This electrical maintenance series will help students understand the basic structure and processes of microprocessors. The series covers number systems and binary arithmetic, basic microprocessor architecture and operation, simple programming, and interface techniques.

The Basic Microprocessor series is designed for advanced electronics students with a thorough knowledge of electronics. It does not, however, assume previous knowledge of microprocessors. All the terms used are explained or defined throughout the courses, so students are not required to have an extensive microprocessor vocabulary to understand the content.

This series is intended to be used as a critical component in your industrial electronics preparation program. Each lesson is designed to provide the background knowledge necessary to develop a solid grounding in microprocessors. Each lesson has specific objectives associated with the information presented. While we cannot guarantee student success, our experience indicates that those who complete the training are likely to accomplish the stated objectives. Furthermore, if these lessons are built into a total curriculum which includes practice in the working environment, it will provide students with the knowledge necessary to proceed into 16-bit microprocessor studies.
P10010  Number Systems & Codes

**Purpose:** The binary number system is the basic language of microprocessors. Binary numbers and data can be more easily manipulated in the octal and hexadecimal number systems than the decimal system. By understanding the binary, octal, hexadecimal and decimal systems, students will have a good foundation in the codes that are used in microprocessors.

**Objectives:** Convert numbers from one number system to another number system; convert decimal and binary numbers to their BCD equivalents; and convert BCD codes to decimal and binary numbers.

P10020  Microcomputer Basics

**Purpose:** Microprocessors are complex electronic circuits which consist of thousands of microscopic transistors. These transistors are arranged to form different circuits, such as registers, counters, and decoders. This course explains how these circuits work together to perform simple tasks.

**Objectives:** Define commonly used microprocessor terms; explain the purpose of typical microprocessor circuits; trace the data flow that takes place between circuits during program execution; describe the difference between inherent, immediate, and direct addressing; and describe the data flow in direct addressing programs.

P10030  Computer Math

**Purpose:** The binary system is used by microprocessors for data processing and control. The computer arithmetic used in this processing includes binary addition, subtraction, multiplication, and division. Other mathematical computer operations require the use of two’s complement and basic logic operations. Understanding these operations will give students a good foundation for computer math.

**Objectives:** Perform binary arithmetic; apply two’s complement arithmetic; manipulate binary numbers using logic operations.

P10040  Introduction to Programming/Branching

**Purpose:** Microprocessors are used primarily to solve complex tasks by performing hundreds of simple tasks very quickly. The basis of this problem solving process is the program or plan which directs and coordinates tasks. This course introduces the fundamentals of writing programs and explains how they are used by the microprocessor.

**Objectives:** Define basic computer languages; interpret simple programs; explain the data flow instructions; and describe the purpose and use of flags in a program.

P10050  Introduction to Programming/Algorithms

**Purpose:** Algorithms are step by step procedures for a particular job. Algorithms usually string together a series of simple tasks to perform more complex tasks. This course demonstrates how programs are written to follow algorithms and direct the steps necessary to solve various problems.

**Objectives:** Explain the use of algorithms for solving problems; interpret a program which converts BCD to binary; and define commands used to perform simple arithmetic.

P10060  6800 Microprocessor

**Purpose:** This course introduces the 6800 microprocessor. Comparisons will be made between the hypothetical model of a microprocessor and the actual configuration of the MPU. Furthermore, some of the instructions frequently used with this MPU are explained.

**Objectives:** Explain the purpose of each block in a block diagram of the 6800 MPU and identify the OPCODE, MPU cycles, number of bytes, and effects of condition code flags for specific program instructions.
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<tr>
<td>P10070</td>
<td>6800 MPU Stack Operation/Subroutines</td>
<td>The 6800 Microprocessor is capable of many logical operations. This course introduces stack operations and subroutines, two more capabilities of the 6800. Students need to understand this information before learning about the 6800’s interfacing capabilities.</td>
<td>Explain the procedures for using the MPU stack and describe the use of subroutines and nested subroutines.</td>
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<td>P11000</td>
<td>Interfacing RAMs/Displays</td>
<td>In order for microprocessors to be effective, they must be interfaced with other circuits to provide an input and output of data. This course presents additional interfacing techniques with which students need to be familiar.</td>
<td>Describe the logic diagram of a simple address decoder and explain how an MPU can drive seven segment displays.</td>
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<tr>
<td>P10080</td>
<td>6800 MPU I/O Operations/Interrupts</td>
<td>This course completes the description of the internal operations of the 6800 Microprocessor with the introduction of input/output operations and interrupts. Students need to understand this information before proceeding to the interfacing capabilities of the 6800 MPU.</td>
<td>Explain input/output operations and interrupts.</td>
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<tr>
<td>P11010</td>
<td>Interfacing Switches</td>
<td>To be effective, microprocessors must be interfaced with circuits. This course introduces some interfacing techniques which are applied to switches.</td>
<td>Describe how a mechanical switch can be interfaced to the MPU and explain the operation of a program that detects contact closure with switches, provides for debouncing, and decodes a keyboard.</td>
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<tr>
<td>P10090</td>
<td>Interfacing Basics</td>
<td>Microprocessors can rapidly manipulate data when a program has been written to guide the process. However, the microprocessor is most effective when it is interfaced, or connected to other circuits which provide the input and output of data. This course introduces some of the basic interfacing techniques which are used to make the MPU more useful.</td>
<td>Define 3 state logic; explain the purpose of each 6800 MPU control line; and explain the timing relationship between the clock signals and information on the address, data, and Read/Write lines.</td>
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<tr>
<td>P11020</td>
<td>Interfacing Peripheral Adapters</td>
<td>This course introduces students to interfacing microprocessors with displays and discusses a special type of support I.C. called the peripheral interface adapter. This device can greatly simplify many interfacing problems.</td>
<td>Describe a peripheral interface adapter or PIA; explain the purpose of the output, control, and data direction register; describe how a simple program can configure the PIA in various input-output combinations; and explain how the PIA can be used to drive displays and encode keyboards.</td>
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