MF608-03

EPSON

CMOS 4-BIT SINGLE CHIP MICROCOMPUTER

E0C623A DEVELOPMENT TOOL MANUAL

ENERGY SAVING EPSON

SEIKO EPSON CORPORATION

E0C623A Development Tool Manual

PREFACE

This manual mainly explains the outline of the development support tool for the 4-bit Single Chip Microcomputer E0C623A.

Refer to the "E0C62 Family Development Tool Reference Manual" for the details (common to all models) of each development support tool. Manuals for hardware development tools are separate, so you should also refer to the below manuals.

Development tools	☞ E0C62 Family Development Tool Reference Manual EVA623A Manual ICE6200 Hardware Manual
Development procedure	☞ E0C62 Family Technical Guide
Device (E0C623A)	☞ E0C623A Technical Manual
Instructions	☞ E0C6200/6200A Core CPU Manual

CONTENTS

1 COMPOSITION OF DEVELOPMENT SUPPORT TOOL 1
1.1 Configuration of DEV623A 1
1.2 Developmental Environment 1
1.3 Development Flow 2
1.4 Production of Execution Disk 3

2 DEVELOPMENT TOOL MANAGEMENT SYSTEM DMS6200 4
2.1 DMS6200 Outline 4
2.2 DMS6200 Quick Reference 4

3 CROSS ASSEMBLER ASM623A 5
3.1 ASM623A Outline 5
3.2 E0C623A Restrictions 5
3.3 ASM623A Quick Reference 6

4 FUNCTION OPTION GENERATOR FOG623A 8
4.1 FOG623A Outline 8
4.2 E0C623A Option List 8
4.3 Option Specifications and Selection Message 10
4.4 FOG623A Quick Reference 17
4.5 Sample File 19

5 SEGMENT OPTION GENERATOR SOG623A ____ *21*
5.1 SOG623A Outline *21*
5.2 Option List *21*
5.3 Segment Ports Output Specifications *22*
5.4 SOG623A Quick Reference *23*
5.5 Sample Files *25*

6 ICE CONTROL SOFTWARE ICS623A ____ *26*
6.1 ICS623A Outline *26*
6.2 ICS623A Restrictions *26*
6.3 ICS623A Quick Reference *27*

7 MASK DATA CHECKER MDC623A ____ *30*
7.1 MDC623A Outline *30*
7.2 MDC623A Quick Reference *30*

APPENDIX A. E0C623A INSTRUCTION SET ____ *33*

B. E0C623A RAM MAP ____ *37*

C. E0C623A I/O MEMORY MAP ____ *38*

D. TROUBLESHOOTING ____ *40*

1 COMPOSITION OF DEVELOPMENT SUPPORT TOOL

Here we will explain the composition of the software for the development support tools, developmental envilonment and how to generate the execution disk.

1.1 Configuration of DEV623A

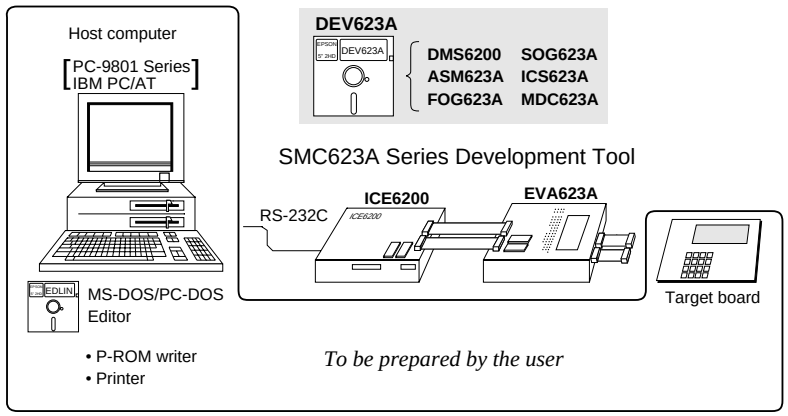
The below software are included in the product of the E0C623A development support tool DEV623A.

1. Development Tool Management System DMS6200 ..... Menu selection for each software / start-up software
2. Cross Assembler ASM623A ..... Cross assembler for program preparation
3. Function Option Generator FOG623A ..... Function option data preparation program
4. Segment Option Generator SOG623A ..... Segment option data preparation program
5. ICE Control Software ICS623A ..... ICE control program
6. Mask Data Checker MDC623A ..... Mask data preparation program

1.2 Developmental Environment

The software product of the development support tool DEV623A operates on the following host systems:

- IBM PC/AT (at least PC-DOS Ver. 2.0)
- NEC PC-9801 Series (at least MS-DOS Ver. 3.1)



When developing the E0C623A, the above-mentioned host computer, editor, P-ROM writer, printer, etc. must be prepared by the user in addition to the development tool which is normally supported by Seiko Epson. *Fig. 1.2.1 System configuration*

Note The DEV623A system requires a host computer with a RAM capacity of about 140K bytes. Since the ICE6200 is connected to the host computer with a RS-232C serial interface, adapter board for asynchronous communication will be required depending on the host computer used.

1.3 Development Flow

Figure 1.3.1 shows the development flow through the DEV623A.

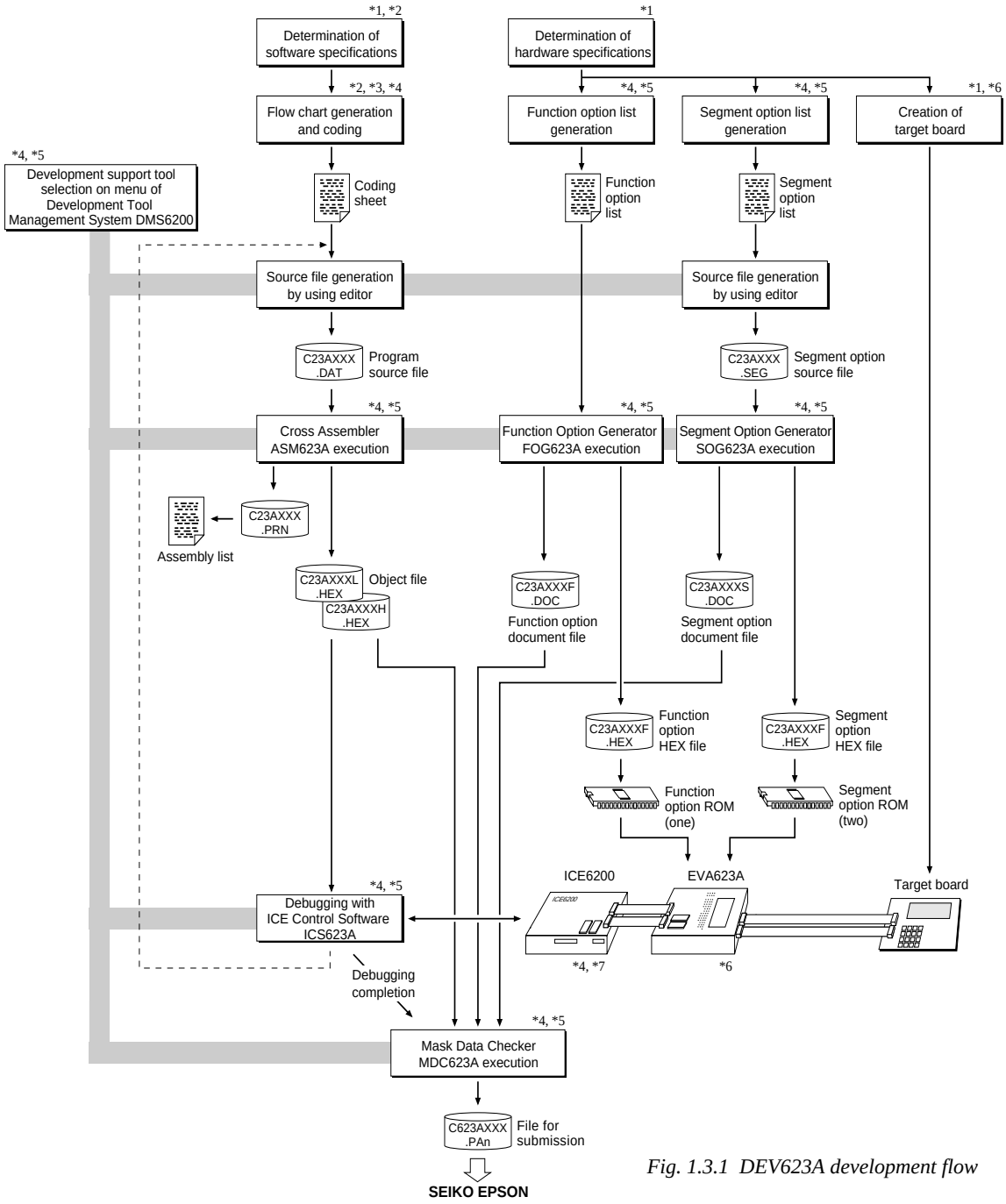


Fig. 1.3.1 DEV623A development flow

Concerning file names

All the input-output file name for the each development support tool commonly use "C23AXXX". In principle each file should be produced in this manner. Seiko Epson will designate the "XXX" for each customer.

☞ Reference Manual

*1 E0C623A Technical Hardware Manual
*2 E0C623A Technical Software Manual
*3 E0C6200/6200A Core CPU Manual
*4 E0C62 Family Development Tool Reference Manual
*5 E0C623A Development Tool Manual (this manual)
*6 EVA623A Manual
*7 ICE6200 Hardware Manual

1.4 Production of Execution Disk

Execution files for each software development support tool and batch and parameter files for the ICE6200 are recorded in the DEV623A floppy disk.
The content of the files contained in the DEV623A floppy disk are shown below.

PC-DOS version	MS-DOS version	Contents
ASM623A.EXE	ASM623A.EXE	Cross Assembler execution file
DMS6200.EXE	DMS6200.EXE	Development Tool Management System execution file
FOG623A.EXE	FOG623A.EXE	Function Option Generator execution file
ICS623AB.BAT	ICS623A.BAT	ICE Control Software batch file
ICS623AW.EXE	ICS623AJ.EXE	ICE Control Software execution file
ICS623AP.PAR	ICS623AP.PAR	ICE Control Software parameter file
MDC623A.EXE	MDC623A.EXE	Mask Data Checker execution file
SOG623A.EXE	SOG623A.EXE	Segment Option Generator execution file

- First copy the entire content of this disk using commands such as DISKCOPY then make the execution disk. Carefully conserve the original floppy disk for storage purposes.
  When copying into a hard disk, make a sub-directory with an appropriate name (DEV623A, etc.) then copy the content of the floppy disk into that subdirectory using the COPY command.

Example:

Copying into a floppy disk

Insert the original disk into the A drive and the formatted disk to be copied into B drive, then execute the DISKCOPY command.

```
A>DISKCOPY  A:  B:↵
```

Copying into a hard disk (C drive)

Make a subdirectory (DEV623A), then insert the original disk into the A drive and execute the COPY command.

```
C\>MD DEV623A↵
C\>CD DEV623A↵
C\DEV623A\>COPY A:*.*↵
```

- Next make a CONFIG.SYS file using Editor or the like.
  When a CONFIG.SYS has previously been made using a hard disk system, check the setting of the FILES within it. (If there is none add it.)
  Set the number of files to be described in CONFIG.SYS at 10 or more, so that the Mask Data Checker MDC623A will handle many files.

Note The driver for the RS-232C must be included in CONFIG.SYS by the host computer.

Example:

Setting of FILES (CONFIG.SYS)

```
C\>TYPE  CONFIG.SYS↵
     :
FILES=20
     :
```

- It is a good idea to copy the editor into the disk to be copied and the subdirectory so you can also select the editor from the DMS6200 menu.

- In "ICS623A(B).BAT" the batch process is indicated such that the ICS623AJ(W).EXE is executed after the execution of the command for the setting of the RS-232C communication parameters. When first executing the ICE Control Software after resetting the host computer, select then activate this batch file from the DMS6200 menu.
  The SPEED (MS-DOS) or MODE (PC-DOS) command is used for setting the RS-232C, so you should copy these commands into the disk to be executed or specify a disk or directory with the command using the PATH command.

RS-232C Setting (PC-DOS version)

```
MODE  COM1:  4800, n, 8, 1, p
```

RS-232C Setting (MS-DOS version)

```
SPEED  R0  9600  B8  PN  S1
```

Note The DMS6200 prepares a menu from files that are in the current directory. Consequently, be sure to arrange the above mentioned files in the same disk or the same directory.

2 DEVELOPMENT TOOL MANAGEMENT SYSTEM DMS6200

2.1 DMS6200 Outline

The DMS6200 (Development Tool Management System) is a software which selects the DEV623A software development support tool and the program such as an editor in menu form and starts it.
In this way the various software frequently executed during debugging can be effectively activated.

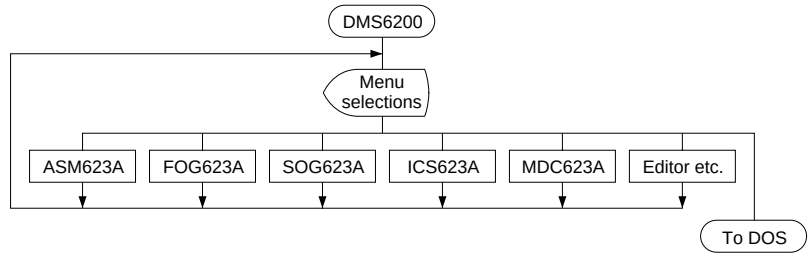


Fig. 2.1.1 DMS6200 execution flow

Refer to the "E0C62 Family Development Tool Reference Manual" for detailes of the operation.

2.2 DMS6200 Quick Reference

■ Starting command

Execution file: **DMS6200.EXE** ***Starting command:*** **DMS6200**↵ ↵ *indicates the Return key.*

■ Display examples

```
   *** E0C6200 Development tool Management System. --- Ver 1.0 ***

EEEEEEEEEE   PPPPPPPP        SSSSSSS       00000000      NNN      NNN
EEEEEEEEEE   PPPPPPPPPP     SSS    SSSS    000     000    NNNN     NNN
EEE          PPP     PPP   SSS     SSS   000       000   NNNNN    NNN
EEE          PPP     PPP    SSS          000       000   NNNNNN   NNN
EEEEEEEEEE   PPPPPPPPPP      SSSSSS      000       000   NNN NNN NNN
EEEEEEEEEE   PPPPPPPP           SSSS     000       000   NNN  NNNNNN
EEE          PPP                 SSS    000       000   NNN   NNNNN
EEE          PPP           SSS     SSS   000     000    NNN    NNNN
EEEEEEEEEE   PPP           SSSS    SSS     000    000    NNN     NNN
EEEEEEEEEE   PPP             SSSSSSS       00000000      NNN      NN

               (C) Copyright 1991 SEIKO EPSON CORP.

                          STRIKE ANY KEY.
```

Start message
When DMS6200 is started, the following message is displayed. For "STRIKE ANY KEY.", press any key to advance the program execution.
To suspend execution, press the "CTRL" and "C" keys together: the sequence returnsto the DOS command level.

```
      DMS6200 Version 1.0     Copyright(C) SEIKO EPSON CORP. 1991.

1) ASM623A .EXE
2) FOG623A .EXE
3) ICS623AB.BAT
4) ICS623AW.EXE
5) MDC623A .EXE
6) SOG623A .EXE

Input Number ? [1  ]
```

Menu screen (PC-DOS Version)
A list of all executable files will appear on this menu screen.
Input the number of the development support tool you wish to start and then press the "RETURN" key. To return to DOS at this point, press the "ESC" key.

```
      DMS6200 Version 1.0     Copyright(C) SEIKO EPSON CORP. 1991.

 1) C23AXXX .DAT
 2) C23AXXX .PRN
 3) C23AXXX .SEG
 :      :
10) C623AXXX.PA0

 Input Number ? [1  ]

   Edit > [ASM623A C23AXXX                                        ]
```

Source file selection screen
To starting ASM623A, select the source file on this screen. When the source file is selected by number, the edit line enclosed in [ ] will appear; enter the option parameter if necessary. Press the "RETURN" key when input is completed. When starting, press the "RETURN" key twice particularly for the support tools which do not require source files. To return to DOS at this point, press the "ESC" key.

3 CROSS ASSEMBLER ASM623A

3.1 ASM623A Outline

The ASM623A cross assembler is an assembler program for generating the machine code used by the E0C623A 4-bit, single-chip microcomputers. The Cross Assembler ASM623A will assemble the program source files which have been input by the user's editor and will generate an object file in Intel-Hex format and assembly list file.
In this assembler, program modularization has been made possible through macro definition functions and programming independent of the ROM page structure has been made possible through the auto page set function. In addition, consideration has also been given to precise error checks for program capacity (ROM capacity) overflows, undefined codes and the like, and for debugging of such things as label tables for assembly list files and cross reference table supplements.

☞ *The format of the source file and its operating method are same as for the E0C62 Family. Refer to the "E0C62 Family Development Tool Reference Manual" for details.*

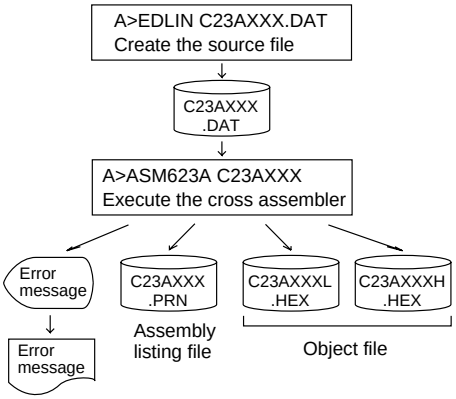


Fig. 3.1.1 ASM623A execution flow

3.2 E0C623A Restrictions

Note the following when generating a program by the E0C623A:

■ ROM area

The capacity of the E0C623A ROM is 1K steps (0000H to 03FFH).
Therefore, the specification range of the memory setting pseudo-instructions and PSET instruction is restricted.

Memory configuration:

Bank: Only bank 0, Page: 4 pages (0 to 3H), each 256 steps

Significant specification range:

ORG	pseudo-instruction:	0000H to 03FFH
PAGE	pseudo-instruction:	00H to 03H
BANK	pseudo-instruction:	Only 0H
PSET	instruction:	00H to 03H

■ RAM area

The capacity of the E0C623A RAM is 134 words (000H to 04FH, 090H to 0AFH, 0E0H, 0E2H to 0EFH, 0F3H, 0F6H, and 0F9H to 0FDH, 4 bits/word). Memory access is invalid when the unused area of the index register is specified.

Example:

```
LD   X,0F5H
LD   Y,05DH
```

F5H is loaded into the IX register, but an unused area has been specified so that the memory accessible with the IX register (MX) is invalid.

5DH is loaded into the IY register, but an unused area has been specified so that the memory accessible with the IY register (MY) is invalid.

■ Undefined codes

The following instructions have not been defined in the E0C623A instruction sets.

```
SLP
PUSH   XP      PUSH   YP
POP    XP      POP    YP
LD     XP,r    LD     YP,r
LD     r,XP    LD     r,YP
```

3.3 ASM623A Quick Reference

■ Starting command and input/output files

_ indicates a blank.
↵ indicates the Return key.
A parameter enclosed by [ ] can be omitted.

Execution file: ASM623A.EXE

Starting command: **ASM623A_ [drive-name:] source-file-name [.shp]_ [-N]↵**

Option:

.shp	Specifies the file I/O drives.
s	Specifies the drive from which the source file is to be input. (A–P, @)
h	Specifies the drive to which the object file is to be output. (A–P, @, Z)
p	Specifies the drive to which the assembly listing file is to be output. (A–P, @, Z) @: Current drive, Z: File is not generated
-N	The code (FFH) in the undefined area of program memory is not created.

Input file: C23AXXX.DAT (Source file)

Output file:
C23AXXXL.HEX (Object file, low-order)
C23AXXXH.HEX (Object file, high-order)
C23AXXX.PRN (Assembly listing file)

■ Display example

```
          *** E0C623A CROSS ASSEMBLER. --- Ver 2.00 ***

EEEEEEEEEE   PPPPPPPP        SSSSSSS       00000000     NNN     NNN
EEEEEEEEEE   PPPPPPPPPP     SSS   SSSS    000    000    NNNN    NNN
EEE          PPP     PPP   SSS     SSS   000      000   NNNNN   NNN
EEE          PPP     PPP    SSS          000      000   NNNNNN  NNN
EEEEEEEEEE   PPPPPPPPPP      SSSSSS      000      000   NNN NNN NNN
EEEEEEEEEE   PPPPPPPP           SSSS     000      000   NNN  NNNNNN
EEE          PPP                 SSS    000      000   NNN   NNNNN
EEE          PPP           SSS   SSS    000      000   NNN    NNNN
EEEEEEEEEE   PPP           SSSS   SSS     000    000    NNN     NNN
EEEEEEEEEE   PPP            SSSSSSS       00000000     NNN      NN

             (C) COPYRIGHT 1991 SEIKO EPSON CORP.

         SOURCE FILE NAME IS " C23AXXX.DAT "

         THIS SOFTWARE MAKES NEXT FILES.

            C23AXXXH.HEX  ...  HIGH BYTE OBJECT FILE.
            C23AXXXL.HEX  ...  LOW BYTE OBJECT FILE.
            C23AXXX .PRN  ...  ASSEMBLY LIST FILE.

DO YOU NEED AUTO PAGE SET? (Y/N) Y                              ...(1)

DO YOU NEED CROSS REFERENCE TABLE? (Y/N) Y                      ...(2)
```

When ASM623A is started, the start-up message is displayed.
At (1), select whether or not the auto-page-set function will be used.
Use ..... Y↵
Not use ..... N↵
If the assembly listing file output is specified, message (2) is displayed. At this stage, cross-reference table generation may be selected.
Generating ..... Y↵
Not generating ..... N↵
When the above operation is completed, ASM623A assembles the source file.
To suspend execution, press the "CTRL" and "C" keys together at stage (1) or (2).

■ Operators

Arithmetic operators		Logical operators	
+a	Monadic positive	a_AND_b	Logical product
-a	Monadic negative	a_OR_b	Logical sum
a+b	Addition	a_XOR_b	Exclusive logical sum
a-b	Subtraction	NOT_a	Logical negation
a*b	Multiplication	**Relational operators**	
a/b	Division	a_EQ_b	True when a is equal to b
a_MOD_b	Remainder of a/b	a_NE_b	True when a is not equal to b
a_SHL_b	Shifts a b bits to the left	a_LT_b	True when a is less than b
a_SHR_b	Shifts a b bits to the right	a_LE_b	True when a is less than or equal to b
HIGH_a	Separates the high-order eight bits from a	a_GT_b	True when a is greater than b
LOW_a	Separates the low-order eight bits from a	a_GE_b	True when a is greater than or equal to b

■ Pseudo-instructions

Pseudo-instruction	Meaning	Example of Use
EQU (Equation)	To allocate data to label	`ABC EQU 9` `BCD EQU ABC+1`
SET (Set)	To allocate data to label (data can be changed)	`ABC SET 0001H` `ABC SET 0002H`
DW (Define Word)	To define ROM data	`ABC DW 'AB'` `BCD DW 0FFBH`
ORG (Origin)	To define location counter	`ORG 100H` `ORG 256`
PAGE (Page)	To define boundary of page	`PAGE 1H` `PAGE 3`
SECTION (Section)	To define boundary of section	`SECTION`
END (End)	To terminate assembly	`END`

MACRO (Macro)	To define macro	`CHECK MACRO DATA`
		`LOCAL LOOP`
		`LOOP CP MX,DATA`
		`JP NZ,LOOP`
		`ENDM`
		
		`CHECK 1`

LOCAL (Local)	To make local specification of label during macro definition	
ENDM (End Macro)	To end macro definition	

■ Error messages

Error message	Explanation
S (Syntax Error)	An unrecoverable syntax error was encountered.
U (Undefined Error)	The label or symbol of the operand has not been defined.
M (Missing Label)	The label field has been omitted.
O (Operand Error)	A syntax error was encountered in the operand, or the operand could not be evaluated.
P (Phase Error)	The same label or symbol was defined more than once.
R (Range Error)	• The location counter value exceeded the upper limit of the program memory, or a location exceeding the upper limit was specified. • A value greater than that which the number of significant digits of the operand will accommodate was specified.
! (Warning)	• Memory areas overlapped because of a "PAGE" or "ORG" pseudo-instruction or both. • A statement exceeded a page boundary although its location was not specified.
FILE NAME ERROR	The source file name was longer than 8 characters.
FILE NOT PRESENT	The specified source file was not found.
DIRECTORY FULL	No space was left in the directory of the specified disk.
FATAL DISK WRITE ERROR	The file could not be written to the disk.
LABEL TABLE OVERFLOW	The number of defined labels and symbols exceeded the label table capacity (4000).
CROSS REFERENCE TABLE OVERFLOW	The label/symbol reference count exceeded the cross-reference table capacity (only when the cross-reference table is generated).

4 FUNCTION OPTION GENERATOR FOG623A

4.1 FOG623A Outline

With the 4-bit single-chip E0C623A microcomputers, the customer may select 13 hardware options. By modifying the mask patterns of the E0C623A according to the selected options, the system can be customized to meet the specifications of the target system.
The Function Option Generator FOG623A is a software tool for generating data files used to generate mask patterns. It enables the customer to interactively select and specify pertinent items for each hardware option. From the data file created with FOG623A, the E0C623A mask pattern is automatically generated by a general purpose computer. The HEX file for the evaluation board (EVA623A) hardware option ROM is simultaneously generated with the data file.

☞ *The operating method is same as for the E0C62 Family. Refer to the "E0C62 Family Development Tool Reference Manual" for details.*

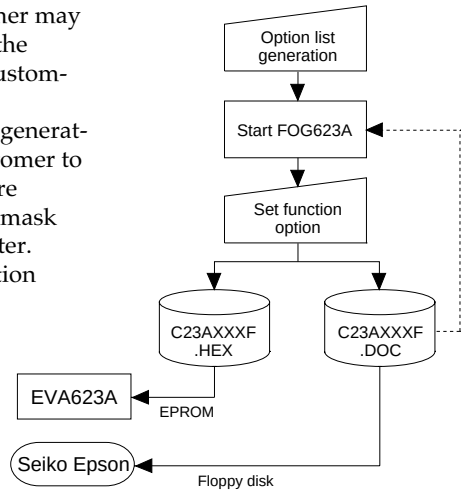


Fig. 4.1.1 FOG623A execution flow

4.2 E0C623A Option List

Multiple specifications are available in each option item as indicated in the Option List. Using "4.3 Option Specifications and Selection Message" as reference, select the specifications that meet the target system. Be sure to record the specifications for unused ports too, according to the instructions provided.

1. DEVICE TYPE

☐ 1. E0C623A (Normal Type)
☐ 2. E0C62L3A (Low Power Type)

2. MULTIPLE KEY ENTRY RESET

• COMBINATION ..... ☐ 1. Not Use
☐ 2. Use K00, K01
☐ 3. Use K00, K01, K02
☐ 4. Use K00, K01, K02, K03

3. INTERRUPT NOISE REJECTOR

• K00–K03 ..... ☐ 1. Use ☐ 2. Not Use

4. INPUT PORT PULL DOWN RESISTOR

• K00 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
• K01 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
• K02 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
• K03 ..... ☐ 1. With Resistor ☐ 2. Gate Direct

5. R00 SPECIFICATION

• OUTPUT TYPE ..... ☐ 1. DC Output
☐ 2. Buzzer Inverted Output (Control bit is R00)
☐ 3. Buzzer Inverted Output (Control bit is R01)
☐ 4. FOUT Output

• FOUT OUTPUT SPACIFICATION

F1	☐ 1.	256[Hz]	F3	☐ 1.	1,024[Hz]
	☐ 2.	512[Hz]		☐ 2.	2,048[Hz]
	☐ 3.	1,024[Hz]		☐ 3.	4,096[Hz]
	☐ 4.	2,048[Hz]		☐ 4.	8,192[Hz]
	☐ 5.	4,096[Hz]		☐ 5.	16,384[Hz]
F2	☐ 1.	512[Hz]	F4	☐ 1.	2,048[Hz]
	☐ 2.	1,024[Hz]		☐ 2.	4,096[Hz]
	☐ 3.	2,048[Hz]		☐ 3.	8,192[Hz]
	☐ 4.	4,096[Hz]		☐ 4.	16,384[Hz]
	☐ 5.	8,192[Hz]		☐ 5.	32,768[Hz]

• OUTPUT SPECIFICATION ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain

6. R01 SPECIFICATION

• OUTPUT TYPE ..... ☐ 1. DC Output ☐ 2. Buzzer Output
• OUTPUT SPECIFICATION ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain

7. OUTPUT SPECIFICATION (R02, R03)

• R02 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain
• R03 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain

8. SI/O FUNCTION

• NOT USE/USE ..... ☐ 1. Not Use ☐ 2. Use
• SI/O SPECIFICATION ..... ☐ 1. LSB First ☐ 2. MSB First
• CLOCK SPECIFICATION ..... ☐ 1. Rising Edge ☐ 2. Falling Edge (*1)
• OUTPUT SPECIFICATION ..... ☐ 1. High Level ☐ 2. Low Level

9. I/O PORT PULL DOWN RESISTOR

• P00 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
• P01 ..... ☐ 1. With Resistor ☐ 2. Gate Direct (*2)
• P02 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
• P03 ..... ☐ 1. With Resistor ☐ 2. Gate Direct

10. I/O PORT FUNCTION

• P00 ..... ☐ 1. I/O Port ☐ 2. Output Port
• P01 ..... ☐ 1. I/O Port ☐ 2. Output Port
• P02 ..... ☐ 1. I/O Port ☐ 2. Output Port
• P03 ..... ☐ 1. I/O Port ☐ 2. Output Port

11. I/O PORT SPECIFICATION

• P00 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain
• P01 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain
• P02 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain
• P03 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain

12. LCD COMMON DUTY

☐ 1. 1/4 Duty
☐ 2. 1/3 Duty

13. OSC1 SYSTEM CLOCK

☐ 1. Crystal
☐ 2. CR

Remarks:

*1 You should select "2. Falling Edge".
*2 Select "2. Gate Direct" when "Use" is selected for SI/O function.

4.3 Option Specifications and Selection Message

Screen that can be selected as function options set on the E0C623A are shown below, and their specifications are also described.

1 Device type

```
*** OPTION  NO.1 ***

--- DEVICE TYPE ---

       1. E0C623A   ( NORMAL TYPE )
       2. E0C62L3A  ( LOW POWER TYPE )

PLEASE SELECT NO.(1) ? 2↵

       1. E0C62L3A  ( LOW POWER TYPE )   SELECTED
```

Select the chip specification.
E0C623A and E0C62L3A denote 3 V power source voltage specification and LOW POWER specification for 1.5 V power source voltage respectively.

2 Multiple key entry reset

```
*** OPTION  NO.2 ***

--- MULTIPLE KEY ENTRY RESET ---

      COMBINATION       1. NOT USE
                        2. USE  K00,K01
                        3. USE  K00,K01,K02
                        4. USE  K00,K01,K02,K03

PLEASE SELECT  NO.(1) ? 2↵

      COMBINATION       2. USE  K00,K01   SELECTED
```

The reset function is set when K00 through K03 are entered.
When "NOT USE" is selected, the reset function is not activated even if K00 through K03 are entered.
When "USE K00, K01" is selected, the system is reset immediately the K00 and K01 inputs go high at the same time. Similarly, the system is reset as soon as the K00 through K02 inputs or the K00 through K03 inputs go high.
However, the system is reset when a high signal is input for more than a rule time (1–3 sec).
The system reset circuit is shown in Figure 4.3.1.

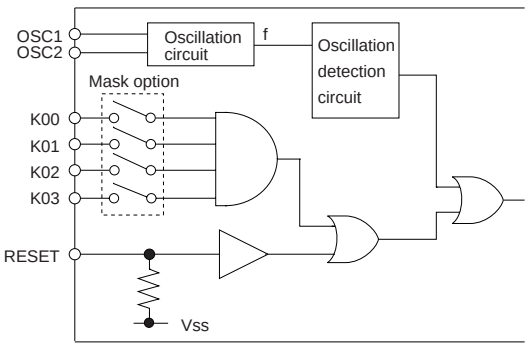


Fig. 4.3.1
System reset circuit

3 Interrupt noise rejector

```
*** OPTION  NO.3 ***

--- INTERRUPT NOISE REJECTOR ---

       K00-K03         1. USE
                       2. NOT USE

PLEASE SELECT NO.(1) ? 1↵

       K00-K03         1. USE   SELECTED
```

Select whether noise rejector will be supplemented to the input interrupter of K00–K03. When "USE" is selected, the entry signal will pass the noise rejector, and occurrence of interrupt errors due to noise or chattering can be avoided. Note, however, that because the noise rejector performs entry signal sampling at 4 kHz, "NOT USE" should be selected when high speed response is required.

4 Input ports pull down resistor

```
*** OPTION  NO.4 ***

--- INPUT PORT PULL DOWN RESISTOR ---

        K00             1. WITH RESISTOR
                        2. GATE DIRECT

PLEASE SELECT NO.(1) ? 1↵

        K01             1. WITH RESISTOR
                        2. GATE DIRECT

PLEASE SELECT NO.(1) ? 1↵

        K02             1. WITH RESISTOR
                        2. GATE DIRECT

PLEASE SELECT NO.(1) ? 1↵

        K03             1. WITH RESISTOR
                        2. GATE DIRECT

PLEASE SELECT NO.(1) ? 1↵

        K00             1. WITH RESISTOR   SELECTED
        K01             1. WITH RESISTOR   SELECTED
        K02             1. WITH RESISTOR   SELECTED
        K03             1. WITH RESISTOR   SELECTED
```

Select whether input ports (K00–K03) will each be supplemented with pull down resistors or not.
When "GATE DIRECT" is selected, see to it that entry floating state does not occur. Select "WITH RESISTOR" pull down resistor for unused ports.
Moreover, the input port status is changed from "H" level (V_{DD}) to "L" (V_{SS}) with pull down resistors, a delay of approximately 1 msec in waveform rise time will occur depending on the pull down resistor and entry load time constant. Because of this, when input reading is to be conducted, ensure the appropriate wait time with the program.
The configuration of the pull down resistor circuit is shown in Figure 4.3.2.

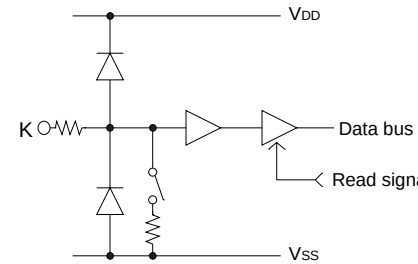


Fig. 4.3.2
Configuration of pull down resistor

5 R00 specification

```
*** OPTION  NO.5 ***

--- R00 SPECIFICATION ---

        OUTPUT TYPE             1. D.C.
                                2. /BZ R00
                                3. /BZ R01
                                4. FOUT

PLEASE SELECT NO.(4) ? 4↵

        F1                      1.   256 [HZ]
                                2.   512 [HZ]
                                3.  1024 [HZ]
                                4.  2048 [HZ]
                                5.  4096 [HZ]

PLEASE SELECT NO.(4) ? 4↵

        F2                      1.   512 [HZ]
                                2.  1024 [HZ]
                                3.  2048 [HZ]
                                4.  4096 [HZ]
                                5.  8192 [HZ]

PLEASE SELECT NO.(4) ? 4↵
```

Select the output specification for R00 terminal. Either complementary output or Pch open drain output may be selected.
When "D.C." (DC output) is selected, R00 becomes a regular output port.
When "/BZ R00" (buzzer inverted output, control bit is R00) is selected, by writing "1" to the R00 register, clock with frequency specified through the software is generated from R00 terminal. When "/BZ R01" (buzzer inverted output, control bit is R01) is selected, by writing "1" to the R01 register, clock with frequency specified through the software is generated from R00 terminal.
When FOUT is selected, clock with frequency selected from R10 terminal is generated by writing "1" to the R10 register.
When the DC output or buzzer inverted output is selected as the output type, the FOUT frequencies cannot be selected.

```
        F3                      1.  1024 [HZ]
                                2.  2048 [HZ]
                                3.  4096 [HZ]
                                4.  8192 [HZ]
                                5. 16384 [HZ]

PLEASE SELECT NO.(4) ? 4↵

        F4                      1.  2048 [HZ]
                                2.  4096 [HZ]
                                3.  8192 [HZ]
                                4. 16384 [HZ]
                                5. 32768 [HZ]

PLEASE SELECT NO.(4) ? 4↵

        OUTPUT SPECIFICATION    1. COMPLEMENTARY
                                2. PCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        OUTPUT TYPE             1. FOUT   SELECTED
        F1                      4.  2048 [HZ]   SELECTED
        F2                      4.  4096 [HZ]   SELECTED
        F3                      4.  8192 [HZ]   SELECTED
        F4                      4. 16384 [HZ]   SELECTED
        OUTPUT SPECIFICATION    1. COMPLEMENTARY   SELECTED
```

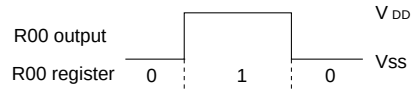


Fig. 4.3.3 Output waveform at DC output selection

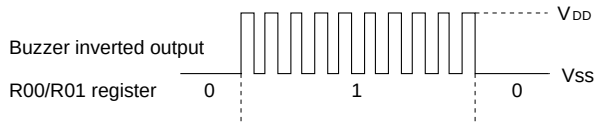


Fig. 4.3.4 Output waveform at buzzer inverted output selection

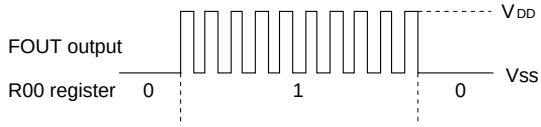


Fig. 4.3.5 Output waveform at FOUT output selection

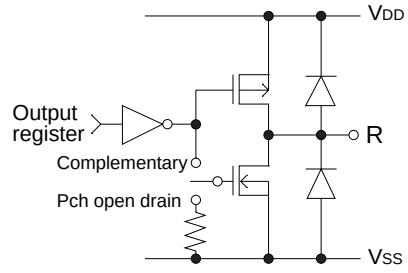


Fig. 4.3.6 Configuration of output circuit

- When DC output is selected
  When R00 register (F3 address, D0 bit) is set to "1", the R00 terminal output goes high (VDD), and goes low (VSS) when set to "0".
  Output waveform is shown in Figure 4.3.3.

- When buzzer inverted output (control bit is R00) is selected
  When R00 register is set to "1", 50% duty and VDD–VSS amplitude square wave is generated at the specified frequency by the software. When set to "0", R00 terminal goes low (VSS). The clock phase when buzzer drive signal is output from R00 terminal is antiphase to that of R01 terminal. Output waveform is shown in Figure 4.3.4.

- When buzzer inverted output (control bit is R01) is selected
  When R01 register is set to "1", 50% duty and VDD–VSS amplitude square wave is generated at the specified frequency by the software. When set to "0", R00 terminal goes low (VSS). The clock phase when buzzer drive signal is output from R00 terminal is antiphase to that of R01 terminal. Output waveform is shown in Figure 4.3.4.

- When FOUT output is selected
  When R00 register is set to "1", 50% duty and VDD–VSS amplitude square wave is generated at the specified frequency. When set to "0", the FOUT terminal goes low (VSS).
  The F1 to F4 FOUT frequencies are set by mask option. One of them is used by the software.
  FOUT output is normally utilized to provide clock to other devices but since hazard occurs at the square wave breaks, great caution must be observed when using it.
  Output waveform is shown in Figure 4.3.5.

The output circuit configuration is shown in Figure 4.3.6.

6 R01 specification

```
*** OPTION  NO.6 ***

--- R01 SPECIFICATION ---

        OUTPUT TYPE             1. D.C.
                                2. BZ OUTPUT

PLEASE SELECT NO.(1) ? 2↵

        OUTPUT SPECIFICATION    1. COMPLEMENTARY
                                2. PCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        OUTPUT TYPE             2. BZ OUTPUT   SELECTED
        OUTPUT SPECIFICATION    1. COMPLEMENTARY   SELECTED
```

Select the output specification for R01 terminal. Either complementary output or Pch open drain output may be selected.
When "D.C." (DC output) is selected, R01 becomes a regular output port.
When "BZ OUTPUT" (buzzer output) is selected, by writing "1" to the R01 register, clock with frequency specified through the software is generated from R01 terminal.

- When DC output is selected
  When R01 register (F3 address, D1 bit) is set to "1", the R01 terminal output goes high (V_{DD}), and goes low (V_{SS}) when set to "0".
  Output waveform is shown in Figure 4.3.7.

Fig. 4.3.7 Output waveform at DC output selection

- When buzzer output is selected
  When R01 register is set to "1", 50% duty and V_{DD}–V_{SS} amplitude square wave is generated at the specified frequency by the software. When set to "0", R01 terminal goes low (V_{SS}). The clock phase when buzzer drive signal is output from R01 terminal is antiphase to that of R00 terminal.
  Output waveform is shown in Figure 4.3.8.

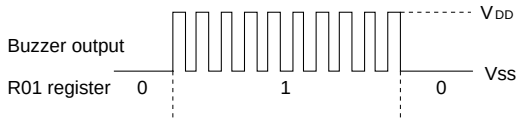


Fig. 4.3.8 Output waveform at buzzer output selection

7 Output port output specification (R02, R03)

```
*** OPTION  NO.7 ***

--- OUTPUT PORT SPECIFICATION ---

        R02                     1. COMPLEMENTARY
                                2. PCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 2↵

        R03                     1. COMPLEMENTARY
                                2. PCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 2↵

        R02                     1. PCH-OPENDRAIN   SELECTED
        R03                     2. PCH-OPENDRAIN   SELECTED
```

Select the output specification for R02 and R03 output ports.
Either complementary output or Pch open drain output may be selected.
When output port is to be used on key matrix configuration, select Pch open drain output.
For unused output ports, select complementary output.
The circuit configuration is the same as that of output ports (R00 shown in Figure 4.3.6).

8 SI/O function

```
*** OPTION  NO.8 ***

--- SI/O FUNCTION ---

        NOT USE/USE             1. NOT USE
                                2. USE

PLEASE SELECT NO.(1) ? 2↲

        SI/O SPECIFICATION      1. LSB
                                2. MSB

PLEASE SELECT NO.(1) ? 1↲

        CLOCK SPECIFICATION     1. RISING EDGE
                                2. FALLING EDGE

PLEASE SELECT NO.(1) ? 1↲

        OUTPUT SPECIFICATION    1. HIGH
                                2. LOW

PLEASE SELECT NO.(1) ? 1↲

        NOT USE/USE             1. USE   SELECTED
        SI/O SPECIFICATION      1. LSB   SELECTED
        CLOCK SPECIFICATION     1. RISING EDGE   SELECTED
        OUTPUT SPECIFICATION    1. HIGH   SELECTED
```

Select whether or not the SI/O function will be used.
When "NOT USE" is selected, the input request fixed for SI/O specification (LSB), Clock specification (Rising edge), and Output specification (High) is displayed. Check each item, pressing the return key after each.
If you specify "USE", you can select any item you want.

- SI/O specification
  Select whether the SI/O input/output data bit permutation will be LSB first or MSB first.

  In case of LSB first,
  data is input/output in the order SD0··7.
  In case of MSB first,
  data is input/output in the order SD7··0.

  Select the one suitable to your programming needs.
  Input/output data permutation is shown in Figure 4.3.9.

- Clock specification
  Select whether the changeing for the serial data at the rising edge or falling edge of the synchronous clock.

- Output specification
  Select the data output level after an initial reset.

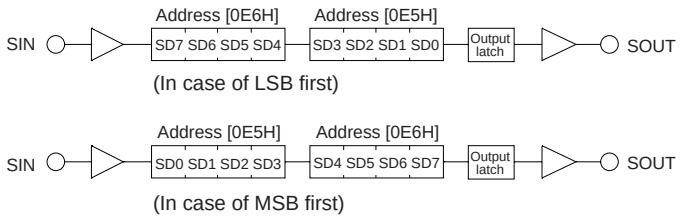


Fig. 4.3.9 Serial data permutation

9 I/O port pull down resistor

```
*** OPTION  NO.9 ***

--- I/O PORT PULL DOWN RESISTOR ---

        P00             1. WITH RESISTOR
                        2. GATE DIRECT

PLEASE SELECT NO.(1) ? 2↵

        P01             1. WITH RESISTOR
                        2. GATE DIRECT    (Note)

PLEASE SELECT NO.(1) ? 2↵

        P02             1. WITH RESISTOR
                        2. GATE DIRECT

PLEASE SELECT NO.(1) ? 2↵

        P03             1. WITH RESISTOR
                        2. GATE DIRECT

PLEASE SELECT NO.(1) ? 2↵

        P00             1. GATE DIRECT   SELECTED
        P01             1. GATE DIRECT   SELECTED
        P02             1. GATE DIRECT   SELECTED
        P03             1. GATE DIRECT   SELECTED
```

Select whether I/O ports (P00–P03) will each be supplemented with pull down resistors or not.

When "USE" for the SI/O function and "WITH RESISTOR" are selected, pull down of each port are controlled as follows:

P00 Always ON
P01 No pull down is set
P02 <In the internal clock mode>
Pull down OFF (through the software)
<In the external clock mode>
Pull down ON (through the software)
P03 Same as P02

Note *When "USE" is selected for the SI/O function, P01 port is set to the output port.*
With this, selecting "WITH RESISTOR" may cause malfunction. Select "GATE DIRECT" for the P01 port.

When "WITH RESISTOR" is selected, the pull down resistor of an I/O port is switched on by the read signal. It is usually switched off to reduce the leak current. So be careful not to create floating state when when you set the port direction as input.

10 I/O port function

```
*** OPTION  NO.10 ***

--- I/O PORT FUNCTION ---

        P00             1. I/O PORT
                        2. OUTPUT PORT

PLEASE SELECT NO.(1) ? 1↵

        P01             1. I/O PORT
                        2. OUTPUT PORT

PLEASE SELECT NO.(1) ? 1↵

        P02             1. I/O PORT
                        2. OUTPUT PORT

PLEASE SELECT NO.(1) ? 1↵

        P03             1. I/O PORT
                        2. OUTPUT PORT

PLEASE SELECT NO.(1) ? 1↵

        P00             1. I/O PORT   SELECTED
        P01             1. I/O PORT   SELECTED
        P02             1. I/O PORT   SELECTED
        P03             1. I/O PORT   SELECTED
```

Select port function of each I/O port. Each of port P00–P03 can be used for both input and output or for output only.

If you specify "USE" in the SI/O function, the input request fixed for P00 (input only), P01 (output only), P02 (input/output), and P03 (input/output) is displayed. Check each item, pressing the return key after each.
If you specify "NOT USE", you can select any item you want.

11 I/O port specification

```
*** OPTION  NO.11 ***

--- I/O PORT OUTPUT SPECIFICATION ---

        P00             1. COMPLEMENTARY
                        2. PCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        P01             1. COMPLEMENTARY
                        2. PCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        P02             1. COMPLEMENTARY
                        2. PCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        P03             1. COMPLEMENTARY
                        2. PCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        P00             1. COMPLEMENTARY   SELECTED
        P01             1. COMPLEMENTARY   SELECTED
        P02             1. COMPLEMENTARY   SELECTED
        P03             1. COMPLEMENTARY   SELECTED
```

Select the output specification to be used during I/O ports (P00–P03) output mode selection.
Either complementary output or Pch open drain output may be selected.
The circuit configuration of the output driver is the same as that of output ports (R00 shown in Figure 4.3.6).
Select complementary output for unused ports.

The I/O ports can control the input/output direction according to the IOC bit (FC address, D0 bit); at "1" and "0" settings, it is set to output port and input port, respectively.
When "NOT USE" is selected for the SI/O function, the pull down resistor of this port is turned on by the read signal and is normally turned off to minimize leak current. Because of this, when the port is set for input, take care that a floating state does not occur in the terminal.

12 LCD common duty

```
*** OPTION  NO.12 ***

--- LCD COMMON DUTY ---

        1. 1/4 DUTY
        2. 1/3 DUTY

PLEASE SELECT NO.(1) ? 1↵

        2. 1/4 DUTY   SELECTED
```

Select the common (drive) duty for the LCD segment.
When 1/4 duty is selected, with 4 COM terminals and 20 SEG terminals, i.e., up to 80 segments may be driven; when 1/3 duty is selected, with 3 COM terminals and 20 SEG terminals, up to 60 segment drives will be possible.

13 OSC1 system clock

```
*** OPTION  NO.13 ***

--- OSC1 SYSTEM CLOCK ---

        1. CRYSTAL
        2. CR

PLEASE SELECT NO.(1) ? 1↵

        1. CRYSTAL   SELECTED
```

Select oscillation circuit that uses OSC1 and OSC2 for the E0C623A/62L3A.
To minimize external components, CR oscillation circuit would be suitable; to obtain a stable oscillation frequency, crystal oscillation circuit would be suitable.
When CR oscillation circuit is selected, only resistors are needed as external components since capacities are built-in.

On the other hand, when crystal oscillation circuit is selected, crystal oscillator and trimmer capacitor are needed as external components. Although when crystal oscillation circuit is selected, it is fixed at 32.768 kHz, when CR oscillation circuit is selected, frequency may be modified to a certain extent depending on the resistance of external components.

4.4 FOG623A Quick Reference

■ Starting command and input/output files

Execution file: FOG623A.EXE

Starting command: **FOG623A**↵ ↵ *indicates the Return key.*

Input file: C23AXXXF.DOC (Function option document file, when modifying)

Output file: C23AXXXF.DOC (Function option document file)
C23AXXXF.HEX (Function option HEX file)

■ Display example

```
     ***  E0C623A FUNCTION OPTION GENERATOR. --- Ver 3.00  ***

EEEEEEEEEE   PPPPPPPP        SSSSSSS       OOOOOOOO     NNN      NNN
EEEEEEEEEE   PPPPPPPPPP     SSS   SSSS    OOO    OOO    NNNN     NNN
EEE          PPP     PPP   SSS     SSS   OOO      OOO   NNNNN    NNN
EEE          PPP     PPP    SSS          OOO      OOO   NNNNNN   NNN
EEEEEEEEEE   PPPPPPPPPP      SSSSSS      OOO      OOO   NNN NNN NNN
EEEEEEEEEE   PPPPPPPP           SSSS     OOO      OOO   NNN  NNNNNN
EEE          PPP                 SSS    OOO      OOO   NNN   NNNNN
EEE          PPP           SSS     SSS   OOO      OOO   NNN    NNNN
EEEEEEEEEE   PPP           SSSS    SSS    OOO    OOO    NNN     NNN
EEEEEEEEEE   PPP             SSSSSSS       OOOOOOOO     NNN      NN

             (C) COPYRIGHT 1991  SEIKO EPSON CORP.

        THIS SOFTWARE MAKES NEXT FILES.

           C23AXXXF.HEX  ...  FUNCTION OPTION HEX FILE.
           C23AXXXF.DOC  ...  FUNCTION OPTION DOCUMENT FILE.

                      STRIKE ANY KEY.
```

Start-up message
When FOG623A is started, the start-up message is displayed.
For "STRIKE ANY KEY.", press any key to advance the program execution.

To suspend execution, press the "CTRL" and "C" keys together: the sequence returns to the DOS command level.

```
*** E0C623A USER'S OPTION SETTING. --- Ver 3.00 ***

CURRENT DATE IS  91/07/19
PLEASE INPUT NEW DATE  :   91/07/22↵
```

Date input
Enter the 2-digit year, month, and day of the month by delimiting them with a slash ("/"). When not modifying the date, press the RETURN key "↵" to continue.

```
*** OPERATION SELECT MENU ***

       1. INPUT NEW FILE
       2. EDIT FILE
       3. RETURN TO DOS

PLEASE SELECT NO.?
```

Operation selection menu
Enter a number from 1 to 3 to select a subsequent operation.
1. To set new function options.
2. To modify the document file.
3. To terminate FOG623A.

```
*** OPERATION SELECT MENU ***

       1. INPUT NEW FILE
       2. EDIT FILE
       3. RETURN TO DOS

PLEASE SELECT NO.? 1↵
PLEASE INPUT FILE NAME? C23A0A0↵                          ..(1)
PLEASE INPUT USER'S NAME? SEIKO EPSON CORP.↵              ..(2)
PLEASE INPUT ANY COMMENT
(ONE LINE IS 50 CHR)? TOKYO DESIGN CENTER↵                ..(3)
                    ? 421-8 HINO HINO-SHI TOKYO 191 JAPAN↵
                    ? TEL 0425-84-2551↵
                    ? FAX 0425-84-8512↵
                    ? ↵
```

Setting new function options
Select "1" on the operation selection menu.
(1) Enter the file name.
(2) Enter the customer's company name.
(3) Enter any comment.
(Within 50 characters x 10 lines)
Next, start function option setting from option No. 1.

```
PLEASE INPUT FILE NAME? C23A0A0↵
EXISTS OVERWRITE(Y/N)? N↵
PLEASE INPUT FILE NAME? C23A0B0↵
PLEASE INPUT USER'S NAME?
```

In case a function option document file with the same name as the file name specified in the current drive exists, the user is asked whether overwrition is desired. Enter "Y" or "N" accordingly.

```
*** OPERATION SELECT MENU ***

        1. INPUT NEW FILE
        2. EDIT FILE
        3. RETURN TO DOS

PLEASE SELECT NO.? 2↵

*** SOURCE FILE(S) ***

C23A0A0          C23A0B0          C23A0C0                . . (1)

PLEASE INPUT FILE NAME? C23A0A0↵                         . . (2)
PLEASE INPUT USER'S NAME? ↵                              . . (3)
PLEASE INPUT ANY COMMENT
(ONE LINE IS 50 CHR)? ↵                                  . . (4)
PLEASE INPUT EDIT NO.? 4↵                                . . (5)
            :
(Modifying function option settings)
            :
PLEASE INPUT EDIT NO.? E↵
```

In step (1), if no modifiable source exists, the following message is displayed and the sequence returns to the operation selection menu.

```
*** SOURCE FILE(S) ***

FUNCTION OPTION DOCUMENT FILE IS NOT FOUND.
```

In step (2), if the function option document file is not in the current drive, the following message is displayed, prompting entry of other file name.

```
PLEASE INPUT FILE NAME? C23A0N0↵
FUNCTION OPTION DOCUMENT FILE IS NOT FOUND.
PLEASE INPUT FILE NAME?
```

Modifying function option settings

Select "2" on the operation selection menu.

(1) Will display the files on the current drive.
(2) Enter the file name.
(3) Enter the customer's company name.
(4) Enter any comment.
Previously entered data can be used by pressing the RETURN key "↵" at (3) and (4).
(5) Enter the number of the function option to be modified. When selection of one option is complete, the system prompts entry of another function option number. Repeat selection until all options to be modified are selected.
Enter "E↵" to end option setting. Then, move to the confirmation procedure for HEX file generation.

```
*** OPTION  NO.2 ***

— MULTIPLE KEY ENTRY RESET —

     COMBINATION       1. Not Use
                       2. Use  K00,K01
                       3. Use  K00,K01,K02
                       4. Use  K00,K01,K02,K03

PLEASE SELECT  NO.(1) ? 2↵

     COMBINATION       2. Use  K00,K01  SELECTED
```

Option selection

The selections for each option correspond one to one to the option list. Enter the selection number. The value in parentheses ( ) indicates the default value, and is set when only the RETURN key "↵" is pressed.
In return, the confirmation is displayed.
When you wish to modify previously set function options in the new setting process, enter "B↵" to return 1 step back to the previous function option setting operation.

```
END OF OPTION SETTING.
DO YOU MAKE HEX FILE (Y/N) ? Y↵                          . . (1)

*** OPTION EPROM SELECT MENU ***

        1. 27C64
        2. 27C128
        3. 27C256
        4. 27C512

PLEASE SELECT NO.? 2↵                                    . . (2)

        2. 27C128   SELECTED

MAKING FILE(S) IS COMPLETED.

*** OPERATION SELECT MENU ***

        1. INPUT NEW FILE
        2. EDIT FILE
        3. RETURN TO DOS

PLEASE SELECT NO.?
```

EPROM selection

When setting function options setting is completed, the following message is output to ask the operator whether to generate the HEX file.

(1) When debugging the program with EVA623A, HEX file is needed, so enter "Y↵". If "N↵" is entered, no HEX file is generated and only document file is generated.
(2) For the option ROM selection menu displayed when "Y↵" is entered in Step (1), select the EPROM to be used for setting EVA623A options.

When a series of operations are complete, the sequence returns to the operation selection menu.

4.5 Sample File

■ Example of function option document file

```
* E0C623A FUNCTION OPTION DOCUMENT  V 3.00
*
* FILE NAME    C23A0A0F.DOC
* USER'S NAME  SEIKO EPSON CORP.
* INPUT DATE   91/06/13
*
* COMMENT      TOKYO DESIGN CENTER
*              421-8 HINO HINO-SHI TOKYO 191 JAPAN
*              TEL 0425-84-2551
*              FAX 0425-84-8512
*
*
* OPTION NO.1
* < DEVICE TYPE >
*                           E0C62L3A  ( LOW POWER TYPE )  --  SELECTED
 OPT0101 02
*
* OPTION NO.2
* < MULTIPLE KEY ENTRY RESET >
*     COMBINATION           USE  K00,K01  ------------------  SELECTED
 OPT0201 02
*
* OPTION NO.3
* < INTERRUPT NOISE REJECTOR >
*     K00-K03               USE  --------------------------  SELECTED
 OPT0301 01
*
* OPTION NO.4
* < INPUT PORT PULL DOWN RESISTOR >
*     K00                   WITH RESISTOR  -----------------  SELECTED
*     K01                   WITH RESISTOR  -----------------  SELECTED
*     K02                   WITH RESISTOR  -----------------  SELECTED
*     K03                   WITH RESISTOR  -----------------  SELECTED
 OPT0401 01
 OPT0402 01
 OPT0403 01
 OPT0404 01
*
* OPTION NO.5
* < R00 SPECIFICATION >
*     OUTPUT TYPE           FOUT  --------------------------  SELECTED
*     F1                    2048 (HZ)  ---------------------  SELECTED
*     F2                    4096 (HZ)  ---------------------  SELECTED
*     F3                    8192 (HZ)  ---------------------  SELECTED
*     F4                    16384 (HZ)  --------------------  SELECTED
*     OUTPUT SPECIFICATION  COMPLEMENTARY  -----------------  SELECTED
 OPT0501 04
 OPT0503 04
 OPT0504 04
 OPT0505 04
 OPT0506 04
 OPT0507 01
*
* OPTION NO.6
* < R01 PORT OUTPUT SPECIFICATION >
*     OUTPUT TYPE           BZ OUTPUT  ---------------------  SELECTED
*     OUTPUT SPECIFICATION  COMPLEMENTARY  -----------------  SELECTED
 OPT0601 02
 OPT0602 01
*
* OPTION NO.7
* < OUTPUT PORT SPECIFICATION R02,R03 >
*     R02                   PCH-OPENDRAIN  -----------------  SELECTED
*     R03                   PCH-OPENDRAIN  -----------------  SELECTED
 OPT0701 02
 OPT0702 02
*
* OPTION NO.8
* < SI/O FUNCTION >
*     NOT USE/USE           USE  --------------------------  SELECTED
```

```
*     SI/O SPECIFICATION     LSB  --------------------------  SELECTED
*     CLOCK SPECIFICATION    RISING EDGE  -------------------  SELECTED
*     OUTPUT SPECIFICATION   HIGH  --------------------------  SELECTED
 OPT0801 02
 OPT0802 01
 OPT0803 01
 OPT0804 01
*
* OPTION NO.9
* < I/O PORT PULL DOWN RESISTOR >
*     P00                    GATE DIRECT  -------------------  SELECTED
*     P01                    GATE DIRECT  -------------------  SELECTED
*     P02                    GATE DIRECT  -------------------  SELECTED
*     P03                    GATE DIRECT  -------------------  SELECTED
 OPT0901 02
 OPT0902 02
 OPT0903 02
 OPT0904 02
*
* OPTION NO.10
* < I/O PORT FUNCTION >
*     P00                    I/O PORT  ----------------------  SELECTED
*     P01                    I/O PORT  ----------------------  SELECTED
*     P02                    I/O PORT  ----------------------  SELECTED
*     P03                    I/O PORT  ----------------------  SELECTED
 OPT1001 01
 OPT1002 01
 OPT1003 01
 OPT1004 01
*
* OPTION NO.11
* < I/O PORT OUTPUT SPECIFICATION >
*     P00                    PCH-OPENDRAIN  -----------------  SELECTED
*     P01                    PCH-OPENDRAIN  -----------------  SELECTED
*     P02                    PCH-OPENDRAIN  -----------------  SELECTED
*     P03                    PCH-OPENDRAIN  -----------------  SELECTED
 OPT1101 02
 OPT1102 02
 OPT1103 02
 OPT1104 02
*
* OPTION NO.12
* < LCD COMMON DUTY >
*                            1/4 DUTY  ----------------------  SELECTED
 OPT1201 01
*
* OPTION NO.13
* < OSC 1 SYSTEM CLOCK >
*                            CRYSTAL  -----------------------  SELECTED
 OPT1301 01
*
*
*
* SEIKO EPSON'S AREA
*
*
*
* OPTION NO.14
 OPT1401 01
*
* OPTION NO.15
 OPT1501 01
 OPT1502 01
*
* OPTION NO.16
 OPT1601 02
 OPT1602 01
*
* OPTION NO.17
 OPT1701 02
*
* OPTION NO.18
 OPT1801 02
\\END
```

Note End mark "¥¥END" may be used instead of "\\END" depending on the PC used. (The code of \ and ¥ is 5CH.)

5 SEGMENT OPTION GENERATOR SOG623A

5.1 SOG623A Outline

With the 4-bit single-chip E0C623A microcomputers, the customer may select the LCD segment options. By modifying the mask patterns of the E0C623A according to the selected options, the system can be customized to meet the specifications of the target system.
The Segment Option Generator SOG623A is a software tool for generating data file used to generate mask patterns. From the data file created with SOG623A, the E0C623A mask pattern is automatically generated by a general purpose computer.
The HEX file for the evaluation board (EVA623A) segment option ROM is simultaneously generated with the data file.

☞ *The operating method is same as for the E0C62 Family. Refer to the "E0C62 Family Development Tool Reference Manual" for details.*

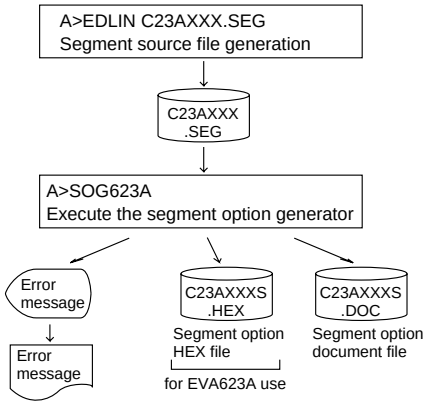


Fig. 5.1.1 SOG623A execution flow

5.2 Option List

TERMINAL NAME	ADDRESS												OUTPUT SPECIFICATION
	COM0			COM1			COM2			COM3			
	H	L	D	H	L	D	H	L	D	H	L	D	
SEG0													SEG output
SEG1													DC output ☐ C ☐ P
SEG2													SEG output
SEG3													DC output ☐ C ☐ P
SEG4													SEG output
SEG5													DC output ☐ C ☐ P
SEG6													SEG output
SEG7													DC output ☐ C ☐ P
SEG8													SEG output
SEG9													DC output ☐ C ☐ P
SEG10													SEG output
SEG11													DC output ☐ C ☐ P
SEG12													SEG output
SEG13													DC output ☐ C ☐ P
SEG14													SEG output
SEG15													DC output ☐ C ☐ P
SEG16													SEG output
SEG17													DC output ☐ C ☐ P
SEG18													SEG output
SEG19													DC output ☐ C ☐ P

Legend: <ADDRESS>
H: High order address, L: Low order address
D: Data bit
<OUTPUT SPECIFICATION>
C: Complementary output
P: Pch open drain output

With the 48-pin plastic package, there are 18 usable segment pins: SEG0 to SEG4, SEG6, and SEG8 to SEG19.

5.3 Segment Ports Output Specifications

For the output specification of the segment output ports SEG0–SEG19 (SEG0–SEG4, SEG6 and SEG8–SEG19, when a 48-pin package to be used), segment output and DC output can be selected in units of two terminals. When used for liquid crystal panel drives, select segment output; when used as regular output port, select DC output. When DC output is selected, either complementary output or Pch open drain output may further be selected.
However, for segment output ports that will not be used, select segment output.
Refer to the "E0C62 Family Development Tool Reference Manual" for the segment option source file creation.

■ When segment output is selected

The segment output port has a segment decoder built-in, and the data bit of the optional address in the segment memory area (090H–0AFH) can be allocated to the optional segment. With this, up to 80 segments (60 segments when 1/3 duty is selected) of liquid crystal panel could be driven.
The segment memory may be allocated only one segment and multiple setting is not possible.
The allocated segment displays when the bit for this segment memory is set to "1", and goes out when bit is set to "0".
Segment allocation is set to H for high address (9–A), to L for low address (0–F), and to D for data bit (0–3) and are recorded in their respective column in the option list. For segment ports that will not be used, write "---" (hyphen) in the H, L, and D columns of COM0–COM3.

Examples

• When 1/4 duty is selected

```
0  901  900  932  903  S
1  912  911  910  923  S
```

• When 1/3 duty is selected

```
0  901  900  932  ---  S
1  912  911  910  ---  S
```

■ When DC output is selected

The DC output can be selected in units of two terminals and up to 20 terminals may be allocated for DC output. Also, either complementary output or Pch open drain output is likewise selected in units of two terminals. When the bit for the selected segment memory is set to "1", the segment output port goes high (V_{DD}), and goes low (V_{SS}) when set to "0". Segment allocation is the same as when segment output is selected but for the while the segment memory allocated to COM1–COM3 becomes ineffective. Write three hyphens ("---") in the COM1–COM3 columns in the option list.

Example

• When complementary output is set to SEG16 and SEG17, and Pch open drain output is set to SEG18 and SEG19.

```
16  AE0  ---  ---  ---  C
17  AF0  ---  ---  ---  C
18  AE1  ---  ---  ---  P
19  AF1  ---  ---  ---  P
```

Note *Only complementary output is enabled as the DC output of the SEG ports of EVA623A. Therefore, complementary output is enabled even if Pch open drain output is selected. Respond to it by adding external circuits as required.*

5.4 SOG623A Quick Reference

■ Starting command and input/output files

_ indicates a blank.
↵ indicates the Return key.
A parameter enclosed by [ ] can be omitted.

Execution file: SOG623A.EXE

Starting command: **SOG623A_ [-H]↵**

Option: -H: Specifies the segment option document file for input file of SOG623A.

Input file: C23AXXX.SEG (Segment option source file)
C23AXXXS.DOC (Segment option document file, when -H option use)

Output file: C23AXXXS.DOC (Segment option document file)
C23AXXXS.HEX (Segment option HEX file)

■ Display example

```
     ***  E0C623A SEGMENT OPTION GENERATOR. --- Ver 3.00  ***

EEEEEEEEEE   PPPPPPPP         SSSSSSS        OOOOOOOO      NNN      NNN
EEEEEEEEEE   PPPPPPPPPP     SSS    SSSS    OOO    OOO     NNNN     NNN
EEE          PPP     PPP   SSS     SSS   OOO      OOO    NNNNN    NNN
EEE          PPP     PPP    SSS          OOO      OOO    NNNNNN   NNN
EEEEEEEEEE   PPPPPPPPPP      SSSSSS      OOO      OOO    NNN NNN  NNN
EEEEEEEEEE   PPPPPPPP           SSSS     OOO      OOO    NNN  NNNNNN
EEE          PPP                SSS     OOO      OOO    NNN   NNNNN
EEE          PPP           SSS    SSS   OOO      OOO    NNN    NNNN
EEEEEEEEEE   PPP           SSSS    SSS    OOO    OOO     NNN     NNN
EEEEEEEEEE   PPP             SSSSSSS       OOOOOOOO      NNN      NN

             (C) COPYRIGHT 1991  SEIKO EPSON CORP.

         SEGMENT OPTION SOURCE FILE NAME IS " C23AXXX.SEG "

         THIS SOFTWARE MAKES NEXT FILES.

            C23AXXXS.HEX  ...  SEGMENT OPTION HEX FILE.
            C23AXXXS.DOC  ...  SEGMENT OPTION DOCUMENT FILE.

                        STRIKE ANY KEY.
```

Start-up message
When SOG623A is started, the start-up message is displayed.
For "STRIKE ANY KEY.", press any key to advance the program execution.

To suspend execution, press the "CTRL" and "C" keys together: the sequence returns to the DOS command level.

```
*** E0C623A USER'S OPTION SETTING. --- Ver 3.00 ***

CURRENT DATE IS  91/07/19
PLEASE INPUT NEW DATE  :   91/07/22↵
```

Date input
Enter the 2-digit year, month, and day of the month by delimiting them with a slash ("/"). When not modifying the date, press the RETURN key "↵" to continue.

```
*** SOURCE FILE(S) ***

C23A0A0         C23A0B0         C23A0C0                          . . (1)

PLEASE INPUT SEGMENT OPTION FILE NAME? C23A0A0↵                  . . (2)
PLEASE INPUT USER'S NAME? SEIKO EPSON CORP.↵                     . . (3)
PLEASE INPUT ANY COMMENT
(ONE LINE IS 50 CHR)? TOKYO DESIGN CENTER↵                       . . (4)
                    ? 421-8 HINO HINO-SHI TOKYO 191 JAPAN↵
                    ? TEL 0425-84-2551↵
                    ? FAX 0425-84-8512↵
                    ? ↵
```

Input file selection
(1) Will display the files on the current drive.
(2) Enter the file name.
(3) Enter the customer's company name.
(4) Enter any comment.
(Within 50 characters x 10 lines)
Then, move to the confirmation procedure for HEX file generation.

```
*** SOURCE FILE(S) ***

SEGMENT OPTION SOURCE FILE IS NOT FOUND.       . . (5) -H option not use

*** SOURCE FILE(S) ***

SEGMENT OPTION DOCUMENT FILE IS NOT FOUND.     . . (6) -H option use
```

In step (1), if no modifiable source exists, an error message (5) or (6) will be displayed and the program will be terminated.

```
PLEASE INPUT SEGMENT OPTION SOURCE FILE NAME? C23A0N0↵
SEGMENT OPTION SOURCE FILE IS NOT FOUND.       . . (7) -H option not use

PLEASE INPUT SEGMENT OPTION DOCUMENT FILE NAME? C23A0N0↵
SEGMENT OPTION DOCUMENT FILE IS NOT FOUND.     . . (8) -H option use
```

In step (2), if the specified file name is not found in the current drive, an error message (7) or (8) is displayed, prompting entry of other file name.

```
END OF OPTION SETTING.
DO YOU MAKE HEX FILE (Y/N) ? Y↵                    ..(1)

*** OPTION EPROM SELECT MENU ***

        1. 27C64
        2. 27C128
        3. 27C256
        4. 27C512

PLEASE SELECT NO.? 2 ↵                             ..(2)

        2. 27C128   SELECTED

MAKING FILE IS COMPLETED.
```

EPROM selection

When selecting file is completed, the following message is output to ask the operator whether to generate the HEX file.

(1) When debugging the program with EVA623A, HEX file is needed, so enter "Y↵". If "N↵" is entered, no HEX file is generated and only document file is generated.

(2) For the option ROM selection menu displayed when "Y↵" is entered in Step (1), select the EPROM to be used for setting EVA623A options.

When a series of operations are complete, the SOG623A generates files. If no error is committed while setting segment options, "MAKING FILE IS COMPLETED" will be displayed and the SOG623A program will be terminated.

■ Error messages

Error message	Explanation
S (Syntax Error)	The data was written in an invalid format.
N (Segment No. Select Error)	The segment number outside the specificable range was specified.
R (RAM Address Select Error)	The segment memory address or data bit outside the specificable range was specified.
D (Duprication Error)	The same data (SEG port No., segment memory address, or data bit) was specified more then once.
Out Port Set Error	The output specifications were not set in units of two ports.

5.5 Sample Files

■ Example of segment option source file

```
; C23A0A0.SEG, VER.3.00
; EVA623A LCD SEGMENT DECODE TABLE
;
 0    900  901  902  903 S       ;1st DIGIT
 1    910  911  912  913 S
 2    920  921  922  923 S
 3    930  931  932  933 S
 4    940  941  942  943 S       ;2nd DIGIT
 5    950  951  952  953 S
 6    960  961  962  963 S
 7    970  971  972  973 S
 8    980  981  982  983 S       ;3rd DIGIT
 9    990  991  992  993 S
10    9A0  9A1  9A2  9A3 S
11    9B0  9B1  9B2  9B3 S
12    9C0  9C1  9C2  9C3 S       ;4th DIGIT
13    9D0  9D1  9D2  9D3 S
14    9E0  9E1  9E2  9E3 S
15    9F0  9F1  9F2  9F3 S
16    A00  A01  A02  A03 S       ;5th DIGIT
17    A10  A11  A12  A13 S
18    A20  ---  ---  --- C       ;DC OUTPUT
19    A30  ---  ---  --- C
```

■ Example of segment option source file

```
* E0C623A SEGMENT OPTION DOCUMENT  V 3.00
*
* FILE NAME    C23A0A0S.DOC
* USER'S NAME  SEIKO EPSON CORP.
* INPUT DATE   91/06/14
* COMMENT      TOKYO DESIGN CENTER
*              421-8 HINO HINO-SHI TOKYO 191 JAPAN
*              TEL 0425-84-2551
*              FAX 0425-84-8512
*
*
* OPTION NO.17
*
* < LCD SEGMENT DECODE TABLE >
*
* SEG COM0 COM1 COM2 COM3 SPEC
*
   0  900  901  902  903  S
   1  910  911  912  913  S
   2  920  921  922  923  S
   3  930  931  932  933  S
   4  940  941  942  943  S
   5  950  951  952  953  S
   6  960  961  962  963  S
   7  970  971  972  973  S
   8  980  981  982  983  S
   9  990  991  992  993  S
  10  9A0  9A1  9A2  9A3  S
  11  9B0  9B1  9B2  9B3  S
  12  9C0  9C1  9C2  9C3  S
  13  9D0  9D1  9D2  9D3  S
  14  9E0  9E1  9E2  9E3  S
  15  9F0  9F1  9F2  9F3  S
  16  A00  A01  A02  A03  S
  17  A10  A11  A12  A13  S
  18  A20  A21  A22  A23  C
  19  A30  A31  A32  A33  C
\\END
```

Note End mark "¥¥END" may be used instead of "\\END" depending on the PC used. (The code of \ and ¥ is 5CH.)

6 ICE CONTROL SOFTWARE ICS623A

6.1 ICS623A Outline

The In-circuit Emulator ICE6200 connects the target board produced by the user via the EVA623A and performs real time target system evaluation and debugging by passing through the RS-232C from the host computer and controlling it. The operation on the host computer side and ICE6200 control is done through the ICE Control Software ICS623A.
The ICS623A has a set of numerous and highly functional emulation commands which provide sophisticated break function, on-the-fly data display, history display, etc., and so perform a higher level of debugging.

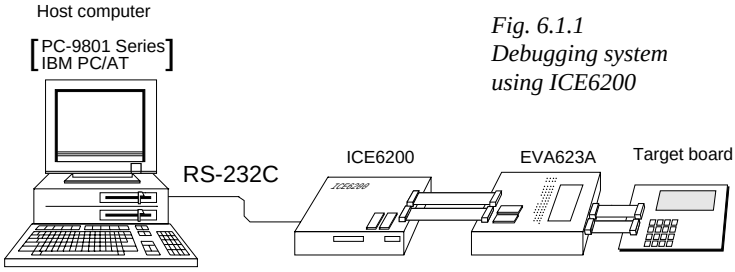


Fig. 6.1.1 Debugging system using ICE6200

☞ *The functions of the ICE6200 and commands are same as for the E0C62 Family. Refer to the "E0C62 Family Development Tool Reference Manual" for details.*

6.2 ICS623A Restrictions

Take the following precautions when using the ICS623A.

■ ROM Area

The ROM area is limited to a maximum address of 3FFH. Assigning data above the 3FFH address causes an error.

■ RAM Area

The RAM area is limited to a maximum address of 0FDH. However, as the following addresses are in the unused area, designation of this area with the ICE commands produces an error.

Unused area: 050H to 08FH, 0B0H to 0DFH, 0E1H, 0F0H to 0F2H, 0F4H to 0F5H, 0F7H to 0F8H

Memory 090H to 0AFH is display memory; 0E0H to 0FDH is I/O memory.
(Refer to the "E0C623A Technical Manual" for details.)

■ Undefined Code

The instructions below are not specified for the E0C623A and so cannot be used.

```
SLP
PUSH    XP          POP   XP          LD    XP,r          LD    r,XP
PUSH    YP          POP   YP          LD    YP,r          LD    r,YP
```

■ OPTLD Command

In the ICS623A, OPTLD command cannot be used.

6.3 ICS623A Quick Reference

■ Starting command and input/output files

↲ *indicates the Return key.*

Execution file:
ICS623A.BAT (ICS623AJ.EXE) . . . for MS-DOS
ICS623AB.BAT (ICS623AW.EXE) . . . for PC-DOS

Starting command:
ICS623A (ICS623AJ)↲ . . . for MS-DOS
ICS623AB (ICS623AW)↲ . . . for PC-DOS

Input file:
C23AXXXL.HEX (Object file, low-order)
C23AXXXH.HEX (Object file, high-order)
C23AXXXD.HEX (Data RAM file)
C23AXXXC.HEX (Control file)

Output file:
C23AXXXL.HEX (Object file, low-order)
C23AXXXH.HEX (Object file, high-order)
C23AXXXD.HEX (Data RAM file)
C23AXXXC.HEX (Control file)

■ Display example

```
          *** E0C623A ICE CONTROL SOFTWARE. --- Ver 3.01 ***

EEEEEEEEEE   PPPPPPPP        SSSSSSS       OOOOOOOO      NNN      NNN
EEEEEEEEEE   PPPPPPPPPP     SSS   SSSS    OOO    OOO    NNNN     NNN
EEE          PPP     PPP   SSS     SSS   OOO      OOO   NNNNN    NNN
EEE          PPP     PPP    SSS          OOO      OOO   NNNNNN   NNN
EEEEEEEEEE   PPPPPPPPPP      SSSSSS      OOO      OOO   NNN NNN  NNN
EEEEEEEEEE   PPPPPPPP           SSSS     OOO      OOO   NNN  NNNNNN
EEE          PPP                SSS     OOO      OOO   NNN   NNNNN
EEE          PPP            SSS   SSS   OOO      OOO   NNN    NNNN
EEEEEEEEEE   PPP            SSSS   SSS    OOO    OOO    NNN     NNN
EEEEEEEEEE   PPP              SSSSSSS       OOOOOOOO     NNN      NN

             (C) COPYRIGHT 1991 SEIKO EPSON CORP.

* ICE POWER ON RESET *
* DIAGNOSTIC TEST OK *
#
```

Start-up message
When ICS623A is started, the start-up message is displayed, and a self-test is automatically performed. ICS623A commands are awaited when the program is properly loaded and the # mark is displayed.
Debugging can be done by entering command after the # mark.
The ICS623A program is terminated by entering the Q (Quit) command.

Note *Confirm that the cables connected properly, then operate the ICS623A.*

■ Error messages

Error message	Meaning	Recover procedure
* COMMUNICATION ERROR OR ICE NOT READY *	ICE6200 is disconnected or power is OFF.	Switch OFF the host power supply, connect cable, and reapply power. Or switch ON power to ICE6200.
* TARGET DOWN (1) *	Evaluation board is disconnected. (Check at power ON)	Switch OFF power to ICE, and connect the evaluation board. Then, apply power to ICE6200.
* TARGET DOWN (2) *	Evaluation board is disconnected. (Check at command execution)	Switch OFF power to ICE, and connect the evaluation board. Then, apply power to ICE6200.
* UNDEFINED PROGRAM CODE EXIST *	Undefined code is detected in the program loaded from ROM or FD.	Convert ROM and FD data with the cross assembler, then restart the ICE6200.
* COMMAND ERROR *	A miss occurs by command input.	Reenter the proper command.
(No response after power on)	The ICE-to-HOST cable is disconnected on the host side.	Switch OFF the host power supply, connect cable, and reapply power.

■ ICE6200 commands

Item No.	Function	Command Format	Outline of Operation
1	Assemble	#A,a ↵	Assemble command mnemonic code and store at address "a"
2	Disassemble	#L,a1,a2 ↵	Contents of addresses a1 to a2 are disassembled and displayed
3	Dump	#DP,a1,a2 ↵	Contents of program area a1 to a2 are displayed
		#DD,a1,a2 ↵	Content of data area a1 to a2 are displayed
4	Fill	#FP,a1,a2,d ↵	Data d is set in addresses a1 to a2 (program area)
		#FD,a1,a2,d ↵	Data d is set in addresses a1 to a2 (data area)
5	Set Run Mode	#G,a ↵	Program is executed from the "a" address
		#TIM ↵	Execution time and step counter selection
		#OTF ↵	On-the-fly display selection
6	Trace	#T,a,n ↵	Executes program while displaying results of step instruction from "a" address
		#U,a,n ↵	Displays only the final step of #T,a,n
7	Break	#BA,a ↵	Sets Break at program address "a"
		#BAR,a ↵	Breakpoint is canceled
		#BD ↵	Break condition is set for data RAM
		#BDR ↵	Breakpoint is canceled
		#BR ↵	Break condition is set for EVA623ACPU internal registers
		#BRR ↵	Breakpoint is canceled
		#BM ↵	Combined break conditions set for program data RAM address and registers
		#BMR ↵	Cancel combined break conditions for program data ROM address and registers
		#BRES ↵	All break conditions canceled
		#BC ↵	Break condition displayed
		#BE ↵	Enter break enable mode
		#BSYN ↵	Enter break disable mode
		#BT ↵	Set break stop/trace modes
		#BRKSEL,REM ↵	Set BA condition clear/remain modes
8	Move	#MP,a1,a2,a3 ↵	Contents of program area addresses a1 to a2 are moved to addresses a3 and after
		#MD,a1,a2,a3 ↵	Contents of data area addresses a1 to a2 are moved to addresses a3 and after
9	Data Set	#SP,a ↵	Data from program area address "a" are written to memory
		#SD,a ↵	Data from data area address "a" are written to memory
10	Change CPU Internal Registers	#DR ↵	Display EVA623ACPU internal registers
		#SR ↵	Set EVA623ACPU internal registers
		#I ↵	Reset EVA623ACPU
		#DXY ↵	Display X, Y, MX and MY
		#SXY ↵	Set data for X and Y display and MX, MY

Item No.	Function	Command Format	Outline of Operation
11	History	#H,p1,p2 ↵	Display history data for pointer 1 and pointer 2
		#HB ↵	Display upstream history data
		#HG ↵	Display 21 line history data
		#HP ↵	Display history pointer
		#HPS,a ↵	Set history pointer
		#HC,S/C/E ↵	Sets up the history information acquisition before (S), before/after (C) and after (E)
		#HA,a1,a2 ↵	Sets up the history information acquisition from program area a1 to a2
		#HAR,a1,a2 ↵	Sets up the prohibition of the history information acquisition from program area a1 to a2
		#HAD ↵	Indicates history acquisition program area
		#HS,a ↵	Retrieves and indicates the history information which executed a program address "a"
		#HSW,a ↵ #HSR,a ↵	Retrieves and indicates the history information which wrote or read the data area address "a"
12	File	#RF,file ↵	Move program file to memory
		#RFD,file ↵	Move data file to memory
		#VF,file ↵	Compare program file and contents of memory
		#VFD,file ↵	Compare data file and contents of memory
		#WF,file ↵	Save contents of memory to program file
		#WFD,file ↵	Save contents of memory to data file
		#CL,file ↵	Load ICE6200 set condition from file
		#CS,file ↵	Save ICE6200 set condition to file
13	Coverage	#CVD ↵	Indicates coverage information
		#CVR ↵	Clears coverage information
14	ROM Access	#RP ↵	Move contents of ROM to program memory
		#VP ↵	Compare contents of ROM with contents of program memory
		#ROM ↵	Set ROM type
15	Terminate ICE	#Q ↵	Terminate ICE and return to operating system control
16	Command Display	#HELP ↵	Display ICE6200 instruction
17	Self Diagnosis	#CHK ↵	Report results of ICE6200 self diagnostic test

↵ means press the RETURN key.

7 MASK DATA CHECKER MDC623A

7.1 MDC623A Outline

The Mask Data Checker MDC623A is a software tool which checks the program data (C23AXXXH.HEX and C23AXXXL.HEX) and option data (C23AXXXF.DOC and C23AXXXS.DOC) created by the user and creates the data file (C623AXXX.PAn) for generating mask patterns. The user must send the file generated through this software tool to Seiko Epson.

Moreover, MDC623A has the capability to restore the generated data file (C623AXXX.PA0) to the original file format .

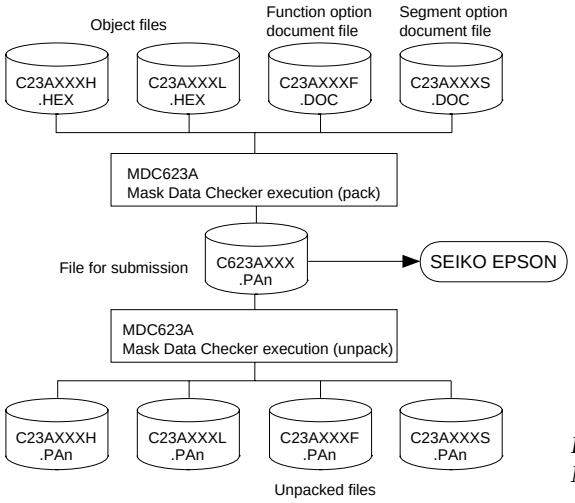


Fig. 7.1.1
MDC623A execution flow

☞ *The operating method is same as for the E0C62 Family. Refer to the "E0C62 Family Development Tool Reference Manual" for details.*

7.2 MDC623A Quick Reference

■ Starting command and input/output files

Execution file: MDC623A.EXE

Starting command: **MDC623A**↵ ↵ *indicates the Return key.*

Input file:

C23AXXXL.HEX	(Object file, low-order)	When packing
C23AXXXH.HEX	(Object file, high-order)	
C23AXXXF.DOC	(Function option document file)	
C23AXXXS.DOC	(Segment option document file)	
C623AXXX.PAn	(Packed file)	When unpacking

Output file:

C623AXXX.PAn	(Packed file)	When packing
C23AXXXL.PAn	(Object file, low-order)	When unpacking
C23AXXXH.PAn	(Object file, high-order)	
C23AXXXF.PAn	(Function option document file)	
C23AXXXS.PAn	(Segment option document file)	

■ Display examples

```
          *** E0C623A PACK / UNPACK PROGRAM Ver 1.00 ***

EEEEEEEEEE   PPPPPPPP        SSSSSSS       OOOOOOOO      NNN      NNN
EEEEEEEEEE   PPPPPPPPPP     SSS   SSSS    OOO    OOO    NNNN     NNN
EEE          PPP     PPP   SSS     SSS   OOO      OOO   NNNNN    NNN
EEE          PPP     PPP    SSS          OOO      OOO   NNNNNN   NNN
EEEEEEEEEE   PPPPPPPPPP      SSSSSS      OOO      OOO   NNN NNN NNN
EEEEEEEEEE   PPPPPPPP           SSSS     OOO      OOO   NNN  NNNNNN
EEE          PPP                 SSS    OOO      OOO   NNN   NNNNN
EEE          PPP           SSS     SSS   OOO      OOO   NNN    NNNN
EEEEEEEEEE   PPP           SSSS   SSS     OOO    OOO    NNN     NNN
EEEEEEEEEE   PPP             SSSSSSS       OOOOOOOO      NNN      NN

             (C) COPYRIGHT 1991 SEIKO EPSON CORP.

                   --- OPERATION MENU ---

                          1. PACK
                          2. UNPACK

                   PLEASE SELECT NO.?
```

Start-up message

When MDC623A is started, the start-up message and operation menu are displayed. Here, the user is prompted to select operation options.

```
                   --- OPERATION MENU ---

                          1. PACK
                          2. UNPACK

                   PLEASE SELECT NO.? 1↵                          ...(1)

       C23AXXXH.HEX --------+
                            |
       C23AXXXL.HEX --------+
                            |-------- C23AXXX.PAn (PACK FILE)
       C23AXXXF.DOC --------+
                            |
       C23AXXXS.DOC --------+

 PLEASE INPUT PACK FILE NAME (C623AXXX.PAn) ?  C623A0A0.PA0↵   ...(2)

       C23A0A0H.HEX --------+
                            |
       C23A0A0L.HEX --------+
                            |-------- C23A0A0.PA0
       C23A0A0F.DOC --------+
                            |
       C23A0A0S.DOC --------+
```

Packing of data

(1) Select "1" in the operation menu.
(2) Enter the file name.
    After submitting the data to Seiko Epson and there is a need to re-submit the data, increase the numeric value of "n" by one when the input is made.
    (Example: When re-submitting data after "C623AXXX.PA0" has been submitted, the pack file name should be entered as "C623AXXX.PA1".)

With this, the mask file (C623AXXX.PAn) is generated, and the MDC623A program will be terminated.
Submit this file to Seiko Epson.

Note Don't use the data generated with the -N option of the Cross Assembler (ASM623A) as program data. If the program data generated with the -N option of the Cross Assembler is packed, undefined program area is filled with FFH code. In this case, following message is displayed.

```
WARNING: FILLED <file_name> FILE WITH FFH.
```

```
                   --- OPERATION MENU ---

                          1. PACK
                          2. UNPACK

                   PLEASE SELECT NO.? 2↵                          ...(1)

 PLEASE INPUT PACKED FILE NAME (C623AXXX.PAn) ?  C623A0A0.PA0↵...(2)

                            +-------- C23A0A0H.PA0
                            |
                            +-------- C23A0A0L.PA0
       C623A0A0.PA0 --------|
                            +-------- C23A0A0F.PA0
                            |
                            +-------- C23A0A0S.PA0
```

Unpacking of data

(1) Select "1" in the operation menu.
(2) Enter the packed file name.

With this, the mask data file (C623AXXX.PAn) is restored to the original file format, and the MDC623A program will be terminated.

Since the extension of the file name remains as "PAn", it must be renamed back to its original form ("HEX" and "DOC") in order to re-debug or modify the restored file.

■ Error messages

Program data error

Error Message	Explanation
1. HEX DATA ERROR : NOT COLON.	There is no colon.
2. HEX DATA ERROR : DATA LENGTH. (NOT 00-20h)	The data length of 1 line is not in the 00–20H range.
3. HEX DATA ERROR : ADDRESS.	The address is beyond the valid range of the program, melody and scale ROM.
4. HEX DATA ERROR : RECORD TYPE. (NOT 00)	The record type of 1 line is not 00.
5. HEX DATA ERROR : DATA. (NOT 00-FFh)	The data is not in the range between 00H and 0FFH.
6. HEX DATA ERROR : TOO MANY DATA IN ONE LINE.	There are too many data in 1 line.
7. HEX DATA ERROR : CHECK SUM.	The checksum is not correct.
8. HEX DATA ERROR : END MARK.	The end mark is not : 00000001FF.
9. HEX DATA ERROR : DUPLICATE.	There is duplicate definition of data in the same address.

Function option data error

Error Message	Explanation
1. OPTION DATA ERROR : START MARK.	The start mark is not "\OPTION". (during unpacking) *
2. OPTION DATA ERROR : OPTION NUMBER.	The option number is not correct.
3. OPTION DATA ERROR : SELECT NUMBER.	The option selection number is not correct.
4. OPTION DATA ERROR : END MARK.	The end mark is not "\\END" (packing) or "\END" (unpacking).*

Segment option data error

Error Message	Explanation
1. SEGMENT DATA ERROR : START MARK.	The start mark is not "\SEGMENT". (during unpacking) *
2. SEGMENT DATA ERROR : DATA.	The segment data is not correct.
3. SEGMENT DATA ERROR : SEGMENT NUMBER.	The SEG No. is not correct.
4. SEGMENT DATA ERROR : SPEC.	The output specification of the SEG terminal is not correct.
5. SEGMENT DATA ERROR : END MARK.	The end mark is not "\\END" (packing) or "\END" (unpacking).*

File error

Error Message	Explanation
1. <File_name> FILE IS NOT FOUND.	The file is not found or the file number set in CONFIG.SYS is less than 10.
2. PACK FILE NAME (File_name) ERROR.	The packed input format for the file name is wrong.
3. PACKED FILE NAME (File_name) ERROR.	The unpacked input format for the file name is wrong.

System error

Error Message	Explanation
1. DIRECTORY FULL.	The directory is full.
2. DISK WRITE ERROR.	Writing on the disk is failed.

** \ sometimes appears as ¥, depending on the personal computer being used.*

APPENDIX A. E0C623A INSTRUCTION SET

Classification	Mnemonic	Operand	Operation Code												Flag				Clock	Operation
			B	A	9	8	7	6	5	4	3	2	1	0	I	D	Z	C		
Branch instructions	PSET	p	1	1	1	0	0	1	0	p4	p3	p2	p1	p0					5	NBP ← p4, NPP ← p3~p0
	JP	s	0	0	0	0	s7	s6	s5	s4	s3	s2	s1	s0					5	PCB ← NBP, PCP ← NPP, PCS ← s7~s0
		C, s	0	0	1	0	s7	s6	s5	s4	s3	s2	s1	s0					5	PCB ← NBP, PCP ← NPP, PCS ← s7~s0 if C=1
		NC, s	0	0	1	1	s7	s6	s5	s4	s3	s2	s1	s0					5	PCB ← NBP, PCP ← NPP, PCS ← s7~s0 if C=0
		Z, s	0	1	1	0	s7	s6	s5	s4	s3	s2	s1	s0					5	PCB ← NBP, PCP ← NPP, PCS ← s7~s0 if Z=1
		NZ, s	0	1	1	1	s7	s6	s5	s4	s3	s2	s1	s0					5	PCB ← NBP, PCP ← NPP, PCS ← s7~s0 if Z=0
	JPBA		1	1	1	1	1	1	1	0	1	0	0	0					5	PCB ← NBP, PCP ← NPP, PCSH ← B, PCSL ← A
	CALL	s	0	1	0	0	s7	s6	s5	s4	s3	s2	s1	s0					7	M(SP-1) ← PCP, M(SP-2) ← PCSH, M(SP-3) ← PCSL+1 SP ← SP-3, PCP ← NPP, PCS ← s7~s0
	CALZ	s	0	1	0	1	s7	s6	s5	s4	s3	s2	s1	s0					7	M(SP-1) ← PCP, M(SP-2) ← PCSH, M(SP-3) ← PCSL+1 SP ← SP-3, PCP ← 0, PCS ← s7~s0
	RET		1	1	1	1	1	1	0	1	1	1	1	1					7	PCSL ← M(SP), PCSH ← M(SP+1), PCP ← M(SP+2) SP ← SP+3
	RETS		1	1	1	1	1	1	0	1	1	1	1	0					12	PCSL ← M(SP), PCSH ← M(SP+1), PCP ← M(SP+2) SP ← SP+3, PC ← PC+1
	RETD	*l*	0	0	0	1	*l*7	*l*6	*l*5	*l*4	*l*3	*l*2	*l*1	*l*0					12	PCSL ← M(SP), PCSH ← M(SP+1), PCP ← M(SP+2) SP ← SP+3, M(X) ← *l*3~*l*0, M(X+1) ← *l*7~*l*4, X ← X+2
System control instructions	NOP5		1	1	1	1	1	1	1	1	1	0	1	1					5	No operation (5 clock cycles)
	NOP7		1	1	1	1	1	1	1	1	1	1	1	1					7	No operation (7 clock cycles)
	HALT		1	1	1	1	1	1	1	1	1	0	0	0					5	Halt (stop clock)
Index operation instructions	INC	X	1	1	1	0	1	1	1	0	0	0	0	0					5	X ← X+1
		Y	1	1	1	0	1	1	1	1	0	0	0	0					5	Y ← Y+1
	LD	X, x	1	0	1	1	x7	x6	x5	x4	x3	x2	x1	x0					5	XH ← x7~x4, XL ← x3~x0
		Y, y	1	0	0	0	y7	y6	y5	y4	y3	y2	y1	y0					5	YH ← y7~y4, YL ← y3~y0
		XP, r*	1	1	1	0	1	0	0	0	0	0	r1	r0					5	XP ← r
		XH, r	1	1	1	0	1	0	0	0	0	1	r1	r0					5	XH ← r
		XL, r	1	1	1	0	1	0	0	0	1	0	r1	r0					5	XL ← r
		YP, r*	1	1	1	0	1	0	0	1	0	0	r1	r0					5	YP ← r
		YH, r	1	1	1	0	1	0	0	1	0	1	r1	r0					5	YH ← r
		YL, r	1	1	1	0	1	0	0	1	1	0	r1	r0					5	YL ← r
		r, XP*	1	1	1	0	1	0	1	0	0	0	r1	r0					5	r ← XP
		r, XH	1	1	1	0	1	0	1	0	0	1	r1	r0					5	r ← XH
		r, XL	1	1	1	0	1	0	1	0	1	0	r1	r0					5	r ← XL
		r, YP*	1	1	1	0	1	0	1	1	0	0	r1	r0					5	r ← YP
		r, YH	1	1	1	0	1	0	1	1	0	1	r1	r0					5	r ← YH
		r, YL	1	1	1	0	1	0	1	1	1	0	r1	r0					5	r ← YL
	ADC	XH, i	1	0	1	0	0	0	0	0	i3	i2	i1	i0			↕	↕	7	XH ← XH+i3~i0+C
		XL, i	1	0	1	0	0	0	0	1	i3	i2	i1	i0			↕	↕	7	XL ← XL+i3~i0+C
		YH, i	1	0	1	0	0	0	1	0	i3	i2	i1	i0			↕	↕	7	YH ← YH+i3~i0+C
		YL, i	1	0	1	0	0	0	1	1	i3	i2	i1	i0			↕	↕	7	YL ← YL+i3~i0+C

"" mean "not in E0C623A Series".*

Classification	Mnemonic	Operand	Operation Code												Flag				Clock	Operation
			B	A	9	8	7	6	5	4	3	2	1	0	I	D	Z	C		
Index operation instructions	CP	XH, i	1	0	1	0	0	1	0	0	i3	i2	i1	i0			↕	↕	7	XH-i3~i0
		XL, i	1	0	1	0	0	1	0	1	i3	i2	i1	i0			↕	↕	7	XL-i3~i0
		YH, i	1	0	1	0	0	1	1	0	i3	i2	i1	i0			↕	↕	7	YH-i3~i0
		YL, i	1	0	1	0	0	1	1	1	i3	i2	i1	i0			↕	↕	7	YL-i3~i0
Data transfer instructions	LD	r, i	1	1	1	0	0	0	r1	r0	i3	i2	i1	i0					5	r←i3~i0
		r, q	1	1	1	0	1	1	0	0	r1	r0	q1	q0					5	r←q
		A, Mn	1	1	1	1	1	0	1	0	n3	n2	n1	n0					5	A←M(n3~n0)
		B, Mn	1	1	1	1	1	0	1	1	n3	n2	n1	n0					5	B←M(n3~n0)
		Mn, A	1	1	1	1	1	0	0	0	n3	n2	n1	n0					5	M(n3~n0)←A
		Mn, B	1	1	1	1	1	0	0	1	n3	n2	n1	n0					5	M(n3~n0)←B
	LDPX	MX, i	1	1	1	0	0	1	1	0	i3	i2	i1	i0					5	M(X)←i3~i0, X←X+1
		r, q	1	1	1	0	1	1	1	0	r1	r0	q1	q0					5	r←q, X←X+1
	LDPY	MY, i	1	1	1	0	0	1	1	1	i3	i2	i1	i0					5	M(Y)←i3~i0, Y←Y+1
		r, q	1	1	1	0	1	1	1	1	r1	r0	q1	q0					5	r←q, Y←Y+1
	LBPX	MX, *I*	1	0	0	1	*I*7	*I*6	*I*5	*I*4	*I*3	*I*2	*I*1	*I*0					5	M(X)←*I*3~*I*0, M(X+1)←*I*7~*I*4, X←X+2
Flag operation instructions	SET	F, i	1	1	1	1	0	1	0	0	i3	i2	i1	i0	↑	↑	↑	↑	7	F←F∨i3~i0
	RST	F, i	1	1	1	1	0	1	0	1	i3	i2	i1	i0	↓	↓	↓	↓	7	F←F∧i3~i0
	SCF		1	1	1	1	0	1	0	0	0	0	0	1				↑	7	C←1
	RCF		1	1	1	1	0	1	0	1	1	1	1	0				↓	7	C←0
	SZF		1	1	1	1	0	1	0	0	0	0	1	0			↑		7	Z←1
	RZF		1	1	1	1	0	1	0	1	1	1	0	1			↓		7	Z←0
	SDF		1	1	1	1	0	1	0	0	0	1	0	0		↑			7	D←1 (Decimal Adjuster ON)
	RDF		1	1	1	1	0	1	0	1	1	0	1	1		↓			7	D←0 (Decimal Adjuster OFF)
	EI		1	1	1	1	0	1	0	0	1	0	0	0	↑				7	I ←1 (Enables Interrupt)
	DI		1	1	1	1	0	1	0	1	0	1	1	1	↓				7	I ←0 (Disables Interrupt)
Stack operation instructions	INC	SP	1	1	1	1	1	1	0	1	1	0	1	1					5	SP←SP+1
	DEC	SP	1	1	1	1	1	1	0	0	1	0	1	1					5	SP←SP-1
	PUSH	r	1	1	1	1	1	1	0	0	0	0	r1	r0					5	SP←SP-1, M(SP)←r
		XP *	1	1	1	1	1	1	0	0	0	1	0	0					5	SP←SP-1, M(SP)←XP
		XH	1	1	1	1	1	1	0	0	0	1	0	1					5	SP←SP-1, M(SP)←XH
		XL	1	1	1	1	1	1	0	0	0	1	1	0					5	SP←SP-1, M(SP)←XL
		YP *	1	1	1	1	1	1	0	0	0	1	1	1					5	SP←SP-1, M(SP)←YP
		YH	1	1	1	1	1	1	0	0	1	0	0	0					5	SP←SP-1, M(SP)←YH
		YL	1	1	1	1	1	1	0	0	1	0	0	1					5	SP←SP-1, M(SP)←YL
		F	1	1	1	1	1	1	0	0	1	0	1	0					5	SP←SP-1, M(SP)←F
	POP	r	1	1	1	1	1	1	0	1	0	0	r1	r0					5	r←M(SP), SP←SP+1
		XP *	1	1	1	1	1	1	0	1	0	1	0	0					5	XP←M(SP), SP←SP+1
		XH	1	1	1	1	1	1	0	1	0	1	0	1					5	XH←M(SP), SP←SP+1
		XL	1	1	1	1	1	1	0	1	0	1	1	0					5	XL←M(SP), SP←SP+1
		YP *	1	1	1	1	1	1	0	1	0	1	1	1					5	YP←M(SP), SP←SP+1

"" mean "not in E0C623A Series".*

Classification	Mnemonic	Operand	Operation Code												Flag				Clock	Operation
			B	A	9	8	7	6	5	4	3	2	1	0	I	D	Z	C		
Stack operation instructions	POP	YH	1	1	1	1	1	1	0	1	1	0	0	0					5	YH← M(SP), SP← SP+1
		YL	1	1	1	1	1	1	0	1	1	0	0	1					5	YL← M(SP), SP← SP+1
		F	1	1	1	1	1	1	0	1	1	0	1	0	↕	↕	↕	↕	5	F← M(SP), SP← SP+1
	LD	SPH, r	1	1	1	1	1	1	1	0	0	0	r1	r0					5	SPH← r
		SPL, r	1	1	1	1	1	1	1	1	0	0	r1	r0					5	SPL ← r
		r, SPH	1	1	1	1	1	1	1	0	0	1	r1	r0					5	r← SPH
		r, SPL	1	1	1	1	1	1	1	1	0	1	r1	r0					5	r← SPL
Arithmetic instructions	ADD	r, i	1	1	0	0	0	0	r1	r0	i3	i2	i1	i0	★	↕	↕		7	r← r+i3~i0
		r, q	1	0	1	0	1	0	0	0	r1	r0	q1	q0	★	↕	↕		7	r← r+q
	ADC	r, i	1	1	0	0	0	1	r1	r0	i3	i2	i1	i0	★	↕	↕		7	r← r+i3~i0+C
		r, q	1	0	1	0	1	0	0	1	r1	r0	q1	q0	★	↕	↕		7	r← r+q+C
	SUB	r, q	1	0	1	0	1	0	1	0	r1	r0	q1	q0	★	↕	↕		7	r← r-q
	SBC	r, i	1	1	0	1	0	1	r1	r0	i3	i2	i1	i0	★	↕	↕		7	r← r-i3~i0-C
		r, q	1	0	1	0	1	0	1	1	r1	r0	q1	q0	★	↕	↕		7	r← r-q-C
	AND	r, i	1	1	0	0	1	0	r1	r0	i3	i2	i1	i0		↕			7	r← r∧ i3~i0
		r, q	1	0	1	0	1	1	0	0	r1	r0	q1	q0		↕			7	r← r∧ q
	OR	r, i	1	1	0	0	1	1	r1	r0	i3	i2	i1	i0		↕			7	r← r∨i3~i0
		r, q	1	0	1	0	1	1	0	1	r1	r0	q1	q0		↕			7	r← r∨q
	XOR	r, i	1	1	0	1	0	0	r1	r0	i3	i2	i1	i0		↕			7	r← r∀i3~i0
		r, q	1	0	1	0	1	1	1	0	r1	r0	q1	q0		↕			7	r← r∀q
	CP	r, i	1	1	0	1	1	1	r1	r0	i3	i2	i1	i0		↕	↕		7	r-i3~i0
		r, q	1	1	1	1	0	0	0	0	r1	r0	q1	q0		↕	↕		7	r-q
	FAN	r, i	1	1	0	1	1	0	r1	r0	i3	i2	i1	i0		↕			7	r∧i3~i0
		r, q	1	1	1	1	0	0	0	1	r1	r0	q1	q0		↕			7	r∧q
	RLC	r	1	0	1	0	1	1	1	1	r1	r0	r1	r0		↕	↕		7	d3← d2, d2← d1, d1← d0, d0← C, C← d3
	RRC	r	1	1	1	0	1	0	0	0	1	1	r1	r0		↕	↕		5	d3← C, d2← d3, d1← d2, d0← d1, C← d0
	INC	Mn	1	1	1	1	0	1	1	0	n3	n2	n1	n0		↕	↕		7	M(n3~n0) ← M(n3~n0)+1
	DEC	Mn	1	1	1	1	0	1	1	1	n3	n2	n1	n0		↕	↕		7	M(n3~n0) ← M(n3~n0)-1
	ACPX	MX, r	1	1	1	1	0	0	1	0	1	0	r1	r0	★	↕	↕		7	M(X) ← M(X)+r+C, X ← X+1
	ACPY	MY, r	1	1	1	1	0	0	1	0	1	1	r1	r0	★	↕	↕		7	M(Y) ← M(Y)+r+C, Y ← Y+1
	SCPX	MX, r	1	1	1	1	0	0	1	1	1	0	r1	r0	★	↕	↕		7	M(X) ← M(X)-r-C, X← X+1
	SCPY	MY, r	1	1	1	1	0	0	1	1	1	1	r1	r0	★	↕	↕		7	M(Y) ← M(Y)-r-C, Y ← Y+1
	NOT	r	1	1	0	1	0	0	r1	r0	1	1	1	1		↕			7	r← $\overline{r}$

Abbreviations used in the explanations have the following meanings.

Symbols associated with registers and memory

A A register
B B register
X XHL register
(low order eight bits of index register IX)
Y YHL register
(low order eight bits of index register IY)
XH XH register
(high order four bits of XHL register)
XL XL register
(low order four bits of XHL register)
YH YH register
(high order four bits of YHL register)
YL YL register
(low order four bits of YHL register)
XP XP register
(high order four bits of index register IX)
YP YP register
(high order four bits of index register IY)
SP Stack pointer SP
SPH High-order four bits of stack pointer SP
SPL Low-order four bits of stack pointer SP
MX, M(X) Data memory whose address is specified with index register IX
MY, M(Y) Data memory whose address is specified with index register IY
Mn, M(n) Data memory address 000H–00FH (address specified with immediate data n of 00H–0FH)
M(SP) Data memory whose address is specified with stack pointer SP
r, q Two-bit register code
r, q is two-bit immediate data; according to the contents of these bits, they indicate registers A, B, and MX and MY (data memory whose addresses are specified with index registers IX and IY)

r		q		Register specified
r1	r0	q1	q0	
0	0	0	0	A
0	1	0	1	B
1	0	1	0	MX
1	1	1	1	MY

Symbols associated with program counter

NBP New bank pointer
NPP New page pointer
PCB Program counter bank
PCP Program counter page
PCS Program counter step
PCSH Four high order bits of PCS
PCSL Four low order bits of PCS

Symbols associated with flags

F Flag register (I, D, Z, C)
C Carry flag
Z Zero flag
D Decimal flag
I Interrupt flag
↓ Flag reset
↑ Flag set
◊ Flag set or reset

Associated withimmediate data

p Five-bit immediate data or label 00H–1FH
s Eight-bit immediate data or label 00H–0FFH
l Eight-bit immediate data 00H–0FFH
i Four-bit immediate data 00H–0FH

Associated with arithmetic and other operations

+ Add
- Subtract
∧ Logical AND
∨ Logical OR
∀ Exclusive-OR
★ Add-subtract instruction for decimal operation when the D flag is set

APPENDIX B. E0C623A RAM MAP

PROGRAM NAME:

P	H	L	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	NAME MSB LSB																
	1	NAME MSB LSB																
	2	NAME MSB LSB																
	3	NAME MSB LSB																
	4	NAME MSB LSB																
	9	NAME MSB LSB																
	A	NAME MSB LSB																
	E	NAME MSB LSB	K03 K02 K01 K00	– – – –	SWL3 SWL2 SWL1 SWL0	SWH3 SWH2 SWH1 SWH0	TM3 TM2 TM1 TM0	SD3 SD2 SD1 SD0	SD7 SD6 SD5 SD4	SCTRG SEN SCS1 SCS0	EIK03 EIK02 EIK01 EIK00	– – – EISIO	– – EISW1 EISW0	– EIT2 EIT8 EIT32	– – – ISIO	– – – IK0	– – ISW1 ISW0	– IT2 IT8 IT32
	F	NAME MSB LSB	– – – –	– – – –	– – – –	R03 R02 R01 R00	– – – –	– – – –	P03 P02 P01 P00	– – – –	– – – –	– TMRST SWRUN SWRST	HLMOD – SVDDT SVDON	CSDC – – –	– – – IOC	XBZR – XFOUT1 XFOUT0	– – – –	– – – –

APPENDIX C. E0C623A I/O MEMORY MAP

Address	Register								Comment
	D3	D2	D1	D0	Name	Init	1	0	
0E0H	K03	K02	K01	K00	K03	–	High	Low	Input port data K03
					K02	–	High	Low	Input port data K02
	R				K01	–	High	Low	Input port data K01
					K00	–	High	Low	Input port data K00
0E2H	SWL3	SWL2	SWL1	SWL0	SWL3	0			Stopwatch timer data 3 (1/100 sec) MSB
					SWL2	0			Stopwatch timer data 2 (1/100 sec)
	R				SWL1	0			Stopwatch timer data 1 (1/100 sec)
					SWL0	0			Stopwatch timer data 0 (1/100 sec) LSB
0E3H	SWH3	SWH2	SWH1	SWH0	SWH3	0			Stopwatch timer data 3 (1/10 sec) MSB
					SWH2	0			Stopwatch timer data 2 (1/10 sec)
	R				SWH1	0			Stopwatch timer data 1 (1/10 sec)
					SWH0	0			Stopwatch timer data 0 (1/10 sec) LSB
0E4H	TM3	TM2	TM1	TM0	TM3	–	High	Low	Clock timer data 2 Hz
					TM2	–	High	Low	Clock timer data 4 Hz
	R				TM1	–	High	Low	Clock timer data 8 Hz
					TM0	–	High	Low	Clock timer data 16 Hz
0E5H	SD3	SD2	SD1	SD0	SD3	–	High	Low	Serial interface data 3
					SD2	–	High	Low	Serial interface data 2
	R/W				SD1	–	High	Low	Serial interface data 1
					SD0	–	High	Low	Serial interface data 0 (LSB)
0E6H	SD7	SD6	SD5	SD4	SD7	–	High	Low	Serial interface data 7 (MSB)
					SD6	–	High	Low	Serial interface data 6
	R/W				SD5	–	High	Low	Serial interface data 5
					SD4	–	High	Low	Serial interface data 4
0E7H	SCTRG	SEN	SCS1	SCS0	SCTRG	–	Trigger	–	Serial interface clock trigger
	SCRUN				SCRUN	–	Run	Stop	Serial interface clock Run/Stop
	W	R/W			SEN	0	Falling	Rising	Serial interface clock edge selection
	R				SCS1	0			Serial interface clock mode selection
					SCS0	0			Serial interface clock mode selection
0E8H	EIK03	EIK02	EIK01	EIK00	EIK03	0	Enable	Mask	Interrupt mask register (K03)
					EIK02	0	Enable	Mask	Interrupt mask register (K02)
	R/W				EIK01	0	Enable	Mask	Interrupt mask register (K01)
					EIK00	0	Enable	Mask	Interrupt mask register (K00)
0E9H	0	0	0	EISIO	0				
					0				
	R			R/W	0				
					EISIO	0	Enable	Mask	Interrupt mask register (serial interface)
0EAH	0	0	EISW1	EISW0	0				
					0				
	R		R/W		EISW1	0	Enable	Mask	Interrupt mask register (stopwatch timer 1 Hz)
					EISW0	0	Enable	Mask	Interrupt mask register (stopwatch timer 10 Hz)
0EBH	0	EIT2	EIT8	EIT32	0				
					EIT2	0	Enable	Mask	Interrupt mask register (clock timer 2 Hz)
	R	R/W			EIT8	0	Enable	Mask	Interrupt mask register (clock timer 8 Hz)
					EIT32	0	Enable	Mask	Interrupt mask register (clock timer 32 Hz)
0ECH	0	0	0	ISIO	0				
					0				
	R				0				
					ISIO	0	Yes	No	Interrupt factor flag (serial interface)
0EDH	0	0	0	IK0	0				
					0				
	R				0				
					IK0	0	Yes	No	Interrupt factor flag (K00–K03)
0EEH	0	0	ISW1	ISW0	0				
					0				
	R				ISW1	0	Yes	No	Interrupt factor flag (stopwatch timer 1 Hz)
					ISW0	0	Yes	No	Interrupt factor flag (stopwatch timer 10 Hz)
0EFH	0	IT2	IT8	IT32	0				
					IT2	0	Yes	No	Interrupt factor flag (clock timer 2 Hz)
	R				IT8	0	Yes	No	Interrupt factor flag (clock timer 8 Hz)
					IT32	0	Yes	No	Interrupt factor flag (clock timer 32 Hz)

Address	Register								Comment
	D3	D2	D1	D0	Name	Init *1	1	0	
0F3H	R03	R02	R01	R00	R03	0	High	Low	Output port data R03
			BUZZER	FOUT	R02	0	High	Low	Output port data R02
					R01	0	High	Low	Output port data R01
	R/W				BUZZER	0	On	Off	Buzzer On/Off control register
					R00	0	High	Low	Output port data R00
					FOUT	0	On	Off	Frequency output control register
0F6H	P03	P02	P01	P00	P03	–	High	Low	I/O port data P03
					P02	–	High	Low	I/O port data P02
	R/W				P01	–	High	Low	I/O port data P01
					P00	–	High	Low	I/O port data P00
0F9H	0	TMRST	SWRUN	SWRST	0				
					TMRST	Reset	Reset	–	Clock timer reset
	R	W	R/W	W	SWRUN	0	Run	Stop	Stopwatch timer Run/Stop
					SWRST	Reset	Reset	–	Stopwatch timer reset
0FAH	HLMOD	0	SVDDT	SVDON	HLMOD	0	Heavy	Normal	Heavy load protection mode register
					0				
	R/W	R		R/W	SVDDT	0	Low	Normal	Supply voltage detection data
					SVDON	0	On	Off	Supply voltage detection circuit On/Off
0FBH	CSDC	0	0	0	CSDC	0	Static	Dynamic	LCD drive switch
					0				
	R/W	R			0				
					0				
0FCH	0	0	0	IOC	0				
					0				
	R			R/W	0				
					IOC	0	Out	In	I/O port I/O control register
0FDH	XBZR	0	XFOUT1	XFOUT0	XBZR	0	2 kHz	4 kHz	Buzzer frequency control
					0				
	R/W	R	R/W		XFOUT1	0			FOUT frequency control
					XFOUT0	0			FOUT frequency control

APPENDIX D. TROUBLESHOOTING

Tool	Problem	Remedy measures
ICE6200	Nothing appears on the screen, or nothing works, after activation.	Check the following and remedy if necessary: • Is the RS-232C cable connected correctly? • Is the RS-232C driver installed? • Is SPEED.COM or MODE.COM on the disk? • Is the execution file correct? MS-DOS ICS623AJ.EXE PC-DOS ICS623AW.EXE • Is the DOS version correct? MS-DOS Ver. 3.1 or later PC-DOS Ver. 2.1 or later • Is the DIP switches that set the baud rate of the main ICE6200 unit set correctly? • Is the breaker of the ICE6200 set to ON?
	The ICE6200 breaker tripped immediately after activation.	Check the following and remedy if necessary: • Are connectors F1 and F5 connected to the EVA623A correctly? • Is the target board power short-circuiting?
	<ILLEGAL VERSION ICE6200> appears on the screen immediately after activation.	The wrong version of ICE6200 is being used. Use the latest version.
	<ILLEGAL VERSION PARAMETER FILE> appears on the screen immediately after activation.	The wrong version of ICS623AP.PAR is being used. Use the latest version.
	Immediate values A (10) and B (11) cannot be entered correctly with the A command.	The A and B registers are reserved for the entry of A and B. Write 0A and 0B when entering A (10) and B (11). *Example:* `LD A, B` Data in the B register is loaded into the A register. `LD B, 0A` Immediate value A is loaded into the B register.
	<UNUSED AREA> is displayed by the SD command.	This message is output when the address following one in which data is written is unused. It does not indicates problem. Data is correctly set in areas other than the read-only area.
	You can not do a real-time run in break-trace mode.	Since the CPU stops temporarily when breaking conditions are met, executing in a real-time is not performed.
	Output from the EVA is impossible when data is written to the I/O memory for Buzzer and Fout output with the ICE command.	Output is possible only in the real-time run mode.
SOG623A	An R error occurs although the address is correctly set in the segment source file.	Check the following and remedy if necessary: • Does the address symbol use capital letters? • Are the output ports set for every two terminals?

Tool	Problem	Remedy measures
ASM623A	An R error occurs although the final page is passed.	The cross assembler is designed to output "R error" every time the page is changed. Use a pseudo-instruction to set the memory, such as ORG or PAGE, to change the page. See "Memory setting pseudo-instructions" in the cross assembler manual.
MDC623A	Activation is impossible.	Check the following and remedy if necessary: • Is the number of files set at ten or more in OS environment file CONFIG.SYS?
EVA623A	The EVA623A does not work when it is used independently.	Check the following and remedy if necessary: • Has the EPROM for F.HEX and S.HEX been replaced by the EPROM for the target? • Is the EPROM for F.HEX and S.HEX installed correctly? • Is the appropriate voltage being supplied? (5V DC, 3A, or more) • Are the program ROMs (H and L) installed correctly? • Is data written from address 4000H? (When the 27C256 is used as the program ROM) • Is the EN/DIS switch on the EVA623A set to EN?
	Target segment does not light.	Check the following and remedy if necessary: • Is an EPROM with an access time of 170 ns or less being used for S.HEX. • Has the VADJ VR inside the EVA623A top cover been turned to a lower setting?

EPSON International Sales Operations

AMERICA

S-MOS SYSTEMS, INC.
150 River Oaks Parkway
San Jose, CA 95134, U.S.A.
Phone: +1-408-922-0200 Fax: +1-408-922-0238
Telex: 176079 SMOS SNJUD

S-MOS SYSTEMS, INC.
EASTERN AREA SALES AND TECHNOLOGY CENTER
301 Edgewater Place, Suite 120
Wakefield, MA 01880, U.S.A.
Phone: +1-617-246-3600 Fax: +1-617-246-5443

S-MOS SYSTEMS, INC.
SOUTH EASTERN AREA SALES AND TECHNOLOGY CENTER
4300 Six Forks Road, Suite 430
Raleigh, NC 27609, U.S.A.
Phone: +1-919-781-7667 Fax: +1-919-781-6778

S-MOS SYSTEMS, INC.
CENTRAL AREA SALES AND TECHNOLOGY CENTER
1450 E.American Lane, Suite 1550
Schaumburg, IL 60173, U.S.A.
Phone: +1-847-517-7667 Fax: +1-847-517-7601

EUROPE

- HEADQUARTERS -
EPSON EUROPE ELECTRONICS GmbH
Riesstrasse 15
80992 Muenchen, GERMANY
Phone : +49-(0)89-14005-0 Fax : +49-(0)89-14005-110

- GERMANY -
EPSON EUROPE ELECTRONICS GmbH
SALES OFFICE
Breidenbachstrasse 46
D-51373 Leverkusen, GERMANY
Phone : +49-(0)214-83070-0 Fax : +49-(0)214-83070-10

- UNITED KINGDOM -
EPSON EUROPE ELECTRONICS GmbH
UK BRANCH OFFICE
G6 Doncastle House, Doncastle Road
Bracknell, Berkshire RG12 8PE, ENGLAND
Phone: +44-(0)1344-381700 Fax: +44-(0)1344-381701

- FRANCE -
EPSON EUROPE ELECTRONICS GmbH
FRENCH BRANCH OFFICE
1 Avenue de l' Atlantique, LP 915 Les Conquerants
Z.A. de Courtaboeuf 2, F-91976 Les Ulis Cedex, FRANCE
Phone: +33-(0)1-64862350 Fax: +33-(0)1-64862355

ASIA

- HONG KONG, CHINA -
EPSON HONG KONG LTD.
20/F., Harbour Centre, 25 Harbour Road
Wanchai, HONG KONG
Phone: +852-2585-4600 Fax: +852-2827-4346
Telex: 65542 EPSCO HX

- CHINA -
SHANGHAI EPSON ELECTRONICS CO., LTD.
4F, Bldg., 27, No. 69, Gui Jing Road
Caohejing, Shanghai, CHINA
Phone: 21-6485-5552 Fax: 21-6485-0775

- TAIWAN, R.O.C. -
EPSON TAIWAN TECHNOLOGY & TRADING LTD.
10F, No. 287,Nanking East Road, Sec. 3
Taipei, TAIWAN, R.O.C.
Phone: 02-2717-7360 Fax: 02-2712-9164
Telex: 24444 EPSONTB

EPSON TAIWAN TECHNOLOGY & TRADING LTD.
HSINCHU OFFICE
13F-3,No.295,Kuang-Fu Road,Sec.2
HsinChu 300,TAIWAN,R.O.C.
Phone: 03-573-9900 Fax: 03-573-9169

- SINGAPORE -
EPSON SINGAPORE PTE., LTD.
No. 1 Temasek Avenue, #36-00
Millenia Tower, SINGAPORE 039192
Phone: +65-337-7911 Fax: +65-334-2716

- KOREA -
SEIKO EPSON CORPORATION
KOREA OFFICE
10F, KLI 63 Bldg., 60 Yoido-Dong
Youngdeungpo-Ku, Seoul, 150-010, KOREA
Phone: 02-784-6027 Fax: 02-767-3677

- JAPAN -
SEIKO EPSON CORPORATION
ELECTRONIC DEVICES MARKETING DIVISION

Electronic Device Marketing Department
IC Marketing & Engineering Group
421-8, Hino, Hino-shi, Tokyo 191-8501, JAPAN
Phone: +81-(0)42-587-5816 Fax: +81-(0)42-587-5624

ED International Marketing Department I
(Europe & U.S.A.)
421-8, Hino, Hino-shi, Tokyo 191-8501, JAPAN
Phone: +81-(0)42-587-5812 Fax: +81-(0)42-587-5564

ED International Marketing Department II (Asia)
421-8, Hino, Hino-shi, Tokyo 191-8501, JAPAN
Phone: +81-(0)42-587-5814 Fax: +81-(0)42-587-5110

In pursuit of **“Saving” Technology**, Epson electronic devices.
Our lineup of semiconductors, liquid crystal displays and quartz devices
assists in creating the products of our customers’ dreams.
Epson IS energy savings.

EPSON

SEIKO EPSON CORPORATION
ELECTRONIC DEVICES MARKETING DIVISION

■ Electronic devices information on the Epson WWW server

http://www.epson.co.jp

Issue APRIL 1998 Printed in Japan Ⓜ A