3466

Building Energy Management Training Systems

LabVolt Series

Datasheet

Festo Didactic
en 120 V - 60 Hz
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General Description

The Building Energy Management Training Systems form a complete introduction to direct digital control (DDC) of heating, ventilation, and air conditioning (HVAC) systems. They cover the main control schemes used in building energy management. This includes single-zone and multi-zone control, constant air volume (CAV) systems, and variable air volume (VAV) systems.

The training systems allow students to acquire hands-on experience with industrial HVAC control equipment. Throughout the program, students connect, configure, and troubleshoot programmable controllers using modern HVAC control software.

The course material also covers important topics related to HVAC systems, such as heating, cooling, free cooling, smoke detection, CO2 level detection, humidity control, and human-machine interfaces (HMI).

The Building Energy Management Training Systems are part of the HVAC-R line of products. Three variants are available:

- Model 3466-0 is a complete training system that includes a workstation with enough space to accommodate two student groups.
- Model 3466-A is a complete training system that does not include the above-mentioned workstation. It is designed to allow a second team of students to perform exercises on the workstation provided with Model 3466-0.
- Model 3466-B is an add-on to the Electric Heating Training System, Model 3460-0. It provides to users that already have this system all the equipment necessary to complete the exercises in the Building Energy Management Training System, Model 3466-0, without any unnecessary duplication of equipment.

Courseware

Full-color courseware is included with the Building Energy Management Training System. The student manual provides all the theoretical matter required, lab exercise procedures to be performed with the training equipment, and review questions. The instructor guide has the same content as the student manual and includes the answers to procedure and review questions.

Topic Coverage

- HVAC systems
- Direct digital control
- Rooftop units and rooftop unit controllers
- Supervisory controllers
- Programmable controllers
- Networks
- Humidity control
- Heating, cooling, and free cooling
- Smoke detection
- CO2 level detection
- Human-machine interfaces
- Occupancy
- Alarms and trends
- Single-zone and multi-zone systems
- Constant air volume systems
- Pressure-dependent variable air volume systems
- Pressure-independent variable air volume systems
- Commissioning
- Troubleshooting
- Estimated program duration: 15 to 20 hours

List of Available Training Systems

Qty	Description	Model number
1	Building Energy Management Training System	3466-00
1	Building Energy Management Training System (Second Team Add-On)	3466-A0
1	Building Energy Management Training System (Add-On to Model 3460-0)	3466-B0

Available Training Systems

Building Energy Management Training System 3466-00

The Building Energy Management Training System is a complete introduction to direct digital control (DDC) of heating, ventilation, and air conditioning (HVAC) systems. It covers the main control schemes used in building energy management.

The training system comprises all the equipment required to perform the exercises in the courseware, as well as a workstation with enough space to accommodate two student groups.

List of Equipment

Qty	Description	Model number
1	Workstation	3451-00
1	Power Source	46200-00
1	Control Transformer	46208-00
2	Programmable Controller	46256-00
1	Programmable Controller Software	46257-00
1	Temperature Network Sensor	46258-00
1	Building Energy Management Training System	46259-00
1	Supervisory Controller	46260-00
1	Multimeter	46290-00
1	Test Lead Kit	46295-06

List of Manuals

Description	Manual number
HVAC Direct Digital Control (Student Manual)	20589-00
HVAC Direct Digital Control (Instructor Guide)	20589-10

Table of Contents of the Manual(s)

HVAC Direct Digital Control (Student Manual) (20589-00)

- 0 Introduction - HVAC Systems
- 1 Familiarization with the Building Energy Management
- 2 Constant Air Volume (CAV) HVAC Systems
- 3 Humidity Control of a CAV HVAC System
- 4 Pressure-Dependent Variable Air Volume (VAV) HVAC Systems
- 5 Pressure-Independent Variable Air Volume (VAV) HVAC Systems
- 6 Supervisory Controller

Optional Equipment

Qty	Description	Model number
1	Table	3452-00

System Specifications

Parameter	Value
Power Requirements	
Voltage	120 V
Current	12 A
Frequency	60 Hz
Physical Characteristics	
Intended Location	On a table able to support the weight of the equipment
Dimensions (H x W x D)	1110 x 490 x 1092 mm (43.8 x 19.3 x 43 in)
Net Weight	TBE

Building Energy Management Training System (Second Team Add-On) 3466-A0

The Building Energy Management Training System (Second Team Add-On) is a complete introduction to direct digital control (DDC) of heating, ventilation, and air conditioning (HVAC) systems. It covers the main control schemes used in building energy management.

The training system comprises all the equipment required to perform the exercises in the courseware, without the workstation included in the Building Energy Management Training System, Model 3466-0. It is designed to allow a second team of students to perform exercises on the workstation provided with Model 3466-0.

List of Equipment

Qty	Description	Model number
1	Power Source	46200-00
1	Control Transformer	46208-00
2	Programmable Controller	46256-00
1	Programmable Controller Software	46257-00
1	Temperature Network Sensor	46258-00
1	Building Energy Management Training System	46259-00
1	Supervisory Controller	46260-00
1	Multimeter	46290-00
1	Test Lead Kit	46295-06

List of Manuals

Description	Manual number
HVAC Direct Digital Control (Student Manual)	20589-00
HVAC Direct Digital Control (Instructor Guide)	20589-10

Table of Contents of the Manual(s)

HVAC Direct Digital Control (Student Manual) (20589-00)

- 0 Introduction - HVAC Systems
- 1 Familiarization with the Building Energy Management
- 2 Constant Air Volume (CAV) HVAC Systems
- 3 Humidity Control of a CAV HVAC System
- 4 Pressure-Dependent Variable Air Volume (VAV) HVAC Systems
- 5 Pressure-Independent Variable Air Volume (VAV) HVAC Systems
- 6 Supervisory Controller

System Specifications

Parameter	Value
Power Requirements	
Voltage	120 V
Current	12 A
Frequency	60 Hz
Physical Characteristics	
Intended Location	Installed in the workstation of the Building Energy Management Training System, Model 3466-0
Dimensions (H x W x D)	TBE
Net Weight	TBE

Building Energy Management Training System (Add-On to Model 3460-0) 3466-B0

The Building Energy Management Training System (Add-On to Model 3460-0) is a complete introduction to direct digital control (DDC) of heating, ventilation, and air conditioning (HVAC) systems. It covers the main control schemes used in building energy management.

The training system is an add-on to the Electricity Fundamentals Training System, Model 3460-0. It provides to users that already have this system all the equipment necessary to complete the exercises in the Building Energy Management Training System, Model 3466-0, without any unnecessary duplication of equipment.

List of Equipment

Qty	Description	Model number
2	Programmable Controller	46256-00
1	Programmable Controller Software	46257-00
1	Temperature Network Sensor	46258-00
1	Building Energy Management Training System	46259-00
1	Supervisory Controller	46260-00
1	Test Lead Kit	46295-B6

List of Manuals

Description	Manual number
HVAC Direct Digital Control (Student Manual)	20589-00
HVAC Direct Digital Control (Instructor Guide)	20589-10

Table of Contents of the Manual(s)

HVAC Direct Digital Control (Student Manual) (20589-00)

- 0 Introduction - HVAC Systems
- 1 Familiarization with the Building Energy Management
- 2 Constant Air Volume (CAV) HVAC Systems
- 3 Humidity Control of a CAV HVAC System
- 4 Pressure-Dependent Variable Air Volume (VAV) HVAC Systems
- 5 Pressure-Independent Variable Air Volume (VAV) HVAC Systems
- 6 Supervisory Controller

Equipment Description

Workstation
3451-00

The workstation allows two student groups to work simultaneously. The structure is pre-assembled, made of steel, and intended for use on a table (not supplied, offered as option). Four pairs of mounting rails firmly hold the modules of the HVAC-R line of products in place. One holder on each side permits users to neatly arrange the test leads. A touch-screen computer mount (not supplied, offered as option) can be attached to either side.

Specifications

Parameter	Value
Available Space	Provides enough space for two student teams, one on each side.
Physical Characteristics	
Intended Location	On a table able to support the weight of the equipment
Dimensions (H x W x D)	TBE
Net Weight	TBE

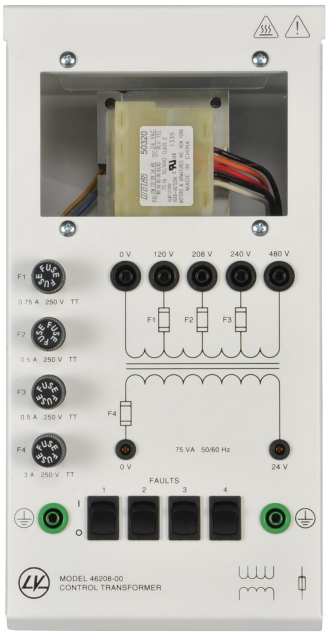
Power Source
46200-00

The Power Source provides power to the other modules of the training system through two 4 mm terminals. The module can be powered via standard single-phase ac power outlets. The power source output voltage is equal to the voltage of the ac power network to which the power source is connected. A thermal-magnetic circuit breaker provides overcurrent and short-circuit protection.

Specifications

Parameter	Value
Power Requirements	
Service Installation	Standard single-phase ac outlet
Current	TBE
Power Output	
Voltage	120 V
Current	10 A
Frequency	60 Hz
Circuit Breaker	
Type	Two-pole, current-limiting, thermal-magnetic
Ratings	12 A
Physical Characteristics	
Dimensions (H x W x D)	292 x 149 x 90 mm (11.5 x 5.87 x 0.35 in)
Net Weight	TBE

Control Transformer 46208-00



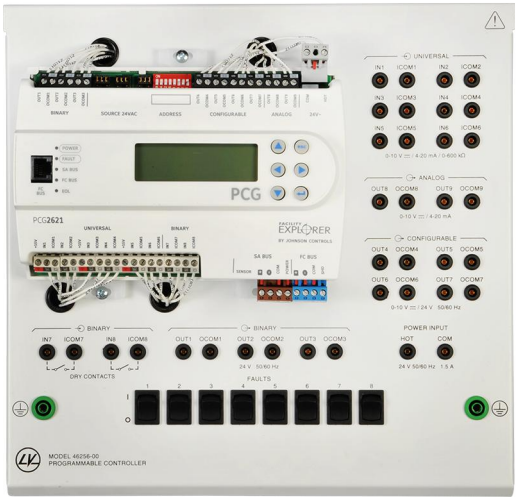
The Control Transformer converts the ac power network voltage to 24 V ac voltage for control purposes. It has taps on the primary side to accommodate different input voltages. Access to the primary windings of the transformer is achieved via 4 mm terminals, while access to the secondary windings is achieved via 2 mm terminals. Terminals on the primary winding as well as the secondary winding are fuse-protected. The module also includes four fault-insertion switches to teach the principles of troubleshooting, as well as two ground terminals.

Specifications

Parameter	Value
Control Transformer	
Ratings	75 VA 50/60 Hz
Primary Terminals	0 V, 120 V, 208 V, 240 V, and 480 V
Secondary Terminals	0 V and 24 V
Fuse 1	
Location	120 V primary terminal
Ratings	250 V – 0.75 A – TT
Fuse 2	
Location	208 V primary terminal
Ratings	250 V – 0.5 A – TT
Fuse 3	
Location	240 V primary terminal
Ratings	250 V – 0.5 A – TT
Fuse 4	

Parameter	Value
Location	0 V secondary terminal
Ratings	250 V – 3 A – TT
Fault-Insertion Switches	4
Physical Characteristics	
Dimensions (H x W x D)	292 x 149 x 90 mm (11.5 x 5.87 x 0.35 in)
Net Weight	TBE

Programmable Controller 46256-00



The Programmable Controller features a typical programmable controller found in DDC systems. This ensures that students are trained on equipment that is actually used for building energy management. The controller has six universal inputs, two binary inputs, two analog outputs, three binary outputs, and four configurable outputs. It has a sensor/actuator bus (SA bus) and a field controller bus (FC bus) to help students become familiar with the different network standards used in modern buildings. The module also includes eight fault-insertion switches to teach the principles of troubleshooting, as well as two ground terminals.

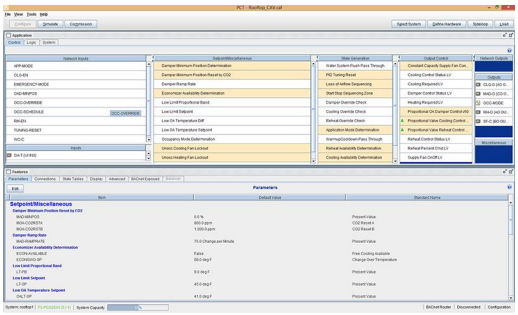
The Programmable Controller requires at least a computer, the Programmable Controller Software, Model 46257, and the Supervisory Controller, Model 46260, for minimal operation.

Specifications

Parameter	Value
Power Input	
Ratings	24 V ac – 1.5 A – 50/60 Hz
Universal Inputs	
Number	6
Ratings	0.10 V dc – 4-20 mA – 0-600 kΩ
Binary Inputs	
Number	2
Type	Dry contacts
Analog Outputs	
Number	2
Ratings	0-10 V dc – 4-20 mA
Configurable Outputs	
Number	4
Ratings	0-10 V dc / 24 V ac – 50/60 Hz
Binary Outputs	

Parameter	Value
Number	3
Ratings	24 V ac – 50/60 Hz
Fault-Insertion Switches	8
Physical Characteristics	
Dimensions (H x W x D)	TBE
Net Weight	TBE

Programmable Controller Software 46257-00



The Programmable Controller Software allows the programming and configuration of the Programmable Controller, Model 46256. It is an industrial HVAC software that allows students to become familiar with the HVAC industry standards. The Programmable Controller Software is required to configure and download programs to the programmable controllers.

Specifications

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

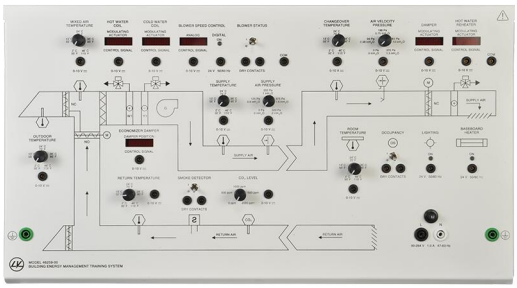
Temperature Network Sensor 46258-00

The Temperature Network Sensor introduces students to the notion of remote temperature set points and familiarizes them with SA bus networks. In a large building, sensors of this type are typically networked to provide temperature information to the controllers. The module also includes four fault-insertion switches to teach the principles of troubleshooting, as well as two ground terminals.

Specifications

Parameter	Value
Temperature Network Sensor	
Type	Johnson Controls NS-BTV7002-0
Ratings	21 mA
Network Connection	SA bus
Fault-Insertion Switches	4
Physical Characteristics	
Dimensions (H x W x D)	292 x 149 x 90 mm (11.5 x 5.87 x 0.35 in)
Net Weight	TBE

Building Energy Management Training System 46259-00



The Building Energy Management Training System is the main module of the training system. It represents the infrastructure of a building to which the programmable controllers connect. The faceplate of this module represents the building rooftop unit, the various temperature and pressure sensors, and the infrastructure of the building (including the zone damper, hot water reheater, zone sensors, lighting system, and baseboard heater).

Adjusting the different buttons allows students to simulate the output signals sent by the different sensors normally available in a building HVAC system. LEDs and bar meters indicate the status of the different elements, while 2 mm leads relay the output signals from the simulated sensors to the controller(s).

Specifications

Parameter	Value
Power Requirements	90-264 V – 1 A – 47-63 Hz
Building Energy Management Training System	
Mixed Air Temperature	Control knob and 0-10 V dc output
Hot Water Coil	Status display and 0-10 V dc control input
Cold Water Coil	Status display and 0-10 V dc control input
Blower Speed Control (Analog)	Status display and 0-10 V dc analog control input
Blower Speed Control (Digital)	On LED and 24 V ac 50/60 Hz digital control input
Supply Temperature	Control knob and 0-10 V dc output
Blower Status	On/off toggle switch and dry contact terminals
Supply Air Pressure	Control knob and 0-10 V dc output
Changeover Temperature	Control knob and 0-10 V dc output
Damper	Status display and 0-10 V dc control input
Air Velocity Pressure	Control knob and 0-10 V dc output
Hot Water Reheater	Status display and 0-10 V dc control input
Outdoor Temperature	Control knob and 0-10 V dc output
Economizer Damper	Status display and 0-10 V dc control input
Return Temperature	Control knob and 0-10 V dc output
Smoke Detectors	On/off toggle switch and dry contact terminals

Parameter	Value
CO2 Level	Control knob and 0-10 V dc output
Room Temperature	Control knob and 0-10 V dc output
Occupancy	On/off toggle switch and dry contact terminals
Lighting	On LED and 24 V ac 50/60 Hz digital control input
Baseboard Heater	On LED and 24 V ac 50/60 Hz digital control input
Physical Characteristics	
Dimensions (H x W x D)	TBE
Net Weight	TBE

Supervisory Controller 46260-00

The Supervisory Controller is primarily used to monitor and control the local network of controllers. A graphical interface, accessed through a remote computer, regroups the necessary information on the system (temperatures, CO2 levels, opening of dampers, etc.) and provides direct control over the inputs and the outputs. This interface (HMI) is particularly useful to troubleshoot the HVAC system. In addition to the HVAC equipment, the Supervisory Controller also manages lighting systems and other electrical equipment to ensure the comfort of the occupants.

The Supervisory Controller module connects to other devices via several communication protocols, such as Ethernet (access to the interface), Zigbee (wireless network), and BACnet (FC bus communications). The module requires power from the Power Source, Model 46200.

Specifications

Parameter	Value
Power Requirements	85-264 V ac – 0.65 A – 47-63 Hz
Communication Protocols	
Communication Protocols	Ethernet
	Zigbee
	BACnet
Physical Characteristics	
Dimensions (H x W x D)	TBE
Net Weight	TBE

Multimeter
46290-00

The Multimeter is ideal to perform voltage, current, and resistance measurements. It is the perfect tool for troubleshooting exercises requiring basic electrical measurements. The model picture does not necessarily represent the actual appearance of the multimeter.

Specifications

Parameter	Value
Multimeter	
DC/AC Voltage	0.1 mV to 600 V
DC/AC Current	0.1 µA to 10 A
Resistance	0.1 Ω to 40 MΩ
Capacitance	1 pF to 100 µF
Frequency	0.001 Hz to 10 MHz
Temperature	760°C (1400°F)
Duty Cycle	0.1-99.9%
Autoranging Feature	Yes
Display Counts	4000
Basic Accuracy	0.5%
Physical Characteristics	
Dimensions (H x W x D)	150 x 70 x 48 mm (5.9 x 2.75 x 1.8 in)
Net Weight	255 g (9 oz)

Test Lead Kit
46295-06

The Test Lead Kit contain all the test leads required to complete the exercises presented in the course material.

Test Lead Kit
46295-B6

The Test Lead Kit contain all the test leads required to complete the exercises presented in the course material.

Optional Equipment Description

Table (Optional)
3452-00

The Table is designed to support the Workstation, Model 3451, as well as any equipment installed in it, and provides enough space for additional small items such as a laptop computer. The table surface is made of hard wood. Four lockable casters ensure easy transportation.

Specifications

Parameter	Value
Physical Characteristics	
Intended Location	On the floor (stands on casters)
Dimensions (H x W x D)	914 x 1524 x 762 mm (36 x 60 x 30 in)
Net Weight	TBE

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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