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EPSON

CMOS 4-BIT SINGLE CHIP MICROCOMPUTER

E0C6274 DEVELOPMENT TOOL MANUAL

ENERGY SAVING EPSON

SEIKO EPSON CORPORATION

E0C6274 Development Tool Manual

PREFACE

This manual mainly explains the outline of the development support tool for the 4-bit Single Chip Microcomputer E0C6274.

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 EVA6274 Manual ICE6200 Hardware Manual
Development procedure	☞ E0C62 Family Technical Guide
Device (E0C6274)	☞ E0C6274 Technical Manual
Instructions	☞ E0C6200/6200A Core CPU Manual

CONTENTS

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 DEV6274

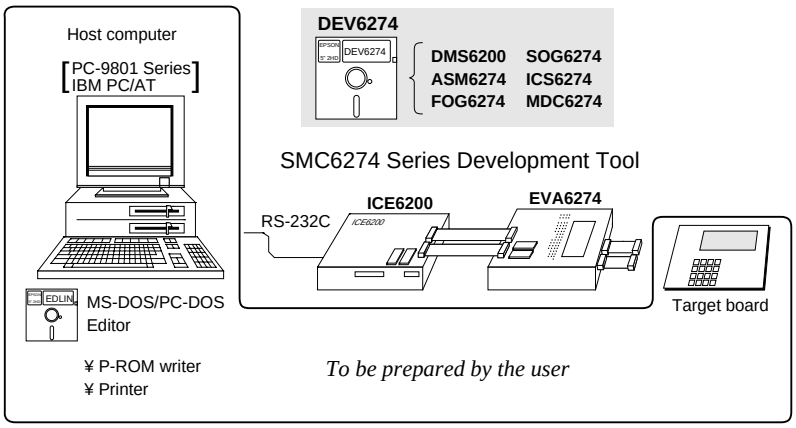
The below software are included in the product of the E0C6274 development support tool DEV6274.

1. Development Tool Management System DMS6200 ..... Menu selection for each software / start-up software
2. Cross Assembler ASM6274 ..... Cross assembler for program preparation
3. Function Option Generator FOG6274 ..... Function option data preparation program
4. Segment Option Generator SOG6274 ..... Segment option data preparation program
5. ICE Control Software ICS6274 ..... ICE control program
6. Mask Data Checker MDC6274 ..... Mask data preparation program

1.2 Developmental Environment

The software product of the development support tool DEV6274 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 E0C6274, 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 DEV6274 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 DEV6274.

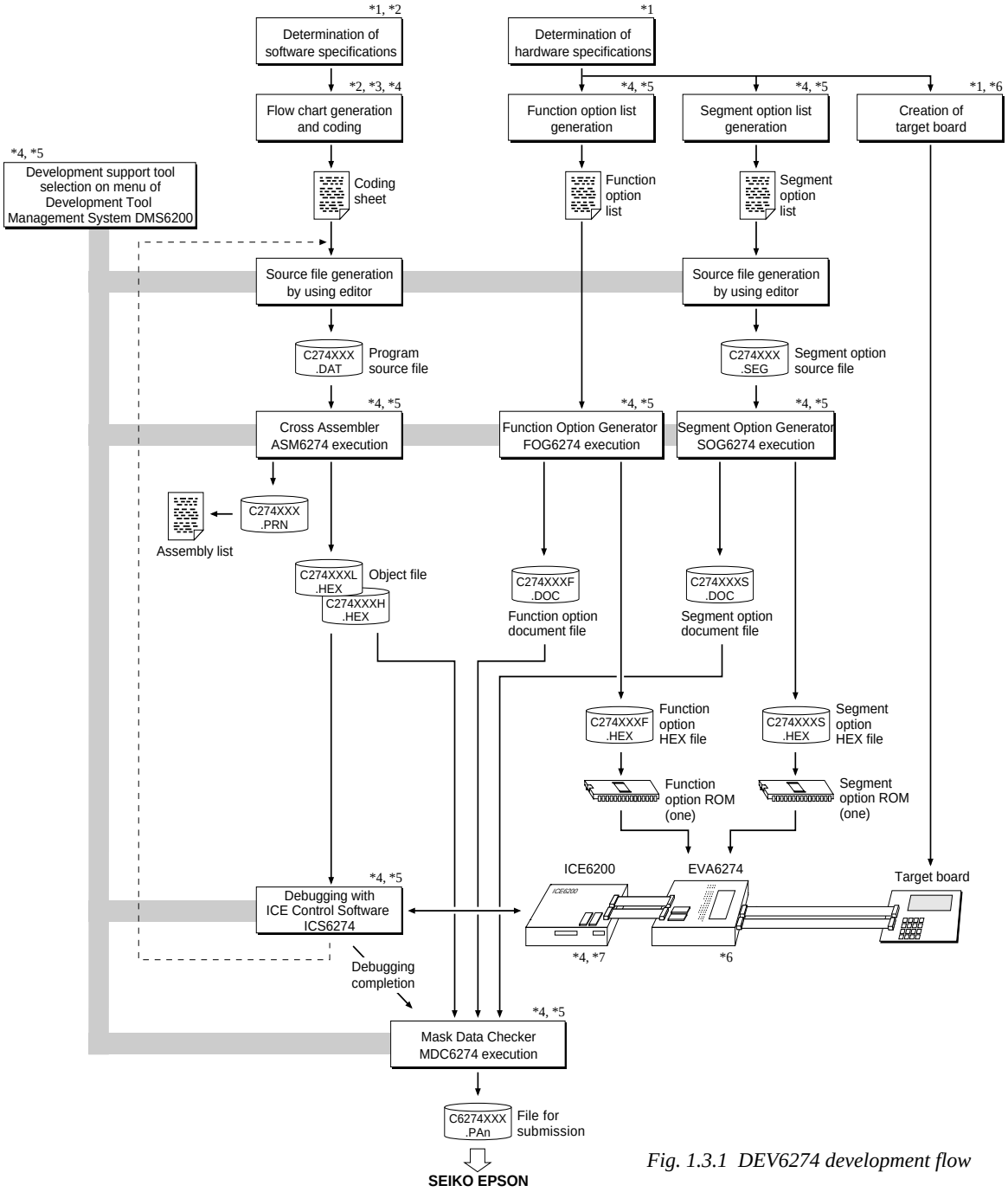


Fig. 1.3.1 DEV6274 development flow

Concerning file names

All the input-output file name for the each development support tool commonly use "C274XXX". In principle each file should be produced in this manner. Seiko Epson will designate the "XXX" for each customer.

☞ Reference Manual

*1 E0C6274 Technical Hardware Manual
*2 E0C6274 Technical Software Manual
*3 E0C6200/6200A Core CPU Manual
*4 E0C62 Family Development Tool Reference Manual
*5 E0C6274 Development Tool Manual (this manual)
*6 EVA6274 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 DEV6274 floppy disk.
The content of the files contained in the DEV6274 floppy disk are shown below.

PC-DOS version	MS-DOS version	Contents
ASM6274.EXE	ASM6274.EXE	Cross Assembler execution file
DMS6200.EXE	DMS6200.EXE	Development Tool Management System execution file
FOG6274.EXE	FOG6274.EXE	Function Option Generator execution file
ICS6274B.BAT	ICS6274.BAT	ICE Control Software batch file
ICS6274W.EXE	ICS6274J.EXE	ICE Control Software execution file
ICS6274P.PAR	ICS6274P.PAR	ICE Control Software parameter file
MDC6274.EXE	MDC6274.EXE	Mask Data Checker execution file
SOG6274.EXE	SOG6274.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 (DEV6274, 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 (DEV6274), then insert the original disk into the A drive and execute the COPY command.

```
C\>MD DEV6274↵
C\>CD DEV6274↵
C\DEV6274\>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 MDC6274 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 "ICS6274(B).BAT" the batch process is indicated such that the ICS6274J(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 DEV6274 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.

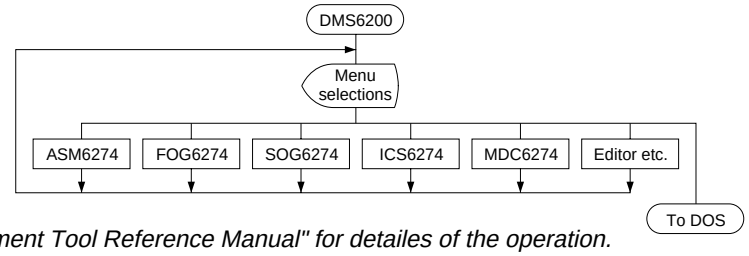


Fig. 2.1.1 DMS6200 execution flow

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       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

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                         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 returns to the DOS command level.

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

1) ASM6274 .EXE
2) FOG6274 .EXE
3) ICS6274B.BAT
4) ICS6274W.EXE
5) MDC6274 .EXE
6) SOG6274 .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) C274XXX .DAT
 2) C274XXX .PRN
 3) C274XXX .SEG
  :     :
10) C6274XXX.PA0

 Input Number ? [1  ]

   Edit > [ASM6274 C274XXX                                        ]
```

Source file selection screen
To starting ASM6274, 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 ASM6274

3.1 ASM6274 Outline

The ASM6274 cross assembler is an assembler program for generating the machine code used by the E0C6274 4-bit, single-chip microcomputers. The Cross Assembler ASM6274 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.*

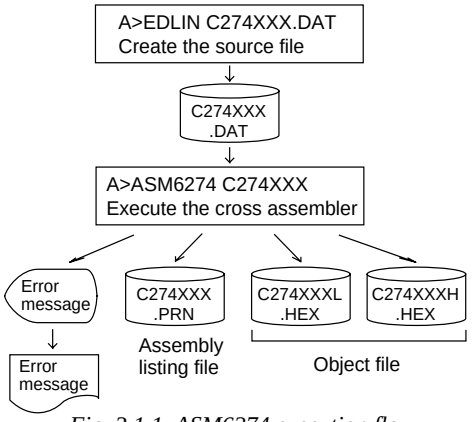

Fig. 3.1.1 ASM6274 execution flow

3.2 E0C6274 Restrictions

Note the following when generating a program by the E0C6274:

■ ROM area

The capacity of the E0C6274 ROM is 4K steps (0000H to 0FFFH).
Therefore, the specification range of the memory setting pseudo-instructions and PSET instruction is restricted.

Memory configuration:

Bank: Only bank 0, Page: 16 pages (0 to 0FH), each 256 steps

Significant specification range:

ORG	pseudo-instruction:	0000H to 0FFFH
PAGE	pseudo-instruction:	00H to 0FH
BANK	pseudo-instruction:	Only 0H
PSET	instruction:	00H to 0FH

■ RAM area

The capacity of the E0C6274 RAM is 600 words (000H to 3FFH, 4 bits/word).
However, note the following points when programming.

(1) The following addresses become unused area. Memory access is invalid when the unused area is specified.
0A0H–0BFH, 0C7H, 0CDH–0CFH, 0D5H, 0FCH–0FEH, 1A0H–1BFH, 1C7H, 1CDH–1CFH, 1D5H, 1FCH–1FEH
2A0H–2BFH, 2C7H, 2CDH–2CFH, 2D5H, 2FCH–2FEH, 3A0H–3BFH, 3C7H, 3CDH–3CFH, 3D5H, 3FCH–3FEH

(2) Since RAM is set for up to 3 page, only the subordinate 2 bits of the page section of the index register which specifies address is effective. (The 2 superordinate bits are ignored.)

Example:

```
LD   A,4
LD   XP,A
LD   X,0D5H
```

0D5H 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.

3.3 ASM6274 Quick Reference

■ Starting command and input/output files

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

Execution file: ASM6274.EXE

Starting command: **ASM6274_ [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: C274XXX.DAT (Source file)

Output file: C274XXXL.HEX (Object file, low-order)
C274XXXH.HEX (Object file, high-order)
C274XXX.PRN (Assembly listing file)

■ Display example

```
          *** E0C6274 CROSS ASSEMBLER. --- Ver 2.00 ***

 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

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          SOURCE FILE NAME IS " C274XXX.DAT "

          THIS SOFTWARE MAKES NEXT FILES.

             C274XXXH.HEX  ...  HIGH BYTE OBJECT FILE.
             C274XXXL.HEX  ...  LOW BYTE OBJECT FILE.
             C274XXX .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 ASM6274 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, ASM6274 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)	• A statement exceeded a page boundary although its location was not specified. • 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.
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 FOG6274

4.1 FOG6274 Outline

With the 4-bit single-chip E0C6274 microcomputers, the customer may select five hardware options. By modifying the mask patterns of the E0C6274 according to the selected options, the system can be customized to meet the specifications of the target system.
The Function Option Generator FOG6274 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 FOG6274, the E0C6274 mask pattern is automatically generated by a general purpose computer.
The HEX file for the evaluation board (EVA6274) 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.*

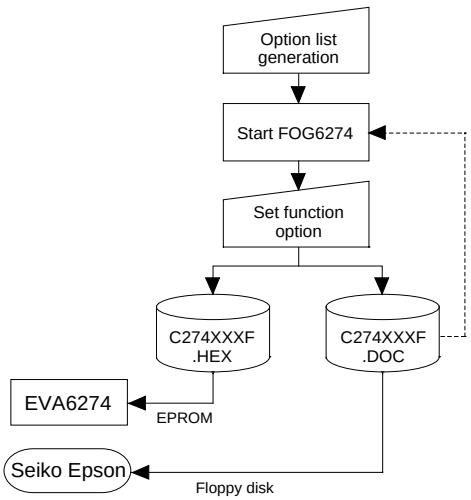


Fig. 4.1.1 FOG6274 execution flow

4.2 E0C6274 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. OSC3 SYSTEM CLOCK

☐ 1. Not Use
☐ 2. Use <CR>
☐ 3. Use <Ceramic>

2. MULTIPLE KEY ENTRY RESET

- COMBINATION ..... ☐ 1. Not Use
  ☐ 2. Use <K00, K01>
  ☐ 3. Use <K00, K01, K02>
  ☐ 4. Use <K00, K01, K02, K03>
- TIME AUTHORIZE ..... ☐ 1. Not Use ☐ 2. Use

3. INPUT PORT PULL UP 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
- K10 ..... ☐ 1. With Resistor ☐ 2. Gate Direct

4. OUTPUT PORT OUTPUT SPECIFICATION

- R00 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- R01 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- R02 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- R03 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain

5. I/O PORT OUTPUT SPECIFICATION

- P00 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P01 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P02 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P03 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P10 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P11 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P12 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P13 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P20 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P21 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P22 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain
- P23 ..... ☐ 1. Complementary ☐ 2. Nch-OpenDrain

6. ADJUSTMENT FOR V_{R1}

☐ 1. External Resistor
☐ 2. Internal Resistor

4.3 Option Specifications and Selection Message

Screen that can be selected as function options set on the E0C6274 are shown below, and their specifications are also described.

1 OSC3 system clock

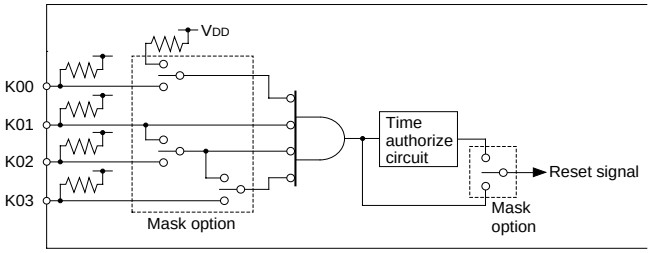
```
*** OPTION  NO.1 ***

--- OSC3 SYSTEM CLOCK ---
                          1. NOT USE
                          2. USE <CR>
                          3. USE <CERAMIC>

PLEASE SELECT NO.(1) ? 2↵

                          2. USE <CR>  SELECTED
```

Select oscillation circuit that uses OSC3 and OSC4. To minimize external components, CR oscillation circuit would be suitable; to obtain a stable oscillation frequency, ceramic 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 ceramic oscillation circuit is selected, ceramic oscillator, gate capacity and drain capacity are needed as external components.

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↵

       TIME AUTHORIZE    1. NOT USE
                         2. USE

PLEASE SELECT NO.(1) ? 1↵

       COMBINATION       2. USE <K00,K01>  SELECTED
       TIME AUTHORIZE    1. NOT USE  SELECTED
```

* If "Not Use" is set for the combination, the time authorize selection is required.



The reset function and time authorize circuit are set when K00 through K03 are entered.
When "Not Use" is set for the combination, the reset function is not activated even if K00 through K03 are entered. When "Use <K00, K01>" is set, the system is reset immediately the K00 and K01 inputs go low at the same time. Similarly, the system is reset as soon as the K00 through K02 inputs or the K00 through K03 inputs go low.
When "Use" is set for the time authorize circuit, a simultaneous low input time is authorized. The system is reset when a signal is input for more than 1 to 2 sec.
If the time authorize circuit is not used, the system is reset when a low signal is input for more than 1.5 msec.
The multiple key entry reset circuit is shown in Figure 4.3.1.

Fig. 4.3.1
Multiple key entry reset circuit

3 Input port pull up resistor

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

--- INPUT PORT PULL UP 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↵

       K10               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
       K10               1. WITH RESISTOR  SELECTED
```

Select whether input ports (K00–K03 and K10) will each be supplemented with pull up resistors or not. When "Gate Direct" is selected, see to it that entry floating state does not occur. Select "With Resistor" pull up resistor for unused ports.
Moreover, the input port status is changed from low level (VSS) to high (VDD) with pull up resistors, a delay in waveform rise time will occur depending on the pull up 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 up resistor circuit is shown in Figure 4.3.2.

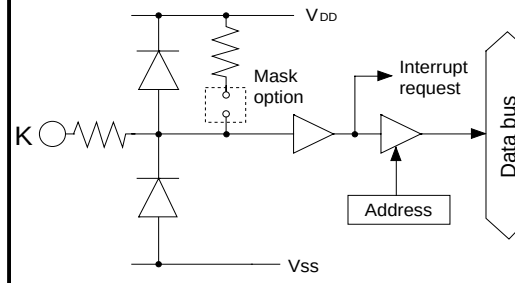


Fig. 4.3.2 Configuration of pull up resistor circuit

4 Output port output specification

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

--- OUTPUT PORT OUTPUT SPECIFICATION ---
        R00             1. COMPLEMENTARY
                        2. NCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        R01             1. COMPLEMENTARY
                        2. NCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        R02             1. COMPLEMENTARY
                        2. NCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        R03             1. COMPLEMENTARY
                        2. NCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        R00             1. COMPLEMENTARY  SELECTED
        R01             1. COMPLEMENTARY  SELECTED
        R02             1. COMPLEMENTARY  SELECTED
        R03             1. COMPLEMENTARY  SELECTED
```

Select the output specification for the output ports (R00–R03).
Either complementary output or Nch open drain output may be selected.
When output port is to be used on key matrix configuration, select Nch open drain output.
For unused output ports, select complementary output.
The output circuit configuration is shown in Figure 4.3.3.

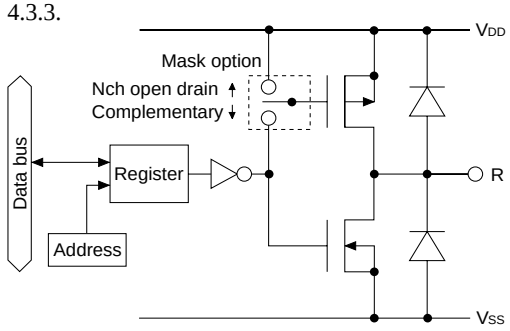


Fig. 4.3.3 Configuration of output circuit

5 I/O port output specification

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

--- I/O PORT OUTPUT SPECIFICATION ---
        P00             1. COMPLEMENTARY
                        2. NCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        P01             1. COMPLEMENTARY
                        2. NCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

                        :

       (Selection for P02–P03, P10–K13 and P20–P22)

                        :

PLEASE SELECT NO.(1) ? 1↵

        P23             1. COMPLEMENTARY
                        2. NCH-OPENDRAIN

PLEASE SELECT NO.(1) ? 1↵

        P00             1. COMPLEMENTARY  SELECTED
        P01             1. COMPLEMENTARY  SELECTED
        P02             1. COMPLEMENTARY  SELECTED
        P03             1. COMPLEMENTARY  SELECTED
        P10             1. COMPLEMENTARY  SELECTED
        P11             1. COMPLEMENTARY  SELECTED
        P12             1. COMPLEMENTARY  SELECTED
        P13             1. COMPLEMENTARY  SELECTED
        P20             1. COMPLEMENTARY  SELECTED
        P21             1. COMPLEMENTARY  SELECTED
        P22             1. COMPLEMENTARY  SELECTED
        P23             1. COMPLEMENTARY  SELECTED
```

Select the output specification to be used during I/O ports (P00–P03, P10–P13 and P20–P23) output mode selection.
Either complementary output or Nch open drain output may be selected.
The circuit configuration of the output driver is the same as that of output ports (R00–R03 shown in Figure 4.3.3).
Select complementary output for unused ports.

The I/O ports can control the input/output direction according to the IOC0–IOC2 register (D6 address, D0 bit–D2 bit); at "1" and "0" settings, it is set to output port and input port, respectively.

When the serial interface function is selected, the output specification of the terminals SOUT, $\overline{\text{SCLK}}$ (during the master mode) and $\overline{\text{SRDY}}$ (during the slave mode) that is used as output in the input/output port of the serial interface is respectively selected by the mask options of P21, P22 and P23.
Selects complementary output for the SIN (P20) output specification.

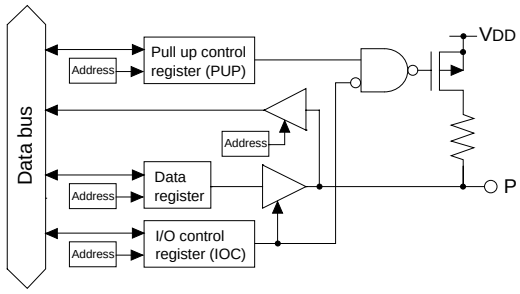


Fig. 4.3.4 Circuit configuration of I/O port

The I/O port circuit configuration is shown in Figure 4.3.4.

6 Adjustment for VR1

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

--- ADJUSTMENT FOR VR1 ---
                      1. EXTERNAL RESISTOR
                      2. INTERNAL RESISTOR

PLEASE SELECT NO.(1) ? 1↵

                      1. EXTERNAL RESISTOR  SELECTED
```

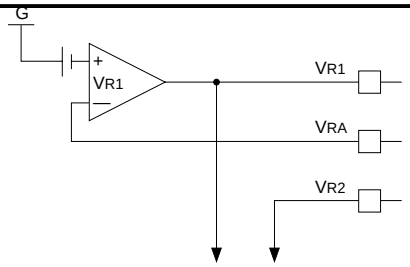


Fig. 3.4.5 Reference voltage generation circuit (when EXTERNAL RESISTOR is selected)

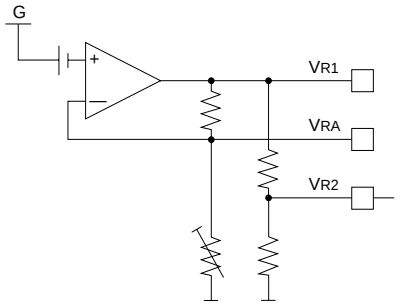


Fig. 3.4.6 Reference voltage generation circuit (when INTERNAL RESISTOR is selected)

Select whether the resistor circuit that adjusts the reference voltage V_{R1} should be attached externally or built into the circuit.
This circuit is required to adjust the reference voltage and other factors that determine A/D precision. When in the resistance measurement mode, it adjusts an input voltage range by means of V_{R1}, and when in the voltage measurement mode and difference voltage measurement mode, it assures precision by generating a V_{R2} reference voltage from V_{R1} divided by resistors.
When "EXTERNAL RESISTOR" is selected, V_{R1}, V_{RA} and V_{R2} are released as shown in Figure 3.4.5, and V_{R1} may be adjusted by an external resistor circuit. The example for the external resistor circuit that supplies the voltage divided from V_{R1} by a resistor to V_{R2} is shown in the Technical Hardware Manual, so you should it as reference.
When "INTERNAL RESISTOR" is selected, the resistor circuit is built-in to supply the reference voltage to V_{R2} as shown in Figure 3.4.6.
"EXTERNAL RESISTOR" setting is effective more than "INTERNAL RESISTOR" setting with respect to both precision and temperature characteristics, so use either of them as applicable.
Refer to the Technical Hardware Manual, for the precision when using either of them.

However, since the EVA6274 is fixed at "INTERNAL RESISTOR", switching of this option is invalid. Refer to "Differences from Actual IC" in the EVA6274 Manual, for the method permitting "EXTERNAL RESISTOR" setting.

4.4 FOG6274 Quick Reference

■ Starting command and input/output files

Execution file: FOG6274.EXE

Starting command: **FOG6274**↵ ↵ *indicates the Return key.*

Input file: C274XXXF.DOC (Function option document file, when modifying)

Output file: C274XXXF.DOC (Function option document file)
C274XXXF.HEX (Function option HEX file)

■ Display example

```
     ***  E0C6274 FUNCTION OPTION GENERATOR. --- Ver 3.13  ***

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.

            C274XXXF.HEX  ...  FUNCTION OPTION HEX FILE.
            C274XXXF.DOC  ...  FUNCTION OPTION DOCUMENT FILE.

                         STRIKE ANY KEY.
```

Start-up message
When FOG6274 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.

```
*** E0C6274 USER'S OPTION SETTING. --- Ver 3.13 ***

CURRENT DATE IS  92/12/01
PLEASE INPUT NEW DATE  :   92/12/20↵
```

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 FOG6274.

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

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

PLEASE SELECT NO.? 1↵
PLEASE INPUT FILE NAME? C2740A0↵                          ..(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? C2740A0↵
EXISTS OVERWRITE(Y/N)? N↵
PLEASE INPUT FILE NAME? C2740B0↵
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) ***

C2740A0         C2740B0         C2740C0                 ..(1)

PLEASE INPUT FILE NAME? C2740A0↵                        ..(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? C2740N0↵
FUNCTION OPTION DOCUMENT FILE IS NOT FOUND.
PLEASE INPUT FILE NAME?
```

In addition, if specified file format is different (such as document file for the other model), the following message is displayed and FOG6274 is terminated.

```
BAD FUNCTION OPTION DOCUMENT FILE.
```

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 EVA6274, 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 EVA6274 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

```
* E0C6274 FUNCTION OPTION DOCUMENT  V 3.13
*
* FILE NAME    C2740A0F.DOC
* USER'S NAME  SEIKO EPSON CORP.
* INPUT DATE   92/12/01
*
* COMMENT      TOKYO DESIGN CENTER
*              421-8 HINO HINO-SHI TOKYO 191 JAPAN
*              TEL 0425-84-2551
*              FAX 0425-84-8512
*
*
* OPTION NO.1
* < OSC3 SYSTEM CLOCK >
*                             NOT USE  ------------------------  SELECTED
 OPT0101 01
*
* OPTION NO.2
* < MULTIPLE KEY ENTRY RESET >
*     COMBINATION             NOT USE  ------------------------  SELECTED
*     TIME AUTHORIZE          NOT USE  ------------------------  SELECTED
 OPT0201 01
 OPT0202 01
*
* OPTION NO.3
* < INPUT PORT PULL UP RESISTOR >
*     K00                     WITH RESISTOR  -----------------  SELECTED
*     K01                     WITH RESISTOR  -----------------  SELECTED
*     K02                     WITH RESISTOR  -----------------  SELECTED
*     K03                     WITH RESISTOR  -----------------  SELECTED
*     K10                     WITH RESISTOR  -----------------  SELECTED
 OPT0301 01
 OPT0302 01
 OPT0303 01
 OPT0304 01
 OPT0305 01
*
* OPTION NO.4
* < OUTPUT PORT OUTPUT SPECIFICATION >
*     R00                     COMPLEMENTARY  -----------------  SELECTED
*     R01                     COMPLEMENTARY  -----------------  SELECTED
*     R02                     COMPLEMENTARY  -----------------  SELECTED
*     R03                     COMPLEMENTARY  -----------------  SELECTED
 OPT0401 01
 OPT0402 01
 OPT0403 01
 OPT0404 01
*
```

```
* OPTION NO.5
* < I/O PORT OUTPUT SPECIFICATION >
*     P00                     COMPLEMENTARY  -----------------  SELECTED
*     P01                     COMPLEMENTARY  -----------------  SELECTED
*     P02                     COMPLEMENTARY  -----------------  SELECTED
*     P03                     COMPLEMENTARY  -----------------  SELECTED
*     P10                     COMPLEMENTARY  -----------------  SELECTED
*     P11                     COMPLEMENTARY  -----------------  SELECTED
*     P12                     COMPLEMENTARY  -----------------  SELECTED
*     P13                     COMPLEMENTARY  -----------------  SELECTED
*     P20                     COMPLEMENTARY  -----------------  SELECTED
*     P21                     COMPLEMENTARY  -----------------  SELECTED
*     P22                     COMPLEMENTARY  -----------------  SELECTED
*     P23                     COMPLEMENTARY  -----------------  SELECTED
 OPT0501 01
 OPT0502 01
 OPT0503 01
 OPT0504 01
 OPT0505 01
 OPT0506 01
 OPT0507 01
 OPT0508 01
 OPT0509 01
 OPT0510 01
 OPT0511 01
 OPT0512 01
*
* OPTION NO.6
* < ADJUSTMENT FOR VR1 >
*                             EXTERNAL RESISTOR  -------------  SELECTED
 OPT0601 01
*
*
*
* SEIKO EPSON'S AREA
*
*
*
* OPTION NO.7
 OPT0701 01
*
* OPTION NO.8
 OPT0801 01
\\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 SOG6274

5.1 SOG6274 Outline

With the 4-bit single-chip E0C6274 microcomputers, the customer may select the LCD segment options. By modifying the mask patterns of the E0C6274 according to the selected options, the system can be customized to meet the specifications of the target system.
The Segment Option Generator SOG6274 is a software tool for generating data file used to generate mask patterns. From the data file created with SOG6274, the E0C6274 mask pattern is automatically generated by a general purpose computer.
The HEX file for the evaluation board (EVA6274) 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.*

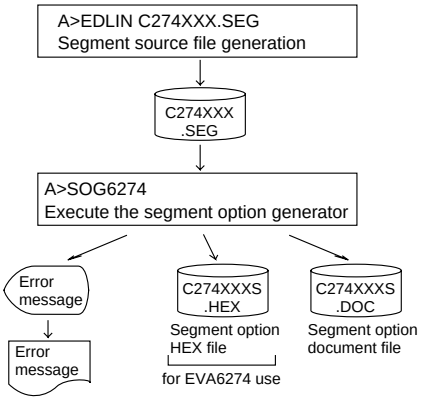


Fig. 5.1.1 SOG6274 execution flow

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 ☐ N
SEG2													SEG output
SEG3													DC output ☐ C ☐ N
SEG4													SEG output
SEG5													DC output ☐ C ☐ N
SEG6													SEG output
SEG7													DC output ☐ C ☐ N
SEG8													SEG output
SEG9													DC output ☐ C ☐ N
SEG10													SEG output
SEG11													DC output ☐ C ☐ N
SEG12													SEG output
SEG13													DC output ☐ C ☐ N
SEG14													SEG output
SEG15													DC output ☐ C ☐ N
SEG16													SEG output
SEG17													DC output ☐ C ☐ N
SEG18													SEG output
SEG19													DC output ☐ C ☐ N
SEG20													SEG output
SEG21													DC output ☐ C ☐ N
SEG22													SEG output
SEG23													DC output ☐ C ☐ N
SEG24													SEG output
SEG25													DC output ☐ C ☐ N
SEG26													SEG output
SEG27													DC output ☐ C ☐ N
SEG28													SEG output
SEG29													DC output ☐ C ☐ N
SEG30													SEG output
SEG31													DC output ☐ C ☐ N

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

Note: 1. Even if there are unused areas, set "---" (hyphens) such that there are no blank columns.
2. When DC output is selected, the display memory of the COM0 column becomes effective.

5.3 Segment Ports Output Specifications

For the output specification of the segment output ports SEG0–SEG31, 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 Nch 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 display memory area (80H–9FH) can be allocated to the optional segment. With this, up to 128 segments (96, 64 or 32 segments when 1/3, 1/2 or 1/1 duty is selected, respectively) of liquid crystal panel could be driven.
The display memory may be allocated only one segment and multiple setting is not possible.
The allocated segment displays when the bit for this display memory is set to "1", and goes out when bit is set to "0".
Segment allocation is set to H for high address (8 or 9), 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  801  800  802  803  S
1  810  811  812  813  S
```

• When 1/3 duty is selected

```
0  800  801  802  ---  S
1  810  811  812  ---  S
```

■ When DC output is selected

The DC output can be selected in units of two terminals and up to 32 terminals may be allocated for DC output. Also, either complementary output or Nch open drain output is likewise selected in units of two terminals. When the bit for the selected display 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 display 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 SEG28 and SEG29, and Nch open drain output is set to SEG30 and SEG31.

```
28  900  ---  ---  ---  C
29  910  ---  ---  ---  C
30  920  ---  ---  ---  N
31  930  ---  ---  ---  N
```

Note *Only complementary output is enabled as the DC output of the SEG ports of EVA6274. Therefore, complementary output is enabled even if Nch open drain output is selected. Respond to it by adding external circuits as required.*

5.4 SOG6274 Quick Reference

■ Starting command and input/output files

Execution file: SOG6274.EXE

Starting command: **SOG6274_ [-H]↵**

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

Option: -H: Specifies the segment option document file for input file of SOG6274.

Input file: C274XXX.SEG (Segment option source file)
C274XXXS.DOC (Segment option document file, when -H option use)

Output file: C274XXXS.DOC (Segment option document file)
C274XXXS.HEX (Segment option HEX file)

■ Display example

```
     ***  E0C6274 SEGMENT OPTION GENERATOR. --- Ver 3.20  ***

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 " C274XXX.SEG "

         THIS SOFTWARE MAKES NEXT FILES.

            C274XXXS.HEX  ...  SEGMENT OPTION HEX FILE.
            C274XXXS.DOC  ...  SEGMENT OPTION DOCUMENT FILE.

                        STRIKE ANY KEY.
```

Start-up message
When SOG6274 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.

```
*** E0C6274 USER'S OPTION SETTING. --- Ver 3.20 ***

CURRENT DATE IS  92/02/17
PLEASE INPUT NEW DATE  :   92/02/20↵
```

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) ***

C2740A0         C2740B0         C2740C0                          . . (1)

PLEASE INPUT SEGMENT OPTION FILE NAME? C2740A0↵                  . . (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? C2740N0↵
SEGMENT OPTION SOURCE FILE IS NOT FOUND.          . . (7)  -H option not use

PLEASE INPUT SEGMENT OPTION DOCUMENT FILE NAME? C2740N0↵
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 EVA6274, 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 EVA6274 options.

When a series of operations are complete, the SOG6274 generates files. If no error is committed while setting segment options, "MAKING FILE IS COMPLETED" will be displayed and the SOG6274 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. Though DC output has been selected for output specification, data are described in COM1–COM3.

5.5 Sample Files

■ Example of segment option source file

```
; C2740A0.SEG, VER.3.20
; EVA6274 LCD SEGMENT DECODE TABLE
;
 0    800  801  802  803 S       ;1st DIGIT
 1    810  811  812  813 S
 2    820  821  822  823 S
 3    830  831  832  833 S
 4    840  841  842  843 S       ;2nd DIGIT
 5    850  851  852  853 S
 6    860  861  862  863 S
 7    870  871  872  873 S
 8    880  881  882  883 S       ;3rd DIGIT
 9    890  891  892  893 S
10    8A0  8A1  8A2  8A3 S
11    8B0  8B1  8B2  8B3 S
12    8C0  8C1  8C2  8C3 S       ;4th DIGIT
13    8D0  8D1  8D2  8D3 S
14    8E0  8E1  8E2  8E3 S
15    8F0  8F1  8F2  8F3 S
16    900  901  902  903 S       ;5th DIGIT
17    910  911  912  913 S
18    920  921  922  923 S
19    930  931  932  933 S
20    940  941  942  943 S       ;6th DIGIT
21    950  951  952  953 S
22    960  961  962  963 S
23    970  971  972  973 S
24    980  981  982  983 S       ;7th DIGIT
25    990  991  992  993 S
26    9A0  9A1  9A2  9A3 S
27    9B0  9B1  9B2  9B3 S
28    9C0  ---  ---  --- C       ;DC OUTPUT
29    9D0  ---  ---  --- C
30    9E0  ---  ---  --- C
31    9F0  ---  ---  --- C
```

■ Example of segment option source file

```
* E0C6274 SEGMENT OPTION DOCUMENT  V 3.20
*
* FILE NAME    C2740A0S.DOC
* USER'S NAME  SEIKO EPSON CORP.
* INPUT DATE   92/02/20
* COMMENT      TOKYO DESIGN CENTER
*              421-8 HINO HINO-SHI TOKYO 191 JAPAN
*              TEL 0425-84-2551
*              FAX 0425-84-8512
*
*
* OPTION NO.8
*
* < LCD SEGMENT DECODE TABLE >
*
* SEG COM0 COM1 COM2 COM3 SPEC
*
   0  800  801  802  803  S
   1  810  811  812  813  S
   2  820  821  822  823  S
   3  830  831  832  833  S
   4  840  841  842  843  S
   5  850  851  852  853  S
   6  860  861  862  863  S
   7  870  871  872  873  S
   8  880  881  882  883  S
   9  890  891  892  893  S
  10  8A0  8A1  8A2  8A3  S
  11  8B0  8B1  8B2  8B3  S
  12  8C0  8C1  8C2  8C3  S
  13  8D0  8D1  8D2  8D3  S
  14  8E0  8D1  8E2  8E3  S
  15  8F0  8D1  8F2  8F3  S
  16  900  901  902  903  S
  17  910  911  912  913  S
  18  920  921  922  923  S
  19  930  931  932  933  S
  20  940  941  942  943  S
  21  950  951  952  953  S
  22  960  961  962  963  S
  23  970  971  972  973  S
  24  980  981  982  983  S
  25  990  991  992  993  S
  26  9A0  9A1  9A2  9A3  S
  27  9B0  9B1  9B2  9B3  S
  28  9C0  9C1  9C2  9C3  C
  29  9D0  9D1  9D2  9D3  C
  30  9E0  9E1  9E2  9E3  C
  31  9F0  9F1  9F2  9F3  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 ICS6274

6.1 ICS6274 Outline

The In-circuit Emulator ICE6200 connects the target board produced by the user via the EVA6274 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 ICS6274.
The ICS6274 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.

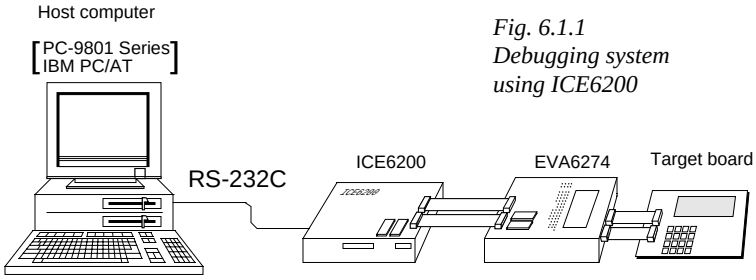


Fig. 6.1.1 Debugging system using ICE6200

☞ *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 ICS6274 Restrictions

Take the following precautions when using the ICS6274.

■ ROM Area

The ROM area is limited to a maximum address of 0FFFH. Assigning data above the 0FFFH address causes an error.

■ RAM Area

The RAM area is limited to a maximum address of 3FFH. However, as the following addresses are in the unused area, designation of this area with the ICE commands produces an error.

Unused area: 0A0H–0BFH, 0C7H, 0CDH–0CFH, 0D5H, 0FCH–0FEH,
1A0H–1BFH, 1C7H, 1CDH–1CFH, 1D5H, 1FCH–1FEH,
2A0H–2BFH, 2C7H, 2CDH–2CFH, 2D5H, 2FCH–2FEH,
3A0H–3BFH, 3C7H, 3CDH–3CFH, 3D5H, 3FCH–3FEH

(Refer to the "E0C6274 Technical Manual" for details.)

■ OPTLD Command

In the ICS6274, OPTLD command can be used.
This command is used to load HEX files (function option and segment option data for LCD) in the EVA6274 memory with the ICE6200.

Load of function option data: `#OPTLD,1,C274XXX↵`
Load of segment option data: `#OPTLD,2,C274XXX↵`

OPTLD *READ HEXA DATA FILE*

Format

#OPTLD,1,<*file name*>↵ ...(1)
#OPTLD,2,<*file name*>↵ ...(2)

Function

(1) Load function option HEX file in the EVA6274 function option data memory.
It is HEX file output by the function option generator and has intel HEX format.

(2) Load segment option HEX file in the EVA6274 segment option data memory.
It is HEX file output by the segment option generator and has intel HEX format.
Since it takes about 11 minutes to load segment option HEX data, when you want to load at high speed, execute this command by changing the EVA6274 operation clock from OSC1 to OSC3. (When OSC3 = 500 kHz, since it takes about 6 minutes to load segment option HEX data.)

* Since function option HEX file cannot be loaded in OSC3 clock operation, you should not change the operation clock.

Examples

```
#OPTLD,1,C274XXX↵ ..... C274XXXF.HEX file is loaded in the function option data memory.
#OPTLD,2,C274XXX↵ ..... C274XXXS.HEX file is loaded in the segment option data memory.
#SD,DF↵
 DF |0:1↵              ..... The OSC3 oscillation is turned ON.
 E0 |0:/↵
#SD,DF↵
 DF |1:3↵              ..... Switching from OSC1 to OSC3.
 E0 |0:/↵
#I↵                    ..... The CPU is reset.
                              (Switches CPU clock to OSC1 when OSC3 oscillation is set.)
```

6.3 ICS6274 Quick Reference

■ Starting command and input/output files

↵ *indicates the Return key.*

Execution file:
ICS6274.BAT (ICS6274J.EXE) . . . for MS-DOS
ICS6274B.BAT (ICS6274W.EXE) . . . for PC-DOS

Starting command:
ICS6274 (ICS6274J)↵ . . . for MS-DOS
ICS6274B (ICS6274W)↵ . . . for PC-DOS

Input file:
C274XXXL.HEX (Object file, low-order)
C274XXXH.HEX (Object file, high-order)
C274XXXD.HEX (Data RAM file)
C274XXXC.HEX (Control file)
C274XXXF.HEX (Function option HEX file)
C274XXXS.HEX (Segment option HEX file)

Output file:
C274XXXL.HEX (Object file, low-order)
C274XXXH.HEX (Object file, high-order)
C274XXXD.HEX (Data RAM file)
C274XXXC.HEX (Control file)

■ Display example

```
          *** E0C6274 ICE CONTROL SOFTWARE. --- Ver 3.01 ***

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.

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

Start-up message
When ICS6274 is started, the start-up message is displayed, and a self-test is automatically performed. ICS6274 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 ICS6274 program is terminated by entering the Q (Quit) command.

Note *Confirm that the cables connected properly, then operate the ICS6274.*

■ 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 EVA6274 CPU 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 EVA6274 CPU internal registers
		#SR ↵	Set EVA6274 CPU internal registers
		#I ↵	Reset EVA6274 CPU
		#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
		#OPTLD,1,file ↵ #OPTLD,2,file ↵	Load function option data from file Load segment option data from 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 MDC6274

7.1 MDC6274 Outline

The Mask Data Checker MDC6274 is a software tool which checks the program data (C274XXXH.HEX and C274XXXL.HEX) and option data (C274XXXF.DOC and C274XXXS.DOC) created by the user and creates the data file (C6274XXX.PAn) for generating mask patterns. The user must send the file generated through this software tool to Seiko Epson.

Moreover, MDC6274 has the capability to restore the generated data file (C6274XXX.PA0) to the original file format.

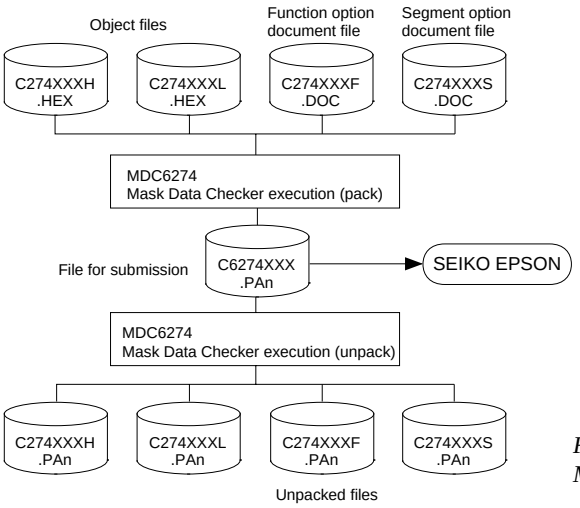


Fig. 7.1.1
MDC6274 execution flow

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

7.2 MDC6274 Quick Reference

■ Starting command and input/output files

Execution file: MDC6274.EXE

Starting command: **MDC6274**↵ ↵ *indicates the Return key.*

Input file:

C274XXXL.HEX	(Object file, low-order)	When packing
C274XXXH.HEX	(Object file, high-order)	
C274XXXF.DOC	(Function option document file)	
C274XXXS.DOC	(Segment option document file)	
C6274XXX.PAn	(Packed file)	When unpacking

Output file:

C6274XXX.PAn	(Packed file)	When packing
C274XXXL.PAn	(Object file, low-order)	When unpacking
C274XXXH.PAn	(Object file, high-order)	
C274XXXF.PAn	(Function option document file)	
C274XXXS.PAn	(Segment option document file)	

■ Display examples

```
          *** E0C6274 PACK / UNPACK PROGRAM Ver 2.000 ***

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 MDC6274 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)

       C274XXXH.HEX --------+
                            |
       C274XXXL.HEX --------+
                            |-------- C274XXX.PAn (PACK FILE)
       C274XXXF.DOC --------+
                            |
       C274XXXS.DOC --------+

PLEASE INPUT PACK FILE NAME (C6274XXX.PAn) ?  C62740A0.PA0↵    ...(2)

       C2740A0H.HEX --------+
                            |
       C2740A0L.HEX --------+
                            |-------- C2740A0.PA0
       C2740A0F.DOC --------+
                            |
       C2740A0S.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 "C6274XXX.PA0" has been submitted, the pack file name should be entered as "C6274XXX.PA1".)

With this, the mask file (C6274XXX.PAn) is generated, and the MDC6274 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 (ASM6274) as program data. If the program data generated with the -N option of the Cross Assembler is packed, following message is displayed.

```
HEX DATA ERROR : DATA (NO FFh)
```

```
                   --- OPERATION MENU ---

                          1. PACK
                          2. UNPACK

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

PLEASE INPUT PACKED FILE NAME (C6274XXX.PAn) ?  C62740A0.PA0↵  ...(2)

                           +-------- C2740A0H.PA0
                           |
                           +-------- C2740A0L.PA0
       C62740A0.PA0 --------|
                           +-------- C2740A0F.PA0
                           |
                           +-------- C2740A0S.PA0
```

Unpacking of data

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

With this, the mask data file (C6274XXX.PAn) is restored to the original file format, and the MDC6274 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 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.
10. HEX DATA ERROR : DATA (NO FFh)	There is an undefined field in the HEX data.

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.
4. VERSION NUMBER ERROR : X.DOC	FOG6274, SOG6274 different from the version No. has been used.

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. E0C6274 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)
	SLP		1	1	1	1	1	1	1	1	1	0	0	1					5	SLEEP (stop oscillation)
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

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, *l*	1	0	0	1	*l*7	*l*6	*l*5	*l*4	*l*3	*l*2	*l*1	*l*0					5	M(X)←*l*3~*l*0, M(X+1)←*l*7~*l*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

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 with immediate data

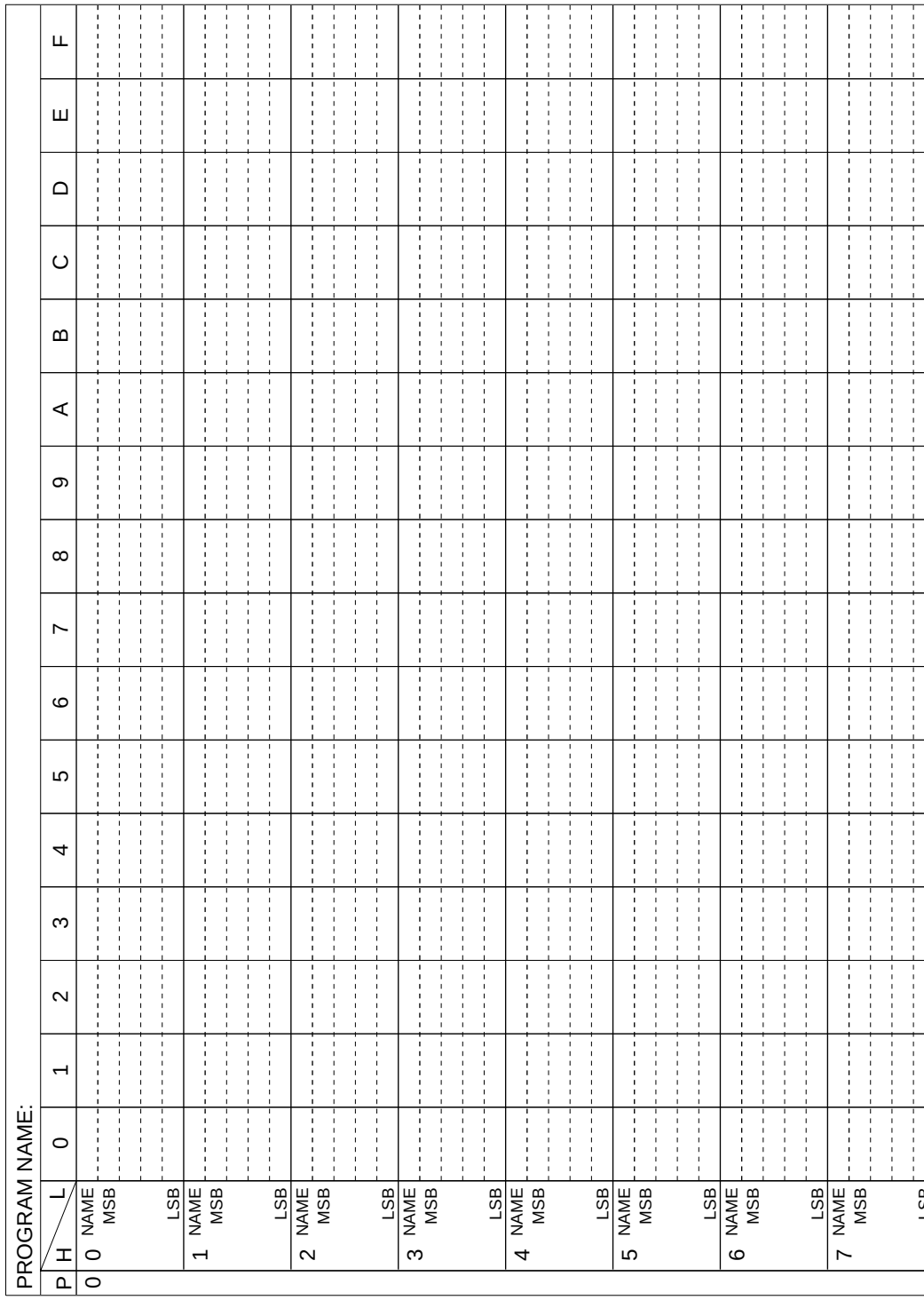
p Five-bit immediate data or label 00H–1FH
s Eight-bit immediate data or label 00H–0FFH
l Eight-bit immediate data 00H–0FFH
i Four-bit immediate data 00H–0FH

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. E0C6274 RAM MAP

RAM map - 1 (000H–07FH)



RAM map - 2 (100H–17FH)

PROGRAM NAME:

P	H \ L		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1	0	NAME																
		MSB																
		LSB																
	1	NAME																
		MSB																
		LSB																
	2	NAME																
		MSB																
		LSB																
	3	NAME																
		MSB																
		LSB																
	4	NAME																
		MSB																
		LSB																
	5	NAME																
		MSB																
		LSB																
	6	NAME																
		MSB																
		LSB																
	7	NAME																
		MSB																
		LSB																

RAM map - 3 (200H–27FH)

PROGRAM NAME:

P	H \ L		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
2	0	NAME																
		MSB																
		LSB																
	1	NAME																
		MSB																
		LSB																
	2	NAME																
		MSB																
		LSB																
	3	NAME																
		MSB																
		LSB																
	4	NAME																
		MSB																
		LSB																
	5	NAME																
		MSB																
		LSB																
	6	NAME																
		MSB																
		LSB																
	7	NAME																
		MSB																
		LSB																

RAM map - 4 (300H–37FH)

PROGRAM NAME:

P	H \ L		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
3	0	NAME																
		MSB																
		LSB																
	1	NAME																
		MSB																
		LSB																
	2	NAME																
		MSB																
		LSB																
	3	NAME																
		MSB																
		LSB																
	4	NAME																
		MSB																
		LSB																
	5	NAME																
		MSB																
		LSB																
	6	NAME																
		MSB																
		LSB																
	7	NAME																
		MSB																
		LSB																

Display memory (80H–9FH), I/O memory (C0H–FFH)

PROGRAM NAME:

P	H	L	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	8	NAME																
		MSB																
1																		
2		LSB																
3	9	NAME																
		MSB																
		LSB																
	C	NAME	ZIPT	ZISIO	ZIK1	ZIK0	ZIAD	ZISW	ZIT	—	ZEIAD	ZEIK	ZSIK0	ZEISW	ZEIT	—	—	—
		MSB	0	0	0	0	0	0	IT1	—	0	0	SIK03	0	EIT1	—	—	—
			0	0	0	0	0	0	IT2	—	EIAD	0	SIK02	0	EIT2	—	—	—
			0	0	0	0	0	ISW1	IT8	—	EISIO	EIK1	SIK01	EISW1	EIT8	—	—	—
		LSB	IPT	ISIO	IK1	IK0	IAD	ISW0	IT32	—	EIPT	EIK0	SIK00	EISW0	EIT32	—	—	—
	D	NAME	ZK0	ZK1	ZDFK0	ZDFK1	ZR0	—	ZIOC	ZPUP	ZP0	ZP1	ZP2	ZSIOC1	ZSIOC2	ZSDL	ZSDH	ZOSCC
		MSB	K03	0	DFK03	0	R03	—	0	0	P03	P13	P23	PFS	0	SD3	SD7	0
			K02	0	DFK02	0	R02	—	IOC2	PUP2	P02	P12	P22	SDP	0	SD2	SD6	0
			K01	0	DFK01	0	R01	—	IOC1	PUP1	P01	P11	P21	SCS1	SCRUN	SD1	SD5	CLKCHG
		LSB	K00	K10	DFK00	DFK10	R00	—	IOC0	PUP0	P00	P10	P20	SCS0	SCTRG	SD0	SD4	OSCC
	E	NAME	ZBZCTL	ZFOCTL	ZTMRST	ZTML	ZTMH	ZWDOG	ZSWCTL	ZSWL	ZSWH	ZPTC1	ZPTC2	ZPTL	ZPTH	ZRDL	ZRDH	ZLCDC
		MSB	BZR03	FOR00	0	TM3	TM7	WDRST	0	SWL3	SWH3	PTR01	PTD1	PT3	PT7	RD3	RD7	LDTY1
			BZR02	0	0	TM2	TM6	0	0	SWL2	SWH2	0	PTD0	PT2	PT6	RD2	RD6	LDTY0
			0	FOFQ1	0	TM1	TM5	WD1	SWRUN	SWL1	SWH1	PTRUN	PTC1	PT1	PT5	RD1	RD5	0
		LSB	BZFQ	FOFQ0	TMRST	TM0	TM4	WD0	SWRST	SWL0	SWH0	PTRST	PTC0	PT0	PT4	RD0	RD4	LCDON
	F	NAME	ZGNDON	ZAMPON	ZAMPDT	ZADRS	ZAIS	ZAI	ZADON	ZAD0	ZAD1	ZAD2	ZAD3	ZIDR	—	—	—	ZSVDC
		MSB	GNDON1	0	0	0	AIS3	AI3	ADON	AD3	AD7	AD11	0	0	—	—	—	SVDS1
			GNDON0	0	0	0	AIS2	AI2	0	AD2	AD6	AD10	0	0	—	—	—	SCDS0
			VRAON	AMPON1	AMPDT1	ADRS1	AIS1	AI1	0	AD1	AD5	AD9	ADP	0	—	—	—	SVDDT
		LSB	VRON	AMPON0	AMPDT0	ADRS0	AIS0	AI0	AI4	AD0	AD4	AD8	AD12	IDR	—	—	—	SVDON

APPENDIX C. E0C6274 I/O MEMORY MAP

I/O memory map (C0H–CCH)

Address *7	Register D3	D2	D1	D0	Name	Init *1	1	0	Comment
C0H	0	0	0	IPT	0	– *2			Unused *5
					0	– *2			Unused *5
	R				0	– *2			Unused *5
					IPT	0	Yes	No	Interrupt factor flag (programmable timer) *4
C1H	0	0	0	ISIO	0	– *2			Unused *5
					0	– *2			Unused *5
	R				0	– *2			Unused *5
					ISIO	0	Yes	No	Interrupt factor flag (serial interface) *4
C2H	0	0	0	IK1	0	– *2			Unused *5
					0	– *2			Unused *5
	R				0	– *2			Unused *5
					IK1	0	Yes	No	Interrupt factor flag (K10) *4
C3H	0	0	0	IK0	0	– *2			Unused *5
					0	– *2			Unused *5
	R				0	– *2			Unused *5
					IK0	0	Yes	No	Interrupt factor flag (K00-K03) *4
C4H	0	0	0	IAD	0	– *2			Unused *5
					0	– *2			Unused *5
	R				0	– *2			Unused *5
					IAD	0	Yes	No	Interrupt factor flag (A/D converter) *4
C5H	0	0	ISW1	ISW0	0	– *2			Unused *5
					0	– *2			Unused *5
	R				ISW1	0	Yes	No	Interrupt factor flag (stopwatch 1 Hz) *4
					ISW0	0	Yes	No	Interrupt factor flag (stopwatch 10 Hz) *4
C6H	IT1	IT2	IT8	IT32	IT1	0	Yes	No	Interrupt factor flag (clock timer 1 Hz) *4
					IT2	0	Yes	No	Interrupt factor flag (clock timer 2 Hz) *4
	R				IT8	0	Yes	No	Interrupt factor flag (clock timer 8 Hz) *4
					IT32	0	Yes	No	Interrupt factor flag (clock timer 32 Hz) *4
C8H	0	EIAD	EISIO	EIPT	0	*2			Unused *5
					EIAD	0	Enable	Mask	Interrupt mask register (A/D converter)
	R	R/W			EISIO	0	Enable	Mask	Interrupt mask register (serial interface)
					EIPT	0	Enable	Mask	Interrupt mask register (programmable timer)
C9H	0	0	EIK1	EIK0	0	– *2			Unused *5
					0	– *2			Unused *5
	R		R/W		EIK1	0	Enable	Mask	Interrupt mask register (K10)
					EIK0	0	Enable	Mask	Interrupt mask register (K00–K03)
CAH	SIK03	SIK02	SIK01	SIK00	SIK03	0	Enable	Disable	Interrupt selection register (K03)
					SIK02	0	Enable	Disable	Interrupt selection register (K02)
	R/W				SIK01	0	Enable	Disable	Interrupt selection register (K01)
					SIK00	0	Enable	Disable	Interrupt selection register (K00)
CBH	0	0	EISW1	EISW0	0	– *2			Unused *5
					0	– *2			Unused *5
	R		R/W		EISW1	0	Enable	Mask	Interrupt mask register (stopwatch 1 Hz)
					EISW0	0	Enable	Mask	Interrupt mask register (stopwatch 10 Hz)
CCH	EIT1	EIT2	EIT8	EIT32	EIT1	0	Enable	Mask	Interrupt mask register (clock timer 1 Hz)
					EIT2	0	Enable	Mask	Interrupt mask register (clock timer 2 Hz)
	R/W				EIT8	0	Enable	Mask	Interrupt mask register (clock timer 8 Hz)
					EIT32	0	Enable	Mask	Interrupt mask register (clock timer 32 Hz)

Remarks

*1 Initial value at the time of initial reset
*2 Not set in the circuit
*3 Undefined
*4 Reset (0) immediately after being read
*5 Constantly "0" when being read
*6 Refer to main manual
*7 Page switching in I/O memory is not necessary

I/O memory map (D0H–DFH)

Address *7	Register D3	D2	D1	D0	Name	Init *1	1	0	Comment
D0H	K03	K02	K01	K00	K03	– *2	High	Low	Input port (K00–K03)
					K02	– *2	High	Low	
	R				K01	– *2	High	Low	
					K00	– *2	High	Low	
D1H	0	0	0	K10	0	– *2			Unused *5
					0	– *2			Unused *5
	R				0	– *2			Unused *5
					K10	– *2	High	Low	Input port (K10)
D2H	DFK03	DFK02	DFK01	DFK00	DFK03	1	↓	↑	Input comparison register (K00–K03)
					DFK02	1	↓	↑	
	R/W				DFK01	1	↓	↑	
					DFK00	1	↓	↑	
D3H	0	0	0	DFK10	0	– *2			Unused *5
					0	– *2			Unused *5
	R			R/W	0	– *2			Unused *5
					DFK10	1	↓	↑	Input comparison register (K10)
D4H	R03	R02	R01	R00	R03	0	High	Low	Output port (R03)
	$\overline{BZ}$	BZ	$\overline{PTOVF}$	$\overline{FOUT}$	$\overline{BZ}$		On	Off	Buzzer inverted output
					R02	0	High	Low	Output port (R02)
					BZ		On	Off	Buzzer output
	R/W				R01	1	High	Low	Output port (R01)
					$\overline{PTOVF}$		Off	On	PTOVF output
					R00	1	High	Low	Output port (R00)
					$\overline{FOUT}$		Off	On	FOUT output
D6H	0	IOC2	IOC1	IOC0	0	– *2			Unused *5
					IOC2	0	Output	Input	I/O control register 2 (P20–P23) *6
	R	R/W			IOC1	0	Output	Input	I/O control register 1 (P10–P13)
					IOC0	0	Output	Input	I/O control register 0 (P00–P03)
D7H	0	PUP2	PUP1	PUP0	0	– *2			Unused *5
					PUP2	0	On	Off	Pull up control register 2 (P20–P23) *6
	R	R/W			PUP1	0	On	Off	Pull up control register 1 (P10–P13)
					PUP0	0	On	Off	Pull up control register 0 (P00–P03)
D8H	P03	P02	P01	P00	P03	– *2	High	Low	I/O port (P00–P03)
					P02	– *2	High	Low	
	R/W				P01	– *2	High	Low	
					P00	– *2	High	Low	
D9H	P13	P12	P11	P10	P13	– *2	High	Low	I/O port (P10–P13)
					P12	– *2	High	Low	
	R/W				P11	– *2	High	Low	
					P10	– *2	High	Low	
DAH	P23	P22	P21	P20	P23	– *2	High	Low	I/O port (P20–P23) When P20–P23 is selected as SIO port, P20–P23 registers will function as register only.
					P22	– *2	High	Low	
	R/W				P21	– *2	High	Low	
					P20	– *2	High	Low	
DBH	PFS	SDP	SCS1	SCS0	PFS	0	Serial I/F	I/O port	P2 port function selection
					SDP	0	LSB first	MSB first	Serial data input/output permutation
	R/W				SCS1	0			Serial interface clock mode selection *6
					SCS0	0			0: slave, 1: PTOVF, 2: CLK/2, 3: CLK
DCH	0	0	SCRUN	SCTRG	0	– *2			Unused *5
					0	– *2			Unused *5
	R			W	SCRUN	0	Run	Stop	Serial interface status
					SCTRG	– *2	Trigger	–	Serial interface clock trigger *5
DDH	SD3	SD2	SD1	SD0	SD3	– *2			Serial interface data (low-order 4 bits) LSB
					SD2	– *2			
	R/W				SD1	– *2			
					SD0	– *2			
DEH	SD7	SD6	SD5	SD4	SD7	– *2			MSB Serial interface data (high-order 4 bits)
					SD6	– *2			
	R/W				SD5	– *2			
					SD4	– *2			
DFH	0	0	CLKCHG	OSCC	0	– *2			Unused *5
					0	– *2			Unused *5
	R		R/W		CLKCHG	0	OSC3	OSC1	CPU system clock switch
					OSCC	0	On	Off	OSC3 oscillation On/Off

I/O memory map (E0H–EFH)

Address *7	Register D3	D2	D1	D0	Name	Init *1	1	0	Comment
E0H	BZR03	BZR02	0	BZFQ	BZR03	0	Buzzer	DC	R03 port output selection
					BZR02	0	Buzzer	DC	R02 port output selection
	R/W		R	R/W	0	– *2			Unused *5
					BZFQ	0	2kHz	4kHz	Buzzer frequency selection
E1H	FOR00	0	FOFQ1	FOFQ0	FOR00	0	FOUT	DC	R00 port output selection
					0	– *2			Unused *5
	R/W	R	R/W		FOFQ1	0			FOUT frequency selection
					FOFQ0	0			0: 512 Hz, 1: 4096 Hz, 2: fosc1, 3: fosc3
E2H	0	0	0	TMRST	0	– *2			Unused *5
					0	– *2			Unused *5
	R			W	0	– *2			Unused *5
					TMRST	– *2	Reset	–	Clock timer and watchdog timer reset *5
E3H	TM3	TM2	TM1	TM0	TM3	– *3			Clock timer data (16 Hz)
					TM2	– *3			Clock timer data (32 Hz)
	R				TM1	– *3			Clock timer data (64 Hz)
					TM0	– *3			Clock timer data (128 Hz)
E4H	TM7	TM6	TM5	TM4	TM7	– *3			Clock timer data (1 Hz)
					TM6	– *3			Clock timer data (2 Hz)
	R				TM5	– *3			Clock timer data (4 Hz)
					TM4	– *3			Clock timer data (8 Hz)
E5H	WDRST	0	WD1	WD0	WDRST	Reset	Reset	–	Watchdog timer reset *5
					0	– *2			Unused *5
	W	R			WD1	0			Watchdog timer data (1/4 Hz)
					WD0	0			Watchdog timer data (1/2 Hz)
E6H	0	0	SWRUN	SWRST	0	– *2			Unused *5
					0	–			Unused *5
	R		R/W	W	SWRUN	0	Run	Stop	Stopwatch timer Run/Stop
					SWRST	Reset	Reset	–	Stopwatch timer reset *5
E7H	SWL3	SWL2	SWL1	SWL0	SWL3	0			MSB
					SWL2	0			Stopwatch timer data 1/100 sec (BCD)
	R				SWL1	0			
					SWL0	0			LSB
E8H	SWH3	SWH2	SWH1	SWH0	SWH3	0			MSB
					SWH2	0			Stopwatch timer data 1/10 sec (BCD)
	R				SWH1	0			
					SWH0	0			LSB
E9H	PTR01	0	PTRUN	PTRST	PTR01	0	PTOVF	DC	R01 port output selection
					0	– *2			Unused *5
	R/W	R	R/W	W	PTRUN	0	Run	Stop	Programmable timer Run/Stop
					PTRST	–	Reset	–	Programmable timer reset (reload) *5
EAH	PTD1	PTD0	PTC1	PTC0	PTD1	0			Programmable timer pre-divider selection
					PTD0	0			0: 1/256, 1: 1/32, 2: 1/4, 3: 1/1
	R/W				PTC1	0			Programmable timer clock source selection
					PTC0	0			0: K10 (NR), 1: K10, 2: fosc1, 3: fosc3
EBH	PT3	PT2	PT1	PT0	PT3	– *3			
					PT2	– *3			Programmable timer data (low-order 4 bits)
	R				PT1	– *3			
					PT0	– *3			LSB
ECH	PT7	PT6	PT5	PT4	PT7	– *3			MSB
					PT6	– *3			Programmable timer data (high-order 4 bits)
	R				PT5	– *3			
					PT4	– *3			
EDH	RD3	RD2	RD1	RD0	RD3	– *3			
					RD2	– *3			Programmable timer reload data
	R/W				RD1	– *3			(low-order 4 bits)
					RD0	– *3			LSB
EEH	RD7	RD6	RD5	RD4	RD7	– *3			MSB
					RD6	– *3			Programmable timer reload data
	R/W				RD5	– *3			(high-order 4 bits)
					RD4	– *3			
EFH	LDTY1	LDTY0	0	LCDON	LDTY1	0			LCD drive duty selection
					LDTY0	0			0: 1/4, 1: 1/3, 2: 1/2, 3: 1/1
	R/W		R	R/W	0	– *2			Unused *5
					LCDON	0	On	Off	LCD display control (LCD display all off)

I/O memory map (F0H–FFH)

Address *7	Register D3	D2	D1	D0	Name	Init *1	1	0	Comment
F0H	GNDON1	GNDON0	VRAON	VRON	GNDON1	0			GND circuit On/Off and mode selection
					GNDON0	0			0: Off, 1: On1, 2: On2, 3: On3 *6
	R/W				VRAON	0	On	Off	VR output voltage adjustment On/Off
					VRON	0	On	Off	VR circuit On/Off
F1H	0	0	AMPON1	AMPON0	0	– *2			Unused *5
					0	– *2			Unused *5
	R		R/W		AMPON1	0	On	On	AMP1 On/Off
					AMPON0	0	On	On	AMP0 On/Off
F2H	0	0	AMPDT1	AMPDT0	0	– *2			Unused *5
					0	– *2			Unused *5
	R				AMPDT1	0	High	Low	AMP1 output data
					AMPDT0	0	High	Low	AMP0 output data
F3H	0	0	ADRS1	ADRS0	0	– *2			Unused *5
					0	– *2			Unused *5
	R		R/W		ADRS1	0			A/D converter resolution selection
					ADRS0	0			0: 6400, 1: 3200, 2: 1600, 3: 800
F4H	AIS3	AIS2	AIS1	AIS0	AIS3	0	Resistor	V(to GND)	AI4/AI3 mode selection
					AIS2	0	Resistor	V(to GND)	AI4/AI2 mode selection
	R/W				AIS1	0	Differ. V	V(to GND)	AI3/AI2 mode selection
					AIS0	0	Differ. V	V(to GND)	AI1/AI0 mode selection
F5H	AI3	AI2	AI1	AI0	AI3	0	On	Off	Analog input terminal AI3 On/Off
					AI2	0	On	Off	Analog input terminal AI2 On/Off
	R/W				AI1	0	On	Off	Analog input terminal AI1 On/Off
					AI0	0	On	Off	Analog input terminal AI0 On/Off
F6H	ADON	0	0	AI4	ADON	0	On	On	A/D converter clear and On/Off
					0	–			Unused *5
	R/W	R		R/W	0	–			Unused *5
					AI4	0	On	On	Analog input terminal AI4 On/Off
F7H	AD3	AD2	AD1	AD0	AD3	0			A/D converter count data
					AD2	0			
	R				AD1	0			
					AD0	0			LSB
F8H	AD7	AD6	AD5	AD4	AD7	0			A/D converter count data
					AD6	0			
	R				AD5	0			
					AD4	0			
F9H	AD11	AD10	AD9	AD8	AD11	0			A/D converter count data
					AD10	0			
	R				AD9	0			
					AD8	0			
FAH	0	0	ADP	AD12	0	– *2			Unused *5
					0	– *2			Unused *5
	R				ADP	0	(+)	(-)	Input voltage polarity
					AD12	0			A/D converter count data (MSB)
FBH	0	0	0	IDR	0	– *2			Unused *5
					0	– *2			Unused *5
	R				0	– *2			Unused *5
					IDR	0	Invalid	Valid	Reading data status
FFH	SVDS1	SVDS0	SVDDT	SVDON	SVDS1	0			SVD criteria voltage setting
					SVDS0	0			0: 2.6 V, 1: 2.5 V, 2: 2.0 V, 3: 1.9 V
	R/W		R	R/W	SCDDT	0	Low	Normal	Supply voltage evaluation data
					SCDON	0	On	Off	SVD circuit On/Off

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 ICS6274J.EXE PC-DOS ICS6274W.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 EVA6274 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 ICS6274P.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.
SOG6274	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
ASM6274	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.
MDC6274	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?
EVA6274	The EVA6274 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 EVA6274 set to EN?
	Target segment does not light.	Check the following and remedy if necessary: • Is an EPROM with an access time of 250 ns or less being used for S.HEX. • Has the VADJ VR inside the EVA6274 top cover been turned to a lower setting?

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