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MDEX

SYSTEM-GENERATION KIT

USER GUIDE

by John Walker

Marinchip Systems

Mill Valley, CA 94941

Marinchip 9900 System Generation Kit

User Guide

For Version 3.1

by John Walker

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Marinchip Systems 16 St. Jude Road
Mill Valley, CA 94941 ■ (415) 383-1545

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1. Introduction

The Marinchip 9900 System Generation Kit allows you to generate the in this manual, you will be able to generate a system with any memory size, any combination of peripheral devices, and include your own custom peripheral drivers. In order to effectively use this kit, you must have access to a running M9900 system with at least 32K of memory and dual floppy disc drives.

Marinchip Text Editor (EDIT), Assembler (ASM), and Linker (LINK), as well as having some experience with the utilities DU and BCOPY. No detailed instructions will be given in how to use these programs; you should refer to the manuals describing each of them. The most important thing in achieving success in system generation is carefully reading and following the instructions, and finding out the cause for anything that does not go as expected, before it causes a lot of trouble later.

Throughout this manual, the discs in the generation kit are referred to by name. We urge you to copy the discs onto blank discs of your own as soon as you receive them, and save the originals in a safe place. A Copyright notice must be affixed to any copy of a Marinchip software disc, and use of the copies is covered by the same provisions of the Software License Agreement as apply for the originals.

1.1. Generation kit contents

The System Generation Kit contains a set of diskettes containing various files. One of these diskettes is labeled "SGK Master", and contains the following files:

- . BOOT\$.SAV Boot file for generated system
- . SHELL\$.OBJ Processor for CREATE/DELETE/DIRECT commands
- . MDEX.REL Relocatable code for system
- . ASM System assembler
- . LINK System linker
- . EDIT System editor
- . CONFIG.ASM System configuration source
- . CONFIG.REL System configuration relocatable
- . SYSDEF System definitions (For COPY in ASM)
- . TERM.REL Terminal handler relocatable
- . DISC.REL Disc handler relocatable
- . PRINT.REL Printer driver relocatable
- . LINKIT LINK command file to build system

The other diskette in the kit is labeled "SGK Source" and contains source for the standard Marinchip I/O drivers. The Source files will include:

- . TERM-IMSIO Terminal driver for IMSAI SIO-2
- . TERM-3PPLUSS Terminal driver for Processor Tech 3P+S
- . TERM-TMS9902 Terminal driver for Marinchip PROM/RAM/SIO

- . DISC-AM200 Disc driver for Alpha Micro AM-200

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- . DISC-TARBELL Disc driver for Tarbell 1011
- . DISC-TELETEK Disc driver for Teletak FDC-II

- . PRINT-SIO Serial I/O Printer driver
- . PRINT-NONE Null driver for Printer-less systems

1.2. Overview of system generation

The basic process of system generation is as follows:

1. Edit the CONFIG.ASM file and set the configuration parameters properly for the system being generated.
2. Choose the disc, terminal, and printer drivers to be used in the system being generated.
3. Edit the disc, terminal, and printer drivers and set the configuration parameters in them properly for the hardware being used in the system.
4. Assemble the configuration file CONFIG.ASM into CONFIG.REL.
5. Assemble the proper disc, terminal, and printer drivers into the DISC.REL, TERM.REL, and PRINT.REL files.
6. Link all the relocatables on the master disc into BOOT\$.SAV.
7. Test the new system on the desired hardware.
8. Copy the new system onto a master system disc.

Each of these steps will be described in more detail below.

2. Updating CONFIG.ASM

The CONFIG.ASM file contains a number of equates that specify parameters affecting the operation of the system. This file should be edited using the text editor to set these parameters properly for the system being built. Each parameter will be discussed below.

2.1. DBGROM

The parameter DBGROM specifies whether the system contains the Debug Monitor in PROM, and if so, the address of the context switch vector to enter it. For systems using the M9900 PROM/RAM board with the debug monitor / disc boot PROM, this parameter should be:

```
DBGROM*    EQU        OFFFC
```

In systems which have only the disc boot in PROM, the parameter should be:

```
DBGROM*    EQU        0
```

This parameter controls the action of the system when the command:

```
DEBUG
```

CRTCON EQU 1

2.6. DIRTRACK

The parameter DIRTRACK specifies the disc track number where the system file directory starts. This parameter should be left at the supplied value:

DIRTRACK* EQU 0

It may be changed, but systems generated with a nonstandard DIRTRACK will not be able to interchange discs with any other M9900 system, so it should be changed only for a very good reason.

2.7. DIRSECTOR

The parameter DIRSECTOR specifies the disc sector where the file directory starts. This parameter should be left at the supplied value:

DIRSECTOR* EQU 1

See the comments under DIRTRACK above about the consequences of changing this to a nonstandard value.

3. Choosing disc, terminal, and printer drivers

The disc, terminal, and printer drivers should be selected to correspond to the hardware to be used on the system being configured. The driver PRINT-NONE is used in systems which do not have a printer, and simply discards all output sent to PRINT.DEV.

If you are developing custom drivers for your own device, examine the supplied drivers for information on how to write your own device driver.

4. Editing device drivers

The next step is to edit the selected device drivers to insert the configuration parameters appropriate to the specific hardware being used. The following sections will discuss the parameters in each of the available drivers. DO NOT CHANGE ANY PARAMETERS NOT MENTIONED BELOW UNLESS YOU ARE VERY SURE WHAT YOU ARE DOING!

Since some of the device drivers are quite long, you may need editor backing files (TEMP1\$ and TEMP2\$) to edit them. The SGK master disc contains backing files large enough to edit these files, so you should use that disc as the system disc when updating these files.

4.1. Disc drivers

4.1.1. DISC-AM200

This is the driver for the Alpha Micro AM-200 controller.

4.1.1.1. PERSCI

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is typed. If DBGROM is nonzero, the system will BLWP to that address. If zero, the system will look for a program named DEBUG on the disc.

2.2. STDWS

The parameter STDWS specifies the location of workspace registers for user programs. In systems which do not use the M9900 PROM/RAM/SIO board, this parameter should be:

```
STDWS* EQU 060
```

In systems which use the M9900 PROM/RAM/SIO board, this parameter should be:

```
STDWS* EQU 0F400
```

Note that in systems using the Teletek FDC-II board and a modified PROM/RAM board which has the RAM section disabled, STDWS must be set to 060. In normal Teletek FDC-II systems, STDWS may be left at 0F400.

2.3. DSKSIZ

The parameter DSKSIZ specifies the number of 128 byte blocks (sectors) present on single density, single sided discs used by the system. For all standard systems using IBM compatible floppy disc drives, this parameter should be:

```
DSKSIZ* EQU 26*77
```

This parameter should be changed only if necessary to accommodate special hardware configurations. The system automatically multiplies this number by the appropriate factor when using double density and/or double sided discs, so it SHOULD NOT be changed when such discs are used.

2.4. TCRDLY

The parameter TCRDLY allows the system to accommodate terminals which require delay characters after carriage returns. If the system console terminal requires no delay (the case for most CRTs and modern hard copy terminals), the parameter should be:

```
TCRDLY* EQU 0
```

For a terminal which requires 5 characters delay following a carriage return the parameter should be:

```
TCRDLY* EQU 5
```

2.5. CRTCON

The parameter CRTCON specifies whether the system console is a CRT device or hard copy device. If CRTCON is nonzero, a CRT is selected, and terminal support will be CRT-oriented. If CRTCON is zero, terminal support will be oriented to a printing terminal. For example:

This parameter controls whether the fast seek of the PerSci drive is to be used, or whether the normal seek of the Wangco drive is used. The system will not run if this parameter does not correspond to the drive being used.

For PerSci:

PERSCI EQU 1

For Wangco:

PERSCI EQU 0

4.1.1.2. FAKEDMA

This parameter, along with the DMABUF parameter described below, allows use of the AM-200 controller in systems containing memory which does not permit DMA access. (Many dynamic memories which will run with the M9900 CPU will not work with the AM-200 controller). If the parameter is set to 0, normal DMA transfers will be done for all I/O. If FAKEDMA is set to 1, all transfers will be done by doing a DMA transfer to the 128 byte area of memory starting at DMABUF (see below), and then copying the data to the destination address. The M9900 CPU is fast enough to do this copying between sectors, so no performance is lost when running in this mode. Unless the system contains memory known not to work with the AM-200, FAKEDMA should be set to 0.

4.1.1.3. DMABUF

The DMABUF parameter controls allocation of the buffer used for read after write verification and for DMA simulation if FAKEDMA is nonzero. If set to zero, the buffer will be generated within the disc handler itself. This is the normal setting when FAKEDMA is zero. If set to a nonzero value, 128 bytes starting at that address will be used for the DMA buffer. This value must be in unused memory above the top address in the operating system. DMABUF need be specified nonzero only when FAKEDMA is nonzero and the memory the operating system will reside in is incapable of DMA transfers.

4.1.2. DISC-TARBELL

This is the driver for the Tarbell Floppy Disc controller (model 1011). This driver may only be used in systems which use the Marinchip PROM/RAM/SIO board, which supplies the 16 bit RAM required by the driver. Note that there is currently no code to support the PerSci fast seek option, so if a PerSci drive is being used, it should be strapped for normal seek (refer to the Tarbell manual for jumpering details).

4.1.2.1. DUAL

The parameter DUAL specifies whether the heads of the two drives attached to the controller are ganged together on a common positioner (as for the PerSci) or whether they are independent (as for two separate drives). For two separate drives use:

DUAL EQU 0

For ganged heads (PerSci) use:

DUAL EQU 1

4.1.2.2. HDLDSK

The parameter HDLDSK specifies whether the disc head will be loaded while a seek operation is performed. The standard value:

HDLDSK EQU 1

will keep the head loaded during seeks, and will run with every disc drive. HDLDSK may be set to zero to minimise head and disc wear, but not all drives will run with the parameter so set. Also, some drives will load and unload the head furiously unless this parameter is set to 1, generating lots of noise and undoubtedly more wear than just leaving the head down.

4.1.2.3. STEPRATE

This parameter specifies the stepping rate at which the disc drive is to run. Refer to the documentation for the floppy disc drive being used to determine the step rate of the drive you are using. A slower step rate will do no harm, but a faster rate than the drive is rated for will cause seek errors. Set the parameter as follows:

STEPRATE EQU	0	For 6 millisecond rate
STEPRATE EQU	2	For 8 millisecond rate
STEPRATE EQU	3	For 10 millisecond rate

4.1.3. DISC-TELETEK

This is the driver for the Teletek FDC-II. This controller is normally used with the PROM/RAM board. The Teletek FDC-II performs I/O via a 1K buffer RAM which is mapped into the user's address space. Marinchip Systems supports use of the controller with this RAM either at OE000 hex or at OF400. Placing the buffer at OF400 allows system memory to be 4K bigger, but requires that the PROM/RAM board be modified to disable the RAM, and that special boot PROMs be used. The following instructions describe use of the Teletek FDC-II with the buffer at OE000. If you wish to run with the buffer at OF400, please contact Marinchip Systems for information on doing this.

4.1.3.1. DUAL

The parameter DUAL specifies whether the heads of the two drives attached to the controller are ganged together on a common positioner (as for the PerSci) or whether they are independent (as for two separate drives). For two separate drives use:

DUAL EQU 0

For ganged heads (PerSci) use:

DUAL EQU 1

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4.1.3.2. DMABUF

The parameter DMABUF specifies the address of the Teletek buffer RAM. For the standard system use:

```
DMABUF EQU 0EC00
```

For the special system with the modified PROM/RAM board use:

```
DMABUF EQU 0F400
```

4.1.3.3. STEPRATE

The parameter STEPRATE specifies the stepping motor speed in milliseconds. STEPRATE must be in the inclusive range from 1 to 16. Refer to the specifications for the disc drive you are using to obtain the proper setting for STEPRATE. The standard value:

```
STEPRATE EQU 6
```

will run with almost all modern disc drives.

4.1.3.4. TWOHEADS

The parameter TWOHEADS specifies whether the driver will respond to the "TWO SIDED" signal from the floppy disc drive to activate double sided access. When using single sided drives, this parameter should be set:

```
TWOHEADS EQU 0
```

which will prevent this signal, not generated by most single sided drives, from causing any confusion. When using double sided drives, set:

```
TWOHEADS EQU 1
```

which will cause the system to sense the type of diskette installed and address it properly.

4.2. Terminal drivers

4.2.1. TERM-IMSIO

This is the terminal driver for the IMSAI SIO2-2. It can also be easily adapted to other boards using the Intel 8251 USART.

4.2.1.1. BOARDADDR

This equate specifies the base address jumpered on the board. It is supplied set to the IMSAI standard value of 0.

```
BOARDADDR EQU 0
```

4.2.2. TERM-3PPLUS

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This driver was written for the Processor Technology 3P+S board, but can be adapted to almost any simple UART or parallel interface. All of the internal parameters will be described below to aid in modification.

4.2.2.1. DEVADR

This parameter specifies the device address jumpered on the board. This is in terms of normal 8080 device address, not 9900 memory-mapped address. It is supplied as our standard address for the 3P+S:

```
DEVADR EQU 020
```

4.2.2.2. OSSTAT

This parameter specifies the offset of the status port from the device address base port. The status port used will be DEVADR+OSSTAT. It is supplied for the 3P+S as:

```
OSSTAT EQU 0
```

4.2.2.3. OSDATA

This parameter specifies the offset of the data port from the device address base port. The data port used will be DEVADR+OSDATA. It is supplied for the 3P+S as:

```
OSDATA EQU 1
```

4.2.2.4. TSTBE

This parameter specifies the Transmitter Buffer Empty bit in the status port. The driver will wait until this bit goes high before sending a character to the board. This is supplied as the 3P+S value:

```
TSTBE EQU 080
```

4.2.2.5. TSRBF

This parameter specifies the Receiver Buffer Full bit in the status port. When this bit goes high the driver will read a character from the data port. This is supplied as the 3P+S value:

```
TSRBF EQU 040
```

4.2.3. TERM-TMS9902

This is the terminal driver for the Marinchip PROM/RAM/SIO board.

4.2.3.1. DEVADR

This specifies the CRU base address of the serial port on the board. This is supplied as the standard value:

```
DEVADR EQU 0
```

4.2.3.2. RESBAUD

The parameter RESBAUD controls whether the driver will go through baud rate determination when initialised. In most systems using the PROM/RAM/SIO board, the system comes up in the debug monitor when powered up. The debug monitor determines the baud rate, so when the system is loaded the port is already programmed. As a result, this parameter is supplied set to 0, which will disable baud rate sensing in the operating system. If set to one, the user will have to hit the space bar after loading the operating system so that baud rate sensing may be done. This parameter must be set to one in systems that load the system directly without ever going into the debug monitor.

RESBAUD EQU 0 To not sense baud rate

RESBAUD EQU 1 To re-sense baud rate

4.3. Printer drivers

4.3.1. PRINT-SIO

This is a general driver for printers connected via serial I/O ports. It supports the Marinchip Printer Interface, Marinchip Quad SIO, IMSAI SIO2-2, and the Processor Technology 3P+S.

4.3.1.1. MSIO

This parameter should be set to 1 if the printer is connected via the Marinchip Printer Interface or Marinchip Quad SIO, and zero otherwise.

4.3.1.2. SIO2

This parameter should be set to 1 if the printer is connected via the SIO-2, and zero otherwise.

4.3.1.3. PTIO

This parameter should be set to 1 if the printer is connected via the 3P+S, and zero otherwise.

4.3.1.4. BOARDADDR

This parameter should be set to the base address of the data and status ports of the I/O board used with the printer. For the Marinchip Printer Interface, this is the CRU base address strapped on the board. For the other boards, this address is the 8080 address jumpered on the board. For a 3P+S jumpered at address 20 hex, use:

BOARDADDR EQU 020

For port A on an IMSAI SIO2-2 strapped for address 0, use:

BOARDADDR EQU 2 Data port base address

For port B on an IMSAI SIO-2 strapped for address 0, use:

BOARDADDR EQU 4

For a Marinchip Printer Interface strapped at CRU address 20 hex, use:

BOARDADDR EQU 020

4.3.1.5. CPUCLK

If MSIO is set to 1, CPUCLK must be set to the CPU clock speed in megahertz. This should be 2 for the standard M9900 CPU, and 3 for the high speed version of the CPU. If MSIO is zero, this parameter is irrelevant.

4.3.1.6. PBAUD

If MSIO is set to 1, PBAUD must be set to the communications baud rate expected by the printer. For example, if the printer is to operate at 9600 baud, you would use:

PBAUD EQU 9600

If MSIO is zero, the setting of PBAUD is irrelevant.

4.3.1.7. FFSIMF

If the printer responds to Form Feed characters (ASCII 0C), by performing a page eject, this tag should be set to 0. If form feeds are to be simulated by software by doing line feeds, this tag should be set to 1.

4.3.1.8. FFDELAY

This tag specifies the number of delay characters to be sent following a form feed character. Refer to the manual describing the printer you are using to determine the proper value. If set to zero, no delay will be sent. If FFSIMF is set to 1, the setting of this tag is irrelevant.

4.3.1.9. AUTOLF

This tag should be set depending on whether the printer automatically performs a LINE FEED upon receiving a carriage return. If the printer does do the line feed, this tag should be set to 1. If the printer does not do a line feed, the tag should be set to 0.

4.3.1.10. CRDELAY

This tag should be set to the number of delay characters required after a carriage return. Refer to the manual describing your printer for the proper settings. If set to zero, no delay will be sent.

4.3.1.11. LFDELAY

This tag should be set to the number of delay characters required after a line feed. Refer to the manual describing your printer for the proper settings. If set to zero, no delay will be sent.

4.3.1.12. MINLINE

Some printers, such as the Memorex 1240, require a minimum number of characters on an output line. If your printer has such a restriction, set the tag MINLINE to the number of characters specified for your printer. (If you should happen to have a Memorex 1240, the right number is 41 for 600 baud).

4.3.1.13. NOCOUNT

This tag specifies whether the printer driver will count lines and automatically skip across the perforation on the printer paper. If set to 0, the driver will count lines and do the skip automatically. If set to 1, this counting and skipping logic will be disabled, and the driver will simply send lines to the printer. Normally this tag should be set to 0, enabling the page formatting logic. For printers such as the T.I. 810, which themselves count lines and skip perforations, it should be set to 1. If this tag is set to 0, the following three parameters should be set properly for the paper to be used in the printer.

4.3.1.13.1. TOPLEN

This specifies the number of lines to skip at the top of the page as a top margin.

4.3.1.13.2. BODYLEN

This specifies the number of lines in the page body. This is equivalent to the number of printable lines on the page (and should equal the total number of lines on the page less TOPLEN and BOTLEN).

4.3.1.13.3. BOTLEN

This specifies the number of lines to skip at the bottom of the page.

4.3.1.14. BUSYFUDGE

This parameter permits support of the printer busy signal on printers like the T.I. 810. If set to 1, the driver will wait for the DATA SET READY status bit to go high before sending a character to the printer. The user must make sure that the printer busy signal has been wired to DATA SET READY (Pin 20) of the RS-232 connector on the interface board. If the board is a 3P+S, the line receiver for DATA SET READY should be jumpered to bit 0 in the control port (Port C). If the printer does not have a busy signal, BUSYFUDGE should be set to 0. When using a Marinchip Printer Interface ordered configured for the T.I. 810, no special cable is required.

4.3.1.15. ETXACK

This parameter enables support of printers such as the NEC Spinwriter which use an ETX - ACK signaling protocol to avoid print buffer overflow. If ETXACK is set to 1, at the end of every line sent to the printer an ETX character will be sent. The system will continue sending ETX characters until the printer responds with an ACK character. Only then will the next line be sent. If ETXACK is set to zero, this protocol will not be used.

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4.3.2. PRINT-NONE

This is a null printer driver for systems without printers. As such, it has no configuration parameters.

5. Assembling configuration file

Now place the SGK Master disc in drive 1, and assemble the configuration file:

```
ASM CONFIG.REL=CONFIG.ASM
```

6. Assembling device drivers

With the SGK Master disc in drive 1, put the SGK Source disc into drive 2, and assemble the updated drivers into the corresponding relocatable files on drive 1. For example, to build a system with the Tarbell disc driver, the Marinchip terminal driver, and no printer, you would use:

```
ASM DISC.REL=2/DISC-TARBELL
ASM TERM.REL=2/TERM-TMS9902
ASM PRINT.REL=2/PRINT-NONE
```

7. Linking the system

Once the drivers have been assembled, they must be linked with the released system kernel and the configuration to form the executable operating system. It is during the link phase that the size of the system is specified. First of all, you must determine the number of bytes in your machine in hexadecimal. A conversion table from "K" to hex size is given below:

"K"	Hex Size
32K	8000
48K	C000
56K	E000
60K	F000

Because of the I/O base at F000, M9900 systems cannot be bigger than 60K. To determine the starting address of the system, you should subtract the size of the system from the size of your machine. Immediately you say, "but I don't". Right. So we'll guess for now. Very few systems turn out to be bigger than 2200 hex. That gives us a system base as follows:

"K"	System Base
32K	5E00
48K	9E00
56K	BE00
60K	CE00

The system base selected from the above table will be used as the <base> in the input to LINK below.

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To link the system, call LINK with no parameters:

```
LINK
```

When link signs on, enter the following commands (waiting for the prompt before each command):

```
BASE <base>  
OUT BOOT$.SAV  
IN @LINKIT  
MAP  
END
```

There should be no undefined symbols in the LINK. If the "-" prompt ever appears, type REF to determine which symbol is undefined, and correct the error in the driver. Copy the MAP output down for later reference, noting the last address used by the system. If this is greater than the size of your machine, you will have to reduce the <base> by the proper amount and try again. If it is more than 100 hex bytes less than the size of your machine, you may wish to re-LINK the system with a higher BASE to make that space available to programs.

8. Testing the new system

At this point, you should have a system prepared properly for your configuration. It is a wise move to test the new system on the desired hardware at this point. Simply place the SGK Master disc in drive 1 of the machine, and follow the normal BOOT procedure. The system should come up and run. Of course, since you don't have a full set of utilities on the SGK master disc, you won't be able to try everything at this point (but you can by changing the disc to a regular system disc after booting).

9. Creating a new master disc

The following steps start with an existing Disc Executive master disc and produce a new master disc with the system you just built.

1. Insert master disc in drive 1.
2. Insert blank disc in drive 2.
3. Call Disc Utility (DU).
4. Type CD 1 2
5. Respond YES to destroying contents of disc 2. (It's blank, right?)
6. When copy terminates, type END.
7. Remove master disc from drive 1.
8. Move new master disc from drive 2 to drive 1.
9. Place SGK Master with newly-generated system in drive 2.
10. Type BCOPY BOOT\$.SAV=2/BOOT\$.SAV
11. Type BCOPY SHELL\$.OBJ=2/SHELL\$.OBJ
12. Make sure both BCOPYs said Terminated by end of input file. If not, re-CREATE files on disc 1 to be as big as files on disc 2.

At this point you have a new master disc, ready for use in the new machine. Make up a label for it which reads as follows:

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MDEX Master <current date>
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Store the System Generation Kit discs away in a safe place until you should need them again.