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CB77SIM V.1.01

User's Manual

Custom Builder for M3T-PD77SIM

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1. Overview

1.1. Setting Up CB77SIM

CB77SIM can be set up in the same way as for PD77SIM. The procedure for setting up PD77SIM is detailed in the "Setup/Functional Outline" part of the PD77SIM V.2.00 User's Manual.

1.2. Features of CB77SIM

CB77SIM provides an environment for using PD77SIM's customize function to create exclusive script commands (hereafter called a "custom command program") or exclusive windows (hereafter called a "custom window program"). The custom command and custom window programs thus created by CB77SIM can be entered in PD77SIM to expand its functions.

The following shows the features of CB77SIM:

1. The same user interface as available with **PD77SIM** is supported.
2. A development environment where programming, building, and debugging all are integrated is provided.
3. Creation of custom command and custom window programs is supported.
4. **PD77SIM**'s Register, Memory, Dump, and Script Windows are supported.

Each feature is detailed in the sections below.

1.2.1. Same user interface as available with PD77SIM

CB77SIM uses the same graphical interface design as PD77SIM, making it possible to use CB77SIM easily in the same way as for PD77SIM.

1.2.2. Development environment where programming, building, and debugging all are integrated

CB77SIM allows you to control a series of operations from creating source files to building and debugging them. The windows supported by CB77SIM include Project, Message, Editor, Local, and Global Windows. Each of these windows allows you to manage projects, display the build result or other status, edit a source file, and display local and global symbols.

1.2.3. Creation of custom command and custom window programs

CB77SIM allows the type of program you are going to create to be specified from the dialog box that is opened when creating a project. In this way you can select the custom command or custom window program to be created.

1.2.4. PD77SIM's Register, Memory, Dump, and Script Windows

Among the windows available with PD77SIM, CB77SIM supports the Register, Memory, Dump, and Script Windows. These windows can be used when creating custom command and custom window programs.

Note: The macro script commands cannot be used in the Script Window.

2.Function of Each Window

Figure 1 shows the window structure of CB77SIM.

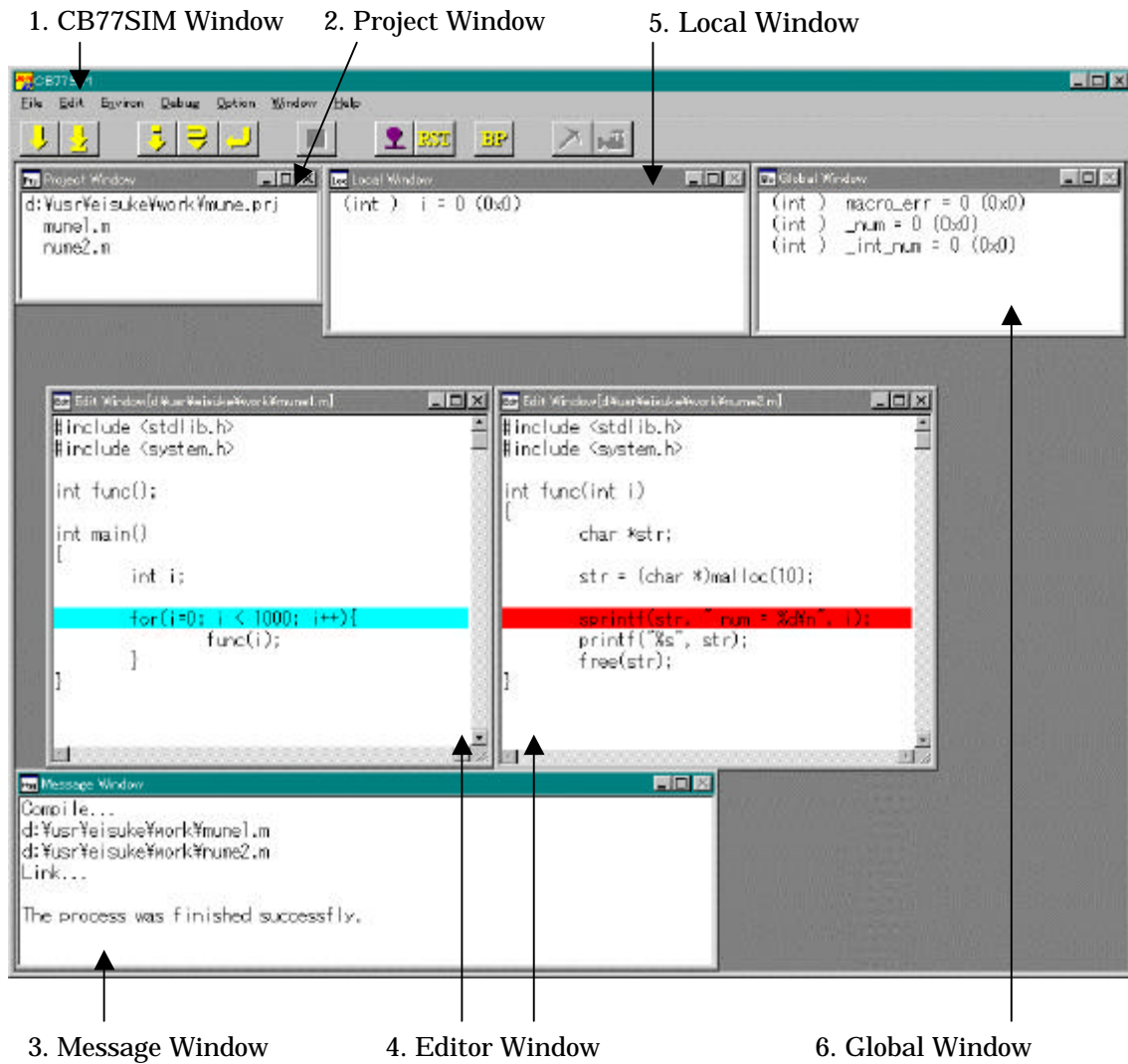


Figure 1. Window structure of CB77SIM

The outline features and the functions of each window of **CB77SIM** are explained below.

2.1. CB77SIM Window

The **CB77SIM** Window is the main window of **CB77SIM**. This is what opens first when you start up **CB77SIM**.

2.1.1. Menu Bar

Tables 1 and 2 below show the menu bar structure of the **CB77SIM** Window.

Table 1. Structure of Menu Bar (CB77SIM Window) (1/2)

Menu item	Items on pull-down menu	Function
[F]ile	[N]ew [S]ource/Header... [P]roject... [O]pen... [S]ave Save [A]s... [C]lose [L]oad module... [R]eload E[x]it	Create new source/header file. Create new project. Open source/project. Save source file. Save file after assigning a name. Close source file. Download target program. Reload target program. Terminate CB77SIM.
[E]dit	C[ut] C[opy] P[aste] F[ind]	Delete specified range. Copy specified range to clipboard. Paste text from clipboard into position. Search for specified character string.
[E]nviron	[I]nit... [P]ath...	Open Init dialog box. Open Path dialog box.
[D]ebug	[G]o [C]ome [S]tep [O]ver Retur[n] [A]nimate [B]reak Point... Break Point [S]et [L]ist... [R]eset [S]top B[ui]ld R[e]Build	Execute Go command. Execute Come command. Execute Step command. Execute Over command. Execute Return command. Execute Animate command. Open Break dialog box. Set or clear breakpoint. Open Break dialog box. Reset program. Stop program execution. Built current project. Rebuild current project.
[O]ption	Changed by window that has focus. (Refer to 3.2 and sections that follow.)	












Table 2. Structure of Menu Bar (CB77SIM Window) (2/2)

Menu item	Items on pull-down menu	Function
[W]indow	[C]ascade [T]ile [A]rrange Icon [R]egister Window M[e]mory Window [D]ump Window Scr[i]pt Window	Display windows one on top of another. Display windows side by side. Line up icons. Open PD77SIM 's Register Window. Open PD77SIM 's Memory Window. Open PD77SIM 's Dump Window. Open PD77SIM 's Script Window.
[H]elp	[I]ndex [A]bout...	Open table of contents of online help. Display version of CB77SIM.

2.1.2.Tool Bar

Table 3 shows the tool bar structure of the CB77SIM Window.

Table 3: Structure of Tool Bar (CB77SIM Window)

Button	Function	Corresponding menu
	Execute Go command	[Debug]-[Go]
	Execute Come command	[Debug]-[Come]
	Execute Step command	[Debug]-[Step]
	Execute Over command	[Debug]-[Over]
	Execute Return command	[Debug]-[Return]
	Stop program execution	[Debug]-[Stop]
	Set/clear breakpoint	[Debug]-[Break Point]-[Set]
	Reset program	[Debug]-[Reset]
	Open Break dialog box	[Debug]-[Break Point...]
	Build project	[Debug]-[Build]
	Rebuild project	[Debug]-[ReBuild]

2.2. Project Window

This window is used to manage the source files of the custom command and custom window programs created by **CB77SIM**. The source file displayed in this window can be opened in the Editor Window by, for example, double-clicking the mouse button.

2.2.1. Menu Bar

Table 4 shows the menu bar structure of the Option menu of the Project Window.

Table 4. Menu Bar Structure of Option Menu (Project Window)

Menu item	Items on pull-down menu	Function
[O]ption	[S]et up... [A]dd File... [D]el File	Open Setup dialog box. Add source file to project. Delete source file from project.

2.3. Message Window

This window is used to display a compile or link error when building a project or other messages during debugging. These messages are initialized when you start building a project. When a compile error is displayed, point to the line in error and double- or single-click the mouse button to select it. Then choose [Option] -> [Jump] from the menu bar to display the corresponding source file in the Editor Window, with the cursor moved to the line in error.

2.3.1. Menu Bar

Table 5 shows the menu bar structure of the Option menu of the Message Window.

Table 5. Menu Bar Structure of Option Menu (Message Window)

Menu item	Items on pull-down menu	Function
[O]ption	[J]ump	Display lines in error.

2.4.Editor Window

This window is used to edit the source file. Multiple instances of this window can be opened at a time, with the source file name displayed on the title bar of each window. The Editor Window provides versatile editing functions, allowing you to input or delete characters, cut and paste to and from the clipboard, and load or save a file. During debugging, furthermore, a breakpoint line is shown in red and the next execution line is shown in blue. If a breakpoint line and the next execution line overlap, they are displayed in yellow.

2.4.1.Menu Bar

The Option menu of the Editor Window does not have any submenu.

2.5.Local Window

This window is used to display the local variables and their values of a function that corresponds to the program counter during debugging. This window is opened when you start debugging a program and is closed when you finish debugging.

2.5.1.Menu Bar

The Option menu of the Local Window does not have any submenu.

2.6.Global Window

This window is used to display global variables and their values during debugging. This window is opened when you start debugging a program and is closed when you finish debugging.

2.6.1.Menu Bar

The Option menu of the Global Window does not have any submenu.

3.Method for Creating a Program

This section explains how to use **CB77SIM** to create a custom command and a custom window program by using a simple program as an example.

3.1.Creating a Custom Command Program

The following shows the procedure for creating a custom command program by using **CB77SIM**.

1. Create a new project for a custom command program.
2. Write a new source file.
3. Add the source file to the project.
4. Build the project.
5. Debug and correct the source file as necessary.
6. Repeat steps 5 and 6 until the program operates properly.

The table below shows specifications of the custom command program to be created in this section.

Program name	m_reset
Parameter	None
Function	Display program counter value before reset. Reset the target MCU. Display program counter value after reset.

3.1.1.Creating New Project for Custom Command Program

Choose [File]-[New]-[Project...] from the CB77SIM Window menu. The dialog box shown below will appear.

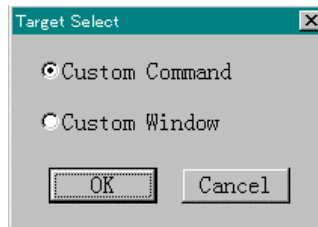


Figure 2. Target Select dialog box

Choose "Custom Command" and press the "OK" button.

A file selection dialog box will open, so input a project name and press the "Save" button. (A file name extension can be omitted.) The diagram below shows an example where "m_reset" is input for the name of the sample custom command program to be created in this section.

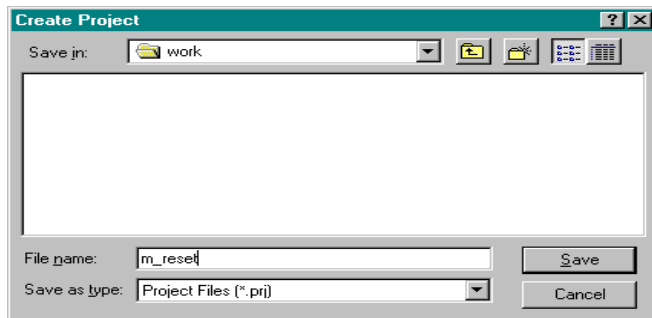


Figure 3. Dialog box for selecting a project name to be created

A Project Window showing the created project file name and a project setup dialog box are opened.

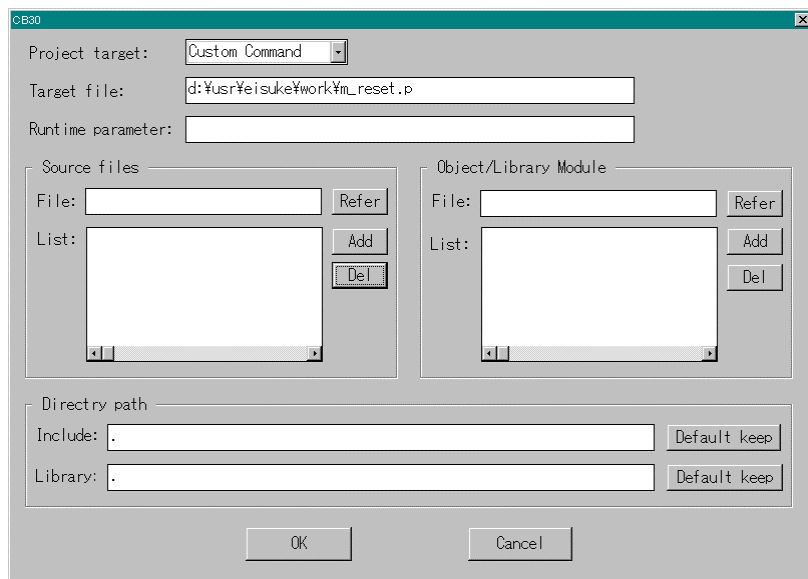


Figure 4. Setup dialog box

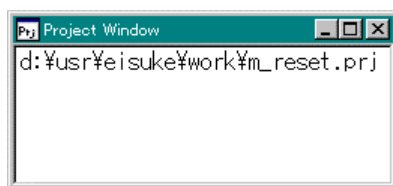


Figure 5. Project Window

The Setup dialog box can be opened from the Option menu of the Project Window to change its settings at any time you want. In this example, we only press the "Cancel" button on the Setup dialog box and leave it intact. For details on how to use the Setup dialog box, refer to Section 3.3, "Using Setup Dialog Box" on page 26.

Thus, with the above, a project file named "m_reset.prj" is created.

3.1.2. Creating New Source File

Choose [File]-[New]-[Source/Header...] from the **CB77SIM** Window menu. The Editor Window shown below will appear.

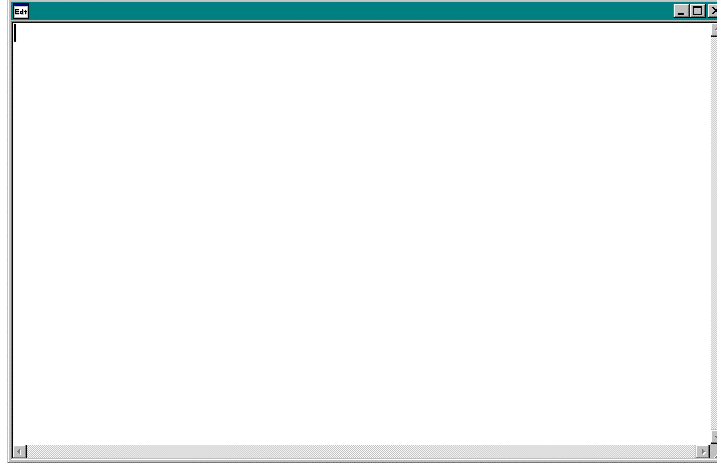


Figure 6. Blank Editor Window

Move focus to this Editor Window and choose [File]-[Save As...] from the **CB77SIM** Window menu to bring up a Save As dialog box. When this dialog box opens, input a file name and press the "Save" button. Specify ".m" for the source file name extension.

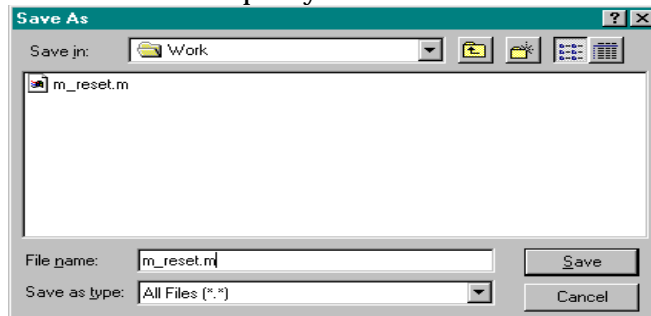


Figure 7. Save As dialog box

The name you have input in the Save As dialog box is displayed on the title bar of the Editor Window.

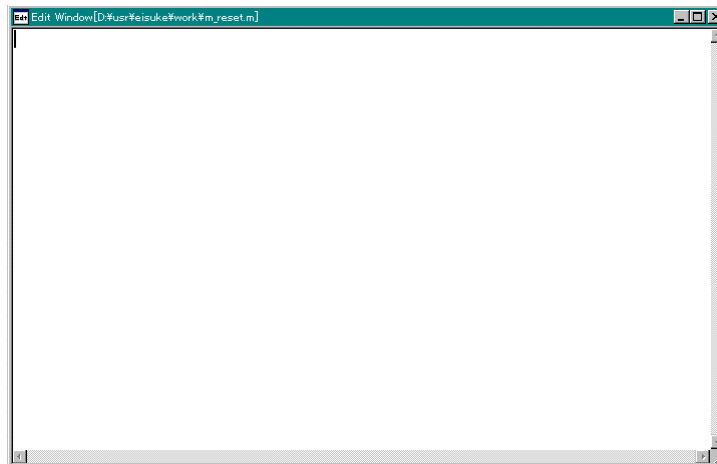
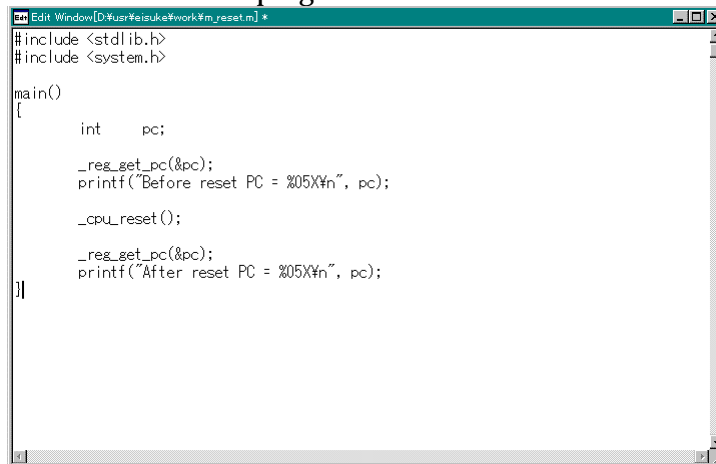


Figure 8. Editor Window with its name shown on title bar

Write a custom command source program in this Editor Window.



```

Edit Window[D:\usr#faisuke#work#m_reset.m] *
#include <stdlib.h>
#include <system.h>

main()
{
    int    pc;

    _reg_get_pc(&pc);
    printf("Before reset PC = %05X\n", pc);

    _cpu_reset();

    _reg_get_pc(&pc);
    printf("After reset PC = %05X\n", pc);
}

```

Figure 9. Editor Window with a source program written in it

For details about programming language specifications, refer to Section 4, "Programming Language Specifications" on page 33.

For details about library function specifications, refer to Section 5, "Reference" on page 34.

The asterisk (*) at the end of the file name on the title bar indicates that changes have been made to this file.

Thus, with the above, a custom command source file named "m_reset.m" is created.

3.1.3. Add Source File to Project

To build the source file created in the preceding section, we need to add it to a project. Choose [Option]-[Add File...] from the Project Window menu to bring up an "Add in source" dialog box. When this dialog box opens, choose the file name you want to be added to a project and press the Open button. The source file name thus added is displayed in the Project Window.

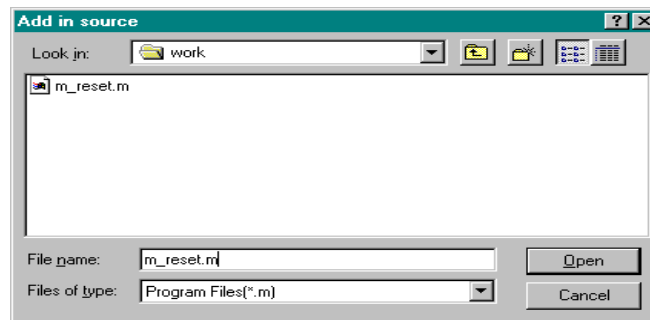


Figure 10. "Add Source" dialog box

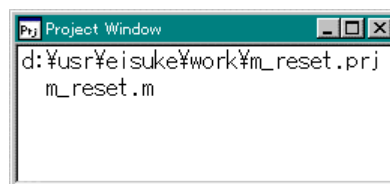


Figure 11. Project Window with a source file added

Thus, with the above, the source file "m_reset.m" is added to the project.

You also can add source files to a project using the Setup dialog box. For details on how to use the Setup dialog box, refer to Section 3.3, "Using Setup Dialog Box" on page 26.

3.1.4. Building a Project

The operation to create a custom command program and a custom window program file by processing the source files added to a project is referred to as "build" or "rebuild." The difference between "build" and "rebuild" is that among the source files added to a project, only those which have been modified since a program file was created previously are processed in the former, whereas all of the source files added to a project are processed in the latter.

To execute Build, choose [Debug]-[Build] from the CB Window menu or press the Build button on the tool bar.

To execute Rebuild, choose [Debug]-[ReBuild] from the CB Window menu or press the Rebuild button on the tool bar.

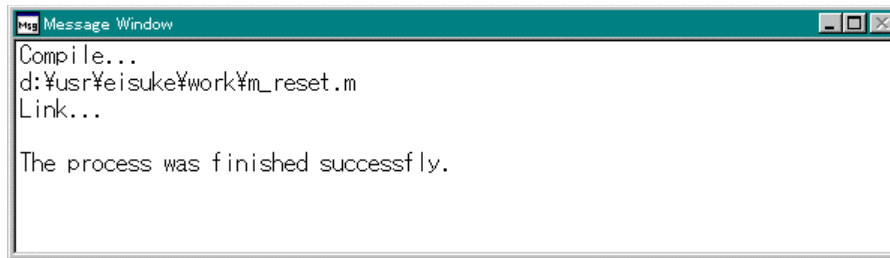


Figure 12. Message Window when succeeded in building

Thus, with the above, a custom command program file is generated by **CB77SIM** providing that no error is found in the source program and in settings of the Setup dialog box.

In this example, the include file and library file search paths remain set to the default value (current directory) because we only pressed the "Cancel" button in the Setup dialog box that opened when creating a project. Therefore, if the project was built following the process described above, a message will be displayed in the Message Window indicating that include files cannot be opened.

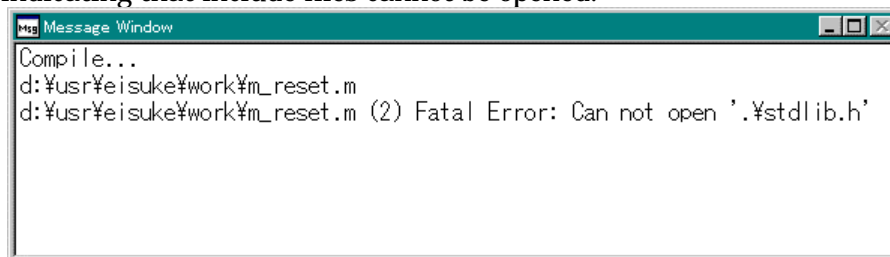


Figure 13. Message Window when an error occurred when building

In this case, click on the error message line displayed in the Message Window and then choose [Option]-[Jump] or double-click on the error message line. The corresponding source line will be displayed in the Editor Window, with the cursor moved to that line.

In the example here, the Build operation can be successfully executed by setting the include file and library file search paths properly.

For details on how to use the Setup dialog box, refer to Section 3.3, "Using Setup Dialog Box" on page 26.

3.1.5. Execution Example of Custom Command Program

The following shows an execution example of the “m_reset” command program that was created in the example above. To execute a command program, press the Go button on the **CB77SIM** Window tool bar.

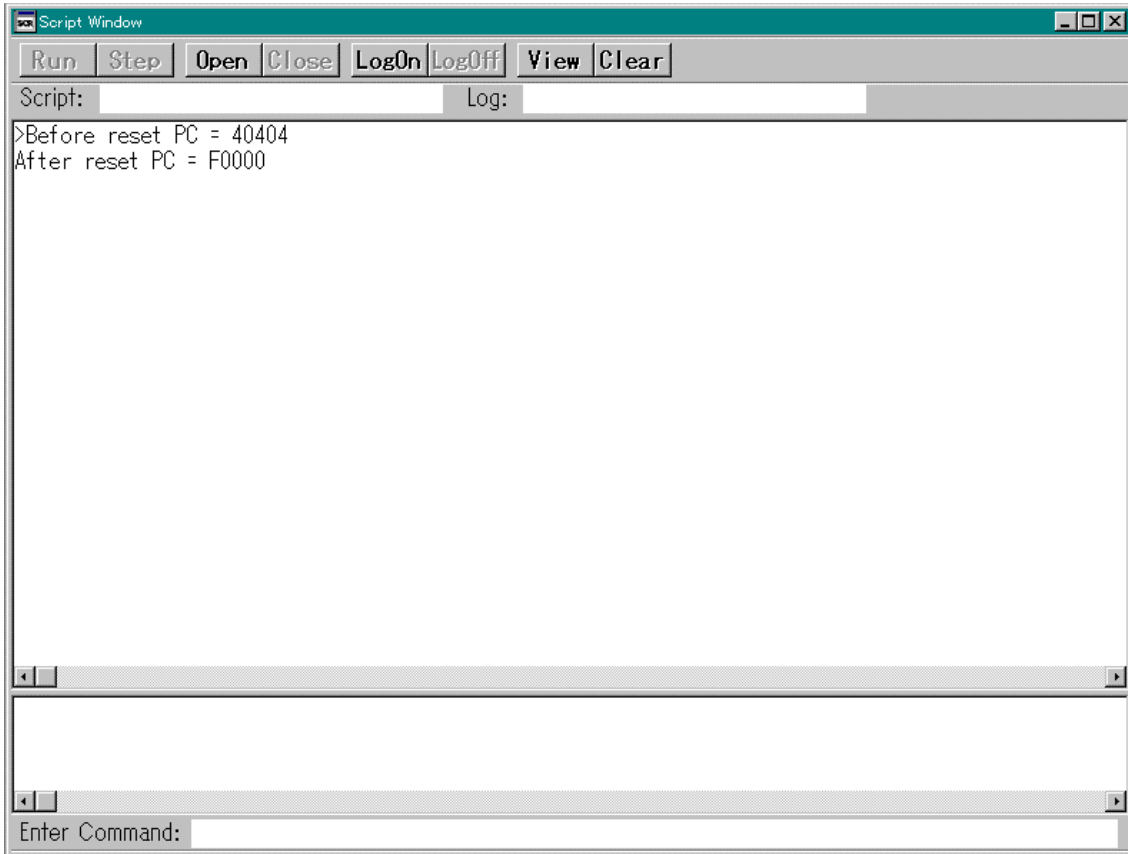


Figure 14. Execution example of custom command program "m_reset.p"

In this example, you will see that the PC address before a reset is 40404H and the PC address after a reset is F0000H.

Output from custom command programs are fed into the Script Window. Therefore, if the Script Window is not open, there is no means of verifying output from custom command programs.

3.2. Creating a Custom Window Program

The following shows the procedure for creating a custom window program by using **CB77SIM**.

1. Create a new project for a custom window program.
2. Edit the framework source file generated by **CB77SIM**.
3. Build the project.
4. Debug and correct the source file as necessary.
5. Repeat steps 3 and 4 until the program operates properly.

The table below shows specifications of the custom window program to be created in this section.

Program name	dump1000
Function	Dump 128 bytes beginning with address 1000H.

3.2.1. Creating New Project for Custom Window Program

Choose [File]-[New]-[Project...] from the CB77SIM Window menu. The dialog box shown below will appear.

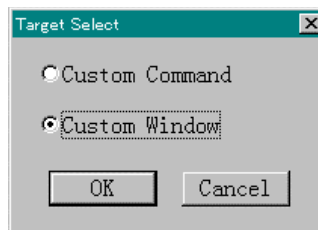


Figure 15. Target Select dialog box

Choose "Custom Window" and press the "OK" button.

A file selection dialog box will open, so input a project name and press the "Save" button. (A file name extension can be omitted.) The diagram below shows an example where "dump1000" is input for the name of the sample custom window program to be created in this section.

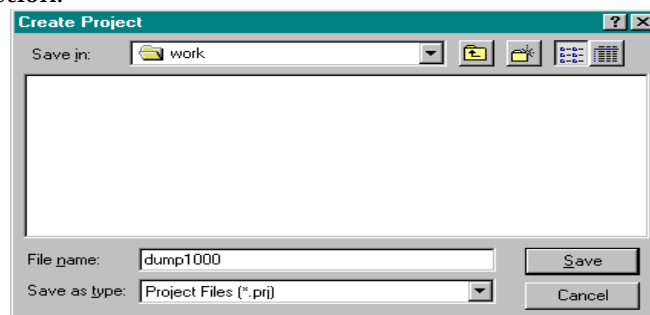


Figure 16. Dialog box for selecting a project name to be created

When the dialog box prompting for your confirmation of whether or not to create framework shown below appears, enter "Yes".

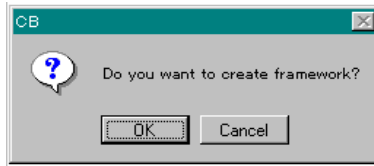


Figure 17. Dialog box for confirmation of framework generation

If you enter "No" here, CB77SIM does not automatically create framework.

A Project Window showing the created project file name and a project setup dialog box are opened.

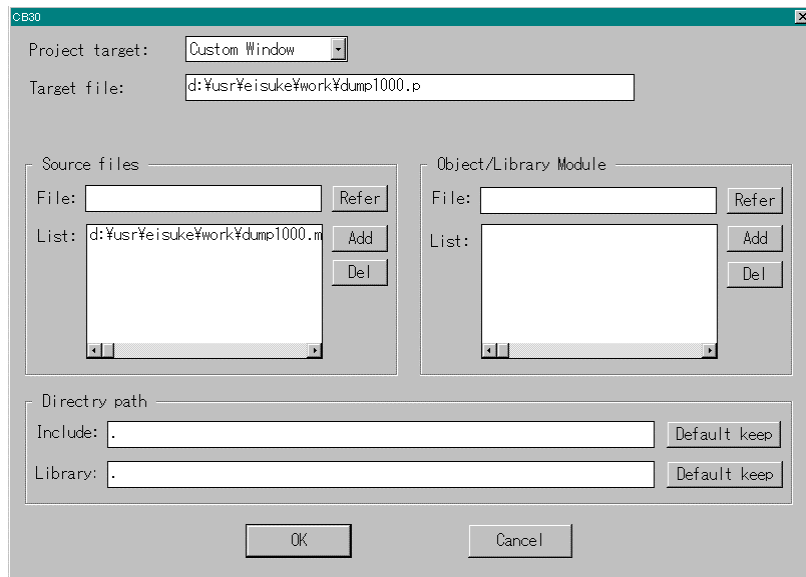


Figure 18. Setup dialog box

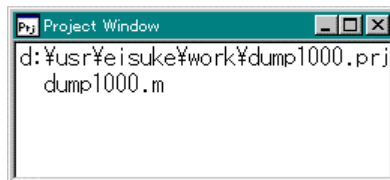


Figure 19. Project Window

The Setup dialog box can be opened from the Option menu of the Project Window to change its settings at any time you want. In this example, we only press the "Cancel" button on the Setup dialog box and leave it intact. For details on how to use the Setup dialog box, refer to Section 3.3, "Using Setup Dialog Box" on page 26.

When creating a project for a custom window program, a framework source file is automatically generated by CB77SIM. In this example, the file "dump1000.m" is automatically generated. Programming of a custom window program is accomplished by editing this framework source file.

Thus, with the above, a project file "dump1000.prj" and a framework source file "dump1000.m" are created.

3.2.2.Editing Automatically Created Framework Source File

The framework source file automatically created by CB77SIM contains a description of the handle functions that correspond to window events.

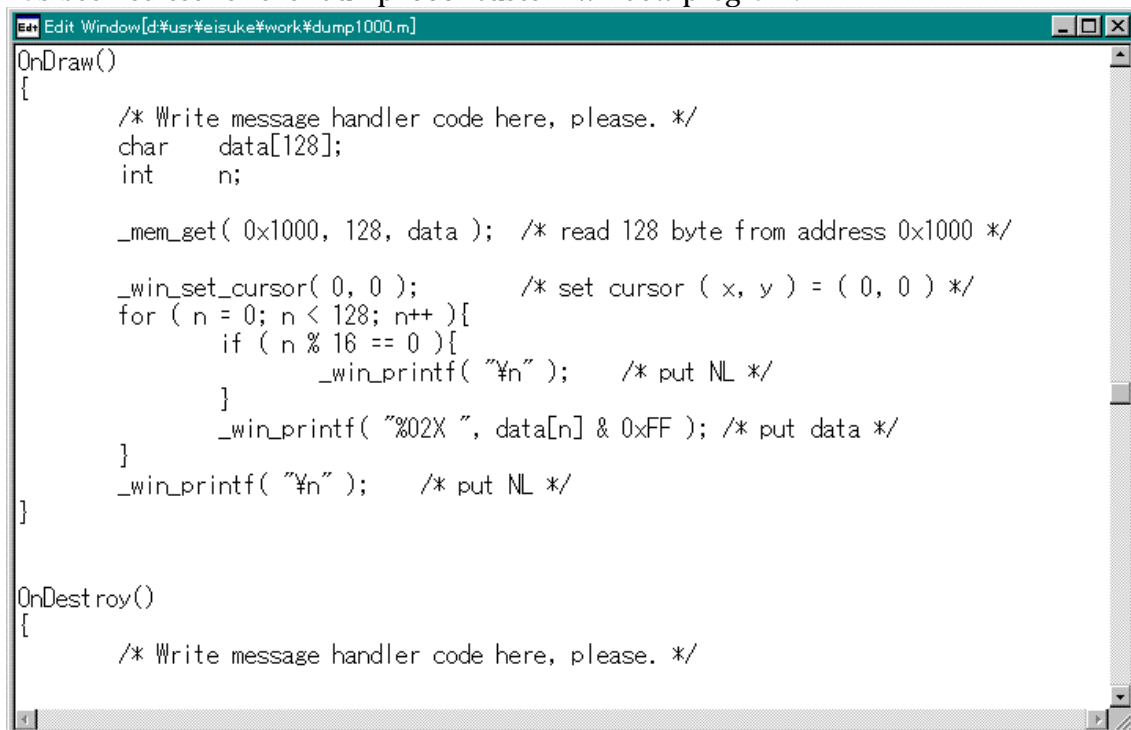
For details about handle functions, refer to Section 5.4, "Handle Functions for Custom Window" on page 91.

Two handle functions are treated in the example here: OnDraw and OnEvent. The OnDraw function is called when an area hidden in some other window need to be displayed. The OnEvent function is called when a change in debugger status is required such as when the target's memory value has been modified.

When the OnDraw function is called, dump1000 gets 128 bytes of memory values starting from address 1000H and convert them into character strings for display in window. To write this series of processing, edit the internal statements of the OnDraw function. Furthermore, when the OnEvent function is called, dump1000 calls the OnDraw function to update the window display.

Note: Do not delete the functions written in the framework source file. Loss of any function in this file makes it impossible to build a project correctly. There is no limit to the functions that can be added to the file.

The diagram below shows an Editor Window displaying the OnDraw function that has been edited for the "dump1000" custom window program.

The image shows a screenshot of a Windows-style editor window titled "Edit Window[d:\usr#eisuke#work#dump1000.m]". The window contains C code for the OnDraw function. The code is as follows:

```
OnDraw()
{
    /* Write message handler code here, please. */
    char    data[128];
    int     n;

    _mem_get( 0x1000, 128, data ); /* read 128 byte from address 0x1000 */

    _win_set_cursor( 0, 0 );      /* set cursor ( x, y ) = ( 0, 0 ) */
    for ( n = 0; n < 128; n++ ){
        if ( n % 16 == 0 ){
            _win_printf( "\n" ); /* put NL */
        }
        _win_printf( "%02X ", data[n] & 0xFF ); /* put data */
    }
    _win_printf( "\n" ); /* put NL */
}

OnDestroy()
{
    /* Write message handler code here, please. */
}
```

Figure 20. Editor Window displaying OnDraw function for dump1000

The method for building a project for a custom window program is the same as used for custom command programs. Refer to Section 3.1.4, "Building a Project" on page 19.

3.2.3. Execution Example of Custom Window Program

The following shows an execution example of the dump1000 window program that was created in the example above. To execute a window program, press the Go button on the **CB77SIM** Window tool bar.

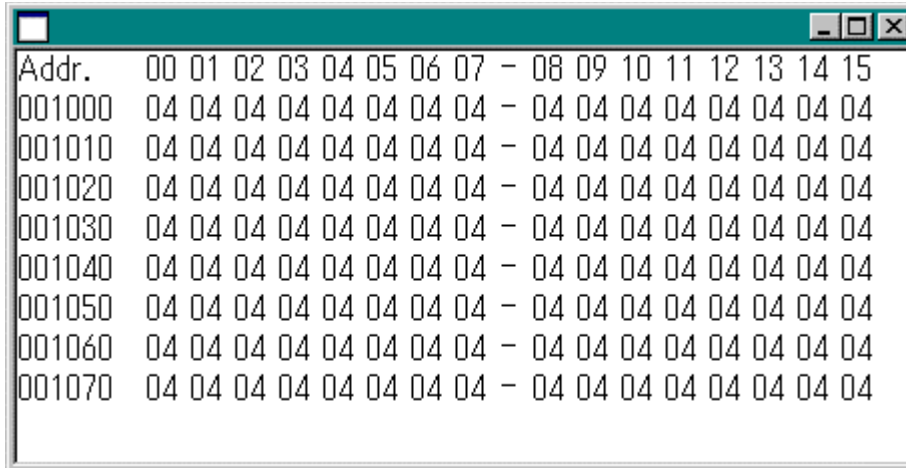


Figure 21. Execution example of custom window program "dump1000.p"

In this example, you will see that 128 bytes beginning with address 1000H are displayed in dump form.

When an area hidden in some other window need to be displayed, a custom window program calls the OnDraw function; when the debugger status need to be updated such as when the target memory contents have been changed, it calls the OnEvent function. Therefore, the dump1000 custom window program has its display automatically updated when a hidden part is displayed or target memory contents are changed.

3.3.Using Setup Dialog Box

The Setup dialog box is provided for setting up a project. This dialog box is opened by choosing [Option]-[Set up...] from the **CB77SIM** Window menu or double-clicking on the project file name displayed in the Project Window.

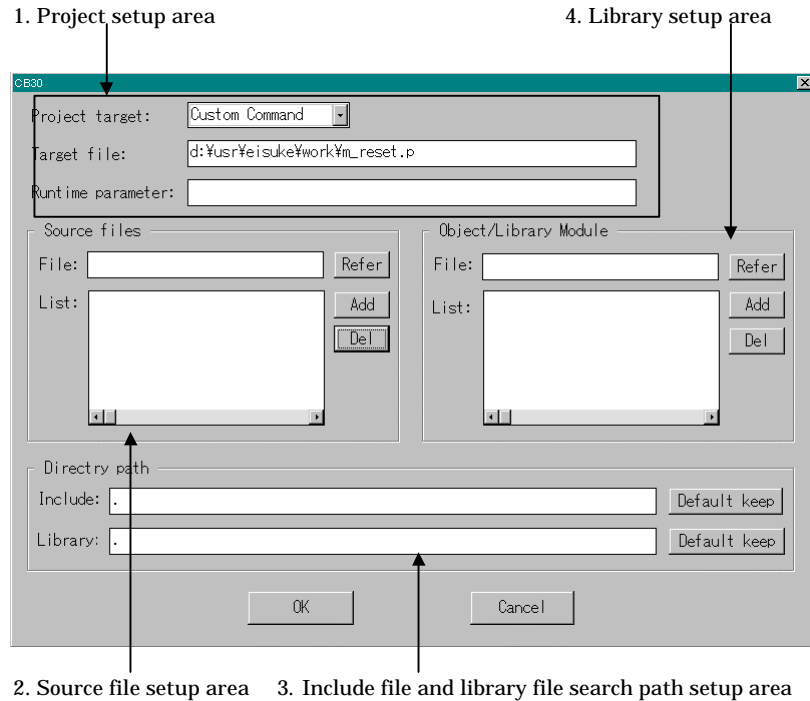


Figure 22. Structure of Setup dialog box

3.3.1.Project Setup Area

This area is comprised of the following three fields:

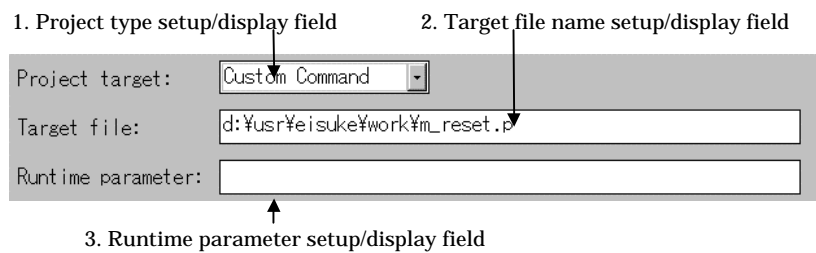


Figure 23. Structure of project setup field

3.3.1.1. Project Type Setup/Display Field

One of the following two project types can be set here.

Custom Command	Create custom command program.
Custom Window	Create custom window program

The project type you have set is displayed in this field

The startup routines and libraries that will be combined during building are selected depending on the project type you choose for the program to be created. A change of the project type only affects the selection of the startup routines and libraries that will be combined during building.

3.3.1.2. Target File Name Setup/Display Field

Set the program file name here that you want to be created when building.

The file name you have set is displayed in this field.

3.3.1.3. Runtime Parameter Setup/Display Field

This field appears when you specified "Custom Command" for the project type. Set the parameters in this field that you want to be passed when debugging a custom command program. The parameters set here are passed to the arguments argc and argv of the main() function in the following manner:

argc	Number of parameters
argv	Pointer array address that contains pointers to areas where character strings specified in parameters are stored

The parameters you have set are displayed in this field.

3.3.2. Source File Setup Area

This area is comprised of the following five fields:

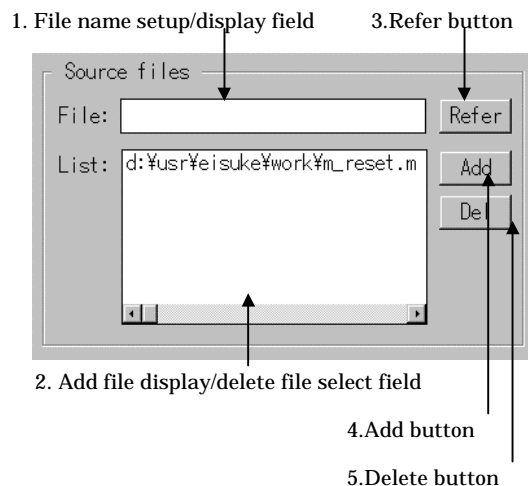


Figure 24: Structure of source file setup area

3.3.2.1. File Name Setup/Display Field

Set a source file name in this field that you want to be added to a project.

The source file set here is added to a project as you press the "Add" button and the source file name is displayed in the add file display/delete file select field.

The source file names added to a project are listed as you press the "Add" button.

3.3.2.2. Add File Display/Delete File Select Field

The source file names added to a project are listed in this field.

An unnecessary source file can be deleted from a project by selecting its file name in this field by clicking on it with the mouse and pressing the "Delete" button.

3.3.2.3. Refer Button

The source file names added to a project are listed in this field.

An unnecessary source file can be deleted from a project by selecting its file name in this field by clicking on it with the mouse and pressing the "Delete" button.

3.3.2.4. Add Button

This button adds the source file that is entered in the file name setup/display field to a project.

When you add a source file, **CB77SIM** checks to see if the file exists. If the specified source file does not exist or has already been added to a project, no file is added.

3.3.2.5. Delete Button

This button deletes the source file from a project that you have selected by clicking on it with the mouse in the add file display/delete file select field.

No file is deleted unless there is any source file selected.

3.3.3. Include File and Library File Search Path Setup Area

This area is comprised of the following four fields:

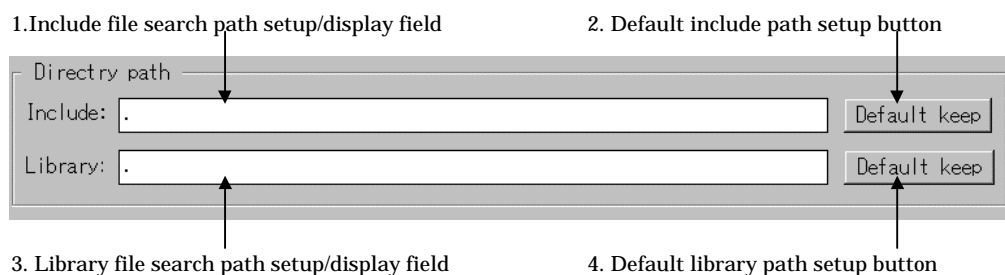


Figure 25. Structure of include file and library file search path setup area

3.3.3.1. Include File Search Path Setup/Display Field

Set the directory in this field that you want to be searched for a file when inclusion of a file is specified by **#include <filename>** in the source file.

Normally, specify a directory where system include files are stored.

The system include files are installed in the `include` directory that is located below the directory where CB77SIM is installed.

The include file search path you have set is displayed in this field.

3.3.3.2. Default Include Path Setup Button

This button sets the directory that is set in the include file search path setup/display field as the default path to be used for CB77SIM when creating a new project.

When you create a new project with CB77SIM after setting the default path with this button, the directory you have set is used as the include file search path.

3.3.3.3. Library File Search Path Setup/Display Field

Set the directory in this field that you want to be searched for a library file to be linked when building a project.

Normally, specify a directory where system library files are stored.

The system library files are installed in the `lib` directory that is located below the directory where **CB77SIM** is installed.

The library file search path you have set is displayed in this field.

3.3.3.4. Default Library Path Setup Button

This button sets the directory that is set in the library file search path setup/display field as the default path to be used for **CB77SIM** when creating a new project.

When you create a new project with **CB77SIM** after setting the default path with this button, the directory you have set is used as the library file search path.

3.3.4. Library Setup Area

This area is comprised of the following five fields:

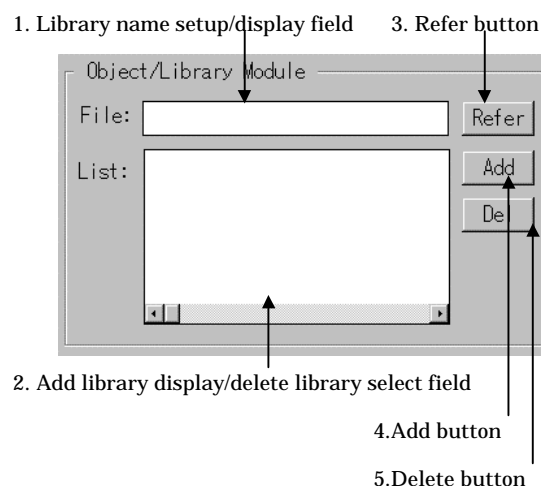


Figure 26. Structure of library setup area

3.3.4.1. Library Name Setup/Display Field

In this field, set a library file name that is added to a project and is not a system library that you want to be linked when building the project.

The library file set here is added to a project as you press the "Add" button and the library file name is displayed in the add library display/delete library select field.

The library file names added to a project are listed as you press the "Add" button.

3.3.4.2. Add Library Display/Delete Library Select Field

The library file names added to a project are listed in this field.

An unnecessary library file can be deleted from a project by selecting its file name in this field by clicking on it with the mouse and pressing the "Delete" button.

3.3.4.3. Refer Button

This button allows you to add a library file to a project without having to input the file name from the keyboard.

When you press the "Refer" button, a file selection dialog box opens. The library file name you choose in this dialog box is input to the library name setup/display field. So proceed and press the "Add" button to add it to a project.

3.3.4.4. Add Button

This button adds the library file that is entered in the library name setup/display field to a project.

When you add a library file, CB77SIM checks to see if the file exists. If the specified library file does not exist or has already been added to a project (including system libraries), no file is added.

3.3.4.5. Delete Button

This button deletes the library file from a project that you have selected by clicking on it with the mouse in the add library display/delete library select field.

No file is deleted unless there is any library file selected.

3.4.Using Breakpoint Dialog Box

The breakpoint dialog box allows you to make various breakpoint settings. Choose the **CB77SIM** menus [Debug] -> [Break Point...] or press the break dialog open button on the tool bar.

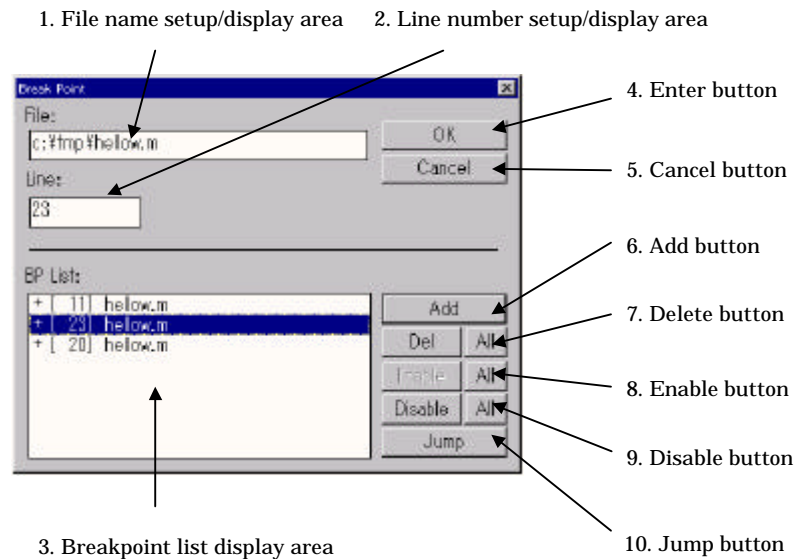


Figure 27. Structure of breakpoint dialog box

3.4.1.File name setup/display area

Specify the file name in which you want to set breakpoints by a full path.

3.4.2.Line number setup/display area

Specify the line number in the file where you want to set a breakpoint.

3.4.3.Breakpoint list area

This area lists the breakpoints that are currently set. When you choose a breakpoint listed in this area, the file name of the selected breakpoint is set in the file name setup/display area, and its line number is set in the line number setup/display area. The +/- symbols in the list area indicate whether the breakpoints are enabled or disabled, which are followed by the display of line numbers and then file names.

3.4.4.Enter button

When you press this button, the breakpoint information you've changed from the breakpoint dialog box is registered in the system before closing the dialog box.

3.4.5.Cancel button

When you press this button, the breakpoint information you've changed from the breakpoint dialog box is canceled and the dialog box is closed without saving anything.

3.4.6.Add button

Use this button to register the breakpoint shown in the file name setup/display and the line number setup/display areas in the breakpoint list area.

3.4.7.Delete button

This button deletes the breakpoint you've selected in the breakpoint list area. Use the ALL button when you want to delete all breakpoints collectively.

3.4.8.Enable button

This button enables the breakpoint you've selected in the breakpoint list area. Use the ALL button when you want to enable all breakpoints collectively.

3.4.9.Disable button

This button disables the breakpoint you've selected in the breakpoint list area. Use the ALL button when you want to disable all breakpoints collectively.

3.4.10.Jump button

This button moves the editor window cursor to the position indicated by the breakpoint you've selected in the breakpoint list area.

4. Programming Language Specifications

The programming language in which programs can be written in CB77SIM is a subset of the C language, and is subject to the following restrictions as compared to the general C language.

- Types struct, union, and enum are nonexistent.
- Variables that involve initialization cannot be declared.

Example:

```
int a = 10;
```

- The static storage class is nonexistent.
- The storage class specifier that can be used is `extern` only.
- The types that can be used are char, int, pointer, and array only.

Example:

```
char a; /* 1Byte */
int b; /* 4Byte */
char *str; /* 4Byte */
int *p; /* 4Byte */
```

- Types char and int are signed types (signed and unsigned specifiers cannot be used).
- Parameter lists cannot be written in the prototype declaration of functions.

Example:

```
int foo(int); /* Error */
int foo2(char *str); /* Error */
```

- Arguments of function definitions are written in the manner similar to ANSI standards.

Example:

```
int func( int a, int b )
{
    ...
}
```

Although parameter types are not checked when calling a function, the type of the function's return value is checked.

- Variables cannot be declared in a intra-function local block.

Example:

```
int func()
{
    ...
    {
        int x; /* Error */
    }
}
```

- The preprocessor cannot expand macros accompanied by parameters. Nor can it define expressions.

Example:

```
#define FUNC(A) A++ /* Error */
#define EXP label + 1 /* Error */
```

- The preprocessor pseudo-instruction `#if` allows only 0 or 1 to be specified in the operand.

5. Reference

5.1. Standard Functions (stdlib.lib)

The stdlib.lib provides the standard functions that can be used in custom command and custom window programs.

The prototype declaration of each function is written in "stdlib.h".

Function name	Description
malloc	Allocate memory from heap area.
free	Release the area allocated by malloc.
strlen	Get the length of character string.
strcat	Concatenate character strings.
strcmp	Compare character strings.
strcpy	Copy character string.
strtoi	Convert character string into value.
gets	Input character string (from Script Window).
exit	Terminate program execution.
fopen	Open a file.
fclose	Close a file.
fseek	Move file pointer.
fgetc	Input character (from file).
fputc	Output character (to file).
fgets	Input character string (from file).
fputs	Output character string (to file).
printf	Output characters with format (to Script Window).
sprintf	Output characters with format (to memory).
fprintf	Output characters with format (to file).

5.1.1. malloc: Allocate memory from heap area

Function name: char *malloc(int size)

Parameter: int size Number of allocated bytes

Returned value: char * Allocated area
NULL Error

Description: This function allocates an area of "size" bytes from the heap area and returns the beginning address of the area. It returns NULL if there is no area that can be allocated.

5.1.2. free: Release the area allocated by malloc() function

Function name: int free(char *p)

Parameter: char *p Area to be released

Returned value: 0 Succeeded
1 Error

Description: This function releases the area allocated by the malloc() function.

5.1.3.strlen: Get the length of character string

Function name: int strlen(char *s)
Parameter: char *s Character string
Returned value: int Character string length of character string
Description: This function returns the length of "s".

5.1.4.strcat: Concatenate character strings

Function name: char *strcat(char *s1, char *s2)
Parameter: char *s1 Character string to which s2 is added
char *s2 Character string to be added
Returned value: char * Character string to which s2 is added
Description: This function concatenates character string s2 to the end of s1 and returns s1.

5.1.5.strcmp: Compare character strings

Function name: int strcmp(char *s1, char *s2)
Parameter: char *s1 Character string 1
char *s2 Character string 2
Returned value: Positive number s1 > s2
0 s1 == s2
Negative number s1 < s2
Description: This function compares character string "s1" and character string s2. It returns a positive number if s1 > s2 or 0 if s1 == s2 or a negative number if s1 < s2.

5.1.6.strcpy: Copy character string

Function name: char *strcpy(char *s1, char *s2)
Parameter: char *s1 Destination
char *s2 Source
Returned value: char * Destination
Description: This function copies character string s2 to s1 including '\0' and returns s1.

5.1.7.strtoi: Convert character string into value

Function name: int strtol(char *str, int radix, int *value)

Parameter: char *str Character string
int radix Conversion radix
int *value Converted value

Returned value: TRUE Succeeded
FALSE Error

Description: This function converts the character string specified by “str” into a numeric value as a value whose radix is specified by “radix”. If the conversion succeeded, the converted value is stored in *value. The values listed below can be specified for “radix”.

Value of radix	Description
0	If str begins with 0x, it is converted as a hexadecimal value; if str begins with 0, it is converted as an octal value. Otherwise, str is converted as a decimal value.
8	str is converted as an octal value.
10	str is converted as an decimal value.
16	str is converted as an hexadecimal value.

5.1.8.gets: Input character string (from Script Window)

Function name: char *gets(char *s)

Parameter: char *s Destination in which stored

Returned value: char * Destination in which stored
NULL Error

Description: This function reads one line from the input area of the Script Window and stores it in “s”. The new-line character at the end of the line is replaced with ‘\0.’ The return value is stored in “s”. NULL is returned if an error has occurred.

5.1.9.exit: Terminate program execution

Function name: int exit(int stat)

Parameter: int stat Program's return value

Returned value: 0 Always 0

Description: This function terminates program execution and returns control to PD77SIM. If “stat” is 0, the operation is assumed to have been processed normally. If “stat” is not 0, an error is assumed and the error message bearing the number that is set in “macro_err” is displayed in the Script Window.

5.1.10.fopen: Open a file

Function name: int fopen(char *filename, char *attr)
Parameter: char *filename File name
char *attr Open mode
Returned value: int File descriptor
NULL Error
Description: This function opens the file specified by "filename" in the mode specified by "attr". If succeeded, the return value is file descriptor.

5.1.11.fclose: Close a file

Function name: int fclose(int fd)
Parameter: int fd File descriptor
Returned value: TRUE Succeeded
FALSE Error
Description: This function closes the file specified by "fd".

5.1.12.fseek: Move file pointer

Function name: int fseek(int fd, int pos, int org)
Parameter: int fd File descriptor
int pos Distance the file pointer is moved
int org Base point of pos
Returned value: TRUE Succeeded
FALSE Error
Description: This function moves the current position in the file specified by "fd" at which the file is written or read. The distance of movement "pos" is specified as an offset from the base point "org" (0: Beginning of file; 1: Current position; 2: End of file).

5.1.13.fgetc: Input character (from file)

Function name: int fgetc(int fd)
Parameter: int fd File descriptor
Returned value: int read value
FALSE Error
Description: This function reads one byte from the file pointer's current position of the file specified by "fd".

5.1.14.fputc: Output character (to file)

Function name: int fputc(char c, int fd)
Parameter: char c Output character
int fd File descriptor
Returned value: TURE Succeeded
FALSE Error
Description: This function outputs one byte specified by "c" to the file pointer's current position of the file specified by "fd".

5.1.15.fgets: Input character string (from file)

Function name: int fgets (char *str, int n, int fd)
Parameter: char *str Area in which to store input character string
int n Maximum number of characters input
int fd File descriptor
Returned value: char * Area in which to store input character string
NULL Error
Description: This function reads one line from the file pointer's current position of the file specified by "fd" and stores it in the area specified by "str".

5.1.16.fputs: Output character string (to file)

Function name: int fputs (char *str, int fd)
Parameter: char *str Area in which to store output character string
int fd File descriptor
Returned value: TURE Succeeded
FALSE Error
Description: This function outputs the character string stored in the area specified by "str" to the file pointer's current position of the file specified by "fd".

5.1.17.printf: Output characters with format (to Script Window)

Function name: int printf(char *format, ...)
Parameter: char *format Format
... Variable parameter
Returned value: Positive number Number of characters output
Negative number Error
Description: This function outputs characters to the Script Window after converting them under control of "format". The return value indicates the number of characters written to the window. A negative number is returned if an error has occurred.

5.1.18.sprintf: Output characters with format (to memory)

Function name: int sprintf(char *s, char *format, ...)
Parameter: char *s Output address
char *format Format
... Variable parameter
Returned value: Positive number Number of characters output
Negative number Error
Description: This function outputs characters to the address specified by "s" after converting them under control of "format". '¥0' is added at the end of output. The return value indicates the number of characters written to memory (not including '¥0'). A negative number is returned if an error has occurred.

5.1.19.fprintf: Output characters with format (to file)

Function name: int fprintf(int fd, char *format, ...)

Parameter: int fd File descriptor
char *format Format
... Variable parameter

Returned value: Positive number Number of characters output
Negative number Error

Description: This function outputs characters to the file specified by “fd” after converting them under control of “format”. The return value indicates the number of characters written to the file. A negative number is returned if an error has occurred.

5.2. System Call Functions for Debugger Operation (system.lib)

The “system.lib” provides the system call functions that can be used in custom command and custom window programs.

The prototype declaration of each function is written in “system.h”.

Function name	Description
_cpu_go	Execute program in free-run mode
_cpu_gb	Execute program with break
_cpu_stop	Stop program execution
_cpu_reset	Reset the target MCU
_cpu_src_step	Execute program one source line at a time
_cpu_step	Execute program one instruction at a time
_cpu_src_over	Execute program one source line at a time including subroutines
_cpu_over	Execute program one instruction at a time including subroutines
_cpu_src_return	Return from current to calling routine one source line at a time
_cpu_return	Return from current to calling routine one instruction at a time
_cpu_wait	Wait until program execution stops
_reg_get_reg	Get register value
_reg_put_reg	Set register value
_reg_get_pc	Get program counter value
_reg_put_pc	Set program counter value
_reg_clear_cache	Clear register cache
_mem_get	Get memory value
_mem_put	Set memory value
_mem_get_endian	Get memory value with endian attached
_mem_put_endian	Set memory value with endian attached
_mem_fill	Fill memory
_mem_move	Transfer memory block
_mem_clear_cache	Clear memory cache
_break_set	Set/enable software break
_break_get	Get settings of software breaks
_break_reset	Clear software break
_break_reset_all	Clear all software breaks
_break_disable	Disable software break
_break_disable_all	Disable all software breaks
_break_enable_all	Enable all software breaks
_break_search	Get attribute of software break settings
_rram_clear	Clear RAM monitor memory
_rram_get_area	Get RAM monitor area
_rram_set_area	Set RAM monitor area
_rram_get_size	Get size of RAM monitor area
_rram_get_data	Get RAM monitor data
_info_check_run	Check execution status

Function name	Description
<code>_info_service</code>	Get information on service contents
<code>_info_cpu</code>	Get CPU information
<code>_info_get_map</code>	Get map information
<code>_info_check_map</code>	Check mapped area
<code>_info_get_suffix</code>	Get load file extension
<code>_info_set_suffix</code>	Set load file extension
<code>_scope_set_obj</code>	Set scope by object file name
<code>_scope_set_addr</code>	Set scope by address
<code>_sym_add_sym</code>	Enter symbols
<code>_sym_val2sym</code>	Get symbol for value
<code>_sym_sym2val</code>	Get value for symbol
<code>_line_addr2line</code>	Get source line for address
<code>_line_line2addr</code>	Get address for source line
<code>_src_get_name</code>	Get list of source file names
<code>_obj_get_name</code>	Get list of object file names
<code>_obj_addr2obj</code>	Get object file name by address
<code>_func_get_name</code>	Get list of function names
<code>_exp_eval</code>	Evaluate assembler expression
<code>_scri_echo_on</code>	Turn on output to script window
<code>_scri_echo_off</code>	Turn off output to script window
<code>_c_exp_eval</code>	Evaluate C-language expression
<code>_get_shared_mem</code>	Get shared variable
<code>_set_shared_mem</code>	Set shared variable
<code>_delete_shared_mem</code>	Delete shared variable
<code>_get_err_msg</code>	Get PD77SIM's error message statement
<code>_get_tick_count</code>	Get elapsed time since Windows startup
<code>_get_time</code>	Get current system date and time
<code>_disp_src_line</code>	Change the contents displayed in program window
<code>_cv_get_data</code>	Get coverage data
<code>_cv_set_data</code>	Set coverage data
<code>_cv_clear_data</code>	Clear coverage data
<code>_cv_clear_cache</code>	Clear coverage cache
<code>_syscom</code>	Execute PD77SIM's script command
<code>_doscom</code>	Execute DOS command

If an error occurs, an error number written in the "Error" item is set in global variable "macro_err". For details about Simulator errors, refer to Section 5.2.72, "List of Simulator Errors" on page 69. For custom command programs, if FALSE is returned from the main() function, an error message corresponding to the error number that is set in "macro_err" is displayed in the Script Window (for PD77SIM) or Error dialog box (for CB77SIM).

5.2.1._cpu_go: Execute program in free-run mode

Function name: int_cpu_go()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function starts executing the target program from the current PC in free-run mode.
Error: Simulator error

5.2.2._cpu_gb: Execute program with break

Function name: int_cpu_gb()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function starts executing the target program from the current PC with breaks included.
Error: Simulator error

5.2.3._cpu_stop: Stop program execution

Function name: int_cpu_stop()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function stops execution of the target program.
Error: Simulator error

5.2.4._cpu_reset: Reset the target CPU

Function name: int_cpu_reset()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function reset the target CPU.
Error: ER_IN1_RUNNING Cannot be reset because it is
executing program.
Other Simulator error

5.2.5._cpu_src_step: Execute program one source line at a time

Function name: int_cpu_src_step()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function starts executing the target program, one source
line at a time, beginning with the current PC.
Error: Simulator error

5.2.6._cpu_step: Execute program one instruction at a time

Function name: int_cpu_step()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function starts executing the target program, one
instruction at a time, beginning with the current PC.
Error: Simulator error

5.2.7._cpu_src_over: Execute program one source line at a time including subroutines

Function name: int_cpu_src_over()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function starts executing the target program, one source
line at a time including subroutines, beginning with the
current PC.
Error: Simulator error

5.2.8._cpu_over: Execute program one instruction at a time including subroutines

Function name: int_cpu_over()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function starts executing the target program, one instruction at a time including subroutines, beginning with the current PC.
Error: Simulator error

5.2.9._cpu_src_return: Return from current to calling routine one source line at a time

Function name: int_cpu_src_return()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function causes program execution to return from the current PC to the calling routine, one source line at a time.
Error: Simulator error

5.2.10._cpu_return: Return from current to calling routine one instruction at a time

Function name: int_cpu_return()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function causes program execution to return from the current PC to the calling routine, one instruction at a time.
Error: Simulator error

5.2.11._cpu_wait: Wait until program execution stops

Function name: int_cpu_wait()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function stops execution of a custom command or custom window program until the target program stops.
Error: Simulator error

5.2.12._reg_get_reg: Get register value

Function name: int _reg_get_reg(int *reg, int regno)

Parameter: int *reg Register value
int regno Register number

Returned value: TRUE Succeeded
FALSE Error

Description: This function gets the value of the register specified by “regno”. In CB77SIM, “regno” is defined as follows:

regno	Register
IN1_REG_A	A register
IN1_REG_B	B register
IN1_REG_X	X register
IN1_REG_Y	Y register
IN1_REG_S	S register
IN1_REG_DT	DT register
IN1_REG_PG	PG register
IN1_REG_PC	Program counter (PG register + PC register)
IN1_REG_PC16	PC register
IN1_REG_DPR	DPR register
IN1_REG_PS	PS register

Error: Simulator error

5.2.13._reg_put_reg: Set register value

Function name: int _reg_put_reg(int reg, int regno)

Parameter: int reg Register value

Returned value: TRUE Succeeded
FALSE Error

Description: This function sets the value of the register specified by “regno”. The definition of “regno” here is the same as for the _reg_get_reg() function.

Error: ER_IN1_DATA_OUTRANGE Data range is invalid.
Other Simulator error

5.2.14._reg_get_pc: Get program counter value

Function name: int _reg_get_pc(int *pc)

Parameter: int *pc Program counter
(PG register + PC register)

Returned value: TRUE Succeeded
FALSE Error

Description: This function gets the program counter (PG register +PC register) value.

Error: Simulator error

5.2.15. **_reg_put_pc: Set program counter value**

Function name: int _reg_put_pc(int pc)
Parameter: int pc Program counter
(PG register + PC register)
Returned value: TRUE Succeeded
FALSE Error
Description: This function sets a program counter (PG register + PC register) value.
Error: ER_IN1_ADDR_OUTRANGE Address range is invalid
Other Simulator error

5.2.16. **_reg_clear_cache: Clear register cache**

Function name: int _reg_clear_cache()
Parameter: None
Returned value: TRUE Return value is always TRUE.
Description: This function clears the register cache.

5.2.17. **_mem_get: Get memory value**

Function name: int _mem_get(int addr, int size, char *data)
Parameter: int addr Address
int size Number of bytes obtained
char *data Location where obtained data is stored
Returned value: TRUE Succeeded
FALSE Error
Description: This function stores "size" bytes of "data" from addr into "data".
Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
Other Simulator error

5.2.18. **_mem_put: Set memory value**

Function name: int _mem_put(int addr, int size, char *data)
Parameter: int addr Address
int size Number of bytes set
char *data Set data
Returned value: TRUE Succeeded
FALSE Error
Description: This function sets data "data" from "addr" into "size" bytes of memory.
Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
Other Simulator error

5.2.19. **_mem_get_endian: Get memory value with endian attached**

Function name: int _mem_get_endian(int addr, int num, int size, int *data)

Parameter: int addr Address
int num Number of data entries
int size Size of one data entry
int *data Location where obtained data is stored

Returned value: TRUE Succeeded
FALSE Error

Description: This function stores “num” entries of data in data size of “size” bytes from “addr” into data[] according to the CPU endian. Numerals 1 to 4 can be specified for “size”.

Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
ER_IN1_DATA_RANGE size is not 1 to 4.
Other Simulator error

5.2.20. **_mem_put_endian: Set memory value with endian attached**

Function name: int _mem_put_endian(int addr, int num, int size, int *data)

Parameter: int addr Address
int num Number of data entries
int size Size of one data entry
int *data Set data

Returned value: TRUE Succeeded
FALSE Error

Description: This function sets “num” entries of data in data size of “size” bytes from data[] into memory locations beginning with “addr” according to the CPU endian

Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
ER_IN1_DATA_RANGE size is not 1 to 4.
Other Simulator error

5.2.21. **_mem_fill: Fill memory**

Function name: int _mem_fill(int start, int end, int data, int size)
Parameter: int start Start address
int end End address
int data Filled data
int size Size of one data entry
Returned value: TRUE Succeeded
FALSE Error
Description: This function fills a memory area from “start” to “end” with data “data” in data size of “size” bytes.
Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
ER_IN1_DATA_RANGE “size” is not 1 to 4.
Other Simulator error

5.2.22. **_mem_move: Transfer memory block**

Function name: int _mem_move(int start, int end, int top)
Parameter: int start Start address
int end End address
int top Beginning address at destination of transfer
Returned value: TRUE Succeeded
FALSE Error
Description: This function transfers data at addresses from “start” to “end” to an area beginning with “top”.
Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
ER_IN1_RUNNING Cannot be transferred because program is executing.
Other Simulator error

5.2.23. **_mem_clear_cache: Clear memory cache**

Function name: int _mem_clear_cache()
Parameter: None
Returned value: TRUE Return value is always TRUE.
Description: This function clears the cache buffer for a module that gets cached memory.

5.2.24. **_break_set: Set/enable software break**

Function name: int _break_set(int addr)
Parameter: int addr Set address
Returned value: TRUE Succeeded
FALSE Error
Description: This function sets a software breakpoint at “addr”. This function also is used to re-enable a breakpoint that has been disabled by _break_disable() or _break_disable_all()
Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
ER_IN1_BP_FULL Breakpoints are full.
Other Simulator error

5.2.25. **_break_get: Get settings of software breaks**

Function name: int _break_get(int *addr, int *attr, int mode)
Parameter: int *addr Address
int *attr Setup attribute
int mode Search start mode
IN1_FIRST : First breakpoint
IN1_NEXT : Second and following breakpoints
Returned value: TRUE Succeeded
FALSE Error
Description: This function stores a breakpoint address in *addr. One of the breakpoint setup attributes shown below is stored in *attr.

IN1_ENABLE_SBRK	Enabled
IN1_DISABLE_SBRK	Disabled

Error: ER_IN1_BP_NOTFOUND No breakpoint can be found.
Other Simulator error

5.2.26. **_break_reset: Clear software break**

Function name: int _break_reset(int addr)
Parameter: int addr Address
Returned value: TRUE Succeeded
FALSE Error
Description: This function clears a breakpoint at “addr”.
Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
ER_IN1_BP_NOTFOUND No breakpoint can be found.
Other Simulator error

5.2.27._break_reset_all: Clear all software breaks

Function name: int _break_reset_all()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function clears all breakpoints.
Error: Other Simulator error

5.2.28._break_disable: Disable software break

Function name: int _break_disable(int addr)
Parameter: int addr Address
Returned value: TRUE Succeeded
FALSE Error
Description: This function disables a breakpoint at “addr”.
Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
ER_IN1_BP_NOTFOUND No breakpoint can be found.
Other Simulator error

5.2.29._break_disable_all: Disable all software breaks

Function name: int _break_disable_all()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function disables all breakpoints set.
Error: Other Simulator error

5.2.30._break_enable_all: Enable all software breaks

Function name: int _break_enable_all()
Parameter: None
Returned value: TRUE Succeeded
FALSE Error
Description: This function enables all breakpoints set.
Error: Other Simulator error

5.2.31. **_break_search: Get attribute of software break settings**

Function name: int _break_search(int addr, int *attr)

Parameter: int addr Address
int *attr Setup attribute

Returned value: TRUE Succeeded
FALSE Error

Description: This function gets the setup attribute of a breakpoint at "addr". One of the following breakpoint setup attributes is stored in *attr.

IN1_ENABLE_SBRK	Enabled
IN1_DISABLE_SBRK	Disabled

Error: ER_IN1_BP_NOTFOUND No breakpoint can be found.
Other Simulator error

5.2.32. **_rram_clear: Clear RAM monitor memory**

Function name: int _rram_clear()

Parameter: None

Returned value: TRUE Succeeded
FALSE Error

Description: This function initializes access states of the RAM monitor memory.

Error: ER_IN1_RUNNING Cannot be cleared because program is executing.
Other Simulator error

5.2.33. **_rram_get_area: Get RAM monitor area**

Function name: int _rram_get_area(int *addr)

Parameter: int *addr Beginning address

Returned value: TRUE Succeeded
FALSE Error

Description: This function stores the beginning address of the RAM monitor memory in *addr.

Error: Simulator error

5.2.34. **_rram_set_area: Set RAM monitor area**

Function name: int _rram_set_area(int addr)

Parameter: int addr Beginning address

Returned value: TRUE Succeeded
FALSE Error

Description: This function sets the beginning address of the RAM monitor area at "addr".

Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
Other Simulator error

5.2.35._rram_get_size: Get size of RAM monitor area

Function name: int _rram_get_size(int *size)
Parameter: int *size size of RAM monitor area
Returned value: TRUE Return value is always TRUE.
Description: This function sets the size of the RAM monitor area in *size.

5.2.36._rram_get_data: Get RAM monitor data

Function name: int _rram_get_data(int addr, int size, char *data,
char *attr)
Parameter: int addr Beginning address
int size Number of bytes
char *data Data
char *attr Access state
Returned value: TRUE Succeeded
FALSE Error
Description: This function gets “size” bytes of data (*data) beginning with “addr” and access state (*attr) from the RAM monitor. One of the access states shown below is stored in *attr.

IN1_RRAM_READ	Read
IN1_RRAM_WRITE	Write
IN1_RRAM_NONE	No access

Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
Other Simulator error

5.2.37._info_check_run: Check execution status

Function name: int _info_check_run(int *status)
Parameter: int *status Execution state
Returned value: TRUE Succeeded
FALSE Error
Description: This function stores the execution state of the target program in *status. One of the following execution status is stored in *status.

IN1_RUN_CPU	Under execution
IN1_STOP_CPU	Idle

Error: Simulator error

5.2.38._info_service: Get information on service contents

Function name: int _info_service(int flag, int *status)

Parameter: int flag Service content
 int *status Availability of support
 TRUE Supported
 FALSE Not supported

Returned value: TRUE Return value is always TRUE.

Description: This function gets information on service contents supported by PD77SIM. For “flag”, specify one of the following service contents.

IN1_SUPPORT_BITSYM	Support for bit symbol
IN1_SUPPORT_C	Support for C-language debugging
IN1_SUPPORT_RAMMONITOR	Support for real-time RAM monitor function
IN1_SUPPORT_RTT	Support for real-time trace
IN1_SUPPORT_CV	Support for coverage measurement
IN1_SUPPORT_PROTCT	Support for protected break
IN1_SUPPORT_EVENT	Support for hardware event

5.2.39._info_cpu: Get CPU information

Function name: int _info_cpu(int flag, int *status)

Parameter: int flag Content of information
 int *status CPU information
 IN1_BIG_ENDIAN Big endian
 IN1_LITTLE_ENDIAN Little endian
 Other Value corresponding to flag

Returned value: TRUE Return value is always TRUE.

Description: This function gets information on the target CPU. For “flag”, specify one of the following information.

IN1_ADDRSIZE	Number of bytes required for storing address value
IN1_MAXADDR	Maximum value of address
IN1_ADDRCOLM	Number of digits with which address values are displayed in hexadecimal
IN1_ENDIAN	Endian of the target CPU
IN1_HWORD_SIZE	Length in bytes of half-word
IN1_WORD_SIZE	Length in bytes of word
IN1_DWORD_SIZE	Length in bytes of double-word
IN1_LWORD_SIZE	Length in bytes of long-word
IN1_MAXDATA	Maximum value of data
IN1_MAXSTACK	Maximum value of stack
IN1_MAX_OBJ	Maximum length in bytes of one instruction

5.2.40._info_get_map: Get map information

Function name: int _info_get_map(int *start, int *end, int mode)
Parameter: int *start Start address
int *end End address
int mode Search start mode
IN1_FIRST : First map
IN1_NEXT : Second and following maps
Returned value: TRUE Succeeded
FALSE Error
Description: This function gets map information. The start and the end addresses of a mapped area are stored in *start and *end, respectively.
Error: IN1_MAP_END No more map

5.2.41._info_check_map: Check mapped area

Function name: int _info_check_map(int start, int end, int *status, int *erraddr)
Parameter: int start Start address
int end End address
int *status Check result
int *erraddr Error address
Returned value: TRUE Succeeded
FALSE Error
Description: This function checks to see if the address range from “start” to “end” is a mapped area. If the address range from “start” to “end” entirely is a mapped area, TRUE is stored in *status. If the address range from “start” to “end” contains any unmapped area, FALSE is stored in *status and the address of the first unmapped area found by searching from “start” is stored in erraddr.
Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.
Other Simulator error

5.2.42._info_get_suffix: Get load file extension

Function name: int _info_get_suffix(char *suffix, int mode)
Parameter: char *suffix Obtained extension
int mode Mode
Returned value: TRUE Return value is always TRUE.
Description: This function gets a file suffix that is added in a file selection dialog box when downloading the target program in the mode specified by “mode”. For “mode”, specify one of the following attributes.

IN1_LOAD	Symbol and program files
IN1_SYM	Symbol file
IN1_ROM	Program file

5.2.43._info_set_suffix: Set load file extension

Function name: int _info_set_suffix(char *suffix, int mode)

Parameter: char *suffix Extension to be set
int mode Mode

Returned value: TRUE Return value is always TRUE.

Description: This function sets a file suffix that is added in a file selection dialog box when downloading the target program in the mode specified by "mode". For "mode", specify one of the following attributes.

IN1_LOAD	Symbol and program files
IN1_SYM	Symbol file
IN1_ROM	Program file

5.2.44._scope_set_obj: Set scope by object file name

Function name: int _scope_set_obj(char *name)

Parameter: char *name Object file name

Returned value: TRUE Succeeded
FALSE Error

Description: This function sets the current scope by an object file name.

Error: ER_SCOPE_NOTFOUND No scope is found that corresponds to the specified object file name.

5.2.45._scope_set_addr: Set scope by address

Function name: int _scope_set_addr(int addr)

Parameter: int addr Address

Returned value: TRUE Succeeded
FALSE Error

Description: This function sets the current scope by an address.

Error: ER_IN1_ADDR_OUTRANGE Address range is invalid.

5.2.46._sym_add_sym: Enter symbols

Function name: int _sym_add_sym(int mode, char *name, int value)

Parameter: int mode Search mode
char *name Symbol
int value Value

Returned value: TRUE Succeeded
FALSE Error

Description: This function enters the symbol (or label) “name” as a global symbol (or label). For “mode”, specify one of the following types.

LOAD_SYMBOL	Symbol first
LOAD_LABEL	Label first

Error: ER_LOAD_ILLEGAL_CHAR Character string contains a character that cannot be used for a symbol or label.
ER_LOAD_MULTIDEFINE A global symbol (or label) of the same name already exists.

5.2.47._sym_val2sym: Get symbol for value

Function name: int _sym_val2sym(int mode, int value, char *symbol)

Parameter: int mode Search mode
int value Value
char *symbol Area in which symbol is stored

Returned value: TRUE Succeeded
FALSE Corresponding symbol could not be found.

Description: This function searches for a symbol character string that corresponds to a value “value” and stores it in “symbol”. For “mode”, specify one of the priorities of search shown below.

LOAD_SYMBOL	Symbol first
LOAD_LABEL	Label first

The table below shows the priorities of search in each mode.

	Searched symbol first		Searched label first
1	Local symbol (within scope)	1	Local label (within scope)
2	Global symbol	2	Global label
3	Local label (within scope)	3	Local symbol (within scope)
4	Global label	4	Global symbol
5	Local symbol (outside scope)	5	Local label (outside scope)
6	Local label (outside scope)	6	Local symbol (outside scope)

5.2.48. **_sym_sym2val: Get value for symbol**

Function name: int _sym_sym2val(int mode, char *symbol, int *value)
Parameter: int mode Search mode
char *symbol Symbol
int *value Value
Returned value: TRUE Succeeded
FALSE Symbol could not be found.
Description: This function searches for a value that corresponds to the symbol character string "symbol" and stores it in *value. The specified "mode" here is the same as for _sym_val2sym().
Error: ER_LOAD_SYMBOL_NOTFOUND Symbol cannot be found.

5.2.49. **_line_addr2line: Get source line for address**

Function name: int _line_addr2line(int addr, int *line, char *filename)
Parameter: int addr Address
int *line Line number
char *filename Area where file name is stored
Returned value: TRUE Succeeded
FALSE Source line information cannot be found.
Description: This function gets the line number (*line) that corresponds to the address "addr" and its file name (filename).
Error: ER_LOAD_FILE_NOTFOUND File cannot be found.
ER_LOAD_SRCINF_NOTFOUND Source information cannot be found.

5.2.50. **_line_line2addr: Get address for source line**

Function name: int _line_line2addr(char *filename, int line, int *addr)
Parameter: char *filename File name
int line Line number
int *addr Address
Returned value: TRUE Succeeded
FALSE Source line information cannot be found.
Description: This function gets the address (*addr) that corresponds to the line (line) in the file (filename).
Error: ER_LOAD_LINE_NOTFOUND Line information cannot be found.

5.2.51. **_src_get_name: Get list of source file names**

Function name: int _src_get_name(char *objname, char *srcname, int mode)

Parameter: char *objname Object file name
char *srcname Area where source file name is stored
int mode Search start mode
LOAD_FIRST : First source file name
LOAD_NEXT : Second and following source file names

Returned value: TRUE Succeeded
FALSE Source file name cannot be found.

Description: This function gets a list of source file names in the object file "objname". If NULL is specified for "objname", a list of source file names in all object files is obtained.

5.2.52. **_obj_get_name: Get list of object file names**

Function name: int _obj_get_name(char *objname, int mode)

Parameter: char *objname Area where object file name is stored
int mode Search start mode
LOAD_FIRST : First source file name
LOAD_NEXT : Second and following source file names

Returned value: TRUE Succeeded
FALSE Object file name cannot be found.

Description: This function gets a list of object file names.

5.2.53. **_obj_addr2obj: Get object file name by address**

Function name: int _obj_addr2obj(int addr, char *objname)

Parameter: int addr Address
char *objname Area where object file name is stored

Returned value: TRUE Succeeded
FALSE Corresponding object file name cannot be found.

Description: This function gets the object file name "objname" that contains the address "addr".

5.2.54. **_func_get_name: Get list of function names**

Function name: int `_func_get_name(char *objname, char *funcname, int mode)`

Parameter: char *objname Object file name
 char *funcname Area where function name is
 stored
 int mode Search start mode
 LOAD_FIRST : First function name
 LOAD_NEXT : Second and following function
 names

Returned value: TRUE Succeeded
 FALSE Function name cannot be found.

Description: This function gets a list of function names in the object file
 "objname". If NULL is specified for "objname", FALSE is
 returned.

5.2.55._exp_eval: Evaluate assembler expression

Function name: int _exp_eval(char *exp, int radix, int mode, int *value)

Parameter: char *exp Assembler expression
 int radix Radix
 int mode Priorities in which symbols (labels) are evaluated
 int *value Area where analysis result is stored

Returned value: TRUE Succeeded
 FALSE Error

Description: This function evaluates the assembler expression (exp) and stores the evaluation result in *value. For “radix”, specify one of the radices of constants shown below.

EXP_DEC	Decimal
EXP_HEX	Hexadecimal
EXP_DEFAULT	Value set by RADIX command is used

For mode, specify one of the priorities of symbol (label) evaluation shown below.

EXP_SYMBOL	Symbol first
EXP_LABEL	Label first

Error:

ER_EXP_SYNTAX	Syntax error
ER_EXP_ZERO	Divide-by-0 error
ER_EXP_LPAR	Left parenthesis missing
ER_EXP_SIZE	Incorrect size specifier
ER_EXP_STRING	Character string not terminated
ER_EXP_LINE	Incorrect line number specified
ER_EXP_VALUE	Incorrect constant value specified
ER_EXP_UNDEF_SYMBOL	Symbol not defined
ER_EXP_PREFIX	Incorrect radix of constant specified
ER_EXP_OVER	Constant value out of range
ER_EXP_UNDEF_MACRO	Macro constant not defined
ER_EXP_ILLEGAL_MACRO	Register name used for macro variable name
ER_EXP_OUTOF_MACRO	Limit number of macro constants exceeded

5.2.56._scri_echo_on: Turn on output to script window

Function name: int _scri_echo_on()

Parameter: None

Returned value: TRUE Return value is always TRUE.

Description: This function turns output to the Script Window on. By default, the Script Window is enabled for output.

5.2.57._scri_echo_off: Turn off output to script window

Function name: int _scri_echo_off()

Parameter: None

Returned value: TRUE Return value is always TRUE.

Description: This function turns output to the Script Window off.

5.2.58._c_exp_eval: Evaluate C-language expression

Function name: int _c_exp_eval(char *exp, int *value1, int *value2,
char *type, char *str, char *misc)

Parameter: char *exp C-language expression
int *value1 Analysis result 1
int *value2 Analysis result 2
char *type Character string showing type of analysis
result
char *str Character string showing analysis result
char *misc Character string showing added
information of analysis result

Returned value: TRUE Succeeded
FALSE Error

Description: This function analyzes the C-language expression specified by "exp" in the current scope. The analysis result is a 64-bit value, with the 32 low-order bits stored in *value1 and the 32 high-order bits stored in *value2. The type name of the analysis result is stored in "type" and the analysis result is stored in "str" after being converted into a character string. If the analysis result is not one that indicates an ordinary value such as a function, addition information is stored in "misc". The information stored in "type", "str", and "misc" can be output for display using the printf() function in the same way as possible with a script command "print".

Error: ER_CEXP_NOT_FOUND Symbol cannot be found.
ER_CEXP_SYNTAX_ERROR Syntax error.
ER_CEXP_NO_SCOPE Scope cannot be found.
ER_CEXP_NO_SYMBOL Symbol cannot be found.
ER_CEXP_NO_FUNC Function cannot be found.
ER_CEXP_RIGHT_WRONG Right-side expression is
inappropriate.
ER_CEXP_DEF_TYPE Copying different type of structure
(union) is inhibited.
ER_CEXP_CANT_ASSIGN Cannot be substituted.
ER_CEXP_NO_TYPE Type cannot be found.
ER_CEXP_CANT_FLOAT Floating-point operation is not
supported.
ER_CEXP_CANT_P_TO_P Specified operation cannot be
performed between pointer types.
ER_CEXP_CANT_SUB_P Specified operation cannot be
performed on pointer type.
ER_CEXP_CANT_P Subtraction by pointer variable
cannot be performed.
ER_CEXP_0_DIV Divide-by-0 is attempted.
ER_CEXP_UNKNOWN_OP Invalid operator is used.
ER_CEXP_BROKEN_TYPE Type information is broken.
ER_CEXP_LEFT_POINT Left-side value must be a pointer
variable.

ER_CEXP_LEFT_STRUCT	Left-side value must be a structure (union) type.
ER_CEXP_NO_MEMBER	Member cannot be found.
ER_CEXP_LEFT_STRUCT_REF	Left-side value must be a reference of structure (union) type.
ER_CEXP_LEFT_WRONG	Left-side value is inappropriate.
ER_CEXP_VAL_NUM	Operand must be a numeric value.
ER_CEXP_CANT_MIN	Specified operand cannot be sign-inverted.
ER_CEXP_CANT_REF	Address value cannot be obtained.
ER_CEXP_LEFT_ARRAY	Array variable is inappropriate.
ER_CEXP_RIGHT_NUM	Element numbers of the array is inappropriate.
ER_CEXP_NOT_POINT	Operand is not an address.
ER_CEXP_CANT_CAST_REG	Cast operation on variables is not supported.
ER_CEXP_CANT_CAST	Specified type to be cast is inappropriate.
ER_CEXP_CAST_NOT_SUPPORT	Cast operation on specified type is not supported.

5.2.59. **_get_shared_mem: Get shared variable**

Function name: int _get_shared_mem(char *name, char *value)

Parameter: char *name Name of shared variable
char *value Value of shared variable

Returned value: TRUE Succeeded
FALSE Shared variable cannot be found.

Description: This function searches for the shared variable specified by "name" and stores its value (character string) in "value". A shared variable means a variable that can be used in common in all custom command and custom window programs. The name and the value of a shared variable are a character string and can be used in a similar manner as the environment variables found in several operation systems. The name and the value of a shared variable can be used in up to 63 bytes.

5.2.60. **_set_shared_mem: Set shared variable**

Function name: int _set_shared_mem(char *name, char *value)

Parameter: char *name Name of shared variable
char *value Value of shared variable

Returned value: TRUE Return value is always TRUE.

Description: This function sets the shared variable specified by "name" in the value specified by "value". If a value is set for the shared variable that has already been set, the previously set value is changed to the value specified by "value". If the shared variable is not defined, a new variable area is allocated.

5.2.61._delete_shared_mem: Delete shared variable

Function name: int _delete_shared_mem(char *name)
Parameter: char *name Name of shared variable
Returned value: TRUE Return value is always TRUE.
Description: This function deletes the shared variable that is specified by “name”. If the shared variable is not defined, nothing is performed.

5.2.62._get_err_msg: Get PD77SIM's error message statement

Function name: int _get_err_msg(int err_no, char *msg)
Parameter: int err_no Error number
char *msg Error message statement
Returned value: TRUE Succeeded
FALSE Error message statement corresponding to error number cannot be found.
Description: This function gets PD77SIM's error message statement that corresponds to the error number specified by “err_no”.

5.2.63._get_tick_count: Get elapsed time since Windows startup

Function name: int _get_tick_count()
Parameter: None
Returned value: Elapsed time since Windows startup (in ms)
Description: This function gets an elapsed time in ms since Windows has started up.

5.2.64._get_time: Get current system date and time

Function name: int _get_time(int *year, int *month, int *dayOfWeek,
int *day, int *hour, int *minute,
int *second, int *milliseconds)

Parameter:	int	*year	Location where current year is stored
	int	*month	Location where current month (1-12) is stored
	int	*dayOfWeek	Location where current day of the week (e.g., Sunday = 0) is stored
	int	*day	Location where current day (1-31) is stored
	int	*hour	Location where current time in hours (1-24) is stored
	int	*minute	Location where current time in minutes (0-59) is stored
	int	*second	Location where current time in seconds (0-59) is stored
	int	*milliseconds	Location where current time in milliseconds (0-999) is stored

Returned value: TRUE Return value is always TRUE.

Description: This function gets the current date and time of the system and stores them in the locations specified by each parameter. If NULL is specified for a parameter, the information corresponding to that parameter is not stored.

5.2.65._disp_src_line: Change the contents displayed in program window

Function name: int disp_src_line(int lineno, char *filename, int addr)

Parameter:	int	lineno	Line number
	char	*filename	File name
	int	addr	Address

Returned value: TRUE Succeeded
FALSE Error

Description: This function updates the contents displayed in PD77SIM's program window. The selected line of the selected (specified by "lineno" and "filename") is displayed in the program window in the source mode. If selected line of the selected source file cannot be displayed, the file is displayed in the disassemble mode beginning with the address specified by "addr".

5.2.66._cv_get_data: Get coverage data

Function name: int _cv_get_data(int saddr, int eaddr, int *rsaddr, int *readdr, char *data)

Parameter: int saddr Start address of data to be obtained
 int eaddr End address of data to be obtained
 int *rsaddr Start address of data actually obtained
 int *readdr End address of data actually obtained
 char *data Coverage data obtained

Returned value: TRUE Succeeded
 FALSE Error

Description: This function stores the coverage data that includes an address range specified by "s_addr" and "e_addr" in the area specified by "data". However, since data for 8 bytes of addresses from each 8-byte alignment is stored in one byte of "data", it can happen that a greater range of data than addresses specified by "s_addr" and "e_addr" actually is stored. For example, if addresses from 3h to 19h are specified, data at addresses from 0h to 1Fh actually are stored. The start and end addresses of the actually obtained data are stored in *rs_addr and *re_addr, respectively. Note that the values stored in *rs_addr and *re_addr can be obtained by calculation using the formula below.

$$*rs_addr = s_addr / 8 * 8$$

$$*re_addr = e_addr / 8 * 8 + 7$$

For "data", specify an array greater than $e_addr - s_addr / 8 + 1$. The format of the coverage data stored in one byte of "data" is as follows:

(Upper row: Bit offset; Lower row: address offset)

7	6	5	4	3	2	1	0
+7	+6	+5	+4	+3	+2	+1	+0

For example, if "s_addr" is 0x400, the coverage results at the addresses offset by the amount corresponding to each bit are stored in "data[0]" as shown below.

(Upper row: Bit offset; Lower row: Address)

7	6	5	4	3	2	1	0
407	406	405	404	403	402	401	400

Consequently, if memory is accessed every other byte beginning with "s_addr", coverage data is stored as shown below.

(Upper row: Bit offset; Lower row: Coverage measurement result)

7	6	5	4	3	2	1	0
0	1	0	1	0	1	0	1

The data stored in data[0] is 01010101B, i.e., 0x55.

Error: ER_IN2_ADDR_OUTRANGE Specified address is out of range.
 ER_IN2_RUNNING Cannot be obtained

		because program is executing.
Other		Simulator error

5.2.67._cv_set_data: Set coverage data

Function name: int _cv_set_data(int s_addr, int e_addr, char *data)

Parameter:	int	s_addr	Set start address
	int	e_addr	Set end address
	char	*data	Set coverage data

Returned value: TRUE Succeeded
FALSE Error

Description: This function sets the coverage data stored in the area specified by "data" in a range of addresses specified by "s_addr" and "e_addr". However, since the coverage data stored in one byte of "data" is for 8 bytes of addresses, specify values for "s_addr" and "e_addr" in increments of 8 bytes. The format of "data" is the same as for the _cv_get_data() function described above.

Error:	ER_IN2_ADDR_OUTRANGE	Specified address is out of range.
	ER_IN2_RUNNING	Cannot be set because program is executing.
	Other	Simulator error

5.2.68._cv_clear_data: Clear coverage data

Function name: int _cv_clear_data()

Parameter: None

Returned value: TRUE Succeeded
FALSE Error

Description: This function clears coverage data.

Error:	ER_IN2_RUNNING	Cannot be cleared because program is executing.
	Other	Simulator error

5.2.69._cv_clear_cache: Clear coverage cache

Function name: int _cv_clear_cache()

Parameter: None

Returned value: TRUE Return value is always TRUE.

Description: This function clears the coverage cache.

5.2.70. **_syscom: Execute PD77SIM's script command**

Function name: int _syscom(char *command)

Parameter: char *command Character string of PD77SIM script

command

Returned value: TRUE Succeeded
FALSE Error

Description: This function executes the character string specified by "command" as a script command of PD77SIM. For a script command that dumps a range of addresses from 1000H to 1FFFH, for example, specify this function as follows:

_syscom("DumpByte 1000, 1FFF");

5.2.71. **_doscom: Execute DOS command**

Function name: int _doscom(char *command)

Parameter: char *command Character string of DOS command

Returned value: TRUE Succeeded
FALSE Error

Description: This function executes the character string specified by "command" as a DOS command. For a command that redirects the output result to a TMP file after specifying a /W option for the DIR command of DOS, specify this function as follows:

_doscom("DIR /W > TMP");

5.2.72. List of Simulator Errors

The table below lists the error numbers that are stored in global variable “macro_err” when a system call function returns FALSE.

Error number	Description
ER_IN2_MCU_RESET	Target is reset.
ER_IN2_ERROR_2	Checksum error is found in received data
ER_IN2_ERROR_3	Specified data does not exist.
ER_IN2_ERROR_4	Target program is executing.
ER_IN2_ERROR_5	Target program is idle.
ER_IN2_ERROR_6	Measurement has already been stopped.
ER_IN2_ERROR_7	Measurement is already being executed.
ER_IN2_ARG_ERROR	Argument error.
ER_IN2_ERROR_9	Measurement is not completed.
ER_IN2_ERROR_G	Number of points exceeds valid range.
ER_IN2_ERROR_H	No break is set.
ER_IN2_ERROR_I	No source line information is loaded.
ER_IN2_ERROR_M	Function range is out of setting.
ER_IN2_MCU_RUN	Target MCU execution error.

5.3. System Call Functions for Window Operation (winlib.lib)

The winlib.lib provides window-operating functions that can be used in custom window programs. The prototype declaration of each function is written in "winlib.h".

Function name	Description
_win_printf	Output text with format included
_win_puts	Output character string to custom window
_win_set_cursor	Set cursor position
_win_set_color	Set text color
_win_set_bkcolor	Set background color
_win_column2dot	Convert cursor coordinates into pixel coordinates
_draw_text_out	Output character string to custom window
_draw_set_color	Set text color
_draw_set_bkcolor	Set background color
_draw_set_bkmode	Set background mode
_draw_set_font	Set font
_draw_get_char_size	Get font size
_draw_line	Draw line
_draw_fill_rect	Fill rectangle
_draw_frame_rect	Draw rectangle
_draw_invert_rect	Reverse rectangle color
_draw_arc	Draw arc of ellipse
_draw_pie	Draw sector
_win_redraw	Redraw custom window
_win_redraw_clear	Redraw custom window
_win_redraw_item	Redraw control item
_win_show_window	Show/hide control item
_win_set_window_title	Set title of custom window
_win_enable_window	Enable/disable control item
_win_button_create	Create button
_win_button_set_text	Change button text
_win_hscroll_range	Set scroll range of horizontal scroll bar
_win_hscroll_pos	Set position of horizontal scroll box
_win_vscroll_range	Set scroll range of vertical scroll bar
_win_vscroll_pos	Set position of vertical scroll box
_win_statusbar_create	Create status bar
_win_statusbar_set_pane	Set items of status bar
_win_statusbar_set_text	Set text of status bar
_win_dialog	Create input dialog box
_win_message_box	Create message box
_win_filedialog	Create file selection dialog box
_win_set_window_pos	Set position of custom window
_win_set_window_size	Set size of custom window
_win_timer_set	Set system timer
_win_timer_kill	Reset system timer

5.3.1. **_win_printf: Output text with format included**

Function name: `int _win_printf(char *format , ...);`

Parameter: `char *forma` Format

`...` Variable parameter

Returned value: `int` Number of characters output

Description: This function outputs characters to the cursor position of the custom window after converting them under control of “format” using the text color specified by the `_win_set_color()` function and the background color specified by the `_win_set_bkcolor()` function. The cursor is set at a position immediately following the last character that is output. The cursor position can be set at any desired place using the `_win_set_cursor()` function. Note that only the character font `FIXED_SYS` can be used.

5.3.2. **_win_puts: Output character string to custom window**

Function name: `int _win_puts(char *str)`

Parameter: `char *str` Output character string

Returned value: `TRUE` Return value is always `TRUE`.

Description: This function outputs a character string specified by `str` to the cursor position of the customer window using the text color specified by the `_win_set_color()` function and the background color specified by the `_win_set_bkcolor()` function. The cursor is set at a position immediately following the last character that is output. The cursor position can be set at any desired place using the `_win_set_cursor()` function. Note that only the character font `FIXED_SYS` can be used.

5.3.3. **_win_set_cursor: Set cursor position**

Function name: `int _win_set_cursor(int x, int y)`

Parameter: `int x` Specified x column of cursor

`int y` Specified y column of cursor

Returned value: `TRUE` Return value is always `TRUE`.

Description: This function moves the cursor to a position specified by “x” and “y”. The cursor position is defined with the origin (0, 0) at the upper left corner of the client area of the custom window, the “x” columns increasing from there to the right and the “y” columns increasing from there to the bottom. One character is output in one column.

5.3.4. `_win_set_color`: Set text color

`int _win_set_color(int color)`

Parameter: `int color` Text color

Returned value: `int` Previous text color

Description: This function sets a color specified by “color” for text. The text color specified by this function is used when a character string is output using the `_win_printf()` and the `_win_puts()` functions. For “color”, specify one of the color constants listed below.

Color constant	Color
<code>COLOR_BLACK</code>	Black
<code>COLOR_BLUE</code>	Blue
<code>COLOR_GREEN</code>	Green
<code>COLOR_CYAN</code>	Sky blue
<code>COLOR_RED</code>	Red
<code>COLOR_MAGENDA</code>	Purple
<code>COLOR_YELLOW</code>	Yellow
<code>COLOR_WHITE</code>	White
<code>COLOR_GRAY</code>	Gray
<code>COLOR_DKBLUE</code>	Dark blue
<code>COLOR_DKGREEN</code>	Dark green
<code>COLOR_DKCYAN</code>	Dark sky blue
<code>COLOR_DKRED</code>	Dark red
<code>COLOR_DKMAGENDA</code>	Dark purple
<code>COLOR_DKYELLOW</code>	Dark yellow
<code>COLOR_LTGRAY</code>	Light gray

5.3.5._win_set_bkcolor: Set background color

Function name: int _win_set_bkcolor(int color)
Parameter: int color Background color of text
Returned value: int Previous background color
Description: This function sets a color specified by “color” for the current background. The text color specified by this function is used when a character string is output using the _win_printf() and the _win_puts() functions. For “color”, specify one of the color constants listed below.

Color constant	Color
COLOR_BLACK	Black
COLOR_BLUE	Blue
COLOR_GREEN	Green
COLOR_CYAN	Sky blue
COLOR_RED	Red
COLOR_MAGENDA	Purple
COLOR_YELLOW	Yellow
COLOR_WHITE	White
COLOR_GRAY	Gray
COLOR_DKBLUE	Dark blue
COLOR_DKGREEN	Dark green
COLOR_DKCYAN	Dark sky blue
COLOR_DKRED	Dark red
COLOR_DKMAGENDA	Dark purple
COLOR_DKYELLOW	Dark yellow
COLOR_LTGRAY	Light gray

5.3.6._win_column2dot: Convert cursor coordinates into pixel coordinates

Function name: int _win_column2dot(int xcol, int ycol,
int *xpix, int *ypix)
Parameter: int xcol X column
int ycol Y column
int *xpix X pixel coordinate of X column position
int *ypix Y pixel coordinate of Y column position
Returned value: TRUE Return value is always TRUE.
Description: This function converts the cursor coordinates specified by “xcol” and “ycol” into pixel coordinates and stores them in *xpix and *ypix.

5.3.7._draw_text_out: Output character string to custom window

Function name: int _draw_text_out(int x, int y, char *str)

Parameter: int x Logical x coordinate of start point of text
int y Logical y coordinate of start point of text
char *str Pointer to character string to be drawn

Returned value: TRUE Return value is always TRUE.

Description: Using the currently selected font, this function writes a character string to a specified position using the text color specified by the _draw_set_color() function and the background color specified by the _draw_set_bkcolor() function.

5.3.8._draw_set_color: Set text color

Function name: int _draw_set_color(int color)

Parameter: int color Text color

Returned value: int Previous text color

Description: This function sets a color specified by "color" for text. The text color specified by this function is used when a character string is output using the _draw_text_out() function. For "color", specify one of the color constants listed below.

Color constant	Color
COLOR_BLACK	Black
COLOR_BLUE	Blue
COLOR_GREEN	Green
COLOR_CYAN	Sky blue
COLOR_RED	Red
COLOR_MAGENDA	Purple
COLOR_YELLOW	Yellow
COLOR_WHITE	White
COLOR_GRAY	Gray
COLOR_DKBLUE	Dark blue
COLOR_DKGREEN	Dark green
COLOR_DKCYAN	Dark sky blue
COLOR_DKRED	Dark red
COLOR_DKMAGENDA	Dark purple
COLOR_DKYELLOW	Dark yellow
COLOR_LTGRAY	Light gray

5.3.9._draw_set_bkcolor: Set background color

Function name: int _draw_set_bkcolor(int color)

Parameter: int color Background color of text

Returned value: int Previous background color

Description: This function sets a color specified by “color” for the current background. The background color specified by this function is used when a character string is output using the _draw_text_out() function. For “color”, specify one of the color constants listed below.

Color constant	Color
COLOR_BLACK	Black
COLOR_BLUE	Blue
COLOR_GREEN	Green
COLOR_CYAN	Sky blue
COLOR_RED	Red
COLOR_MAGENDA	Purple
COLOR_YELLOW	Yellow
COLOR_WHITE	White
COLOR_GRAY	Gray
COLOR_DKBLUE	Dark blue
COLOR_DKGREEN	Dark green
COLOR_DKCYAN	Dark sky blue
COLOR_DKRED	Dark red
COLOR_DKMAGENDA	Dark purple
COLOR_DKYELLOW	Dark yellow
COLOR_LTGRAY	Light gray

If the background mode is a "Fill" mode, the system fills space between style-specified lines, space between brushed hatch lines, and the background of character cells with the background color.

5.3.10._draw_set_bkmode: Set background mode

Function name: int _draw_set_bkmode(int flag)

Parameter: int flag Set mode

Returned value: TRUE Return value is always TRUE.

Description: This function sets a background mode. Specify whether you want the area to be filled with the background color before drawing text. If TRUE is specified for “flag”, the background is filled with the current background color (default). If FALSE is specified for “flag”, the background is not changed before drawing text.

5.3.11. **_draw_set_font: Set font**

Function name: `int _draw_set_font(int size, int font)`

Parameter: `int size` Font size
`int font` Font constant

Returned value: `TRUE` Return value is always `TRUE`.

Description: This function specifies the size and the style of the current drawing font. For “font”, specify some of the following font constants combined with a |.

Font constant	Font style
<code>FONT_FIXED_SYS</code>	"FixedSys"
<code>FONT_MINTYO</code>	" MS mincho"
<code>FONT_GOTHIC</code>	" MS Gothic"
<code>FONT_TIMESNEWROMAN</code>	"Times New Roman"
<code>FONT_CENTURY</code>	"Century"
<code>FONT_ARIAL</code>	"Arial"
<code>FONT_BOLD</code>	Bold
<code>FONT_ITALIC</code>	Italic

5.3.12. **_draw_get_char_size: Get font size**

Function name: `int _draw_get_char_size(int *pWidth, int *pHeight)`

Parameter: `int *pWidth` Location where character width is stored

`int *pHeight` Location where character height is stored

Returned value: `TRUE` Return value is always `TRUE`.

Description: This function gets the size of the font character currently being set.

5.3.13._draw_line: Draw line

Function name: int _draw_line(int x1, int y1, int x2, int y2, int color)

Parameter: int x1 Starting x coordinate of line
int y1 Starting y coordinate of line
int x2 Ending x coordinate of line
int y2 End y coordinate of line
int color Color of line

Returned value: TRUE Return value is always TRUE.

Description: This function draws a line with a specified color between specified coordinate points. For “color” specify one of the color constants shown below.

Color constant	Color
COLOR_BLACK	Black
COLOR_BLUE	Blue
COLOR_GREEN	Green
COLOR_CYAN	Sky blue
COLOR_RED	Red
COLOR_MAGENDA	Purple
COLOR_YELLOW	Yellow
COLOR_WHITE	White
COLOR_GRAY	Gray
COLOR_DKBLUE	Dark blue
COLOR_DKGREEN	Dark green
COLOR_DKCYAN	Dark sky blue
COLOR_DKRED	Dark red
COLOR_DKMAGENDA	Dark purple
COLOR_DKYELLOW	Dark yellow
COLOR_LTGRAY	Light gray

5.3.14. **draw_fill_rect: Fill rectangle**

Function name: `int _draw_fill_rect(int x1, int y1, int x2, int y2, int color)`

Parameter:

<code>int</code>	<code>x1</code>	Upper left x coordinate of rectangle
<code>int</code>	<code>y1</code>	Upper left y coordinate of rectangle
<code>int</code>	<code>x2</code>	Lower right x coordinate of rectangle
<code>int</code>	<code>y2</code>	Lower right y coordinate of rectangle
<code>int</code>	<code>color</code>	Color with which to fill

Returned value: `TRUE` Return value is always `TRUE`.

Description: This function draws a rectangle filled with a specified color with its upper left and lower right corners at specified coordinates. For “color” specify one of the color constants shown below.

Color constant	Color
<code>COLOR_BLACK</code>	Black
<code>COLOR_BLUE</code>	Blue
<code>COLOR_GREEN</code>	Green
<code>COLOR_CYAN</code>	Sky blue
<code>COLOR_RED</code>	Red
<code>COLOR_MAGENDA</code>	Purple
<code>COLOR_YELLOW</code>	Yellow
<code>COLOR_WHITE</code>	White
<code>COLOR_GRAY</code>	Gray
<code>COLOR_DKBLUE</code>	Dark blue
<code>COLOR_DKGREEN</code>	Dark green
<code>COLOR_DKCYAN</code>	Dark sky blue
<code>COLOR_DKRED</code>	Dark red
<code>COLOR_DKMAGENDA</code>	Dark purple
<code>COLOR_DKYELLOW</code>	Dark yellow
<code>COLOR_LTGRAY</code>	Light gray

5.3.15._draw_frame_rect: Draw rectangle

Function name: int _draw_frame_rect(int x1, int y1, int x2, int y2, int color)

Parameter: int x1 Upper left x coordinate of rectangle
int y1 Upper left y coordinate of rectangle
int x2 Lower right x coordinate of rectangle
int y2 Lower right y coordinate of rectangle
int color Color of rectangle

Returned value: TRUE Return value is always TRUE.

Description: This function draws lines to form a rectangle filled with a specified color with its upper left and lower right corners at specified coordinates. For “color” specify one of the color constants shown below.

Color constant	Color
COLOR_BLACK	Black
COLOR_BLUE	Blue
COLOR_GREEN	Green
COLOR_CYAN	Sky blue
COLOR_RED	Red
COLOR_MAGENDA	Purple
COLOR_YELLOW	Yellow
COLOR_WHITE	White
COLOR_GRAY	Gray
COLOR_DKBLUE	Dark blue
COLOR_DKGREEN	Dark green
COLOR_DKCYAN	Dark sky blue
COLOR_DKRED	Dark red
COLOR_DKMAGENDA	Dark purple
COLOR_DKYELLOW	Dark yellow
COLOR_LTGRAY	Light gray

5.3.16._draw_invert_rect: Reverse rectangle color

Function name: int _draw_invert_rect(int x1, int y1, int x2, int y2)

Parameter: int x1 Upper left x coordinate of rectangle
int y1 Upper left y coordinate of rectangle
int x2 Lower right x coordinate of rectangle
int y2 Lower right y coordinate of rectangle

Returned value: TRUE Return value is always TRUE.

Description: This function reverses the color of the rectangle with its upper left and lower right corners at specified coordinates.

5.3.17._draw_arc: Draw arc of ellipse

Function name: `int _draw_arc(int x1, int y1, int x2, int y2, int x3, int y3, int x4, int y4, int color)`

Parameter:

<code>int x1</code>	Upper left x coordinate of boundary rectangle (logical unit)
<code>int y1</code>	Upper left y coordinate of boundary rectangle (logical unit)
<code>int x2</code>	Lower right x coordinate of boundary rectangle (logical unit)
<code>int y2</code>	Lower right y coordinate of boundary rectangle (logical unit)
<code>int x3</code>	x coordinate of starting point to draw arc (logical unit)
<code>int y3</code>	y coordinate of starting point to draw arc (logical unit)
<code>int x4</code>	x coordinate of ending point to draw arc (logical unit)
<code>int y4</code>	y coordinate of ending point to draw arc (logical unit)
<code>int color</code>	Color of arc

Returned value: `TRUE` Succeeded
`FALSE` Error

Description: This function draws an arc of a ellipse. Specify the coordinates of a boundary rectangle (x1, y1) and (x2, y2) and the starting point (x3, y3) and ending point (x4, y4) of an arc. The starting and ending points of an arc do not need to be on a line of arc. A line that links a specified starting point and the center of a boundary rectangle is calculated and the starting point of an arc is calculated from it. The ending point is calculated in the same way. For "color" specify one of the color constants shown below.

Color constant	Color
<code>COLOR_BLACK</code>	Black
<code>COLOR_BLUE</code>	Blue
<code>COLOR_GREEN</code>	Green
<code>COLOR_CYAN</code>	Sky blue
<code>COLOR_RED</code>	Red
<code>COLOR_MAGENDA</code>	Purple
<code>COLOR_YELLOW</code>	Yellow
<code>COLOR_WHITE</code>	White
<code>COLOR_GRAY</code>	Gray
<code>COLOR_DKBLUE</code>	Dark blue
<code>COLOR_DKGREEN</code>	Dark green
<code>COLOR_DKCYAN</code>	Dark sky blue
<code>COLOR_DKRED</code>	Dark red
<code>COLOR_DKMAGENDA</code>	Dark purple
<code>COLOR_DKYELLOW</code>	Dark yellow
<code>COLOR_LTGRAY</code>	Light gray

5.3.18._draw_pie: Draw sector

Function name: `int _draw_pie(int x1, int y1, int x2, int y2, int x3, int y3, int x4, int y4, int framecolor, int paintcolor)`

Parameter:

<code>int x1</code>	Upper left x coordinate of boundary rectangle (logical unit)
<code>int y1</code>	Upper left y coordinate of boundary rectangle (logical unit)
<code>int x2</code>	Lower right x coordinate of boundary rectangle (logical unit)
<code>int y2</code>	Lower right y coordinate of boundary rectangle (logical unit)
<code>int x3</code>	x coordinate of starting point to draw sector (logical unit)
<code>int y3</code>	y coordinate of starting point to draw sector (logical unit)
<code>int x4</code>	x coordinate of ending point to draw sector (logical unit)
<code>int y4</code>	y coordinate of ending point to draw sector (logical unit)
<code>int framecolor</code>	Color of framing line of sector
<code>int paintcolor</code>	Color with which to fill sector

Returned value: TRUE Succeeded
FALSE Error

Description: This function draws a sector. Define the circumferential circle of a sector by the boundary rectangle of an ellipse (x1, y1) and (x2, y2). For “framecolor” and “paintcolor”, specify the following color constants.

Color constant	Color
COLOR_BLACK	Black
COLOR_BLUE	Blue
COLOR_GREEN	Green
COLOR_CYAN	Sky blue
COLOR_RED	Red
COLOR_MAGENDA	Purple
COLOR_YELLOW	Yellow
COLOR_WHITE	White
COLOR_GRAY	Gray
COLOR_DKBLUE	Dark blue
COLOR_DKGREEN	Dark green
COLOR_DKCYAN	Dark sky blue
COLOR_DKRED	Dark red
COLOR_DKMAGENDA	Dark purple
COLOR_DKYELLOW	Dark yellow
COLOR_LTGRAY	Light gray

5.3.19._win_redraw: Redraw custom window

Function name: int _win_redraw()
Parameter: None
Returned value: TRUE Return value is always TRUE.
Description: This function redraws a custom window without erasing its display.

5.3.20._win_redraw_clear: Redraw custom window

Function name: int _win_redraw_clear()
Parameter: None
Returned value: TRUE Return value is always TRUE.
Description: This function redraws a custom window after erasing its display.

5.3.21._win_redraw_item: Redraw control item

Function name: int _win_redraw_item(int handle)
Parameter: int handle Handle of control item
Returned value: TRUE Return value is always TRUE.
Description: This function redraws a control item specified by handle (e.g., button).

5.3.22._win_show_window: Show/hide control item

Function name: int _win_show_window(int handle, int flag)
Parameter: int handle Handle of control item
int flag TRUE: Displayed FALSE: Not displayed
Returned value: TRUE Return value is always TRUE.
Description: This function specifies whether or not to display a control item specified by "handle" (e.g., button). The specified control item is displayed when TRUE is specified for "flag" and is not displayed when FALSE is specified.

5.3.23._win_set_window_title: Set title of custom window

Function name: int _win_set_window_title(char *title)
Parameter: char *title Window title
Returned value: TRUE Return value is always TRUE.
Description: This function sets a character string specified by "title" in the title of a custom window.

5.3.24._win_enable_window: Enable/disable control item

Function name: int _win_enable_window(int handle, int flag)
Parameter: int handle Handle of control item
int flag TRUE: Enabled FALSE: Disabled
Returned value: TRUE Return value is always TRUE.
Description: This function specifies a state of the control item specified by "handle" (e.g., button). The specified control item is enabled when TRUE is specified for "flag" and is disabled when FALSE is specified. When disabled, the control item is displayed in gray.

5.3.25. **_win_button_create: Create button**

Function name: `int _win_button_create(int x1,int y1,int x2,int y2, char *str,int id)`

Parameter: `int` `x1` Upper left x coordinate of button
 `int` `y1` Upper left y coordinate of button
 `int` `x2` Lower right x coordinate of button
 `int` `y2` Lower right y coordinate of button
 `char` `*str` Button control text
 `int` `id` Button control ID

Returned value: `int` Handle of button

Description: This function creates a button in an area specified by “x1”, “y1”, “x2”, and “y2” that displays the text specified by “str” on its surface. The control ID specified by “id” is sent to message handler as the argument `nID` of the `OnCommand()` handle function when the button is clicked.

5.3.26. **_win_button_set_text: Change button text**

Function name: `int _win_button_set_text(int handle. char *text)`

Parameter: `int` `handle` Handle of button
 `char` `*text` Button control text

Returned value: `TRUE` Succeeded
 `FALSE` Error

Description: This function changes the text displayed on the button specified by “handle” to one that is specified by “text”.

5.3.27. **_win_hscroll_range: Set scroll range of horizontal scroll bar**

Function name: `int _win_hscroll_range(int min, int max)`

Parameter: `int` `min` Minimum scroll position of horizontal scroll bar
 `int` `max` Maximum scroll position of horizontal scroll bar

Returned value: `TRUE` Return value is always `TRUE`.

Description: This function specifies the minimum and maximum scroll positions of the horizontal scroll bar of a custom window. If 0 is specified for both “min” and “max”, the horizontal scroll bar is not displayed. By default, the horizontal scroll bar is hidden, with both parameters set to 0. The recommended scroll range is 0 to 100.

5.3.28. **_win_hscroll_pos: Set position of horizontal scroll box**

Function name: `int _win_hscroll_pos(int pos)`

Parameter: `int` `pos` New position of horizontal scroll box

Returned value: `TRUE` Return value is always `TRUE`.

Description: This function sets the current position of the horizontal scroll box of a custom window and redraws the scroll bar to make it fit the new position of the horizontal scroll box. The new position must be within the scroll range.

5.3.29._win_vscroll_range: Set scroll range of vertical scroll bar

Function name: `int _win_vscroll_range(int min, int max)`

Parameter: `int` `min` Minimum scroll position of vertical scroll bar
 `int` `max` Maximum scroll position of vertical scroll bar

Returned value: `TRUE` Return value is always `TRUE`.

Description: This function specifies the minimum and maximum scroll positions of the vertical scroll bar of a custom window. If 0 is specified for both “min” and “max”, the vertical scroll bar is not displayed. By default, the vertical scroll bar is hidden, with both parameters set to 0. The recommended scroll range is 0 to 100.

5.3.30._win_vscroll_pos: Set position of vertical scroll box

Function name: `int _win_vscroll_pos(int pos)`

Parameter: `int` `pos` New position of vertical scroll box

Returned value: `TRUE` Return value is always `TRUE`.

Description: This function sets the current position of the vertical scroll box of a custom window and redraws the scroll bar to make it fit the new position of the vertical scroll box. The new position must be within the scroll range.

5.3.31._win_statusbar_create: Create status bar

Function name: `int _win_statusbar_create(int cnt)`

Parameter: `int` `cnt` Number of items on status bar

Returned value: `TRUE` Return value is always `TRUE`.

Description: This function creates a status bar at bottom of a custom window. For “cnt”, set the number of items on this status bar.

5.3.32. **_win_statusbar_set_pane: Set items of status bar**

Function name: int _win_statusbar_set_pane(int index, int style, int size)

Parameter: int index Index number of status bar item
int style Style of item
int size Size of item (in pixels)

Returned value: TRUE Return value is always TRUE.

Description: This function sets the style specified by “style” and the size specified by “size” for the item on the created status bar that is specified by “index”. For “style”, specify one of the styles shown below.

Style	Description
SBPS_NOBORDERS	Does not have 3D boundary line round pane.
SBPS_POPOUT	Has boundary line displayed in inverse video with text raised to the surface.
SBPS_DISABLED	Does not draw text.
SBPS_NORMAL	Neither stretched nor inverted. Does not have boundary line either.
SBPS_STRETCH	Stretches pane to fill unused space. Only one pane of this style is allowed for the status bar. This style can be combined with some other style using a .

5.3.33. **_win_statusbar_set_text: Set text of status bar**

Function name: int _win_statusbar_set_text(int index, char *text)

Parameter: int index Index number of status bar item
char *text Text displayed on status bar

Returned value: TRUE Return value is always TRUE.

Description: This function sets text to be displayed in a status bar item.

5.3.34. **_win_dialog: Create input dialog box**

Function name: int _win_dialog(char *str, char *buf)

Parameter: char *str Character string for message to be displayed
char *buf Location where obtained character string is stored

Returned value: TRUE OK button is pressed

FALSE Cancel button is pressed

Description: This function opens an input dialog box and gets one line of character string.

5.3.35. `_win_message_box`: Create message box

Function name: `int _win_message_box(char *str, char *title, int style)`
 Parameter: `char *str` Message to be displayed
 `char *title` Title of message box
 `int style` Operation and content of message box
 Returned value: `int` Execution result of functions shown below

Value	Meaning
0	No sufficient memory
IDABORT	[Stop] button selected
IDCANCEL	[Cancel] button selected
IDIGNORE	[Ignore] button selected
IDNO	[No] button selected
IDOK	[OK] button selected
IDRETRY	[Retry] button selected
IDYES	[Yes] button selected

Description: This function creates a message box. For “style”, specify the following styles combined with a |.

Style	Description
MB_ABORTRETRYIGNORE	Message box contains three pushbuttons: [Stop], [Retry], and [Ignore].
MB_APPLMODAL	Operation of PD77SIM/CB77SIM is stopped until message box is responded (default).
MB_DEFBUTTON1	First button is the default. The first button is always the default unless MB_DEFBUTTON2 or MB_DEFBUTTON3 is specified.
MB_DEFBUTTON2	Second button is the default.
MB_DEFBUTTON3	Third button is the default.
MB_ICONEXCLAMATION	Exclamation mark icon is displayed in the message box.
MB_ICONHAND	Same as MB_ICONSTOP.
MB_ICONINFORMATION	Icon with lowercase "i" in a circle is displayed in the message box.
MB_ICONQUESTION	Question mark (?) icon is displayed in the message box.
MB_ICONSTOP	[STOP] icon is displayed in the message box.
MB_OK	Message box contains an [OK] pushbutton.
MB_OKCANCEL	Message box contains [OK] and [Cancel] pushbuttons.
MB_RETRYCANCEL	Message box contains [Retry] and [Cancel] pushbuttons.
MB_SYSTEMMODAL	All applications are suspended until the user responds to the message box. Use this message box to inform serious and potentially dangerous errors (e.g., memory shortage) that require immediate corrective action.

Style(continued from preceding page)	Description
MB_YESNO	Message box contains two pushbuttons: [Yes] and [No].
MB_YESNOCANCEL	Message box contains three pushbuttons: [Yes], [No], and [Cancel].

5.3.36. **_win_filedialog: Create file selection dialog box**

Function name `int _win_filedialog(char *title, int openFileDialog, char *defExt, char *defFileName, int flags, char *filter, char *fileName)`

Parameter:

<code>char *title</code>	Title of dialog box
<code>int openFileDialog</code>	Specification to open or save
<code>char *defExt</code>	Default file name extension
<code>char *defFileName</code>	Default file name
<code>int flags</code>	Flag to customize dialog box
<code>char *filter</code>	Specify a filter
<code>char *fileName</code>	Destination where acquired file name is store

Returned value: TRUE OK button was pressed.
FALSE Cancel button was pressed.

Description: This function creates a file selection dialog box and gets a selected file name. For "title", specify the title of the dialog box. For "openFileDialog", specify TRUE when building a dialog box to "Open a file" and FALSE when building a dialog box to "Save file after giving it a name." For "defExt", specify a file name extension you want to be automatically added when a file name is input in the file name edit box without adding an extension. No extension is added if you specify NULL here. For "defFileName", specify the file name that is displayed first in the file name entering edit box. No file name is displayed if you specify NULL here. For "flags", specify the styles shown below by combining them with |.

Flag	Description
OFN_ALLOWMULTISELECT	This flag specifies that multiple choices can be selected in the "File name" list box. (When you create a dialog box using a private template, the LBS_EXTENDEDSEL value must be specified in the definition of the "File name" list box.)

Flag	Description
OFN_CREATEPROMPT	This flag specifies that if a specified file cannot be found, the user be asked to confirm whether a new file need be created by the dialog box function. (This flag sets the OFN_PATHMUSTEXIST and OFN_FILEMUSTEXIST flags automatically.)
OFN_FILEMUSTEXIST	This flag specifies that the user can only input an existing file name in the "File name" entry field. If an invalid file name is input in the "File name" entry field by the user when this flag is set, the dialog box function displays a warning in the message box. When this flag is set, the OFN_PATHMUSTEXIST is set also.
OFN_HIDEREADONLY	This flag turns off (hides) the [Read-only] check box.
OFN_NOCHANGEDIR	This flag directs the dialog box to reset the current directory to one that was selected when calling the dialog box.
OFN_NONETWORKBUTTON	This flag turns off the [Network] button to disable it from being used.
OFN_NOREADONLYRETURN	This flag specifies that the [Read-only] check box of the returned file be not checked, and that the file be not placed in a write-protected directory.
OFN_NOTESTFILECREATE	This flag specifies that a file be not created before closing the dialog box. This flag must be set if the application saves a file in the network-shared point that is "Created but not corrected." If the application sets this flag, the library does no longer check whether the file is write-protected, disk capacity is available, the drive door is open, and whether the network is protected. Once the file is closed while in this state, it cannot be reopened. Therefore, applications that use this flag must handle files with caution.
OFN_OVERWRITEPROMPT	If a selected file already exists, this flag causes the dialog box for "Saving file after giving it a name" to generate a message box. The user must confirm whether the file can be overwritten.

Flag	Description
OFN_PATHMUSTEXIST	This flag specifies that the user can only input a valid path. If an invalid path is input in the "File name" entry field by the user when this flag is set, the dialog box function displays a warning in the message box.
OFN_READONLY	When creating a dialog box, this flag ensures that the [Read-only] check box by default is checked. It also indicates the status of the [Read-only] check box when the dialog box is closed.

For "filter", specify a pair of character strings to specify the filters that identify a file by using the format shown below. In the example below, filters (*.m;*.h) and (*.*) are specified.

```
"Files(*.m;*.h) | *.m;*.h | All Files(*.*) | *.* | |"
```

Once filters are specified, the file list box displays only the selected ones, with others gone. The selected file name is stored in "FileName". If multiple files are selected in cases when selection of multiple files is allowed, the space character is stored as the delimiter.

5.3.37. **_win_set_window_pos: Set position of custom window**

Function name: `int _win_set_window_pos(int x, int y)`

Parameter: `int x` New left-side position of custom window
`int y` New upper-side position of custom window

Returned value: `TRUE` Succeeded
`FALSE` Error

Description: This function changes the position of a custom window.

5.3.38. **_win_set_window_size: Set size of custom window**

Function name: `int _win_set_window_size(int cx, int cy)`

Parameter: `int cx` New width of custom window
`int cy` New height of custom window

Returned value: `TRUE` Succeeded
`FALSE` Error

Description: This function changes the size of a custom window.

5.3.39._win_timer_set: Set system timer

Function name: int _win_timer_set(int nId, int nElapse)

Parameter: int nId Timer identifier other than 0
int nElapse Time-out value (in ms)

Returned value: TRUE Succeeded
FALSE Error

Description: This function sets a system timer that has the timer identifier specified by "nId". A time-out value is specified, so that each time the timer times out, the system stores the timer identifier value in parameter nIDEvent and calls the OnTimer() handler function. To reset the timer, use the _win_timer_kill() function.

5.3.40._win_timer_kill: Reset system timer

Function name: int _win_timer_kill(int nId)

Parameter: int nId Timer identifier other than 0

Returned value: TRUE Succeeded
FALSE Error

Description: This function resets the system timer specified by "nId".

5.4.Handle Functions for Custom Window

Handle functions are written in a framework that is automatically generated by CB77SIM when creating a new project in the custom window creation mode. These functions are called when a custom window receives a message from Windows. The table below lists the handle functions.

Handle function name	Description
OnChar	When a key that can be converted into ASCII character code is pressed, this function is called following the OnKeyDown() handle function.
OnCommand	Called when command message is received.
OnCreate	Called when window creation is requested.
OnDestroy	Called when window destruction is requested.
OnDraw	Called when window redrawing is requested.
OnEvent	Called when PD77SIM event is received.
OnHScroll	Called when horizontal scroll bar is clicked.
OnKeyDown	Called when a key other than system keys is pressed.
OnKeyUp	Called when a key other than system keys is released.
OnLButtonDbkClk	Called when left mouse button is double-clicked.
OnLButtonDown	Called when left mouse button is pressed.
OnLButtonUp	Called when left mouse button is released.
OnMouseMove	Called when mouse cursor is moved.
OnRButtonDbkClk	Called when right mouse button is double-clicked.
OnRButtonDown	Called when right mouse button is pressed.
OnRButtonUp	Called when right mouse button is released.
OnSize	Called when window size is changed.
OnTimer	Called when time-out interval is informed due to elapsed time of timer.
OnVScroll	Called when vertical scroll bar is clicked.

5.4.1. Specifications of Data Passed to Handle Functions

A handle function is called when the custom window receives a message from Windows. When calling a handle function, the custom window stores the information attached to the message in an area indicated by global variable “_HandleMsgBlock” to make it referencible from the handle function.

The following shows an example of how information is passed to a handle function via global variable “_HandleMsgBlock”.

```
extern char  _HandleMsgBlock[32];

OnSize()
{
    int      nType; /* Message data */
    int      cx;;   /* Message data */
    int      cy;    /* Message data */

    /* Restore message data */
    nType = ((int*)_HandleMsgBlock)[0];
    cx = ((int*)_HandleMsgBlock)[1];
    cy = ((int*)_HandleMsgBlock)[2];

    /* Write message handler code hear, please. */
}
```

At the beginning of a handle function, the information stored in “_HandleMsgBlock” is stored in a local variable of the handle function. Once this processing is made, the information passed to the handle function can be referenced as a variable. The information passed to handle functions varies with each handle function. The contents of these processing are written in framework by default.

5.4.2. OnChar Handle Function

Function name: OnChar

Description: When a key that can be converted into ASCII character code is pressed, this function is called following the OnKeyDown() handle function.

Data: The information stored in _HandleMsgBlock is shown below:

ASCII character code	4 bytes
Repeat count	4 bytes
Flag(unused)	4 bytes

Variables: The variables set by “_HandleMsgBlock” are shown below.

```
int      nChar      ASCII character code value
int      nRepCnt    Repeat count value indicating a
                    number of times a key stroke is
                    generated while the key is held
                    down.
int      nFlags     Not used in this version.
```

5.4.3. OnCommand Handle Function

Function name: OnCommand
Description: This function is called when a command message is received from Windows.
Data: The information stored in _HandleMsgBlock is shown below:

Command ID	4 bytes
Advice message	4 bytes
Handle	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.
int nId Command ID of control item
int nMsg Advice message of control item
int nHandle Handle of control item

Supplement: This handle function is called mainly when an event occurs in the control items set for the custom window. The ID number to identify the control item is set in "nId"; the advice message to identify the encountered event is set in "nMsg"; and the handle of the control item is set in "nHandle". The values set in these variables differ with each control item. For details, refer to specifications of the system call functions that are used to manipulate the control items.

5.4.4. OnCreate Handle Function

Function name: OnCreate
Description: This function is called when a request to create a window is received. This function performs such operations as to generate control items, etc. and to initialize variables.
Data: None
Variables: None

5.4.5. OnDestroy Handle Function

Function name: OnDestroy
Description: This function is called when a request to destroy a window is received. This function performs such operations as to free an allocated heap area.
Data: None
Variables: None

5.4.6. OnDraw Handle Function

Function name: OnDraw
Description: This function is called when a request to redraw a window is received. The cases where this function is called are when it is necessary to display part of a window that is hidden by some other window. This function performs such operations as to redraw a custom window.
Data: None
Variables: None

5.4.7. OnEvent Handle Function

Function name: OnEvent

Description: This function is called when a PD77SIM event is received from PD77SIM. The cases where this function is called are when it is necessary to change the PD77SIM status. This function performs such operations as to get memory values and redraw a window as necessary.

Data: The information stored in _HandleMsgBlock is shown below:

PD77SIM event number	4 bytes
----------------------	---------

Variables: The variables set by _HandleMsgBlock are shown below.
int nEventID PD77SIM event numbers listed below

PD77SIM event number	Cases when event is received
EVENT_GO	Start of execution
EVENT_STOP	Stop of execution
EVENT_RESET	Reset
EVENT_STEP	Execution of Step command
EVENT_OVER	Execution of Over command
EVENT_RETURN	Execution of Return command
EVENT_PUT_REG	Change of register value
EVENT_REG_PC	Change of PC value
EVENT_PUT_MEM	Change of memory value
EVENT_LOAD	Program load
EVENT_ADD_SYMBOL	Addition of assembler symbol
EVENT_DEL_SYMBOL	Deletion of assembler symbol
EVENT_SBRK	Change of software breakpoint
EVENT_TRACE_START	Start of trace measurement
EVENT_TRACE_END	End of trace measurement
EVENT_TRACE_PASS	Passage of trace point
EVENT_FUNC	Change of displayed function
EVENT_FILE	Change of displayed file
EVENT_UP	Change of scope to high-level function
EVENT_DOWN	Change of scope to low-level function
EVENT_MAP	Change of map
EVENT_PATH	Change of search path
EVENT_RAMDISP	Redrawing of real-time RAM monitor
EVENT_RAMINFO	Redrawing of real-time RAM monitor
EVENT_HWBRK	Change of hardware break settings
EVENT_EXIT	Termination of PD77SIM
EVENT_FONT	Change of font
EVENT_TAB	Change of tabstop value
EVENT_CWATCH_UPDATE	Redrawing of C watch window
EVENT_SCRIPT_INIT	Initialization of script window
EVENT_TIME_10MS	Timer interrupt at 10 ms intervals

5.4.8. OnHScroll Handle Function

Function name: OnHScroll

Description: This function is called when the horizontal scroll bar is clicked.

Data: The information stored in `_HandleMsgBlock` is shown below:

Scroll bar code	4 bytes
Position of scroll box	4 bytes

Variables: The variables set by `_HandleMsgBlock` are shown below.

int `nSBCode` Scroll bar code indicating one of the following scroll requests

Value	Description
<code>SB_LEFT</code>	Scroll to left edge
<code>SB_ENDSCROLL</code>	End of scroll
<code>SB_LINELEFT</code>	Scroll to left
<code>SB_LINERIGHT</code>	Scroll to right
<code>SB_PAGELEFT</code>	Scroll one page to left
<code>SB_PAGERIGHT</code>	Scroll one page to right
<code>SB_RIGHT</code>	Scroll to right edge
<code>SB_THUMBPOSITION</code>	Scroll to absolute position (current position specified by <code>nPos</code>)
<code>SB_THUMBTRACK</code>	Drag scroll box to specified position (current position specified by <code>nPos</code>)

int `nPos` Position when `nSBCode` is `SB_THUMBPOSITION` or `SB_THUMBTRACK`.

5.4.9. OnKeyDown Handle Function

Function name: OnKeyDown

Description: This function is called when a key is pressed. However, the keys that belong to the "system keys" do not have any effect. Although the "system keys" are defined differently depending on the type of personal computer, they normally consist of the Alt key and some other key that is entered simultaneously with the Alt key.

Data: The information stored in _HandleMsgBlock is shown below:

Virtual key code	4 bytes
Repeat count	4 bytes
Flag	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.

int nChar Virtual key code value of key
 int nRepCnt Repeat count value indicating a number of times a key stroke is generated while the key is held down.
 int nFlags One of the following status flags

Bit	Description
0-7	Unused.
8	Extension key. Function keys and keys on numeric keypad. (This bit is 1 for extended keys; otherwise, 0.)
11-12	Unused.
13	Always 0.
14	Immediately preceding key status. (This bit is 1 when a key is pressed when called; otherwise, 0.)
15	Always 0.

For details about virtual key code, refer to "About virtual key code" in the next page.

[About virtual key code]

To support all models available, Windows has virtual keys defined to the actual keys on the keyboard. For example, when depression of the F1 key is detected, Windows converts it into the virtual key code that corresponds to the F1 key and informs depression of the F1 key to the application. Thanks to the use of virtual keys, the application need not be concerned with the difference in the keyboard.

In CB77SIM, the following virtual key codes can be used.

Virtual key code	Corresponding key on keyboard
VK_CANCEL	Ctrl + Break
VK_BACK	Backspace
VK_TAB	Tab
VK_CLEAR	5 on numeric keypad when Num Lock is off
VK_RETURN	Enter
VK_SHIFT	Shift
VK_CONTROL	Ctrl
VK_MENU	Alt
VK_PAUSE	Pause
VK_CAPITAL	Casp Lock
VK_ESCAPE	Esc
VK_SPACE	Spasebar
VK_PRIOR	Page Up
VK_NEXT	Page Down
VK_END	End
VK_HOME	Home
VK_LEFT	Left
VK_UP	Up
VK_RIGHT	Right
VK_DOWN	Down
VK_SNAPSHOT	Print Screen
VK_INSERT	Ins
VK_DELETE	Del
VK_NUMPAD0	0 on numeric keypad when Num Lock is on
VK_NUMPAD1	1 on numeric keypad when Num Lock is on
VK_NUMPAD2	2 on numeric keypad when Num Lock is on
VK_NUMPAD3	3 on numeric keypad when Num Lock is on
VK_NUMPAD4	4 on numeric keypad when Num Lock is on
VK_NUMPAD5	5 on numeric keypad when Num Lock is on
VK_NUMPAD6	6 on numeric keypad when Num Lock is on
VK_NUMPAD7	7 on numeric keypad when Num Lock is on
VK_NUMPAD8	8 on numeric keypad when Num Lock is on
VK_NUMPAD9	9 on numeric keypad when Num Lock is on

Virtual key code	Corresponding key on keyboard		
VK_MULTIPLY	*	on numeric keypad (extended keyboard)	
VK_ADD	+	on numeric keypad (extended keyboard)	
VK_SUBTRACT	-	on numeric keypad (extended keyboard)	
VK_DIVIDE	/	on numeric keypad (extended keyboard)	
VK_F1	Function key	F1	
VK_F2	Function key	F2	
VK_F3	Function key	F3	
VK_F4	Function key	F4	
VK_F5	Function key	F5	
VK_F6	Function key	F6	
VK_F7	Function key	F7	
VK_F8	Function key	F8	
VK_F9	Function key	F9	
VK_F10	Function key	F10	
VK_F11	Function key	F11	(extended keyboard)
VK_F12	Function key	F12	(extended keyboard)¥
VK_NUMLOCK	Num Lock		
VK_SCROLL	Scroll Lock		

For keys to and keys to , virtual key code values "0" to "9" and values "A" to "Z" are used, respectively.

5.4.10.OnKeyUp Handle Function

Function name: OnKeyUp

Description: This function is called when a key is released. However, the keys that belong to the "system keys" do not have any effect. Although the "system keys" are defined differently depending on the type of personal computer, they normally consist of the Alt key and some other key that is entered simultaneously with the Alt key.

Data: The information stored in _HandleMsgBlock is shown below:

Virtual key code	4 bytes
Repeat count	4 bytes
Flag	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.

int	nChar	Virtual key code value of key
int	nRepCnt	Repeat count value that indicates the number of times the key stroke is generated while the key is held down. This value is 1 when the OnKeyUp handle function is called.
int	nFlags	One of the following status flags

Bit	Description
0-7	Unused.
8	Extension key. Function keys and keys on numeric keypad. (This bit is 1 for extended keys; otherwise, 0.)
11-12	Unused.
13	Always 0.
14	Immediately preceding key status. (This bit is 1 when a key is pressed when called; otherwise, 0.)
15	Always 0.

For details about virtual key code, refer to "About virtual key code" in the preceding page.

5.4.11. OnLButtonDblClk Handle Function

Function name: OnLButtonDblClk

Description: This function is called when the left mouse button is double-clicked.

Data: The information stored in _HandleMsgBlock is shown below:

Type of virtual key	4 bytes
x coordinate of cursor	4 bytes
y coordinate of cursor	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.

int nFlags Virtual key that is pressed
The stored value is a logical sum of the following values representing a virtual key.

Value	Description
MK_CONTROL	Ctrl key pressed
MK_LBUTTON	Left mouse button pressed
MK_MBUTTON	Middle mouse button pressed
MK_RBUTTON	Right mouse button pressed
MK_SHIFT	Shift key pressed

int x x coordinate of mouse cursor
int y y coordinate of mouse cursor
Coordinates are always a relative position referenced to the upper left corner of the window.

5.4.12. OnLButtonDown Handle Function

Function name: OnLButtonDown

Description: This function is called when the left mouse button is pressed.

Data: The information stored in _HandleMsgBlock is shown below:

Type of virtual key	4 bytes
x coordinate of cursor	4 bytes
y coordinate of cursor	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.

int nFlags Virtual key that is pressed
The stored value is a logical sum of the following values representing a virtual key.

Value	Description
MK_CONTROL	Ctrl key pressed
MK_LBUTTON	Left mouse button pressed
MK_MBUTTON	Middle mouse button pressed
MK_RBUTTON	Right mouse button pressed
MK_SHIFT	Shift key pressed

int x x coordinate of mouse cursor
int y y coordinate of mouse cursor
Coordinates are always a relative position referenced to the upper left corner of the window.

5.4.13. OnLButtonUp Handle Function

Function name: OnLButtonUp

Description: This function is called when the left mouse button is released.

Data: The information stored in _HandleMsgBlock is shown below:

Type of virtual key	4 bytes
x coordinate of cursor	4 bytes
y coordinate of cursor	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.

int nFlags Virtual key that is pressed
The stored value is a logical sum of the following values representing a virtual key.

Value	Description
MK_CONTROL	Ctrl key pressed
MK_LBUTTON	Left mouse button pressed
MK_MBUTTON	Middle mouse button pressed
MK_RBUTTON	Right mouse button pressed
MK_SHIFT	Shift key pressed

int x x coordinate of mouse cursor
int y y coordinate of mouse cursor
Coordinates are always a relative position referenced to the upper left corner of the window.

5.4.14. OnMouseMove Handle Function

Function name: OnMouseMove

Description: This function is called when the mouse cursor is moved.

Data: The information stored in _HandleMsgBlock is shown below:

Type of virtual key	4 bytes
x coordinate of cursor	4 bytes
y coordinate of cursor	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.

int nFlags Virtual key that is pressed
The stored value is a logical sum of the following values representing a virtual key.

Value	Description
MK_CONTROL	Ctrl key pressed
MK_LBUTTON	Left mouse button pressed
MK_MBUTTON	Middle mouse button pressed
MK_RBUTTON	Right mouse button pressed
MK_SHIFT	Shift key pressed

int x x coordinate of mouse cursor
int y y coordinate of mouse cursor
Coordinates are always a relative position referenced to the upper left corner of the window.

5.4.15. OnRButtonDbClick Handle Function

Function name: OnRButtonDbClick
 Description: This function is called when the right mouse button is double-clicked
 Data: The information stored in _HandleMsgBlock is shown below:

Type of virtual key	4 bytes
x coordinate of cursor	4 bytes
y coordinate of cursor	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.
 int nFlags Virtual key that is pressed
 The stored value is a logical sum of the following values representing a virtual key.

Value	Description
MK_CONTROL	Ctrl key pressed
MK_LBUTTON	Left mouse button pressed
MK_MBUTTON	Middle mouse button pressed
MK_RBUTTON	Right mouse button pressed
MK_SHIFT	Shift key pressed

int x x coordinate of mouse cursor
 int y y coordinate of mouse cursor
 Coordinates are always a relative position referenced to the upper left corner of the window.

5.4.16. OnRButtonDown Handle Function

Function name: OnRButtonDown
 Description: This function is called when the right mouse button is pressed.
 Data: The information stored in _HandleMsgBlock is shown below:

Type of virtual key	4 bytes
x coordinate of cursor	4 bytes
y coordinate of cursor	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.
 int nFlags Virtual key that is pressed
 The stored value is a logical sum of the following values representing a virtual key.

Value	Description
MK_CONTROL	Ctrl key pressed
MK_LBUTTON	Left mouse button pressed
MK_MBUTTON	Middle mouse button pressed
MK_RBUTTON	Right mouse button pressed
MK_SHIFT	Shift key pressed

int x x coordinate of mouse cursor
 int y y coordinate of mouse cursor
 Coordinates are always a relative position referenced to the upper left corner of the window.

5.4.17. OnRButtonUp Handle Function

Function name: OnRButtonUp

Description: This function is called when the right mouse button is released.

Data: The information stored in _HandleMsgBlock is shown below:

Type of virtual key	4 bytes
x coordinate of cursor	4 bytes
y coordinate of cursor	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.

int nFlags Virtual key that is pressed
 The stored value is a logical sum of the following values representing a virtual key.

Value	Description
MK_CONTROL	Ctrl key pressed
MK_LBUTTON	Left mouse button pressed
MK_MBUTTON	Middle mouse button pressed
MK_RBUTTON	Right mouse button pressed
MK_SHIFT	Shift key pressed

int x x coordinate of mouse cursor

int y y coordinate of mouse cursor

Coordinates are always a relative position referenced to the upper left corner of the window.

5.4.18.OnSize Handle Function

Function name: OnSize

Description: This function is called when the window size is changed.

Data: The information stored in _HandleMsgBlock is shown below:

Type of size change	4 bytes
New width	4 bytes
New height	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.

int nType One of the following types of size changes that is requested

Value	Description
SIZE_MAXIMIZED	Maximized display
SIZE_MINIMIZED	Iconification
SIZE_RESTORED	Size changed, but SIZE_MINIMIZED and SIZE_MAXIMIZED are not applied.
SIZE_MAXHIDE	Message is sent to all pup-up windows when several other windows are maximized in size.
SIZE_MAXSHOW	Message is sent to all pup-up windows when several other windows are restored to previous size.

int cx New width of client area

int cy New height of client area

5.4.19.OnTimer Handle Function

Function name: OnTimer

Description: This function is called when a time-out interval is informed due to an elapsed time of the timer.

Data: The information stored in _HandleMsgBlock is shown below:

Timer identifier	4 bytes
------------------	---------

Variables: The variables set by _HandleMsgBlock are shown below.

int nIDEvent Identification number of timer

5.4.20.OnVScroll Handle Function

Function name: OnVScroll

Description: This function is called when the vertical scroll bar is clicked.

Data: The information stored in _HandleMsgBlock is shown below:

Scroll bar code	4 bytes
Position of scroll box	4 bytes

Variables: The variables set by _HandleMsgBlock are shown below.

int nSBCode Scroll bar code indicating one of the following scroll requests

Value	Description
SB_BOTTOM	Scroll to bottom
SB_ENDSCROLL	End of scroll
SB_LINEDOWN	Scroll one line down
SB_LINEUP	Scroll one line up
SB_PAGEDOWN	Scroll one page down
SB_PAGEUP	Scroll one page up
SB_THUMBPOSITION	Scroll to absolute position (current position specified by nPos)
SB_THUMBTRACK	Drag scroll box to specified position (current position specified by nPos)
SB_TOP	Scroll to top

int nPos Position when nSBCode is SB_THUMBPOSITION or SB_THUMBTRACK.

[MEMO]

CB77SIM V.1.01 User's Manual

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CB77SIM V.1.01
User's Manual



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