

Industrial Controls Training Systems 8036-00

FESTO

LabVolt Series

Datasheet



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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 Electromechanical 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, Model 3105-0, the Industrial Controls Single-Rail Workstation, Model 3105-A, or the Industrial Controls Double-Rail Workstation, Model 3105-B.

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	Basic Controls Training System _____	581502 (8036-10)
1	Programmable Logic Controller Training System (add-on to 8036-1 or 8036-E) _____	581509 (8036-20)
1	Motor Drives Training System (add-on to 8036-1 or 8036-E in conjunction with 8036-2) _____	581511 (8036-30)
1	Sensors Training System (add-on to 8036-2) _____	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

Qty	Description	Model number
1	Digital Tachometer _____	581427 (8920-40)
1	Digital Multimeter _____	579782 (8946-20)
1	Stopwatch _____	781371 (77660-00)

Optional Equipment

Qty	Description	Model number
1	Industrial Controls Double-Rail Tabletop Workstation _____	8105474 (3105-C0) ¹
1	Single-Phase Manual Starter _____	585971 (3121-20)
1	Solid-State Relay _____	585989 (3133-20)
1	Speed Switch _____	586006 (3146-20)
1	Field Rheostat _____	586007 (3151-10)
1	Prony Brake _____	581336 (3154-10)
1	Industrial Controls Training System - eSeries _____	586013 (3161-E0)
1	Industrial Controls Training System Simulation Software _____	586017 (3161-H0)
1	Universal Motor _____	586023 (3167-10)
1	Dahlander Two-Speed Induction Motor _____	586030 (3168-20)
1	Two-Value Capacitor Motor _____	586036 (3169-10)
1	Machine Mounting Plate _____	581340 (3170-20)
1	Motor Terminal Module _____	586042 (3171-20)
1	Single-Phase Motor _____	586052 (3172-20)
1	Reversible AC Motor _____	586060 (3174-30)
1	Two-Speed Motor _____	586061 (3175-00)
1	Polyphase Motor _____	586071 (3176-20)
1	Three-Phase Wound-Rotor Induction Motor _____	586073 (3177-10)
1	Synchronous Motor/Generator _____	586080 (3178-10)
1	DC Motor (EMS version) _____	586086 (3179-A0)
1	DC Control Relay _____	586094 (3180-10)
1	DC Contactor _____	586100 (3181-10)
1	DC Time-Delay Relay _____	586106 (3182-10)
1	Manual DC Motor Starter _____	586113 (3187-10)
1	Three-Phase Rheostat _____	586119 (3188-10)
1	AC Power Supply (single-sided) _____	8105400 (3196-A0) ²
1	AC/DC Power Supply _____	586127 (3197-30)
1	Small Blank Industrial Controls Module _____	586133 (3198-00)
1	Medium Blank Industrial Controls Module _____	586134 (3198-10)
1	Large Blank Industrial Controls Module _____	586135 (3198-20)
1	Diffuse Reflective Photoelectric Switch _____	587984 (6377-B0)
1	Extended Warranty for the Industrial Controls Training System _____	595866 (8036-EW) ³
1	Phase Converter _____	586844 (8896-00)
1	Personal Computer _____	579785 (8990-00)
1	Clamp-On Meter _____	777911 (38707-00)
1	Industrial Controls Training Systems (Manuals on CD-ROM) _____	580468 (39436-A0)

¹ This workstation can replace the Mobile Workstation, Model 3103-40.

² This power supply can replace the AC Power Supply, Model 3196-30, in case only one side is needed.

³ Price can be calculated as follows: for 1 additional year *7% of total net, for 2 additional years *12% of total net and for 3 additional years *15% of total net. For details and options, contact services.didactic@festo.com.

Available Training Systems

Basic Controls Training System 581502 (8036-10)



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

List of Equipment

Qty	Description	Model number
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	Contactors _____	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	AC Power Supply (double-sided) _____	581365 (3196-30)
1	Connection Lead and Accessory Set _____	581429 (8951-80)
1	Fuses _____	582126 (37889-00)

Qty	Description	Model number
1	Magnetic Labels _____	582140 (38503-00)

List of Manuals

Description	Manual number
Troubleshooting (Student Manual) _____	580480 (85082-00)
Troubleshooting (Instructor Guide) _____	580482 (85082-10)
Industrial Controls Training Systems Series 3100 (User Guide) _____	583973 (27073-E0)
Basic Controls (Student Manual) _____	603859 (49409-00)
Basic Controls (Instructor Guide) _____	603861 (49409-10)

Table of Contents of the Manual(s)

Troubleshooting (Student Manual) (580480 (85082-00))

- 1-1 Voltmeter Method of Troubleshooting
- 1-2 Ohmmeter Method of Troubleshooting
- 1-3 Troubleshooting a Basic Electrical Circuit
- 2-1 Troubleshooting a Manual Reversing Starter Circuit
- 2-2 Troubleshooting a Motor Starter with Jogging Circuit
- 2-3 Troubleshooting a Plugging with Time Relay Circuit
- 3-1 Troubleshooting a PLC Circuit
- 3-2 Troubleshooting a PLC Reversing Motor Starter with Jogging Circuit
- 3-3 Troubleshooting a PLC Motor Starter with Jogging Circuit
- 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 (Student Manual) (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 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 to 8036-1 or 8036-E) 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
2	Switches _____	581250 (3112-00)
1	Pilot Lights 24 V dc _____	581261 (3115-A0)
1	Programmable Logic Controller (Moeller EASY-512-DC-R) _____	581285 (3128-00)
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
Programmable Logic Controller (Student Manual) _____	580464 (39436-00)
Programmable Logic Controller (Instructor Guide) _____	580466 (39436-10)
Troubleshooting (Student Manual) _____	580480 (85082-00)
Troubleshooting (Instructor Guide) _____	580482 (85082-10)

Table of Contents of the Manual(s)

Programmable Logic Controller (Student Manual) (580464 (39436-00))

- 1-1 PLC Overview
- 1-2 Control Relay Functions
- 1-3 Boolean Logic and Markers
- 1-4 Timing Relay Functions
- 1-5 Counter and Comparator Functions
- 2-1 Interfacing Voltages
- 2-2 Motor Starters with Jogging
- 2-3 Reversing Motor Starters with Jogging

Troubleshooting (Student Manual) (580480 (85082-00))

- 1-1 Voltmeter Method of Troubleshooting
- 1-2 Ohmmeter Method of Troubleshooting
- 1-3 Troubleshooting a Basic Electrical Circuit
- 2-1 Troubleshooting a Manual Reversing Starter Circuit
- 2-2 Troubleshooting a Motor Starter with Jogging Circuit
- 2-3 Troubleshooting a Plugging with Time Relay Circuit
- 3-1 Troubleshooting a PLC Circuit
- 3-2 Troubleshooting a PLC Reversing Motor Starter with Jogging Circuit
- 3-3 Troubleshooting a PLC Motor Starter with Jogging Circuit
- 4-1 Troubleshooting an AC Drive Circuit
- 4-2 Troubleshooting an AC Drive Braking and Jogging Circuit
- 4-3 Troubleshooting a DC Drive Circuit

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 8036-1 or 8036-E in conjunction with 8036-2) 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	Power Diodes	581337 (3165-10)

Qty	Description	Model number
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 (Student Manual) _____	580480 (85082-00)
Troubleshooting (Instructor Guide) _____	580482 (85082-10)
Motor Drives (Student Manual) _____	593906 (52733-00)
Motor Drives (Instructor Guide) _____	593907 (52733-10)

Table of Contents of the Manual(s)

Troubleshooting (Student Manual) (580480 (85082-00))

- 1-1 Voltmeter Method of Troubleshooting
- 1-2 Ohmmeter Method of Troubleshooting
- 1-3 Troubleshooting a Basic Electrical Circuit
- 2-1 Troubleshooting a Manual Reversing Starter Circuit
- 2-2 Troubleshooting a Motor Starter with Jogging Circuit
- 2-3 Troubleshooting a Plugging with Time Relay Circuit
- 3-1 Troubleshooting a PLC Circuit
- 3-2 Troubleshooting a PLC Reversing Motor Starter with Jogging Circuit
- 3-3 Troubleshooting a PLC Motor Starter with Jogging Circuit
- 4-1 Troubleshooting an AC Drive Circuit
- 4-2 Troubleshooting an AC Drive Braking and Jogging Circuit
- 4-3 Troubleshooting a DC Drive Circuit

Motor Drives (Student Manual) (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 to 8036-2) 581516 (8036-40)



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

List of Equipment

Qty	Description	Model number
1	Plastic Bottle _____	764073 (76768-00)
1	Limit Switch _____	581328 (3149-00)
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 (Student Manual) _____	580470 (39654-00)
Sensors (Instructor Guide) _____	580472 (39654-10)

Table of Contents of the Manual(s)

Sensors (Student Manual) (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	

Parameter	Value
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.

List of Equipment

Qty	Description	Model number
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 _____	581261 (3115-A0)
1	Three-Phase Manual Starter _____	581271 (3126-00)
1	Control Relay _____	581289 (3130-20)
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	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) _____	581365 (3196-30)
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 Series 3100 (User Guide) _____	583973 (27073-E0)
Motor Drives (Student Manual) _____	593902 (52731-00)
Motor Drives (Instructor Guide) _____	593903 (52731-10)

Table of Contents of the Manual(s)

Motor Drives (Student Manual) (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
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	Industrial Controls Single-Rail Workstation _____	581243 (3105-A0)
1	Switches _____	581250 (3112-00)
1	Pilot Lights 24 V dc _____	581261 (3115-A0)
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 Series 3100 (User Guide)	583973 (27073-E0)
Motor Drives (Student Manual)	593904 (52732-00)
Motor Drives (Instructor Guide)	593905 (52732-10)

Table of Contents of the Manual(s)

Motor Drives (Student Manual) (593904 (52732-00))

- 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 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. 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.

List of Equipment

Qty	Description	Model number
1	Industrial Controls Tabletop Workstation	581242 (3105-00)

Qty	Description	Model number
2	Switches _____	581250 (3112-00)
1	Emergency Button _____	581252 (3114-00)
1	Pilot Lights 24 V dc _____	581261 (3115-A0)
1	Three-Phase Manual Starter _____	581271 (3126-00)
1	Control Relay _____	581289 (3130-20)
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	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)

List of Manuals

Description	Manual number
Industrial Controls Training Systems Series 3100 (User Guide) _____	583973 (27073-E0)
Motor Drives (Student Manual) _____	593902 (52731-00)
Motor Drives (Instructor Guide) _____	593903 (52731-10)

Table of Contents of the Manual(s)

Motor Drives (Student Manual) (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
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	Contactors _____	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 (Student Manual) _____	580480 (85082-00)
Troubleshooting (Instructor Guide) _____	580482 (85082-10)
Basic Controls (Student Manual) _____	603859 (49409-00)
Basic Controls (Instructor Guide) _____	603861 (49409-10)

Table of Contents of the Manual(s)

Troubleshooting (Student Manual) (580480 (85082-00))

- 1-1 Voltmeter Method of Troubleshooting
- 1-2 Ohmmeter Method of Troubleshooting
- 1-3 Troubleshooting a Basic Electrical Circuit
- 2-1 Troubleshooting a Manual Reversing Starter Circuit
- 2-2 Troubleshooting a Motor Starter with Jogging Circuit
- 2-3 Troubleshooting a Plugging with Time Relay Circuit
- 3-1 Troubleshooting a PLC Circuit

- 3-2 Troubleshooting a PLC Reversing Motor Starter with Jogging Circuit
- 3-3 Troubleshooting a PLC Motor Starter with Jogging Circuit
- 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 (Student Manual) (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	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	Contactors _____	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 (Student Manual) _____	580480 (85082-00)
Troubleshooting (Instructor Guide) _____	580482 (85082-10)
Industrial Controls Training Systems Series 3100 (User Guide) _____	583973 (27073-E0)
Basic Controls (Student Manual) _____	603855 (49408-00)
Basic Controls (Instructor Guide) _____	603857 (49408-10)

Table of Contents of the Manual(s)

Troubleshooting (Student Manual) (580480 (85082-00))

- 1-1 Voltmeter Method of Troubleshooting
- 1-2 Ohmmeter Method of Troubleshooting
- 1-3 Troubleshooting a Basic Electrical Circuit
- 2-1 Troubleshooting a Manual Reversing Starter Circuit
- 2-2 Troubleshooting a Motor Starter with Jogging Circuit
- 2-3 Troubleshooting a Plugging with Time Relay Circuit
- 3-1 Troubleshooting a PLC Circuit
- 3-2 Troubleshooting a PLC Reversing Motor Starter with Jogging Circuit
- 3-3 Troubleshooting a PLC Motor Starter with Jogging Circuit
- 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 (Student Manual) (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 Series 3100 (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 Series 3100 (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 Series 3100 (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 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 Series 3100 (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 581261 (3115-A0)



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.

Specifications

Parameter	Value
Lights	
Type	Green, red
Rating	24 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)

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

Parameter	Value
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)

Contacteur 581278 (3127-20)



The Contacteur 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 (Moeller EASY-512-DC-R) 581285 (3128-00)



The Programmable Logic Controller consists of a small controller programmed in ladder logic with eight inputs (24 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 (Easy-Soft) 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	Moeller EASY-512-DC-R (identical to 1760-L12BWB Allen-Bradley Pico Controller)
Power Requirement	2 W - 24 V dc
Inputs (8)	
Digital (11 to I8)	24 V dc
Analog (I7, I8)	0-10 V dc
Contacts (4)	
Type	4 NO contact sets
Rating	4 A - 24 V dc
Accessories	Cable for PC, Easy-Soft 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 - 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	
	3A - 250 V - 50/60 Hz
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·m ² (0.380 lbf·ft ²)
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)	

Parameter	Value
Total Power (Continuous)	50 W
Total Power (Intermittent Duty)	250 W (3 min ON / 20 min Off)
Value	10 Ω (100W)
Tap	50%
Accuracy	$\pm 5\%$
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)
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

Parameter	Value
Full-Load Current	1.8 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)	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)	

Parameter	Value
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

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
Power Requirements	350 W - 120 V ac
Power Output	325 W - 0-130 V 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 k Ω - 0.5 W
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 228 x 97 mm (8 x 9 x 5.8 in)
Net Weight	1.5 kg (3.4 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) 581365 (3196-30)



The AC Power Supply is designed to supply electrical power to equipment in the Industrial Controls Training Systems. It has two independent sets of controls, indicators, and output connectors and outlets, each set being located at one end of the unit. This allows a single AC Power Supply to power the equipment setups of two student groups working on the same Workstation. The AC Power Supply requires three-phase ac power for operation. A five-prong male-plug,

mains power cable is used to connect the AC Power Supply to a three-phase ac power outlet. A three-phase

circuit breaker is located on each side of the power supply to turn the power on and off and provide overcurrent protection.

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	
Voltage (Three-Phase)	120/208 V - 60 Hz
Current	Two 5 A outlets
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 mm (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.

Specifications

Parameter	Value
4 mm Safety Banana Plug Leads Characteristics	
Cross Section	1 mm ² (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
	Alignment tool

Parameter	Value
	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.

Specifications

Parameter	Value
2 mm Safety Banana Plug Leads Characteristics	
Cross Section	0.5 mm ² (987 cmils)
Rated Current	10 A
Rated Voltage	30 V ac / 60 V dc
2 mm Safety Banana Plug Leads Quantities	
Yellow, 45 cm (18 in)	13
Blue, 45 cm (18 in)	13
Red, 60 cm (24 in)	16
Black, 60 cm (24 in)	17

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.

Specifications

Parameter	Value
4 mm Safety Banana Plug Leads Characteristics	
Cross Section	1 mm ² (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 mm ² (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
	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.

Specifications

Parameter	Value
4 mm Safety Banana Plug Leads Characteristics	
Cross Section	1 mm ² (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 mm ² (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.

Specifications

Parameter	Value
4 mm Safety Banana Plug Leads Characteristics	
Cross Section	1 mm ² (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

**Plastic Bottle
764073 (76768-00)**



The Plastic Bottle is an easy-grip translucent high-density polyethylene bottle with a capacity of 4 liters (1 gal), supplied by McMaster-Carr Supply Co.

Specifications

Parameter	Value
Material	Translucent plastic
Capacity	4730 ml (160 oz)
Physical Characteristics	
Dimensions (H x W x D)	280 x 135 x 135 mm (11 x 5.3 x 5.3 in)
Net Weight	0.36 kg (0.8 lb)

Optional Equipment Description

**Industrial Controls Double-Rail Tabletop Workstation (Optional)
8105474 (3105-C0)**



This Industrial Controls Double-Rail Tabletop Workstation consists of a inclined mounting rails designed to be placed on top of a regular table. Two pairs of mounting rails holds the control modules firmly in place.

A safety bar is attached to each bottom rail and prevents students from removing modules during laboratory exercises. A padlock is provided to lock the safety bars in place once all modules are inserted in

the workstation.

Manual

Description

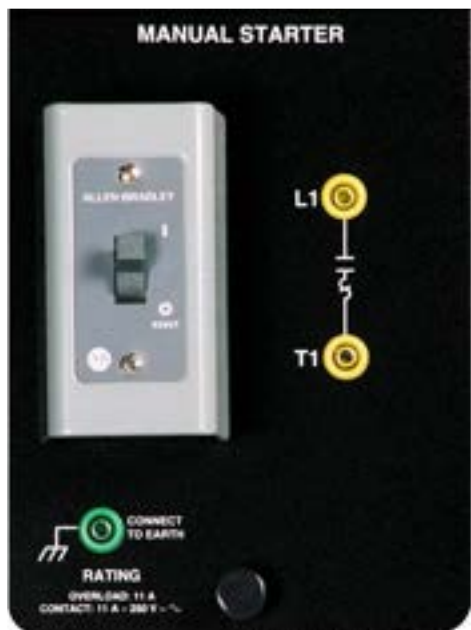
Manual number

Industrial Controls Training Systems Series 3100 (User Guide) _____ 583973 (27073-E0)

Specifications

Parameter	Value
Physical Characteristics	
Dimensions	404 x 954 x 432 mm (15.9 x 37.5 x 17 in)
Net Weight	13.6 kg (30 lb)

Single-Phase Manual Starter (Optional) 585971 (3121-20)



The Manual Starter consists of a single-phase circuit breaker with thermal overload protection.

Specifications

Parameter	Value
Contacts	
Type	SPST
Rating	11 A - 250 V ac
Overload	4.5 A
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	0.9 kg (2 lb)

Solid-State Relay (Optional) 585989 (3133-20)



The Solid-State Relay is an industrial-type, solid-state relay designed to switch ac power loads. The switching device consists of two inverse-parallel (back-to-back) SCR's. Switching control is through an opto-isolated input and provides zero voltage switching.

Specifications

Parameter	Value
Control	
Type	Optoisolated with zero-cross turn-on
Voltage Range	90-250 V ac
Impedance	60 k Ω
Contact	
Type	Back-to-back SCR
Voltage Range	24-250 V ac
Current Range	0.04-6 A ac
Frequency range	
Frequency Range	47-63 Hz
Fault Switches	3
Physical characteristics	
Dimensions (H x W x D)	203 x 153 x 108 mm (8 x 6 x 4.25 in)
Net Weight	0.36 kg (0.79 lb)

Speed Switch (Optional) 586006 (3146-20)



The Speed Switch consists of a low-speed sensing switch for use in motor control systems, such as plugging and reversing circuits. The switch is supplied with coupling and mounting brackets.

Specifications

Parameter	Value
Running Speed	30-2000 r/min
Approximate Trip Point	25-70 r/min
Contacts	
Forward Direction	SPDT
Reverse Direction	SPDT
Rating	10 A - 480 V ac
Physical Characteristics	
Dimensions (H x W x D)	137 x 205 x 165 mm (5.4 x 8 x 6.5 in)
Net Weight	2.5 kg (4.9 lb)

Field Rheostat (Optional) 586007 (3151-10)



The Field Rheostat consists of a 75 W, fuse-protected rheostat, rated to operate with dc and ac machines.

Specifications

Parameter	Value
Rheostat	
Power (Continuous)	40 W
Power (Intermittent Duty)	75 W (10 min On / 20 min Off)
Total Resistance	500 Ω
Circuit Breaker	
Current	0.5 A
Fault Switches	
	2
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 90 mm (8 x 6 x 3.5 in)
Net Weight	0.9 kg (2 lb)

Prony Brake (Optional) 581336 (3154-10)



The Prony Brake is used for loading motors. The brake is complete with scales and pulley. The torque is determined from the lever arm length and the value indicated by the scales.

Specifications

Parameter	Value
Torque Range	0-6 N-m (0-54 lbf-in)
Physical Characteristics	
Dimensions (H x W x D)	280 x 305 x 100 mm (11 x 12 x 3.9 in)
Net Weight	1.8 kg (4 lb)

Industrial Controls Training System - eSeries (Optional) 586013 (3161-E0)



This site-license eLearning course bundle is intended to be used in conjunction with the Industrial Controls Training System, Series 8036. It contains five courses, all of which begin with a pretest and end with a posttest. Each course includes the topics covered in the book-based content and their related hands-on exercises. Exercise procedures are presented in enhanced PDF format. Completed exercises may be printed,

saved to a specific location, and submitted (emailed) to the instructor. Exercise presentation of technical content is accompanied by voiceover narration to minimize the amount of on-screen reading.

The following learning platforms are available:

- 3161-E – Industrial Controls Training System - eSeries
- 3161-F – Industrial Controls Training System - SCORM
- 3161-G – Industrial Controls Training System - Stand-Alone

It is also possible to obtain each of the above eLearning formats with the addition of the Industrial Controls Training System 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:

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

Topic Coverage

- Basic Controls
- Programmable Logic Controller
- Motor Drives
- Sensors
- Troubleshooting

Specifications

Parameter	Value
Computer Requirements	A currently available personal computer running under one of the following operating systems: Windows® 7 or Windows® 8.

Industrial Controls Training System Simulation Software (Optional) 586017 (3161-H0)



The Industrial Controls Simulation Software features true simulations of the components of the Industrial Controls Training System, Series 8036. The precise simulations allow students to complete all the exercises in the training system courseware on a computer without the need for any actual equipment. 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 can be used as a stand-alone product or in

conjunction with the different available eLearning course formats (eSeries, SCORM, and stand-alone).

Universal Motor (Optional) 586023 (3167-10)



The Universal Motor has exposed commutator bars and adjustable brushes to allow students to study the effect of armature reactions and commutation while the machine is running under load. The armature winding, the series field winding, and the compensation winding are terminated independently. Students can observe the effects of both

inductive and conductive compensation on motor speed and torque for both ac and dc input voltage sources.

The motor is supplied with a silk-screened faceplate showing the motor connections and a twelve-pin connector to fit with the Motor Terminal Module, Model 3171-2.

Specifications

Parameter	Value
Rating	
Voltage	120 V ac/dc
Output Power	175 W
Full Load Speed	1800 r/min
Full Load Current	3 A
Physical Characteristics	
Dimensions (H x W x D)	175 x 320 x 165 mm (6.9 x 12.6 x 6.5 in)
Net Weight	8.2 kg (18 lb)

Dahlander Two-Speed Induction Motor (Optional) 586030 (3168-20)



The Dahlander Two-Speed Induction Motor uses the method of pole changing based on the consequent pole principally known as the Lindström-Dahlander winding. By the insertion of the special interconnection jumper, this motor can be configured to obtain three different types of motors. Students can obtain a two-speed constant power motor, a two-speed variable torque motor, and a two-speed constant torque motor using the same motor and different

interconnection jumpers.

The motor is supplied with three faceplates showing the motor connections in three different configurations: constant power, variable torque, and constant torque. A twelve-pin connector to fit with the Motor Terminal Module, Model 3171-2, is also included.

Specifications

Parameter	Value
Two-Speed Constant-Power Motor Ratings	
Output Power	175 W
Stator Voltage (Three-Phase)	208 V - 60 Hz
Full-Load Speed	3200/1740 r/min
Full-Load Current	1.1/1.4 A
Two-Speed Variable-Torque Motor Ratings	
Output Power	175/44 W
Stator Voltage (Three-Phase)	208 V - 60 Hz
Full-Load Speed	3325/1670 r/min
Full-Load Current	1.4/0.5 A
Two-Speed Constant-Torque Motor Ratings	
Output Power	175 W
Stator Voltage (Three-Phase)	208 V - 60 Hz
Full-Load Speed	3325/1670 r/min
Full-Load Current	1.3/1 A
Physical Characteristics	
Dimensions (H x W x D)	175 x 335 x 165 mm (6.9 x 13.2 x 6.5 in)
Net Weight	8.2 kg (18 lb)

Two-Value Capacitor Motor (Optional) 586036 (3169-10)



The Two-Value Capacitor Motor is fitted with a running capacitor and two running windings that are independently terminated to facilitate experimentation of various machine connections and to allow operation from a two-phase source of power. The design of this machine has been optimized so that the machine operates like a two-phase motor at full load when connected to a single-phase source.

The motor is supplied with a silk-screened faceplate showing the motor

connections and a twelve-pin connector to fit with the Motor Terminal Module, Model 3171-2.

Specifications

Parameter	Value
Rating	
Line Voltage	120 V ac
Output Power	175 W
Full-Load Speed	1715 r/min
Full-Load Current	2.8 A
Physical Characteristics	
Dimensions (H x W x D)	175 x 335 x 165 mm (6.9 x 13.2 x 6.5 in)
Net Weight	8.2 kg (18 lb)

Machine Mounting Plate (Optional) 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)
Net Weight	3.6 kg (7.9 lb)

Motor Terminal Module (Optional) 586042 (3171-20)



The Motor Terminal Module consists of a twelve-terminal module with connection points for the rotating machines of the Industrial Controls Training Systems. The faceplate of the Motor Terminal Module is designed to be replaced by the faceplate provided with the rotating machine currently connected to the terminal module.

Specifications

Parameter	Value
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 303 x 75 mm (8 x 11.9 x 3 in)
Net Weight	1.8 kg (4 lb)

Single-Phase Motor (Optional) 586052 (3172-20)



The Single-Phase Motor module consists of a single-phase, squirrel-cage induction motor. A capacitor allows the motor to develop a starting torque.

Specifications

Parameter	Value
Ratings	
Power	249 W
Stator Voltage	115/230 V - 60 Hz
Full-Load Speed	1740 r/min
Full-Load Current	3.4/1.7 A
Physical Characteristics	
Dimensions (H x W x D)	218 x 224 x 273 mm (8.6 x 8.8 x 11.75 in)
Net Weight	TBE

Reversible AC Motor (Optional) 586060 (3174-30)



The Reversible AC Motor module consists of a reversible, single-phase gear motor having an output speed of 30 r/min. It is supplied with three perforated disks (a metallic disk, a transparent plastic disk, and a fiber disk). The disks are used to learn the characteristics of sensors. The sensors can be mounted on the motor chassis or on the work surface.

Specifications

Parameter	Value
Input Voltage	110/120 V - 50/60 Hz
Speed	30 r/min
Full Load Current	
Full-Load Current	0.28 A
Accessories	3 detection disks: metallic, transparent, and fiber
Physical Characteristics	
Dimensions (H x W x D)	150 x 170 x 254 mm (5.9 x 6.7 x 10 in)
Net Weight	TBE

Two-Speed Motor (Optional) 586061 (3175-00)



The Two-Speed Motor is a three-phase, squirrel-cage, two-winding induction motor. Depending on how its two windings are connected, the motor operates at either a high-speed setting (four-pole motor) or a low-speed setting (six-pole motor).

Specifications

Parameter	Value
Ratings	
Output Power	560/249 W
Stator Voltage	230 V - 60 Hz
Full-Load Speed	1725/1140 r/min
Full-Load Current	2.8/1.6 A
Physical Characteristics	
Dimensions (H x W x D)	173 x 279 x 254 mm (6.8 x 11 x 10 in)
Net Weight	TBE

Polyphase Motor (Optional) 586071 (3176-20)

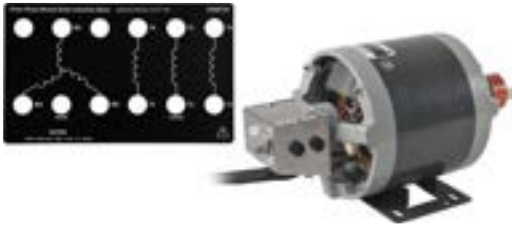


The Polyphase Motor consists of a three-phase, four-pole, squirrel-cage induction motor. The motor is dual voltage and can operate at either a low-voltage or a high-voltage setting.

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
Physical Characteristics	
Dimensions (H x W x D)	170 x 323 x 175 mm (6.7 x 12.7 x 6.9 in)
Net Weight	TBE

Three-Phase Wound-Rotor Induction Motor (Optional) 586073 (3177-10)



The Three-Phase Wound-Rotor Induction Motor is fitted with stator winding phases that are independently terminated and identified on the faceplate to permit operation in either delta or star (wye) configuration. The rotor windings of the motor are

brought out to the faceplate via external slip rings and brushes. This machine can be used as a wound-rotor induction motor, phase shifter, single-phase variable coupling transformer, three-phase transformer, selsyn control, frequency converter or asynchronous induction generator. The speed of this machine can be controlled through the use of the Three-Phase Rheostat, Model 3188-1.

The motor is supplied with a silk-screened faceplate showing the motor connections and a twelve-pin connector to fit with the Motor Terminal Module, Model 3171-2.

Specifications

Parameter	Value
Ratings	
Output Power	175 W
Stator Voltage (Three-Phase)	120/208 V - 60 Hz
Rotor Voltage (Three-Phase)	60/104 V - 60 Hz
Full-Load Speed	1500 r/min
Full-Load Current	1.3 A
Physical Characteristics	
Dimensions (H x W x D)	175 x 335 x 165 mm (6.9 x 13.2 x 6.5 in)
Net Weight	8.2 kg (18 lb)

Synchronous Motor/Generator (Optional) 586080 (3178-10)



The Synchronous Motor/Generator is designed so that each phase of the stator windings of this machine is independently terminated and identified on the faceplate, allowing operation in either delta or star (wye) configuration. The rotor of this machine is equipped with a squirrel-cage damper and salient pole windings in order for the machine to exhibit the same properties as

industrial high-power synchronous machines. Variable dc excitation to the salient pole windings is fed through the externally mounted slip rings and brushes which are pre-wired to a rheostat and control switch mounted on the faceplate. This machine can also be operated either as a three-phase synchronous motor or as a three-phase synchronous generator (or condenser).

The motor is supplied with a silk-screened faceplate showing the motor connections and a twelve-pin connector to fit with the Motor Terminal Module, Model 3171-2.

Specifications

Parameter	Value
Motor Ratings	
Output Power	175 W
Stator Voltage (Three-Phase)	208 V - 60 Hz
Rotor Induction Voltage	120 V dc
Full-Load Speed	1800 r/min
Full-Load Current	0.33 A
Physical Characteristics	
Dimensions (H x W x D)	175 x 335 x 165 mm (6.9 x 13.2 x 6.5 in)
Net Weight	8.2 kg (18 lb)

DC Motor (EMS version) (Optional) 586086 (3179-A0)



The DC Motor (EMS version) consists of a permanent magnet 90 V dc motor that can be used with the DC Drive, Model 3184. Model 3179-A uses the same motor as the DC Motor, Model 3179-2, but in a standard full-size EMS module.

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)	308 x 291 x 440 mm (12.1 x 11.5 x 17.3 in)
Net Weight	TBE

DC Control Relay (Optional) 586094 (3180-10)



The DC Control Relay consists of a control relay with two normally open and two normally closed contacts.

Specifications

Parameter	Value
Coil	
Nominal Voltage	120 V dc
Contacts	
Type	2 NO contact sets and 2 NC contact sets
Rating	1 A at 120 V – DC
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 175 mm (8 x 6 x 6.9 in)
Net Weight	1.8 kg (4 lb)

DC Contactor (Optional) 586100 (3181-10)



The DC Contactor module consists of a dc contactor with two normally open contacts in series and one auxiliary contact.

Specifications

Parameter	Value
Coil	
Nominal Voltage	120 V dc
Contacts	
Type	2 NO contact sets

Parameter	Value
Rating	2 A - 250 V ac
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 228 x 145 mm (8 x 9 x 5.7 in)
Net Weight	1.8 kg (4 lb)

DC Time-Delay Relay (Optional) 586106 (3182-10)



The DC Time-Delay Relay consists of a dc relay with pneumatic time-delay attachment. Delay attachment can provide on-delay or off-delay for one normally open and one normally closed contact.

Specifications

Parameter	Value
Coil	
Nominal Voltage	120 V dc
Contacts	
Type	NO, NC contact sets
Rating	1 A at 120 V – DC
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	1.8 kg (4 lb)

Manual DC Motor Starter (Optional) 586113 (3187-10)



The Manual DC Motor Starter consists of a manually operated variable-resistance starter. The starter can be wired as either a three- or four-point dc starter to be used with the DC Motor, Model 3179-2.

Specifications

Parameter	Value
Power Input	120 V dc
Output	
Maximum Field Current	0.4 A dc
Maximum Armature Current	3 A dc
Physical Characteristics	
Dimensions (H x W x D)	203 x 328 x 75 mm (8 x 12 x 3 in)
Net Weight	1.8 kg (4 lb)

Three-Phase Rheostat (Optional) 586119 (3188-10)



The Three-Phase Rheostat provides the mechanism for controlling motor starting torque and speed by varying the resistance in the motor circuit of the wound rotor motor. One knob adjusts the three rheostats, each of which is protected by a circuit breaker.

Specifications

Parameter	Value
Rheostats (3)	
Power	75 W
Total Resistance	16 Ω
Physical Characteristics	
Dimensions (H x W x D)	203 x 305 x 75 mm (8 x 12 x 3 in)
Net Weight	TBE

AC Power Supply (single-sided) (Optional) 8105400 (3196-A0)



The AC Power Supply (single-side) is designed to supply electrical power to equipment in the Industrial Controls Training Systems in combination with the Double-Rail Tabletop Workstation, Model 3105-C. The AC Power Supply requires three-phase ac power for operation. A five-prong male-plug, mains power cable is used to connect the AC Power Supply to a three-phase ac power outlet. A three-phase circuit breaker is located on the front panel of the power supply to turn the power on

and off and provide overcurrent protection.

Specifications

Parameter	Value
Module Requirements	
Maximum Current	5 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	
Voltage (Three-Phase)	120/208 V - 60 Hz
Current	Two 5 A outlets
Physical Characteristics	
Dimensions	160 x 155 x 327 mm (6.3 x 6.1 x 12.9 in)
Net Weight	4.2 kg (9.2 lb)

AC/DC Power Supply (Optional) 586127 (3197-30)



The AC/DC Power Supply provides both ac and dc 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, two ac power receptacles, dual sets of four color-coded banana jacks for three-phase voltage, and dual sets of two color-coded banana jacks for fixed dc output. All outputs are circuit-breaker protected. The AC/DC 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 requirement	
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
AC Output	
Voltage (Three-Phase)	120/208 V - 60 Hz
Current	Two 5 A outlets
DC Output	
Voltage	120 V dc
Current	Two outlets, 4 A total
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	6.8 kg (15 lb)

Small Blank Industrial Controls Module (Optional) 586133 (3198-00)



The Small Blank Industrial Controls Module is a 15.3 cm (6 in) wide blank industrial controls module that can be used to mount customized control devices.

Specifications

Parameter	Value
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 153 x 75 mm (8 x 6 x 3 in)
Net Weight	0.5 kg (1.1 lb)

Medium Blank Industrial Controls Module (Optional) 586134 (3198-10)

The Medium Blank Industrial Controls Module is a 22.8 cm (9 in) wide blank industrial controls module that can be used to mount customized control devices.

Specifications

Parameter	Value
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 228 x 75 mm (8 x 9 x 3 in)

Parameter	Value
Net Weight	0.7 kg (1.5 lb)

Large Blank Industrial Controls Module (Optional) 586135 (3198-20)



The Large Blank Industrial Controls Module is a 30.5 cm (12 in) wide blank industrial controls module that can be used to mount customized control devices.

Specifications

Parameter	Value
Fault Switches	4
Physical Characteristics	
Dimensions (H x W x D)	203 x 305 x 75 mm (8 x 12 x 3 in)
Net Weight	0.9 kg (2.0 lb)

Diffuse Reflective Photoelectric Switch (Optional) 587984 (6377-B0)



The Diffuse Reflective 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	Diffusive reflective

Parameter	Value
Transistor Output Type	Sourcing (PNP)
Sensing Distance	200 mm (8 in)
Light Source Type	Visible Red LED
Light Source Wavelength	700 nm (27.6 microinch)
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)

Extended Warranty for the Industrial Controls Training System (Optional) 595866 (8036-EW)

The Festo Didactic Extended Warranty program offers you the flexibility to add to the standard two-year manufacturer's warranty. The Extended Warranty provides coverage for up to three additional years, for a total of five years of protection on your investment for your industrial controls training equipment.

Extended Warranty terms are the same as the terms for the current two-year manufacturer warranty.

Phase Converter (Optional) 586844 (8896-00)



The Phase Converter converts a single-phase supply into a five-wire (wye configuration including neutral and ground) three-phase supply. This converter recreates a true three-phase power supply (with a phase voltage difference of about 10%) for three-phase motor control circuits. The phase converter can supply power to

two teams working on the same workstation for the Industrial Controls Training System (most of the exercises can be performed simultaneously using only one converter). This converter is not recommended for the Electric Power Technology motor and controls.

This model is available only in its 120 V and 60 Hz variant.

Specifications

Parameter	Value
Input Current	7 A (Single-Phase)
Output Current	1.2 A (Three-Phase)
Maximum Error on Phase Voltage	15%
Physical Characteristics	
Dimensions (H x W x D)	305 x 540 x 275 mm (12 x 21.2 x 10.8 in)
Net Weight	38.1 kg (84 lb)

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 Amprobe AM-510 Tool Kit Digital Multimeter with Battery Test. 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)

Personal Computer (Optional) 579785 (8990-00)



The Personal Computer consists of a desktop computer running under Windows® 10. A monitor, keyboard, and mouse are included.

Specifications

Parameter	Value
Power Requirements	
Current	2 A
Service Installation	Standard single-phase ac outlet

Clamp-On Meter (Optional) 777911 (38707-00)



The Clamp-On Meter consist of a clamp-on multimeter with the following features:

- It can measure alternating voltage values of up to 600 V and alternating current values of up to 600 A
- It can measure resistance and perform continuity tests
- It is fitted with an autoranging feature that selects the proper range for any given measurement
- It can be clamped to conductors with a diameter of up to 2.5 cm (1 in)
- It is fitted with a data hold feature that can retain certain values
- It includes 2 AAA batteries

Specifications

Parameter	Value
Current	
Range	0-600 A
Accuracy	2% at 50-60 Hz
Resolution	0.1 A at 200 A
Voltage	
Range	0-600 V
Accuracy	1.5% at 50-60 Hz
Resolution	0.1 V at 200 V
Resistance	
Range	0-200 Ω
Accuracy	1.9%
Resolution	0.1 Ω
Physical Characteristics	
Dimensions (H x W x D)	29 x 50 x 187 mm (1.1 x 2.0 x 7.1 in)
Net Weight	0.2 kg (0.44 lb)

Industrial Controls Training Systems (Manuals on CD-ROM) (Optional) 580468 (39436-A0)

List of Manuals

Description	Manual number
Industrial Controls Training Systems Series 3100 (User Guide)	590447 (27073-E0)
Basic Controls (Student Manual)	591358 (39163-00)
Basic Controls (Instructor Guide)	591360 (39163-10)
Programmable Logic Controller (Student Manual)	591374 (39436-00)
Programmable Logic Controller (Instructor Guide)	591376 (39436-10)
Motor Drives (Student Manual)	591390 (39653-00)
Motor Drives (Instructor Guide)	591392 (39653-10)
Sensors (Student Manual)	591394 (39654-00)
Sensors (Instructor Guide)	591396 (39654-10)
Troubleshooting (Student Manual)	591620 (85082-00)
Troubleshooting (Instructor Guide)	591622 (85082-10)
Motor Drives (Student Manual)	591684 (85626-00)
Motor Drives (Instructor Guide)	591685 (85626-10)
Motor Drives (Student Manual)	591688 (85725-00)
Motor Drives (Instructor Guide)	591689 (85725-10)
Basic Controls (Student Manual)	592073 (87774-00)
Basic Controls (Instructor Guide)	592075 (87774-10)
Motor Drives (Student Manual)	594219 (52731-00)
Motor Drives (Instructor Guide)	594220 (52731-10)
Motor Drives (Student Manual)	594221 (52732-00)
Motor Drives (Instructor Guide)	594222 (52732-10)
Motor Drives (Student Manual)	594223 (52733-00)
Motor Drives (Instructor Guide)	594224 (52733-10)
Basic Controls (Student Manual)	603953 (49408-00)
Basic Controls (Student Manual)	603955 (49408-10)
Basic Controls (Student Manual)	603957 (49409-00)
Basic Controls (Instructor Guide)	603959 (49409-10)

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.

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