 or 2 (see the Equipment Description section for precision on each piece of equipment), Class A</p> <ul style="list-style-type: none"> Group 1: Equipment covered by this standard that is not classified as Group 2. <p>Group 2: Industrial, scientific, and medical radio-frequency (ISM RF) equipment that intentionally generates or uses radio-frequency energy (9 kHz to 400 GHz), locally applied via electromagnetic radiation, inductive or capacitive coupling, for purposes such as material treatment, inspection, analysis, or energy transfer.</p> <ul style="list-style-type: none"> Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances. Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.
United States	<p>FCC Title 47 CFR Part 15</p> <ul style="list-style-type: none"> Class A Digital device: A digital device that is marketed for use in a commercial, industrial or business environment.

Compliance statements

United States (FCC)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

 CAUTION
<p>Changes or modifications to the unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.</p>

FCC § 15.105 (a)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can

radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The EVSE Metering & Authentication module contains the RFID card reader module, FDD ID: WP5TWN4F10

Canada (ISED)

The EVSE Metering & Authentication module contains the RFID card reader module, IC: 7948A-TWN4F10

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

European Union

The EVSE - Metering & Authentication module contains an RFID module, model TWN4 Palon Compact M Light from ELATEC GmbH:

elatec-rfid.com/int/product-detail/twn4-palon-compact-m-light

The TWN4 Palon Compact family of products comply with the Radio Equipment Directive 2014/53/EU. The product's EU/UK declarations can be found in the download section of the product's web page (see link above) or at the following address:

elatec.com/approvals

CE Importer:

Festo Didactic SE
Rechbergstr. 3
73770 Denkendorf
Germany
Tel.: +49 711 3467-0
did@festo.com

US Importer:

Festo Didactic Inc.
607 Industrial Way West
Eatontown, NJ 07724
United States
Tel.: +1 732 938-2000
Toll Free: +1-800-522-8658
services.didactic@festo.com

CA Manufacturer:

Festo Didactic Ltée/Ltd
675, rue du Carbone
Québec (Québec) G2N 2K7
Canada
Tel.: +1 418 849-1000
Toll Free: +1-800-522-8658
services.didactic@festo.com

UK Importer:

Festo Ltd
Applied Automation Centre
Brackmills
Northampton, NN4 7PY
United Kingdom
T +44 800 626 422
info_gb@festo.com

www.festo.com



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