

Source file Converter for M37900 Series SC79 Operation Guide

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Chapter 1 Overview

1.1 Functions

SC79 converts assembler directive commands, structure description instructions, and part of assembler mnemonics described in files written in assembly language for use with the 7700 family so that the assembler system for the 7900 series can assemble them.

Chapter 2 Specification of software

2.1 Coding Rule

- length of file name
File names SC79 processes can be up to 255 characters (255 bytes) long including a directory specified.
- length of name
The names of symbols, labels, macros, etc. used in files SC79 processes can be up to 255 characters (255 bytes) long respectively.
- number of names
The total number of symbols, labels, macros, etc. used in files SC79 processes depends on the memory of your host machine that runs SC79.

Chapter 3 Input and Output file

3.1 Input file

- Files written in assembly language for use with the 7700 family
You can use any file extension other than “.a79”. If you omit the extension when starting up a program, “.a77” is added to go ahead with processing. Files involved in errors occurring in PRE77 and RASM77 cannot be properly converted by SC79.

3.2 Output file

- Assembly-language files for use with the 7900 series
The extension of input file name is changed into “.a79”. A file having the same name, if present, is overwritten.
When specifying -E option, the file name becomes the same as the input file name.
- Tag file
SC79 generates a tag file that indicates errors and warnings only when you choose the command option (-T).
The file will be given the file name resulting from changing the extension of the input file name into “.stg”.
Processing this file by use of an editor that has the tag-jump functions allows you to easily correct errors. Because the information that SC79 could not be

corrected is output in it, confirm contents.

Chapter 4 Operation

4.1 Starting SC79

4.1.1 Rules for Specifying Command line

sc79 (input file) (command option) <RET>

Command parameters can be specified in any desired order.

4.1.2 Input file name

Specify one or more file names.

Specifying a file name whose extension is “.a79” results in an error.

You can omit the extension of a file name having the extension “.a77”.

You can specify only up to 300 files.

4.1.3 Command option

Command option	Function
-E	Outputs the change results to the input file.
-T	Generates an error tag file
-V	Indicates the version of SC79

The way of using -E option

When not using -E option, the extension becomes “.a79” about the include file, too. Therefore, you must correct the line that “.include” was described. However, when using -E option, you don't have to correct the line that “.include” was described.

[Precaution]

- If any of the multiple input files thus specified contains an error, that file is not processed in the subsequent processing stages.
- When specifying -E option, because an input file is overwritten to the change result, we recommend you to generate the backup file beforehand.

Chapter 5 Contents of Process

5.1 Convert Directive Commands

5.1.1 Bit symbol definition .EQU

The character string to be changed

- The bit symbol definition “.EQU” is changed into “.BTEQU”.

Before change

```
bitsym .EQU 1,MEM
```

After change

```
bitsym .BTEQU 1,MEM
```

5.1.2 Declare external reference (direct page) .DPEXT

The character string to be changed

- SC79 splits “.DPEXT” into two lines “.DPSYM” and “.GLB”.

Before change

```
.DPEXT glsym
```

After change

```
.DPSYM glsym  
.GLB glsym
```

5.1.3 Declare external reference (data bank) .DTEXT

The character string to be changed

- SC79 splits “.DTEXT” into two lines “.DTSYM” and “.GLB”.

Before change

```
.DTEXT glsym
```

After change

```
.DTSYM glsym  
.GLB glsym
```

5.1.4 Correct address alignment .EVEN

The character string to be changed

- SC79 changes “.EVEN” to “.ALIGN 2”.

Before change

```
.SECTION PROG  
.BYTE 01H  
.EVEN
```

After change

```
.SECTION PROG  
.BYTE 01H  
.ALIGN 2
```

5.1.5 Declare public label or symbol .PUB

The character string to be changed

- SC79 changes “.PUB” to “.GLB”.

Before change

```
.PUB    WORK1, WORK2
```

After change

```
.GLB    WORK1, WORK2
```

5.1.6 Declare external reference .EXT

The character string to be changed

- SC79 changes “.EXT” to “.GLB”.

Before change

```
.EXT    E_LABEL
```

After change

```
.GLB    E_LABEL
```

5.1.7 Control list output .LIST, .NLIST

The character string to be changed

- SC79 changes “.LIST” to “.LIST ON”.
- SC79 changes “.NLIST” to “.LIST OFF”.

Before change

```
.LIST                                ;Starts of outputting list.  
.NLIST                              ;Suppresses of outputting list.
```

After change

```
.LIST    ON                        ; Starts of outputting list.  
.LIST    OFF                       ; Suppresses of outputting list.
```

5.1.8 Control macro expansion list .LISTM, .NLISTM

The character string to be changed

- SC79 adds ‘;’ to the beginning of the line “.LISTM” and of the line “.NLISTM”, so as to comment out these lines. SC79 outputs a warning to these lines.

Before change

```
.LISTM                                ;Starts of outputting the macro expansion listing.  
.NLISTM                              ;Suppresses of outputting the macro expansion listing.
```

After change

```
;.LISTM                                ;Starts of outputting the macro expansion listing.  
;.NLISTM                              ;Suppresses of outputting the macro expansion listing.
```

5.1.9 Specify columns count .COL

The character string to be changed

- SC79 changes “.COL” to “.FORM ,”.

Before change

```
.COL 100
```

After change

```
.FORM ,100
```

5.1.10 Specify lines per page .LINE

The character string to be changed

- SC79 changes “.LINE” to “.FORM”.

Before change

```
.LINE 60
```

After change

```
.FORM 60
```

5.1.11 Specify library filename .LIB

The character string to be changed

- SC79 adds ‘;’ to the beginning of the line “.LIB”, so as to comment out this line. You need to specify the response to this directive command when you execute the linker. For this reason, SC79 outputs a warning to this directive command line.

Before change

```
.LIB LIB1,LIB2,LIB3
```

After change

```
; .LIB LIB1,LIB2,LIB3
```

5.1.12 Specify re-locatable filename .OBJ

The character string to be changed

- SC79 adds ‘;’ to the beginning of the line “.OBJ”, so as to comment out this line. You need to specify the response to this directive command when you execute the linker. For this reason, SC79 outputs a warning to this directive command line.

Before change

```
.OBJ OBJ1,OBJ2,OBJ3
```

After change

```
; .OBJ OBJ1,OBJ2,OBJ3
```

5.1.13 Specify MCU type .MCU

The character string to be changed

- SC79 adds ';' to the beginning of the line ".MCU", so as to comment out this line. The M37900 series is not applicable to the MCU type. For this reason, SC79 outputs a warning to this directive command line.

Before change

```
.MCU M37750
```

After change

```
; .MCU M37750
```

5.1.14 Debugging Directive commands

The character string to be changed

- SC79 adds ';' to the beginning of the line Debugging directive command, so as to comment out this line.

```
.CLINE .FUNC .ENDFUNC .LANGUAGE .POINTER .SOURCE
```

Before change

```
.CLINE 10
```

After change

```
; .CLINE 10
```

5.1.15 Reserved Directive commands of RASM77

The character string to be changed

- SC79 adds ';' to the beginning of the respective directive command lines given below so as to comment out the lines. If a module name has been declared, SC79 generates its module name as a label.

```
Declare program name .PROGNAME  
Declare area name .IO .ENDIO .RAM .ENDRAM  
Declare module name .PROCMAIN .PROCSUB .PROCINT  
.ENDPROC
```

Before change

```
.PROCMAIN MAIN  
:
```

```
JMP MAIN  
.ENDPROC
```

After change

```
; .PROCMAIN MAIN  
MAIN:  
:
```

```
JMP MAIN
```

; .ENDPROC

5.2 Convert Macro Instructions

5.2.1 Macro name

The character string to be changed

- SC79 deletes the colon (:) that immediately follows the macro name.

Before change

```
FCLR: .MACRO
```

After change

```
FCLR .MACRO
```

5.2.2 Repeat Macro instruction

The character string to be changed

- SC79 changes “.REPEAT - .ENDM” to “.MREPEAT - .ENDR”.

Before change

```
.REPEAT 3  
NOP  
.ENDM
```

After change

```
.MREPEAT 3  
NOP  
.ENDR
```

5.2.3 Character concatenation operator

The character string to be changed

- SC79 changes “\$” character concatenation operator to “@”.

Before change

```
OBYTE: .MACRO Oval  
.BYTE Oval$  
.ENDM
```

After change

```
OBYTE .MACRO Oval  
.BYTE Oval@o  
.ENDM
```

5.3 Convert Structured Preprocessor Instruction

5.3.1 IF statement

The character string to be changed

- SC79 converts LIF and LLIF to IF.
- SC79 converts LELSE and LLELSE to ELSE.

Before change

```
LIF [sym1] != 10
```

After change

```
IF [sym1] != 10
```

5.3.2 FOR statement

The character string to be changed

- SC79 converts LFOR and LLFOR to FOR.

5.3.3 DO statement

The character string to be changed

- SC79 converts LDO and LLDO to DO.

5.3.4 SWITCH statement

The character string to be changed

- SC79 converts LSWITCH and LLSWITCH to SWITCH.

5.3.5 BREAK statement

The character string to be changed

- SC79 converts LBREAK and LLBREAK to REAK.

5.3.6 CONTINUE statement

The character string to be changed

- SC79 converts LCONTINUE and LLCONTINUE to CONTINUE.

5.3.7 GOTO statement

The character string to be changed

- SC79 converts LGOTO and LLGOTO to GOTO.

5.3.8 Endless loop

The character string to be changed

- SC79 converts EVER to FOREVER.

Before change

WHILE EVER

After change

WHILE FOREVER

5.3.9 Memory and Memory Bit

The character string to be changed

- SC79 converts {LABEL} to [LABEL].

Before change

{lab} = 5

After change

[lab] = 5

5.3.10 Register name

The character string to be changed

- SC79 converts DPR to DP.
- SC79 converts DBR to DT.
- SC79 converts PBR to PG.
- SC79 converts PSR to PS.

5.3.11 Operation involving a carry

1. Addition and Subtraction involving a carry

The character string to be changed

- SC79 converts WITH_C to “.C” and adds it next to the addition and subtraction symbol.

Before change

[ANS_A] = [WORK] + 10 WITH_C

[ANS_S] = [WORK] - 10 WITH_C

After change

[ANS_A] = [WORK] + .C 10

[ANS_S] = [WORK] - .C 10

2. Rotate operation involving a carry

The character string to be changed

- SC79 converts WITH_C to “.R” and adds it next to Rotate operation symbol.

Before change

```
[ANS_L] = [WORK] << 2 WITH_C  
[ANS_R] = [WORK] >> 2 WITH_C
```

After change

```
[ANS_L] = [WORK] << .R 2  
[ANS_R] = [WORK] << .R 2
```

5.4 Mnemonic

5.4.1 Direct indirect long

The character string to be changed

- SC79 deletes the last character L from mnemonics and adds it to the operand.

```
ADCL  ANDL  CMPL  DIVL  DIVSL  EORL  
LDAL  MPYL  MPYSL  ORAL  SBCL  STAL
```

Before change

```
ADCL  A, (1EH)
```

After change

```
ADC   A, L(1EH)
```

5.4.2 LDM instruction

The character string to be changed

- SC79 replaces the LDM instruction with the MOVMM instruction and transposes the sequence of operands.

Before change

```
LDM  #imm, mem
```

After change

```
MOVMM  mem, #imm
```

Assembler AS79 for the 7900 series replaces the instructions for use with the 7700 series given below with the instructions for use with the 7900 series, while SC79 doesn't carry out these replacements.

```
CLB  LDM  SEB  TAD  TBD  TDA  TDB
```

5.5 Location symbol

The character string to be changed

- SC79 converts * location symbol to \$.

Before change

BCC *+3

After change

BCC \$+3

5.6 Conversion table

5.6.1 Conversion table of Directive Commands

Item	Before change	After change
Bit symbol definition	.EQU	.BTEQU
Declare external reference	.DPEXT	.DPSYM .GLB
	.DTEXT	.DTSYM .GLB
Correct address alignment	.EVEN	.ALIGN
Declare public label or symbol	.PUB	.GLB
Declare external reference	.EXT	
Control list output	.LIST	.LIST ON
	.NLIST	.LIST OFF
Control macro expansion list	.LISTM	;.LISTM
	.NLISTM	;.NLISTM
Specify library filename	.LIB	;.LIB
Specify relocatable filename	.OBJ	;.OBJ
Specify MCU type	.MCU	;.MCU
Specify columns count	.COL 150	.FORM ,150
Specify lines per page	.LINE 60	.FORM 60
Debugging	.CLINE	; .CLINE
	.FUNC	;.FUNC
	.ENDFUNC	;.ENDFUNC
	.LANGUAGE	;.LANGUAGE
	.POINTER	;.POINTER
	.SOURCE	;.SOURCE
Reserved Directive commands of RASM77	.PROGNAME progname	;.PROGNAME progname
	.IO	;.IO
	.ENDIO	;.ENDIO
	.RAM	;.RAM
	.ENDRAM	;.ENDROM
	.PROCMAIN label	;.PROMAIN label label:
	.PROCSUB label	;.PROCSUB label label:
	.PROCINT label	;.PROCINT label label:
.ENDPROC	;.ENDPROC	

5.6.2 Conversion table of Macro Instructions

Item	Before change	After change
Macro name definition	Macname: .MACRO	Macname .MACRO
Repeat macro instruction	.REPEAT	.MREPEAT
	.ENDM	.ENDR
Character concatenation operator	\$	@

5.6.3 Conversion table of Structured Preprocessor Instruction

Item	Before change	After change
IF statement	LIF	IF
	LLIF	
	LELSE	ELSE
	LLELSE	
FOR statement	LFOR	FOR
	LLFOR	
DO statement	LDO	DO
	LLDO	
SWITCH statement	LSWITCH	SWITCH
	LLSWITCH	
BREAK state	LBREAK	BREAK
	LLBREAK	
CONTINUE statement	LCONTINUE	CONTINUE
	LLCONTINUE	
GOTO statement	LGOTO	GOTO
	LLGOTO	
Addition involving a carry	+WITH_C	+.C
Subtraction involving a carry	-WITH_C	-.C
Right Rotate operation involving a carry	>> WITH_C	>>.R
Left Rotate operation involving a carry	<< WITH_C	<<.R
Endless loop	EVER	FOREVER
Memory and Memory Bit	{LABEL}	[LABEL]
Register name	DPR	DP
	DBR	DT
	PBR	PG
	PSR	PS

5.6.4 Conversion table of Mnemonic

Item	Before change	After change
add with carry	ADCL Acc,(LABEL)	ADC Acc,L(LABEL)
logical and	ANDL Acc,(LABEL)	AND Acc,L(LABEL)
compare	CMPL Acc,(LABEL)	CMP Acc,L(LABEL)
divide	DIVL (LABEL)	DIV L(LABEL)
divide with sign	DIVSL (LABEL)	DIVS L(LABEL)
exclusive or memory with accumulator	EORL Acc,(LABEL)	EOR Acc,L(LABEL)
load accumulator with memory	LDAL Acc,(LABEL)	LDA Acc,L(LABEL)
multiply	MPYL (LABEL)	MPY L(LABEL)
multiply with sign	MPYSL (LABEL)	MPYS L(LABEL)
or memory with accumulator	ORAL Acc,(LABEL)	ORA Acc,L(LABEL)
subtract with carry	SBCL Acc,(LABEL)	SBC Acc,L(LABEL)
store accumulator in memory	STAL Acc,(LABEL)	STA Acc,L(LABEL)
load immediate to memory	LDM #imm,mem	MOVM mem,#imm

Acc shown in Table stands for either accumulator A or accumulator B.

5.6.5 Conversion table of Location symbol

Item	Before change	After change
Location symbol	*	\$

Chapter 6 Precautions on using SC79

6.1 Precautions

SC79 is the supplementary tool when changing from the program for 7700 series into the program for 7900 series and is not the one which guarantees operation in 7900 series about the change result. Please be sure to evaluate the change result. Mitsubishi Electric Corporation and Mitsubishi Electric Semiconductor Systems Corporation assume no responsibility for any damage, liability or other loss resulting from the information contained herein.

1. About Input file

- Specify a file free from errors output by PRE77 and RASM77.
- Do not convert again, by use of SC79, a file once converted with SC79.
If two or more files having the same root name but different extension are present, change their file names in advance.

Example)

Suppose two files are present whose names are test.p77 and test.a77 respectively.

```
sc79 test.p77<RET> ----- generates test.a79
```

```
sc79 test.a77<RET> ----- generates test.a79 (overwrites the former)
```

test.a79 will be a file resulting from converting test.a77

2. About ".INCLUDE" directive command.

- .SC79 doesn't change the file name specified by the ".INCLUDE" directive command. SC79 outputs a warning to this line, so check the file name.

Example)

```
.INCLUDE file1.a77 ----- outputs a warning
```

Because sc79 changes "file1.a77" into "file1.a79", you must correct ".INCLUDE" line.

- When specifying -E option, you don't have to change the file name which is specified by the ".include" directive command. Because the file name isn't changed when -E option is specified.

Example) d:\ SC79 file1.inc -E <RET>

```
.INCLUDE file1.inc ----- To change isn't necessary.
```

3. About ".LIB" and ".OBJ" directive command

- AS79 has no directive commands corresponding to ".LIB" and ".OBJ". SC79 converts these lines to comment lines and outputs warnings. In using AS79, specify a library file or a re-locatable file by use of ln79.

4. About the arithmetic operator precedence

- The arithmetic operator precedence is different between AS79 and RASM77. SC79 outputs a warning to the lines including arithmetic operator(s), so check the source file for operators.

[RASM77]

No arithmetic priority ranking is set for binary operators. Expressions with more than one binary operator are calculated from left to right.

[AS79]

Ordinary four rules of arithmetic and similar arithmetic priority ranking are set for binary operators.

RASM77	AS79
3 4+5*6	3 4+5*6
=7+5*6	=3 4+30
=12*6	=3 34
=72	=35

5. About Addressing specifier and EQU symbol (offset calculation)

- Offsets are calculated differently between AS79 and RASM77. SC79 doesn't carry out conversion as to offset calculations. Check the source file for them.

[RASM77]

If the operand is symbol defined by pseudo-command “.EQU”, offset of operand and direct page register or data page register is not calculated.

[AS79]

Unless specially specified, offset of operand and direct page register or data page register is calculated without respect for the type of operand, and the result is generated as an operand code.

RASM77	AS79
sym .equ 34h	sym .equ 34h
.DT 12h	.DT 12h
LDA A,DP:sym	LDA A,DP:sym
;CODE is A534	;CODE is 1A22

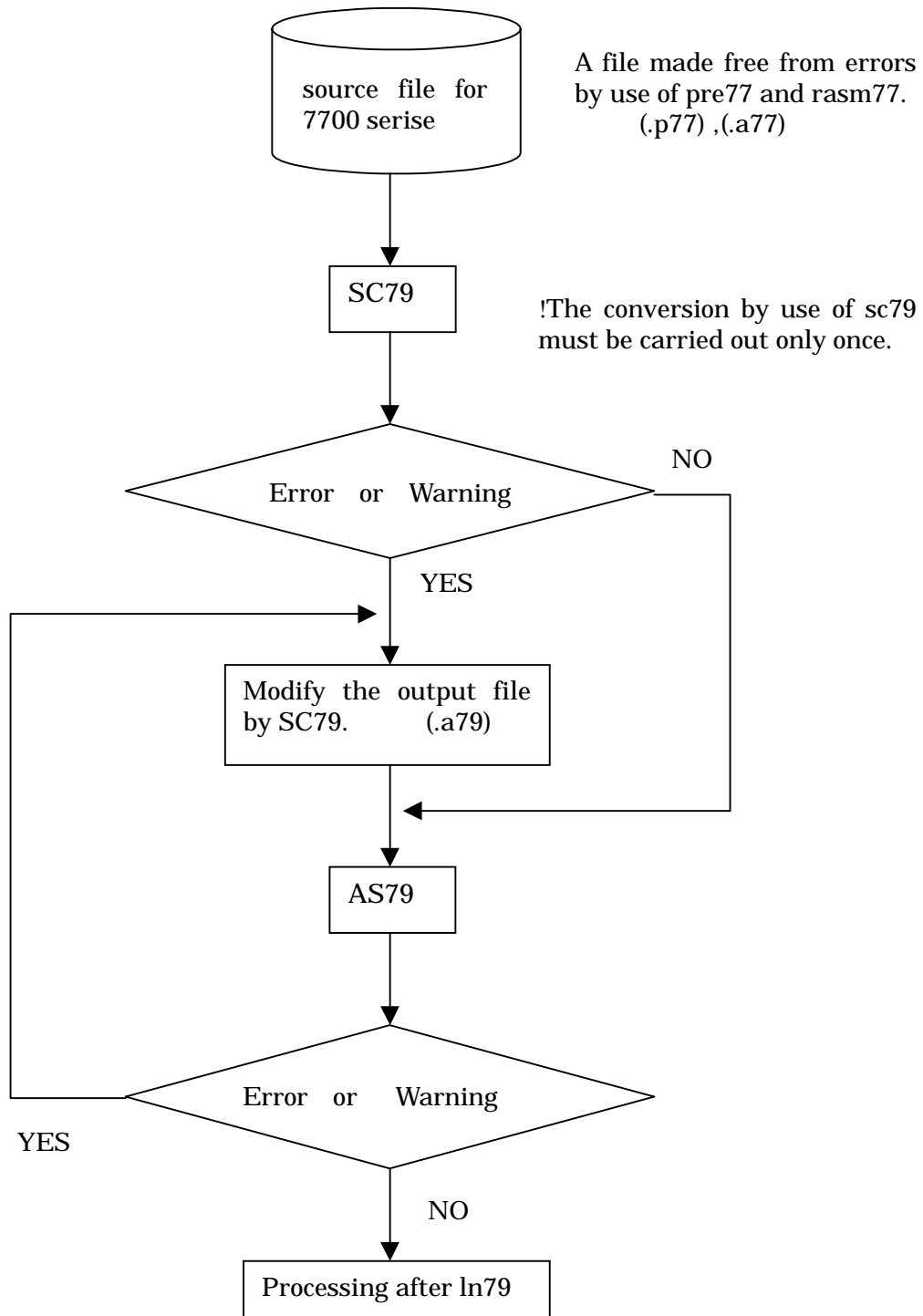
6. About “.REPEATC” and “.REPEATI” macro instruction

- AS79 has no directive commands corresponding to the macro instructions “.REPEATC” and “.REPEATI”. SC79 doesn't convert these directive commands. Check the source file for them.

6.2 The flow of source program conversion from the 7700 series to the 7900 series.

To convert assembly-language programs/structured programs for use with the 7700 series into those for use with the 7900 series by use of SC79, follow the steps given below.

<The flow of source program conversion from the 7700 series to the 7900 series>



Chapter 7 Error Messages

7.1 Error Messages

Error message	Meaning and actions
'xx' is already changed by SC79	The 'xx' file is already changed by SC79. ⇒ Check the file name.
Can't create file 'xx'	The 'xx' file cannot be generated. ⇒ Check the directory capacity.
Can't create Temporary file	Temporary file cannot be generated. ⇒ Specify directory in environment variable 'TMP' so that a temporary file will be created in some place other than the current directory.
Can't open file 'xx'	The 'xx' file cannot be opened. ⇒ Check the file name.
Can't write file 'xx'	Data cannot be written to the 'xx' file. ⇒ Check the permission of the file.
Command line is too long	The command line has too many characters. ⇒ Re-input the command.
Invalid option 'xx' is used	An invalid command option 'xx' is used. ⇒ Re-input the command correctly.
No input files specified	No input file is specified. ⇒ Specify an input file.
Not enough memory	Memory is insufficient. ⇒ Divide the file and re-run. Or increase the memory capacity.
Too many files	Too many files are specified. ⇒ Reduce the number of files. You can specify only up to 300 files.

7.2 Warning Messages

Warning message	Meaning and actions
More than one binary operator	Two or more binary operators have been described. ⇒ Check the operation precedence.
'INCLUDE' statement exist	.INCLUDE directive command is specified. ⇒ Check the include file name.
Invalid statement '.LIB' is used	AS79 doesn't have the .LIB directive command. This line has been commented out. ⇒ Check this line.
Invalid statement '.OBJ' is used	AS79 doesn't have the .OBJ directive command. This line has been commented out. ⇒ Check this line.
Invalid statement '.LISTM' is used	AS79 doesn't have the .LISTM directive command. This line has been commented out. ⇒ Check this line.
Invalid statement '.NLISTM' is used	AS79 doesn't have the .NLISTM directive command. This line has been commented out. ⇒ Check this line.
Invalid statement '.MCU' is used	AS79 doesn't have the .MCU directive command. This line has been commented out. ⇒ Check this line.

[About the output form of message]

SC79 shows error and warning messages about the file contents by the line number of the output file.

example) sample.a79 23 Warning (sc79): 'INCLUDE' statement exist