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General Description

The 32-Bit Microprocessor module builds on the student’s knowledge of digital circuitry gained in Digital Logic Fundamentals, Model 91014, and Digital Circuit Fundamentals 1 and 2, Models 91015 and 91016. The 80386DX CPU can be used as a stand-alone unit or in conjunction with the FACET base unit to demonstrate microprocessor, memory, and I/O concepts, and communication with analog systems via A-to-D and D-to-A converters.

A keypad and a 2-line x 16-character alphanumeric LCD display allow direct interaction with the CPU. All address, data, and control signals are connected to headers for easy access and expansion to off-board circuits. Additional hardware features include 32-kbyte static RAM, 16-kbyte ROM with monitor, RS-232 serial port, 8-bit parallel port, and LED indicators for address and data buses.

An on-board logic probe, single bus cycle execution mode, and the practical, hands-on approach of the courseware guide students in the analysis and troubleshooting of 32-bit microprocessor systems. The circuit board may be used in the FACET base unit or as a stand-alone trainer.

• When used in the FACET base unit, the course can be performed through the interactive Learning Management System (LMS) format.

• When used as a stand-alone trainer, the course is performed in a conventional way by using the provided student manual and instructor guide. In that case, a power pack (provided with the stand-alone trainer) must be used to supply power to the circuit board if it is used without a base unit.

This module is available in the following language variants:

• English variant: 91017-20
• French variant: 91017-21
• Spanish variant: 91017-22

Topic Coverage

• Introduction to the Circuit Board and its Operation
• Bus States, 32-Bit Bus Transfers
• Read and Write Cycles
• CPU Initialization
• Memory Control Signals, Address Decoding, Data Transfers
• Ports: DAC and ADC Ports, PPI and Keypad Interface, Display and Serial Ports
• Non-maskable and Maskable Interrupts, Exceptions
• Immediate, Register and Memory Addressing Modes
• Instruction Formats and Using the 80386 CPU Instructions
• Troubleshooting Basics and 32-Bit Microprocessor Troubleshooting
• Application Board Familiarization (Requires the Optional Microprocessor Application Board, Model 91602)
• DC Motor Control (Requires the Optional Microprocessor Application Board, Model 91602)
• Temperature Control (Requires the Optional Microprocessor Application Board, Model 91602)

Features & Benefits
• 16 KB monitor ROM/User ROM
• Serial data port (RS-232)
• Parallel data port (8-bit)
• Single-bus cycle control
• Single-instruction cycle control
• On-board applications interface
• On-board logic probe for signal tracing
• Optional microprocessor application board to demonstrate practical microprocessor-based temperature/motor control
• Interrupt controller
• ADC/DAC

Optional Equipment

<table>
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<tr>
<th>Qty</th>
<th>Description</th>
<th>Model number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Microprocessor Application Board</td>
<td>581224 (91602-20)</td>
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Optional Manual(s)

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
<th>Model number</th>
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<tbody>
<tr>
<td>1</td>
<td>32-Bit Microprocessor (Student Manual)</td>
<td>585366 (90876-00)</td>
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<td>1</td>
<td>32-Bit Microprocessor (Student Workbook)</td>
<td>580777 (91577-Q0)</td>
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<td>1</td>
<td>32-Bit Microprocessor (Instructor Guide)</td>
<td>580779 (91577-R0)</td>
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Module Options Description

Microprocessor Application Board
581224 (91602-20)

The Microprocessor Application Board is an add-on to the 32-Bit Microprocessor, Model 91017. It allows students to study how microprocessors can control and communicate with external devices. The Application Board has two application circuits: a DC Motor Controller and a Temperature Controller.

The DC Motor Controller has a motor whose speed and direction of rotation can be controlled by the microprocessor. Mounted on the motor’s shaft is a fan blade that makes it easier for

1 The manuals 32-Bit Microprocessor, both the student manual and instructor guide, are also available in computer-based format.
students to see the direction of rotation. The motor’s shaft also has an encoder disk with optical interrupter that provides feedback on the motor speed to the microprocessor, allowing closed-loop control of the motor speed.

The Temperature Controller uses two temperature transducers whose output current is a function of their temperature. One transducer is thermally bonded to a resistor that is used as a heater. The microprocessor controls the turning on and turning off of the heater, whose status is indicated by an LED indicator. The other transducer is used as a room-temperature reference, allowing the microprocessor to perform closed-loop control of the temperature.

The Microprocessor Application Board interfaces to the 32-Bit Microprocessor Board via I/O control lines and digital-to-analog (DAC) and analog-to-digital (ADC) converters. Test points on the Application Board permit the monitoring of the digital and analog signals exchanged between the Microprocessor and Application Boards, using an oscilloscope, logic probe, or voltmeter.

**Manual**

<table>
<thead>
<tr>
<th>Description</th>
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<tr>
<td>Microprocessor Application Board (User Guide)</td>
<td>585395 (91747-00)</td>
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**Table of Contents of the Manual(s)**

**Microprocessor Application Board (User Guide) (585395 (91747-00))**
- 1 Motor Speed and Direction Control
- 2 Switched Mode Motor Control
- 3 Open Loop Heater Control
- 4 Closed Loop Temperature Controller

**Optional Manual(s)**

<table>
<thead>
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<th>Qty</th>
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<td>1</td>
<td>Microprocessor Application Board (User Guide)</td>
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**Specifications**

<table>
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<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td><strong>Physical Characteristics</strong></td>
<td></td>
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<tr>
<td>Dimensions (H x W x D)</td>
<td>57 x 238 x 149 mm (2.5 x 9.25 x 5.75 in)</td>
</tr>
<tr>
<td>Net Weight</td>
<td>0.8 kg (1.8 lb)</td>
</tr>
</tbody>
</table>
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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