

MITSUBISHI SINGLE-CHIP MICROCOMPUTER

M16C/62 StarterKit2

(MSA0654G01/G02)

USER'S MANUAL

keep safety first in your circuit designs !

- ✦ Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

- ✦ These materials are intended as a reference to assist our customers in the selection of the Mitsubishi semiconductor product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Mitsubishi Electric Corporation or a third party.
- ✦ Mitsubishi Electric Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts or circuit application examples contained in these materials.
- ✦ All information contained in these materials, including product data, diagrams and charts, represent information on products at the time of publication of these materials, and are subject to change by Mitsubishi Electric Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for the latest product information before purchasing a product listed herein.
- ✦ Mitsubishi Electric Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
- ✦ The prior written approval of Mitsubishi Electric Corporation is necessary to reprint or reproduce in whole or in part these materials.
- ✦ If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination. Any diversion or reexport contrary to the export control laws and regulations of JAPAN and/or the country of destination is prohibited.
- ✦ Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for further details on these materials or the products contained therein.

Microsoft, MS, and MS-DOS are registered trademarks of Microsoft Corporation of the U.S.

Windows95 and Windows98 are trademarks of Microsoft Corporation of the U.S.

IBM and PC/AT are registered trademarks of International Business Machines Corporation of the U.S.

Pentium is a trademark of Intel Corporation of the U.S.

Adobe and Acrobat are registered trademarks of Adobe Systems Incorporated.

Preface

Thank you for purchasing M16C/62 StarterKit2 G01/G02.

This manual describes how to use the hardware and software products included with M16C/62 StarterKit2 G01/G02. The manual consists of the following parts:

Table of Contents

1. Contents of Product Package	1
1.1. M16C/62 StarterKit2 Product List	1
1.2. CD-ROM	1
1.2.1. Software Products	1
1.2.2. Monitor Program and other programs	3
1.2.3. Electronic Manuals	3
1.3. System Requirements	4
2. Gurantee and Support	5
2.1. Gurantee	5
2.2. Support	5
3. System Configuration	6
3.1. Host Computer	7
3.2. StarterKit2 (MSA0654 G01/G02)	7
3.3. Remote Debugger KD30	7
3.4. Compiler KNC30WA	8
3.5. SW for programming external Flash memory	8
4. Setting Up Hardware	9
4.1 Connecting Each Unit	9
5. Setting Up Software	10
5.1. Operating Environment	10
5.2. Installing KD30	11
5.2.1. Installation Procedure	11
5.2.2. Starting Up KD30	11
5.2.3. Quitting KD30	13
5.3. Installing KNC30WA	13
5.3.1. Installation Procedure	13
5.3.2. Checking Operation of KNC30WA	14
5.4. Installing FlashWriter	15
5.4.1. Installation Procedure	15
5.4.2. Stating Up FlashWriter	15
5.4.3. Quitting FlashWriter	16
5.5. Uninstalling KD30	17
5.6. Uninstalling KNC30WA	17
5.7. Uninstalling FlashWriter	17
5.8. Referencing Electronic Manuals	17

6. Usage Precautions	18
6.1. Limitations on Pin Usage	18
6.2. Limitations on Using M16C/62 Peripheral Functions	18
6.3. Caution when use the memory expansion mode	19
6.4. Memory Map	19
6.5. Status After Reset	20
6.6. Restrictions on Register Operation	21
6.7. Restrictions on Interrupts	22
6.8. Restrictions on Breakpoints	23
6.9. Restrictions on STOP Modes or WAIT Modes	23
6.10. User Programs Real-time Capability	24
6.11. Exceptional Step Execution	24
6.12. Performing Debug Using Symbols	26
6.13. Corrective Action when Communication Error Occurs at Start up	26
6.14. Corrective Action when Communication Error Occurs During Debug	27
6.15. Corrective Action when Error Occurs During Download	27
7. How to Repair The Monitor Program	28
7.1. How to repair	28
7.2. Modify files	29
7.3. Limit of Frequency	31
8. MSA0654 G01/G02	32
8.1. External Specifications	32
8.2. Power Supply Requirements	33
8.3. Environment Requirements	34
8.4. Block Diagram	34
8.5. Memory Map	35
8.6. Using MSA0654	36
8.6.1. Connect Requirements	37
8.6.2. JUMPER SET	39
8.6.3. LED	40
8.6.4. switch	41

1. Contents of Product Package

This section shows the contents of the M16C/62 StarterKit2's product package(MSA0654-G01/G02). When unpacking your M16C/62 StarterKit2, check to see that all products listed below are included.

1.1. M16C/62 StarterKit2 Product List

Table 1-1 lists the products included in the M16C/62 StarterKit2.

Product Name	Quantity	Remark
M16C/62 StarterKit2 MSA0652-G01orG02	1 pc.	
Serial cable exclusive to M16C/62 StarterKit2 (Used to connect MSA0654 and the host computer)	1 pc.	
CD-ROM	1 pc.	Compiler KNC30WA Remote debugger KD30 Flash Writer S/W Manuals Sample Program Monitor Program

Table 1-1. M16C/62 StarterKit2 Product List

1.2. CD-ROM

The CD-ROM contains software products necessary for developing programs and electronic manuals as well. Here follow the contents of the CD-ROM.

CD-ROM — Japanese
 └─ English

1. Contents of Product Package

1.2.1. Software Products

Following directory is store in English root directry.

(1) MSA0654 directory

Include MSA0654G01/G02's manual.

(2) KD30 directory

This directory contains various commands available for KD30. The contents of this directory are listed in Table 1-2.

(3) KNC30WA directory

This directory contains various commands available for KNC30WA. The contents of this directory are listed in Table 1-3.

(4) FlashWriter directory

This directory contains various commands available for Flash Writer. The contents of this directory are listed in Table 1-4.

(5) Acrobat directory

This directory contains various commands available for Acrobat Reader. The contents of this directory are listed in Table 1-5.

Directory Name	Content	Outline
\KD30 \ Manual	kd30ue.pdf	KD30's manula
\KD30 \ Setup	setup.exe	Setup-file for KD30

Table 1-2. Contents of KD30 Directory

Directory Name	Content	Outline
\KNC30WA\Manul	as30ue.pdf	KAS30's manula
	nc30ue.pdf	KNC30's manula
\KNC30WA \Setup	setup.exe	Setup-file for KNC30WA(English)
	.	Setup other files

Table 1-3. Contents of KNC30WA Directory

Directory Name	Content	Outline
\FlashWR	M16CFlash.exe	Flash Writting S/W for Monitor program
	Manula_e.pdf	Flash Writer S/W's manual

Table 1-4. Contents of FlashWriter Directory

Directory Name	Content	Outline
\Acrobat	Ar32e301.exe	Setup file for Acrobat Reader3.0
	Readme.txt	Readme

Table 1-5. Contents of Acrobat Directory

1.2.2. Monitor Program and other programs

Monitor program and other programs are listed in Table 1-6.

Directory Name	Content	Outline
\Program \moniter \mot	*.mot	S format file of Monitor program
\Program \moniter \source	*.*	Source files of monitor program
\Program \sample	*.*	Sample programs

Table 1-6. Contents of Monitor program and other programs Directory

1.2.3. Electronic Manuals

- (1) M16C/62 Group Data Sheet (files in PDF)
- (2) M16C/62 Group User's Manual (files in PDF)
- (3) M16C/60 Series Software Manual (files in PDF)
- (4) M16C/60 Series Programming Manual for Assembly Language (files in PDF)
- (5) M16C/60 Series Programming Manual for C Language (files in PDF)
- (6) M16C/60 Series Collection of Sample Programs (files in PDF)

1.3. System Requirements

In addition to the products listed above, you must have the following equipment before you can use the M16C/62 StarTerKit2.

(1) Personal computer

For details about a personal computer, refer to Section 5.1, "Operating Environment."

(2) Power supply

For details about power supply requirements, refer to Section 8.2, "Power Supply Requirements."

2. Gurantee and Support

2.1. Gurantee

(HardWare)

In one year , We troubleshoot your problem with no charge provided that you use this product in an environment stated under section 8 and you use under section 6.

One year later or when you use this product besides a method mentioned above , we repair it by compensation.

- (1) MSA0654 G01 or G02
- (2) Serial Cable (MF_Ten_Nine cable)

In requesting the repair of this product , contacts your distributor or nearest office of Mitsubishi Electric.

(SoftWare)

In one month, We change it no charge , when it's medium breaks down. There is not a guarantee except this.

- (1) KNC30WA
- (2) KD30
- (3) FlashWriter

2.2. Support

You can have support of this product and the latest infomation about it referred to from hamepage. Please make use of it.

URL: <http://www.infocom.mesc.co.jp/M16C/mctope.htm>

3. System Configuration

The following lists the hardware and software products required for using the product.

- (1) Host computer (No package)
- (2) M16C/62 StarterKit2 (MSA0654G01 / G02)
- (3) Serial cable exclusive to the cable debugger
- (4) Remote debugger KD30
- (5) Compiler KNC30WA
- (6) Power supply (No package)
- (7) S/W for programing internal Flashmemory

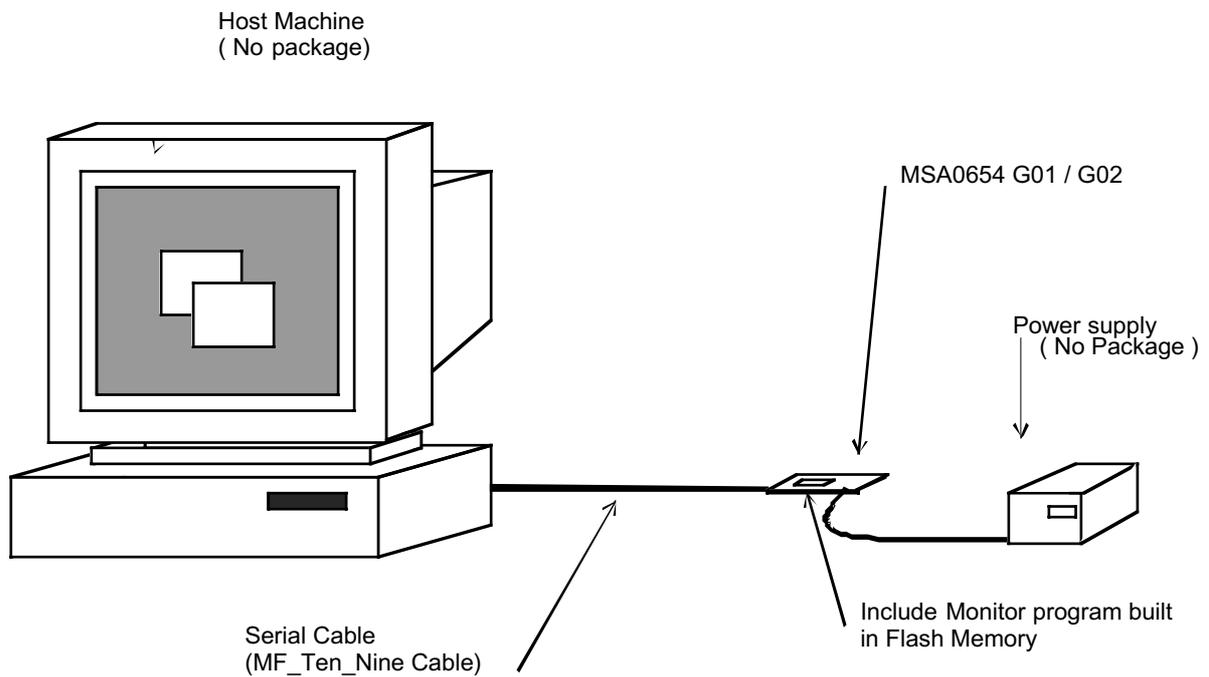


Figure 3-1 shows a system configuration of the product

3.1. Host Computer

KD30 and KNC30WA run on the host computer listed in Table 3-1 below.

Table 3-1. Host Computer

Host Computer Name	OS
IBM PC/AT series or its compatible	Microsoft Windows 95
	Microsoft Windows 98

3.2. M16C/62 Starter Kit 2 (MSA0654 G01/G02)

The StarterKit2 incorporates the M16C family of Mitsubishi's 16-bit single-chip microcomputer. (MSA0654G01 : M30624FGLFP , MSA0654G02 : M30624FGFP) A debugging monitor program has been written to the microcomputer M16C mounted on the board.

3.3. Remote Debugger (KD30)

KD30 is a remote debugger that runs on the host computer. While communicating with the debug monitor program, this debugger provides a highly efficient evaluation environment. This debugger is compatible with PD30 at operation level. PD30 is the debug software used to control Mitsubishi's M16C emulators.

features of KD30

- (1) Source line debug for assembly language , structured assembly language , C language.
- (2) KD30 have go command with 2 point breakpoint.
- (3) KD30 have RAM monitor function.
RAM monitor function is that dump command practice with any cycle.
- (4) KD30 have window for variable of C language.

3.4. Compiler KNC30WA

KNC30WA is the C compiler for the M16C family. KNC30WA generates debug information files from C language and the assembly language source files.

features of KNC30WA:

- (1) KNC30WA can compile a source file consisting of less than 500 lines.
- (2) Program's ROM size is within 64Kbytes.

KNC30WA is upward compatible with the compiler for the M16C family (NC30WA). All programs developed using KNC30WA can be compiled by NC30WA in the same way.

3.5. S/W for programming internal Flash memory of M16C Flash MCU (Flash Writer)

FlashWriter is windows software. FlashWriter will changed the monitor program.

4. Setting Up Hardware

4.1. Connecting Each Unit

MSA0654 G01/G02 connect to each unit. (Figure 4-1)

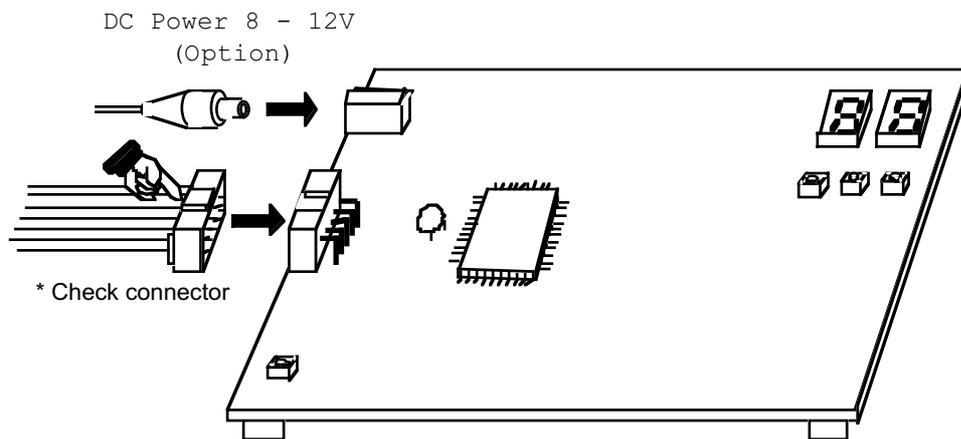


Figure 4-1 Connect to each unit

5. Setting Up Software

5.1. Operating Environment

The software include StarterKit2 run on the host computer under the OS version that are listed respectively in Table 5-1.

Table 5-1. Operating Environment

Host Computer	IBM PC/AT series and its compatible
OS	Microsoft Windows 95 , Microsoft Windows 98
CPU	486DX4-100 MHz or Pentium 75 MHz or newer recommended
Memory	8 Mbytes or more (16 Mbytes recommended)

** Operation of KNC30WA30 on Windows 95 or Windows 98**

KNC30WA operates from the DOS prompt of Microsoft Windows 95 or Windows 98.

** Operation of KNC30WA and KD30 on Windows 95 or Windows 98**

No special character (include space code) can be included in the file name. Nor can a network drive name be used for KNC30WA and KD30. When using a network drive name, be sure to assign it to the drive

5.2. Installing KD30

5.2.1. Installation Procedure

Follow the procedure described below to install KD30.

- (1) Run ' setup.exe ' in KD30 on CD-ROM.
- (2) Display the install's window , and install under the window.

5.2.2. Starting Up KD30

Before you can start up KD30, you must first set up hardware. For this setup, refer to Section 4, Setting Up Hardware.”

To start up KDB30, click [start] - [program] - [MITSUBISHI-TOOL] - [KD30] for Windows 95. When you call up KD30, an Init dialog box (Figure 5.1) appears. Use this dialog box to set the operating environment required for start-up of KD30.

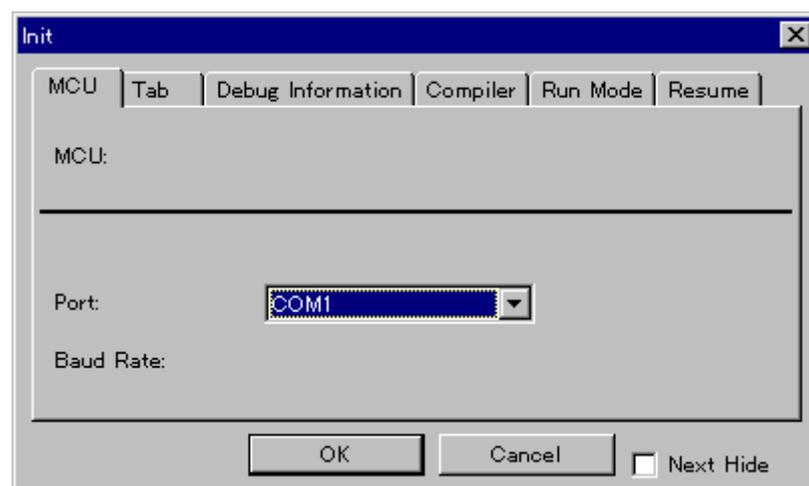


Figure 5-1. Init Window

The Init dialog box is detailed in KD30's manual. Here, set the following item to ensure that KD30 starts up normally.

5. Setting Up Software

When you have finished setting the above, click on the <OK> button in the Init dialog box. If communication between MSA0654G01/G02 and personal computer is performed normally, KD30 starts up automatically and a window like the one shown in Figure 5-2 appears.

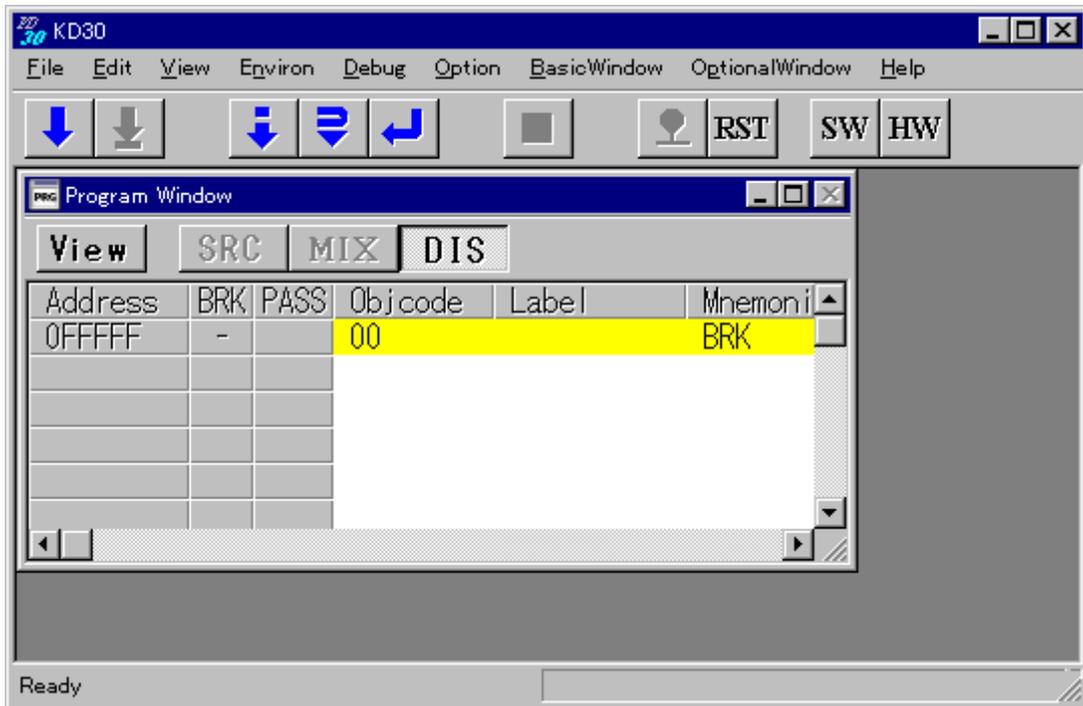


Figure 5-2. KD30 window

If MSA0654 G01/G02 fails to communicate with the personal computer, an error dialog box like the one shown in Figure 5-3 or Figure 5-4 appears.



Figure 5-3. Example of error dialog box1 at start-up



Figure 5-4. Example of error dialog box2 at start-up

When you click on the <OK> button in this error dialog box, the Init dialog box pops up again. If this error dialog box is displayed, refer to Section 6.13. "Corrective Action when Communication Error Occurs at Start-up".
KD30's detail operation read KD30's manual.

5.2.3. Quitting KD30

To quit KD30, select the menus [File] -> [Exit]. When you select the Exit menu, the Exit window shown in Figure 5-5 appears, so click on the <OK> button. If you click on the <Cancel> button, KD30 is not terminated.

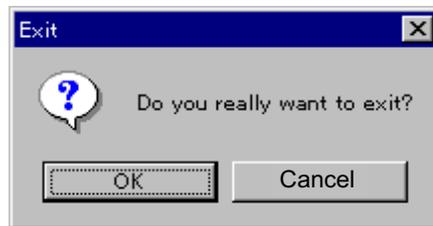


Figure 5-5. Warning dialog box

5.3. Installing KNC30WA

5.3.1. Installation Procedure

- (1) Run ' setup.exe ' in KNC30 on CD-ROM.
- (2) Display the install's window , and install under the window.
- (3) When install , display message of change 'Autoexec.bat' file.When not change 'Autoexec.bat' file, change 'Autoexec.bat' file yourself under part.

Add the following lines to AUTOEXE.BAT:

```
SET BIN30=(Install directory)\BIN30
SET LIB30=(Install directory)\LIB30
SET INC30=(Install directory)\INC30
SET TMP30=(Install directory)\TMP
PATH=%PATH%;%BIN30%
```

- (4) computer restart after install.

< Caution >

KNC30WA uses the same environment variables as used by NC30WA. Note that if you are using NC30WA in combination with KNC30WA, the same environment variables are referenced.

5.3.2. Checking Operation of KNC30WA

Input the following command to check that KNC30WA operates normally.

(1) Command input

>KNC30 -v

(2) Result

All program versions are displayed as shown below:

```
M16C/60 KNC30 COMPILER V.1.00
Copyright 1988 MITSUBISHI ELECTRIC CORPORATION
and MITSUBISHI ELECTRIC SEMICONDUCTOR SYSTEMS CORPORATION
All Rights Reserved.
```

(3) If KNC30WA does not start up...

(a) Check to see if the command path PATH is set correctly.

(b) If " a Windows NT character-mode" appears when executing a command, check the settings of the DOS window given below.

1)Choose the property of the DOS window.

2)Choose the button for "Advanced Program Settings" of program tag.

3)Remove the check in the check box of:

Prevent MS-DOS -based programs from detecting Windows.

4)Close the DOS window, then execute the command again.

(4) If version numbers are not displayed...

Check to see if each command (listed in Section 1.2, Software Product List) is expanded correctly in the directory you have specified for BIN30.

5.4. Installing FlashWriter

5.4.1. Installation Procedure

- (1) Create a directory on the personal computer's hard disk where you want the software to be installed.
- (2) Copy all the contents of the directory \KDB30 held in the CD-ROM to the directory created in step 1.

5.4.2. Stating Up FlashWriter

Before you can start up KD30, you must first connect the serial cable (MF_Ten_Nine cable) to MSA0652.

To start up KDB30, click 'M16Cflash.exe in a created directory.

When you call up FlashWriter, a windows appears.(Figure 5-6) Select a baudrate in purudown list.

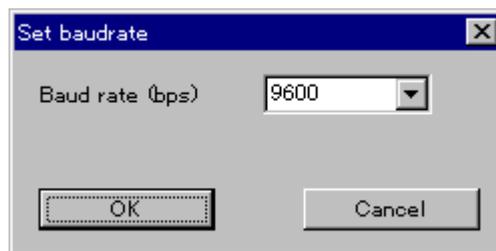


Figure 5-6. Set baudrate Window

When click <OK> button , a windows appears.(Figure 5-7)

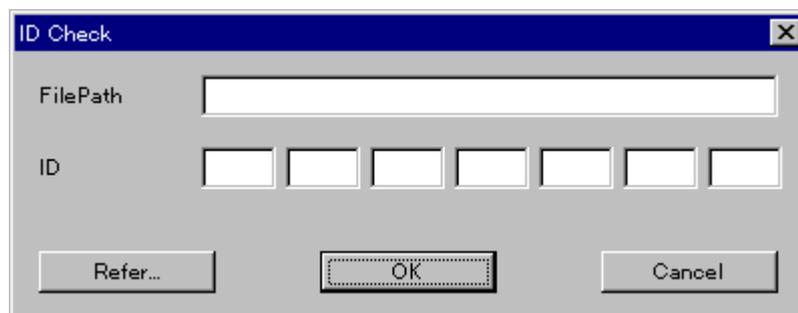


Figure 5-7. ID check Window

Detail operation of ID check Window and FlashWriter check FlashWriter's manual.

When Figure 5-8 appears , please check to connection between MF_Ten_Nine cable and MSA0654G01/G02 or power on MSA0654G01/G02.



Figure 5-8. Connection error Window

5.4.3. Quitting FlashWriter

When FlashWriter quit. click <Exit> on Figure 5-9.



Figure 5-9. Main Window

5.5. Uninstalling KD30

To uninstall KD30. appears [start] - [setting] - [control panel] and click <add and move>. Select a <KD30 Ver2.00> in any list , click <add and move>. Appears uninstalling window , uninstall KD30.

5.6. Uninstalling KNC30WA

To uninstall KNC30WA. appears [start] - [setting] - [control panel] and click <add and move>. Select a <KNC30WA Ver1.00> in any list , click <add and move>. Appears uninstalling window , uninstall KNC30WA.

5.7. Uninstalling FlashWriter

To uninstall FlashWriter. delete a FlashWriter's directory.

5.8. Referencing Electronic Manuals

Electronic Manuals of the Product are in the form of files in PDF (portable document format). To reference them, the user needs Adobe Acrobat Reader, which is held in the CD-ROM attached, so install it when necessary.

- (1) Start up the installer on the CD-ROM holding the product.
- (2) Install Adobe Acrobat Reader according to what are contained in the Readme file.

The user can download Adobe Acrobat Reader from the home page of Adobe Systems Incorporated. For latest information as to Adobe Acrobat Reader, go to the following URLs.
<http://www.adobe.co.jp>
<http://www.adobe.com>

6. Usage Precautions

This section describes the precautions to be observed when using tMSA0654G01/G02. Always be sure to read this section before you use MSA0654G01/G02.

Table 6-1. List of Usage Precautions

Item	Sections To See
Precautions on creating programs	6.4, "Memory Map" 6.5, "Status After Reset" 6.6, "Restrictions on Register Operation" 6.7, "Restrictions on Interrupts"
Precautions on debugging programs	6.8, "Restrictions on Breakpoints" 6.9, "Restrictions on STOP Modes or WAIT Modes" 6.10, "User Program's Realtime Capability" 6.11, "Exceptional Step Execution" 6.12, "Performing Debug Using Symbols" 6.13, "Corrective Action when Communication Error Occurs at Startup" 6.14, "Corrective Action when Communication Error Occurs During Debug"

6.1. Limitations on Pin Usage

- (1) TxD1 and RxD1 (UART1) pins

These pins are used to communicate with the host computer. Do not connect these pins to any other pins.

- (2) NMI (P85) pin

NMI pin needs pull up.

6.2. Limitations on Using M16C/62 Peripheral Functions

The UART1 transmit and receive interrupts are used for communication between the monitor program and the host computer.

UART1 cannot be used in the user program.

6.3. Caution when use the memory expansion mode

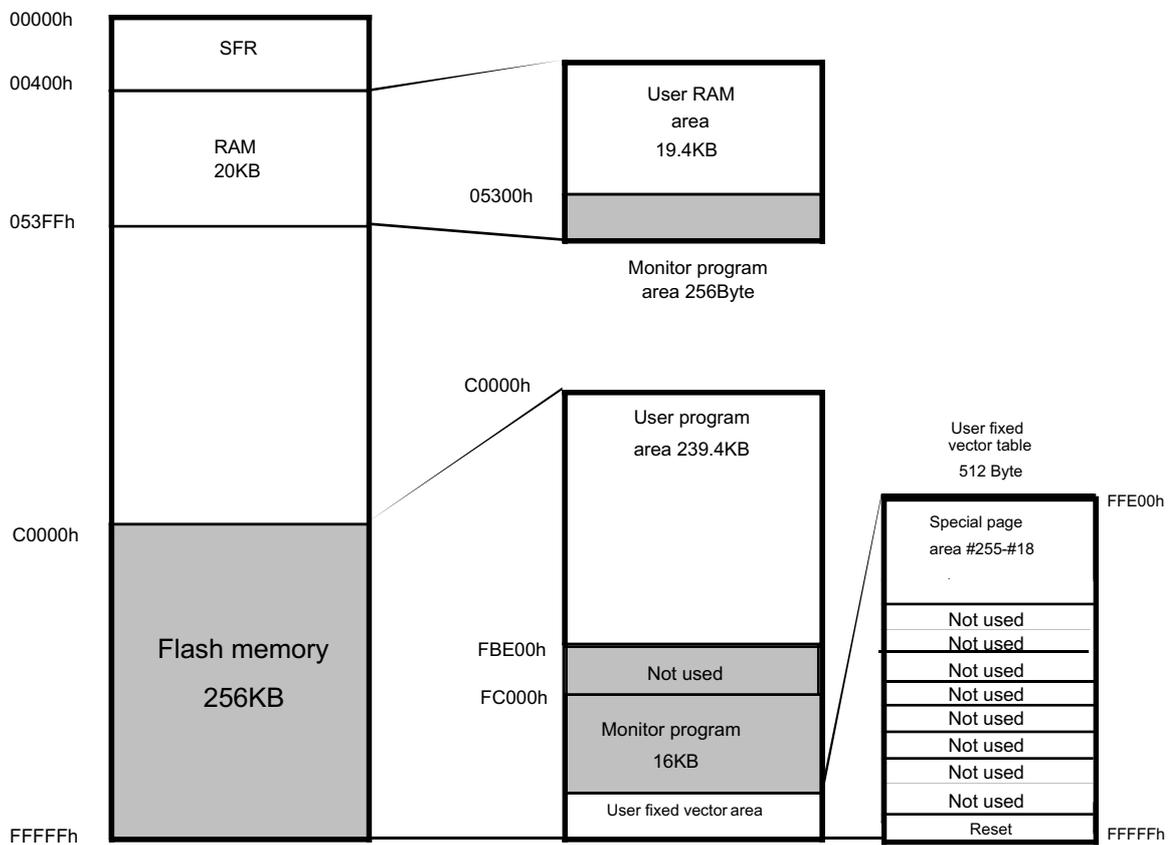
When use the memory expansion mode in use program , get off the below regitance on bord. So whne can't get off the registance, can't use the memory expansion mode.

The registance : R12

6.4. Memory Map

Figure 6-1 shows the MSA0654G01/G02's memory map.

The area the user can use is as much as [internal RAM area - 19.4Kbyte , internal FlashROM area - 239.4Kbyte].



For use internal RAM 20Kbyte , internal ROM 256Kbyte, The monitor program write '1' to bit of Processor Mode Register 1's internally reserved area extension.

Figure 6-1. MSA0654G01/G02's memory map

6.5. Status After Reset

Table 6-2 lists the registers that are initialized by the monitor program when MSA0654G01/G02 is reset. The status of all other registers depends on the microcomputers internal operation performed after a reset.

Table 6-2. Initial Register Values after Reset

Register Name	Initial Value
Processor mode register 0	Initialized to 00_{16} . Processor mode: Single-chip mode
Processor mode register 1	Initialized to 08_{16} . Internally reserved area extension
System clock control register 0	Initialized to 08_{16} .
System clock control register 1	Initialized to 20_{16} . Selected main clock divide ratio: Not divide
ISP (interrupt stack pointer)	Initialized to $044FF_{16}$.
UART1 Transmit/Receive Mode Register	Initialized to 05_{16} .
UART1 Transfer Speed Register	Initialized to $1A_{16}$.
UART1 Transmit/Receive Control Register 0	Initialized to 10_{16} .
UART1 Transmit/Receive Control Register 1	Initialized to 05_{16} .
UART1 Interrupt Control Register 0	Initialized to 07_{16} .
UART transmit/receive control register 2	Initialized to 03_{16} .

6.6. Restrictions on Register Operation

Table 6-3 lists the restrictions on register operation. If you modify the content of a register which is inhibited against modification, the operation of the monitor program cannot be guaranteed.

Table 6-3. Restrictions on Register Operation(1/2)

Register Name	Restriction
Processor mode register 0	Do not modify this register.
Processor mode register 1	When changing this register in the user program, always be sure to set bit 3 to 1.
ISP	Set a value below 0530016. Values 0530016 through 053FF16 are used by the monitor program.
Protect register	If the monitor program starts immediately after Protect Register bit 2 (Port P9 Direction Register and SI/O3,4 Control Register write enable bit) is set to 1 (enabled), a write to some address by the monitor program occurs, so that the P9 Direction Register write enable bit is reset to 0 (disabled). Consequently, the P9 Direction Register cannot be written to in the following cases: <ol style="list-style-type: none"> 1) When a break to at the instruction that sets the write enable bit to 1 occurs 2) When Go, Step, Over, or Return to the instruction that sets the write enable bit to 1 is executed 3) When the P9 Direction Register is operated on from the dump window, etc.
Flag register	Write to the D flag and I flag is ignored. (Always D flag is 0, I flag is 1)

Table 6-3. Restrictions on Register Operation(2/2)

Register Name	Restriction
UART1 transmit/receive mode register	Don't make changes.
UART1 bitt rate generator	
UART1 transmit/receive control register 0	
UART1 transmit/receive control register 1	
UART1 interrupt control register 0	
UART transmit/receive control register 2	Don't change bits 0, 2, 4, 5, and 6
UART1 transmit buffer register	Don't write any data to this register.
UART1 receive buffer register	Don't read this register.

6.7. Restrictions on Interrupts

(1) Interrupt vector tables that reside in the fixed vector table

Interrupt vector tables that reside in the fixed vector table are not use the user program except reset. When used Interrupt vector tables that reside in the fixed vector table, will be change that they not run. The monitor program sets dummy function (REIT function) on Interrupt vector tables that reside in the fixed vector table.

Table 6-4. Interrupt Vector Table Addresses

Interrupt Cause	Specification for CPU	Specification for Kit
Undefined	FFFDC ₁₆ ~FFFDF ₁₆	Use inhibited *
Overflow	FFFE0 ₁₆ ~FFFE3 ₁₆	Use inhibited *
BRK instruction	FFFE4 ₁₆ ~FFFE7 ₁₆	Use inhibited
Address match	FFFE8 ₁₆ ~FFFEB ₁₆	Use inhibited
Single-step	FFFEC ₁₆ ~FFFEF ₁₆	Use inhibited
Watchdog timer	FFFF0 ₁₆ ~FFFF3 ₁₆	Use inhibited
DBC	FFFF4 ₁₆ ~FFFF7 ₁₆	Use inhibited
NMI	FFFF8 ₁₆ ~FFFFB ₁₆	Use inhibited
Reset	FFFFC ₁₆ ~FFFFF ₁₆	FFFFC ₁₆ ~FFFFF ₁₆

*) Interrupt of Undefined , Overflow run at UND , INTO instruction.

UND , INTO instruction not use in the user program.

(2) Interrupts located in the variable vector table

The UART1 transmit/receive interrupts are used by the monitor program and cannot be used by a user program. All other interrupts can be used by a user program.

(a) When using INTB to set up the variable vector table, set **0FCB6BH** at the addresses (software interrupt numbers 19, 20) that correspond to the UART1 transmit/receive interrupts.

(b) Do not disable interrupts (by clearing the I flag). *)

A monitor program use interrupt of UART1. If in interrupt program have disable interrupt time over 260us, will occur communication error. When this time, set I flag = 1 at top of a interrupt program.

(c) When using interrupts in your program, do not set the Interrupt Priority Level (IPL) to 7.

*) When change a interrupt control register, need to be disable interrupt. When be disable interrupt (I flag = 0), can't be STEP command function while disable interrupt.
(check to Capter 6.11)

6.8. Restrictions on Breakpoints

(1) Do not set a breakpoint in an instruction immediately after the LDC instruction. No break occurs even when you set a breakpoint in an instruction immediately after the LDC instruction.

(b) Program execution cannot be stopped by a break in the INT instruction. Once a break occurs, the GO command cannot be used thereafter.

< Exsample >

```
NOP
NOP
NOP
INT #3 <- BREAK GO from the interrupt source cannot be used
NOP
NOP
```

6.9. Restrictions on STOP Modes or WAIT Modes

The monitor program cannot be run in STOP modes and WAIT modes. Can't be changed STOP modes or WAIT modes in user program.

6.10. User Programs Real-time Capability

KD30 has two user program execution modes: Sampling Mode and Free-run Mode. In Sampling Mode, the monitor program periodically monitors the user programs execution status to detect stoppage of the user program caused by a break, etc. For this reason, the monitor program requests an interrupt during user program execution. Consequently, the user programs real-time capability is lost. In Free-run Mode, the user program execution is not monitored, so its real-time capacity is guaranteed.

(1) Sampling Mode

In this mode, the user programs execution status is periodically monitored when executing Go or Come. Therefore, this mode allows you to detect stoppage of the user program caused by a break, etc. Choose this mode when you perform regular debug.

(2) Free-run Mode

In this mode, the user programs execution status is not monitored when executing Go or Come. Although for this reason the user programs real-time capability is guaranteed, you cannot detect stoppage of the user program caused by a break, etc. Therefore, even when the user program has stopped, KD30 does not stop the operation executed by Go or Come. If you want to stop KD30, press the STOP button. Choose this mode when you want to run your program in real time.

6.11. Exceptional Step Execution

If the following two instructions are STEP, they operate differently than they are executed normally.

(1) REIT instruction , JMPS instruction , JSRS instruction

When above instruction is STEP, the program stops after executing one instruction after returning from the interrupt.

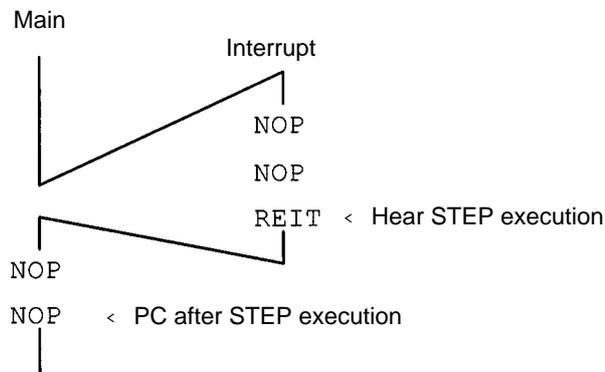


Figure 6-2. Example of operation when REIT instruction is STEP

(2) INT instructions

From the INT instruction, you cannot successively step through the internal processing of the INT instruction.

Figure 6-3. Example of operation when INT instruction is STEP

```

NOP
NOP
INT #3 <- STEP  Skipped over when STEP is executed.
NOP
JMP  MAIN

INT_3:
NOP <- Address at which program execution ought to stop.
NOP
NOP
REIT

```

When using the INT instruction to debug your program, follow the procedure shown below.

< Exsample >

Set a software break for the internal processing of the INT instruction and use it in combination with the Go command.

Figure 3. Example for debugging a program using INT instruction

```

NOP
NOP
INT #3
NOP
JMP  MAIN

INT_3:
NOP <- BREAK
NOP
NOP
REIT

```

Execution by GO command



(3) operation of while disable interrupt

When to be disable interrupt , can't use STEP command while disable interrupt. 1 STEP command go at enable interrupt.

< Exsample>

```
FCLR I          ; Disable interrupt
AND #00H , 0055H ; Change Timer Interrupt
NOP
NOP
FSET I          ; Enable Interrupt
```

1 STEP command
go to enable
interrupt



6.12. Performing Debug Using Symbols

To debug your program using symbols in KD30, add the debug option (-g) in KNC30WA before compile the programs.

6.13. Corrective Action when Communication Error Occurs at Start up

If a communication error occurs during start up, check the following:

- (1) Whether the MSA0654G01/G02 hardware is correctly set up
- (2) Whether cable is firmly connected and whether the power is turned on.
- (3) Whether the serial port set in the Init dialog box matches the actual serial port where the MSA0654G01/G02 is connected.

6.14. Corrective Action when Communication Error Occurs During Debug

If a communication error occurs during debug, one probable cause is that the monitor program is made to go wild by the user program (ex, user programs runaway or access to monitor area). In such a case, follow the procedure below to initialize the system:

- (1) Press the [OK] button in the error dialog box to close it.
- (2) When an Exit dialog box appears, press the [Cancel] button to close it.
- (3) Reset the hardware by working the reset jumper on the CPU board (or turn off the power and turn it back on again) to reset the hardware.
- (4) Press KD30 reset button.

When the above is done, you can restart debugging. However, because the data in the user program area may have been damaged, recommends downloading your program again before you start debugging.

If many communication error happen , check this.

-> * your program have interrupt program. And don't set I flag in interrupt program.

When this interrupt program spend a time over 260us, please set I flag = 1 in the beginning of interrupt program.

6.15. Corrective Action when Error Occurs During Download

When a wrong occurs during download or reload (Ex. stop download), may be a problem that a part of program will be running. When run download or reload , will have to push a reset button on KD30 before running download or reload. After , will be download or reload.

7. How to Repair The Monitor Program

7.1. How to repair

When change a MSA0654G01/G02's clock , must to repair the monitor program. This chapter is how to repair the monitor program.

Follow the procedure described below to correct the monitor program.

- (1) Short the CNVSS pin (shown below) on the MSA0654. (Figure 7-1)
- (2) Set 10MHz oscillator for MSA0654G01, or 16MHz oscillator for MSA0654G02.
- (3) Turn on the power to the MSA0654G01/G02.
- (4) Start FlashWriterSW include MSA0654-G01/G02.
- (5) Write the corrected the monitor program to MSA0654G01/G02 with FlashWriter.

ID-code is all 00H when first write the monitor program.

- (6) Turn off the power to the MSA0654G01/G02.
- (7) Open the CNVss pin at Figure 7-1.

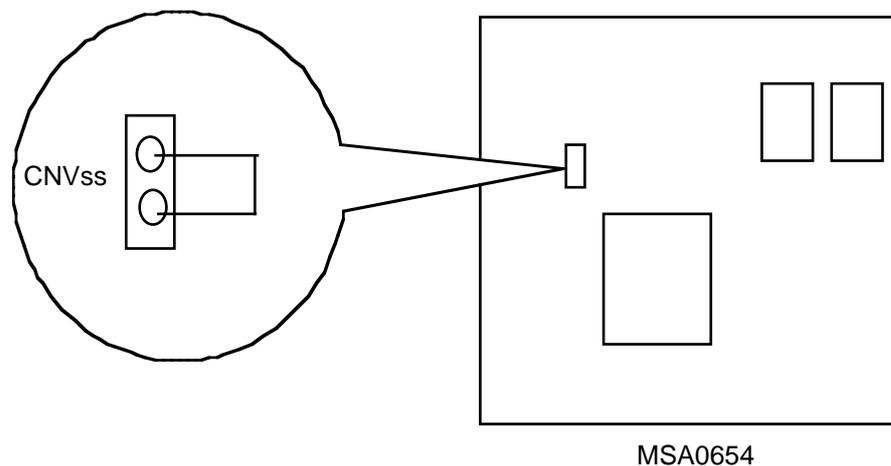


Figure 7-1 Setting MSA0654

7.2. Modify files

If changed MSA0654G01/G02's clock frequency, need to change baud rate settings of the monitor program and set up the wait cycles for write to the flash memory and the divide-by value. Show modify files at table 7-1.

Change files	Description for files
Mon_cnt.a30	Initializes the monitor. Others include the main routine.
F_ram8.a30	Program to download into flash memory.

Table 7-1. List of modified files

```
<How to repair>
FILE : mon_cnt.a30
Lines  Program
126 ;-----*****
127 ;   Setting Baudrate generater
128 ;-----*****
129 ;   If you changed the resonator, refer to the comment
130 ;   below as you set the baud rate for the new resonator.
131 ;   Note that the f_ram8.a30 file must also be modified.
132 ;
133 ;-----****
134
135 MOV.B   #25,U1BRG ; Sending speed 38400 BPS(16M)
136 ; MOV.B   #19,U1BRG ; Sending speed 38400 BPS(12M)
137 ; MOV.B   #15,U1BRG ; Sending speed 38400 BPS(10M)
138 ; MOV.B   #12,U1BRG ; Sending speed 38400 BPS(8M)
139 ; MOV.B   #9,U1BRG  ; Sending speed 38400 BPS(6M)
140 ;
141 ;
142 ;-----*****
```

Baud rates are set here. Refer to the values shown table 7-2 as you change baud rate settings as necessary.

Clock (MHz)	6	8	10	12	16
Baudrate	9	12	15	19	25

Table 7-2. Comparison of clock and baud-rate

7. How to Repair The Monitor Program

FILE : F_ram8.a30

```

line program
35 ;-----*****
36 ;   Setting up wait cycles for write to flash memory
37 ;-----*****
38 ;   If you changed the resonator, you need to change the
39 ;   operation frequency for write to flash memory.
40 ;   12.5 MHz or less when internal wait cycles are inserted
41 ;   6.25 MHz or less when no internal wait cycles are inserted
43 ;   Note:
44 ;   There is an entry on the 152nd line of this file that requires the
45 ;   same modification.
46 ;-----*****
46 BSET 0,0AH           ; enable register of protect
48 MOV.B #01000000B,CM1 ; 1/2
49 ; MOV.B #00000000B,CM1 ; 1/1
50 BCLR 6,CM0
51 BCLR 0,0AH          ; disable egistor of protect
52
53 BSET 1,0aH          ; enable register of protect

55 BSET 7,PM1          ; 1 WAIT
56 ; BCLR 7,PM1        ; 0 WAIT
57 BCLR 1,0AH          ; disable register of protect
58 ;-----*****

```

Set up the divide-by value and wait cycles by referring to the notes written above.

Cock (MHz)	6	8	10	12	16
Divide-value	1	1	1/2	1/2	1/2
Wait	0	0	0	1	1

Table 7-3. Example for setting up the divide-by value and wait cycles relative to the clock

```

FILE : f_ram8.a30
line program
153 ;-----****
154 ;   Setting up wait cycles for write to flash memory
155 ;-----****
156 ;   If you changed the resonator, you need to change the
157 ;   operation frequency for write to flash memory.
158 ;   12.5 MHz or less when internal wait cycles are inserted
159 ;   6.25 MHz or less when no internal wait cycles are inserted
160 ;-----****
161 BSET    0,0AH      ; enable register of protect
162 MOV.B   #01000000B,CM1 ; 1/2
163 ; MOV.B  #00000000B,CM1 ; 1/1
164 BCLR    6,CM0
165 BCLR    0,0AH      ; disable register of protect
166
167 BSET    1,0AH      ; enable register of protect
168 MOV.B   #10001000B,PM1 ; 0 wait
169 ; MOV.B  #00001000B,PM1 ; 1 wait
170 BCLR    1,0AH      ; disable register of protect
171 ;-----****

```

Set up the divide-by value and wait cycles by referring to the notes written above.

7.3. Limit of Frequency

The monitor program is running in the following frequency range of MSA0654G01/G02's clock. With the clock frequencies outside of this range, device operation cannot be guaranteed, so use the clock frequencies of this range.

6 MHz (MIN) to 10 MHz (MAX) (MSA0654-G01)

6 MHz (MIN) to 16 MHz (MAX) (MSA0654-G02)

* However, the device cannot operate with the following clocks:

* When the main clock = 6 MHz, divide-by-8 and divide-by-16 clocks

* When the main clock = 10 MHz, divide-by-16 clock

* The subclock (Xcin) used as BCLK

8. MSA0654 G01/G02

8.1. External Specifications

Tables 8-1 and 8-2 list external specifications of MSA0654 G01/G02.

Table 8-1. External Specifications of MSA0654 G01/G02

Item	Content
MCU	MSA0654G01 MCU:M30624FGLFP Operation mode: Single chip mode Clock frequency: Main clock 10 MHz MSA0654G02 MCU:M30624FGFP Operation mode: Single chip mode Clock frequency: Main clock 16 MHz
Memory	Internal memory RAM: 20KB(19.8KB open to the user) FLASH ROM: 256KB(239.4KB open to the user)

Table 8-2. External Specifications of MSA0654 G01/G02

Item	Content
Connector	[CN1]: Serial interface connector [CN2]: Power supply connector [CN3]: Throuh hall contact for DC power supply MSA0654G01 : 3V MSA0654G02 : 5V
Switch	[SW1]: push button(connected INT0) [SW2]: push button(connected INT1) [SW3]: push button(connected ADTRG) [SW4]: push button(connected RESET)
LED	[LED1]:uesr I/O(connected P0_0 to P0_7) [LED2]:uesr I/O(connected P0_0 to P0_7)

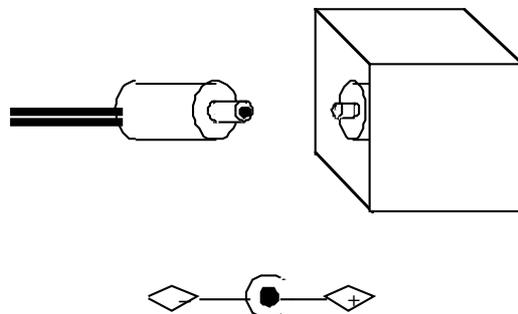
8.2. Power Supply Requirements

Table 8-3 lists and Figure 8-1 connector Pin assign power requirements of MSA0654 G01/G02.

Table 8-3. Power Requirements

	Power Supply Voltage	Power Supply Current
Vcc	DC 8[V] to 12[V]	500 [mA] (max.)
GND	0 [V] (reference voltage)	—

Figure 8-1 connector Pin assing



note) It plug correspond to old "EIAJ" standard

8.3. Environment Requirements

Table 8-4 lists environment requirements for using and storing MSA0654 G01/G02. When storing MSA0654 G01/G02, place it in a conductive bag and then in a packing box. The packing box in which your product was shipped from the factory is desirable.

Table 8-4. Environment Requirements

Environment Condition	Ambient Temperature	Ambient Humidity
When using	Operating ambient temperature: 0 to 55°C (No corrosive gas allowed)	30 to 80% (No dewdrops allowed)
When stored	Storage ambient temperature: -30 to 75°C (No corrosive gas allowed)	30 to 80% (No dewdrops allowed)

8.4 Block Diagram

Figure 8-2 shows a block diagram of MSA0654 G01/G02.

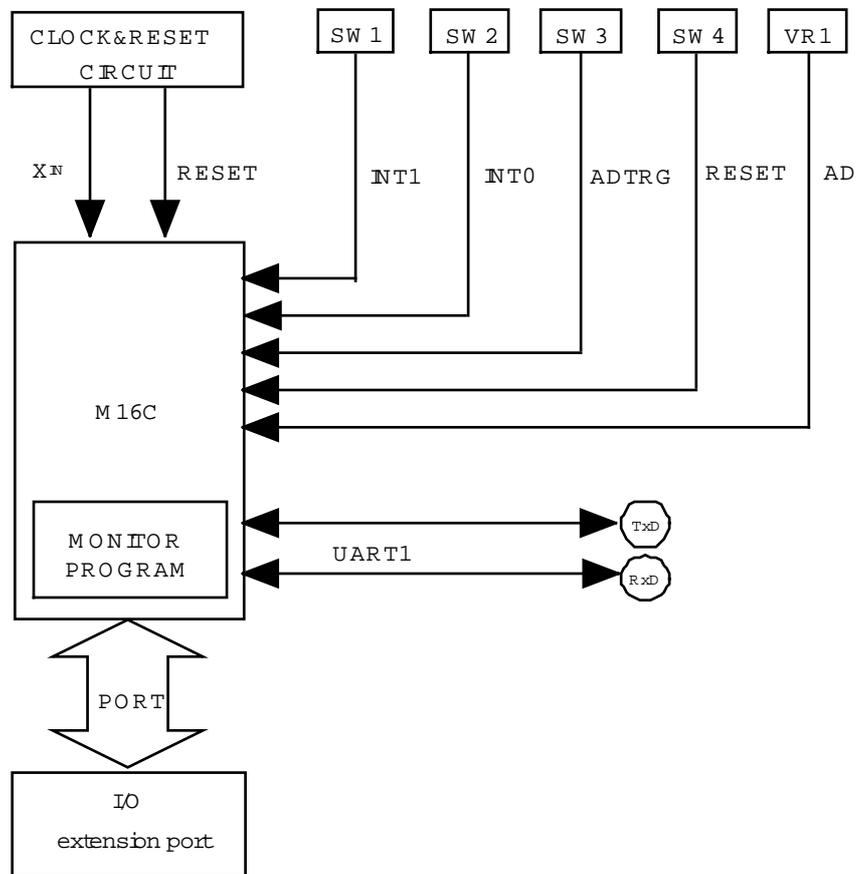


Figure 8-2. Block diagram of MSA0654

8.5. Memory Map

Figure 8-3 shows a memory map of MSA0654 G01/G02.
Use of a user area (RAM 19.8KB,FlashROM 239.4KB).

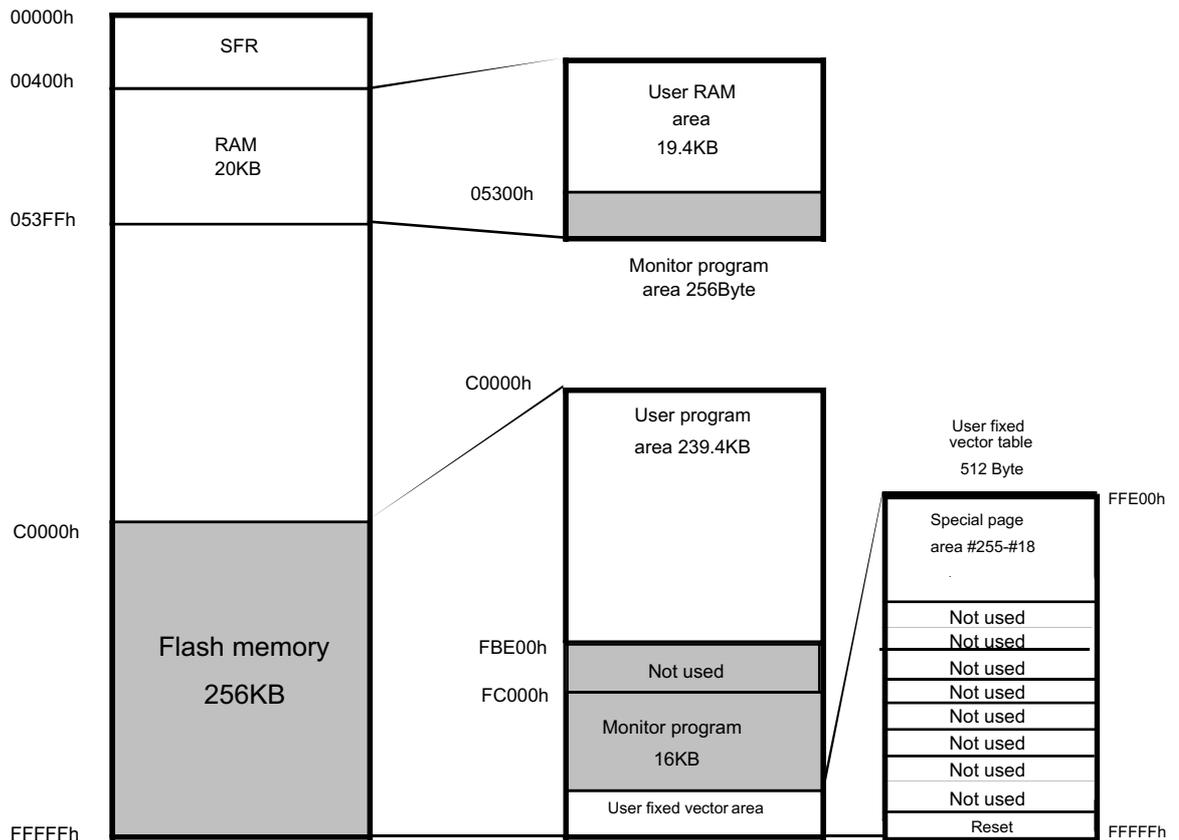


Figure 8-3. MSA0654 memory map

8.6. Using MSA0654

MSA0654 G01/G02 has 12 jumper (JP1 to JP5 and 2-3 pin of JP8 dose short as Default. If change, cut line), 2 LEDs and 4 switch and 1 variable resistance are prepared.

Refer to the next page for the pin arrangement of CN4.

Figure 8-4 shows the location of each part of MSA0654 G01/G02.

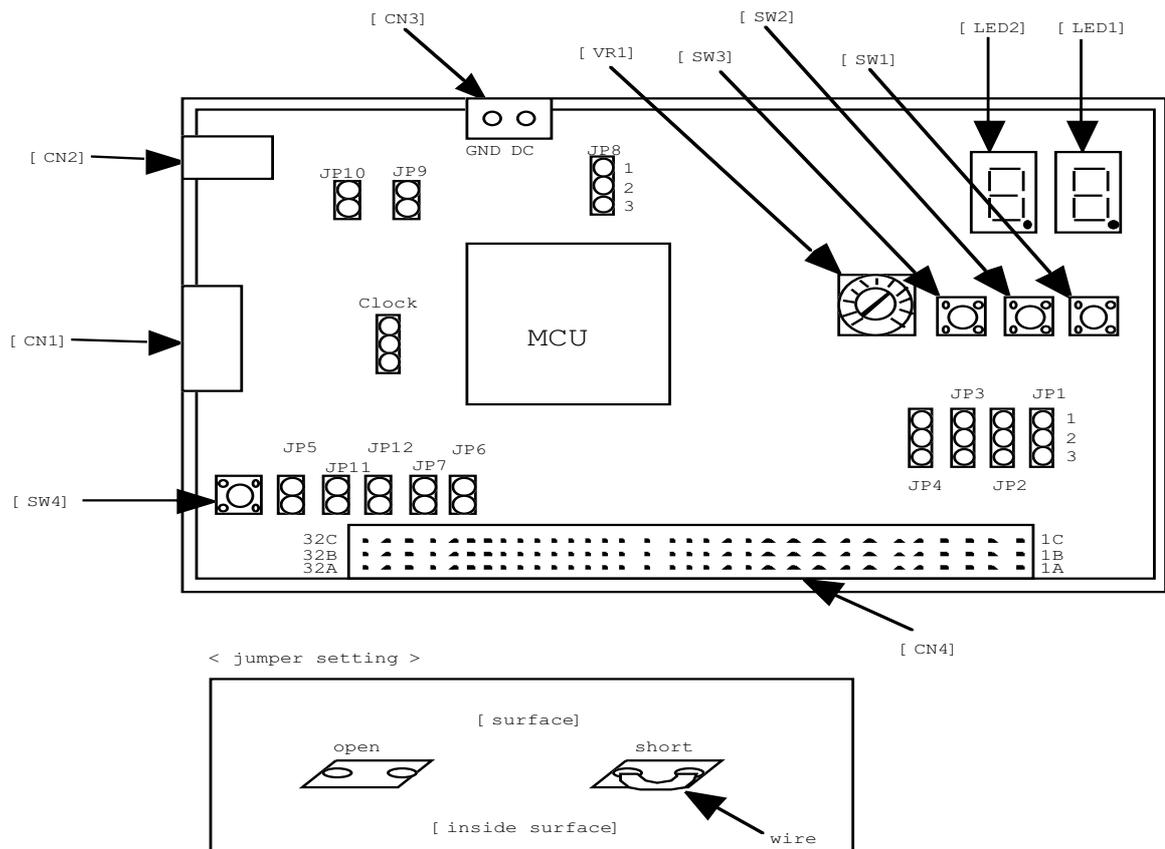


Figure 8-4. Location of each part of MSA0654

8.6.1. Connect Requirements

Table 8-5 connector requirements and Table 8-6 CN2 connector Pin assign and Table 8-7 CN4 connector Pin assign of MSA0654 G01/G02.

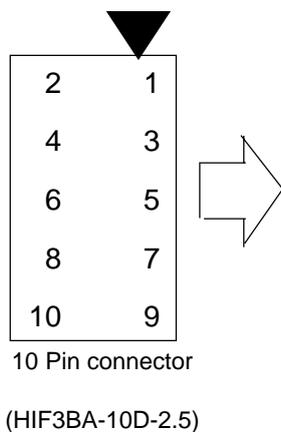
note) Connect nothing with 31,32pin. When it is not KD308 normal connected.

Table 8-5 connector requirements

Connect No		Connect No	
CN1	NETWORK CONNECT	SW1	SWITCH
CN2	8V-12V POWER SUPPLY CONNECT	SW2	SWITCH
CN3	POWER SUPPLY CONNECT Hall only	VR1	VARIABLE RESISTANCE
CN4	EXTEND CONNECT	LED1	USER I/O
SW1	SWITCH	LED2	USER I/O
SW2	SWITCH		

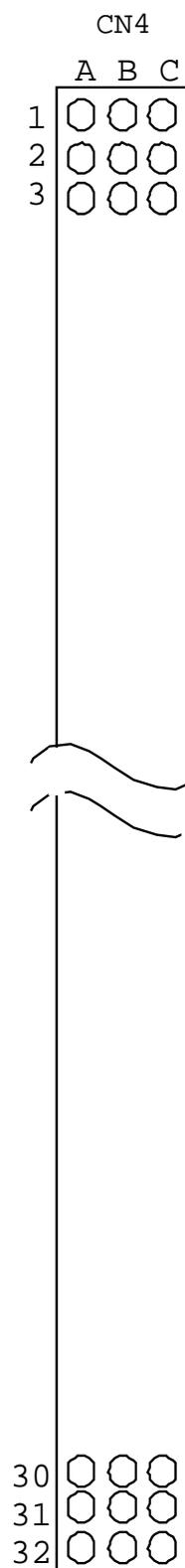
Table 8-6 CN2 connector Pin assign

CN2(PIN NO)	PORT	SIGNAL
1		VCCMON
2		
3		
4	P6_6	RxD
5		
6		
7		GND
8		
9		
10	P6_7	TxD



Receive connector ← { Straight Type:HIF3FC-10PA-2.54DSA
Angle Type:HIF3FC-10PA-2.54DS

Table 8-7 CN4 connector Pin assign



CN4A	PINNo	SIGNAL	CN4B	PINNo	SIGNAL	CN4C	PINNo	SIGNAL
1A	100	ADTRG	1B	VCC	NC	1C	VCC	NC
2A	97	AN0	2B	98	VREF	2C	99	AVCC
3A	94	P10_2	3B	95	P10_1	3C	96	AVSS
4A	91	P10_5	4B	92	P10_4	4C	93	P10_3
5A	88	LED1,2	5B	89	P10_7	5C	90	P10_6
6A	85	LED1,2	6B	86	LED1,2	6C	87	LED1,2
7A	82	LED1,2	7B	83	LED1,2	7C	84	LED1,2
8A	79	P1_1	8B	80	P1_0	8C	81	LED1,2
9A	76	P1_4	9B	77	P1_3	9C	78	P1_2
10A	73	P1_7	10B	74	P1_6	10C	75	P1_5
11A	70	P2_2	11B	71	P2_1	11C	72	P2_0
12A	67	P2_5	12B	68	P2_4	12C	69	P2_3
13A	63	P3_0	13B	65	P2_7	13C	66	P2_6
14A	59	P3_3	14B	60	P3_2	14C	61	P3_1
15A	56	P3_6	15B	57	P3_5	15C	58	P3_4
16A	53	P4_1	16B	54	P4_0	16C	55	P3_7
17A	50	P4_4	17B	51	P4_3	17C	52	P4_2
18A	47	P4_7	18B	48	P4_6	18C	49	P4_5
19A	44	P5_2	19B	45	P5_1	19C	46	CE
20A	41	EPM	20B	42	P5_4	20C	43	P5_3
21A	38	P6_0	21B	39	P5_7	21C	40	P5_6
22A	35	P6_3	22B	36	P6_2	22C	37	P6_1
23A	32	RXD1	23B	33	P6_5	23C	34	P6_4
24A	29	P7_1	24B	230	P7_0	24C	31	TXD1
25A	26	P7_4	25B	27	P7_3	25C	28	P7_2
26A	23	P7_7	26B	24	P7_6	26C	25	P7_5
27A	20	INT0	27B	21	P8_1	27C	22	P8_0
28A	17	P8_5	28B	18	P8_4	28C	19	INIT1
29A	10	XCIN	29B	111	XCOUT	29C	12	RESET
30A	5	P9_2	30B	56	P9_1	30C	7	P9_0
31A	2	P9_5	31B	3	P9_4	31C	4	P9_3
32A	1	P9_6	32B	GND	NC	32C	GND	NC

8.6.2. JUMPER SET

Table 8-8 jumper setting MSA0654 G01/G02.

Table 8-8 jumper setting

JUMPER No	Default mode	FUNCTION
JP1 (AN0)	1-2 Short *)	A-D0 input 1-2 Short : connect VARIABLE RESISTANCE 2-3 Short : connect Extend connector
JP2 (AVcc)	1-2 Short *)	A-D analogue input terminal 1-2 Short : connect MCU's Vcc 2-3 Short : connect Extend connector
JP3 (Vref)	1-2 Short *)	A-D analogue based terminal 1-2 Short : connect MCU's Vcc 2-3 Short : connect Extend connector
JP4 (AVss)	1-2 Short *)	A-D analogue input terminal 1-2 Short : connect MCU's GND 2-3 Short : connect Extend connector
JP5 (RESET)	Short *)	on board divce reset Short : Reset for SW4 Open : connect Extend connector
JP6 (RXD)	Open	UART1 input **) Short : connect Extend connector Open : connect CN4
JP7 (TXD)	Open	UART1 input **) Short : connect Extend connector Open : connect CN4
JP8 (Power)	2-3 Short *)	power supply control 1-2 Short : for use CN3 2-3 Short : for use CN1 Open : for use target board's power ***)
JP9 (BYTE)	Open	BYTE pin input Short : 8 bits access external BUS (External memory mode only) Open : 16 bits access external BUS (External memory mode only)
JP10 (CNVss)	Open	MCU mode input Short : use for modify a monitor program ****) Open : single MCU mode
JP11 (P87)	Open	Xcin input Short : connect Extebd connector Open : used on board sub-clock (hall only)
JP12 (P88)	Open	Xcout input Short : connect Extebd connector Open : used on board sub-clock (hall only)

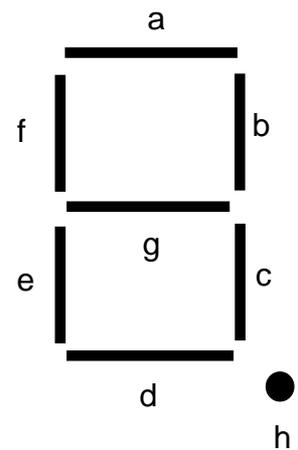
- *) This pin is short on back side. If modify , cut line on back side.
- **) Can't changed. If chang , can not connect KD30.
- ***) OPEN is to do jumper from to prevent reverse electric currento the connector CN2 due to what is done so, and supply a power supply on the board.
It can be used for the function that a user is optional.
- ****) When modify a monitor program , it is short. When modify a monitor program , show it capter 7.

8.6.3. LED

Table 8-9 show LED and port connection about the connection with each LED and the port in the following.

Table 8-9 show LED and port connection

SEGMENT1,2	PORT	Pin No	ACTIVE
a	P0_0	88	L
b	P0_1	87	L
c	P0_2	86	L
d	P0_3	85	L
e	P0_4	84	L
f	P0_5	83	L
g	P0_6	82	L
h	P0_7	81	L



figur 8-5 segment

DIGIT	PORT	Pin No	ACTIVE
LED1	P1_0	80	L
LED2	P1_1	79	L

8.6.4. switch

Table 8-10 show switch, INT0,INT1 of MCU, get crowded, and SW1,SW2 are the witches connected with the input terminal.

ADTRG,RESET of MCU profit get crowded, and SW3,SW4 are the switches connected with the input terminal.

It can be used for the function that a user is optional. Show the connection of each switch and the input terminal in the following.

Table 8-10 switch

SW	INPUT TERMINAL	FUNCTION
SW1	INT0	
SW2	INT1	
SW3	ADTRG	
SW4	RESET	

M16C/62 StarterKit2 USER'S MANUAL Rev.B

Mar. 1999 1st version

Jul. 1999 2nd version

Edited by

Mitsubishi Electric Semiconductor Systems Corporation

Published by

Mitsubishi Electric Semiconductor Systems Corporation

This book, or parts thereof, may not be reproduced in any form without permission of Mitsubishi Electric Corporation.

©1999 MITSUBISHI ELECTRIC SEMICONDUCTOR SYSTEMS CORPORATION