

# FACET<sup>®</sup> Electronics Training System 91000

**FESTO**

**LabVolt Series**

Datasheet



\* The product images shown in this document are for illustration purposes; actual products may vary. Please refer to the Specifications section of each product/item for all details. Festo Didactic reserves the right to change product images and specifications at any time without notice.

Festo Didactic  
en  
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## General Description

The FACET® Electronics Training Systems is a unique combination of hardware and software that provides a complete learning solution. It is a modular training system that encompasses four areas of study:

- Basic Principles of Electricity and Electronics
- Digital and Microprocessor Electronics
- Industrial Electronics
- Communications

The hardware components of the FACET® training systems are completely safe and designed for durability. Circuits can be faulted to teach real-world troubleshooting. Students perform experiments on a wide range of electronics and electricity training modules that combine theory and application with practical skill-training techniques. Boards connect with a base unit that distributes power and controls the circuits of the different learning modules.

The courses can be provided by traditional student manual or eSeries courseware. The eSeries is an interactive multimedia courseware that enhances learning speed and retention by featuring circuit design, analysis, and troubleshooting. The instructor guide and supportive pre- and post-tests provide instructors and students with an extensive overview and working knowledge.

A complete training work station consists of the following:

- 1) Base unit
- 2) Boards
- 3) Courseware
- 4) Instruments
- 5) Options

Each component requires to make a selection between the different possible configurations. The configurations are described in the following table.

Selection 1	Selection 2	Selection 3	Selection 4
Type of Base Unit (Different voltage and language variants)	Which topics? (Different language variants)	Which type of course delivery?	Instrumentation package
Manually operated	30 boards covering 30 different topics	Paper format (Student Manuals and Instructor Guides)	Traditional instruments: <ul style="list-style-type: none"> <li>• DMM</li> <li>• Scope</li> <li>• Signal generator</li> </ul>
Computer interface		CBT: eSeries content <ol style="list-style-type: none"> <li>1. Mind-Sight LCMS <ul style="list-style-type: none"> <li>• Local network appliance</li> <li>• Hosted version</li> </ul> </li> <li>2. Stand-alone disk</li> <li>3. SCORM</li> </ol>	Virtual instruments: <ul style="list-style-type: none"> <li>• Interface and software</li> </ul>

FACET is suitable for a multitude of training purposes in educational, industrial, and military training laboratories. Estimated TOTAL program duration: 400 hours.

## 1) Base Units

The FACET base units provide protection and voltage conditioning circuitry to run each FACET board. Specific features of all FACET base units include:

- Distributed  $\pm 15$  V dc and variable  $\pm 0$ -10 V dc power to the various circuit training modules. Coarse and fine controls are provided to adjust the variable  $\pm 0$ -10 V dc supplies.
- Self-protection against short-circuit, reverse voltage, overvoltage, and overcurrent conditions.
- Long-life ZIF connector, with a rotary knob that locks the training module into the base unit. The ZIF connector itself is protected from damage by built-in stops.
- The fingers on the connectors are gold-plated for added durability.
- Includes an accessory kit containing terminal posts, connectors, adapters, and patch cords required to perform experiments on the FACET training module.

Base units come in two variants:

- Stand-alone

The Manual System Base Unit contains a total of thirty-two circuit modification (CM) and fault switches. Students manually select CM switches as the course progresses, while the protected fault switches are reserved for instructor use by means of an integrated locking cover assembly.

- Computerized (USB link)

The computerized base unit is linked to the computer automatically by the courseware when needed, and can also be activated via a USB port by the teacher through password-protected software. The computerized base unit contains thirty-two relays controlled by commands from the student's computer circuit modifications (CM) and faults are switched in and out automatically by the software.

A message on the student's computer screen indicates that a CM or fault is activated. In the troubleshooting exercises, faults are also inserted automatically by the computer, thereby freeing the instructor to assist students with individual activities.

## 2) Boards

The FACET program consist of 30 topics. Each topic is covered by a board. The boards are sold separately and can be grouped in 4 areas of study.

### Basic Electronics

- DC Fundamentals
- DC Network Theorems
- AC 1 Fundamentals
- AC 2 Fundamentals
- Semiconductor Devices
- Transistor Amplifier Circuits
- Transistor Power Amplifiers
- Transistor Feedback Circuits
- Power Supply Regulation Circuits
- FET Fundamentals
- Operational Amplifier Fundamentals
- Operational Amplifier Applications
- Magnetism and Electromagnetism

### Digital and microprocessors

- Digital Logic Fundamentals
- Digital Circuit Fundamentals 1
- Digital Circuit Fundamentals 2
- 32-Bit Microprocessor
- Microcontroller System Development
- Breadboard
- Digital Signal Processor (DSP)

### Industrial electronics

- Transducer Fundamentals
- Motors, Generators, and Controls
- Power Transistors and GTO Thyristor
- Thyristors and Power Control Circuits

### Communications

- Analog Communications
- Digital Communications 1
- Digital Communications 2
- Fiber Optic Communications
- Communications Transmission Lines
- QPSK/OQPSK/DPSK

\* Does not offer troubleshooting exercises

Note that all boards are available in three different languages: English, French, and Spanish. In this data sheet, the boards are listed in English by default. This is indicated by the -20 at the end of each board part number. To obtain the same board in French, replace the -20 by -21, and to obtain it in Spanish, replace the -20 by -22.

### 3) Courseware

The courses can be provided by traditional paper manuals or computer-based training courseware.

- Standard Courseware for Manual System

FACET manuals (for Stand-Alone FACET) are offered for customers using this product in the traditional paper format. These manuals have been adapted to match the current content of the eSeries version, providing students with practical working knowledge and troubleshooting skills related to specific electronics principles.

- FACET's computer based training: Festo LX

Festo LX courses enhances learning speed and retention by featuring interactive multimedia courseware for circuit design, analysis and troubleshooting.

There is one course per board.

### 4) Instruments

Measuring and displaying instrumentation is needed to perform the courses.

Two variants are available:

- Standard hardware modules: include DMM/signal generator and oscilloscope.
- Virtual instrumentation package: the VI package consists of a USB interface unit and a software.

### 5) Optional Equipment

Optional equipment may include:

- Storage enclosure
- Generator buffer
- Accessory kit
- Base unit upgrade
- Microprocessor application board
- Microprocessor add-on board

### Topic Coverage

- Basic Electricity & Electronics
- Digital and Microprocessor Electronics
- Industrial Electronics
- Communications Systems
- Estimated TOTAL program duration: 400 hours

### Features & Benefits

- Durable construction integrating mechanical components capable of thousands of cycles of operation.
- Voltage regulation and protection against over-voltage and short-circuit conditions for safety in training.
- Minimal wiring required to save lab time.
- Variety of industrial-grade components provide broad, hands-on, real-world training experience.

- Student-controlled and computer-activated circuit modification capability.
- Fault-insertion capability to teach troubleshooting.
- Comprehensive curriculum.
- Sturdy trays for easy handling and connection to base unit.
- Silk-screened circuit and component identification.
- Gold-plated zero insertion force (ZIF) connector technology.

## List of Available Training Systems

Qty	Description	Model number
1	Manual Base Unit with Built-In Power Supply _____	580866 (91000-3X)
1	Computer Interface Base Unit with Built-In Power Supply _____	580867 (91000-5X)

## Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>1</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

## Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>2</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

## Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>3</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

## Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>4</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

<sup>1</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>2</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>3</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>4</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>5</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>6</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>7</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>8</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>9</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>10</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

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<sup>5</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>6</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>7</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>8</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>9</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>10</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.



**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>11</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>12</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>13</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>14</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>15</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>16</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

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<sup>11</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>12</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>13</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>14</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>15</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>16</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>17</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>18</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>19</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>20</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>21</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>22</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

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<sup>17</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>18</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>19</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>20</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>21</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>22</sup> Replaces the oscilloscope , multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

## Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>23</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

## Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>24</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

## Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>25</sup>
1	IEC power cable 90° - NEMA (Type B) _____	582145 (86331-00)

## Equipment Description

### Manual Base Unit with Built-In Power Supply 580866 (91000-3X)



The Manual Base Unit with Built-In Power Supply contains a total of 32 circuit-modification (CM) and fault switches. Students manually select CM switches as the course progresses, while the protected fault switches are reserved for the instructor use by means of an integrated locking cover assembly.

This base unit comprises an accessory kit containing the terminal posts, connectors, adapters, and patch cords required to perform experiments on the FACET training module.

Two light-emitting diodes (LEDs) on the base unit also indicate that power is on and that experiments can be performed.

## Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>26</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>27</sup>

<sup>23</sup> Replaces the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>24</sup> Replaces the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>25</sup> Replaces the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>26</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>27</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>28</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>29</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>30</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>31</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>32</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>33</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>34</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>35</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>36</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>37</sup>

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<sup>28</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>29</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>30</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>31</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>32</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>33</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>34</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>35</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>36</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>37</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>38</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>39</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>40</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>41</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>42</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>43</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>44</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>45</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>46</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>47</sup>

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<sup>38</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>39</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>40</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>41</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>42</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>43</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>44</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>45</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>46</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>47</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>48</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>49</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>50</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>51</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>52</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>53</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>54</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>55</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>56</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>57</sup>

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<sup>48</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>49</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>50</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>51</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

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<sup>55</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>56</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>57</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>58</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>59</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>60</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>61</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>62</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>63</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>64</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>65</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>66</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>67</sup>

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<sup>58</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>59</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>60</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>61</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

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<sup>63</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>64</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>65</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>66</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>67</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>68</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>69</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>70</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>71</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>72</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>73</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Dual-Trace Digital Storage Oscilloscope _____	585695 (798-10) <sup>74</sup>
1	Digital Multimeter / Function Generator _____	580851 (1247-10) <sup>75</sup>

**Specifications**

Parameter	Value
<b>Power Requirements</b>	
Service Installation	Standard single-phase ac outlet
Voltage	100-250 V ac
Current	0.4-0.65 A
Frequency	50/60 Hz
<b>Physical Characteristics</b>	
Intended Location	On a table able to support the weight of the equipment
Dimensions (H x W x D)	152 x 305 x 356 mm (6 x 12 x 14 in)
Net Weight	3.1 kg (6.9 lb)

<sup>68</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>69</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>70</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>71</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>72</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>73</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>74</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.

<sup>75</sup> Required for every board except 14, 15, 16 and 20. The Virtual Instrument Package can replace the Digital Multimeter/Function Generator as well as the Dual-Trace Oscilloscope.



## Computer Interface Base Unit with Built-In Power Supply 580867 (91000-5X)



The Computer Interface Base Unit with Built-In Power Supply contains 32 relays controlled by commands from the student's computer. The computerized base unit is linked to the computer automatically by the courseware when needed, and can also be activated via a USB port by the teacher through a password-protected software. Circuit modifications (CM) and faults are switched in and out automatically by the software. A message on the student's computer screen indicates that a CM or fault is activated. In the troubleshooting exercises, faults are also inserted automatically by the computer, thereby freeing the

instructor to assist students with individual activities.

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>76</sup>

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>77</sup>

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>78</sup>

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>79</sup>

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>80</sup>

<sup>76</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>77</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>78</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>79</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>80</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>81</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>82</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>83</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>84</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>85</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>86</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

<b>Qty</b>	<b>Description</b>	<b>Model number</b>
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>87</sup>

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<sup>81</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>82</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

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<sup>87</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>88</sup>

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>89</sup>

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>90</sup>

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>91</sup>

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>92</sup>

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>93</sup>

### Additional Equipment Required to Perform the Exercises (Purchased separately)

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>94</sup>

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<sup>88</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>89</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>90</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>91</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>92</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>93</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>94</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>95</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>96</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>97</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>98</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>99</sup>

**Additional Equipment Required to Perform the Exercises (Purchased separately)**

Qty	Description	Model number
1	Virtual Instrument Package _____	8098535 (1250-20) <sup>100</sup>

**Specifications**

Parameter	Value
<b>Power Requirements</b>	
Service Installation	Standard single-phase ac outlet
Voltage	100-250 V ac
Current	0.4-0.65 A
Frequency	50/60 Hz
<b>Computer Requirements</b>	A currently available personal computer with USB 2.0 ports, running under one of the following operating systems: Windows® 7 or Windows® 8.

<sup>95</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>96</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>97</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>98</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>99</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

<sup>100</sup> Can be replaced by the oscilloscope, multimeter and function generator. Can be replaced by a multimeter for boards 14, 15, 16 and 20 only. Requires a PC running Windows.

Parameter	Value
<b>Physical Characteristics</b>	
Intended Location	On a table able to support the weight of the equipment
Dimensions (H x W x D)	152 x 305 x 356 mm (6 x 12 x 14 in)
Net Weight	3.1 kg (6.9 lb)

## Optional Equipment Description

### Dual-Trace Digital Storage Oscilloscope (Optional) 585695 (798-10)



The Dual trace digital storage oscilloscope enables students to measure, observe, and display results to perform the courses.

The Dual-Trace Digital Storage Oscilloscope is a affordable oscilloscope that is ideally suited for general purpose use in any classroom laboratory.

Two low-capacitance probes are included with the unit.

Specifications:

- Input Channels: 2
- Bandwidth: 50 MHz (at input BNC)
- Maximum Input Voltage: 400 V CATII
- Auto Measure System
- Display: Color TFT 17.8 cm (7 in)
- Interfaces: USB host, USB devices, pass/fail output

### Features & Benefits

- Color, 17.8 cm (7 in) TFT
- Multi-language, on-display menu
- 50 MHz bandwidth
- 1 GSa/s maximum sampling rate
- 2 ns/div to 100 s/div time base
- 1 mV/div to 10V/div vertical sensitivity
- $\pm 3\%$  accuracy
- USB ports
- Compact design
- Light weight

## Digital Multimeter / Function Generator (Optional) 580851 (1247-10)



The Digital Multimeter / Function Generator is a compact, general-purpose instrumentation module that provides the necessary test equipment (except the oscilloscope) to perform the courses in the FACET program. The module consists of a sine/square/triangle waveshape function generator and an auto-ranging digital multimeter. All instruments share a common power input and are housed in a portable enclosure.

All components, switches, and terminals are mounted in a tamper-resistant manner. The module's design protects the instruments from inadvertent short circuits and overloads in the context of the FACET training system.

### Manual

#### Description

#### Manual number

Digital Multimeter / Function Generator (User Guide) \_\_\_\_\_ 583878 (20799-E0)

### Features & Benefits

- Easy-to-read, silk-screened front panel
- 3½ digit auto-ranging multimeter
- Function generator
- A tilt bail is included and can be attached using a screwdriver

## Virtual Instrument Package (Optional) 8098535 (1250-20)



The Virtual Instrument Package replaces conventional desktop test equipment with a powerful, space-saving, virtual instrumentation package that gives students state-of-the-art tools to measure, analyze, observe, and display the results of electronic circuit tests.

Fully integrated with the FACET® Electronics Training program, the Virtual Instrument Package enables students to conduct all experiments of the FACET® curriculum. The complete Virtual Instrument Package consists of an interface unit for data

acquisition connections, and a Windows-based software.

The interface is connected to the computer via a USB connection. The software displays the various instruments in separate windows and includes the following virtual instruments and signal source: a dual-channel oscilloscope, a multimeter, a spectrum analyzer, and a waveform generator.

### Specifications

Parameter	Value
<b>Oscilloscope / Channels</b>	
Nb channel	2ch
Type	BNC
Sampling rate	500 MS/s max

Parameter	Value
Range	±200mV to ±80V
Resolution	8, 12, 14, 16 bits, user selectable
Impedance	1 MΩ, 25pF
<b>Oscilloscope / Trigger</b>	
Source	Ch1, Ch2, External
Mode	Rising, Falling, inside/outside window
Level	0 to 100 % of full scale
<b>DMM / Voltage mode</b>	
Range	±200mV to ±80V
Accuracy	2% of full scale
Impedance	1 MΩ, 30pF
Protection	200 V
<b>DMM / Current mode</b>	
Range	20mA to 400mA
Accuracy	2% of full scale
Protection	electronic, self restoring fuse, 500mA
<b>DMM / Resistance mode</b>	
Range	100 Ω to 2MΩ
Accuracy	3% of full scale
<b>Signal generator</b>	
Output channel	1 analog, BNC
Resolution	12 bits
Signal type	Sine, square, triangle, arbitrary
Frequency range	0.1 to 20 MHz
Amplitude range	0.12, 1.2, 12 V
Accuracy	0.4 % of full range
Impedance	50 Ω

### IEC power cable 90° - NEMA (Type B) (Optional) 582145 (86331-00)



This power cord connects the equipment to a wall outlet. It is intended for use in North America, Central America, Brazil, Colombia, Ecuador, Korea, Japan, Taiwan, Thailand, and the Philippines.

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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