To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

Send any inquiries to http://www.renesas.com/inquiry.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as "Specific" without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.

   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.

   "Specific": Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

M16C/60 Series and M16C/20 Series

General-purpose Program for Indirect Subroutine Call

1. Abstract

This program executes an indirect subroutine call instruction after setting the relative jump address for indirect jump. It also executes an indirect subroutine call instruction by using a 20-bit absolute address.

2. Introduction

For indirect jump based on relative addresses, this program uses an extended access instruction (LDE) to set the relative jump address for the indirect jump. In this program, since relative addresses are within the range that can be represented with 8 bits, ".B (byte size)" is used to set the offset data.

For indirect jump based on absolute addresses, this program adds the content of the address register, with its sign ignored, to the start address of the memory area where 20-bit absolute addresses are stored and jumps to the memory location (20-bit absolute address) indicated by the result. The memory area in which to store 20-bit absolute addresses is allocated in units of 3 bytes.

(1) Indirect subroutine call (relative)

Subroutine name : SUBIND_W	ROM capacity : 19 bytes
Interrupt during execution : Accepted	Number of stacks used : 3 bytes

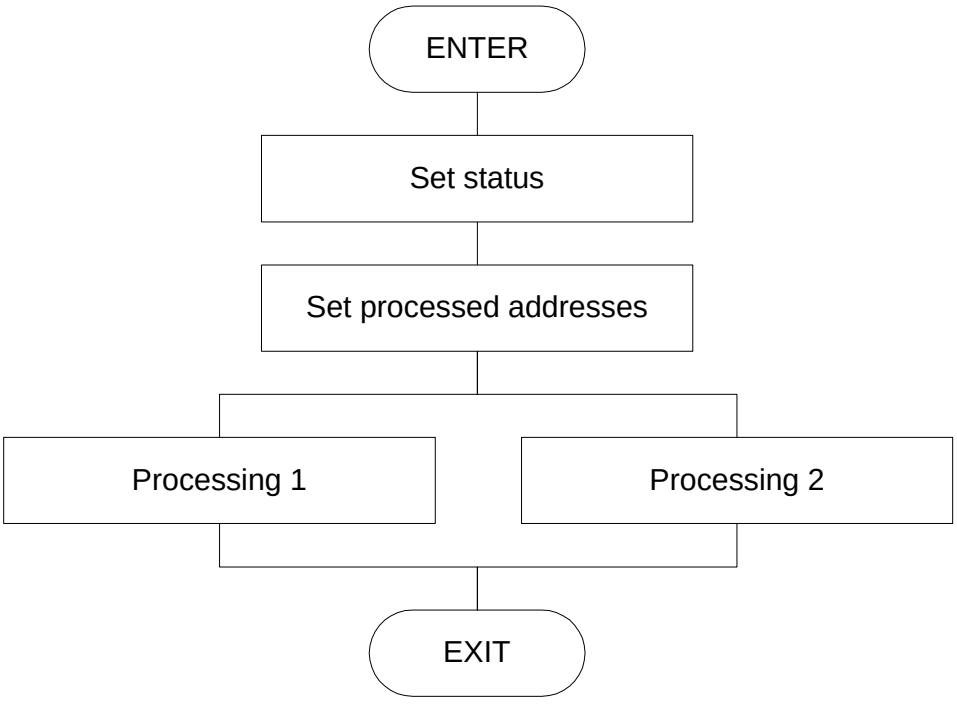
Register/memory	Input	Output	Usage condition
R0	-	-	Unused
R1	-	-	Unused
R2	-	-	Unused
R3	-	-	Unused
A0	-	Indeterminate	Processing status
A1	-	Indeterminate	Processing relative address
MODE	Current processing status	Next processing status	←
Usage precautions	The indirect jump address set here is a relative address.		

(2) Indirect subroutine call (absolute)

Subroutine name : SUBIND_A	ROM capacity : 26 bytes
Interrupt during execution : Accepted	Number of stacks used : 3 bytes

Register/memory	Input	Output	Usage condition
R0	-	-	Unused
R1	-	-	Unused
R2	-	-	Unused
R3	-	-	Unused
A0	-	Indeterminate	Address pointer
A1	-	-	Unused
MODE	Current processing status	Next processing status	←
Usage precautions	The indirect jump address set here is a 20-bit absolute address.		

3. Flowchart



4. The example of a reference program

```
;*********************************************************************
; *
; M16C General-purpose Programs *
; CPU : M16C *
; *
;*********************************************************************
VramTOP     .EQU     000400H             ; Declares start address of RAM
VromTOP     .EQU     0F0000H             ; Declares start address of ROM
Vsb         .EQU     0400H               ; Sets SB
            .SECTION    RAM,DATA
            .ORG     VramTOP             ; RAM area
MODE:          .BLKB      1             ; Processing status
MD_0        .EQU     0                   ; Status No. 0
MD_1        .EQU     1                   ; Status No. 1
;=====================================================================
; Title     : Indirect subroutine call
; Outline   : Branches processing using an indirect subroutine call (relative)
; Input     : ----------------------------> Output:
; R0 ( )                          R0 (Unused)
; R1 ( )                          R1 (Unused)
; R2 ( )                          R2 (Unused)
; R3 ( )                          R3 (Unused)
; A0 ( )                          A0 (Indeterminate)
; A1 ( )                          A1 (Indeterminate)
; Stack amount used: 3 bytes
;=====================================================================
            .SECTION    PROGRAM,CODE
            .ORG     VromTOP             ; ROM area
            .SB      Vsb                 ; Declares SB register value
            .SBSYM      MODE             ;
   LDC         #Vsb,SB                  ; Sets initial values for SB register
SUBIND_W:                               ;
   MOV.B       MODE,A0                  ;
   LDE.B       JUMPaddress[A0],A1       ; Sets jump address
JUMP_offset:                            ;
   JSRI.W      A1                       ; Jumps to each processing
   RTS                                  ;
MODE_0:                                 ;
   MOV.B       #MD_1,MODE               ;
   RTS                                  ;
MODE_1:                                 ;
   MOV.B       #MD_0,MODE               ;
   RTS                                  ;
JUMPaddress:                            ;
            .BYTE       MODE_0-JUMP_offset ;
            .BYTE       MODE_1-JUMP_offset ;
```

```
;===============================================================
; Title    : Indirect subroutine call
; Outline  : Branches processing using an indirect subroutine call (absolute).
; Input    : ------------------------------> Output:
; R0 ( )                          R0 (Unused)
; R1 ( )                          R1 (Unused)
; R2 ( )                          R2 (Unused)
; R3 ( )                          R3 (Unused)
; A0 ( )                          A0 (Indeterminate)
; A1 ( )                          A1 (Unused)
; Stack amount used: 3 bytes
;===============================================================
SUBIND_A:
   MOV.B      MODE,A0                  ;
   SHL.W      #1,A0                    ;
   ADD.B      MODE,A0                  ; Sets jump pointer
   JSRI.A     JSRaddress[A0]           ; Jumps to each processing
   RTS                                 ;
JSR_0:                                 ;
   MOV.B      #MD_1,MODE               ;
   RTS                                 ;
JSR_1:                                 ;
   MOV.B      #MD_0,MODE               ;
   RTS                                 ;
JSRaddress:                            ;
            .ADDR JSR_0                ;
            .ADDR JSR_1                ;
            .END                       ;
```

5. Reference

SOFTWARE MANUAL
M16C/60 M16C/20 Series SOFTWARE MANUAL
(Acquire the most current version from Renesas web-site)

6. Web-site and contact for support

Renesas Web-site

http://www.renesas.com

Contact for Renesas technical support

Mail to : support_apl@renesas.com

REVISION HISTORY

Rev.	Date	Description	
		Page	Summary
1.00	Jul 08, 2002	-	First edition issued

Keep safety first in your circuit designs!

1. Renesas Technology 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 nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corporation 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 Renesas Technology Corporation or a third party.
2. Renesas Technology 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, programs, algorithms, or circuit application examples contained in these materials.
3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corporation or an authorized Renesas Technology Corporation product distributor for the latest product information before purchasing a product listed herein.
   The information described here may contain technical inaccuracies or typographical errors.
   Renesas Technology Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
   Please also pay attention to information published by Renesas Technology Corporation by various means, including the Renesas Technology Corporation Semiconductor home page (http://www.renesas.com).
4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology 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 Renesas Technology Corporation or an authorized Renesas Technology Corporation 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.
6. The prior written approval of Renesas Technology Corporation is necessary to reprint or reproduce in whole or in part these materials.
7. 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.
8. Please contact Renesas Technology Corporation for further details on these materials or the products contained therein.