Software User's Guide

winIDEA

Version 2008

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Debug Session 97

Introduction

About This Manual

This manual is a guide to the winIDEA environment.

It covers following topics:

- The development environment – workspace and window handling
- The integrated editor
- Debug features
- FLASH programming features
- The integrated build manager
- The integrated script language

For hardware specific topics refer to the hardware manual.

Integrated Development Environment

The winIDEA application is an integrated development environment that encompasses all phases of program development in a single, easy to use yet powerful environment.

- winIDEA runs on Windows NT, 2000, XP and Vista platforms
- The integrated multi-file editor serves as an area for both writing and debugging your program source.
- All other windows can be docked to a fixed position, thus eliminating the need for rearrangement after tile, cascade or resize operations.
- The Build Manager can be configured to support any third party command line driven compiler toolset, featuring background compilation, multiple build targets, file level compiler settings and much more.
- The hardware interface allows attachment to any debugger that supports the iOPEN interface.
- The extensive context-sensitive help covers all aspects of winIDEA.

Installation

System Requirements

Hardware

- PC with a Pentium or better CPU
- 128 MB or more memory
- 200 MB or more hard disk space.

Software

winIDEA supports Windows NT 4, 2000, XP, Vista or higher.

Note: In case the on-line help does not work, this could be solved by reinstalling the Microsoft Internet Explorer or by installing winIDEA onto a local hard disk.

Software Installation

- Insert the distribution CD-ROM disk in the CD-ROM drive. Master setup will start automatically.
  Select the “Install winIDEA’ option.
- Follow the installation wizard

Note: on Windows NT you must have administrator privilege to successfully install the communication driver.

Installing the winIDEA Update

Updates to winIDEA are published regularly on the internet. To update winIDEA:

- Get an update link if published on the web site or if it is given to you by support and download it
- Run the update
- Follow the installation wizard

winIDEA Command Line Options

There are a number of command line options availabe when starting winIDEA.

The options are:

/DEMO run in demo mode

/LOG:<domain> generate a log of activities for <domain>. Available domains and their numbers are visible in Help/Support/Log dialog

/DOWNLOAD start download immediately after loading the project

/DOWNLOAD:<file name> download the specified file

<file name>.jrf load the specified workspace

<file name>.isl execute the specified script file after loading the workspace

Development Environment

Workspaces

winIDEA organizes project development in workspaces. Each workspace contains the information on how the files necessary for a successful build of your project are related to each other, along with information on other features that aid development, such as bookmarks, breakpoints, desktop layout etc.

The workspace file is the mother of your workspace. She will be very happy if her children (project files, etc.) are kept in her directory or its sub-directories.

Virtually all of the workspace information (except some user preferences, like color and keyboard settings) is stored in a workspace file (.XJRF and .JRF extension). Ideally you will organize your project in a new directory where the workspace file will be located. This is considered to be your working directory. You are free to create sub-directories and place your source files there. All file path information in a workspace is stored relative to the workspace file location, so you will be able to move and copy the workspace to any other directory without disturbing its functionality.

Path Specifications

At various places in winIDEA, especially when configuring project settings, you will need to enter file paths. To assure maximum workspace moveability, winIDEA recognizes and internally maintains three different path specifications:

- Paths to files in the directory or sub-directory of the workspace file. These are stored and displayed in relative form.
- Paths to files that can be stored in relative form to the compiler toolset directory (see "General page" on page 244).
  These are stored in relative form to the compiler toolset path, but displayed in absolute form.
- Paths that can not be stored in relative form to either of above referential directories. These are stored and displayed in absolute form.

Working with Workspaces

There is not much you can do in winIDEA without having a workspace open. To get you there, you will either open an existing workspace (one you have created previously or an example workspace shipped with the installation files) or create a new one from scratch.

Opening an Existing Workspace

- Select the ‘Open Workspace…’ command from the ‘File’ menu

- Browse for the workspace file
- Click the ‘Open’ button after selecting the desired workspace file

Alternatively you can select a previously opened workspace from the workspace file pick list in the ‘File’ menu.

- Open the ‘File’ menu
- Four most recently used workspaces are listed on shortcuts 5 through 8. Select the workspace of your choice.

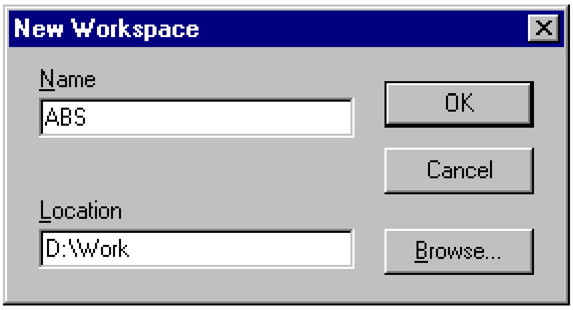
Note: winIDEA can read (but not write) workspace files created by earlier winIDEA versions (.IRF extension).
After changes have been made, winIDEA will save the new workspace information in a .XJRF and .JRF file.

XML Format workspace files

winIDEA always generates both legacy binary (.QRF and .JRF) and XML format (.XQRF and .XJRF) workspace files. The default file format used by winIDEA is defined in the Tools/Options/Environment menu, which selects the format implicit for workspace restore and backup, source control, etc. operations.

Creating a New Workspace

- Select the 'New Workspace…' command from the 'File' menu
- After prompted for workspace directory and name, browse for directory of your choice (an empty new directory is recommended) and enter the name for the workspace file.



Name: ABS

Location: D:\Work

New Workspace dialog

A newly created workspace contains only default project and hardware settings.

Saving Workspaces

Whenever the current workspace is to be closed, it is saved automatically. This can happen either upon exiting winIDEA or opening or creating a new workspace.

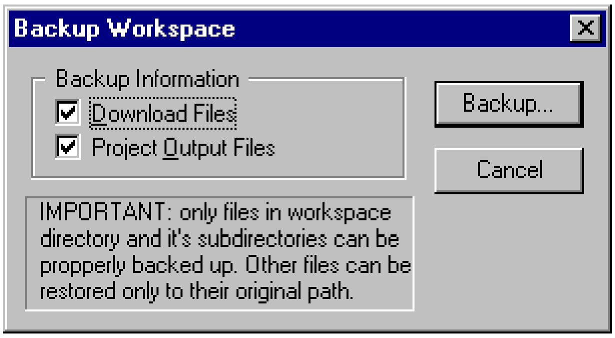
You can however explicitly save a workspace with the 'Save Workspace…' command. You will find this most useful when creating workspaces with the same project and hardware configuration (which is often the case), and sometimes with the same set of project files.

- Select the 'Save Workspace…' command from the 'File' menu
- Browse for an existing workspace file or
- browse for the desired directory and enter the name of the new workspace file manually
- Click the 'Save' button when finished

Backup a Workspace

winIDEA's workspace backup feature gives you the possibility to archive all workspace files in a single file, which you can restore with the Restore Workspace command.

To backup a workspace select the 'Backup Workspace' command from the file menu.



Backup Information

☑ Download Files

☑ Project Output Files

IMPORTANT: only files in workspace directory and it's subdirectories can be propperly backed up. Other files can be restored only to their original path.

Backup Workspace dialog

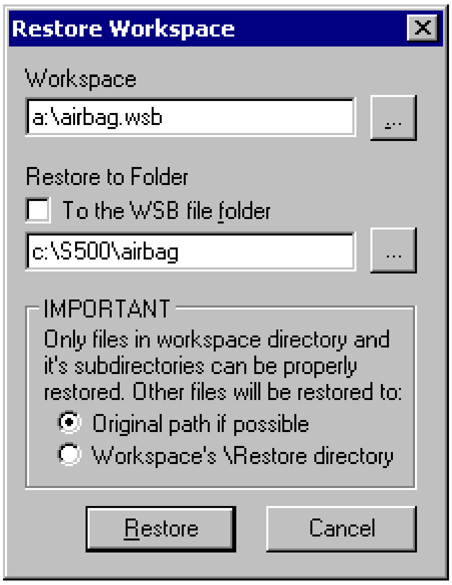
When backing up a workspace, winIDEA always stores configuration files (.JRF and .QRF) and project source files. Optionally, you can choose to backup project output files (object, listing…) and download files.

To start the backup, click the 'Backup…' button and specify a file name. If your backup target is on a removable disk, winIDEA swill ask you to provide enough media to span the backup file.

Note: if possible, winIDEA will store file paths relative to the workspace file. This way you can restore a workspace to a different directory. Files that are not located in the workspace directory or one of its sub-directories are stored with their absolute paths.

Restore a Workspace

An archived workspace (.WSB) can be restored by the 'Restore Workspace' command.



a:\airbag.wsb

□ To the WSB file folder

c:\S500\airbag

IMPORTANT
Only files in workspace directory and it's subdirectories can be properly restored. Other files will be restored to:

● Original path if possible
○ Workspace's \Restore directory

Restore Workspace dialog

Workspace

Specifies the workspace archive

Restore to Folder

Specifies the folder where you want to restore the workspace to.

If there are any files in the archive that were stored with their absolute paths, winIDEA can restore them to:

- the same folder the .WSB file is residing, this can be achieved by checking the ‘To the WSB file folder’ option
- their original path. If the original path can not be accessed, winIDEA restores the files to the 'Restore' sub-directory
- the 'Restore' sub-directory

Hardware Plug-In

The winIDEA environment can connect to any hardware tool via the iOPEN interface. The 'hardware tool' is actually a software component that implements the server side of the iOPEN interface and which in turn controls proprietary hardware (or software like a simulator).

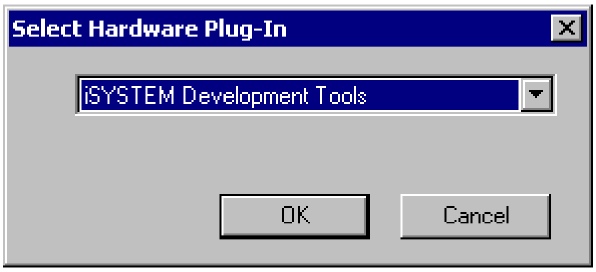
Through this interface the winIDEA can access following:

- Debug functions like accessing memory, setting breakpoints, manipulating CPU operation etc. including real-time trace, profiler and coverage features (see "Debug Session" on page 97).
- FLASH device-programming capabilities (see "FLASH Programming" on page 221).
- Memory device (RAM, ROM, and FLASH) simulation capabilities
- Logic analyzer functions

When a plug-in is attached, it will insert its menus into winIDEA's through which its specific configuration is performed.

Configuration

The hardware plug-in can be selected by the 'Hardware Plug-In…' command on the Tools menu.



Select Hardware Plug-In

iSYSTEM Development Tools

The Hardware Plug-In selection dialog

Select the desired plug-in from the list.

Note: the list will only show plug-ins currently available. A plug-in is available if its controlling component (a DLL) is located in winIDEA's \BIN directory.

Window Management

The winIDEA is a Multiple Document Interface (MDI) application, which means that several documents can be viewed and edited at the same time. In this case the term 'document' applies to source code files (typically C sources) for your project that you create and edit using the built-in or an external editor, build using the Build Manager and debug with the integrated debugger. The MDI interface enables you to open and process one or more of your source files, which are displayed in standard MDI child windows.

There is however plenty of other types of information to be displayed in specialized windows, like the project workspace window (displaying project hierarchy), the output window (displaying build output), specialized debugger windows, etc.

Besides standard MDI windows, winIDEA introduces two more window types that can be manipulated easier than MDI windows.

The type of the window can be set from its context menu:

- MDI child – the standard window
- Dockable – a window that can be docked like a toolbar
- Mini Frame – a window that can be floated above other windows or even outside the winIDEA application window

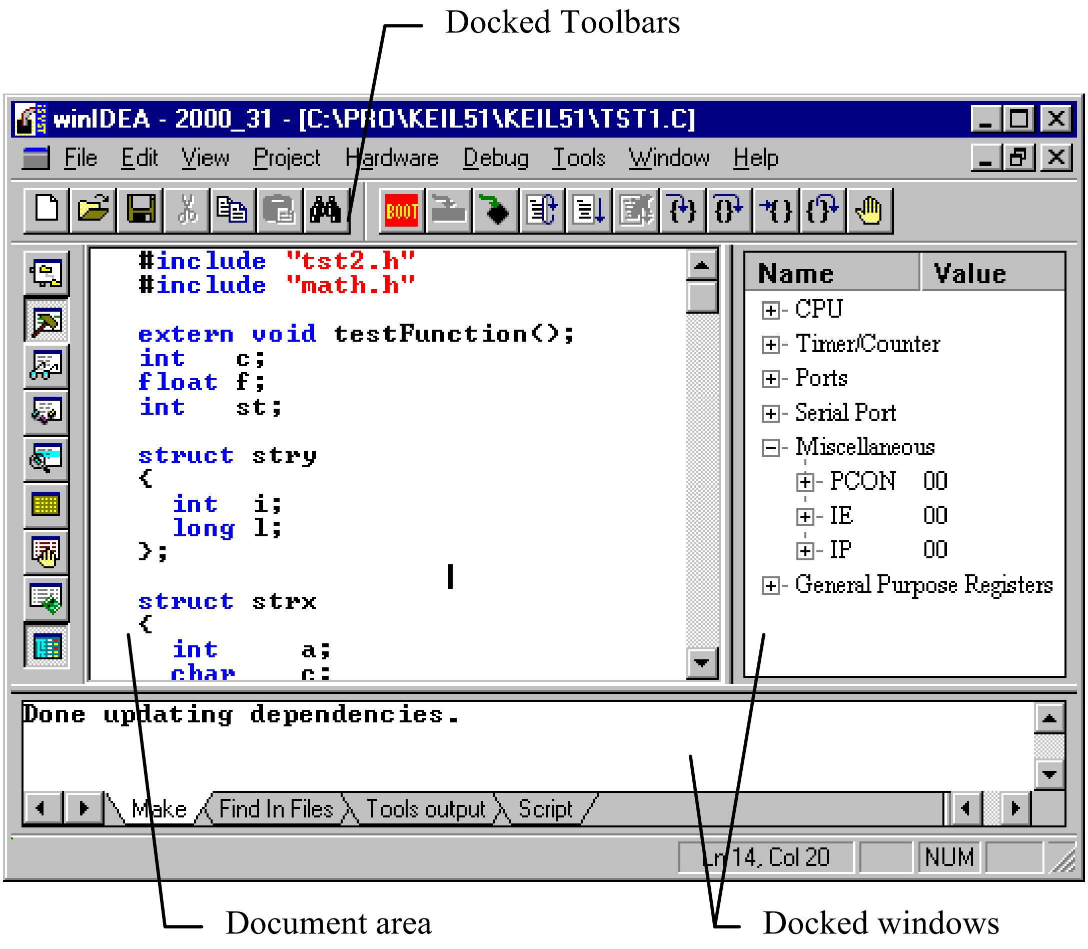
Dockable windows

Dockable toolbars have been around in mainstream Windows programs for some years now, and everyone has come to appreciate that the toolbar is always visible and at the same time not occupying any unnecessary desktop real estate.

winIDEA promotes the same concept to specialized windows that you will want to have around all the time. Once they are docked, a document can not obscure them, they are not subject to repositioning during tile and cascade operations and they minimize desktop real estate consumption by not displaying a caption bar.

The area occupied by docked windows and toolbars is out of reach of your documents. When a document is maximized, it will grow to occupy the remainder of the winIDEA's application window.

Typically you will create your preferred window layout along with colors and fonts in a matter of minutes and then never feel the need to reposition a window again. Your documents are then best viewed maximized. They can easily be switched by the document selector bar, the ‘Ctrl+Tab’ keyboard shortcut or through the window list on the ‘Window’ menu.



```
#include "tst2.h"
#include "math.h"

extern void testFunction();
int    c;
float f;
int    st;

struct stry
{
   int  i;
   long l;
};

struct strx
{
   int      a;
   char     c;
```

Name	Value
⊞- CPU	
⊞- Timer/Counter	
⊞- Ports	
⊞- Serial Port	
⊟- Miscellaneous	
⊞- PCON	00
⊞- IE	00
⊞- IP	00
⊞- General Purpose Registers	

```
Done updating dependencies.
```

Window drag cursor

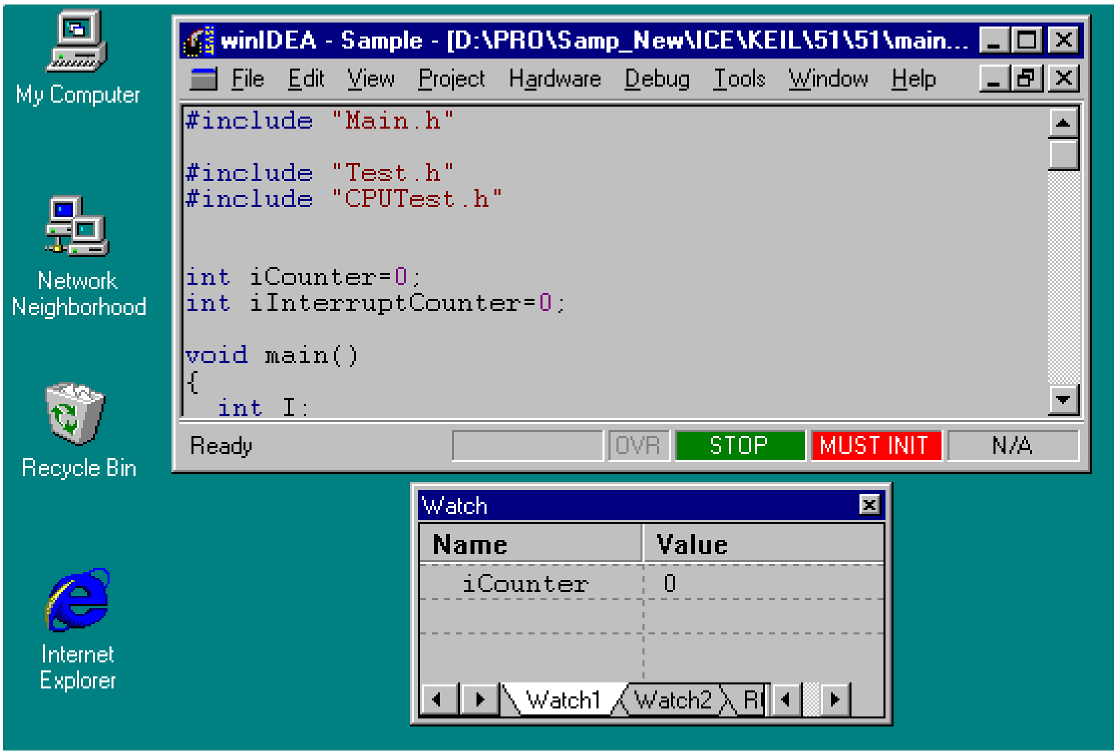
Docking a Window

Place the mouse cursor on the border of the selected window (the mouse cursor will change to the drag shape when placed over the window border),

- Hold down the left mouse button while dragging the window to its new location.
- Release the mouse button.

Mini Frame Windows

A mini frame window can be floated anywhere on the desktop. If placed over winIDEA application window, it will overlap all its MDI and docked windows.


My Computer
Network Neighborhood
Recycle Bin
Internet Explorer
winIDEA - Sample - [D:\PRO\Samp_New\ICE\KEIL\51\51\main...
File Edit View Project Hardware Debug Tools Window Help
Ready
OVR
STOP
MUST INIT
N/A
Watch
Watch1
Watch2
R

```
#include "Main.h"

#include "Test.h"
#include "CPUTest.h"


int iCounter=0;
int iInterruptCounter=0;

void main()
{
  int I;
```

Name	Value
iCounter	0

winIDEA and the Watch window as a mini frame window

Desktops

The window layout that you see in winIDEA is called a desktop. The Desktop can be configured in any way, with opening additional windows, moving the windows etc. The desktop configuration is saved with the workspace information, so that every time you open a workspace, the window settings as you saved them the last time are shown.

Four desktop templates are provided to simplify desktop configuration. They can be selected using the View/Preset Desktop option. Any of those can, of course, be modified to your preference.

Full screen operation

The working area of winIDEA can be enlarged to the whole screen. To enable this option, select the View/Full Screen option. This hides the window control and the menu bar and thus enables you to use the maximum workspace your desktop allows.

With full screen mode, on the other hand, the menus are not visible. This can sometimes cause you be unable to select menu entries. The menus can always be invoked with the shortcut key (for example, by pressing Alt+F, the File menu is invoked). You can select menus in the same way as if they were visible – that means that you can also 'walk' through the menus with the arrow keys.

The full screen mode can be disabled by clicking the View/Full Screen option again. The shortcut key for this is Alt+V for the View menu and F for Full Screen.

Context Menus

Following Windows 95 guidelines for user interface design, every winIDEA's window has a context menu, activated either by a right mouse click in the window or with a 'Shift+F10' keyboard shortcut.

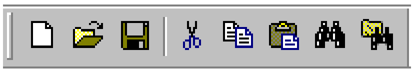
You will find context menus richer in options and faster to manipulate than the global menu. Along with toolbars, context menus make a trip to the menu bar a rarity.

Toolbars

Toolbars provide easy, one-click access to most often used commands, which have been grouped in following categories:

File Toolbar

The File Toolbar contains source file management commands - i.e. file and edit operations.



The File Toolbar

New File button

New File button (File / New command) opens a new edit window which has no physical file attached. When working with such edit windows a Save command request (explicit or upon closing the window) will bring up the Save As dialog box asking you to specify the file name.

Open File button

Open File button (File / Open command) prompts you for a name of an existing file and when selected, displays the contents of the file in a new edit window.

Save File button

Save File button (File / Save command) saves contents of the current edit window to its file. If the edit window has no file attached (when opened with the File / New command), the 'Save As' dialog will open and ask you to specify the name for the file.

Cut Text button

Cut Text button (Edit / Cut command) removes the currently selected text and puts it in the Windows clipboard.
The Cut Text button is enabled only when an edit window is open and contains a block of selected text.

Copy Text button

Copy Text button (Edit / Copy command) copies the currently selected text and puts it in the Windows clipboard.
The Copy Text button is enabled only when an edit window is open and contains a block of selected text.

Paste Text button

Paste Text button (Edit / Paste command) inserts the text contained in the Windows clipboard at the current edit window's insertion point. Any currently selected text is replaced by the inserted text.
The Paste Text button is enabled only when an edit window is open and the Windows clipboard contains text.

Find Text button

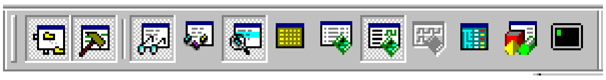
Find Text button (Edit / Find… command) opens the Find dialog box where you specify the text you wish to search for.

Find in Files button

Find in Files button (File / Find In Files command) opens the Find in Files dialog box where you specify the text you wish to search for and the location where to search for it.

View Toolbar

View Toolbar buttons control specialized windows state.



The View Toolbar

Buttons that control the window state appear pressed when the corresponding window is open, and up when the window is closed.

Project Workspace Window button

Project Workspace Window button opens and closes the Project Workspace window.
Available when a workspace is loaded.

Output Window button

Output Window button opens and closes the Output window.

Watch Window button

Watch Window button opens and closes the Watch window.
Available when a workspace is loaded.

Variables Window button

Variables Window button opens and closes the Variables window.
Available when a workspace is loaded.

Disassembly Window button

Disassembly Window button opens and closes the Disassembly window.
Available when a workspace is loaded.

Memory Window button

Memory Window button opens a dialog where you specify the memory area and the address you wish to view. After that a new Memory window opens.
Available when the debug hardware is active.

Profiler button

The Profiler Window button opens and closes the Profiler window.
Available when a workspace is loaded.

Execution Coverage button

The Execution Coverage Window button opens and closes the Execution Coverage window.
Available when a workspace is loaded.

Access Coverage button

The Access Coverage Window button opens and closes the Access Coverage window.
Available when a workspace is loaded.

Trace Window button

Trace Window button opens and closes the Trace window.
Available when a workspace is loaded.

SFR Window button

Special Function Registers Window button opens and closes the SFR window.
Available when a workspace is loaded.

Operating System Window button

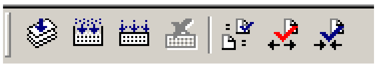
Operating System Window button opens and closes the Operating System window.
Available when an Operating System is configured.

Terminal Window button

Terminal Window button opens and closes the Terminal window.
.

Project Toolbar

Project Toolbar buttons control Build Manager operation



The Project Toolbar

Compile / Assemble button

Compile / Assemble button processes the file in the active edit window. According to its type either the compiler or the assembler is run.
Available when an edit window containing a project file is open.

Make button

Make button starts the 'Make' process in which all project files that are 'out of date' (modified since their last compilation) are processed according to their type.
Available when a workspace is loaded and Build Manager is idle.

Rebuild button

Rebuild button starts the 'Build' process in which all project files are processed according to their type.
Available when a workspace is loaded and Build Manager is idle.

Stop Build button

Stop Build button interrupts current Build Manager operation.
Available when Build Manager is active.

Get Latest Version button

The Get Latest Version button gets the latest version of files from the Source Control Database.
Available when the Source Control is configured and active.

Check Out button

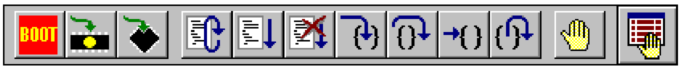
The Check Out button Checks Out the selected files from Source Control.
Available when the Source Control is configured and active.

Check In button

The Check In button Checks In the selected files to Source Control.
Available when the Source Control is configured and active.

Debug Toolbar

Debug Toolbar buttons control debug system operation



The Debug Toolbar

Debug Download button

Debug Download button performs an initialization (if necessary) and a download to the debug system.
Available if the currently selected hardware supports debugging.

Reset button

Reset button performs an initialization of the emulator (if necessary) and resets the CPU.
Available if the currently selected hardware supports debugging.

Run button

Run button starts the CPU.
Available when debugging is active and the CPU is stopped.

Stop button

Stop button stops the CPU.
Available when debugging is active and the CPU is running.

Step Into button

Step Into button performs a single instruction step when the Disassembly Window is active or a single high-level language step when the edit window is active.
Available when debugging is active.

Step Over button

Step Over button performs a 'Step Over' operation.
When the Disassembly Window is active, this will yield a single instruction step unless a subroutine is called or a block instruction is being executed. In such case, the subroutine (or the block instruction) is executed in real-time and the CPU is stopped immediately afterwards.
When the edit window is active, a single high level step in the current high level function is performed, unless the step would take program execution to a different high-level function. In such case CPU is set in running until execution returns to the current function.
Available when debugging is active and the CPU is stopped.

Run Until button

Run Until button places the CPU in running until the current insertion point (when the edit window is active) or marked instruction (when the disassembly window is active) is reached.
Available when debugging is active.

Run Until Return button

Run Until Return button places the CPU in running until the exit from the current high-level (C, C++) function is reached.
Available when debugging is active and the CPU is stopped inside a high-level function.

Toggle Breakpoint button

Toggle Breakpoint button sets (or clears) an execution breakpoint at the insertion position in the active edit window, or the marked instruction in the disassembly window.
Available when either edit or disassembly windows are active.

Breakpoints button

Breakpoints button opens the Breakpoints dialog, where all types of breakpoints can be configured.
Available when a workspace is loaded.

Document Management

Document Windows

The winIDEA is a Multiple Document Interface (MDI) application, which means that several documents can be viewed and edited at the same time. The term ‘document’ applies to user generate files. The MDI interface allows opening and processing one or more of your source files, which are displayed in standard MDI child windows.

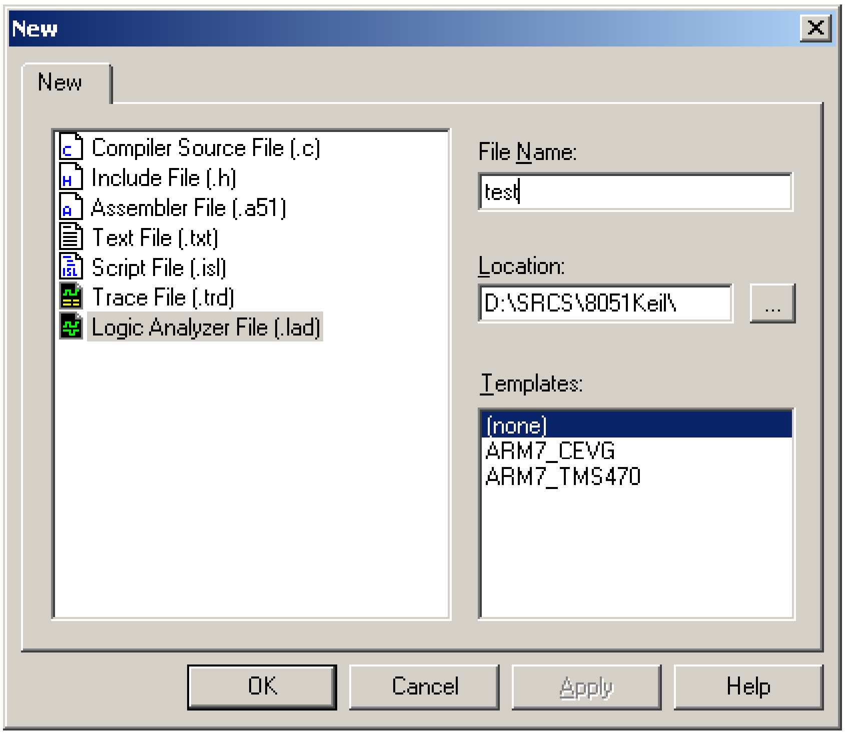
winIDEA supports following document types:

- ASCII text files
- Logic analyzer files

Creating a New Document

To create a new document, select the 'New…' command from the File menu.

In the dialog, select the type of the document, and specify its name and location (folder).



File Name: test

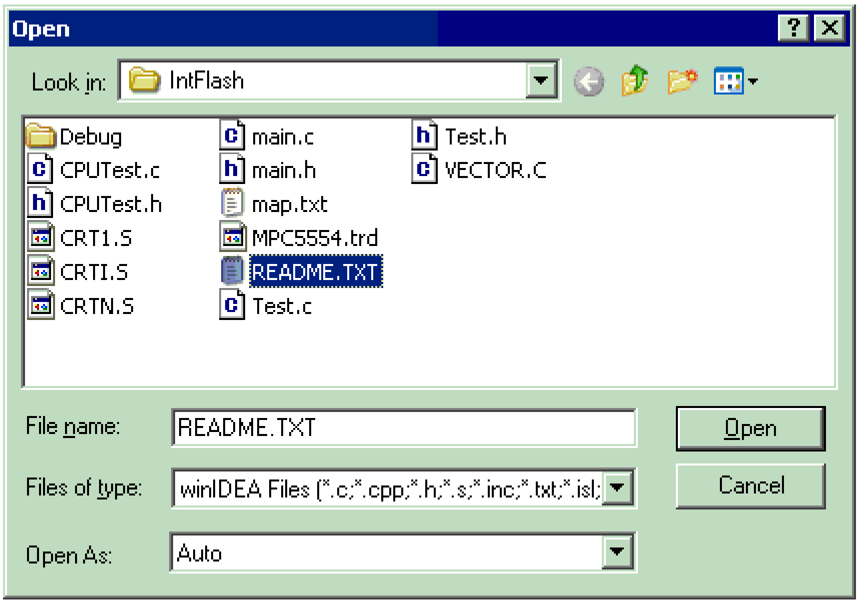
Location: D:\SRCS\8051Keil\

New document dialog

The document can also be based on a template. A template is a pre-configured file – in case of an Analyzer file, it contains CPU specific configuration.

Opening an Existing Document

To open an existing document, select the 'Open…' command from the File menu.



File name: README.TXT

Files of type: winIDEA Files (*.c;*.cpp;*.h;*.s;*.inc;*.txt;*.isl;

Open As: Auto

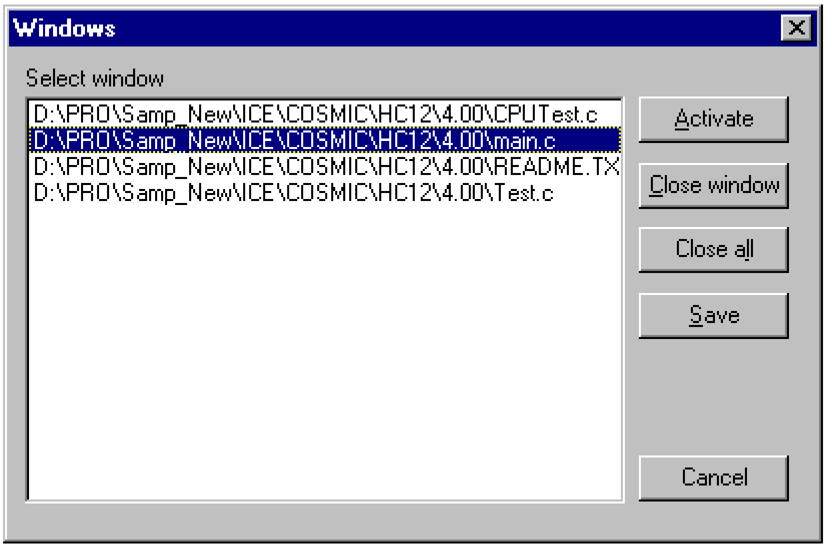
Open File dialog

Open As

Allows you to enforce the type of the document. By default the document type is determined by file extension. The extension is matched to the extension of all supported documents. If no matching document is found, the file is shown as ASCII text file.

Document Window List

The Window list is available on the Window menu.



D:\PRO\Samp_New\ICE\COSMIC\HC12\4.00\CPUTest.c
D:\PRO\Samp_New\ICE\COSMIC\HC12\4.00\main.c
D:\PRO\Samp_New\ICE\COSMIC\HC12\4.00\README.TX
D:\PRO\Samp_New\ICE\COSMIC\HC12\4.00\Test.c

The Open window list

Activate

Activates the selected window. Available if one and only one window is selected.

Close Window

Closes all selected windows.

Close All

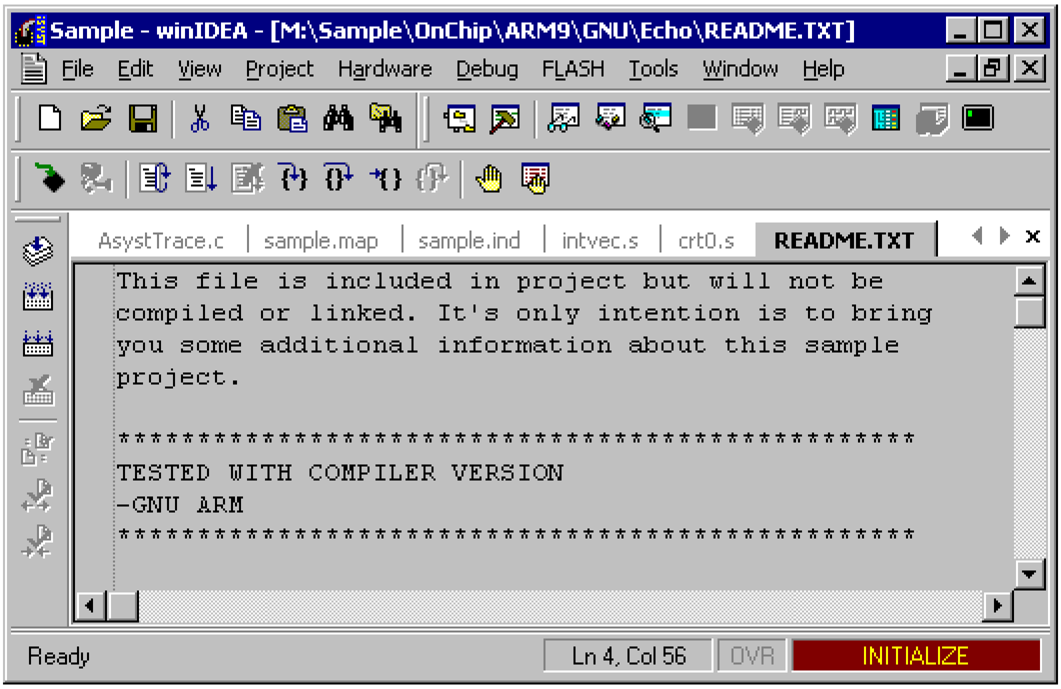
Closes all windows.

Save

Saves all selected windows.

Document Selector Bar

The Document Selector Bar displays names record of all currently open files as a push button bar. When a file is opened a new button with its name is added to the button bar.



```
This file is included in project but will not be
compiled or linked. It's only intention is to bring
you some additional information about this sample
project.

***************************************************
TESTED WITH COMPILER VERSION
-GNU ARM
***************************************************
```

Document Selector Bar

You can now keep your editors maximized all the time and switch between them easily without making trips to the window menu.

The Editor

The editor is the place where you will probably spend most of your time, both when writing as well as debugging your sources. winIDEA's integrated editor supports you with basic functions for editing non-document type files, like:

- find and replace operations
- copy, cut and paste via system clipboard
- drag and drop text operation

as well as some advanced programming aid features, like:

- automatic indent
- color syntax source coloring
- debug watch tips, etc.

All editor related commands are available from the 'Edit' menu.

Selecting Text

Selecting a block of text is necessary when you wish to copy it to the clipboard, move or copy it to another location using drag and drop, or erasing it.

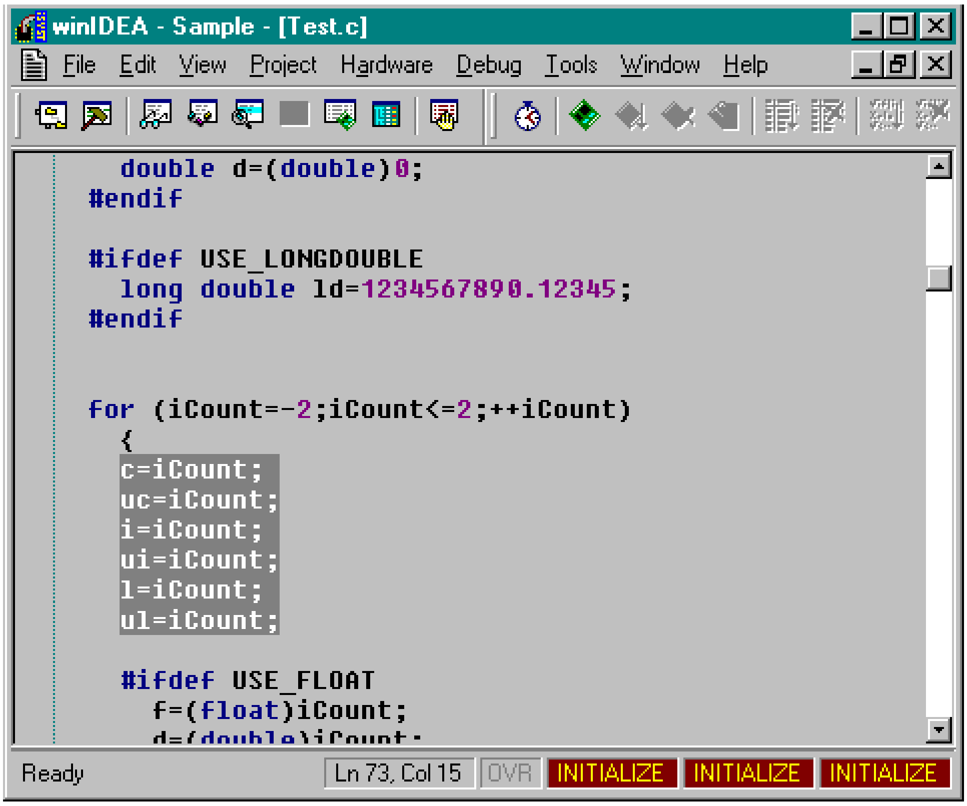
Selecting Text with Mouse

- Position the mouse on the place in the editor window where you wish the selected block to begin,
- Press the left mouse button,
- While keeping the left mouse button pressed, drag the mouse to the location where you want the selected block to end,
- Release the mouse button

Selecting a Block of Text with Mouse

Beside the regular selection, the editor can also select rectangular text blocks (block selections).

- Position the mouse on the place in the editor window where you wish the selected block to begin,
- Hold down the 'Alt' key and press the left mouse button,
- While keeping the left mouse button pressed, drag the mouse to the location where you want the selected block to end,
- Release the mouse button

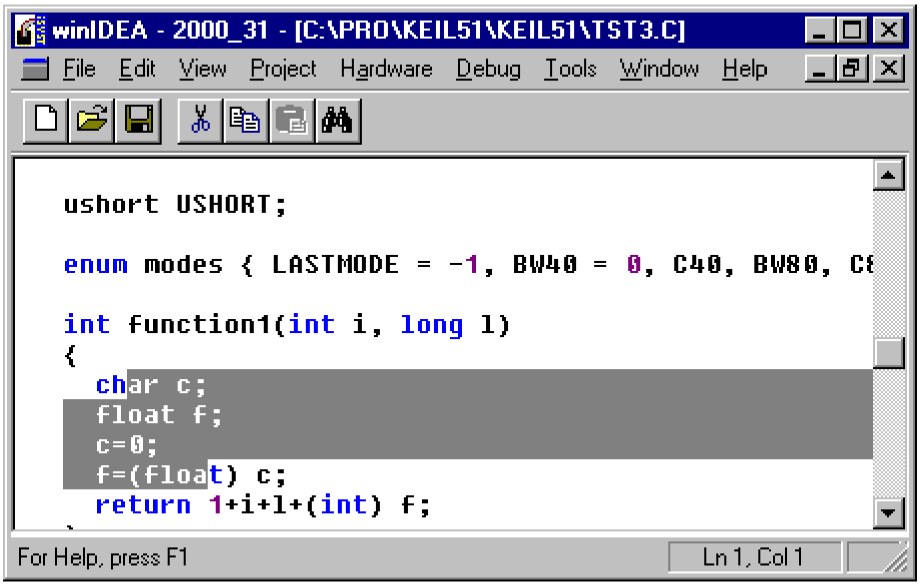


```
  double d=(double)0;
#endif

#ifdef USE_LONGDOUBLE
  long double ld=1234567890.12345;
#endif


for (iCount=-2;iCount<=2;++iCount)
  {
  c=iCount;
  uc=iCount;
  i=iCount;
  ui=iCount;
  l=iCount;
  ul=iCount;

  #ifdef USE_FLOAT
    f=(float)iCount;
    d=(double)iCount;
```

A block selection

Selecting Text with Keyboard

- Position the insertion point (caret) on the place in the editor window where you wish the selected block to begin
- Press the 'Shift' key
- While keeping the 'Shift' key pressed, use movement keys to select the desired block
- Release the 'Shift' key

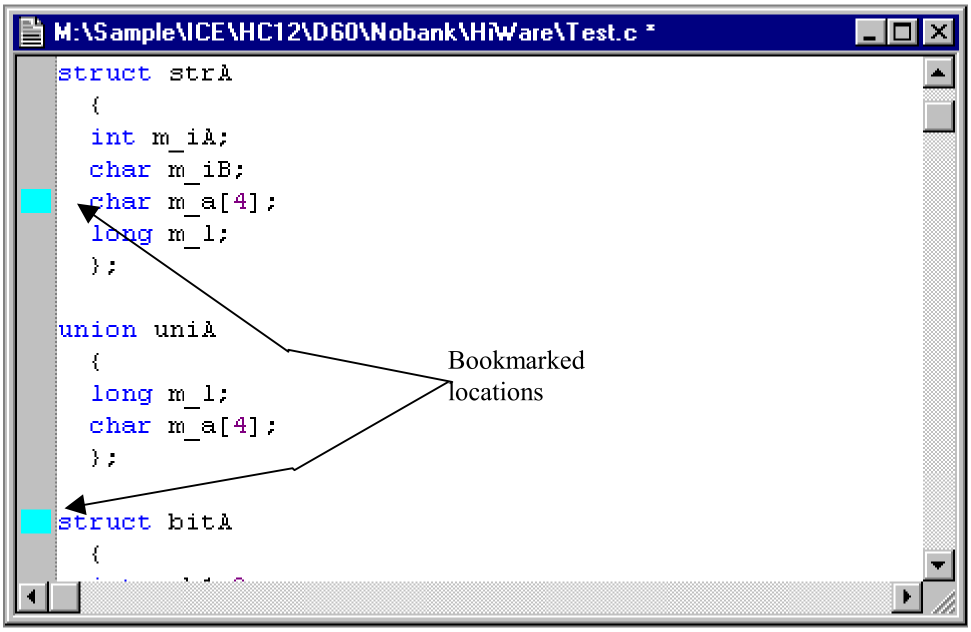


```
ushort USHORT;

enum modes { LASTMODE = -1, BW40 = 0, C40, BW80, C8

int function1(int i, long l)
{
  char c;
  float f;
  c=0;
  f=(float) c;
  return 1+i+l+(int) f;
```

Selected Text in edit window

Bookmarking the Text

When a text file is being edited, bookmarks can be set to the required locations. This enables you to jump to bookmarks easier and doesn't require you to remember the locations in the text file by heart.



```
struct strA
  {
  int m_iA;
  char m_iB;
  char m_a[4];
  long m_l;
  };

union uniA
  {
  long m_l;
  char m_a[4];
  };

struct bitA
  {
```

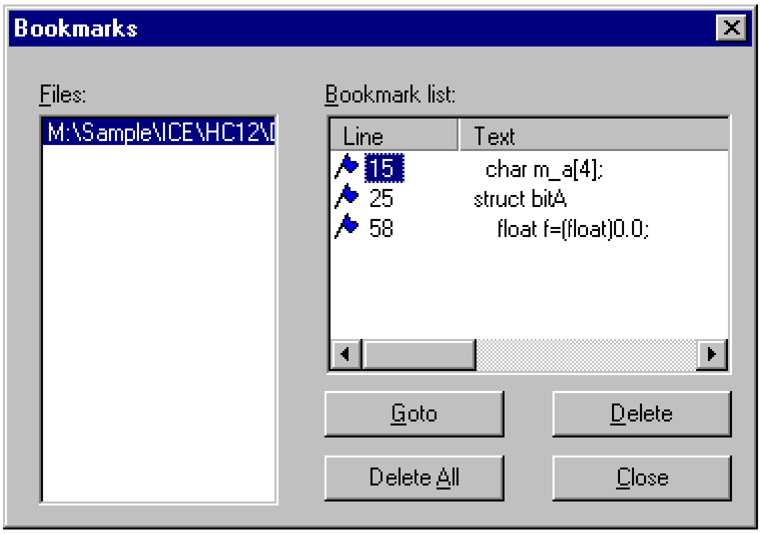
Source window with bookmarked locations

The bookmark is set or removed using the Edit/Toggle Bookmark menu option or the keyboard shortcut Ctrl+F2.

When editing a file, you can immediately jump to the next bookmark location by selecting Edit/Next Bookmark from the menu or by pressing the F2 keyboard shortcut.

Editing Bookmarks

The bookmarks can be edited using the Edit/Bookmarks… menu option or by pressing the Alt+F2 keyboard shortcut.



Files: M:\Sample\ICE\HC12\

Line	Text
15	char m_a[4];
25	struct bitA
58	float f=(float)0.0;

Bookmarks window

In the Bookmarks window, you can manage the bookmarks currently set in the edited file.

Goto

The editor jumps to the selected bookmark.

Delete

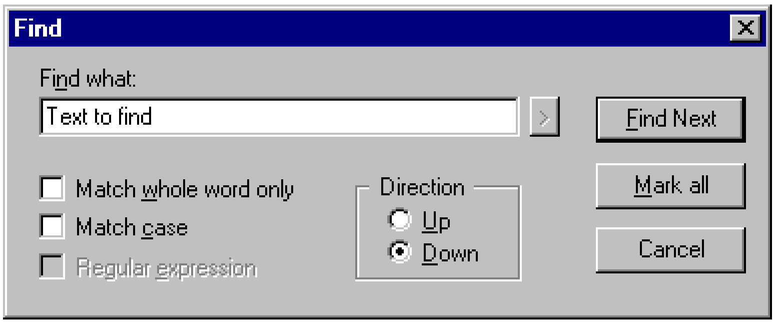
The selected bookmark is deleted.

Delete All

All bookmarks are deleted.

Search and Replace Operations

Search and replace operations can operate on an entire source file, or just on currently selected text (if any). You can search for whole words - characters in front or behind the searched word must not be identifier characters (letters, digits, and underscore), and it can be case sensitive or insensitive.



Find

Find what: Text to find

□ Match whole word only
□ Match case
□ Regular expression

Direction
○ Up
● Down

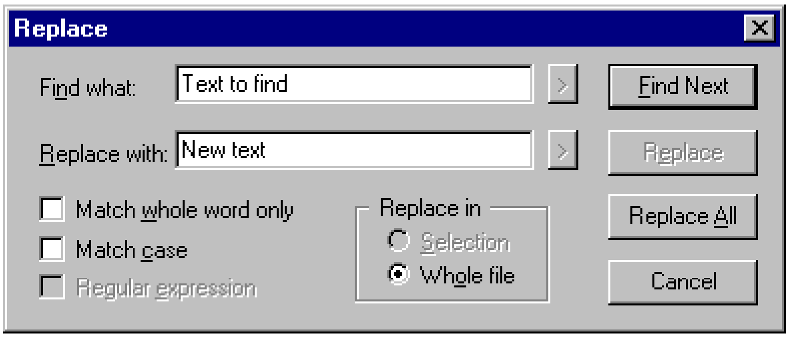
The Find dialog

Finding Text

- Open the 'Find' dialog box,
- Enter the string you wish to search for,
- Specify search options (scope, case, whole words)
- Select the 'Find Next' button to begin search

Replacing Text

- Open the 'Replace' dialog box,
- Enter the string you wish to search for and the string you wish to replace it with,
- Specify search options (scope, case, whole words)
- Select the 'Replace All' to automatically replace all occurrences, or use 'Find Next' and 'Replace' button confirm replace of individual occurrences



Replace

Find what: Text to find

Replace with: New text

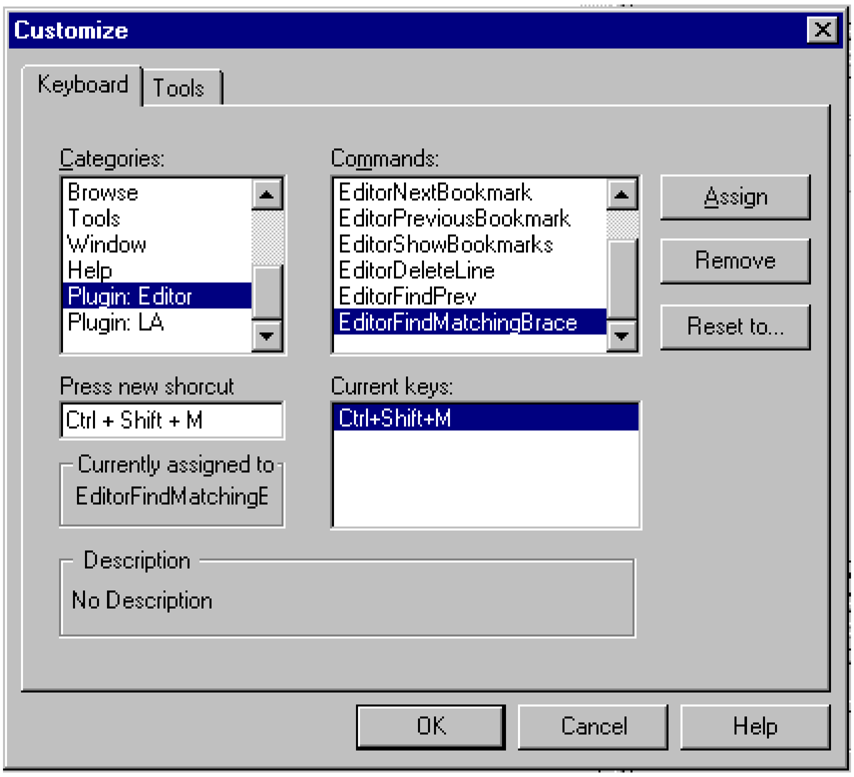
□ Match whole word only
□ Match case
□ Regular expression

Replace in
○ Selection
● Whole file

The Replace Dialog

Find Matching Brace option

The editor includes an option to find the matching brace. This option by default does not have any keyboard shortcut assigned to nor is there an option in the menu. Therefore, a keyboard shortcut must be manually selected in the Tools/Customize menu. In the Keyboard shortcut configuration menu the command for this option, “EditorFindMatchingBrace”, can be found in the category “Plugin: Editor”. Select a keyboard shortcut that would best fit your needs.



Press new shorcut: Ctrl + Shift + M

Currently assigned to: EditorFindMatchingE

Current keys: Ctrl+Shift+M

Description: No Description

Customize dialog, Keyboard shortcut configuration

For more information, see “Keyboard Shortcuts” on page 342.

Clipboard operations

winIDEA supports Windows clipboard copy, paste and cut operations.

Copying Text to Clipboard

- Select a block of text
- Select the 'Copy' command from the Edit menu.

Cutting Text to Clipboard

- Select a block of text
- Select the 'Cut' command from the Edit menu.

The selected block will be removed from the editor.

Pasting Text from Clipboard

- Make sure the desired text is placed in the clipboard.
- Position the insertion point to the place where you wish to insert the text
- Select the 'Paste' command from the Edit menu.

Drag and Drop

A quick alternative to clipboard's copy and paste operation when it comes to simple move or copy operations inside winIDEA is the usage of editor's drag and drop ability.

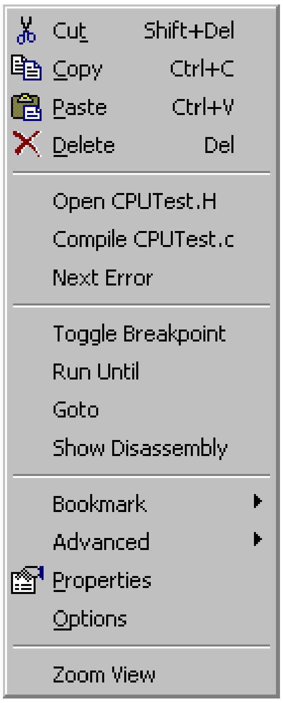
Moving Text using Drag and Drop

- Select a block of text
- Place the mouse cursor over the selected block of text – the text drag cursor will replace the I beam cursor
- Press the left mouse button
- While keeping the left mouse button pressed, move the mouse to the location where you wish to move the selected block
- Release the mouse button

Copying Text using Drag and Drop

- Select a block of text
- Place the mouse cursor over the selected block of text – the text drag cursor will replace the I beam cursor
- Press the left mouse button
- While keeping the left mouse button pressed, move the mouse to the location where you wish to move the selected block
- Before releasing the mouse button, press the 'Ctrl' key.
- While keeping the 'Ctrl' key pressed, release the mouse button.

The Context Menu

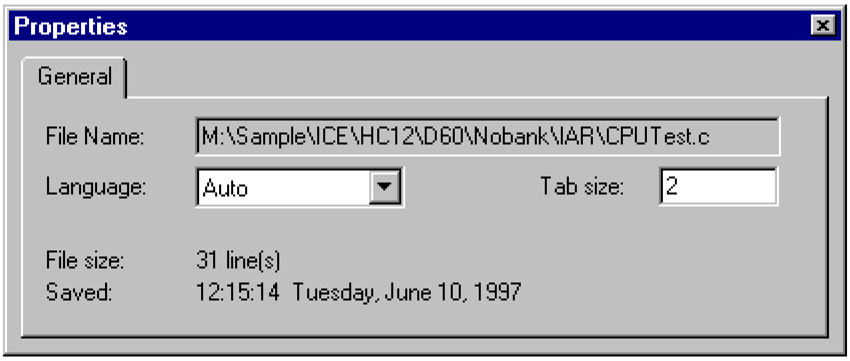


Edit Window's context menu

In the editor's popup context menu, you will find editor, build and debug commands that are used most often.

Editor Properties

Selecting the 'Properties' command from the context menu brings up a mini frame window showing properties of the current editor.



File Name: M:\Sample\ICE\HC12\D60\Nobank\IAR\CPUTest.c

Language: Auto

Tab size: 2

File size: 31 line(s)

Saved: 12:15:14 Tuesday, June 10, 1997

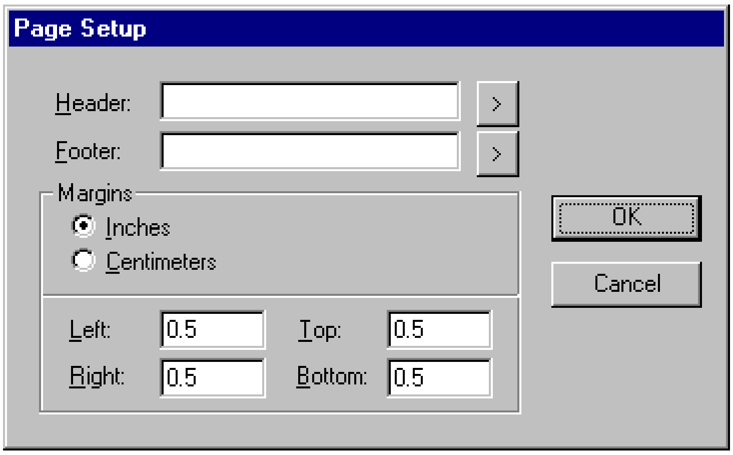
Editor Properties

Printing

winIDEA supports simple printout of the current editor window or selection contents.

Page Setup

In the Page Setup dialog the header, footer and paper margins are configured.



● Inches

○ Centimeters

Left: 0.5

Top: 0.5

Right: 0.5

Bottom: 0.5

Page Setup dialog

Header and Footer

You can configure any text as header or footer, as well as insert strings provided by winIDEA, such as file name, current date and time, etc. These macros are available by clicking the '>' button on the right of the edit line’s.

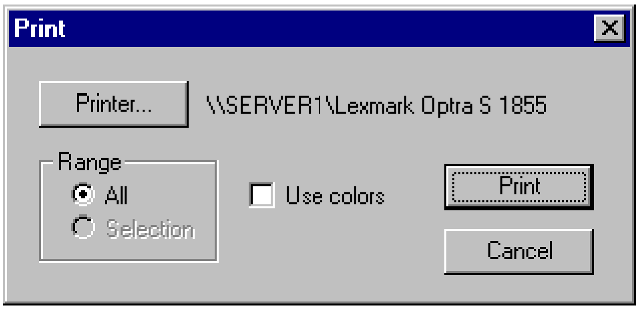
Margins

You can specify margins on all 4 sides of the paper.

Note that paper size, as well as other printer properties, is configured in Printer Settings available from the Print dialog.

Print

In the Print dialog, the printer, its settings, print range and optional coloring are configured.



Print dialog

Printer

Shows the printer on which the text will be printed. Use 'Settings…' to change the printer or its properties.

Range

Specifies whether the entire source file or only the current selection should be printed.

Use Colors

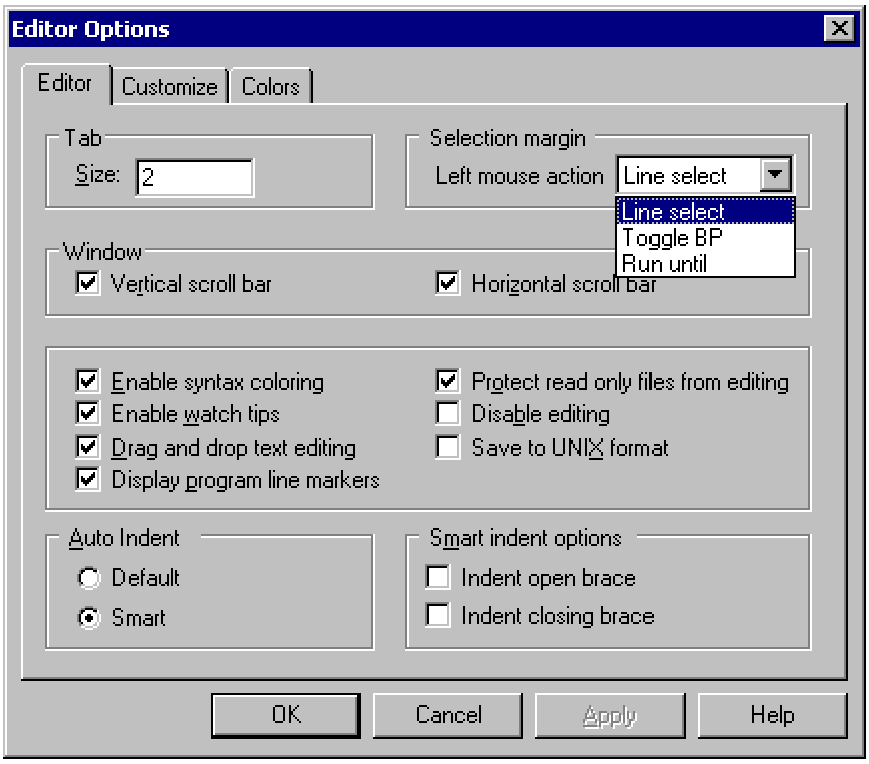
When checked, text will be printed in the colors used on the screen.

Print

Starts printing.

Configuring Editor Options

Several editor options can be customized. You will find them all in the editor pane of the Options dialog (Edit menu).



Editor Options

Editor | Customize | Colors

Tab
Size: 2

Selection margin
Left mouse action: Line select
Line select
Toggle BP
Run until

Window
☑ Vertical scroll bar
☑ Horizontal scroll bar

☑ Enable syntax coloring
☑ Enable watch tips
☑ Drag and drop text editing
☑ Display program line markers
☑ Protect read only files from editing
☐ Disable editing
☐ Save to UNIX format

Auto Indent
○ Default
● Smart

Smart indent options
☐ Indent open brace
☐ Indent closing brace

Editor Options pane

Tab Settings

Tab settings determine how the editor will interpret Tab characters in a file and how Tab keystrokes will be handled.

Tab size

determines character indent of each Tab character in the file

Selection margin

Left mouse action

The action upon the left mouse button click in the editor's selection margin is configurable between:

- Line select (default) – allows easier selection of multiple lines of text
- Toggle BP – toggles an execution breakpoint
- Run until – runs the CPU until it reaches the indicated source position

Window Settings

Vertical Scroll Bar

determines whether a vertical scroll bar is displayed or not.

Horizontal Scroll Bar

determines whether a horizontal scroll bar is displayed or not.

Enable syntax coloring

when checked, files which are compiled (typically .C files) are colored assuming ANSI C syntax.

Enable Watch Tips

when checked placing the mouse cursor over an expression that can be evaluated, evaluates and displays its value.

See "Watch Tips" on page 45.

Display Program Line Markers

When selected, a couple of characters wide margin is reserved for special markers like bookmarks, breakpoints, etc. on the left side of the editor. This way painting of indicators does not obscure syntax coloring or text selections.

Drag and Drop Text Editing

When enabled, the text can be dragged and dropped.

Protect Read-only Files from Editing

when checked, winIDEA will refuse to edit files with read-only attribute set. When cleared, winIDEA will allow editing but will ask for a new file name when attempting to save or close the modified file.

Disable Editing

When checked, winIDEA opens all files as read-only i.e. it will not allow any modifications to their contents.

Save to Unix format

When checked, the file is saved to Unix format. This means that when checked, text files are saved with LF only line delimiter. The default DOS format uses CR-LF delimiters.

Default Auto Indent

New line indentation is set to the same value as in the previous line.

Smart Auto Indent

New line indentation is set according to the text before previous editor caret position. Additionally you can choose to indent open and/or closing brace. Smart indent is supported only when editing C/C++ source or header files. Indentation step is the same as current tab size.

Further Customization

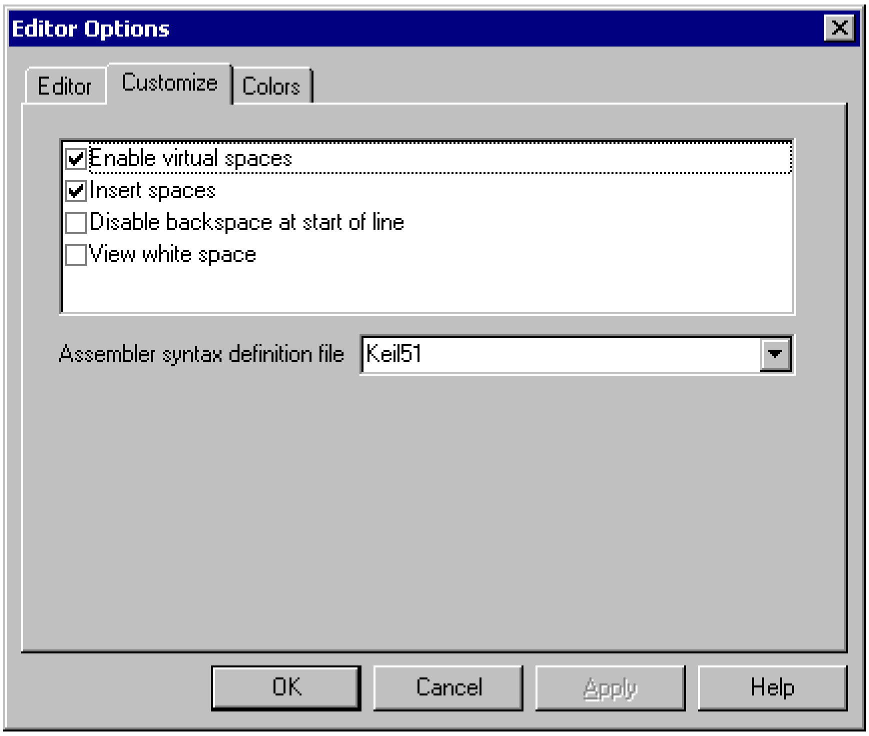
Enable Virtual Spaces

If enabled, the insertion point caret can be moved to locations where no text exists.

Insert Spaces

Specifies whether Tab keystrokes are written to file as Tab characters or an equivalent number of whitespace characters is written.

You may choose not to insert spaces to preserve disk space, this may however cause source debugging problems with compilers that generate column debug information and usually interpret tabs as 8 characters long. If you see displaced position indicators when debugging, either change the tab size to whatever size your compiler assumes, or select the 'Insert Spaces' option in the first place.



☑ Enable virtual spaces
☑ Insert spaces
□ Disable backspace at start of line
□ View white space

Assembler syntax definition file: Keil51

Customize Options pane

Disable Backspace at Start of Line

Prevents joining of lines using the Backspace key.

View White Space

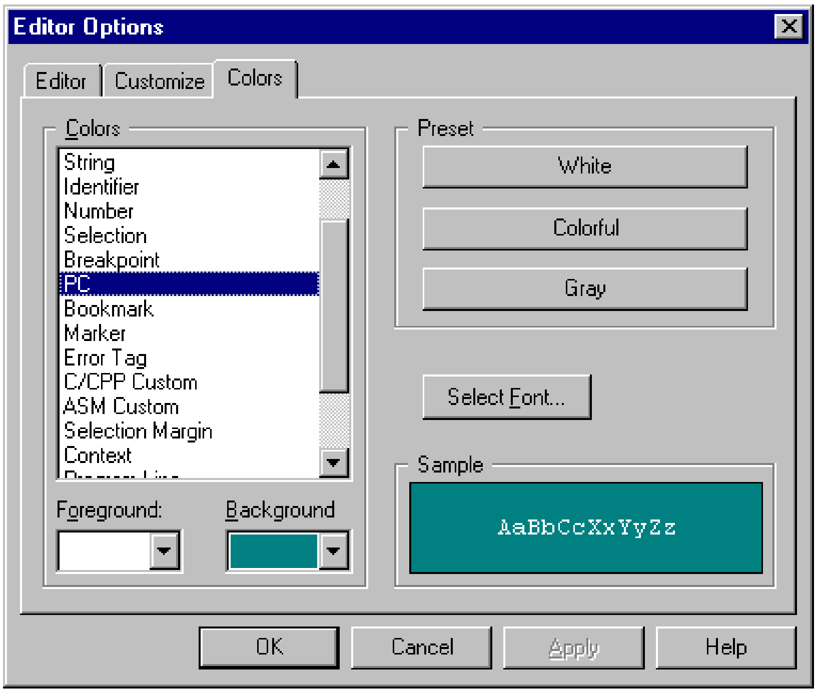
Shows white space characters (blanks and tabs).

Assembler Syntax Definition File

Since there is no syntax standard for assemblers, the syntax must be configured in a definition file specified here. The dialog will list all syntax definition files located in the ‘CCS’ subdirectory of winIDEA’s installation directory. If no color syntax coloring is required, leave the field blank. For more information on CCS file specification please see "Color Syntax Files Definition" on page 382.

Customizing Colors

The colors can be customized to your specific requirements. This can be done in the Editor/Options/Colors pane.



Editor Options

Colors:
- String
- Identifier
- Number
- Selection
- Breakpoint
- PC
- Bookmark
- Marker
- Error Tag
- C/CPP Custom
- ASM Custom
- Selection Margin
- Context

Sample: AaBbCcXxYyZz

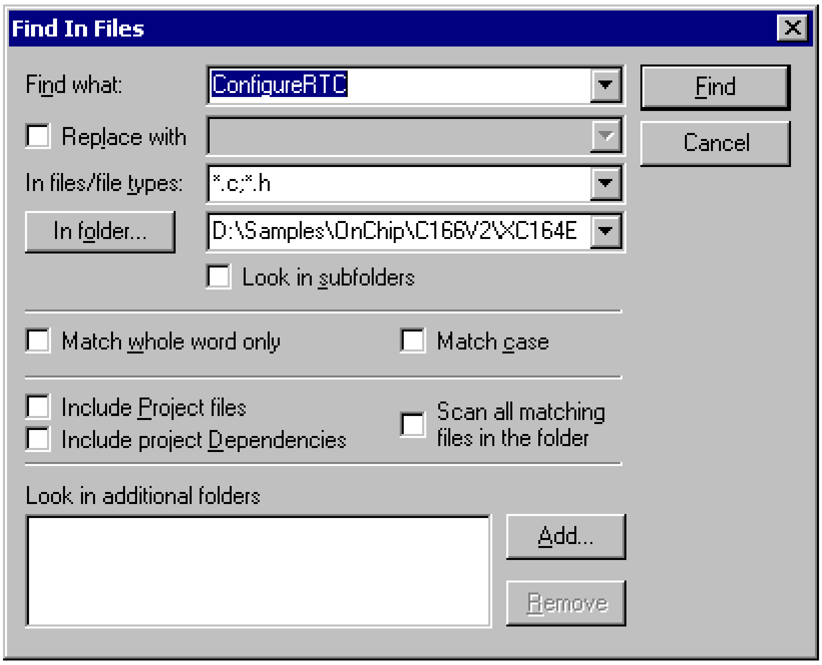
Editor Options, Colors pane

For every different view a color and font can be set. The color of the foreground and the background can be selected using the appropriate tabs, and the font using the ‘Select Font…’ tab.

Find in Files Utility

The Find in Files Utility is an integrated multi-file string search utility. With its aid, you can easily search for any string occurrence in any number of files.

To initiate the search, select the 'Find in Files…' command in the File menu. In the dialog that opens, select all of the files you wish to include in search.



Find what: ConfigureRTC

□ Replace with

In files/file types: *.c;*.h

In folder...: D:\Samples\OnChip\C166V2\XC164E

□ Look in subfolders

□ Match whole word only

□ Match case

□ Include Project files

□ Include project Dependencies

□ Scan all matching files in the folder

Look in additional folders

The Find in Files dialog

First, the string to be searched must be defined in the 'Find what' box and the file types or file names in the 'In files/file types' box and the base folder, in which the string is to be searched.

The search string can be replaced with another, if the ‘Replace with’ option is checked and the replacement string is entered.

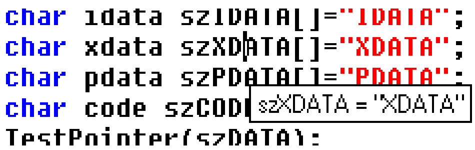
The search options can be defined next, whether only whole words should be found, the case should be matched and whether to look for occurences in subfolders.

You can easily include all your project files by checking 'Include Project files', files that they depend on by checking 'Include project Dependencies', or any number of files and directories of your choice, you have entered in the 'Look in additional folders' box. If 'Scan all matching files in folder' is checked, all files matching the 'In files/file types' description in all folders, where project files (if 'Include Project files' is checked) or project dependencies (if 'Include project Dependencies' is checked) reside.

Find in Files results are shown in the Output Window (see "Output Window" on page 264) on the Find In Files pane. Simple double clicking on a line displayed in the Output Window will open the file and position you at the place where the string was found.

Watch Tips

Watch Tips are an advanced debugging aid. Instead of entering the variable name whose value you wish to view, you can let the mouse cursor rest over the variable name in the editor for a moment. Its value (if it can be calculated) is displayed in a small popup 'Watch Tip' which goes away when you move the mouse again or start using the keyboard.



```
char idata szIDATA[]="IDATA";
char xdata szXDATA[]="XDATA";
char pdata szPDATA[]="PDATA";
char code szCOD
TestPointer(szDATA);
```

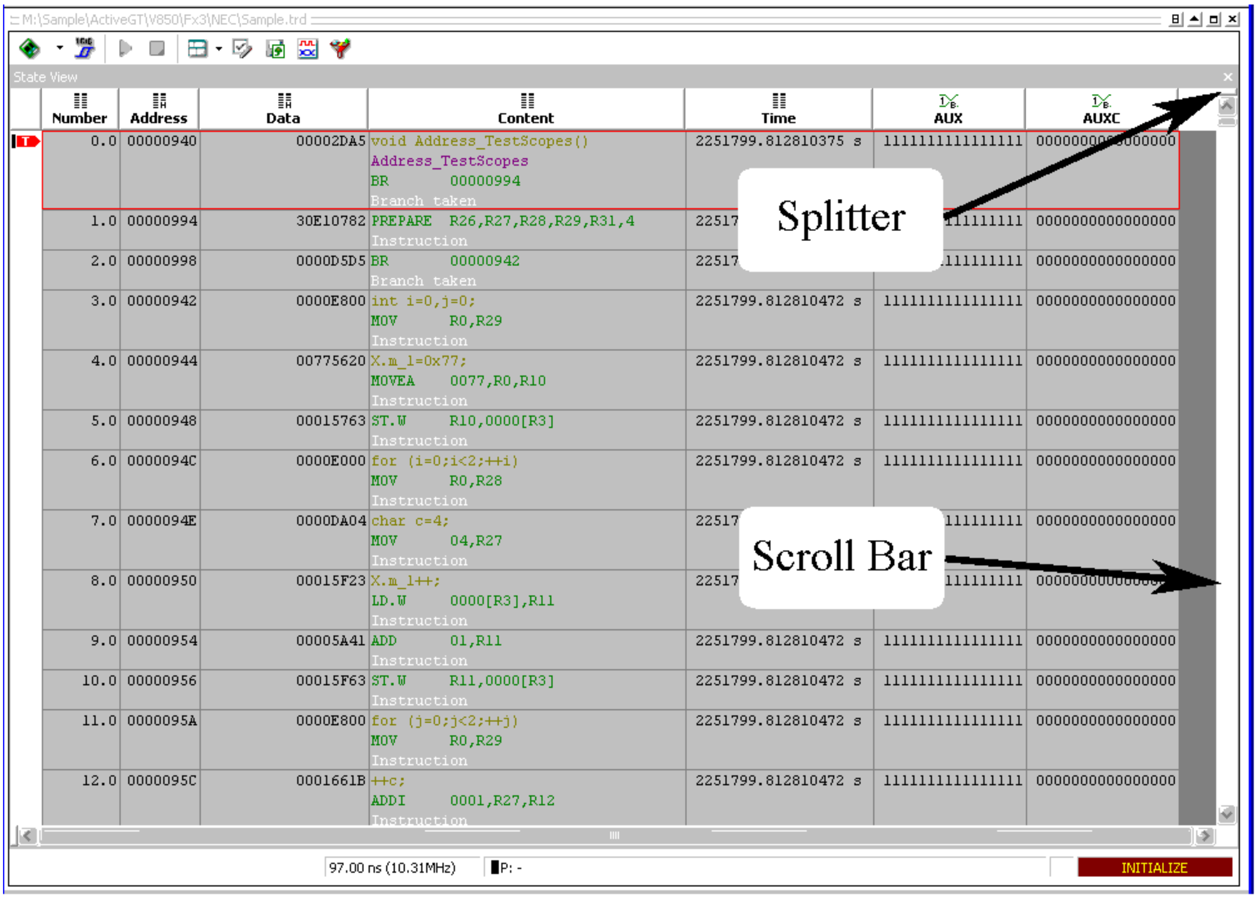
szXDATA variable value shown in a Watch Tip

The Trace

The Trace is a specially developed solution to make debugging easier. The Trace records the required data through the debug interface.

The Trace window is a document inside winIDEA. This gives the user the possibility to save all recordings into a file. Trace files have a .TRD extension.

When a Trace document is opened, the default window is shown.



M:\Sample\ActiveGT\V850\Fx3\NEC\Sample.trd

State View

	Number	Address	Data	Content	Time	AUX	AUXC
T	0.0	00000940	00002DA5	void Address_TestScopes() Address_TestScopes BR 00000994 Branch taken	2251799.812810375 s	1111111111111111	0000000000000000
	1.0	00000994	30E10782	PREPARE R26,R27,R28,R29,R31,4 Instruction	22517	11111111	0000000000000000
	2.0	00000998	0000D5D5	BR 00000942 Branch taken	22517	11111111	0000000000000000
	3.0	00000942	0000E800	int i=0,j=0; MOV R0,R29 Instruction	2251799.812810472 s	1111111111111111	0000000000000000
	4.0	00000944	00775620	X.m_l=0x77; MOVEA 0077,R0,R10 Instruction	2251799.812810472 s	1111111111111111	0000000000000000
	5.0	00000948	00015763	ST.W R10,0000[R3] Instruction	2251799.812810472 s	1111111111111111	0000000000000000
	6.0	0000094C	0000E000	for (i=0;i<2;++i) MOV R0,R28 Instruction	2251799.812810472 s	1111111111111111	0000000000000000
	7.0	0000094E	0000DA04	char c=4; MOV 04,R27 Instruction	22517	11111111	0000000000000000
	8.0	00000950	00015F23	X.m_l++; LD.W 0000[R3],R11 Instruction	22517	11111111	0000000000000
	9.0	00000954	00005A41	ADD 01,R11 Instruction	2251799.812810472 s	1111111111111111	0000000000000000
	10.0	00000956	00015F63	ST.W R11,0000[R3] Instruction	2251799.812810472 s	1111111111111111	0000000000000000
	11.0	0000095A	0000E800	for (j=0;j<2;++j) MOV R0,R29 Instruction	2251799.812810472 s	1111111111111111	0000000000000000
	12.0	0000095C	0001661B	++c; ADDI 0001,R27,R12 Instruction	2251799.812810472 s	1111111111111111	0000000000000000

97.00 ns (10.31MHz) P: -

Default window

In this window, the signal values can be monitored. The times are organized vertically while the signals are organized horizontally. Different states can be defined. A state can be defined with a simple statement (for example, when signal CH100 is high, this is the "Power On" state) or with more complex definitions (for example, when signal CH100 is high or signal CH101 is low and signal CH102 is high, this is the "Normal" state). The states are shown in a special column. The Timing and State views are described in detail later.

Getting Started

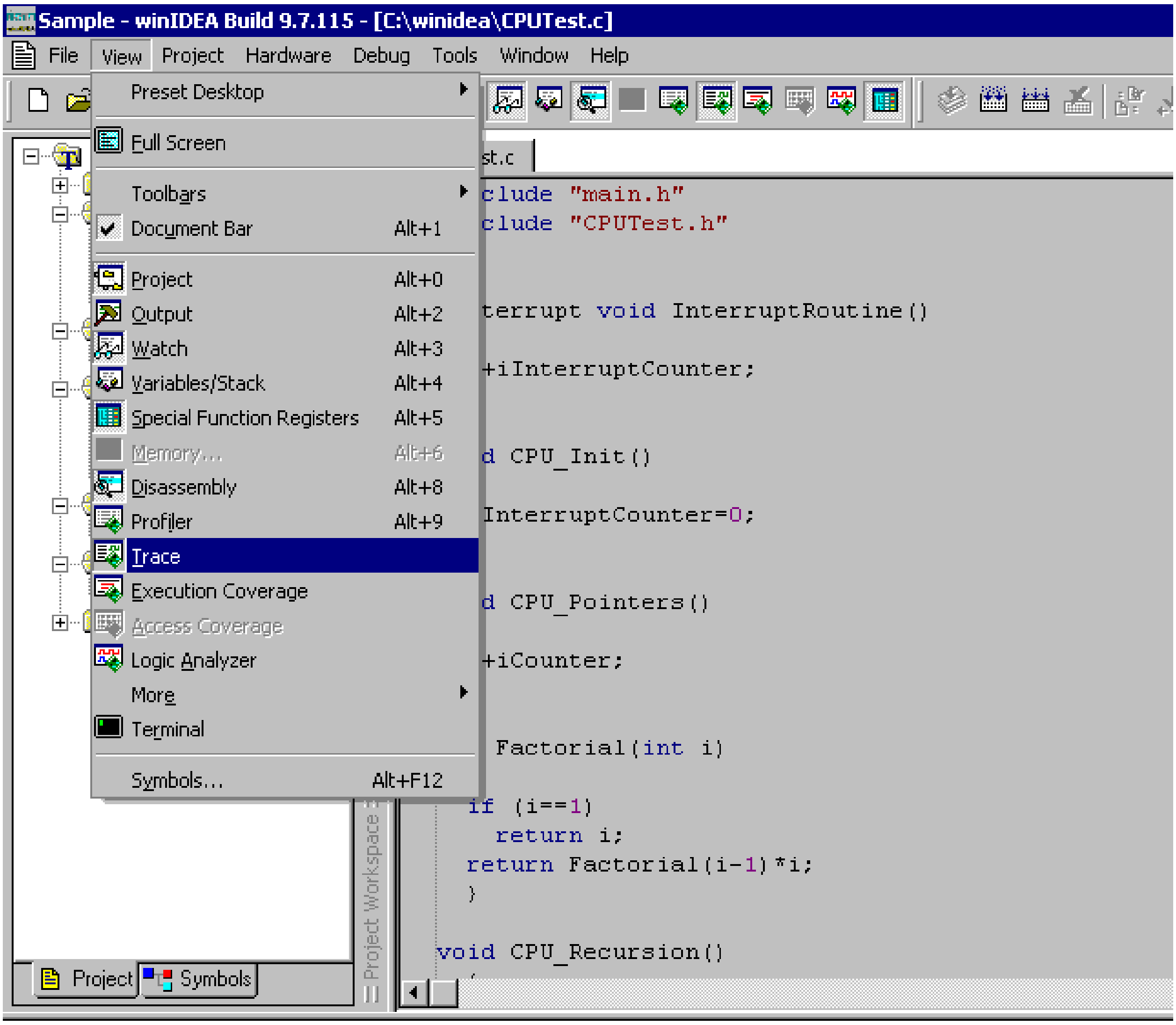
To start using the Trace, the first step is to configure the hardware. Please see the Setting up the Hardware section.

When working with the Trace, please note that the menus are dependent on the window, which is focused. If for example you are working with the Editor, the options in the menu are related to the editor, if you are working with the Trace, the menus shown are related to the Trace.

To focus a window, left-click on it. The focused window can be identified with two blue stripes in the name or description of the window.

Creating and Opening Trace Documents

The easiest way to create new and open existing Trace documents is by using the icons in the View toolbar or by using the View menu.



```
clude "main.h"
clude "CPUTest.h"

terrupt void InterruptRoutine()

+iInterruptCounter;

d CPU_Init()

InterruptCounter=0;

d CPU_Pointers()

+iCounter;

 Factorial(int i)

if (i==1)
  return i;
return Factorial(i-1)*i;
}

void CPU_Recursion()
```

The View menu and View toolbar

To open a Trace document, click on the **Trace** button or select the appropriate one from the menu.

When opening a document with these buttons, always a document with the same filename as the workspace is opened. For example, if the workspace is named Sample, the Trace document Sample.TRD is opened. If a document with this name does not yet exist, it is created.

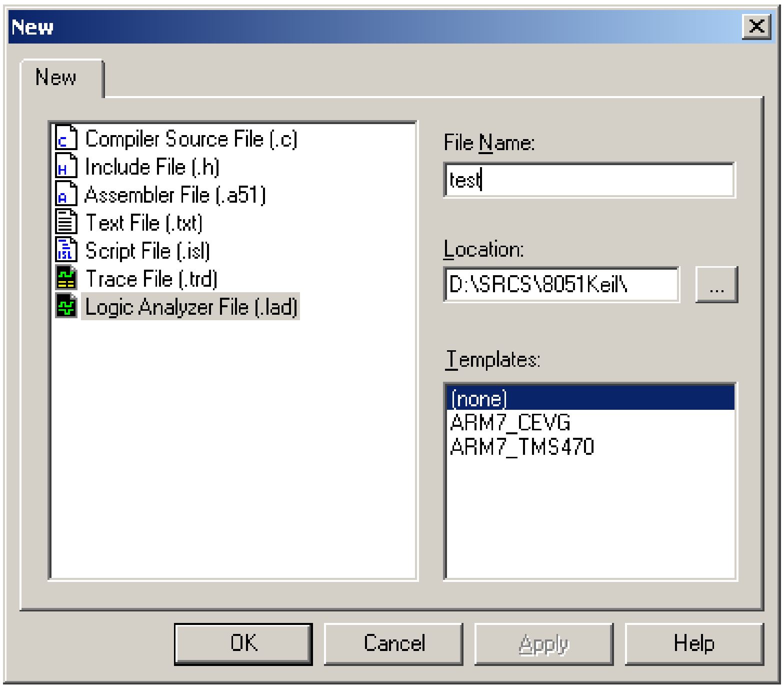
If the button is pressed again, the document is closed.

Creating a new Trace Document

The Trace documents are saved in separate files with all details. If a special recording is required, that you would not like to save as the default Trace document, a new Trace document can be created.

To create a new Trace document, select ‘New’ from the ‘File’ menu.

A dialog box appears where a new file name and file location is entered.



- Compiler Source File (.c)
- Include File (.h)
- Assembler File (.a51)
- Text File (.txt)
- Script File (.isl)
- Trace File (.trd)
- Logic Analyzer File (.lad)

File Name: test

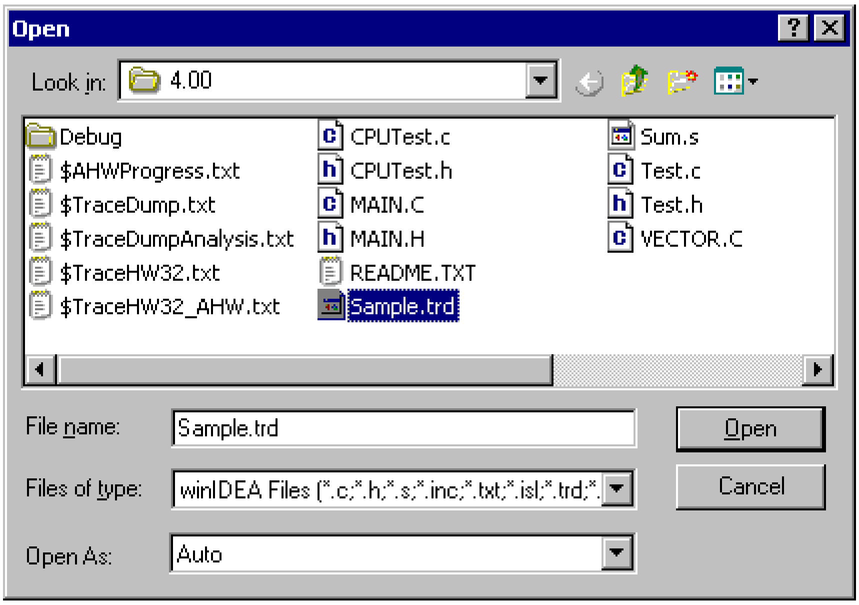
Location: D:\SRCS\8051Keil\

Templates:
- (none)
- ARM7_CEVG
- ARM7_TMS470

New file dialog

When new files are created, templates can be used. Template files are files located in the Templates folder (located under the folder where winIDEA was installed). Some templates are provided, but the user can also use his own. The templates will be discussed later on.

Opening an Trace Document



Look in: 4.00

Debug	CPUTest.c	Sum.s
$AHWProgress.txt	CPUTest.h	Test.c
$TraceDump.txt	MAIN.C	Test.h
$TraceDumpAnalysis.txt	MAIN.H	VECTOR.C
$TraceHW32.txt	README.TXT	
$TraceHW32_AHW.txt	Sample.trd	

File name: Sample.trd

Files of type: winIDEA Files (*.c;*.h;*.s;*.inc;*.txt;*.isl;*.trd;*.

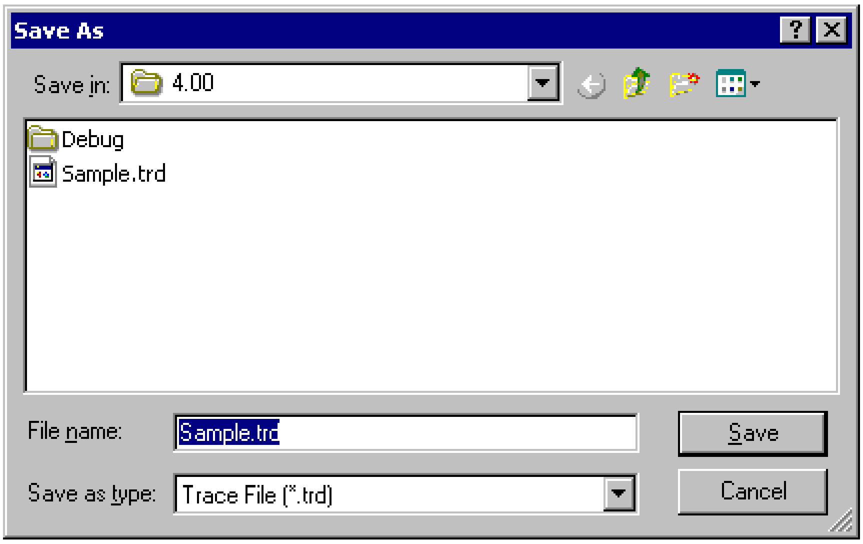
Open As: Auto

Open dialog

To open an existing Trace document, select ‘Open’ from the ‘File’ menu. This is especially useful if the recordings have been saved to another file, not the default Trace document.

A file selection dialog box appears. Select the file you want to open and click ‘Open’. The Trace files have a TRD extension.

Saving a Trace Document



Save As

Save in: 4.00

Debug
Sample.trd

File name: Sample.trd

Save as type: Trace File (*.trd)

Save as dialog

After you’ve recorded a sequence that you would like to save, select ‘Save’ or ‘Save As’ from the ‘File’ menu.

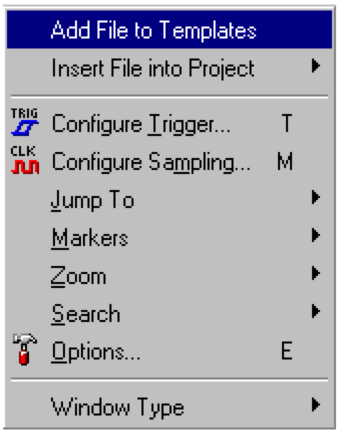
A dialog box appears where the default name can be confirmed or a new one can be entered.

Creating Templates

The user can create his own templates for all documents, including the Trace document.

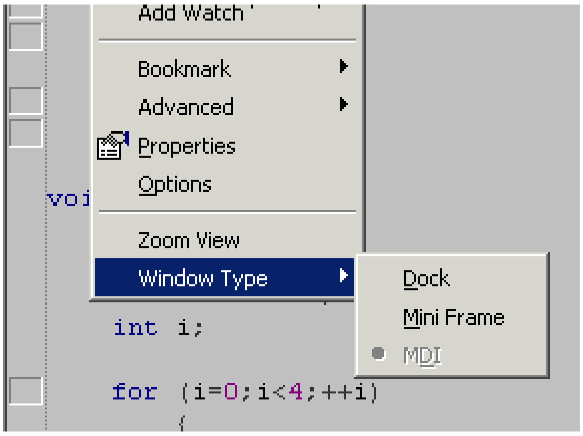
In a template, all settings will be saved and new files with the same initial settings can be generated. This is especially useful when, for example, multiple Trace recordings are needed, but all with the same settings for signals and groups.

To create a template, right-click with the mouse in the Trace window and select the **'Add File to Templates'** option.



The Add File to Templates option

The Trace Window Type



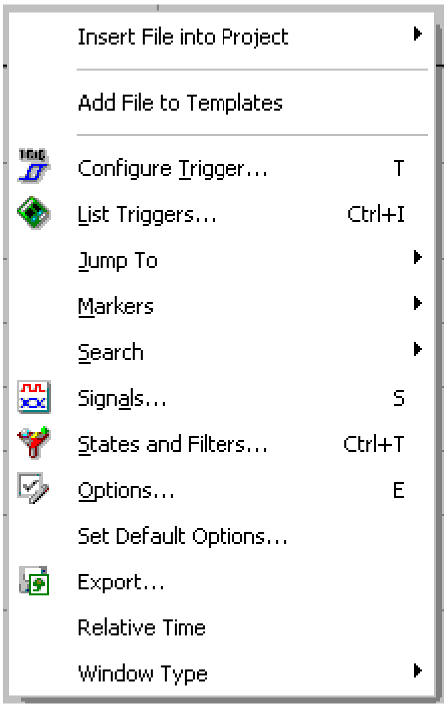
```
voi
    int i;

    for (i=0;i<4;++i)
```

All documents can be either docked in the main window, used as a mini frame or as a normal document in a MDI (Multiple Document Interface). Use the context menus to select docking options.

Context Menus

By right-clicking the mouse a context menu occurs. The content of the menus depends on where the mouse has been clicked. Different context menus are available when the mouse has been clicked on a signal name or when it has been clicked in the signals area. Options are briefly described here, for more information please see the appropriate section in the manual.

State View



When the context menu is invoked in the State view by clicking on a signal, these options are shown.

Insert File into Project

The Trace file can be inserted into the project into any of the existing groups.

Add File to Templates

The Trace file can be saved as a template with this option.

Configure Trigger

The trigger can be configured here.

List Triggers

Displays the list of Triggers.

Jump To

This option allows you to jump to the Trigger Position, the Pointer or the Source. The option Synchronize allows you to synchronize the two views (Timing and State).

Markers

Markers can be set and removed and the zero point can be set and reset.

Search

The Search option allows you to find occurrences of certain samples. Also, the next and the previous occurrence can be found.

Signals

The Signals dialog is invoked with this option.

States and Filters

The States and Filters dialog is invoked with this option.

Options

The Trace Options can be set in the Options menu.

Set Default Options

By selecting this option, the current view options will be used when creating a new document.

Relative Time

The time can be displayed in either absolute format or relative to the CPU start. If relative time display is desired, select this option.

Working with Signals

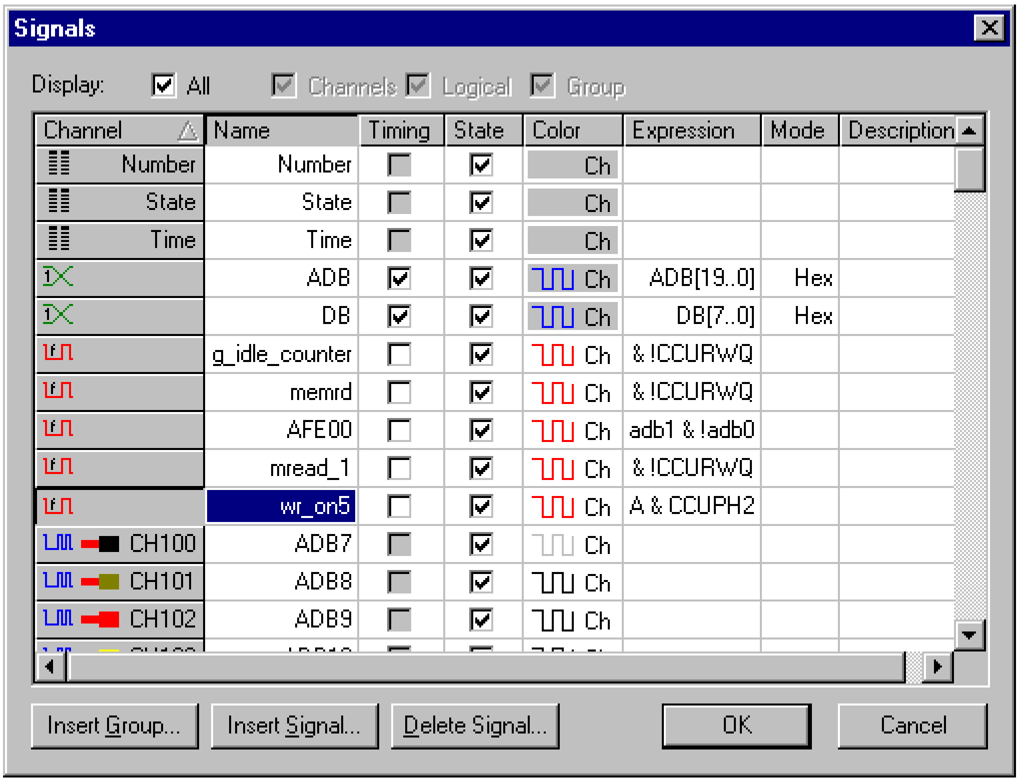
A Signal is a base unit when working with the Trace and represents data, monitored through Trace. The signals can be edited either in the Signals menu or in the main Trace window in State or Timing view.

There are a few rules concerning signal names:

- Signal names must start with the character ‘A’ trough ‘Z’, ‘a’ trough ‘z’ or underscore. They mustn’t start with the number or any other non-alpha character. Also, the space and local characters can not be used in the signal name.
- The signal names are case insensitive, therefore the name *A001* and *a001* are the same signal.
- The leading zeros in the signal name are ignored, therefore the name *A001* is the same signal as *A1*.

Editing Signals in the Signals dialog

The signals can be managed in the Signals dialog, invoked in the Edit/Signals menu, by pressing the shortcut **S** or by clicking on the **Configure Signals** icon in winIDEA.



Channel	Name	Timing	State	Color	Expression	Mode	Description
Number	Number	☐	☑	Ch			
State	State	☐	☑	Ch			
Time	Time	☐	☑	Ch			
	ADB	☑	☑	Ch	ADB[19..0]	Hex	
	DB	☑	☑	Ch	DB[7..0]	Hex	
	g_idle_counter	☐	☑	Ch	& !CCURWQ		
	memrd	☐	☑	Ch	& !CCURWQ		
	AFE00	☐	☑	Ch	adb1 & !adb0		
	mread_1	☐	☑	Ch	& !CCURWQ		
	wr_on5	☐	☑	Ch	A & CCUPH2		
CH100	ADB7	☐	☑	Ch			
CH101	ADB8	☐	☑	Ch			
CH102	ADB9	☐	☑	Ch			

Signals dialog

Selecting the signals is best done with the mouse. The Signals dialog utilizes both mouse buttons. The left mouse button can be used as in every other window in Windows:

- To select a single signal, click the signal name,
- To select multiple signals, press the **SHIFT** or **CTRL** key, click the first signal name, hold the key, move the mouse pointer over another signal name and left click – the **SHIFT** key selects all signals between the two mouse clicks, the **CTRL** key selects only the signals you click on. The combination of **SHIFT** and **CTRL** keys can also be used.

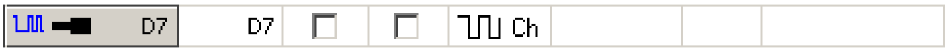
To edit the selected cell or cells, click on the cell, which has last been selected (the focused cell). The left-click anywhere outside the focused cell unselects the cells.

The right mouse button is used in this dialog strictly for editing. You can right-click on any selected cell and this will invoke the editing of that field. By using the right mouse button there is no fear to lose the cell selection.

The first column shows the hardware related channel names, which can not be changed and displays the type of the signal shown in that row.

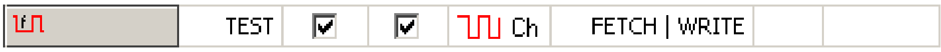
In general, there are four types of signals, marked with different icons:

- Physical signals



Each channel corresponds to one physical connection

- Logic signals



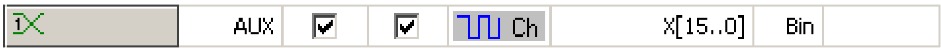
Defined by user (with expression similar to C expressions)

Available operators: OR, XOR, AND, NOT, EQUAL, NOT EQUAL

Available constants: HEX, DEC, BIN, debug symbol, strings

Expression:	Evaluates to one when:
CH100	CH100 equals 1
CH100==0	CH100 equals 0
CH100 & CH101	CH100 equals 1 and ch101 equals 1
ADR1==0x100	ADR1 equals 0x100
ADR1=={Type_Struct}	ADR1 equals value of symbol Type_Struct
Content==”mov”	CONTENT signal has “mov” string in state view

- Group signals

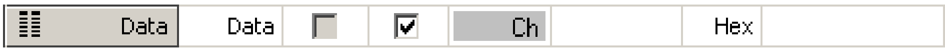


Defined as group of up to 64 other signals

Each binary signal can be in any number of groups

Display mode can be set to HEX, BIN or DEC

- State signals



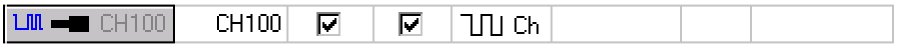
Available only in TRD files for trace and in LAD files if bus analysis is implemented

The next cell contains the signal name, which can be changed by clicking on the name.

The next two columns hold the signal status for timing and for state view. Signal status is displayed with a checkbox.

☑ Visible Signal □ Hidden Signal

The signal can also be unavailable (in both Timing and State views). This status occurs when the signal is not available in the hardware. If a signal is not available, its name is in gray color.



These states mean the following:

- **Enabled**. Signal is visible and active.
- **Hidden**. Signal is not visible and its value is not calculated.
- **Not Available**. Signal is not active and its value is not calculated.

To change signal’s status, click inside the white rectangle. The status changes cyclically from visible to disabled (in timing view) to hidden state. Also the status of selected signals can be changed.

To change the ‘Not Available’ state, the hardware configuration must be changed. The signal corresponds to the physical signal on the inactive module – refer to Hardware User’s Guide, the ‘Trace’ section.

The fifth column holds the colors of the signal line, signal background and the value. To change it, click on the colored rectangle. A color selection pop-up appears. The procedure to change color is the same as already explained in the subchapter “Global Settings”.

Expressions are displayed in the next column, but only for logical and group signals. To change the signal’s expression, double-click or right-click the cell. This invokes the ‘Define Logical Signal Expression’ or the ‘Define Group Signal Expression’ dialog depending on the signal type. If the expression is not valid, the old expression is preserved.

The display mode of signals can be changed. The values can be displayed Binary, Decimal or Hexadecimal. The display mode can only be changed for signals that evaluate to more than one bit (if a signal only has a logical state of 0 or 1, the display mode can not be changed).

You can describe every signal in the ‘Descriptions’ field for better explanation.

Insert Group

To insert a new group, press the **Insert Group** button. Creation of groups will be discussed in detail later.

Insert Signal

To insert a new logical signal, press the **Insert Signal** button. Creation of signals will be discussed in detail later.

Delete Signal

To delete a signal, press the **Delete Signal** button.

Only logical, group and 'Not Available' signals can be deleted. Physical signals (channels) can not be deleted. To delete a signal, select it and select ‘Delete’ from the pop-up menu or press the shortcut **Del**. A message box will appear asking you to confirm the deletion.

Let’s take a look at the following signals:

A = CH100 & CH101

B = A & CH102

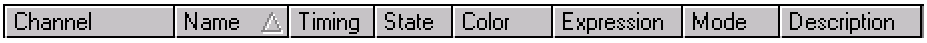
B signal is dependent on A signal. If A signal is deleted, B signal will be removed as well.

When a group signal is created, all contained signals become hidden by default. If such a signal is deleted, all contained signals are displayed back.

Sorting signals

The signals inside the Signals dialog can be sorted by every column.

To sort the signals, for example, by name, right-click the button Name on top of the column. Right-click the button again to alternate between ascending and descending sorting. An arrow will occur next to the name by which the signals are sorted.



In this case, the signals are sorted ascending by name.

Renaming signals

Every signal can be renamed. To rename a single signal, double-click with the left mouse button or right-click the name of the signal that you wish to rename and type the new name.

If the new signal name matches the name of some other signal, program warns you with error message “Invalid Signal Name”. You have to change the signal name to avoid conflict with other signals.

Repetitive tasks, such as naming bus signals are simplified. Type a new name with an index at the tail of the name. For example: rename **CH103** to **DATA1**. Don’t press **ENTER**. Instead, press the down arrow. You can see a suggested name (**DATA2**) for the next signal. To accept it press **ENTER**, to discard it press the **ESC** key and to continue renaming signals press down arrow again. Auto decrement works in the same way, except that the number at the end of the name decreases until it reaches zero. To auto decrement signal name, press the up arrow.

Also, multiple signals can be renamed at once. For example, if you wish to rename signals from **CH100** to **CH104** to **A100** to **A104**, select the signals from **CH100** to **CH104**, edit one of the signals, type A instead of CH, then press Enter or click outside the edit box. The numerical part of the signal name will be preserved and the text part of the signal name will be changed. If the name contains no numerical information, the name will not be changed.

If the entered signal name already exists, the previous name will be preserved. Immediately after the new name is accepted, the changed signal name is visible in the signal names area.

To accept all changes click ‘OK’, to discard them, click ‘Cancel’ or press ‘ESC’.

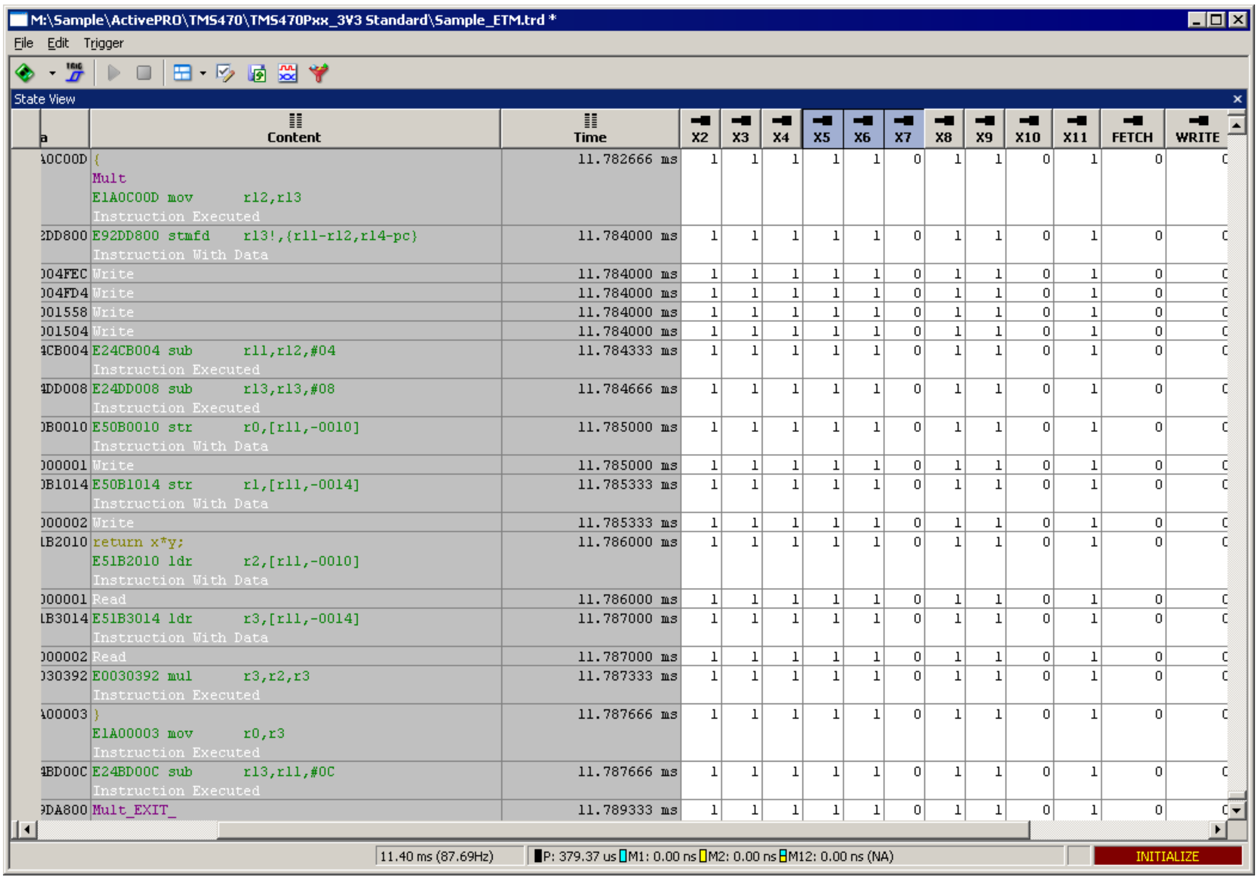
The signal can be renamed regardless of its status (hidden, disabled, visible).

The signals can be displayed in the Signals window all at once or by groups. To select just a certain group of signals, deselect 'All' and select the required group. For example, to display the Group signals, deselect 'All' and select 'Group' only.

Selecting Signals

On many occasions it is more convenient to have some signals grouped together and for this you have to move some signals from one position to the other. By selecting the required signals you can simply drag and drop them.

Signals can be selected only within the signal names area. The procedure to select signals is the same as selecting files in the Windows Explorer.



M:\Sample\ActivePRO\TMS470\TMS470Pxx_3V3 Standard\Sample_ETM.trd *
File
Edit
Trigger
State View

a	Content	Time	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	FETCH	WRITE
A0C00D	{ Mult E1A0C00D mov r12,r13 Instruction Executed	11.782666 ms	1	1	1	1	1	0	1	1	0	1	0	C
2DD800	E92DD800 stmfd r13!,{r11-r12,r14-pc} Instruction With Data	11.784000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)04FEC	Write	11.784000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)04FD4	Write	11.784000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)01558	Write	11.784000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)01504	Write	11.784000 ms	1	1	1	1	1	0	1	1	0	1	0	C
4CB004	E24CB004 sub r11,r12,#04 Instruction Executed	11.784333 ms	1	1	1	1	1	0	1	1	0	1	0	C
4DD008	E24DD008 sub r13,r13,#08 Instruction Executed	11.784666 ms	1	1	1	1	1	0	1	1	0	1	0	C
)B0010	E50B0010 str r0,[r11,-0010] Instruction With Data	11.785000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)00001	Write	11.785000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)B1014	E50B1014 str r1,[r11,-0014] Instruction With Data	11.785333 ms	1	1	1	1	1	0	1	1	0	1	0	C
)00002	Write	11.785333 ms	1	1	1	1	1	0	1	1	0	1	0	C
1B2010	return x*y; E51B2010 ldr r2,[r11,-0010] Instruction With Data	11.786000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)00001	Read	11.786000 ms	1	1	1	1	1	0	1	1	0	1	0	C
1B3014	E51B3014 ldr r3,[r11,-0014] Instruction With Data	11.787000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)00002	Read	11.787000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)30392	E0030392 mul r3,r2,r3 Instruction Executed	11.787333 ms	1	1	1	1	1	0	1	1	0	1	0	C
A00003	} E1A00003 mov r0,r3 Instruction Executed	11.787666 ms	1	1	1	1	1	0	1	1	0	1	0	C
4BD00C	E24BD00C sub r13,r11,#0C Instruction Executed	11.787666 ms	1	1	1	1	1	0	1	1	0	1	0	C
9DA800	Mult_EXIT_	11.789333 ms	1	1	1	1	1	0	1	1	0	1	0	C

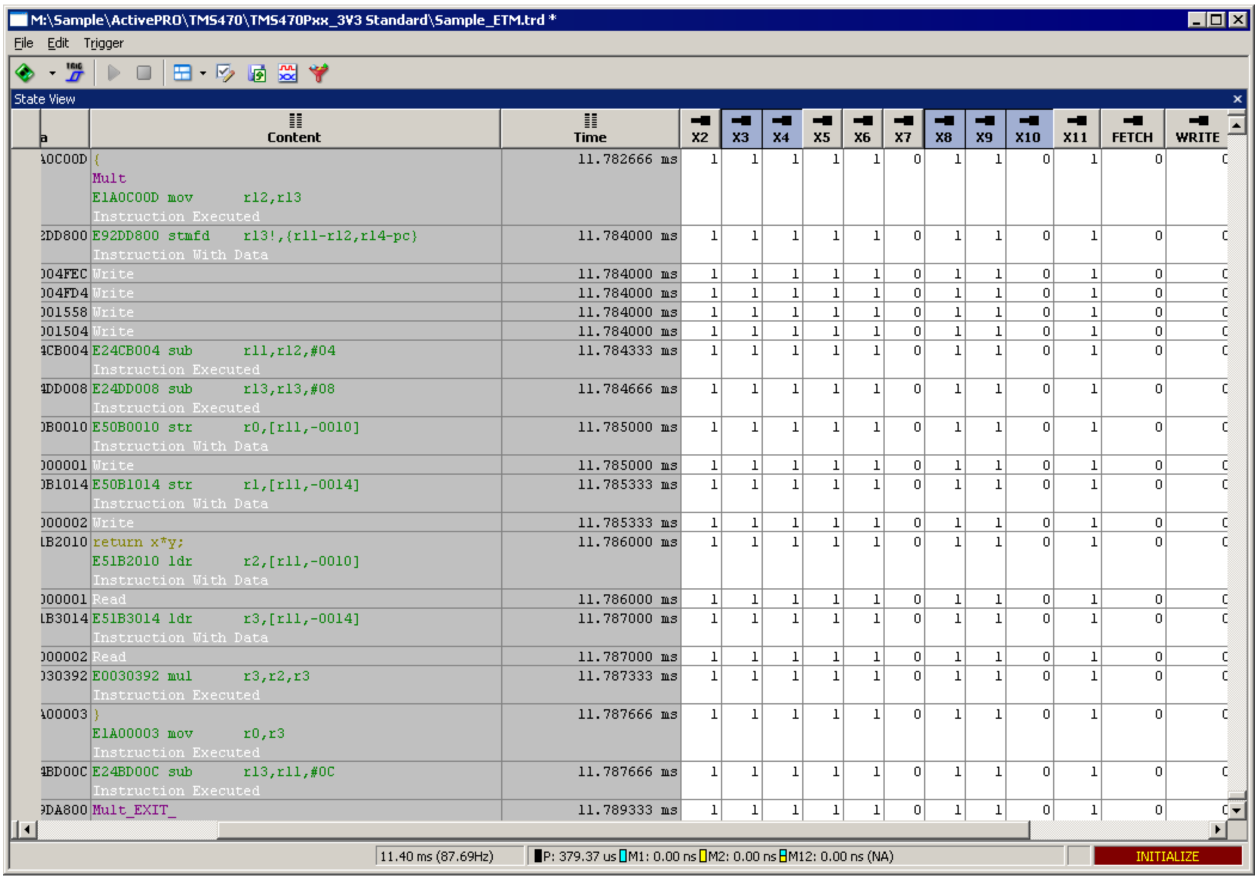
11.40 ms (87.69Hz) | P: 379.37 us M1: 0.00 ns M2: 0.00 ns M12: 0.00 ns (NA) | INITIALIZE

Selecting multiple signals

To select a single signal, click the signal name.

To select multiple signals, press the **SHIFT** or **CTRL** key, click the first signal name, hold the key, move the mouse pointer over another signal name and left click.

For example: press and hold the **SHIFT** key, left click the **X5** signal name, move the mouse over the signal **X7** and left click again. Selected signals are now highlighted.



M:\Sample\ActivePRO\TMS470\TMS470Pxx_3V3 Standard\Sample_ETM.trd *

a	Content	Time	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	FETCH	WRITE
A0C00D	{ Mult E1A0C00D mov r12,r13 Instruction Executed	11.782666 ms	1	1	1	1	1	0	1	1	0	1	0	C
2DD800	E92DD800 stmfd r13!,{r11-r12,r14-pc} Instruction With Data	11.784000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)04FEC	Write	11.784000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)04FD4	Write	11.784000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)01558	Write	11.784000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)01504	Write	11.784000 ms	1	1	1	1	1	0	1	1	0	1	0	C
4CB004	E24CB004 sub r11,r12,#04 Instruction Executed	11.784333 ms	1	1	1	1	1	0	1	1	0	1	0	C
4DD008	E24DD008 sub r13,r13,#08 Instruction Executed	11.784666 ms	1	1	1	1	1	0	1	1	0	1	0	C
)B0010	E50B0010 str r0,[r11,-0010] Instruction With Data	11.785000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)00001	Write	11.785000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)B1014	E50B1014 str r1,[r11,-0014] Instruction With Data	11.785333 ms	1	1	1	1	1	0	1	1	0	1	0	C
)00002	Write	11.785333 ms	1	1	1	1	1	0	1	1	0	1	0	C
1B2010	return x*y; E51B2010 ldr r2,[r11,-0010] Instruction With Data	11.786000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)00001	Read	11.786000 ms	1	1	1	1	1	0	1	1	0	1	0	C
1B3014	E51B3014 ldr r3,[r11,-0014] Instruction With Data	11.787000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)00002	Read	11.787000 ms	1	1	1	1	1	0	1	1	0	1	0	C
)30392	E0030392 mul r3,r2,r3 Instruction Executed	11.787333 ms	1	1	1	1	1	0	1	1	0	1	0	C
A00003	} E1A00003 mov r0,r3 Instruction Executed	11.787666 ms	1	1	1	1	1	0	1	1	0	1	0	C
4BD00C	E24BD00C sub r13,r11,#0C Instruction Executed	11.787666 ms	1	1	1	1	1	0	1	1	0	1	0	C
9DA800	Mult_EXIT_	11.789333 ms	1	1	1	1	1	0	1	1	0	1	0	C

11.40 ms (87.69Hz) P: 379.37 us M1: 0.00 ns M2: 0.00 ns M12: 0.00 ns (NA) INITIALIZE

Selecting multiple signals not in sequence

To select multiple signals that are not in sequence do the following: left click the **X3** signal, press and hold the **CTRL** key and left click the **X4** signal. Move the mouse over the **X8** signal and left click. Still hold the **CTRL** key, press and hold the **SHIFT** button, move the mouse over the **X10** signal and left click. You can now depress both keys.

To deselect selected signals, left click within the signals area.

If the main window is split, some signals can be selected in the upper and the others in the lower window. This is useful in case you are working with many signals and not all of them can be displayed at once.

Hiding Signals

Sometimes it is convenient for the user to be able to hide certain signals that he currently does not use or require. This way, a bigger number of signals important to the user can be seen at once on the screen.

Select the signals to hide. Within the signal names area right click and select ‘Hide’ from the pop-up menu or press the shortcut **CTRL + H**.

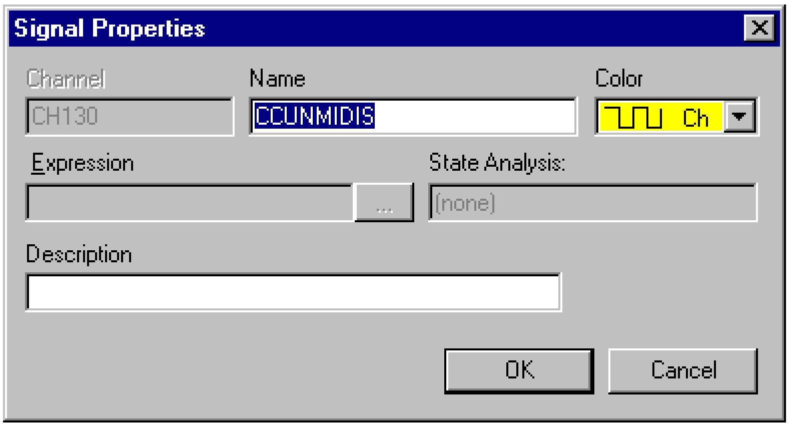
A hidden signal can be shown again through the Configure Signals menu.

Deleting Signals

Only logical, group and 'Not Available' signals can be deleted. To delete a signal, select it and select ‘Delete’ from the pop-up menu or press the shortcut **Del**. A message box will appear asking you to confirm the deletion.

Changing the Signals

Changing signal properties is a straightforward process. Select signals and right click within the signal names area. From the pop-up menu, select 'Properties' and the 'Signal Properties' dialog appears. Double-click with the left mouse button on the signal name area opens the 'Signal Properties' dialog as well. If more than one signal is selected only the properties that are common to all these signals are enabled. In general, if more than one signal is selected only the color field is enabled.



Signal Properties

Channel: CH130

Name: CCUNMIDIS

Color: Ch

Expression:

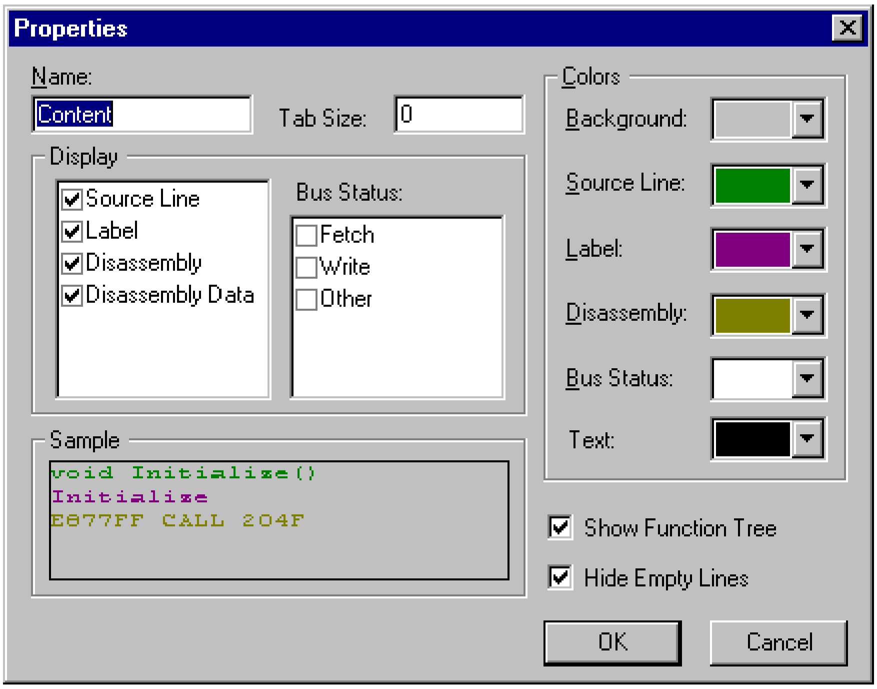
State Analysis: (none)

Description:

Signal properties dialog

In case if a logical signal or a group signal is selected, all the fields are enabled. If a channel is selected, the expression field is disabled.

Also, a different dialog can occur for a specific signal, especially in the case of the Content signal (the signal that contains the disassembly and source code).



Properties

Name: Content

Tab Size: 0

Display

- ☑ Source Line
- ☑ Label
- ☑ Disassembly
- ☑ Disassembly Data

Bus Status:

- □ Fetch
- □ Write
- □ Other

Sample

```
void Initialize()
Initialize
E877FF CALL 204F
```

Colors

- Background:
- Source Line: 🟩
- Label: 🟪
- Disassembly:
- Bus Status:
- Text: ⬛

☑ Show Function Tree

☑ Hide Empty Lines

Signal properties dialog for the Content signal

For this signal, special properties can be defined. The content that is to be shown can be selected in this dialog and the colors of the content can be modified. The sample content is shown for easier configuration.

If the **'Show Function Tree'** is unchecked, the function tree will not be generated. The Function Tree will be discussed in more detail later.

Empty lines can be hidden for a more readable display. This is done by checking the **'Hide Empty Lines'** checkbox.

Moving Selected Signals

If you want to monitor only a few dependant signals, it is much more convenient if they are located side by side. For example, if we would like to inspect channels 10 and 121 and would like them both to be visible in the same window, we need to reposition one signal to the other.

In order to change signal positions they must be selected first. Left click and hold the mouse button on one of the selected signals. Cursor changes to reflect the currently active operation. Move the mouse up or down to drag the signals. If the selected signals are not in a sequence, they will be, after the drag operation is completed. While you drag with the mouse a hashed line is displayed under the cursor, which helps you to visually determine the new position for the signal. If the cursor passes the application borders or signals area, the program ensures that the dashed line (target position of signals) is always visible.

To cancel the drag operation, press the **ESC** key.

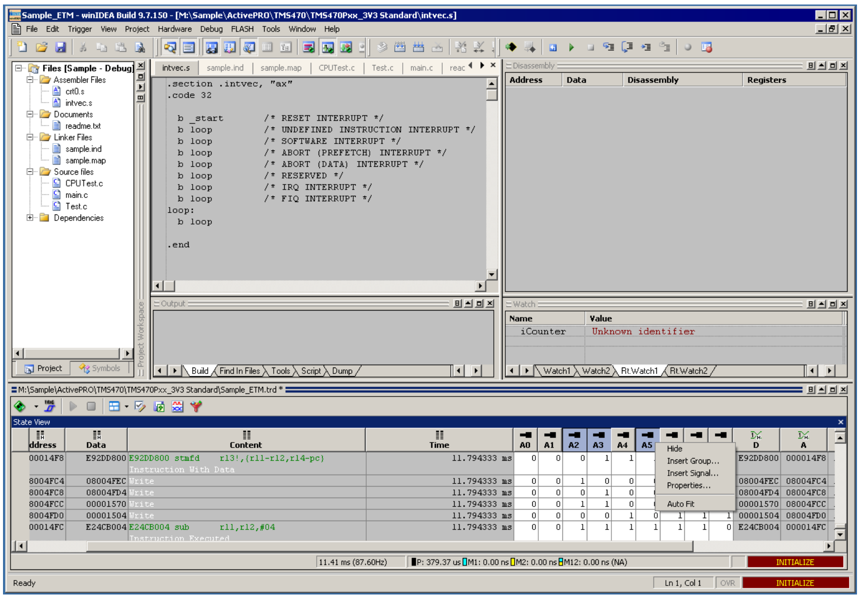
Renaming Signals

Renaming signals can be done in the Properties window. Invoke the properties of the signal and the 'Name' field will be automatically selected. Change the signal name and click ‘OK’ to accept changes or ‘Cancel’ to discard changes.

If the new signal name matches the name of some other signal, program warns you with error message “Invalid Signal Name”. You have to change the signal name to avoid conflict with other signal.

The signals can be also renamed in the Signals dialog.

Creating Group Signals


Sample_ETM - winIDEA Build 9.7.150 - [M:\Sample\ActivePRO\TMS470\TMS470Pxx_3V3 Standard\intvec.s]

```
.section .intvec, "ax"
.code 32

  b _start        /* RESET INTERRUPT */
  b loop          /* UNDEFINED INSTRUCTION INTERRUPT */
  b loop          /* SOFTWARE INTERRUPT */
  b loop          /* ABORT (PREFETCH) INTERRUPT */
  b loop          /* ABORT (DATA) INTERRUPT */
  b loop          /* RESERVED */
  b loop          /* IRQ INTERRUPT */
  b loop          /* FIQ INTERRUPT */
loop:
  b loop

.end
```

Name	Value
iCounter	Unknown identifier

M:\Sample\ActivePRO\TMS470\TMS470Pxx_3V3 Standard\Sample_ETM.trd *

State View

ddress	Data	Content	Time	A0	A1	A2	A3	A4	A5				D	A
00014F8	E92DD800	E92DD800 stmfd r13!,{r11-r12,r14-pc} Instruction With Data	11.794333 ms	0	0	0	1	1					E92DD800	000014F8
8004FC4	08004FEC	Write	11.794333 ms	0	0	1	0	0					08004FEC	08004FC4
8004FC8	08004FD4	Write	11.794333 ms	0	0	0	1	0					08004FD4	08004FC8
8004FCC	00001570	Write	11.794333 ms	0	0	1	1	0					00001570	08004FCC
8004FD0	00001504	Write	11.794333 ms	0	0	0	0	1	0	1	1	1	00001504	08004FD0
00014FC	E24CB004	E24CB004 sub r11,r12,#04 Instruction Executed	11.794333 ms	0	0	1	1	1	1	1	1	0	E24CB004	000014FC

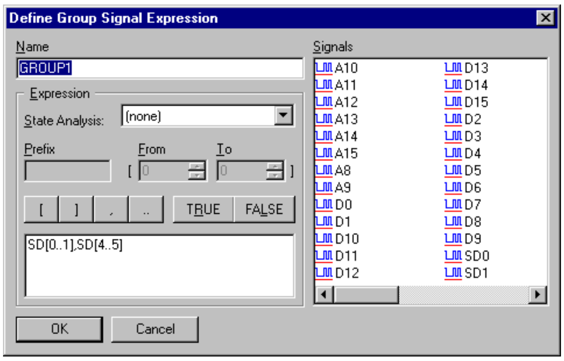
11.41 ms (87.60Hz)　P: 379.37 us M1: 0.00 ns M2: 0.00 ns M12: 0.00 ns (NA)　INITIALIZE

Ready　Ln 1, Col 1　OVR　INITIALIZE

Creating group signals

Group signals are signals composed from channels and logical signals. The maximum number of signals within a single group is limited to 64. Group signal may be equaled with bus.

To define a group, you can select the signals first. In the signal names area right click and from the pop-up menu select ‘Insert Group’, click on the **Insert Group Signal** button or press the shortcut **CTRL + SHIFT + G**. If signals are selected first, its names will already be placed into the Expressions field.


Define Group Signal Expression

Name: GROUP1

State Analysis: (none)

Prefix:

From: 0 To: 0

SD[0..1],SD[4..5]

Defining group signal expressions

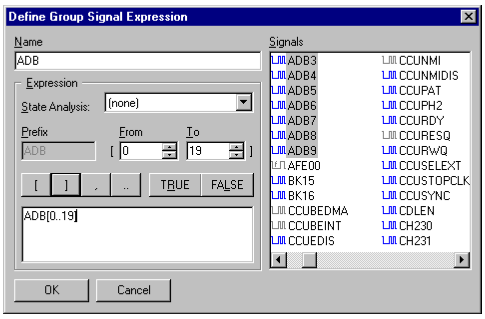
A ‘Define Group Signal Expression’ dialog box appears with the default signal name, in our case **GROUP1**.

If **GROUP1** has already been defined, another default name is generated (**GROUP2**).

First type the new group name, if the default one is not accepted. The Trace automatically generates an expression from the selected signals. If the signals form a unique expression, ‘From’ and ‘To’ fields become visible.

What is a unique expression?

This is an expression, which can be written in a form: **PREFIX[FROM..TO]**. Most buses belong to this category. It is very rare to define a group signal from signals with different **PREFIX** for example: **SD0, SD1, AD0, AD1**.


Define Group Signal Expression

Name: ADB

State Analysis: (none)

Prefix: ADB

From: 0 To: 19

ADB[0..19]

Entering expressions

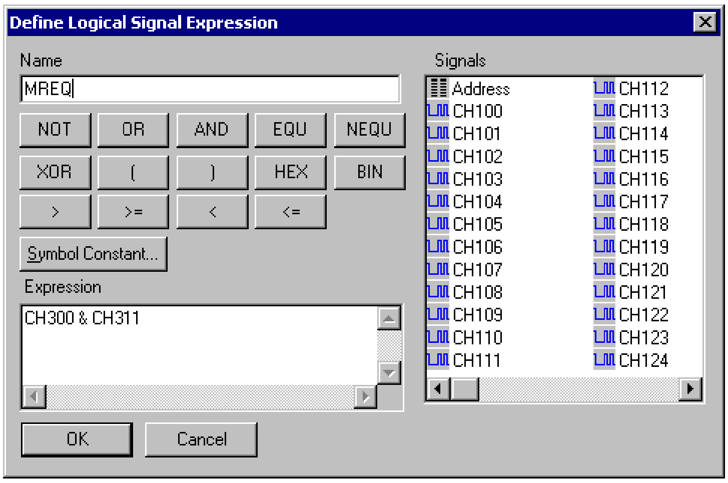
It is allowed to freely type the expression in the ‘Expression’ field. While you type **PREFIX**, ‘From’ and ‘To’ fields are updated automatically. If the expression cannot be converted to a unique form, these fields become disabled. On the right side of dialog box is a list of available signals that can be selected by double clicking on signal names. The procedure to select multiple signals is the same as described above. To add these signals to the expression, press the **ENTER** key. Signals are added and the expression is optimized.

There are usually two reasons that prevent you to add a new group signal:

- The signal name is not valid.
- The expression is not valid.

If an expanded group is selected, all the contained signals are selected as well. Individual signals inside a group cannot be selected, only a whole group.

Creating Logical Signals



Name: MREQ

Expression: CH300 & CH311

Creating logical signals

Logical signals are signals made of channels, group signals and other logical signals separated with logical operators.

Sometimes in the specific target device (e.g. CPLD or FPGA) a logic signal is generated from target signals and you would like to observe its state even if it's not available on the target (e.g. signal exists only internally in the FPGA). In such cases, the Trace allows you to define equivalent logic signal combined of measured target signals.

To insert a logical signal, you have to move the mouse cursor over the signal names area and right click. From the Edit pop-up menu, select 'Insert Signal' or press the shortcut **CTRL + L**. A 'Define Logical Signal Expression' dialog opens.

Enter the signal name, then click inside the 'Expression' field and start typing the logical expression. A logical signal can be composed also by clicking the signal names and operator buttons.

Supported operators are:

Operator	NOT	OR	AND	EQU	NEQU	XOR	HEX	BIN	Symbol	String
Symbol	!	|	&	=	!=	^	0x	%	{ }	" "

After selecting 'OK', the expression is validated. If there are errors in the expression the message box occurs informing you about the error. For example "**CH104)**" is not a valid expression and a message box will be displayed informing you about that.

Compact form of group expressions is not allowed in logical signal expression.

For example, "**CH[100..102]=2**" is not a valid logical signal expression. A dialog box will be displayed informing you that "CH" signal is not defined. Instead you have to define group signal first e.g. "**CH[100..102]**" and name it as **DATA**. Now, you can define logical signal as **DATA = 2**.

It is not permitted to enter recursive logical expressions. For example, if you define logical expressions:

A = CH100 & CH101

B = A & CH102

The second expression is dependent on the first expression. But let's change the first expression to:

A = B & CH101

The program finds an error in expression and informs you that recursive expressions are not allowed.

Let’s take a look at the next expressions:

GROUP = CH[100..102]

LOGICAL = GROUP

This is a valid expression. It evaluates to 0 whenever GROUP equals 0 and evaluates to 1 for all other values of GROUP signal.

To add multiple logical signals click the **Configure Signals** button on the toolbar or press the shortcut **S**.

The 'Signals' menu is shown. Deselect the 'All' option and only leave the 'Logical' option checked. The procedure for entering names and expressions is the same as the procedure for entering names and expressions for group signals. New signals can be added using the 'Insert Signal' button.

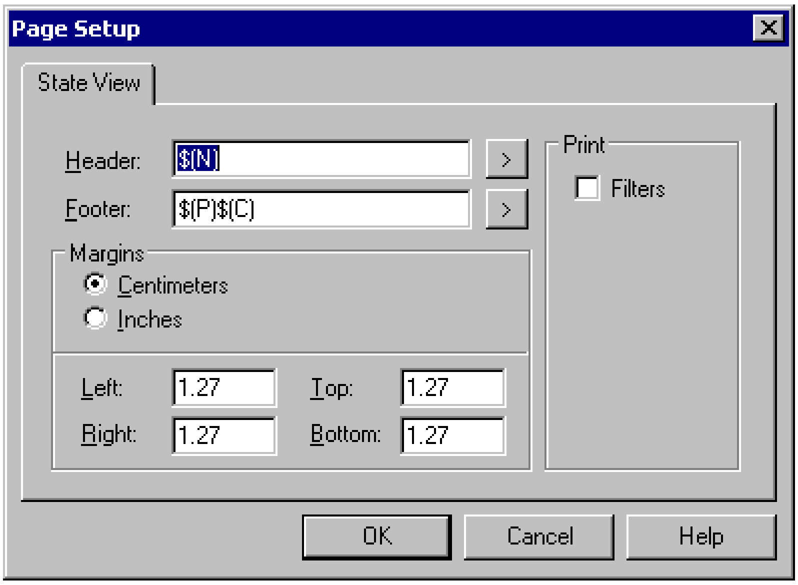
Note that signal names are case insensitive; therefore ‘MREQ’ is the same signal as ‘mreq’. To avoid uppercase/lowercase confusion, it is recommended to use either lowercase or uppercase characters for all signal names.

Printing Signals

Page Setup

When preparing to print signals, options to customize the printed view can be set in this dialog.

Print when printing the State View



Header: $(N)

Footer: (P)(C)

Margins

● Centimeters

○ Inches

Left: 1.27

Top: 1.27

Right: 1.27

Bottom: 1.27

Print

□ Filters

Page Setup, State View setup

When printing the State View, additionally the printing of filters can be enabled or disabled.

Header and Footer

First, the Header and the Footer of every page can be set. They can contain any text and certain macros have been predefined which insert important information. These macros are: File Name, Current Time, Current Date and Page Number; the alignment of the Header and the Footer can also be set with macros. The macros can be entered with the > insert macro button.

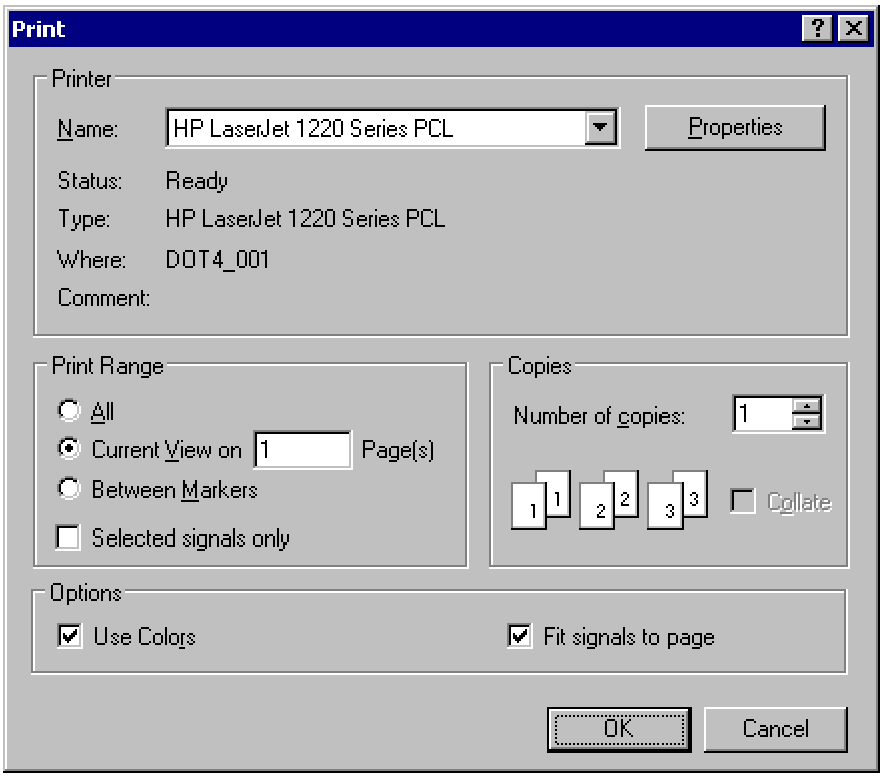
The Margins

The margins can be entered either in inches or in centimeters. The margins for every side of the page can be set.

Print data

Certain parts of information can be excluded from the printout. If an information is to be printed, it should be checked under 'Print'.

Printing



Print

Printer

Name: HP LaserJet 1220 Series PCL

Status: Ready

Type: HP LaserJet 1220 Series PCL

Where: DOT4_001

Comment:

Print Range

○ All

● Current View on 1 Page(s)

○ Between Markers

□ Selected signals only

Copies

Number of copies: 1

□ Collate

Options

☑ Use Colors

☑ Fit signals to page

Print dialog

Select ‘Print’ from the ‘File’ menu. The ‘Print’ dialog box appears.

Printer

Select the appropriate printer if you have access to more than one printer. The ‘Properties’ button opens the printer driver properties.

Print Range

The range to be printed can be set here. The range can be either the range currently shown on screen, the range can be set between markers or all recorded data can be printed.

You can then choose to print only the selected signals by checking the ‘Selected signals only’ option, otherwise all signals will be printed.

Copies

If more than one copy of the printout is required, the desired number can be selected here. With the ‘Collate’ option, the print order is defined.

Options

Check the ‘Use colors’ option to enable color printing.

Check the ‘Fit signals to page’ to fit all signals to one page width.

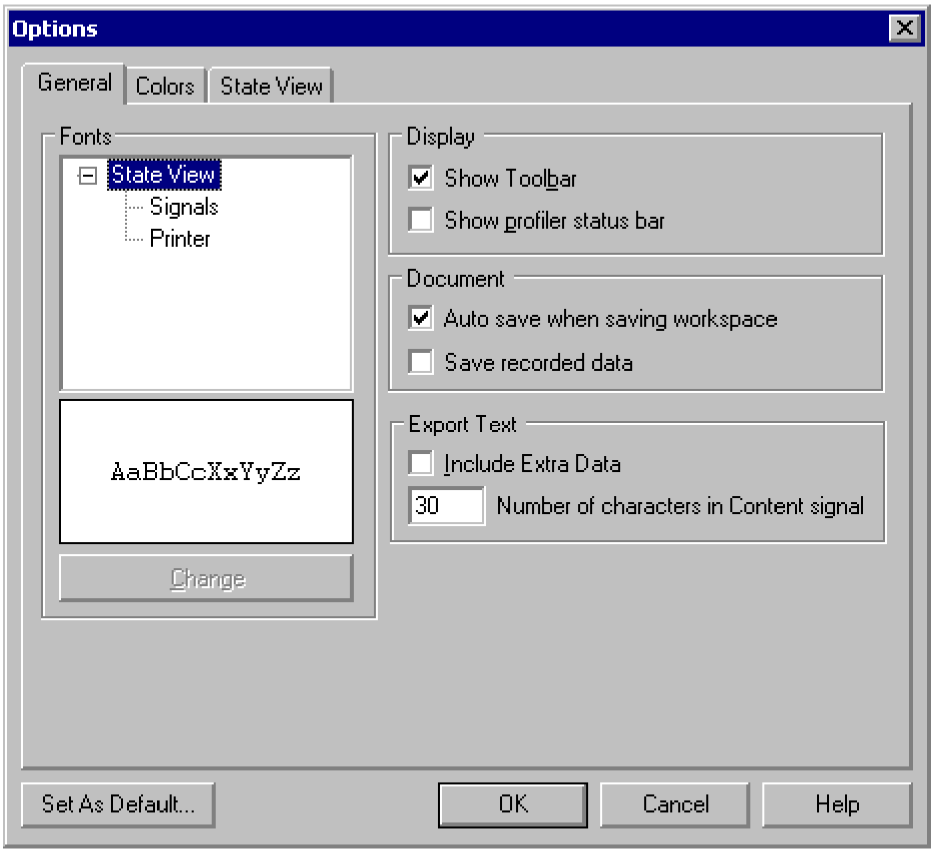
After all settings are correct, click the ‘OK’ button.

Setting up the Environment

Global Settings

General options

All global settings are set in the 'Trace Options' dialog. To change settings, click the 'Options' button on the Trace toolbar, select the Edit/Options in the menu or press the shortcut **E**.



Display

☑ Show Toolbar

□ Show profiler status bar

Document

☑ Auto save when saving workspace

□ Save recorded data

Export Text

□ Include Extra Data

30 Number of characters in Content signal

Trace Options, General dialog

In this dialog, general Trace settings can be modified.

The signal names and bus values in the timing view and the signals in the state view are shown with the default font. To change the font type and size click on, for example, 'Signal Names'. On the right the current font will be shown. With the Change button another font can be selected. Only monotype fonts are available.

A different printer font can be selected for both the timing and the state view. The defined font is used when signals are printed.

The option whether the toolbar should be visible or not is also present on this display. If a larger viewable size is required, the toolbar can be turned off. The toolbar can be turned on again by checking the 'Show Toolbar' option again. The options dialog is accessible with the shortcut key '**E**' or by right clicking in the Trace window and selecting 'Options'.

Management of recorded data

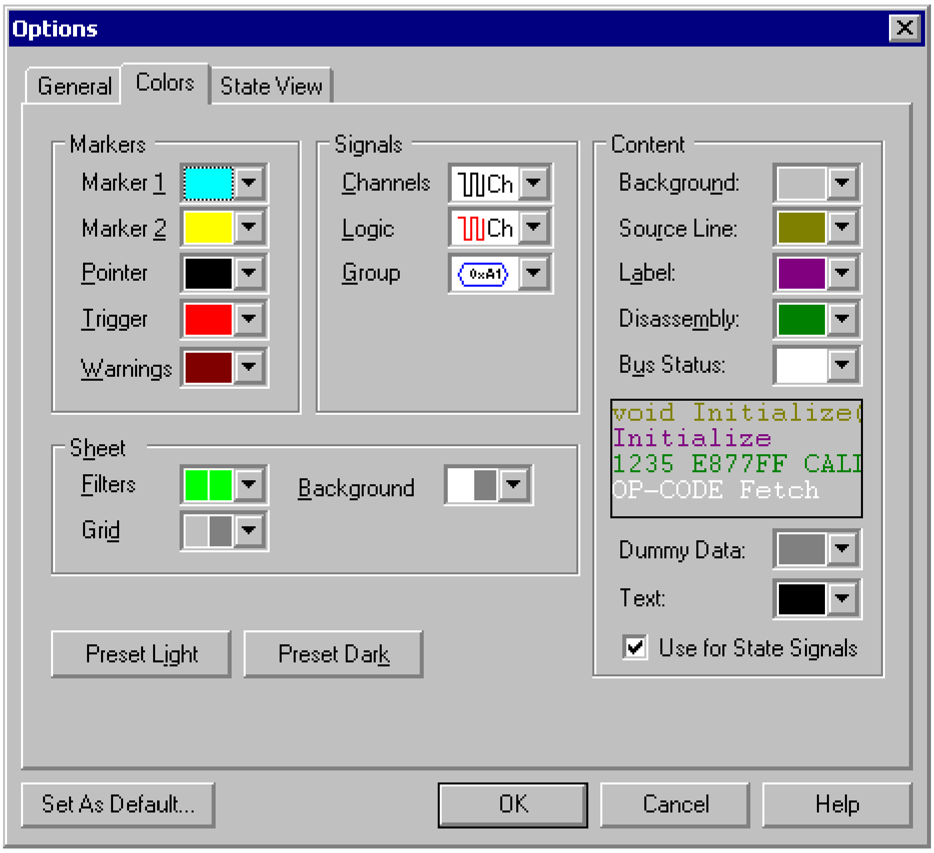
Save Recorded Data

In many cases, the samples (the recorded data) does not need to be saved. If this option is disabled, only the Trace settings are saved into the Trace file.

Auto Save when Saving Workspace

The Trace settings can be automatically saved when the workspace is being saved.

Colors



```
void Initialize(
Initialize
1235 E877FF CALL
OP-CODE Fetch
```

☑ Use for State Signals

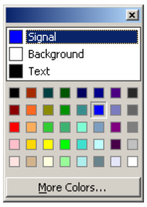
Trace Options, Colors dialog

All global settings are set in the ‘Trace Options’ dialog. To change settings, click the ‘Options’ button on the Trace toolbar or press the shortcut **E**.

The first group of settings lets you to change markers, pointer and trigger colors. Markers are used for measuring the distance between two samples. Each button shows current active color.

Color selection dialog

To change, for example, **Marker 1** color, click the down arrow on the button. A color selection pop-up appears. Move the mouse pointer over the colored rectangles. Left click on the color you want to change to. To accept new **Marker 1** color, left double-click or click outside the pop-up window. If the rectangle is pushed the currently active color matches the color of the pushed rectangle. Click the ‘More Colors’ button to open a standard Windows color selection dialog, where you can select any color supported by your graphic adapter.

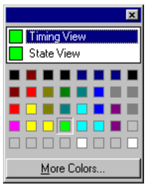


Color selection dialog for logical signals

The second group of settings lets you to change channels, logical and group signals. The signal buttons show preview of wave, background and value colors. To change the color of signals click the down arrow on the button and a color selection pop-up appears.

In the upper frame ‘Signal’ is selected. To change the color use the same method as described above. To change the signal’s background color, click the word ‘Background’ and select the appropriate color. To accept all changes click outside the pop-up window.

The colors set in this window only apply for newly created signals. The signals already defined in the Trace are not affected by this setting.



Color selection dialog for filters, grid and background

The third group of settings lets you change filter, grid and background colors for timing and state view separately. To change the color of signals click the down arrow on the button and a color selection pop-up appears. If 'Timing View' is selected, the color change will apply to the Timing view, if 'State View' is selected, the color change will apply to the State view.

The fourth group defines the colors of the content information.

Dummy Data

All bits of the data bus are recorded, but for some bus cycles not all of them are important. For example, if an instruction generates an 8-bit write on a 16-bit bus, only 8 bits of the data bus are valid in the corresponding data transfer cycle. If the non-valid part of the data transfer can be determined, it is described as 'Dummy Data' and as such marked with the selected color.

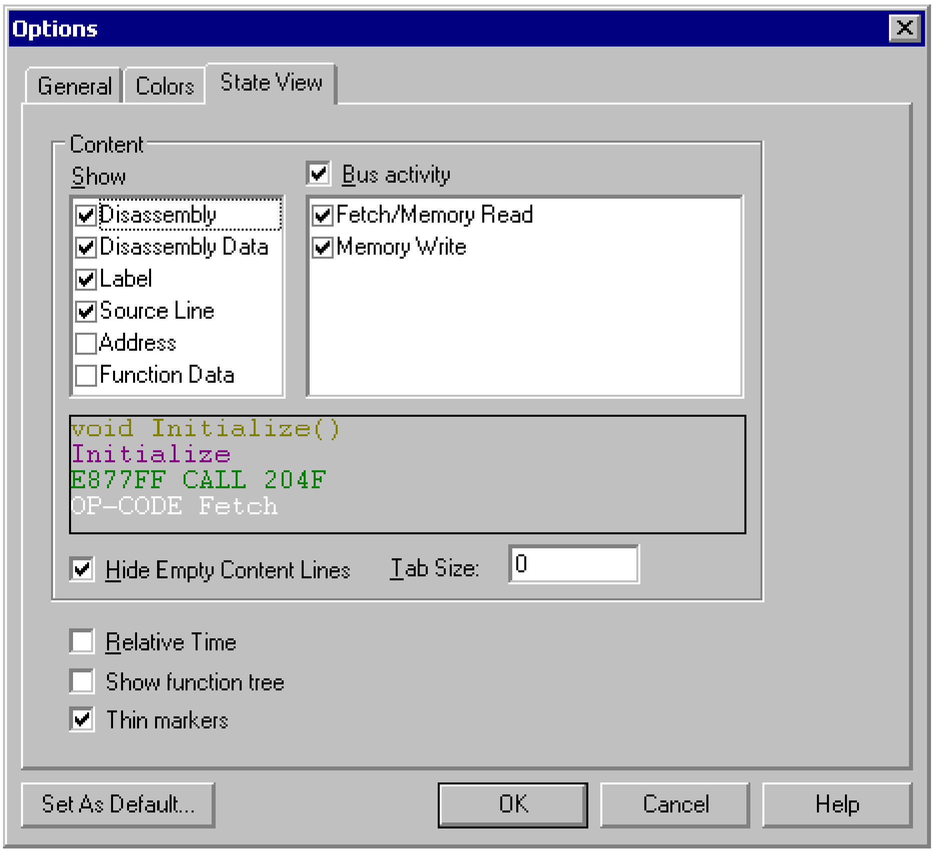
Use for State Signals

If this option is checked, the colors in this dialog are used for state signals.

Presets

Two preset color schemes are available, the light and the dark scheme.

State view options



Options

General | Colors | State View

Content

Show

☑ Disassembly
☑ Disassembly Data
☑ Label
☑ Source Line
□ Address
□ Function Data

☑ Bus activity

☑ Fetch/Memory Read
☑ Memory Write

```
void Initialize()
Initialize
E877FF CALL 204F
OP-CODE Fetch
```

☑ Hide Empty Content Lines   Tab Size: 0

□ Relative Time
□ Show function tree
☑ Thin markers

In this window which type of data will be shown can be selected and which bus statuses can be seen.

Relative Time

With this option, the relative and absolute timings are toggled.

Tab Size

The size of the tabs for disassembly information can be set.

Hide Empty Lines

Empty lines in the Content signal can be hidden. This is especially the case when certain content is not shown and is not important to the user.

Show Function Tree

If the function tree should be shown, check this option. The Function Tree is discussed in detail later.

Thin Markers

This option toggles between two types of views when browsing the State view. Normally the whole line, currently being browsed is marked with a black background. If thin markers are selected, only the lines above and under the current line are bolded.

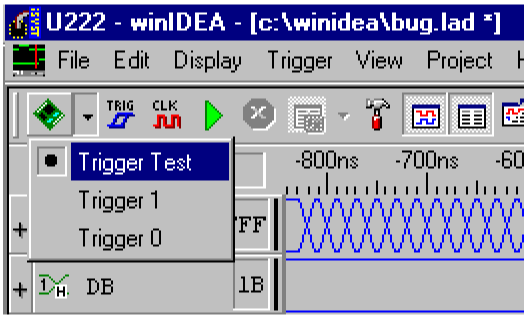
Save as Default

All options can be saved as default that will be used the next time a new document will be created.

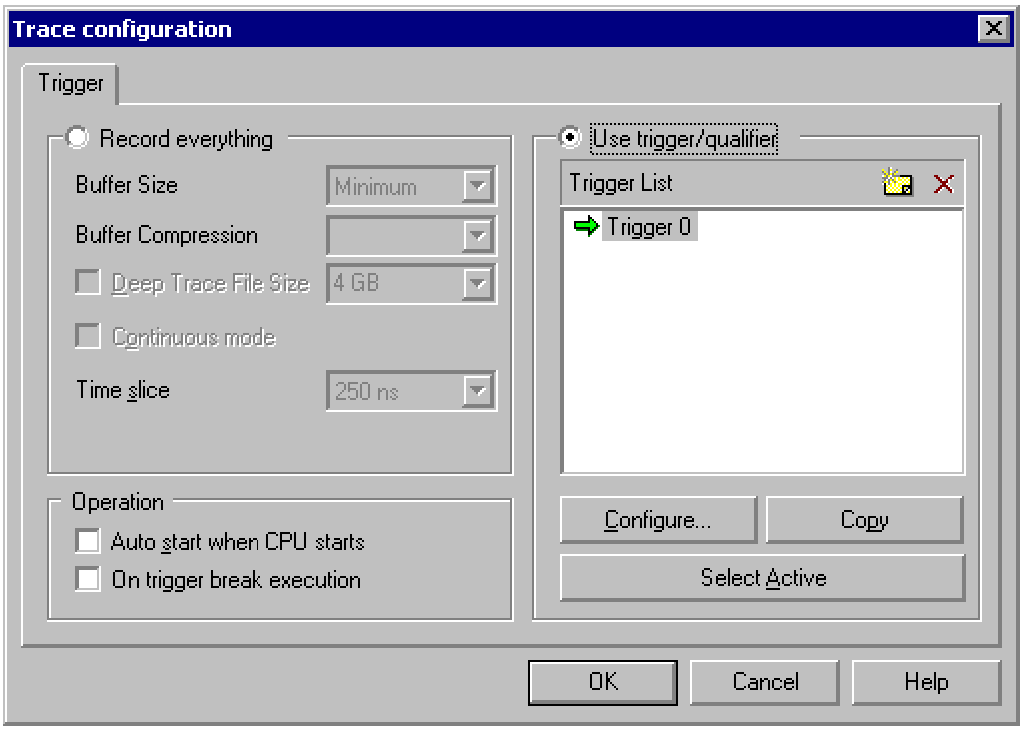
Recording the Signals

Trigger Configuration

There can be any number of triggers defined. Active trigger can be set from the main toolbar,



or from the trigger list dialog box:



Trace configuration

Trigger

○ Record everything

Buffer Size: Minimum

Buffer Compression:

□ Deep Trace File Size: 4 GB

□ Continuous mode

Time slice: 250 ns

Operation

□ Auto start when CPU starts

□ On trigger break execution

● Use trigger/qualifier

Trigger List

Trigger 0

Trigger Configuration dialog

The trigger configuration is explained in detail in the Hardware User's Guide, 'Trace' section.

Start Recording

Make sure all channels you use are properly connected. Before you begin, check if the trigger is properly set. The trigger configuration is explained in detail in the Setting up Hardware section of this document.

You are now ready to start recording. Click the ▶ **Begin** button in the toolbar or right click inside signals area and select 'Start Trigger' from the pop-up menu or simply press the shortcut **Ctrl+B**. The Trace waits for the trigger event. When the trigger condition is met, the Trace starts to load a buffer. At the beginning, the signals are loaded to fill the current view frame. After that signals continue to load around the current view. If this is the first time you start recording, signals are loaded around the trigger. Even if you change the trigger condition, the Trace still starts to load the buffer around the trigger.

To force an immediate trigger event press the **SPACE** key.

To stop loading signals press the **ESC** key.

Navigating Through the Document

All Windows applications use scroll bars to navigate trough the document. The Trace is no exception. Beside the standard scroll bars and standard icons, other navigation shortcuts are available.

You are also welcome to use the wheel of the mouse. To scroll with a wheel, move mouse pointer inside the Trace window and roll the wheel. Each wheel movement scrolls signals up or down. If the main signal window is split, to scroll trough signals in the upper window position the mouse pointer there and then roll the wheel. Use the same method to scroll in the lower window.

If you hold **CTRL** key while rolling the wheel, the program scrolls the view left or right depending on the rolling direction.

List of navigation shortcuts:

←	Scrolls view to the left for one tenth of screen size
→	Scrolls view to the right for one tenth of screen size
↑	Scrolls view one signal up
↓	Scrolls view one signal down
Home	Scrolls view to the start of buffer
End	Scrolls view to the buffer's end
PgUp	Scrolls view one page up
PgDn	Scrolls view one page down
CTRL + →	Scrolls view to the right from 20% - 100% of screen size
CTRL + ←	Scrolls view to the left from 20% - 100% of screen size
CTRL + Home	Scrolls view to the first signal
CTRL + End	Scrolls view to the last signal
J	Jump to trigger position
P	Jump to pointer position
1	Jump to Marker 1
2	Jump to Marker 2

Using Markers and Pointers

For simple time and frequency measurements markers should be used. Each marker can have a different color. To change markers and pointer width select either ‘Same as sample’ or ‘Two points’ in the ‘Trace Settings’ dialog (shortcut **E**).

To set marker or pointer in the main window use these shortcuts:

Left mouse click	– sets the pointer position
Ctrl + Left mouse click	– sets the **Marker 1** position
Ctrl + Right mouse click	– sets the **Marker 2** position

Info bar holds information about pointer and marker positions and the time difference between **Marker 1** and **Marker 2**.

Note: All absolute marker and pointer positions are measured relative to the trigger position.

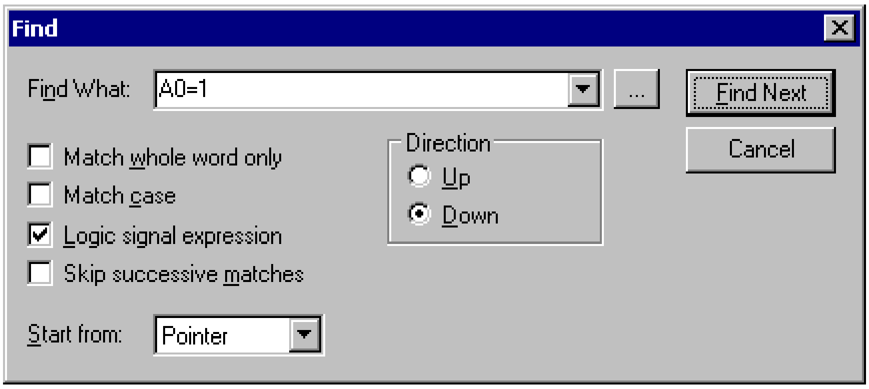
When clicking with mouse on any sample, all signal values in the signal names area are updated.

To drag and move a marker or a pointer, move the cursor over it, click and hold the left mouse button and move the mouse left to drag left or right to drag to the right. If the cursor goes out of the main application window, the program ensures that the marker is always visible by scrolling the signals left or right depending on the dragging direction.

Pattern Searching

While using the Trace, you can use the **Find** command to search for signal patterns.

To find a signal pattern, click the **Find** button on the toolbar or within the signals area, right click and select ‘Search’ from the menu and ‘Find’ from the submenu or simply press the shortcut **CTRL+F** or **ALT+F3**.



Find

Find What: A0=1

☐ Match whole word only

☐ Match case

☑ Logic signal expression

☐ Skip successive matches

Direction: ○ Up ● Down

Start from: Pointer

Find dialog

Also, an expression can be searched for. Check the 'Logic signal expression' option and enter the expression in the ‘Find’ tab either by typing or press the triple dot button to create an expression via the ‘Define Logical Signal Expression’ dialog box. Select search direction and the position from where the search begins.

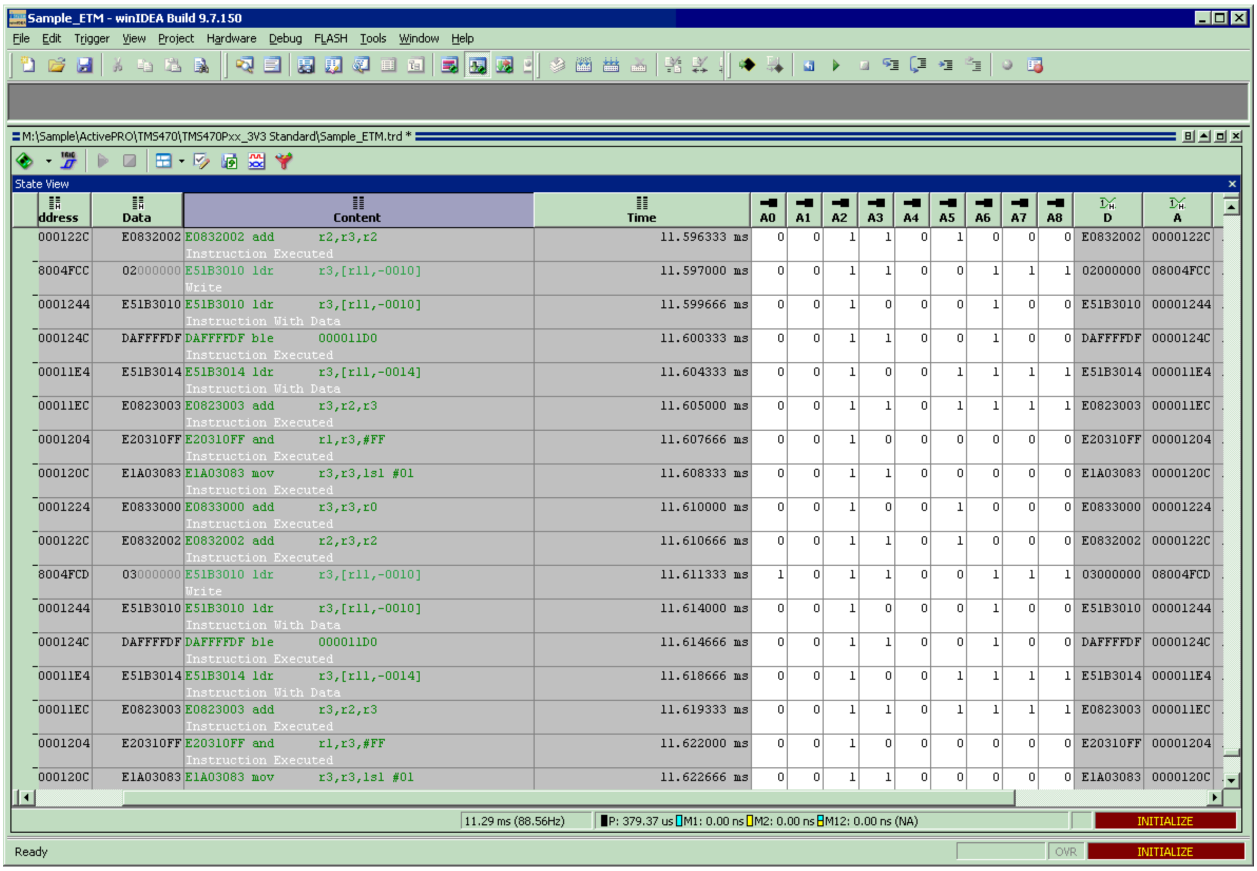
Search items are added to the history list whenever the user presses the **Find** button. When an element from the history list is selected, it is shown in the 'Expression' field and can be edited.

You can use the shortcut **F3** to find the next occurrence or the shortcut **Shift+F3** to find the previous occurrence of pattern. The same command is available within the signals area, right click and select ‘Search’ from menu and select ‘Find Next’ or 'Find Previous' from the submenu.

Setting Filters and States

Filters and states help you visually mark or find signal patterns.

Example: We have an application with TIM_INT0 interrupt routine, which occurs periodically. Interrupt routine code is executed from 0x2420 to 0x247A. The filter can be set in this range and then the interrupt execution can be easily found in the Trace buffer.


Sample_ETM - winIDEA Build 9.7.150
File Edit Trigger View Project Hardware Debug FLASH Tools Window Help
M:\Sample\ActivePRO\TMS470\TMS470Pxx_3V3 Standard\Sample_ETM.trd *
State View

ddress	Data	Content	Time	A0	A1	A2	A3	A4	A5	A6	A7	A8	D	A
000122C	E0832002	E0832002 add r2,r3,r2 Instruction Executed	11.596333 ms	0	0	1	1	0	1	0	0	0	E0832002	0000122C
8004FCC	02000000	E51B3010 ldr r3,[r11,-0010] Write	11.597000 ms	0	0	1	1	0	0	1	1	1	02000000	08004FCC
0001244	E51B3010	E51B3010 ldr r3,[r11,-0010] Instruction With Data	11.599666 ms	0	0	1	0	0	0	1	0	0	E51B3010	00001244
000124C	DAFFFFDF	DAFFFFDF ble 000011D0 Instruction Executed	11.600333 ms	0	0	1	1	0	0	1	0	0	DAFFFFDF	0000124C
00011E4	E51B3014	E51B3014 ldr r3,[r11,-0014] Instruction With Data	11.604333 ms	0	0	1	0	0	1	1	1	1	E51B3014	000011E4
00011EC	E0823003	E0823003 add r3,r2,r3 Instruction Executed	11.605000 ms	0	0	1	1	0	1	1	1	1	E0823003	000011EC
0001204	E20310FF	E20310FF and r1,r3,#FF Instruction Executed	11.607666 ms	0	0	1	0	0	0	0	0	0	E20310FF	00001204
000120C	E1A03083	E1A03083 mov r3,r3,lsl #01 Instruction Executed	11.608333 ms	0	0	1	1	0	0	0	0	0	E1A03083	0000120C
0001224	E0833000	E0833000 add r3,r3,r0 Instruction Executed	11.610000 ms	0	0	1	0	0	1	0	0	0	E0833000	00001224
000122C	E0832002	E0832002 add r2,r3,r2 Instruction Executed	11.610666 ms	0	0	1	1	0	1	0	0	0	E0832002	0000122C
8004FCD	03000000	E51B3010 ldr r3,[r11,-0010] Write	11.611333 ms	1	0	1	1	0	0	1	1	1	03000000	08004FCD
0001244	E51B3010	E51B3010 ldr r3,[r11,-0010] Instruction With Data	11.614000 ms	0	0	1	0	0	0	1	0	0	E51B3010	00001244
000124C	DAFFFFDF	DAFFFFDF ble 000011D0 Instruction Executed	11.614666 ms	0	0	1	1	0	0	1	0	0	DAFFFFDF	0000124C
00011E4	E51B3014	E51B3014 ldr r3,[r11,-0014] Instruction With Data	11.618666 ms	0	0	1	0	0	1	1	1	1	E51B3014	000011E4
00011EC	E0823003	E0823003 add r3,r2,r3 Instruction Executed	11.619333 ms	0	0	1	1	0	1	1	1	1	E0823003	000011EC
0001204	E20310FF	E20310FF and r1,r3,#FF Instruction Executed	11.622000 ms	0	0	1	0	0	0	0	0	0	E20310FF	00001204
000120C	E1A03083	E1A03083 mov r3,r3,lsl #01	11.622666 ms	0	0	1	1	0	0	0	0	0	E1A03083	0000120C

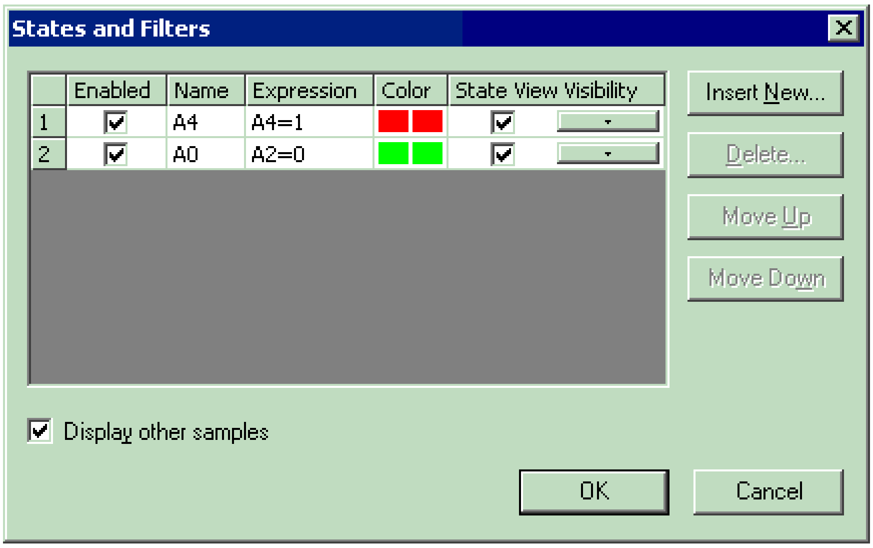
11.29 ms (88.56Hz) P: 379.37 us M1: 0.00 ns M2: 0.00 ns M12: 0.00 ns (NA) INITIALIZE

Ready OVR INITIALIZE

Logic analysis with no filters

In general, on slow computers many defined filters slow down the signal redrawing, therefore don’t forget to disable filters when you don’t need them any more.

On the first picture signals without filters are displayed.



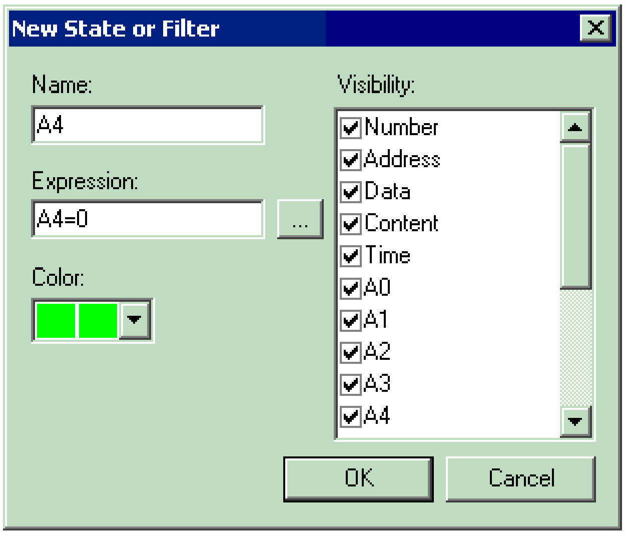
	Enabled	Name	Expression	Color	State View Visibility
1	☑	A4	A4=1	🟥🟥	☑
2	☑	A0	A2=0	🟩🟩	☑

☑ Display other samples

Adding states and filters

Adding filters is a straightforward process. Click on Edit/States and Filters or press the shortcut **Ctrl+T**. The 'States and Filters' tab appears.

To add a new state or filter, press the 'Insert New...' button.



Name: A4

Expression: A4=0

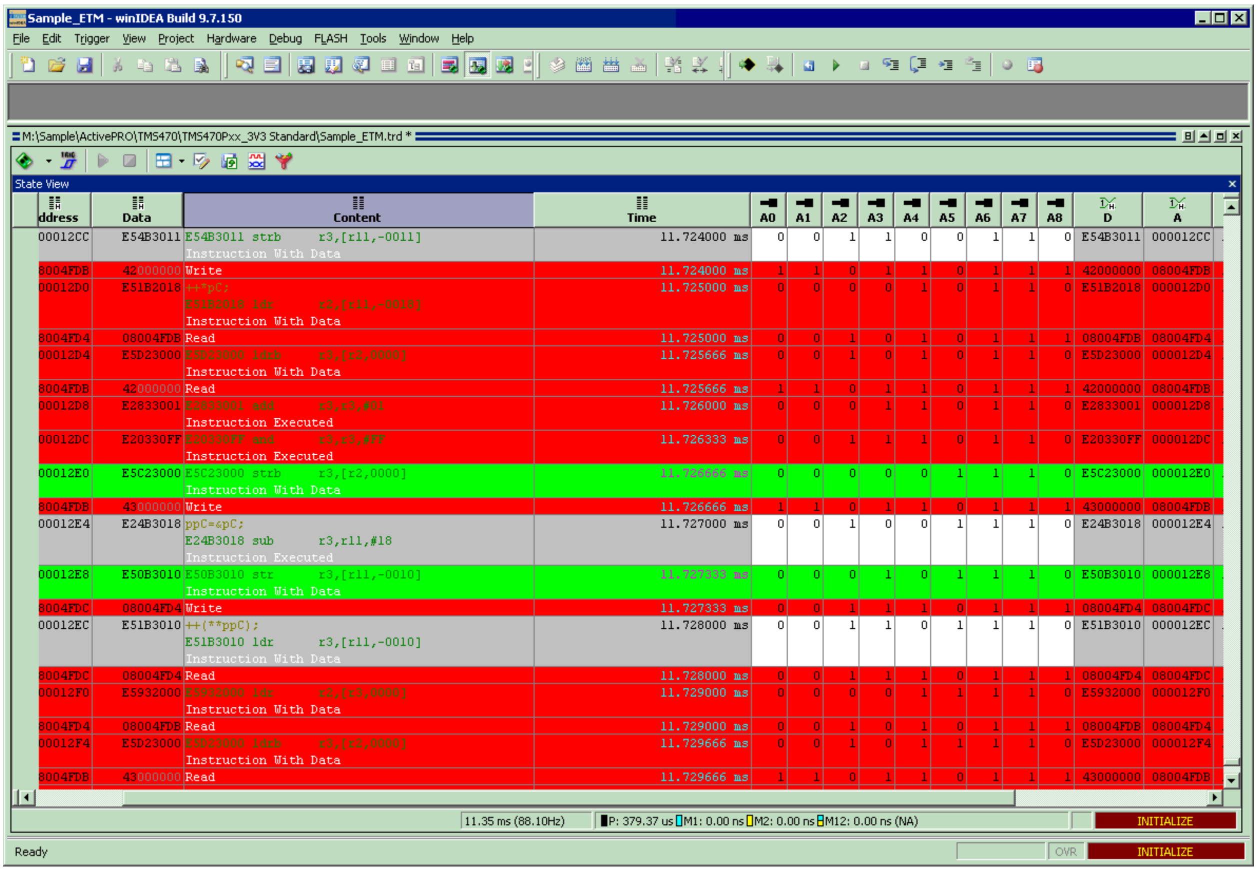
Color: 🟩🟩

Visibility:
☑ Number
☑ Address
☑ Data
☑ Content
☑ Time
☑ A0
☑ A1
☑ A2
☑ A3
☑ A4

New state or filter dialog

Type its name in the 'Name' field. Select the color and enter the expression either by typing or press the triple dot button to create the expression via the 'Define Logical Signal Expression' dialog box. When you are satisfied with the data entered, click the 'OK' button. By default all newly added filters are enabled. To disable the adequate filter double-click the check box to clear it. To restore the disabled filter double click the check box again.

In a certain filter or state, the visibility of signals can be set. For example, should during the above state the A0 signal not be visible, uncheck the checkbox in front of A0. In this case, the signal value will not be shown.


Sample_ETM - winIDEA Build 9.7.150
File Edit Trigger View Project Hardware Debug FLASH Tools Window Help
State View
INITIALIZE
OVR
INITIALIZE

M:\Sample\ActivePRO\TMS470\TMS470Pxx_3V3 Standard\Sample_ETM.trd *

ddress	Data	Content	Time	A0	A1	A2	A3	A4	A5	A6	A7	A8	D	A
00012CC	E54B3011	E54B3011 strb r3,[r11,-0011] Instruction With Data	11.724000 ms	0	0	1	1	0	0	1	1	0	E54B3011	000012CC
8004FDB	42000000	Write	11.724000 ms	1	1	0	1	1	0	1	1	1	42000000	08004FDB
00012D0	E51B2018	++*pC; E51B2018 ldr r2,[r11,-0018] Instruction With Data	11.725000 ms	0	0	0	0	1	0	1	1	0	E51B2018	000012D0
8004FD4	08004FDB	Read	11.725000 ms	0	0	1	0	1	0	1	1	1	08004FDB	08004FD4
00012D4	E5D23000	E5D23000 ldrb r3,[r2,0000] Instruction With Data	11.725666 ms	0	0	1	0	1	0	1	1	0	E5D23000	000012D4
8004FDB	42000000	Read	11.725666 ms	1	1	0	1	1	0	1	1	1	42000000	08004FDB
00012D8	E2833001	E2833001 add r3,r3,#01 Instruction Executed	11.726000 ms	0	0	0	1	1	0	1	1	0	E2833001	000012D8
00012DC	E20330FF	E20330FF and r3,r3,#FF Instruction Executed	11.726333 ms	0	0	1	1	1	0	1	1	0	E20330FF	000012DC
00012E0	E5C23000	E5C23000 strb r3,[r2,0000] Instruction With Data	11.726666 ms	0	0	0	0	0	1	1	1	0	E5C23000	000012E0
8004FDB	43000000	Write	11.726666 ms	1	1	0	1	1	0	1	1	1	43000000	08004FDB
00012E4	E24B3018	ppC=&pC; E24B3018 sub r3,r11,#18 Instruction Executed	11.727000 ms	0	0	1	0	0	1	1	1	0	E24B3018	000012E4
00012E8	E50B3010	E50B3010 str r3,[r11,-0010] Instruction With Data	11.727333 ms	0	0	0	1	0	1	1	1	0	E50B3010	000012E8
8004FDC	08004FD4	Write	11.727333 ms	0	0	1	1	1	0	1	1	1	08004FD4	08004FDC
00012EC	E51B3010	++(**ppC); E51B3010 ldr r3,[r11,-0010] Instruction With Data	11.728000 ms	0	0	1	1	0	1	1	1	0	E51B3010	000012EC
8004FDC	08004FD4	Read	11.728000 ms	0	0	1	1	1	0	1	1	1	08004FD4	08004FDC
00012F0	E5932000	E5932000 ldr r2,[r3,0000] Instruction With Data	11.729000 ms	0	0	0	0	1	1	1	1	0	E5932000	000012F0
8004FD4	08004FDB	Read	11.729000 ms	0	0	1	0	1	0	1	1	1	08004FDB	08004FD4
00012F4	E5D23000	E5D23000 ldrb r3,[r2,0000] Instruction With Data	11.729666 ms	0	0	1	0	1	1	1	1	0	E5D23000	000012F4
8004FDB	43000000	Read	11.729666 ms	1	1	0	1	1	0	1	1	1	43000000	08004FDB

11.35 ms (88.10Hz) P: 379.37 us M1: 0.00 ns M2: 0.00 ns M12: 0.00 ns (NA)

Ready

Logic analysis with filters applied

To change the color of a filter, double-click the color rectangle and select a new color for the filter.

If more than one filter is defined, the first filter has the highest priority. This is important when two or more filters overlap. To change the priorities, select the filter of which priority you want to change and press either the ‘Move Up’ button to increase the priority of the filter or the ‘Move Down’ button to decrease the filter priority.

To delete a filter, select a filter (the filter number) you want to delete and press the ‘Delete’ button. Multiple filters can also be deleted. Select the required filters and press the 'Delete' button.

The procedure for changing expressions in the list in the ‘Filters’ tab is the same as changing of logical signal expression (refer to subchapter “Creating Logical Signals”). In practice it’s not often to set more than three filters.

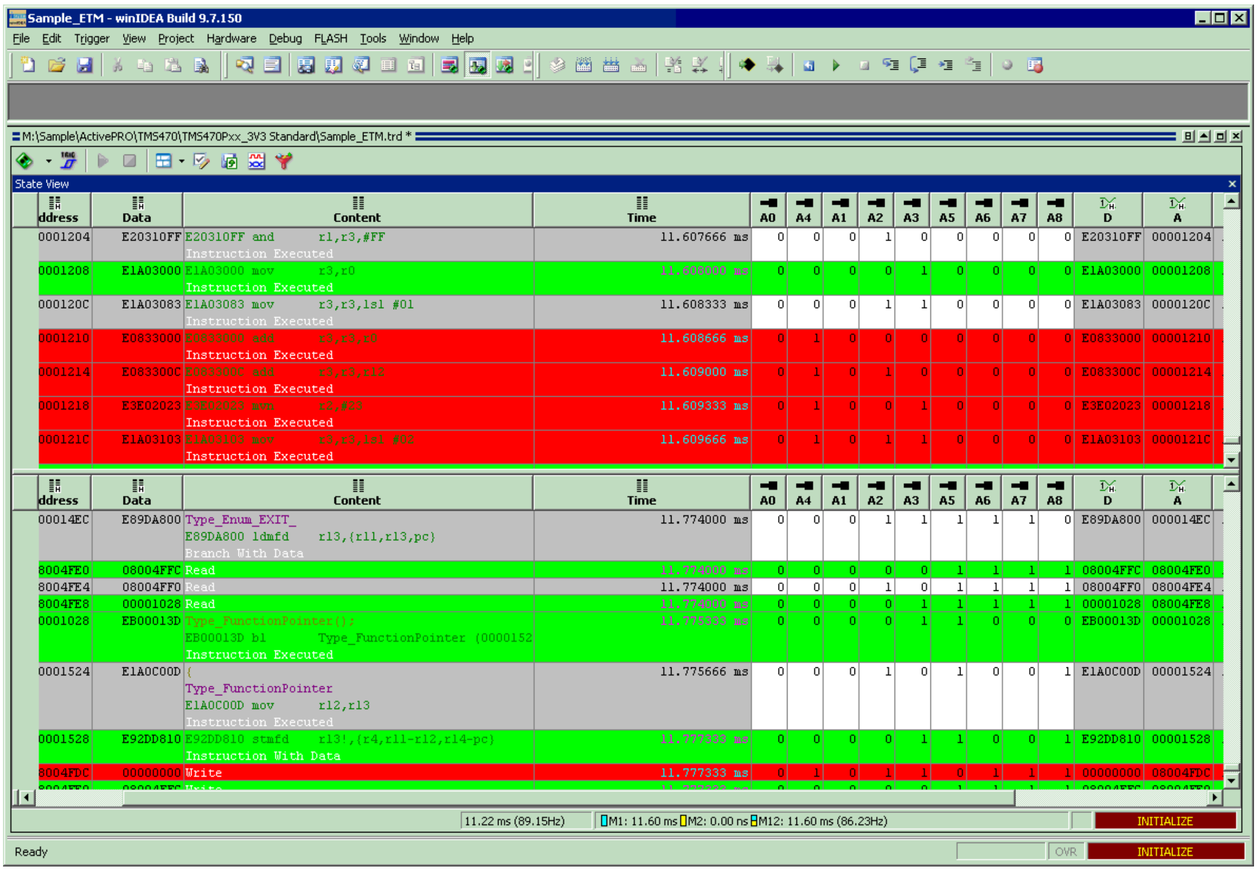
Display Other Samples

Filters can also be used for hiding data. If we uncheck the option "Display other samples" in the dialog box, then all samples not belonging to any of the filters will be hidden.

Using the Splitter

In some cases repositioning the signals is not the best solution. For example, we need to inspect different timings. In this case, we can use the splitter.

The splitter window is useful especially when using low-resolution PC monitors. The splitter enables the main window to be partitioned.


Sample_ETM - winIDEA Build 9.7.150
File Edit Trigger View Project Hardware Debug FLASH Tools Window Help
M:\Sample\ActivePRO\TMS470\TMS470Pxx_3V3 Standard\Sample_ETM.trd *
State View
11.22 ms (89.15Hz)
M1: 11.60 ms M2: 0.00 ns M12: 11.60 ms (86.23Hz)
INITIALIZE
Ready
OVR
INITIALIZE

ddress	Data	Content	Time	A0	A4	A1	A2	A3	A5	A6	A7	A8	D	A
0001204	E20310FF	E20310FF and r1,r3,#FF Instruction Executed	11.607666 ms	0	0	0	1	0	0	0	0	0	E20310FF	00001204
0001208	E1A03000	E1A03000 mov r3,r0 Instruction Executed	11.608000 ms	0	0	0	0	1	0	0	0	0	E1A03000	00001208
000120C	E1A03083	E1A03083 mov r3,r3,lsl #01 Instruction Executed	11.608333 ms	0	0	0	1	1	0	0	0	0	E1A03083	0000120C
0001210	E0833000	E0833000 add r3,r3,r0 Instruction Executed	11.608666 ms	0	1	0	0	0	0	0	0	0	E0833000	00001210
0001214	E083300C	E083300C add r3,r3,r12 Instruction Executed	11.609000 ms	0	1	0	1	0	0	0	0	0	E083300C	00001214
0001218	E3E02023	E3E02023 mvn r2,#23 Instruction Executed	11.609333 ms	0	1	0	0	1	0	0	0	0	E3E02023	00001218
000121C	E1A03103	E1A03103 mov r3,r3,lsl #02 Instruction Executed	11.609666 ms	0	1	0	1	1	0	0	0	0	E1A03103	0000121C

ddress	Data	Content	Time	A0	A4	A1	A2	A3	A5	A6	A7	A8	D	A
00014EC	E89DA800	Type_Enum_EXIT_ E89DA800 ldmfd r13,{r11,r13,pc} Branch With Data	11.774000 ms	0	0	0	1	1	1	1	1	0	E89DA800	000014EC
8004FE0	08004FFC	Read	11.774000 ms	0	0	0	0	0	1	1	1	1	08004FFC	08004FE0
8004FE4	08004FF0	Read	11.774000 ms	0	0	0	1	0	1	1	1	1	08004FF0	08004FE4
8004FE8	00001028	Read	11.774000 ms	0	0	0	0	1	1	1	1	1	00001028	08004FE8
0001028	EB00013D	Type_FunctionPointer(); EB00013D bl Type_FunctionPointer (0000152 Instruction Executed	11.775333 ms	0	0	0	0	1	1	0	0	0	EB00013D	00001028
0001524	E1A0C00D	{ Type_FunctionPointer E1A0C00D mov r12,r13 Instruction Executed	11.775666 ms	0	0	0	1	0	1	0	0	1	E1A0C00D	00001524
0001528	E92DD810	E92DD810 stmfd r13!,{r4,r11-r12,r14-pc} Instruction With Data	11.777333 ms	0	0	0	0	1	1	0	0	1	E92DD810	00001528
8004FDC	00000000	Write	11.777333 ms	0	1	0	1	1	0	1	1	1	00000000	08004FDC

Setting the splitter

To split the main window, drag the splitter, which is, if the splitter is not active already, located over the vertical scroll-bar as a small rectangular button. Move the cursor over that button. The cursor changes its shape. Left click and hold the mouse button. Move the mouse cursor down. Release the mouse button, when you are satisfied with the splitter position. When the splitter is active dragging the splitter line can change its position. If the main window size changes, height of both windows is also changed, but the proportion between these two windows stays the same.

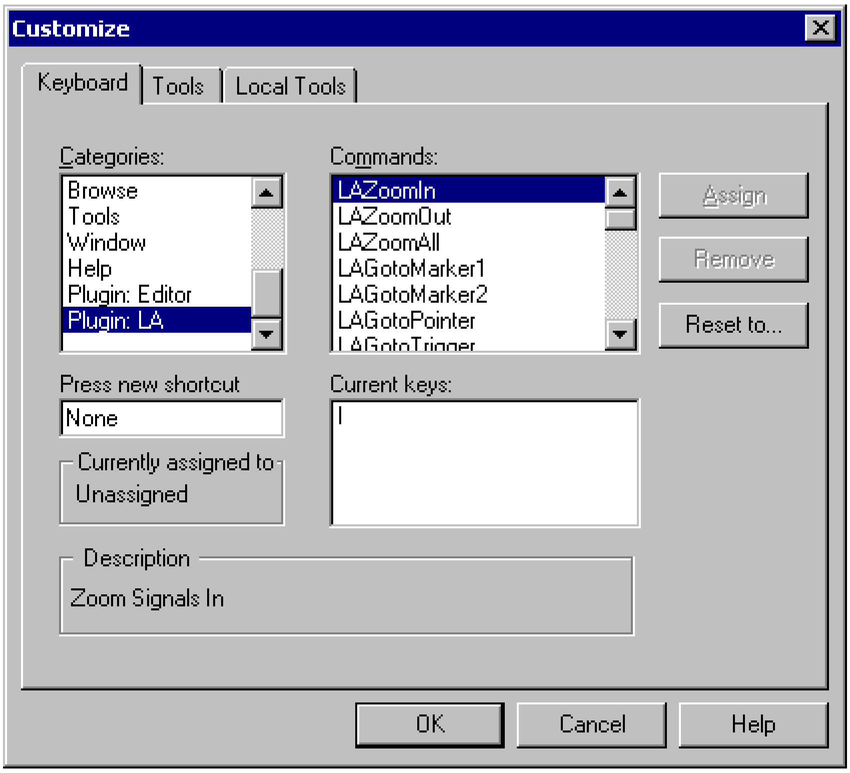
Remove the splitter window by dragging splitter line up to the top of the main window or down to the bottom of the main window. If you drag it up, the lower window will be preserved and vice versa. Any changes made in one window are also visible in the other window.

The splitter is available separately for Timing view and for State view.

List of all Default Shortcuts

←	Scrolls view to the left for one tenth of the screen size
→	Scrolls view to the right for one tenth of the screen size
↑	Scrolls view one signal up
↓	Scrolls view one signal down
Home	Scrolls view to the start of buffer
End	Scrolls view to the buffer’s end
PgUp	Scrolls view one page up
PgDn	Scrolls view one page down
CTRL + **Home**	Scrolls view to the first sample
CTRL + **End**	Scrolls view to the last sample
J	Jump to trigger position
P	Jump to pointer position
1	Jump to Marker 1
2	Jump to Marker 2
E	Shows General Settings dialog box
S	Shows Signals All dialog box
CTRL + F, ALT + F3	Shows Find dialog box
CTRL + F3	Find next pattern
SHIFT + F3	Find previous pattern
CTRL + T	Shows States and Filters dialog box
B	Begin trigger
T	Set trigger
SPACE	Trigger now
ESC	Stop loading samples
CTRL + H	Hide selected signals
Alt + Enter	Set signal properties
CTRL + Shift + G	Insert group signal after the selected signal
CTRL + L	Insert logical signal after the selected signal
CTRL + Del	Remove markers

Changing Shortcuts



Categories: Plugin: LA

Commands: LAZoomIn

Press new shortcut: None

Currently assigned to: Unassigned

Description: Zoom Signals In

Customizing shortcuts

To change the default shortcuts:

- Open the ‘Tools/Customize’ dialog.
- Select ‘Plugin: LA’ in the ‘Categories:’ field in the ‘Keyboard’ tab.

All the commands are displayed inside the ‘Commands’ list. Select the command of which the shortcut you would like to change. Current key assignment is displayed under Current keys. To add a new shortcut, click inside the ‘Press new shortcut’ field and press the new shortcut, e.g. “+” on the numerical pad. You have to press the ‘Assign’ button to add a newly defined shortcut to a list of current assigned keys.

Many key combinations are already defined as shortcuts. That is why you have to check, if the shortcut you want to assign is not currently in use by any other command.

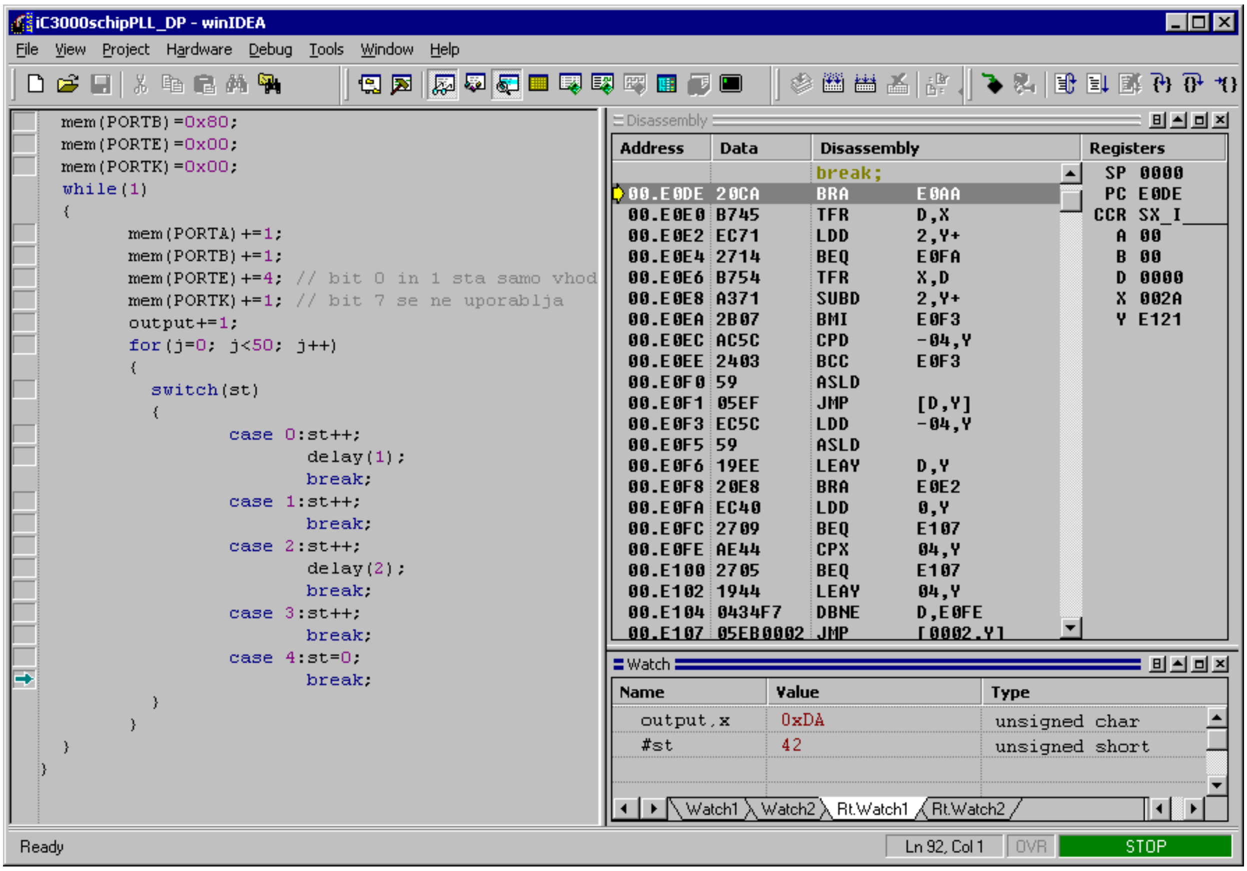
To remove the shortcut for the selected command, select that shortcut inside ‘Current keys’ list and press the ‘Remove’ button.

Some shortcuts are defined in categories other than the ‘Plugin: LA’, e.g. ‘Find Next Pattern’ can be found under the ‘Edit’ category (command name is ‘EditRepeatFind’)

Handling Multiple Trace Records

Let's assume that there is no trace session opened and active in winIDEA.

After initialising the debugger you should have following or similar window layout (no trace window opened):



iC3000schipPLL_DP - winIDEA
File View Project Hardware Debug Tools Window Help
Disassembly
Watch
Watch1 Watch2 Rt.Watch1 Rt.Watch2
Ready
Ln 92, Col 1
OVR
STOP

```
mem(PORTB)=0x80;
mem(PORTE)=0x00;
mem(PORTK)=0x00;
while(1)
{
        mem(PORTA)+=1;
        mem(PORTB)+=1;
        mem(PORTE)+=4; // bit 0 in 1 sta samo vhod
        mem(PORTK)+=1; // bit 7 se ne uporablja
        output+=1;
        for(j=0; j<50; j++)
        {
          switch(st)
          {
                case 0:st++;
                       delay(1);
                       break;
                case 1:st++;
                       break;
                case 2:st++;
                       delay(2);
                       break;
                case 3:st++;
                       break;
                case 4:st=0;
                       break;
          }
        }
}
}
```

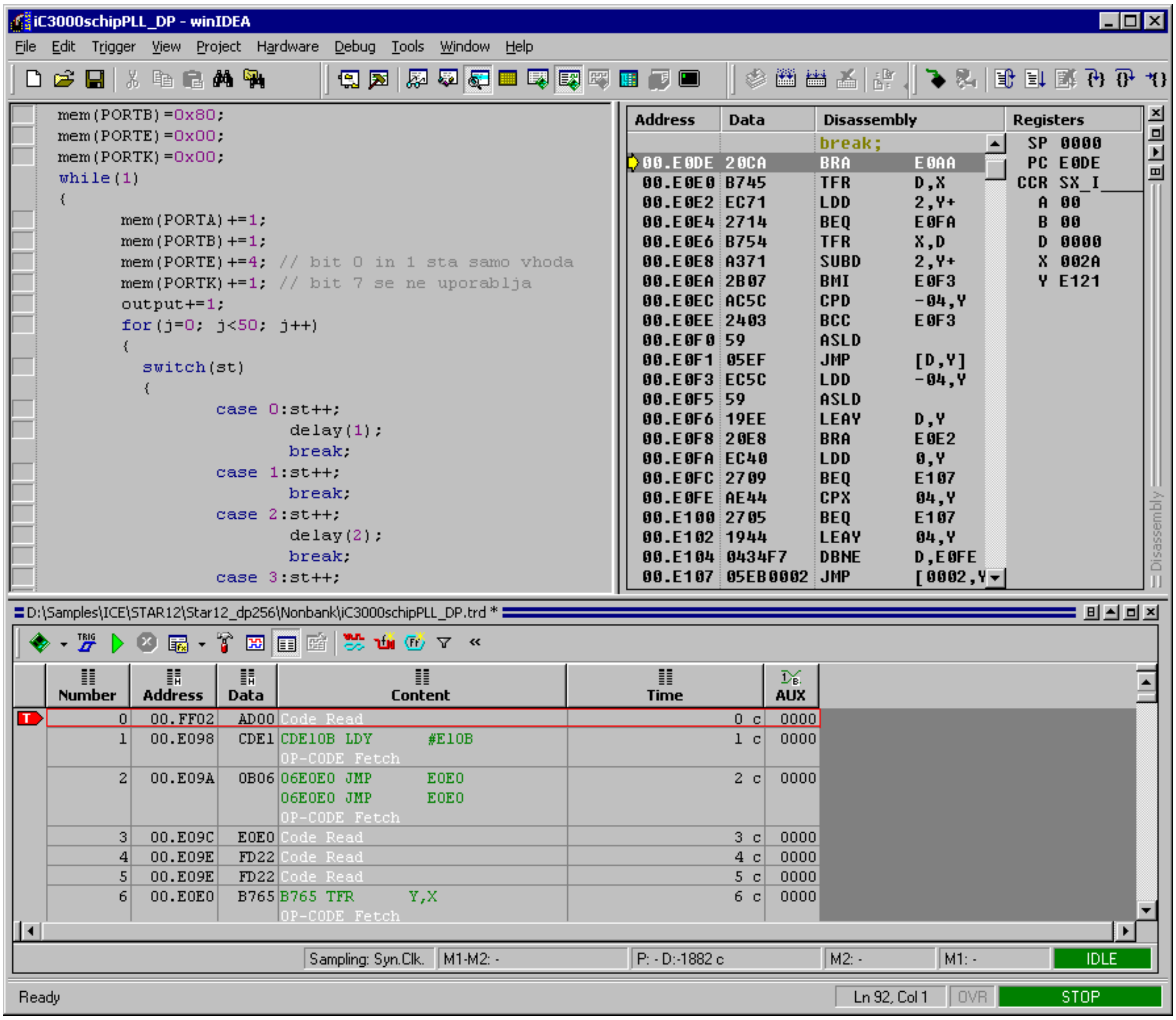
```
Address   Data      Disassembly
                    break;
00.E0DE   20CA      BRA     E0AA
00.E0E0   B745      TFR     D,X
00.E0E2   EC71      LDD     2,Y+
00.E0E4   2714      BEQ     E0FA
00.E0E6   B754      TFR     X,D
00.E0E8   A371      SUBD    2,Y+
00.E0EA   2B07      BMI     E0F3
00.E0EC   AC5C      CPD     -04,Y
00.E0EE   2403      BCC     E0F3
00.E0F0   59        ASLD
00.E0F1   05EF      JMP     [D,Y]
00.E0F3   EC5C      LDD     -04,Y
00.E0F5   59        ASLD
00.E0F6   19EE      LEAY    D,Y
00.E0F8   20E8      BRA     E0E2
00.E0FA   EC40      LDD     0,Y
00.E0FC   2709      BEQ     E107
00.E0FE   AE44      CPX     04,Y
00.E100   2705      BEQ     E107
00.E102   1944      LEAY    04,Y
00.E104   0434F7    DBNE    D,E0FE
00.E107   05EB0002  JMP     [0002,Y]
```

```
Registers
 SP  0000
 PC  E0DE
CCR  SX_I
  A  00
  B  00
  D  0000
  X  002A
  Y  E121
```

Name	Value	Type
output,x	0xDA	unsigned char
#st	42	unsigned short

Next, open the trace window from the ‘View/Trace’ menu, set it up and record one program flow. The user should have below window layout.

Note that the source window is ‘MDI’ type and the trace window ‘Dock’ type. Modify them if necessary using ‘Window Type’ option from the local menu.



```
   mem(PORTB)=0x80;
   mem(PORTE)=0x00;
   mem(PORTK)=0x00;
   while(1)
   {
           mem(PORTA)+=1;
           mem(PORTB)+=1;
           mem(PORTE)+=4; // bit 0 in 1 sta samo vhoda
           mem(PORTK)+=1; // bit 7 se ne uporablja
           output+=1;
           for(j=0; j<50; j++)
           {
             switch(st)
             {
                     case 0:st++;
                            delay(1);
                            break;
                     case 1:st++;
                            break;
                     case 2:st++;
                            delay(2);
                            break;
                     case 3:st++;
```

```
Address   Data      Disassembly              Registers
                    break;                     SP  0000
00.E0DE   20CA      BRA      E0AA              PC  E0DE
00.E0E0   B745      TFR      D,X              CCR  SX_I
00.E0E2   EC71      LDD      2,Y+               A  00
00.E0E4   2714      BEQ      E0FA               B  00
00.E0E6   B754      TFR      X,D                D  0000
00.E0E8   A371      SUBD     2,Y+               X  002A
00.E0EA   2B07      BMI      E0F3               Y  E121
00.E0EC   AC5C      CPD      -04,Y
00.E0EE   2403      BCC      E0F3
00.E0F0   59        ASLD
00.E0F1   05EF      JMP      [D,Y]
00.E0F3   EC5C      LDD      -04,Y
00.E0F5   59        ASLD
00.E0F6   19EE      LEAY     D,Y
00.E0F8   20E8      BRA      E0E2
00.E0FA   EC40      LDD      0,Y
00.E0FC   2709      BEQ      E107
00.E0FE   AE44      CPX      04,Y
00.E100   2705      BEQ      E107
00.E102   1944      LEAY     04,Y
00.E104   0434F7    DBNE     D,E0FE
00.E107   05EB0002  JMP      [0002,Y
```

D:\Samples\ICE\STAR12\Star12_dp256\Nonbank\iC3000schipPLL_DP.trd *

	Number	Address	Data	Content	Time	AUX
T	0	00.FF02	AD00	Code Read	0 c	0000
	1	00.E098	CDE1	CDE10B LDY #E10B OP-CODE Fetch	1 c	0000
	2	00.E09A	0B06	06E0E0 JMP E0E0 06E0E0 JMP E0E0 OP-CODE Fetch	2 c	0000
	3	00.E09C	E0E0	Code Read	3 c	0000
	4	00.E09E	FD22	Code Read	4 c	0000
	5	00.E09E	FD22	Code Read	5 c	0000
	6	00.E0E0	B765	B765 TFR Y,X OP-CODE Fetch	6 c	0000

Sampling: Syn.Clk. | M1-M2: - | P: - D:-1882 c | M2: - | M1: - | IDLE

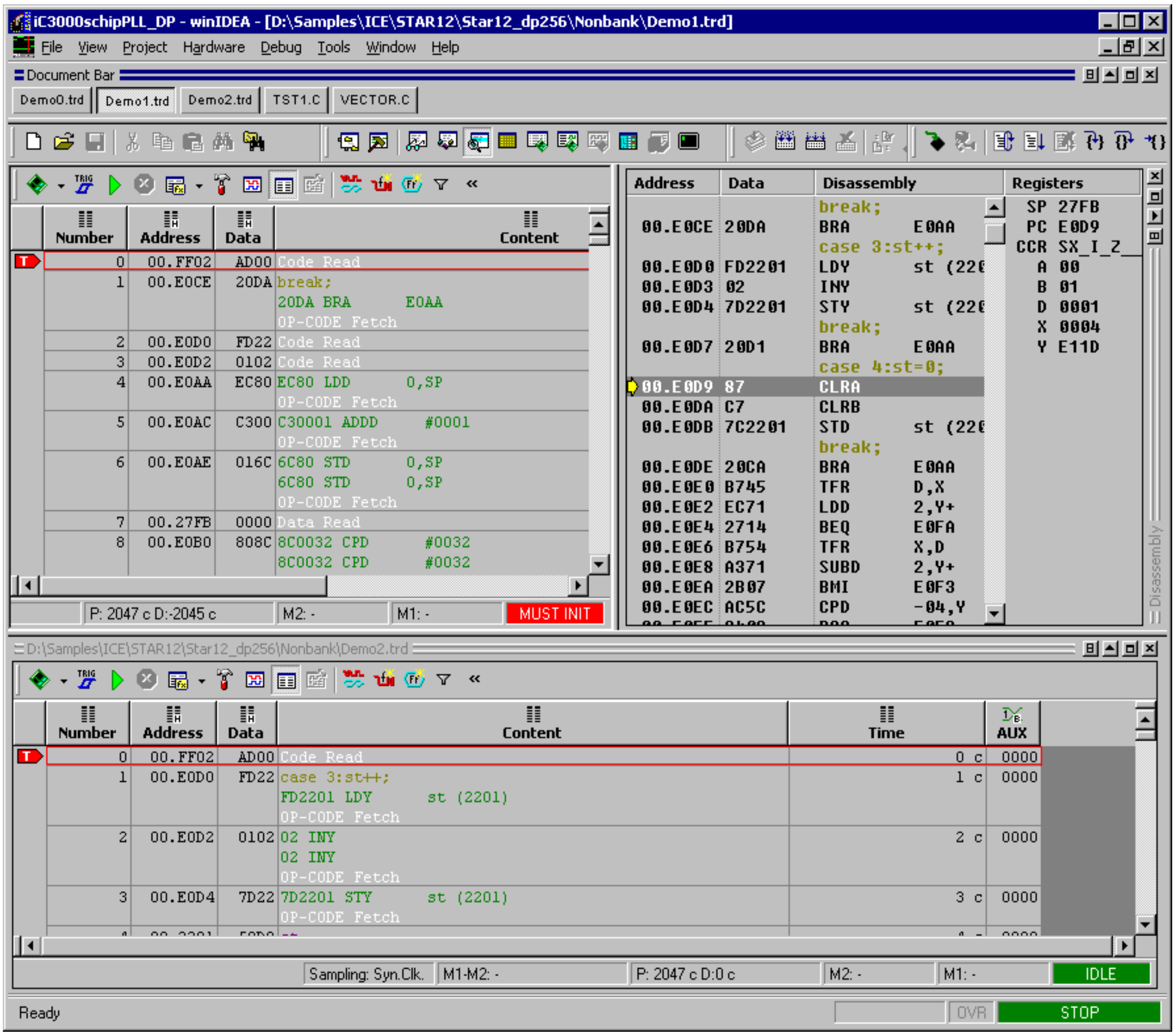
Ready | Ln 92, Col 1 | OVR | STOP

Now, make sure that the trace window is active (if not, select it) and select 'Save as' from the 'File' menu. A trace file is saved with the .trd extension.

Now record another two program flows using trace window and save them under different names.

Let's assume we have three trace files now (Demo0.trd, Demo1.trd, Demo2.trd) and we want to inspect them. Open each file by selecting 'Open' from the 'File' menu. The files are opened in the editor window probably overlapping each other (MDI window type). You may switch among them by using Ctrl-Tab shortcut.

Now, open the Document bar from the View menu (ALT-1). Using the Document bar the user is able to navigate through the trace records easily.

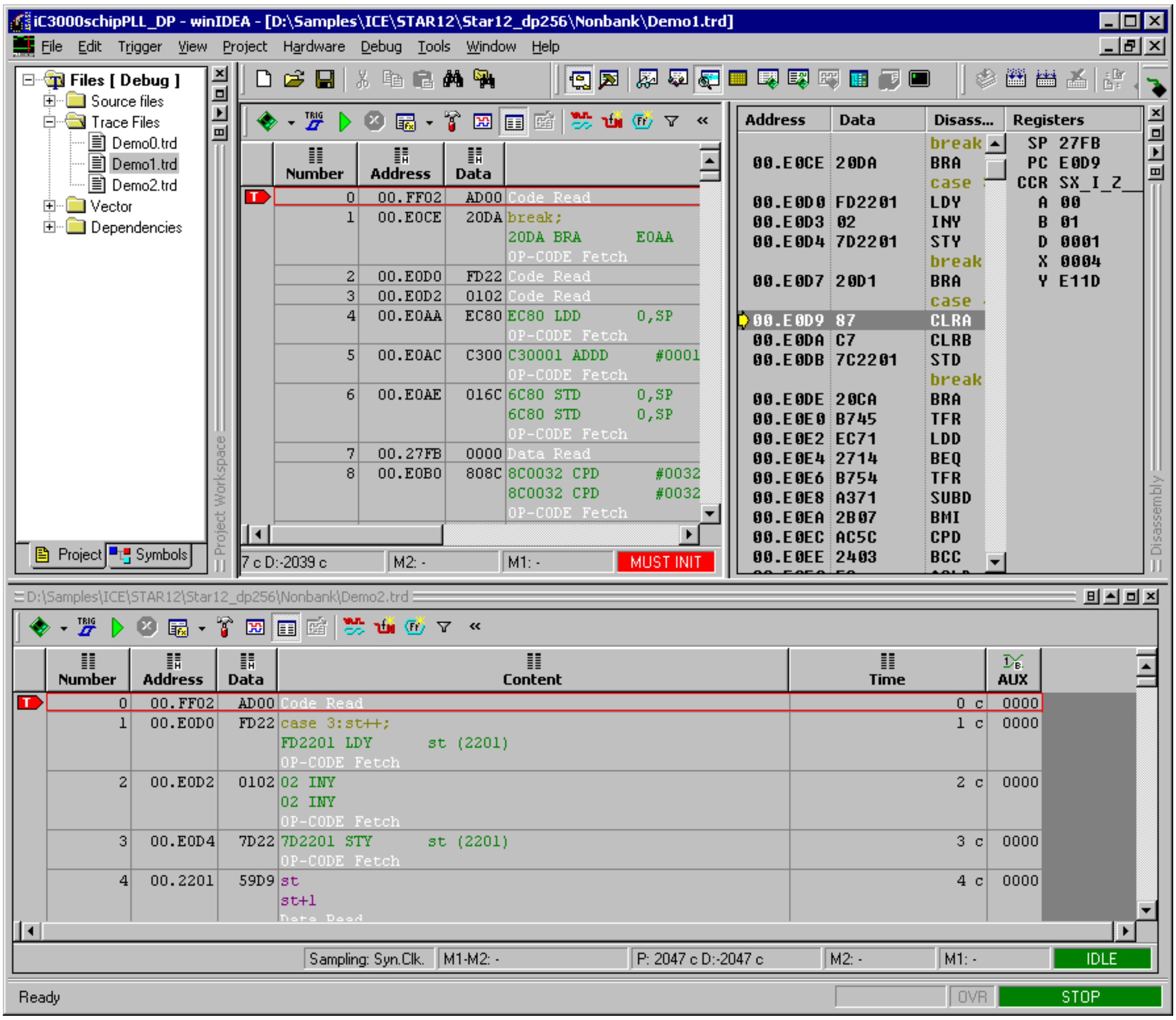

iC3000schipPLL_DP - winIDEA - [D:\Samples\ICE\STAR12\Star12_dp256\Nonbank\Demo1.trd]
File View Project Hardware Debug Tools Window Help
Document Bar
Demo0.trd
Demo1.trd
Demo2.trd
TST1.C
VECTOR.C
TRIG
D:\Samples\ICE\STAR12\Star12_dp256\Nonbank\Demo2.trd
Disassembly
Ready
OVR
STOP

```
   Number   Address   Data  Content
T       0   00.FF02   AD00  Code Read
        1   00.E0CE   20DA  break;
                            20DA BRA       E0AA
                            OP-CODE Fetch
        2   00.E0D0   FD22  Code Read
        3   00.E0D2   0102  Code Read
        4   00.E0AA   EC80  EC80 LDD       0,SP
                            OP-CODE Fetch
        5   00.E0AC   C300  C30001 ADDD    #0001
                            OP-CODE Fetch
        6   00.E0AE   016C  6C80 STD       0,SP
                            6C80 STD       0,SP
                            OP-CODE Fetch
        7   00.27FB   0000  Data Read
        8   00.E0B0   808C  8C0032 CPD     #0032
                            8C0032 CPD     #0032

P: 2047 c D:-2045 c    M2: -    M1: -    MUST INIT
```

```
Address    Data     Disassembly              Registers
                    break;                    SP  27FB
00.E0CE    20DA     BRA        E0AA           PC  E0D9
                    case 3:st++;             CCR  SX_I_Z__
00.E0D0    FD2201   LDY        st (220         A  00
00.E0D3    02       INY                        B  01
00.E0D4    7D2201   STY        st (220         D  0001
                    break;                     X  0004
00.E0D7    20D1     BRA        E0AA            Y  E11D
                    case 4:st=0;
00.E0D9    87       CLRA
00.E0DA    C7       CLRB
00.E0DB    7C2201   STD        st (220
                    break;
00.E0DE    20CA     BRA        E0AA
00.E0E0    B745     TFR        D,X
00.E0E2    EC71     LDD        2,Y+
00.E0E4    2714     BEQ        E0FA
00.E0E6    B754     TFR        X,D
00.E0E8    A371     SUBD       2,Y+
00.E0EA    2B07     BMI        E0F3
00.E0EC    AC5C     CPD        -04,Y
```

```
   Number   Address   Data  Content                          Time   AUX
T       0   00.FF02   AD00  Code Read                         0 c   0000
        1   00.E0D0   FD22  case 3:st++;                      1 c   0000
                            FD2201 LDY       st (2201)
                            OP-CODE Fetch
        2   00.E0D2   0102  02 INY                            2 c   0000
                            02 INY
                            OP-CODE Fetch
        3   00.E0D4   7D22  7D2201 STY       st (2201)        3 c   0000
                            OP-CODE Fetch

Sampling: Syn.Clk.    M1-M2: -    P: 2047 c D:0 c    M2: -    M1: -    IDLE
```

The other alternative to the Document bar is to use the project manager. Instead of opening the Document bar, select 'Project' from the View menu (ALT-0) and the 'Project Workspace' window is opened. Now add a group called 'Trace files' using local menu. Next, click on a newly created group, select 'Add files' from the local menu and add all three trace files. Now the user is able to navigate through the trace files by simply clicking the file of interest.



	Number	Address	Data	
T	0	00.FF02	AD00	Code Read
	1	00.E0CE	20DA	break; 20DA BRA E0AA OP-CODE Fetch
	2	00.E0D0	FD22	Code Read
	3	00.E0D2	0102	Code Read
	4	00.E0AA	EC80	EC80 LDD 0,SP OP-CODE Fetch
	5	00.E0AC	C300	C30001 ADDD #0001 OP-CODE Fetch
	6	00.E0AE	016C	6C80 STD 0,SP 6C80 STD 0,SP OP-CODE Fetch
	7	00.27FB	0000	Data Read
	8	00.E0B0	808C	8C0032 CPD #0032 8C0032 CPD #0032 OP-CODE Fetch

Address	Data	Disass...
		break
00.E0CE	20DA	BRA
		case
00.E0D0	FD2201	LDY
00.E0D3	02	INY
00.E0D4	7D2201	STY
		break
00.E0D7	20D1	BRA
		case
00.E0D9	87	CLRA
00.E0DA	C7	CLRB
00.E0DB	7C2201	STD
		break
00.E0DE	20CA	BRA
00.E0E0	B745	TFR
00.E0E2	EC71	LDD
00.E0E4	2714	BEQ
00.E0E6	B754	TFR
00.E0E8	A371	SUBD
00.E0EA	2B07	BMI
00.E0EC	AC5C	CPD
00.E0EE	2403	BCC

Registers	
SP	27FB
PC	E0D9
CCR	SX_I_Z_
A	00
B	01
D	0001
X	0004
Y	E11D

	Number	Address	Data	Content	Time	AUX
T	0	00.FF02	AD00	Code Read	0 c	0000
	1	00.E0D0	FD22	case 3:st++; FD2201 LDY st (2201) OP-CODE Fetch	1 c	0000
	2	00.E0D2	0102	02 INY 02 INY OP-CODE Fetch	2 c	0000
	3	00.E0D4	7D22	7D2201 STY st (2201) OP-CODE Fetch	3 c	0000
	4	00.2201	59D9	st st+1 Data Read	4 c	0000

Execution Coverage

Execution coverage records all addresses being executed and as a result displays which code is executed or not executed. It can be used to verify a test code, which should exercise a complete target application. It also helps finding a so called “dead code”, the code that is never executed. Such code represents undesired overhead when assigning code memory resources.

Depending on the implementation, execution coverage operates either in off-line or real-time operation mode.

Off-line execution coverage features:

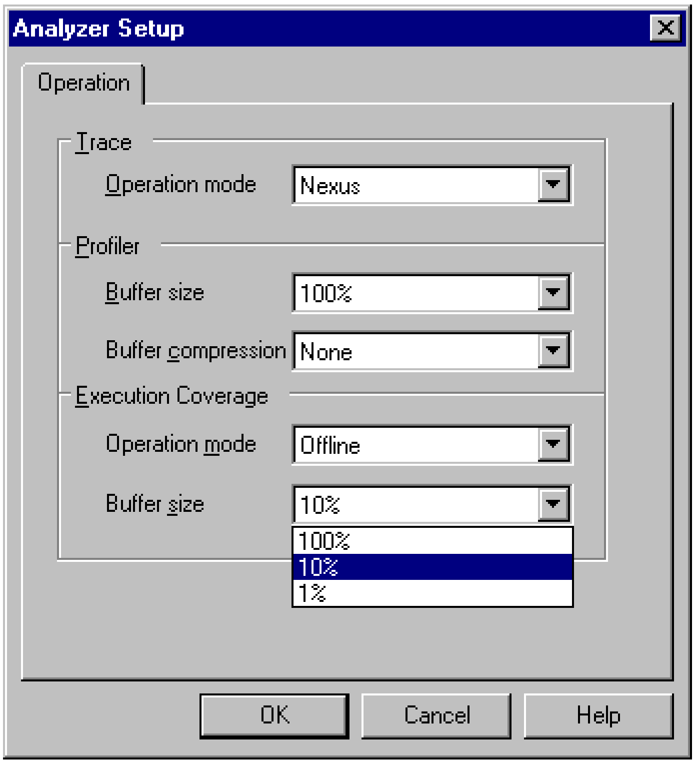
- decision coverage
- statement coverage, which should be used when real-time execution coverage is not available

Real-time execution coverage features:

- statement coverage running indefinitely

Off-line Execution Coverage

Execution coverage based on the emulator’s default trace operates in a so called off-line operation mode and is available for all debuggers providing the trace functionality. In this case, the trace hidden to the user is configured for ‘Record everything’ operation mode and then the program execution traced. After the trace buffer is full, the content is uploaded to the PC, execution coverage software analysis performed and at the end the results displayed. Time of program execution being tested directly depends on the target CPU speed and the trace buffer size. Upload time to the PC depends on the trace buffer size and the iC3000 unit. In case of iTRACE GT or Active GT development platform with 1GB or more trace buffer, it is recommended to use ic3000 GT unit which offers a high-speed trace upload to the PC. Off-line execution coverage trace buffer size is configurable in the ‘Hardware/Analyzer Setup’ dialog (1, 10 or 100%).



Trace

Operation mode: Nexus

Profiler

Buffer size: 100%

Buffer compression: None

Execution Coverage

Operation mode: Offline

Buffer size: 10%

100%
10%
1%

Off-line execution coverage analysis tests the following two metrics:

- **Statement Coverage** identifies which executable code was executed and which was not executed
- **Decision Coverage** exercises all conditional branch instructions and identifies if the instruction was taken, not taken, taken in both directions or not executed at all.

Off-line execution coverage has its advantages and disadvantages. It's available on all development systems featuring trace and features decision coverage metric. Decision coverage is an add-on to the statement coverage (a standard feature on the in-circuit emulators). However, the execution time of the off-line execution coverage test is limited by the trace buffer size and can never run infinitely. Further, due to the off-line trace based concept, it's impossible to identify which parts of the code were not tested or were tested but were not executed. Thereby, off-line execution coverage must be used with cautious to obtain reliable and valid information for the code under the test.

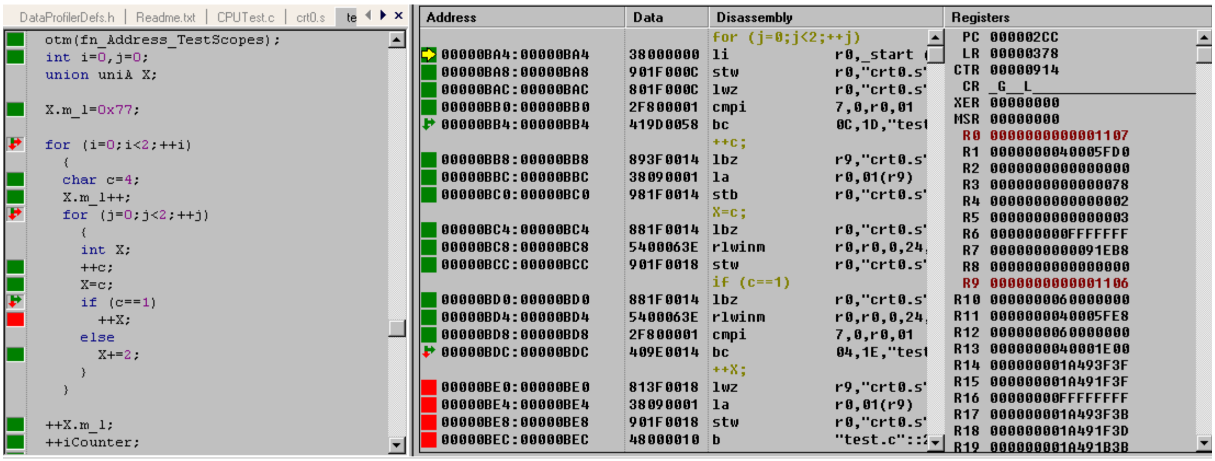
A so called unit test, where the decision coverage becomes a necessity, is getting more and more important in the test departments. It is impossible to set up a test application and environment, which would systematically cover and test all possible paths in the target application. However, a unit test comes very close to this and can be run systematically. It first identifies all functions of the target application and then each function is individually stressed with different input parameters and the output results verified. One of the output results is also decision coverage metrics next to the decision coverage. Executed logical paths within the function are identified with the decision and statement coverage (while the function is exercised with input parameters).

Real-time Execution Coverage

Real-time execution coverage is based on a hardware logic, which in real-time registers all executed program addresses. It features statement coverage but no decision coverage since it keeps the information on all executed program addresses but without any history, which would tell which address was executed when and in what order. The major advantage of the real-time execution coverage is that it can run **indefinitely**, which does not apply for the off-line coverage.

Results

Statement and decision coverage results are displayed in the execution coverage, the source and the disassembly window.

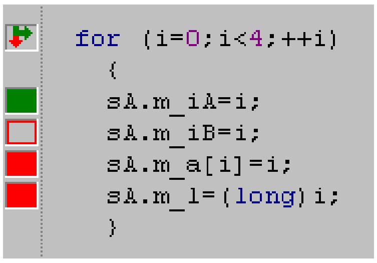


```
otm(fn_Address_TestScopes);
int i=0,j=0;
union uniA X;

X.m_l=0x77;

for (i=0;i<2;++i)
  {
  char c=4;
  X.m_l++;
  for (j=0;j<2;++j)
    {
    int X;
    ++c;
    X=c;
    if (c==1)
      ++X;
    else
      X+=2;
    }
  }

++X.m_l;
++iCounter;
```

```
Address              Data      Disassembly
                               for (j=0;j<2;++j)
00000BA4:00000BA4    38000000  li        r0,_start (
00000BA8:00000BA8    901F000C  stw       r0,"crt0.s'
00000BAC:00000BAC    801F000C  lwz       r0,"crt0.s'
00000BB0:00000BB0    2F800001  cmpi      7,0,r0,01
00000BB4:00000BB4    419D0058  bc        0C,1D,"test
                               ++c;
00000BB8:00000BB8    893F0014  lbz       r9,"crt0.s'
00000BBC:00000BBC    38090001  la        r0,01(r9)
00000BC0:00000BC0    981F0014  stb       r0,"crt0.s'
                               X=c;
00000BC4:00000BC4    881F0014  lbz       r0,"crt0.s'
00000BC8:00000BC8    5400063E  rlwinm    r0,r0,0,24,
00000BCC:00000BCC    901F0018  stw       r0,"crt0.s'
                               if (c==1)
00000BD0:00000BD0    881F0014  lbz       r0,"crt0.s'
00000BD4:00000BD4    5400063E  rlwinm    r0,r0,0,24,
00000BD8:00000BD8    2F800001  cmpi      7,0,r0,01
00000BDC:00000BDC    409E0014  bc        04,1E,"test
                               ++X;
00000BE0:00000BE0    813F0018  lwz       r9,"crt0.s'
00000BE4:00000BE4    38090001  la        r0,01(r9)
00000BE8:00000BE8    901F0018  stw       r0,"crt0.s'
00000BEC:00000BEC    48000010  b         "test.c"::
```

```
Registers
 PC  000002CC
 LR  00000378
CTR  00000914
 CR  _G__L
XER  00000000
MSR  00000000
 R0  0000000000001107
 R1  0000000040005FD0
 R2  0000000000000000
 R3  0000000000000078
 R4  0000000000000002
 R5  0000000000000003
 R6  00000000FFFFFFFF
 R7  0000000000091EB8
 R8  0000000000000000
 R9  0000000000001106
R10  0000000060000000
R11  0000000040005FE8
R12  0000000060000000
R13  0000000040001E00
R14  000000001A493F3F
R15  000000001A491F3F
R16  00000000FFFFFFFF
R17  000000001A493F3B
R18  000000001A491F3D
R19  000000001A491B3B
```

Source and disassembly window

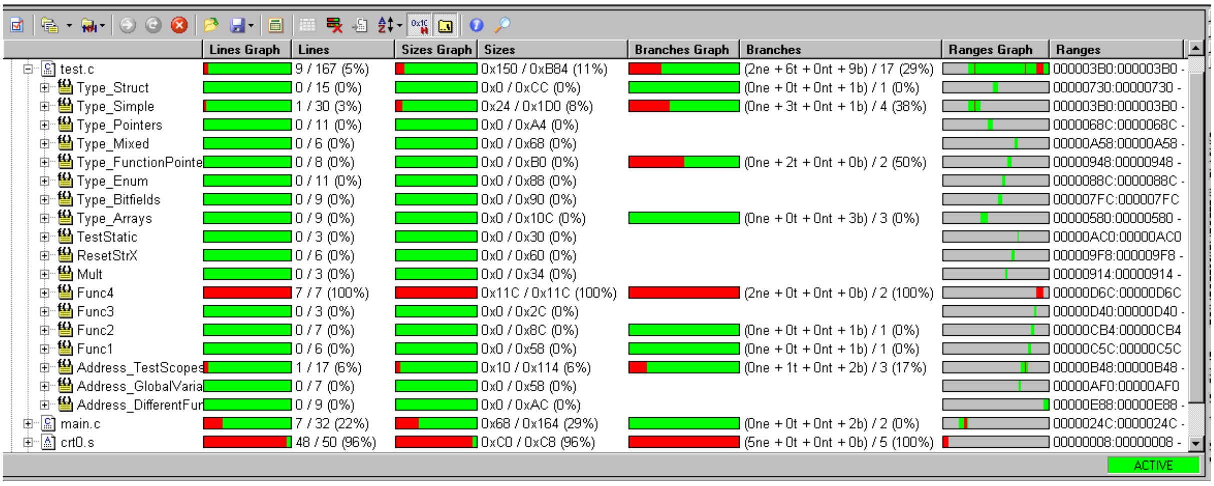


```
for (i=0;i<4;++i)
  {
  sA.m_iA=i;
  sA.m_iB=i;
  sA.m_a[i]=i;
  sA.m_l=(long)i;
  }
```

Functions, which have not been executed, are marked with a red box. Fully executed functions are marked with a blank box while partially executed functions are marked with a red frame.

Red and green arrows in the source and disassembly window display decision coverage results. Looking in the disassembly window, the customer can identify a state of all conditional branches: taken, not taken, taken in both directions and not executed.

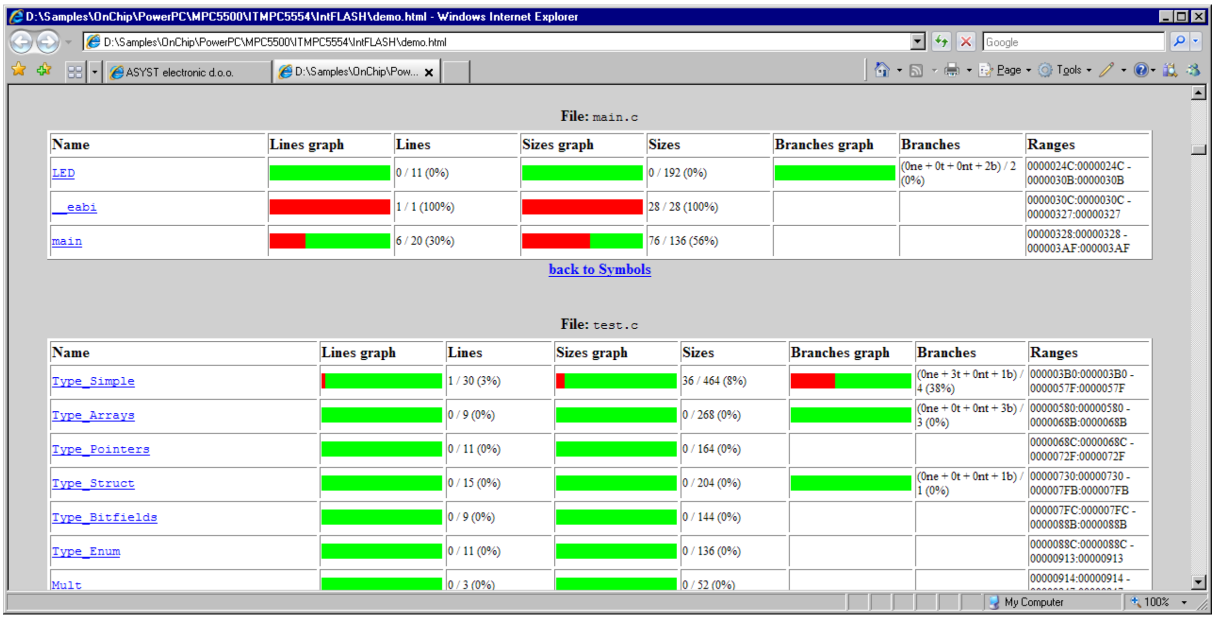
Decision coverage works on an object level and therefore the results are exact for the CPU instructions, which are displayed in the disassembly window. Decision coverage results displayed in the source window cannot be exact as the results in the disassembly window. Source lines consist of more instructions and therefore decision coverage information of more instructions is merged into a single source window information mark, which can no longer display the details available in the disassembly window. Branches column in the execution coverage window provides information on how many instructions are not executed (ne), taken (t), not taken (nt) or taken in both directions (b) within a source line.



	Lines Graph	Lines	Sizes Graph	Sizes	Branches Graph	Branches	Ranges Graph	Ranges
test.c	🟥🟩	9 / 167 (5%)	🟥🟩	0x150 / 0xB84 (11%)	🟥🟩	(2ne + 6t + 0nt + 9b) / 17 (29%)		000003B0:000003B0 -
Type_Struct	🟩	0 / 15 (0%)	🟩	0x0 / 0xCC (0%)	🟩	(0ne + 0t + 0nt + 1b) / 1 (0%)		00000730:00000730 -
Type_Simple	🟥🟩	1 / 30 (3%)	🟥🟩	0x24 / 0x1D0 (8%)	🟥🟩	(0ne + 3t + 0nt + 1b) / 4 (38%)		000003B0:000003B0 -
Type_Pointers	🟩	0 / 11 (0%)	🟩	0x0 / 0xA4 (0%)				0000068C:0000068C -
Type_Mixed	🟩	0 / 6 (0%)	🟩	0x0 / 0x68 (0%)				00000A58:00000A58 -
Type_FunctionPointe	🟩	0 / 8 (0%)	🟩	0x0 / 0xB0 (0%)	🟥🟩	(0ne + 2t + 0nt + 0b) / 2 (50%)		00000948:00000948 -
Type_Enum	🟩	0 / 11 (0%)	🟩	0x0 / 0x88 (0%)				0000088C:0000088C -
Type_Bitfields	🟩	0 / 9 (0%)	🟩	0x0 / 0x90 (0%)				000007FC:000007FC
Type_Arrays	🟩	0 / 9 (0%)	🟩	0x0 / 0x10C (0%)	🟩	(0ne + 0t + 0nt + 3b) / 3 (0%)		00000580:00000580 -
TestStatic	🟩	0 / 3 (0%)	🟩	0x0 / 0x30 (0%)				00000AC0:00000AC0
ResetStrX	🟩	0 / 6 (0%)	🟩	0x0 / 0x60 (0%)				000009F8:000009F8 -
Mult	🟩	0 / 3 (0%)	🟩	0x0 / 0x34 (0%)				00000914:00000914 -
Func4	🟥	7 / 7 (100%)	🟥	0x11C / 0x11C (100%)	🟥	(2ne + 0t + 0nt + 0b) / 2 (100%)		00000D6C:00000D6C
Func3	🟩	0 / 3 (0%)	🟩	0x0 / 0x2C (0%)				00000D40:00000D40 -
Func2	🟩	0 / 7 (0%)	🟩	0x0 / 0x8C (0%)	🟩	(0ne + 0t + 0nt + 1b) / 1 (0%)		00000CB4:00000CB4
Func1	🟩	0 / 6 (0%)	🟩	0x0 / 0x58 (0%)	🟩	(0ne + 0t + 0nt + 1b) / 1 (0%)		00000C5C:00000C5C
Address_TestScopes	🟥🟩	1 / 17 (6%)	🟥🟩	0x10 / 0x114 (6%)	🟥🟩	(0ne + 1t + 0nt + 2b) / 3 (17%)		00000B48:00000B48 -
Address_GlobalVaria	🟩	0 / 7 (0%)	🟩	0x0 / 0x58 (0%)				00000AF0:00000AF0
Address_DifferentFur	🟩	0 / 9 (0%)	🟩	0x0 / 0xAC (0%)				00000E88:00000E88 -
main.c	🟥🟩	7 / 32 (22%)	🟥🟩	0x68 / 0x164 (29%)	🟩	(0ne + 0t + 0nt + 2b) / 2 (0%)		0000024C:0000024C -
crt0.s	🟥🟩	48 / 50 (96%)	🟥🟩	0xC0 / 0xC8 (96%)	🟥	(5ne + 0t + 0nt + 0b) / 5 (100%)		00000008:00000008 -

Execution coverage window

Execution coverage results can be saved in a file (XML and XML compressed format) and can be open any time later. This allows analyzing and sharing execution coverage results without the emulator being hooked up. Additionally, execution coverage results can be saved in an html format for report and presentation purposes. Next chapter describes handling and use of execution coverage window.



D:\Samples\OnChip\PowerPC\MPC5500\ITMPC5554\IntFLASH\demo.html - Windows Internet Explorer
D:\Samples\OnChip\PowerPC\MPC5500\ITMPC5554\IntFLASH\demo.html
Google
ASYST electronic d.o.o.
D:\Samples\OnChip\Pow...
Page
Tools
My Computer
100%

File: `main.c`

Name	Lines graph	Lines	Sizes graph	Sizes	Branches graph	Branches	Ranges
LED	🟩	0 / 11 (0%)	🟩	0 / 192 (0%)	🟩	(0ne + 0t + 0nt + 2b) / 2 (0%)	0000024C:0000024C - 0000030B:0000030B
__eabi	🟥	1 / 1 (100%)	🟥	28 / 28 (100%)			0000030C:0000030C - 00000327:00000327
main	🟥🟩	6 / 20 (30%)	🟥🟩	76 / 136 (56%)			00000328:00000328 - 000003AF:000003AF

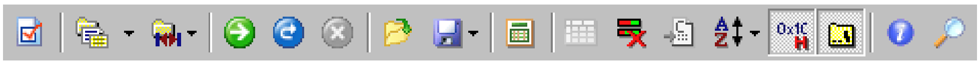
back to Symbols

File: `test.c`

Name	Lines graph	Lines	Sizes graph	Sizes	Branches graph	Branches	Ranges
Type_Simple	🟥🟩	1 / 30 (3%)	🟥🟩	36 / 464 (8%)	🟥🟩	(0ne + 3t + 0nt + 1b) / 4 (38%)	000003B0:000003B0 - 0000057F:0000057F
Type_Arrays	🟩	0 / 9 (0%)	🟩	0 / 268 (0%)	🟩	(0ne + 0t + 0nt + 3b) / 3 (0%)	00000580:00000580 - 0000068B:0000068B
Type_Pointers	🟩	0 / 11 (0%)	🟩	0 / 164 (0%)			0000068C:0000068C - 0000072F:0000072F
Type_Struct	🟩	0 / 15 (0%)	🟩	0 / 204 (0%)	🟩	(0ne + 0t + 0nt + 1b) / 1 (0%)	00000730:00000730 - 000007FB:000007FB
Type_Bitfields	🟩	0 / 9 (0%)	🟩	0 / 144 (0%)			000007FC:000007FC - 0000088B:0000088B
Type_Enum	🟩	0 / 11 (0%)	🟩	0 / 136 (0%)			0000088C:0000088C - 00000913:00000913
Mult	🟩	0 / 3 (0%)	🟩	0 / 52 (0%)			00000914:00000914 -

HTML report

Toolbars



Toolbars are explained in order from the left to the right.

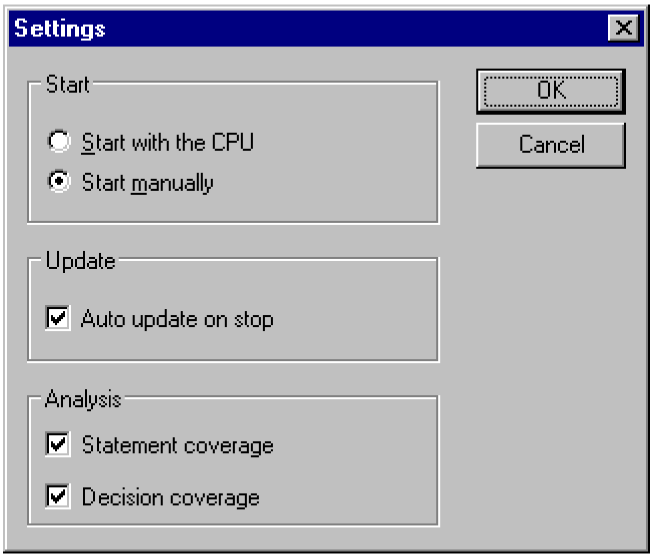
Settings

Execution coverage can be started manually on request or automatically as soon as the program is run.

Results can be automatically updated every time the program is stopped or on request by stopping the execution coverage.

Display of Statement and Decision coverage can be individually enabled/disabled. Per default both are enabled.

Note: Decision coverage is available for off-line execution coverage only


Settings

Start
○ Start with the CPU
● Start manually

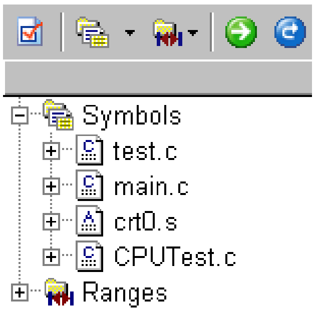
Update
☑ Auto update on stop

Analysis
☑ Statement coverage
☑ Decision coverage

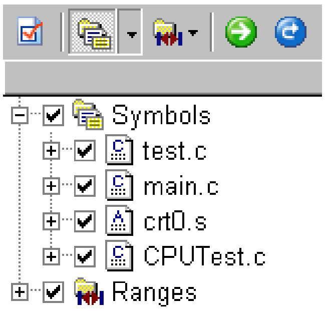
Configure symbols

Program areas analyzed by the execution coverage can be configured through ‘Configure symbols’ toolbar or ‘Configure ranges’ toolbar or as a mixture of both. As soon as a symbol or a range is added, a newly covered area can be seen in the Symbols and Ranges tree structure in the execution coverage window.

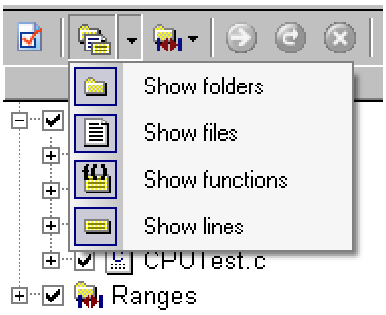
Click on the toolbar to activate the configuration



Configuration inactive



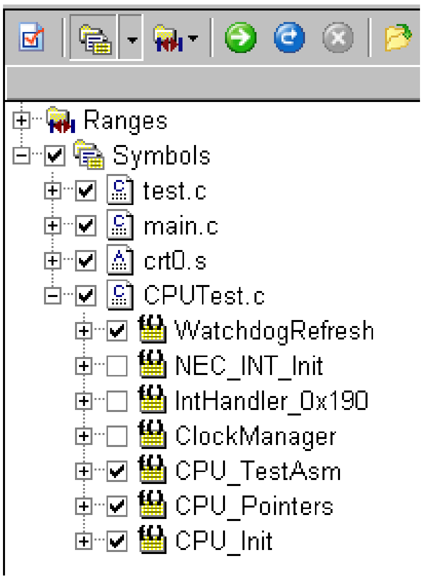
Configuration activated



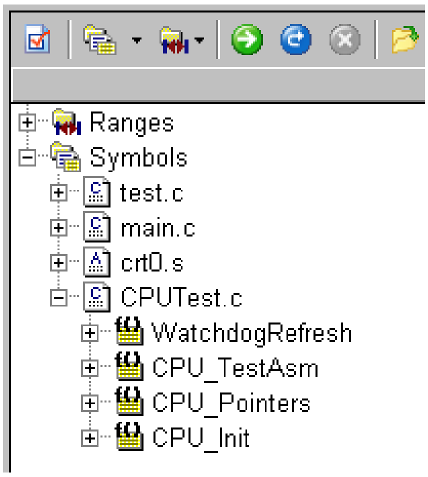
Types of displayed symbols are selected in the configuration tree on the right side of the toolbar (see above picture).

Selection or de-selection of a symbol is done via mouse by clicking on the square or tick next to the symbol or by clicking on the symbol and then use Space keyboard to toggle between selection and de-selection.

Left picture shows configuration of symbols and the picture on the right shows final configuration after the configuration is deactivated by clicking on the 'Configure symbols' toolbar.



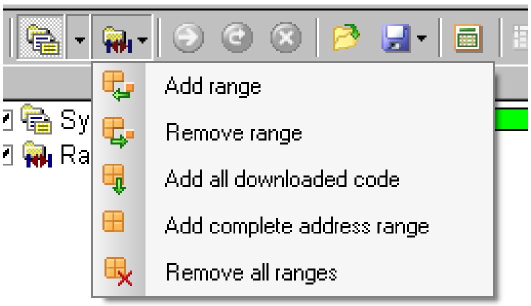
- Ranges
- ☑ Symbols
  - ☑ test.c
  - ☑ main.c
  - ☑ crt0.s
  - ☑ CPUTest.c
    - ☑ WatchdogRefresh
    - □ NEC_INT_Init
    - □ IntHandler_0x190
    - □ ClockManager
    - ☑ CPU_TestAsm
    - ☑ CPU_Pointers
    - ☑ CPU_Init



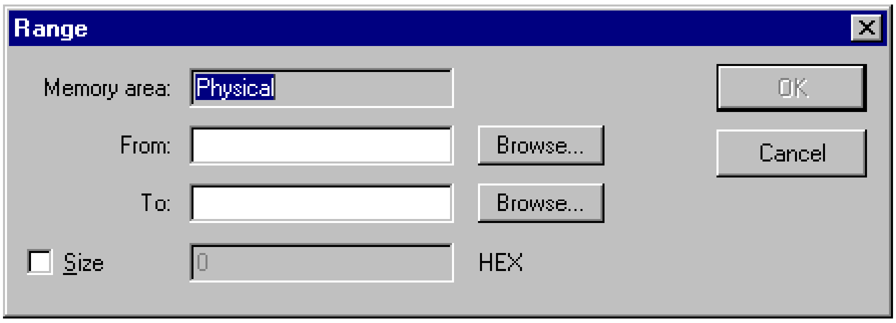
- Ranges
- Symbols
  - test.c
  - main.c
  - crt0.s
  - CPUTest.c
    - WatchdogRefresh
    - CPU_TestAsm
    - CPU_Pointers
    - CPU_Init

Configure ranges

Available range options can be seen on the below picture.



Add range & Remove range



Range

Memory area: Physical

From: Browse...

To: Browse...

□ Size 0 HEX

OK

Cancel

Add all downloaded code

This configures execution coverage for all downloaded code. This is the most recommended configuration and works fine as long as there are no areas to be tested, which are not part of the download file and as long as the download file contains correct information. In case of any doubts, use other configuration choices.

Add complete address range

It yields a complete CPU address space for off-line execution coverage while for the real-time execution coverage working address space is limited by the hardware and covers first 8MBytes (MPC5500 Nexus RTR) of the CPU address space.

Start

Starts execution coverage session.

Continue

Continues execution coverage session. Execution coverage can be run and results added in addition to the previous session or even to an old session being loaded into the current workspace.

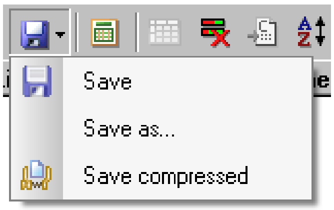
Stop

Stops execution coverage session.

Load

Loads results from saved execution coverage session.

Save



Saves results in XML format (*.ccv) or compressed XML format (*.ccvgz).

Report

Generates a report in an html format, which can be used for presentations or easy sharing execution coverage results.

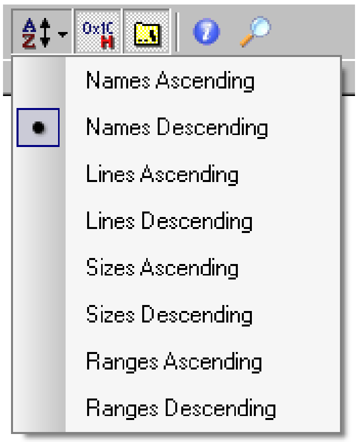
Show not executed only

When selected, it displays not executed parts of the code only.

Display source window, Go to source

It jumps to the source, when symbol is selected and toolbar pressed. The alternative is double click on the symbol.

Sort



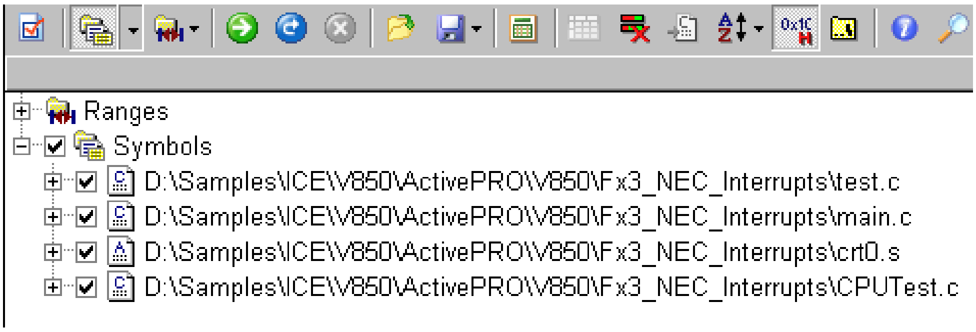
Symbols and ranges can be sorted by different type and ordering. Clicking the column name (e.g. Lines, Sizes,…) in the execution coverage window performs sorting too.

Hexadecimal display

Displays numbers in a hexadecimal format instead of a default decimal.

Show relative paths

Displays relative paths next to the symbol names instead of absolute paths.



Ranges
Symbols
D:\Samples\ICE\V850\ActivePRO\V850\Fx3_NEC_Interrupts\test.c
D:\Samples\ICE\V850\ActivePRO\V850\Fx3_NEC_Interrupts\main.c
D:\Samples\ICE\V850\ActivePRO\V850\Fx3_NEC_Interrupts\crt0.s
D:\Samples\ICE\V850\ActivePRO\V850\Fx3_NEC_Interrupts\CPUTest.c

Absolute paths displayed

Information

The user can enter tester name, test ID, time, date, environment information and comments as part of the execution coverage session,

Search

Search can be used to find a symbol in the results.

Getting Started with Execution Coverage

1. Configure real-time or off-line execution coverage in the ‘Hardware/Analyzer Setup’.
2. Open execution coverage window either from ‘View/Execution Coverage’ or from ‘File/New/Execution Coverage File (.ccv)’
3. Configure areas to be tested for the statement and/or decision coverage. Program areas covered by the execution coverage can be configured through ‘Configure symbols’ use or ‘Configure ranges’ use or as a mixture of both. When areas are configured through the symbols, debug download must be performed first.
4. Execute debug reset, start execution coverage and run the application. Stop the application or execution coverage to view the results.

Debug Session

Download Files

winIDEA IDE features two types of downloads:

- 'Debug' Download often called Download
- Target Download

Download

Download loads files defined in the Download Files tab.

Target Download

Target Download loads files defined in the Download Files or Target Download tab depending on the setting in the Target download field in the Options tab. Additionally, a file defined in the Target Download tab can be executed on a demand any time during the debugging. If the user wants to load a file at a certain stage during debug session (simulation, testing,...), he should:

- specify any file that he will be using, in the 'Target Download' list.
- at the desired time, the file to be loaded should be selected and loaded by clicking the 'Download' button in the 'Target Download' dialog.

The development system and target application requirements dictate, which download type needs to be used.

Normally, beside the code a file contains a debug information, which is generated by the compiler/assembler and allows high-level source debugging. To be able to use a high-level source debugging, the user needs to instruct the linker to output the debug information beside the code. WinIDEA supports most of the existing debug formats. Of course, binary, Intel or Motorola hex files without the debug information can be loaded as well.

Loading files on debuggers with overlay emulation memory

On In-Circuit and Active emulation systems, Download loads files into the overlay emulation memory, while the CPU is held in reset. The debugger loads files directly into the memory bypassing the CPU. Thereby, only overlay emulation memory is accessible by the Download.

Target Download is used when it’s necessary to load the files to the target (writable) memory or into the internal CPU memory other than the internal flash or ROM, for instance RAM or EEPROM. If some of the memory is not writable out of the CPU reset, the user needs to add an initialization (CPU configuration) sequence, which is carried out before the Target Download. The CPU being emulated or its emulation substitute (e.g. bondout) resides on the development system and carries out Target Download. Thereby, all CPU memory resources, including overlay emulation memory, are accessible by the Target Download.

Loading files on on-chip debuggers (no overlay emulation memory)

If an on-chip debugger is used, there is no need to use the Target Download option. If it is used, this may yield downloading the code twice (depending on settings).

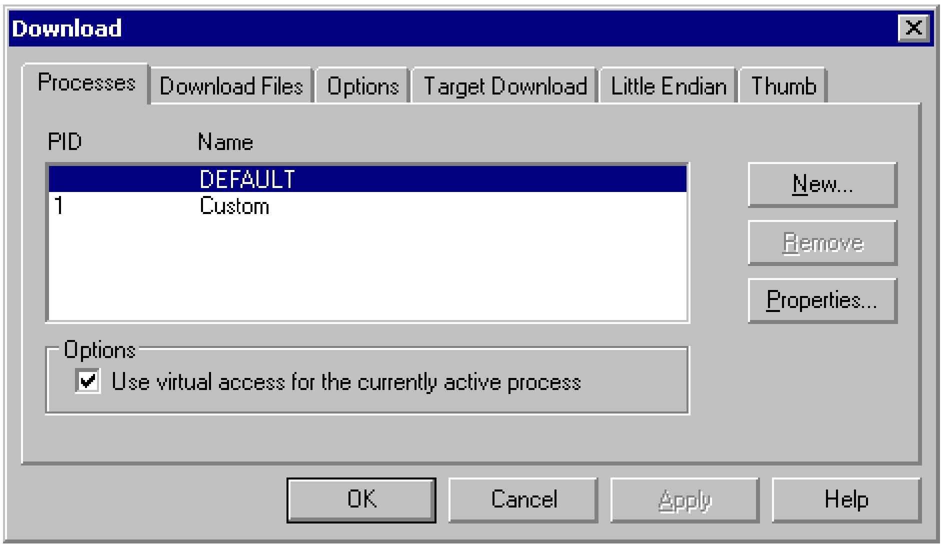
Downloading from script program

If certain files must be loaded during script execution:

- specify any file that will be used, in the 'Target Download' list.
- use the APIDownloadFile1 script function to load the desired file.

Configuring Processes

On certain CPU families, the memory area can be split into several processes.



PID	Name
	DEFAULT
1	Custom

Options

☑ Use virtual access for the currently active process

Process specification dialog

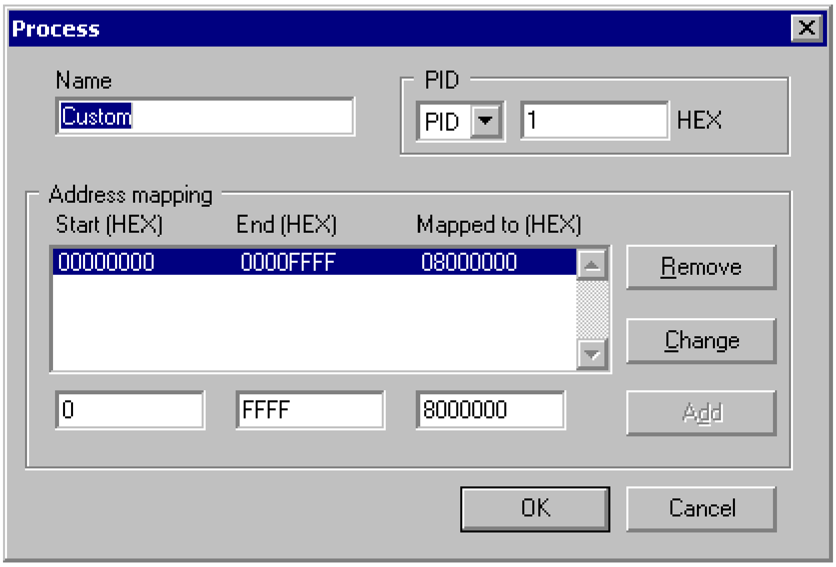
A new process can be added using the ‘New…’ button, a non-default process can be removed using the ‘Remove’ button and the properties of a process can be edited using the ‘Properties…’ button.

Note: the Process dialog is not available on all CPU families.

Use virtual access for the currently active process

If this option is checked, virtual access is used for the currently active process.

Customizing processes



Name: Custom

PID: PID 1 HEX

Address mapping

Start (HEX)	End (HEX)	Mapped to (HEX)
00000000	0000FFFF	08000000

0 FFFF 8000000

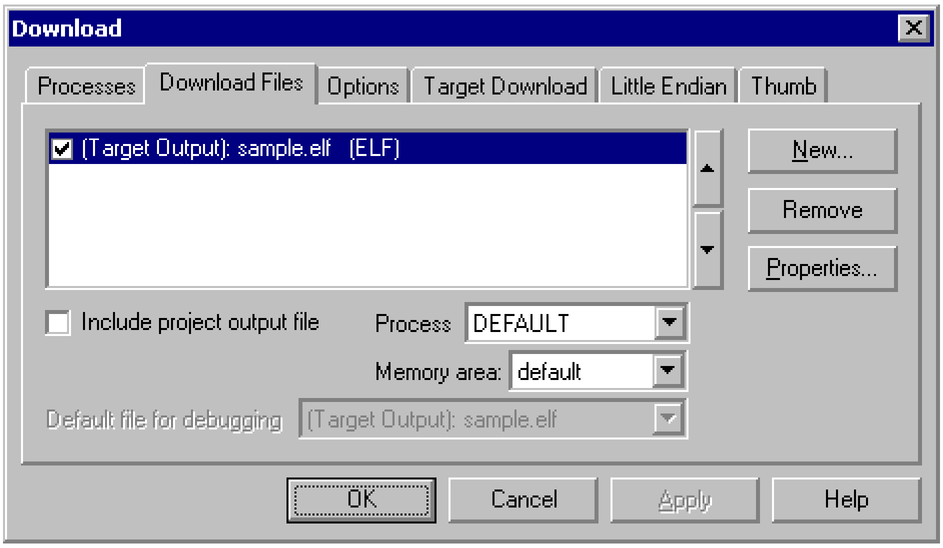
Process customization dialog

A custom process can be defined in this dialog. The name of the process is specified and the processes's PID, if needed, can be specified.

The memory area where the process is located is specified in the Address mapping section. The start, end and the location it is mapped to are specified in the entry boxes below. New areas are added using the 'Add' button, the selected one can be changed to the one specified below using the 'Change' button or removed using the 'Remove' button.

Configuring Download Files

To configure download files select the 'Download Files' command on the Debug menu.



☑ (Target Output): sample.elf (ELF)

☐ Include project output file

Process: DEFAULT

Memory area: default

Default file for debugging: (Target Output): sample.elf

The Download Files dialog

In the above figure, one download file is defined. The name is 'sample.elf' and is located in the directory of current project target (see "Directory Organization" on page 234). Its type is ELF and is loaded without any offset.

You can add more files by clicking the ‘New…’ button, delete the selected downlaod file by clicking the ‘Remove’ button, or edit properties of the currently selected file using the 'Properties…' button.

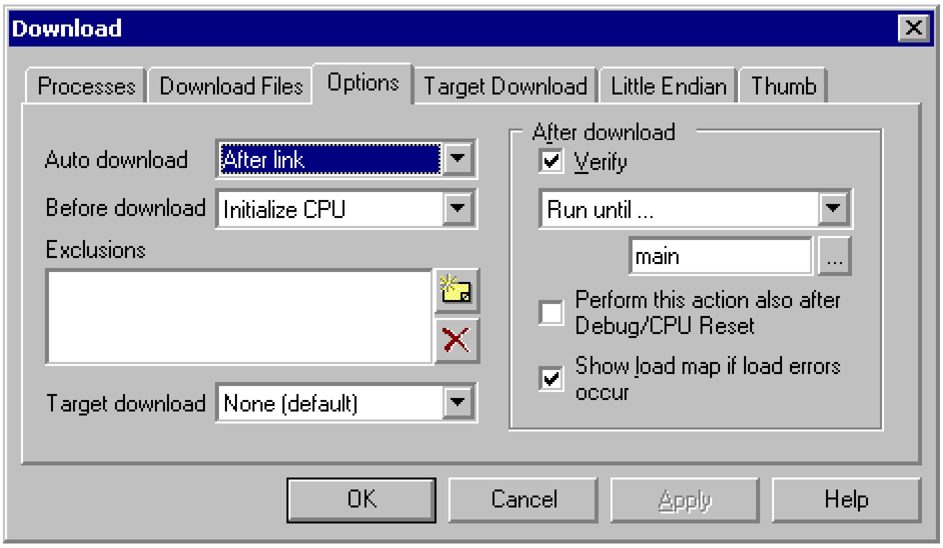
For every download file the Process can be specified (when using a CPU family with the ability to run multiple processes) and the memory area to which it is downloaded.

If more than one file are specified, the default file for debugging should be selected in the ‘Default file for debugging’ option.

Include project output file

If this option is selected, the file that is output by the project is automatically added to the download files list.

Download Options



Auto download: After link

Before download: Initialize CPU

Exclusions

Target download: None (default)

After download

☑ Verify

Run until ...

main

□ Perform this action also after Debug/CPU Reset

☑ Show load map if load errors occur

Download Options page

Auto download

Determines when an automatic download should be performed (see “Executable File” on page 245). The options are:

- **Never** - No automatic download is performed
- **After link** - Download is performed when link process completes
- **Prompt when changed** - User is prompted to confirm download when a change to the download files is detected
- **When changed** - Download is performed when a change to the download files is detected

Before download

An action to be performed before download can be selected here.

- **Nothing -** Do nothing. Note that the emulation must already be started (typically through Debug/CPU Reset command).
- **Initialize CPU** – Initializes the CPU as defined in the Hardware/Emulation Options/Initialization menu (default)

After download…

An action can be performed after the download completes.

- **Nothing (Stop)** - The CPU is stopped on its RESET position. No program code is executed.
- **Run until… -** The CPU is set to running until it reaches the specified position (typically the 'main' function, but any function can be selected with the ... button).
- **Run** - The CPU is set to running.
- **Go to program entry point -** Presets the program execution point to the program entry point (if one is specified in the download file). This option is usualy used along with Before download/Reset for… option.
- **Go to… -** Presets the execution point to the specified address (any function can be selected with the ... button).

Perform this action also after Debug/CPU Reset

If this option is selected, the action defined in the ‘After download…’ option is also performed when a Debug or CPU reset occurs.

Show load map when download errors occur

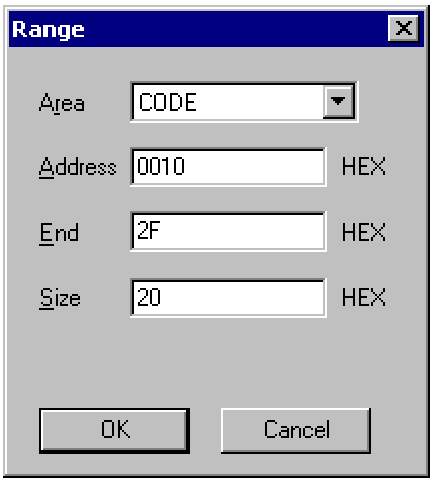
When checked, a load map error will be reported if code is loaded outside debugger range or code overlaps.

Verify

When checked, the downloaded code is verified after download finishes.

Exclusions

Multiple memory range exlusions can be defined. New areas can be specified by pressing the 'New area' button.



Area: CODE

Address: 0010 HEX

End: 2F HEX

Size: 20 HEX

Memory Exclusions definition

The configured areas can be edited by double-clicking on the area. An area can be removed by pressing the ☒ 'Remove area' button.

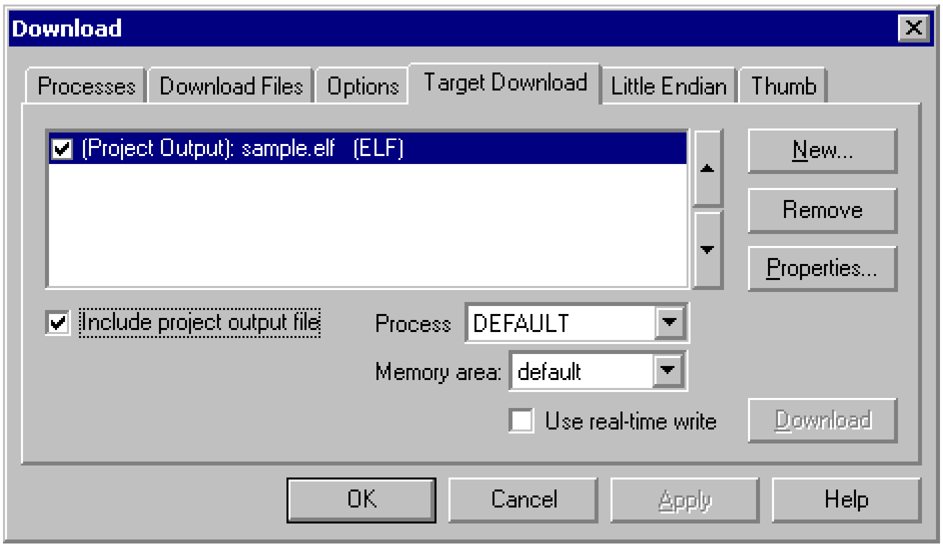
Target Download

After the primary download a secondary download can be performed. This is usually used to load program code to target memory that is accessible after the debugged CPU has been released from reset.

- **None (default) -** No target download is performed
- **Download files** - Target download is performed with the original set of download files
- **Target download files -** Target download is performed with the set of download files specified in the Target Download page.

Target Download Files

This page specifies download files, which are used in a secondary download if the '**Target download files**' option is specified in the Download files options page.



Download

☑ (Project Output): sample.elf (ELF)

☑ Include project output file

Process: DEFAULT

Memory area: default

□ Use real-time write

Target Download Files dialog

Download

At any desired time, the file to be loaded can be selected and loaded by clicking the 'Download' button.

Memory area

This setting lets you override the default memory area for the file. Use this when you wish to load the code from the file to a memory area other than CPUs program area (for example loading into XDATA memory on 8051).

Include project output file

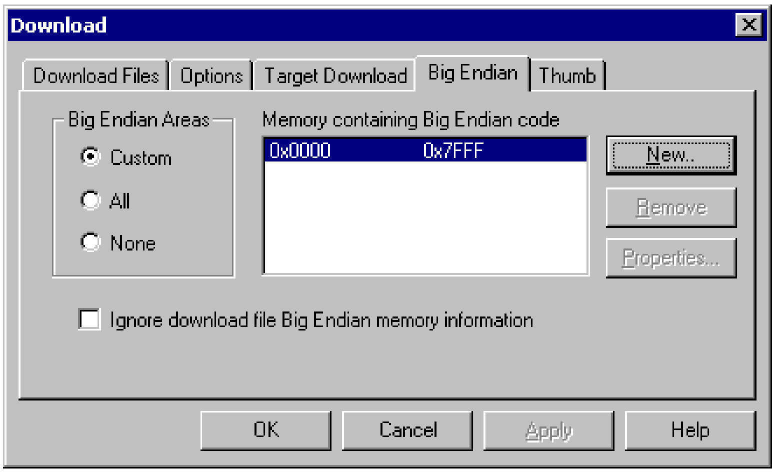
This option automatically includes the project output file.

Use real-time write

Real-time writes are performed for target download if this option is selected.

Big and Little Endian/Thumb setup

On certain CPUs, some memory areas are used in a different memory organization that the others, either as Big Endian vs. Little Endian and Thumb set vs. ARM set. The memory areas which contain Big Endian code and Thumb code can be set in the Debug Options/Big Endian and Debug Options/Thumb, respectivelly.



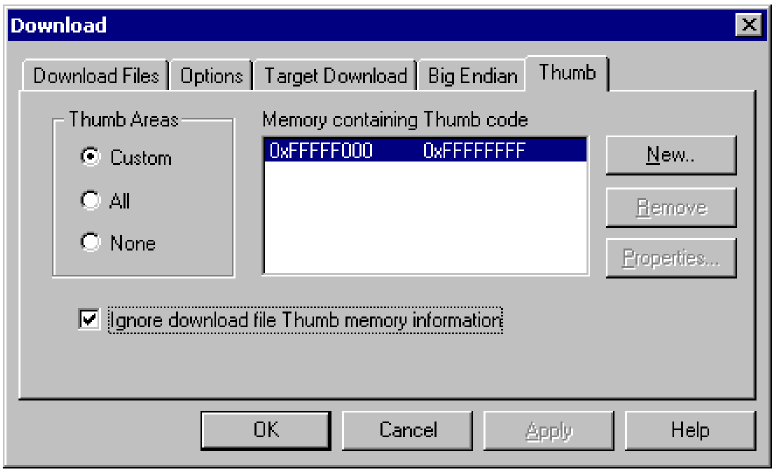
Big Endian Areas
● Custom
○ All
○ None

Memory containing Big Endian code

0x0000	0x7FFF

□ Ignore download file Big Endian memory information

Big Endian Memory Area specification



Thumb Areas
● Custom
○ All
○ None

Memory containing Thumb code

0xFFFFF000	0xFFFFFFFF

☑ Ignore download file Thumb memory information

Thumb Memory Area Specification

Big Endian/Thumb Areas

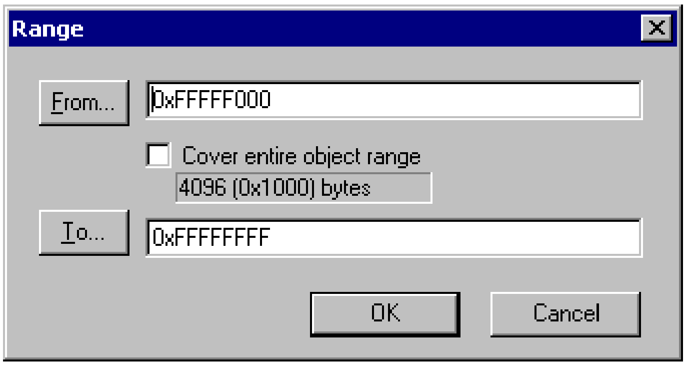
The areas can be set in three ways:

- **All** – all areas are Big Endian or Thumb
- **None** – all areas are Little Endian or ARM
- **Custom** – memory areas custom specified hold Big Endian or Thumb code

Memory Containing Big Endian/Thumb code

Here, custom memory areas containing Big Endian or Thumb code are specified. Multiple areas can be specified. New areas are defined by pressing the 'New…'

button, existing ones can be edited by pressing the 'Properties…' button or removed by pressing the 'Remove…' button.



From...: 0xFFFFF000

☐ Cover entire object range

4096 (0x1000) bytes

To...: 0xFFFFFFFF

Specifying the memory range

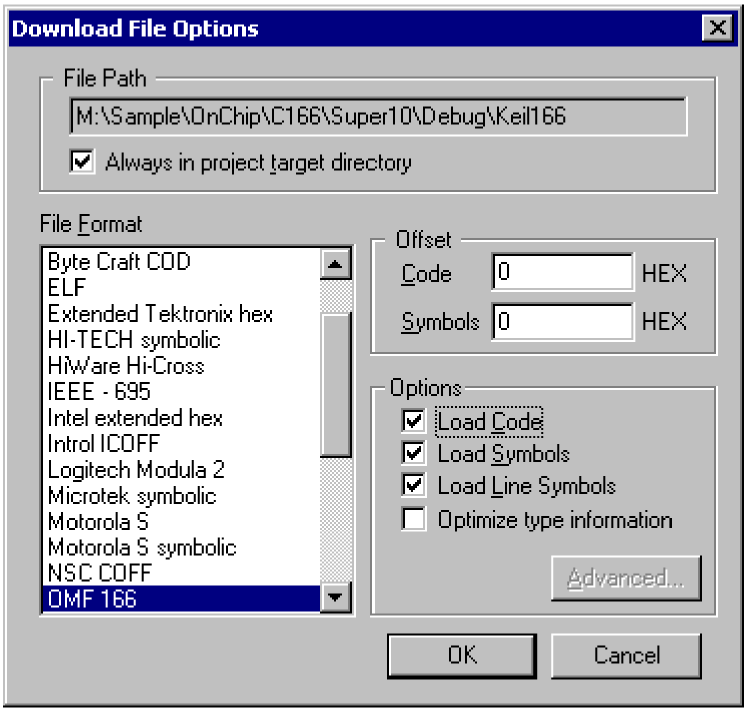
The memory range can be specified with absolute address or by selecting the area using the symbol browser by pressing either the 'From…' or the 'To…' button. If an object is specified in the 'From…' area and 'Cover entire object range' is checked, the entire object range of the object will be declared as either Big Endian or Thumb.

Ignore download file Big Endian/Thumb memory information

If this option is checked, the memory area information from the download file about Big Endian or Thumb memory areas are ignored and only the areas specified here are regarded.

Download File

In the Download File Options dialog, properties of a download file are configured.



Download File Options

File Path

M:\Sample\OnChip\C166\Super10\Debug\Keil166

☑ Always in project target directory

File Format

- Byte Craft COD
- ELF
- Extended Tektronix hex
- HI-TECH symbolic
- HiWare Hi-Cross
- IEEE - 695
- Intel extended hex
- Introl ICOFF
- Logitech Modula 2
- Microtek symbolic
- Motorola S
- Motorola S symbolic
- NSC COFF
- OMF 166

Offset

Code: 0 HEX

Symbols: 0 HEX

Options

☑ Load Code

☑ Load Symbols

☑ Load Line Symbols

☐ Optimize type information

Download File Options dialog

File Path

Indicates the path of the download file.

If the 'Always in project target directory' option is checked, then file's directory is ignored and the file is always searched for in the current project target's directory (see "Directory Organization" on page 234).

By checking this option, you can quickly switch project targets (see "Targets" on page 235) without having to redefine download files paths (remember that Build Manager will move all generated files to target output directory, which is different for every target).

File Format

Setting determines the file format of the download file. winIDEA will attempt to determine the format automatically as a file is added to the download files list, but you have to make sure that this setting is correct. Refer to your linker documentation for information on what formats your linker can generate.

Offset

Determines the value that will be added to address of every absolute object loaded. This includes program code and absolute symbols. Since all absolute object files contain address information, you will always use zero offset except for binary files. The offset can be defined for both symbols and code.

Load Code

Loads the code.

Load Symbols

Loads symbolic information.

Load Line Symbols

This option should always be on for files containing source debug information.

Optimize type information

Sometimes the compiler generates multiple type definition tags (typically for every time the header file that contains them, is included by some C/C++ file).

The result are multiple entries under Browser/Typedefs, which isn't wrong, but file conversion time can take much longer.

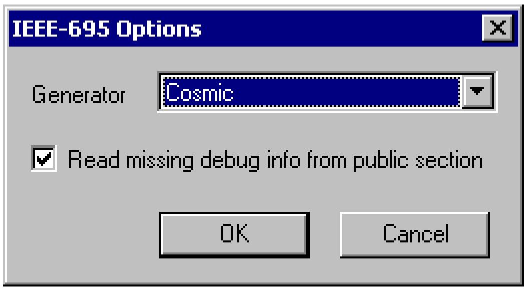
If this option is checked, then types that already exist are not 'multiplied'.

If the program uses structures that have equal names, but different definitions, then variables of the 'optimized' type will not be displayed as expected, but rather using the first type structure with that name.

Advanced

This button opens an advanced options dialog for the selected file format.

IEEE-695 Options Dialog



IEEE-695 Options

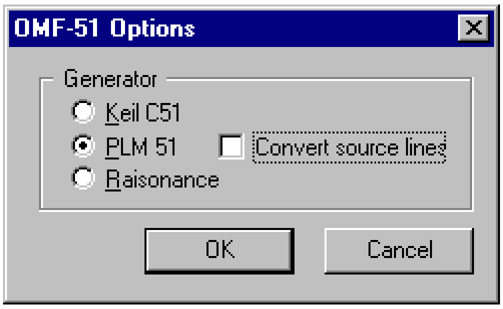
Generator: Cosmic

☑ Read missing debug info from public section

IEEE-695 Options dialog

From available compiler vendors, select the one that generated the download file and whether missing debug info should be loaded from the public section.

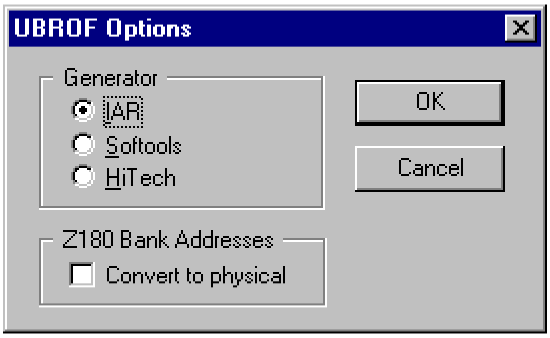
OMF-51 Options Dialog



OMF-51 Options dialog

From available compiler vendors, select the one that generated the download file and, in case of PLM 51, whether source lines should be converted.

UBROF Options Dialog



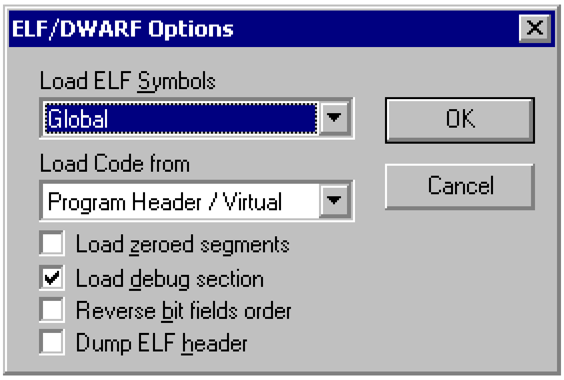
UBROF Options dialog

From available compiler vendors, select the one that generated the download file.

Convert to physical

When using Z180 Bank Addresses, the compiler can in some cases generate addresses, which should not be converted to physical addresses. Uncheck this option in this case.

ELF/DWARF Options Dialog



Load ELF Symbols: Global

Load Code from: Program Header / Virtual

- ☐ Load zeroed segments
- ☑ Load debug section
- ☐ Reverse bit fields order
- ☐ Dump ELF header

ELF/DWARF Options dialog

In this dialog you can select which ELF symbols are to be loaded, whether zeroed segments should be loaded or not and whether debug information is loaded.

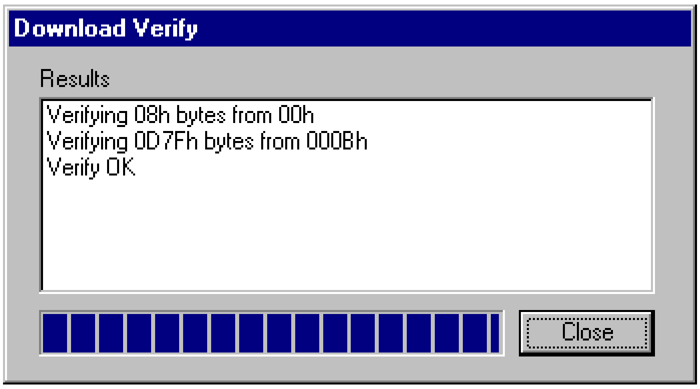
The bit field order can be reversed for different endian applications.

The code can be loaded from the Program Header using Physical or Virtual addresses or from sections. The default option is Program Header / Physical, other options should be used if this option fails.

If required, the ELF header can be dumped.

Verify Download

The 'Verify Download' command performs a verification of code that was downloaded.



```
Verifying 08h bytes from 00h
Verifying 0D7Fh bytes from 000Bh
Verify OK
```

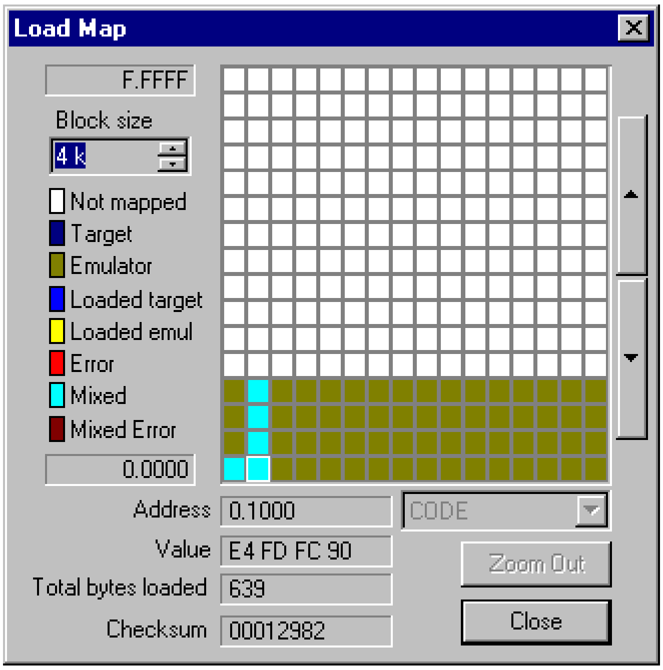
The Download Verify dialog

The verification process reads all the memory ranges that were written in the download process and compares the contents read with the code that was actually downloaded.

You can instruct winIDEA to perform an automatic download verify after every download (see "Download Options" on page 101).

Load Map

The 'Load Map…' command opens a dialog showing locations where code has been loaded during the last download.



Address 0.1000

Value E4 FD FC 90

Total bytes loaded 639

Checksum 00012982

Load Map dialog

By clicking on the map, the view zooms into selected area.

Locations indicated as errors indicate either:

- overlapping of download code, or
- loading into non mapped areas

Note: the load map opens automatically after download, if errors are detected.

Debug Information

Although you can debug target programs without any debug information, such debugging is reduced to setting breakpoints, running in the disassembly window and inspecting memory in memory windows.

To take full advantage of winIDEA's debugging capabilities, make sure that your compiler and linker include debug information in the output file.

Two additional symbol manipulation features are implemented to facilitate high level and symbolic debugging:

Symbol name prefix handling

Some compilers change (decorate) names of global symbols (variables, functions and code labels) by adding a prefix to the symbol name (most often an underscore).

This 'feature' confuses the user and defeats some of winIDEA's debugging features (like "Watch Tips" on page 45). Therefore a symbol 'de-prefix' feature has been implemented to remove such decoration. See "Symbols" on page 126 for more information.

Selective disabling of debug information

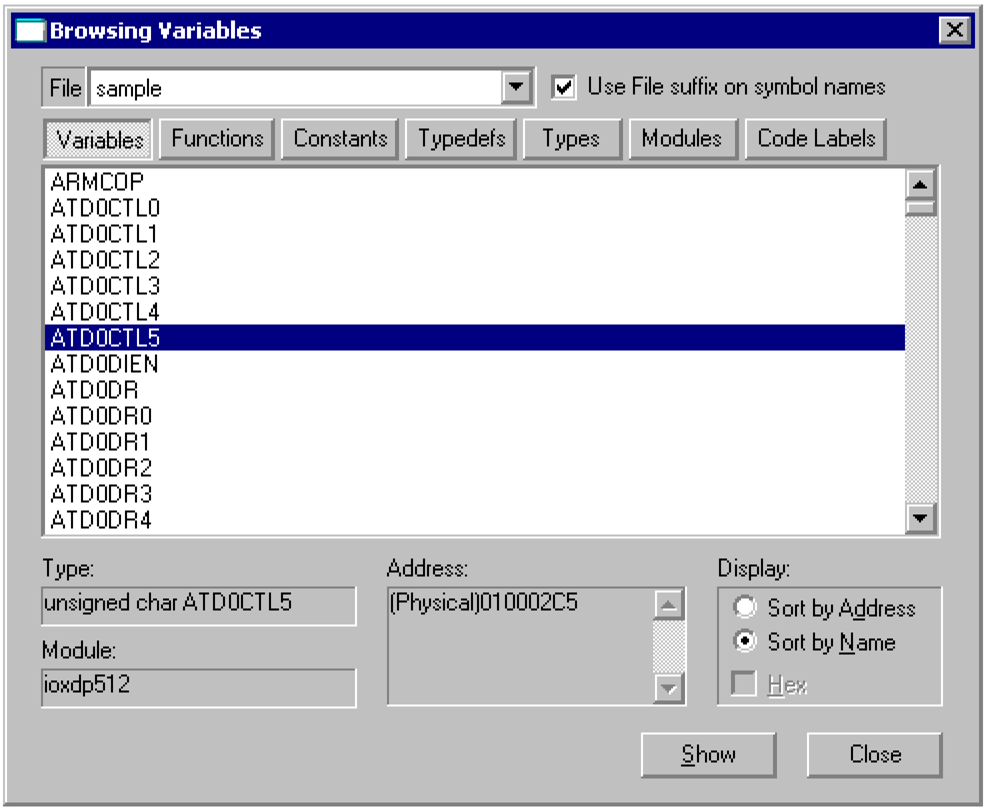
winIDEA allows selective debug information disabling for modules and functions which you do not wish to debug (debugged code, interrupt routines, etc.). See "Debugging" on page 127 for more information.

Symbol Browser

Currently loaded symbols can be viewed in the Symbol Browser dialog (View menu).

This dialog will also open upon browse request from a dialog, which supports symbolic address entries. On these occasions you can click the Select button to transfer the currently selected symbol to the dialog where the browse request was initiated.

The dialog is resizable and its screen position is restored the next time it opens.



Browsing Variables

File: sample

☑ Use File suffix on symbol names

ARMCOP
ATD0CTL0
ATD0CTL1
ATD0CTL2
ATD0CTL3
ATD0CTL4
ATD0CTL5
ATD0DIEN
ATD0DR
ATD0DR0
ATD0DR1
ATD0DR2
ATD0DR3
ATD0DR4

Type: unsigned char ATD0CTL5

Module: ioxdp512

Address: (Physical)010002C5

Display:
○ Sort by Address
● Sort by Name
□ Hex

Symbol Browser dialog

winIDEA maintains seven different lists of symbol classes (selectable on the top of the symbol browser window). You can display each list by selecting the appropriate symbol class selector button.

For every selected item, its address and type are displayed. Also, the module where the item is defined, is specified.

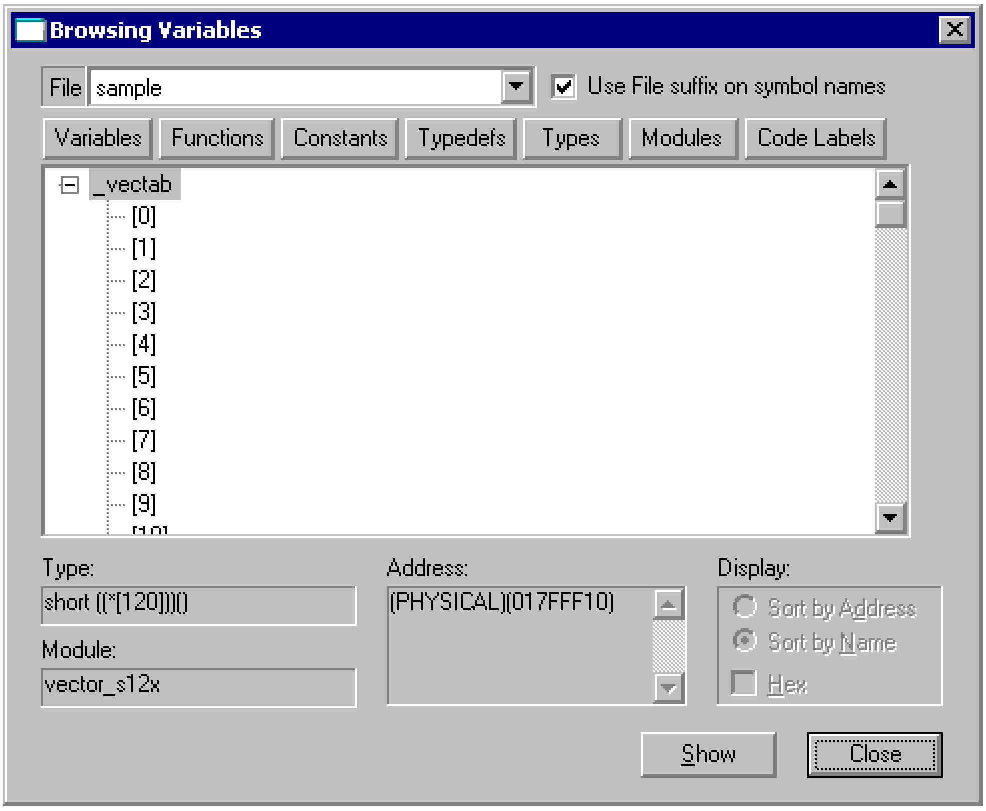
If more download files are selected, the 'File' option becomes available and allows selection of the download file the symbols of which you would like to browse.

You can choose to display the selected list sorted by address or by name.

By pressing the 'Show' button the selected Function, Module or Code Label will be shown in the aproppriate file. Do note that this function is not ment to be used for watching a certain varialbe, for that the Watch window should be used.

Variables

The Variables list holds global variables.



Type: short ((*[120]))()

Module: vector_s12x

Address: (PHYSICAL)(017FFF10)

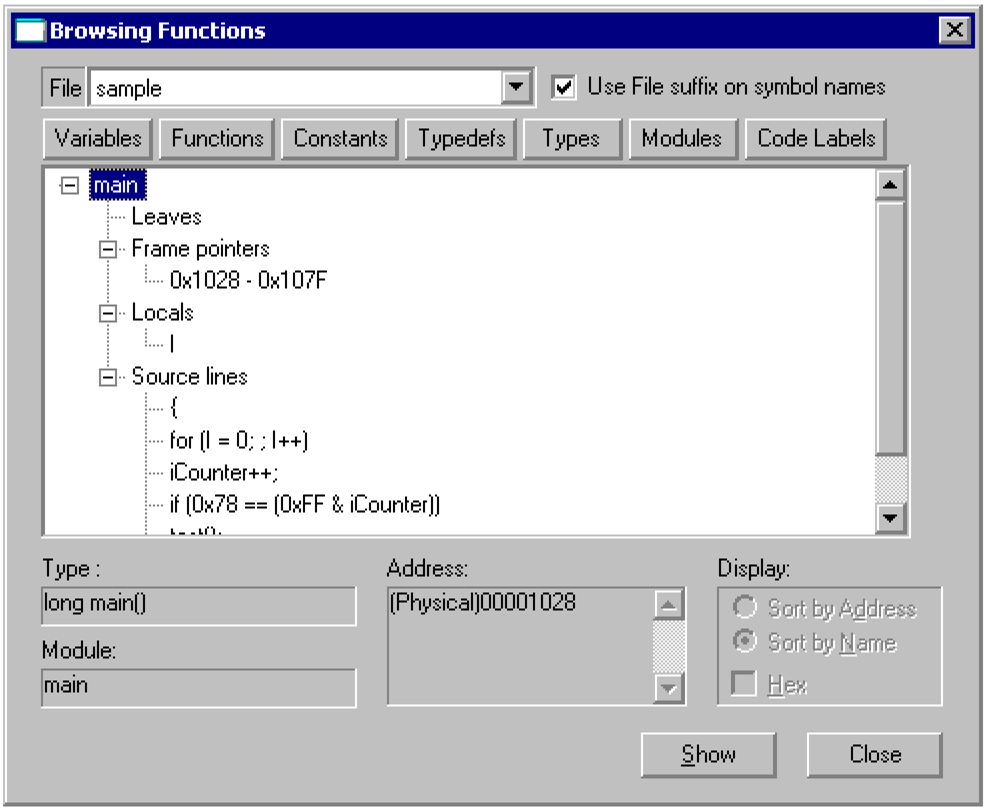
Symbol Browser dialog, browsing a variable

A global variable symbol associates name, address and type. By double clicking a variable in the list, the selected variable can be browsed further.

The currently selected item’s address and type are displayed.

Functions

The Functions list holds C language functions.



File: sample

☑ Use File suffix on symbol names

```
main
  Leaves
  Frame pointers
    0x1028 - 0x107F
  Locals
    I
  Source lines
    {
    for (I = 0; ; I++)
    iCounter++;
    if (0x78 == (0xFF & iCounter))
```

Type : long main()

Module: main

Address: (Physical)00001028

○ Sort by Address

● Sort by Name

□ Hex

Symbol Browser dialog, browsing a function

A function symbol associates name, type, entry address, one or more exit point addresses, a list of local variables, nested blocks with their local variables and a list of source lines that the function is built of. By double clicking a function in the list, the selected function is browsed further.

- The Leaves leaf displays all exit points from the function. Each selected exit point's address is displayed.
- The Locals leaf displays all local variables of the function. A selected local variable's address and type are displayed.
- The Source lines leaf displays all of a function's source lines for which debug information is generated. A selected line's address and source are displayed.

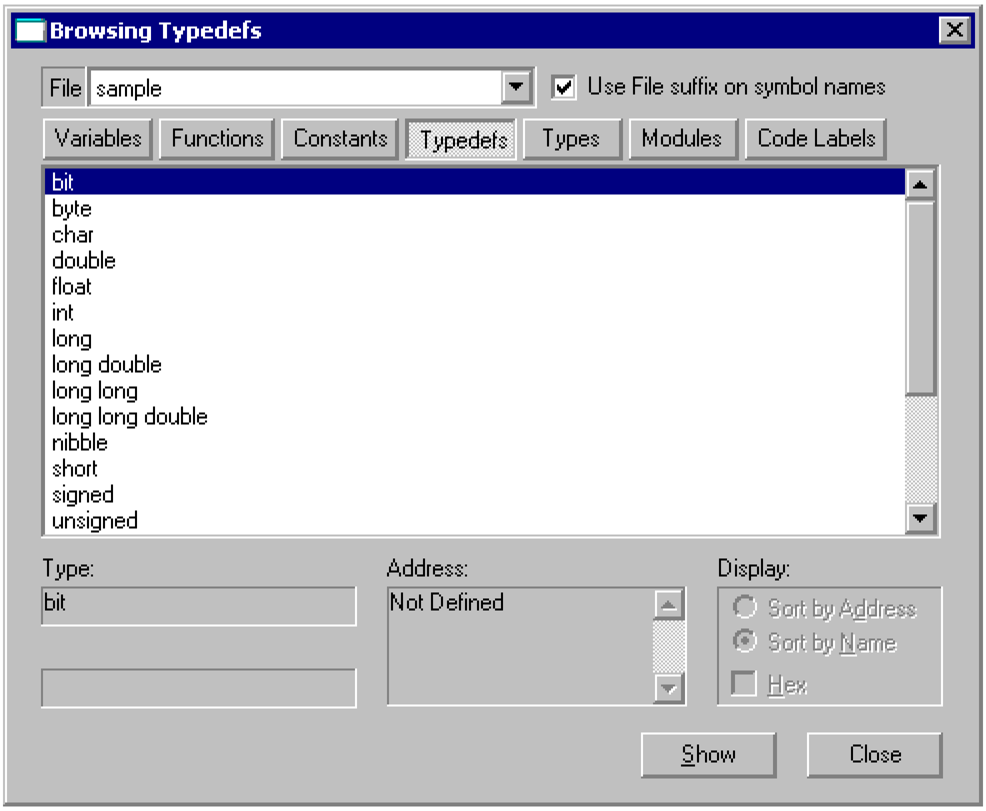
Constants

The Constants list displays all constants.

A constant associates a name and value.

Typedefs

The Typedefs list displays all typedef definitions. These include standard C type names like 'int', 'float', etc.



Browsing Typedefs

File: sample

☑ Use File suffix on symbol names

bit
byte
char
double
float
int
long
long double
long long
long long double
nibble
short
signed
unsigned

Type: bit

Address: Not Defined

Display:
○ Sort by Address
● Sort by Name
□ Hex

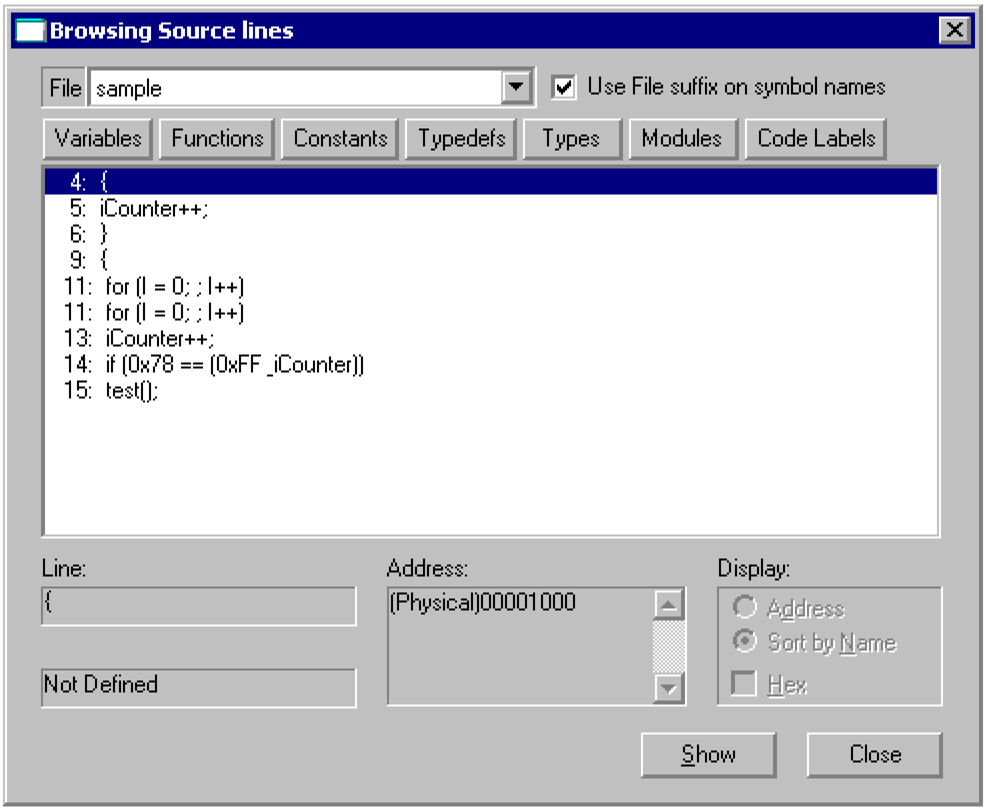
Symbol Browser dialog, browsing a typedef

For every selected item, its type is displayed. Since a type is not bound to a target location, no address information is displayed.

In the above figure, a union of the following declaration is displayed:

Modules

The Modules list displays all program modules for which debug information is available. These will usually be modules generated from your C project files, as well as library modules.



File: sample

```
 4:  {
 5:  iCounter++;
 6:  }
 9:  {
11:  for (I = 0; ; I++)
11:  for (I = 0; ; I++)
13:  iCounter++;
14:  if (0x78 == (0xFF _iCounter))
15:  test();
```

Line: {

Not Defined

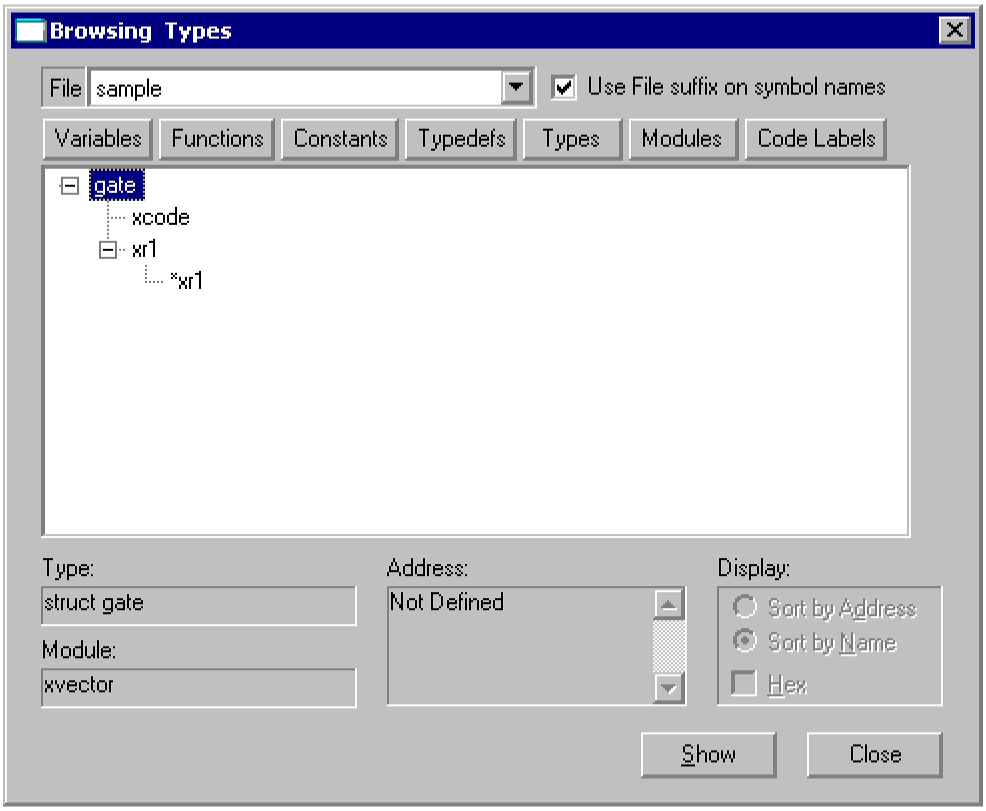
Address: (Physical)00001000

Symbol Browser dialog, browsing a module

By double clicking on a module, a list of all its source lines, for which debug information is available, is displayed. For every selected line its address and source are displayed. By clicking the 'Show' button, the module is opened in the browser and the selected line is displayed.

Types

The Types list displays all structured types (struct, union, class) as well as enums.



Type: struct gate

Module: xvector

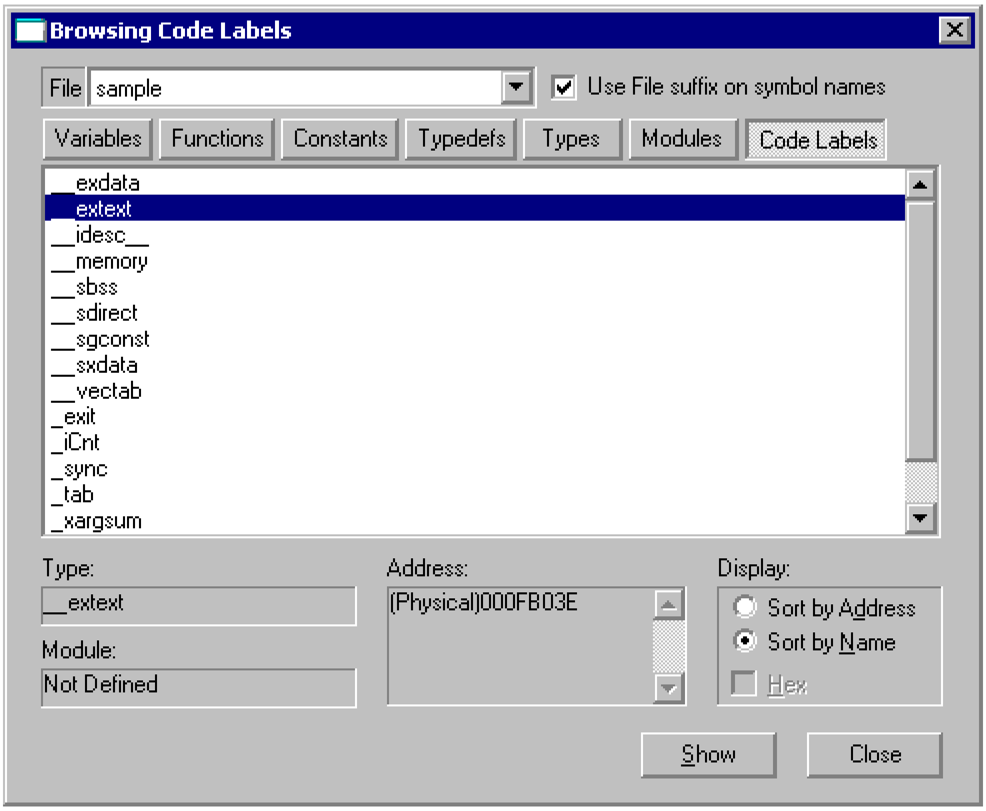
Address: Not Defined

Symbol Browser dialog, browsing a type

By double clicking on a type, the type can be browsed further.

Code Labels

The Code Labels list displays all low level (assembler) symbols, which associate only a name and target address.



File: sample

☑ Use File suffix on symbol names

__exdata
__extext
__idesc__
__memory
__sbss
__sdirect
__sgconst
__sxdata
__vectab
_exit
_iCnt
_sync
_tab
_xargsum

Type: __extext

Module: Not Defined

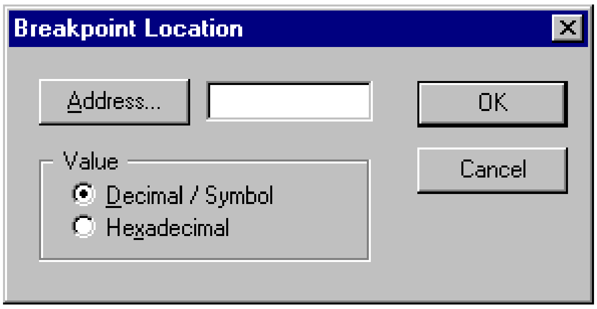
Address: (Physical)000FB03E

Display:
○ Sort by Address
● Sort by Name
□ Hex

Symbol Browser dialog, browsing a module

For a selected code label, its address is displayed. A code label can not be browsed further.

Specifying Addresses and Values



Value
● Decimal / Symbol
○ Hexadecimal

Entering address for a breakpoint

Throughout winIDEA you will find yourself in situations where an address or value must be specified. Usually a dialog looking like this will appear:

You can chose to enter values either in symbolic or hexadecimal form.

Decimal/Symbol

When this option is selected, you can click the button that opens the browser (in the above figure the Address… button). You can also enter values manually using C syntax.

If you wish to enter hexadecimal values, prefix them with '0x'.

Hexadecimal

For those of you who do not have ten fingers but rather Ah, you can select the 'Hexadecimal' option. You will not be able to use the browser, but you do not need to prefix hex numbers with '0x' prefix.

winIDEA will memorize your preferred entry number base, so you do not need to select the Value option the next time the dialog opens.

Quick browsing to functions

When browsing the editor, you can immediately jump to the definition of the function you are looking at. When the cursor is positioned on the function name, press the F12 shortcut (or the selected shortcut for BrowseGotoDefinition, if you have changed the shortcuts), and another editor will pop up and position the cursor to the location, at which this function is defined.

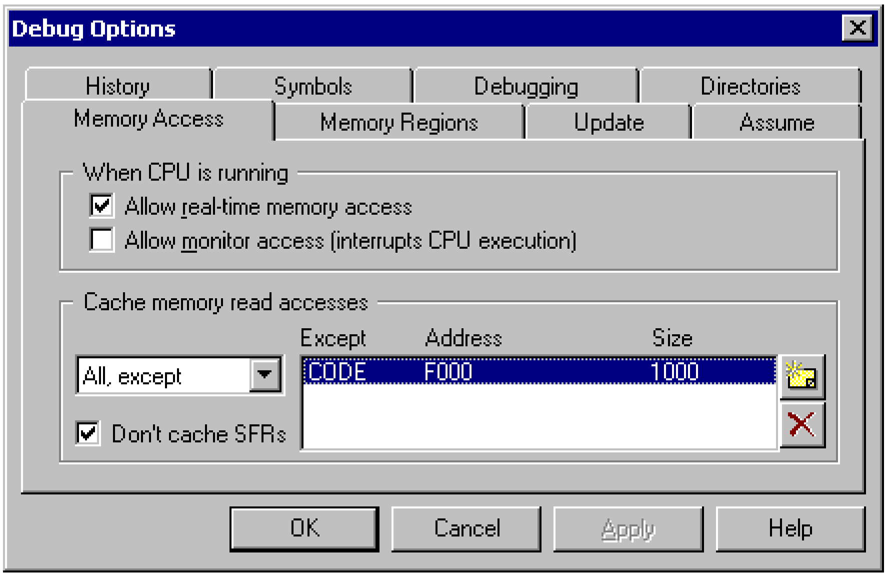
To return to the original location, press Ctrl+* on the numeric keypad (or the shortcut defined for BrowsePopContext).

Debug Options

In the Debug Options dialog you can control some finer operational settings of the debug system.

Memory Access

In the Memory Access page you can specify how winIDEA is permitted to access target memory.



When CPU is running

☑ Allow real-time memory access

☐ Allow monitor access (interrupts CPU execution)

Cache memory read accesses

All, except

☑ Don't cache SFRs

Except	Address	Size
CODE	F000	1000

Debug Options dialog, Memory Access page

When CPU is running

You can allow winIDEA to access memory of the debugged system even when it is running.

- Allow real-time access - when checked winIDEA will use real-time access for reading and writing. This access is not available for internal CPU memory.
  Reading or writing a byte using this method will stall the CPU for one CPU cycle only.

- Allow monitor access - when checked winIDEA is permitted to use monitor access. Monitor access stops the CPU, performs memory access and sets the CPU running. Since this can take several hundred milliseconds (depending on the speed of the PC and CPU), use this option only if the CPU can be interrupted for such intervals.

Cache memory read accesses

Memory read accesses can be cached. This can greatly improve IDE performance. A memory that is read will not be read again until a write access is performed or program execution point is advanced. Care must be taken to exclude memory regions which can be corrupted with read access (some SFRs on some CPUs).

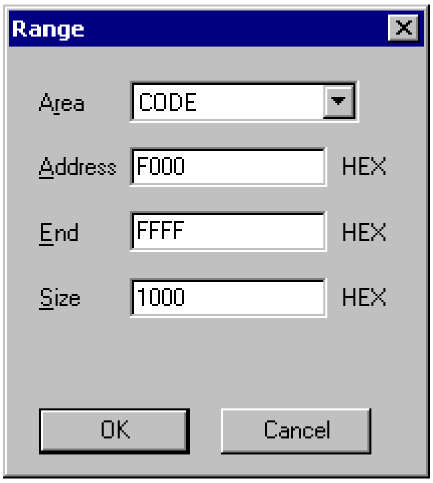
- **None** - no caching is performed (default)
- **None, except** - no caching except in the regions specified in the Except list
- **All, except** - all memory accesses are cached, except for regions in the Except list
- **All** - all memory accesses are cached

Multiple regions can be defined in the exception dialog.

Don’t cache SFRs

If this option is selected, the SFRs will not be cached.

Entering memory areas



Range

Area: CODE

Address: F000 HEX

End: FFFF HEX

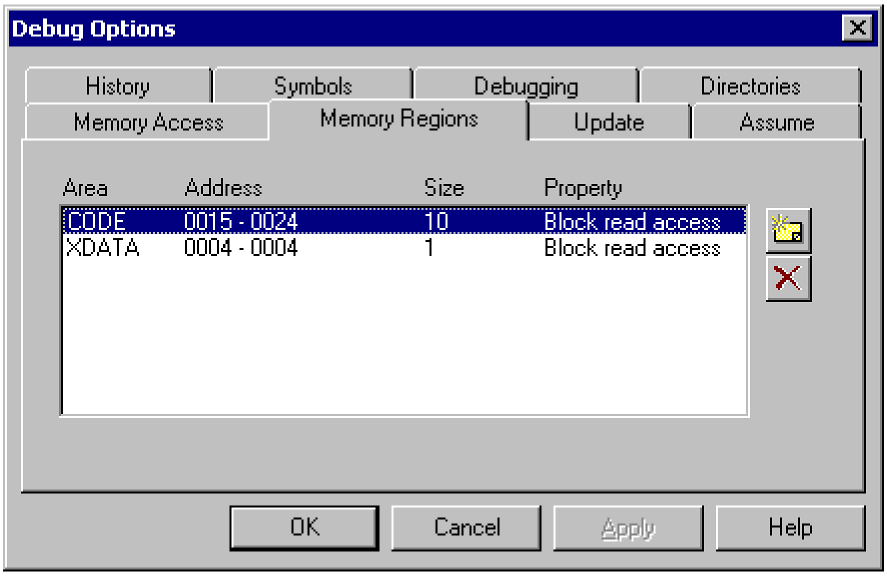
Size: 1000 HEX

Memory area definiton

Specify the Address, the memory area and the size of the memory area to include/exclude.

Memory Regions

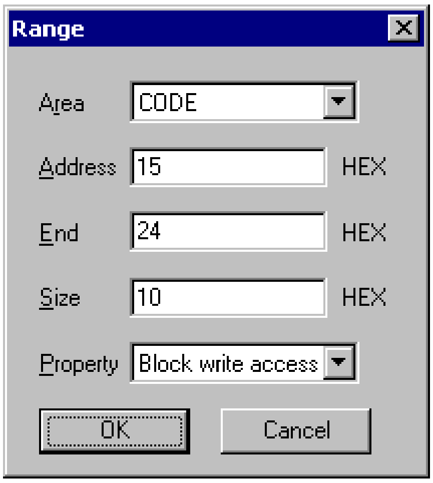
This dialog allows specification of memory regions to which memory access should be restricted.



Area	Address	Size	Property
CODE	0015 - 0024	10	Block read access
XDATA	0004 - 0004	1	Block read access

Memory regions configuration

An individual region entry specifies the memory space, starting address and end address/region size. The region can have restricted read or write access. If read and write access must be restricted, define two regions with equal placement, one with blocked read and the other with blocked write access.



Area: CODE

Address: 15 HEX

End: 24 HEX

Size: 10 HEX

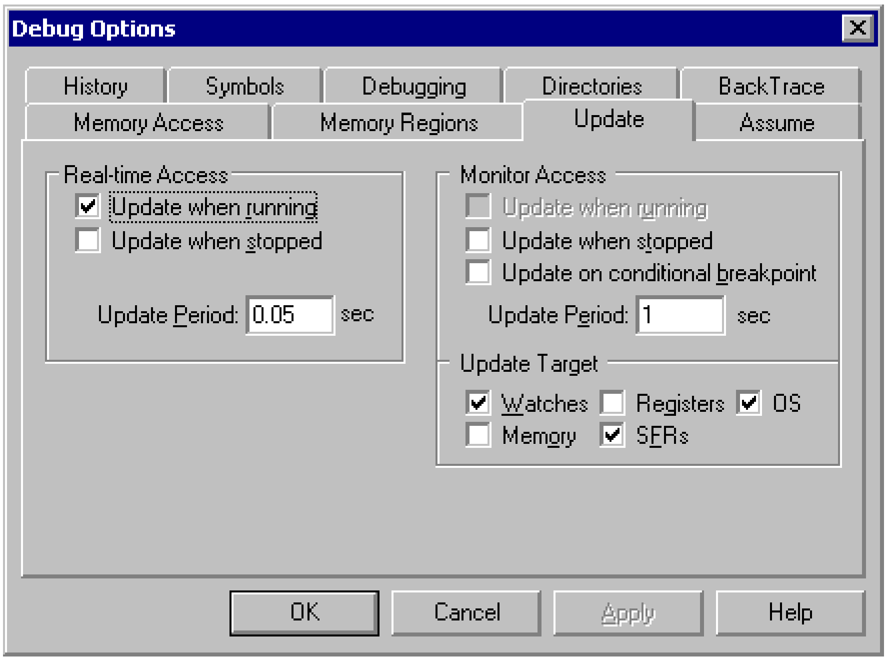
Property: Block write access

Range specification

This feature can be used to specify the location of FLASH memory, which can fail if write access is attempted to it (attemting to set a software breakpoint).

Update

winIDEA can periodically update information on the desktop.



Real-time Access

☑ Update when running

☐ Update when stopped

Update Period: 0.05 sec

Monitor Access

☐ Update when running

☐ Update when stopped

☐ Update on conditional breakpoint

Update Period: 1 sec

Update Target

☑ Watches ☐ Registers ☑ OS

☐ Memory ☑ SFRs

Debug Options dialog, Update page

Real-time Access

On emulators with real-time access capabilities, watch expressions on real-time panes of the Watch window can be updated periodically in real-time.

You can instruct winIDEA to update these expressions when the CPU is running and when the CPU is stopped.

Update Period

determines the time interval in which winIDEA updates real-time watches.

Monitor Access

Accessing memory using debug monitor gives you access to all memory available to the CPU, the CPU must however be stopped for this purpose.

You can instruct winIDEA to update all configured **update targets** when

- The CPU is running,
- when the CPU is stopped
- when a conditional breakpoint's condition is evaluated to zero.

Note: when CPU stops, all debug windows are refreshed automatically. ‘Update when stopped’ should only be used if background interrupts are serviced, otherwise this option only degrades performance.

Update Period

determines the time interval at which the selected update targets are updated.

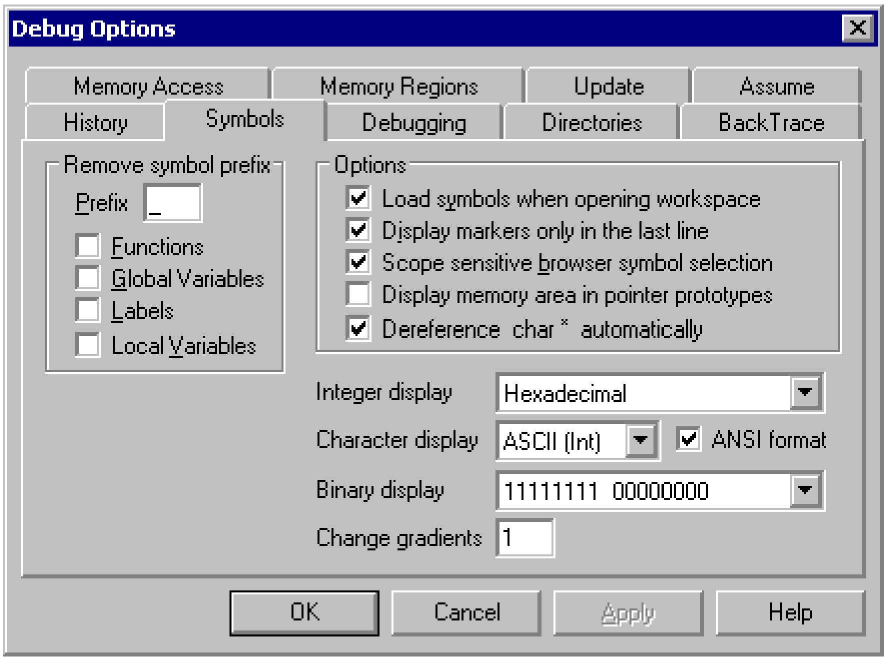
Update Target

defines the desktop information that is to be updated. This can be:

- expressions in the watch window
- currently open memory windows
- the register pane of the disassembly window
- the SFR window's expanded registers
- operating system window

Symbols

The 'Symbols' page of the Debug Options dialog allows you to manipulate symbolic information loaded from download files.



Remove symbol prefix

Prefix _

☐ Functions
☐ Global Variables
☐ Labels
☐ Local Variables

Options

☑ Load symbols when opening workspace
☑ Display markers only in the last line
☑ Scope sensitive browser symbol selection
☐ Display memory area in pointer prototypes
☑ Dereference char * automatically

Integer display: Hexadecimal

Character display: ASCII (Int) ☑ ANSI format

Binary display: 11111111 00000000

Change gradients: 1

Debug Options dialog, Symbols page

Remove Symbol Prefix

Some compilers prepend underscores (or similar characters) to global symbols which usually get in the way during a debug session.

You can instruct winIDEA to remove such prefixes from functions, global and local variables and code labels.

The global variable marker in winIDEA is #. This means that if you have a global variable called VAR, but are currently in function which also defines a variable named VAR and you type 'VAR' in the watch window, winIDEA will display the local variable as its visibility obscurs the global symbol. If you wish to see the global symbol too, then type in #VAR.

Load Symbols When Opening Workspace

This option instructs winIDEA to save symbols when closing workspace and load them again when the same workspace opens. This way you have symbolic information available before program download is performed.

Display Markers Only In the Last Line

If this option is selected, the markers in the editor window are displayed only in the last line, where the code is generated. With this option, the confusion of markers in lines where no actual code is generated is no longer possible.

Scope Sensitive Browser Symbol Selection

If this option is checked, the symbols in the browser are scope sensitive, i.e. when a static symbol is selected to be watched, it has a prefix, specifying in which function it is defined. If this option is unchecked, the user will be unable to browse static symbols outside the function, procedure or file, in which they are defined.

Display memory area in pointer prototypes

If checked, the memory area the pointer points to is displayed in the pointer prototype.

Dereference char* automatically

Normally, the char* is automatically dereferenced (i.e. the string pointed to is shown). In some cases this can lead to exceptions if the pointer address is not valid and debugging is no longer possible. If this is the case, automatic dereferencing can be turned off with this option.

Integer Type Display

Defines preferential number base system for displaying integer values.

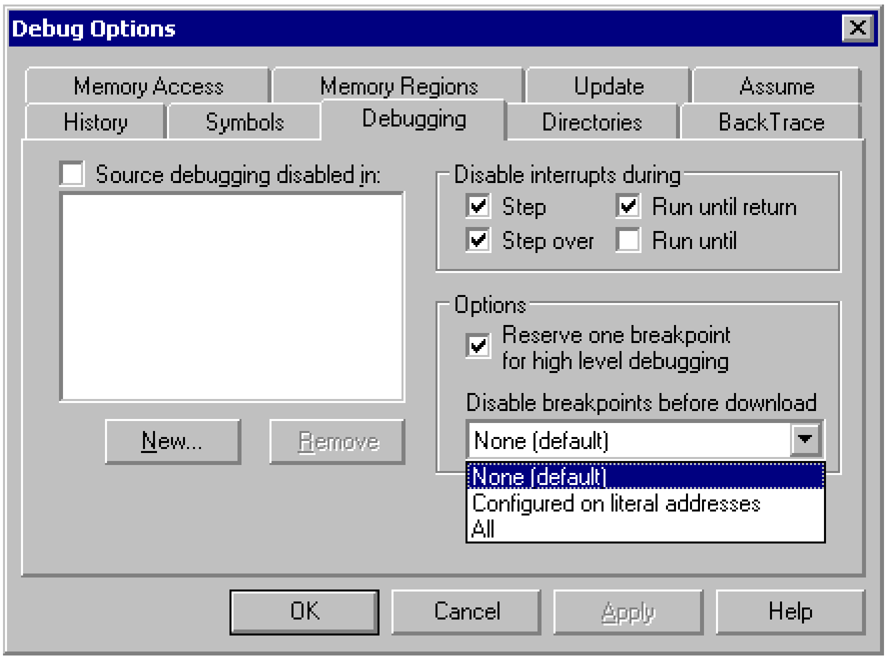
'char' Type Display

Defines how values of types 'char' and 'unsigned char' are displayed.

- ASCII displays the value as a character
- ANSI format defines whether non-pritable characters will be shown as ANSI characters
- Integer displays the value as a number
- Both displays value in both representations

Debugging

The debugging page allows source debug information manipulation. You can enter functions and modules in which high level debugging is disabled. This way you can prevent the source debugger from stepping into interrupt routines or debugged code.



☐ Source debugging disabled in:

Disable interrupts during

☑ Step ☑ Run until return

☑ Step over ☐ Run until

Options

☑ Reserve one breakpoint for high level debugging

Disable breakpoints before download

None (default)

- None (default)
- Configured on literal addresses
- All

Debug Options, Debugging page

Note: functions are indicated with parentheses so you can distinguish them from a module with the same name.

Disable interrupts during

Checking an option disables interrupts during checked high-level step operations.

Options

Reserve one breakpoint for high level debugging

By default, one breakpoint is reserved for high-level debugging. If software breakpoint functionallity is not needed, the breakpoint can be released for the user program to use. If this is the case, uncheck the 'Reserve one breakpoint for high level debugging' option.

Disable breakpoints before download

When the option ‘Configured on literal addresses’ is selected, the software disables breakpoints configured on literal addresses before download. Breakpoint set in the disassembly window is understood under the term breakpoint set on a literal addresses. Breakpoints set in the source window are set on line symbols and thus they don’t represent any problems when re-linking the project. When a breakpoint is set on an instruction in the disassembly window, it’s set on a first byte of the CPU instruction. After re-linking the project, the same instruction may be reallocated and the breakpoint is no longer set on a first byte. The option prevents setting a breakpoint on an address not aligned with the CPU instruction.

Also, all breakpoints can be disabled using the ‘All’ option. Use this option if the target system is not ready for setting breakpoints after initialization. For example – the chip selects for program code point to default FLASH memory, whereas the debug session runs from RAM. Since FLASH memory device can get ‘confused’ if the debugger tries to write to it (by attempting to set software breakpoints), this option can be used to prevent this from happening. Once the chip selects have been configured, just click ‘Enable all’ in the Breakpoints dialog.

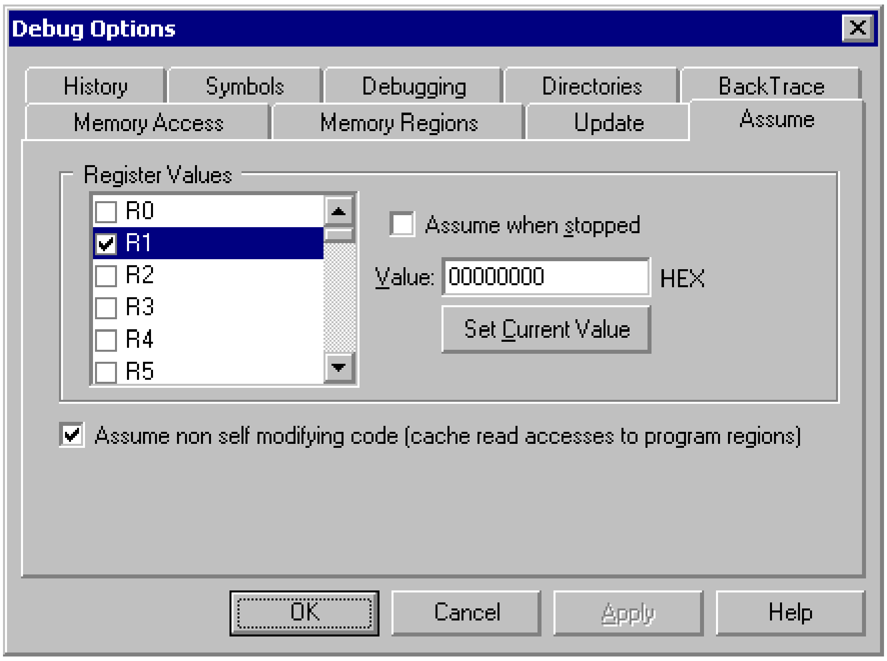
If no breakpoints are to be disabled (in normal debugging operation), this option is to be set to ‘None (default)’.

Assume

The 'Assume' page allows specification of values of register which remain constant in course of program execution.

This feature is necessary for compilers that access global variables with a relative addressing mode to a certain CPU register (typically the A5 on 68k CPUs). To access a certain variable the register value must be known to establish the address of the variable. If the CPU is running, it must be stopped to read out the register unless the value of the register is specified in this dialog.

If the value of a certain register is required but can not be accessed (CPU running, halted etc.), its assumed value is used.



Register Values

- □ R0
- ☑ R1
- □ R2
- □ R3
- □ R4
- □ R5

□ Assume when stopped

Value: 00000000 HEX

Set Current Value

☑ Assume non self modifying code (cache read accesses to program regions)

Debug Options, Assume page

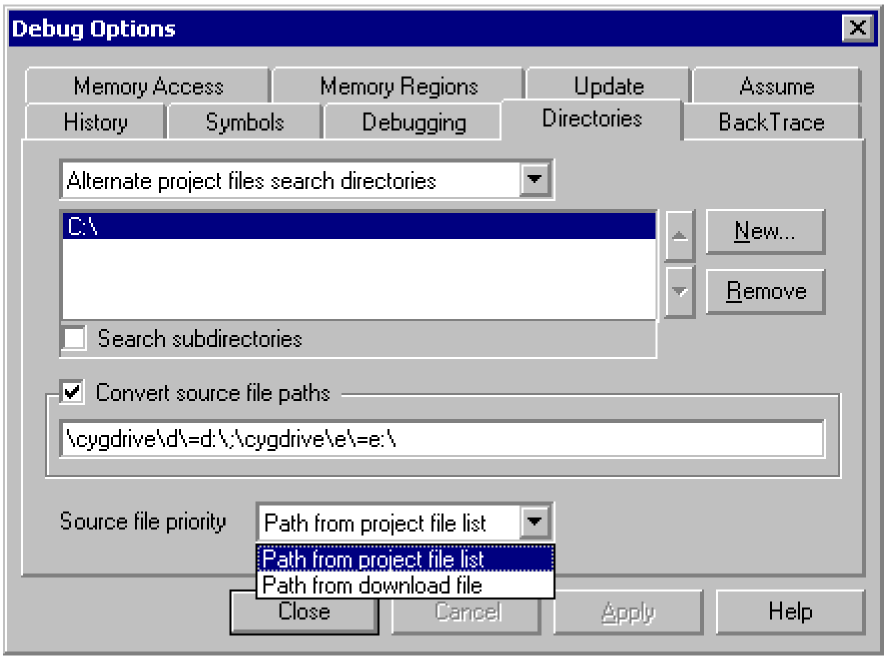
In the above figure the value 100000h is configured to be assumed for register A5. This value will be used if the register can not be accessed due to CPU's state.

Assume non self modifying code (cache read accesses to program regions)

If this option is checked, read accesses to program regions are cached.

Directories

In the 'Directories' page of the Debug Options dialog, you can configure alternative search directories for project files and download files search directories. You will want to use this feature if you are using an external make utility, and don't wish to specify project files in the 'Project files' dialog. Download files search direcotries are usualy specified when running in OS Run mode debug mode.



Alternate project files search directories

C:\

□ Search subdirectories

☑ Convert source file paths

\cygdrive\d\=d:\;\cygdrive\e\=e:\

Source file priority: Path from project file list

Path from project file list
Path from download file

Debug Options, Directories page

After program download, winIDEA will attempt to locate sources for modules reported in the download file.

- first it will try to match the module name to a project file listed in the project list. If no match is found then the module name remains unchanged.
- if no source file exists in the established directory, winIDEA will scan all listed directories (in order of specification) for an occurrence of this file.
- if no match is found for the module, no source debugging is available for it.

If the '**Search subdirectories**' option is checked, winIDEA will also search subdirectories of the specified directories.

If the '**Convert source file paths**' option is checked, winIDEA automatically converts paths defined. The conversion is defined in the format <original path specified in the download file>=<path as seen from the current workstation>

Multiple path conversion paths can be specified and separated by a comma (,) or semicolon (;).

Example:

The statement d:\cygwin\demo=e:\demo

converts paths **From**: d:\cygwin\demo **To**: e:\demo.

This converts the paths starting with 'd:\cygwin\demo' to 'e:\demo':

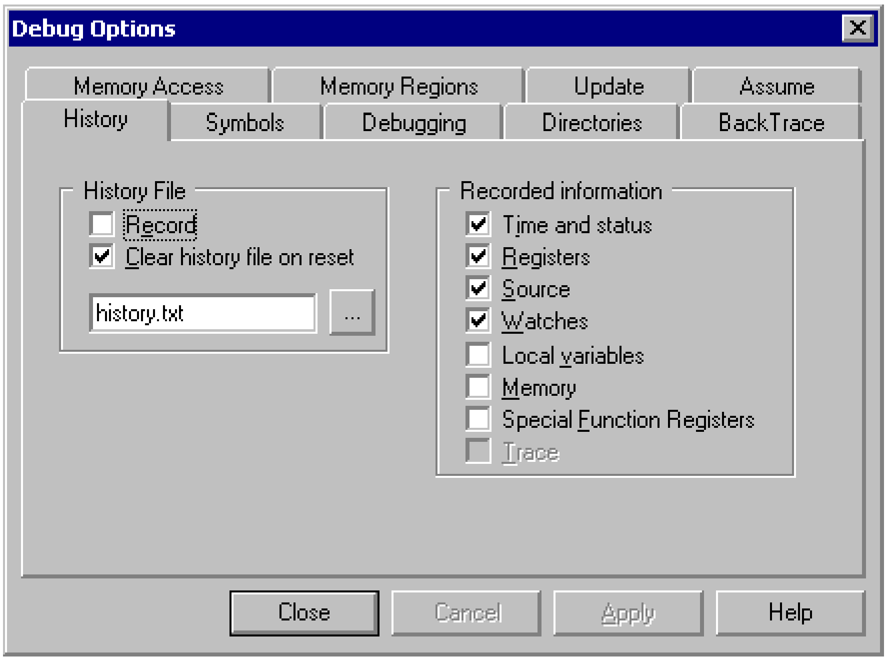
'd:\cygwin\demo\main.c' -> 'e:\demo\main.c'

Source file priority

The option defines which source files take priority – from the path of the project file list or the download file path.

History

In the history page of the Debug Options dialog, you can configure the type of information that is stored in a history file every time the CPU stops.



History File

☐ Record

☑ Clear history file on reset

history.txt

Recorded information

☑ Time and status

☑ Registers

☑ Source

☑ Watches

☐ Local variables

☐ Memory

☐ Special Function Registers

☐ Trace

Debug Options, Directories page

History File

Specifies the path to the history file.

Record

when checked, the history file is recorded.

Clear history on reset

when checked, the history file is cleared when the CPU is reset. When cleared, history entries are appended to the existing file’s contents.

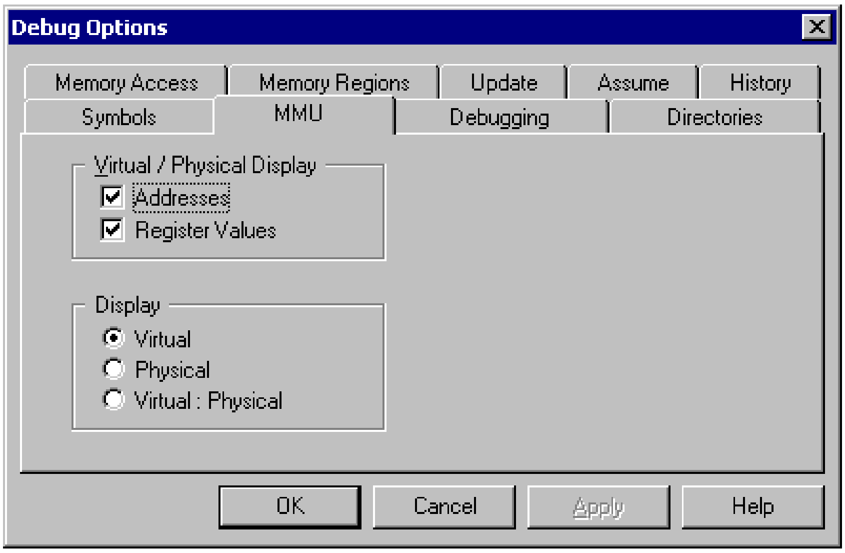
Recorded Information

specifies what information should be written to the history file.

MMU Options

The MMU Page allows configuration of virtual/physical address display. Display of physical addresses can be enabled individually for addresses and register values.

Virtual display is the default as it reflects the address seen by the CPU core. Physical address indicates a value seen after MMU translation to external devices, like memory etc.



Debug Options

Virtual / Physical Display

☑ Addresses

☑ Register Values

Display

● Virtual

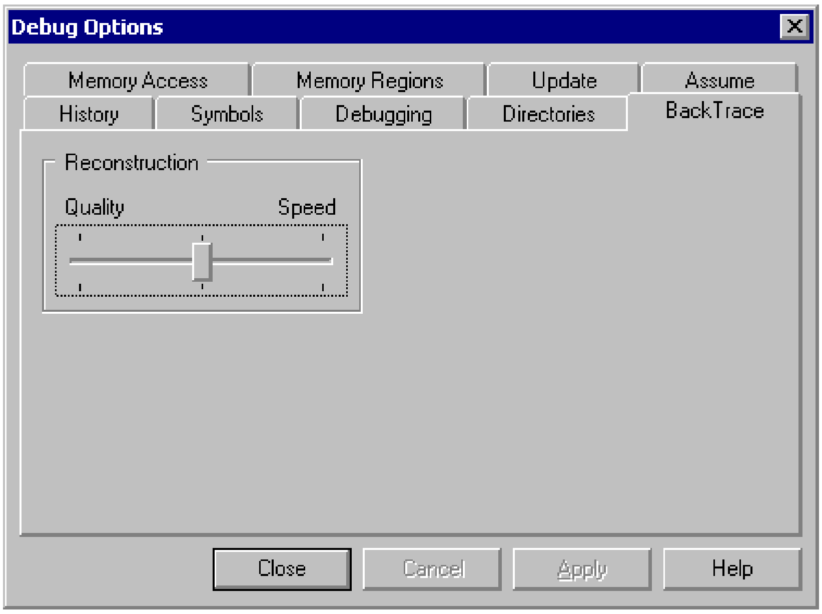
○ Physical

○ Virtual : Physical

Debug options, MMU page

BackTrace options

The Backtrace reconstructs the trace of the emulated program. A complete reconstruction is a very time consuming process therefore always a compromise between speed and quality of reconstruction is used. The user can decide the ratio between quality of reconstruction and speed of reconstruction in three steps.



Debug Options

Reconstruction

Quality — Speed

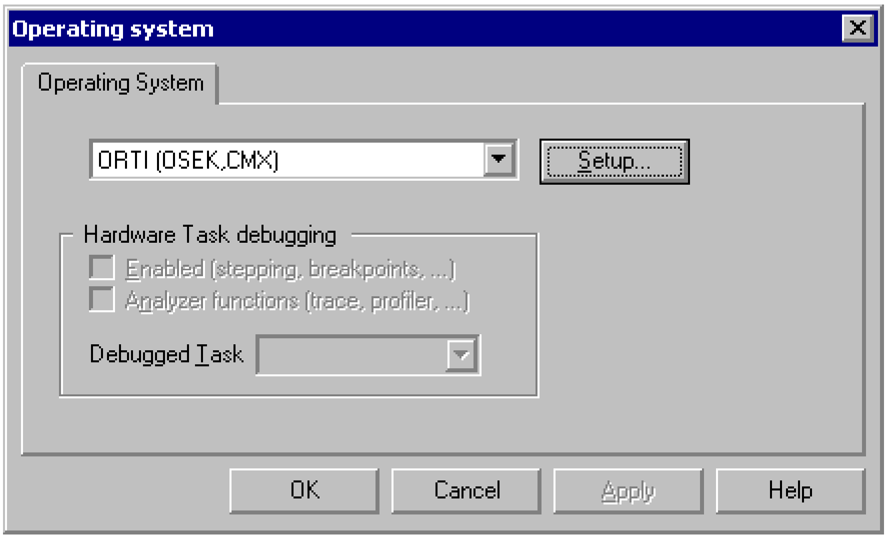
Debug options, BackTrace page

Operating System Support

winIDEA provides limited support for debugging operating systems. Most commonly it will show state of operating system kernel objects.

Operating System Selection

In the Operating System page, the operating system that is used in the application should be specified.



Operating System page

Operating system

Specifies the type of the system used.

- **None** No OS awareness (default)
- **<name>** OS specified in the list
- **Custom** OS awareness by custom configuration

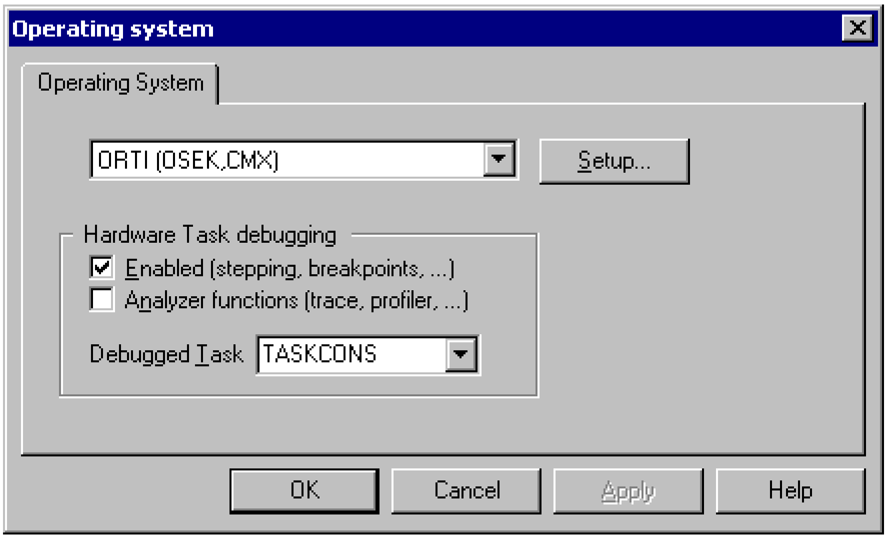
Setup

Configures the selected OS.

Task debugging

The emulator provides hardware capabilities for task debugging. To enable it:

- Check the Enabled option in the Debug/Operating System dialog



ORTI (OSEK,CMX)

Hardware Task debugging

☑ Enabled (stepping, breakpoints, ...)

□ Analyzer functions (trace, profiler, ...)

Debugged Task: TASKCONS

- Select the task to be debugged.
- If you wish to perform task specific Trace operations, check the Trace functions option

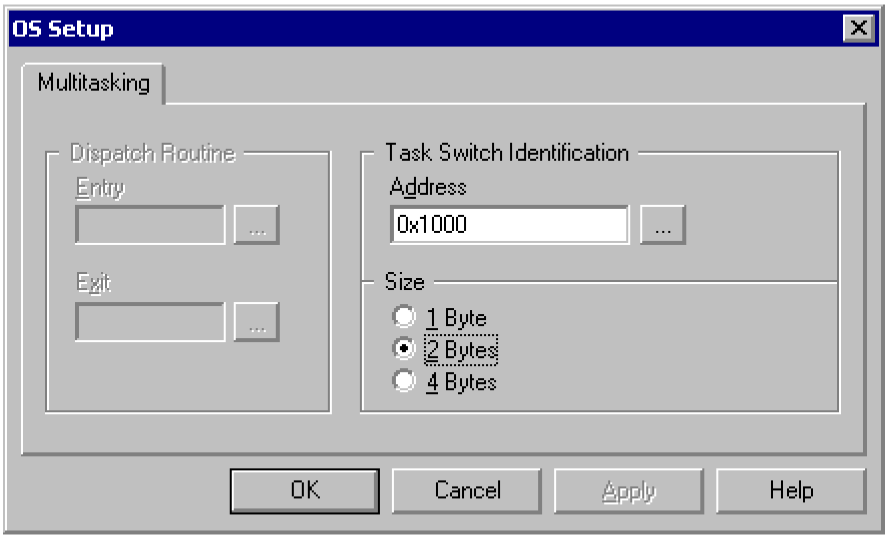
Now, only breakpoints that occur in the context of task **TASKCONS** stop execution.

Note: this function is hardware dependend. For more information, please consult the Hardware User's Guide.

Note: For OS profiling the '**Trace Functions**' option should be disabled.

Custom

Allows customized configuration of an operating system.



Address: 0x1000

Size:
○ 1 Byte
● 2 Bytes
○ 4 Bytes

Operating system, Custom operating system setup

Task switching is supported using a custom operating system. For this application, the information where the operating system stores the ID of the current task must be specified under 'Task Switch Identification Address'.

For more information see "Specifying Addresses and Values" on page 119.

Also the size of the ID must be specified under 'Size'.

OSEK Operating System Support

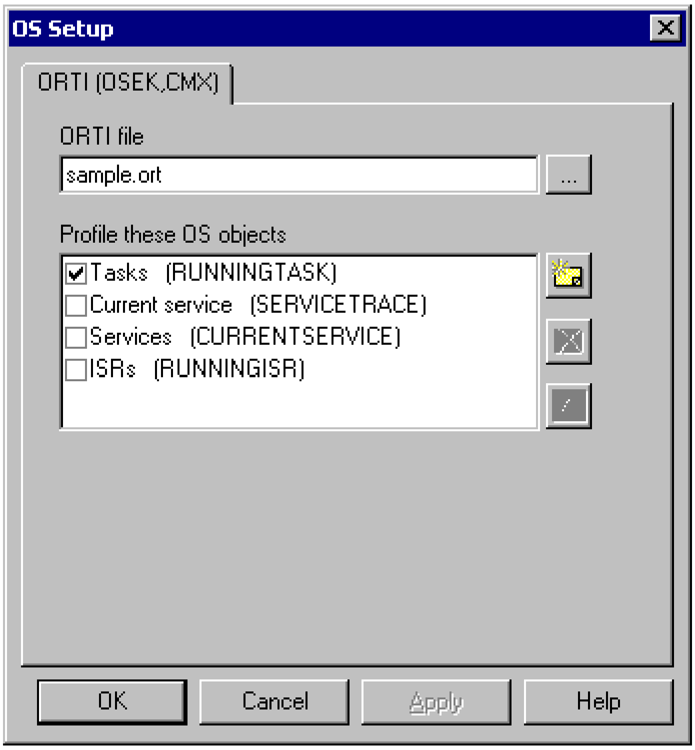
This section describes the implementation of the OSEK operating system in winIDEA.

It assumes that:

- Hardware is configured properly,
- An OSEK builder was used to generate the application, with debug support for at least RUNNINGTASK indication.
- The OSEK and user sources have been compiled and linked to an executable,
- The executable is listed in the Debug/Files for download dialog

Configuration

In the Debug/Operating system dialog, select the **OSEK** option and click the **Setup…** button to configure OSEK options.



ORTI file

sample.ort

Profile these OS objects

☑ Tasks (RUNNINGTASK)
□ Current service (SERVICETRACE)
□ Services (CURRENTSERVICE)
□ ISRs (RUNNINGISR)

OS Setup, OSEK page

ORTI file

In the **ORTI file** field specify the path to the ORTI file generated by the OSEK builder.

- Click OK in both dialogs to confirm configuration
- Perform Debug/Download

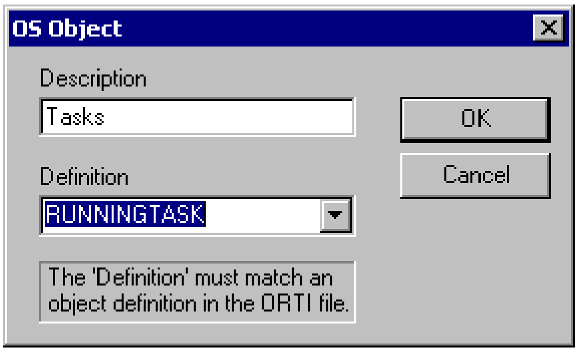
Note: winIDEA supports ORTI 0.9 through 2.1.

Profile these OS objects

Select the OS objects to profile. Objects can be added, removed or modified; enabled or disabled.

OS Objects

The OS objects can be added, removed or edited.



Description: Tasks

Definition: RUNNINGTASK

The 'Definition' must match an object definition in the ORTI file.

OS Objects dialog

Description

Enter the description of the OS object.

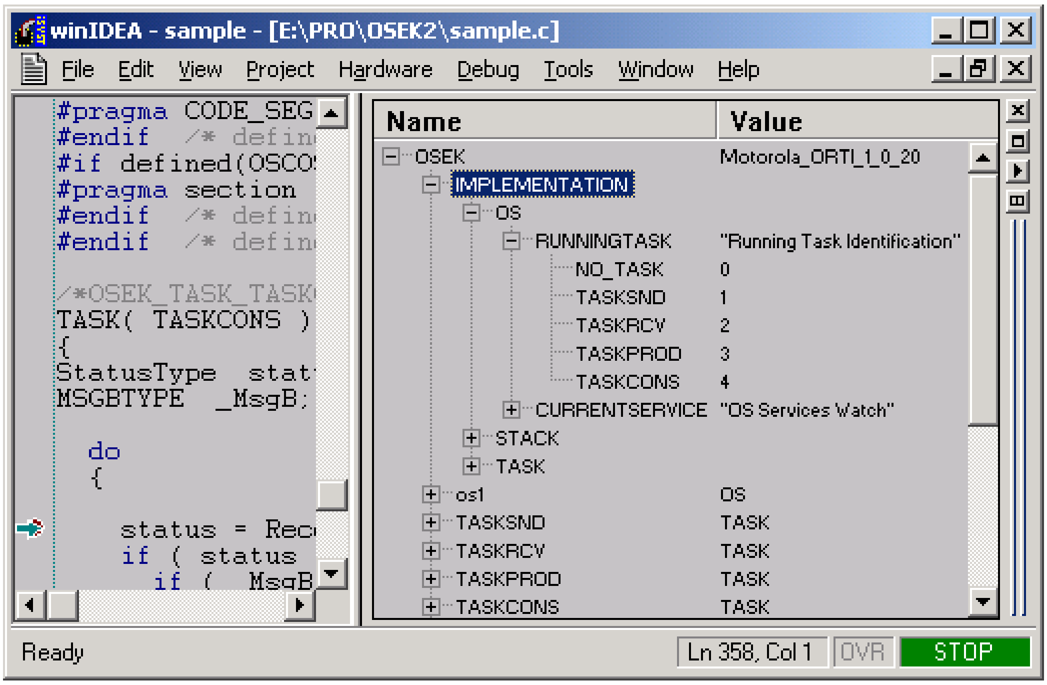
Definition

The objects, defined with the TOTRACE attribute in the ORTI file will be shown here. They can be selected as OS objects, that should be profiled.

Viewing OSEK objects

OSEK objects are displayed in the OS window

- Select the View/Operating System menu item
- The top item in the OS window displays the operating system (OSEK), value displays the version as reported in the ORTI file.



```
#pragma CODE_SEG
#endif   /* defin
#if defined(OSCO
#pragma section
#endif   /* defin
#endif   /* defin

/*OSEK_TASK_TASK
TASK( TASKCONS )
{
StatusType  stat
MSGBTYPE   _MsgB;

  do
  {

    status = Rec
    if ( status
      if (  MsgB
```

Name	Value
OSEK	Motorola_ORTI_1_0_20
IMPLEMENTATION	
OS	
RUNNINGTASK	"Running Task Identification"
NO_TASK	0
TASKSND	1
TASKRCV	2
TASKPROD	3
TASKCONS	4
CURRENTSERVICE	"OS Services Watch"
STACK	
TASK	
os1	OS
TASKSND	TASK
TASKRCV	TASK
TASKPROD	TASK
TASKCONS	TASK

IMPLEMENTATION

The item **IMPLEMENTATION** is special as it defines the layout of other display OSEK objects. In the figure above, it defines layout of **OS**, **STACK** and **TASK** objects.

The **OS** object layout (expanded) defines two members: **RUNNINGTASK** and **CURRENTSERVICE**. Every member has a description identifying its meaning, displayed in the **Value** column.

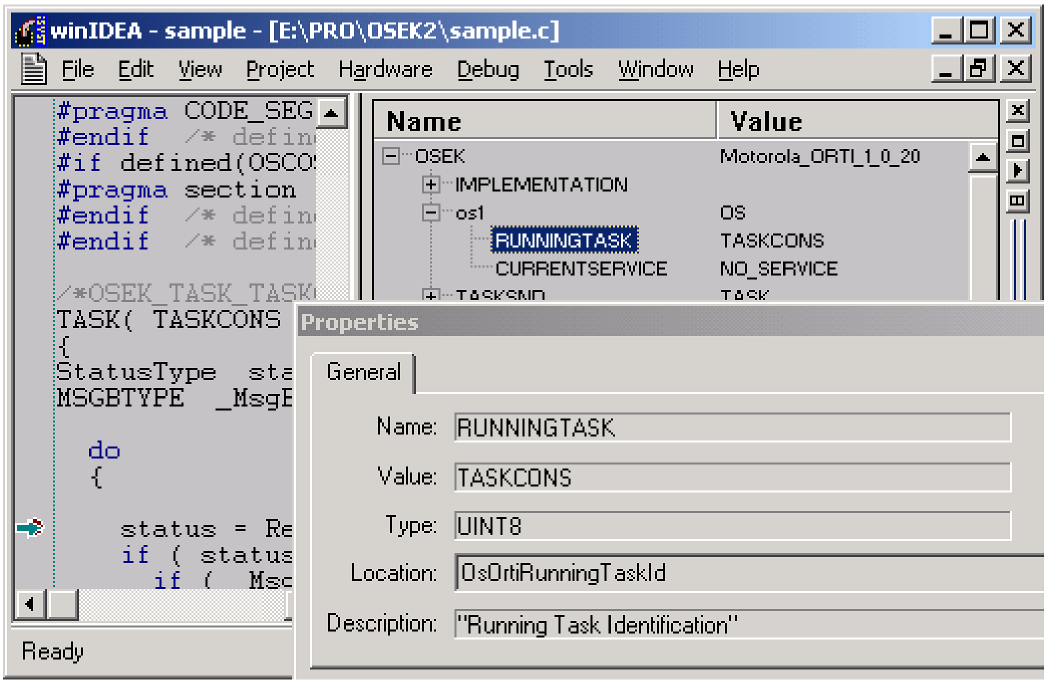
When an OS object member is expanded, it shows valid values (if applicable) for this member to assume. In the above figure, the **RUNNINGTASK** can assume values 0 through 4. When value 0 is contained, **NO_TASK** task is executing, value 1 refers to **TASKSND** etc.

Note: the IMPLEMENTATION

Objects

There can be one or more objects of a type defined in the **IMPLEMENTATION** part. In this example, one OS type object, 5 TASK and 9 STACK objects exist.

When an OS object is expanded it will shown current values for its members.


winIDEA - sample - [E:\PRO\OSEK2\sample.c]
File Edit View Project Hardware Debug Tools Window Help
Ready

```
#pragma CODE_SEG
#endif  /* defin
#if defined(OSCO
#pragma section
#endif  /* defin
#endif  /* defin

/*OSEK_TASK_TASK
TASK( TASKCONS
{
StatusType  sta
MSGBTYPE  _MsgB

  do
  {

    status = Re
    if ( status
      if (  Msc
```

Name	Value
OSEK	Motorola_ORTI_1_0_20
IMPLEMENTATION	
os1	OS
RUNNINGTASK	TASKCONS
CURRENTSERVICE	NO_SERVICE
TASKSND	TASK

Properties

General

Name: RUNNINGTASK

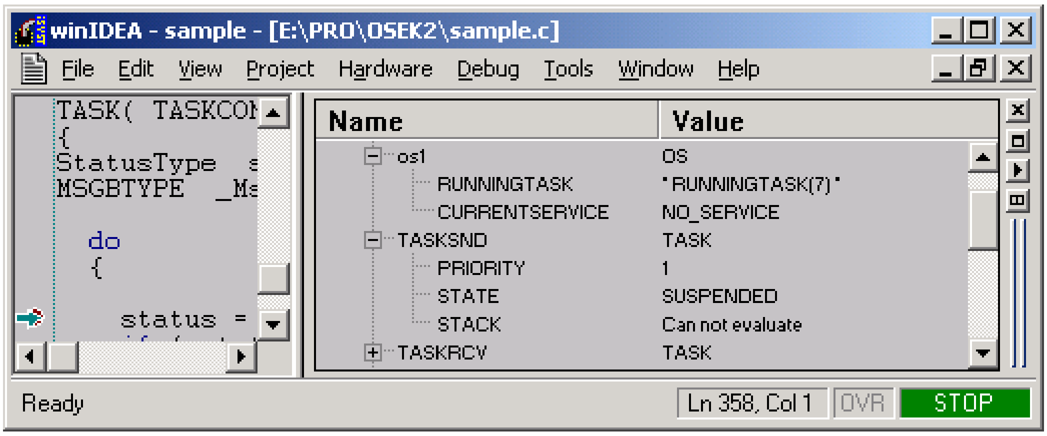
Value: TASKCONS

Type: UINT8

Location: OsOrtiRunningTaskId

Description: "Running Task Identification"

In the above figure, the **os1** object (of type **OS**), shows current values for **RUNNINGTASK** and **CURRENTSERVICE**. winIDEA reads out its values and maps them to the defintion table (**IMPLEMENTATION/OS/RUNNINGTASK**, **IMPLEMENTATION/OS/CURRENTSERVICE**).


winIDEA - sample - [E:\PRO\OSEK2\sample.c]
File Edit View Project Hardware Debug Tools Window Help
Ready
Ln 358, Col 1
OVR
STOP

```
TASK( TASKCON
{
StatusType  s
MSGBTYPE  _Ms

  do
  {

    status  =
```

Name	Value
os1	OS
RUNNINGTASK	'RUNNINGTASK(7)'
CURRENTSERVICE	NO_SERVICE
TASKSND	TASK
PRIORITY	1
STATE	SUSPENDED
STACK	Can not evaluate
TASKRCV	TASK

There are two situations where a value of an OS object member can not be displayed.

- If the member contains value that can not be found in the definition table (which should only occur before OS initialization starts). See **RUNNINGTASK** in below figure.
- If the expression, by which the value is calculated can not be evaluated. In the bellow figure the **STACK** of **TASKSND** task is not allocated as the task is suspended.

OSE Operating System Support

winIDEA realizes OSE Freeze mode kernel awareness by interfacing a Kernel Awareness Package (KAP) provided by OSE. Besides making use of the KAP itself, winIDEA exposes the KAP interface to external applications, like OSE Illuminator, via TCP/IP. Such external clients must connect to the PC that runs winIDEA instead of specifying the targets IP address.

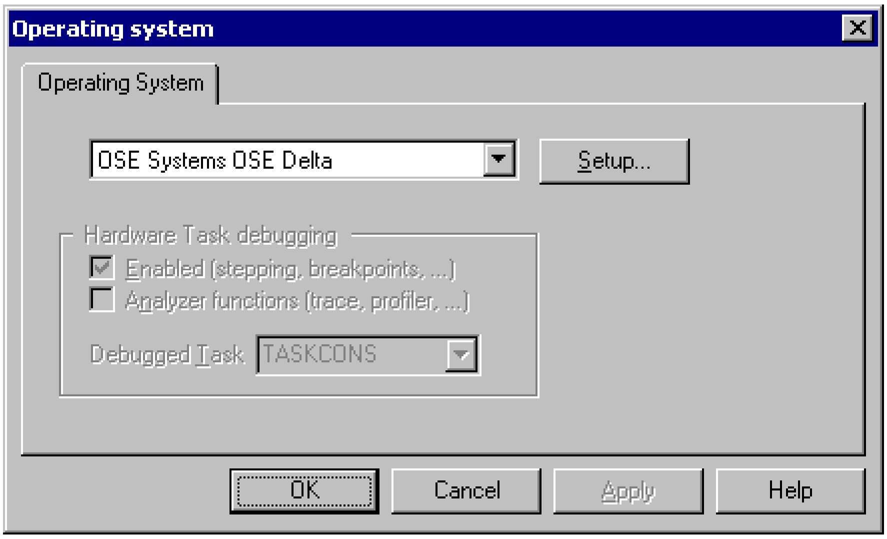
winIDEA provides memory and register access functions to the KAP, through which the kernel objects are accessed.

For Freeze Mode debugging, a Freeze Mode Debugger (emulator) and winIDEA OSE Freeze Mode license is required for this operation.

For Run Mode debugging, the winIDEA OSE Run Mode license is required, which also includes the Freeze Mode license.

Freeze Mode Configuration

First, OSE Delta must be configured in the Operating System dialog.



Operating System: OSE Systems OSE Delta

Hardware Task debugging

☑ Enabled (stepping, breakpoints, ...)

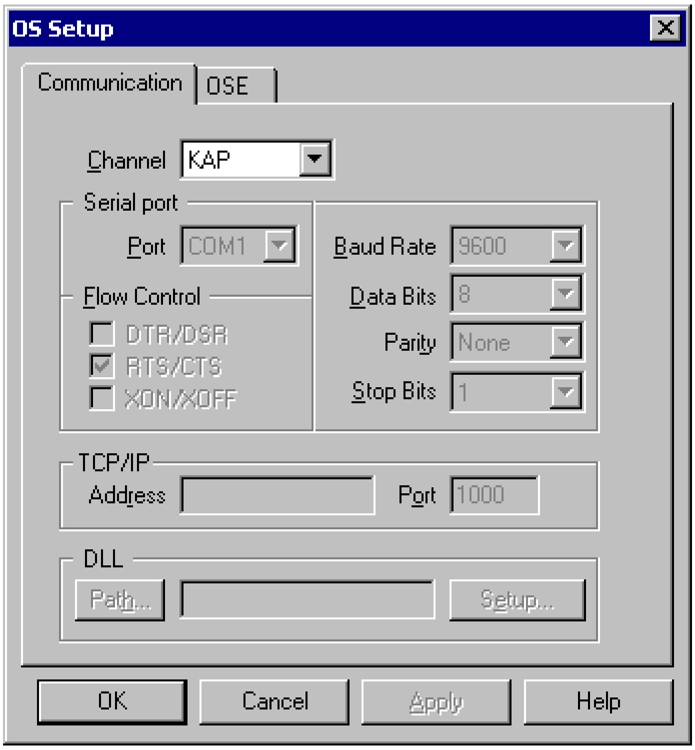
□ Analyzer functions (trace, profiler, ...)

Debugged Task: TASKCONS

OSE Delta Operating system configuration

Next, press the 'Setup…' button.

In the **Communication** page select the **KAP** option. This instructs winIDEA to load the KAP and retrieve kernel object information through it.



Channel: KAP

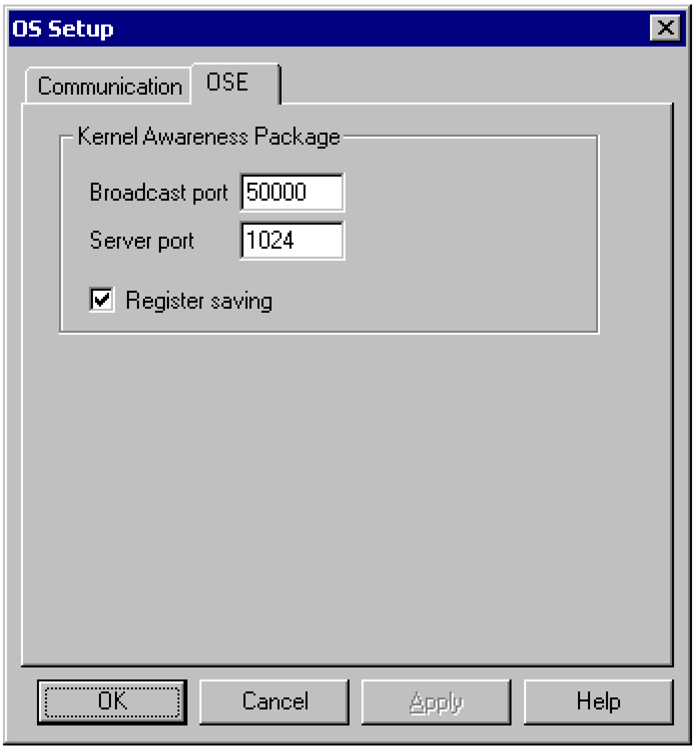
Serial port
- Port: COM1
- Flow Control: ☐ DTR/DSR ☑ RTS/CTS ☐ XON/XOFF
- Baud Rate: 9600
- Data Bits: 8
- Parity: None
- Stop Bits: 1

TCP/IP
- Address:
- Port: 1000

DLL

OSE Communication configuration

In the **OSE** page specify the ports through which the KAP is exposed to external clients.



Kernel Awareness Package
- Broadcast port: 50000
- Server port: 1024
- ☑ Register saving

OSE KAP configuration

Broadcast port

Broadcast port specifies the UDP port on which winIDEA will send out broadcast indicating its availability. Broadcasts are sent out periodically every 30 seconds.

Server port

Server port specifies the TCP port on which winIDEA accepts connections from external clients. Any client connecting to winIDEA must specify this port along with machines IP address.

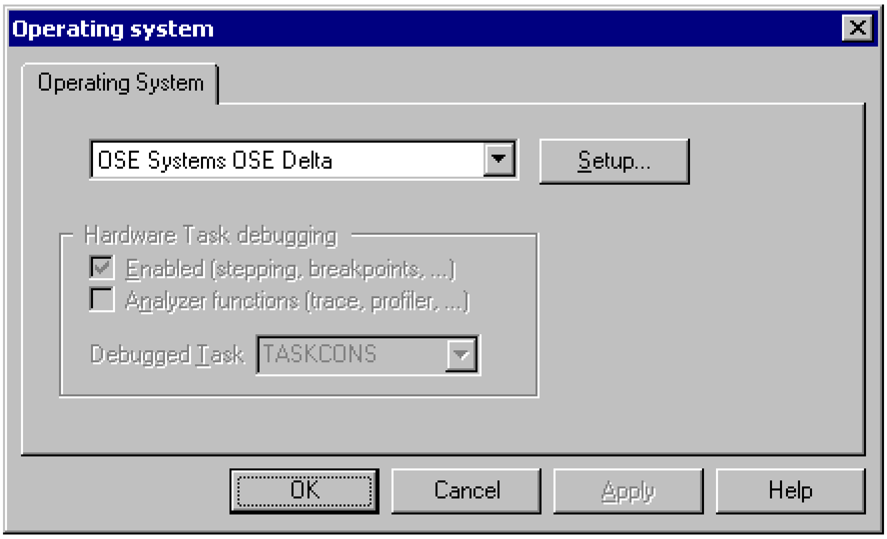
Note: machine IP address and Server port are a part of the Broadcast. The Illuminator is able to decode the broadcast and resolve both the IP address and the TCP port. The default Illuminator broadcast port is 50000.

Register saving

If enabled, OSE will preserve contents of all registers for a switched-out processes. This ensures higher quality of restored process context.

Run Mode Configuration

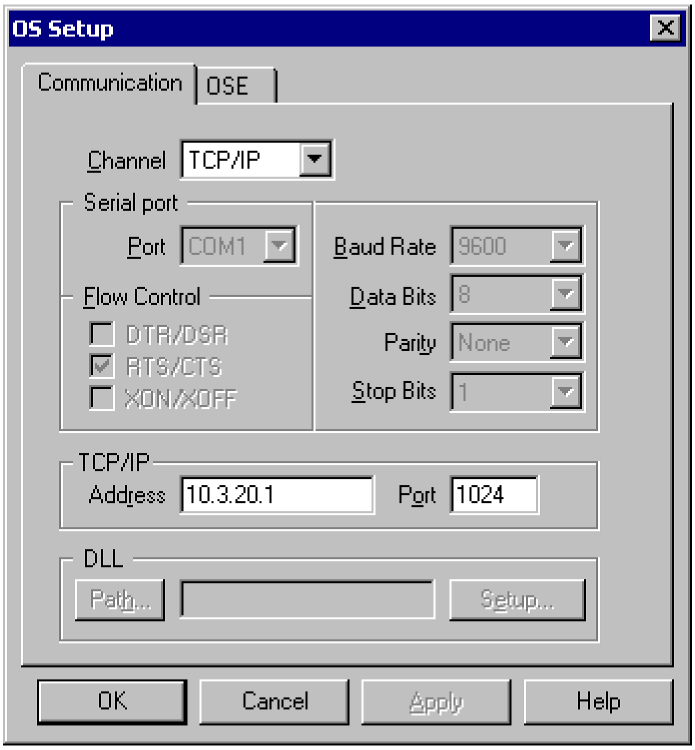
First, OSE Delta must be configured in the Operating System dialog.



OSE Delta Operating system configuration

Next, press the 'Setup…' button.

In the **Communication** page select the **TCP/IP** option. This specifies winIDEA the TCP/IP port of the target.



OS Setup

Communication | OSE

Channel: TCP/IP

Serial port

Port: COM1

Baud Rate: 9600

Data Bits: 8

Parity: None

Stop Bits: 1

Flow Control

□ DTR/DSR

☑ RTS/CTS

□ XON/XOFF

TCP/IP

Address: 10.3.20.1

Port: 1024

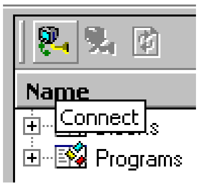
DLL

Path... | | Setup...

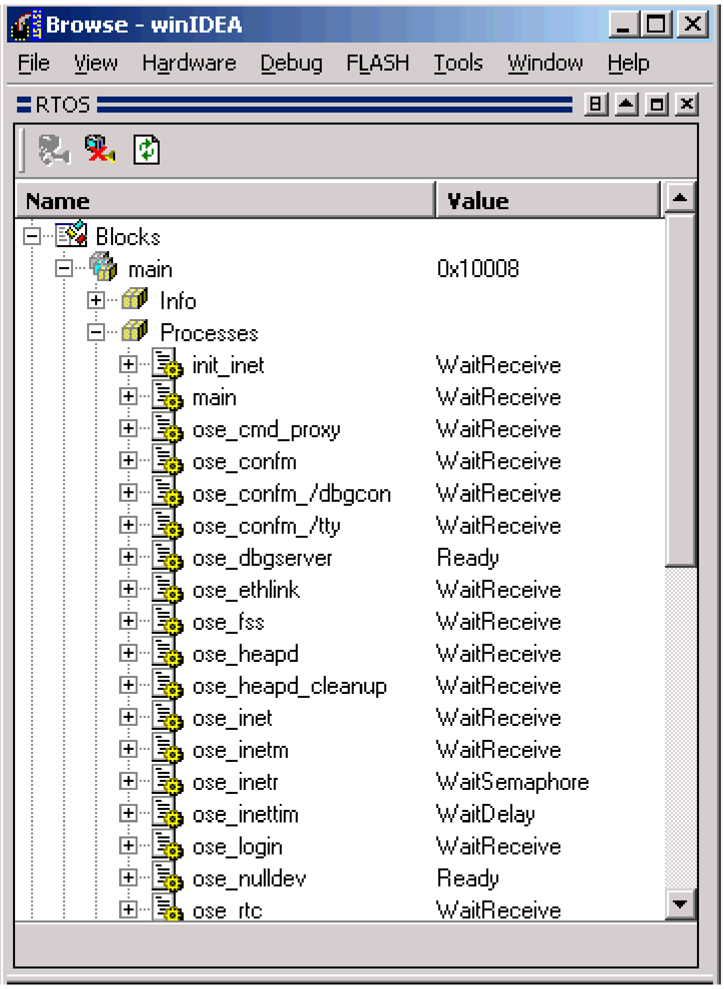
OK | Cancel | Apply | Help

OSE TCP/IP settings

Close the window and press ‘Connect’ on the Operating system toolbar.



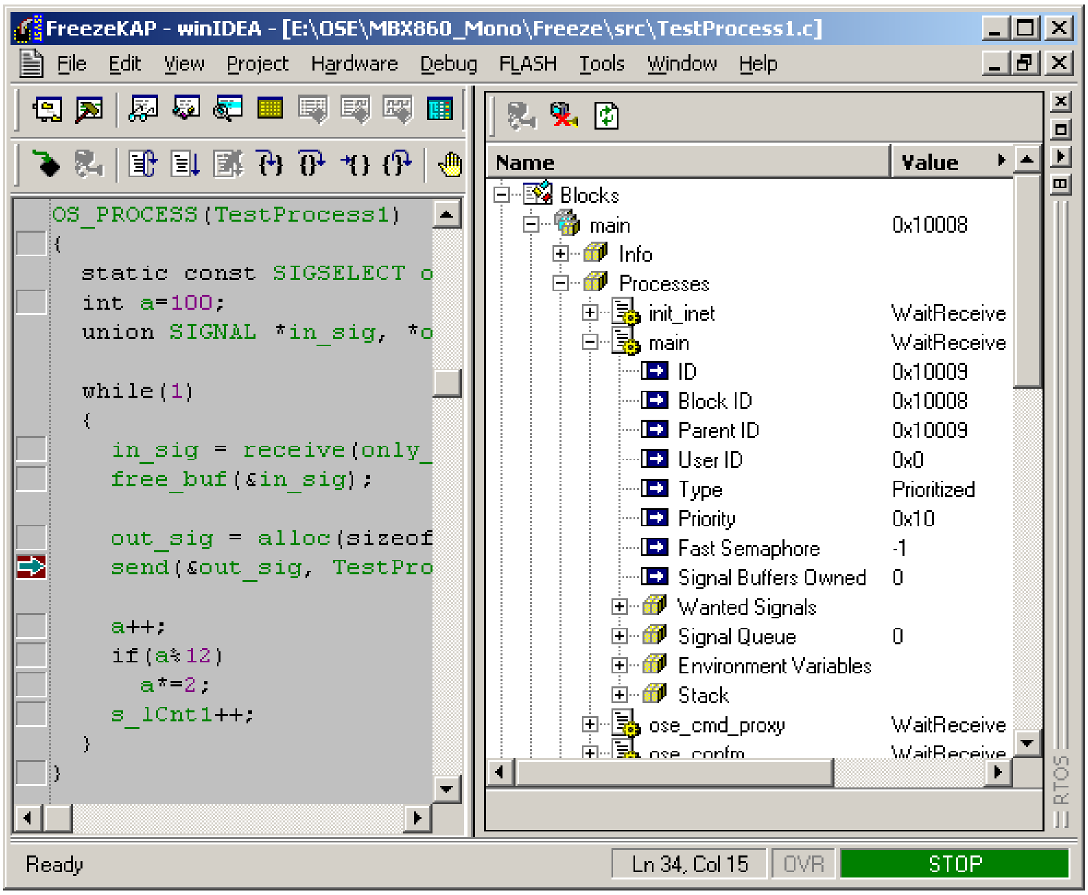
Now, winIDEA is connected to the target. The OSE System Browser can be started now. The OSE System Browser is a special operating mode of winIDEA. It resembles the OSE Iluminator strongly, but is capable of opening individual OSE Processes for debugging.



Name	Value
Blocks	
main	0x10008
Info	
Processes	
init_inet	WaitReceive
main	WaitReceive
ose_cmd_proxy	WaitReceive
ose_confm	WaitReceive
ose_confm_/dbgcon	WaitReceive
ose_confm_/tty	WaitReceive
ose_dbgserver	Ready
ose_ethlink	WaitReceive
ose_fss	WaitReceive
ose_heapd	WaitReceive
ose_heapd_cleanup	WaitReceive
ose_inet	WaitReceive
ose_inetm	WaitReceive
ose_inetr	WaitSemaphore
ose_inettim	WaitDelay
ose_login	WaitReceive
ose_nulldev	Ready
ose_rtc	WaitReceive

OSE System Browser

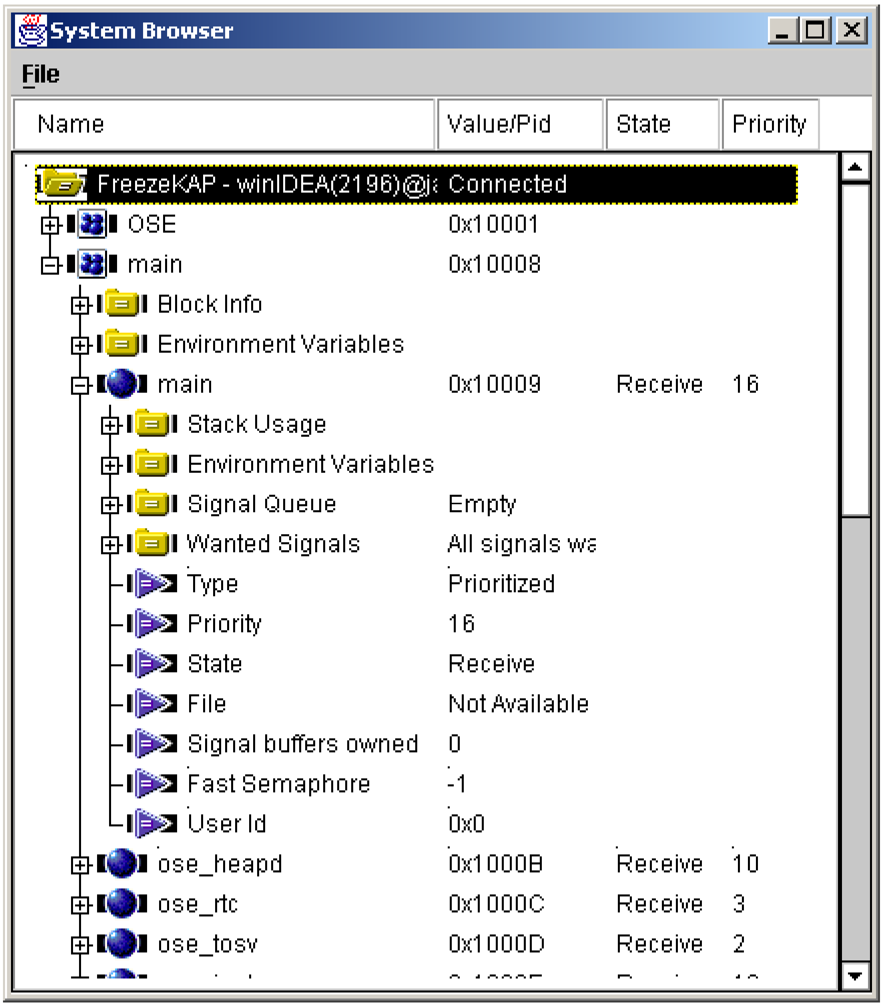
Freeze Mode Debug Operation


FreezeKAP - winIDEA - [E:\OSE\MBX860_Mono\Freeze\src\TestProcess1.c]
File Edit View Project Hardware Debug FLASH Tools Window Help
RTOS
Ready
Ln 34, Col 15
OVR
STOP

```
OS_PROCESS(TestProcess1)
{
  static const SIGSELECT o
  int a=100;
  union SIGNAL *in_sig, *o

  while(1)
  {
    in_sig = receive(only_
    free_buf(&in_sig);

    out_sig = alloc(sizeof
    send(&out_sig, TestPro

    a++;
    if(a%12)
      a*=2;
    s_lCnt1++;
  }
}
```

Name	Value
Blocks	
main	0x10008
Info	
Processes	
init_inet	WaitReceive
main	WaitReceive
ID	0x10009
Block ID	0x10008
Parent ID	0x10009
User ID	0x0
Type	Prioritized
Priority	0x10
Fast Semaphore	-1
Signal Buffers Owned	0
Wanted Signals	
Signal Queue	0
Environment Variables	
Stack	
ose_cmd_proxy	WaitReceive
ose_confm	WaitReceive

RTOS window in winIDEA



Name	Value/Pid	State	Priority
FreezeKAP - winIDEA(2196)@j	Connected		
OSE	0x10001		
main	0x10008		
Block Info			
Environment Variables			
main	0x10009	Receive	16
Stack Usage			
Environment Variables			
Signal Queue	Empty		
Wanted Signals	All signals wa		
Type	Prioritized		
Priority	16		
State	Receive		
File	Not Available		
Signal buffers owned	0		
Fast Semaphore	-1		
User Id	0x0		
ose_heapd	0x1000B	Receive	10
ose_rtc	0x1000C	Receive	3
ose_tosv	0x1000D	Receive	2

OSE System Browser window

KAP operation is initiated automatically after the CPU emulation is started. winIDEA, Illuminator or other clients operate as usual.

In winIDEA, open the OS window and click the **Connect** button.

In the Illuminator System Browser, double click on the listed target.

Restoring process context

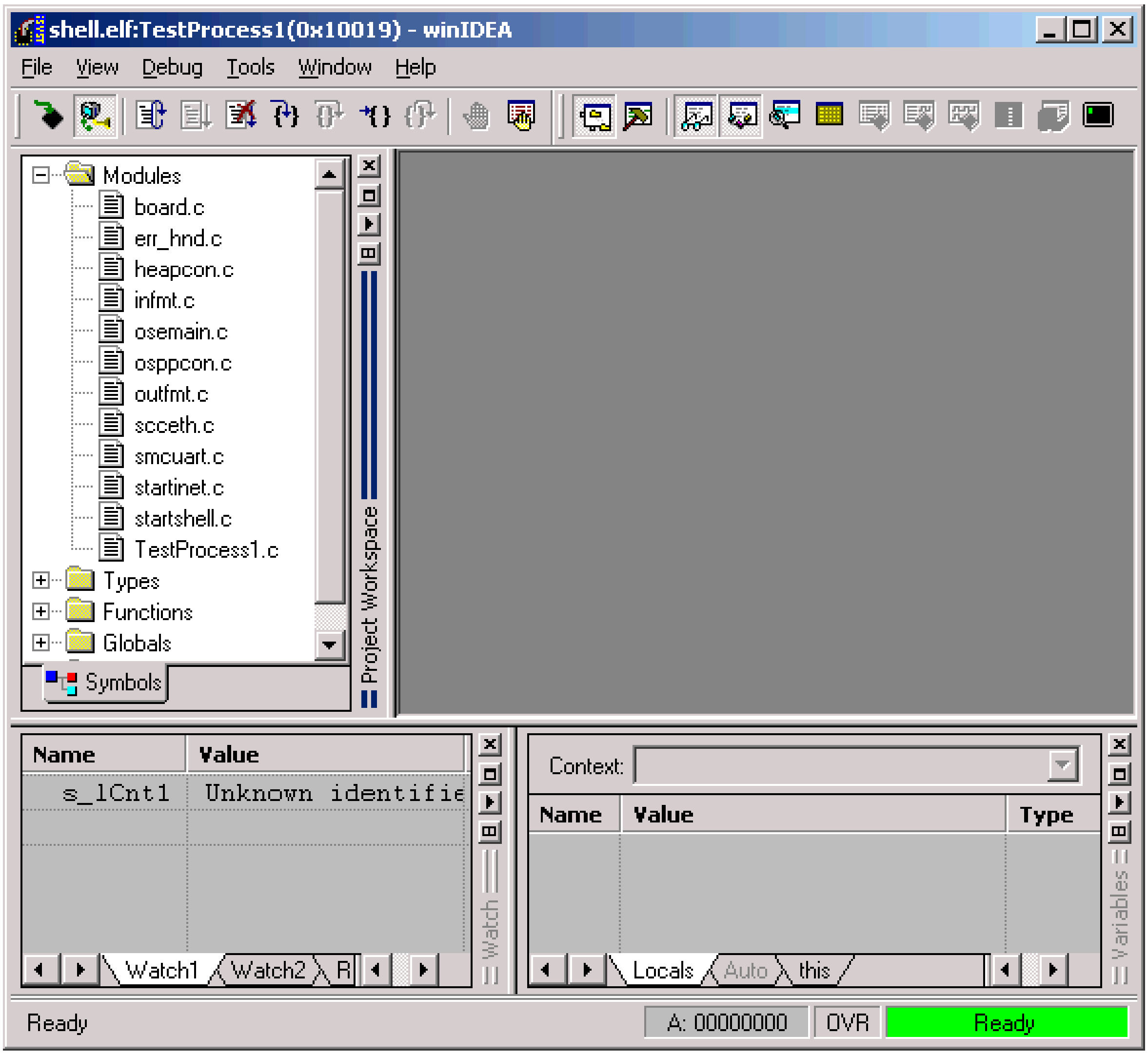
Process context can be restored by selecting the 'Set Context' command from the OS window local menu, or by double-clicking on the process. This will show execution point of the selected process, values of local variables and the call stack.

Inspecting memory

For some kernel objects, like process stack range, memory can viewed by selecting the 'View memory' from OS window local menu, or by dragging the object into an existing memory window.

OSE Run Mode Debug Session

Run mode debug session is started by double clicking a process in the System Browser.



Name	Value
s_lCnt1	Unknown identifie

Name	Value	Type

Ready A: 00000000 OVR Ready

The newly launched winIDEA indicates the debugged process in the title bar:

```
<module name>:<process name>(<process ID>)
```

In this case:

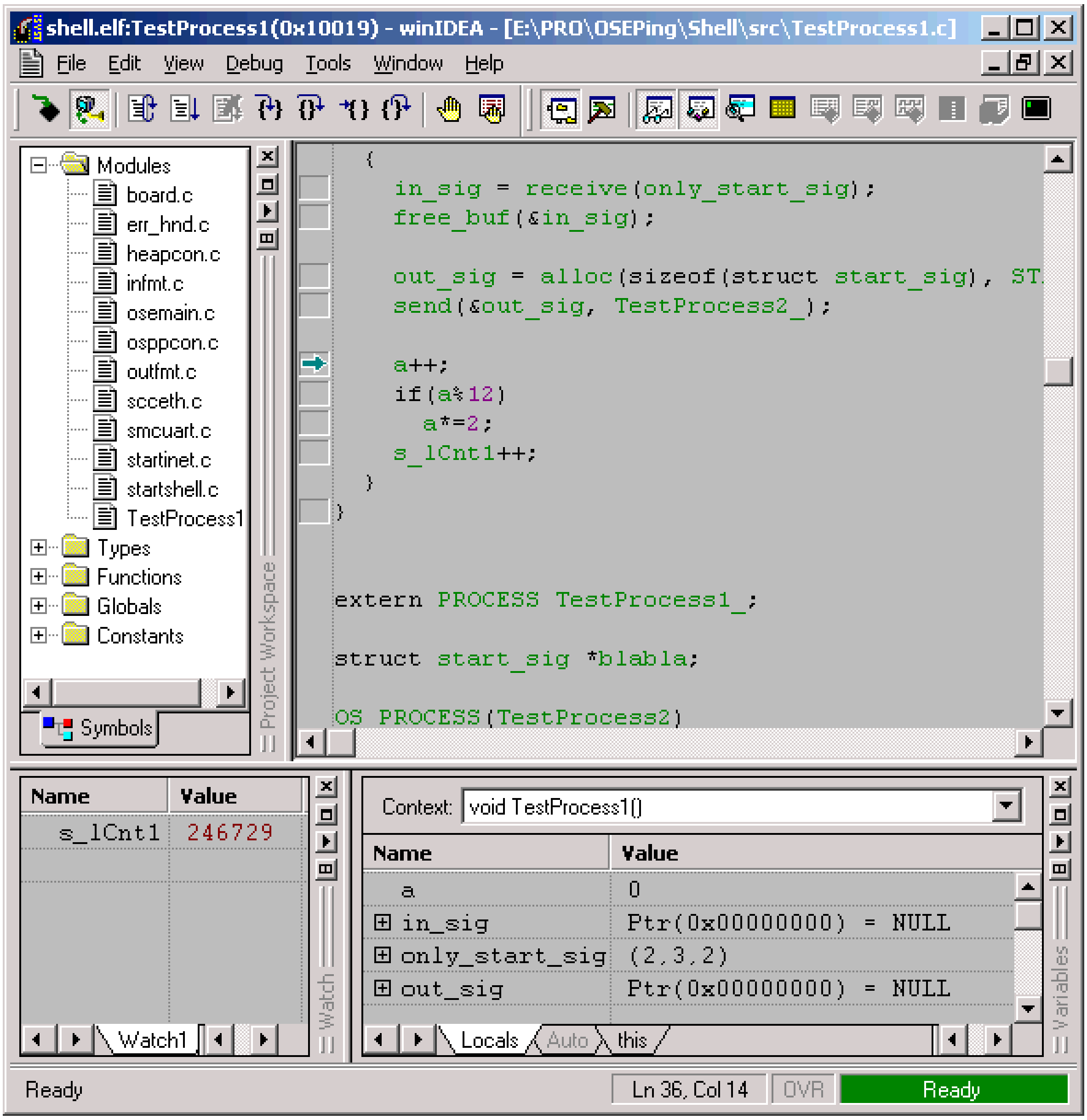
```
shell.elf:TestProcess1(0x10019)
```

Indicates that this instance of winIDEA is debugging TestProcess1 with process ID 0x10019 in module shell.elf.

Debugging a Single Process

The status in the bottom right corner indicates the current OSE status of the process. Light green color indicates regular operation i.e. no interference of a debugger.

To debug a process, click the ‘Stop’ icon in the toolbar. The status will turn dark green, and current execution point will be indicated.



```
    {
      in_sig = receive(only_start_sig);
      free_buf(&in_sig);

      out_sig = alloc(sizeof(struct start_sig), ST
      send(&out_sig, TestProcess2_);

      a++;
      if(a%12)
        a*=2;
      s_lCnt1++;
    }
}


extern PROCESS TestProcess1_;

struct start_sig *blabla;

OS_PROCESS(TestProcess2)
```

Name	Value
s_lCnt1	246729

Name	Value
a	0
⊞ in_sig	Ptr(0x00000000) = NULL
⊞ only_start_sig	(2,3,2)
⊞ out_sig	Ptr(0x00000000) = NULL

Use regular debug commands (Step, Step Over, set breakpoints etc.) to debug the process.

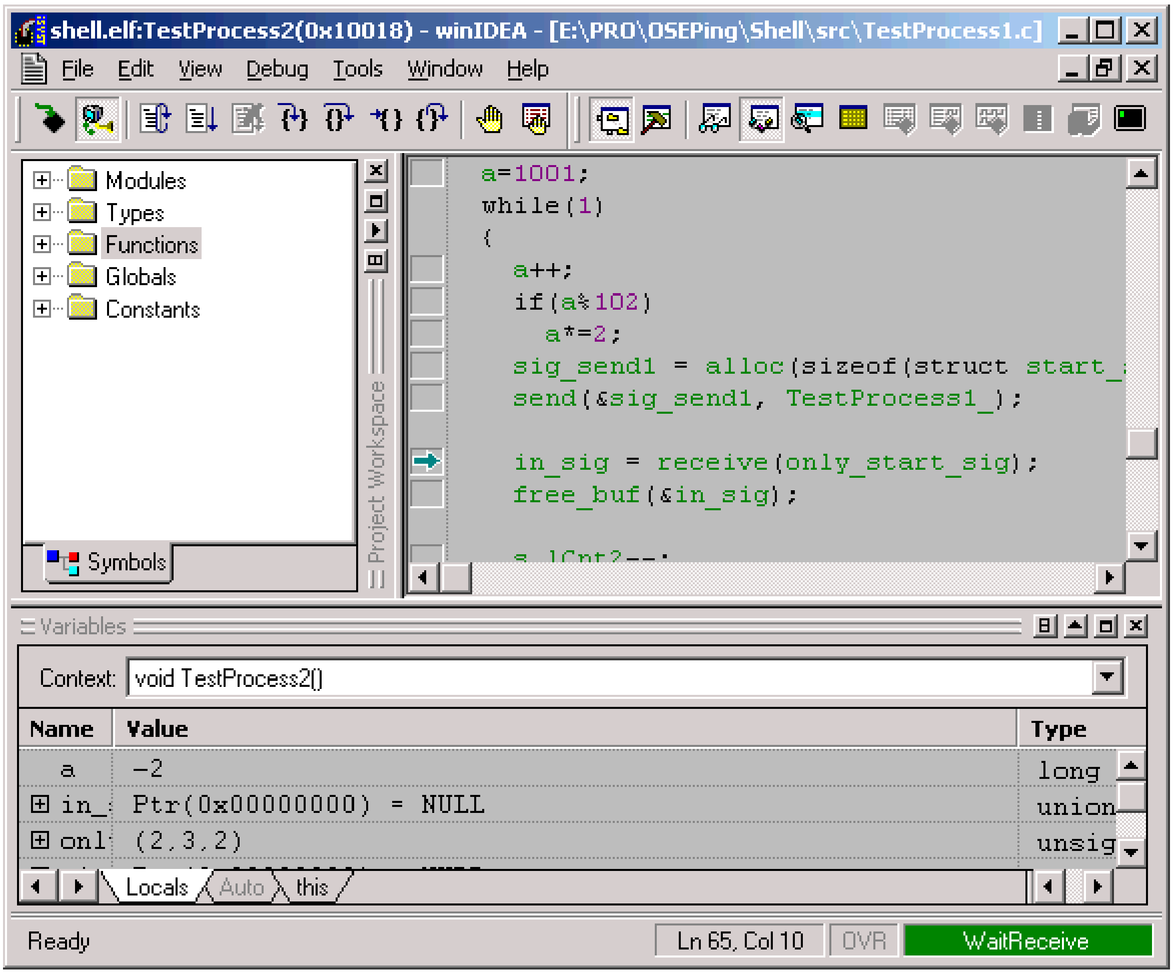
To find/open source files used in the module quickly, expand the ‘Modules’ group in the workspace window. Similarly, expand the ‘Functions’ group to quickly locate functions.

Debugging Multiple Processes

There is no limit on the number of concurrently debugged processes. To open further processes for debugging, switch back to the System Browser and double click the desired process.

In this example the TestProcess2 is exchanging signals with the TestProcess1. To debug this inter-process communication:

- Open the TestProcess2 by double clicking it in the system Browser.
- Intercept the process by clicking the ‘Stop’ button.


shell.elf:TestProcess2(0x10018) - winIDEA - [E:\PRO\OSEPing\Shell\src\TestProcess1.c]
File Edit View Debug Tools Window Help
Modules
Types
Functions
Globals
Constants
Symbols
Project Workspace
Variables
Locals
Auto
this

```
a=1001;
while(1)
{
  a++;
  if(a%102)
    a*=2;
  sig_send1 = alloc(sizeof(struct start_
  send(&sig_send1, TestProcess1_);

  in_sig = receive(only_start_sig);
  free_buf(&in_sig);

  a_lCnt2--;
```

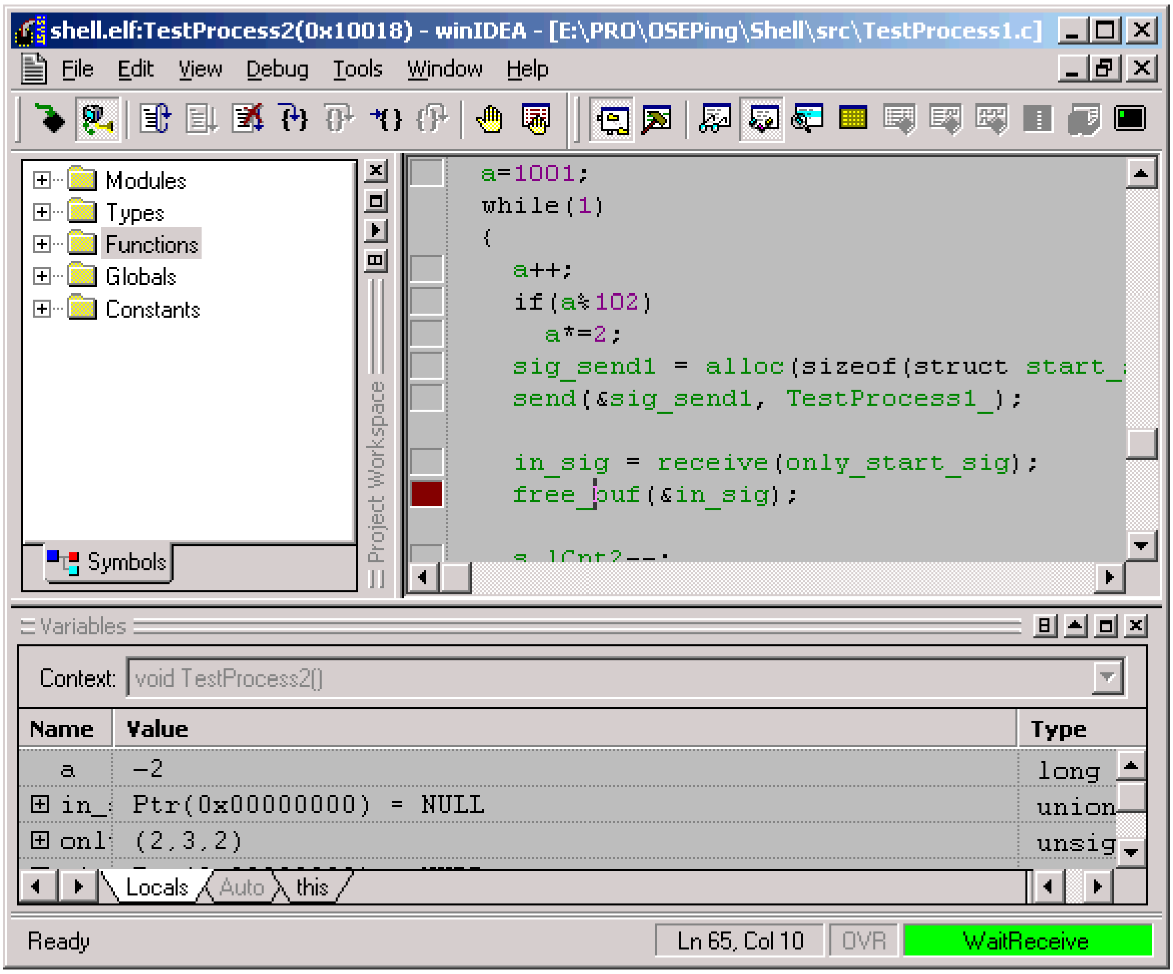
Context: void TestProcess2()

Name	Value	Type
a	-2	long
⊞ in_	Ptr(0x00000000) = NULL	union
⊞ onl	(2,3,2)	unsig

Ready | Ln 65, Col 10 | OVR | WaitReceive

As shown in the source editor and by the status, the process is blocked (WaitReceive status) on a call to 'receive'. This is expected behavior since the requested signal is generated by TestProcess1, which is currently intercepted and in no position to send it.

- Set a breakpoint after this line (on the free_buf call). You can do so either by keyboard shortcut (F9), clicking the 'Toggle breakpoint' button or from local menu.
- Set the process to running – click the 'Run' button, press F5 or select Debug/Run.



```
a=1001;
while(1)
{
  a++;
  if(a%102)
    a*=2;
  sig_send1 = alloc(sizeof(struct start_
  send(&sig_send1, TestProcess1_);

  in_sig = receive(only_start_sig);
  free_buf(&in_sig);

  s_lCnt2--;
```

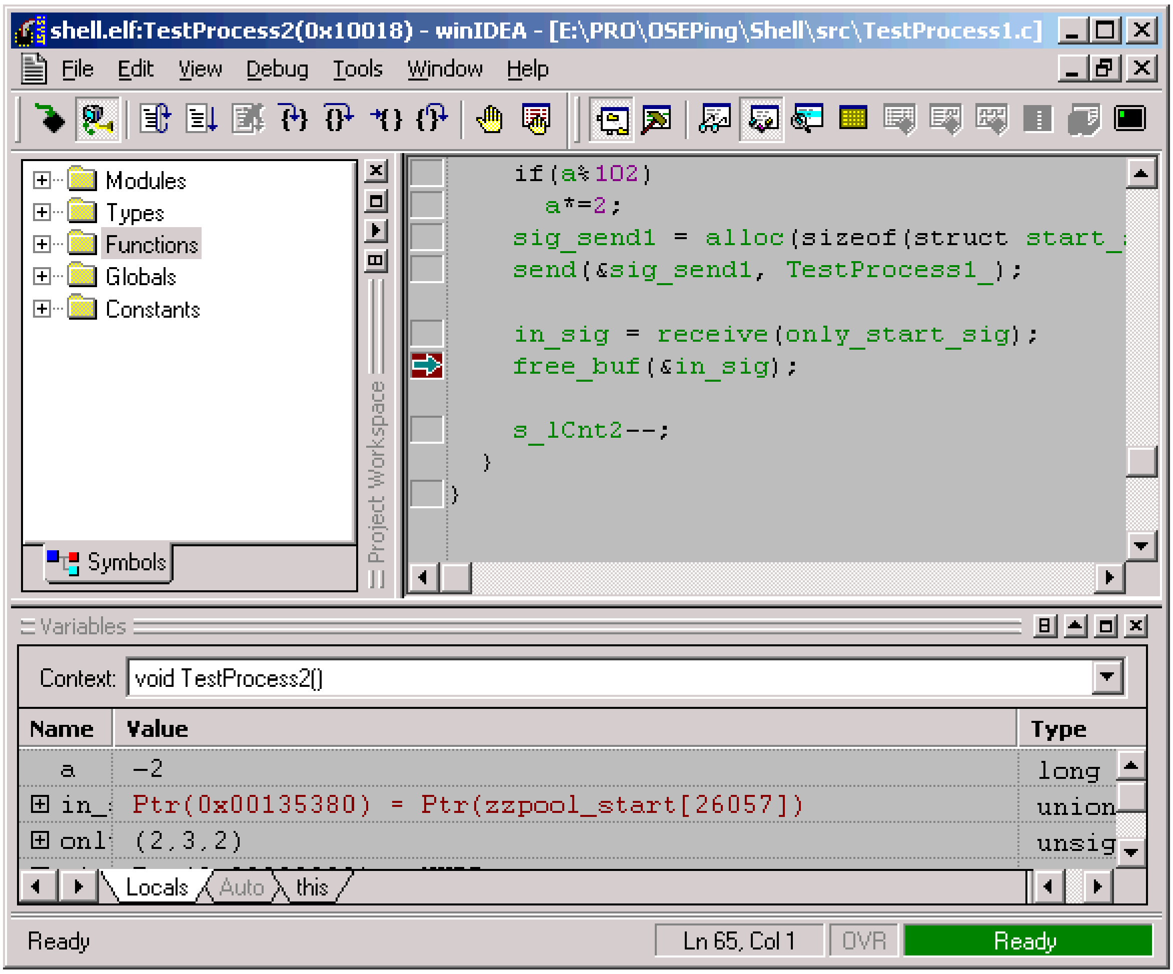
Context: void TestProcess2()

Name	Value	Type
a	-2	long
⊞ in_	Ptr(0x00000000) = NULL	union
⊞ onl	(2,3,2)	unsig

Ready | Ln 65, Col 10 | OVR | WaitReceive

Status shows not intercepted (light green) but blocked (WaitReceive).

- Now switch to TestProcess1 and set it to running
- Switch back to TestProcess2


shell.elf:TestProcess2(0x10018) - winIDEA - [E:\PRO\OSEPing\Shell\src\TestProcess1.c]
File Edit View Debug Tools Window Help
Modules
Types
Functions
Globals
Constants
Symbols
Project Workspace
Variables
Locals
Auto
this
Ready
Ln 65, Col 1
OVR
Ready

```
    if(a%102)
      a*=2;
    sig_send1 = alloc(sizeof(struct start_
    send(&sig_send1, TestProcess1_);

    in_sig = receive(only_start_sig);
    free_buf(&in_sig);

    s_lCnt2--;
  }
}
```

Context: void TestProcess2()

Name	Value	Type
a	-2	long
⊞ in_	Ptr(0x00135380) = Ptr(zzpool_start[26057])	union
⊞ onl	(2,3,2)	unsig

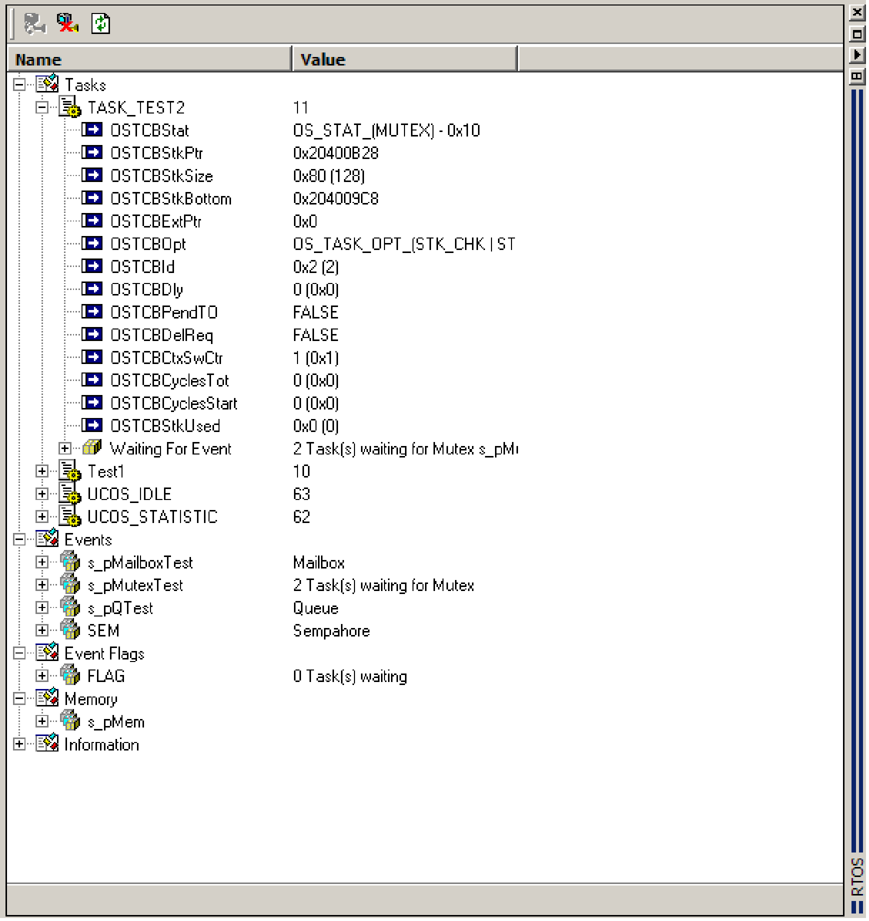
As the TestProcess1 was released, it sent a signal, which was received by the TestProcess2.

TestProcess2 returned from the receive call (unblocked) and hit a breakpoint. The status shows intercepted (dark green) but ready to run (Ready).

If you check back the TestProcess1, the situation is reversed – it is now waiting for a signal from TestProcess2.

µC/OS-II Operating System Support

winIDEA will provide listing of the operating system object in the Operating System window (View/Operating System). The requirement is that µC/OS-II is built with the debug symbols switched on.

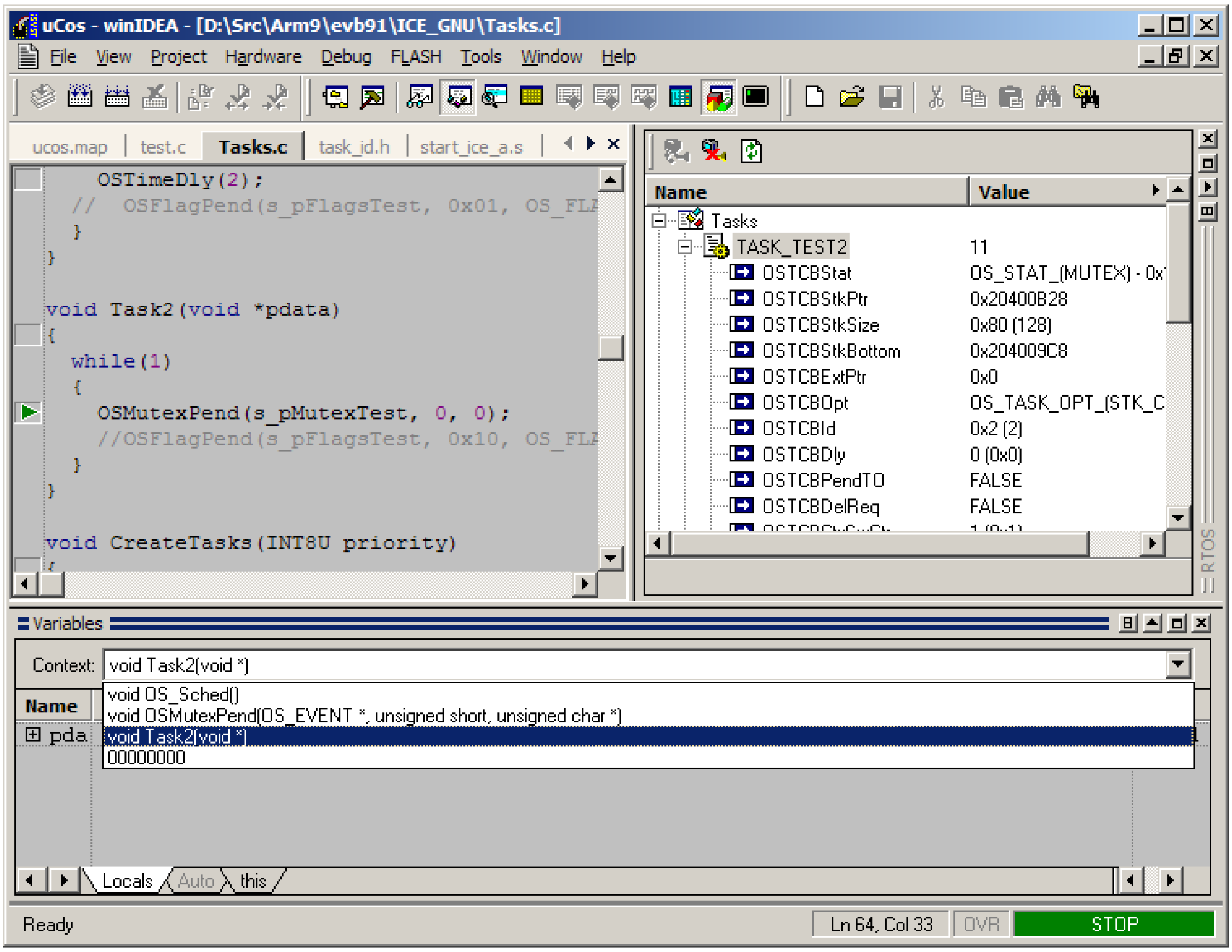


Name	Value
Tasks	
TASK_TEST2	11
OSTCBStat	OS_STAT_(MUTEX) - 0x10
OSTCBStkPtr	0x20400B28
OSTCBStkSize	0x80 (128)
OSTCBStkBottom	0x204009C8
OSTCBExtPtr	0x0
OSTCBOpt	OS_TASK_OPT_(STK_CHK | ST
OSTCBId	0x2 (2)
OSTCBDly	0 (0x0)
OSTCBPendTO	FALSE
OSTCBDelReq	FALSE
OSTCBCtxSwCtr	1 (0x1)
OSTCBCyclesTot	0 (0x0)
OSTCBCyclesStart	0 (0x0)
OSTCBStkUsed	0x0 (0)
Waiting For Event	2 Task(s) waiting for Mutex s_pM
Test1	10
UCOS_IDLE	63
UCOS_STATISTIC	62
Events	
s_pMailboxTest	Mailbox
s_pMutexTest	2 Task(s) waiting for Mutex
s_pQTest	Queue
SEM	Sempahore
Event Flags	
FLAG	0 Task(s) waiting
Memory	
s_pMem	
Information	

RTOS window in winIDEA

Integration is CPU independent.

By double clicking on the each task, winIDEA will set the current context to the selected task. After preseting the context, winIDEA will use the register values used before the selected task was preempted. Callers tree can also be shown in the Callstack window.



uCos - winIDEA - [D:\Src\Arm9\evb91\ICE_GNU\Tasks.c]
File View Project Hardware Debug FLASH Tools Window Help
ucos.map | test.c | Tasks.c | task_id.h | start_ice_a.s
Variables
Locals | Auto | this
Ready | Ln 64, Col 33 | OVR | STOP
RTOS

```
      OSTimeDly(2);
  //  OSFlagPend(s_pFlagsTest, 0x01, OS_FLA
    }
}

void Task2(void *pdata)
{
  while(1)
  {
    OSMutexPend(s_pMutexTest, 0, 0);
    //OSFlagPend(s_pFlagsTest, 0x10, OS_FLA
  }
}

void CreateTasks(INT8U priority)
```

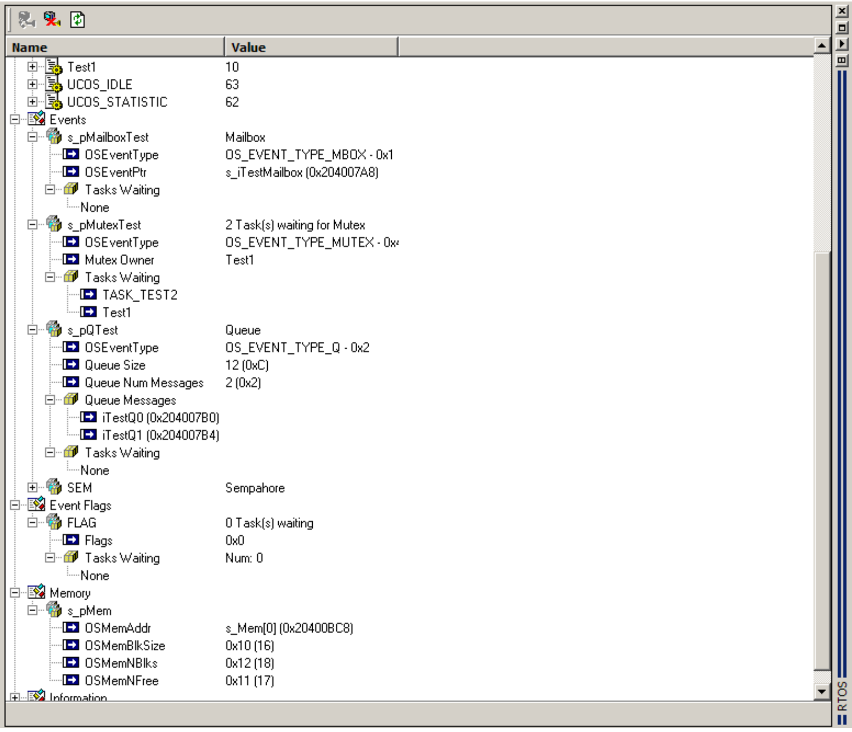
Name	Value
Tasks	
TASK_TEST2	11
OSTCBStat	OS_STAT_(MUTEX) - 0x
OSTCBStkPtr	0x20400B28
OSTCBStkSize	0x80 (128)
OSTCBStkBottom	0x204009C8
OSTCBExtPtr	0x0
OSTCBOpt	OS_TASK_OPT_(STK_C
OSTCBId	0x2 (2)
OSTCBDly	0 (0x0)
OSTCBPendTO	FALSE
OSTCBDelReq	FALSE

Context: void Task2(void *)

- void OS_Sched()
- void OSMutexPend(OS_EVENT *, unsigned short, unsigned char *)
- void Task2(void *)
- 00000000

Name
pda

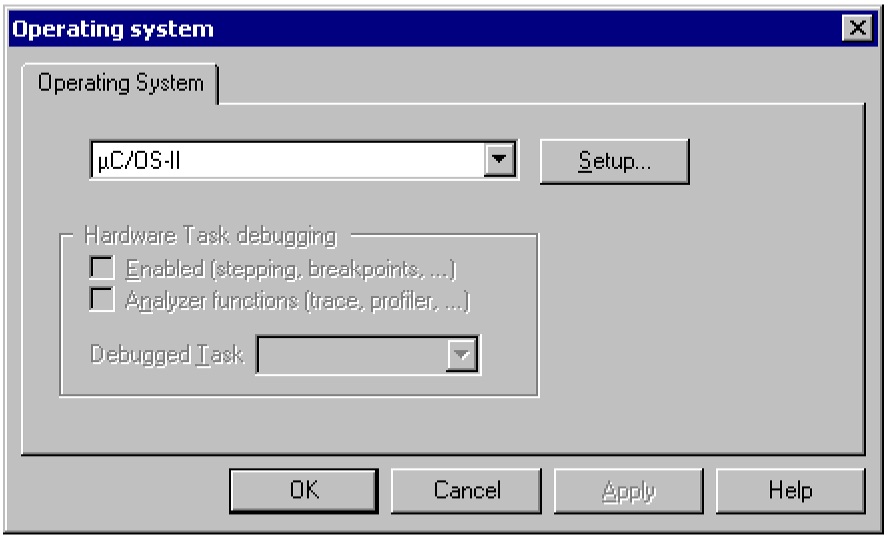
winIDEA with variables and RTOS window



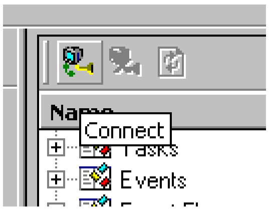
Name	Value
Test1	10
UCOS_IDLE	63
UCOS_STATISTIC	62
Events	
s_pMailboxTest	Mailbox
OSEventType	OS_EVENT_TYPE_MBOX - 0x1
OSEventPtr	s_iTestMailbox (0x204007A8)
Tasks Waiting	
None	
s_pMutexTest	2 Task(s) waiting for Mutex
OSEventType	OS_EVENT_TYPE_MUTEX - 0x
Mutex Owner	Test1
Tasks Waiting	
TASK_TEST2	
Test1	
s_pQTest	Queue
OSEventType	OS_EVENT_TYPE_Q - 0x2
Queue Size	12 (0xC)
Queue Num Messages	2 (0x2)
Queue Messages	
iTestQ0 (0x204007B0)	
iTestQ1 (0x204007B4)	
Tasks Waiting	
None	
SEM	Sempahore
Event Flags	
FLAG	0 Task(s) waiting
Flags	0x0
Tasks Waiting	Num: 0
None	
Memory	
s_pMem	
OSMemAddr	s_Mem[0] (0x20400BC8)
OSMemBlkSize	0x10 (16)
OSMemNBlks	0x12 (18)
OSMemNFree	0x11 (17)
Information	

When possible, winIDEA will show symbols instead of plain numbers.

The µC/OS-II integtration is enabled in the Debug/Operating system dialog box

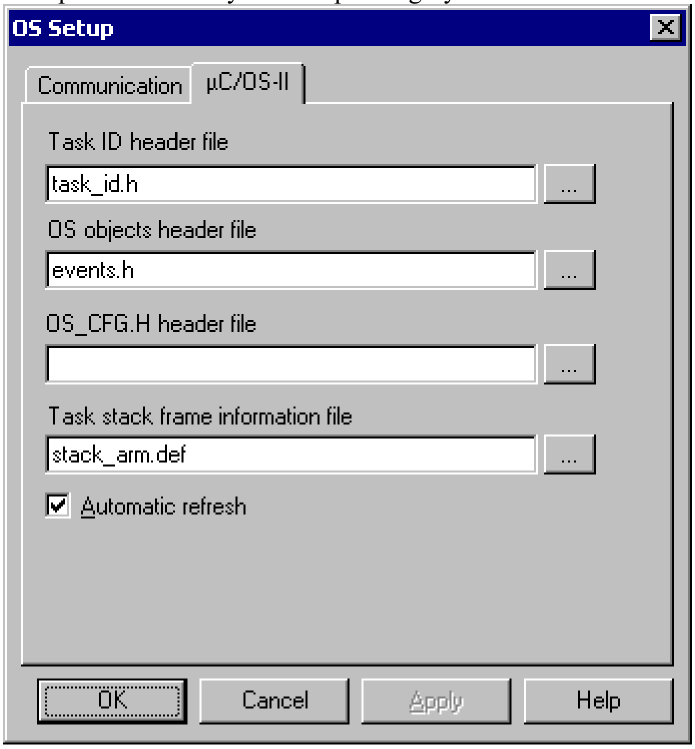


and by clicking 'Connect' in the Operating System window toolbar.



µC/OS-II settings

All file settings are optional. However the user is welcome to use them in order to improve readability of the Operating System window.



Task ID header file: task_id.h

OS objects header file: events.h

OS_CFG.H header file:

Task stack frame information file: stack_arm.def

☑ Automatic refresh

Task ID header file

The task can be named in µC/OS-II in several ways. Naming is dependent on µC/OS-II version and on the setting in os_cfg.h. If `OS_TASK_CREATE_EXT_EN` is not enabled and `OS_TASK_NAME_SIZE` is less than 1 then the only information about the task is its priority. This is also the case when the task is created with `OSTaskCreate`.

If the tasks are created with `OSTaskCreateExt`, then the `id` parameter can be used to identify this task. For example if the content of the Task ID header file is

```
#ifndef __task_id_h__
#define __task_id_h__


#define TASK_TEST1     1
#define TASK_TEST2     2


#endif
```

then the task will be shown as `TASK_TEST1` when created with `OSTaskCreateExt` and `id` parameter set to `1`.

When `OSTaskNameSet` is used, then winIDEA will use this name. Note that only numbers in `#define` can be used.

OS objects header file

The same name problem occurs with other OS objects. If `OsxxxNameSet` functions are not used, then there is no way to name the OS object with a frendly name. You can however enumerate all the global pointers in this file, so that they will hold the address of the objects. For example when creating the sempahore

```
OS_EVENT *s_pSemaphoreTest=OSSemCreate(5);
```

pSemaphoreTest will hold address of the created object. If the content of the header file is

```
#define s_pMutexTest MY_MUTEX
#define s_pSemaphoreTest MY_SEMAPHORE
```

then this semaphore event will be named MY_SEMAPHORE.

winIDEA will use this names for all OS_EVENT, OS_FLAG_GRP and OS_MEM types.

You can also reuse this file in your source code. The usage of the same value for the define statement as its name is suggested:

#define s_pMutexTest s_pMutexTest

This way the name of the variable will be the same as the object shown in the Operating System window.

OS_CFG.h header file

If left empty winIDEA will try to find it in the workspace folder. It is used internally for parsing of some µC/OS-II configuration settings.

Task stack frame information file

µC/OS-II operating system is practically completely CPU independent. One of the things that is CPU specific is the task stack frame when the context is switched. This information is used by winIDEA when preseting the context to the selected task. It is defined in `OSTaskStkInit` in `os_cpu_c.c`. winIDEA already supports a number of CPUs internally. However, when the user changes `OSTaskStkInit`, the set context function can also be used by defining this file.

For example if `OSTaskStkInit` is

```
    OS_STK *stk;
  opt      = opt;
  stk      = ptos;    // Load stack pointer
  *(stk)   = (OS_STK)task;           // Entry Point
  *(--stk) = (INT32U)0;              // LR
  *(--stk) = (INT32U)0;              // R12
  *(--stk) = (INT32U)0;              // R11
  *(--stk) = (INT32U)0;              // R10
  *(--stk) = (INT32U)0;              // R9
  *(--stk) = (INT32U)0;              // R8
  *(--stk) = (INT32U)0;              // R7
  *(--stk) = (INT32U)0;              // R6
  *(--stk) = (INT32U)0;              // R5
  *(--stk) = (INT32U)0;              // R4
  *(--stk) = (INT32U)0;              // R3
  *(--stk) = (INT32U)0;              // R2
  *(--stk) = (INT32U)0;              // R1
  *(--stk) = (INT32U)pdata;          // R0
  *(--stk) = (INT32U)SVC_MODE;       // CPSR
  *(--stk) = (INT32U)SVC_MODE;       // SPSR
  return ((OS_STK *)stk);
```

Then the content of the Task stack frame information file should be

```
#define REG_SIZE 4
#define STACK_PTR R13

#define R13  68
#define SPSR 0
#define CPSR 4
#define R0   8
#define R1   12
#define R2   16
#define R3   20
#define R4   24
#define R5   28
#define R6   32
#define R7   36
#define R8   40
#define R9   44
#define R1   48
#define R11  52
#define R12  56
// sp not saved
#define R14  60
#define R15  64
```

`REG_SIZE` is the default size for all regsiters. `STACK_PTR` is the name of the stack pointer. All other `#define` statements define the offset of the individual register from the stack pointer of individual task saved in `OSTCBStkPtr` member of the `OS_TCB`. All names used must be the same as used in winIDEA disassembly window.

Automatic refresh

When winIDEA and the µC/OS-II Operating System are connected and this setting is enabled, the Operating System window will be refreshed automatically when needed (memory changed, CPU stopped). If the setting of this option decreases performance, then uncheck this option and use the ‘Refresh’ button in the Operating System toolbar.

Breakpoints

Besides reading and writing memory, debugging is all about breakpoints.

A breakpoint is a way to stop the CPU. There are various kinds of breakpoints available:

- **Implicit execution breakpoints** are transparent to users, but used heavily for step, step over, run until and run until return operations.

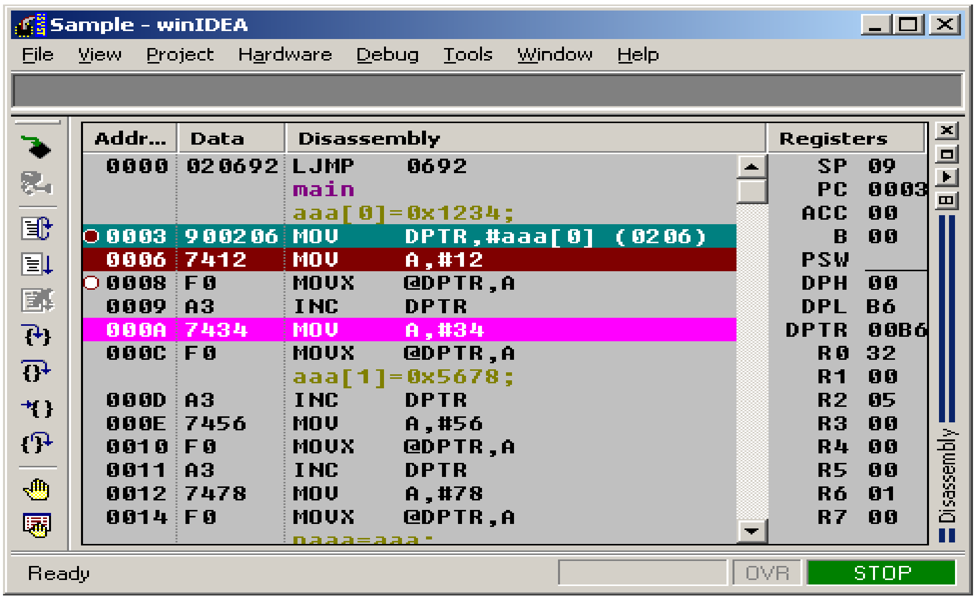
- **Execution breakpoints** are used to break CPU execution before it executes the instruction on the breakpoint address. These can be either hardware execution breakpoints or software execution breakpoints.

- **Hardware specific breakpoints** depend on the capabilities of the attached debugger. Refer to debugger manual for more information.

When a breakpoint is hit, the CPU is stopped and winIDEA updates its windows to reflect the new situation.

Execution Breakpoints

Execution breakpoints act when the CPU attempts to execute the instruction at the breakpoint location.



```
0000 020692 LJMP  0692
            main
            aaa[0]=0x1234;
0003 900206 MOV   DPTR,#aaa[0] (0206)
0006 7412   MOV   A,#12
0008 F0     MOVX  @DPTR,A
0009 A3     INC   DPTR
000A 7434   MOV   A,#34
000C F0     MOVX  @DPTR,A
            aaa[1]=0x5678;
000D A3     INC   DPTR
000E 7456   MOV   A,#56
0010 F0     MOVX  @DPTR,A
0011 A3     INC   DPTR
0012 7478   MOV   A,#78
0014 F0     MOVX  @DPTR,A
            paaa=aaa;
```

Registers	
SP	09
PC	0003
ACC	00
B	00
PSW	
DPH	00
DPL	B6
DPTR	00B6
R0	32
R1	00
R2	05
R3	00
R4	00
R5	00
R6	01
R7	00

Execution breakpoint indicated in source window

This is the most commonly used breakpoint type. winIDEA makes extensive use of them to implement functions like 'Step', 'Step Over', 'Run Until' and 'Run Until Return'. These implicitly used breakpoints are not visible to you.

The picture shows

- an active breakpoint on address 0x0003, shown as a circle (program counter indicator taking precedence),

- an active breakpoint on address 0x0006, the entire line painted,

- a disabled breakpoint on address 0x0008, shown as a circle of inverted color

- an invalid breakpoint (not set on beginning of an instruction) on address 0x000B, the entire line painted with a different color

In situations where simple stepping through a program is not enough, you can explicitly set an execution breakpoint. Such execution breakpoints are indicated in both source and disassembly window.

An execution breakpoint can be set in two ways.

The quick and easy way is to:

- use a shortcut key or,
- select the 'Toggle breakpoint' command from editor's or disassembly window's context menu.

This command will set an execution breakpoint at the:

- insertion point of the editor or,
- at the indicator position of the disassembly window

To configure advanced breakpoint options, you must open the Breakpoints dialog (View menu).

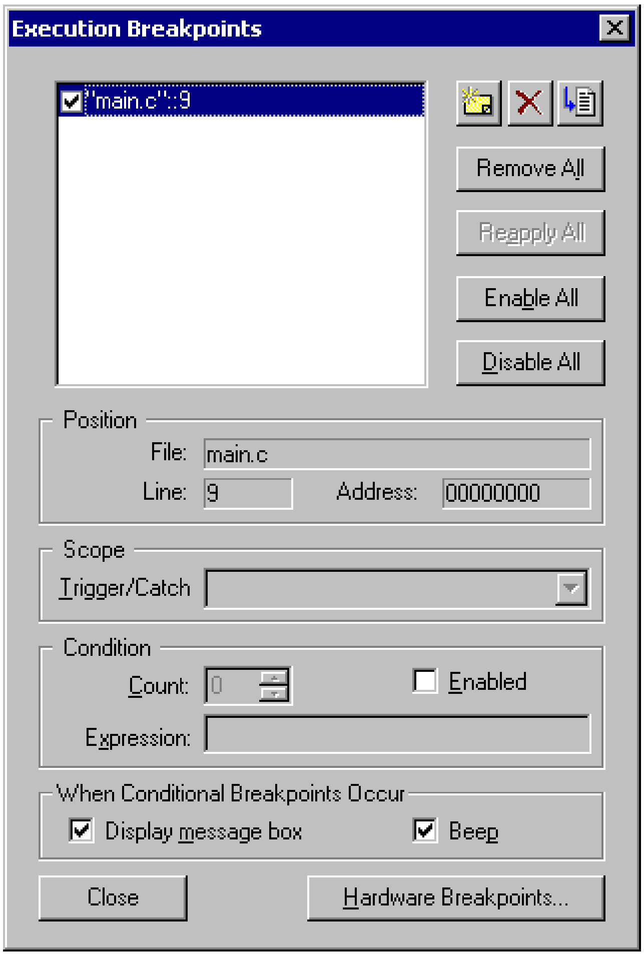
Note: execution breakpoints are available on all emulation types (In-Circuit, BDM, etc.)

Execution Breakpoints Window

In the Execution Breakpoints window, you can customize existing breakpoints and add new execution breakpoints.

The breakpoint window is resizable and its screen position is restored the next time it is loaded.

The window is modeless, i.e. you can keep it open while using other winIDEA functions.



Execution Breakpoints

☑ "main.c"::9

Position

File: main.c

Line: 9 Address: 00000000

Scope

Trigger/Catch

Condition

Count: 0 □ Enabled

Expression:

When Conditional Breakpoints Occur

☑ Display message box ☑ Beep

Breakpoints dialog, execution page

Every breakpoint can be enabled or disabled by checking/unchecking the box in front of the breakpoint definition.

New -

Inserts a new breakpoint.

Remove -

Removes the highlighted breakpoint.

Remove All

Removes all breakpoints.

Goto Source -

Jumps to the breakpoint location in the source.

Reapply All

Typically this option is used in applications with software breakpoints. This option is used, when the programming code, where the breakpoints are located, is written over, for example when the code is self modifying. If breakpoints are first set, then a debug download is initiated. If a code modification occurs, the previously set breakpoints are overwritten and will not be active any more. Therefore, the breakpoints must be applied again by pushing the 'Reapply All' button.

Enable All

Enables all breakpoints.

Disable All

Disables all breakpoints. Especially useful when final application tests are performed.

Position

Position shows the source file and line of selected breakpoint and its address in the target system.

You can enable or disable a breakpoint by configuring the 'Active' option.

Condition

Conditional breakpoints are an advanced breakpoint feature provided by winIDEA. When a breakpoint is hit and the condition is enabled - 'Enabled' option checked, winIDEA performs the following checks:

- first the conditional expression is evaluated. If no expression is specified a non-zero result is assumed.
- if the expression evaluates to non-zero, the breakpoint occurrence counter is incremented.
- if the breakpoint occurrence counter is less or equal to 'Count' specified, CPU execution is resumed, otherwise the CPU remains stopped.

When Conditional Breakpoints Occur

You can instruct winIDEA to issue a beep and/or display a message indicating that a conditional breakpoint has occurred.

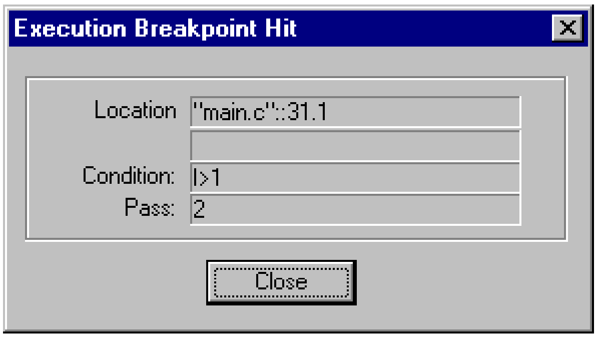
This setting is global for all execution breakpoints.

Hardware Breakpoints

Provides a link to a dialog where hardware breakpoints, other then execution breakpoints, can be configured.

Breakpoint report dialog

If the **Display message box** option in the execution breakpoints dialog is set, a message box like this one will come up every time a conditional breakpoint is hit or the condition can not be evaluated.



Execution Breakpoint Hit

Location "main.c"::31.1

Condition: I>1

Pass: 2

Breakpoint report dialog

Location

Specifies the location of the breakpoint.

Condition

Specifies the breakpoint condition. This field can also show evaluation error if the condition was not entered properly.

Pass

Indicates the pass count for breakpoint occurrence.

Source Debugging

If your compiler can generate source debug information, you will probably spend most of the time debugging in your own sources.

winIDEA provides you with quick yet powerful functions to control program flow. All commands are available in the Debug menu as well as in the Debug toolbar.

Note: no debugging is available until the emulator has been initialized and the program loaded.

Reset

Reset button

Reset command will place the CPU in reset state, release it from reset and stop it before it executes the first instruction.
For CPU's that need to perform chip initialization within specified number of clocks after the CPU has been released from reset (68HC11), use the **Reset and Run** command, which does not stop the CPU after it is released from reset.

Run

Run button

Run command sets the CPU running.
This command is available if the CPU is currently stopped.

Stop

Stop button

Stop command stops the CPU immediately.
This command is available only if the CPU is running.

On occasions where the CPU can not be stopped without a legal (instruction aligned) execution breakpoint and no line symbol is hit within one second after stop has been issued, winIDEA reports:

```
Can not stop, use breakpoints to stop execution.
```

In such case set an execution breakpoint to a location in the program where you know the CPU is executing from often.

Note: stop requires breakpoints only on REmulator and Intel's 251 family on In-Circuit emulator.

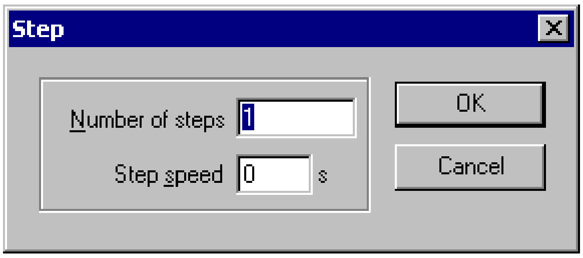
Step Into button

Step

Step command performs a single program step. When calling a function, the function will be stepped in.
If the CPU is running, step command causes the CPU to stop when it reaches the next source line.

If interrupt servicing in background has been disabled, no interrupt will be serviced during this step.

Selecting Step… command from Debug menu opens the Step dialog, where you can specify the number of steps you wish to execute.



Number of steps 1

Step speed 0 s

Step dialog

- Number of steps set to one acts the same as a single step
- If zero is specified, winIDEA will step until step is aborted with the 'Stop Stepping' command (Debug menu).

Step Over button

Step Over

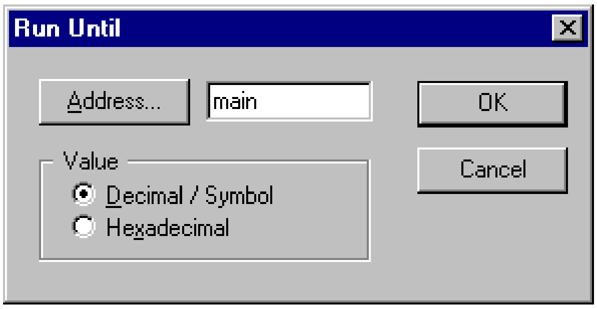
Step Over command performs a single program step inside the current function. Any function(s) called by executing the current line are not stepped in.
If interrupt servicing in background has been disabled, no interrupt will be serviced during this step.
This command is available if the CPU is currently stopped.

Run Until

Run Until button

Run Until command sets the CPU running until its execution reaches the current insertion point.

Selecting Run Until… command from Debug menu opens the Run Until dialog, where you can specify the address where you want the CPU to stop.



main

Value

● Decimal / Symbol

○ Hexadecimal

Run Until dialog

Run Until Return

Run Until Return button

Run Until Return command sets the CPU running until its execution reaches an exit point from the current function.

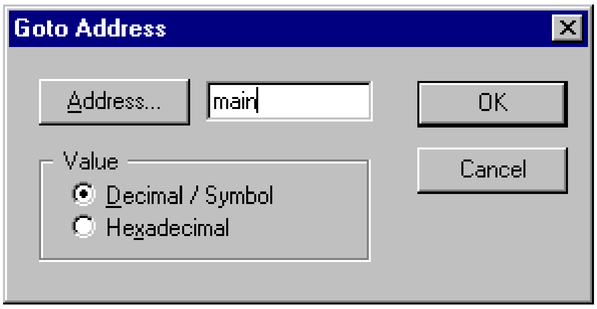
If interrupt servicing in background has been disabled, no interrupt will be serviced during this operation.

This command is available if the CPU is currently stopped.

Go-to Address

Go to Address command presets the CPU's program counter register (PC, IP, etc.) to the current insertion point.

Selecting Goto Address… command from Debug menu opens the Goto Address dialog, where you can specify the address you want to preset the CPU's program counter to.



Address... main

Value

● Decimal / Symbol

○ Hexadecimal

Goto Address dialog

Note: use this command with caution. Since regular program execution is skipped, going out of the current function without readjusting the stack will cause the program to crash. Even jumping inside a function can skip over vital instructions that an optimizing compiler put in locations you don't expect.

Show Execution Point

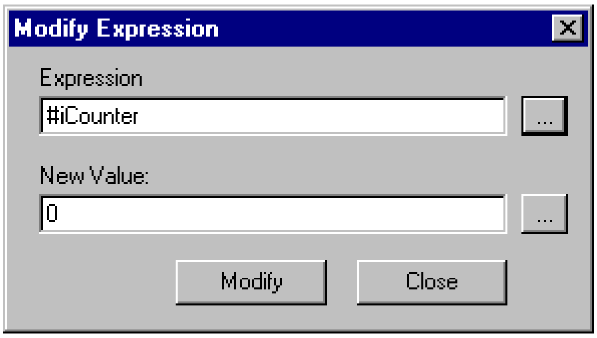
This option shows the current execution point in the source.

Snapshot

This option refreshes opened windows. It is used during running state of the CPU.

Modify Expression

With this option an expression can be modified.



Expression
#iCounter

New Value:
0

Modify Expression dialog

First, the expression must be entered or selected with the '...' button.

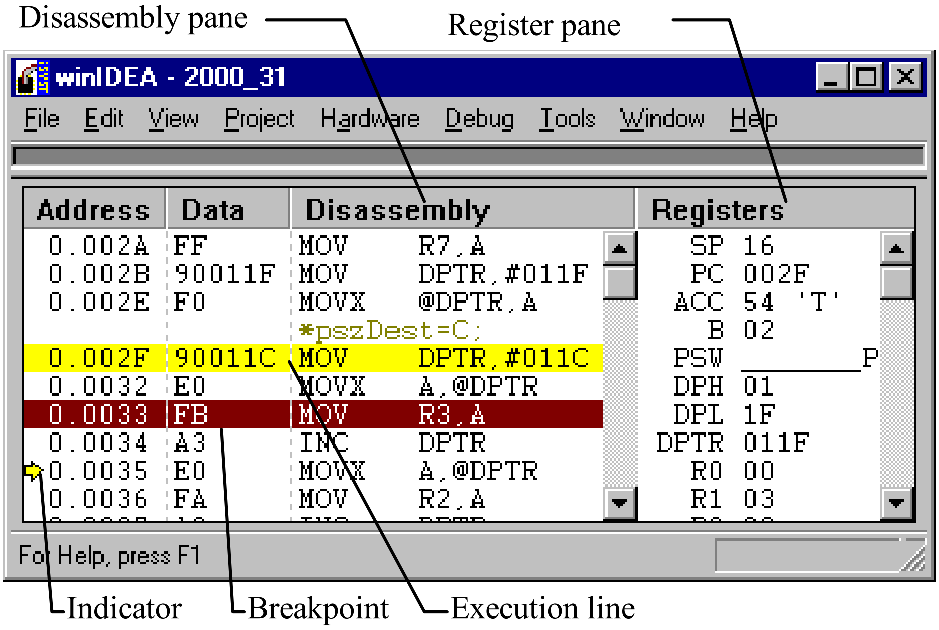
Then, the new value is entered or selected with the '...' button.

Setting Execution Breakpoints

Setting and clearing an execution breakpoint (see "Execution Breakpoints" on page 159) in source is easy. The 'Toggle Breakpoint' command available in Debug and editor's context menu sets an execution breakpoint at the current insertion point. If a breakpoint is already set on this location, it is cleared.

Disassembly Window

Programmers will mainly use the disassembly window where no source debug information is available. Its functions nearly duplicate source-debugging functions.



```
 Address   Data     Disassembly               Registers
 0.002A    FF       MOV     R7,A               SP  16
 0.002B    90011F   MOV     DPTR,#011F         PC  002F
 0.002E    F0       MOVX    @DPTR,A           ACC  54  'T'
                    *pszDest=C;                 B  02
 0.002F    90011C   MOV     DPTR,#011C        PSW  ________P
 0.0032    E0       MOVX    A,@DPTR           DPH  01
 0.0033    FB       MOV     R3,A              DPL  1F
 0.0034    A3       INC     DPTR             DPTR  011F
 0.0035    E0       MOVX    A,@DPTR            R0  00
 0.0036    FA       MOV     R2,A               R1  03
```

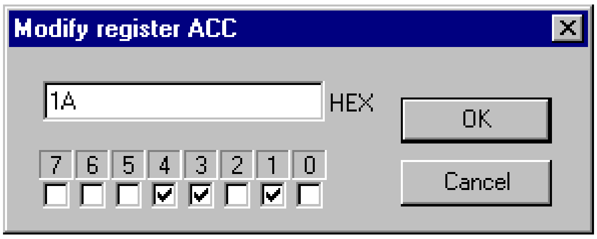
Disassembly window

The Disassembly window consists of two independent scrollable panes, which you can resize by dragging delimiters in the header.

Registers Pane

Lists all CPU's registers along with their values.

Double clicking a register opens the Modify Register dialog where the selected register can be modified.



Modify register ACC

1A HEX

7	6	5	4	3	2	1	0
□	□	□	☑	☑	□	☑	□

Modify Register dialog

The register can be modified by entering a hexadecimal value or bitwise.

Disassembly Pane

lists the target program in disassembled form. The program execution point and breakpoints are indicated, as well as an arrow indicator with which you can move up and down to view other parts of the program, set and clear breakpoints, run until, etc.

Disassembly pane always displays disassembled instruction, but you can additionally instruct it to display:

- source - if a line symbol's address matches the address of the disassembled instruction, the source line is displayed before the instruction.
- labels - if a code label's address matches the address of the disassembled instruction, the name of the label is displayed before the instruction.
- symbols - if an absolute location is addressed by an instruction and that address matches a global variable or a code label, the symbol's address is displayed instead of the value.
- Example: variable 'var' is located at address 1000h:

```
MOV A,(1000)
```

is replaced by

```
MOV A,(var)
```

- symbol values - if symbols are enabled and you still wish to see the absolute number, enabling this setting will display the value as well. In the previous example this would yield:

```
MOV A,(var)   (1000)
```

All above options can be set from the context menu, or in the Options dialog.

Suspending and Resuming Program Execution

When the disassembly window is selected (the arrow indicator is visible), program flow control will apply to it even if editor windows are opened. Some of these commands perform exactly the same as if used from editor. These are:

- Reset
- Run
- Stop

Step

Step Into button

Step command performs a single instruction step. When calling a routine, it will be stepped in. Performing a Step on block execution commands (LDIR, REP, etc.) will execute individual iterations step by step.
If the CPU is running, step command causes the CPU to stop.

If interrupt servicing in background has been disabled, no interrupt will be serviced during this step.

When the Step… command is selected from the Debug menu, winIDEA operates as described in "Step" on page 166, only this time, steps are performed in the disassembly window.

Step Over

Step Over button

Step Over command performs a single instruction step. If the current instruction is a call to a sub routine or a block instruction, the CPU is set running until the instruction after the current instruction is reached.
If interrupt servicing in background has been disabled, no interrupt will be serviced during this step.
This command is available if the CPU is currently stopped.

Run Until

Run Until button

Run Until command sets the CPU running until its execution reaches the current indicator position.
Selecting Run Until… command from Debug menu operates as described in "Run Until" on page 167

Go-to Address

Go to Address command presets the CPU's program counter register (PC, IP, etc.) to the current indicator position.

Selecting Goto Address… command from Debug menu operates as described in "Go-to Address" on page 168

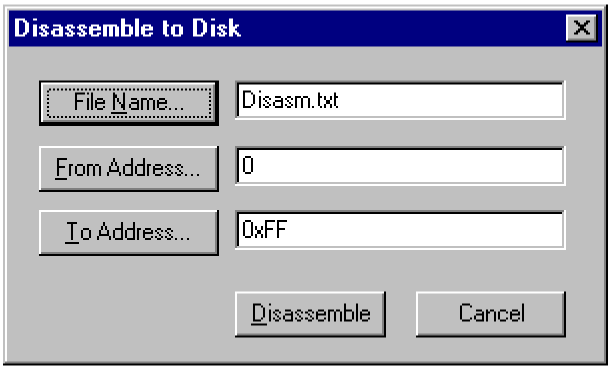
Note: use this command with caution. Since regular program execution is skipped, make sure that the stack pointer and other important registers are not corrupted by this action. Careless usage can lead the program to crash.

Setting Execution Breakpoints

Setting and clearing an execution breakpoint (see "Execution Breakpoints" on page 159) in the disassembly window is easy. The 'Toggle Breakpoint' command available in the Debug and disassembly pane's context menu sets an execution breakpoint at the current indicator point. If a breakpoint is already set on this location, it is cleared.

Disassembling To Disk

The 'Disassemble to disk' command available in the disassembly pane's context menu, opens a dialog where you can specify the range of addresses that you wish to disassemble and store in a disk file.



File Name...: Disasm.txt

From Address...: 0

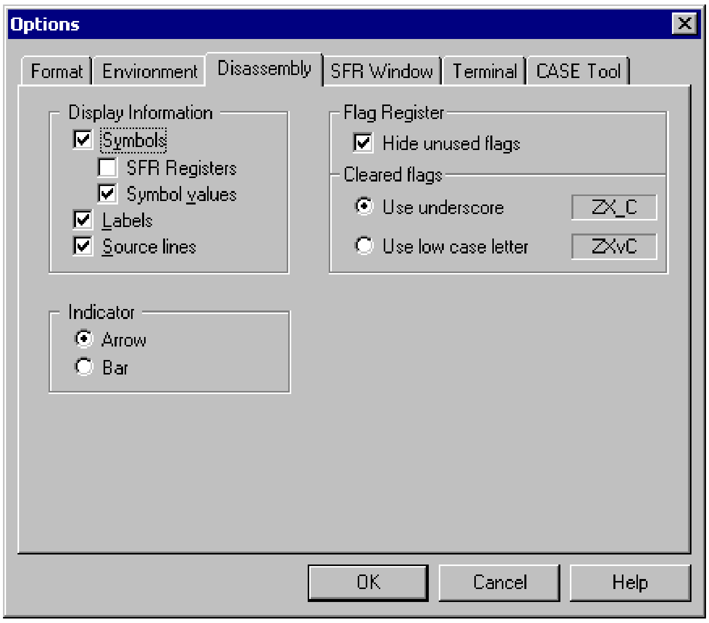
To Address...: 0xFF

Disassemble to Disk dialog

Use buttons to browse for file and addresses. When finished click the 'Disassemble' button to disassemble.

Disassembly options

Certain options for disassembly can be set using the Tools/Options window, the Disassembly pane.



Display Information
- ☑ Symbols
  - □ SFR Registers
  - ☑ Symbol values
- ☑ Labels
- ☑ Source lines

Flag Register
- ☑ Hide unused flags

Cleared flags
- ● Use underscore ZX_C
- ○ Use low case letter ZXvC

Indicator
- ● Arrow
- ○ Bar

Disassembly options

Display information

Select the information to display in the disassembly window. If 'SFR Registers' option is checked, the name of the SFR register addressed by the instruction will be shown.

Indicator

The Disassembly window indicator can be displayed as a bar or an arrow.

Hide Unused Flags

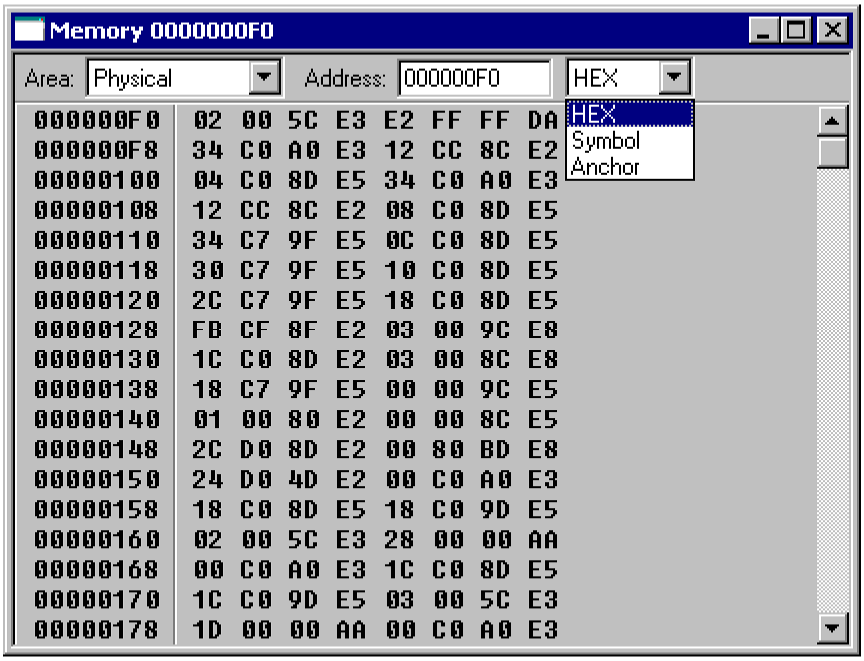
Check this option if you want unused flags to be hidden.

Cleared Flags

With this option you can select how the cleared flags will be displayed – with an underscore or a low case letter.

Memory Window

Memory windows are best suited for a raw view of the CPU's memory. winIDEA allows multiple memory windows to be opened.



Memory 000000F0

Area: Physical

Address: 000000F0

HEX

```
000000F0  02 00 5C E3 E2 FF FF DA
000000F8  34 C0 A0 E3 12 CC 8C E2
00000100  04 C0 8D E5 34 C0 A0 E3
00000108  12 CC 8C E2 08 C0 8D E5
00000110  34 C7 9F E5 0C C0 8D E5
00000118  30 C7 9F E5 10 C0 8D E5
00000120  2C C7 9F E5 18 C0 8D E5
00000128  FB CF 8F E2 03 00 9C E8
00000130  1C C0 8D E2 03 00 8C E8
00000138  18 C7 9F E5 00 00 9C E5
00000140  01 00 80 E2 00 00 8C E5
00000148  2C D0 8D E2 00 80 BD E8
00000150  24 D0 4D E2 00 C0 A0 E3
00000158  18 C0 8D E5 18 C0 9D E5
00000160  02 00 5C E3 28 00 00 AA
00000168  00 C0 A0 E3 1C C0 8D E5
00000170  1C C0 9D E5 03 00 5C E3
00000178  1D 00 00 AA 00 C0 A0 E3
```

Memory Window

In a memory window the following elements are visible:

- Memory area selector - shows which of the CPU's memory areas is currently displayed
- List field - is used to enter either the address or the symbol or anchor from which you wish to list the memory.
- Address type field – used to select the type of the address specified (either HEX for Hexadecimal memory address, Symbol or Anchor)

When ‘Anchor’ is specified, the window is repositioned to the value of the expression, specified in ‘Address’, when the CPU stops. For example: @SP always shows the stack.

- Address column - displays the address of the first item in the numerical display area at the same line
- Numerical display area - displays memory contents in binary, hexadecimal or signed or unsigned decimal or floating point format.
- ASCII display area - displays memory contents in ASCII format, if selected in the Display Mode window

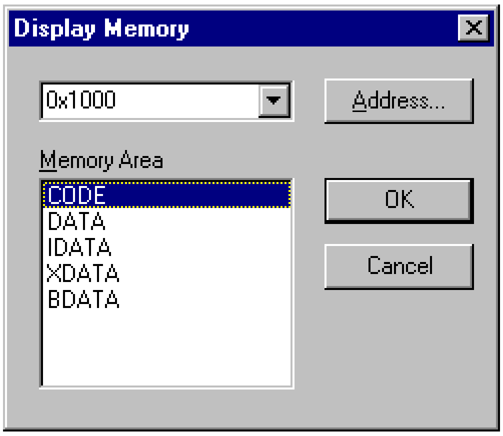
The memory window will also color locations that have changed in the previous action, and indicate the location of the stack pointer when in range.

Opening a Memory Window

Memory Window button

A memory window is opened by selecting the Memory… command from the View menu or by clicking the memory window button on View toolbar.

You can select the initial memory area and address where the memory window should open in the Display memory dialog. You can change memory window's area and address later, by using the memory area selector and list field in the window.



Display Memory dialog

Memory Display Mode

A memory window can display memory contents in various ways. The Display Mode dialog, available from memory window's context menu allows you to configure how the window displays.

Display type

Determines the number format shown in the numerical display area.

If the 'Character Display' option is checked an ASCII display will be shown.

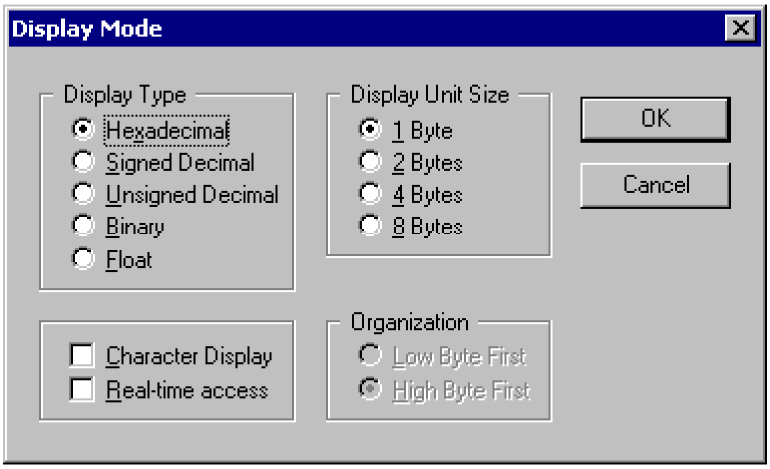
Display Unit Size

This setting determines how many bytes will be grouped to form a value in the numerical display area.

For example if the display type is set to 'Signed Decimal' and display unit size to '2 bytes' the values shown will range from -32768 to 32767.

For float display type unit sizes of 4 and 8 are available, for all other display types sizes of 1, 2 and 4 bytes can be used.

Note: the memory window always aligns itself according to display unit size setting. (If 4 bytes are selected, the window will align itself on a 4-byte boundary).



Display Mode

Display Type
● Hexadecimal
○ Signed Decimal
○ Unsigned Decimal
○ Binary
○ Float

Display Unit Size
● 1 Byte
○ 2 Bytes
○ 4 Bytes
○ 8 Bytes

□ Character Display
□ Real-time access

Organization
○ Low Byte First
● High Byte First

Memory window's Display Mode dialog

Organization

When grouping several bytes, their ordering inside the group can be specified either to 'Low Byte First' which should be used on Zilog and most Intel CPUs, and 'High Byte First' used on Motorola CPUs.

Example:

Memory Address	0	1
Data	0xAA	0xBB

Low Byte First (little endian): WORD value is 0xBBAA

High Byte First (big endian): WORD value is 0xAABB

Character Display

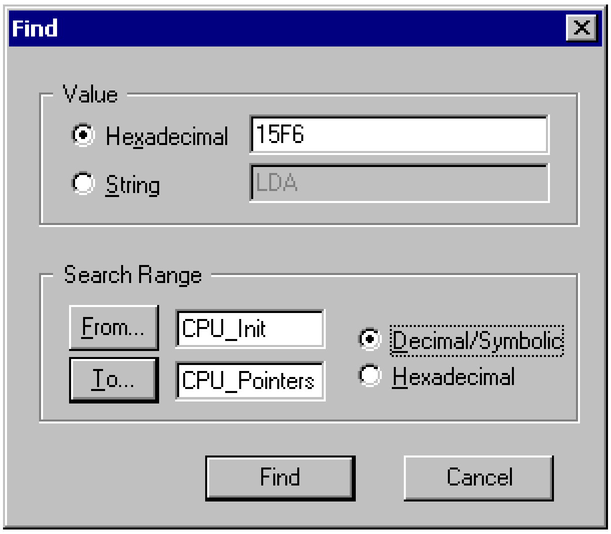
This option selects whether the memory contents will be shown with characters or not.

Real-time Access

Selects whether real-time access is used or not.

Finding Memory Contents

A very helpful function for browsing the memory is the Find option. It is invoked using the Ctrl+F shortcut.



● Hexadecimal: 15F6
○ String: LDA

From...: CPU_Init
To...: CPU_Pointers
● Decimal/Symbolic
○ Hexadecimal

Find in Memory window

Value

With this function, a specified value can be found in the Memory window. The value can be either hexadecimal (the checkbox 'Hexadecimal' is selected and the value is entered) or a string (the checkbox 'String' is selected and the string to be searched for is entered).

Search Range

The search range in which the value is to be searched for is entered here. The search range can be either hexadecimal - the checkbox 'Hexadecimal' is selected and the hexadecimal values are entered into the 'From…' and 'To…' windows, or decimal or symbolic. If the checkbox 'Decimal/Symbolic' is selected, the search range can be selected with the 'From…' and 'To…' buttons. Pressing one of those invokes the Symbol Browser. For more information on selecting symbols, see "Symbol Browser" on page 113.

Modifying Memory Contents

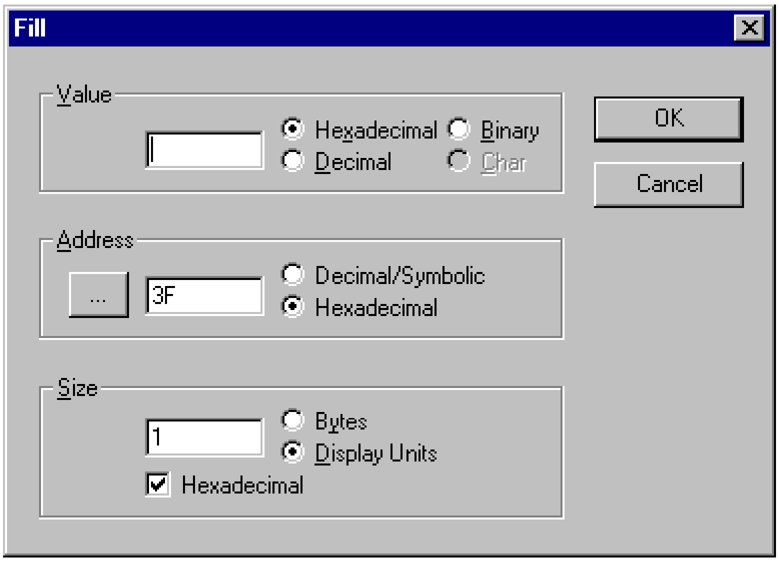
Memory contents can be modified directly in either the ASCII display area, or in the numerical display area.

To modify a location:

- make sure it is visible
- click on it with the left mouse button - a block caret will appear covering the selected location
- enter the new value.

Note: If the memory does not change, the CPU might have problems with write access to that location.

When entering value in the ASCII display area or when using binary or hexadecimal display types, individual digits can be modified directly. In decimal (float and integer) display mode however, entering a new value automatically opens the Memory Fill dialog.



Value:
● Hexadecimal ○ Binary
○ Decimal ○ Char

Address: 3F
○ Decimal/Symbolic
● Hexadecimal

Size: 1
○ Bytes
● Display Units
☑ Hexadecimal

Memory Fill dialog

Value

Enter the new value.

Let winIDEA know what numeric format you are using.

Address

This is initially set to the address that was selected at the time the dialog opened. You can modify this value if you wish to change some other memory location.

Size

Determines how many locations you wish to fill with the specified value.

If you wish to specify the size in hexadecimal format, make sure the 'Hexadecimal' option is checked.

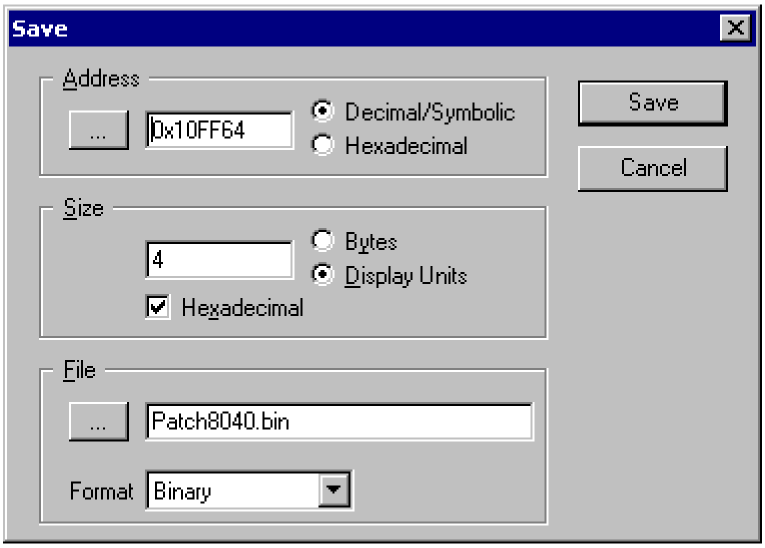
The Bytes/Display Units setting should be set as follows:

- if you wish to fill a certain number of consecutive bytes, select Bytes option
- if you wish to set values in the format that is currently displayed, select Display Units option. (Example: if you display 4 byte floats and wish to set ten consecutive floats to value 1.0).

Note: you can open the Memory Fill dialog in any other display mode by pressing the 'Enter' key.

Saving To Disk

You can save a region of memory to a binary disk file by selecting the 'Save To Disk…' command from the memory window's context menu.



Save

Address: 0x10FF64 — ● Decimal/Symbolic ○ Hexadecimal

Size: 4 — ○ Bytes ● Display Units

☑ Hexadecimal

File: Patch8040.bin

Format: Binary

Save memory to disk dialog

Address

Determines the address from which the memory will be saved.

Size

Determines how many bytes or current display units will be saved.

If you specify the size in hexadecimal format, make sure the 'Hexadecimal' option is checked.

File

Determines the file to which the memory will be saved.

Format

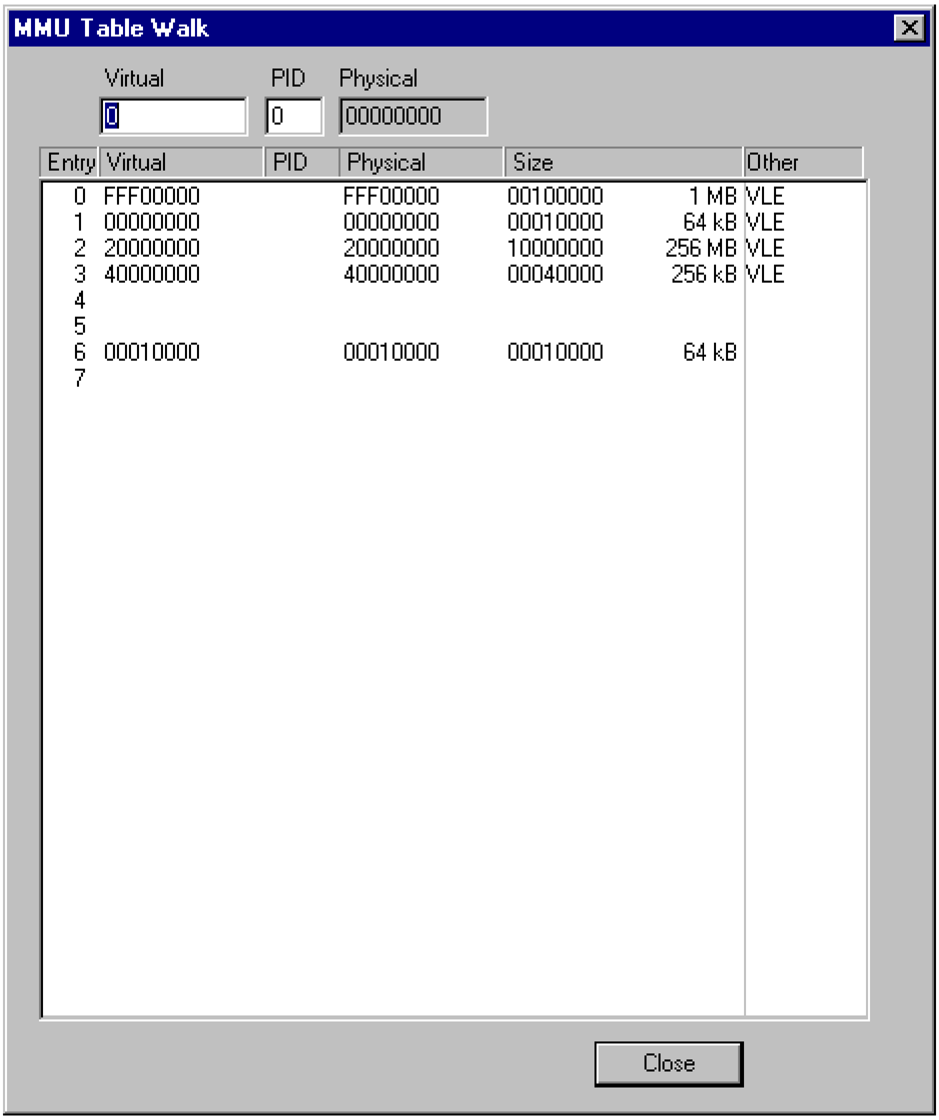
Defines the format in which the file will be saved.

Click the Save button to save the memory to disk.

MMU Table Walk Window

The MMU Table Walk window displays virtual to physical address mapping of individual memory pages. The window can be selected from the Debug/MMU Table Walk menu for all CPUs with MMU.

A direct entry of a virtual address is possible.



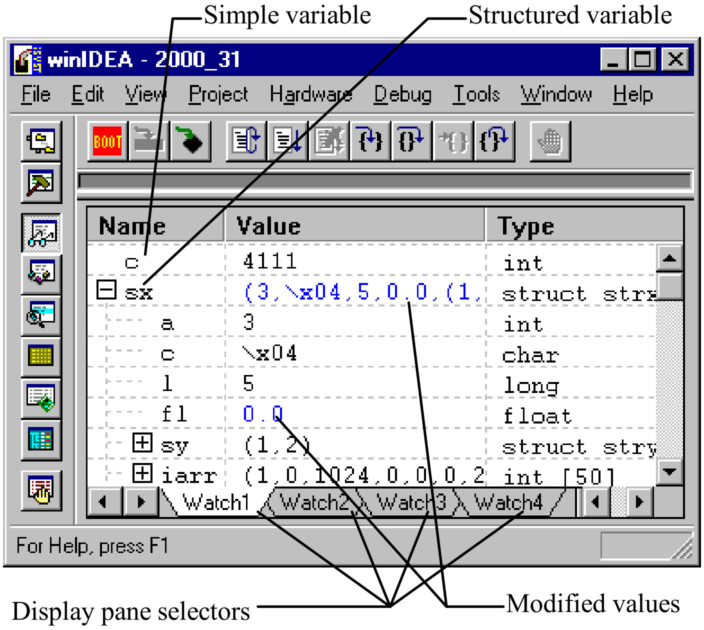
Virtual: 0
PID: 0
Physical: 00000000

Entry	Virtual	PID	Physical	Size		Other
0	FFF00000		FFF00000	00100000	1 MB	VLE
1	00000000		00000000	00010000	64 kB	VLE
2	20000000		20000000	10000000	256 MB	VLE
3	40000000		40000000	00040000	256 kB	VLE
4						
5						
6	00010000		00010000	00010000	64 kB	
7						

The MMU Table Walk dialog

Watch Window

The watch window is best suited for watching and modifying high level variables - symbols with associated type. You do not need to bother with their locations; you only need to specify their name.



Name	Value	Type
c	4111	int
⊟ sx	(3,\x04,5,0.0,(1,	struct strx
a	3	int
c	\x04	char
l	5	long
fl	0.0	float
⊞ sy	(1,2)	struct stry
⊞ iarr	(1,0,1024,0,0,0,2	int [50]

Watch Window

The watch window consists of four functionally identical panes, which are easily switched by clicking on the appropriate pane selector. This way you can configure a larger number of watches without having to constantly scroll.

Adding Watch Expressions

To configure a new watch expression you can:

- select an empty line in the watch window
- start entering the watch expressions

or

- select Add Watch… command from watch window's context menu
- from the Browser dialog (see "Symbol Browser" on page 113) select a symbol you want to watch

or

- select the expression you wish to watch in the editor and drag it to the watch window

Expression Conventions

A watch expression can be any legal C expression, with exception of the ternary '?' operator. Here are some examples of legal expressions:

```
c           variable 'c'
a[3]        third element of array 'a'
a[c+3]*2    can you figure it out?
```

The expression syntax has been extended to allow usage of registers and absolute memory locations in expressions:

- use the '@' prefix to specify a register.

```
@IX         register IX
```

- use the ':' prefix to access absolute memory. If the CPU has more than one memory area, use memory area specifier before the colon:

```
:0x1000         byte on address 1000h
XDATA:0x30      byte on XDATA 30h
```

Overriding default scope

The ANSI C expression evaluator was extended to allow accessing static variables (file or function scope) even when program execution is out of the relevant scope. The syntax is as follows:

To access a variable that is static on a file scope:

```
<module name>#<var name>
```

Example:

To access gs_byCount variable in the TESTFILE module

```
TESTFILE#gs_byCount
```

To access a variable that is static on a function scope:

```
<function name>##<var name>
```

Example:

To access s_byCount variable in the main function

```
main##s_byCount
```

Expression Type Modifiers

winIDEA will display high level variable values formatted according to their type. If you wish to override default formatting or to enforce a type to a typeless expression, you can use type modifiers.

A type modifier is a comma followed by a set of characters after the expression:

```
<expression>,<type modifier>
```

Following type modifiers are available:

Character	**Action**
I	force 16 bit signed integer type
W	force 16 bit unsigned integer type
L	force 32 bit signed integer type
U	force 32 bit unsigned integer type
F	force 32 bit float type
E	force 64 bit float type
C	force 8 bit character type
M	hexadecimal dump
S	display as zero terminated string
X or H	hexadecimal formatting
D	decimal formatting
B	binary formatting
R	display member names
a	show elements of array from
<number>	repeat <number> times

If the watch window should display a number and the read information is not a number (for example infinity), the display will show NAN (Not A Number).

Example 1:

```
:0x1000,I   ->    7281
```

displays locations 0x1000-0x1001 as a signed 16-bit integer.

```
:0x1000,F2  ->    (4.01,3.14)
```

displays locations 0x1000-0x1007 as an array of two 32-bit floats.

```
structure,rx      ->    (a:0x3,y:0x55)
```

displays variable 'structure', showing member names and their values formatted hexadecimal.

```
largearray,a500
```

displays the array 'largearray', starting from the 500th element in the array. This enables watching arrays greater than 256 bytes.

Example 2:

If your program looks like:

```
void ZeroBuf(int nBufCount, char * pcBuf)
{
  for (int I=0; I<nBufCount, I++)
    *pcBuf++=0;
}
```

then watches like this will show:

```
nBufCount,d    the value of nBufCount in decimal
pcBuf          the address that the pcBuf points at
*pcBuf         the character at location that the
              pcBuf points at
```

Example 3:

When trying to monitor SP content, it is very convenient to monitor it in the watch window.

To monitor SP content, use following syntax in the watch pane:

```
:(@SP-8),8m       displays 8 bytes down from current
SP
:(@SP),6m   displays 6 bytes up from current SP
```

When using standard memory window to monitor the SP, the user has to enter the physical address where the SP points to.

Modifying Values

winIDEA can only modify values of expressions that evaluate to a target system address (also called Lvalues). You can not modify constant expressions or Rvalues. Here are some expressions whose value can be modified:

```
c                 variable 'c'
:0x1000           memory at address 1000h
```

and following can't:

```
1                  constant
c+1                Rvalue
```

To modify value of an expression you can:

- click in the value column of the expression you wish to modify
- enter the new value. This can be any valid watch expression.

Note: If the expression does not change, the CPU might have problems with write access to that location.

Watching Complex Expressions

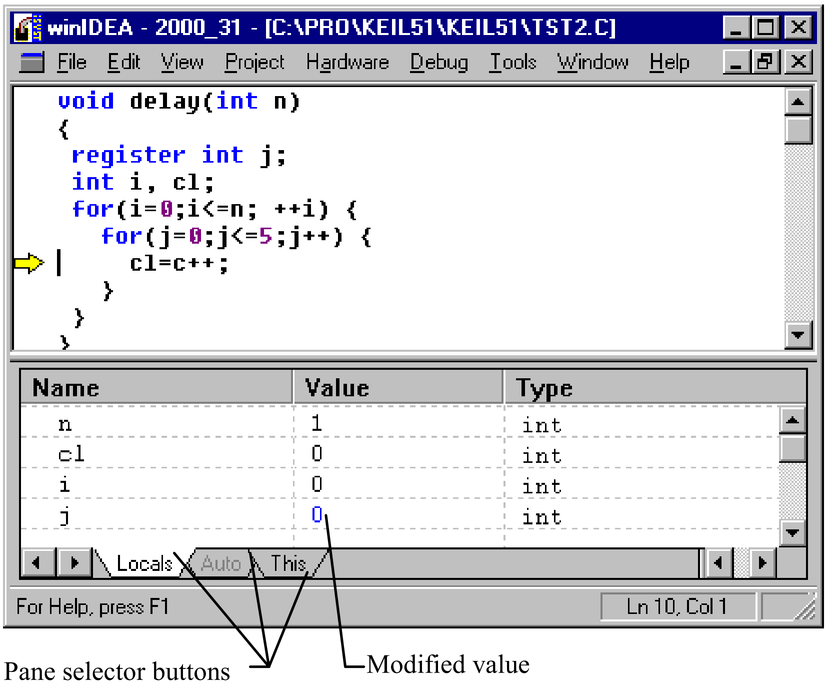
Complex data types can be watched by expanding the tree box expression.

Structures, unions and classes members will also be shown. If these are complex as well, they can be expanded further until a simple type is reached.

When expanding a pointer the value that the pointer points to is shown in the expanded leaf. This can again be expanded until a simple type is reached.

Variables Window

The 'Variables' window is an automated watch window. All expressions shown are configured automatically. In general, you will be using watch window for global symbols or expressions and variables window for local symbols, which change quickly, as you step in and out of functions.



winIDEA - 2000_31 - [C:\PRO\KEIL51\KEIL51\TST2.C]
File Edit View Project Hardware Debug Tools Window Help
Locals
Auto
This
For Help, press F1
Ln 10, Col 1

```
void delay(int n)
{
 register int j;
 int i, cl;
 for(i=0;i<=n; ++i) {
   for(j=0;j<=5;j++) {
     cl=c++;
   }
 }
}
```

Name	Value	Type
n	1	int
cl	0	int
i	0	int
j	0	int

Pane selector buttons

Modified value

Variable Window

The variable Window has three panes, each showing its specific variables.

All shown variables are configured automatically and can not be changed manually.

Note: Variables window only show valid contents when the CPU is stopped, the variables shown, and their address depend on current execution point of the CPU.

Locals Pane

The 'Locals' pane displays local variables of the current high level function.

Auto Pane

The auto pane displays local, global and member variables that are used in expressions in the high level statement that executed previously and in the statement that will execute next.

‘this’ Pane

This pane shows the data member of the current C++ class object.

Entries in this pane are visible only when the CPU is stopped inside a member function of a C++ class.

Modifying Values

To modify the value of a symbol you can:

- click in the value column of the expression you wish to modify
- enter the new value. This can be any valid watch expression.

Note: If the expression does not change, the CPU might have problems with write access to that location.

Watching Complex Symbols

Complex data types can be watched by expanding the tree box expression.

Structures, unions and classes members will also be shown. If these are complex as well, they can be expanded further until a simple type is reached.

When expanding a pointer the value that the pointer points to is shown in the expanded leaf. This can again be expanded until a simple type is reached.

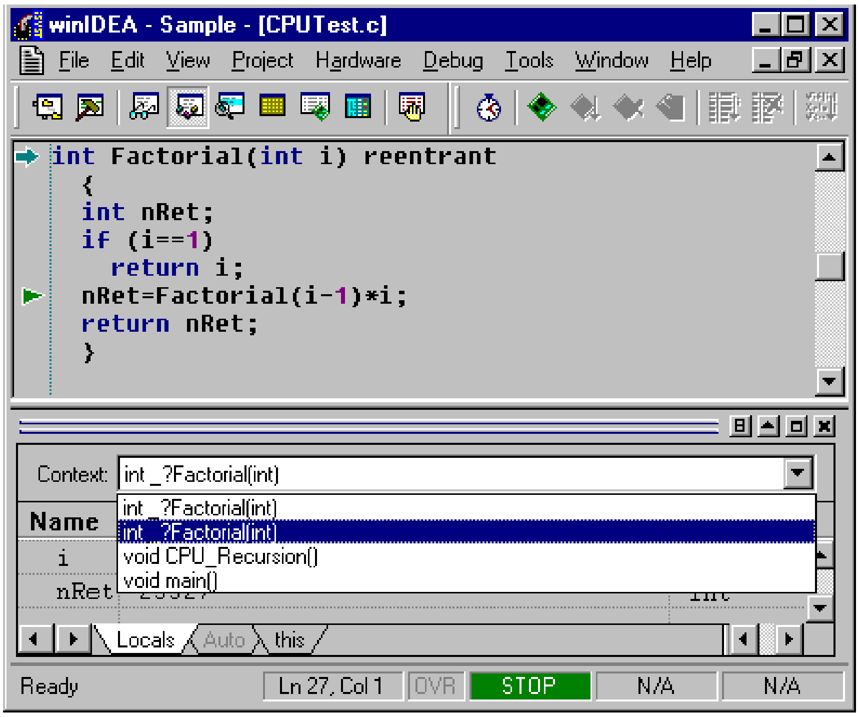
The Call Stack

During a debug session, the Call Stack displays the stack of function calls that are currently active. When a function is called, it is pushed onto the stack. When the function returns, it is popped off the stack.

The Call Stack window displays the currently executing function at the top of the stack and older function calls below that. The window also displays parameter types for each function call.

You can navigate to a function's source code or disassembled object code from the Call Stack. If source code for the selected function is not available, it displays the function's object code in the Disassembly window.

Navigating to a function's code changes the view of the program shown in the Variables window and other debugger windows (i.e. displays local variables and register values for the selected function context), but does not change the next line of execution or the value stored in the program counter.



winIDEA - Sample - [CPUTest.c]
File Edit View Project Hardware Debug Tools Window Help

```
int Factorial(int i) reentrant
  {
  int nRet;
  if (i==1)
    return i;
  nRet=Factorial(i-1)*i;
  return nRet;
  }
```

Context: int _?Factorial(int)

int _?Factorial(int)
int _?Factorial(int)
void CPU_Recursion()
void main()

Name
i
nRet
Locals Auto this
Ready
Ln 27, Col 1
OVR
STOP
N/A
N/A

The Variables window displaying the call stack

When a context other than the active is selected, the program execution point is indicated with a triangular indicator.

In the above figure, the function 'Factorial' was just called itself recursively. Current execution point is indicated with the cyan arrow indicator and the green triangle indicator shows the position of the program counter for the selected context – in this case the position from where the 'Factorial' called itself recursively.

Note: the call stack is reconstructed by analyzing the function prologue. For the analysis to succeed, the function prologue must consist of sequential instructions only.

Some compilers for 8 bit CPUs optimize code size by putting stack frame setup code in separate subroutines, to which they branch immediately upon function entry. In such cases the call stack analysis will fail.

In rare occasions, intensive optimization of code can prevent call stack reconstruction. In such case, reduce the level of optimization during development stage.

Analyzer Tools

The 'Analyzer Tools' dialog controls real-time analysis features of the debugger.

Note: the 'Analyzer Tools' dialog contains items that are under control of winIDEA. Any debugger specific configuration like trace trigger configuration is performed in debugger configuration dialogs.

Profiler

Execution profiler helps identifying performance bottlenecks. The user can find which functions are most time consuming or time critical and need to be optimized.

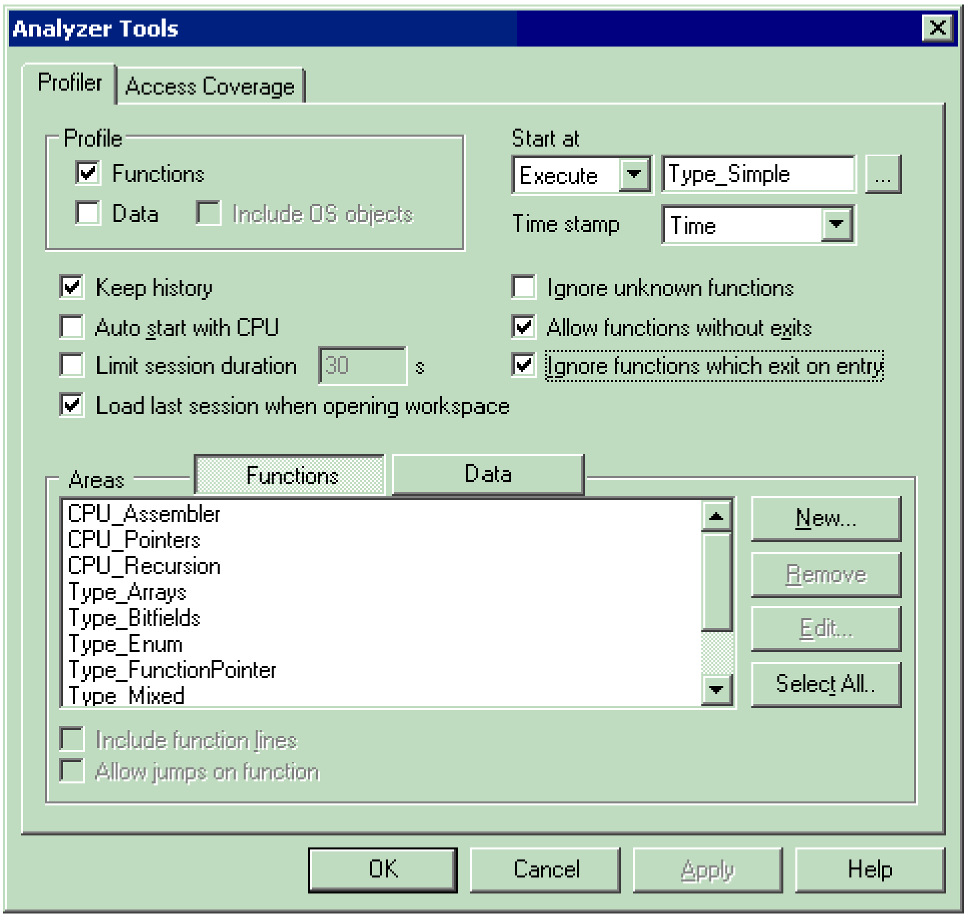
Its functionality is based on the trace recording entries and exits from profiled functions. A profiler area can be any section of code with a single entry point and one or more exit points. The nature of the profiler requires quality high-level debug information on function entry and exit points, or such areas must be setup manually. The recordings are then statistically processed and for each function the following information is calculated:

- total execution time
- minimum execution time
- maximum execution time
- average execution time
- number of executions/calls

Execution profiler relies on the fact that recorded instructions are also executed. It can therefore only be used on CPUs without the execution pipeline or on CPUs whose pipeline is reconstructed by the development tool.

Profiler Mode Operation Options

The profiler page of the Analyzer Tools dialog controls profiler operation.



Profile
☑ Functions
□ Data □ Include OS objects

Start at: Execute, Type_Simple

Time stamp: Time

☑ Keep history
□ Auto start with CPU
□ Limit session duration 30 s
☑ Load last session when opening workspace

□ Ignore unknown functions
☑ Allow functions without exits
☑ Ignore functions which exit on entry

CPU_Assembler
CPU_Pointers
CPU_Recursion
Type_Arrays
Type_Bitfields
Type_Enum
Type_FunctionPointer
Type_Mixed

□ Include function lines
□ Allow jumps on function

Analyzer Tools dialog, Profiler page

Profile

The Profiler allows simultaneous profiling of Functions and Data objects (including OS objects).

The Function profiler is realized by tracing function entries and exits. The execution time of a function indicates the difference between these two points. In case the function calls another function which is also included in profiling, the time spent in that function will not be included in the original function.

Data profiler is realized by tracing write accesses to a variable. For every profiled data object a separate statistic is maintained. Time, shown for every value that is written to the object, indicates how long the object assumed the respective value. The time is measured from the point the value is written up to the next write (even with the same value).

Auto start when CPU starts

When checked, the winIDEA will start the trace whenever winIDEA starts the CPU.

Start at

The starting point determines the program address that must be executed for the profiler to start. You may use this option to synchronize multiple profiler sessions on the same event.

Continuous operation

Enables continuous operation of the profiler.

Note: When continuos mode is selected in the profiler, the code execution cannot be recorded properly, therefore nothing is displayed. The main feature and use of profiler is actually Code Statistics.

Time stamp

The profiler time stamp can be defined here.

Keep History

When checked, full history is maintained.When using deep buffers or continuous profiling, this option should be unchecked to prevent system resource drain.

Limit session duration

The Profiler session duration is limited to the specified number of seconds when checked. After the specified duration, the profiler stops recording.

Load last session when opening workspace

When checked, the last session will be reloaded when the workspace is opened.

Allow functions without exits

When checked, winIDEA allows functions without exits (typically main on embedded applications).

It is legal for a function to have no exit, but on some occasions the compiler might choose an instruction sequence other then the return instruction to exit from a function (Z80 example: RET = POP HL / JP(HL). winIDEA does not detect such exit points and profiling such functions will cause a profiler error.

Ignore functions which exit on entry

When checked, winIDEA will ignore (instead or reporting an error) functions whose only instruction is the return statement. Such functions defeat the concept of the profiler, which requires separate entry and exit point(s).

Include function lines

This option specifies if for the selected functions their inbound lines should be profiled too.

This option is not available for assembler routines and for configurations that do not support line profiling.

Allow jumps on function

This option should be used if the starting address (entry point) of the function can be jumped to (not as a recursive call) from within the function. This can be the case on functions with no prolog code, where the first statement is a 'while' or a 'do-while' statement.

If this option is checked, winIDEA will expect a single return from the function even if it's entry was recorded multiple times.

Note: functions without prolog code are typically non-recursive functions without any local variables or parameters.

Configuring Areas

Use the 'Remove' button to remove a profiler area and the 'New…' button to add profiler areas. The ‘Edit’ button edits the selected area, the ‘Select All’ button selects all configured areas.

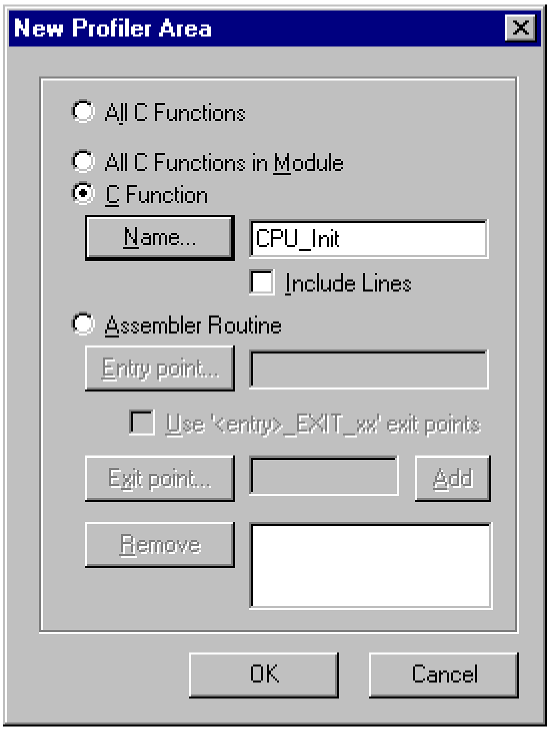
OTM…

If the CPU supports special tracing, like OTM on Nexus based CPUs, another option is presented by the ‘OTM…’ button. The configured option is treated like a data object.

Configuring Function Profiler Areas

In the 'New Profiler Area' dialog you can specify new areas that you wish to profile.

Note: On some compilers (HiWare), the function debug-info is generated for functions, that aren't really functions, especially when library functions call each other with JMP, not with CALL instructions. Because of that, profiler errors occur. In this case, the workaround is not to include library functions in profiler areas.



New Profiler Area

○ All C Functions

○ All C Functions in Module

● C Function

Name... CPU_Init

□ Include Lines

○ Assembler Routine

□ Use '<entry>_EXIT_xx' exit points

The Profiler Area dialog

All C functions

This option adds all C functions to the profiler area list.

All C functions in module

This option adds all C functions in the module specified in the 'Name' box.

C Function

This option adds the function specified in the 'Name' box.

Assembler routine

This option adds the assembler routine specified. For every assembler routine you must specify its SINGLE entry point and ALL its exit points.

Use the 'Add' button to add the exit point specified in the 'Exit point' field to the exit point list.

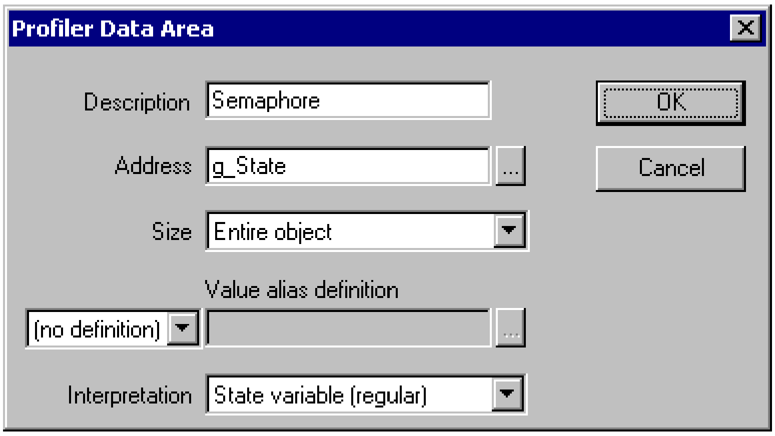
Alternatively you can use the **Use '<entry>_EXIT_xx' exit points** option. If you chose this option, the routine's exit points must be matched by according code labels.

Example:

The three exit points of the 'ServiceIRQ' routine must be named 'ServiceIRQ_EXIT_0', 'ServiceIRQ_EXIT_1' and 'ServiceIRQ_EXIT_2'.

Configuring Data Profiler Areas

New Data profiler areas are defined by pressing the ‘New’ button when ‘Data’ Areas are selected.


Profiler Data Area

Description: Semaphore

Address: g_State

Size: Entire object

Value alias definition: (no definition)

Interpretation: State variable (regular)

Data Profiler Area definition dialog

Description

Description of the data object.

Address

The Address of the data object (typically a varaiable).

Size

The size of the object. The ‘Entire object’ option selects the entire variable.

Value Alias Definition

The values that the data object assumes will be shown verbatim in the profiler window. If a definition is provided for these values, the (more descriptive) form will be used. The definition can be either an enum type or a file with #define directives.

Interpretation

- **State variable (regular):** profiler will show statistics for every value that is written to the object, without further processing;
- **Area entry/Exit ident by LSB:** the data object oerves as indicator of function/service entries and exits. The LSB bit of the value indicates that the function has entered (1) or exited (0);

- **Area entry exit ident by Zero:** the data object serves as indicator of function/service entries and exits. The value of zero indicates that the function has exited.

Function Profiling via Data Objects

To do function profiling via data objects, you need to modify the program code to perform a memory write upon function entry and exit.

Example:

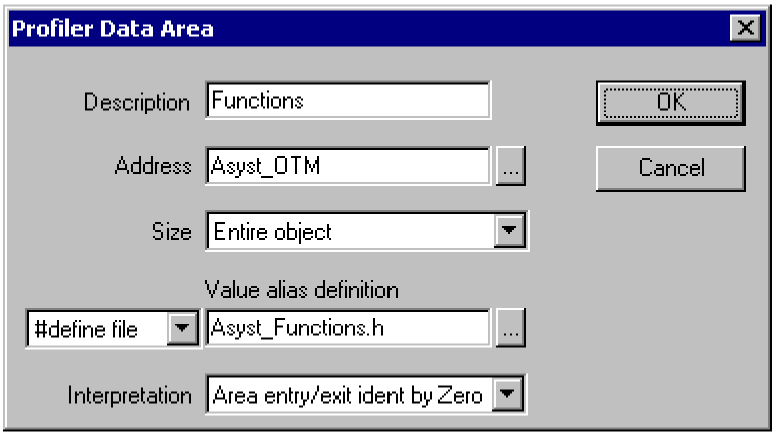
File Asyst_Functions.h:

```
#define fn_Func1 1
#define fn_Func2 2
#define fn_main  3
extern char Asyst_OTM;
```

File main.c:

```
void Func1()
{
  Asyst_OTM = fn_Func1;
  ...
  Asyst_OTM = 0;
}
void Func2()
{
  Asyst_OTM = fn_Func2;
  ...
  Asyst_OTM = 0;
}
void main()
{
  Asyst_OTM = fn_main;
  ...
  Asyst_OTM = 0;
}
```

Next, set the Profiler Data Area as follows:



Description: Functions

Address: Asyst_OTM

Size: Entire object

Value alias definition: #define file — Asyst_Functions.h

Interpretation: Area entry/exit ident by Zero

Data area configuration

If the value alias starts with ‘**fn_**’ then this prefix is removed and the value is recognized as a function and can be tracked from the profiler window by double clicking on the name.

Troubleshooting the Profiler

A profiler may yield unexpected results when profiling a function without an exit point. Consider the following example:

```
void main()
{
  for(;;)
  {
    ScanInputEvents();  // 1000 CALL ScanInputEvents
    DisplayStatus();    // 1004 CALL DisplayStatus
  }                     // 1008 JMP  1000
}
```

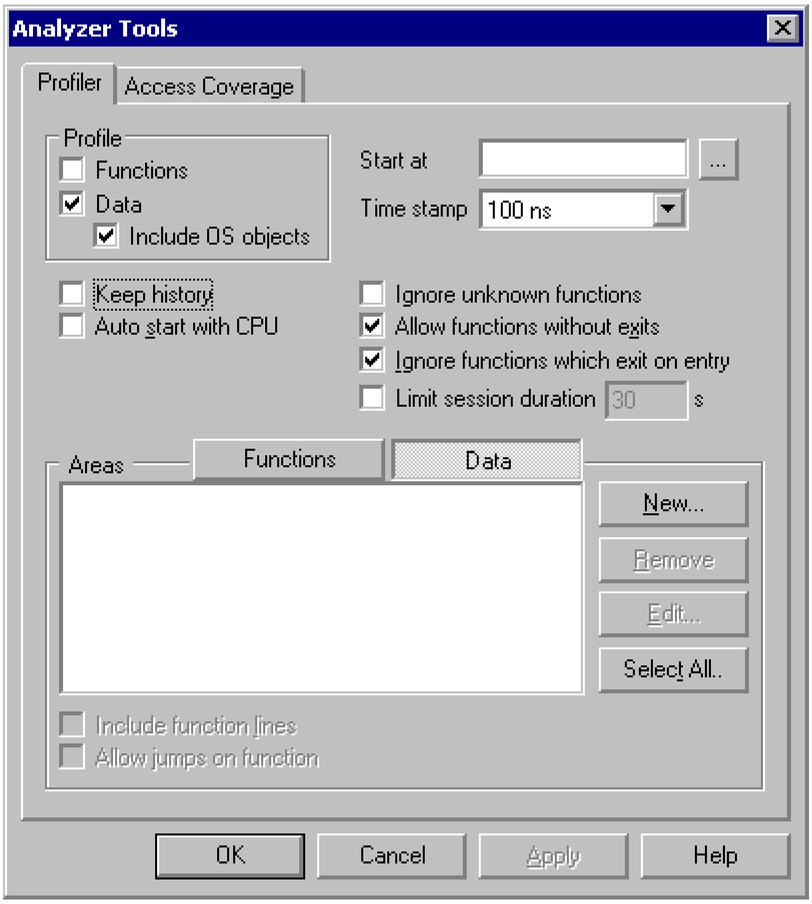
As the loop is endless, some compilers generate no function epilogue. This way, the JMP instruction is recognized as the last function instruction and thus assumed to be the function exit point. As it is being recorded periodically, the profiler will assume that the function is exiting from recursive calls - which results in incorrect results.

To avoid such situations, remove this function from the profile list.

Data and OS Profiler

The OS profiler can be used to record task and service activity.

To enable OS profiler, the profiler must be configured in ‘Debug/Analyzer Tools/Profiler’.



Analyzer Tools

Profile
□ Functions
☑ Data
☑ Include OS objects

Start at

Time stamp 100 ns

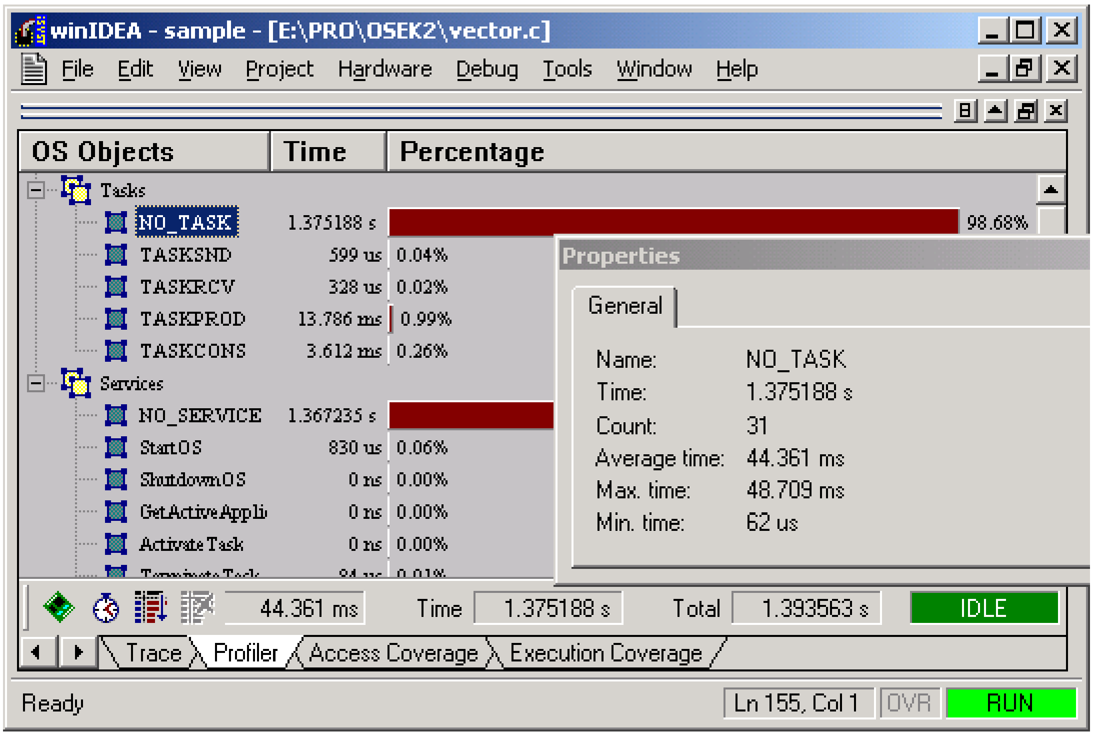
□ Keep history
□ Auto start with CPU

□ Ignore unknown functions
☑ Allow functions without exits
☑ Ignore functions which exit on entry
□ Limit session duration 30 s

Areas

□ Include function lines
□ Allow jumps on function

- Open the Profiler window (**View/Profiler/Coverage**)
- Start the profiler
- Select **Data Statistics** from the context menu to view time and activation statistics. Individual object’s statistics can be inspected by selecting Properties command from the context menu.


winIDEA - sample - [E:\PRO\OSEK2\vector.c]
File Edit View Project Hardware Debug Tools Window Help
Properties
General
Trace Profiler Access Coverage Execution Coverage
Ready
Ln 155, Col 1
OVR
RUN

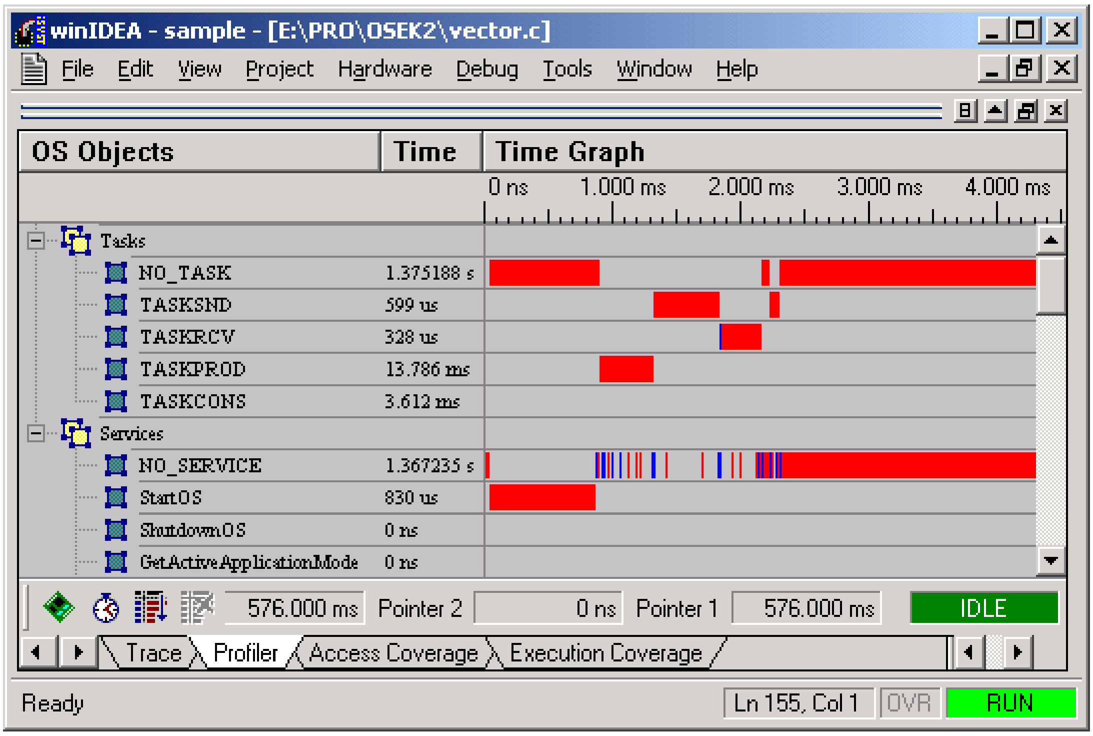
OS Objects	Time	Percentage
Tasks		
NO_TASK	1.375188 s	98.68%
TASKSND	599 us	0.04%
TASKRCV	328 us	0.02%
TASKPROD	13.786 ms	0.99%
TASKCONS	3.612 ms	0.26%
Services		
NO_SERVICE	1.367235 s	
StartOS	830 us	0.06%
ShutdownOS	0 ns	0.00%
GetActiveAppli	0 ns	0.00%
ActivateTask	0 ns	0.00%
TerminateTask	84 us	0.01%

Name: NO_TASK
Time: 1.375188 s
Count: 31
Average time: 44.361 ms
Max. time: 48.709 ms
Min. time: 62 us

44.361 ms Time 1.375188 s Total 1.393563 s IDLE

OS Statistics and properties

- Select **OS Execution** from the context menu to view execution history.


winIDEA - sample - [E:\PRO\OSEK2\vector.c]
File Edit View Project Hardware Debug Tools Window Help
Time Graph
0 ns
1.000 ms
2.000 ms
3.000 ms
4.000 ms
Trace Profiler Access Coverage Execution Coverage
Ready
Ln 155, Col 1
OVR
RUN

OS Objects	Time
Tasks	
NO_TASK	1.375188 s
TASKSND	599 us
TASKRCV	328 us
TASKPROD	13.786 ms
TASKCONS	3.612 ms
Services	
NO_SERVICE	1.367235 s
StartOS	830 us
ShutdownOS	0 ns
GetActiveApplicationMode	0 ns

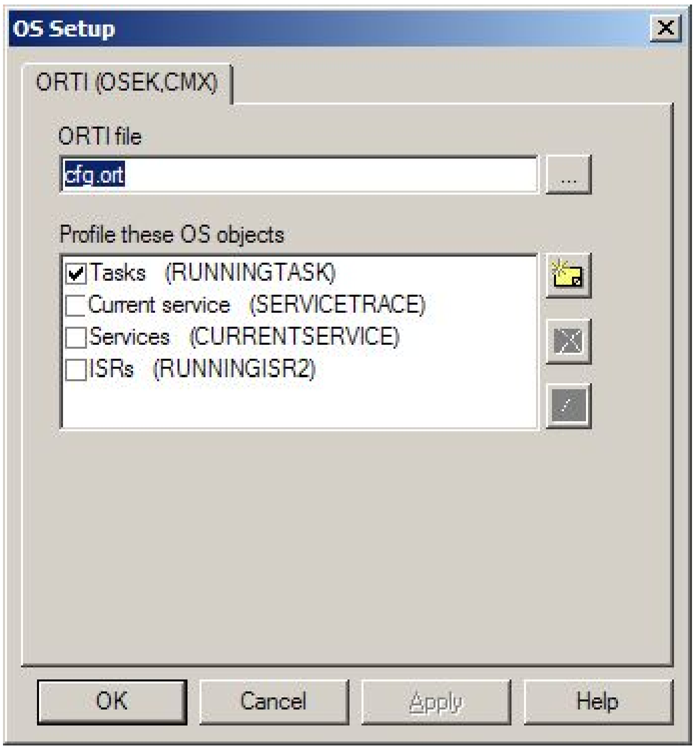
576.000 ms Pointer 2 0 ns Pointer 1 576.000 ms IDLE

Execution History

Simultaneous OS Object and Data Profiler Usage

Simultaneous profiling of OS objects and data is also supported. For this, do the following:

- Select the OS Objects you want to profile



OS Setup

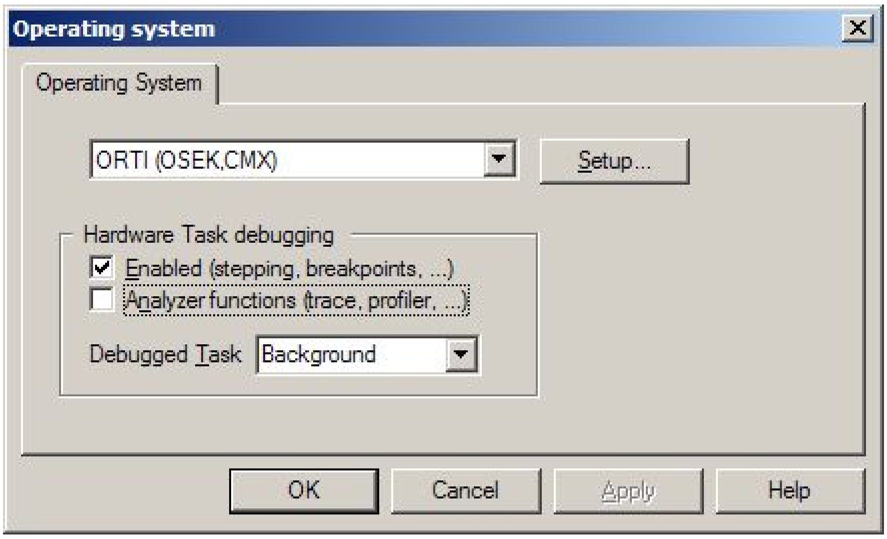
ORTI (OSEK,CMX)

ORTI file: cfg.ort

Profile these OS objects

☑ Tasks (RUNNINGTASK)
□ Current service (SERVICETRACE)
□ Services (CURRENTSERVICE)
□ ISRs (RUNNINGISR2)

- Make sure, the Task Debugging/Analyzer Functions option is disabled



Operating system

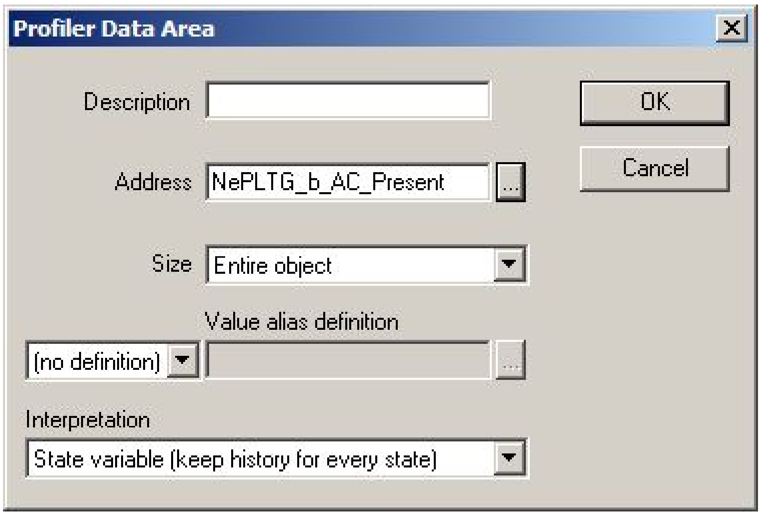
Operating System: ORTI (OSEK,CMX)

Hardware Task debugging

☑ Enabled (stepping, breakpoints, ...)
□ Analyzer functions (trace, profiler, ...)

Debugged Task: Background

- define additional data objects to profile


Profiler Data Area

Description

Address NePLTG_b_AC_Present

Size Entire object

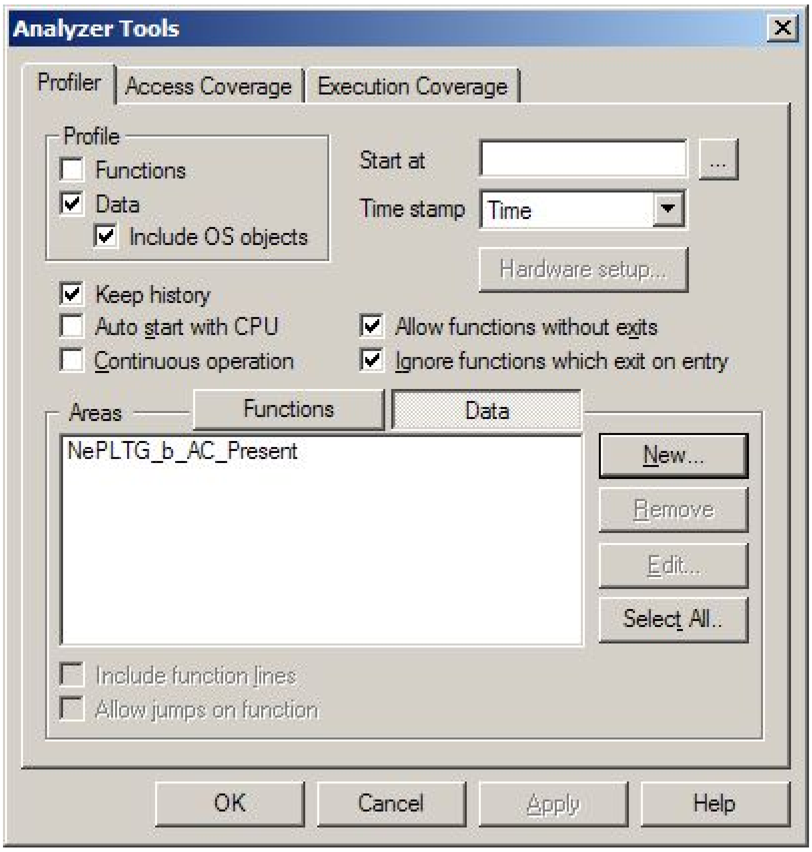
Value alias definition

(no definition)

Interpretation

State variable (keep history for every state)

- The Profiler configuration should look like this:


Analyzer Tools

Profile
- □ Functions
- ☑ Data
  - ☑ Include OS objects

Start at

Time stamp Time

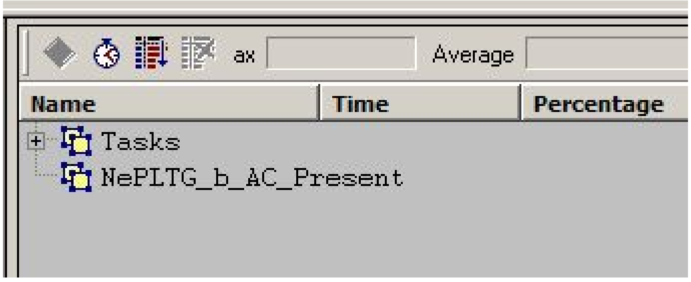
- ☑ Keep history
- □ Auto start with CPU
- □ Continuous operation
- ☑ Allow functions without exits
- ☑ Ignore functions which exit on entry

Areas — Functions | Data

NePLTG_b_AC_Present

- □ Include function lines
- □ Allow jumps on function

- Begin profiling, the window will show OS and other variables:

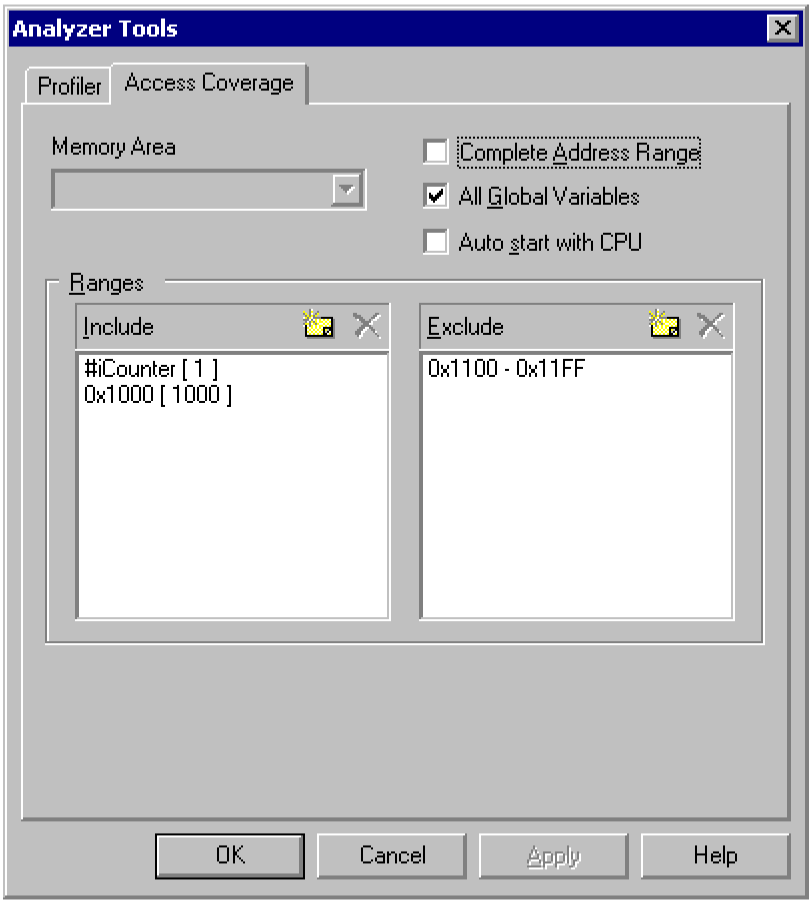


Name	Time	Percentage
Tasks		
NePLTG_b_AC_Present		

Access Coverage

Access coverage is a data access analysis method. You will typically start access coverage immediately after download or reset. Whenever the CPU stops, winIDEA will show which memory areas have been accessed. Two display types are possible:

- Graphical
- Memory Ranges



□ Complete Address Range
☑ All Global Variables
□ Auto start with CPU

Include:
#iCounter [1]
0x1000 [1000]

Exclude:
0x1100 - 0x11FF

Analyzer Tools dialog, Access Coverage page

Complete Address Range

Sets the coverage range to cover the complete address range.

All Global Symbols

Sets the coverage to cover all global symbols.

Auto start with CPU

When checked, the winIDEA will start the coverage whenever winIDEA starts the CPU.

Memory Area

Specifies the memory area in which the coverage is to be run.

Include Ranges

Specifies the ranges in which the coverage should run.

Exclude Ranges

Specifies the ranges that the coverage should exclude.

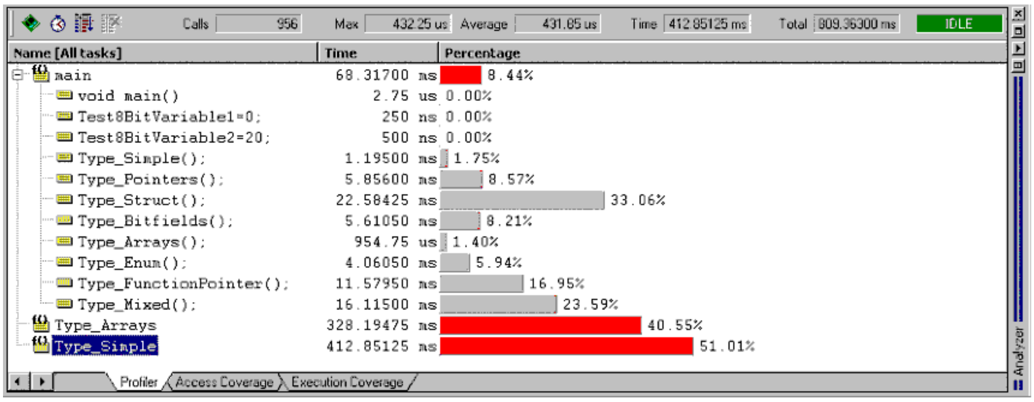
Profiler Window

The Profiler window displays information acquired with a real-time debug tool (see "Analyzer Tools" on page 190).

Its specialized panes show profiler and coverage results.

Profiler Pane

The Profiler pane of the Trace window displays results obtained in profiler.



Calls 956 Max 432.25 us Average 431.85 us Time 412.85125 ms Total 809.36300 ms IDLE

Name [All tasks]	Time	Percentage
main	68.31700 ms	8.44%
void main()	2.75 us	0.00%
Test8BitVariable1=0;	250 ns	0.00%
Test8BitVariable2=20;	500 ns	0.00%
Type_Simple();	1.19500 ms	1.75%
Type_Pointers();	5.85600 ms	8.57%
Type_Struct();	22.58425 ms	33.06%
Type_Bitfields();	5.61050 ms	8.21%
Type_Arrays();	954.75 us	1.40%
Type_Enum();	4.06050 ms	5.94%
Type_FunctionPointer();	11.57950 ms	16.95%
Type_Mixed();	16.11500 ms	23.59%
Type_Arrays	328.19475 ms	40.55%
Type_Simple	412.85125 ms	51.01%

Profiler pane, statistical view

Name column

Shows the name of the area.

Functions whose lines have been profiled, can be expanded, to show line-profiling results.

Statistical View

In the statistical view, results of the entire profiler session are shown.

Time/Count column

In time display mode, the time spent in the area is shown; in count display mode, number of entries in the area is shown.

Note: the time result of a function is cumulative i.e. times spent (and recorded) in embedded lines are added to the total function time as well.
The count result of a function is not cumulative.

Minimum and maximum execution time are not available for source lines. If a profiler object is a function, minimum and maximum execution times are shown.

Percentage column

Shows graphical representation of the time/count column relative to total time/count or if Lines Relative to Function is selected in the context menu, to the time/count spent in the function.

Result bar

The result bar shows the results for the currently selected area.

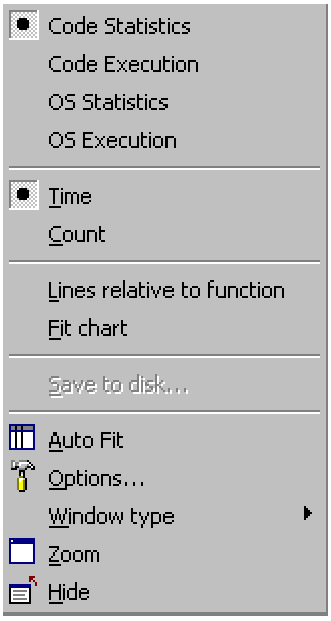
- Total - shows total time for the entire profile session
- Time - shows total time spent in the selected area
- Average - shows average time spent in the selected area
- Max - shows maximum time spent in the selected area

Note: Maximum time spent is not available for source lines.

- Calls - shows number of entries (calls) to the selected area.

Context menu options

Various options can be set in the context menu, i.e. the menu invoked by right clicking in the Profiler pane.



Profiler's context menu

Time and Count

The profiler pane can show either time or count results.

Lines relative to function

When a percentage of time spent is shown, it can be shown relative to the whole recording time (the whole recording time represents 100%) or relative to the function (the time spent in the function represents 100%).

Access Coverage Pane

The Access Coverage pane of the Coverage/Profiler window displays results obtained in the access coverage mode.

Note: Access Coverage is not available for all architectures.

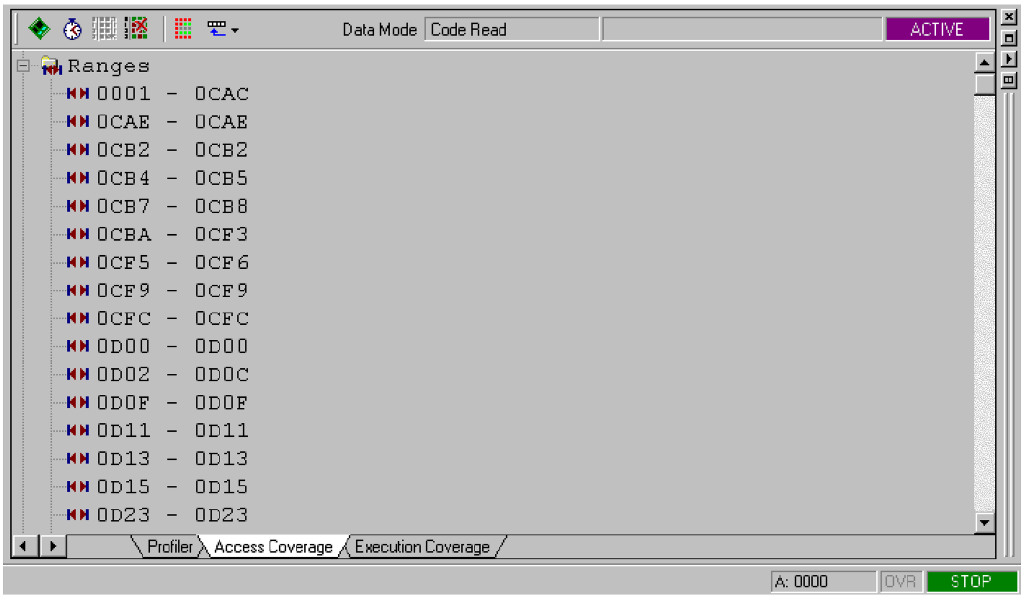
The pane is updated every time the CPU stops. This process consists of:

- Loading the coverage data from the debugger.
- Coverage data analysis, where the loaded information is analyzed.

Two display modes available:

Memory Areas

Memory areas display mode shows a list of memory ranges that were not accessed yet, in hexadecimal format.



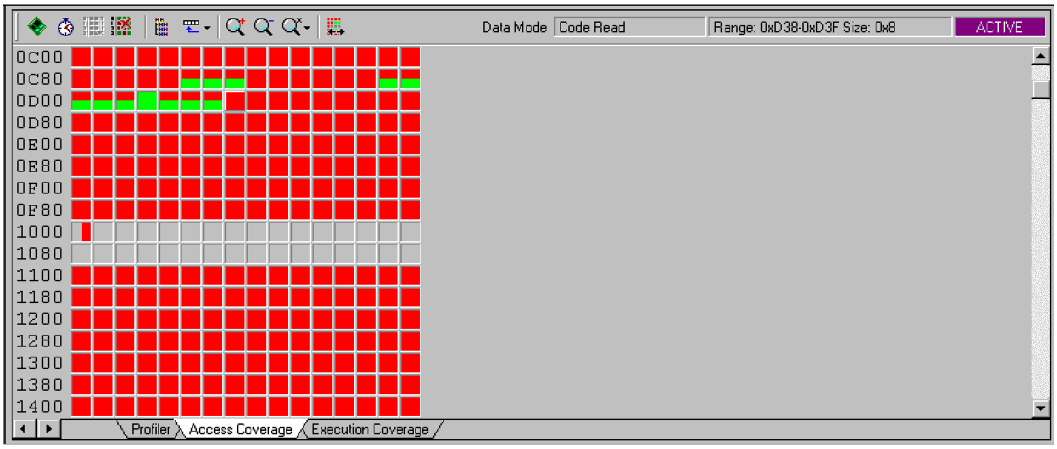
Data Mode Code Read

```
Ranges
  0001 - 0CAC
  0CAE - 0CAE
  0CB2 - 0CB2
  0CB4 - 0CB5
  0CB7 - 0CB8
  0CBA - 0CF3
  0CF5 - 0CF6
  0CF9 - 0CF9
  0CFC - 0CFC
  0D00 - 0D00
  0D02 - 0D0C
  0D0F - 0D0F
  0D11 - 0D11
  0D13 - 0D13
  0D15 - 0D15
  0D23 - 0D23
```

Access Coverage pane, Memory areas

Graphics Map

Graphics map display mode shows the same information as the memory areas display mode, however in a graphical map format.



Data Mode: Code Read

Range: 0xD38-0xD3F Size: 0x8

Access Coverage pane, Graphics map

In the above figure, accessed areas are marked red and non-accessed blue.

Special Function Registers Window

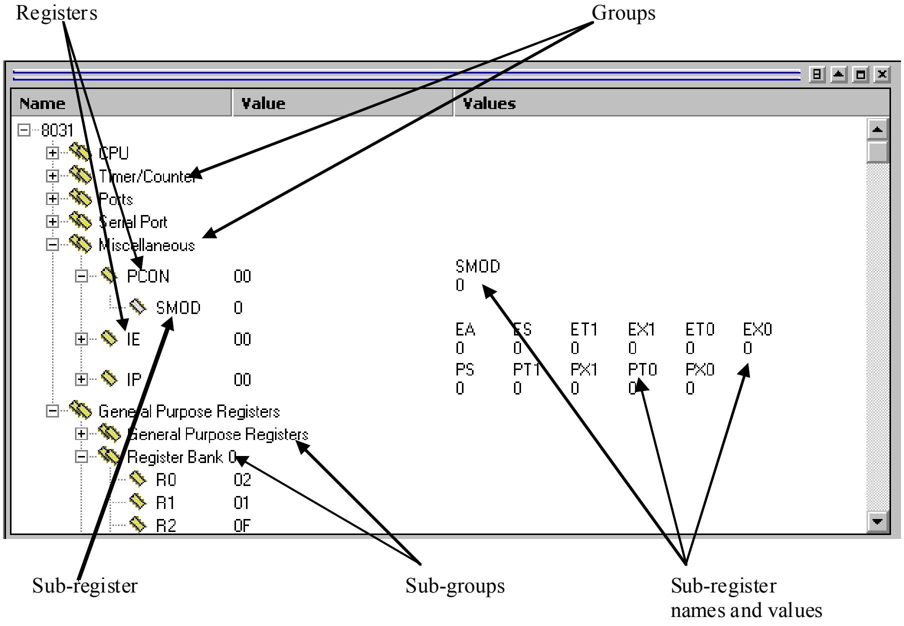
SFR Window button

winIDEA provides a specialized window (SFR window) to display CPU's on-chip special function registers.
To open the SFR window, select the 'Special Function Registers…' command from the View menu, or click the SFR window icon on the view toolbar.

The SFR window organizes CPU's registers hierarchically into two levels of groups (groups and sub groups) and two levels of registers (registers and sub registers).

A group is a collection of registers that serve a module on the CPU. If you are currently working on serial communication, you will see all involved registers by expanding the 'Serial Port' group.

When there area many (nearly) identical CPU modules, a group will contain a sub-group for every such module. In the figure below, the 'General Purpose Registers' group contains all 4 register bank sub groups as well as the 'General Purpose Registers' sub group, which duplicates registers of the currently active, register bank.



```
Name                          Value     Values
⊟ 8031
  ⊞ CPU
  ⊞ Timer/Counter
  ⊞ Ports
  ⊞ Serial Port
  ⊟ Miscellaneous
     ⊟ PCON                   00        SMOD
                                        0
          SMOD                0
     ⊞ IE                     00        EA   ES   ET1  EX1  ET0  EX0
                                        0    0    0    0    0    0
     ⊞ IP                     00        PS   PT1  PX1  PT0  PX0
                                        0    0    0    0    0
  ⊟ General Purpose Registers
     ⊞ General Purpose Registers
     ⊟ Register Bank 0
          R0                  02
          R1                  01
          R2                  0F
```

SFR Window showing 8031 CPU's registers

A register corresponds to a CPU's special function register. Along with the name, its current value is displayed.

Where a special function register contains fields of bits, it can be expanded to show these sub registers. In the above figure, the PCON register contains the SMOD sub-register.

SFR Register Display mode

The value of a register can be displayed in following display modes:

- binary
- hexadecimal
- decimal
- character

You can specify the display mode by selecting the register and specifying the display mode from the context menu.

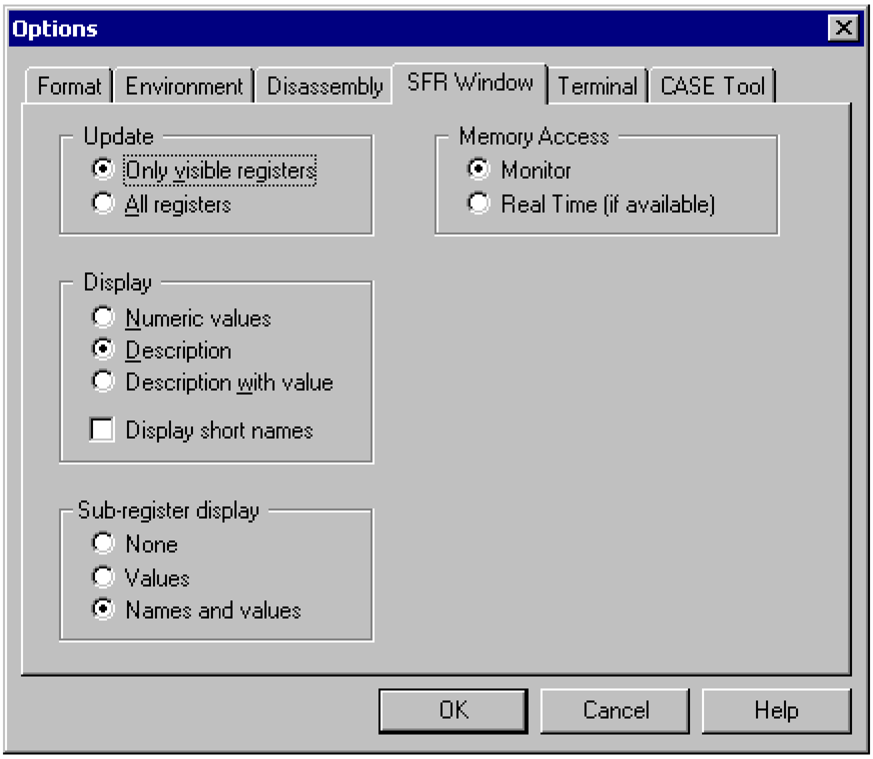
Modifying a register

To modify register value, double click on its value. In the in-place edit field that opens enter the new value using the same number base as the register is displayed in.

Note: whenever possible, sub registers are modified without writing the entire register (bit addressable registers). If a sub register can not be accessed independently of its register, the register is first read, sub register bits are adjusted, and the whole register is written back.

Customizing the SFR Window

SFR Window operation and display are controlled by choosing the 'SFR Window' page of the Tools/Options dialog (also accessible from SFR Windows's context menu).



Update
- ● Only visible registers
- ○ All registers

Memory Access
- ● Monitor
- ○ Real Time (if available)

Display
- ○ Numeric values
- ● Description
- ○ Description with value
- □ Display short names

Sub-register display
- ○ None
- ○ Values
- ● Names and values

SFR Window options dialog

Update

A powerful microcontroller can have several thousand special function registers. Getting the value for every one of them might take several seconds to complete. It is thus recommended to update only visible registers. In this case, values of hidden registers are retrieved when the register becomes visible.

Display

To facilitate identification of register value, a textual description can be shown along with the value.

Note that this feature is CPU and register dependent and may not be available for all registers.

If ‘Display Short Names’ is checked, only short names of SFRs will be shown.

Sub-Register Display

The sub-registers can be shown with values, names and values or not at all.

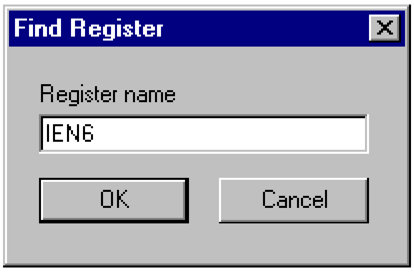
Note that this feature is CPU and register dependent and may not be available for all registers.

Memory Access

The memory can be accessed through a monitor or real-time access can be enabled. If you wish to monitor SFRs in the Real Time Watch window, Real Time Access must be enabled.

Finding a Register in the SFR Window

When browsing in the SFR window, thousands of SFRs can be displayed; therefore finding a certain one can be sometimes quite difficult. A Find option has been implemented for this purpose, which is invoked by pressing the 'Ctrl+F' shortcut key and typing in the string to be found.



IEN6

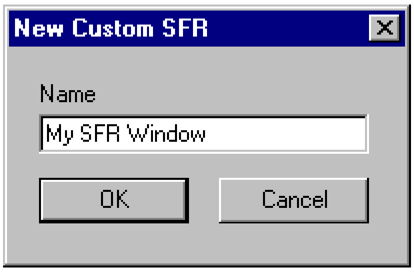
Find Register dialog

Custom SFR Windows

Since in modern microcontrollers also thousands of special function registers can be available, browsing through all can be very time consuming since very rarely monitoring of all SFRs is needed. To make the monitoring of SFRs easier, a custom SFR window can be built. In a custom SFR window the user can specify which SFRs are to be seen.

Creating and using a custom SFR window

Custom SFR windows are managed in the View/Custom SFR menu. To create a new window, click on the View/Custom SFR/New… menu item. A dialog pops up asking you to name the new SFR window.

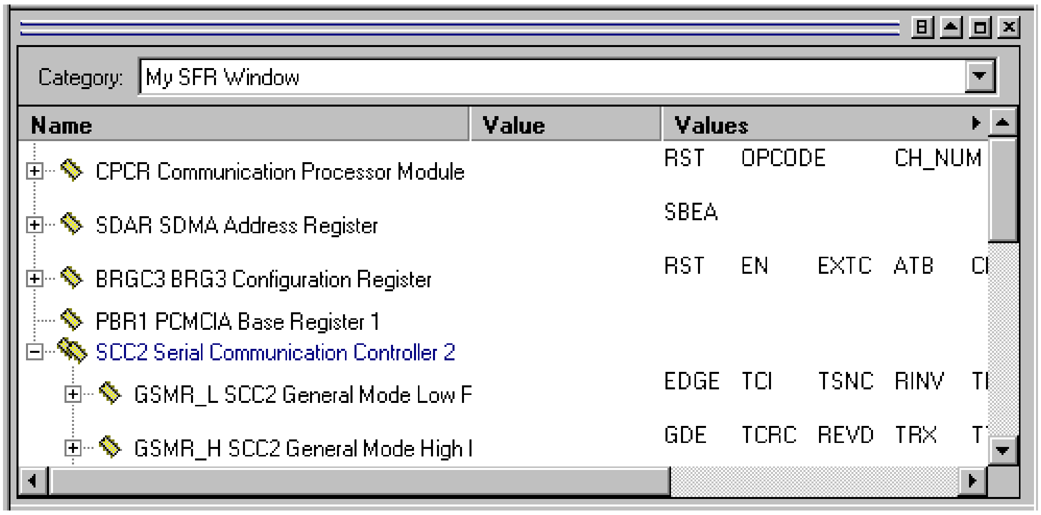


My SFR Window

New Custom SFR dialog

More than one SFR window can be created.

A custom SFR window pops up displaying the newly created window. Items from the main SFR window can be added to the new window using drag & drop. Whole groups or standalone registers can be dragged to the new window.



Category: My SFR Window

Name	Value	Values
⊞ CPCR Communication Processor Module		RST OPCODE CH_NUM
⊞ SDAR SDMA Address Register		SBEA
⊞ BRGC3 BRG3 Configuration Register		RST EN EXTC ATB CI
PBR1 PCMCIA Base Register 1		
⊟ SCC2 Serial Communication Controller 2		
⊞ GSMR_L SCC2 General Mode Low F		EDGE TCI TSNC RINV TI
⊞ GSMR_H SCC2 General Mode High I		GDE TCRC REVD TRX T

Custom SFR window

In the Category menu, the name of the currently selected SFR window is shown. If more than one SFR window has been created, here different SFR window displays can be selected.

Sharing SFR windows

For every SFR window you create, a configuration file is written in the project directory with the name of <window name>.CSF. This file can be shared to anyone who would need the new window. Only the .CSF file needs to be copied to the project directory of the other user. Upon opening the project the next time, the new SFR window will be available in the View/Custom SFR menu.

Deleting custom SFR windows

If a custom SFR window should be deleted, delete the <window name>.CSF file in the project directory.

Terminal Window

The terminal window features VT52 and VT100 protocol emulation and can communicate through standard COM ports and additionally through special debugger communication port (e.g. JTAG on ARM family) or shared target memory. This might be very useful especially since many evaluation boards already feature a serial port and the kernel of such boards usually already contains serial communication support, newer boards even include a VT100 terminal. Such boards become quickly operational using the terminal window.

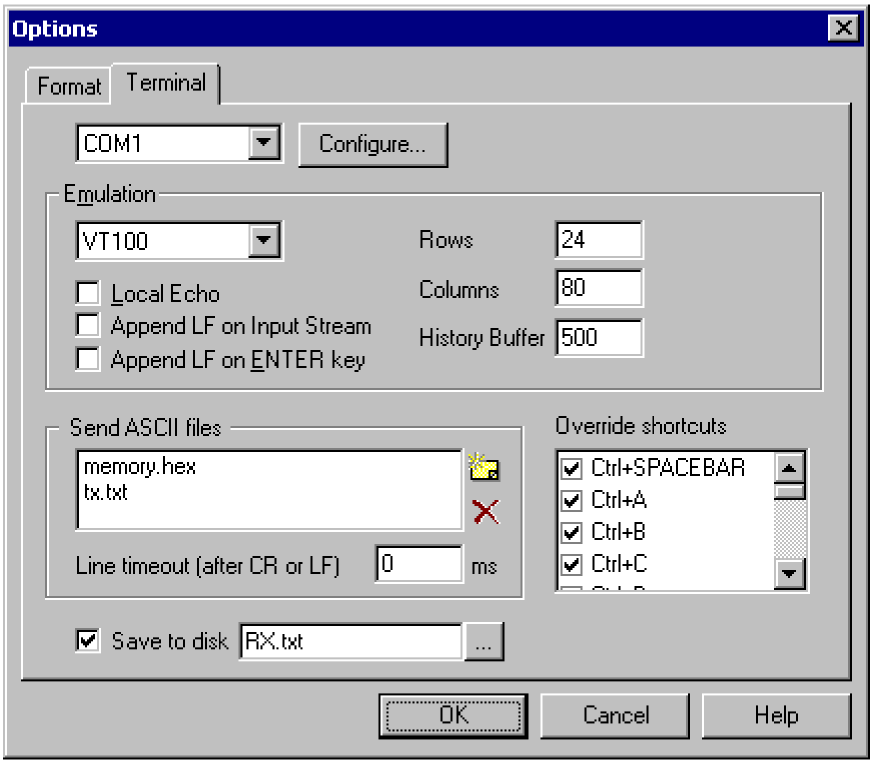
The debugging can also become easier as the application can send messages itself to the terminal window.

The terminal window is invoked with the View/Terminal option.

Terminal Window Setup

The terminal window is set up using the Tools/Options menu. You can invoke the Options menu by right clicking in the terminal and selecting Options.

Alternatively, the Options menu is invoked by clicking on the icon.



COM1

Emulation: VT100

Rows: 24

Columns: 80

History Buffer: 500

□ Local Echo

□ Append LF on Input Stream

□ Append LF on ENTER key

Send ASCII files:
memory.hex
tx.txt

Line timeout (after CR or LF): 0 ms

Override shortcuts:
☑ Ctrl+SPACEBAR
☑ Ctrl+A
☑ Ctrl+B
☑ Ctrl+C

☑ Save to disk: RX.txt

Terminal window options menu

Channel

First, a channel must be selected. The channel can be either “Debugger” or “COM1” to “COM4”. By selecting “COM1” to “COM4”, a standard serial communications port is used. This enables the user to set the communication port properties by pressing the 'Configure...' button, described later.

Emulation

The emulation properties are defined here.

Emulation Type

First, the type of emulation is selected. The terminal window can emulate either the VT52 or VT100 standard. The latest is especially useful since some evaluation boards already include VT100 support on-board and therefore communication can be established very quickly.

The Terminal window can also provide input/output communication for Semihosting support.

Local Echo

If this option is selected, the character typed or sent to the other side will be shown in the terminal.

Append LF on Input Stream

If this option is selected, a line feed will be sent on the end of an input stream.

Append LF on ENTER Key

When the Enter key is pressed, a line feed will be appended.

Rows and Columns

The size of the emulation screen is selected here and the size of the history buffer. The standard emulation screen size is 24 rows high by 80 columns wide, but if another size is desired, it should be entered here.

History Buffer

The History Buffer saves the output of the terminal and here the desired size of the buffer can be set.

Send ASCII Files

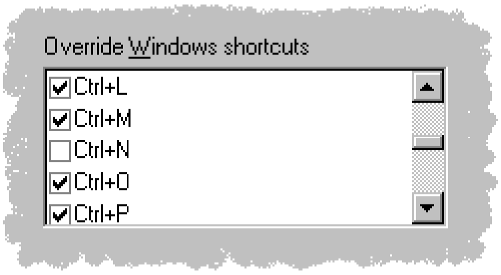
Sending of ASCII files is simplified. If ASCII files will be needed to be sent to the other side of the terminal, they can be selected in this menu and then sent easily in the Terminal window. The files are added using the 'Add file' button, a file can be removed using the 'Remove file' button.

Timeout after CR or LF

When sending files, the terminal waits for the specified amount of time after every Carriage Return or Line Feed symbol.

Override shortcuts

When emulating the terminal, certain combinations of keys pressed can either control the Windows operating system, winIDEA, or can be transferred through the communication channel. By default, all key-press combinations (shortcuts) with the control key (Ctrl) are transferred through the communication channel. If a shortcut should not be transferred through the communication channel but be handled by Windows or winIDEA^{TM}, uncheck the box in front of the shortcut.



Override Windows shortcuts

☑ Ctrl+L
☑ Ctrl+M
□ Ctrl+N
☑ Ctrl+O
☑ Ctrl+P

Override Windows shortcuts options

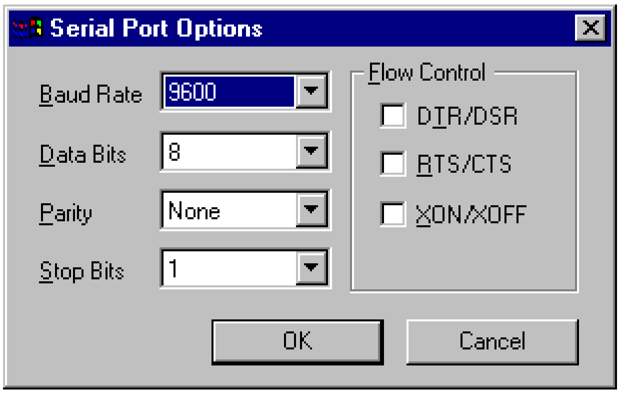
For example, if you wish the Ctrl+N shortcut to continue operating as "New File" command, the checkbox in front of Ctrl+N must be unchecked.

Save to disk

When checked, the received alphanumeric and CR/LF characters are output to the specified file.

Configuration

The serial port configuration is performed by pressing the 'Configure...' button in the Tools/Options/Terminal dialog.



Serial Port Options

Baud Rate: 9600
Data Bits: 8
Parity: None
Stop Bits: 1

Flow Control
□ DTR/DSR
□ RTS/CTS
□ XON/XOFF

Serial Port Configuration Options

Baud Rate

Selects the baud rate the terminal is connected with.

Data Bits

Selects the number of data bits in the communication.

Parity

Selects the type of parity used.

Stop Bits

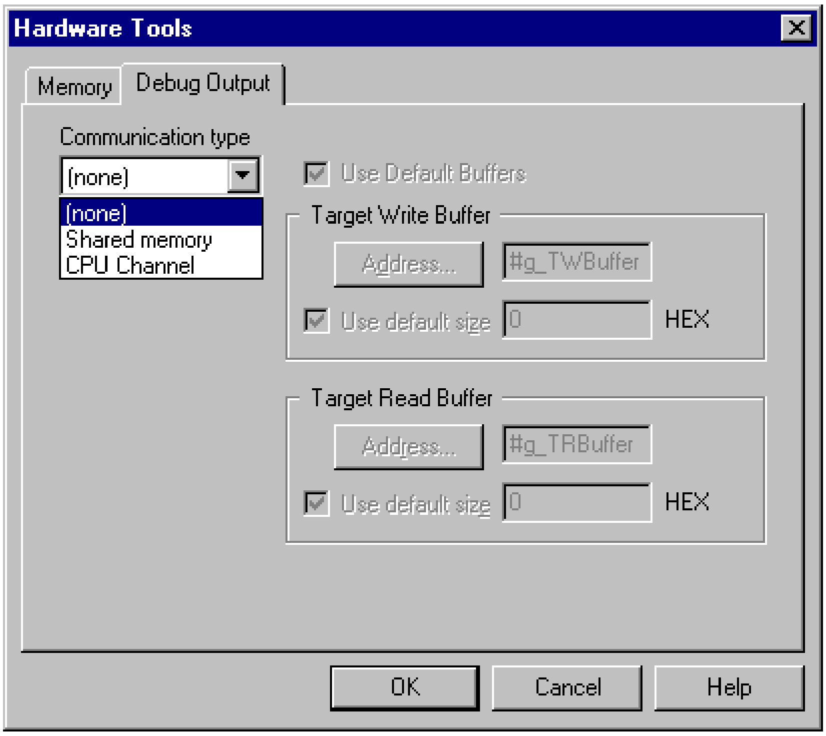
Selects the number of stop bits in the communication.

Flow Control

Selects the type of flow control used.

Setting the Properties of the Debugger Interface

If the terminal window should communicate through special debugger communication port, the ‘Channel’ must be set to “Debugger”. In this case additional communication properties are set in the ‘Hardware/Tools/Debug Output’ tab.



Communication type: (none)

☑ Use Default Buffers

Target Write Buffer

#g_TWBuffer

☑ Use default size 0 HEX

Target Read Buffer

#g_TRBuffer

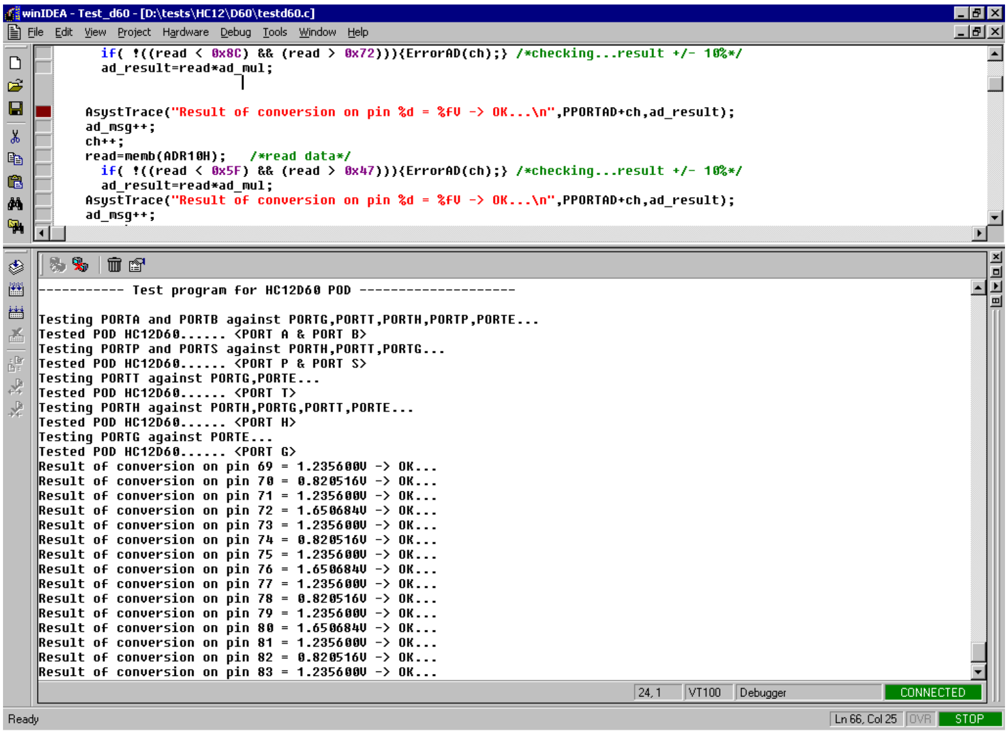
☑ Use default size 0 HEX

Hardware Tools, Debug output

The communication type can be shared memory or special CPU channel depending on the specific CPU. Select the supported communication type. When ‘Shared memory’ is used, the user’s program writes information into a pre-specified memory location from where the data is being read by winIDEA. The user’s program can read from terminal window as well.

Some CPUs can communicate with terminal window via serial debug channel. On such CPUs ‘CPU Channel’ must be selected. In case of ARM family, the terminal window displays all information send from the CPU through debug JTAG channel. Likewise the terminal window can send back to the CPU required information via the JTAG channel.

To enable the benefits of the terminal window with shared memory, all the necessary functions have been already prepared. Three functions allow the user to send information to the terminal window and to receive the information from the terminal window. To use these functions, the file `AsystTrace.c` delivered with winIDEA must be compiled and linked to your application. Note that `AsystTrace.c` makes use of the standard string library, which must be linked to the target application.



winIDEA - Test_d60 - [D:\tests\HC12\D60\testd60.c]
File Edit View Project Hardware Debug Tools Window Help

```
    if( !((read < 0x8C) && (read > 0x72))){ErrorAD(ch);} /*checking...result +/- 10%*/
    ad_result=read*ad_mul;

  AsystTrace("Result of conversion on pin %d = %fV -> OK...\n",PPORTAD+ch,ad_result);
  ad_msg++;
  ch++;
  read=memb(ADR10H);   /*read data*/
    if( !((read < 0x5F) && (read > 0x47))){ErrorAD(ch);} /*checking...result +/- 10%*/
    ad_result=read*ad_mul;
  AsystTrace("Result of conversion on pin %d = %fV -> OK...\n",PPORTAD+ch,ad_result);
  ad_msg++;
```

```
----------- Test program for HC12D60 POD --------------------

Testing PORTA and PORTB against PORTG,PORTT,PORTH,PORTP,PORTE...
Tested POD HC12D60...... <PORT A & PORT B>
Testing PORTP and PORTS against PORTH,PORTT,PORTG...
Tested POD HC12D60...... <PORT P & PORT S>
Testing PORTT against PORTG,PORTE...
Tested POD HC12D60...... <PORT T>
Testing PORTH against PORTH,PORTG,PORTT,PORTE...
Tested POD HC12D60...... <PORT H>
Testing PORTG against PORTE...
Tested POD HC12D60...... <PORT G>
Result of conversion on pin 69 = 1.235600V -> OK...
Result of conversion on pin 70 = 0.820516V -> OK...
Result of conversion on pin 71 = 1.235600V -> OK...
Result of conversion on pin 72 = 1.650684V -> OK...
Result of conversion on pin 73 = 1.235600V -> OK...
Result of conversion on pin 74 = 0.820516V -> OK...
Result of conversion on pin 75 = 1.235600V -> OK...
Result of conversion on pin 76 = 1.650684V -> OK...
Result of conversion on pin 77 = 1.235600V -> OK...
Result of conversion on pin 78 = 0.820516V -> OK...
Result of conversion on pin 79 = 1.235600V -> OK...
Result of conversion on pin 80 = 1.650684V -> OK...
Result of conversion on pin 81 = 1.235600V -> OK...
Result of conversion on pin 82 = 0.820516V -> OK...
Result of conversion on pin 83 = 1.235600V -> OK...
```

The terminal window in winIDEA

Following functions declared in `AsystTrace.h` are available:

*int AsystTrace(const char *pFormat,...);*

This function can be used in the same way as the standard “printf” function. The output is redirected to the terminal window. If the communication buffer is full, the function does not return until there is enough place for the formatted string. The formatted string must never exceed the allocated buffer (the size is defined in `AsystTrace.h`).

return value

0

int AsystKbhit(void);

return value

Returns a nonzero value if there is at least one character available from the terminal window.

char AsystGetch(void);

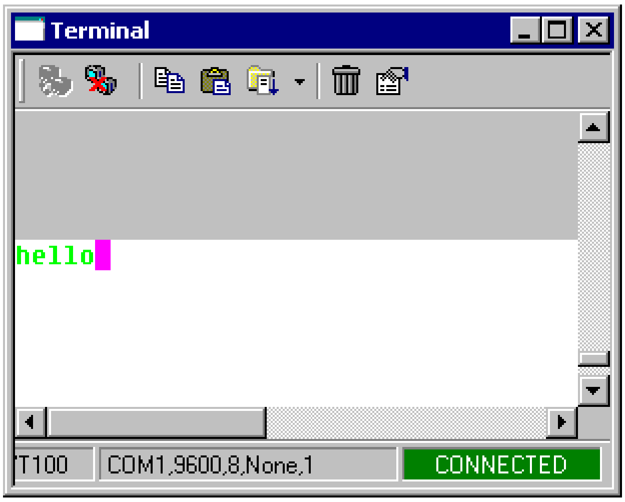
The function waits for the first available character from the terminal window.

return value

Returns the received character from the terminal window.

The Terminal Window

The Terminal Window can be invoked in the View menu by pressing the Terminal button.



```
hello
```

T100 | COM1,9600,8,None,1 | CONNECTED

The Terminal Window

The Terminal window will appear blank, with communication properties in the bottom. In our case, the properties would mean, that the cursor is in position 1, 1 (which means row 1, column 1), the emulation type is VT100, and the terminal is connected through the COM1 serial port, with 9600 bps, 8 bit, Parity None, 1 stop bit.

Connect

The 'Connect' button connects the terminal.

Disconnect

The 'Disconnect' button disconnects the terminal.

Copy

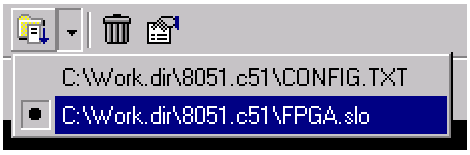
The 'Copy' button copies the selected text to clipboard.

Paste

The 'Paste' button pastes the text from clipboard to the terminal.

Send ASCII

The 'Send ASCII' button sends the ASCII file through the terminal. If the 'Send' button is pressed, the ASCII file selected is sent.


C:\Work.dir\8051.c51\CONFIG.TXT
● C:\Work.dir\8051.c51\FPGA.slo

The ASCII file is selected by pressing the 'Select' arrow and selecting the file, the file selected has a bullet next to the name.

Clear History Buffer

The 'Clear History Buffer' button clears the history.

Options

The 'Options' button opens the Terminal Window Configuration window.

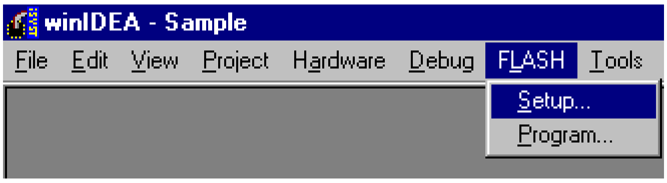
List of supported VT100 Commands

ESC 7	Save Cursor
ESC 8	Restore Cursor
ESC H	Horizontal tabulation set
ESC D	Index
ESC E	Next line
ESC M	Reverse Index
ESC c	Reset To Initial State
ESC [A	Cursor Up
ESC [B	Cursor Down
ESC [C	Cursor Forward
ESC [D	Cursor Backward
ESC [K	Erase from cursor to end of line
ESC [J	Erase from cursor to end of screen
ESC [g	Clear tab at current cursor position
ESC [0m	Atttributes off
ESC [1m	Bold or Increased intensity
ESC [4m	Underscore
ESC [5m	Blink
ESC [7m	Negative (reverse) image
ESC [nD	Cursor backward n chars
ESC [nB	Cursor down n lines
ESC [nC	Cursor forward n chars
ESC [m;nH	Cursor position to column m and row n
ESC [nA	Cursor up n lines
ESC [nJ	Erase in display
	n = 0 - erase from cursor down
	n = 1 - erase from cursor up
	n = 2 - clear screen
ESC [nK	Erase In Line
	n = 0 - erase from cursor to right
	n = 1 - erase from cursor to left
	n = 2 - erase from current line to end of screen
ESC [m;nf row n	Set horizontal and vertical cursor position to column m and
ESC [ng	Tabulation clear
	n = 0 - clear tab at cursor
	n = 3 - clear all tabs

FLASH Programming

Introduction

If the attached hardware (see "Hardware Plug-In" on page 16) supports FLASH device programming, winIDEA will create a FLASH menu through which FLASH-programming capabilities of the hardware plug-in can be used.



The FLASH menu

winIDEA can support both on-chip and external FLASH programming.

Note: Internal CPU FLASH refers to the CPU currently configured by the Hardware plug-in.

When using newer/UMI internal FLASH devices, those are handled by the hardware plug-in and winIDEA considers these regions to be writable. For more information on UMI FLASH programming, please see the Hardware User’s Guide.

Programming

Make sure that the target system is properly connected to the programmer and the target system is ready for programming.

Next configure the appropriate device.

Configuration

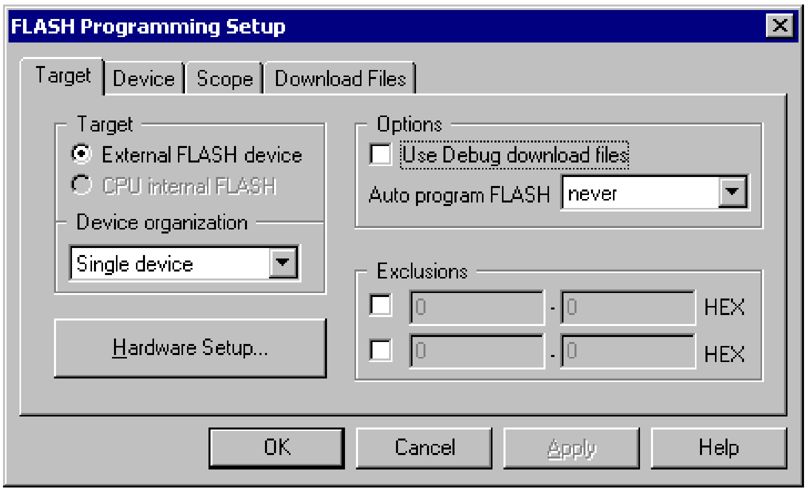
Software configuration consists of:

- Target configuration – either on-chip FLASH or external FLASH device
- Device configuration – manufacturer and type specification
- Scope configuration – determines whether the entire chip or only parts of it will be used in the operation
- Download files configuration – files the FLASH will be programmed with.

To start the setup, select the 'Setup…' command from the FLASH menu.

Target

The Target page will be shown if on-chip FLASH programming is available.



FLASH Programming Setup

Target

● External FLASH device
○ CPU internal FLASH

Device organization: Single device

Options

□ Use Debug download files

Auto program FLASH: never

Exclusions

□ 0 - 0 HEX
□ 0 - 0 HEX

FLASH Programming Setup dialog, Target page

Target

Specify the FLASH target. Options that are not available are disabled.

Note: If internal FLASH device programming is not supported (or not available) and external FLASH is then this Setup tab is not shown.

Options

The 'Use Debug download files' can be used to override settings on the 'Download Files' page and use download files configured for debug system instead.

Several options to automatically program the FLASH can be selected with the 'Auto program FLASH…' option.

The options include:

- **never** – the FLASH is never programmed automatically;
- **after link** – the FLASH is programmed immediatelly after link;
- **before download** – the FLASH is programmed before download.

Device Organization

Device Organization determines the target device organization. This is either a single device (8 or 16 bit) or two 8- or 16-bit devices in parallel organization (common address bus with A1 used as device's A0, one device holds even addresses, the other odd addresses).

- **Single device** – select if you wish to program a single standing device;
- **Two devices** – select if you wish to program the device in parallel configuration;
- **Four Devices** – selects if you wish to program both devices in parallel configuration.

Hardware Setup

For information on setting up hardware, please refer to the hardware manual.

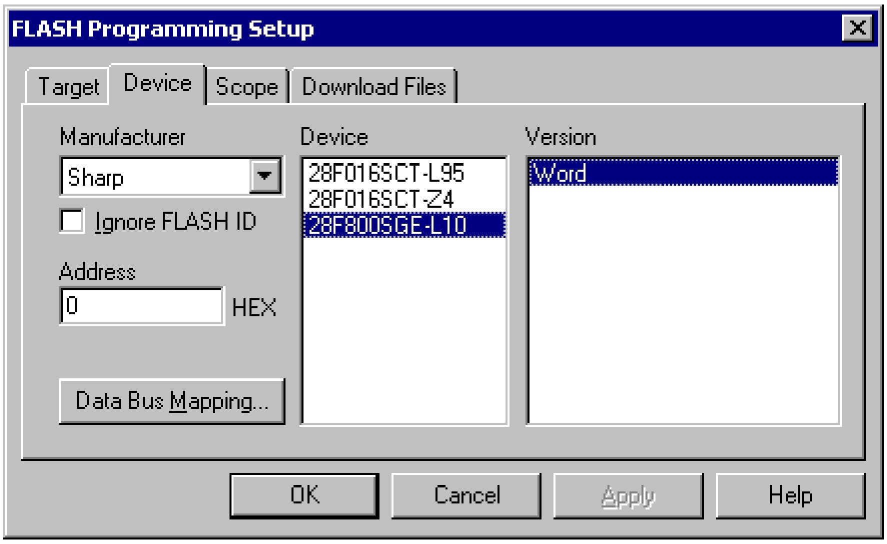
Exclusions

Up to two memory areas to exclude when programming FLASH can be defined here.

Device

In the Device page of the 'FLASH Programming Setup' dialog, the external FLASH device type is configured. If you are programming CPU's on-chip FLASH, these settings are ignored.

Note: If external FLASH device programming is not available then the Device tab is not shown.



Manufacturer: Sharp

□ Ignore FLASH ID

Address: 0 HEX

Device:
28F016SCT-L95
28F016SCT-Z4
28F800SGE-L10

Version:
Word

FLASH Programming Setup dialog, Device page

Manufacturer

Select the manufacturer of the FLASH device. The device list will be updated after the manufacturer is selected.

Ignore FLASH ID

When programming, the FLASH ID is checked. If this is not desired, please check the 'Ignore Flash ID' option.

Device and Version

Select the FLASH device. If there is only a single version of the device, the 'Version' list will be disabled and will show only 'default' value. Should there be different versions of the device (like 8 and 16 bit data bus versions), select the one that you are using.

Address

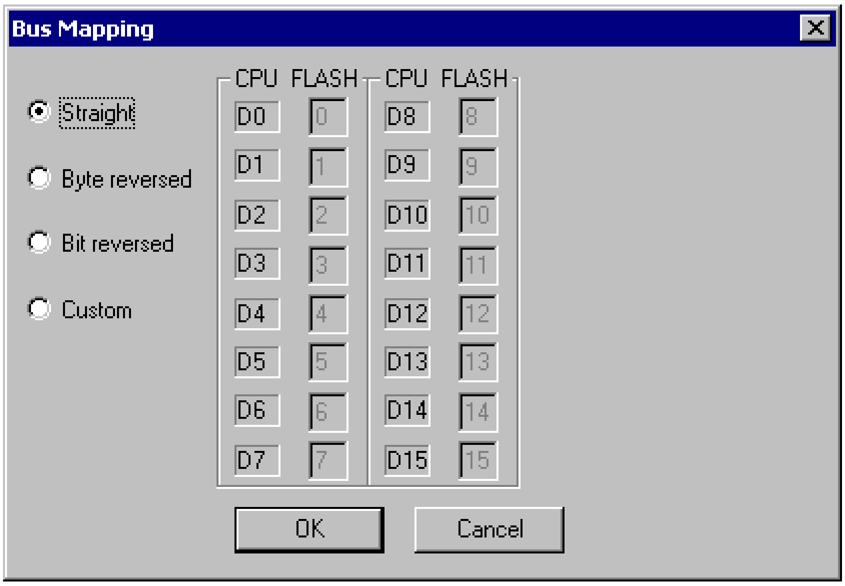
Specify the address of the device in the target system – the address that the CPU uses to access the device.

Little Endian Target

Check this option if the target system is a Little Endian Target, i.e. swaps the low and high byte of a 16-bit data bus.

Data Bus Mapping

The Bus Mapping dialog is invoked by pressing 'Data Bus Mapping' in the FLASH Programming Setup/Device menu.



● Straight
○ Byte reversed
○ Bit reversed
○ Custom

CPU	FLASH	CPU	FLASH
D0	0	D8	8
D1	1	D9	9
D2	2	D10	10
D3	3	D11	11
D4	4	D12	12
D5	5	D13	13
D6	6	D14	14
D7	7	D15	15

Bus mapping dialog

The Bus mapping is useful when the data in the FLASH is mapped differently than on the CPU.

Straight

The bits are mapped directly.

Byte reversed

The bytes are reversed, i.e. the first byte in the FLASH is mapped as the second byte for the CPU, the second FLASH byte is mapped as the first CPU byte.

Bit reversed

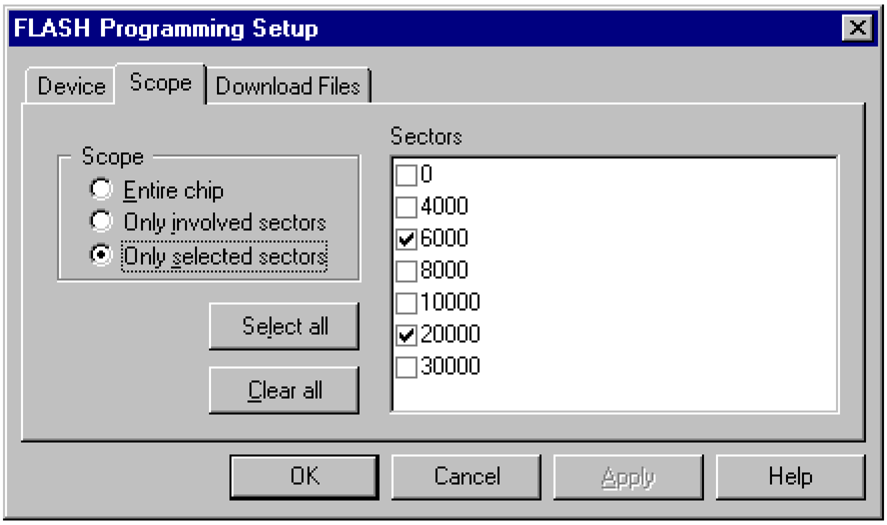
The bits are reversed. The first FLASH bit is the last CPU bit, the last FLASH bit is the first CPU bit.

Custom

Custom mapping can be defined here.

Scope

Settings in the Scope page determine whether the entire device will be operated on or just certain parts of it.



Scope

○ Entire chip
○ Only involved sectors
● Only selected sectors

Sectors

□ 0
□ 4000
☑ 6000
□ 8000
□ 10000
☑ 20000
□ 30000

FLASH Programming Setup dialog, Scope page

Entire Chip

When selected, the entire chip will subject to erase and program operations.

Only involved sectors

When selected, only sectors, where the download file's code is loaded will be erased and/or programmed.

Only selected sectors

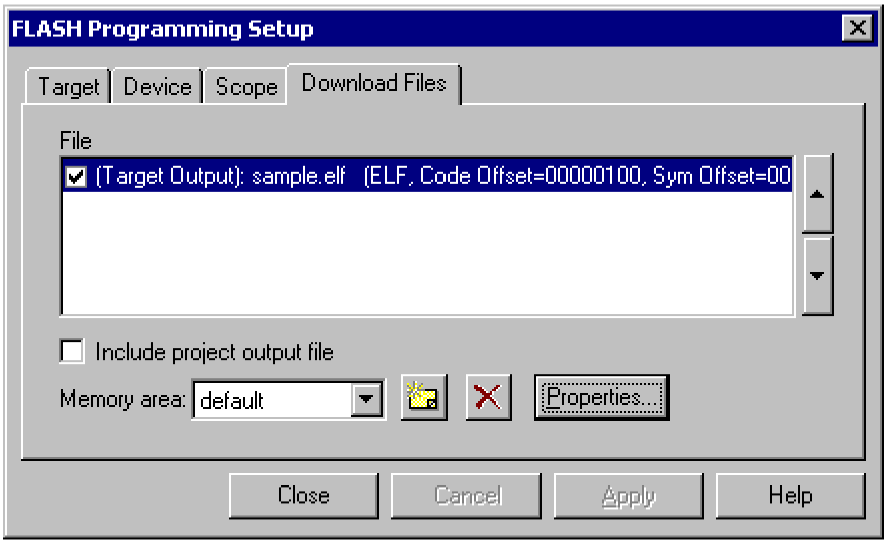
When selected, only sectors that are explicitly checked in the Sectors list will be operated on.

You can use 'Select all' to select all sectors and the 'Clear all' to deselect them.

Download Files

In the 'Download Files' page the files that will be used for programming the device are specified.

Note: Settings on this page are ignored if 'Use Debug download files' option is selected on the 'Target' page.



☑ (Target Output): sample.elf (ELF, Code Offset=00000100, Sym Offset=00

□ Include project output file

Memory area: default

FLASH Programming Setup dialog, Download Files page

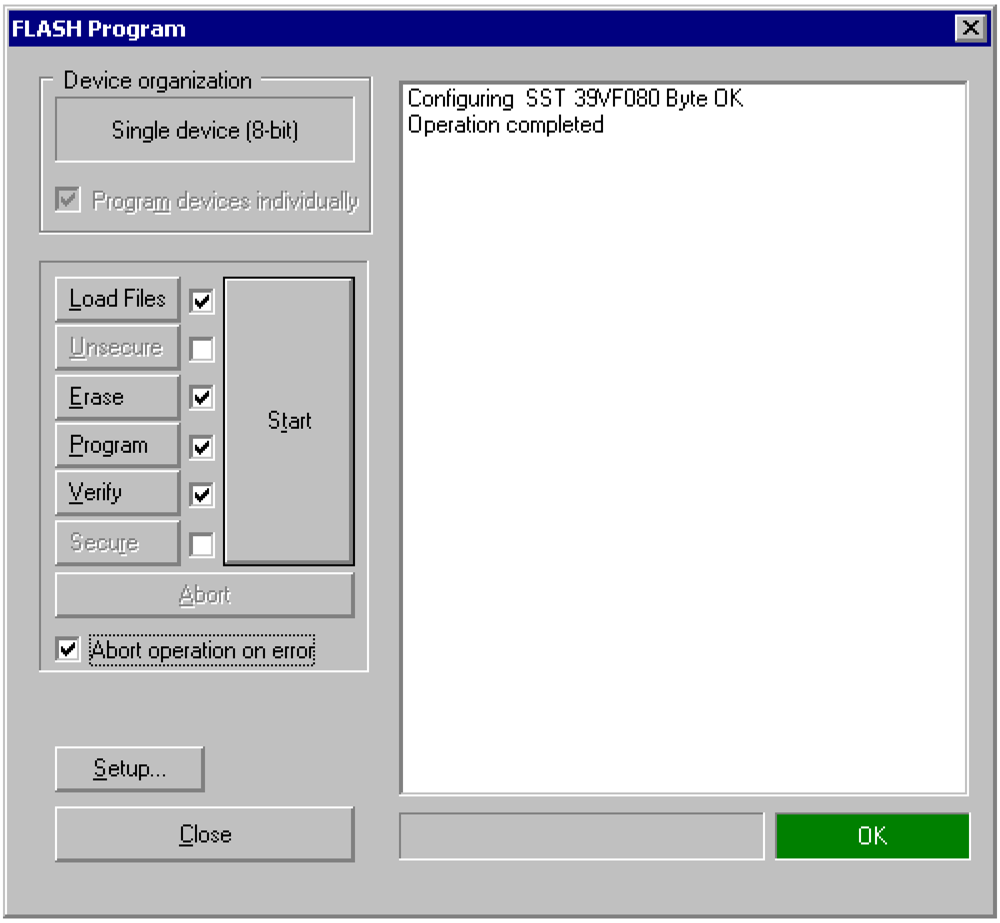
See also "Download File" on page 107 for more information

Note: When using files other than those intended for EPROM burning (for example absolute object files with debug information), make sure that they contain all the code necessary in an EPROM system.

Special care should be taken when programming EPROM for a banked system. The absolute object file usually holds a single instance of the common area, although the common area must be multiplied in every bank. If you suspect that not the entire code is loaded, use the object to hex converter supplied by the compiler manufacturer, and specify the generated hex file as the download file.

Device Programming

After you have configured the device and prepared the target system and programmer, select the 'Program…' command from the FLASH menu.



FLASH Program

Device organization

Single device (8-bit)

☑ Program devices individually

☑ Load Files

□ Unsecure

☑ Erase

☑ Program

☑ Verify

□ Secure

☑ Abort operation on error

```
Configuring  SST 39VF080 Byte OK
Operation completed
```

FLASH Program dialog

Device organization

The target device organization is specified in the Flash Programming Setup dialog, the Target pane. This is either a single device (8 or 16 bit) or multiple 8- or 16-bit devices in parallel organization (common address bus with A1 used as device's A0, one device holds even addresses, the other odd addresses).

Program devices individually allows you to program only one device at the time.

Load Files

Click this button to load the download files to winIDEA's internal cache.

Unsecure

Select this option to unsecure the FLASH.

Erase

Click this button to erase the configured scope (see "Little Endian Target" on page 224).

Program

Click this button to program the configured scope.

Note: this button is disabled if the download files have not been loaded.

Verify

Click this button to verify if programming was successful.

Secure

Select this option to secure the FLASH.

Start

Performs all operations checked next to the Load/Erase/Program/Verify buttons.

Abort

Aborts the current operation.

Setup

Opens the FLASH Programming Setup dialog – see "Configuration" on page 222.

Results

The Results list shows results of operations performed on the FLASH device.

Build Manager

Introduction

One of the goals in the development of winIDEA was to achieve a tight integration of all stages of program development (edit, build and debug) by a single application.

winIDEA provides its own editor and powerful debugging capabilities, it lacks however an integrated compiler toolset. Instead, virtually any third party command line driven compiler, assembler and linker can be integrated to run as a part of winIDEA.

winIDEA provides several specialized objects that facilitate this integration. You will manage you project hierarchy in the Project Workspace Window, run compilers using the Project Toolbar and configure compiler options in the Project Settings dialog.

Project configuration file carries the same name as the workspace file. They always go hand in hand.

In addition winIDEA separates project configuration settings from workspace settings in a separate project configuration file. This file is generated automatically when the workspace file (.JRF) is generated. It carries the same name, however with a different extension (.QRF). This separation allows teams of developers to share the same copy of the .QRF file while every developer can customize his individual setting in the workspace file.

When using source code control and versioning systems (SourceSafe, PVCS, etc.) you will want to control the project (.QRF) file as well as your source files. Since the workspace file (.JRF) is user specific, it should not be shared.

Note: If you copy the workspace file (.JRF) to a new directory, always copy the project configuration file (.QRF) too, otherwise you will have no project settings when you open the workspace file in the new location.

Note: In winIDEA versions earlier than 8.5, the project configuration file had a .PRF extension. This file is read by newer versions, but changes are saved to the new QRF format.

Detecting Changes to the Project

When the build manager is configured properly, it will check all project files and recompile/assemble those where:

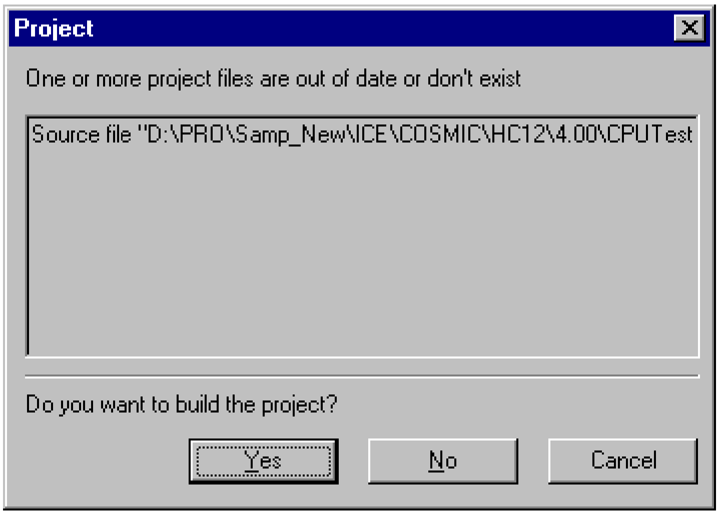
- the objet file doesn't exist
- the object file is older than the project file
- any of the header files used by a C project file is newer than the object file
- compiler/assembler settings for the project file have changed

A project will be linked (output file generated) when:

- the output file doesn't exist
- any of the object files is newer than existing output file
- linker settings have changed
- the indirection file has changed

This check is performed before the CPU operation is advanced (download, step, etc.).

In such case the below dialog will ask you whether the project should be rebuild.



One or more project files are out of date or don't exist

Source file "D:\PRO\Samp_New\ICE\COSMIC\HC12\4.00\CPUTest

Do you want to build the project?

The 'Project not up to date' dialog

Yes

Choose 'Yes' to rebuild the project.

No

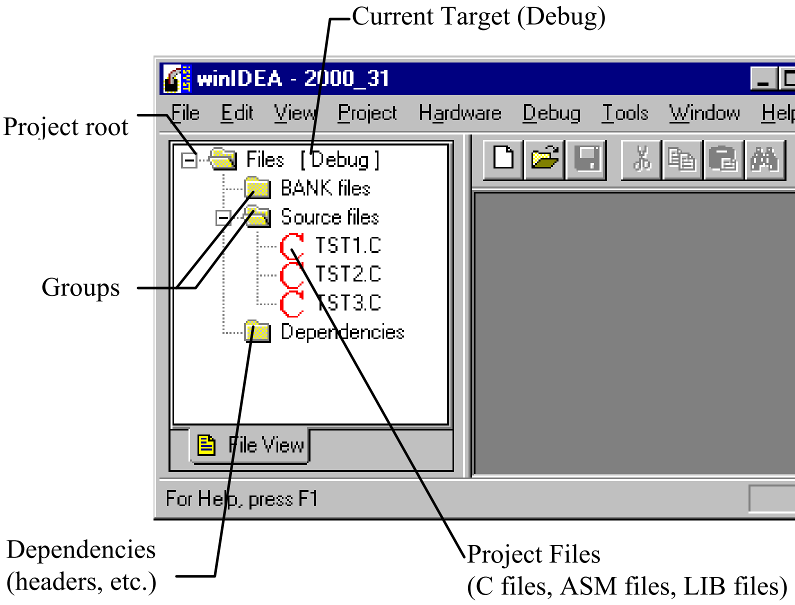
If you choose 'No' the project will not be rebuild and winIDEA will not prompt you again until the project is rebuild explicitly.

Cancel

Choose 'Cancel' to abort the attempted operation. The project is not rebuilt.

Project Organization

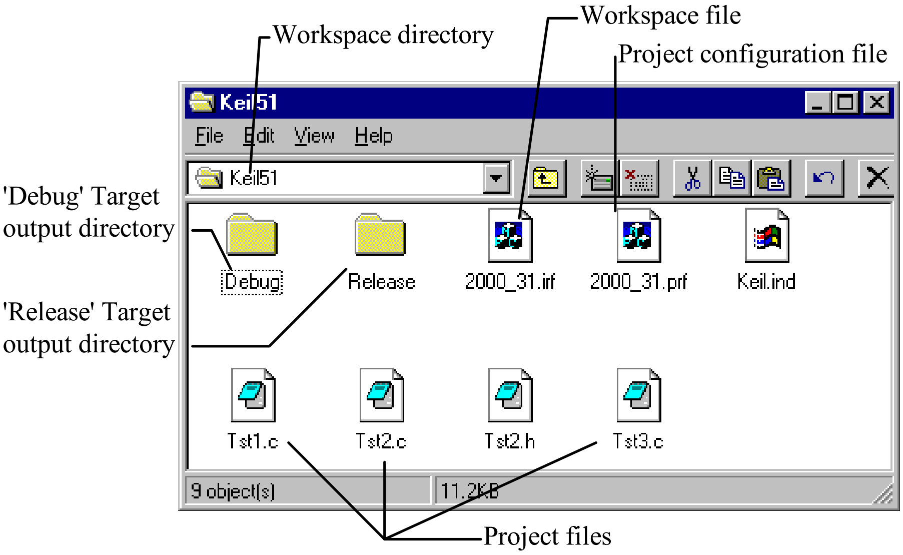
winIDEA adds two hierarchical levels between the project and files that it consists of (project files). These two levels are an abstract organizational form, which you can use if you feel the need to, or not use at all - especially for small projects.



Project Workspace Window showing project hierarchy

Directory Organization

As strongly recommended in the "Workspaces" section on page 11, all workspace and project related files are placed in the workspace directory or one of its sub-directories. The figure below illustrates a small project.



Typical Directory Organization

You can see the workspace file (2000_31.JRF) along with a matching project configuration file (2000_31.qrf).

All project files (Tst1.c through Tst3.c) and some header files are located in the same directory. For larger projects you will usually want to place project files in sub-directories whose names resemble group names, but this is entirely your choice.

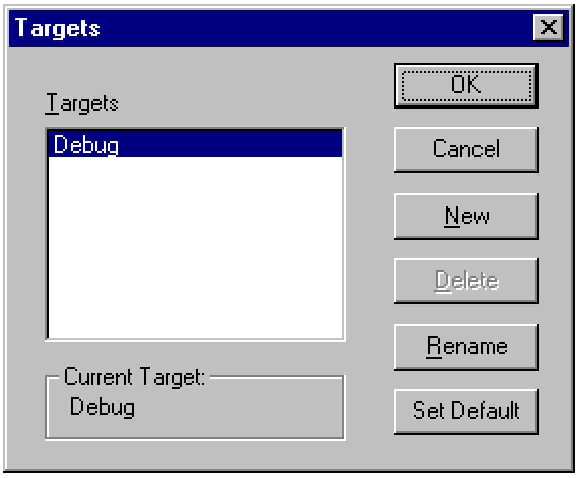
The Debug sub-directory contains files generated by processing project files when the 'Debug' target is selected. This includes object, listing, map, absolute object, symbol files, etc. in short everything that can be regenerated every time. The Release sub-directory holds the same set of files, only this time they are generated by selecting the 'Release' target.

This separation of source and output files keeps your source directories clean and brings additional advantages as described next.

Targets

A project can have one or more **Targets**.

A Target controls all project files by defining default command line options for newly added project files, and by defining an **Output Directory** for all intermediate files generated in compile, assemble and link process.



Targets dialog

Before inserting any project files in the project, you should review and modify the target settings in the Project Settings dialog.

Note: Target settings are shown, and can be edited when target's name is selected in the tree view of the project.

Every project file that you insert in the project will assume these target settings.

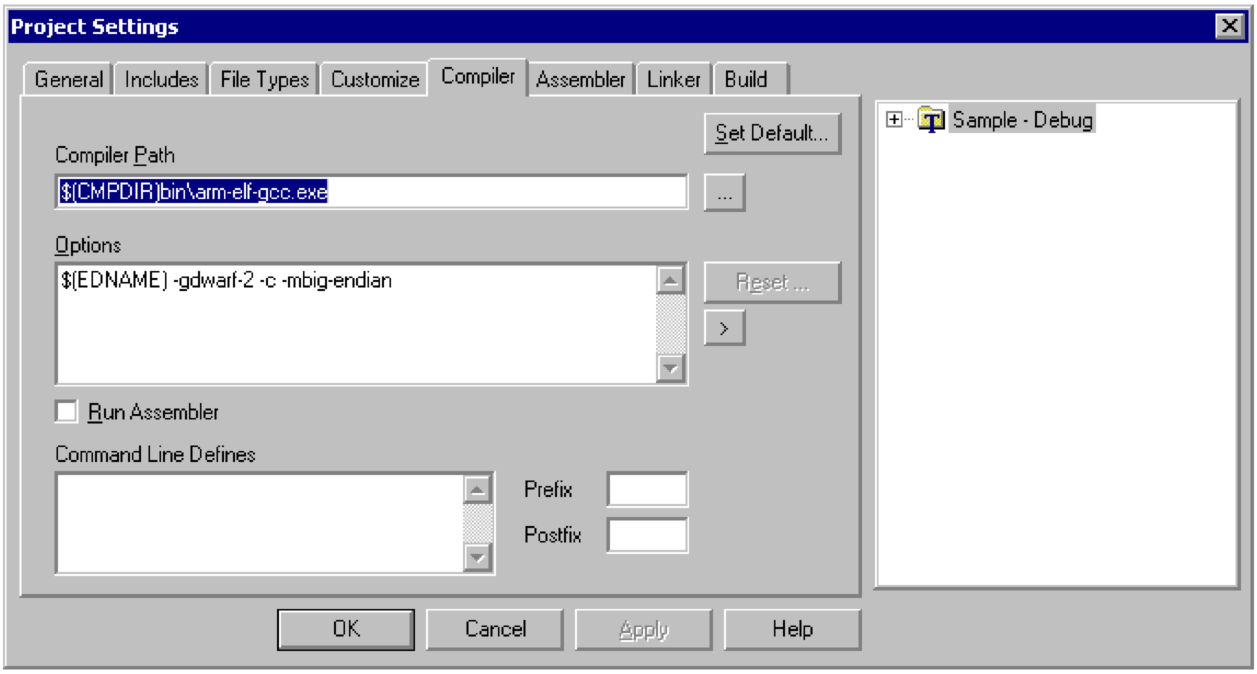
Later on, if you decide to modify targets settings, open the Project Settings dialog, select the desired Target and configure new Target settings.

Use the 'Reset…' button

To apply Target settings to all project files - by doing so, you reset settings for every project file (including those, whose settings have been set explicitly) to current Target settings.

Use the 'Set Default…' button

To discard current Target settings and return to winIDEA's hard coded default settings - by doing so you will change Target settings - which will apply to newly added project files and to existing project files whose settings have not been explicitly set (see below).


Project Settings

Compiler Path: $(CMPDIR)bin\arm-elf-gcc.exe

Options: $(EDNAME) -gdwarf-2 -c -mbig-endian

□ Run Assembler

Command Line Defines

Prefix

Postfix

Review command line settings for compiler and assembler

Why Would You Want to Use More than One Target

In course of development you will sometimes wish to maintain a version that is easy to debug (debug info, no optimizations, conditionally compiled debugging aid code), and a version that you release in the finished product (no debug info, full optimization, no unnecessary code, etc.).

Traditionally, you would work with so called 'Debug' settings when generating debuggable code. When you wished to create a 'Release' version, you would change all settings and make a full build of your project. This is inconvenient because:

- it takes quite a while to make a full build of a large project
- if some files need special compiler settings (disable debugging in certain modules etc.), you must take special care in defining settings for these files every time you change 'global' settings.
- you then need to do this all again to return settings back to 'Debug mode'

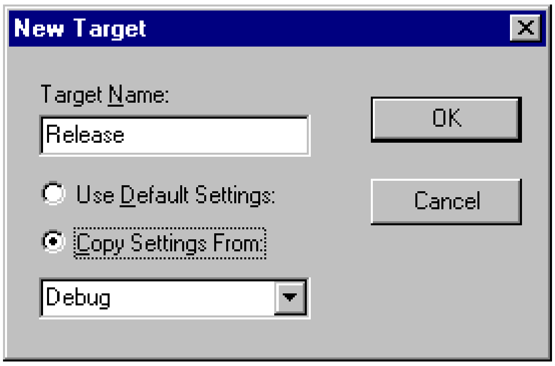
winIDEA's Build Manager solves this

- by maintaining settings for all configured targets, not just the current one - so you have to define them only once
- by keeping intermediate files (object, listing) in a separate Output directory - which is different for every Target. Beside keeping your source directories clean, this assures that object files located in 'Debug' target directory are compiled with Debug settings and object files in 'Release' target directory with Release settings.
  Hence, rebuilds are not necessary. When switching Targets you only perform a 'Make'.

Adding a Target

Note: When a new project is created, a Target named 'Debug' is generated automatically.

- Open the Targets dialog in the Project menu.
- Select the 'New…' button
- In the 'New Target' dialog specify the name for the new target and choose whether default options should be used, or target settings copied from an existing target.



Target Name: Release

○ Use Default Settings:

● Copy Settings From: Debug

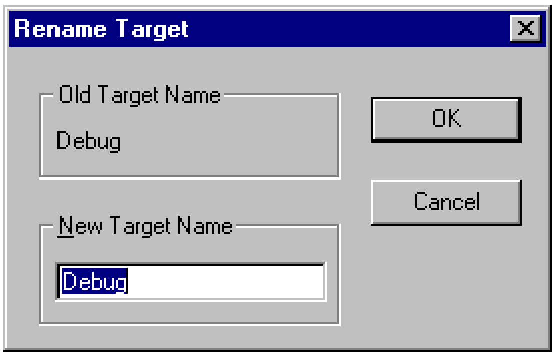
New Target dialog

- Select OK button to finish

Note: when copying settings from an existing target, only target settings are copied - not for every individual project file. Files with explicitly set settings assume Target options in the new target. If you need to, you must configure them manually.

Renaming a Target

To rename a target click the **Rename** button in the Project/Targets dialog.



Rename Target dialog

New Target Name

Specify the new name for the target.

Groups

A **Group** is a collection of project files. Every Group exists in every target and groups the same project files. Besides being a visual aid in browsing project hierarchy, group names can be used in the link process.

What Groups don't have, are compilation and assembly settings, output directories, etc.

Why would You Want to Use More than One Group

- If you wish to enforce link order of an object file or group of object files, the easiest way to do it is to define as many groups (with descriptive names) as necessary. For a banked system, for example, such names could be 'Common', 'Vectors', 'Bank 1' and 'Bank 2’, but also 'Jack's files', 'Nancy's files' etc.
- When a hundred or more project files are used, you will find it hard to find them in the Project Workspace window. By organizing them in groups (again with descriptive names) you will find them much faster.

Adding a Group

- Open the Context menu of the Project Workspace Window
- Select the 'Add Group…' command
- Enter then name for the new group when prompted for it
- Select the OK button to finish

Project Files

Project files are the meat of your project. By compiling, assembling and linking them, your project is built.

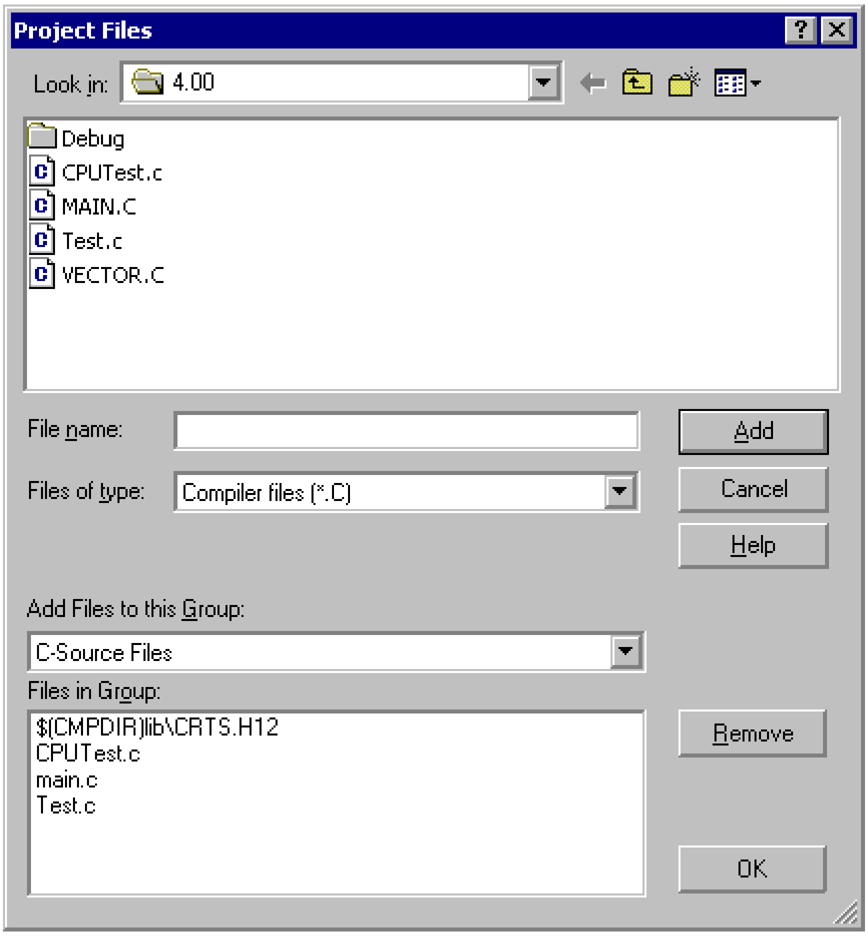
winIDEA divides project files by their extension into four types:

- compiler source files (typically .C extension)
- assembler source files (sometimes .ASM, but also .A51, .S07, …)
- object and library files (.OBJ, but also .H11, .R03…)
- files that do not take part in the build process - text files, graphics - anything that you find handy to have available by mouse click in the Project Workspace Window.

Configuring Project Files

- Select the 'Project Files…' command from the Project menu
- In the Project Files dialog, select the files you wish to add, and the group you wish to add them to.
- Select the OK button to finish.

When a project file is inserted in the project, a set of settings for every existing target is generated for it. For every target, current target settings are used.



Project Files

Look in: 4.00

Debug
CPUTest.c
MAIN.C
Test.c
VECTOR.C

File name:

Files of type: Compiler files (*.C)

Add Files to this Group: C-Source Files

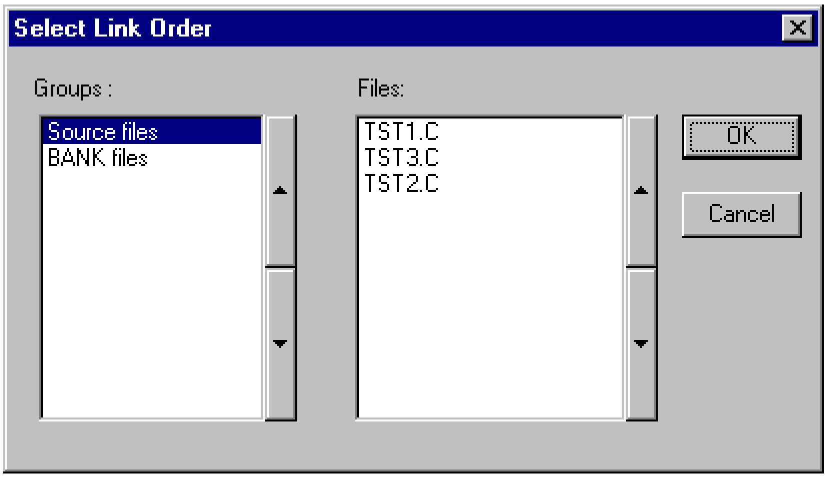
Files in Group:
$(CMPDIR)lib\CRTS.H12
CPUTest.c
main.c
Test.c

The Project Files dialog

Alternatively, you can add a file which is open in an editor, by selecting the 'Add to project' command from editor's local menu.

Link Order of Files and Groups

On certain occasions the project's object and library files must be linked in specific order. The Build Manager will process groups and their project files in alphabetical order unless specified differently in the link order dialog.



Link Order dialog

To open the link order dialog:

- select the target in the project workspace window
- right-click it to open the context menu
- select the Link Order… command

Build Manager passes groups to the linker as they are listed in the Group list. You can change the ordering of groups by selecting a group and moving it up and down in the list with the arrow buttons right of the list.

Inside a group, project files are processed as they are listed in the Files list.

Compiler Tool-set Integration

To take maximum advantage of winIDEA's Build Manager, numerous settings must be configured properly. winIDEA ships with ready-made example projects for all major compilers, which you can use as template workspaces for your new projects.

For quick starts and small projects, you can use an example workspace as a template for your workspace, for bigger projects however you will want to have more control over the Build Manager's settings.

You have already learned how to add targets and groups, what remains is the Project Settings dialog, where global, target and project file specific settings can be configured.

Scope of Settings

Project settings can have one of following scopes:

- Global scope - always valid (example: path to assembler EXE)
- Target scope - valid when the respective target is selected (example: Target's output directory)
- File scope - valid when a file is being compiled or assembled (example: compiler command line options)

Configuring Settings for Multiple Files

Settings for multiple files can be configured simultaneously. To do so:

- expand the project hierarchy as needed
- select project files, groups and targets that you wish to manipulate
- configure settings that you wish all selected files to assume

In the figure below, settings for following files are being manipulated:

- main.c in the 'Debug' target
- All files in the 'BANK Files' group in the 'Debug' target
- All files in the 'Release' target

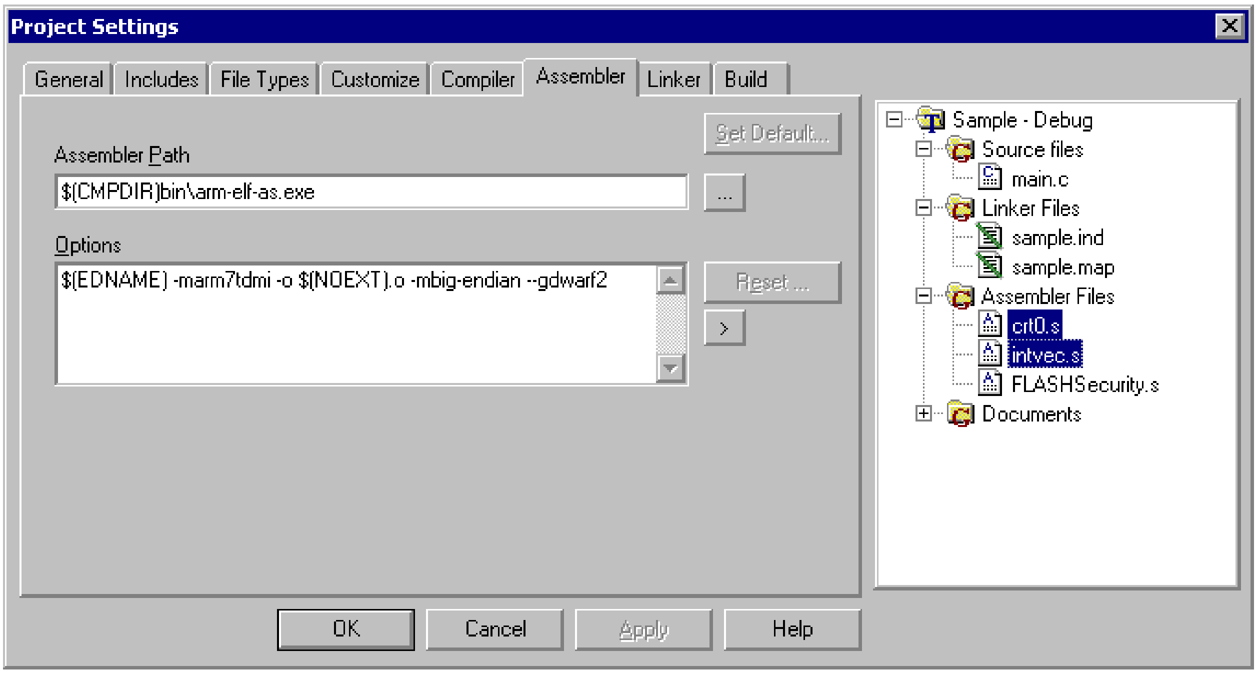
In dialog pages where target and project file specific settings can be set, you will notice two buttons which are used to reset settings.

The 'Reset' button

Clicking on 'Reset' button will preset settings for currently selected files to current target settings. In previous example this means:

- main.c in the 'Debug' target assumes current 'Debug' target settings
- All files in the 'BANK Files' group in the 'Debug' target assume current 'Debug' target settings
- All files in the 'Release' target assume 'Release' target settings

In other words, selecting 'Reset' on any file or group of files, discards all settings that were defined explicitly (for a project file after it has been inserted into project).



Assembler Path: $(CMPDIR)bin\arm-elf-as.exe

Options: $(EDNAME) -marm7tdmi -o $(NOEXT).o -mbig-endian --gdwarf2

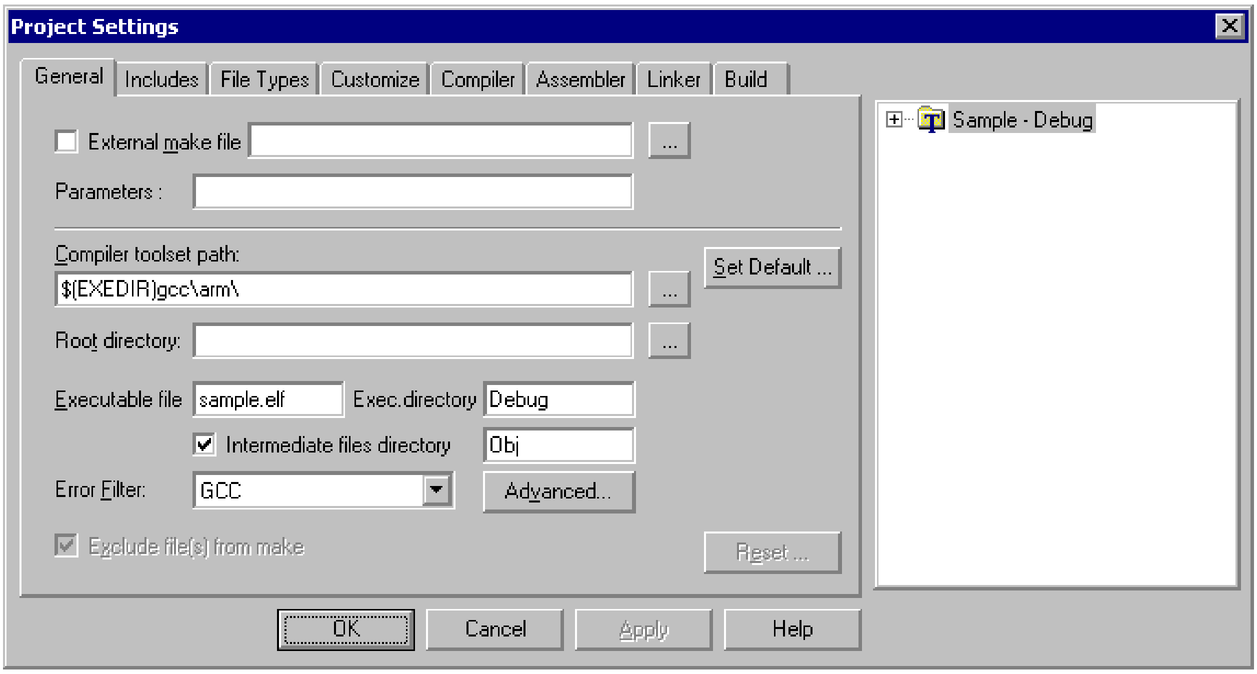
Setting options for multiple files simultaneously

The 'Set Default' button

The 'Set Default' is enabled only when a target is selected. Clicking it will cause the selected target to assume settings that are hard coded into winIDEA.

This will also affect settings of all project files in the target whose settings have not been changed explicitly.

General page



Project Settings

□ External make file

Parameters :

Compiler toolset path: $(EXEDIR)gcc\arm\

Root directory:

Executable file sample.elf Exec.directory Debug

☑ Intermediate files directory Obj

Error Filter: GCC

☑ Exclude file(s) from make

Project Settings dialog, General page

External Make File

When this option is checked the Build Manager will not attempt to build the project by itself but will rather call an external batch file - which you must specify. This batch file is now in charge of creating the absolute object file.

This option effectively disables the Build Manager. All make and build requests are routed to the external make file. It will however still detect modifications to either project or include files and invoke the external make file when necessary.

This setting has global scope.

Parameters

The string specified here will be passed to the external make file.

This setting has global scope.

Compiler toolset path

Compiler toolset path defines the directory where compiler, assembler, linker and companion files have been installed. Although you will see absolute paths to compiler, assembler and linker or to library files included in the project files list, all these paths are internally kept as relative to this directory. If you have different version of your compiler installed in different directories, you can easily switch amongst them just by changing this path.

This setting has global scope.

This option also accepts entries with environment variables enclosed in % signs.

Example:

The environment variable C_BASE is set to 'X:\C51'.

The entry in the 'compiler toolset path' option set to '%C_BASE%\BIN' would yield 'X:\C51\BIN'.

Executable Directory

Defines the directory where executable files are stored when the selected target is active.

This setting has target scope.

Intermediate files directory

Intermediate files directory option controls placement of temporary files generated during compile and assembler runs. If the option is checked, these will be put in the specified subdirectory of the Root directory.

If this option is not checked, the intermediate files will be placed into the Executable directory.

This setting has target scope.

Executable File

Defines the name of the file, which is generated at the end of the build process. This will usually be the final executable (absolute object file) generated by linker. This file must be known by the Build Manager to tell a successful build from an unsuccessful one.

Although you must specify only the name of the file (without any path specification), the file is always searched for in the current target's output directory.

This setting has global scope.

Root Directory

Specifies a root directory for project files location. Using a root directory, winIDEA can store paths to project files in relative from, thus assuring workspace moveability.

If this field is left blank the workspace directory (see "Workspaces" on page 11) is used as the root directory.

This setting has global scope.

This option also accepts entries with environment variables enclosed in % signs.

Example:

The environment variable C_BASE is set to 'X:\C51'.

The entry in the 'root directory' option set to '%C_BASE%\BIN' would yield 'X:\C51\BIN'.

Error Filter

Defines the method by which output emitted by translation tools (compiler, assembler and linker) is filtered to extract errors and warnings.

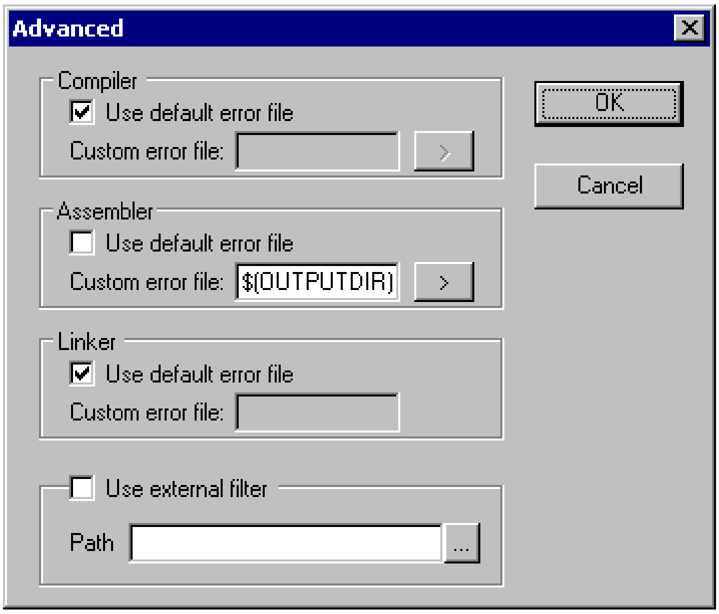
If your compiler is not supported, you can still view unfiltered output in the 'tools' pane of the output window.

This setting has global scope.

Advanced

Clicking this button configures advanced filter options.

The default settings in the advanced dialog are hard coded in the winIDEA for the currently selected filter.



Compiler

☑ Use default error file

Custom error file:

Assembler

☐ Use default error file

Custom error file: $(OUTPUTDIR)

Linker

☑ Use default error file

Custom error file:

☐ Use external filter

Path

Advanced filter options

You may change this options if no filter is available for you version of compiler.

Use default error file

If this option is checked, the default error file for the generated tool is used. This file can be either captured STDOUT or STDERR stream or a file with a standard named or extension.

This standard file is hard coded in winIDEA for the current filter.

Use Custom error file

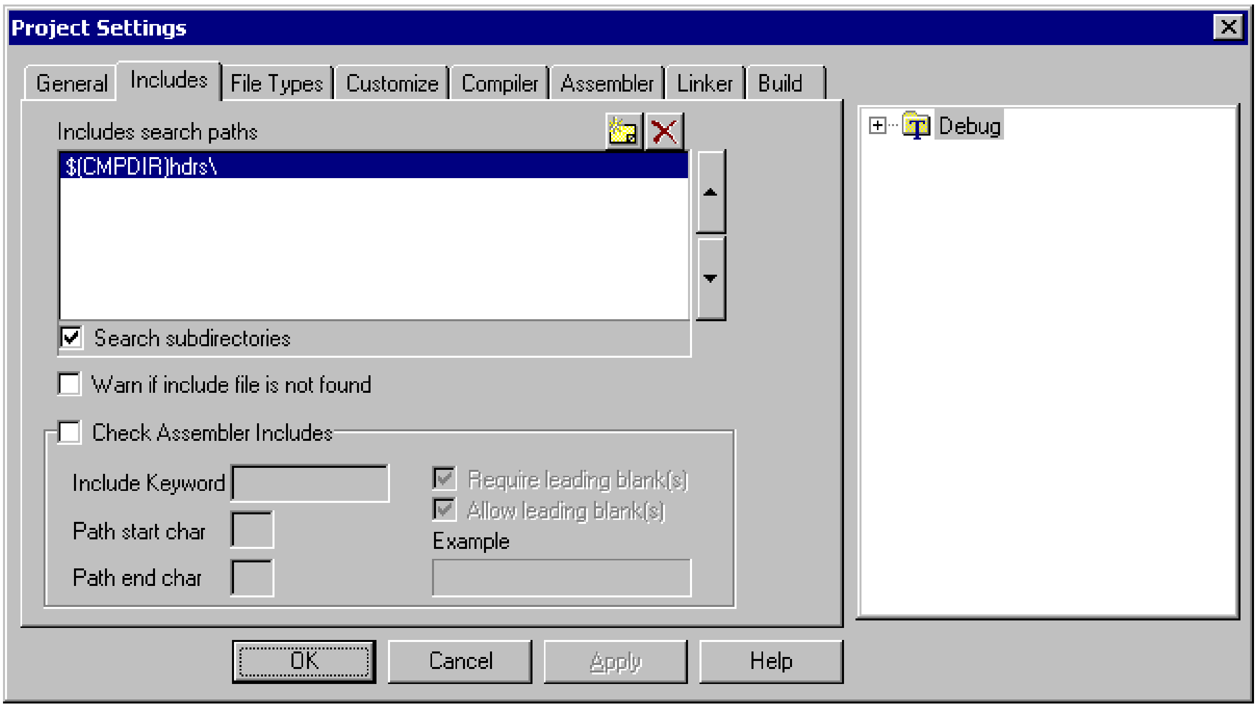
Check this option to override the default error file. You can use macro names available by clicking the '>' button.

Exclude File from Make

When this option is checked the selected file will not be processed by any of the translation tools, no matter what type it is.

This setting has file scope.

Includes



Includes search paths

$(CMPDIR)hdrs\

☑ Search subdirectories

□ Warn if include file is not found

□ Check Assembler Includes

Include Keyword

Path start char

Path end char

☑ Require leading blank(s)

☑ Allow leading blank(s)

Example

Debug

Project Settings, Includes page

Include Search Paths

The Include File Directories list holds a record of all directories that should be searched for include files. The include files are searched in directories in order of their appearance in ‘Includes search paths’ dialog. The order can be changed by pressing the ‘up’ or ‘down’ arrow.

If ‘Search subdirectories’ at a selected path is selected, also the subdirectories of this path are searched.

Note: these directories are used by the Build Manager to search for include files used by project files to determine whether an include file has changed, in which case the project file needs to be recompiled.
If the compiler itself requires include files path specification, you must provide

this separately in the form that your compiler expects (environment variables, command line options, configuration files, etc.)

This setting has global scope.

Warn if include file is not found

This option toggles whether a warning is issued when an include file is found or not.

Check Assembler Includes

Since there is no standard (like ANSI for C/C++) to define an include file for an assembler, the include syntax must be described manually.

If 'Check assembler Includes ' is checked, assembler project files will be searched for includes

Require leading blanks

Check if the include directive must not start in the first column.

Allow leading blanks

Check if the include directive can start in any column, including the first.

Include Keyword

Specify the include directive keyword.

Path start char

Specify the character that immediately preceeds the include file name.

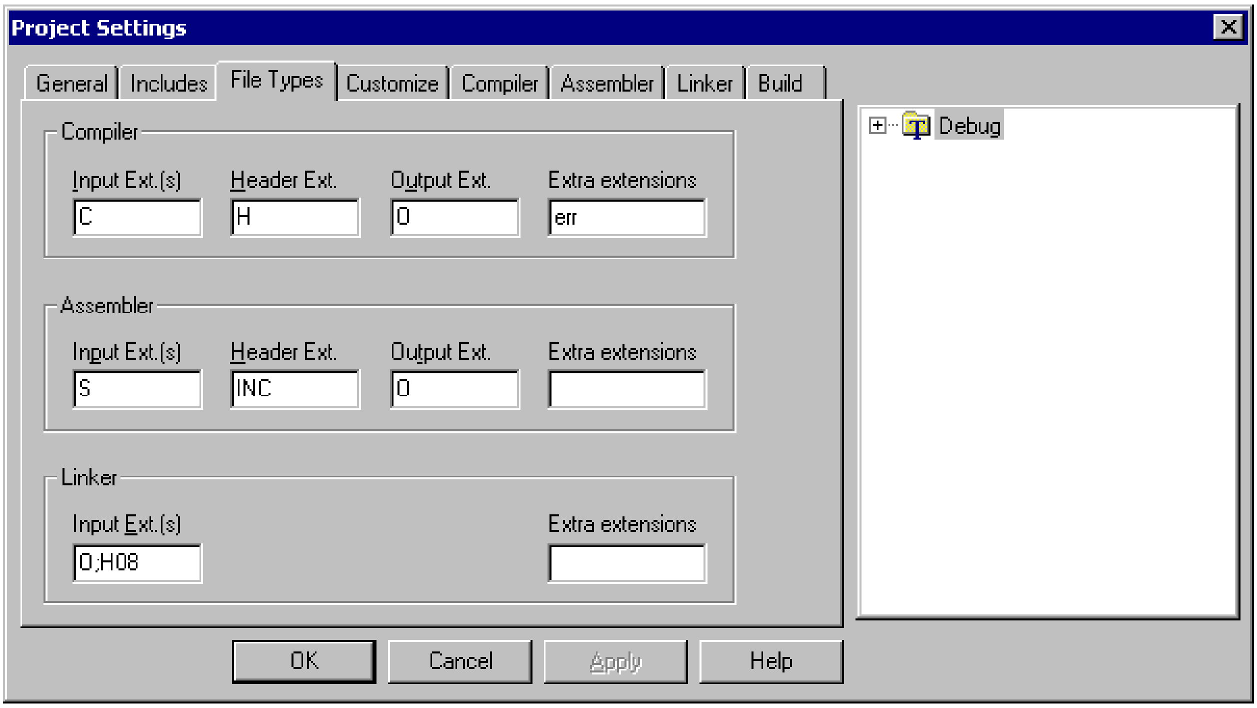
Path end char

Specify the character that immediately follows the include file name.

The dialog will show an example of the current configuration in the 'Example' field.

File Extensions page

The File Extensions page defines file extensions by which files handled by the Build Manager are identified.



Compiler

Input Ext.(s): C
Header Ext.: H
Output Ext.: O
Extra extensions: err

Assembler

Input Ext.(s): S
Header Ext.: INC
Output Ext.: O
Extra extensions:

Linker

Input Ext.(s): O;H08
Extra extensions:

Project Settings dialog, File Extensions page

All settings on this page have global scope.

For every build step the extra extensions indicate other types of files that can be generated in the process. A file that carries the same name and one of the extensions specified here is moved to the output directory along with the object file.
These types can be specified when the "Don't use time based build manager" option on the Customize page is selected.

Compiler extensions

These are the types of files that a standard C compiler deals with:

- C files - winIDEA's project files (usually .C or .CPP). If more than one extension is possible, separate them with commas or semicolons.
- Header files - included by project files
  (usually .H)
- Output files generated by compiling a C file (usually .OBJ). If your compiler generates assembler source, specify the extension of generated assembler source files.

Assembler extensions

For assembler the following extensions must be defined:

- Assembler source files - winIDEA's project files. If more than one extension is possible, separate them with commas or semicolons.
- Object files generated by compiling an assembler file (usually .OBJ)

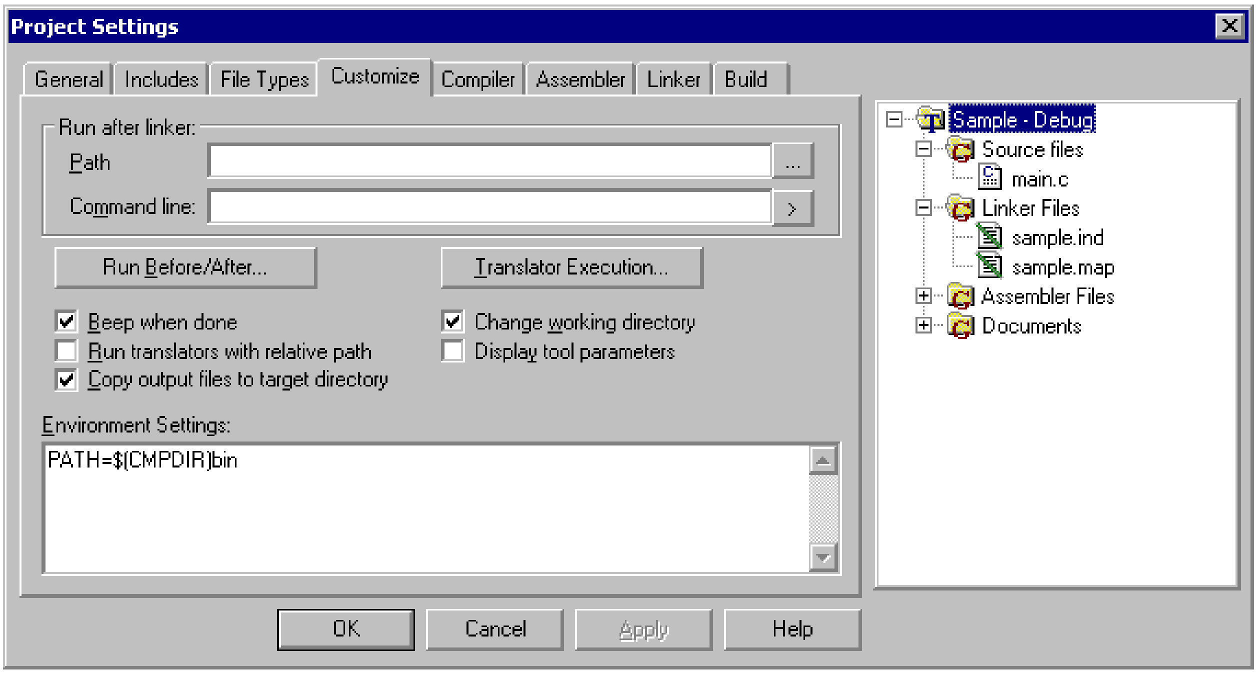
Linker extensions

- For the linker, only input extensions must be specified. These include object file extensions and library file extensions.

Customize page

Customize page contains additional options for running translators.

All settings on this page have global scope.



Run after linker:

Path:

Command line:

☑ Beep when done

□ Run translators with relative path

☑ Copy output files to target directory

☑ Change working directory

□ Display tool parameters

Environment Settings:

```
PATH=$(CMPDIR)bin
```

Project Settings dialog, Customize page

Run After Linker

After link process successfully terminates, sometimes additional tools (object file converters, etc.) must be ran. If you need to run a tool or a batch file, specify its path and command line arguments here.

Run translators with relative path

When checked, the translator is passed a relative path of the file(s) it requires for translation.
Otherwise absolute paths are used.

Copy output files to target directory

When checked, all files generated in process of translation (object, listing, etc.) are moved to current target's output directory.
Otherwise no files are moved.

Beep when done

By default, winIDEA beeps after the build is done. With this option, the beep can be turned off.

Change working directory

When checked, the current (working) directory is changed to the directory of the file being processed.
This is required by some compilers.

Display tool parameters

Displays parameters passed to the tool.

Show tool window

Under certain conditions a compiler/assembler/linker or a custom tool, which is spawned by winIDEA, can create it's own subprocesses, which run independently of it and winIDEA has no knowledge of them. If such a process hangs, or awaits user input, winIDEA can not abort it.

The bad thing about this is that users don't see the spawned process screen, as winIDEA launches the initial process in a hidden window.

If this option is checked, the spawned process will be shown in a normal window. Since compiling multiple files will cause windows to pop-up and close for every file, this option is off by default. It should only be used if 'hang' situations occur.

Environment Settings

Some compilers require special environment variables that tell them where to search for include files, library files, etc. Traditionally you had to set these options with SET command in the AUTOEXEC.BAT file. You can still do it the old way, but you can also specify them in this field.

To set a variable X to value A, write

```
X=A
```

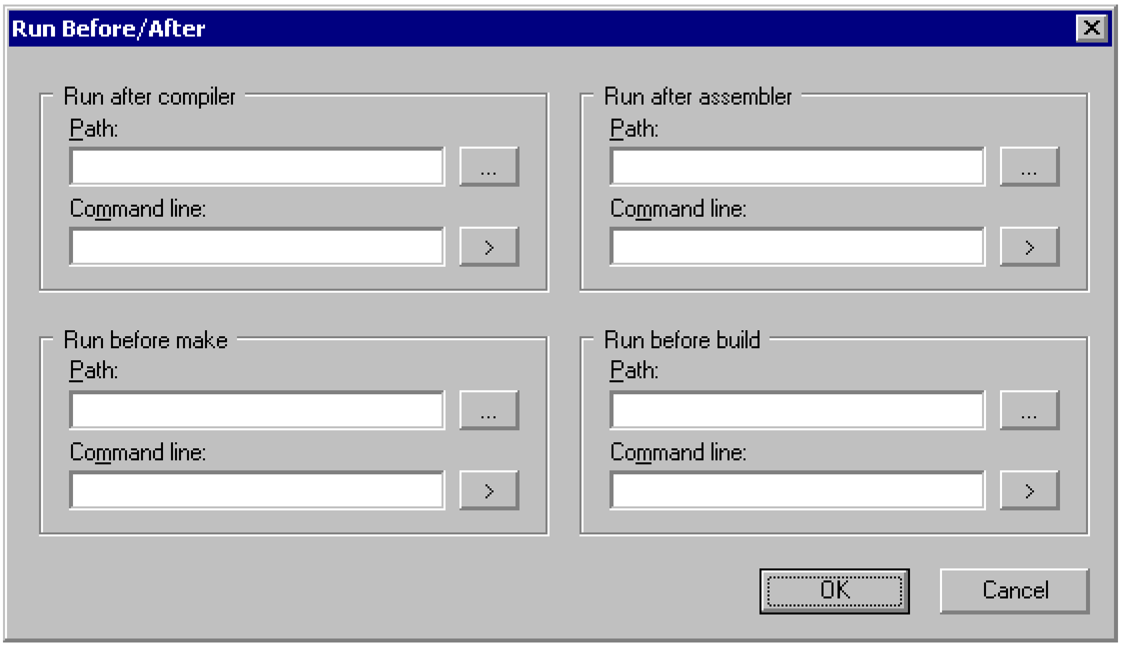
Note: you must not use the SET keyword when defining the variable.

You can use existing environment variables in new definitions. Following definition extends the PATH variable to include new path:

```
PATH=%PATH%;c:\C51
```

Run Before/After

Actions preceding make/build or following compile or assembly execution can be configured. In this case, select the 'Run Before/After' button.



Run Before/After dialog

Translator Execution

Clicking the 'Translator Execution…' will open the Advanced Translator Execution dialog, where you can define how individual tools are spawned and their output captured.

Run with command interpreter

When checked the tool is not spawned directly, but rather with a command interpreter.

If the tool fails to start or it's output can not be captured with default settings, you may try changing this option.

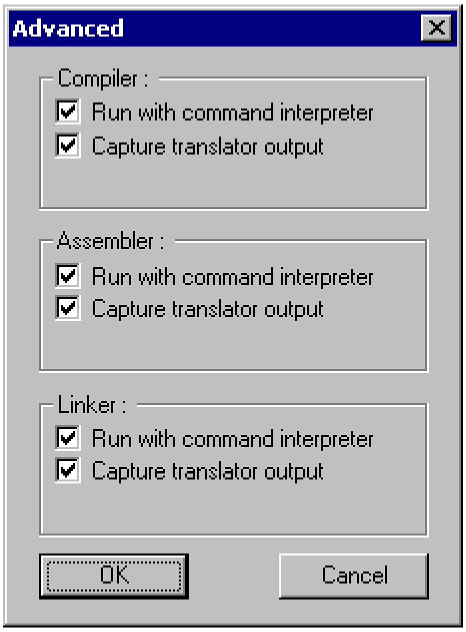
In general the option should be checked when running under Windows NT and unchecked when running under Windows 9x.

If the compiler is installed in a path with blanks, this option must be cleared. If the compiler doesn’t operate in this case, the path must be renamed so it doesn’t contain blanks.

Capture translator output

When checked the STDOUT and STDERR streams are indirected to a disk file which winIDEA later uses to filter out the error messages.

In general this option should be checked. The only case are tools that expect input on the STDIN stream or send file output to the STDOUT stream. In such case this option should be unchecked (for such tools the error output is usually generated in a separate error file).



Advanced

Compiler :

☑ Run with command interpreter

☑ Capture translator output

Assembler :

☑ Run with command interpreter

☑ Capture translator output

Linker :

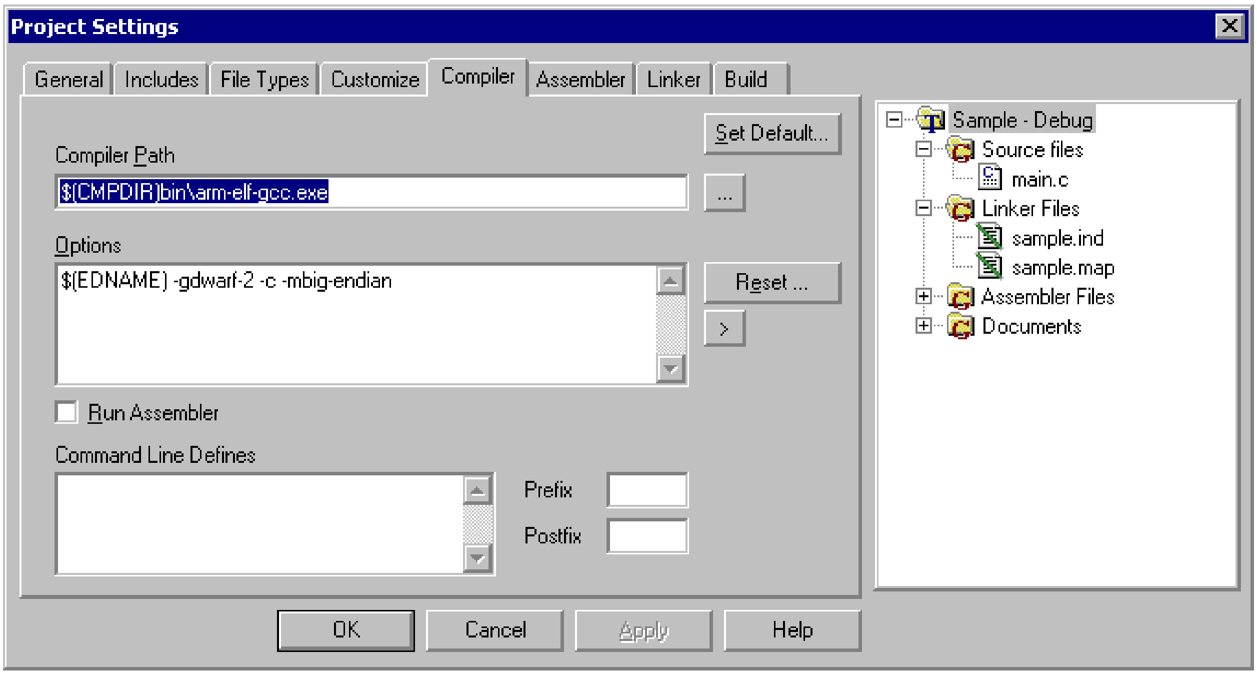
☑ Run with command interpreter

☑ Capture translator output

Advanced Translator execution options

Compiler page

The compiler page contains options specific to the C compiler. If you are using only assembler, you do not need to set any options on this page.



Project Settings

Compiler Path: $(CMPDIR)bin\arm-elf-gcc.exe

Options: $(EDNAME) -gdwarf-2 -c -mbig-endian

□ Run Assembler

Command Line Defines

Prefix

Postfix

Project Settings dialog, Compiler page

Compiler Path

Specifies the path to the compiler's EXE file.

This setting has global scope.

If you wish to call up a batch file, you can not specify its path directly, but must create an intermediate batch file that calls up your batch file.

If the compiler path is left blank, then the first argument in the 'Options' setting should be the translator path. This allows per file configuration of the used compiler (since, for example, some older ARM compilers provide a separate compiler for ARM and Thumb mode).

Example:

Files are compiled with COMPILE.BAT. To call it from winIDEA, create a new batch file COMPILE1.BAT containing:

```
CALL COMPILE.BAT %1
```

Specify COMPILE1.BAT as the path to the compiler. winIDEA will replace occurrences of %1 in the batch file with options configured on the page.

Compiler Command Line Options

In this edit field you must enter command line options you wish the compiler to be called with when the selected file is compiled. These will usually be code generation options, conditional defines, etc.

Additionally macro entries are supported, available from the button on the right of the Options edit field. The simplest command line option will usually contain the macro for the file name being compiled:

```
$(EDNAME)
```

This macro will expand to the full file name at the time when the compiler is invoked.

This setting has file scope.

Run Assembler

When this option is checked, the Build Manager will run the assembler on the output file generated by compiler.

This setting has file scope.

Command Line Defines

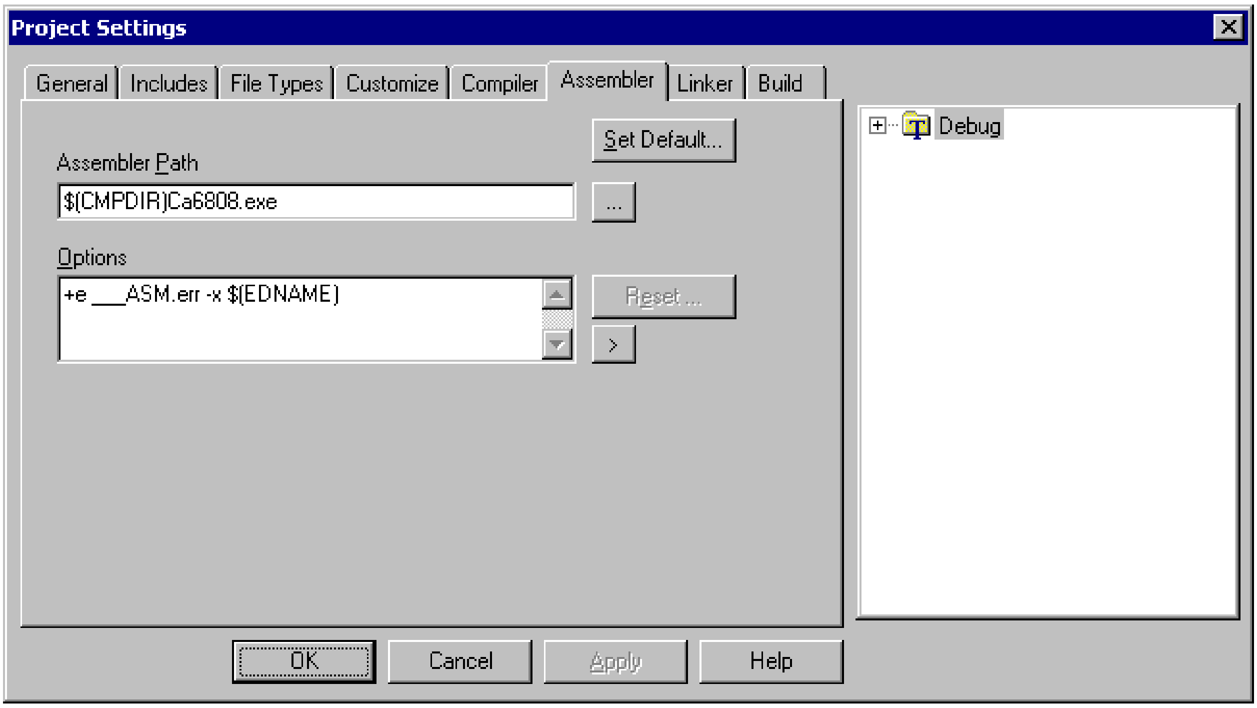
In this option all command line defines, needed for the compiler to operate, can be specified.

Prefix/Postfix

The Prefix and Postfix are used when the `$(DEFINES)` macro is used. Every command line define specified is completed with the value specified in the Prefix and Postfix options.

Assembler page

The assembler page contains options specific to the assembler. If you are using only compiler, you do not need to set any options on this page.



Assembler Path

$(CMPDIR)Ca6808.exe

Options

+e ___ASM.err -x $(EDNAME)

Project Settings dialog, Assembler page

Assembler Path

Specifies the path to the assembler's EXE file.

This setting has global scope.

If you wish to call up a batch file, you can not specify its path directly, but must create an intermediate batch file that calls up your batch file.

If the assembler path is left blank, then the first argument in the 'Options' setting should be the translator path. This allows per file configuration of the used assembler (since, for example, some older ARM assemblers provide a separate assembler for ARM and Thumb mode).

Example:

Files are compiled with ASSM.BAT. To call it from winIDEA, create a new batch file ASSM1.BAT containing:

```
CALL ASSM.BAT %1
```

Specify the ASSM1.BAT as the path to assembler. winIDEA will replace occurrences of %1 in the batch file with options configured on the page.

Assembler Command Line Options

In this edit field you must enter command line options you wish the assembler to be called with when the selected file is assembled. These will usually be code generation options, conditional defines, etc.

Additionally macro entries are support, available from the button on the right of the Options edit field. The simplest command line option will usually contain the macro for the file name being assembled:

```
$(EDNAME)
```

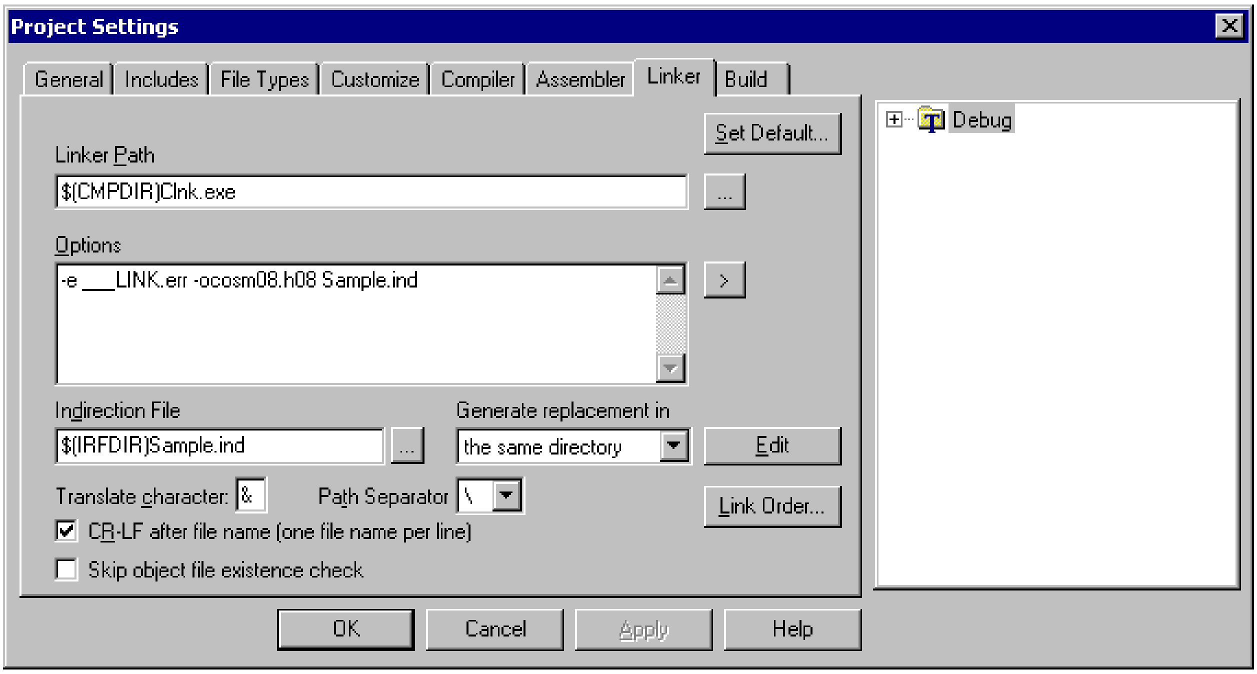
This macro will expand to the full file name at the time that the assembler is invoked.

This setting has file scope.

Linker page

The linker page contains options specific to the linker.

All settings on this page have global scope.



Project Settings

General | Includes | File Types | Customize | Compiler | Assembler | Linker | Build

Linker Path: $(CMPDIR)Clnk.exe

Options: -e ___LINK.err -ocosm08.h08 Sample.ind

Indirection File: $(IRFDIR)Sample.ind

Generate replacement in: the same directory

Translate character: &

Path Separator: \

☑ CR-LF after file name (one file name per line)

☐ Skip object file existence check

Project Settings dialog, Linker Page

Linker Path

Specifies the path to the linker's EXE file.

If the linker path is left blank, then the first argument in the 'Options' setting should be the translator path. This allows per file configuration of the used linker (since, for example, some older ARM linkers provide a separate linker for ARM and Thumb mode).

Linker Command Line Options

In this field you must enter command line options you wish the linker to be called with. These will usually be only a path to the Indirection File with perhaps some additional options.

Link Order

Click this button to change the order in which object files are passed to the linker. See "Link Order of Files and Groups" on page 240.

Skip object file existence check

If this option is checked, winIDEA will not check whether all linker input files (object, library) exist. By default, this option is off.

Linker Indirection File options

Due to large number of options that a linker must handle, most linkers can retrieve linkage options from an **indirection file** (also called command file, link file etc.).

Build Manager uses the indirection file to tell the linker which object and library files should be linked. It will search the indirection file for occurrence of translation **characters**, and replace them with a list of object files generated from the project files list.

The following features and rules apply to creating indirection files that can be used by winIDEA:

- All occurrences of %1 are replaced with options specified in the Linker Command Line Options field
- All occurrences of %2 are replaced with the name of the final output file (see "Executable File" on page 245).
- Occurrences of translate characters are replaced with the names of object files.

All these conversions do not have any influence on the original indirection file. From it a new file is generated and the linker is given this file as the indirection file. When the linker finishes, this file is erased. The location, where this file is generated, is specified in the '**Generate Replacement in**' option.

Generate replacement in

The replacement file for the Linker Indirection file will be generated in the location, specified here. The available locations are:

- ***the same directory*** : creates the replacement indirection file in the same directory as the original indirection file. This option is the default and recommended as it allows the indirection file to contain references to other files in relative form.
- ***Project Root directory*** : creates the replacement indirection file in the Project Root directory
- ***Target Exec directory*** : creates the replacement indirection file in the current target's Exec directory. Note: this was default location in winIDEA 2005 and earlier.

Translation Character

When the translation character ('&' default) is encountered in the indirection file the Build Manager replaces it with the names of object files derived from the project files list.

There must always be at least two translation characters. The string of characters that they embed is used as the delimiter between object files:

Example:

if project files are TST1.C, TST2.C, TST3.C and LIBRARY.LIB, then

```
&,&
```

expands to

```
TST1.OBJ,TST2.OBJ,TST3.OBJ,LIBRARY.LIB
```

If you check the 'CR-LF After File Name' option, then every object/library file name will be written in a new line:

For the previous example:

```
TST1.OBJ,
TST2.OBJ,
TST3.OBJ,
LIBRARY.LIB
```

If more than two translation characters occur, the following syntax applies:

```
&<prefix>&<delimiter>&<postfix>&<group>&
```

For each project file <prefix> will be put before the file name, and <postfix> behind the name. Project files will be delimited with <delimiter>.

If a group (see "Groups" on page 238) is specified, then only project files that belong to the specified group are inserted at that position.

If in the previous example LIBRARY.LIB and TST1.C belong to group 'COMMON' and TST2 and TST3 to group 'BANK1' then following code:

```
BASE 0
&load &&&COMMON&
BASE 8192
&load &&&BANK1&
```

generates:

```
BASE 0
load LIBRARY.LIB
load TST1.OBJ
BASE 8192
load TST2.OBJ
load TST3.OBJ
```

The Build Manager will keep a record of which groups have already been written, so if a translation character sequence without group specification is found, the object files of all remaining groups are written in that place.

Here is a summary of how fields between translation characters will be interpreted for different numbers of translation characters:

```
         &<delimiter>&
&<prefix>&<delimiter>&
&<prefix>&<delimiter>&<postfix>&
&<prefix>&<delimiter>&<postfix>&<group>&
```

Note: The placement of tags in the indirection file takes precedence over link order settings.

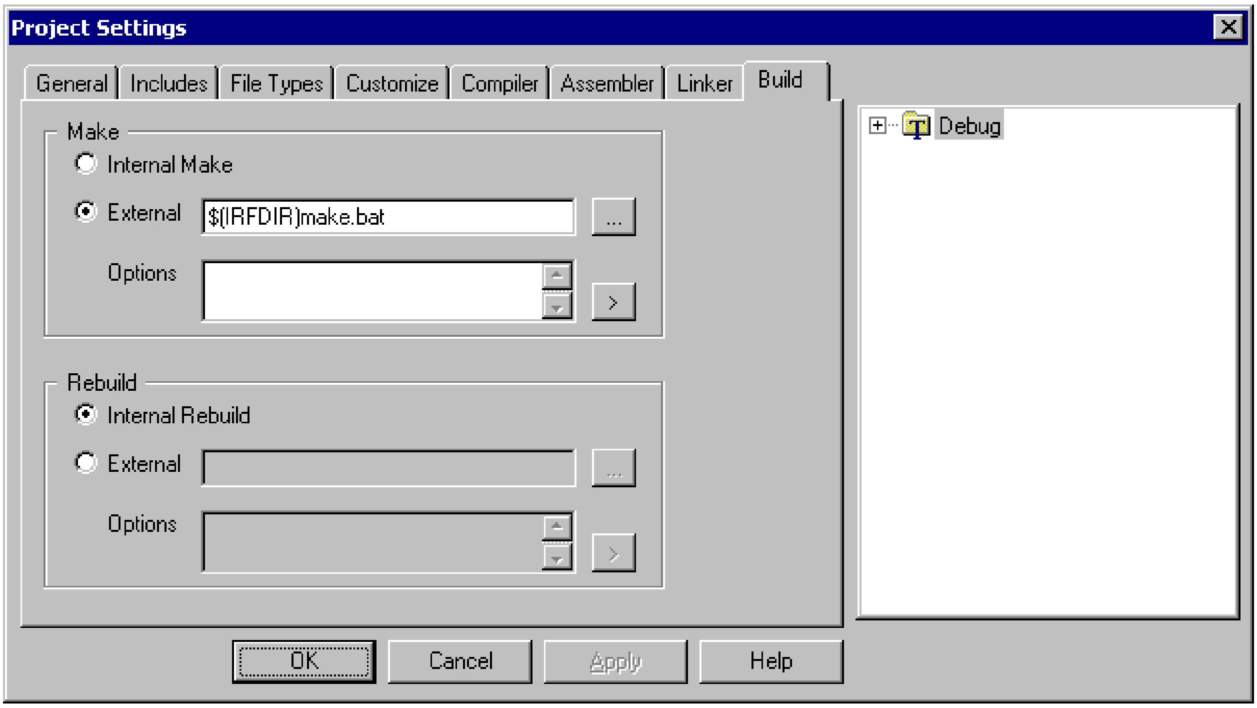
Path separator

This character is used in the indirection file to construct a full path to an object file. Most linkers understand the backslash '\', but others expect a forward slash '/'.

Build Page

The build page contains options related to build operations.

All settings on this page have global scope.



Project Settings

Make

○ Internal Make

● External $(IRFDIR)make.bat

Options

Rebuild

● Internal Rebuild

○ External

Options

Project Settings dialog, Build page

Settings on this page allow you to specify how **Project/Make** and **Project/Rebuild** operations are performed.

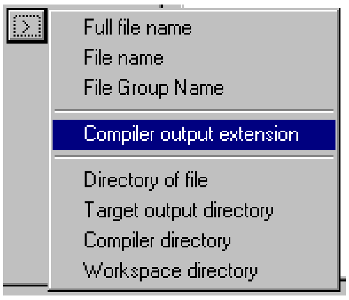
- Internal (default) - uses winIDEA's integrated make utility. In case of Make command, all project files that are out of date are recompiled and finally linked. In case of Rebuild, all project files are recompiled and linked.
- External – the specified executable is invoked. It is the responsibility of this executable to perform the requested operation.

Note: Unlike General/Use External Make which invokes the external make utility after winIDEA identified one or more files being outdated, these tools are ran unconditionally.

Build Manager Macros

Whenever defining command line options, build manager macros can be used.

The macro list is invoked by pressing the > button. The macros that are normally used for the option you are defining command line for are shown.



Build Manager Macros selection

The selected macro is translated to a simple note in the command line, which will be translated to the selected option. For example, the macro selected above, 'Compiler output extension' would translate to $(COUTEXT), which would translate when generating the command line option to, for example, OUT, which is the compiler output file extension.

Available Build Manager Macros and their descriptions

The macros listed here are marked by the macro name, its verbose name as it appears when pressint the > button, and their description.

$(CMPDIR)/Compiler directory

Path specified in the 'Project/Settings/General/Compiler toolset path'

$(IRFDIR)/Workspace directory

The Project root directory

$(EXEDIR)/winIDEA directory

The directory where winIDEA.exe is located

$(EDNAME)/Full file name

The file name of the file currently compiled/assembled

$(DIR)/Directory of file

The directory of the file currently compiled/assembled

$(NOEXT)/File name

The file name of the file currently compiled/assembled, without file extension

$(OUTPUTFILE)/Output file name

The name specified in 'Project/Settings/General/Output file name'

$(OUTPUTDIR)/Target output directory

Current target output directory as specified in 'Project/Settings/General/Output directory'

$(OUTPUTPATH)/Full Target output directory

Current target output directory as specified in 'Project/Settings/General/Output directory' in full path form.

$(OUTPUTNOEXT)/Output file path without extension

The name with path specified in 'Project/Settings/General/Output file name', without file extension

$(OUTPUTNAME)/Output file name without extension

The file name specified in 'Project/Settings/General/Output file name', without file extension

$(CEXT)

File extension specified in 'Project/Settings/File Extensions/Compiler/Input Ext'.

$(COUTEXT)/Compiler Output Extension

File extension specified in 'Project/Settings/File Extensions/Compiler/Output Ext'.

$(AEXT)

File extension specified in 'Project/Settings/File Extensions/Assembler/Input Ext'.

$(AOUTEXT)/Assembler Output Extension

File extension specified in 'Project/Settings/File Extensions/Assembler/Output Ext'.

$(FILEGROUP)/File Group Name

The name of the Group to which the currently compiled/assembled file belongs.

$(INDPATH)/Indirection File Path

Expands the full path of the indirection file name.

$(DEFINES)/List of C preprocessor defines

The list of defines parsed to the C preprocessor.

Using an Example Workspace as a Template

You can make a quick start by modifying one of the example projects for the compiler that you use as follows:

- Use Windows Explorer to create a new directory for the new workspace
- Copy workspace (.JRF) and project configuration (.QRF) files from the example project directory. You can rename them if you wish, just make sure that .JRF and .QRF extensions remain and that the names are the same.
- Copy any project files you wish to include in your project from the example directory. This could be startup files, interrupt function examples, etc.
- Open the newly copied workspace in winIDEA.
- Remove unused example project files from the project files list
- Add your project files to the project files list
- Select the Build command to rebuild the entire project

Build Session

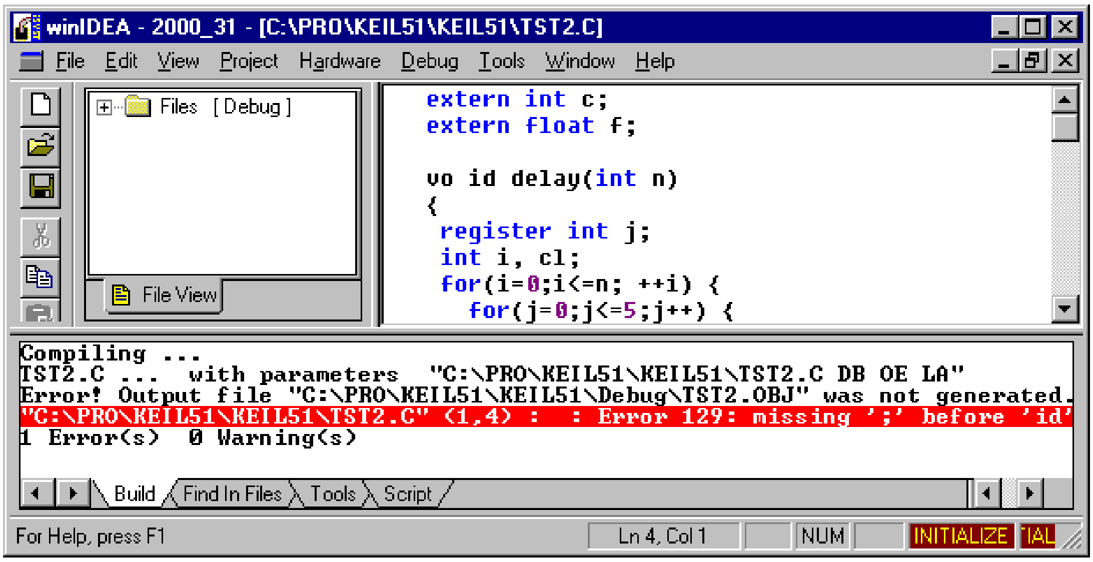
When the Build Manager processes a project file or links the project it creates a child process with redirected standard handles (STDOUT and STDERR). The child process runs in a hidden window, so you do not get to see it while it runs. Any captured output is displayed in the Output window after the process ends.

Output Window

The Output Window is a scrollable, terminal style window that shows raw or filtered output emitted by external tools spawned by winIDEA.

Build Pane

The Build pane displays build progress and compiler, assembler and linker output filtered by respective filter programs. If no filters have been configured, only build progress and unsuccessful generation of expected output file is displayed.


winIDEA - 2000_31 - [C:\PRO\KEIL51\KEIL51\TST2.C]
File Edit View Project Hardware Debug Tools Window Help
Files [Debug]
File View
Build
Find In Files
Tools
Script
For Help, press F1
Ln 4, Col 1
NUM
INITIALIZE
IAL

```
    extern int c;
    extern float f;

    vo id delay(int n)
    {
     register int j;
     int i, cl;
     for(i=0;i<=n; ++i) {
       for(j=0;j<=5;j++) {
```

```
Compiling ...
TST2.C ...  with parameters  "C:\PRO\KEIL51\KEIL51\TST2.C DB OE LA"
Error! Output file "C:\PRO\KEIL51\KEIL51\Debug\TST2.OBJ" was not generated.
"C:\PRO\KEIL51\KEIL51\TST2.C" (1,4) :  : Error 129: missing ';' before 'id'
1 Error(s)  0 Warning(s)
```

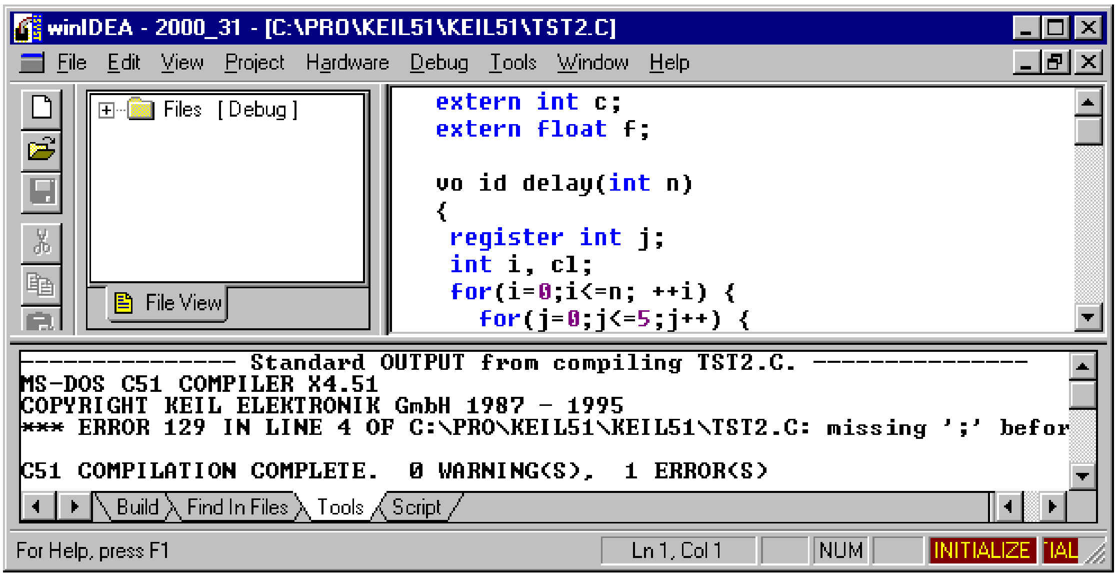
Output Window, Build Pane

In above figure the highlighted line is a filtered error message. By double clicking on it, the source file of the error is opened and positioned to the location of the error.

If no filter was configured for the compiler all lines but this one would have been displayed.

Tools Pane

The 'Tools' pane displays all output emitted to standard output (STDOUT) and standard error (STDERR) by any external tool, including build tools. No filtering occurs.


winIDEA - 2000_31 - [C:\PRO\KEIL51\KEIL51\TST2.C]
File Edit View Project Hardware Debug Tools Window Help
Files [Debug]
File View
Build
Find In Files
Tools
Script
For Help, press F1
Ln 1, Col 1
NUM
INITIALIZE
IAL

```
extern int c;
extern float f;

vo id delay(int n)
{
 register int j;
 int i, cl;
 for(i=0;i<=n; ++i) {
   for(j=0;j<=5;j++) {
```

```
--------------- Standard OUTPUT from compiling TST2.C. ---------------
MS-DOS C51 COMPILER X4.51
COPYRIGHT KEIL ELEKTRONIK GmbH 1987 - 1995
*** ERROR 129 IN LINE 4 OF C:\PRO\KEIL51\KEIL51\TST2.C: missing ';' befor

C51 COMPILATION COMPLETE.  0 WARNING(S),  1 ERROR(S)
```

Output Window, Tools pane

In above figure, error messages were emitted to STDOUT, you can review them but no automatic error source tracking is available.

Note: tools output is captured only when the 'Capture Translators Output' ("Customize page" on page 250) option is checked.

Building

winIDEA's Build Manager can build on demand (compile or assemble) a single project file, all modified project files (make) or all project files (rebuild).

Building a Single Project File

- Open the project file that you wish to build
- Write any desired changes to the source
- Select 'Compile/Assemble' command from the context menu, from the Project menu or click the Compile button on the Project toolbar.

Compile button

alternatively you can:

- Select a file in the Project Workspace window
- Select the 'Compile/Assemble' command from the context menu

Building All Modified Project Files

This is probably the build command you will be using most, since Build Manager automatically detects which files need to be built and performs all necessary actions to get the project up to date.

To build all modified project files

- Select the 'Make' command from the Project menu

or

- Click the Make button on the Project toolbar

Make button

Building All Project Files

On certain occasions, such as when you upgrade your compiler or suspect that the 'Make' didn't get the project built OK, you can instruct the Build Manager to build all project files unconditionally.

To build all project files

- Select the 'Rebuild' command from the Project menu

or

- Click the Rebuild button on the Project toolbar

Rebuild button

Breaking the Build

winIDEA's Build Manager performs all actions in background, so you are free to continue with your work while build is in progress. If for some reason you wish to abort building

- Select the 'Stop Build' command from the Project menu

or

- Click the Stop Build button on the Project toolbar.

Stop Build button

Workgroup Support

winIDEA's file access is designed to allow multiple developers to work on a project.

When two or more developers share project code, simultaneous write access to shared files must be avoided. This is usually achieved through use of a source/revision control system like RCS, PVCS or SourceSafe.

Currently winIDEA integrates to Microsoft's Visual Source Safe and Intersolv PVCS. When integrated support is enabled, following operations are available from winIDEA:

- Add to source control
- Remove from source control
- Get latest version
- Check-in
- Check-out
- Undo check-out
- Refresh status

If a different source control system is used, all these operations must be performed manually in the source control application.

Configuring the source control system

To enable integration to a source control system, select the 'Settings…' command from the Project/Source Control menu.

Source Control System

Determines the source control system, which winIDEA can integrate.

To perform vendor specific configuration, click the 'Configure…' button.

Get files when opening the workspace

Executes a 'Get' command immediately after workspace is loaded.

Check out source files when edited

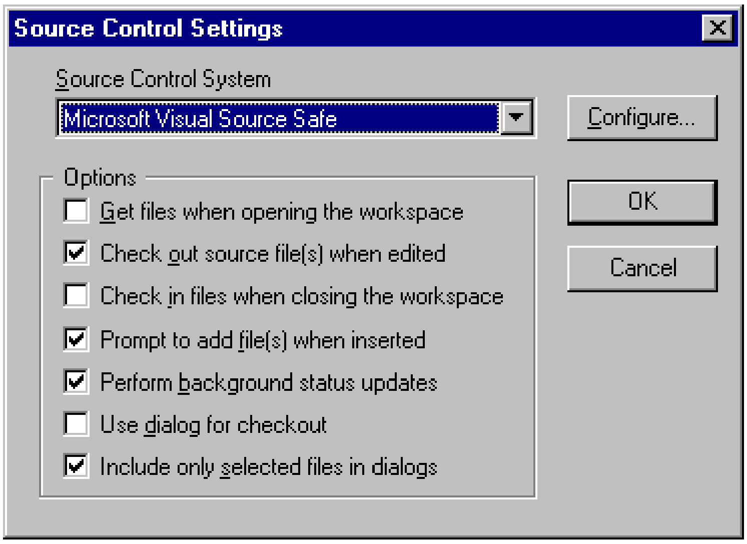
When a file marked read-only is under source control, winIDEA checks it out automatically.

Check in files when closing the workspace

Checks-in all checked-out files when a workspace is closed.

Prompt to add files when inserted

When a file is inserted in the project, winIDEA will prompt you whether you wish to put the file under source control.



Source Control Settings

Source Control System: Microsoft Visual Source Safe

Options

□ Get files when opening the workspace

☑ Check out source file(s) when edited

□ Check in files when closing the workspace

☑ Prompt to add file(s) when inserted

☑ Perform background status updates

□ Use dialog for checkout

☑ Include only selected files in dialogs

The Source Control Settings dialog

Perform background status updates

Source control status is checked periodically in the background.

Use dialog for checkout

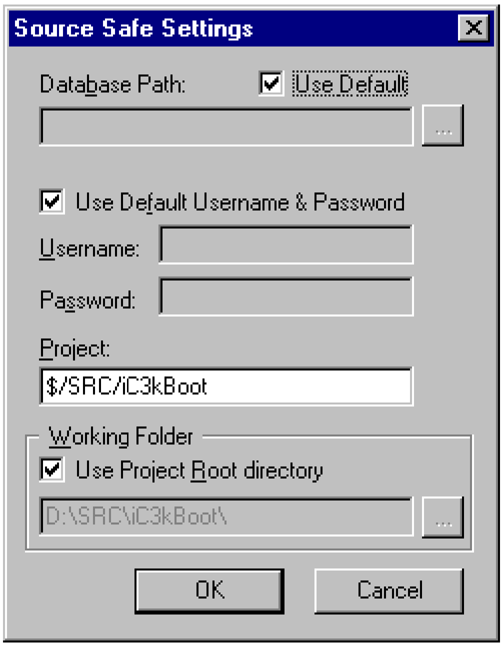
Before file(s) are checked out, the operation is confirmed in a dialog.

Include only selected files in dialogs

Only files selected (in the workspace window or the active file) are shown in a confirmation dialog.

Microsoft Visual Source Safe

Note: Microsoft Visual Source Safe must be properly installed and running before attempting to use it with winIDEA. Please refer to the user's manual of the software for more information.



Database Path: ☑ Use Default

☑ Use Default Username & Password

Username:

Password:

Project: $/SRC/iC3kBoot

Working Folder

☑ Use Project Root directory

D:\SRC\iC3kBoot\

Source Safe settings dialog

Database Path

Specifies the path to the Source Safe database.

Select 'Use Default' option, to use the database path stored in the system registry.

Username and Password

Specifies the user name and password to use when connecting to the source safe server.

Select the 'Use Default Username & Password' option to use the default.

The username and password can be read from the environment variables. To do this, the variable must be enclosed in the ‘%’ sign, for example to use the username from the environment variable called ‘USERNAME’, enter the text ‘%USERNAME%’ into the appropriate window.

Project

Specify the source safe path to the project to which the workspace's project is mapped in.

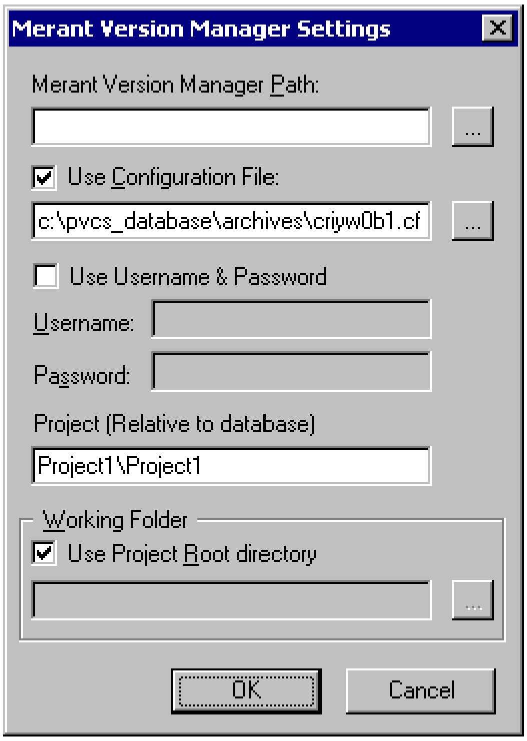
Working Folder

Specify the working directory – typically a folder on the local disk.

Select the 'Use Project Root directory' to use the setting specified in the Project/Settings/General dialog.

Merant Version Manager

Note: Merant Version Manager must be properly installed and running before attempting to use it with winIDEA. Please refer to the user's manual of the software for more information.



Merant Version Manager Path:

☑ Use Configuration File:

c:\pvcs_database\archives\criyw0b1.cf

□ Use Username & Password

Username:

Password:

Project (Relative to database)

Project1\Project1

Working Folder

☑ Use Project Root directory

Merant Version Manager settings dialog

Merant Version Manager Path

Specifies the path to the Merant executable.

Use Configuration File

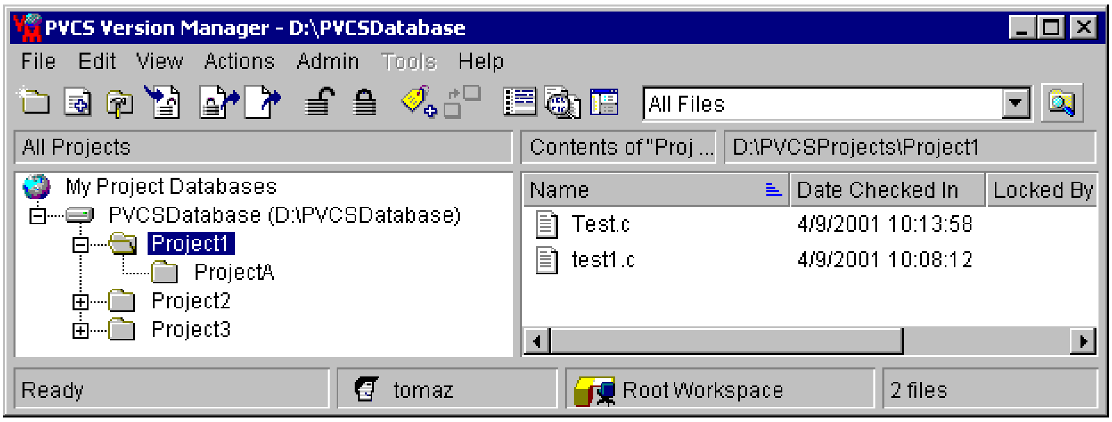
Indicates that the specified configuration file should be used.

Use Username & Password

Specifies the username and password to use for the Merant database.

Project (Relative to database)

Enter the project name, relative to the database here. In the upper example, the project 'Project1' would be used.



Merant Version Manager configuration

Working Folder

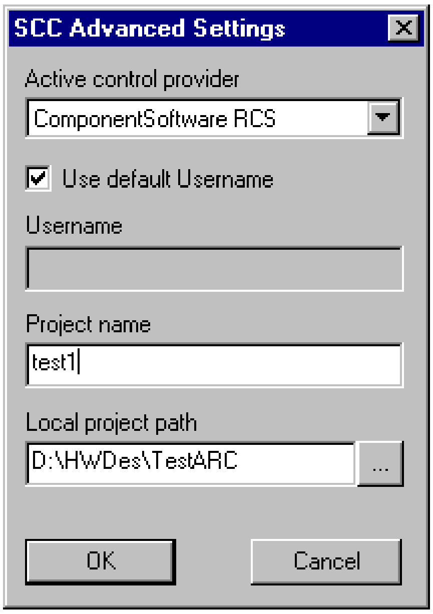
Specify the working directory – typically a folder on the local disk.

Select the 'Use Project Root directory' to use the setting specified in the Project/Settings/General dialog.

Source Code Control Interface (SCCI) Systems

Note: The SCCI software must be properly installed and running before attempting to use it with winIDEA. Please refer to the user's manual of the software for more information.

The Source Code Control (SCC) Interface is a common protocol for source code control providing software. To configure the integration, select 'SCCI Providers' in the Source Control System and press the 'Configure' button.


SCC Advanced Settings

Active control provider: ComponentSoftware RCS

☑ Use default Username

Username:

Project name: test1

Local project path: D:\HWDes\TestARC

SCCI settings dialog

Active control provider

Select the source control provider. All SCC providers will be listed here.

Note: the interface was tested only with ComponentSoftware RCS Source Control and ClearCase.

Username

If the SCCI software uses the same username with which the user is logged in to Windows, keep the 'Use default Username' checkbox checked. Is an other username needed, uncheck the checkbox and enter the correct username.

Project name

Enter the project name, recorded to the master database of the SCCI software (the Repository, if CS-RCS is used).

Local Project Path

Enter the path of the project on the local disk here. The path should not end with a backslash (\), or the software will not be able to save the project to the database.

User interface to a source control system

winIDEA will use different icon colors in the workspace window to indicate file status:

- White background is used for files which are not controlled
- Gray background is used for files that were found in a source control system

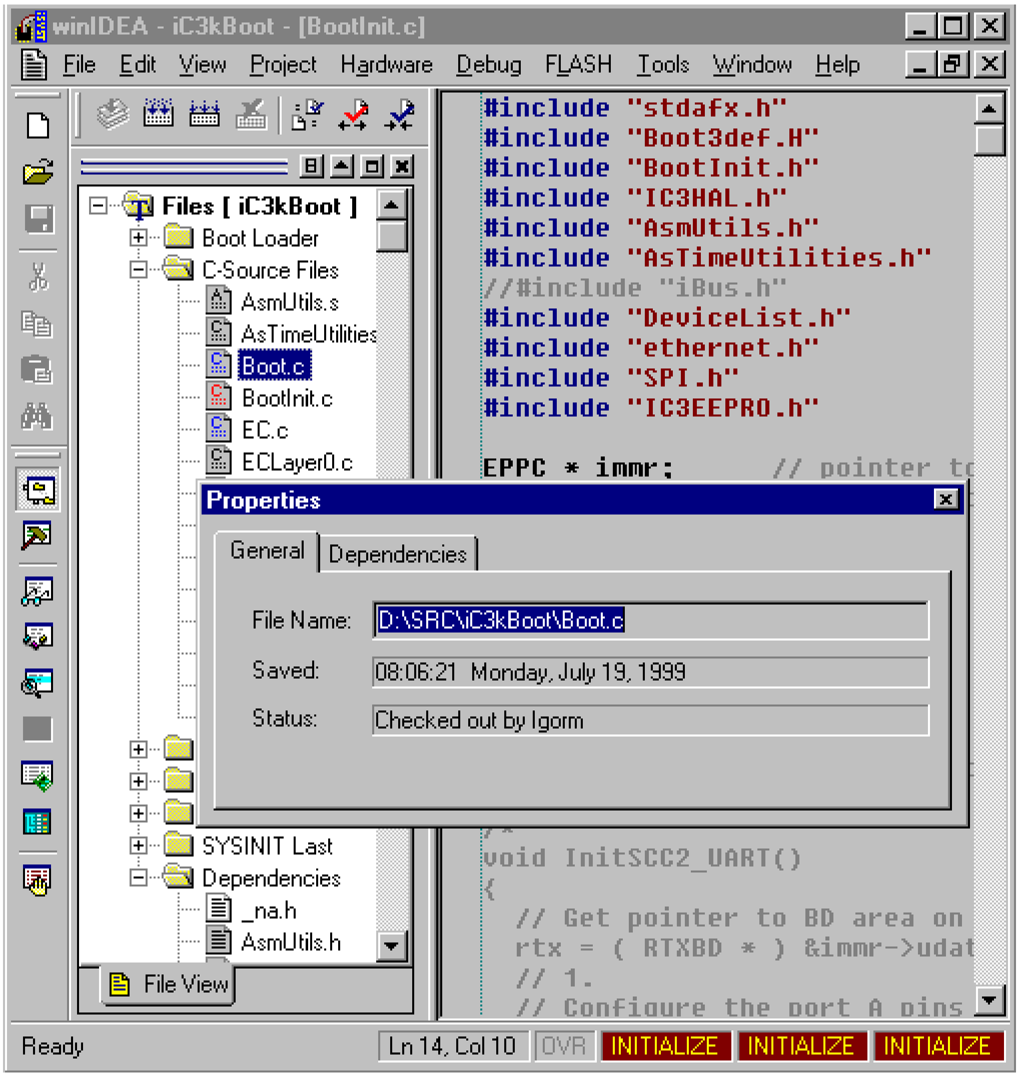
Files, which are source controlled, are furthermore colored:

- Black icon text indicates that the file is checked-in (is available for check-out)
- Red icon text indicates that the file is checked-out (is available for editing)
- Blue icon text indicates that the file is checked-out by another user, or to a different directory

To view detailed source control information:

- Select the file in the workspace window
- Select the 'Properties…' command from the context menu.

Beside file system information, the source control status is displayed in the bottom line. You will find this very useful, when you wish to identify the developer who has a file checked-out that you wish to edit.



```
#include "stdafx.h"
#include "Boot3def.H"
#include "BootInit.h"
#include "IC3HAL.h"
#include "AsmUtils.h"
#include "AsTimeUtilities.h"
//#include "iBus.h"
#include "DeviceList.h"
#include "ethernet.h"
#include "SPI.h"
#include "IC3EEPRO.h"

EPPC * immr;        // pointer tc

void InitSCC2_UART()
{
  // Get pointer to BD area on
  rtx = ( RTXBD * ) &immr->udat
  // 1.
  // Configure the port A pins
```

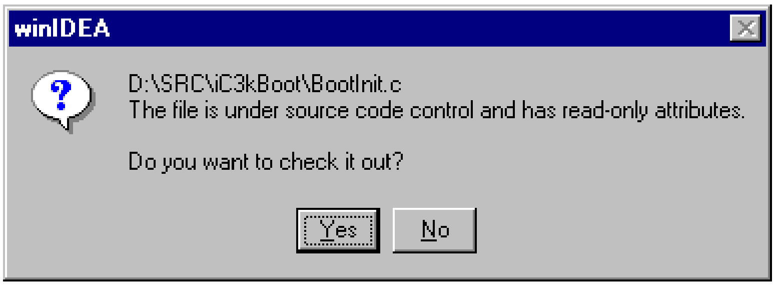
File Name: D:\SRC\iC3kBoot\Boot.c

Saved: 08:06:21 Monday, July 19, 1999

Status: Checked out by Igorm

Workspace window appearance in a source control enabled project.

If an attempt is made to alter contents of file, winIDEA will check if read-write access to the file can be gained through check-out operation. If so, it will prompt for confirmation.



D:\SRC\iC3kBoot\BootInit.c
The file is under source code control and has read-only attributes.

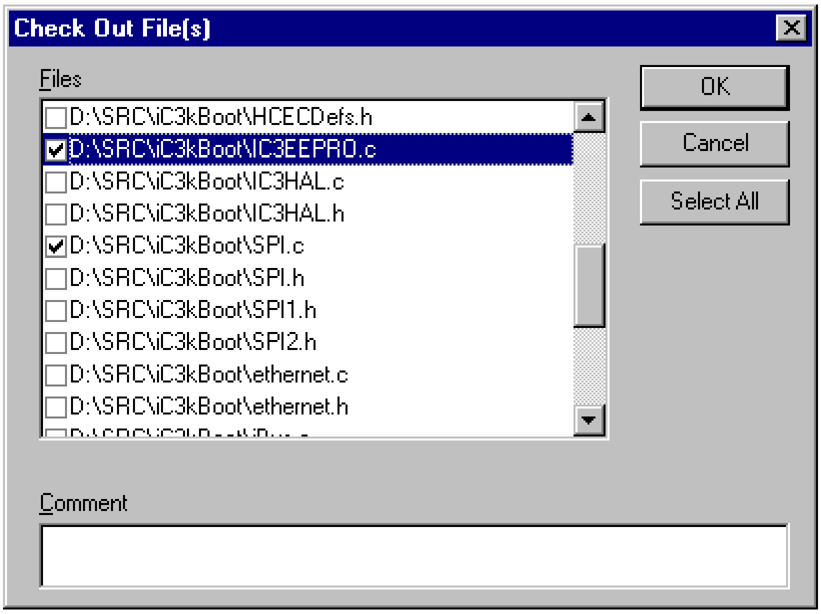
Do you want to check it out?

The check-out prompt

Source Control File Selection

Before a source control operation is performed, a file selection dialog pops up. Depending on the selection mode, different files are shown in the dialog.

- If the source control operation is requested with an editor being active, then only that file is listed in the dialog.
- If some files or groups of files are selected in the workspace window, then only selected files are shown
- Otherwise all controlled files for which the requested operation is available are listed.



□ D:\SRC\iC3kBoot\HCECDefs.h
☑ D:\SRC\iC3kBoot\IC3EEPRO.c
□ D:\SRC\iC3kBoot\IC3HAL.c
□ D:\SRC\iC3kBoot\IC3HAL.h
☑ D:\SRC\iC3kBoot\SPI.c
□ D:\SRC\iC3kBoot\SPI.h
□ D:\SRC\iC3kBoot\SPI1.h
□ D:\SRC\iC3kBoot\SPI2.h
□ D:\SRC\iC3kBoot\ethernet.c
□ D:\SRC\iC3kBoot\ethernet.h

Check-out selection dialog

Which files to put under source control

The following files should be stored in a source control system database:

- program source files. These include C compiler source and include files, assembler source and include files.
- project configuration file (.QRF). See Build Manager "Introduction" on page 231
- any other shared files

The following files are private to user/workstation:

- workspace file (.JRF). See "Workspaces" on page 11.
- intermediate files generated in build process (object files, listing files, assembler files generated by compiling C source, etc.)
- download files

Script Language

winIDEA Script Language

winIDEA provides a simple C-like script language that can be used to facilitate common task like testing. The script files are identified by the ISL extension.

ISL Syntax

The syntax of ISL resembles that of the C programming language. If you are familiar with C it will be easy to write programs in ISL.

The strings in ISL follow C syntax. The backslash character '\' is treated as start of an escape sequence. Here's a list of supported escape sequences:

Character	**ASCII Representation**	**ASCII Value**	**Escape Sequence**
Newline	NL (LF)	10 or 0x0a	\n
Horizontal tab	HT	9	\t
Vertical tab	VT	11 or 0x0b	\v
Backspace	BS	8	\b
Carriage return	CR	13 or 0x0d	\r
Formfeed	FF	12 or 0x0c	\f
Alert	BEL	7	\a
Backslash	\	92 or 0x5c	\\
Question mark	?	63 or 0x3f	\?
Single quotation mark	'	39 or 0x27	\'
Double quotation mark	"	34 or 0x22	\"

An ISL program is based on a single non-document text file.

ISL constitutes of different tokens. These tokens are:

- ISL-keywords
- ISL-operators
- ISL-identifiers
- ISL-string literal
- ISL-numbers

ISL-keywords

- declare
- do
- else
- for
- function
- if
- int
- loop
- return
- var
- void
- while

ISL operators

Operator	Description	Example
=	assign	a=2
+	plus	a=2+3
-	minus	a=a-1
/	divide	a=a/2
*	multiply	a=a*2
&&	logic AND	a&&b
||	logic OR	a||b
!	logic not	!a
==	equal	a==b
!=	not equal	a!=b
<	less	a<b
>	great	a>b
<=	less or equal	a<=b
>=	great or equal	a>=b
( )	parenthesis	(((a-2)*3)+1)/2

ISL identifiers

ISL identifiers are used to name variables and functions. All identifiers are case sensitive and may contain the following characters:

- underscore '_'
- letters ('A'-'Z' and 'a' to 'z')
- digits ('0' to '9').
  A digit must not be the first character of an identifier.

String literals

Have the form:

```
"character-list"
```

Where character-list is a list of ANSI characters.

Currently ISL does not support string variables, but you can use a string literal as a parameter to winIDEA's built in functions (All these function have prefix API).

Example:

```
ISL_APIPrintString( "Hello");
```

ISL numbers

All ISL numbers are signed 4 byte integers.

Your first ISL program

Here is the listing of your first ISL program.

```
function void main()
{
      APIPrintString("Hello!");
}
```

To create and run it proceed as follows:

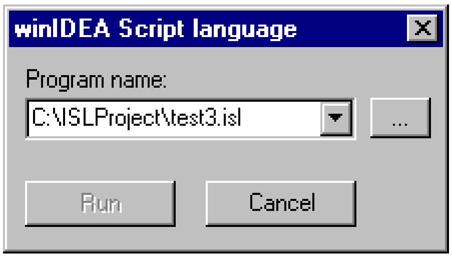
- run winIDEA
- create a new file
- write the above ISL program
- save this file, giving it ".ISL" extension. (for example "Hello.isl").
- select "Run ISL" command from Tools menu or editor's local menu.

Output generated by an ISL program is displayed in the Output window.

If winIDEA can not interpret the ISL program, errors are written to the Build pane of the Output window.

Running a script program

To run a script program, select the 'Run Script…' command from the Tools menu.



The 'Run Script' dialog

In the dialog specify the script file to execute.

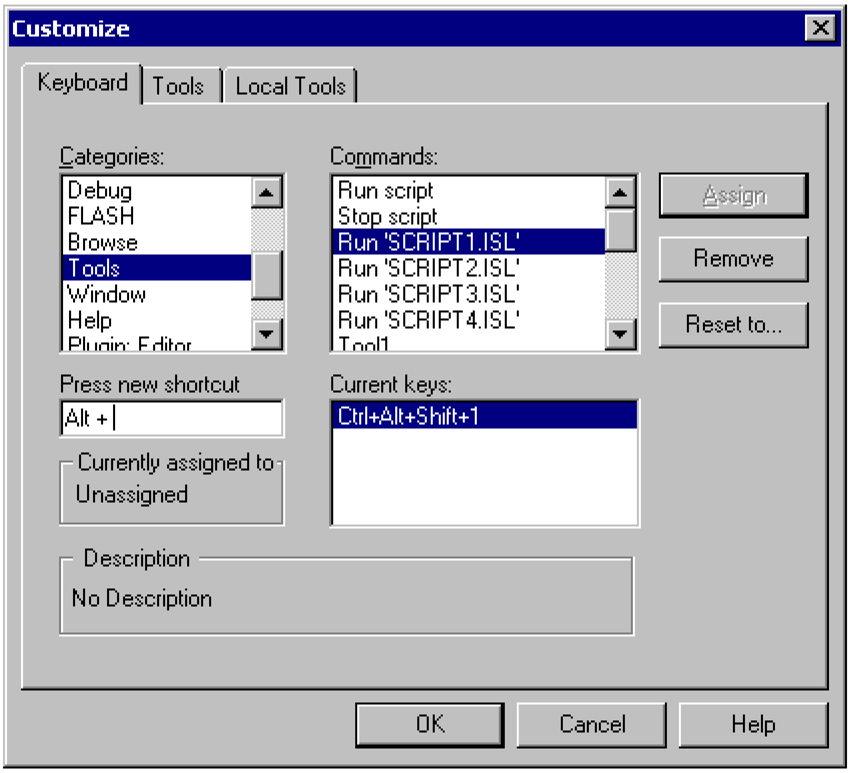
Alternatively, you can start a script program if the script file is open in the editor and you select the 'Run Script' command from the context menu.

Another alternative is to run the script as a keyboard shortcut.

Running a script program as a keyboard shortcut

Four different script programs can be defined to be run as a keyboard shortcut. There are two prerequisites for this:

- the script program must be named 'SCRIPT1.ISL' through 'SCRIPT4.ISL', and
- the appropriate keyboard shortcut must be defined in the 'Tools/Customize/Keyboard' menu in the 'Tools' category for running >Run 'SCRIPT1.ISL'< through >Run 'SCRIPT4.ISL'<.



Categories:
Debug
FLASH
Browse
Tools
Window
Help
Plugin: Editor

Commands:
Run script
Stop script
Run 'SCRIPT1.ISL'
Run 'SCRIPT2.ISL'
Run 'SCRIPT3.ISL'
Run 'SCRIPT4.ISL'
Tool1

Press new shortcut: Alt +

Current keys: Ctrl+Alt+Shift+1

Currently assigned to: Unassigned

Description: No Description

ISL from beginning

ISL program is divided into two parts:

- global declaration block
- functions part, where global declaration block can be omitted. Every function or scope can also have its own local declaration block.

Every ISL program must have one function named 'main'. This function does not accept any parameters, returns no value and must not be declared in the global declaration block. Execution of an ISL program will begin with this function.

Global declaration block

If you will not use any global variable and there will only be the function main in your ISL program there is no need for the global declaration block. The main purpose of this block is to declare global variables and functions for later use.

Remember that you don’t have to declare function the main and all others API functions.

The syntax of the declaration block has the following form:

```
_declaration_block_ =
declare
{
 _function_declaration_;
 _variable_declaration_;
}
```

Function declaration

```
_function_declaration_=
function _return_type_ <Name> (var _variable_type_,…);
```

```
_return_type_ =
void or int
```

```
_variable_type_ =
int
```

Function declaration example:

```
function int Max (var int ,var int );
```

```
function void Test ();
```

Variable declaration

```
_variable_declaration_;
```

```
var _variable_type_ <Name>;
```

Variable declaration example:

```
var int a;
```

In the following example we will write a program which prints the numbers from 0 to 10 in the output window.

```
declare
{
 var int a;
}

function void main()
{
 for (a=0; a<10; a=a+1)
 {
  APIPrintF1("%d",a);
 }
}
```

For printing numbers we used APIPrintF1 which is a simplified version of C function printf. The format specifier recognizes only %d, thus the APIPrintF1 ("%d", a) replaces %d with the value of variable formatted decimally.

In the next example we will show how to use a user defined function. Here is the listing of this example.

```
declare
{
 function int Max(var int, var int);
}

function void main()
{
 declare
 {
  var int a;
 }
 a=Max(2,7);
 APIPrintF1("Max of 2,7 is %d.",a);
}

function int Max(var int a, var int b)
{
 if (a>b)
 {
  return a;
 }
 return b;
}
```

The function 'Max' was first declared in the global declaration block as explained before. The definition of a function is similar to declaration, only this time you must provide variables names as well. Here is the syntax.

```
_function_definition_=

function _return_type_ <Name> (var _variable_type_ 
<Name>, ...)
{
 _function_body_;
}
```

In this example we also use the local declaration block for declaring-defining variable a. The Local declaration has the same syntax as the global declaration block. Function declarations are not supported in the local declaration block.

Expressions

Expressions consist of operators, numbers and variables and are very similar to C expressions. The precedence and associativity is the same as in C language.

Example:

```
a=2*5/7;
```

```
a=b+c;
```

Statements

ISL supports five different types of statements. These are:

- if-else
- loop
- for
- while
- do-while

All statements are very similarly to C statements, except for the 'loop' which is not found in C language. Here is the syntax for all ISL statements.

if-else statement

```
if =
if (_expression_)
{
 _block_body_
}
```

Example:

```
if (a>3)
{
 a=a+1;
}
```

or

```
if - else =
if (_expression_)
{
 _block_body_
}
else
{
 _block_body_
}
```

Example:

```
if (a<3)
{
 a=a+1;
}
else
{
 if (a==4)
 {
  a=0;
 }
 else
 {
  a=a-1;
 }
}
```

loop statement

```
loop =
loop ( _number_)
{
 _block_body_
}
```

Example:

```
loop(10)
{
 APIPrintString("ten times");
}
```

The loop statement repeats the _block_body_ _number_ times. Loop is very simple to use when you need some action only to repeat _number_ times.

for statement

```
for =
for(expression1;expression2;expression3)
{
 _block_body_
}
```

Example:

```
for (a=3;a<6;a=a+1)
{
 APIPrintF1("%d",a);
}
```

or

```
for (;;)
{
 APIPrintString("Forever.");
}
```

while statement

```
while =
while(expression1)
{
 _block_body_
}
```

Example:

```
a=0;
while (a<10)
{
 a=a+1;
 APIPrintF1(“%d”,a);
}
```

or

```
while (1)
{
 APIPrintString(“Forever.”);
}
```

do-while statement

```
do -while =
do
{
 block_body
} while (expression1);
```

Example:

```
a=0;
do
{
 a=a+1;
 APIPrintF1(“%d”,a);
} while (a<10);
```

or

```
do
{
 APIPrintString(“Forever.”);
} while(1);
```

Software API Functions

Summary of all supported software API functions

The API funcitons are sorted in alphabetical order.

int APIAppendOutput(string strFileName, int bOutput);

void APIBeep();

int APIBeginTrace();

int APIClearBreakpoint(int iType, int iHandle);

int APIClearBreakpoints();

void APIClearDisplay();

int APICompareFiles(string pszFile1, string pszFile2, bool bDumpDifLines);

int APICopyMemory(int iFromMemArea, int iFromAddress, int iSize, int iToMemArea, int iToAddress);

int APICreateProcess(string strApplicationName, string strCmdLine, BOOL bSync);

int APIDownload();

int APIDownloadFile(int iFileIndex);

int APIDownloadFile1(string strFileName, int nReserved);

int APIEvaluate(string strExpression);

int APIEvaluate1(int iAccessMethod, string strExpression);

int APIEvaluate2(int nAccessMode, string strExpression);

void APIExit(int iExitCode);

int APIFillMemory(int iAccessMethod, int iMemArea, int iAddress, int iValue, int iSize);

int APIFLASHProgramFile(string strFileName);

void APIGoto(LONG lAddress);

void APIGoto1(string strAddress);

void APIGotoLC(int iLine, int iColumn);

int APIInputNumber(string pszMessage);

int APILoadProject(string strFileName);

int APILoadProject1(string strFileName, int bSaveOld);

void APIMessageBox(string strMessage);

int APIMessageBoxYesNo(string strMessage);

int APIModify(string strLValue, string strExpression);

int APIModify1(string strLValue, int nValue);

int APIOpenMemoryDumpFile(string strFileName, int iForWrite);

int APIPassParameter(string strClass, string strTitle, int iParameter);

void APIPrintB(int iValue, int iNumBits, int iNumBlanks);

void APIPrintF1(string strText,int iV0);

void APIPrintF1LC(int iLine, int iColumn, string strText,int iV0);

void APIPrintF2(string strText,int iV1,int iV2);

void APIPrintF3(string strText,int iV1,int iV2,int iV3);

void APIPrintInteger(int iValue);

void APIPrintIntegerLC(int iLine, int iColumn, int iValue);

void APIPrintString(string strText);

void APIPrintStringLC(int iLine, int iColumn, string strText);

int APIProjectImport(string strImportFileName, int iReserved);

int APIProjectIsUpToDate(int iReserved);

int APIProjectMake(int iLinkMakeBuild);

int APIProjectSetTarget(string strTargetName);

int APIReadInt(int nAccessMode, int nMemArea, int nAddress, int nSize, int nBigEndian);

int APIReadMemory(int iMemArea, int iAddress, int iSize);

int APIReadMemory1(int iAccessMethod, int iMemArea, int iAddress, int iSize);

int APIReadMemory2(int iAccessMethod, str strLocation, int iSize);

int APIReadMemoryDump(int iAccessMode, int iMemArea, int iAddress, int iSize, int iReserved)

int APIReset(int bAndRun);

int APIRun();

int APISaveAccessCoverage(string strFileName, int nFlags);

int APISaveExecutionCoverage(string strFileName, int nFlags);

int APISaveProfiler(string strFileName, int nFlags);

int APISaveProject(string strFileName);

int APISaveTrace

int APISetBreakpoint(int iType, string strBP);

int APISetOutput(string strFileName, int bOutput);

int APISetOutput1(string strFileName, int bOutput, int bNoDefaultCRLF);

void APISetRegisterDump(int bDump);

void APISleep(int nMiliseconds);

int APIStepInto(int bHighLevel, int iNumSteps);

int APIStepOver(int iHighLevel, int iNumSteps);

int APIStop();

int APIVerifyDownload();

int APIWaitStatus(int nStatus);

int APIWaitStatus1(int nStatus, int iTimeout);

int APIWriteInt(int nAccessMode, int nMemArea, int nAddress, int nSize, int nBigEndian, int nValue);

int APIWriteMemory(int iMemArea, int iAddress, int iValue, int iSize);

int APIWriteMemory1(int iAccessMethod, int iMemArea, int iAddress, int iValue, int iSize);

int APIWriteMemory2(int iAccessMethod, str strLocation, int iValue, int iSize);

int APIWriteMemoryDump(int iAccessMode, int iMemArea, int iAddress, int iSize, int iReserved);

int APIWriteTrace(str strFileName, int nFrom, int nTo);

Please note that all string values use the same sting literals as the ISL language and follow the ANSI C convention for escape sequences:

Character	**ASCII Representation**	**ASCII Value**	**Escape Sequence**
Newline	NL (LF)	10 or 0x0a	\n
Horizontal tab	HT	9	\t
Vertical tab	VT	11 or 0x0b	\v
Backspace	BS	8	\b
Carriage return	CR	13 or 0x0d	\r
Formfeed	FF	12 or 0x0c	\f
Alert	BEL	7	\a
Backslash	\	92 or 0x5c	\\
Question mark	?	63 or 0x3f	\?
Single quotation mark	'	39 or 0x27	\'
Double quotation mark	"	34 or 0x22	\"

Also, please note that the integer values in the ISL language can store 32-bit values.

Please note that there is also a connection of hardware API functions. For more information on Hardware API Functions, please consult the Hardware User's Guide.

int APIAppendOutput(string strFileName, int bOutput);

Configures file and screen output.

return value

Returns 1 on success, 0 on failure

strFileName

Defines the name of the file that is to receive output. If the file already exists, the output will be appended to it.

If this parameter is blank, output is not written to any file.

bOutput

When set to 1 output is written to the output window, if set to 0, output is not written to the output window.

void APIBeep();

Beeps the system tweeter.

Example

APIBeep();

Beeps the tweeter

int APIBeginTrace();

Begins trace

return value

Returns 1 on success, 0 on failure

Example

APIBeginTrace();

Begins the trace

int APIClearBreakpoint(int iType, int iHandle);

Clears a breakpoint

return value

Returns 1 on success, 0 on failure

iType

Defines breakpoint type (see APISetBreakpoint)

iHandle

Specifies the handle of the breakpoint (see APISetBreakpoint)

Example

A=APISetBreakpoint(0,"0x1234")

...

APIClearBreakpoint(0, A);

Clears the execution breakpoint you have previously set with APISetBreakpoint and its handle has been stored to the variable 'A'.

int APIClearBreakpoints();

Clears all execution breakpoints

return value

Returns 1 on success, 0 on failure

Example

APIClearBreakpoints();

Clears all breakpoints

void APIClearDisplay();

Clears the output window.

Example

APIClearDisplay();

Clears the output window.

int APICompareFiles(string pszFile1, string pszFile2, bool bDumpDifLines)

Compares two files

return value

Returns 1 if files compare OK, 0 if files are different

pszFile1 and pszFile2

Files that should be compared

bDumpDifLines

When set to 1 lines in which there are differences are listed.

Example

APICompareFiles("C:\\File1.txt", "C:\\File2.txt", 1);

Compares files C:\File1.txt and C:\File2.txt and lists the differences between them.

int APICopyMemory(int iFromMemArea, int iFromAddress, int iSize, int iToMemArea, int iToAddress);

Copies a range of memory to another location

return value

Returns 1 on success, 0 on failure

iFromMemArea

Specifies CPUs memory area where the memory is to be copied from

iFromAddress

Address to copy from

iSize

Number of bytes to be copied

iToMemArea

Specifies CPUs memory area where the memory is to be copied to

iToAddress

Address to copy to

int APICreateProcess(string strApplicationName, string strCmdLine, BOOL bSync);

This function creates a new process on the host.

return value

If process is successfully created the return value is 0 if bSync is 0; otherwise it is the exit code of the child process.

In case of failure, the return value is –1.

strApplicationName

The path to the application.

strCmdLine

Command line parameters for the application.

bSync

If 0, the APICreateProcess will return immediately, otherwise, it will wait for the child process to terminate.

Note: use this function to spawn a child process that can perform any further processing of output obtained by script execution.

Example

APICreateProcess("c:\\test\\test.exe", "/demo /run", 0);

Runs the program c:\test\test.exe with the command line parameters '/demo /run' and doesn't wait for it to finish.

int APIDownload();

Performs program download.

return value

Returns 1 on success, 0 on failure

Example

APIDownload();

Perform the program download.

int APIDownloadFile(int iFileIndex);

Performs program download of a file specified in the ‘Debug/Files For Download…/Target Download Files’ tab.

iFileIndex

The index of the download file from the ‘Debug/Files For Download…/Target Download Files’ tab. Index 0 corresponds to the first file specified in the ‘Target Download Files’ tab.

return value

Returns 1 on success, 0 on failure

Example

APIDownloadFile(1)

Downloads second file from the file list in the 'Debug/Files for

download/Target download' tab

int APIDownloadFile1(string strFileName, int nReserved);

Performs program download of a file matching the strFileName string specified in the ‘Debug/Files For Download…/Target Download Files’ tab.

strFileName

The name of the download file from the ‘Debug/Files For Download…/Target Download Files’ tab.

nReserved

Reserved for future use.

return value

Returns 1 on success, 0 on failure

Example

APIDownloadFile1("Sample.bin", 0)

Downloads Sample.bin file from the file list in the 'Debug/Files for

download/Target download' tab

int APIEvaluate(string strExpression);

Evaluates the expression and outputs the result. The output must be first defined with the function APISetOutput or APISetOutput1.

return value

Returns 1 on success, 0 on failure

strExpression

A valid C expression to evaluate

int APIEvaluate1(int iAccessMethod, string strExpression);

Evaluates the expression and returns the result

return value

The value of the evaluated expression. If the expression can not be evaluated, 0 is returned.

iAccessMethod

Defines the access method to be used. Currently following values are defined:

- 0 – regular monitor access. If the CPU is running, it is stopped, memory is read and CPU set running again
- 1 – real-time access. For the function to succeed with this access mode, the debugger must support real-time access

strExpression

A valid C expression to evaluate

int APIEvaluate2(int nAccessMode, string strExpression);

Evaluates the expression and outputs the result. The output must be first defined with the function APISetOutput or APISetOutput1.

return value

Returns 1 on success, 0 on failure

nAccessMode

Defines the access method to be used. Currently following values are defined:

- 0 – regular monitor access. If the CPU is running, it is stopped, memory is read and CPU set running again
- 1 – real-time access. For the function to succeed with this access mode, the debugger must support real-time access

strExpression

A valid C expression to evaluate

void APIExit(int iExitCode);

Exits winIDEA.

iExitCode

This value is returned to the calling process.

Example

APIExit(99)

Exits winIDEA with exit code 99.

int APIFillMemory(int iAccessMethod, int iMemArea, int iAddress, int iValue, int iSize);

Used to fill a memory range. The LSB of iValue is used to fill iSize bytes.

return value

Returns 1 on success, 0 on failure

iAccessMethod

Defines the access method to be used. Currently following values are defined:

- 0 – regular monitor access. If the CPU is running, it is stopped, memory is read and CPU set running again
- 1 – real-time access. For the function to succeed with this access mode, the debugger must support real-time access

iMemArea

Specifies CPUs memory area - zero based index of memory area as seen in the Open Memory Window dialog.

iAddress

Address to write to

iValue

The value to be written (only the LSB is used)

iSize

Number of bytes to fill

int APIFLASHProgramFile(string strFileName);

Writes the file to the FLASH using current FLASH settings

return value

Returns 1 on success, 0 on failure

strFileName

File that should be written to the FLASH memory. When file path is given, the download files list is searched for a matching entry. If found, the settings from the download file are used, otherwise the file settings are auto detected.

If the strFileName is empty, all the files configured in the FLASH setup are used.

void APIGoto(LONG iAddress)

Presets execution point.

return value

Returns 1 on success, 0 on failure

iAddress
The address to preset the execution point to

void APIGoto1(string strAddress)

Presets execution point.

return value

Returns 1 on success, 0 on failure

strAddress
The address to preset the execution point to

void APIGotoLC(int iLine, int iColumn);

Positions the print point of the output window.

iLine, iColumn

The line and column of the new print position. A subsequent print operation will be printed on that position.

int APIInputNumber(string pszMessage);

Opens a dialog asking you to enter a number.

pszMessage

The message which the dialog shows.

return value

Returns the number entered, returns 0 if Cancel is pressed.

Example:

```
function void main()
{
  declare
  {
    var int a;
  }
  a=APIInputNumber("Enter number:");
}
```

int APILoadProject(string strFileName);

Opens workspace file defined by strFileName

strFileName

Path of the project workspace to open.

return value

Returns 1 on success, 0 on failure

int APILoadProject1(string strFileName, int bSaveOld);

Opens workspace file defined by strFileName

strFileName

Path of the project workspace to open.

bSaveOld

Specify 1 to save changes to the existing workspace, or 0 to discard them.

Exits winIDEA.

iExitCode

The return code passed to the calling process.

void APIMessageBox(string strMessage);

Displays a message box.

strMessage

The text of the message to be displayed.

int APIMessageBoxYesNo(string strMessage);

Displays a message box, giving 'Yes' and 'No' buttons as choice.

return value

If user selects 'Yes' function returns 1, otherwise 0.

strMessage

The text of the message to be displayed.

int APIModify(string strLValue, string strExpression);

Modifies a location

return value

Returns 1 on success, 0 on failure

strLValue

The expression to be modified - this expression must evaluate to a target location

strExpression

The new value that strLValue should assume

Example:

```
APIModify("#iCounter", ":0x1200")
```

Modifies the global variable iCounter with the value from the address 0x1200.

int APIModify1(string strLValue, int nValue);

Writes ‘nValue’ into ‘strLValue’

return value

Returns 1 on success, 0 on failure

strLValue

The expression to be modified - this expression must evaluate to a target location

nValue

The new value that strLValue should assume - this could be either a number literal or an integer script variable.

int APIOpenMemoryDumpFile(string strFileName, int iForWrite);

Opens or closes a dump file for memory write source or memory read destination.

return value

Returns 1 on success, 0 on failure

strFileName

Specifies the path to the dump file. if this string is empty the file that was last open is closed

iForWrite

0 for read destination, 1 for write destination

Note: one 'for write' file and one 'for read' file can be open simultaneously.

int APIPassParameter(string strClass, string strTitle, int iParameter);

Passes parameter iParameter to the desktop window specified by strClass/strTitle.

The parameter is passed using the Windows WM_COPYDATA message.

strClass

The name of the class of the desktop window. If this parameter is empty, winIDEA will pass NULL in the FindWindow call to obtain the receiver window handle.

strTitle

The name of the desktop window. If this parameter is empty, winIDEA will pass NULL in the FindWindow call to obtain the receiver window handle.

iParameter

The iParameter is packed into the dwData field of the COPYDATASTRUCT whose address is passed in the LPARAM field of the message. Other fields are set to zero.

return value

Returns 1 if the window could be found, 0 if not.

void APIPrintB(int iValue, int iNumBits, int iNumBlanks);

Binary print value.

iValue

The value to be printed.

iNumBits

Number of bits to print.

iNumBlanks

Number of blanks to insert between individual bits.

void APIPrintF1(string strText,int iV0);

Formatted print of one value.

strText

The format string to be used for formatting. Should contain only one formatting (%) character.

The standard sptrinf function is used to format the string.

iV0

The value to be printed.

void APIPrintF1LC(int iLine, int iColumn, string strText,int iV0);

Formatted print of one value.

iLine, iColumn

The line and column of the print position.

strText

The format string to be used for formatting. Should contain only one formatting (%) character.

The standard sptrinf function is used to format the string.

iV0

The value to be printed.

void APIPrintF2(string strText,int iV1,int iV2);

Formatted print of two values.

strText

The format string to be used for formatting. Should contain only two formatting (%) characters.

The standard sptrinf function is used to format the string.

iV0, iV1

Values to be printed.

void APIPrintF3(string strText,int iV1,int iV2,int iV3);

Formatted print of three values.

strText

The format string to be used for formatting. Should contain only three formatting (%) characters.

The standard sptrinf function is used to format the string.

iV0, iV1, iV2

Values to be printed.

void APIPrintInteger(int iValue);

Prints decimally formatted iValue.

iValue

The value to be printed.

void APIPrintIntegerLC(int iLine, int iColumn, int iValue);

Prints decimally formatted iValue on position specified by iLine and iColumn.

iLine, iColumn

The line and column of the print position.

iValue

The value to be printed.

void APIPrintString(string strText);

Prints strText.

strText

The text to be printed.

void APIPrintStringLC(int iLine, int iColumn, string strText);

Prints strText on position specified by iLine and iColumn.

iLine, iColumn

The line and column of the print position.

strText

The text to be printed.

int APIProjectImport(string strImportFileName, int iReserved);

This function imports project configuration for an XML file.

return value

1 in case of success, 0 in case of failure.

strImportFileName

Path to the XML file containing project information.

iReserved

Reserved, must be 0.

int APIProjectMake(int iLinkMakeBuild);

Makes the current project.

return value

Returns 1 on success, 0 on failure

iLinkMakeBuild

Specifies the make operation to perform:

- 0 - Link
- 1 - Make
- 2 – Rebuild

int APIProjectIsUpToDate(int iReserved);

Checks whether the current project is up to date.

return value

Returns 0 is not up to date, otherwise non-zero

iReserved

Reserved for future use.

int APIProjectSetTarget(string strTargetName);

Sets the current project target.

return value

Returns 1 on success, 0 on failure

strTargetName

Name of the new target.

int APIReadInt(int nAccessMode, int nMemArea, int nAddress, int nSize, int nBigEndian);

Reads an integer from memory

return value

The function returns the integer read, 0 if access fails

nAccessMode

Defines the access method to be used. Currently following values are defined:

- 0 - regular monitor access. If the CPU is running, it is stopped, memory is read and CPU set running again
- 1 – real-time access. For the function to succeed with this access mode, the debugger must support real-time access

nMemArea

Specifies CPUs memory area - zero based index of memory area as seen in the Open Memory Window dialog.

nAddress

Start address

nSize

The size of the integer in bytes

nBigEndian

0 if the memory is to be interpreted as low byte first

organization, 1 if high byte first organization

int APIReadMemory(int iMemArea, int iAddress, int iSize);

Reads memory and dumps it to output. The output must be first defined with the function APISetOutput or APISetOutput1.

return value

Returns 1 on success, 0 on failure

iMemArea

Specifies CPUs memory area - zero based index of memory area as seen in the Open Memory Window dialog.

iAddress

Start address

iSize

Number of bytes to read

int APIReadMemory1(int iAccessMethod, int iMemArea, int iAddress, int iSize);

Reads memory and dumps it to output. The output must be first defined with the function APISetOutput or APISetOutput1.

return value

Returns 1 on success, 0 on failure

iAccessMethod

Defines the access method to be used. Currently following values are defined:

- 0 -   regular monitor access. If the CPU is running, it is stopped, memory is read and CPU set running again
- 1 – real-time access. For the function to succeed with this access mode, the debugger must support real-time access

iMemArea

Specifies CPUs memory area - zero based index of memory area as seen in the Open Memory Window dialog.

iAddress

Start address

iSize

Number of bytes to read

int APIReadMemory2(int iAccessMethod, string strLocation, int iSize);

Reads memory and dumps it to output. The output must be first defined with the function APISetOutput or APISetOutput1.

return value

Returns 1 on success, 0 on failure

iAccessMethod

Defines the access method to be used. Currently following values are defined:

- 0 – regular monitor access. If the CPU is running, it is stopped, memory is read and CPU set running again
- 1 – real-time access. For the function to succeed with this access mode, the debugger must support real-time access

strLocation

A name of variable, label or an expression evaluating to a memory location. Typically a name of a variable.

iSize

Number of bytes to read

int APIReadMemoryDump(int iAccessMode, int iMemArea, int iAddress, int iSize, int iReserved);

Reads iSize bytes from memory and writes in the dump file

return value

Returns 1 on success, 0 on failure

iAccessMode

Defines the access method to be used. Currently following values are defined:

- 0 – regular monitor access. If the CPU is running, it is stopped, memory is read and CPU set running again
- 1 – real-time access. For the function to succeed with this access mode, the debugger must support real-time access

iMemArea

Specifies CPUs memory area - zero based index of memory area as seen in the Open Memory Window dialog.

iAddress

Start address

iSize

Number of bytes to read

iReserved

Reserved, must be zero

Example:

the bellow program reads 0x1000 bytes from address 0 in the dump file. It then opens the dump file for MemoryWrite access and writes the same bytes to address 0x2000 - hence copying 0x1000 bytes from 0x0000 to 0x2000.

```
function void main()
{
  APIOpenMemoryDumpFile("DUMP.DMP", 0);
  APIReadMemoryDump(0, 0, 0, 0x1000, 0);
  APIOpenMemoryDumpFile("", 0);
  APIOpenMemoryDumpFile("DUMP.DMP", 1);
  APIWriteMemoryDump(0, 0, 0x2000, 0x1000, 0);
  APIOpenMemoryDumpFile("", 1);
}
```

int APIReset(int bAndRun);

Resets the CPU

return value

Returns 1 on success, 0 on failure

bAndRun

Set to 1 if you wish the CPU to resume running immediately after being released from RESET state.
If this parameter is set to 0, the CPU will enter STOP mode after released.

int APIRun();

Sets the CPU in running.

return value

Returns 1 on success, 0 on failure

int APISaveAccessCoverage(string strFileName, int nFlags);

Saves access coverage data to a text file.

return value

Returns 1 on success, 0 on failure

strFileName

Specifies the path of the file where the data should be saved to.

nFlags

A value mask, whose bits specify:

- 0x01 - use hexadecimal numbers
- 0x02 - write only not accessed areas

int APISaveExecutionCoverage(string strFileName, int nFlags);

Saves execution coverage data to a text file.

return value

Returns 1 on success, 0 on failure

strFileName

Specifies the path of the file where the data should be saved to.

nFlags

A value mask, whose bits specify:

- 0x01 - use hexadecimal numbers
- 0x02 - write only not executed areas

int APISaveProfiler(string strFileName, int nFlags);

Saves profiler data to a text file.

return value

Returns 1 on success, 0 on failure

strFileName

Specifies the path of the file where the data should be saved to.

nFlags

Reserved, must be zero.

int APISaveProject(string strFileName);

Saves the workspace

strFileName

Path of the workspace file to which the configuration is saved.

return value

Returns 1 on success, 0 on failure

int APISaveTrace(string strFileName, int nFlags);

Saves profiler data to a text file.

return value

Returns 1 on success, 0 on failure

strFileName

Specifies the path of the file where the data should be saved to.

nFlags

Reserved, must be zero.

int APISetBreakpoint(int iType, string strBP);

Sets a breakpoint

return value

On success returns a breakpoint handle - used by APIClearBreakpoint to clear the breakpoint, on failure -1 is returned

iType

Defines the type of breakpoint to be set

- 0 - for execution breakpoints
- 1 - for memory access breakpoints
- 2 - for IO access breakpoints (Z80 family only)

strBP

Defines the breakpoint address

numerical	"0x1234"
symbolic	"main"
range (type 1 and 2)	"0x1000-0x1FFF"

int APISetOutput(string strFileName, int bOutput);

Configures file and screen output.

return value

Returns 1 on success, 0 on failure

strFileName

Defines the name of the file that is to receive output.

If this parameter is blank, output is not written to any file.

bOutput

When set to 1 output is written to the output window, if set to 0, output is not written to the output window.

int APISetOutput1(string strFileName, int bOutput, int bNoDefaultCRLF);

Configures file and screen output.

return value

Returns 1 on success, 0 on failure

strFileName

Defines the name of the file that is to receive output.

If this parameter is blank, output is not written to any file.

bOutput

When set to 1 output is written to the output window, if set to 0, output is not written to the output window.

bNoDefaultCRLF

When set to 1 a default CR-LF (new line) will not be generated automatically after every screen print. To enforce positioning in a new line, append the '\n' character to the string printed.

void APISetRegisterDump(int iDump);

Controls register printing.

iDump

Set to 2 if all registers should be dumped every time program execution stops.

Set to 1 if only the PC (Program Counter) register is to be dumped.

Set to 0 if no registers should be dumped.

void APISleep(int nMiliseconds);

Suspends winIDEA for the specified amount of time.

nMilliseconds

the number of milliseconds to wait.

int APIStepInto(int bHighLevel, int iNumSteps);

Executes single program steps.

return value

Returns 1 on success, 0 on failure

bHighLevel

Set to 1 if you wish to perform single high level (source level) program steps, set to 0 to execute single instruction steps.

iNumSteps

Specifies the number of steps to be executed

int APIStepOver(int iHighLevel, int iNumSteps);

Executes single program steps, without stepping into function and subroutine calls.

return value

Returns 1 on success, 0 on failure

bHighLevel

Set to 1 if you wish to perform single high level (source level) program steps, set to 0 to execute single instruction steps.

iNumSteps

Specifies the number of steps to be executed

int APIStop();

Stops the code execution.

return value

Returns 1 on success, 0 on failure

int APITerminalConnect(int nOn);

This function opens and connects the terminal window. Set 0 to disconnect, set 1 to open and connect, set 2 to disconnect and close.

return value

Returns 1 on success, 0 on failure

int APIVerifyDownload();

Verifies the downloaded code.

return value

Returns 1 on success, 0 if verify fails

int APIWaitStatus(int nStatus);

Pauses ISL execution until the specified status is reached

return value

Returns 1 on success, 0 on failure

nStatus

Specifies the status to wait for

- 0 - CPU STOP
- 1 - CPU RUN
- 2 - TRACE WAITING
- 3 - TRACE SAMPLING
- 4 - TRACE LOADING
- 5 - TRACE IDLE
- 6 - PROJECT BUILD FINISHED

Notes on using APIWaitStatus

When using APIWaitStatus in combination with APIReset, certain problems can occur.

```
APISetBreakpoint(iBPType, "0x948D");

/* Reset and run */

APIReset(1);

/* Wait till CPU runs */

APIWaitStatus( 1 );
```

```
         first you set a breakpoint,

         next you reset and run the CPU,

         you wait until the CPU state is running.
```

This script is interpreted on the PC and runs asynchronously of the target execution program that is started in step 2 (CPU is set into running before APIReset(1) returns. If a breakpoint is hit before APIWaitStatus(1) is called, the CPU will already be stopped and the APIWaitStatus will wait forever.

The solution is not to use the APIWaitStatus(1) at all, unless you want to wait for external resets or IRQs that can independently of the winIDEA set CPU to running. The script functions like APIReset(1) and APIRun, always set CPU to running, and there is no need to wait for it.

int APIWaitStatus1(int nStatus, int iTimeout);

Pauses ISL execution until the specified status is reached or until the timeout is reached

return value

Returns 0 on timeout, 1 on success, 2 on success but the waited operation failed for other reasons, i.e. waiting for build to finish succeeded, but the building itself had errors.

nStatus

Specifies the status to wait for

- 0 - CPU STOP
- 1 - CPU RUN
- 2 - TRACE WAITING
- 3 - TRACE SAMPLING
- 4 - TRACE LOADING
- 5 - TRACE IDLE
- 6 - PROJECT BUILD FINISHED

iTimeout

Specifies the maximum time in milliseconds to wait for the specified status. If the timeout is reached before the status is reached, the function returns 0.

int APIWriteInt(int nAccessMode, int nMemArea, int nAddress, int nSize, int nBigEndian, int nValue);

Writes an integer (nValue) to memory

return value

Returns 1 on success, 0 on failure

nAccessMode

Defines the access method to be used. Currently following values are defined:

- 0 – regular monitor access. If the CPU is running, it is stopped, memory is read and CPU set running again
- 1 – real-time access. For the function to succeed with this access mode, the debugger must support real-time access

nMemArea

Specifies CPUs memory area - zero based index of memory area as seen in the Open Memory Window dialog.

nAddress

Start address

nSize

The size of the integer in bytes

nBigEndian

0 if the memory is to be interpreted as low byte first

organization, 1 if high byte first organization

nValue

The value to be written

int APIWriteMemory(int iMemArea, int iAddress, int iValue, int iSize);

Writes a value to memory

return value

Returns 1 on success, 0 on failure

iMemArea

Specifies CPUs memory area - zero based index of memory area as seen in the Open Memory Window dialog.

iAddress

Address to write to

iValue

The value to be written

iSize

Number of bytes used in iValue to write (1-4)

Example:

to write 0x1234 to address 0x1000, area 0

```
APIWriteMemory(0, 0x1000, 0x1234, 2)
```

size is 2 because 0x1234 takes 2 bytes

to write 0x00001234 to address 0x1000, area 0

```
APIWriteMemory(0, 0x1000, 0x1234, 4)
```

size is 4 because 0x00001234 takes 4 bytes

int APIWriteMemory1(int iAccessMethod, int iMemArea, int iAddress, int iValue, int iSize);

Writes a value to memory

return value

Returns 1 on success, 0 on failure

iAccessMethod

Defines the access method to be used. Currently following values are defined:

- 0 – regular monitor access. If the CPU is running, it is stopped, memory is read and CPU set running again
- 1 – real-time access. For the function to succeed with this access mode, the debugger must support real-time access

iMemArea

Specifies CPUs memory area - zero based index of memory area as seen in the Open Memory Window dialog.

iAddress

Address to write to

iValue

The value to be written

iSize

Number of bytes used in iValue to write (1-4)

int APIWriteMemory2(int iAccessMethod, str strLocation, int iValue, int iSize);

Writes a value to memory

return value

Returns 1 on success, 0 on failure

iAccessMethod

Defines the access method to be used. Currently following values are defined:

- 0 – regular monitor access. If the CPU is running, it is stopped, memory is read and CPU set running again
- 1 – real-time access. For the function to succeed with this access mode, the debugger must support real-time access

strLocation

Expression evaluating to a memory location. Typically a name of a variable.

iValue

The value to be written

iSize

Number of bytes used in iValue to write (1-4)

int APIWriteMemoryDump(int iAccessMode, int iMemArea, int iAddress, int iSize, int iReserved);

Reads iSize bytes from the dump file and writes them into memory.

return value

Returns 1 on success, 0 on failure

iAccessMode

Defines the access method to be used. Currently following values are defined:

- 0 – regular monitor access. If the CPU is running, it is stopped, memory is read and CPU set running again
- 1 – real-time access. For the function to succeed with this access mode, the debugger must support real-time access

iMemArea

Specifies CPUs memory area - zero based index of memory area as seen in the Open Memory Window dialog.

iAddress

Address to write to

iSize

Number of bytes used in iValue to write (1-4)

iReserved

Reserved, must be zero

int APIWriteTrace(string strFileName, int nFrom, int nTo);

Outputs trace buffer to the file specified.

return value

Returns 1 on success, 0 on failure

strFileName

Specifies the filename of the trace buffer output file.

nFrom

Specifies the starting frame. Frame numbers are relative to trigger position.

nTo

Specifies the last frame.

Examples for working with API functions

Example 1

For a particular test function the 7th bit of the accumulator is to be read. Accumulator is bit addressable but how to do that using ISL APIs?

ANSWER

You can use APIReadMemory or APIEvaluate instead. To read only one bit use the following syntax:

Read bit 7 from address 0x82

```
(:0x82>>6) & 0x1
```

Read bit 4 from R13 register

```
(@R13>>3) & 0x1
```

Example 2

We are using an Emulator and winIDEA and an HC05PV8 POD. How can we access and modify CPU registers?

ANSWER

The syntax to access SFRs is the same as in the watch window: To access register XYZ, you must write @XYZ

The script provides following functions:

```
int APIEvaluate1(int nAccessMode, string
strExpression);
```

and

```
int APIModify(string strLValue, string strExpression);
```

so write:

```
APIEvaluate1(0, "@XYZ");
APIModify("@XYZ", "0");
```

Example 3

The APIDownloadFile is defined as:

```
Int APIDownloadFile(int iFileIndex)
```

What does the file index exactly mean? I understand that it is some number pertaining to the files listed for downloading so that they may be downloaded independently. But in the download file list table no such number is mentioned. If I assume the number according to the order of files, the download process fails for second file onwards.

ANSWER

Index 0 in the API functions means first file in the 'Download Files' menu.

Index 2 therefore means 3rd file in the 'Download Files' menu.

```
function void main()
{
if(!APIDownloadFile(2))
{
APIMessageBox("Code wasn't loaded succesfully");
}
else
{
APIMessageBox("Code was loaded succesfully");
}
APIStepInto(0,2);
}
```

Example 4

The output is dumped to the target result file using APISetOutput. This result file created using the APISetOutput is to be compared with the reference file. But once APISetOutput starts dumping the output to the file, it does not stop and sends subsequent messages also from the output window. So the APICompareFiles function is unable to open the result file and the comparison does not take place. Is there any method by which we can stop the APISetOutput function before initiating the process of comparison?

ANSWER

You have to close the connection - output to file.

You can do this with APISetOutput with its parameter strFileName - if this parameter is blank, output is not written to any file.

Example 5 – a full ISL example file

The example file below can be used for testing of API functions.

```
declare
        {
  function void step();
  function void step1();
  function void trace();
  function void dl();
  var int a;
  var int b;
  var int c;
        }

function void main()
        {
  if(APIMessageBoxYesNo(" Do you want to test a POD in TARGET? "))
        {
        //HASYSTSetClock(1,16000);
                HASYSTSetMapping(0,0x0,0xFFFF,1);
                HASYSTSetMapping(1,0x0,0xFFFF,0);
                dl();
          APICopyMemory(0,0x0,0xFFFE,4,0x0);
                HASYSTSetMapping(0,0x0,0xFFFF,0);
                dl();
                }
  else
        {
                HASYSTSetMapping(0,0x0,0xFFFF,1);
                HASYSTSetMapping(1,0x0,0xFFFF,2);
          if(APIMessageBoxYesNo(" Do you want to test 24MHz clock?
"))
        {
                HASYSTSetClock(1,24000);
                }
          }
        dl();
        if(APIStepInto(1,1)==0)
                {
                return;
                }
        a=HASYSTSetAccessBP(0, "c");
        if (a<0)
          {
    return;
          }
  APIRun();
  APIWaitStatus(0);
  HASYSTClearAccessBP(0, a);
  APISetOutput("trace.hys",0);
  trace();
  APISetOutput("test1.hys",1);
  b=APISetBreakpoint(0, "testFunction");
  if (b<0)
        {
    return;
          }
  APIWaitStatus(0);
        APIClearBreakpoint(0, b);
        c=APISetBreakpoint(0, "_test");
  if (c<0)
        {
    return;
          }
  APIRun();
  APIWaitStatus(0);
  APIModify("i","0");
  APIModify("j","0");
  APIModify("c","0");
        step();
        APIClearBreakpoint(0, c);
  b=APISetBreakpoint(0, "_delay");
  if (b<0)
        {
    return;
        }
  APIRun();
  APIWaitStatus(0);
  APIModify("f","0");
  APIModify("st","0");
        step1();
  APIClearBreakpoint(0, b);
  a=HASYSTSetAccessBP(0, "c");
  if (a<0)
        {
         return;
        }
  APIRun();
  APIWaitStatus(0);
  HASYSTClearAccessBP(0, a);
  APIEvaluate("c");
  APIEvaluate("f");
  APIEvaluate("st");
        APISetOutput("trcstop.hys",1);
        APIBeep();
  APIBeep();
}
        function void step()
                {
                if(APIStepInto(1,1)==0)
                {
            return;
                  }
                loop(10)
                        {
                        if(APIStepInto(1,1)==0)
                        {
                    return;
                          }
                        else
                                {
                          APIEvaluate("i");
                          APIEvaluate("j");
                          APIEvaluate("n");
                          APIEvaluate("c");
                          }
                        }
                loop(10)
                        {
                        if(APIStepInto(0,1)==0)
                        {
                    return;
                          }
                        else
                                {
                          APIEvaluate("i");
                          APIEvaluate("j");
                          APIEvaluate("n");
                          APIEvaluate("c");
                          }
                        }
                }

        function void step1()
                {
                loop(10)
                        {
                        if(APIStepInto(1,1)==0)
                        {
                    return;
                          }
                        else
                                {
                          APIEvaluate("c");
                          APIEvaluate("f");
                          APIEvaluate("st");
                          }
                }
                loop(10)
                        {
                        if(APIStepInto(0,1)==0)
                        {
                    return;
                          }
                        else
                                {
                          APIEvaluate("c");
                          APIEvaluate("f");
                          APIEvaluate("st");
                          }
                }
                }


        function void trace()
        {
                HASYSTSetTraceOperation(0);
                HASYSTSetTraceTrigger("test");
                APIBeginTrace();
                APIRun();
                APIWaitStatus(5);
                APIWriteTrace(-20,500);
        }

        function void dl()
                {
          if (APIDownload()==0)
                        {
            return;
                  }
                }
```

Frequently Asked Questions on API Functions

Q: How can I stop the code execution via the script. APIExit and return terminate winIDEA and the script respectively.

A: Use the new APIStop function, introduced in winIDEA 9.1. If you use an older version, use APIStepInto(0, 1). It executes a single instruction step - effectively stopping the CPU prior to that.

Q: I tried APIModify1 to change the register values but it only works if the CPU is not running.

A: That's how it's supposed to work. Makes no sense modifying a register while the CPU is running.

Q: How can you dump a register value into a variable?

A: Use APIModify("variable name", "@register name"). For example to store the value of register R0 to variable 'xyz' write: APIModify("xyz", "@R0").

See also "Expression Conventions" on page 183 for help on legal expressions.

Q: How can I dump an address segment content into a variable? The APIReadMemory only fetches the value to the output window.

A: Use APIModify("variable name", ":address"). For example to load a byte from address 0x1000 into variable 'xyz' write: APIModify("xyz", ":0x1000").

See also "Expression Conventions" on page 183 for help on legal expressions.

Q: When it says strExpression for APIEvaluate or elsewhere, what is this? Any C expression or statement? What if I include a conditional statement, the function return is the satisfaction of the condition? It seems it accepts any string when only returning False for the erroneous ones.

A: See also help on legal expressions in winIDEA help/Debug Session/Watch window/Adding Watch expressions/Expression conventions. All C expressions except for the '?' operator are supported. An expression like: '3*(2>=1)' yields 3 as the result.

Q: How the APIEvaluate could be used to read a register content, as expressed by the example?

A: Append the @ sign before the name of the register - can also be a SFR register.

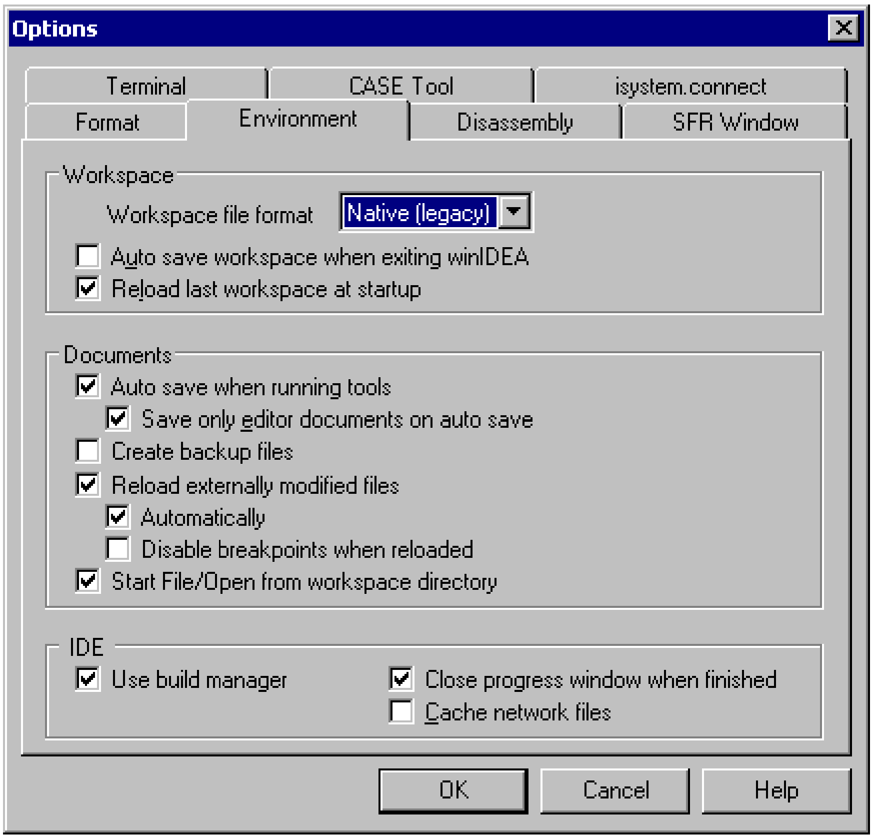
APIEvaluate("@DDRA");

Customizing the Environment

Environment Options

The environment appearance is controlled in two dialogs, the Options dialog and the Customize dialog, both available in the Tools menu.

winIDEA Environment



Workspace

Workspace file format: Native (legacy)

□ Auto save workspace when exiting winIDEA

☑ Reload last workspace at startup

Documents

☑ Auto save when running tools

☑ Save only editor documents on auto save

□ Create backup files

☑ Reload externally modified files

☑ Automatically

□ Disable breakpoints when reloaded

☑ Start File/Open from workspace directory

IDE

☑ Use build manager

☑ Close progress window when finished

□ Cache network files

Options Dialog, Environment page

Workspace file format

Defines the default file format used by winIDEA. This is either the legacy binary format (.jrf and .qrf extensions), or XML format (.xjrf / .xqrf) extensions. Note that winIDEA always saves in both file formats. This setting affects only the files shown when selecting a new workspace to open.

Auto save workspace when exiting winIDEA

When checked, the workspace is automatically saved. Otherwise you are prompted whether you wish to save it or not.

Reload last workspace at startup

When checked, the last workspace that was open when winIDEA most recently terminated is reloaded.

Auto save when running tools

When an external tool is ran, the files will be automatically saved if this option is selected.

Save only editor documents on auto save

Only editor files will be saved automatically, not the analyzer documents.

Create backup files

If this option is checked, winIDEA will create backup files of every file saved. Whenever a file is saved, winIDEA will also save the old file and add the extension '.bak' to it. For example, when saving 'main.c', the old file will be saved under the name 'main.c.bak'.

Reload externally modified files automatically

If a file is modified outside winIDEA (for example in an other editor), it will be reloaded automatically if this option is checked.

Disable breakpoints when reloaded

When a loaded file is reloaded, breakpoints are disabled if this option is checked.

Start File/Open from workspace directory

If this option is checked, the File/Open will always start up in the workspace directory, otherwise the last location where files have been opened is used.

Use build manager

If this option is unchecked, the build manager will not be used. See "Build Manager" on page 231 for more information.

Close progress window when finished

When checked, a progress window is closed when the process has finished.

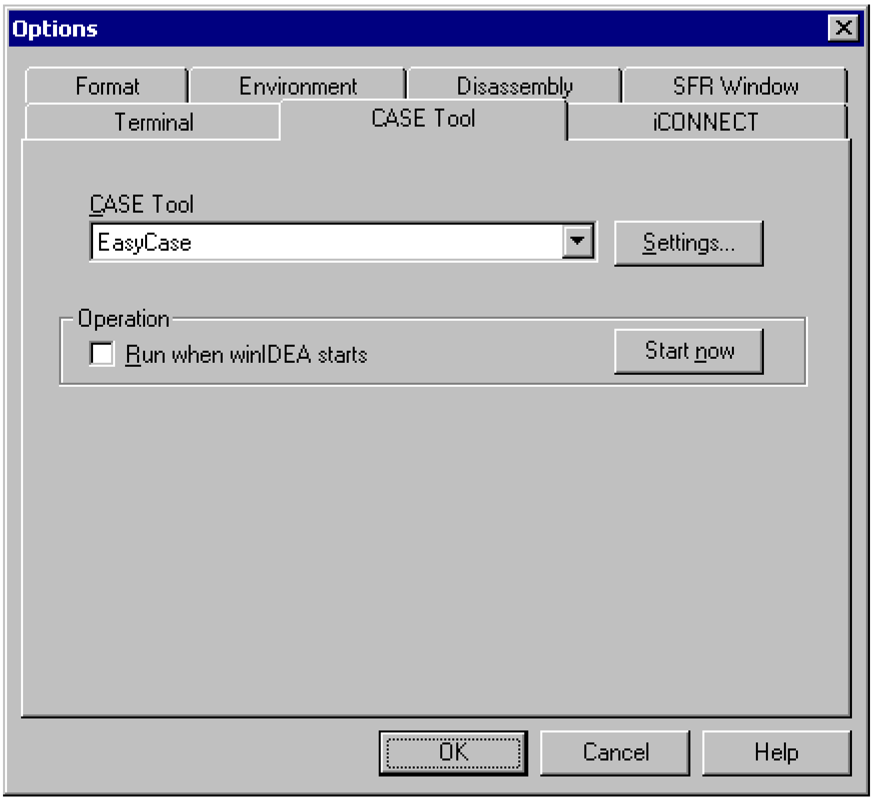
Cache network files

If this option is checked accesses to files located on the network are 'cached', i.e. a temporary copy of the accessed file is created in the TEMP directory.

Checking this option improves performance on Novell networks. If you are using TCP/IP or Microsoft's NetBEUI, clear this option, since the operating system itself caches network accesses.

CASE Tool Integration

winIDEA supports integration of different CASE tools. The CASE tools are integrated by inserting the appropriate data into the Tools/Options/CASE Tool window.



CASE Tool: EasyCase

☐ Run when winIDEA starts

CASE Tool setup window

CASE Tool

The CASE Tool to be integrated is defined here. If no CASE Tool should be integrated, this setting should be set to “None”. When a tool is selected, its properties can be selected using the “Settings…” button.

Settings

Invokes the settings regarding the selected CASE Tool.

Run when winIDEA starts

Starts the CASE Tool when winIDEA starts. When winIDEA exits, the CASE Tool is closed as well.

Start now

Starts the CASE Tool.

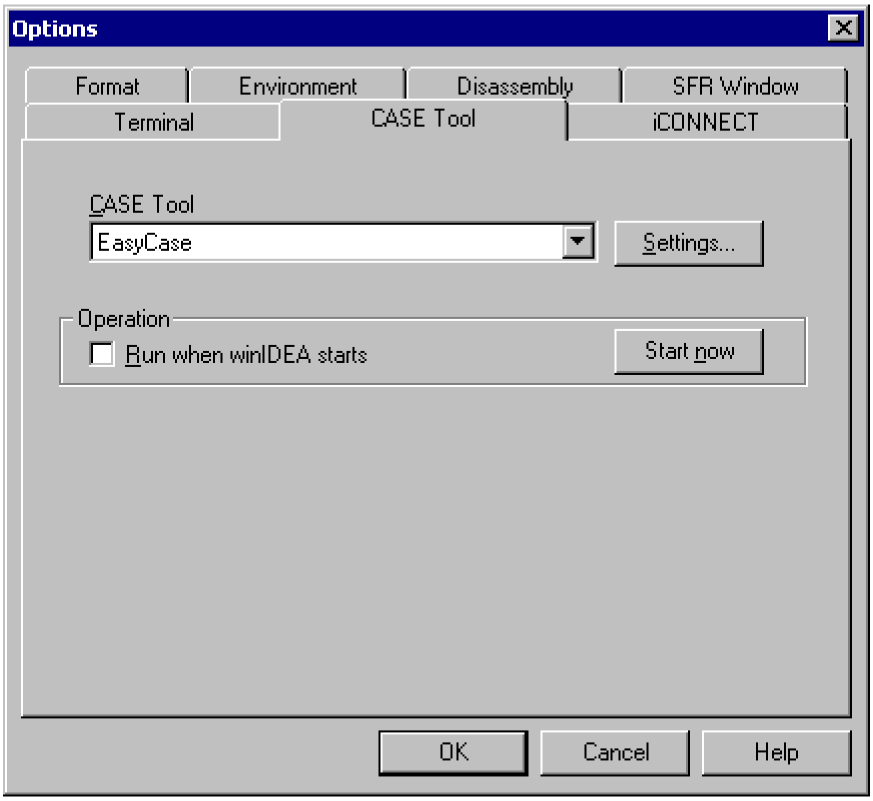
EasyCASE/EasyCode Integration

winIDEA provides an interface to the Easy Case/Easy Code application. Integration includes:

- Source debugging/tracking in either winIDEA or EasyCASE
- Setting execution breakpoints in either winIDEA or EasyCASE.

Settings

First, the CASE Tool should be selected.



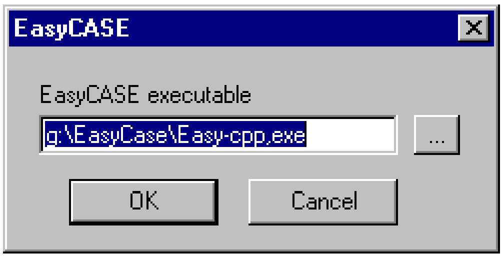
CASE Tool: EasyCase

Operation

☐ Run when winIDEA starts

CASE Tool setup window

If EasyCase is used, the path to the EasyCASE executable is specified by pressing the Settings button.



EasyCASE executable: g:\EasyCase\Easy-cpp.exe

EasyCASE Settings page

The executable can be searched using the "…" button, which opens a file browser.

If EasyCode is used, no additional settings are necesarry, since all necesarry information is automatically copied from the EasyCode installation.

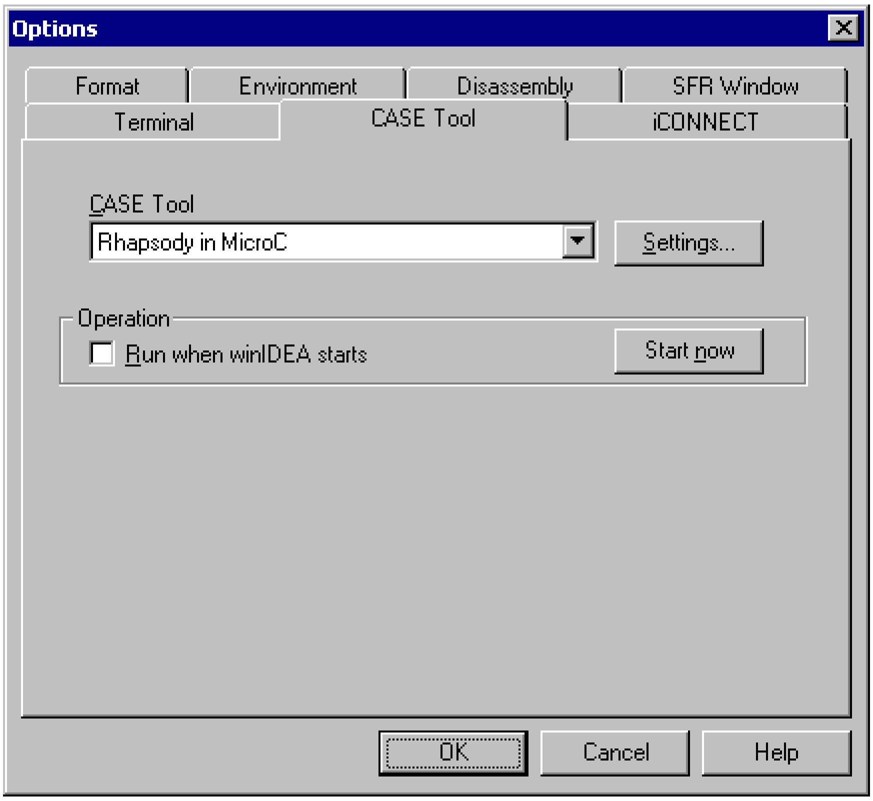
Rhapsody in MicroC Integration

WinIDEA provides an interface to Rhapsody in MicroC application.

The link between winIDEA and Rhapsody in MicroC enables the graphical representation of the various states of the application to be shown directly in Rhapsody in MicroC. This animation takes place in the graphical back animation (GBA) server, a component of Rhapsody in MicroC. If the application stops, the GBA server also displays the current state, which gives the user quick feedback where the application has stopped.

Settings

First, the CASE Tool should be selected.



Options

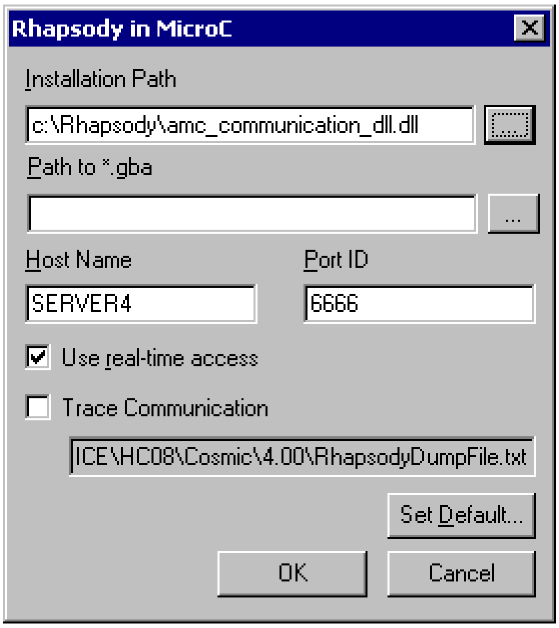
CASE Tool: Rhapsody in MicroC

Operation

□ Run when winIDEA starts

CASE Tool setup window

By clicking Settings, the installation path to the Rhapsody dll is specified. The installation path should be set to the location where amc_communication_dll.dll is located. If Rhapsody will be running on a remote computer, this dll must be copied to the local computer (computer where winIDEA is running).



Rhapsody in MicroC

Installation Path: c:\Rhapsody\amc_communication_dll.dll

Path to *.gba:

Host Name: SERVER4

Port ID: 6666

☑ Use real-time access

□ Trace Communication

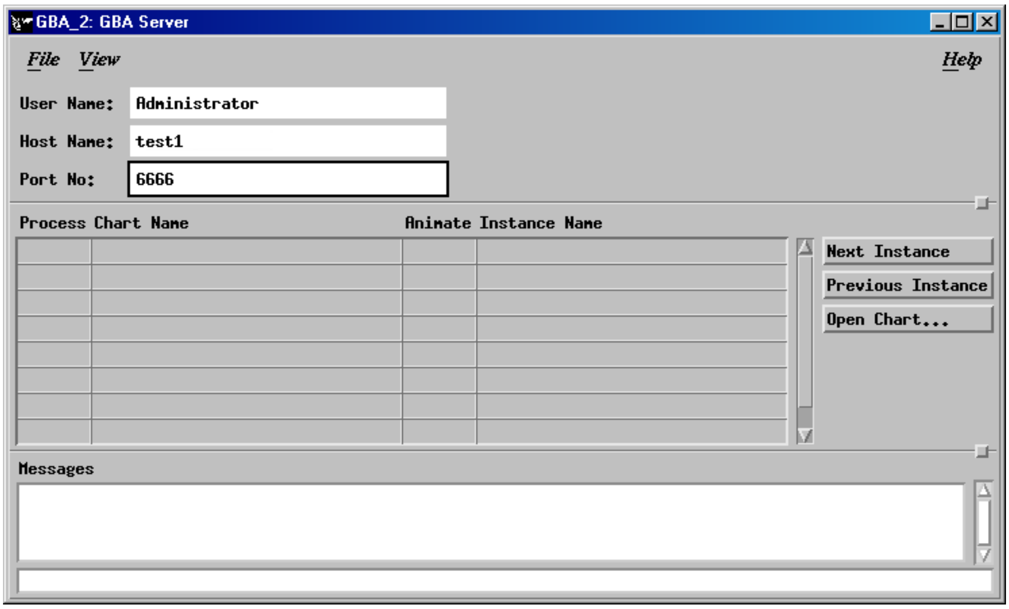
ICE\HC08\Cosmic\4.00\RhapsodyDumpFile.txt

Rhapsody in MicroC Settings page

The dll can be searched using the "…" button, which opens a file browser.

Host Name and Port ID

The Host Name can be the name of the remote or local computer. Port ID should be set to the same value as in the Rhapsody GBA Server.



GBA_2: GBA Server

User Name: Administrator

Host Name: test1

Port No: 6666

winIDEA communicates with Rhapsody in MicroC through the TCP/IP protocol which must also be installed.

Set Default

If Rhapsody is installed on a local computer, the Set Default button can be clicked and winIDEA will try to fill in all settings automatically.

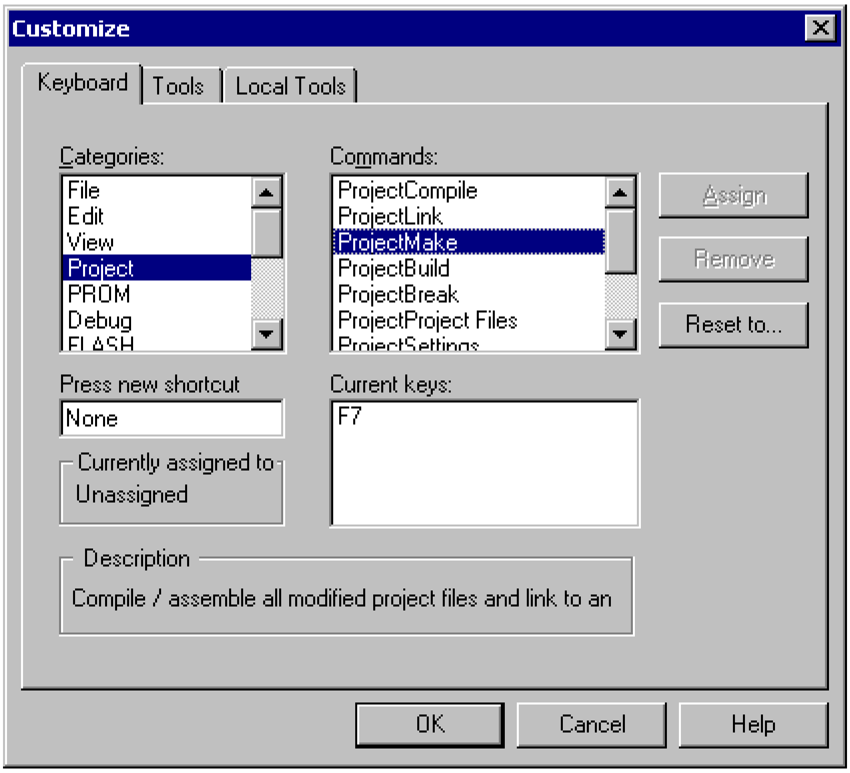
Use real-time access

When “Use real-time access” is checked winIDEA will access target memory when the program is running. Whenever possible, check this option.

Keyboard Shortcuts

Despite being a graphical Windows application, the nature of work that you perform inside winIDEA keeps your fingers on the keyboard, and reaching for the mouse to perform frequent actions like step, wastes your time and health.

winIDEA therefore provides fully customizable keyboard shortcuts for all commands available on the menu and toolbars. You can configure these on the Keyboard page of the Customize dialog.



Press new shortcut: None

Currently assigned to: Unassigned

Current keys: F7

Description: Compile / assemble all modified project files and link to an

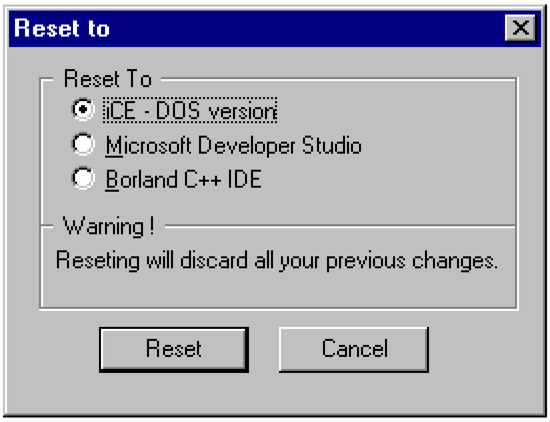
Customize dialog, Keyboard shortcut configuration

To configure a shortcut for a command:

- Select the command category in the Categories list
- In the Commands list select the command for which you wish to configure a shortcut
- Select the 'Press new shortcut' field
- Press the desired shortcut combination
- Click the Assign button

You can reset the keyboard shortcuts by selecting the 'Reset to…' button and selecting the desired set.

Preset keyboard schemes



Reset to

Reset To

● iCE - DOS version
○ Microsoft Developer Studio
○ Borland C++ IDE

Warning !

Reseting will discard all your previous changes.

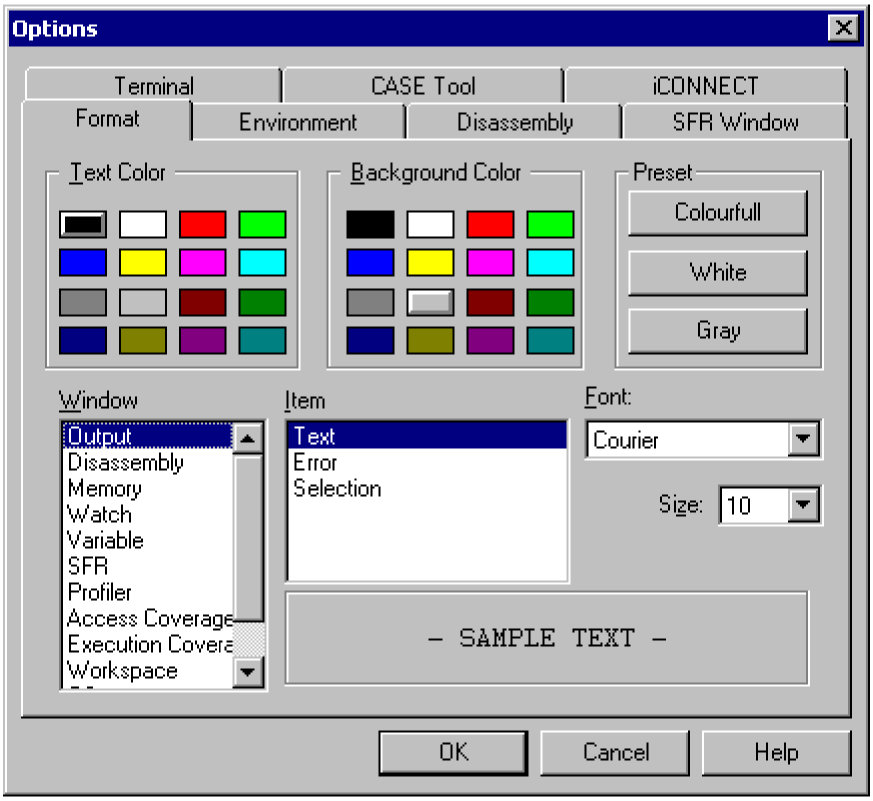
The reset keyboard dialog

winIDEA comes with three predefined sets of shortcuts:

- iCE DOS version
- Microsoft Developer Studio
- Borland C++ IDE

Window Colors

Colors and fonts can be configured individually for virtually all winIDEA's workspace visual elements in the Format page of the Options dialog.



Options

Window: Output

Disassembly

Memory

Watch

Variable

SFR

Profiler

Access Coverage

Execution Covera

Workspace

Item: Text

Error

Selection

Font: Courier

Size: 10

– SAMPLE TEXT –

Options dialog, Format page

To configure appearance of a window:

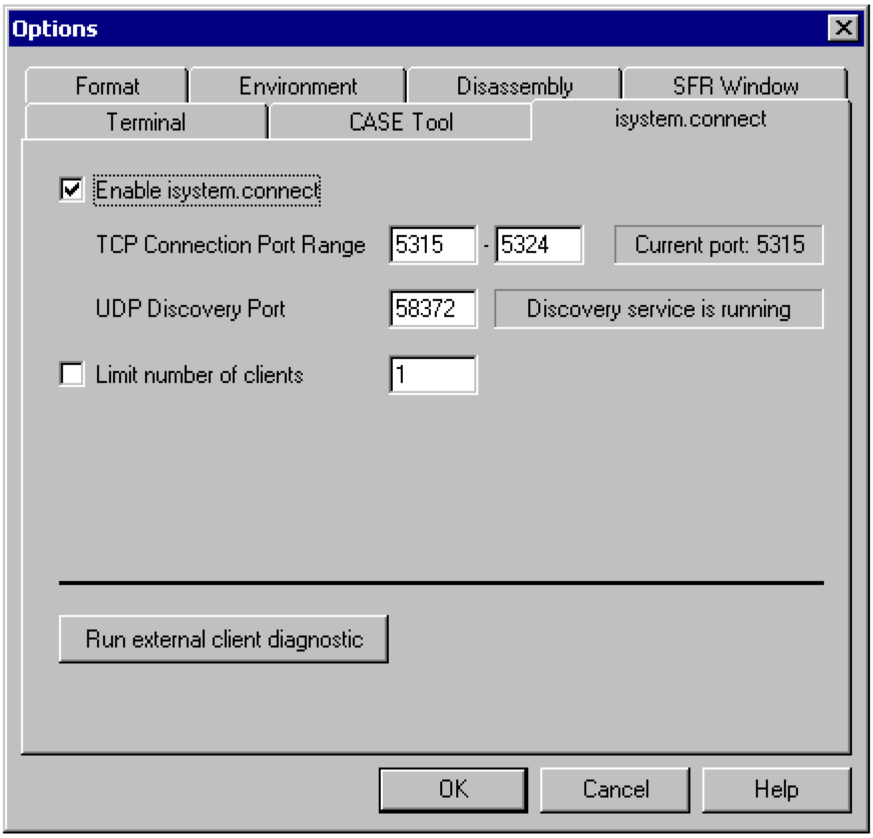
- In the Window list select the window for which you wish to configure colors and font,
- Select the font to be used and its size in the window,
- In the Item list select individual items and configure text and background color for each item.

isystem.connect

isystem.connect is a gateway protocol that allows third party applications to access some of winIDEA's functionallity, like accessing memory, controling the CPU etc.

Please note that when isystem.connect is enabled, winIDEA generates a small amount of network traffic scanning the UDP discovery port and opens and listens to the TCP connection ports. A warning from your firewall may be seen regarding these actions.

If network access is not desired and the extended funcionality of isystem.connect is not needed, please disable isystem.connect.



☑ Enable isystem.connect

TCP Connection Port Range 5315 - 5324 Current port: 5315

UDP Discovery Port 58372 Discovery service is running

□ Limit number of clients 1

Options dialog, isystem.connect page

Enable isystem.connect

Check this option to allow third party applications to access winIDEA via isystem.connect.

TCP Connection Port Range

Specify on which TCP ports should winIDEA establish the isystem.connect service. When winIDEA starts (or the isystem.connect is enabled), it will scan these prots to find the first free port and start listening on it for incomming connections.

UDP Discovery port

This port is used for broadcast discoveries initiated by the isystem.connect client application. When the client requests connection to winIDEA, an UDP broadcast on a UDP port is issued. All winIDEAs listening on that port will respond and the client can then choose to which instance it will connect.

Limit number of clients

This option allows limitation of simultaneous isystem.connect connections to one winIDEA instance.

Note: If you are unsure about TCP and UDP port settings, contact your network administrator.

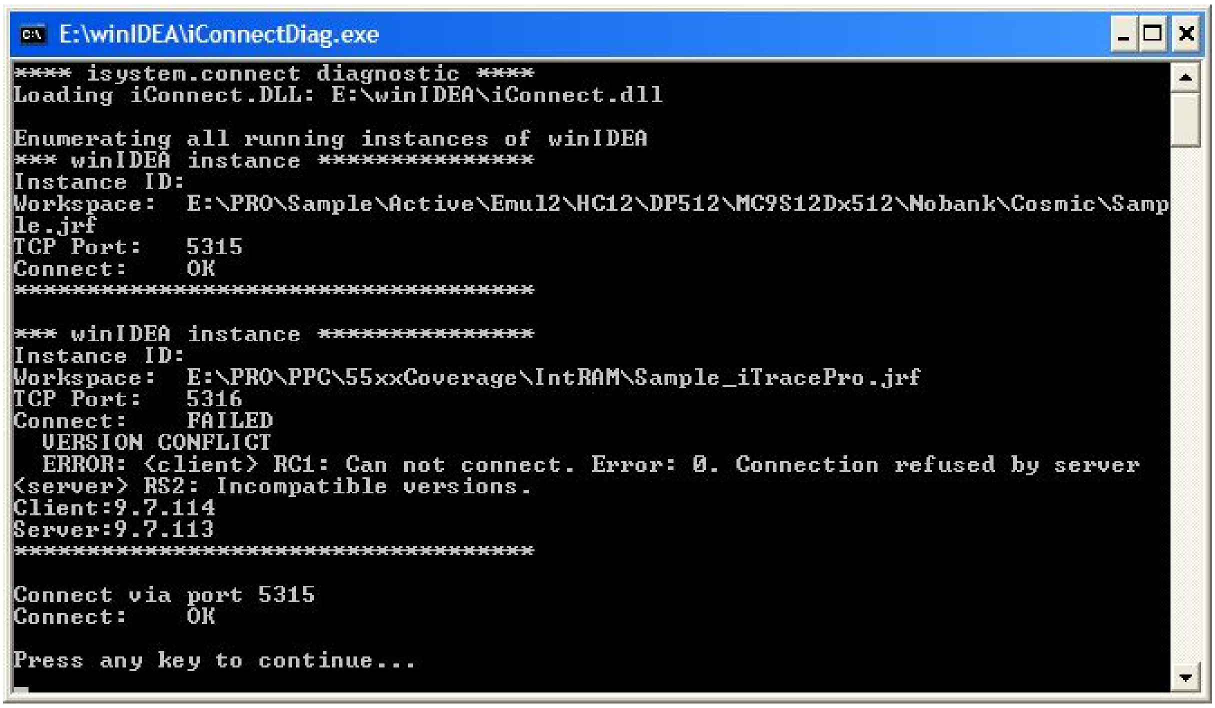
Run External Client Diagnostics

winIDEA supports detailed isystem.connect diagnostics, which should be performed when an isystem.connect client application is having problems connecting to winIDEA. Such problems are typically caused by:

- third party antivirus software blocking UDP/TCP ports. winIDEA disables the Windows firewall but is not aware of Norton, Avast, NOD32, etc.

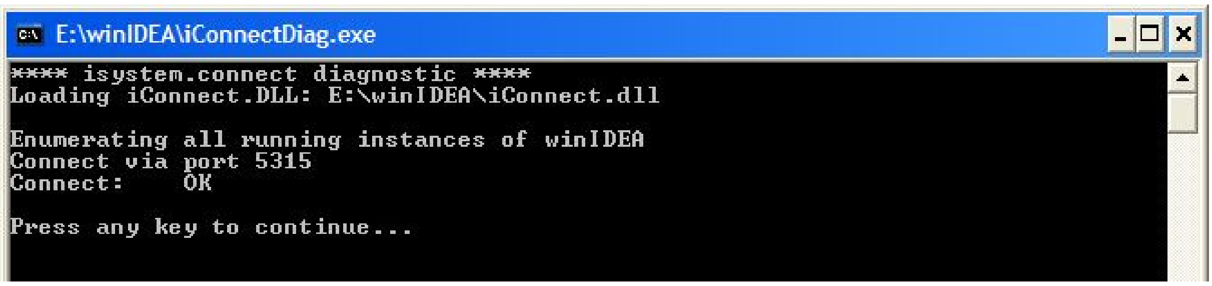
- different versions of winIDEA running (intalled is OK, just not active at the same time) simultaneously on the PC

The 'Run external diagnostic' button launches iConnectDiag.exe which is using our standard isystem.connect utility classes to enumerate all running instances of winIDEA and attempts to connect to each of them.



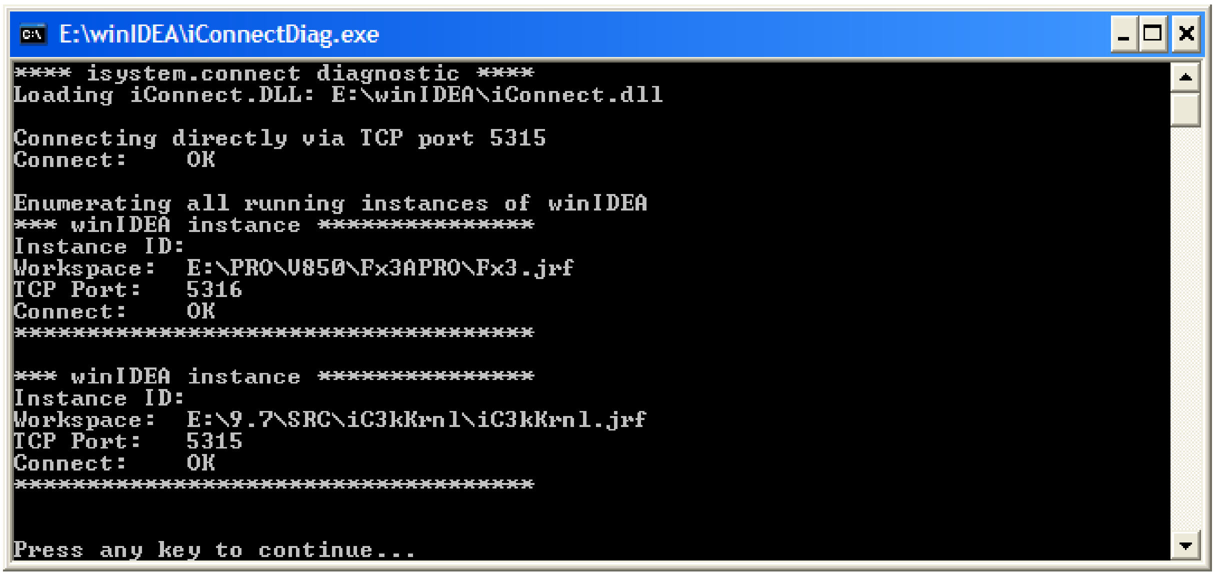
```
**** isystem.connect diagnostic ****
Loading iConnect.DLL: E:\winIDEA\iConnect.dll

Enumerating all running instances of winIDEA
*** winIDEA instance ****************
Instance ID:
Workspace:  E:\PRO\Sample\Active\Emul2\HC12\DP512\MC9S12Dx512\Nobank\Cosmic\Samp
le.jrf
TCP Port:   5315
Connect:    OK
************************************

*** winIDEA instance ****************
Instance ID:
Workspace:  E:\PRO\PPC\55xxCoverage\IntRAM\Sample_iTracePro.jrf
TCP Port:   5316
Connect:    FAILED
  VERSION CONFLICT
  ERROR: <client> RC1: Can not connect. Error: 0. Connection refused by server
<server> RS2: Incompatible versions.
Client:9.7.114
Server:9.7.113
************************************

Connect via port 5315
Connect:    OK

Press any key to continue...
```

The above screenshot shows diagnostics when two different winIDEA build instances are active.



```
**** isystem.connect diagnostic ****
Loading iConnect.DLL: E:\winIDEA\iConnect.dll

Enumerating all running instances of winIDEA
Connect via port 5315
Connect:     OK

Press any key to continue...
```

This sceenshot shows firewall blocking UDP discovery but a direct TCP connect is still working.



```
**** isystem.connect diagnostic ****
Loading iConnect.DLL: E:\winIDEA\iConnect.dll

Connecting directly via TCP port 5315
Connect:     OK

Enumerating all running instances of winIDEA
*** winIDEA instance ***************
Instance ID:
Workspace:   E:\PRO\V850\Fx3APRO\Fx3.jrf
TCP Port:    5316
Connect:     OK
************************************

*** winIDEA instance ***************
Instance ID:
Workspace:   E:\9.7\SRC\iC3kKrnl\iC3kKrnl.jrf
TCP Port:    5315
Connect:     OK
************************************


Press any key to continue...
```

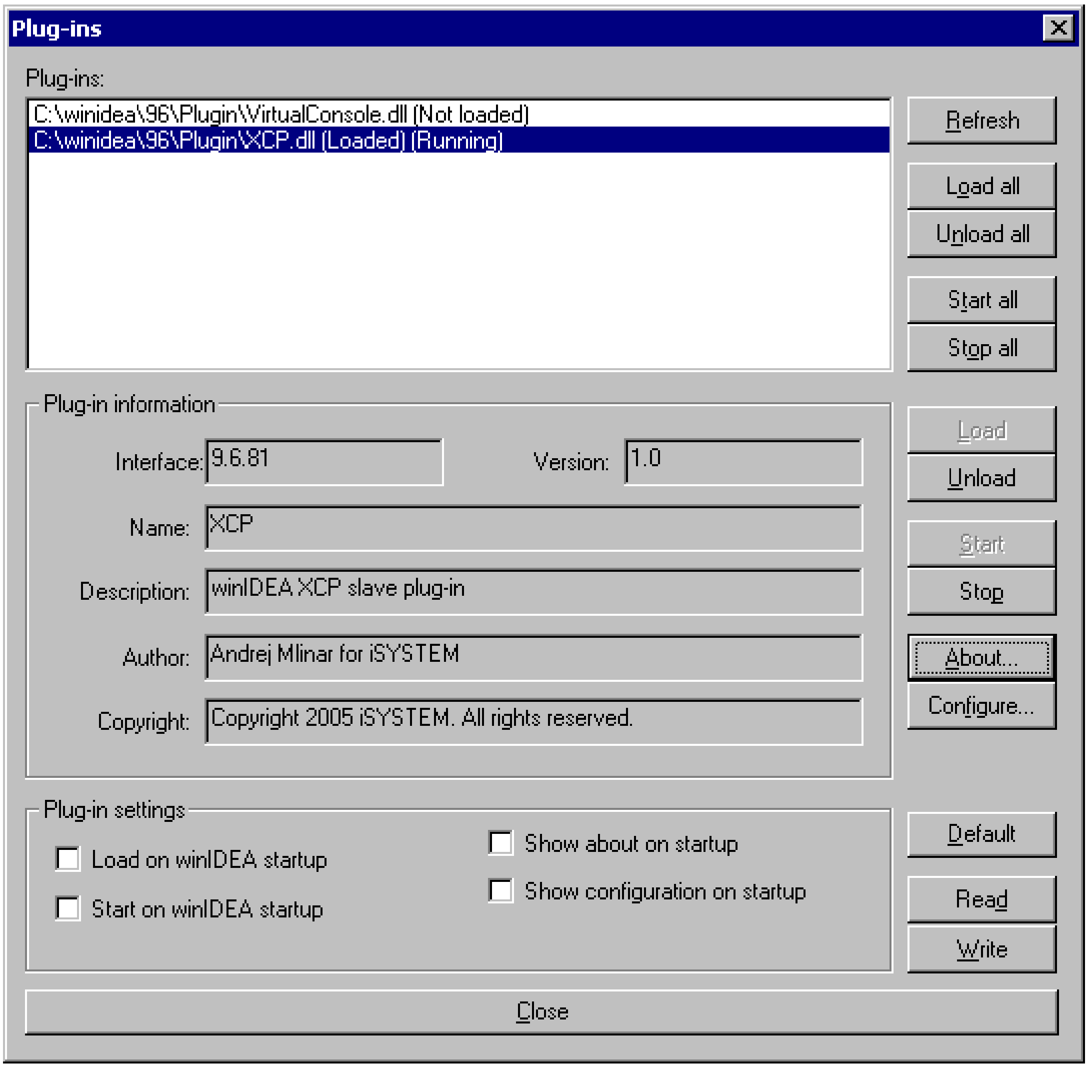
This sceenshot was taken with two instances running, with no UDP or TCP blocking.

For more information on isystem.connect, please refer to a standalone document, describing isystem.connect functions. For the latest information, please contact your local distributor.

XCP Slave Plug-In

Introduction

A target under winIDEA control can be accessed with XCP over TCP or UDP. winIDEA is shipped with a software plug-in that implements XCP slave functionality.



Plug-ins

Plug-ins:

C:\winidea\96\Plugin\VirtualConsole.dll (Not loaded)
C:\winidea\96\Plugin\XCP.dll (Loaded) (Running)

Plug-in information

Interface: 9.6.81

Version: 1.0

Name: XCP

Description: winIDEA XCP slave plug-in

Author: Andrej Mlinar for iSYSTEM

Copyright: Copyright 2005 iSYSTEM. All rights reserved.

Plug-in settings

☐ Load on winIDEA startup

☐ Start on winIDEA startup

☐ Show about on startup

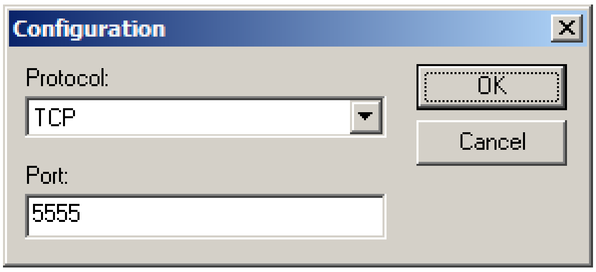
☐ Show configuration on startup

Usage

The plug-in is shipped with winIDEA. It is by default configured to be loaded and started automatically with winIDEA. The default protocol is TCP and the default port is 5555.

In order to access the XCP slave plug-in configuration open the winIDEA software plug-in dialog (winIDEA “Tools” menu, “Software plug-ins…” menu item), select the XCP plug-in from the plug-in list and click the “Configuration…” button.

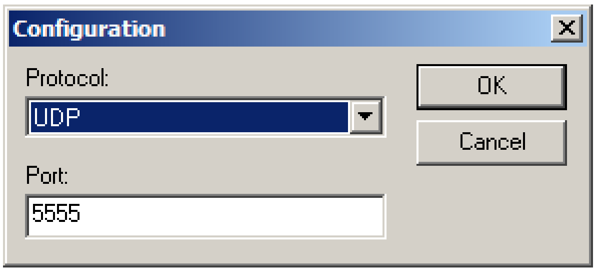
The following dialog shows:


Configuration

Protocol: TCP

Port: 5555

You can change the protocol opening the drop-down list; available protocols are TCP and UDP.


Configuration

Protocol: UDP

Port: 5555

The port can be configured on this dialog. Type the required port name in the “Port” edit control.

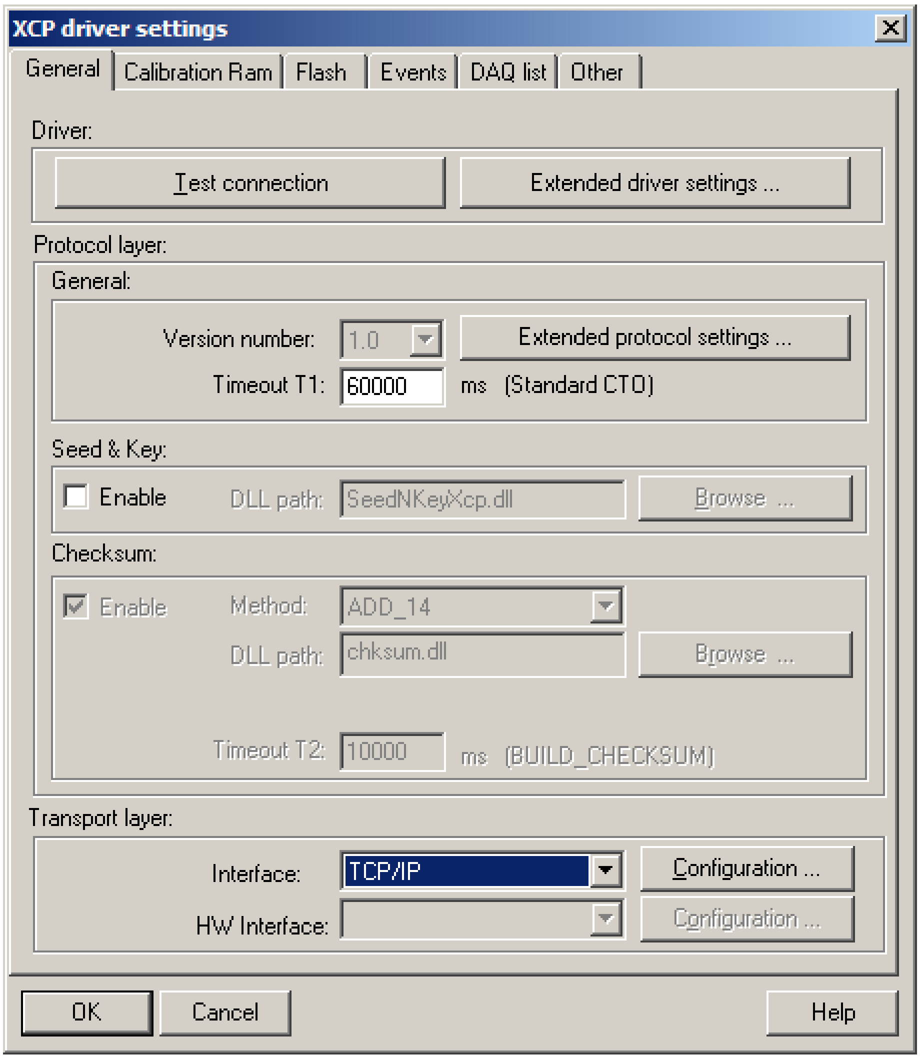
To apply the new settings press the “OK” button, the settings are applied, the plug-in is restarted.

To discard the changes press the “Cancel” button.

For more information about winIDEA software plug-ins refer to the related user or development documentation.

Configuring Vector CANape

Inside CANape go to open the “Tools” menu, select the “Driver configuration…” menu item. The following dialog displays:



XCP driver settings

General | Calibration Ram | Flash | Events | DAQ list | Other

Driver:

Protocol layer:

General:

Version number: 1.0

Timeout T1: 60000 ms (Standard CTO)

Seed & Key:

□ Enable   DLL path: SeedNKeyXcp.dll

Checksum:

☑ Enable   Method: ADD_14

DLL path: chksum.dll

Timeout T2: 10000 ms (BUILD_CHECKSUM)

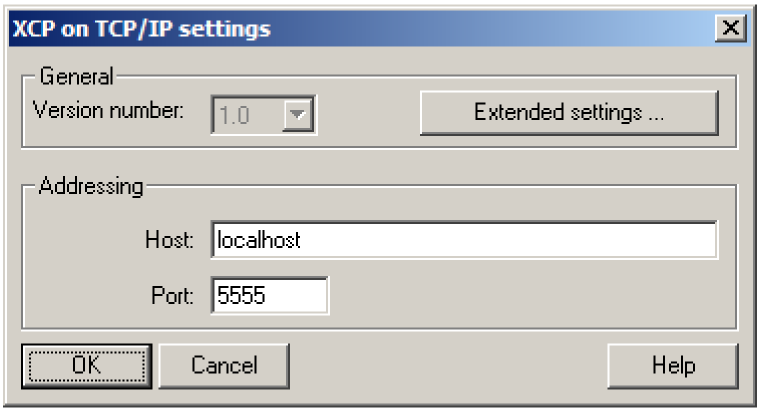
Transport layer:

Interface: TCP/IP

HW Interface:

In the transport layer control group, in the interface drop-down list select TCP/IP or UPD/IP depending on the settings you have chosen for winIDEA’s XCP slave plug-in.

If you press the “Interface” “Configuration” button the following dialog displays:


XCP on TCP/IP settings

General

Version number: 1.0

Addressing

Host: localhost

Port: 5555

Here you can setup the port used and the hostname or IP address of the computer running the winIDEA instance controlling the target you want to calibrate.

You may experience problems when running the XCP slave on a different host from CANape. To work around this issue make sure the host name configuration was loaded properly at every startup and test several times for connection. This is a known CANape issue. For more information please consult the CANape support page or contact Vector.

Configuring other XCP masters

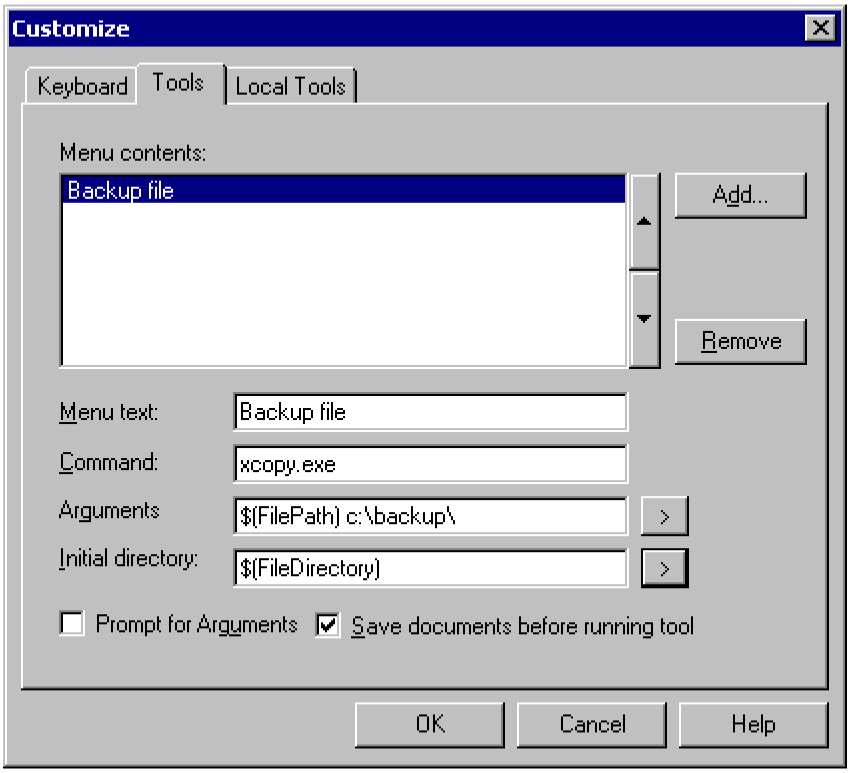
The XCP protocol implementation of the winIDEA XCP slave complies with the XCP standard. Any XCP master should be able to communicate with the winIDEA XCP slave plug-in. Make sure that the protocol and port settings on the master and the slave match. For information on how to configure the transport protocol on your XCP master consult your application’s documentation.

Custom Tools

winIDEA allows integration of external third party tools, which can be ran from the tools menu.

Tools are configured in the Tools and Local Tools pages of the Customize dialog.

The Tools defined in the 'Tools' page are common to all winIDEA workspaces, whereas tools defined in the 'Local Tools' page are available only to the current workspace.



Menu contents: Backup file

Menu text: Backup file

Command: xcopy.exe

Arguments $(FilePath) c:\backup\

Initial directory: $(FileDirectory)

☐ Prompt for Arguments ☑ Save documents before running tool

Customize dialog, Tool configuration page

To add a new tool:

- click the 'Add' button,
- configure the text that should appear in the menu (Menu text)
- specify the path to the tool (executable)
- configure any command line arguments that should be passed to the tool when invoked (Arguments). You can use special file macros when the tool is to operate on a currently open source file.
- specify the initial directory for the tool.

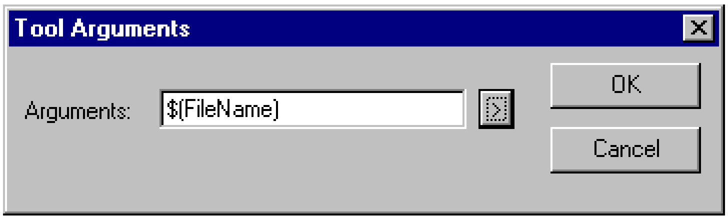
Prompt for Arguments

When checked the 'Tool Arguments' dialog will open prior to every tool invocation.

Save documents before running tool

When checked all documents will be saved before the tool is ran.

Tool Arguments



$(FileName)

Tool Arguments dialog

This dialog opens upon invocation of a tool with 'Prompt for Arguments' option selected.

The string that you specify here will be passed to the toll in the command line.

Entering License Information

What is a License

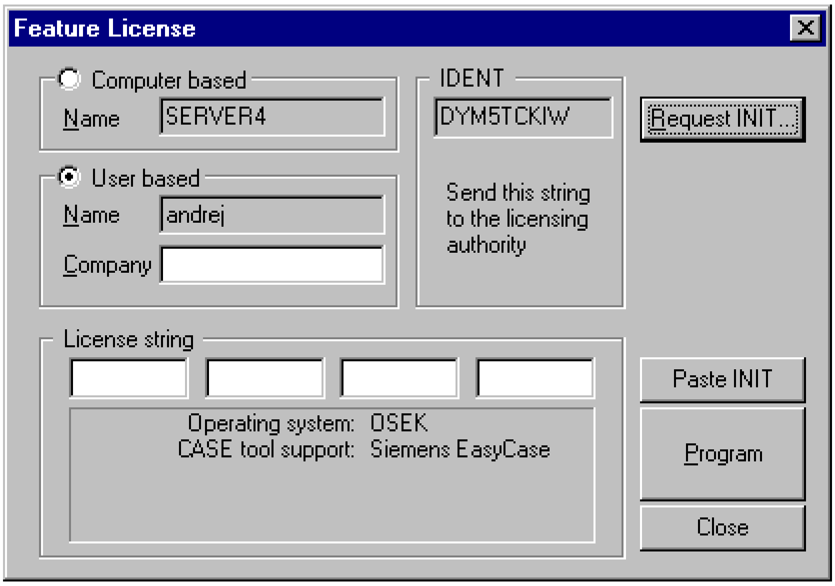
Operating systems support and interoperability with CASE tools can be licensed for you using the Tools/Feature License menu option.

How to Obtain a License

A license comes as an encrypted initialization string, which you request from your local distributor and, which he can send you via mail, e-mail, FAX or over the phone.

Programming the License

The software licenses are programmed in the Tools/Feature License dialog.



Feature License

○ Computer based

Name SERVER4

● User based

Name andrej

Company

IDENT

DYM5TCKIW

Send this string to the licensing authority

License string

Operating system: OSEK
CASE tool support: Siemens EasyCase

The Tools/Feature License menu

The current license status can be seen in the license information pane.

The IDENT value is the identification code of your software.

The four INIT fields are the place where you must enter the initialization string. The INIT string is requested with pressing the 'Request INIT...' button.

When finished, select the Program button to license the Emulator with the new license.

Computer based vs. User based

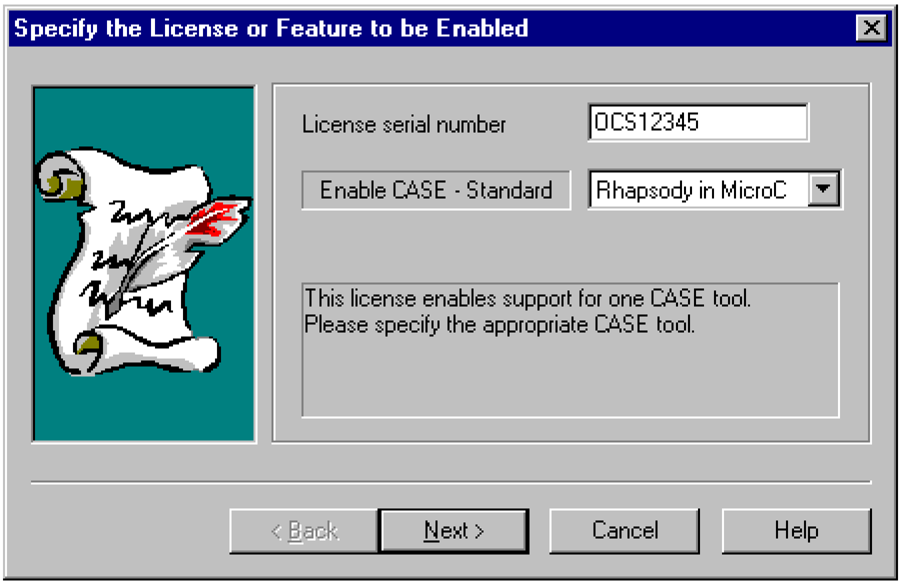
The licenses are normally computer based, this means that the licensed tools will be available to everyone that works on that computer with no limitation; the tools, on the other hand, will not work on a different computer.

The licenses can also be user based. This means that the licensed tools are available on every computer, where the user is logged in with the specified user name.

Request INIT

To request an INIT string, press the 'Request INIT...' button.

First step: Specify the License or Feature to be Enabled



License serial number: 0CS12345

Enable CASE - Standard: Rhapsody in MicroC

This license enables support for one CASE tool.
Please specify the appropriate CASE tool.

License serial number request

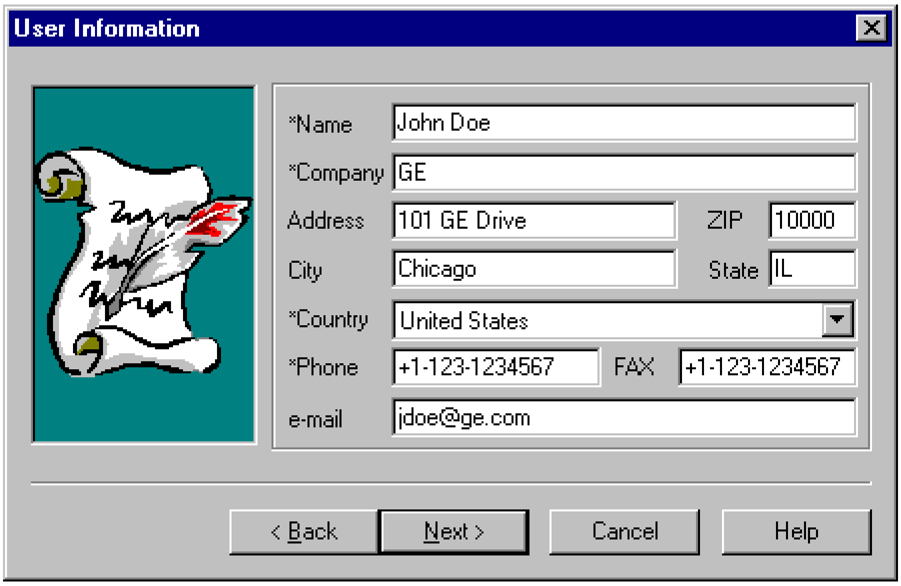
The licensing wizard requires you to insert the license serial number. To obtain the license serial number, contact your iSYSTEM distributor first, you can purchase a license from him and you will also receive a serial number.

There are two types of licenses: Standard and Professional. The Standard license enables the usage of one software tool, while the Professional license enables you to use all tools from the selected family (for example, the professional RTOS license will enable the usage of all operating systems; the professional CASE license will enable all CASE Tools).

If you have purchased a standard license, you will need to enter the tool you will be using.

Once you have entered the serial number, press the Next button.

Second step: User Information



User Information

*Name John Doe

*Company GE

Address 101 GE Drive ZIP 10000

City Chicago State IL

*Country United States

*Phone +1-123-1234567 FAX +1-123-1234567

e-mail jdoe@ge.com

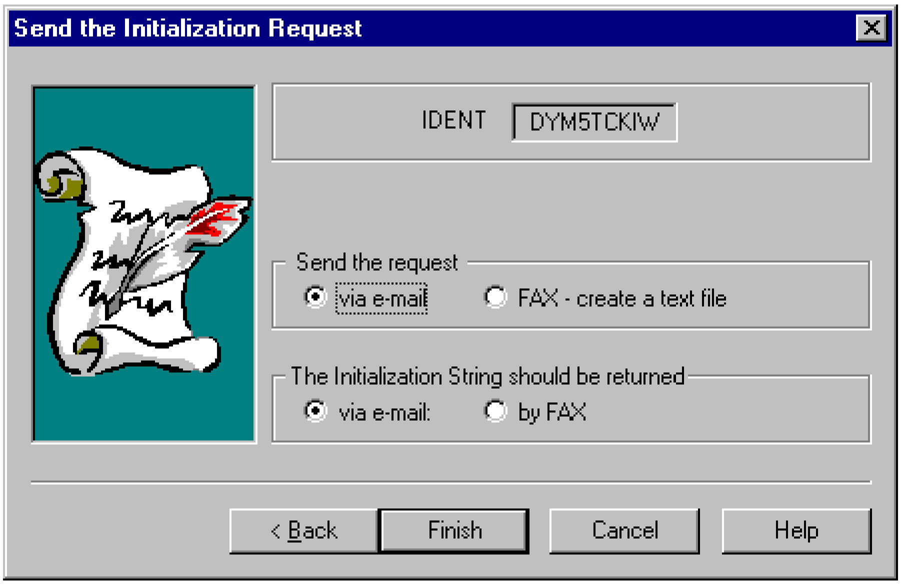
User information dialog

Now, please enter your user information. The information is needed by iSYSTEM to confirm your license. When you have entered the information, please press the Next button.

Third step: Send the Initialization Request

The program will now show the system's IDENT that will be sent to the distributor. There are options, which define the sending and receiving method for the request.

'Send the request via e-mail' will generate an e-mail message with your default e-mail handler and try to send it. If the mail handler is not running, it will send the message immediately after it is started. If the e-mail generation is unsuccessful, the program will issue a warning and ask you to manually send the request file to iSYSTEM.



Send the Initialization Request

IDENT DYM5TCKIW

Send the request
● via e-mail ○ FAX - create a text file

The Initialization String should be returned
● via e-mail: ○ by FAX

Send the Initialization Request dialog

'Send the request through FAX' will generate a text file, which you will be asked to print out and fax to iSYSTEM.

If the option 'The Initialization String should be returned via e-mail' is selected, the initialization string will be returned to the e-mail address defined in the User information dialog. If the information was not entered, the e-mail based request will be replied to.

If the option 'The Initialization String should be returned by FAX' is selected, the initialization string will be faxed to you to the fax number, defined in the User information dialog.

Entering the Initialization String

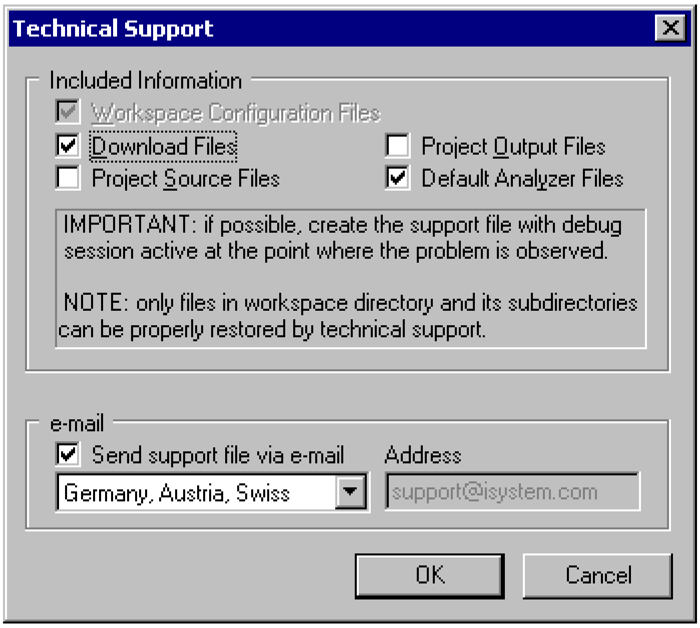
When you have received the initialization string, enter it in the Tools/Feature License dialog. If you have received the initialization string through e-mail, copy the string to clipboard. In the License page, press the Paste INIT button. With this, the string will be automatically entered. Now, press the Program button to program the new license. Now, the requested features are available immediately.

Technical Support

winIDEA provides a packing utility, which puts the files of your choice into a single file, which you can send to your technical support engineer.

Preparing Files for Technical Support

- Select Support/Technical Support… command from the Help menu



Technical Support

Included Information

☑ Workspace Configuration Files

☑ Download Files

☐ Project Output Files

☐ Project Source Files

☑ Default Analyzer Files

IMPORTANT: if possible, create the support file with debug session active at the point where the problem is observed.

NOTE: only files in workspace directory and its subdirectories can be properly restored by technical support.

e-mail

☑ Send support file via e-mail

Address

Germany, Austria, Swiss

support@isystem.com

Technical Support dialog

On selecting the OK button, the attached emulator is diagnosed. (Diagnostic information is written to file 'CONFIG.TXT' in the workspace directory.)

It is recommended that the support file is generated at the moment where the error or incorrect behaviour is observed. winIDEA will pack the current register content and stack in the report file, making it easier for support personel to reproduce the problem.

Note: make sure that hardware is properly configured.

winIDEA can pack following files:

- workspace configuration files. These are the workspace file (.JRF and .XJRF) and project configuration files (.QRF and .XQRF). See "Workspaces" on page 11.
- download files. These are files specified in download files dialog for debug and PROM systems. See "Download Files" on page 97.
  These files should be sent when you experience any kind of problem with the debugger.
- project source files. These are your .C and .H source files specified in the project files dialog. See "Project Files" on page 239.
  Send these files if there are problems with building, source debugging or the debugger problem can not be made visible without source files.
- project output files. These are files located in the current target's output directory (see "Root Directory" on page 246).
  Usually these files are not required. Since sending them usually

generates a very large file, send them only when requested by support engineer.

- default Analyzer files. These are your .trd and .lad files (see "The Trace" on page 46), that bear the same name as the workspace file.

Note: winIDEA can only pack files that are located in or bellow the workspace directory. See "Path Specifications" on page 11.

winIDEA does not save the linker indirection files or any other files used by the build indirectly. A workaround is to add these files to the project. Their extension will prevent them from being compiled/linked, but they will be seen in the project window and will be included in the backup/support file.

The resulting file is named 'SUPPORT.WSB' and is stored in the workspace directory.

The Support File can be sent via e-mail to support personel automatically. Please specify your country, if it is listed in the menu, otherwise select ‘Other…’ and specify the e-mail address as provided to you by the support personel.

Appendix

Build Manager Temporary Build Files

Following files are generated by Build Manager before or during build process.

File name	Description
___STOUT.RDR	contains captured output emitted by translator to standard output device
___FSOUT.RDR	contains filtered output from translator
___STERR.RDR	contains captured output emitted by translator to standard error device
___CMP.<ext>	compiler options - when compiler can retrieve them from a file. Extension of this file is equal to extension supported by compiler for these purposes.
___CMP.BAT	batch file used to run compiler or assembler.
___ASM.<ext>	assembler options - when assembler can retrieve them from a file. Extension of this file is equal to extension supported by assembler for these purposes.
___LNK.<ext>	linker indirection file. Extension of this file is equal to extension supported by linker for these purposes.
___LNK.BAT	batch file used to run.

Note: the files above are generated only when necessary.

Menu Reference

File Menu

Contains source document management commands.

New

Creates a new unnamed document. The new document is fully editable. When closing or saving unnamed documents, the save as dialog will prompt you for the name of the file where the document should be saved.

Open

Opens an existing file.

Close

Closes the active editor.

Save

Saves the contents of the active editor to its file. If the editor contains a new unnamed document, the Save As dialog will prompt you for the name of the file where the document should be saved.

Save As...

Opens the Save As dialog where you can enter the name of the file where the document should be saved.

Save All

Saves all editors, which have been modified.

Page Setup

Opens the Print Setup dialog, where page layout is configured.

Print

Opens the Print dialog, where the printer and its settings are configured, and printing can be started.

Find in Files

Searches for a string occurrence across multiple files.

See "Find in Files Utility" on page 44.

Workspace

Opens workspace management options:

New workspace...

Creates a new workspace.

See "Creating a New Workspace" on page 13.

Open Workspace...

Opens an existing workspace.

See "Opening an Existing Workspace" on page 11.

Save Workspace...

Saves the current workspace.

See "Saving Workspace" on page 13.

Available if a workspace is open.

Backup Workspace...

Saves a backup (.wsb) file of your workspace.

See "Backup a Workspace" on page 14.

Restore Workspace...

Restores the workspace from a backup (.wsb) file.

See "Restore a Workspace" on page 15.

Workspace Pick List

Opens the workspace selected from the pick list.

winIDEA maintains a list of four most recently used workspaces. These are displayed on the File menu's pick list.

To open a workspace from the pick list

- select the workspace file on the pick list.

File Pick List

Opens the file selected from the pick list.

winIDEA maintains a list of four most recently used files. These are displayed on the File menu's pick list.

To open a file from the pick list

- select the file on the pick list.

Exit

Exists winIDEA.

Edit Menu

Contains source document management commands.

See "Document Management" on page 25.

Find...

Searches for text occurrence in the active editor window.

See "Finding Text" on page 35.

Replace...

Replaces text in the active editor window.

See "Replacing Text" on page 35.

Find Next

Repeats the last find command.

Go To...

Lists the active editor window from a specified line.

Undo

Undoes the last editor modification.

Redo

Undoes the last Undo operation.

Cut

Removes the currently selected text from the editor window and puts it on the clipboard.

See "Cutting Text to Clipboard" on page 36.

Copy

Copies the currently selected text to the clipboard.

See "Copying Text to Clipboard" on page 36.

Paste

Inserts the text from the clipboard into the current editor window.

See "Pasting Text from Clipboard" on page 37.

Delete

Removes the currently selected text from the editor window.

Select All

Selects the whole text of the edited file.

Toggle Bookmark

Toggles a bookmark on the edited line.

Next Bookmark

Jumps to the next bookmark.

Bookmarks...

Displays a list of all bookmarks in the current editor window.

Options...

Opens the editor options dialog.

See "Configuring Editor Options" on page 41.

View Menu

Contains dockable windows management commands.

See "Window Management" on page 17.

Preset Desktop

Contains commands, which set the desktop layout to a predefined template.

Edit/Build

Sets the desktop layout to a predefined Edit/Build template.

Debug - High Level

Sets the desktop layout to a predefined high level debugging template.

Debug - Low Level

Sets the desktop layout to a predefined Low level debugging template.

Full

Sets the desktop layout to a predefined full desktop template.

Full Screen

Expands winIDEA through the full screen.

See "Full screen operation" on page 19.

Toolbars

Contains toolbar show/hide commands.

See "Toolbars" on page 20.

File

Shows or hides the File toolbar.

See "File Toolbar" on page 21.

View

Shows or hides the View toolbar.

See "View Toolbar" on page 22.

Project

Shows or hides the Project toolbar.

See "Project Toolbar" on page 23.

Debug

Shows or hides the Debug toolbar.

See "Debug Toolbar" on page 24.

Document Bar

Shows or hides the Document selector bar.

See "Document Selector Bar" on page 29.

Project

Shows or hides the Project workspace window.

Output

Shows or hides the Output window.

See "Output Window" on page 264.

Watch

Shows or hides the Watch window.

See "Watch Window" on page 182.

Variables

Shows or hides the Variables window.

See "Variables Window" on page 187.

Special Function Registers

Shows or hides the SFR window.

See "Special Function Registers Window" on page 208.

Custom SFR

Shows the custom SFR window.

See "Custom SFR Windows" on page 211.

New

Generates a new SFR window.

Custom SFR Pick List

Opens the custom SFR window selected from the pick list.

The custom SFR windows you have generated are listed in the pick list.

To open a custom SFR window from the pick list

- select the custom SFR window from the pick list.

Memory...

Opens a new memory window.

See "Opening a Memory Window" on page 175.

Disassembly

Shows or hides the Disassembly window.

See "Disassembly Window" on page 170.

Profiler

Shows or hides the Profiler window.

See "Profiler Window" on page 204.

Execution Coverage

Shows or hides the Execution Coverage window.

See “Execution Coverage” on page 87.

Trace

Shows or hides the Trace window.

See "The Trace" on page 46.

Operating System

Shows or hides the Operating System window.

See "Operating System Support" on page 133.

Terminal

Shows or hides the Terminal window.

See "Terminal Window" on page 213.

Symbols...

Opens the browser dialog.

See "Symbol Browser" on page 113.

Project Menu

Contains Build Manager commands.

Compile/Assemble

Compiles the file in the active editor.

See "Building a Single Project File" on page 266.

Link

Links the project.

Make

Builds all modified files and links the project.

See "Building All Modified Project Files" on page 266.

Rebuild

Builds all files and links the project.

See "Building All Project Files" on page 266.

Stop Build

Terminates the current Build Manager operation.

See "Breaking the Build" on page 266.

Source Control

Shows the Source Control options.

See "Workgroup Support" on page 267.

Settings...

Configures the Source Control.

See "Configuring the source control system" on page 267.

Get Latest Version...

Gets the latest version of the file.

Check Out...

Checks out the file.

Check In...

Checks in the file.

Undo Checkout...

Undoes the checkout (invalidates changes and reverts to the file in source control).

Add to Source Control...

Adds the file to source control.

Remove from Source Control...

Removes the file from source control.

Refresh Status

Refreshes the status of files under source control.

Project Files...

Opens the project files dialog where you can manage files that constitute a project.

See "Project Files" on page 239.

Settings...

Opens the Project Settings dialog.

See "Compiler Tool-set Integration" on page 242.

Targets...

Opens the Targets dialog.

See "Targets" on page 235.

Update All Dependencies

Updates all project dependencies. The dependency list is used when a Make is executed to determine which files need to be built.

Add to Templates...

Adds the current file to templates. Enables you to be able to open a file based on the selected one.

Debug Menu

Contains debug system management commands.

Download

Initializes the hardware and loads download files to the emulator.

See "Download Files" on page 97.

Files for Download...

Opens a dialog where download files can be configured.

See "Download Files" on page 97.

Verify Download

Verifies the download by comparing the downloaded code with the core read back from the debugger.

See "Verify Download" on page 110.

Show Load Map...

Displays the load map.

See "Load Map" on page 111.

Operating System

Opens the Operating System configuration dialog.

See "Operating System Support" on page 133.

Run

Sets the CPU running.

See "Run" on page 165.

Reset and Run

Resets the CPU and sets it in running.

Stop

Stops the CPU.

See "Stop" on page 165.

CPU Reset

Resets the CPU.

See "Reset" on page 165.

Step

Executes a single step.

Step...

When selected from the menu a dialog opens where the number of steps to be executed is configured.

When selected with a keyboard shortcut or toolbar button, a single step is executed.

See "Step" on page 166.

Step Over

Performs a single step inside current function.

See "Step Over" on page 166.

Run Until

Runs until current caret position.

Run Until...

When selected from the menu a dialog opens where the address to run to can be specified.

When selected with a keyboard shortcut or toolbar button the CPU is set running until it reaches the current caret position.

See "Run Until" on page 167.

Go-to Address...

When selected from the menu a dialog opens where the address to set the program execution point to can be specified.

When selected with a keyboard shortcut or toolbar button the CPU's execution point is preset to current position.

See "Go-to Address" on page 168.

Run until Return

Sets the CPU running until its execution reaches the exit of the current function.

See "Run Until Return" on page 167.

Show Execution Point

Shows the current execution point.

Snapshot

Refreshes opened windows.

Modify Expression

Modifies an expression.

See "Modify Expression" on page 169.

Breakpoints...

Opens the breakpoint configuration dialog.

See "Breakpoints" on page 159.

Hardware Breakpoints...

Opens the hardware breakpoint configuration dialog.

See "Hardware Breakpoints" on page 163.

Toggle Execution Breakpoint

Sets or clears an execution breakpoint on the current caret position.

See "Setting Execution Breakpoints" on page 169.

Analyzer Tools

Opens the Analyzer Tools dialog.

See "Analyzer Tools" on page 190.

Start Profiler

Activates the Profiler module.

See "Profiler" on page 191.

Start Access Coverage

Activates the access coverage module.

See "Access Coverage" on page 202.

Start Execution Coverage

Activates the execution coverage module.

See “Execution Coverage” on page 87.

Debug Options...

Opens the Debug Options dialog, where debug system operation options are configured.

See "Debug Options" on page 121.

Tools Menu

Contains commands that control winIDEA environment and custom tools.

Hardware Plug-In...

Selects the hardware plug-in.

See "Hardware Plug-In" on page 16.

Disconnect

Disconnects winIDEA from the Emulator.

Normally, winIDEA locks the Emulator for exclusive use from the first download and until the workplace closes. Is the Emulator shared and somebody else would like to be using it, you can release it by pressing the Disconnect button, without having to close the workplace.

Options...

Opens the Options dialog.

Customize…

Opens the Customize dialog where keyboard shortcuts and custom tools can be configured.

See "Keyboard Shortcuts" on page 342 and "Custom Tools" on page 352.

Feature License

Opens the dialog to license additional features.

See "Entering License Information" on page 354.

Run Script…

Runs a script program. See "Script Language" on page 277.

Stop Script...

Stops the script program. See "Script Language" on page 277.

Custom Tool

For every configured custom tool a menu item is generated. By selecting them the tools is run.

Window Menu

Contains window management commands.

Cascade

Cascades all open editors windows.

Tile

Tiles all open editor windows.

Close All

Closes all open editor windows.

Windows

Displays a dialog where currently open editor windows are listed.

Help Menu

Contains help commands.

winIDEA Contents

Opens winIDEA help file.

Technical Support

Opens a dialog where you can select the files that you wish to pack and send to your technical support engineer.

About

Displays winIDEA version and copyright information.

Hardware User's Guide

Opens the Hardware User's Guide.

SLO Text Format Specification

This is a specification of a text type symbol table that can be read in by winIDEA.

You can use an additional download file of SIT format to define custom symbols that are otherwise not available in the main download files, or you can write a SIT format converter to load symbols from a file of an unsupported type.

File Extension

The file must carry a '.SIT' extension.

File Header

The first line must contain the following string to allow type recognition:

260691SLO

File Tags

MODULE tag

Defines a program module generated from a source file or a precompiled object module or library.

```
MODULE <module name> [,module source]
```

- <module name> is a mandatory field, up to 8 characters
- [module source] is an optional field specifying the path to the source file from which the module was generated.

LINE tag

Defines a high level or assembler statement association between a line in source code of the preceding MODULE definition and a target location.

```
LINE <address>,<line> {,column {,last ln. {,last col.}}}
```

- <address> is the address of the code associated with the line symbol
- <number> defines the position of the line in the source file
- {column} is optional, defining the column in which the line starts
- {last ln.} is optional, defining the last line of the line symbol
- {last col.} is optional, defining the last column of the line symbol

GLOBAL tag

Defines a global variable, defined in the preceding MODULE definition. If there was no preceding MODULE definition it is associated to a predefined global module with blank name.

```
GLOBAL <name>,<address> {,type}
```

- <name> is name of the variable
- <address> is the address of the variable
- {type} is optional, defining the type of variable

LABEL tag

Defines a code label (usually generated by assembler), defined in the preceding MODULE definition. If there was no preceding MODULE definition it is associated to a predefined global module with blank name.

```
LABEL <name>,<address>
```

- <name> is name of the label
- <address> is address of the label

CONSTANT tag

Defines an association between a name and a value, typically defined by an EQU statement or a C const definition.

```
CONSTANT <name>,<value>
```

- <name> is name of the constant
- <value> is a decimal (if not explicitly specified hex with the 0x prefix) value of the constant

FUNCTION tag

Defines a high level procedure or a nested block. A function will have a non-blank name and is assumed to be defined in the preceding MODULE definition. A nested block caries a blank name. Its scope definition does not necessary refer to the preceding FUNCTION declaration, but is calculated from its address. Blocks that can not be fitted in a function are not allowed.

```
FUNCTION <name>,<address>,<exit address 1>,…<exit
address n>
```

- <name> is name of the function. If blank, than this is a block definition
- <address> is the first address of the function/block.
- <exit address 1>,..,<exit address n> are exit addresses from the function/block. At least one exit (higher most) must be specified.

LOCAL tag

Defines a local variable. It is assumed to be defined in the preceding FUNCTION definition (true function or a block)

```
LOCAL <name>,<address> {,type}
```

- <variable name> is name of the variable
- <address> is address of the variable
- {type} is optional, defining the type of variable

FORMULA tag

Defines a way to calculate a physical location. A formula must be defined prior to its usage in any address definition.

```
FORMULA <number>,<definition>
```

- <number> is the index number of the formula by which it will be referred to in address definitions (1-255)
- <definition> is a string, defining the way a physical address is calculated. See CPU appendix for information on defined formulas.

Address Specification

<address> of an object is a decimal value, or hexadecimal if prefixed with a '0x' prefix.

```
10     address 10 (0Ah)
```

```
0x10   address 16 (10h)
```

Optionally the address value can be preceded by a number and a colon sign, thus overriding the default physical linear address mapping.

```
2:10   value 10 applied on formula 2.
```

If formula 2 was defined as '(SP+ADDRESS)' then the 10 specifies a 10-byte offset from the SP register.

Example:

```
FORMULA 1 (IO)(ADDRESS)
```

```
GLOBAL  port 1:0x40
```

Type Specification

<type> of a variable can be one of the types below

type	type description
void	void type
bit	a single bit
s8	signed 8 bit entity (char)
u8	unsigned 8 bit entity (unsigned char)
s16	signed 16 bit entity (short)
u16	unsigned 16 bit entity (unsigned short)
s32	signed 32 bit entity (long)
u32	unsigned 32 bit entity (unsigned long)
f32	32 bit float number (float)
f64	64 bit float number (double)
f80	80 bit float number (long double)

Pointer Specification

A type can be prefixed by a 'p' thus specifying a pointer to the type:

```
ps8   pointer to s8
                  *char
```

Size of a pointer can be specified by a decimal digit following the 'p'. If no size is specified a value 2 is assumed.

```
p2s8  2 byte pointer to s8
                  *char
```

The memory area to which the pointer is pointing can be specified by a decimal number following the 'p<size>' where <size> is a mandatory single digit pointer size specifier. The number that follows specifies the index of a linear formula that points to the memory area. If no number is specified the default formula (ADDRESS) is assumed (CODE area on 8031 CPU family).

```
p24s8 2 byte pointer to s8, the object pointed to, is
accessed by 4-th formula
```

If the 4-th formula was defined (XDATA)(ADDRESS), then this is a pointer to a char variable located in XDATA memory area.

```
                  * xdata char
```

Array Specification

A type can be prefixed by an 'a' followed by a number, thus specifying an array of the type:

```
a40s8 array of 40 s8 elements
                  char[40]
```

```
a10pu16 array of 10 pointers to u16 elements
                  unsigned int *[40]
```

Examples

A SIT file can contain just simple user extensions to the symbol table, thus defining additional symbols:

```
260691SLO

GLOBAL HeapOrigin,0x4000

LABEL  start,0
```

The above file defines an untyped global symbol 'HeapOrigin', located on address 4000h and program label 'start' on address 0h.

If you write your own translator from your linker output or listing file the SIT file might look something like this:

```
260691SLO

FORMULA    1,(IX+ADDRESS)

MODULE     STARTUP,C:\LUKNA\STARTUP.ASM

LABEL      start,0

GLOBAL     StackTop,0xFFFF

CONSTANT   StackSize,0x1000

MODULE     MAIN,C:\LUKNA\MAIN.C

LINE       0x1000,10

LINE       0x1008,12

LINE       0x1010,13

LINE       0x103C,17

LINE       0x106A,18

LINE       0x1070,20

GLOBAL     c,0x4000,s8

FUNCTION   main,0x1000,0x1080

LOCAL      i,1:-2,s16

FUNCTION   ,0x1010,0x106A

LOCAL      i,1:-6,f32
```

If you decide to write your own translator, this is the order in which to do it:

- write the 260691SLO header
- write all required formulas
- write global variables and labels that are not defined in any of modules
- write module by module with its lines, globals, labels and functions

Accepted Formulas

The list below shows formulas that are accepted:

Formula string	Description
(ADDRESS)	default linear addressing mode
<register>	variable stored in a CPU register. Example: R0
(<register>+ADDRESS)	offset from a CPU register. Example: (SP+ADDRESS)
((<variable>)+ADDRESS)	offset from a variable. '<variable>' is a simple type variable. Example: ((?C_XBP)+ADDRESS).

All above formulas can be preceded by a memory area specifier, thus defining the CPU memory area. If none is specified the default program area is assumed.

(<memory area>)<formula>

Example:

```
(XDATA)(ADDRESS)
```

linear addressing in the XDATA area

Color Syntax Files Definition

Special Keyword Definition

Keyword coloring has proven itself many times for developers, since information is organised also in colors. The colors for standard keywords for C/C++ can be specified in the Editor Options/Colors dialog. Also, special keywords can be defined, for example special typedefs can be defined as keywords for both C/C++ files and Assembler files. The keywords are defined in two special files called ‘C.CCS’ for C/C++ keywords and ‘ASM.CCS’ for Assembler keywords. The coloring of keywords is defined also in the Editor Options/Colors dialog, under ‘C/CPP Custom’ and ‘ASM Custom’, respectivelly.

The ‘C.CCS’ and ‘ASM.CCS’ are expected by winIDEA to be located in the 'CCS' subdirectory of winIDEA's installation directory.

C.CCS and ASM.CCS File Syntax

‘C.CCS’ and ‘ASM.CCS’ syntax is simple. Text of every line in the file is considered a keyword, and the file is a plain text file.

Example (c.ccs):

```
UINT
DWORD
BYTE
```

Example (asm.ccs)

```
SECTION
MODULE
DB
DS
```

Assembler Color Syntax File Definition

This is a specification of the Assembler Color Syntax file. Since there is no syntax standard for assemblers, the syntax must be configured in a definition file specified in the Edit/Options/Customize dialog (see “Further Customization” on page 43).

The dialog will list all syntax definition files located in the 'CCS' subdirectory of winIDEA's installation directory.

CCS File Syntax

The definition file is a plain text file and must have the extension '.CCS'.

```
IDENTIFIER_CHAR_FIRST: <list of characters that can start
an identifier>

IDENTIFIER_CHAR: <list of characters that can be used in an
identifier after the first character>

KEYWORDS:

        <keyword 1>

        <keyword 2>

        ...

        <keyword N>

KEYWORDS1:

        <keyword1 1>

        <keyword1 2>

        ...

        <keyword1 N>

COMMENT_EOLN: <string that starts a comment valid until the
end of the line>

COMMENT_OPEN: <string that starts a multi line comment>

COMMENT_CLOSE: <string that ends a multi line comment>

STRING_CHAR: <character that starts and ends a string>

CHAR_CHAR: <character that starts a character definition>

CASE_SENSITIVE: yes | no <selects case sensitivity>
```

The order of tags in the definition file is not important. If a certain tag is ommited, the following default is assumed:

```
IDENTIFIER_CHAR_FIRST:
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ_

IDENTIFIER_CHAR:
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123
456789_
```

No keywords, comments and strings are recognized.

Example (Keil A51 assembler):

```
IDENTIFIER_CHAR_FIRST:
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ_?$

IDENTIFIER_CHAR:
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123
456789_?

KEYWORDS:

        ADC

        ADD

        ...

        XRL

KEYWORDS1:

        BIT

        CODE

        ...

        SEGMENT

COMMENT_EOLN: ;

STRING_CHAR: '
```

Glossary of Terms

AUX

Auxiliary signals recorded by trace board

Bank-switching

Memory range expansion technique used mainly on 8 bit CPUs

BDM

Background Debug Mode - special debug aid module found on some Motorola CPUs

Breakpoint

Real-time condition that stops the CPU.

Browser

Symbol table navigation tool.

Build Manager

Program module, which interfaces third party compilers

Code Coverage

Execution analysis method which finds non-executed program code

Context Menu

A local menu holding commands that are specific to a window. Activated with right mouse button.

Debug Areas

Emulated CPU's memory ranges covered by emulation memory. Full debugging is not available outside these areas.

Debug monitor

Program code residing in the target system’s memory, which communicates with emulator and handles debug requests.

Download

Operation that initializes hardware, loads the program and starts emulation.

Download file

File holding symbolic and/or program information, loaded by winIDEA upon download request.

Emulation memory

Memory provided by in-circuit emulator. Used instead of target's memory.

Evaluation period

A one-month period, where no license limits apply.

Group

Build Manager's organization structure. Groups project files.

In-Circuit emulation

CPU emulation technique, using target CPU replacement

Indirection file

Configuration file used by linker.

JTAG

Special on-chip debug aid module found on some CPUs

Link Order

Order in which object modules are passed to linker.

Memory mapping

In-circuit emulation memory configuration. Determines which memory requests are serviced by emulator and which are passed to target.

ONCE

ON-Chip Emulation

Output Directory

The directory where all files created in a build session are moved to.

Pattern generator

Programmable signal generator found on in-circuit emulation units

Performance analysis

Execution analysis method, which determines CPU time, spent in program functions

POD

In-circuit emulation adapter which plugs into the target's CPU socket.

Profiler

Performance analysis method, based on recording function entries and exits

Project configuration file

File which holds compiler interface configurations as well as a list of user source files that participate in the build.

Project file

User's source file used in the build process.

PROM simulation

ROM, RAM, FLASH simulation

PROM system

Hardware and software that control ROM/RAM simulator operation

Pseudo device

A logical grouping of physical PROM devices and configurations. Facilitates handling multi-device simulation.

Qualifier

Trace condition specifying what type of information is recorded.

Real-time access

In-circuit emulation memory access method. Allows reading and writing of memory without stopping the CPU.

REmulation

CPU emulation technique, using a combination of memory device replacement and simulation

SFR

Special Function Register

Single chip

CPU without external memory.

Target

Build Manager's set of configuration options.

Target system

User hardware whose program is being debugged

Trace

Optional debug module, used for real-time program execution analysis

Trigger

Complex real-time trace condition which controls trace board activation.

Watchdog

A hardware timer, which resets the CPU, if not serviced periodically by the target program.

Workspace

The full set of configuration, project and other files involved in one project.

Workspace file

The central file which holds all workspace configuration information, except for Build Manager configuration.

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