Guide to This Manual 1

CHAPTER 1
GUIDE TO THIS MANUAL

This manual describes the 8XC196KC/KD embedded microcontroller. It is intended for use by both software and hardware designers familiar with the principles of microcontrollers and with the 8XC196KC/KD architecture.

1.1. MANUAL CONTENTS

This manual contains 14 chapters, 3 appendixes, a glossary, and an index. This chapter, Chapter 1, provides an overview of the manual. This section summarizes the contents of the remaining chapters and appendixes. The remainder of this chapter describes notational convertions and terminology used throughout the manual and provides references to related documentation.

Chapter 2 — Introduction to the 8XC196KC/KD — provides an overview of the 8XC196KC/KD hardware and software. The hardware portion compares the two devices and describes the core, internal timing, internal peripherals, and special operating modes. The software portion provides an overview of the MCS®-96 instruction set. It discusses differences between the 8XC196KC/KD instruction set and that of the 8096BH and offers guidelines for program development. (For detailed information about the 8XC196KC/KD instruction set, see Appendix A.)

Chapter 3 — Data Types and Addresses — defines the operand types and addressing modes supported by the MCS-96 architecture. (For additional information about the instruction set, see Chapter 2 and Appendix A.)

Chapter 4 — Memory Partitions — describes the addressable memory space within the 8XC196KC and 8XC196KD. (For additional information about the signals and registers discussed in this chapter, see Appendix B and Appendix C.)

Chapter 5 — Interrupts — describes the interrupt control circuitry, priority scheme, and timing for both standard and Peripheral Transaction Server (PTS) interrupts. It also describes the three special interrupts and the five PTS modes. It also explains interrupt programming and control. (For additional information about the instructions and registers discussed in this chapter, see Appendix A and Appendix C.)

Chapter 6 — I/O Ports — describes the five input/output ports of the 8XC196KC/KD, explains how to program the ports, and provides hardware connection hints for quasi-bidirectional ports. (For additional information about the signals and registers discussed in this chapter, see Appendix B and Appendix C.)

Chapter 7 — Serial I/O Port — describes the synchronous mode (Mode 0) and the three asynchronous modes (Modes 1, 2, and 3) of the serial I/O port's Universal Asynchronous Receiver and Transmitter (UART) and describes how to program the serial I/O port. (For additional information about the signals and registers discussed in this chapter, see Appendix B and Appendix C.)

Chapter 8 — High-Speed Input/Output Unit — describes the HSIO unit, the timer/counter-based I/O system that consists of four individual peripheral modules: Timer 1, Timer 2, the High-Speed Input module, and the High-Speed Output module. It also describes how to program each module. (For additional information about the signals and registers discussed in this chapter, see Appendix B and Appendix C.)

Chapter 9 — Analog-to-Digital Converter — provides an overview of the analog-to-digital (A/D) converter and describes how to program the converter, read the conversion results, and interface with external circuitry. (For additional information about the signals and registers discussed in this chapter, see Appendix B and Appendix C.)

Chapter 10 — Pulse Width Modulator — provides a functional overview of the Pulse Width Modulator (PWM) modules, describes how to program them, and provides sample circuitry for converting the PWM outputs to analog signals. (For additional information about the signals and registers discussed in this chapter, see Appendix B and Appendix C.)

Chapter 11 — Minimum Hardware Considerations — describes options for providing the basic requirements for 8XC196KC/KD operation within a system and discusses other hardware considerations.

Chapter 12 — Special Operating Modes — provides an overview of the Idle, Powerdown, and On-Circuit Emulation (ONCE) modes and describes how to enter and exit each mode. (For descriptions of the instructions discussed in this chapter, see Appendix A; for additional information about the signals and registers, see Appendix B and Appendix C.)

Chapter 13 — Interfacing with External Memory — lists the external memory signals and describes the registers that control the external memory interface and the various external bus modes and features. It discusses bus-width and memory configurations, internal Ready control, the bus-hold protocol, and bus-control modes. Finally, it provides timing information for the system bus.

Chapter 14 — Programming the Nonvolatile Memory — contains procedures and guidelines to help you program the nonvolatile, One-Time-Programmable Read-Only Memory (OTPROM). (For additional information about the signals and registers discussed in this chapter, see Appendix B and Appendix C.)

Appendix A — 8XC196KC/KD Instruction Set Reference — provides reference information for the 8XC196KC/KD instruction set. It describes each instruction; shows the relationships between instructions and Program Status Word (PSW) flags; and lists hexadecimal opcodes, instruction lengths, and execution times. (For additional information about the instruction set, see Chapters 2 and 3. For detailed information about the PSW flags, see Appendix C.)

Appendix B — 8XC196KC/KD Signal Descriptions — provides reference information for the pin functions of the 8XC196KC and 8XC196KD, including descriptions of the pin functions, reset status of the I/O and control pins, and package pin assignments.

Appendix C — 8XC196KC/KD Registers — provides reference information for the registers and interrupts of the 8XC196KC/KD. It describes each register in detail and provides information about interrupts, including sources, vectors, and priorities.

Glossary — defines terms with special meaning used throughout the manual.

Index — lists key topics with page number references.

1.2. NOTATIONAL CONVENTIONS AND TERMINOLOGY

The following notations and terminology are used throughout this manual. The Glossary defines other terms with special meanings.

— The pound symbol (#) has either of two meanings, depending on the context. When used with a signal name, the symbol means that the signal is active low. When used in an instruction, the symbol prefixes an immediate value in immediate addressing mode.

italics — Italics identify variables and introduce new terminology. The context in which italics are used distinguishes between the two possible meanings. Variables must be replaced with correct values.

Assert and Deassert — The terms *assert* and *deassert* refer to the act of making a signal active (enabled) and inactive (disabled), respectively. The polarity (high/low) is defined by the signal name. Active-low signals are designated by a pound symbol (#) suffix; active-high signals have no suffix. To assert RD# is to drive it low; to assert ALE is to drive it high; to deassert RD# is to drive it high; to deassert ALE is to drive it low.

Device Names — The notation *8XC196KC/KD* is used to refer to both devices when information applies to both. When information differs between devices, the individual names *8XC196KC* and *8XC196KD* are used. For those rare cases in which information differs between different versions of the same device, the version is also used (e.g., *8XC196KC-C* or *8XC196KC (C-Step)*). The data sheets listed in the "Related Documents" section on page 1-5 contain device- and version-specific information.

Instructions Instruction mnemonics are shown in upper case to avoid confusion. You may use either upper case or lower case.

Numbers Hexadecimal numbers are represented by a string of hexadecimal digits followed by the character *H*. If the number would otherwise begin with *A* through *F*, a zero prefix is added. (For example, *FF* is shown as *0FFH*.) Decimal and binary numbers are represented by their customary notations. (That is, 255 is a decimal number; 1111 1111 is a binary number.)

Units of Measure The following abbreviations are used to represent units of measure:

A	amps, amperes
DCV	direct current volts
Kbyte	kilobytes
KΩ	kilo-ohms
mA	milliamps, milliamperes
Mbyte	megabytes
MHz	megahertz
ms	milliseconds
mW	milliwatts
ns	nanoseconds
pF	picofarads
W	watts
V	volts
µA	microamps, microamperes
µF	microfarads
µs	microseconds

Register Bits Bit locations are indexed by 0–7 (or 0–15), where bit 0 is the least-significant bit and 7 (or 15) is the most-significant bit. An individual bit is represented by the register name, followed by a period and the bit number. For example, WSR.7 is bit 7 of the Window Select Register. In some discussions, bit names are used. For example, the name of WSR.7 is HLDEN.

Register Names Register names are shown in upper case. For example, TIMER2 is the Timer 2 register; Timer 2 is the timer. If a register name contains a lower case character, it represents more than one register. For example, PWM*x*_CONTROL represents three registers: PWM0_CONTROL, PWM1_CONTROL, and PWM2_CONTROL.

Reserved Bits Certain bits are described as *reserved* bits. These bits are not used in the 8XC196KC/KD, but they may be used in future implementations. To help ensure that a current software design is compatible with future implementations, reserved bits should be cleared (given a value of "0").

Set and Clear The terms *set* and *clear* refer to the value of a bit or the act of giving it a value. If a bit is *set*, its value is "1"; *setting* a bit gives it a "1" value. If a bit is *clear*, its value is "0"; *clearing* a bit gives it a "0" value.

Signal Names Signal names are shown in upper case. When several signals share a common name, an individual signal is represented by the signal name, followed by a period and a number. For example, the five HSO signals are named HSO.1, HSO.2, etc. Port pins are represented in the same manner: P0.0, P0.1, P0.2, etc. Exceptions are the PWM*x* pins, ACH*x* pins and AD*x* pins. For compatability with earlier devices, these signal names do not use the period to separate the name and number. A pound symbol (#) appended to a signal name identifies an active-low signal.

1.3. RELATED DOCUMENTS

The following documents contain additional information that is useful in designing systems that incorporate the 8XC196KC/KD microcontroller. These documents are available through Intel Literature. In the U.S. and Canada call 1-800-548-4725 to order.

1.3.1. Software Literature

iC-96 Compiler User's Guide	Order Number 481195
MCS®-96 Macro Assembler User's Guide for DOS Systems	Order Number 122350
MCS®-96 Utilities User's Guide for DOS Systems	Order Number 122355
PL/M-96 User's Guide (for DOS and Intel Systems)	Order Number 481643
PL/M-96 User's Guide for DOS Systems	Order Number 481644
The 8096 Floating-Point Arithmetic Library for DOS Systems	Order Number 122365

1.3.2. Hardware Literature

Embedded Microcontrollers and Processors Handbook (2 vols.)	Order Number 270645
Embedded Applications Handbook	Order Number 270648

1.3.3. Individual Data Sheets

These data sheets are included in the *Embedded Microcontrollers and Processors Handbook* and are also available individually.

8XC196KC Commercial/Express CHMOS Microcontroller	Order Number 270942
8XC196KD Commercial CHMOS Microcontroller	Order Number 272145

1.3.4. Application Notes

These applications notes are included in the *Embedded Applications Handbook.*

AP-125, Designing Microcontroller Systems for Electrically Noisy Environments

AP-406, MCS®-96 Analog Acquisition Primer

These applications notes are included in the *Embedded Microcontrollers and Processors Handbook* and are also available individually.

AP-428, Distributed Motor Control Using the 80C196KB Order Number 270701

AP-466, Using the 80C196KB Order Number 272116

1.3.5. Related Software

The following software package is an on-line reference guide and a graphical learning tool.

ApBUILDER Order Number 272216