EPSON

CMOS 8-BIT SINGLE CHIP MICROCOMPUTER
S5U1C88112D Manual
(Development Software Tool for S1C88112)

SEIKO EPSON CORPORATION

The information of the product number change

Starting April 1, 2001, the product number has been changed as listed below. Please use the new product number when you place an order. For further information, please contact Epson sales representative.

Configuration of product number

Devices

S1　C　88104　F　0A01　00

- Packing specification
- Specification
- Package (D: die form; F: QFP)
- Model number
- Model name (C: microcomputer, digital products)
- Product classification (S1: semiconductor)

Development tools

S5U1　C　88348　D1　1　00

- Packing specification
- Version (1: Version 1 *2)
- Tool type (D1: Development Tool *1)
- Corresponding model number (88348: for S1C88348)
- Tool classification (C: microcomputer use)
- Product classification
  (S5U1: development tool for semiconductor products)

*1: For details about tool types, see the tables below. (In some manuals, tool types are represented by one digit.)
*2: Actual versions are not written in the manuals.

Comparison table between new and previous number

S1C88 Family processors

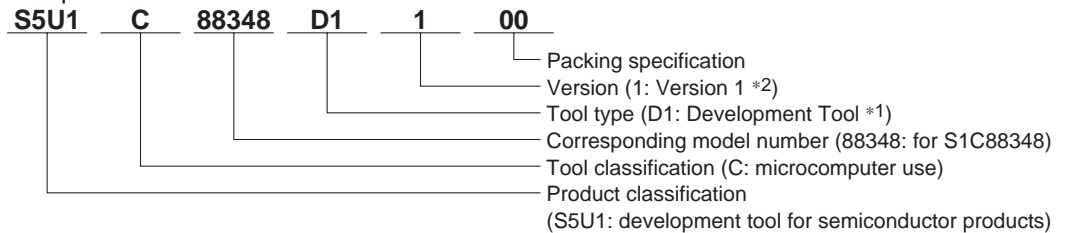| Previous No.	New No.	Previous No.	New No.
E0C88104	S1C88104	E0C88365	S1C88365
E0C88112	S1C88112	E0C88F360	S1C8F360
E0C88308	S1C88308	E0C88408	S1C88408
E0C88316	S1C88316	E0C88409	S1C88409
E0C88317	S1C88317	E0C88816	S1C88816
E0C88348	S1C88348	E0C88832	S1C88832
E0C88P348	S1C8P348	E0C88862	S1C88862
E0C88349	S1C88349	E0C88F816	S1C8F816

Comparison table between new and previous number of development tools

Development tools for the S1C88 Family

Previous No.	New No.	Previous No.	New No.
88ISAIF	S5U1C88000H4	DEV88816	S5U1C88816D
ADP88348	S5U1C88348X	DEV88832	S5U1C88832D
ADP88360	S5U1C88360X	DEV88862	S5U1C88862D
DEV88104	S5U1C88104D	DMT88348-DB	S5U1C88348T
DEV88112	S5U1C88112D	ICE88UR	S5U1C88000H5
DEV88308	S5U1C88308D	PRC88316	S5U1C88316P
DEV88316	S5U1C88316D	PRC88348	S5U1C88348P
DEV88317	S5U1C88317D	PRC88365	S5U1C88365P
DEV88348	S5U1C88348D	PRC88409	S5U1C88409P
DEV88365	S5U1C88365D	PRC88816	S5U1C88816P
DEV88408	S5U1C88408D	SAP88	S5U1C88000S
DEV88409	S5U1C88409D	URS88348	S5U1C88348Y

Development tools for the S1C63/88 Family

Previous No.	New No.
ADS00002	S5U1C88000X1
GWH00002	S5U1C88000W2
URM00002	S5U1C88000W1

Contents

1 OUTLINE OF PACKAGE

1.1 Preface

The "S1C88112 Development Tool" package is a software development tool package for the CMOS 8-bit single chip microcomputer S1C88 Family, and consists of software tools necessary for debugging by the ICE (S5U1C88000H5) and mask option setting of the S1C88112. The "S1C88 Family Assembler Package" is also necessary for the software development.

Program unused area filling utility **fil88112**

Function option generator **fog88112**

Mask data checker **mdc88112**

Self-diagnostic program **t88112**

1.2 Provided Floppy Disks

This package includes the following floppy disks which are necessary for debugging by the ICE and mask option setting of the IC for the S1C88112 development.

1) 3.5" floppy disk (2HD) for IBM-PC/AT 1
2) S5U1C88112D Manual (Development Software Tool for S1C88112) (this manual) 1

The type of the personal computer that can be used with the development system and the restrictions are described in "2.1 System Configuration", be sure to read before to use.

Keep the original disk in a safe place as a backup after copying the contents to hard disk or other floppy disk.

Note: Use the DISKCOPY for backup of the original disk.

The contents of the floppy disk and installation procedure of the software development tools are explained in "2.2 Installation".

1.3 Outline of Software Tool

Figure 1.3.1 shows the software development flow.
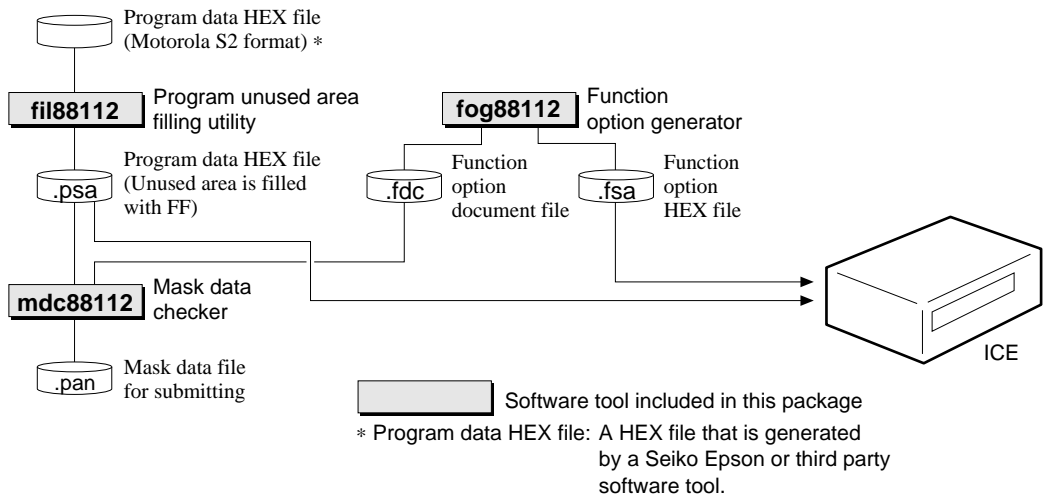
Fig. 1.3.1 Software development flow

Outline of the basic function of each program are as follows.

1.3.1 Program unused area filling utility <fil88112>

The program unused area filling utility fil88112 is a tool for filling the unused area of the S1C88112 built-in ROM with the FF and setting the system code for the system reserved area of the S1C88112 when debugging using the ICE and for submitting mask data to Seiko Epson, for S1C88112 software development.

1.3.2 Function option generator <fog88112>

In the S1C88112, 8 items such as an I/O port function can be selected as mask option. The function option generator fog88112 is a tool that can interactively select the S1C88112 mask option settings and generates the mask option setting file for the ICE and the function option document file for generating the mask pattern.

1.3.3 Mask data checker <mdc88112>

The mask data checker mdc88112 is a tool to check the format of the program data that the unused area of the built-in ROM is filled with FFH and the S1C88112 system code is set and the function option document file for generating mask pattern, and to convert data developed by the customer to the mask data for submitting to Seiko Epson. So the customer's data becomes mask IC exactly.

1.3.4 Self-diagnostic program <t88112>

This package includes the self-diagnostic program to check the ICE and the Peripheral Circuit Board (S5U1C88316P) hardware and the function option data. Perform a self-diagnostic of the ICE and Peripheral Circuit Board periodically using this program when using the ICE and the Peripheral Circuit Board for debugging.

Note: When submitting mask data to Seiko Epson, you should use the mdc88112 and it must include program data in the mask data, even if you use the S1C88112 in the MPU mode that does not need to make a mask for internal ROM; it needs masking only for the mask option (I/O settings, etc.).

2 DEVELOPMENTAL ENVIRONMENT AND INSTALL

Here we will explain the configuration of the program development system and installation procedure for the software tools.

2.1 System Configuration

The system configuration that is necessary for the program development using this package is shown below.

2.1.1 Development using IBM-PC/AT

Model: IBM-PC ⁄ AT and the full compatible (∗1)
DOS: PC-DOS ver. 3.3 or higher
MS-DOS ver. 3.3 or higher
RAM capacity:
640K bytes (∗2)
Hard disk drive:
Free space more than 200K bytes is necessary (∗3)
Floppy disk drive:
3.5 inches, 2HD (1.44M bytes),
1 drive or more
CRT & graphic board:
EGA, VGA (text display only, fixed at 80 character $\times$ 25 lines)
Printer: For listing (only character printing)
Other software:
Editor For source file creation ⁄ modification

Restrictions:
∗1 Compatible with models that use Intel 80×86 system for CPU.
∗2 This system operates in the real mode and does not use EMS and protected memory.
∗3 Assumes to use HD basically.

2.2 Installation

Here we will explain the installing of the programs included in this package. The contents of the floppy disk supplied with this package are shown in Figure 2.2.1.
Keep the original disk in a safe place as a backup after installing.

Note: Use the DISKCOPY for backup of the original disk.

2.2.1 Installer

This package includes the exclusive installer "setup112.exe" to install the software tools on the customer's disk drive. Install the software tools in this package by starting this installer.

Path name to install is fixed at \88112 in the default, but the setting that appending the upper layered path name to \88112 is possible.
When installing other software tools of the S1C88 Family, by setting the same upper layered path name like this, file management on the disk will be easy.

Example: When setting to append "EPSON" in the upper layered path name.

\ —— <EPSON> —— \<asm88>   "S1C88 Family Assembler Package"

Upper layered path name set when installing

(This package)
\<88112> —— • • • •   "S1C88112 Development Tool" package
\<test>
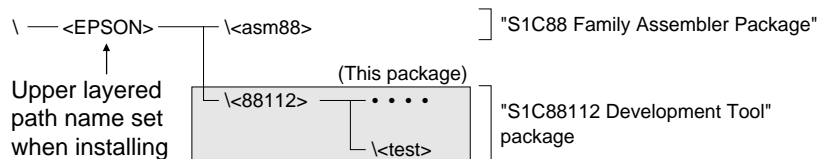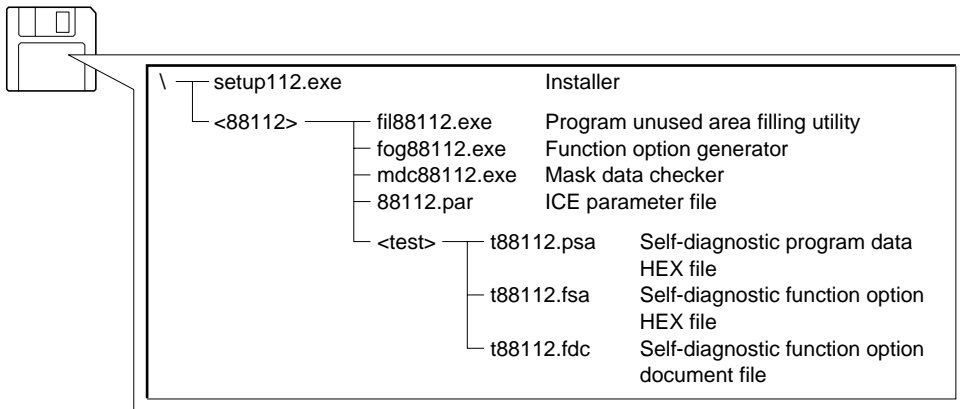
Fig. 2.2.1 Contents of floppy disk

Note: The batch file is installed in the directory ···\<88112>. Use it after copying to your work directory if necessary.

2.2.2 Installation procedure

The S1C88 Family software tools need capacity approximate 200K bytes including a work area in case of all the program is installed. Therefore, we recommend to use HD (hard disk) basically. The twin-drive FD model can be used.
The exclusive installer in this package checks the free space on the disk to be installed. If there is not enough free space on the install destination disk, reserve free space on the disk to perform file deletion and backup.

■ Operation procedure
(1) Insert the floppy disk in this package into a drive.

(2) Start the installer.
When starting the installer, be sure to set English mode.

      A:setup112↵

Hereafter, install according to the messages displayed as below.

1. Initial screen

```
─────── E0C88 Family Development Tool Install Utility Ver. X.XX ───────

              Copyright(C) SEIKO EPSON CORP. 1993–1996

          ******** E0C88112 Development Tool ********

Enter install drive from   [ A ]      ←────── Transfer source drive (original disk)

Enter copy drive & path to [ C:\88112\                           ]

                                  ↑
                                  └───── Transfer destination drive
                                         and path (default setting)

                                          (Quit :  Ctrl + C )

************************  Message Window  ************************
*   OK : Enter                                                  *
*   Caution : Install and copy drive must be set different name *
*                                                               *
*****************************************************************
```

2. Changing transfer destination drive and path

```
┌──────── E0C88 Family Development Tool Install Utility Ver. X.XX ────────┐
│                                                                          │
│               Copyright(C) SEIKO EPSON CORP. 1993-1996                   │
│                                                                          │
│             ******** E0C88112 Development Tool ********                  │
│                                                                          │
│ Enter install drive from   [ A ] ◄──────    The transfer source drive can also be changed by
│                                             return the cursor to this position.
│ Enter copy drive & path to [ C:\88112\                            ]
│                                             The appending path of the transfer destination disk can
│                                             be set by setting the cursor to this position.
│                                             The transfer destination drive can also be changed by
│                                             setting the cursor to this position.
│                                                (Quit :  Ctrl + C )
│                                                                          │
│ *************************  Message Window  *************************
│ *  Enter appends a path from default setting (max 40 char)       *
│ *                                                                *
│ *                                                                *
│ ******************************************************************
└──────────────────────────────────────────────────────────────────────────┘
```

3. Registration of appending path of transfer destination

```
┌──────── E0C88 Family Development Tool Install Utility Ver. X.XX ────────┐
│                                                                          │
│               Copyright(C) SEIKO EPSON CORP. 1993-1996                   │
│                                                                          │
│             ******** E0C88112 Development Tool ********                  │
│                                                                          │
│  Enter install drive from   [ A ]                                        │
│                                                                          │
│  Enter copy drive & path to [ C:\EPSON\88112\                     ]
│                                                                          │
│                                             Set appending path to transfer destination disk.
│                                                                          │
│                                                (Quit :  Ctrl + C )
│                                                                          │
│ *************************  Message Window  *************************
│ *  Enter appends a path from default setting (max 40 char)       *
│ *                                                                *
│ *                                                                *
│ ******************************************************************
└──────────────────────────────────────────────────────────────────────────┘
```

4. Confirmation of transfer source disk (original) insertion

```
┌──────── E0C88 Family Development Tool Install Utility Ver. X.XX ────────┐
│                                                                          │
│                   Copyright(C) SEIKO EPSON CORP. 1993–1996               │
│                                                                          │
│               ******** E0C88112 Development Tool ********                │
│                                                                          │
│  Install drive from : A:\              ◄──────── Confirm setting by Enter key
│                                                                          │
│  Copy drive to      : C:\EPSON\88112\  ◄──────── Confirm setting by Enter key
│                                                                          │
│                                                                          │
│                        ┌────── Volume name of original disk             │
│                        │                                                 │
│                        │                                                 │
│                        ▼                           (Quit :  Ctrl + C )   │
│  ************************  Message Window  ************************       │
│  *   Insert install disk [ 88112_DISK1 ] to specified drive     *       │
│  *                                                              *        │
│  *                        Press any key to continue_            *        │
│  ****************************************************************        │
└──────────────────────────────────────────────────────────────────────┘
```

After setting the transfer source drive and transfer destination drive by Enter key respectively, the installer waits for confirmation of the transfer source disk (original) insertion.

⇩

Installation starts by inputting any key in this status.

The file name to be transferred is displayed in the "Message Window" during installing. When the installation is completed normally, an end message is displayed in the "Message Window".

5. Error

```
┌──────── E0C88 Family Development Tool Install Utility Ver. X.XX ────────┐
│                                                                          │
│                   Copyright(C) SEIKO EPSON CORP. 1993–1996               │
│                                                                          │
│               ******** E0C88112 Development Tool ********                │
│                                                                          │
│  Install drive from : A:\                                                │
│                                                                          │
│  Copy drive to      : C:\EPSON\88112\                                    │
│                                                                          │
│                                                                          │
│                                                                          │
│                                                    (Quit :  Ctrl + C )   │
│  ************************  Message Window  ************************       │
│  *   Insufficient disk space  ◄── If an error has occurred during installing, an error  *
│  *                                 message is displayed in the "Message Window".  *
│  *                        Press any key to continue_            *        │
│  ****************************************************************        │
└──────────────────────────────────────────────────────────────────────┘
```

Note: When an error which is not fatal is generated in the installing stage, the installer returns to the initial screen and the operation can be continued. However, when "Quit" or a fatal error is generated, the installer is forcibly terminated. (In this case, delete all the file which are installed incompletely.)

<Messages of installer>

1. Start-up message

```
E0C88 Family Development Tool Install Utility Ver. X.XX
Copyright (C) SEIKO EPSON CORP. 1993-1996
```

2. Setting, confirmation and operating messages

Message	Explanation
Enter install drive from	Transfer source drive name
Enter copy drive & path to	Transfer destination drive name
Caution : Install and copy drive must be set different name	Transfer source drive name and transfer destination drive name must be set to different names.
Insert install disk [volume name] to specified drive	Insert the transfer source disk [volume name] into the specified drive.
Copy drive and path is [drive and path name]	Transfer destination drive and path is [drive name and path name].
Enter appends a path from default setting (max 40 char)	Input path name appending to the default setting.
Install drive from : [Install drive and path name]	Transfer source drive is [drive name and path name].
Copy drive to : [Copy drive and path name]	Transfer destination drive is [drive name and path name].
Copying [reading file]	Reading transfer source file [file name].
to [writing file]	Writing transfer destination file [file name].
Press any key to continue	Press any key to continue the installer.
Press any key to exit	Press any key to terminate the installer.
E0C88 Family Dev. Tools install utility has been successfully	Installation of the S1C88 Family software tools has been succeeded.
Good-bye from E0C88 Family Dev. Tools install utility	Terminates installation of the S1C88 Family software tools.

3. Error messages

Error message	Explanation
Incorrect DOS Version use DOS 3.X or later	DOS version is incorrect.
Write protect error	Transfer destination disk has been protected from writing.
Unit No. is not exist	There is no unit number.
Drive not ready	The drive is not ready.
Install disk is different	Disk to be installed is different.
Seek error	Seek error has been generated.
Media type is different	Disk is different.
Sector not found	Sector cannot be detected.
Write error	Write error has been generated.
Read error	Read error has been generated.
Other error	Other error has been generated.
Disk error on [drive]	Disk error has been generated on [drive].
Cannot create the path	Path cannot be created.
Setting path already exists enter another drive and path	Since the set path already exists, set another drive and path.
Insufficient disk space	Disk space is insufficient.
Insufficient disk space, insert other disk	Since the disk space is insufficient, insert another disk.
Bad select the install drive	Drive specification for transfer source disk is wrong.
Bad select the copy drive	Drive specification for transfer destination disk is wrong.
Error : [Reading file] Cannot open source file	Transfer source file cannot be read.
Error : [Writing file] Cannot open out file	Transfer destination file cannot be written.
E0C88 Family Dev. Tools install utility has been terminated	Installation of the S1C88 Family software tools has been terminated.
Caution : Delete temporary installed and files	Since the installation of the S1C88 Family software tools has been terminated, delete all the file which are installed incompletely.

3 DETAILED EXPLANATION OF TOOLS

3.1 Program Unused Area Filling Utility (fil88112)

3.1.1 Outline of fil88112

The fil88112 is a tool for filling the unused area of the S1C88112 built-in ROM (000000H–002FFFH) with the FF and setting the system code for the system reserved area of the S1C88112 when debugging using the ICE and for submitting mask data to Seiko Epson, for S1C88112 software development.

It serves to enhance the compatibility between the data debugged by the customer using the ICE and the mask data for submission to Seiko Epson. After downloading an fil88112 output file to the ICE and debugging using the ICE, use the mask data checker (mdc88112) to convert it into mask data for submission to Seiko Epson.
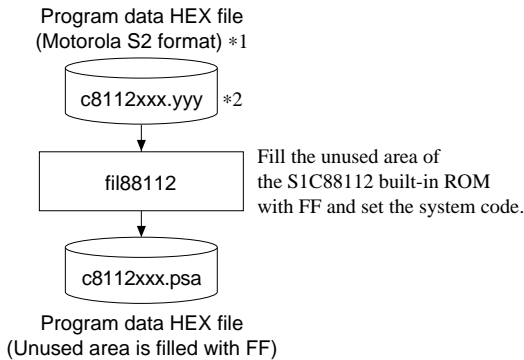
Program data HEX file
(Motorola S2 format) *1

c8112xxx.yyy *2

fil88112 — Fill the unused area of
the S1C88112 built-in ROM
with FF and set the system code.

c8112xxx.psa

Program data HEX file
(Unused area is filled with FF)

Fig. 3.1.2.1 fil88112 execution flow

*1 A HEX file that is generated by a Seiko Epson or third party software tool.

*2 Since the customer code is entered in the xxx part of the file name, it should be as designated by Seiko Epson.

Replace the yyy with an extension of the HEX file generated by a Seiko Epson or third party software tool.

3.1.2 Execution flow and input/output files

Figure 3.1.2.1 shows the fil88112 execution flow.

(1) Preparation of program data HEX file
Prepare a Hex file (Motorola S2 format) generated by a Seiko Epson or third party software tool.

(2) fil88112 execution
A file (c8112xxx.psa) in the format where the unused area of the S1C88112 built-in ROM has been filled by the FFH, for debugging the above mentioned program data HEX file on the ICE, and of the type (mdc88112) for submission of mask data to Seiko Epson is generated by execution of the program unused area filling utility (fil88112). At this time, the system codes F1H and FFH are also set to the system reserved areas (addresses 000024H and 000025H) of the S1C88112.

Note: Since the customer code is entered in the xxx part of the file name, it should be as designated by Seiko Epson.

3.1.3 Operation procedure

To start fil88112, insert the work disk into the current drive at the DOS command level (state in which a prompt such as A> is displayed) and then enter the command as following format.

```
fil88112 <file> ↵
```

↵ indicates the Return key.

■ **Input file name (c8112xxx.yyy)**

Specify the program data HEX file name to fill the unused area of the built-in ROM.

The fil88112 accepts only Hex files (Motorola S2 format) generated by a Seiko Epson or third party software tool.

When a file for other than the current drive is specified, the path name (drive/directory) must be specified in front of the file name.

        Example: A>fil88112 b:\test\c81120a0.sa

■ **Start-up message**

When fil88112 is started, the following message is displayed.

Example: File name: c81120a0.sa

```
A>fil88112 c81120a0.sa↵
FIL88112 Unused Area Filling Utility Version X.XX
Copyright (C) SEIKO EPSON CORP. 1993–1996
```

■ **End message**

When a series of operation are complete, the fil88112 displays the following message and returns to DOS command level.

(1) When terminated normally

```
A>fil88112 c81120a0.sa↵
FIL88112 Unused Area Filling Utility Version X.XX
Copyright (C) SEIKO EPSON CORP. 1993–1996
  ...........................................
Unused Area Filling Completed
System Area Data Set Completed
A>
```

In this case, since the PATH name of the drive/directory will not be set upon start-up, the post conversion program HEX file (c81120a0.psa) with the built-in ROM unused area filled and the S1C88112 system code set is generated in the directory.

The proceeding status is indicated by a period (.) during fil88112 execution.

(2) When an error has been occurred

```
A>fil88112 c81120a0.sa↵
FIL88112 Unused Area Filling Utility Version X.XX
Copyright (C) SEIKO EPSON CORP. 1993–1996


       C81120A0.SA 5:        File Format Error         ...Example of error message
A>
```

If an error is generated during fil88112 execution, it displays the file name producing the error, the line number and an error message, then terminates the fil88112.

Also, when an error has been generated, a post-conversion program data HEX file (c8112xxx.psa) is not generated. (In the event of a warning message, a post-conversion program data HEX file is generated.)

(3) In the event of forced termination

To forcibly terminate the execution of the fil88112, enter "CTRL" + "C". (This can also be done by pressing the "STOP" key on the host machine you are using.)

3.1.4 Error messages and warning message

fil88112 error messages and warning message are listed below.

Table 3.1.4.1 Error message

Error message	Explanation
Can't Find File	The specified input file does not exist.
Syntax Error: Input File	An input file name has not been specified.
File Format Error	The input file format is wrong. (∗1)
Can't Open File	The input file cannot be opened.
Not S Record	The input file is not S record format.
Data Length	The data length of 1 line is too short.
Too Many Data In One Line	The data length of 1 line is too long.
Not 3Byte Address	The address length is not 3 bytes (including S1, S3, S7 and S9 record).
Check Sum Error	The check sum does not match.
Duplicate Error	There is a duplicate definition of data in the same address.
Can't Use Vector 24H System Reserve	The physical addresses 000024H and 000025H cannot be used as
Can't Use Vector 25H System Reserve	a vector because they are reserved as a system area for the S1C88112.
Insufficient disk space	There is no disk space.
Write Error	An error has occurred while writing data.

∗1 A file format error will occur under the following conditions:
- Another record has followed the S8 record.
- Something other than a hexadecimal number is included in the file.
- There is a line that consists of less than 12 characters.
- There is an S8 record that has more or less than 12 characters or of which the byte count is not 04.
- There is an S4, S5 or S6 record included in the file.
- There is no S8 record.

Table 3.1.4.2 Warning message

Warning message	Explanation
Warning: No 00H Address	There is no data in the physical address 000000H.

Note: When there is no data in the physical address 000000H, it will output a warning message and filled the data FFH.

3.1.5 fil88112 execution example

■ Input file example (c81120a0.sa)

```
S2240000000000102250425050010030607CE00F9CE01FACE02CE03CE04CE0545CE06CE070899
S224000020090A450C360D45780B0E0FCE08FACE09FACE0ACE0BCE0CCE0D12CE0ECE0F10113C
S224000040121314AB15C5BB131617CE10B5CE1177CE12CE13CE14CE15AACE16CE1718191AB5
S224000060191C631D34121B1E1FCE1801CE1997CE1ACE1BCE1CCE1D89CE1ECE1F2021221048
S22400008024FF25EEFF232627CE2088CE2141CE22CE23CEB0109C10CEB210CEB110D8562088
S2240000A0CE24CE2510CE26CE2728292A102CFF2DEEFF2B2E2FCE28A3CE29C6CE2ACE2BCEF0
S2240000C0B4109D10CEB510D96648CEB610CE2CCD2D10CE2ECE2F38393A103CFF3DEEFF3BA3
S2240000E03E3FCE3865CE3927CE3ACE3BCEB8109E10CEB910DA1035CEBA10CE3CCE3D10CE4F
S2240001003ECE3F3031321034FF35EEFF333637CE3080CE3155CE32CE33CEBC44CEBFA1CE5A
S224000120BD9FCEBE73DBB62ACE34CE3510CE36CE379496109710DCFF109510808184828589
S2240001406C838688898C8A8DC58B8ECED8CED9CEA0CEA1CEA29FCEA3CEA4CEA5CEA655CE6D
S2240001600A74041CEC0CEC14243B01044FFCED0EEFF454647CE4092CE4110CE42CE43CEC9D9
S224000180CEC8CECACECB48494A4BB1104CFFCED1EEFF4D4E4FCE48CCCE4961CE4ACE4BCE92
S2240001A0C2B420CEC39F1050515253B21054FFCED2EEFF555657CE50B9CE5138CE52CE530B
S2240001C058595A5BB3105CFFCED3EEFF5D5E5FCE58D2CE59E8CE5ACE5B78FF79FF7AFF7BB3
S2240001E0FFDDFF5A7DFF7EFF7FFFCED4EEFFCED5EEFFCED6EEFFCED7EEFF68696A6BB510A1
S2240002006CFF6D6E6FCE6066CE6155CE62CE6360616263B61064FF656667CE68FACE6989DA
S2240002206C6ACE6B70717273B71074FF757677CE7899CE7988CE7ACE7BCE4412CE4CAFCEEC
S22400024054A9CE5C55CE4512CE4DAFCE55A9CE5D55CE46CE4ECE56CE5ECE47CE4FCE57CE3D
S2240002605FCECDCEC505CECCCEC440CECECEC630CECFCEC730CCCDF6F7FFCEAECEAFCE90DD
S2240002800CE91CE92FFCE93CE94CE95CE96FFCE97CE98CE99CE9AFFCE9BCE9CCE9DCE9EFFD0
S2240002A0CE9FCE80CE81CE82FFCE83CE84CE85CE86FFCE87CE88CE89C8AFFCE8BCE8CCEBD
S2240002C08DCE8EFFCE8FDEDFCEA8CF00CF01CF02CF03C00050CF20CF21CF22CF23C100606C
```

```
    :         :         :         :         :         :         :         :         :         :
```

```
S224000420CF7494CF7594CF7694CF7794C8C9CACBCFB7CFB6CFB5CFB4AFACADAEA9ABAAA8C1
S224000440CFBCCFBDCFB0CFB1CFB2CFB3A0A2A3A1A6A5A4A7CFB8CFB9F118E416CEE813CEB9
S224000460E910CEEA0DCEEB0ACEEC07CEED04CEEE01CEEFFECEE3FBCEE2F8CEE1F5CEE0F226
S224000480CEE7EFE5EDCEE5EAE7E8CEE6E5CEE4E2E6E0FD77F4F30400EC0100EDFEFFEFFB62
S2240004A0FFEEF8FFF5F6F01BE019CEF816CEF913CEFA10CEFB0DCEFC0ACEFD07CEFE04CEBC
S2240004C0FF01CEF3FECEF2FBCEF1F8CEF0F5CEF7F2E1F0CEF5EDE3EBCEF6E8CEF4E5E2E315
S2200004E0FB0010F20400E80100E9FEFFEBFBFFFAF8FFF8F9FAFC55FECEDCCEDDD6
S804000000FB
```

■ **Output file example (c81120a0.psa)**

F1H and FFH are set in the system reserved area (addresses 000024H and 000025H) for S1C88112.

```
S22400000000001022504 25050010030607CE00F9CE01FACE02CE03CE04CE0545CE06CE070899
S224000020090A450C F1FF 45780B0E0FCE08FACE09FACE0ACE0BCE0CCE0D12CE0ECE0F10118F
S224000040121314AB15C5BB131617CE10B5CE1177CE12CE13CE14CE15AACE16CE1718191AB5
S224000060191C631D34121B1E1FCE1801CE1997CE1ACE1BCE1CCE1D89CE1ECE1F2021221048
S22400008024FF25EEFF232627CE2088CE2141CE22CE23CEB0109C10CEB210CEB110D8562088
S2240000A0CE24CE2510CE26CE2728292A102CFF2DEEFF2B2E2FCE28A3CE29C6CE2ACE2BCEF0
S2240000C0B4109D10CEB510D96648CEB610CE2CCD2D10CE2ECE2F38393A103CFF3DEEFF3BA3
S2240000E03E3FCE3865CE3927CE3ACE3BCEB8109E10CEB910DA1035CEBA10CE3CCE3D10CE4F
S2240001003ECE3F3031321034FF35EEFF333637CE3080CE3155CE32CE33CEBC44CEBFA1CE5A
S2240001200BD9FCEBE73DBB62ACE34CE3510CE36CE379496109710DCFF109510808184828589
S2240001406C838688898C8A8DC58B8ECED8CED9CEA0CEA1CEA29FCEA3CEA4CEA5CEA655CE6D
S2240001600A74041CEC0CEC14243B01044FFCED0EEFF454647CE4092CE4110CE42CE43CEC9D9
S2240001800CEC8CECACECB48494A4BB1104CFFCED1EEFF4D4E4FCE48CCCE4961CE4ACE4BCE92
S2240001A0C2B420CEC39F1050515253B21054FFCED2EEFF555657CE50B9CE5138CE52CE530B
S2240001C058595A5BB3105CFFCED3EEFF5D5E5FCE58D2CE59E8CE5ACE5B78FF79FF7AFF7BB3
S2240001E0FFDDFF5A7DFF7EFF7FFFCED4EEFFCED5EEFFCED6EEFFCED7EEFF68696A6BB510A1
S2240002006CFF6D6E6FCE6066CE6155CE62CE6360616263B61064FF656667CE68FACE6989DA
S224000220CE6ACE6B70717273B71074FF757677CE7899CE7988CE7ACE7BCE4412CE4CAFCEEC
S22400024054A9CE5C55CE4512CE4DAFCE55A9CE5D55CE46CE4ECE56CE5ECE47CE4FCE57CE3D
S2240002605FCECDCEC505CECCCEC440CECECEC630CECFCEC730CCCDF6F7FFCEAECEAFCE90DD
S224000280CE91CE92FFCE93CE94CE95CE96FFCE97CE98CE99CE9AFFCE9BCE9CCE9DCE9EFFD0
S2240002A0CE9FCE80CE81CE82FFCE83CE84CE85CE86FFCE87CE88CE89CE8AFFCE8BCE8CCEBD
S2240002C08DCE8EFFCE8FDEDFCEA8CF00CF01CF02CF03C00050CF20CF21CF22CF23C100606C
S2240002E0CF40CF41C20070CF42CF43C30080CF44CF45CF680090CF04CF05CF06CF07CF60D3
S2240003005699CF24CF25CF26CF27CF61A246CF08CF09CF0ACF0BD0CCCCCF28CF29CF2ACF7E
S2240003202BD1BBBBCF48CF49D2DDDDCF4ACF4BD3EEEECF4CCF4DCF6AFFFFCF0CCF0DCF0EA7
S224000340CF0FCF620010CF2CCF2DCF2ECF2FCF632010CF18CF19CF1ACF1BD42010CF38CFA9
S22400036039CF3ACF3BD52010D62010D72010CF5CCF5DCF6C2010909192938798999A9B8F96
S224000380CFE0B8EEFFCFE1CFC0CFE2CFD0CFE3CFD8C42010CFF8CFF9CF7087BCEEFFBDEE7F
S2240003A0FFBEEEFFBFEEFFCF7CEEFFCFE4B9EEFFCFE5CFC1CFE6CFD1CFE7CFD9C52010CF96
S2240003C0F4CFF5CF7187CFC4CFC5CFC6CFC7CFE8BAEEFFCFE9CFC2CFEACFD2CFEBCFDAC61D
S2240003E02010CFFACF7287CFD4CFD5CFD6CFD7CFECBBEEFFCFEDCFC3CFEECFD3CFEFCFDB2D
S224000400C72010CFFECF7387CFDCCFDDCFDECFDFCFF0CF78EEFFCFF1CFF2CFF3CF6E2010F5
S224000420CF7494CF7594CF7694CF7794C8C9CACBCFB7CFB6CFB5CFB4AFACADAEA9ABAAA8C1
```

```
    :       :       :       :       :       :       :       :       :       :
```

```
S224002DC0FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF0E
S224002DE0FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFEE
S224002E00FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFCD
S224002E20FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFAD
S224002E40FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF8D
S224002E60FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF6D
S224002E80FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF4D
S224002EA0FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF2D
S224002EC0FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF0D
S224002EE0FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFED
S224002F00181800005AA5000101000001000100010002000000401011121314151617181969
S224002F201A1B1C1D1E1F2F3F0F3FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF3B
S224002F40FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF8C
S224002F60FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF6C
S224002F80FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF4C
S224002FA0FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF2C
S224002FC0FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF0C
S224002FE0FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFEC
S804000000FB
```

3.2 Function Option Generator (fog88112)

3.2.1 Outline of fog88112

With the 8-bit single chip S1C88112 microcomputer, the customer may select 8 mask options. By modifying the mask patterns of the S1C88112 according to the options selected by the customer, the system can be customized to meet the specifications of the target system. Also, two types of selected item that adapt the oscillation circuit specification of the ICE to the actual IC can be set. The fog88112 function option generator is a software tool for generating the document file used to generate mask patterns. It lets the customer interactively select the mask option for the S1C88112. From the data file created with fog88112, the S1C88112 mask pattern is automatically generated by a CAD machine at Seiko Epson. In addition, HEX data in the Motorola S2 format necessary for debugging using the ICE can be created. By downloading this data file from the host machine when debugging with the ICE, the same option functions as the actual IC can be executed on the ICE.

3.2.2 Execution flow and input/output files

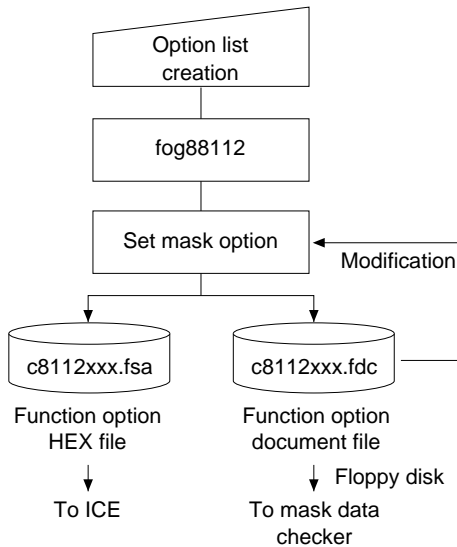Figure 3.2.2.1 shows the fog88112 execution flow.

Fig. 3.2.2.1 fog88112 execution flow

(1) Option list creation

Select the S1C88112 mask options that meet the specifications of the customer's target system and record them in the option list (paper for recording items in preparation for input operation; explained later). At this time, decide the option for the ICE use.

(2) fog88112 execution

Start fog88112 and select the mask options for the S1C88112 according to the display on screen. Since options can be selected using the interactive format, a device such as a source file is not necessary when creating data.

In addition, when correcting the contents, once it has been set, the necessary points alone can be corrected by inputting the document file that was output by fog88112.

As a result, fog88112 generates the following two files by option settings.

- *Function option document file (c8112xxx.fdc)*
  This is a document file in which the selected mask option items for the S1C88112 have been recorded, used to generate mask patterns at Seiko Epson. You can correct part of this file by inputting it using the fog88112.
  This file must be run through the mdc88112 mask data checker with the completed program file, and be submitted to Seiko Epson.

- *Function option HEX file (c8112xxx.fsa)*
  This is a data file for setting the S1C88112 mask options when debugging by the ICE. This file is generated by a Motorola S2 type format. When debugging is done using the ICE, download this file into the ICE by the command.

Remarks

* Since the customer code is entered in the xxx part of the file name, it should be as designated by Seiko Epson.

* Copy the document file and the program file (c8112xxx.psa) in a batch to another floppy disk and submit it to Seiko Epson.

* Refer to the ICE help file for the method of downloading the mask options into the ICE.

3.2.3 Option list

The following options can be set for the S1C88112 and ICE.

Multiple specifications are available in each option item as indicated in the Option List. Using "3.2.7 Option selection and option specification" as reference, select the specifications that meet the target system and check the appropriate box. Be sure to record the specifications for unused functions too, according to the instructions provided.

The option selection is done interactively on the screen during fog88112 execution, using this option list as reference.

Peripheral Circuit Board (S5U1C88316P) option list

A OSC1 SYSTEM CLOCK
    ☐ 1. Internal Clock (32.768 kHz)
    ☐ 2. User Clock

B OSC3 SYSTEM CLOCK
    ☐ 1. Internal Clock (4.9152 MHz)
    ☐ 2. User Clock

S1C88112 mask option list (1/2)

1 OSC1 SYSTEM CLOCK
    ☐ 1. Crystal
    ☐ 2. External Clock
    ☐ 3. CR
    ☐ 4. Crystal (with Gate Capacity)

2 OSC3 SYSTEM CLOCK
    ☐ 1. Crystal
    ☐ 2. Ceramic
    ☐ 3. CR
    ☐ 4. External Clock

3 MULTIPLE KEY ENTRY RESET
    • Combination ... ☐ 1. Not Use
    ☐ 2. Use K00, K01
    ☐ 3. Use K00, K01, K02
    ☐ 4. Use K00, K01, K02, K03

4 MPU MODE INITIAL SET
    ☐ 1. 512K (MAX)
    ☐ 2. 512K (MIN)
    ☐ 3. 64K

5 SVD RESET
    ☐ 1. Not Use
    ☐ 2. Use

6 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
    • K04 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
    • K05 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
    • K06 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
    • K07 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
    • K10 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
    • K11 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
    • MCU/$\overline{\text{MPU}}$ ..... ☐ 1. With Resistor   ☐ 2. Gate Direct
    • $\overline{\text{RESET}}$ .... ☐ 1. With Resistor   ☐ 2. Gate Direct

S1C88112 mask option list (2/2)

7 I/O PORT PULL UP RESISTOR
- P00 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P01 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P02 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P03 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P04 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P05 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P06 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P07 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P10 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P11 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P12 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P13 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P14 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P15 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P16 .... ☐ 1. With Resistor   ☐ 2. Gate Direct
- P17 .... ☐ 1. With Resistor   ☐ 2. Gate Direct

8 OUTPUT PORT SPECIFICATION
- R00 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R01 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R02 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R03 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R04 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R05 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R06 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R07 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R10 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R11 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R12 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R13 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R14 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R15 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R16 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain
- R17 .... ☐ 1. Complementary   ☐ 2. Nch Open Drain

3.2.4 Starting procedure

■ Starting command

```
fog88112  ↵
```

    ↵ indicates the Return key.

To start fog88112, insert the work disk into the current drive at the DOS command level (state in which a prompt such as A> is displayed), then enter the program name.

■ Start-up message

```
A>fog88112
E0C88112 Function Option Generator Version X.XX
Copyright (C) SEIKO EPSON CORP. 1993–1996

THIS SOFTWARE MAKES THE FOLLOWING FILES

     C8112XXX.FSA . . . FUNCTION OPTION HEX FILE.
     C8112XXX.FDC . . . FUNCTION OPTION DOCUMENT FILE.
```

When fog88112 is started, the start-up message is displayed.

Here we will explain the actual operation method of fog88112 according to the screen displayed.
To suspend execution, press the "CTRL" and "C" keys together; the sequence returns to the DOS command level. (It is possible by pressing "STOP" key depending on the PC used.)

■ Date input

```
CURRENT DATE IS '96/04/13
PLEASE INPUT NEW DATE :  '96/04/16↵
```

Following the start-up message, the date currently set in the host computer is displayed, prompting entry of a new date. When modifying the date, 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 selection menu

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

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

PLEASE SELECT NO. ?
```

When the date is set, the operation selection menu is displayed on the screen. Enter a number from 1 to 3 to select a subsequent operation.

The items indicate the following.

1. *INPUT NEW FILE:*
   Used to set new function option file.

2. *EDIT FILE:*
   Used to read the already-generated function option document file and set or modify the option contents. In this case, the current drive must contain the function option document file (c8112xxx.fdc) generated by "1. INPUT NEW FILE".

3. *RETURN TO DOS:*
   Used to terminate fog88112 and return to the DOS command level.

3.2.5 Setting new function options (INPUT NEW FILE)

This section explains how to set new function option file.

* In the examples, ↵ indicates the Return key.

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

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

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


PLEASE INPUT FILE NAME ? c8112xxx↵                        .. (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 0425-87-5816↵
                      ? FAX 0425-87-5624↵
                      ? ↵
```

(1) PLEASE SELECT NO.?

Select "1. INPUT NEW FILE" on the operation selection menu.

(2) PLEASE INPUT FILE NAME?

Enter the function option document (and HEX) file name to be generated. Do not enter the extension of the file name. A small letter is converted to a capital letter and outputs to the document file. Alphabetic characters and "0" to "9" can be used.

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 overwritten is desired. Enter "Y" or "N" accordingly.

```
PLEASE INPUT FILE NAME? c8112xxx↵
EXISTS OVERWRITE(Y/N)?
```

(3) PLEASE INPUT USER'S NAME?

Enter the customer's company name.
Up to 40 characters may be entered. If 41 or more characters are entered, they are ignored. "[" and "]" is displayed by conversion to "(" and ")".

(4) PLEASE INPUT ANY COMMENT

Enter any comment. Up to 50 characters may be entered in one line. If 51 or more characters are entered in one line, they are ignored. Up to 10 comment lines may be entered. To end entry of comments, press the Return key.
A small letter is displayed by conversion to a capital letter.
Include the following in comment lines:

• Company, department, division, and section names
• Company address, phone number, and FAX number
• Other information, including technical information

The below symbols for the inputting of (3) and (4) cannot be used. When those symbols are input, it displays an "ILLEGAL CHARACTER" error message, then again returns to the input status for that line.
"$", "\"("¥"), "|", back-quote ... input disable

Next, start mask option setting for S1C88112. For new settings, select options OPTION A, B and OPTION No. 1 to No. 8 sequentially and interactively.
See "3.2.7 Option selection and option specification" for the selection procedure of each function option.

3.2.6 Modifying function option settings (EDIT FILE)

This section explains how to modify the settings in the function option file.

* In the examples, ⏎ indicates the Return key.

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

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

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


*** SOURCE FILE(S) ***


C81120A0         C81120B0         C81120C0         .. (2)


PLEASE INPUT FILE NAME ? c81120a0⏎                .. (3)
PLEASE INPUT USER'S NAME ? ⏎                      .. (4)
PLEASE INPUT ANY COMMENT
(ONE LINE IS 50 CHR)  ? ⏎                          .. (5)
PLPRC88316/112DIT NO. ? 4⏎                         .. (6)
```

(1) PLEASE SELECT NO.?
Select "2. EDIT FILE" on the operation selection menu.

(2) *** SOURCE FILE(S) ***
Will display the function option document files on the current drive.
If no modifiable source exists, the following message is displayed and the program is terminated.

```
FUNCTION OPTION DOCUMENT …
        … FILE IS NOT FOUND.
```

(3) PLEASE INPUT FILE NAME?
Enter a file name. Do not enter the extension of the file name. If the function option document file (c8112xxx.fdc) is not in the current drive, an error message like the one below is output, prompting entry of other file name.

```
PLEASE INPUT FILE NAME? c81120n0⏎
FUNCTION OPTION DOCUMENT …
        … FILE IS NOT FOUND.
```

(4) PLEASE INPUT USER'S NAME?
When modifying the customer's company name, enter a new name. The previously entered name may be used by pressing the Return key.

(5) PLEASE INPUT ANY COMMENT
When modifying a comment, enter all the comment lines anew, beginning with the first line; comment data cannot be partially modified. Previously entered comment data can be used by pressing the Return key. The input conditions are the same as for new settings.

(6) PLEASE INPUT EDIT NO.?
Enter the number (A, B, 1–8) of the option to be modified, then start setting the option contents (See "3.2.7 Option selection and option specification").
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.
If the Return key is pressed without entering a number, the option of the subsequent number can be selected.

Enter "E⏎" to end option setting. Then, move to the confirmation procedure for the function option HEX file generation (See "3.2.8 HEX file generation").

Example:
• When modifying the settings of the option of No. 8
```
PLEASE INPUT EDIT NO.? 8⏎
```
• When ending setting
```
PLEASE INPUT EDIT NO.? E⏎
```

3.2.7 Option selection and option specification

Selection procedure for function options are described below.

* Option selection is done interactively. For new settings (INPUT NEW FILE), set all options OPTION A, B and OPTION No. 1 to No. 8 sequentially; to modify settings (EDIT FILE), the specified option number may be set directly.

* The selections for each option correspond one to one to the option list. While referring to the contents recorded in the option list, enter the selection number.

* In the message that prompts entry, the value in parentheses ( ) indicates the default value in case of new settings, or the previously set value in case of setting modification. This value is set when only the Return key is pressed.

* In the selection examples, "⏎" indicates the Return key input.

• ***Example of option selection***

```
*** OPTION NO.3 ***
--- 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⏎

        2. USE K00,K01          SELECTED
```

• ***Modifying procedure when wrong number is selected in new setting (INPUT NEW FILE)***
When you wish to modify previously set option in the new setting process (INPUT NEW FILE), enter "B⏎" to return 1 step back to the previous function option setting operation.

```
*** OPTION NO.3 ***
--- 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) ? B⏎

*** OPTION NO.2 ***
--- OSC3 SYSTEM CLOCK ---

        1. CRYSTAL
        2. CERAMIC
        3. CR
        4. EXTERNAL CLOCK

PLEASE SELECT NO.(1) ?
```

When all of option settings are completed in new settings, move to the confirmation procedure for the function option HEX file generation (See "3.2.8 HEX file generation").
When modify settings are completed, move to the confirmation procedure for the function option HEX file generation (See "3.2.8 HEX file generation") by entering "E⏎".

Screen that can be selected as function options set on the Peripheral Circuit Board is shown below.
Please refer to the "S1C88112/104 Technical Manual" for detailed specification of the S1C88112.

Peripheral Circuit Board (S5U1C88316P) options

Selects the OSC1 and OSC3 system clocks for the Peripheral Circuit Board.
These option selections are valid when performing software development on the ICE. For the system clocks
to be used on the actual IC (S1C88112), select them with S1C88112 mask options OPTION No. 1 and No. 2.

A OSC1 system clock

```
#PRC88316/112 OPTION
*** OPTION A ***
--- OSC1 SYSTEM CLOCK ---

        1. INTERNAL CLOCK(32.768KHz)
        2. USER CLOCK

PLEASE SELECT NO.(1) ? 1↵

        1. INTERNAL CLOCK(32.768KHz)    SELECTED
```

When "1. INTERNAL CLOCK(32.768KHz)" is
selected, 32.768 kHz system clock generated
from the built-in crystal oscillation circuit is
supplied to the Peripheral Circuit Board.
When "2. USER CLOCK" is selected, a rectangular wave clock can be input to the Peripheral
Circuit Board from outside through OSC1.

B OSC3 system clock

```
*** OPTION B ***
--- OSC3 SYSTEM CLOCK ---

        1. INTERNAL CLOCK(4.9152MHz)
        2. USER CLOCK

PLEASE SELECT NO.(1) ? 1↵

        1. INTERNAL CLOCK(4.9152MHz)    SELECTED
```

When "1. INTERNAL CLOCK(4.9152MHz)" is
selected, 4.9152 MHz system clock generated
from the built-in crystal oscillation circuit is
supplied to the Peripheral Circuit Board.
When "2. USER CLOCK" is selected, a rectangular wave clock can be input to the Peripheral
Circuit Board from outside through OSC3.

S1C88112 mask options

1 OSC1 system clock

```
*** OPTION NO.1 ***
--- OSC1 SYSTEM CLOCK ---

        1. CRYSTAL
        2. EXTERNAL CLOCK
        3. CR
        4. CRYSTAL (WITH GATE CAPACITY)

PLEASE SELECT NO.(1) ? 1↵

        1. CRYSTAL              SELECTED
```

2 OSC3 system clock

```
*** OPTION NO.2 ***
--- OSC3 SYSTEM CLOCK ---

        1. CRYSTAL
        2. CERAMIC
        3. CR
        4. EXTERNAL CLOCK

PLEASE SELECT NO.(1) ? 1↵

        1. CRYSTAL              SELECTED
```

3 Multiple key entry reset

```
*** OPTION NO.3 ***
--- 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) ? 1↵

        1. NOT USE              SELECTED
```

4 MPU mode initial set

```
*** OPTION NO.4 ***
--- MPU MODE INITIAL SET ---

        1. 512K(MAX)
        2. 512K(MIN)
        3. 64K

PLEASE SELECT NO.(3) ? 1↵

        1. 512K(MAX)            SELECTED
```

5 SVD reset

```
*** OPTION NO.5 ***
--- SVD RESET ---

        1. NOT USE
        2. USE

PLEASE SELECT NO.(1) ? 1↵

        1. NOT USE              SELECTED
```

6 Input port pull up resistor

```
*** OPTION NO.6 ***
--- 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↵

                   :
        (Selection for K02–K07, K10 and K11)
                   :
PLEASE SELECT NO.(1) ? 1↵

 MCU/~MPU:  1. WITH RESISTOR
            2. GATE DIRECT

PLEASE SELECT NO.(1) ? 1↵

   ~RESET:  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
     K04:  1. WITH RESISTOR     SELECTED
     K05:  1. WITH RESISTOR     SELECTED
     K06:  1. WITH RESISTOR     SELECTED
     K07:  1. WITH RESISTOR     SELECTED
     K10:  1. WITH RESISTOR     SELECTED
     K11:  1. WITH RESISTOR     SELECTED
 MCU/~MPU:  1. WITH RESISTOR     SELECTED
   ~RESET:  1. WITH RESISTOR     SELECTED
```

7 I/O port pull up resistor

```
*** OPTION NO.7 ***
--- I/O PORT PULL UP RESISTOR ---

      P00:  1. WITH RESISTOR
            2. GATE DIRECT

PLEASE SELECT NO.(1) ? 1↵

      P01:  1. WITH RESISTOR
            2. GATE DIRECT

PLEASE SELECT NO.(1) ? 1↵


                 :
         (Selection for P02–P07 and P10–P16)
                 :

PLEASE SELECT NO.(1) ? 1↵

      P17:  1. WITH RESISTOR
            2. GATE DIRECT

PLEASE SELECT NO.(1) ? 1↵

      P00:  1. WITH RESISTOR    SELECTED
      P01:  1. WITH RESISTOR    SELECTED
      P02:  1. WITH RESISTOR    SELECTED
      P03:  1. WITH RESISTOR    SELECTED
      P04:  1. WITH RESISTOR    SELECTED
      P05:  1. WITH RESISTOR    SELECTED
      P06:  1. WITH RESISTOR    SELECTED
      P07:  1. WITH RESISTOR    SELECTED
      P10:  1. WITH RESISTOR    SELECTED
      P11:  1. WITH RESISTOR    SELECTED
      P12:  1. WITH RESISTOR    SELECTED
      P13:  1. WITH RESISTOR    SELECTED
      P14:  1. WITH RESISTOR    SELECTED
      P15:  1. WITH RESISTOR    SELECTED
      P16:  1. WITH RESISTOR    SELECTED
      P17:  1. WITH RESISTOR    SELECTED
```

8 Output port specification

```
*** OPTION NO.8 ***
--- OUTPUT PORT SPECIFICATION ---

      R00:  1. COMPLEMENTARY
            2. NCH-OPEN DRAIN

PLEASE SELECT NO.(1) ? 1↵

      R01:  1. COMPLEMENTARY
            2. NCH-OPEN DRAIN

PLEASE SELECT NO.(1) ? 1↵


                 :
         (Selection for R02–R07 and R10–R16)
                 :

PLEASE SELECT NO.(1) ? 1↵

      R17:  1. COMPLEMENTARY
            2. NCH-OPEN DRAIN

PLEASE SELECT NO.(1) ? 1↵

      R00:  1. COMPLEMENTARY    SELECTED
      R01:  1. COMPLEMENTARY    SELECTED
      R02:  1. COMPLEMENTARY    SELECTED
      R03:  1. COMPLEMENTARY    SELECTED
      R04:  1. COMPLEMENTARY    SELECTED
      R05:  1. COMPLEMENTARY    SELECTED
      R06:  1. COMPLEMENTARY    SELECTED
      R07:  1. COMPLEMENTARY    SELECTED
      R10:  1. COMPLEMENTARY    SELECTED
      R11:  1. COMPLEMENTARY    SELECTED
      R12:  1. COMPLEMENTARY    SELECTED
      R13:  1. COMPLEMENTARY    SELECTED
      R14:  1. COMPLEMENTARY    SELECTED
      R15:  1. COMPLEMENTARY    SELECTED
      R16:  1. COMPLEMENTARY    SELECTED
      R17:  1. COMPLEMENTARY    SELECTED
```

3.2.8 HEX file generation

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

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

DO YOU MAKE HEX FILE (Y/N) ?
Enter "Y" to generate the HEX file (c8112xxx.fsa). If "N" is entered, no HEX file is generated and only document file (c8112xxx.fdc) is generated.
Since the function option HEX file (c8112xxx.fsa) is needed when debugging the program with the ICE, normally set "Y".

When debugging with the ICE, download the generated HEX file into the ICE.

When the above operation is completed, fog88112 generates the function option HEX file and function option document file. And then the following message is output and the sequence returns to the operation selection menu. However, when "N" is input in the above selection for the function option HEX file, the end message shown below is not displayed.

```
MAKING FILE(S) IS COMPLETED.
```

3.2.9 End procedure

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

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

PLEASE SELECT NO.? 3⏎
```

When a series of operations are complete, the sequence returns to the operation selection menu. Execution of fog88112 can be ended by selecting "3. RETURN TO DOS" on this menu. If "1. INPUT NEW FILE" or "2. EDIT FILE" is selected, setting function options can be performed again.

fog88112 can be forcibly terminated by pressing the "CTRL" and "C" keys together during program execution. (It is possible by pressing "STOP" key depending on the PC used.) However, in this case, the correct function option HEX file and function option document file are not generated.

3.2.10 Error message

Here following is a list of the fog88112 error messages.

Table 3.2.10.1 fog88112 error message list

Error message	Explanation
ILLEGAL CHARACTER!!	There is an input character error.
	An input disable character has been input.
FUNCTION OPTION DOCUMENT FILE IS NOT FOUND.	There is no document file at the time of the setting modification (EDIT FILE).
	There is no document file with the input file name at the time of the setting modification (EDIT FILE).
FILE NAME ERROR	9 characters or more have been input for the file name input.
BAD FUNCTION OPTION DOCUMENT FILE. - file name -	A function option document file other than for the S1C88112 is specified during modification (EDIT FILE).

3.2.11 Sample files

■ Example of function option document file

```
* E0C88112 FUNCTION OPTION DOCUMENT  V X.XX
*
* FILE NAME    C81120A0.FDC
* USER'S NAME  SEIKO EPSON CORP.
* INPUT DATE   '96/04/16
* COMMENT      TOKYO DESIGN CENTER
*              421-8 HINO HINO-SHI TOKYO 191 JAPAN
*              TEL 0425-87-5816
*              FAX 0425-87-5624
*
* #PRC88316/112 OPTION
* *** OPTION A ***
* --- OSC1 SYSTEM CLOCK ---
*     INTERNAL CLOCK(32.768KHZ) ------------------------  SELECTED
*OPT0A01 01
*
* *** OPTION B ***
* --- OSC3 SYSTEM CLOCK ---
*     INTERNAL CLOCK(4.9152MHZ) ------------------------  SELECTED
*OPT0B01 01
*
* #E0C88112 OPTION
* *** OPTION NO.1 ***
* --- OSC1 SYSTEM CLOCK ---
*     CRYSTAL  -----------------------------------------  SELECTED
 OPT0101 01
*
* *** OPTION NO.2 ***
* --- OSC3 SYSTEM CLOCK ---
*     CRYSTAL  -----------------------------------------  SELECTED
 OPT0201 01
*
* *** OPTION NO.3 ***
* --- MULTIPLE KEY ENTRY RESET ---
*     COMBINATION       NOT USE --------------------  SELECTED
 OPT0301 01
*
* *** OPTION NO.4 ***
* --- MPU MODE INITIAL SET ---
*     512K(MAX) ----------------------------------------  SELECTED
 OPT0401 01
*
* *** OPTION NO.5 ***
* --- SVD RESET ---
*     NOT USE  -----------------------------------------  SELECTED
 OPT0501 01
*
* *** OPTION NO.6 ***
* --- INPUT PORT PULL UP RESISTOR ---
*     K00               WITH RESISTOR ---------------  SELECTED
*     K01               WITH RESISTOR ---------------  SELECTED
*     K02               WITH RESISTOR --------------  SELECTED
*     K03               WITH RESISTOR --------------  SELECTED
*     K04               WITH RESISTOR --------------  SELECTED
*     K05               WITH RESISTOR ---------------  SELECTED
*     K06               WITH RESISTOR ---------------  SELECTED
*     K07               WITH RESISTOR ---------------  SELECTED
*     K10               WITH RESISTOR ---------------  SELECTED
*     K11               WITH RESISTOR ---------------  SELECTED
```

```
*      MCU/~MPU              WITH RESISTOR ---------------- SELECTED
*      ~RESET               WITH RESISTOR ---------------- SELECTED
 OPT0601 01
 OPT0602 01
 OPT0603 01
 OPT0604 01
 OPT0605 01
 OPT0606 01
 OPT0607 01
 OPT0608 01
 OPT0609 01
 OPT0610 01
 OPT0611 01
 OPT0612 01
*
* *** OPTION NO.7 ***
* --- I/O PORT PULL UP RESISTOR ---
*      P00                  WITH RESISTOR ---------------- SELECTED
*      P01                  WITH RESISTOR ---------------- SELECTED
*      P02                  WITH RESISTOR ---------------- SELECTED
*      P03                  WITH RESISTOR ---------------- SELECTED
*      P04                  WITH RESISTOR ---------------- SELECTED
*      P05                  WITH RESISTOR ---------------- SELECTED
*      P06                  WITH RESISTOR ---------------- SELECTED
*      P07                  WITH RESISTOR ---------------- SELECTED
*      P10                  WITH RESISTOR ---------------- SELECTED
*      P11                  WITH RESISTOR ---------------- SELECTED
*      P12                  WITH RESISTOR ---------------- SELECTED
*      P13                  WITH RESISTOR ---------------- SELECTED
*      P14                  WITH RESISTOR ---------------- SELECTED
*      P15                  WITH RESISTOR ---------------- SELECTED
*      P16                  WITH RESISTOR ---------------- SELECTED
*      P17                  WITH RESISTOR ---------------- SELECTED
 OPT0701 01
 OPT0702 01
 OPT0703 01
 OPT0704 01
 OPT0705 01
 OPT0706 01
 OPT0707 01
 OPT0708 01
 OPT0709 01
 OPT0710 01
 OPT0711 01
 OPT0712 01
 OPT0713 01
 OPT0714 01
 OPT0715 01
 OPT0716 01
*
* *** OPTION NO.8 ***
* --- OUTPUT PORT SPECIFICATION ---
*      R00                  COMPLEMENTARY ---------------- SELECTED
*      R01                  COMPLEMENTARY ---------------- SELECTED
*      R02                  COMPLEMENTARY ---------------- SELECTED
*      R03                  COMPLEMENTARY ---------------- SELECTED
*      R04                  COMPLEMENTARY ---------------- SELECTED
*      R05                  COMPLEMENTARY ---------------- SELECTED
*      R06                  COMPLEMENTARY ---------------- SELECTED
*      R07                  COMPLEMENTARY ---------------- SELECTED
*      R10                  COMPLEMENTARY ---------------- SELECTED
*      R11                  COMPLEMENTARY ---------------- SELECTED
*      R12                  COMPLEMENTARY ---------------- SELECTED
*      R13                  COMPLEMENTARY ---------------- SELECTED
```

```
*       R14                     COMPLEMENTARY  ---------------  SELECTED
*       R15                     COMPLEMENTARY  ---------------  SELECTED
*       R16                     COMPLEMENTARY  ---------------  SELECTED
*       R17                     COMPLEMENTARY  ---------------  SELECTED
 OPT0801 01
 OPT0802 01
 OPT0803 01
 OPT0804 01
 OPT0805 01
 OPT0806 01
 OPT0807 01
 OPT0808 01
 OPT0809 01
 OPT0810 01
 OPT0811 01
 OPT0812 01
 OPT0813 01
 OPT0814 01
 OPT0815 01
 OPT0816 01
*
*
* SEIKO EPSON'S AREA
*
*
 OPT0901 01
 OPT0902 01
 OPT0903 01
 OPT0904 01
 OPT0905 01
 OPT0906 01
 OPT0907 01
 OPT0908 01
*
 OPT1001 01
\\END
```

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

■ **Example of function option HEX file (Motorola S2 format)**

```
S21100200000010000000001000044000000006A
S804000000FB
```

3.3   Mask Data Checker (mdc88112)

3.3.1 Outline of mdc88112

The mdc88112 mask data checker is a software tool that checks the format of the program data (c8112xxx.psa) that the unused area of the built-in ROM is filled with FFH by fil88112 and option data (c8112xxx.fdc) created by the user and creates the data file (c8112xxx.pan) for generating mask patterns. The user must send the file generated through this software tool to Seiko Epson. Moreover, mdc88112 has the capability to restore the generated data file (c8112xxx.pan) to the original file format (c8112xxx.usa and c8112xxx.ufd).
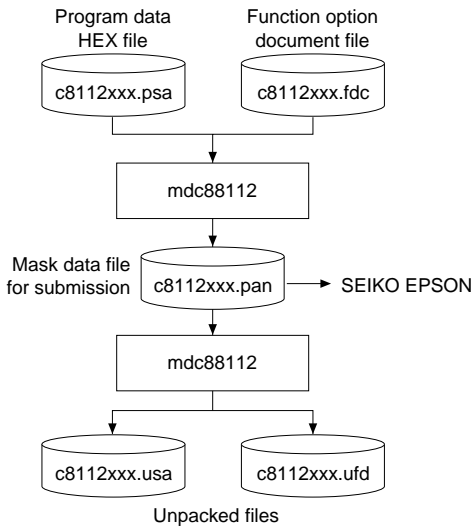
Fig. 3.3.2.1 mdc88112 execution flow

3.3.2 Execution flow and input/output files

Figure 3.3.2.1 shows the mdc88112 execution flow.

(1) Preparation of program data file (c8112xxx.psa)
Prepare the program data HEX file generated from the program unused area filling utility (fil88112).

(2) Preparation of function option data file (c8112xxx.fdc)
Prepare the function option data file generated from the function option generator (fog88112).

(3) Packing of data
Using the mask data checker (mdc88112), compile the program data HEX file and function option document file in one data file for masking (c8112xxx.pan). This file must be sent to Seiko Epson.

(4) Unpacking of data
The data file for masking (c8112xxx.pan) generated by packing processing can be restored to the original program data HEX file and function option document file using the mask data checker (mdc88112).

Note: Since the customer code is entered in the xxx part of the file name, it should be as designated by Seiko Epson.

NOTE: Program data HEX file to be packed/unpacked

mdc88112 executes the following processing for the program data file generated by the user.

Since the built-in ROM capacity of the S1C88112 is 12K bytes (000000H–002FFFH), the packing/unpacking processing by the mdc88112 is done for only the 12K bytes area from the top of program data that can be masked into ROM.

When packing, the mdc88112 extracts the part (12K bytes) to be masked into the S1C88112 built-in ROM and generates the pack data for generating the mask. When restoring the program data by unpacking, only 12K bytes of program data generated as the pack data is restored. Be careful: the program data exceeding 12K bytes becomes invalid in the mdc88112 if the program data created by the user exceeds 12K bytes.
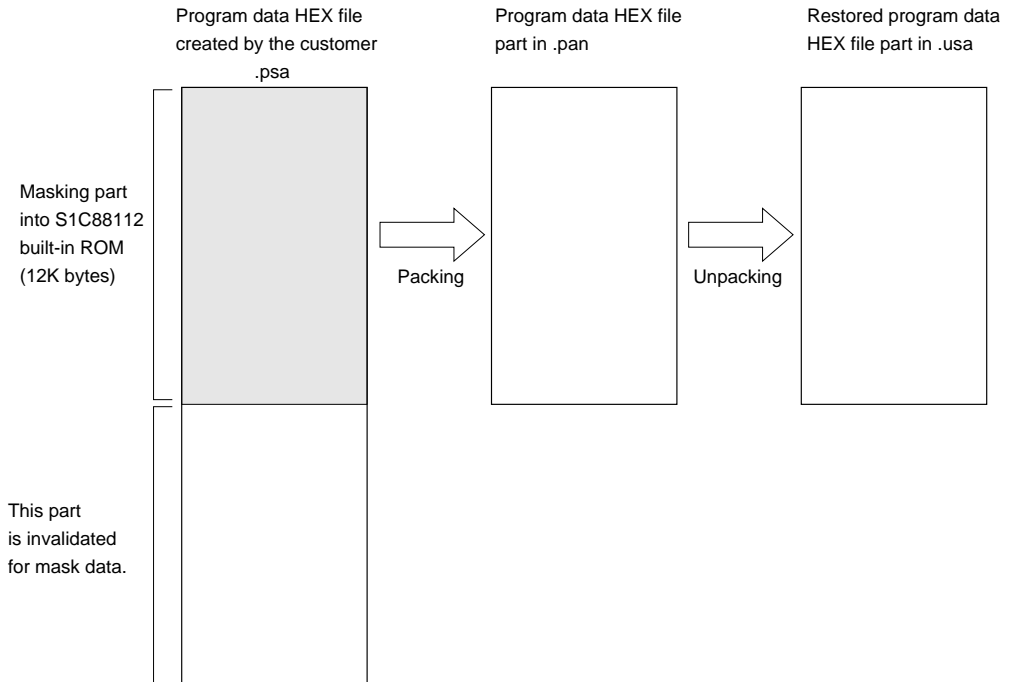

Fig. 3.3.2.2 Program data HEX file to be packed/unpacked

When submitting mask data to Seiko Epson, you should use the mdc88112 and it must include program data in the mask data, even if you use the S1C88112 in the MPU mode that does not need to make a mask for internal ROM; it needs masking only for the mask option (I/O settings, etc.).

3.3.3 Creating work disk

In order to prevent accidents due to misoperations such as program erasures, place a write protection tab on the mask data checker system disk and keep it as master disk; actual operation should be conducted on other disks.

Create a work disk and copy "mdc88112.exe" on it.

3.3.4 Copying data files

When submitting data to Seiko Epson, copy on the work disk the data generated from the program unused area filling utility (fil88112) and the function option generator (fog88112).

Be sure to assign the following file names. (Since the customer code is entered in the xxx part of the file name, it should be as designated by Seiko Epson.)

• *Program data c8112xxx.psa*
• *Function option data c8112xxx.fdc*

3.3.5 Starting procedure

To start mdc88112, insert the work disk into the current drive at the DOS command level (state in which a prompt such as A> is displayed) and then enter the command as following format.

■ Start-up command

```
mdc88112 -[p u] <file>  ↵
```

↵ indicates the Return key.

■ Option

The below options have been set for the start-up command of the mdc88112.

1) *-p*

Specification of packing. When this option has been specified, the output file name must also be specified. In this case, the program data HEX file (.psa) and function option document file (.fdc) must have the same name (excluding the extension) as the specified output file name. Furthermore, generation of the output file and reading of the input files are done only for the current drive.

Example: `A>mdc88112 -p c81120a0.pa0↵`

2) *-u*

Specification of unpacking. When this option has been specified, an input file name must also be specified.

Furthermore, reading of the input file and generation of the output files are done only for the current drive.

Example: `A>mdc88112 -u c81120a0.pa0↵`

3) *Default (When option has not been specified)*

When an option has not been specified, it is designed such that pack/unpack processing can be selected from the operation menu displayed, following start-up. It is set-up such that the packing file name to be output or input can also be specified according to the message displayed.

■ Start-up message

When mdc88112 is started, the following message is displayed.

```
 ┌─ Display 1 ──────────────────────────────┐
 │ Example: When option has not been specified. │
 │                                          │
 │ A>mdc88112                               │
 │ E0C88112 Mask Data Checker Version X.XX  │
 │ Copyright (C) SEIKO EPSON CORP. 1993-1994 │
 │                                          │
 │      --- OPERATION MENU ---              │
 │                                          │
 │          1. PACK                         │
 │          2. UNPACK                       │
 │                                          │
 │       PLEASE SELECT NO.?                 │
 │                                          │
 └──────────────────────────────────────────┘
```

When an option has not been specified at the time the start-up command is input, the operation menu is displayed and the user is prompted to select operation. When creating masking data for submission to Seiko Epson, select "1"; when the masking data is to be split and restored to the original format (c8112xxx.psa and c8112xxx.fdc), select "2". When an option has been specified at the time of start-up of the mdc88112, it executes directly the selected packing or unpacking processing without displaying this operation menu.

Note: In OS environment setup file "CONFIG.SYS", the number of files that can be opened at the same time must be set at least 10.
Example: FILES = 20

3.3.6 Packing of data

When generating data for submission to Seiko Epson, specify -p option at the time of start-up of the mdc88112 (see "1)" in "3.3.5 Starting procedure") or select "1. PACK" in the operation menu (see "3)" in "3.3.5 Starting procedure").
When "1. PACK" is selected in the operation menu, the user is prompted for the name of the file to be generated. (See Display 2.)

Since the customer code is entered in the xxx part of the file name, it should be as designated by Seiko Epson.
Moreover, after submitting the masking data to Seiko Epson and there is need to re-submit the masking data for reasons such as faulty programs, etc., increase the numeric value of "n" by one when the input is made. (Example: When re-submitting data after "c8112xxx.pa0" has been submitted, the pack file name should be entered as "c8112xxx.pa1".)

In addition, access to the input files when packing data is done only for program data HEX file (.psa) and function option document file (.fdc) that have the same name (excluding the extension) as the specified output file name on the current drive.

When the -p option has been specified at mdc88112 start-up, it executes directly the packing processing without displaying the operation menu and confirmation message of the file name to be generated.

If there is no problem in inputting of the file name and the content of the input file, it generates the packed data for masking and displays the generated file name. (See Display 3.)

With this, the data file for masking (c8112xxx.pan) is generated. Submit this file to Seiko Epson.

Display 2

```
        C8112XXX.PSA --------+
                             +-------- C8112XXX.PA0 (PACK FILE)
        C8112XXX.FDC --------+

PLEASE INPUT PACK FILE NAME (C8112XXX.PAn) ? c81120a0.pa0 ↵
```

Display 3

Example: In case of the output file name is "c81120a0.psa".

```
        C81120A0.PSA --------+
                             +-------- C81120A0.PA0
        C81120A0.FDC --------+
```

3.3.7 Unpacking data

When restoring the packed data to original file format, specify -u option at the time of start-up of the mdc88112 (see "2)" in "3.3.5 Starting procedure") or select "2. UNPACK" in the operation menu (see "3)" in "3.3.5 Starting procedure").

When "2. UNPACK" is selected in the operation menu, the user is prompted for the input file name. (See Display 4.)

When the -u option has been specified at mdc88112 start-up, it executes directly the unpacking processing without displaying the operation menu and confirmation message of the input file name (packed data) to be input.

If there is no problem in the file name and the content of the input file, it executes the unpacking processing and displays the generated file name. (See Display 5.)

With this, the data file for masking (c8112xxx.pan) is restored to the original file format, making it possible to male comparison with the original data. The restored data file names will be as follows:
• *Program data c8112xxx.usa*
• *Function option data c8112xxx.ufd*

Display 4
```
PLEASE INPUT PACKED FILE NAME (C8112XXX.PAn) ? c81120a0.pa0⏎
```

Display 5
```
Example: In case of the input file name is "c81120a0.pa0"

                     +-------- C81120A0.USA
C81120A0.PA0 --------+
                     +-------- C81120A0.UFD
```

3.3.8 End procedure

When a series of operations are complete, the mdc88112 displays the following message and returns to the DOS command level.

When terminated normally

Display 6
```
PACK/UNPACK COMPLETED
A>
```

The output file is generated in the same directory as the input file.

When an error has been occurred

Display 7
```
HEX DATA ERROR : NOT S RECORD   ...Example of error message
A>
```

When an error has occurred, an output file is not generated.

3.3.9 Error message

In the packing operation, program data HEX file and function option data file are checked; in the unpacking operation, the packed file is checked. If there is any abnormal format, the message below is displayed. The mdc88112 error message lists are indicated below.

Table 3.3.9.1 Program data error message list

Message	Explanation
MESSAGE : SEPARATED DATA WITH 12K AS MASK DATA	When data in ".psa" exceeds 12K bytes (built-in ROM capacity of the S1C88112), it packs the 0000H to 2FFFH data as mask data.

Error message	Explanation
HEX DATA ERROR : NOT S RECORD.	There is no S record.
HEX DATA ERROR : DATA LENGTH.(NOT 24H)	The data length of 1 line is not 24H.
HEX DATA ERROR : ADDRESS.	The address length is not 3 bytes.
HEX DATA ERROR : TOO MANY DATA IN ONE LINE.	There are too many data in 1 line.
HEX DATA ERROR : CHECK SUM.	The checksum is not correct.
HEX DATA ERROR : DUPLICATE.	There is duplicate definition of data in the same address.
HEX DATA ERROR : NO 00H ADDRESS	There is no data in the physical address 00H.
HEX DATA ERROR : NO FILLED FILE WITH FFH	The data of the unused area are not FFH.

Table 3.3.9.2 Function option data error message list

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

Table 3.3.9.3 File error message list

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

Table 3.3.9.4 System error message list

Error message	Explanation
Directory Full	The directory is full.
Disk Write Error	Writing on the disk is failed.

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

3.3.10 Packed file

■ Configuration of packed file

The packed file is configured according to the following format:

```
                              *
                              *   E0C88112 MASK DATA VER X.XX
                              *
Program data header     ─\ROM1
Model name              ─E0C88112XXX PROGRAM ROM
Program data            ┌S224000000...........................................
(Motorola S2 format)    │S224000020...........................................
                        │  :        :        :        :        :        :        :
                        └S804000000FB
End mark                ─\END
Function option header  ─\OPTION1
                        ┌* E0C88112 FUNCTION OPTION DOCUMENT  V X.XX
                        │*
                        │* FILE NAME    C8112XXX.FDC
                        │* USER'S NAME  SEIKO EPSON CORP.
                        │* INPUT DATE   '96/04/16
                        │*
                        │* #PRC88316/112 OPTION
                        │* *** OPTION A ***
Function option data    │* --- OSC1 SYSTEM CLOCK ---
                        │*     INTERNAL CLOCK (32.768KHZ)  -----------   SELECTED
                        │*
                        │ :        :        :        :        :        :        :
                        │* #E0C88112 OPTION
                        │* *** OPTION NO.1 ***
                        │* --- OSC1 SYSTEM CLOCK ---
                        │*     CRYSTAL  -----------------------------   SELECTED
                        │ OPT0101 01
                        │ :        :        :        :        :        :        :
                        └ OPT1001 01
End mark                ─\END
```
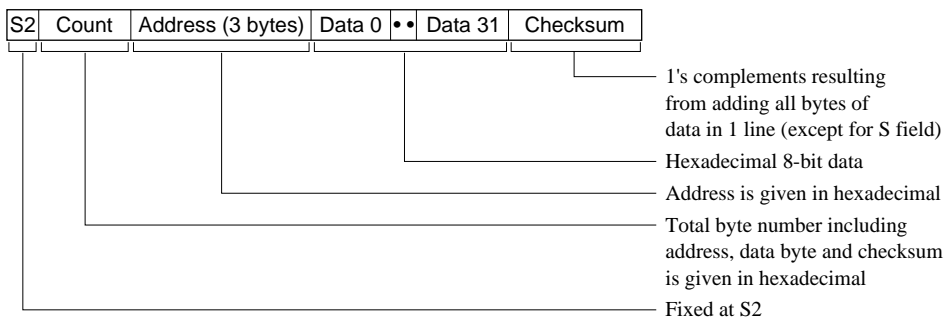
                    * \ sometimes appears as ¥, depending on the personal computer being used.

■ Program data

(1) Data line

The program data is configured as follows, using Motorola S2 format:

S2	Count	Address (3 bytes)	Data 0	••	Data 31	Checksum

- 1's complements resulting from adding all bytes of data in 1 line (except for S field)
- Hexadecimal 8-bit data
- Address is given in hexadecimal
- Total byte number including address, data byte and checksum is given in hexadecimal
- Fixed at S2

(2) End mark

S804000000FB

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3.4 Self-diagnostic Program (t88112)

3.4.1 Outline of t88112

t88112 is a self-diagnostic program to check the operation of the hardware tool ICE that is used for program debugging of the S1C88 Family.
Perform a self-diagnostic of the ICE and Peripheral Circuit Board periodically using this program when using the ICE and the Peripheral Circuit Board for debugging.

3.4.2 File configuration

(1) Program data HEX file (t88112.psa)

This is the main unit of the self-diagnostic program generated by the fil88112 and in which FFH is filled in the unused area of the internal ROM and the system code is set to the system reserved area of the S1C88112.

(2) Function option HEX file (t88112.fsa)

This is the file generated by the fog88112 to set the mask option into the ICE and the Peripheral Circuit Board, and is used at self-diagnosis.

(3) Function option document file (t88112.fdc)

This is the document file generated by the fog88112 and the setting contents of the function option HEX file mentioned above are described.

3.4.3 Operation procedure

After installing the Peripheral Circuit Board into the ICE, self-diagnosis of the ICE and the Peripheral Circuit Board can be done by the following operating test.
For the following operating test, the self-diagnostic program (t88112.psa) and the function option HEX data (t88112.fsa) in this package are used.
Perform the below operations with the ICE.

■ Operation Check on ICE

Execute by reading the self-diagnostic program (t88112.psa) and the function option HEX data (t88112.fsa) into the ICE.
Please refer the ICE help file for loading, execution.

Diagnostic procedure

Check using the VDC0–2, OSCC, LCDC, CMP0ON, CMP1ON, SVDON and HVLD LEDs on the Peripheral Circuit Board. If the below light statuses are verified following system reset, it is normal. The cycle count indicates a 1 second interval and the light status of the below LED changes every second. When it returns to 1 after 20, it then repeats the cycle again.

Cycle count	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	1	2	
VDC0	○	●	○	○	○	●	○	○	○	●	○	○	○	●	○	○	○	●	○	○	○	●	●: ON (lit)
VDC1	●	○	●	○	●	○	●	○	●	○	●	○	●	○	●	○	●	○	●	○	●	○	○: OFF (not lit)
VDC2	○	○	○	●	○	○	○	○	●	○	○	○	●	○	○	○	●	○	○	○	●	○	○	✳: Brinking
OSCC	○	○	○	●	○	○	○	○	●	○	○	○	●	○	○	○	●	○	○	○	●	○	○	
LCDC	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
CMP0ON	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	
CMP1ON	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	
SVDON	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	
HVLD	○	✳	○	●	○	✳	○	●	○	✳	○	●	○	✳	○	●	○	✳	○	●	○	✳	

4 88112.par FILE

The 88112.par file is a macro file that contains the information for the S1C88112. The ICE sets its operating environment by loading this parameter file. Therefore, the ICE cannot start up if this parameter file does not exist.

4.1 Contents of 88112.par File

The supplied 88112.par file contains the following information.

```
[Options]
Prcclksel=0                 ...(1)
Vdddown=0                   ...(2)
CC=0                        ...(3)
DIAG=0                      ...(4)

[MAP Config]
;E0C88112 MAP Configuration Setting
;   000000-00FFFF:Define 1 byte unit
;   010000-27FFFF:Define 256 bytes unit
;
;syntax:<Start address> <End address> [E][I][U][S][W]
;       E:Emulation memory
;       I:I/O (PRC Board) memory
;       U:User memory
;       S:Stack area
;       W:Write protect (Default does not protect)

;Internal ROM
Map0=000000 002FFF E W    ...(5)

;Internal RAM
;Stack area
Map1=00F000 00F0FF E S

;I/O memory
Map2=00FF00 00FF02 I
Map3=00FF12 00FF13 I
Map4=00FF20 00FF25 I
Map5=00FF30 00FF34 I
Map6=00FF35 00FF36 I W
Map7=00FF40 00FF40 I
Map8=00FF41 00FF41 I W
Map9=00FF42 00FF42 I
Map10=00FF43 00FF43 I W
Map11=00FF44 00FF45 I
Map12=00FF48 00FF4A I
Map13=00FF50 00FF53 I
Map14=00FF54 00FF55 I W
Map15=00FF60 00FF63 I
Map16=00FF70 00FF78 I
```

4.2 Description of the Parameters

The parameters (1) to (4) are fixed items, so do not modify their settings. Parameter (5) and the following parameters are used to set the memory allocations and memory conditions.

General format:
Map<Serial number>
    = <Start address> <End address> <Switch>

■ Serial number

The Map parameter must have a serial number within the range from 0 to 1023.
The serial numbers must not be specified in a special order.
If a number is duplicated, the parameter set first is enabled and the others are disabled.

■ Address settings

Addresses can be set in byte units for the range from 000000 to 00FFFF. Areas exceeding 010000 should be done using 265 byte units. (****00–****FF).

■ Switch

The following five letters are available for specifying <Switch>: E, I, U, S and W.

- *Switches for allocating memories (E, I, U switches)*
  The I switch allocates the specified address area to the memory on the Peripheral Circuit Board.
  The E switch allocates the specified area to the emulation memory on the ICE.
  The U switch allocates the specified area to the user's memory on the target board.

- *Switch for setting a stack area (S switch)*
  The S switch sets the specified area as a stack area.

- *Switch for disabling writing in certain areas*
  The W switch sets the specified area as a ROM area that cannot be written on. When an area is specified without the W switch, the ICE will regard it as a RAM area.

■ Comments

The ICE identifies a line that begins with a semicolon (;) as a comment line. Comments cannot be placed following parameters (e.g., `Map0=000000 002FFF EW ;internal ROM`).

4.3 Emulation Memory

The ICE (S5U1C88000H5) has built-in a 64KB emulation memory for the memory space from 000000 to 00FFFF and a 512KB emulation memory that can be used as an expanded memory area exceeding address 010000. The emulation memory allows the user to use it as a memory that will be connected externally in the actual product. Thus it is not necessary to mount the external memory on the target board to develop the program. However, prepare the external memory on the target board when developing a product that needs a larger memory than 512KB at a location exceeding address 010000.

■ Notes

- ICE88UR for Windows gets the path information for loading the parameter file from the ICE88UR.INI file.
  Installation of ICE for Windows makes the DEFAULT.PAR file in the same directory as the ICE88UR.EXE file installed and sets the path information in the ICE88UR.INI file so that the debugger will refer to the DEFAULT.PAR file. It is therefore necessary to edit the path description in the \WINDOWS\ICE88UR.INI file. When the 88112.par file exists in the directory the same as the ICE88UR.EXE file, only the file name part should be modified.

- The parameters (1) to (4) must be described in the part that begins with an [Options] line and the parameters following (5) must be described after the [MAP Config] line. Do not delete [Options] and [MAP Config].

EPSON   International Sales Operations

AMERICA

EPSON ELECTRONICS AMERICA, INC.

- HEADQUARTERS -
1960 E. Grand Avenue
El Segundo, CA 90245, U.S.A.
Phone: +1-310-955-5300   Fax: +1-310-955-5400

- SALES OFFICES -

West
150 River Oaks Parkway
San Jose, CA 95134, U.S.A.
Phone: +1-408-922-0200   Fax: +1-408-922-0238

Central
101 Virginia Street, Suite 290
Crystal Lake, IL 60014, U.S.A.
Phone: +1-815-455-7630   Fax: +1-815-455-7633

Northeast
301 Edgewater Place, Suite 120
Wakefield, MA 01880, U.S.A.
Phone: +1-781-246-3600   Fax: +1-781-246-5443

Southeast
3010 Royal Blvd. South, Suite 170
Alpharetta, GA 30005, U.S.A.
Phone: +1-877-EEA-0020   Fax: +1-770-777-2637

EUROPE

EPSON EUROPE ELECTRONICS GmbH

- HEADQUARTERS -
Riesstrasse 15
80992 Munich, GERMANY
Phone: +49-(0)89-14005-0   Fax: +49-(0)89-14005-110

SALES OFFICE
Altstadtstrasse 176
51379 Leverkusen, GERMANY
Phone: +49-(0)2171-5045-0   Fax: +49-(0)2171-5045-10

UK BRANCH OFFICE
Unit 2.4, Doncastle House, Doncastle Road
Bracknell, Berkshire RG12 8PE, ENGLAND
Phone: +44-(0)1344-381700   Fax: +44-(0)1344-381701

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

BARCELONA BRANCH OFFICE
Barcelona Design Center
Edificio Prima Sant Cugat
Avda. Alcalde Barrils num. 64-68
E-08190 Sant Cugat del Vallès, SPAIN
Phone: +34-93-544-2490   Fax: +34-93-544-2491

ASIA

EPSON (CHINA) CO., LTD.
28F, Beijing Silver Tower 2# North RD DongSanHuan
ChaoYang District, Beijing, CHINA
Phone: 64106655   Fax: 64107319

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

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

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

HSINCHU OFFICE
13F-3, No. 295, Kuang-Fu Road, Sec. 2
HsinChu 300
Phone: 03-573-9900   Fax: 03-573-9169

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

SEIKO EPSON CORPORATION KOREA OFFICE
50F, KLI 63 Bldg., 60 Yoido-dong
Youngdeungpo-Ku, Seoul, 150-763, KOREA
Phone: 02-784-6027   Fax: 02-767-3677

SEIKO EPSON CORPORATION
ELECTRONIC DEVICES MARKETING DIVISION

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

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

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

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