

The MSX Red Book

(Revised version 1997/08/06)
(This version: 2001/03/17 by enribar)

Notes from the editor:

- The book was scanned and converted (via O.C.R.) by one person and edited by another (using an IBM PC compatible), independently.
- All pages have a fix size of 64 lines. The width was not justified to make future modifications easier, though no line is longer than 80 columns.
- This book only covers standard MSX. The BIOS entry points from 0000H to 01B5H should be used instead of the called entries described in the book, because other machines (MSX2, MSX2+, MSX turbo R and customized ones) have different positions for the routines. The use of internal BIOS routine addresses are responsible for many programs only running in MSX.
- Some errors present in the original book were fixed, though it was tried to keep it as unaltered as possible. All page numbers match the originals, except undetected errors already present in the original.
- Most figures were modified due to the text-only nature of this file. The character set used during edition was the International IBM PC's one. The following special characters were used and should be changed to the corresponding ones of other character sets:

Frame Ú-Â-¿ Pound: œ
characters: ³ ³ ³ Micro: æ
 Ã-Ä-Å
 ³ ³ ³
 À-Á-Û

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INTRODUCTION

1. Aims

This book is about MSX computers and how they work. For technical and commercial reasons MSX computer manufacturers only make a limited amount of information available to the end user about the design of their machines. Usually this will be a fairly detailed description of Microsoft MSX BASIC together with a broad outline of the system hardware. While this level of documentation is adequate for the casual user it will inevitably prove limiting to anyone engaged in more sophisticated programming.

The aim of this book is to provide a description of the standard MSX hardware and software at a level of detail sufficient to satisfy that most demanding of users, the machine code programmer. It is not an introductory course on programming and is necessarily of a rather technical nature. It is assumed that you already possess, or intend to acquire by other means, an understanding of the Z80 Microprocessor at the machine code level. As there are so many general purpose books already in existence about the Z80 any description of its characteristics would simply duplicate widely available information.

2. Organization

The MSX Standard specifies the following as the major functional components in any MSX computer:

- (1) Zilog Z80 Microprocessor
- (2) Intel 8255 Programmable Peripheral Interface
- (3) Texas 9929 Video Display Processor
- (4) General Instrument 8910 Programmable Sound Generator
- (5) 32 KB MSX BASIC ROM
- (6) 8 KB RAM minimum

Although there are obviously a great many additional components involved in the design of an MSX computer they are all small-scale, non-programmable ones and therefore "invisible" to the user. Manufacturers generally have considerable freedom in the selection of these small-scale components. The programmable components cannot be varied and therefore all MSX machines are identical as far as the programmer is concerned.

Chapters 1, 2 and 3 describe the operation of the Programmable Peripheral Interface, Video Display Processor and Programmable Sound Generator respectively. These three devices provide the interface between the Z80 and the peripheral hardware on a standard MSX machine. All occupy positions on the Z80 I/O (Input/output) Bus.

Chapter 4 covers the software contained in the first part of the MSX ROM. This section of the ROM is concerned with controlling the machine hardware at the fine detail level and is known as the ROM BIOS (Basic Input Output System). It is structured in such a way that most of the functions a machine code programmer requires, such as keyboard and video drivers, are readily available.

Chapter 5 describes the software contained in the remainder of the ROM, the Microsoft MSX BASIC Interpreter. Although this is largely a text-driven program, and consequently of less use to the programmer, a close examination reveals many points not documented by manufacturers.

Chapter 6 is concerned with the organization of system memory. Particular attention is paid to the Workspace Area, that section of RAM from F380H to FFFFH, as this is used as a scratchpad by the BIOS and the BASIC Interpreter and contains much information of use to any application program.

Chapter 7 gives some examples of machine code programs that make use of ROM features to minimize design effort. It is believed that this book contains zero defects, if you know otherwise the author would be delighted to hear from you. This book is dedicated to the Walking Nightmare.