Industrial Controls Training Systems
8036

LabVolt Series

Datasheet

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Festo Didactic
en 120 V - 60 Hz
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Table of Contents

General Description

The Industrial Controls Training Systems are designed to teach the theory and techniques of electric motor controllers. They allow students to select and mount control devices to form typical control circuits, and to troubleshoot them once a fault is inserted. The systems offer unique controls training possibilities, are modular, and include insertable faults.

The Industrial Controls Training Systems comprise four basic systems, each covering a particular topic that deals with various aspects of industrial controls equipment operation. The following systems are available:

- Basic Controls, Model 8036-1, provides students with a complete basic training in motor controls.

- Programmable Logic Controller, Model 8036-2, introduces students to PLCs for motor operation control.

- Motor Drives, Model 8036-3, introduces students to dc and ac drives.

- Sensors, Model 8036-4, introduces students to photoelectric and proximity switches.

The control devices and motors in the 8036 Series are of standard industrial quality, and can be used conjointly with the 0.2 kW machines in the 0.2 kW Eletromechnical Training Systems, Models 8001 and 8006. Device designations can be added to each module with magnetic labels. Each module is equipped with up to four faults that can be inserted by the instructor using switches hidden behind the faceplate. Typical faults include open coils and contacts, dirty contacts, shorted connection, and crossed wires.

The modules in the 8036 Series are designed to be mounted in the Industrial Controls Mobile Workstation, Model 3103-4 (this model is double-sided and can accommodate two student groups simultaneously), the Industrial Controls Tabletop Workstation, the Industrial Controls Single-Rail Workstation, or the Industrial Controls Double-Rail Workstation.

The modules of the Industrial Controls Training Systems can be interconnected with those of other training systems for interdisciplinary training applications. Connections are made using flexible PVC leads terminated with 4 mm safety plugs. These leads allow safe connection of components since the live parts of their plugs are concealed and insulated, preventing accidental contact. The leads are provided in three different lengths, each identified by a distinctive color. For safety, smaller connection leads are also provided for the low-voltage applications running at 24 V dc. This prevents high-voltage and low-voltage leads from being mixed accidentally.

Safety bars are attached to each rail of the industrial controls workstations. These bars can be used to prevent students from removing modules during laboratory exercises. Padlocks are provided to lock the safety bars in place once all modules are inserted in the workstation.

Integration into 8001 and 8006 Electromechanical Training Systems

The Industrial Controls Training Systems can be integrated into the 0.2 kW Electromechanical Training Systems, Models 8001 and 8006, using the workstation and power supply provided with these systems. To implement a complete Industrial Controls Training System compatible with the Electromechanical Training Systems, the following models are required:

- 8036-2: Programmable Logic Controller
- 8036-4: Sensors
- 8036-B: Motor Drives
- 8036-E: Basic Controls

Courseware

The Industrial Controls Training Systems courseware consists of student manuals and instructor guides. The student manuals are divided into several units, each consisting of a series of hands-on exercises dealing with a particular topic of industrial controls. Each exercise provides a clearly stated objective, a discussion, an exercise procedure, a summary, and a set of review questions. An additional ten-question test at the end of each unit allows the student to verify what was learned in the unit.

Refer to the Table of Contents of the Manual(s) sections of this datasheet for a list of the topics covered in each student manual.

The instructor guides contain the practical results and the answers for each hands-on exercise in the student manuals. They also contain the answers to the unit test questions.

eLearning Formats

The courseware is also available in three eLearning formats for users preferring a computer-based approach:

- Model 3161- E: eSeries format, facilitated by the Mind-Sight eLearning system.
- Model 3161-F: SCORM-based format, designed to be hosted by a third-party, SCORM 1.2 compliant management system.
- Model 3161-G: Stand-alone format, available on CD-ROM. This format runs on a web browser and does not require any management system.

It is possible to obtain each of the above eLearning formats in addition to the Industrial Controls Training Systems Simulation Software, Model 3161-H, a simulation software that allows students to complete all the exercises in the training system courseware on a computer without the need for any actual equipment. The following variants are available:

- Model 3161-J: Industrial Controls Training System and Simulation Software - eSeries
- Model 3161-K: Industrial Controls Training System and Simulation Software - SCORM
- Model 3161-L: Industrial Controls Training System and Simulation Software - Stand-Alone

Please refer to our website at www.labvolt.com for more information about the Mind-Sight, SCORM, and Stand-Alone eLearning formats.

Topic Coverage

- Basic Controls
- Programmable Logic Controller
- Motor Drives
- Sensors
- Troubleshooting
- Estimated program duration: 125 hours

Features & Benefits

- Extensive array of modules makes it possible to create setups filling a large number of training needs
- Wide variety of modules representative of control components found in the industry
- Comprehensive curriculum including student manuals with hands-on exercises and instructor guides
- Includes safety features such as a lockable cut-out switch, a tagout device, and banana plug leads
- Insertion of faults to teach troubleshooting

- Cost-effective, high-quality solution
- Sturdy, mobile, two-sided workstation
- Designed according to CSA standards
- Contains advanced devices (PLC, AC Drive, PWM, DC Drive, Softstarter) and common electrical panel components
- Electrical connections between the modules mirror real-life connections
- The motors in the training system are actual industrial machines
- A simulation software allows students to complete all the exercises in the training system courseware on a computer without the need for any actual equipment

List of Available Training Systems

Qty	Description	Model number
1	Industrial Controls Training Systems Level 1: Basic Controls	581502 (8036-10)
1	Programmable Logic Controller Training System (Add-on)	581509 (8036-20)
1	Motor Drives Training System (add-on to 8036 Basic + 8036 PLC)	581511 (8036-30)
1	Sensors Training System (Add-on)	581516 (8036-40)
1	Motor Drives Training System (Stand-Alone)	581518 (8036-A0)
1	Motor Drives Training System (Add-On to 8001 or 8006)	581522 (8036-B0)
1	Motor Drives Training System (Stand-Alone, 120 V Version)	581526 (8036-C0)
1	Basic Controls Training System (Second Team, Add-On to 8036-1)	581527 (8036-D0)
1	Basic Controls Training System (Add-On to 8001 or 8006)	581530 (8036-E0)

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Switches	581250 (3112-00) [1]
1	Digital Tachometer	581427 (8920-40)
1	Digital Multimeter	579782 (8946-20)
1	Connection Lead Set	581430 (8951-E0) [2]
1	Stopwatch	781371 (77660-00)

[1] 2 units needed for the Drives (Level 3), already included in the level 2 or in the standalone versions.

[2] 1 unit needed for the Drives (Level 3), already included in the level 2 or in the standalone versions.

Available Training Systems

Industrial Controls Training Systems Level 1: Basic Controls 581502 (8036-10)

The Industrial Controls Training Systems are designed to teach the theory and techniques of electric motor controllers. They allow students to select and mount control devices to form typical control circuits, and to troubleshoot them once a fault is inserted. The systems offer unique controls training possibilities, are modular, and include insertable faults.

The Basic Controls Training System provides students with a complete basic training in motor controls.

List of Equipment

Qty	Description	Model number
1	Basic Controls (Student Manual)	603859 (49409-00)
1	Basic Controls (Instructor Guide)	603861 (49409-10)
1	Troubleshooting (Student Manual)	580480 (85082-00)
1	Troubleshooting (Instructor Guide)	580482 (85082-10)
1	Industrial Controls Mobile Workstation	581240 (3103-40)
2	Push Buttons	581244 (3110-20)
1	Selector Switches	581247 (3111-20)
1	Emergency Button	581252 (3114-00)
2	Pilot Lights	581255 (3115-20)
1	Dual Contactors	581263 (3119-00)
1	Lockout Module	581267 (3125-10)
1	Three-Phase Manual Starter	581271 (3126-00)
1	Contactor	581278 (3127-20)
1	Control Relay	581289 (3130-20)
1	Overload Relay	581295 (3131-30)
1	Time-Delay Relay	595976 (3132-40)
1	Three-Pole Fuse Holder	581305 (3137-00)
1	Control Transformer	581309 (3138-30)
1	Cam Switch	581320 (3140-30)
1	Inertia Wheel	581327 (3147-10)
1	Starting Resistors	581329 (3150-10)
1	Brake Motor	581341 (3176-A0)
1	Soft Starter	581361 (3186-00)

Qty	Description	Model number
1	AC Power Supply (double-sided)	8128819 (3196-40)
1	Connection Lead and Accessory Set	581429 (8951-80)
1	Fuses	582126 (37889-00)
1	Magnetic Labels	582140 (38503-00)

List of Manuals

Description	Manual number
Troubleshooting (Workbook)	580480 (85082-00)
Troubleshooting (Workbook (Instructor))	580482 (85082-10)
Industrial Controls Training Systems (User Guide)	583973 (27073-E0)
Basic Controls (Workbook)	603859 (49409-00)
Basic Controls (Workbook (Instructor))	603861 (49409-10)

Table of Contents of the Manual(s)

Troubleshooting (Workbook) (580480 (85082-00))

Basic Controls (Workbook) (603859 (49409-00))

- 6-1 Time Relays
- 6-2 Plugging with Time Relays
- 6-3 Primary Resistor Starters with Time Relays

Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Digital Tachometer	581427 (8920-40)
1	Digital Multimeter	579782 (8946-20)

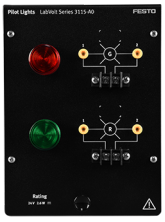
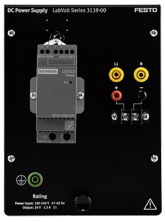
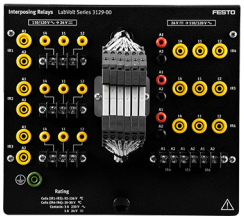
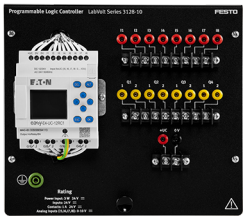
Software

Qty	Description	Model number
1	Industrial Controls Training System Simulation Software	8150126 (3161-M0) [3]

System Specifications

Parameter	Value
System Requirements	
Maximum Current	15 A
Typical Current	1.5 A per student group
AC Power Network Installation	3 phases (120/208 V – 60 Hz), star (wye) configuration including neutral and ground wires, protected by a 20 A circuit breaker
AC Power Network Connector	NEMA L21-20
Physical Characteristics	
Intended Location	On the floor (stands on casters)
Dimensions (H x W x D)	1930 x 1170 x 710 mm (76 x 46 x 28 in)
Net Weight	TBE

Programmable Logic Controller Training System (Add-on) 581509 (8036-20)

The Programmable Logic Controller Training System introduces students to the use of PLCs for motor control.

List of Equipment

Qty	Description	Model number
1	Programmable Logic Controller (Workbook)	8144469 (81444-69)
1	Programmable Logic Controller (Workbook(Instructor))	8144471 (81444-71)

[3] Allows students to complete all the exercises in the training system courseware on a computer without the need for any actual equipment.

Qty	Description	Model number
1	Troubleshooting (Student Manual)	580480 (85082-00)
1	Troubleshooting (Instructor Guide)	580482 (85082-10)
2	Switches	581250 (3112-00)
1	Pilot Lights 24 V dc	8196641 (3115-B0)
1	Programmable Logic Controller (Eaton EASY-E4-UC-12RC1)	8139899 (3128-10)
1	Interposing Relays	581287 (3129-00)
1	DC Power Supply	581318 (3139-00)
1	Connection Lead Set	581430 (8951-E0)

List of Manuals

Description	Manual number
Troubleshooting (Workbook)	580480 (85082-00)
Troubleshooting (Workbook (Instructor))	580482 (85082-10)
Programmable Logic Controller (Workbook (Instructor))	8144469 (81444-69)
Programmable Logic Controller (Workbook)	8144471 (81444-71)

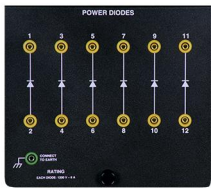
Table of Contents of the Manual(s)

Troubleshooting (Workbook) (580480 (85082-00))

System Specifications

Parameter	Value
Physical Characteristics	
Intended Location	In any Industrial Controls workstation (no workstation is provided with the training system)
Dimensions (H x W x D)	TBE
Net Weight	TBE

Motor Drives Training System (add-on to 8036 Basic + 8036 PLC) 581511 (8036-30)



The Motor Drives Training System introduces students to the use of dc and ac drives.

List of Equipment

Qty	Description	Model number
1	Motor drives (Workbook)	593906 (52733-00)
1	Motor drives (Workbook(Instructor))	593907 (52733-10)
1	Troubleshooting (Student Manual)	580480 (85082-00)
1	Troubleshooting (Instructor Guide)	580482 (85082-10)
1	Power Diodes	581337 (3165-10)
1	DC Motor	581346 (3179-20)
1	AC Drive	592522 (3183-20)
1	DC Drive	581356 (3184-00)

List of Manuals

Description	Manual number
Troubleshooting (Workbook)	580480 (85082-00)
Troubleshooting (Workbook (Instructor))	580482 (85082-10)
Motor Drives (Workbook)	593906 (52733-00)
Motor Drives (Workbook (Instructor))	593907 (52733-10)

Table of Contents of the Manual(s)

Troubleshooting (Workbook) (580480 (85082-00))

- 4-3 Troubleshooting a DC Drive Circuit

Motor Drives (Workbook) (593906 (52733-00))

- 1.1 AC Drive Overview
- 1.2 Volts per Hertz Characteristics
- 1.3 Ramp and Torque Boost
- 1.4 Protection
- 1.5 Braking and Jogging
- 1.6 Remote Controls
- 2.1 DC Drive Overview
- 2.2 Current Limiting and IR Compensation

System Specifications

Parameter	Value
Physical Characteristics	
Intended Location	In any Industrial Controls workstation (no workstation is provided with the training system)
Dimensions (H x W x D)	TBE
Net Weight	TBE

Sensors Training System (Add-on) 581516 (8036-40)

The Sensors Training System introduces student to photoelectric and proximity switches.

List of Equipment

Qty	Description	Model number
1	Plastic Bottle	8125654 (76768-A0)
1	Sensors (Workbook)	580470 (39654-00)
1	Sensors (Workbook (Instructor))	580472 (39654-10)
1	Limit Switch	581328 (3149-00)
1	Quick Lock Tool	582164 (89417-00)
1	Background Suppression Photoelectric Switch	582361 (6373-B0)
1	Polarized Retroreflective Photoelectric Switch	582362 (6374-B0)
1	Inductive Proximity Switch	582363 (6375-B0)
1	Capacitive Proximity Switch	582364 (6376-B0)
1	Reflective Block	582366 (6396-00)

List of Manuals

Description	Manual number
Sensors (Workbook)	580470 (39654-00)
Sensors (Workbook (Instructor))	580472 (39654-10)

Table of Contents of the Manual(s)

Sensors (Workbook) (580470 (39654-00))

- 1 Introduction to Sensors
- 2 Background Suppression Photoelectric Switch
- 3 Polarized Retroreflective Photoelectric Switch
- 4 Capacitive Proximity Switch
- 5 Inductive Proximity Switch
- 6 Limit Switch
- 7 Motor-Operated Circuits Using Sensors (optional - requires the optional Reversible AC Motor Model 3174-3)
- 8 PLC-Controlled Circuits Using Sensors (optional - requires the optional Reversible AC Motor Model 3174-3)

System Specifications

Parameter	Value
Physical Characteristics	
Intended Location	In any Industrial Controls workstation (no workstation is provided with the training system)
Dimensions (H x W x D)	TBE
Net Weight	TBE

Motor Drives Training System (Stand-Alone) 581518 (8036-A0)

The Motor Drives Training System is a complete stand-alone system that allows students to perform the same exercises as in the Motor Drives Training System, Model 8036-3. The system is designed to be used directly on a tabletop.

Topic Coverage:

- AC Drive

- DC Drive

List of Equipment

Qty	Description	Model number
1	Motor Drives (Instructor Guide)	593902 (52731-00)
1	Motor Drives (Student Manual)	593903 (52731-10)
1	Industrial Controls Tabletop Workstation	581242 (3105-00)
2	Switches	581250 (3112-00)
1	Emergency Button	581252 (3114-00)
1	Pilot Lights 24 V dc	8196641 (3115-B0)
1	Three-Phase Manual Starter	581271 (3126-00)
1	Control Relay	581289 (3130-20)
1	Control Transformer	581309 (3138-30)

Qty	Description	Model number
1	Cam Switch	581320 (3140-30)
1	Inertia Wheel	581327 (3147-10)
1	Starting Resistors	581329 (3150-10)
1	Power Diodes	581337 (3165-10)
1	Machine Mounting Plate	581340 (3170-20)
1	Brake Motor	581341 (3176-A0)
1	DC Motor	581346 (3179-20)
1	AC Drive	592522 (3183-20)
1	DC Drive	581356 (3184-00)
1	AC Power Supply (double-sided)	8128819 (3196-40)
1	Connection Lead and Accessory Set	581431 (8951-H0)
1	Magnetic Labels	582140 (38503-00)

List of Manuals

Description	Manual number
Industrial Controls Training Systems (User Guide)	583973 (27073-E0)
Motor Drives (Workbook)	593902 (52731-00)
Motor Drives (Workbook (Instructor))	593903 (52731-10)

Table of Contents of the Manual(s)

Motor Drives (Workbook) (593902 (52731-00))

System Specifications

Parameter	Value
System Requirements	
Maximum Current	15 A per student group
Typical Current	1.5 A per student group
AC Power Network Installation	3 phases (120/208 V – 60 Hz), star (wye) configuration including neutral and ground wires, protected by a 20 A circuit breaker
AC Power Network Connector	NEMA L21-20
Physical Characteristics	
Intended Location	On a table able to support the weight of the equipment
Dimensions (H x W x D)	200 x 935 x 195 mm (7.9 x 37.4 x 7.7 in)
Net Weight	TBE

Motor Drives Training System (Add-On to 8001 or 8006)
581522 (8036-B0)

The Motor Drives Training System is an add-on to the Electromechanical Training System, Model 8001 or Model 8006, that allows students to perform the same exercises as in the Motor Drives Training System, Model 8036-3, using the power supply, motors, and additional equipment provided with Model 8001 or Model 8006.

List of Equipment

Qty	Description	Model number
1	Motor Drives (Workbook)	593904 (52732-00)
1	Motor Drives (Workbook (Instructor))	593905 (52732-10)
1	Industrial Controls Single-Rail Workstation	581243 (3105-A0)
1	Switches	581250 (3112-00)
1	Pilot Lights 24 V dc	8196641 (3115-B0)
1	AC Drive	592522 (3183-20)
1	DC Drive	581356 (3184-00)
1	Connection Lead Set	581432 (8951-I0)
1	Magnetic Labels	582140 (38503-00)

List of Manuals

Description	Manual number
Industrial Controls Training Systems (User Guide)	583973 (27073-E0)
Motor Drives (Workbook)	593904 (52732-00)
Motor Drives (Workbook (Instructor))	593905 (52732-10)

Table of Contents of the Manual(s)

Motor Drives (Workbook) (593904 (52732-00))

- 2.1 DC Drive Overview
- 2.2 Current Limiting and IR Compensation

Software

Qty	Description	Model number
1	Industrial Controls Training System Simulation Software	8150126 (3161-M0) [4]

System Specifications

Parameter	Value
Physical Characteristics	
Intended Location	On top of an EMS workstation, either the Mobile Workstation, Model 8110, or the Workstation, Model 8134
Dimensions (H x W x D)	200 x 935 x 85 mm (7.9 x 37.4 x 3.3 in)
Net Weight	TBE

Motor Drives Training System (Stand-Alone, 120 V Version) 581526 (8036-C0)

The Motor Drives Training System is an alternative version of the Motor Drives Training System, Model 8036-A, that is designed to operate at a voltage and frequency of 120 V and 60 Hz. The system is designed to be used directly on a tabletop. Both the dc and the ac drives are connected directly to a wall outlet. This system is only available for 120 V – 60 Hz networks.

Topic Coverage:

- AC Drive

- DC Drive

List of Equipment

Qty	Description	Model number
1	Motor Drives (Instructor Guide)	593902 (52731-00)
1	Motor Drives (Student Manual)	593903 (52731-10)
1	Industrial Controls Tabletop Workstation	581242 (3105-00)
2	Switches	581250 (3112-00)
1	Emergency Button	581252 (3114-00)
1	Pilot Lights 24 V dc	8196641 (3115-B0)
1	Three-Phase Manual Starter	581271 (3126-00)
1	Control Relay	581289 (3130-20)
1	Control Transformer	581309 (3138-30)

[4] Allows students to complete all the exercises in the training system courseware on a computer without the need for any actual equipment.

Qty	Description	Model number
1	Cam Switch	581320 (3140-30)
1	Inertia Wheel	581327 (3147-10)
1	Starting Resistors	581329 (3150-10)
1	Power Diodes	581337 (3165-10)
1	Machine Mounting Plate	581340 (3170-20)
1	Brake Motor	581341 (3176-A0)
1	DC Motor	581346 (3179-20)
1	AC Drive	592525 (3183-C0)
1	DC Drive	581356 (3184-00)
1	Connection Lead and Accessory Set	581431 (8951-H0)
1	Magnetic Labels	582140 (38503-00)
2	Power Cord	582144 (85360-00)

List of Manuals

Description	Manual number
Industrial Controls Training Systems (User Guide)	583973 (27073-E0)
Motor Drives (Workbook)	593902 (52731-00)
Motor Drives (Workbook (Instructor))	593903 (52731-10)

Table of Contents of the Manual(s)

Motor Drives (Workbook) (593902 (52731-00))

- 1-1 AC Drive Overview
- 1-2 Volts per Hertz Characteristics
- 1-3 Ramp and Torque Boost
- 1-4 Protection
- 1-5 Braking and Jogging
- 1-6 Remote Controls
- 2-1 DC Drive Overview
- 2-2 Current Limiting and IR Compensation

System Specifications

Parameter	Value
Physical Characteristics	
Intended Location	On a table able to support the weight of the equipment
Dimensions (H x W x D)	200 x 935 x 195 mm (7.9 x 37.4 x 7.7 in)
Net Weight	TBE

Basic Controls Training System (Second Team, Add-On to 8036-1) 581527 (8036-D0)

The Basic Controls Training System is designed to be used with the Industrial Controls Mobile Workstation, Model 3103-4. It contains all the equipment necessary for a second team to perform the exercises in the Basic Controls Training System, without unnecessary duplication of the equipment that can be shared by the first team. This means that Model 8036-D contains all the equipment included in Model 8036-1, with the exception of the following equipment: the Industrial Controls Mobile Workstation, Model 3103-3, and the AC Power Supply, Model 3196-3.

List of Equipment

Qty	Description	Model number
1	Basic Controls (Student Manual)	603859 (49409-00)
1	Basic Controls (Instructor Guide)	603861 (49409-10)
1	Troubleshooting (Student Manual)	580480 (85082-00)
1	Troubleshooting (Instructor Guide)	580482 (85082-10)
2	Push Buttons	581244 (3110-20)
1	Selector Switches	581247 (3111-20)
1	Emergency Button	581252 (3114-00)
2	Pilot Lights	581255 (3115-20)
1	Dual Contactors	581263 (3119-00)
1	Lockout Module	581267 (3125-10)
1	Three-Phase Manual Starter	581271 (3126-00)
1	Contactor	581278 (3127-20)
1	Control Relay	581289 (3130-20)
1	Overload Relay	581295 (3131-30)
1	Time-Delay Relay	595976 (3132-40)
1	Three-Pole Fuse Holder	581305 (3137-00)
1	Control Transformer	581309 (3138-30)
1	Cam Switch	581320 (3140-30)
1	Inertia Wheel	581327 (3147-10)
1	Starting Resistors	581329 (3150-10)
1	Brake Motor	581341 (3176-A0)
1	Soft Starter	581361 (3186-00)
1	Connection Lead and Accessory Set	581429 (8951-80)
1	Fuses	582126 (37889-00)
1	Magnetic Labels	582140 (38503-00)

List of Manuals

Description	Manual number
Troubleshooting (Workbook)	580480 (85082-00)
Troubleshooting (Workbook (Instructor))	580482 (85082-10)
Basic Controls (Workbook)	603859 (49409-00)
Basic Controls (Workbook (Instructor))	603861 (49409-10)

Table of Contents of the Manual(s)

Troubleshooting (Workbook) (580480 (85082-00))

- 4-1 Troubleshooting an AC Drive Circuit
- 4-2 Troubleshooting an AC Drive Braking and Jogging Circuit
- 4-3 Troubleshooting a DC Drive Circuit

Basic Controls (Workbook) (603859 (49409-00))

- 1-1 Lockout/Tagout Procedure
- 1-2 Control Panel Devices
- 1-3 Manual Starters
- 1-4 Contactors and Control Relays
- 1-5 Current Protection Devices
- 2-1 Specifications Reading
- 2-2 Symbols, Designations, and Diagrams
- 3-1 Motor Starters
- 3-2 Two-Wire and Three-Wire Controls
- 3-3 Manual Reversing Starters
- 3-4 Reversing Starters
- 3-5 Multiple Push Buttons
- 4-1 Friction Brakes
- 4-2 Motor Starters with Jogging
- 4-3 Reversing Starters with Jogging
- 5-1 Primary Resistor Starters
- 5-2 Soft Starters
- 6-1 Time Relays
- 6-2 Plugging with Time Relays
- 6-3 Primary Resistor Starters with Time Relays

System Specifications

Parameter	Value
System Requirements	
Maximum Current	15 A
Typical Current	1.5 A per student group
AC Power Network Installation	3 phases (120/208 V – 60 Hz), star (wye) configuration including neutral and ground wires, protected by a 20 A circuit breaker
AC Power Network Connector	NEMA L21-20
Physical Characteristics	
Intended Location	On the second side of an Industrial Controls Workstation (no workstation is provided with the training system)
Dimensions (H x W x D)	TBE
Net Weight	TBE

Basic Controls Training System (Add-On to 8001 or 8006) 581530 (8036-E0)

The Basic Controls Training System is an add-on to systems 8001 or 8006 that allows students to perform the same exercises in the Basic Controls Training System, Model 8036-1, using the power supply, motors, and additional equipment provided with systems 8001 or 8006.

List of Equipment

Qty	Description	Model number
1	Basic Controls (Student Manual)	603855 (49408-00)
1	Basic Controls (Instructor Guide)	603857 (49408-10)
1	Troubleshooting (Student Manual)	580480 (85082-00)

Qty	Description	Model number
1	Troubleshooting (Instructor Guide)	580482 (85082-10)
1	Industrial Controls Double-Rail Workstation	585964 (3105-B0)
2	Push Buttons	581244 (3110-20)
1	Selector Switches	581247 (3111-20)
1	Emergency Button	581252 (3114-00)
2	Pilot Lights	581255 (3115-20)
1	Dual Contactors	581263 (3119-00)
1	Lockout Module	581267 (3125-10)
1	Three-Phase Manual Starter	581271 (3126-00)
1	Contactor	581278 (3127-20)
1	Control Relay	581289 (3130-20)
1	Overload Relay	581295 (3131-30)
1	Time-Delay Relay	595976 (3132-40)
1	Three-Pole Fuse Holder	581305 (3137-00)
1	Control Transformer	581309 (3138-30)
1	Cam Switch	581320 (3140-30)
1	Starting Resistors	581329 (3150-10)
1	Brake Motor (EMS version)	581344 (3176-B0)
1	Soft Starter	581361 (3186-00)
1	Connection Lead Set	581434 (8951-M0)
1	Zero Friction Machine	581442 (8969-00)
1	Inertia Wheel	581462 (9126-00)
1	Fuses	582126 (37889-00)
1	Magnetic Labels	582140 (38503-00)

List of Manuals

Description	Manual number
Troubleshooting (Workbook)	580480 (85082-00)
Troubleshooting (Workbook (Instructor))	580482 (85082-10)
Industrial Controls Training Systems (User Guide)	583973 (27073-E0)
Basic Controls (Workbook)	603855 (49408-00)
Basic Controls (Workbook (Instructor))	603857 (49408-10)

Table of Contents of the Manual(s)

Troubleshooting (Workbook) (580480 (85082-00))

- 4-3 Troubleshooting a DC Drive Circuit

Basic Controls (Workbook) (603855 (49408-00))

- 1-1 Lockout/Tagout Procedure
- 1-2 Control Panel Devices
- 1-3 Manual Starters
- 1-4 Contactors and Control Relays
- 1-5 Current Protection Devices
- 2-1 Specifications Reading
- 2-2 Symbols, Designations, and Diagrams
- 3-1 Motor Starters
- 3-2 Two-Wire and Three-Wire Controls
- 3-3 Manual Reversing Starters
- 3-4 Reversing Starters
- 3-5 Multiple Push Buttons
- 4-1 Friction Brakes
- 4-2 Motor Starters with Jogging
- 4-3 Reversing Starters with Jogging
- 5-1 Primary Resistor Starters
- 5-2 Soft Starters
- 6-1 Time Relays
- 6-2 Plugging with Time Relays
- 6-3 Primary Resistor Starters with Time Relays

System Specifications

Parameter	Value
Power Requirements	
Current	15 A
Electrical Distribution	Three-phase, five wires, wye-connected, including neutral and ground
Physical Characteristics	
Intended Location	On top of an EMS workstation, either the Mobile Workstation, Model 8110, or the Workstation, Model 8134
Dimensions (H x W x D)	427 x 935 x 85 mm (16.8 x 37.4 x 3.3 in)
Net Weight	TBE

Equipment Description

Industrial Controls Mobile Workstation 581240 (3103-40)

The Industrial Controls Mobile Workstation is a double-sided, mobile workstation on casters. The workstation has an A-frame configuration, is constructed of steel, and can accommodate two student groups simultaneously. Four pairs of mounting rails hold the control modules firmly in place. Additional mounting rails underneath the work surface increase the workstation storage capability. The work surface and storage shelf are protected against scratches by a rubber carpet.

Safety bars are attached to each rail of the Industrial Controls Mobile Workstation. These bars prevent students from removing modules during laboratory exercises. Padlocks are provided to lock the safety bars in place once all modules are inserted in the workstation.

Manual

Description	Manual number
Industrial Controls Training Systems (User Guide)	583973 (27073-E0)

Specifications

Parameter	Value
Physical Characteristics	
Dimensions (H x W x D)	1930 x 1168 x 711 mm (76 x 46 x 28 in)
Net Weight	109 kg (240 lb)

Industrial Controls Tabletop Workstation 581242 (3105-00)

This Industrial Controls Tabletop Workstation consists of an inclined mounting rail designed to be placed on top of a regular table. One pair of mounting rails holds the control modules firmly in place.

A safety bar is attached to the rail of the Industrial Controls Tabletop Workstation. This bar prevents students from removing modules during laboratory exercises. A padlock is provided to lock the safety bar in place once all modules are inserted in the workstation.

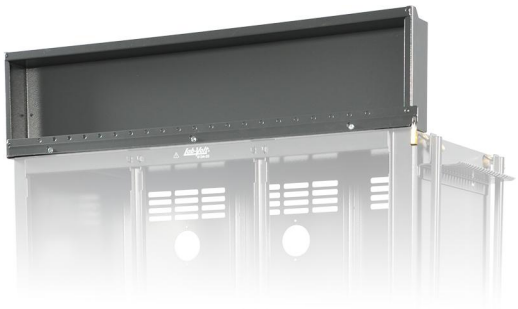
Manual

Description	Manual number
Industrial Controls Training Systems (User Guide)	583973 (27073-E0)

Specifications

Parameter	Value
Physical Characteristics	
Intended Location	On a table able to support the weight of the workstation and installed equipment
Dimensions (H x W x D)	200 x 935 x 195 mm (7.9 x 37.4 x 7.7 in)
Net Weight	4.5 kg (10 lb)

Industrial Controls Single-Rail Workstation 581243 (3105-A0)



The Industrial Controls Single-Rail Workstation consists of a single pair of mounting rails designed to be installed on top of the Workstation, Model 8134, or Mobile Workstation, Model 8110, to facilitate interconnection between the Industrial Controls Training Systems, Series 8036, and the Electric Power Technology Training Systems, series 8010.

A safety bar is attached to the rail of the Industrial Controls Single-Rail Workstation. This bar prevents students from removing modules during laboratory exercises. A padlock is provided to lock the safety bar in place once all modules are inserted in the workstation.

Manual

Description	Manual number
Industrial Controls Training Systems (User Guide)	583973 (27073-E0)

Specifications

Parameter	Value
Physical Characteristics	
Intended Location	Installed on top of a Workstation, Model 8134, or Mobile Workstation, Model 8110
Dimensions (H x W x D)	200 x 935 x 85 mm (7.9 x 37.4 x 3.3 in)
Net Weight	5.9 kg (13 lb)

Industrial Controls Double-Rail Workstation
585964 (3105-B0)

The Industrial Controls Single-Rail Workstation consists of two pairs of mounting rails designed to be installed on top of the Workstation, Model 8134, or Mobile Workstation, Model 8110, to facilitate interconnection between the Industrial Controls Training Systems, Series 8036, and the Electric Power Technology Training Systems, series 8010.

A safety bar is attached to each rail of the Industrial Controls Double-Rail Workstation. These bars prevents students from removing modules during laboratory exercises. Padlocks are provided to lock the safety bars in place once all modules are inserted in the workstation.

Manual

Description	Manual number
Industrial Controls Training Systems (User Guide)	583973 (27073-E0)

Specifications

Parameter	Value
Physical Characteristics	
Intended Location	Installed on top of a Workstation, Model 8134, or Mobile Workstation, Model 8110
Dimensions (H x W x D)	427 x 935 x 85 mm (16.8 x 37.4 x 3.3 in)
Net Weight	11.3 kg (25 lb)

Push Buttons
581244 (3110-20)

The Push Buttons module consists of two momentary-action, push-button switches. One switch (upper switch) has a green push button while the other has a red push button. Both switches have normally open (NO) and normally closed (NC) contacts.

Specifications

Parameter	Value
Contacts (Green Push Button)	
Type	NO, NC contact sets
Rating	4 A - 240 V ac
Contacts (Red Push Button)	
Type	NO, NC contact sets
Rating	4 A - 240 V ac
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 100 mm (8 x 6 x 3.9 in)
Net Weight	0.9 kg (2 lb)

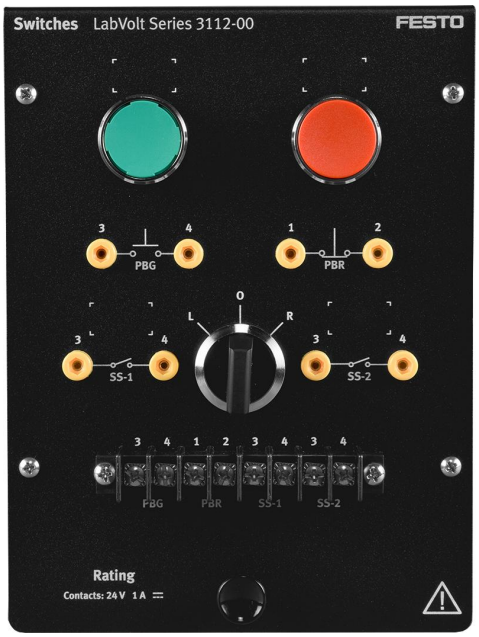
Selector Switches 581247 (3111-20)

The Selector Switches module consists of a three-position, two-pole selector switch and a single-pole double-throw toggle switch. It allows the user to alternate between two control circuit branches through the selector (at the top) or the toggle (at the bottom) switches. The two switches work independently. Selecting a position activates or deactivates the maintained contacts.

Specifications

Parameter	Value
Contacts (Selector Switch)	
Type	4 NO contact sets
Rating	4 A - 240 V ac
Contacts (Toggle Switch)	
Type	SPDT
Rating	4 A - 240 V ac
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 105 mm (8 x 6 x 4.1 in)
Net Weight	0.9 kg (2 lb)

Switches
581250 (3112-00)



The Switches module consists of two general-purpose push buttons, one green with a normally open contact and one red with a normally closed contact, and a three-position, single-pole selector switch. Electrical connections can be made using either the banana jacks or the terminal block.

Specifications

Parameter	Value
Contact (Green Push Button)	
Type	NO contact set
Rating	1 A - 24 V dc
Contact (Red Push Button)	
Type	NC contact set
Rating	1 A - 24 V dc
Contacts (Selector Switch)	
Type	2 NO contact sets
Rating	1 A - 24 V dc
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 105 mm (8 x 6 x 4.1 in)
0.9 kg (2 lb)	0.9 kg (2 lb)

Emergency Button
581252 (3114-00)

The Emergency Button consists of an emergency push button with two sets of contacts, both normally closed, that can be used to control devices operating at low and high voltages. Electrical connections for the low-voltage contact can be made using either the banana jacks or the terminal block.

Specifications

Parameter	Value
Contacts	
Type	2 NC contact sets
Rating	3 A - 240 V ac / 1 A - 24 V dc
Fault Switches	2
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 110 mm (8 x 6 x 4.3 in)
0.9 kg (2.0 lb)	0.9 kg (2.0 lb)

Pilot Lights
581255 (3115-20)

The Pilot Lights module consists of two low-power electric lights. One light is green while the other is red. Both lights are rated at a voltage of 110/120 V.

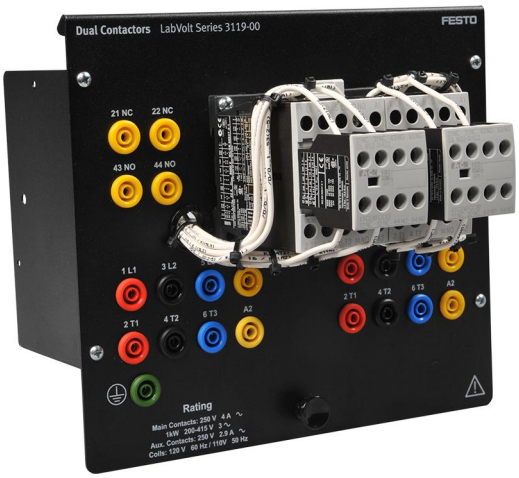
Specifications

Parameter	Value
Lights	
Color	Green, red
Rating	110/120 V - 2.6 W
Fault Switches	2
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 95 mm (8 x 6 x 3.7 in)
Net Weight	0.9 kg (2 lb)

Pilot Lights 24 V dc
8196641 (3115-B0)

The Pilot Lights module consists of two low-power electric lights. One light is green while the other is red. Both lights are rated at a voltage of 24 V. Electrical connections can be made using either the banana jacks or the terminal block.

Dual Contactors
581263 (3119-00)



The Dual Contactors module consists of two mechanically interlocked, three-pole contactors with two auxiliary contacts. Each contactor also comes with three additional auxiliary contacts, not wired to the front panel, for direct connection with other devices.

Specifications

Parameter	Value
Coils	120 V - 60 Hz / 110 V - 50 Hz
Main Contacts	
Type	3 NO contact sets (x2)
Rating	1 kW at 200-415 V ac
Auxiliary Contacts	
Type	NO, NC contact set
Rating	2.9 A - 250 V ac
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 228 x 200 mm (8 x 9 x 7.9 in)
Net Weight	1.7 kg (3.8 lb)

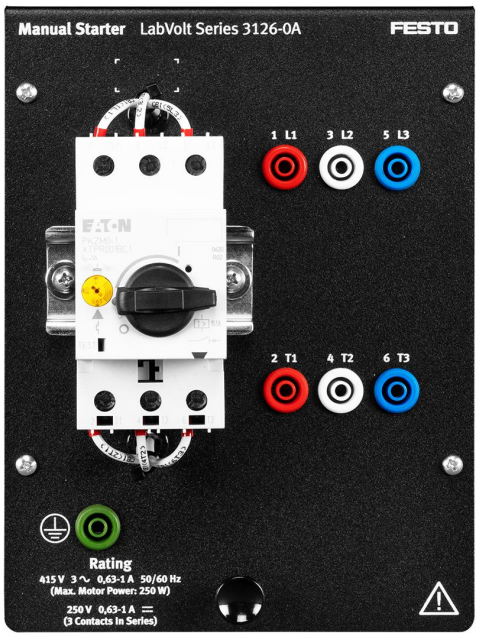
Lockout Module
581267 (3125-10)

The Lockout Module consists of a lockable three-phase disconnect switch. The lockout device is a six-lock scissor type and the disconnect switch is a three-pole unit. Three padlocks and three identification tags are also included. One module is required for single-sided stations, while two are required for double-sided stations.

Specifications

Parameter	Value
Contact	
Type	TPST
Rating	5 A - 450 V ac
Physical characteristics	
Dimension (H x W x D)	203 x 153 x 155 mm (8 x 6 x 6.1 in)
Net Weight	1.4 kg (3.1 lb)

Three-Phase Manual Starter
581271 (3126-00)



The Three-Phase Manual Starter consists of a three-phase circuit breaker with thermal overload protection.

Specifications

Parameter	Value
Contacts	
Type	TPST
Rating (AC)	370 W
Rating	5 A - 250 V dc
Overload Release	1.6-2.5 A
Short Circuit Release	35 A
Fault Switches	3
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 160 mm (8 x 6 x 6.3 in)
Net Weight	1.1 kg (2.4 lb)

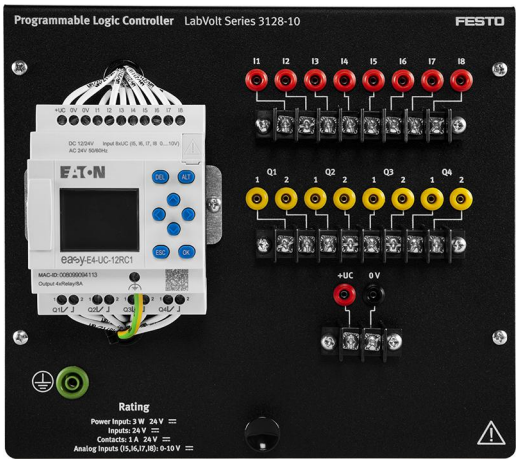
Contactor
581278 (3127-20)

The Contactor consists of a three-pole contactor with a normally open auxiliary contact.

Specifications

Parameter	Value
Coil	120 V - 60 Hz / 110 V - 50 Hz
Main Contacts	
Type	3 NO contact sets
Rating	1 kW at 200-415 V ac
Auxiliary Contact	
Type	NO contact set
Rating	2.9 A - 250 V ac
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 155 mm (8 x 6 x 6.1 in)
Net Weight	1 kg (2.3 lb)

Programmable Logic Controller (Eaton EASY-E4-UC-12RC1)
8139899 (3128-10)

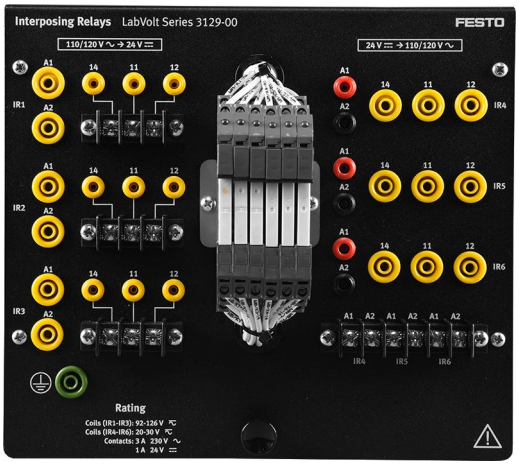


The Programmable Logic Controller consists of a small controller programmed in four different languages (ST, FBD, LD, EDP) with eight inputs (24 V dc), four of them can be turned into analog inputs (0-10 V dc), and four relay outputs. The programming is done using the LCD screen and the keypad on the controller or using the programming software (easySoft) and cable included in this model. Electrical connections can be made using either the banana jacks or the terminal blocks.

Specifications

Parameter	Value
Controller Type	Eaton easyE4-UC-12RC1
Power Requirement	3 W - 24 V dc
Inputs (8)	
Digital (I1 to I8)	24 V dc
Analog (I5 to I8)	0-10 V dc
Outputs (4)	
Type	NO contacts
Rating	1 A - 24 V dc
Accessories	Communication cable and easySoft programming software
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 228 x 140 mm (8 x 9 x 5.5 in)
Net Weight	1.5 kg (3.3 lb)

Interposing Relays 581287 (3129-00)



The Interposing Relays module consists of a bidirectional voltage converter for high and low control voltages. This model is equipped with three relays with 24 V dc coils and three relays with 110/120 V ac coils. Electrical connections for the low-voltage coils and contacts can be made using either the banana jacks or the terminal blocks.

Specifications

Parameter	Value
Coils	
Low-Voltage (3)	20-30 V ac/dc
High-Voltage (3)	92-126 V ac/dc
Contacts	
Low-Voltage (3)	1 A - 24 V dc
High-Voltage (3)	3 A - 230 V ac
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 228 x 174 mm (8 x 9 x 6.9 in)
Net Weight	1.5 kg (3.2 lb)

Control Relay
581289 (3130-20)

The Control Relay is a general purpose, industrial-type relay with two sets of normally open (NO) contacts and two sets of normally closed (NC) contacts.

Specifications

Parameter	Value
Coil	120 V - 60 Hz / 110 V - 50 Hz
Contacts	
Type	2 NO contact sets, 2 NC contact sets
Rating	4 A - 250 V ac
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 155 mm (8 x 6 x 6.1 in)
Net Weight	1 kg (2.3 lb)

Overload Relay
581295 (3131-30)

The Overload Relay consists of a three-phase, bimetallic overload relay with one normally closed and one normally open contact with an adjustable setting range.

Specifications

Parameter	Value
Overload (3 Phase)	1.6-2.4 A
Contacts	
Type	NO, NC contact set
Rating	1.5 A - 250 V ac
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 180 mm (8 x 6 x 7.1 in)
Net Weight	1 kg (2.3 lb)

Time-Delay Relay 595976 (3132-40)

The Time Relay consists of a multifunction time relay with multiple ranges, one normally open contact and one normally closed contact. The relay enables the implementation of a large variety of functions.

Specifications

Parameter	Value
Coil	
	12-240 V - DC/AC (50/60 Hz)
Range	
	0.05 s - 100 h (multiple ranges)
Functions (13)	
A	On-delay
B	OFF-delay with control signal
C	ON-delay and OFF-delay with control signal
D	Flasher relay, symmetrical, starting with interval
E	Passing make contact, interval relay
F	Retriggerable interval relay with deactivated control signal
G	Passing make contact with control signal, not retriggerable
H	OFF-delay with control signal
I	Additive ON-delay, not retriggerable, with control signal
J	Flasher relay, symmetrical, starting with pulse
K	Pulse-delay relay, fixed pulse (1 s) and settable pulse delay
L	Pulse-delay relay with control signal
M	Retriggerable interval relay with activated control signal
Contacts	
AC-15	3A - 250 V - 50/60 Hz
DC-13	1 A at 24 V, 0.2 A at 125 V and 0.1 A at 250 V
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 172 mm (8 x 6 x 6.8 in)

Three-Pole Fuse Holder
581305 (3137-00)

The Three-Pole Fuse Holder consists of a three-phase fuse holder. The module is supplied with three blown-out fuses that can be used for troubleshooting activities. Additional fuses for this model are available in the Fuses kit, Model 37889.

Specifications

Parameter	Value
Rating	
Alternating Current	6 A - 415 V - 50/60 Hz - 3 phase
Direct Current	6 A - 250 V
Fuse Type	Class CC
Fuses	Supplied with 3 blown fuses (working fuses are supplied with Model 37889)
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 152 mm (8 x 6 x 6 in)
Net Weight	1 kg (2.3 lb)

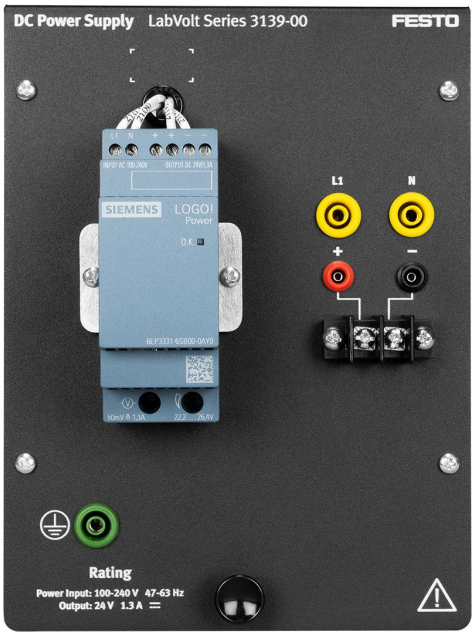
Control Transformer
581309 (3138-30)

The Control Transformer converts the ac power network voltage (e.g., 208 V, 380 V, 415 V) to 110/120 V. The primary windings of the transformer are fuse-protected to prevent damage to the equipment.

Specifications

Parameter	Value
Power	96 VA
Primary Winding	
Voltage	208 V
Current	0.46 A
Fuses (Class CC, Time Delay)	0.60 A
Secondary Winding	
Voltage	120 V
Current	0.80 A
Fault Switches	2
Physical Characteristics	
Dimensions (H x W x D)	203 x 228 x 172 mm (8 x 9.1 x 6.8 in)
Net Weight	3.8 kg (8.4 lb)

DC Power Supply
581318 (3139-00)



The DC Power Supply provides 24 V dc for low-voltage controls, such as programmable logic controllers. The low-voltage connections can be made using either miniature banana jacks or a terminal block.

Specifications

Parameter	Value
Power Requirements	
Current	0.35-0.7 A
Voltage	100-240 V
Frequency	47-63 Hz
Power Output	1.3 A - 24 V dc
Fault Switches	2
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 140 mm (8 x 6 x 5.5 in)
Net Weight	1.0 kg (2.1 lb)

Cam Switch
581320 (3140-30)

The Cam Switch consists of a manually operated drum switch. The switch control lever has three positions: Off, Forward, and Reverse. The Cam Switch is suitable for both single-phase and three-phase ac motor control. It can also be used to control series and compound dc motors.

Specifications

Parameter	Value
Contacts	
Type	Reversing switch with OFF position
Rating (Alternating Current)	5 A - 230 V ac
Rating (Direct Current)	1.1 A - 125 V dc
Fault Switches	3
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 115 mm (8 x 6 x 4.5 in)
Net Weight	0.9 kg (2 lb)

Inertia Wheel
581327 (3147-10)

The Inertia Wheel consists of a flywheel with sufficient inertia to increase the acceleration time of the machines in the Industrial Controls Training Systems to over 1.3 s.

Specifications

Parameter	Value
Moment of Inertia	0.016 kg·m² (0.380 lbf·ft²)
Physical Characteristics	
Dimensions (H x W x D)	55 x 150 x 153 mm (2.2 x 5.9 x 6 in)
Net Weight	5.6 kg (12.3 lb)

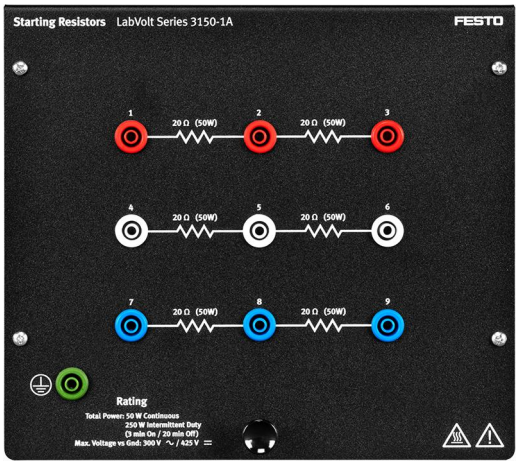
Limit Switch 581328 (3149-00)

The Limit Switch consists of a limit switch with two contacts, one normally open and one normally closed. The model can be used directly with the Reversible AC Motor, Model 3174-3, and become part of its mechanism.

Specifications

Parameter	Value
Contacts	
Type	NO, NC contact sets
Rating	1 A - 24 V dc
Physical Characteristics	
Dimensions (H x W x D)	127 x 216 x 229 mm (5.0 x 8.5 x 9 in)
Net Weight	0.8 kg (1.8 lb)

Starting Resistors 581329 (3150-10)



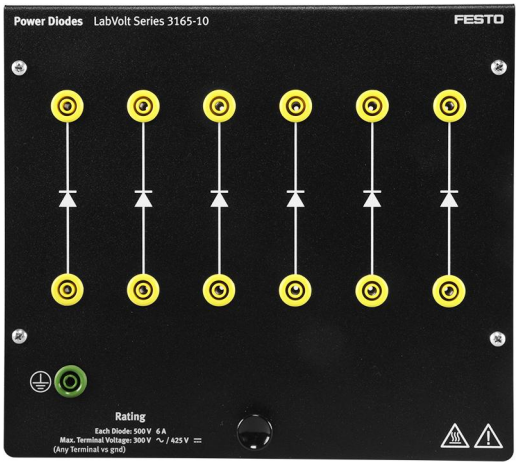
The Starting Resistors consists of six power resistors, each fitted with a 50% tap. These resistors allow dc and ac motors to be started with a reduced voltage.

Specifications

Parameter	Value
Resistors (3)	
Total Power (Continuous)	50 W

Parameter	Value
Total Power (Intermittent Duty)	250 W (3 min ON / 20 min Off)
Value	10 Ω (100W)
Tap	50%
Accuracy	±5%
Physical Characteristics	
Dimensions (H x W x D)	203 x 228 x 92 mm (8 x 9 x 3.6 in)
Net Weight	0.9 kg (2 lb)

Power Diodes
581337 (3165-10)



The Power Diodes module consists of six silicon rectifier diodes. The anode and cathode of all diodes are wired to independent front panel terminals, thereby allowing the diodes to be connected in any single-phase and three-phase rectifier configuration.

Specifications

Parameter	Value
Diodes (6)	
Peak Reverse Voltage	500 V
Average Rectified Forward Current	6 A
Physical Characteristics	
Dimensions (H x W x D)	203 x 228 x 43 mm (8 x 9 x 1.7 in)
Net Weight	0.9 kg (2 lb)

Machine Mounting Plate
581340 (3170-20)

The Machine Mounting Plate consists of a motor work surface designed to be used on top of a table (without Workstation Model 3103). The motors fix to the work surface using screws and knurled nuts. The protective guard which comes with it can also be fixed as well as the different sensors of the system.

Specifications

Parameter	Value
Physical Characteristics	
Dimensions (H x W x D)	38 x 559 x 216 mm (1.5 x 22 x 8.5 in)

Parameter	Value
Net Weight	3.6 kg (7.9 lb)

Brake Motor 581341 (3176-A0)

The Brake Motor consists of a three-phase, four-pole, squirrel-cage induction motor equipped with a spring set brake for holding and stopping (fail-safe). The motor is dual voltage and can operate at either a low-voltage or a high-voltage setting.

Specifications

Parameter	Value
Motor Ratings	
Output Power	249 W
Stator Voltage (Three-Phase)	208 V - 60 Hz
Full-Load Speed	1725 r/min
Full-Load Current	1.5 A
Brake Ratings	
Voltage	208 V - 60 Hz
Inrush Current	2.2 A
Holding Current	0.2 A
Physical Characteristics	
Dimensions (H x W x D)	200 x 235 x 415 mm (7.9 x 9.3 x 16.3 in)
Net Weight	13 kg (28 lb)

Brake Motor (EMS version) 581344 (3176-B0)

The Brake Motor (EMS Version) consists of a three-phase, four-pole, squirrel-cage induction motor equipped with a spring-set brake for holding and stopping (fail-safe). The motor is dual voltage and can operate at either a low-voltage or a high-voltage setting.

Model 3176-B uses the same motor as Model 3176-A, enclosed in a standard EMS full-size module.

Specifications

Parameter	Value
Motor Ratings	
Output Power	249 W
Stator Voltage (Three-Phase)	208 V - 60 Hz
Full-Load Speed	1725 r/min
Full-Load Current	1.8 A
Brake Ratings	
Voltage	208 V - 60 Hz

Parameter	Value
Inrush Current	2.2 A
Holding Current	0.2 A
Physical Characteristics	
Dimensions (H x W x D)	308 x 291 x 440 mm (12.1 x 11.5 x 17.3 in)
Net Weight	TBE

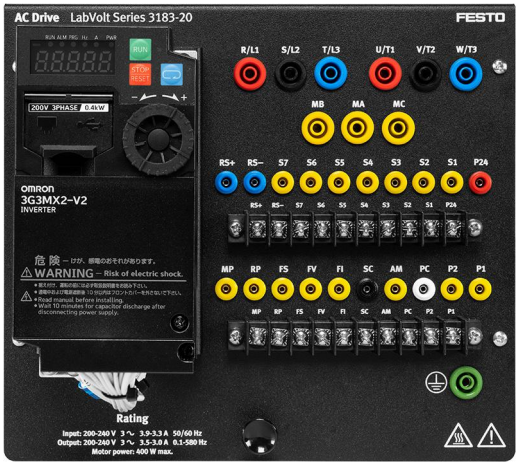
DC Motor 581346 (3179-20)

The DC Motor consists of a permanent magnet 90 V dc motor that can be used with the DC Drive, Model 3184.

Specifications

Parameter	Value
Ratings	
Output Power	249 W
Armature Voltage	90 V dc
Full-Load Speed	1750 r/min
Full-Load Current	3.6 A
Physical Characteristics	
Dimensions (H x W x D)	191 x 295 x 171 mm (7.5 x 11.6 x 6.7 in)
Net Weight	8.9 kg (19.6 lb)

AC Drive 592522 (3183-20)



The AC Drive consists of a variable frequency speed drive with V/Hz control. The AC Drive has programmable inputs and outputs, digital and analog (for PID Control). Some electrical connections can be made using either the banana jacks or the terminal blocks.

Specifications

Parameter	Value
Power requirements	
Three Phase	3.9 A - 200-240 V
Frequency	50/60 Hz
Power output (three phase)	
Power	400 W
Voltage	200-240 V
Frequency	0.1-580 Hz
Inputs	
Digital (7)	24 V dc
Analog (2)	0 - 10 V dc (1), 4 - 20 mA (1)
Contacts (Configurable)	
Type	SPDT
Rating	2.5 A - 250 V ac
Outputs	
Analog (1)	1 mA - 0-10 V dc
Transistor (1)	50 mA - 27 V dc
Faults	
Faults switches	4
Physical Characteristics	
Dimension (H x W x D)	TBE
Net Weight	TBE

AC Drive
592525 (3183-C0)

The AC Drive consists of a variable frequency speed drive with V/Hz control. The AC Drive has programmable

inputs and outputs, digital and analog (for PID Control). Some electrical connections can be made using either

the banana jacks or the terminal blocks.

The AC Drive is available in two versions. Model 3183-2 requires three-phase supply (208, 380, or 415 V).

Model 3183-C requires a single-phase supply (120 V - 60 Hz) and connects directly to any standard wall outlet

with a separate power cord equipped with a 5 A fuse (Model 85360). Model 3183-C is not available for 220, 240

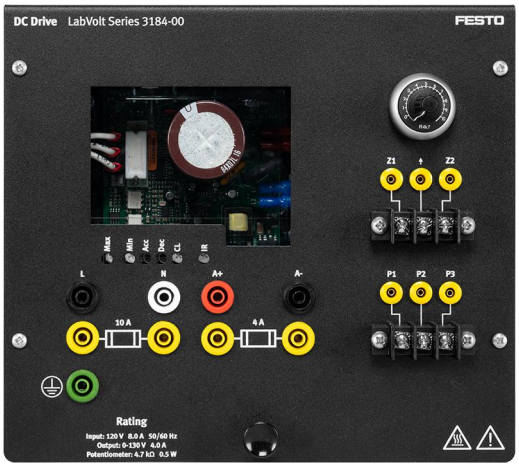
V - 50 Hz line supplies.

Specifications

Parameter	Value
Power Requirements	
Single-Phase	4.8 A - 120 V ac - 60 Hz
Power Output (Three-Phase)	
Power	400 W
Voltage	200-240 V
Frequency	0.1-580 Hz
Inputs	
Digital (7)	24 V dc
Analog (2)	0 - 10 V dc (1), 4 - 20 mA (1)
Contacts (Configurable)	
Type	SPDT

Parameter	Value
Rating	2.5 A - 250 V ac
Outputs	
Analog (1)	1 mA - 0-10 V dc
Transistor (1)	50 mA - 27 V dc
Faults	
Faults switches	4
Physical Characteristics	
Dimension (H x W x D)	TBE
Net Weight	TBE

DC Drive
581356 (3184-00)



The DC Drive consists of a pulse-width modulated (PWM) dc motor speed control with maximum and minimum speed, current limitation, and IR compensation adjustments. Some electrical connections can be made using either the banana jacks or the terminal blocks.

Specifications

Parameter	Value
Input	
Nominal Voltage	115 V ±10%
Maximum Current	8.0 A
Frequency	50/60 Hz
Output	
Voltage	0-130 V dc
Load Current	4.0 A dc
Speed Range	50:1
Trimpot Adjustments	Minimum and maximum speeds, current limit, IR compensation, Acceleration, Deceleration
Analog Input	0-5 V dc
Potentiometer	4.7 kΩ - 0.5 W
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 228 x 108 mm (8 x 9 x 4.3 in)
Net Weight	1.65 kg (3.64 lb)

Soft Starter
581361 (3186-00)

The Soft Starter consists of a three-phase soft starter with starting and stopping ramp adjustments.

Specifications

Parameter	Value
Control Electronics Requirements	
Voltage	24-230 V
Current	4-25 mA
Power Electronics Requirements	
Voltage	200-230 V ac
Input Current	2.2 A
Output Power	373 W
Starting and Stopping	
Starting Time	0.1-20 s
Starting Voltage	40-100%
Down-ramp Time	0-20 s
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 203 mm (8 x 6 x 8 in)
Net Weight	1 kg (2.3 lb)

AC Power Supply (double-sided)
8128819 (3196-40)

The AC Power Supply provides ac power for the Industrial Controls Training System. The outlet is fed from a three-phase, four-wire breaker panel supplied elsewhere. The power supply contains input and output pilot lamps, two "on-off" switches and dual sets of four color-coded banana jacks for three-phase voltage. All outputs are circuit-breaker protected. The AC Power Supply mounts on the upper shelf of the Mobile Workstation, Model 3103-4, and can provide power to both sides of the workstation.

Specifications

Parameter	Value
Module Requirements	
Maximum Current	15 A
AC Power Network Installation	3 phases (120/208 V – 60 Hz), star (wye) configuration including neutral and ground wires, protected by a 20 A circuit breaker
AC Power Network Connector	NEMA L21-20
Output	
AC Output	120/208 V - 60 Hz - 5 A
Physical Characteristics	
Dimensions (H x W x D)	185 x 155 x 310 mm (7.3 x 6.1 x 12.2 in)
Net Weight	4.5 kg (9.9 lb)

Background Suppression Photoelectric Switch 582361 (6373-B0)

The Background Suppression Photoelectric Switch consists of a light source and a receiver combined in the same casing. The sensor is mounted on a flexible support for easy positioning. The model has one normally open and one normally closed contact, and the electrical connections are made using either the banana jacks or the terminal block.

Specifications

Parameter	Value
Switch	
Type	Background suppression
Transistor Output Type	Sourcing (PNP)
Sensing Distance	100 mm (3.9 in)
Light Source Type	Infrared
Light Source Wavelength	880 nm (34.6 microinch)
Response Time (Sensor Only)	1.0 ms
Light Beam Detection Modes	Light operate / Dark operate
Supply Voltage	24 V dc
Contacts	SPDT, 24 V dc, 3 A
Physical Characteristics	
Dimensions (H x W x D)	400 x 127 x 127 mm (16 x 5 x 5 in)
Net Weight	0.8 kg (1.9 lb)

Polarized Retroreflective Photoelectric Switch 582362 (6374-B0)

The Polarized Retroreflective Photoelectric Switch consists of a light source and a receiver combined in the same casing. This sensor requires a special retroreflective surface. The sensor is mounted on a flexible support for easy positioning. The model has one normally open and one normally closed contact, and the electrical connections are made using either the banana jacks or the terminal block.

Specifications

Parameter	Value
Switch	
Type	Polarized retroreflective
Transistor Output Type	Sourcing (PNP)
Sensing Distance	3 m (9.8 ft)
Light Source Type	Visible red
Light Source Wavelength	660 nm (26.0 microinch)
Response Time (Sensor Only)	1.0 ms
Light Beam Detection Modes	Light operate / Dark operate
Sensor Output Type	Relay output
Supply Voltage	24 V dc
Contacts	SPDT, 24 V dc, 3 A
Physical Characteristics	
Dimensions (H x W x D)	400 x 127 x 127 mm (16 x 5 x 5 in)
Net Weight	0.8 kg (1.9 lb)

Inductive Proximity Switch 582363 (6375-B0)

The Inductive Proximity Switch is sensitive to metals. The sensor is mounted on a flexible support for easy positioning. The model has one normally open and one normally closed contact, and the electrical connections are made using either the banana jacks or the terminal block.

Specifications

Parameter	Value
Switch	
Type	Inductive shielded
Transistor Output Type	Sourcing (PNP)
Sensing Distance	5 mm (0.2 in)
Switching Frequency	1000 Hz
Supply Voltage	24 V dc
Contacts	SPDT, 24 V dc, 3 A
Physical Characteristics	
Dimensions (H x W x D)	400 x 127 x 127 mm (16 x 5 x 5 in)
Net Weight	0.9 kg (2.0 lb)

Capacitive Proximity Switch 582364 (6376-B0)

The Capacitive Proximity Switch is sensitive to every material. The sensor is mounted on a flexible support for easy positioning. The model has one normally-open and one normally-closed contact, and the electrical connections are made using either the banana jacks or the terminal block.

Specifications

Parameter	Value
Switch	
Type	Capacitive unshielded
Transistor Output Type	Sourcing (PNP)
Sensing Distance	5-20 nm (0.2-0.8 in)
Switching Frequency	100 Hz
Supply Voltage	24 V dc
Contacts	SPDT, 24 V dc, 3 A
Physical Characteristics	
Dimensions (H x W x D)	400 x 127 x 127 mm (16 x 5 x 5 in)
Net Weight	0.9 kg (2.0 lb)

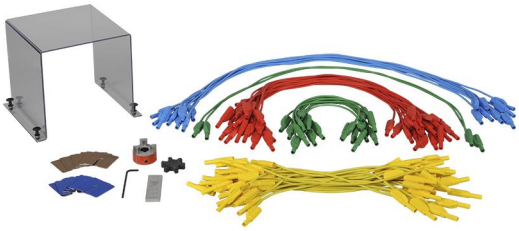
Reflective Block
582366 (6396-00)

The Reflective Block consists of a block with various types of reflection surfaces: white, black, shiny metallic, matte black metallic, and retroreflective. The dimensions of the block are: 75 x 75 x 75 mm (3 x 3 x 3 in).

Specifications

Parameter	Value
Surfaces	White, black, shiny metallic, matte black metallic, retroreflective
Physical Characteristics	
Dimensions (H x W x D)	75 x 75 x 75 mm (3 x 3 x 3 in)
Net Weight	300 g (0.7 lb)

Connection Lead and Accessory Set
581429 (8951-80)



This Connection Lead and Accessory Set consists of extra-flexible leads terminated with stacking 4 mm safety banana plugs. The leads are supplied in different lengths. The set also includes a variety of accessories to install and align a dc motor and a brake motor part of training system 8036.

4mm: 10 x 30 cm green, 35 x 30 cm yellow, 20 x 60 cm red, 8 x 90 cm blue 2 x 90 cm green. Guard, shims, coupling, straightedge, etc.

Specifications

Parameter	Value
4 mm Safety Banana Plug Leads Characteristics	
Cross Section	1 mm² (1974 cmil)
Rated Current	19 A
Rated Voltage	600 V, CAT II
4 mm Safety Banana Plug Leads Quantities	
Yellow, 30 cm (12 in)	35
Green, 30 cm (12 in)	10
Red, 60 cm (24 in)	20
Blue, 90 cm (36 in)	8
Green, 90 cm (36 in)	2
Accessories	
Includes:	Coupling

Parameter	Value
	Alignment tool
	Shims
	Allen key
	Safety guard

Connection Lead Set 581430 (8951-E0)

This Connection Lead Set consists of extra-flexible leads terminated with stacking 2 mm banana plugs. The leads are supplied in two different lengths and are color coded.

2mm: 10 x 45 cm yellow, 10 x 60 cm red, 5 x 60 cm black.

Specifications

Parameter	Value
2 mm Safety Banana Plug Leads Characteristics	
Cross Section	0.5 mm² (987 cmils)
Rated Current	10 A
Rated Voltage	30 V ac / 60 V dc
2 mm Safety Banana Plug Leads Quantities	
Black, 60 cm (24 in)	5
Red, 60 cm (24 in)	10
Yellow, 45 cm (18 in)	10

Connection Lead and Accessory Set 581431 (8951-H0)

This Connection Lead and Accessory Set consists of extra-flexible leads terminated with stacking 4 mm safety banana plugs. In addition, the set includes stacking 2 mm banana plug leads of different lengths and a variety of accessories to install and align a dc motor and a brake motor.

4mm: 3 x 30 cm green, 13 x 30 cm yellow, 4 x 60 cm red, 4 x 90 cm blue 3 x 90 cm green. 2mm: 4 x 15 cm white, 15 x 60 cm red. Shims, coupling, straightedge, etc.

Specifications

Parameter	Value
4 mm Safety Banana Plug Leads Characteristics	
Cross Section	1 mm² (1974 cmil)
Rated Current	19 A
Rated Voltage	600 V, CAT II
4 mm Safety Banana Plug Leads Quantities	
Yellow, 30 cm (12 in)	13
Green, 30 cm (12 in)	3
Red, 60 cm (24 in)	4
Blue, 90 cm (36 in)	4
Green, 90 cm (36 in)	3
2 mm Safety Banana Plug Leads Characteristics	
Cross Section	0.5 mm² (987 cmils)
Rated Current	10 A
Rated Voltage	30 V ac / 60 V dc
2 mm Safety Banana Plug Leads Quantities	
White, 15 cm (6 in)	4
Red, 60 cm (24 in)	15
Accessories	
Includes:	Coupling
	Alignment tool
	Shims

Parameter	Value
	Allen key

Connection Lead Set 581432 (8951-I0)

This Connection Lead Set consists of extra-flexible leads terminated with stacking 4 mm safety banana plugs. In addition, the set includes stacking 2 mm banana plug leads of different lengths.

4mm: 1 x 30 cm green, 6 x 150 cm black, 1 x 150 cm green. 2mm: 3 x 15 cm white, 9 x 60 cm red.

Specifications

Parameter	Value
4 mm Safety Banana Plug Leads Characteristics	
Cross Section	1 mm² (1974 cmil)
Rated Current	19 A
Rated Voltage	600 V, CAT II
4 mm Safety Banana Plug Leads Quantities	
Green, 30 cm (12 in)	1
Black, 150 cm (60 in)	6
Green, 150 cm (60 in)	1
2 mm Safety Banana Plug Leads Characteristics	
Cross Section	0.5 mm² (987 cmils)
Rated Current	10 A
Rated Voltage	30 V ac / 60 V dc
2 mm Safety Banana Plug Leads Quantities	
White, 15 cm (6 in)	3
Red, 60 cm (24 in)	9

Connection Lead Set 581434 (8951-M0)

This Connection Lead Set consists of extra-flexible leads terminated with stacking 4 mm safety banana plugs. The leads are supplied in different lengths and colors.

4mm: 10 x 30 cm green, 25 x 30 cm yellow, 5 x 60 cm red, 2 x 90 cm blue, 2 x 90 cm green, 5 x 150 cm black, 1 x 150 cm green.

Specifications

Parameter	Value
4 mm Safety Banana Plug Leads Characteristics	
Cross Section	1 mm² (1974 cmil)
Rated Current	19 A
Rated Voltage	600 V, CAT II
4 mm Safety Banana Plug Leads Quantities	
Yellow, 30 cm (12 in)	25
Green, 30 cm (12 in)	10
Red, 60 cm (24 in)	5
Blue, 90 cm (36 in)	2
Green, 90 cm (36 in)	2
Black, 150 cm (60 in)	5
Green, 150 cm (60 in)	1

Zero Friction Machine
581442 (8969-00)

The Zero Friction Machine is used to perform the friction compensation calibration of various Festo machines, such as the Four-Quadrant Dynamometer/Power Supply, Model 8960-2.

Inertia Wheel
581462 (9126-00)

The balanced Inertia Wheel securely attaches to any 0.2 kW machine. When the inertia wheel is rotated at 1800 r/min, it stores 790 joules of energy (550 joules at 1500 r/min).

Fuses
582126 (37889-00)

The Fuses kit consists of three class cc, time delay fuses to be used with the Three-Pole Fuse Holder, Model 3137.

Specifications

Parameter	Value
Fuse	
Type	Class cc, time delayed
Rating	3 A
Quantity	3

Magnetic Labels
582140 (38503-00)

The Magnetic Labels kit consists of 10 x 20 mm white labels used to identify the components, as in actual control panels.

Specifications

Parameter	Value
Size	10 x 20 mm (0.4 x 0.8 in)
Quantity	46 identified labels, 34 blank labels

Power Cord
582144 (85360-00)

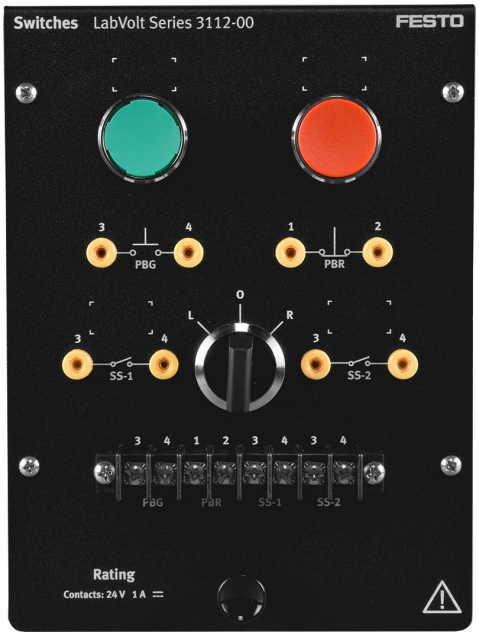
The Power Cord is a fuse-protected power cord that connects to the AC Drive, Model 3183-B. It can be powered from any standard wall outlet.

Specifications

Parameter	Value
Input	120 V - 60 Hz
Fuse	5 A
Length	2 m (6.56 ft)

Optional Equipment Description

Switches (Optional) 581250 (3112-00)

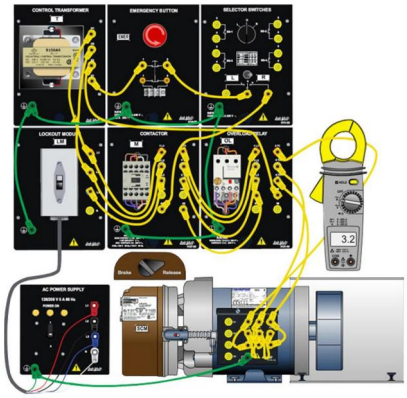


The Switches module consists of two general-purpose push buttons, one green with a normally open contact and one red with a normally closed contact, and a three-position, single-pole selector switch. Electrical connections can be made using either the banana jacks or the terminal block.

Specifications

Parameter	Value
Contact (Green Push Button)	
Type	NO contact set
Rating	1 A - 24 V dc
Contact (Red Push Button)	
Type	NC contact set
Rating	1 A - 24 V dc
Contacts (Selector Switch)	
Type	2 NO contact sets
Rating	1 A - 24 V dc
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 105 mm (8 x 6 x 4.1 in)
0.9 kg (2 lb)	0.9 kg (2 lb)

Industrial Controls Training System Simulation Software (Optional) 8150126 (3161-M0)



The Industrial Controls Simulation Software features simulations of the components of the Industrial Controls Training System, Series 8036. The simulations allow students to complete all the exercises in the training system courseware on a computer without the need for any actual equipment. The course itself on Industrial Controls is available through our new learning portal, Festo LX. Note that the simulation software is specially designed to perform the exercises found in the courseware, and cannot be used to perform customized exercises.

The software is delivered as a digital download with a site license agreement (no limit of users).

Digital Tachometer (Optional) 581427 (8920-40)

The Digital Tachometer indicates motor rotation speed either in a clockwise or counterclockwise direction. The measured speed is automatically indicated on a five-digit display and is updated every second to enable measurement of acceleration and deceleration.

Coupling to the shaft of a motor is accomplished through a rubber tip attached to the Digital Tachometer. The optical sensor can also be used with a reflective tape to read motor speed. Designed to fit comfortably in either the right or left hand, the tachometer is constructed to withstand years of rugged use.

Specifications

Parameter	Value
Direction of Rotation	CW and CCW
Speed Range	0.5-19 999 r/min (Contact Tacho) / 5-99999 r/min (Photo Tacho)
Accuracy	0.05% + 1 digit
Resolution (up to 999.9 r/min)	0.1 r/min
Resolution (1000 r/min and above)	1 r/min
Sampling Time	1 s (for speeds › 60 r/min)
Display	5 digits
Memory Hold Time	5 minutes after measurement
Power	Four 1.5 V AA cells
Accessories Included	Rubber contact tip, rubber contact ring, instruction manual, storage case, reflective tape, and batteries
Physical Characteristics	
Dimensions (H x W x D)	80 x 250 x 120 mm (3.1 x 9.8 x 4.7 in)
Net Weight	0.61 kg (1.34 lb)

Digital Multimeter (Optional) 579782 (8946-20)

The Digital Multimeter consists of an Extech EX350 Digital Multimeter. It is ideal to perform voltage, current, and resistance measurements in exercises.

Specifications

Parameter	Value
Voltage	
Ranges	0-600 V ac/dc
Current	
Range	0-10 A ac/dc
Resistance	
Range	0-40 MΩ
Physical Characteristics	
Dimensions (H x W x D)	182 x 90 x 45 mm (7.17 x 3.54 x 1.77 in)
Net Weight	354 g (0.78 lb)

Connection Lead Set (Optional) 581430 (8951-E0)

This Connection Lead Set consists of extra-flexible leads terminated with stacking 2 mm banana plugs. The leads are supplied in two different lengths and are color coded.

2mm: 10 x 45 cm yellow, 10 x 60 cm red, 5 x 60 cm black.

Specifications

Parameter	Value
2 mm Safety Banana Plug Leads Characteristics	
Cross Section	0.5 mm² (987 cmils)
Rated Current	10 A
Rated Voltage	30 V ac / 60 V dc
2 mm Safety Banana Plug Leads Quantities	
Black, 60 cm (24 in)	5
Red, 60 cm (24 in)	10
Yellow, 45 cm (18 in)	10

Reflecting the commitment of Festo Didactic to high quality standards in product, design, development, production, installation, and service, our manufacturing and distribution facility has received the ISO 9001 certification.

Festo Didactic SE

Rechbergstrasse 3
73770 Denkendorf
Germany

P. +49(0)711/3467-0
F. +49(0)711/347-54-88500

Festo Didactic Inc.

607 Industrial Way West
Eatontown, NJ 07724
United States

P. +1-732-938-2000
F. +1-732-774-8573

Festo Didactic Ltée/Ltd

675 rue du Carbone
Québec QC G2N 2K7
Canada

P. +1-418-849-1000
F. +1-418-849-1666

www.labvolt.com

www.festo-didactic.com