

PureBasic Reference Manual

6.11

<http://www.purebasic.com/>

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Part I
General

Chapter 1

Introduction

PureBasic is an "high-level" programming language based on established "BASIC" rules. It is mostly compatible with any other "BASIC" compiler. Learning PureBasic is very easy! PureBasic has been created for beginners and experts alike. Compilation time is extremely fast. This software has been developed for the Windows operating system. We have put a lot of effort into its realization to produce a fast, reliable and system-friendly language.

The syntax is easy and the possibilities are huge with the "advanced" functions that have been added to this language like pointers, structures, procedures, dynamic lists, maps, interfaces, modular programming (modules), an inline assembler and much more. For the experienced coder, there are no problems gaining access to any of the legal OS structures or API objects.

PureBasic is a portable programming language which currently works on Linux, Mac OS X and Windows computer systems. This means that the same code can be compiled natively for the OS and use the full power of each. There are no bottlenecks like a virtual machine or a code translator, the generated code produces an optimized executable.

The main features of PureBasic

- x86 and x64 support
- 83 native libraries
- Hundreds of functions
- Built-in arrays, dynamic lists, complex structures, maps, pointers and variable definitions
- Supported types: Byte (8-bit), Word (16-bit), Long (32-bit), Quad (64-bit), Float (32-bit), Double (64-bit) and Characters
- User defined types (structures)
- Built-in string types (characters), including ascii and unicode
- Powerful macro support
- Constants, binary and hexadecimal numbers supported
- Expression reducer by grouping constants and numeric numbers together
- Standard arithmetic support in respect of sign priority and parenthesis: +, -, /, *, and, or, «, »
- Extremely fast compilation
- Procedure support for structured programming with local and global variables
- All Standard BASIC keywords: If-Else-EndIf, Repeat-Until, etc
- Specialized libraries to manipulate BMP pictures, windows, gadgets, DirectX, etc
- Specialized libraries are very optimized for maximum speed and compactness
- The Win32 API is fully supported as if they were BASIC keywords
- Inline Assembler
- Precompiled structures with constants files for extra-fast compilation
- Integrated debugger to follow the execution of a program and correct errors more easily
- Configurable CLI compiler
- Dedicated editor with automatically highlighted syntax
- Very high productivity, comprehensive keywords, online help

- System friendly, easy to install and easy to use
- IDE and help available in english, french and german
- SDK Visual C
- Compilation of windowed program, console and DLL
- Creation of integrated wysiwyg windows
- Creation of windows with automatic reorganization of gadgets (layout) with the 'Dialog' library
- 33 native gadgets
- 1 gadget specialized in OpenGL
- 1 scintilla gadget
- Process, thread, mutex, semaphore
- Drag'n drop
- DPI for MS Windows
- QT and GTK3 for Linux
- DirectX and OpenGL systems
- Import of static (lib) or dynamic libraries (dll, so, etc.)
- Drawing with antialiasing with the 'Vector' library
- 3D functions with the 3D engine OGRE
- Pseudotypes: p-ascii, p-utf8, p-bstr, p-unicode, p-variant
- Array, linked-list (list), maps, Database (MySQL, SQLite, ODBC, PostgreSQL, Maria)
- json, xml
- Regular expression
- http, ftp, mail, application server / client, CGI and FastCGI
- Cypher
- OnError
- Compressor/decompressor: BriefLZ, JCALG1, LZMA, Tar, Zip
- ini file
- Printer, serial port
- Runtime

Here is the exhaustive list of all the libraries that PureBasic offers:

1	Windows & system :
2	arrays
3	cgi
4	cipher
5	clipboard
6	console
7	database
8	date
9	debugger
10	desktop
11	dialog
12	dragdrop
13	file
14	filesystem
15	font
16	ftp
17	gadget
18	help
19	http
20	json
21	library
22	lists
23	mail
24	maps
25	math
26	memory
27	menu
28	network
29	onerror
30	packer

31 preference
32 printer
33 process
34 regularexpression
35 requester
36 runtimes
37 scintilla
38 serialport
39 sort
40 statusbar
41 string
42 system
43 systray
44 thread
45 toolbar
46 window
47 xml
48
49 2D & Medias :
50 2ddrawing
51 audiocd
52 font
53 image
54 imageplugin
55 joystick
56 keyboard
57 mouse
58 movie
59 music
60 screen
61 sound
62 soundplugin
63 sprite
64 vectordrawing
65
66 3D Engine :
67 billboard
68 camera
69 engine3d
70 entity
71 entityanimation
72 gadget3d
73 joint
74 light
75 material
76 mesh
77 node
78 nodeanimation
79 particle
80 sound3d
81 specialeffect
82 spline
83 staticgeometry
84 terrain
85 text3d
86 texture
87 vehicle
88 vertexanimation
89 window3d

Chapter 2

Terms And Conditions

This program is provided "**AS IS**". Fantaisie Software are NOT responsible for any damage (or damages) attributed to PureBasic. You are warned that you use PureBasic at your own risk. No warranties are implied or given by Fantaisie Software or any representative.

The demo version of this program may be freely distributed provided all contents, of the original archive, remain intact. You may not modify, or change, the contents of the original archive without express written consent from Fantaisie Software.

PureBasic has an user-based license. This means you can install it on every computer you need but you can't share it between two or more people.

All components, libraries, and binaries are copyrighted by Fantaisie Software. The PureBasic license explicitly forbids the creation of DLLs whose primary function is to serve as a 'wrapper' for PureBasic functions.

Fantaisie Software reserves all rights to this program and all original archives and contents.

PureBasic uses the Scintilla editing component and its related license can be consulted [here](#) .

PureBasic uses GCC compiler and its related license can be consulted [here](#) and [here](#)

The PureBasic uses FASM flat assembler and its related license can be consulted [here](#)

The PureBasic uses PellesC toolchain and its related license can be consulted [here](#)

PureBasic built-in libraries uses opensources components, the licenses can be consulted [here](#) and [here](#)

Chapter 3

System requirements

PureBasic will run on Windows XP, Windows Vista, Windows 7, Windows 8 and Windows 10 (in both 32-bit and 64-bit edition), Linux (kernel 2.2 or above) and MacOS X (10.8.5 or above).

If there are any problems, please contact us.

Windows

For many graphic functions like 3D or Sprites there is needed the DirectX9.0c version. Windows Vista and later don't have installed this from start, so it need to be installed manually.

You can download and install it via the "DirectX End-User Runtime Web Installer" here:

<http://www.microsoft.com/en-us/download/details.aspx?displaylang=en&id=35>.

Linux

Required packages to use PureBasic:

- sdl 1.2 devel (For games)
- gtk 3 (For GUI programs)
- libstdc++ devel
- gcc correctly installed
- iodbcc and iodbcc-devel to be able to use the Database commands (see www.iodbcc.org)
- libwebkit should be installed to have the WebGadget() working.
- xine and xine-devel for the Movie commands Check the INSTALL and README file for more information.

MacOS X

You need to install the Apple developer tools to be able to use PureBasic. The tools can be found either on one of the install CDs or on the Apple web site: <http://developer.apple.com/>

Be aware to use the latest version of the tools (e.g. XCode), which is needed for your OS version! The commandline tools needs to be installed from XCode once installed.

Chapter 4

Installation

To install PureBasic, just click on the install wizard, follow the steps, and then click on the PureBasic icon (found on the desktop or in the start-menu) to launch PureBasic.

To use the command line compiler, open a standard command line window (CMD) and look in the "Compilers\" subdirectory for PBCompiler.exe. It's a good idea to consider adding the "PureBasic\Compilers\" directory to the PATH environment variable to make the compiler accessible from any directory.

Important note: to avoid conflicts with existing PureBasic installations (maybe even with user-libraries), please install a new PureBasic version always in its own new folder. See also the chapter Using several PureBasic versions .

Chapter 5

Order

PureBasic is a low-cost programming language. In buying PureBasic you will ensure that development will go further and faster. For personal use (i.e.: not used by a commercial organization) the updates are unlimited, unlike most other software out there. This means when you buy PureBasic you will get all future updates for free, on the web site. Better still, you get the three versions of PureBasic (MacOSX, Linux and Windows) for the same price! For ease of ordering, you can safely use our secure online method. Thanks a lot for your support!

The demo-version of PureBasic is limited as shown below:

- No DLL can be created
- you can't use the whole external Win32 API support
- no development kit for external libraries
- maximum number of source lines: 800

Full version of PureBasic:

Price for full version: 79 Euros

There are special prices for company licences (499 Euros) and educational licences (199 Euros for a school class).

Online Ordering

Payment online (www.purebasic.com) is available and very secure. (Note: Such orders are handled directly by Fred.)

If you live in Germany or Europe and prefer paying to bank account you can also send your registration to the German team member. In this case please send your order to following address:

André Beer
Siedlung 6
09548 Deutschneudorf
Germany
e-mail: andre@purebasic.com

Bank Account:

Deutsche Kreditbank AG
Account 15920010 - Bank code 12030000
(For transactions from EU countries: IBAN: DE03120300000015920010 -
BIC/Swift-Code: BYLADEM1001)

Paypal:
andrebeer@gmx.de
(This address can be used for Paypal transaction, if you want
personal contact to or an invoice from André.)

Delivering of the full version

The full version will be provided via your personal download account, which you will get on www.purebasic.com after successful registration. If you order from André, just write an e-mail with your full address or use this registration form and print it or send it via e-mail.

Chapter 6

Contact

Please send bug reports, suggestions, improvements, examples of source coding, or if you just want to talk to us, to any of the following addresses:

Frédéric 'AlphaSND' Laboureur

Fred 'AlphaSND' is the founder of Fantaisie Software and the main coder for PureBasic. All suggestions, bug reports, etc. should be sent to him at either address shown below:

s-mail :

Frédéric Laboureur
10, rue de Lausanne
67640 Fegersheim
France

e-mail : fred@purebasic.com

André Beer

André is responsible for the complete German translation of the PureBasic manual and website.

PureBasic can be ordered in Germany also directly at him.

Just write an email with your full address (for the registration) to him. If needed you can also get an invoice from him. For more details just take a look [here](#).

e-mail : andre@purebasic.com

Chapter 7

Acknowledgements

We would like to thank the many people who have helped in this ambitious project. It would not have been possible without them !

- All the registered users: To support this software... Many Thanks !

Coders

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Miscellaneous

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<http://flatassembler.net/>
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- **Jacob Navia:** For the linker (from the Lcc32 package) which was used in previous PureBasic versions
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- **Jean R. VIALE:** To have greatly improved the french documentation, and still doing it !

Part II

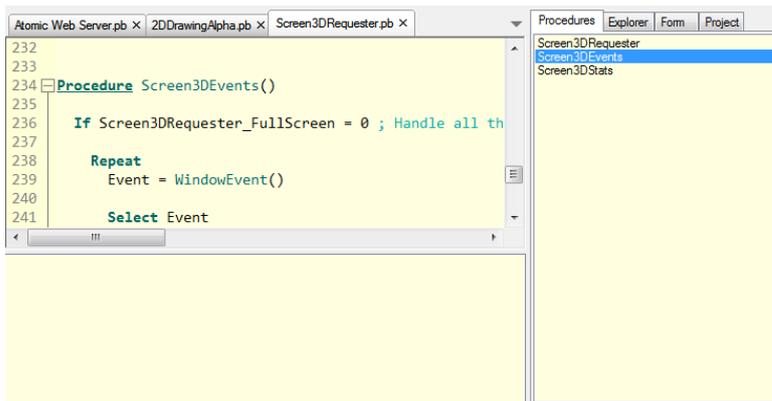
The PureBasic Editor

Chapter 8

Getting Started

The PureBasic IDE allows you to create and edit your PureBasic source codes, as well as run them, debug them and create the final executable. It has both an interface to the PureBasic Compiler , as well to the PureBasic Debugger .

The IDE main window contains of 3 major parts:



The code editing area (below the toolbar)

Here all the source codes are displayed. You can switch between them with the tabs located right above it.

The tools panel (on the right side by default)

Here you have several tools to make coding easier and increase productivity. The tools displayed here can be configured, and it can even be completely removed. See Customizing the IDE for more information.

The error log (located below the editing area)

In this area, the compiler errors and debugger messages are logged. It can be hidden/shown for each source code separately.

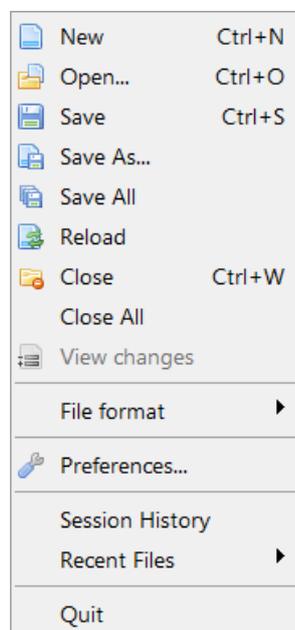
Other than that, there is the main menu and the toolbar. The toolbar simply provides shortcuts to menu features. It can be fully customized. To find out what each button does, move your mouse over it and wait until a small tool-tip appears. It shows the corresponding menu command. The menu commands are explained in the other sections.

Chapter 9

Working with source files

The file menu allows you to do basic file operations like opening and saving source codes. You can edit multiple source code files at the same time. You can switch between them using the panel located under the Toolbar. Also the shortcut keys Ctrl+Tab and Ctrl+Shift+Tab can be used to jump to the next or previous open source file, respectively. The IDE allows the editing of non-sourcecode text files. In this "plain text" mode, code-related features such as coloring, case correction, auto complete are disabled. When saving plain text files, the IDE will not append its settings to the end of the file, even if this is configured for code files in the Preferences . Whether or not a file is considered a code-file or not depends on the file extension. The standard PureBasic file extensions (pb, pbi and pbf) are recognized as code files. More file extensions can be recognized as code files by configuring their extension in the "Editor" section of the Preferences .

Contents of the "File" menu:



New

Create a new empty source code file.

Open

Open an existing source code file for editing.

Any text file will be loaded into the source-editing field. You can also load binary files with the Open menu. These will be displayed in the internal File Viewer .

Save

Saves the currently active source to disk. If the file isn't saved yet, you will be prompted for a filename. Otherwise the code will be saved in the file it was saved in before.

Save As...

Save the currently active source to a different location than it was saved before. This prompts you for a new filename and leaves the old file (if any) untouched.

Save All

Saves all currently opened sources.

Reload

Reloads the currently active source code from disk. This discards any changes not yet saved.

Close

Closes the currently active source code. If it was the only open code, the IDE will display a new empty file.

Close All

Closes all currently opened sources.

View changes

Shows the changes made to the current source code compared to its version that exists on the hard drive.

File format

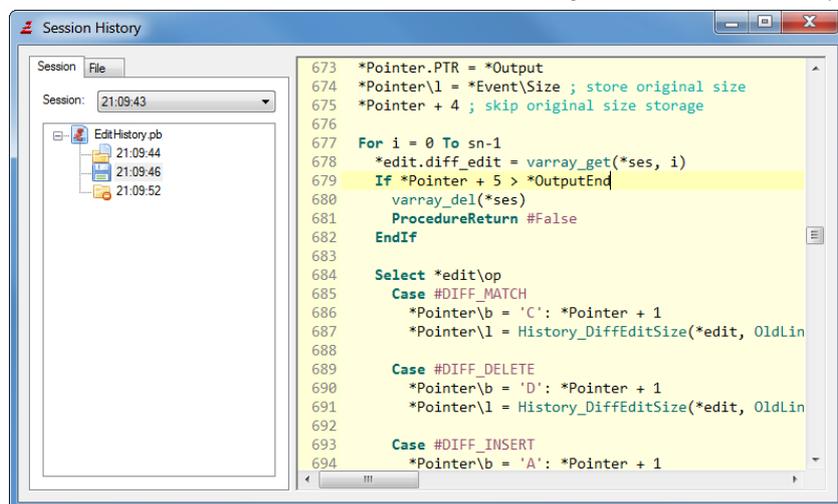
In this submenu you can select the text encoding as well as the newline format which should be used when the currently active source code is saved to disk. The IDE can handle files in Ascii or UTF-8. The newline formats it can handle are Windows (CRLF), Linux/Unix (LF) and MacOSX (CR). The defaults for newly created source codes can be set in the preferences .

Preferences

Here you can change all the settings that control the look & behavior of the IDE. For a detailed description of that see Customizing the IDE .

Session history

Session history is a powerful tool which regularly records changes made to any files in a database. A session is created when the IDE launch, and is closed when the IDE quits. This is useful to rollback to a previous version of a file, or to find back a deleted or corrupted file. It's like source backup tool, limited in time (by default one month of recording). It's not aimed to replace a real source code version control system like SVN or GIT. It's complementary to have finer change trace. The source code will be stored without encryption, so if you are working on sensitive source code, be sure to have this database file in a secure location, or disable this feature. To configure the session history tool, see preferences .



Recent Files

Here you can see a list of the last accessed files. Selecting a file in this submenu will open it again.

Quit

This of course closes the IDE. You will be asked to save any non-saved source codes.

Chapter 10

Editing features

The PureBasic IDE acts like any other Text Editor when it comes to the basic editing features. The cursor keys as well as Page Up/Page Down, Home and End keys can be used to navigate through the code. Ctrl+Home navigates to the beginning of the file and Ctrl+End to the End.

The default shortcuts Ctrl+C (copy), Ctrl+X (cut) and Ctrl+V (paste) can be used for editing. The "Insert" key controls whether text is inserted or overwritten. The Delete key does a forward delete.

Holding down the Shift key and using the arrow keys selects text.

The shortcuts Ctrl+Shift+Up and Ctrl+Shift+Down allow you to move a line up or down.

The shortcut Ctrl+D duplicates a selection.

In Windows, the shortcuts Ctrl+Plus and Ctrl+Minus allow you to zoom in and out the display of all tabs and Ctrl+0 restores the default zoom. Linux and OSX users can create them themselves. The shortcut Ctrl+mouse wheel only zooms the current tab.

The shortcuts Ctrl+Tab and Ctrl+Shift+Tab allow you to move around the open tabs.

There are many shortcuts available, like Ctrl+Shift+U/L/X to change the case, etc. Go to Preferences (menu "Files" / "Preferences / General / Shortcuts").

Furthermore, the IDE has many extra editing features specific to programming or PureBasic.

Indentation:

When you press enter, the indentation (number of space/tab at the beginning of the line) of the current and next line will be automatically corrected depending on the keywords that exist on these lines. A "block mode" is also available where the new line simply gets the same indentation as the previous one. The details of this feature can be customized in the preferences .

Tab characters:

By default, the IDE does not insert a real tab when pressing the Tab key, as many programmers see it as a bad thing to use real tabs in source code.

It instead inserts two spaces. This behavior can be changed in the Preferences. See Customizing the IDE for more information.

Special Tab behavior:

When the Tab key is pressed while nothing or only a few characters are selected, the Tab key acts as mentioned above (inserting a number of spaces, or a real tab if configured that way).

However when one or more full lines are selected, the reaction is different. In that case at the beginning of each selected line, it will insert spaces or a tab (depending on the configuration). This increases the indentation of the whole selected block.

Marking several lines of text and pressing Shift+Tab reverses this behavior. It removes spaces/tabs at the start of each line in order to reduce the indentation of the whole block.

Indentation/Alignment of comments:

Similar to the special tab behavior above, the keyboard shortcuts Ctrl+E and Ctrl+Shift+E (CMD+E and CMD+Shift+E on OSX) can be used to change the indentation of only the comments in a selected block of code. This helps in aligning comments at the end of code lines to make the code more readable. The used shortcut can be configured in the preferences .

Selecting blocks of code:

The shortcut Ctrl+M (CMD+M on OSX) can be used to select the block of code that contains caret position (i.e. the surrounding If block, loop or procedure). Repeated usage of the shortcut selects further surrounding code blocks.

The shortcut Ctrl+Shift+M (CMD+Shift+M on OSX) reverses the behavior and reverts the selection to the block that was selected before the last usage of the Ctrl+M shortcut.

The used shortcuts can be configured in the preferences .

Double-clicking on source text:

Double-clicking on a word selects the whole word as usual. However in some cases, double-clicking has a special meaning:

When double-clicking on the name of a procedure call, while holding down the Ctrl Key, the cursor automatically jumps to the declaration of this procedure (the source containing this must currently open or part of the same project).

When double-clicking on an IncludeFile or XincludeFile statement, the IDE will try to open that file. (This is only possible if the included file is written as a literal string, and not through for example a constant.)

In the same way, if you double-click on an IncludeBinary statement, the IDE will try to display that file in the internal file viewer .

Marking of matching Braces and Keywords:

```
46 Select Event
47   Case #PB_Event_Gadget
48     Select EventGadget()
49   Case 1
50     SetGadgetState(10,
51     EndSelect
52   Case #PB_Event_Menu ; We
53     SetGadgetText(10, GetGa
54   EndSelect
```

When the cursor is on an opening or closing brace the IDE will highlight the other brace that matches it. If a matching brace could not be found (which is a syntax error in PureBasic) the IDE will highlight the current brace in red. This same concept is applied to keywords. If the cursor is on a Keyword such as "If", the IDE will underline this keyword and all keywords that belong to it such as "Else" or "EndIf". If there is a mismatch in the keywords it will be underlined in red. The "Goto matching Keyword" menu entry described below can be used to quickly move between the matching keywords.

The brace and keyword matching can be configured in the Preferences .

Command help in the status bar:

ButtonGadget(#Gadget, x, y, **Width**, Height, Text\$ [, Flags]) - Create a button gadget in the current GadgetList.

While typing, the IDE will show the needed parameters for any PureBasic function whose parameters you are currently typing. This makes it easy to see any more parameters you still have to add to this function. This also works for procedures, prototypes, interfaces or imported functions in your code as long as they are declared in the same source code or project.

Folding options:

```
319 Procedure.s ZipFileReques
377
378 Procedure.s OpenZipFileRe
379   ProcedureReturn ZipFile
380 EndProcedure
381
```

When special folding keywords are encountered (`Procedure` / `EndProcedure` by default. More can be added), the IDE marks the region between these keywords on the left side next to the line numbers with a `[-]` at the starting point, followed by a vertical line to the end point.

By clicking on the `[-]`, you can hide ("fold") that section of source code to keep a better overview of larger source files. The `[-]` will turn into a `[+]`. By clicking again, the code will again be shown ("unfolded") again.

Note: Even though the state of these folded code lines is remembered when you save/reopen the file, the actual created code file always contains all lines. This only affects the display of the code in the IDE, not the code itself.

Another default fold keyword is `;"{"` and `;"}"`. Since `;"` marks a comment in PB, these will be totally ignored by the compiler. However, they provide the possibility to place custom fold points that do not correspond to a specific PB keyword.

Auto complete:

```
7
8 prod
9 Procedure
10 ProcedureC
11 ProcedureCDLL
12 ProcedureDLL
   ProcedureReturn
```

So that you do not have to remember the exact name of every command, there is the Auto complete feature to make things easier.

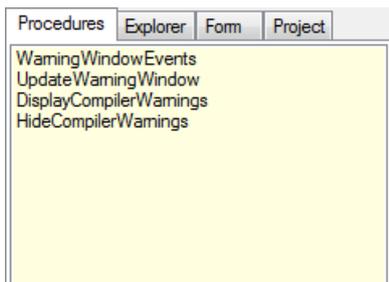
After you have typed the beginning of a command, a list of possible matches to the word start you have just typed will be displayed. A list of options is also displayed when you typed a structured variable or interface followed by a `"\"`.

You can then select one of these words with the up/down keys and insert it at the point you are by pressing the Tab key. You can also continue typing while the list is open. It will select the first match that is still possible after what you typed, and close automatically when either you have just typed an exact match or if there are no more possible matches in the list.

Escape closes the auto complete list at any time. It also closes if you click with the mouse anywhere within the IDE.

Note: You can configure what is displayed in the Auto complete list, as well as turning off the automatic popup (requiring a keyboard shortcut such as `Ctrl+Space` to open list) in the Preferences. See the Auto complete section of Customizing the IDE for more information.

Tools Panel on the side:



Many tools to make navigating/editing the source code easier can be added to the Tools Panel on the side of the editor window. For an overview of them and how to configure them, see Built-in Tools .

The Edit Menu:

Following is an explanation of the Items in the Edit menu. Note that many of the Edit menu items are also accessible by right clicking on the source code, which opens a popup menu.

	Undo	Ctrl+Z
	Redo	Ctrl+Y
<hr/>		
	Cut	Ctrl+X
	Copy	Ctrl+C
	Paste	Ctrl+V
<hr/>		
	Insert comments	Ctrl+B
	Remove comments	Ctrl+Shift+B
	Format indentation	Ctrl+I
<hr/>		
	Select All	Ctrl+A
<hr/>		
	Goto...	Ctrl+G
	Goto matching Keyword	Ctrl+K
	Goto recent Line	Ctrl+L
<hr/>		
	Toggle current fold	F4
	Toggle all folds	Ctrl+F4
<hr/>		
	Add/Remove Marker	Ctrl+F2
	Jump to Marker	F2
	Clear Markers	
<hr/>		
	Find/Replace...	Ctrl+F
	Find Next	F3
	Find in Files...	Ctrl+Shift+F

Undo

Undoes the last done action in the code editing area. There is an undo buffer, so several actions can be undone.

Redo

Redo the last action undone by the undo function.

Cut

Copy the selected part of the source code to the clipboard and remove it from the code.

Copy

Copy the selected text to the Clipboard without deleting it from the code.

Paste

Insert the content of the Clipboard at the current position in the code. If any text is selected before this, it will be removed and replaced with the content of the Clipboard.

Insert comments

Inserts a comment (";") before every line of the selected code block. This makes commenting large blocks of code easier than putting the ; before each line manually.

Remove comments

Removes the comment characters at the beginning of each selected line. This reverts the "Insert comments" command, but also works on comments manually set.

Format indentation

Reformats the indentation of the selected lines to align with the code above them and to reflect the keywords that they contain. The rules for the indentation can be specified in the preferences .

Select all Selects the whole source code.

Goto

This lets you jump to a specific line in your source code.

Goto matching Keyword

If the cursor is currently on a keyword such as "If" this menu option jumps directly to the keyword that matches it (in this case "EndIf").

Goto recent line

The IDE keeps track of the lines you view. For example if you switch to a different line with the above Goto function, or with the Procedure Browser tool. With this menu option you can jump back to the previous position. 20 such past cursor positions are remembered.

Note that this only records greater jumps in the code. Not if you just move up/down a few lines with the cursor keys.

Toggle current fold

This opens/closes the fold point in which the cursor is currently located.

Toggle all Folds

This opens/closes all fold points in the current source. Very useful to for example hide all procedures in the code. Or to quickly see the whole code again when some of the code is folded.

Add/Remove Marker

Markers act like Bookmarks in the source code. Their presence is indicated by a little arrow next to the line numbers. You can later jump to these markers with the "Jump to marker" command.

The "Add/Remove Marker" sets or removes a marker from the current line you are editing.

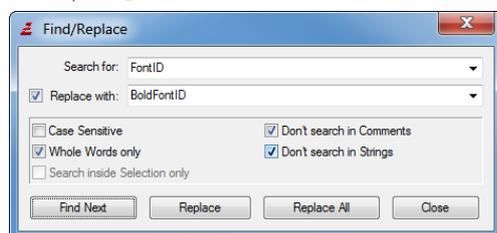
Note: You can also set/remove markers by holding down the Ctrl Key and clicking on the border that holds the markers (not the Line-number part of it).

Jump to Marker

This makes the cursor jump to the next marker position further down the code from the current cursor position. If there is no marker after the cursor position, it jumps to the first one in the source code. So by pressing the "Jump to Marker" shortcut (F2 by default) several times, you can jump to all the markers in the code.

Clear Markers This removes all markers from the current source code.

Find/Replace



The find/replace dialog enables you to search for specific words in your code, and also to replace them with something else.

The "Find Next" button starts the search. The search can be continued after a match is found with the Find Next menu command (F3 by default).

You can make the search more specific by enabling one of the checkboxes:

Case Sensitive : Only text that matches the exact case of the search word will be found.

Whole Words only : Search for the given word as a whole word. Do not display results where the search word is part of another word.

Don't search in Comments : Any match that is found inside a comment is ignored.

Don't search in Strings : Any match that is found inside a literal string (in " ") is ignored.

Search inside Selection only : Searches only the selected region of code. This is really useful only together with the "Replace All" button, in which case it will replace any found match, but only inside the selected region.

By enabling the "Replace with" checkbox, you go into replace mode. "Find Next" will still only search, but with each click on the "Replace" button, the next match of the search word will be replaced by whatever is inside the "Replace with" box.

By clicking on "Replace All", all matches from the current position downwards will be replaced (unless "Search inside Selection only" is set).

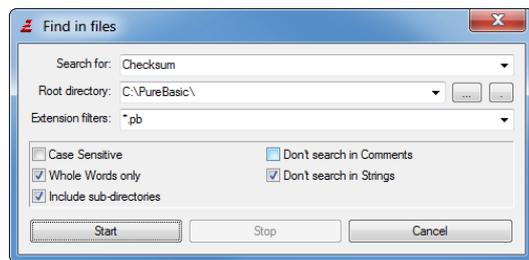
Find Next

This continues the search for the next match of the last search started by the Find/Replace dialog.

Find Previous

This continues the search for the previous match of the last search started by the Find/Replace dialog.

Find in Files



The Find in Files Dialog lets you carry out a search inside many files in a specific directory.

You have to specify a search keyword, as well as a base directory ("root directory") in which to search. You can customize the searched files by specifying extension filters. Any number of filters can be given separated by ",". (*.*) or an empty extension field searches all files). As with "Find/Replace", there are checkboxes to make the search more specific.

The "Include sub-directories" checkbox makes it search (recursively) inside any subdirectory of the given root directory too.

When starting the search, a separate window will be opened displaying the search results, giving the file, line number as well as the matched line of each result.

Double-clicking on an entry in the result window opens that file in the IDE and jumps to the selected result line.

Chapter 11

Managing projects

The IDE comes with features to easily handle larger projects. These features are completely optional. Programs can be created and compiled without making use of the project management. However, once a program consists of a number of source code and maybe other related files, it can be simpler to handle them all in one project.

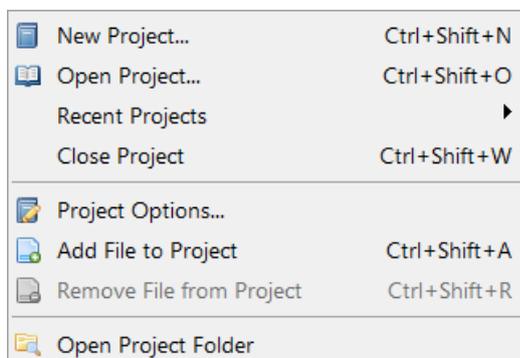
Project management overview

A project allows the management of multiple source codes and other related files in one place with quick access to the files through the project tool . Source files included in a project can be scanned for AutoComplete even if they are not currently open in the IDE. This way functions, constants, variables etc. from the entire project can be used with AutoComplete. The project can also remember the source files that are open when the project is closed and reopen them the next time to continue working exactly where you left off.

Furthermore, a project keeps all the compiler settings in one place (the project file) and even allows to manage multiple "compile targets" per project. A compile target is just a set of compiler options. This way multiple versions of the same program, or multiple smaller programs in one project can be easily compiled at once.

To compile a project from a script or makefile, the IDE provides command-line options to compile a project without opening a user interface. See the section on command-line options for more details. All filenames and paths in a project are stored relative to the project file which allows a project to be easily moved to another location as long as the relative directory structure remains intact.

The Project menu



New Project

Creates a new project. If there is a project open at the time it will be closed. The project options window will be opened where the project filename has to be specified and the project can be configured.

Open Project

Opens an existing project. If there is a project open at the time it will be closed. Previously open source codes of the project will be opened as well, depending on the project configuration.

Recent Projects

This submenu shows a list of recently opened project files. Selecting one of the entries opens this project.

Close Project

Closes the currently open project. The settings will be saved and the currently open source files of the project will be closed, depending on the project configuration.

Project Options

Opens the project options window. See below for more information.

Add File to Project

Adds the currently active source code to the current project. Files belonging to the project are marked with a ">" in the file panel.

Remove File from Project

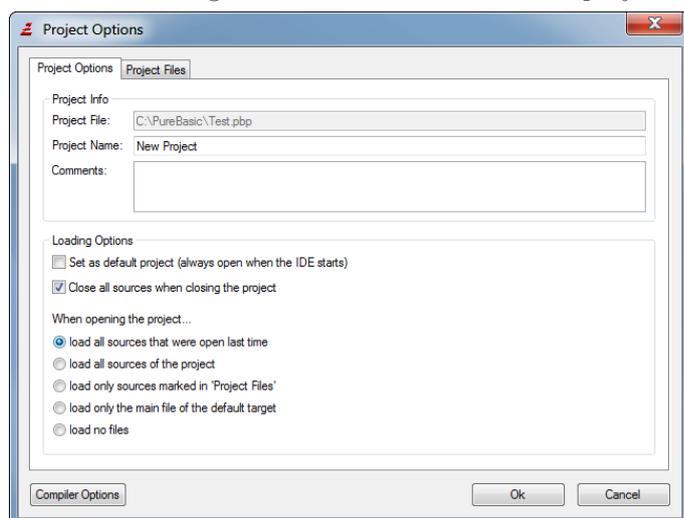
Removes the currently active source from the current project.

Open Project folder

Opens the folder that contains the project file in whatever file manager is available on the system.

The project options window

The project options window is the central configuration for the project. The general project settings as well as the settings for the individual files in the project can be made here.



The following settings can be made on the "Project Options" tab:

Project File

Shows the filename of the project file. This can only be changed during project creation.

Project Name

The name of the project. This name is displayed in the IDE title bar and in the "Recent Projects" menu.

Comments

This field allows to add some comments to the project. They will be displayed in the project info tab.

Set as default project

The default project will be loaded on every start of the IDE. Only one project can be the default project at a time. If there is no default project, the IDE will load the project that was open when the IDE was closed last time if there was one.

Close all sources when closing the project

If enabled, all sources that belong to the project will be closed automatically when the project is closed. When opening the project...

load all sources that where open last time

When the project is opened, all the sources that were open when the project was closed will be opened again.

load all sources of the project

When the project is opened, all (source-)files of the project will be opened.

load only sources marked in 'Project Files'

When the project is opened, only the files that are marked in the 'Project Files' tab will be opened. This way you can start a session always with this set of files open.

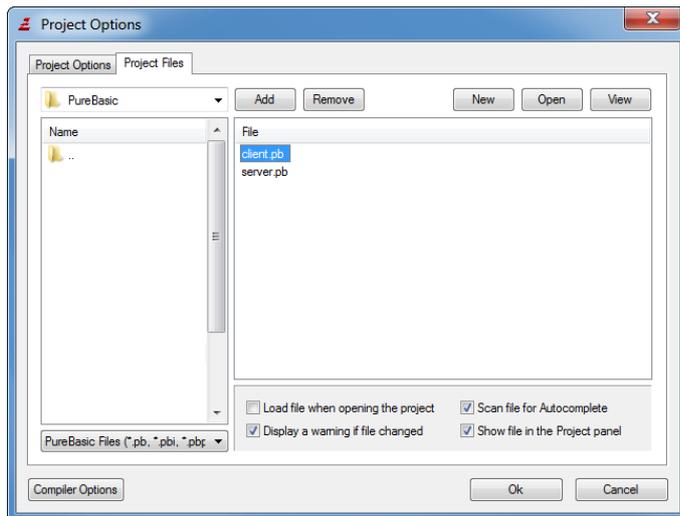
load only the main file of the default target

When the project is opened, the main file of the default target will be opened too.

load no files

No source files are opened when the project is opened.

The "Project Files" tabs shows the list of files in the project on the right and allows changing their settings. The explorer on the left is for the selection of new files to be added.



The buttons on the top have the following function:

Add

Add the selected file(s) in the explorer to the project.

Remove

Remove the selected files in the file list from the project.

New

Shows a file requester to select a filename for a new source file to create. The new file will be created, opened in the IDE and also added to the project.

Open

Shows a file requester to select an existing file to open. The file will be opened in the IDE and added to the project.

View

Opens the selected file(s) in the file list in the IDE or if they are binary files in the FileViewer.

The checkboxes on the bottom specify the options for the files in the project. They can be applied to a single file or to multiple files at once by selecting the files and changing the state of the checkboxes. The settings have the following meaning:

Load file when opening the project

Files with this option will be loaded when the project is open and the "load only sources marked in 'Project Files'" option is specified on the "Project Options" tab.

Display a warning if file changed

When the project is closed, the IDE will calculate a checksum of all files that have this option set and display a warning if the file has been modified when the project is opened the next time. This allows to be notified when a file that is shared between multiple projects has been edited while working on another project. This option should be disabled for large data files to speed up project loading and saving, or for files which are changed frequently to avoid getting a warning every time the project is opened.

Scan file for AutoComplete

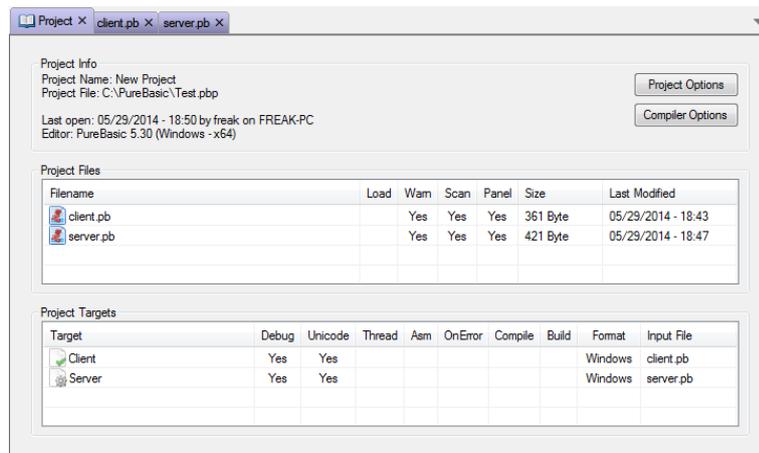
Files with this option will be scanned for AutoComplete data even when they are not currently loaded in the IDE. This option is on by default for all non-binary files. It should be turned off for all files that do not contain source code as well as for any files where you do not want the items to turn up in the AutoComplete list.

Show file in Project panel

Files with this option will be displayed in the project side-panel. If the project has many files it may make sense to hide some of them from the panel to have a better overview and faster access to the important files in the project.

The project overview

When a project is open, the first tab of the file panel shows an overview of the project and its files.

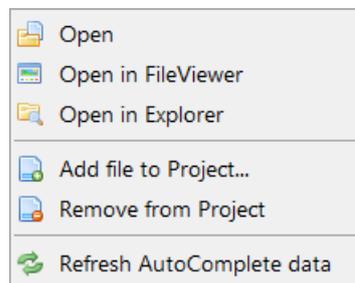


Project Info

This section shows some general info about the project, such as the project filename, its comments or when and where the project was last opened.

Project Files

This section shows all files in the project and their settings from the Project Options window. Double-clicking on one of the files opens the file in the IDE. Right-clicking displays a context menu with further options:



Open - Open the file in the IDE.

Open in FileViewer - Open the file in the FileViewer of the IDE.

Open in Explorer - Open the file in the operating systems file manager.

Add File to Project - Add a new file to the project.

Remove File from Project - Remove the selected file(s) from the project.

Refresh AutoComplete data - Rescan the file for AutoComplete items.

Project Targets

This section shows all compile targets in the project and some of their settings. Double-clicking on one of the targets opens this target in the compiler options . Right-clicking on one of the targets displays a context menu with further options:

Edit target - Open the target in the compiler options.

Set as default target - Set this target as the default target.

Enable in 'Build all Targets' - Include this target in the 'Build all Targets' compiler menu option.

The project panel

There is a sidepanel tool which allows quick access to the files belonging to the project. For more information see the built-in tools section.

Chapter 12

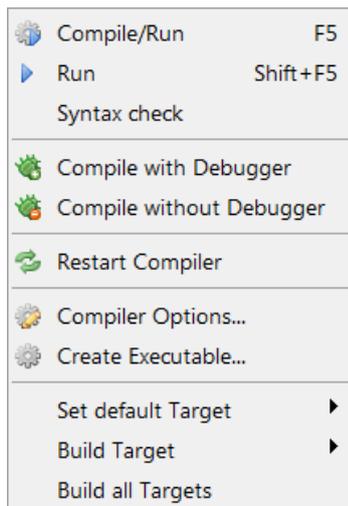
Compiling your programs

Compiling is simple. Just select "Compile/Run" (F5 by default) and your program will be compiled and executed for a testing run.

To customize the compiling process, you can open the "Compiler options" dialog. The settings made there are associated with the current source file or the current project, and also remembered when they are closed. The place where this information is saved can be configured. By default, it is saved at the end of the source code as a comment (invisible in the IDE).

In case of an error that prevents the compiler from completing the compilation, it aborts and displays an error-message. This message is also logged in the error log, and the line that caused the error is marked. A number of functions from older versions of PureBasic that have been removed from the package still exist for a while as a compatibility wrapper to allow older codes to be tested/ported more easily. If such a function is used in the code, the compiler will issue a warning. A window will be opened displaying all warnings issued during compilation. Double-clicking on a warning will display the file/line that caused the warning. Note that such compatibility wrappers will not remain indefinitely but will be removed in a future update, so it is recommended to fix issues that cause a compiler warning instead of relying on such deprecated functions.

The compiler menu



Compile/Run

This compiles the current source code with the compiler options set for it and executes it. The executable file is stored in a temporary location, but it will be executed with the current path set to the directory of the source code; so loading a file from the same directory as the source code will work.

The source code need not be saved for this (but any included files must be saved).

The "Compile/Run" option respects the debugger setting (on or off) from the compiler options or

debugger menu (they are the same).

Run

This executes the last compiled source code once again. Whether or not the debugger is enabled depends on the setting of the last compilation.

Compile with Debugger

This is the same as "Compile/Run" except that it ignores the debugger setting and enabled the debugger for this compilation. This is useful when you usually have the debugger off, but want to have it on for just this one compilation.

Compile without Debugger

Same as "Compile with Debugger" except that it forces the debugger to be off for this compilation.

Restart Compiler (not present on all OS)

This causes the compiler to restart. It also causes the compiler to reload all the libraries and resident files, and with that, the list of known PureBasic functions, Structures, Interfaces and Constants is updated too. This function is useful when you have added a new User Library to the PB directory, but do not want to restart the whole IDE. It is especially useful for library developers to test their library.

Compiler Options

This opens the compiler options dialog, that lets you set the options for the compilation of this source file.

Create executable

This opens a save dialog, asking for the executable name to create. If the executable format is set to DLL, it will create a DLL on Windows, shared object on Linux and dylib on OS X. When creating an executable on OS X, appending '.app' at the executable name will create a bundled executable with the necessary directory structure, including the icon. If no '.app' is set, then it will create a regular console-like executable.

Set default Target

When a project is open, this submenu shows all compile targets and allows to quickly switch the current default target. The default target is the one which is compiled/executed with the "Compile/Run" menu entry.

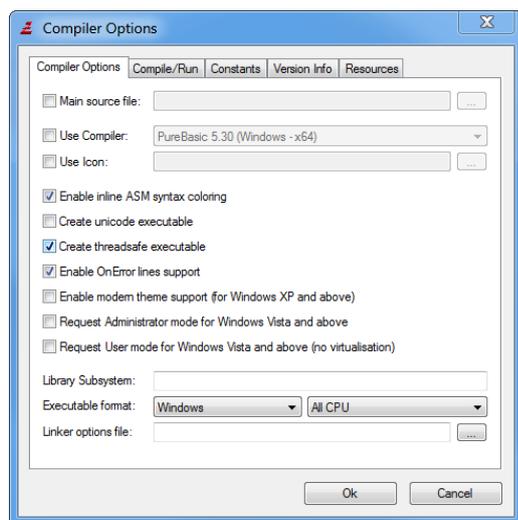
Build Target

When a project is open, this submenu shows all compile targets and allows to directly compile one of them.

Build all Targets

When a project is open, this menu entry compiles all targets that have this option enabled in the compiler options. A window is opened to show the build progress.

Compiler options for non-project files



Main source file

By enabling this option, you can define another file that will be the one sent to the compiler instead of this one. The use of this is that when you are editing a file that does not run by itself, but is included into another file, you can tell the compiler to use that other file to start the compilation.

Note: When using this option, you **MUST** save your source before compiling, as only files that are written to disk will be used in this case. Most of the compiler settings will be taken from the main source file, so when setting this, they are disabled. Only some settings like the debugger setting will be used from the current source.

Use Compiler

This option allows the selection of a different compiler to use instead of the compiler of the current PureBasic version. This makes it easy to compile different versions of the same program (x86 and x64) without having to start up the IDE for the other compiler just for the compilation. Additional compilers for this option have to be configured in the preferences .

If the compiler version matches that of the default compiler but the target processor is different then the built-in debugger of the IDE can still be used to debug the compiled executable. This means that an executable compiled with the x86 compiler can be debugged using the x64 IDE and vice versa. If the version does not match then the standalone debugger that comes with the selected compiler will be used for debugging to avoid version conflicts.

Use Icon (Windows and MacOS X only)

Here you can set an icon that will be displayed when viewing the created executable in the explorer. It is also displayed in the title bar of your programs windows and the Taskbar.

Windows: The icon must be in ICO format (Windows Icon).

MacOS X: The icon must be in ICNS format (Macintosh Icon). To create such an icon, you should create PNG files in the dimensions 128x128, 48x48, 32x32 and 16x16 of your image and then use the tool "Icon Composer" that comes with the OSX developer tools to create the ICNS file. It should be located in /Developer/Applications/Utilities/. To be displayed once the application has just been created, the Finder may need to be restarted.

Optimize generated code

This enables the C code optimizer.

Enable inline ASM syntax coloring

This enables the inline ASM syntax coloring. See the Inline x86 ASM section of the help-file for more information on this option.

Create thread-safe executable

This tells the compiler to use a special version of certain commands to make them safe to be used in threads. See the Thread library for more information.

This also enables the Debugger to display correct information if threads are used. Without this option, the debugger might output wrong line numbers when threads are involved for example.

Enable modern theme support (Windows only)

Adds support for skinned windows on Windows XP, Windows Vista, Windows 7 or Windows 8.

Request Administrator mode for Windows Vista and above (Windows only)

The created executable will always be started with administrator rights on Windows Vista and above (it will not launch if the administrator password is not entered). This option should be set for programs that need to access restricted folders or restricted areas of the registry to get full access.

If this option is turned on, the standalone debugger will automatically selected when debugging, so the program can be tested in administrator mode.

Note: This option has no effect when the program is run on other versions of Windows.

Request User mode for Windows Vista and above (Windows only)

This option disables the "Virtualization" feature for this executable on Windows Vista and above.

Virtualization caused file and registry access to be redirected to a special user folder if the user does not have the needed rights to do the operation (this is done for compatibility with older programs).

Note that this redirection is done without notifying the user; this can lead to some confusion if he tries to find saved files on the file-system. Because of this, it is recommended to disable this feature if the program complies with the Windows Vista file/registry access rules.

Note: This option has no effect when the program is run on other versions of Windows. It cannot be combined with the "Administrator mode" option above.

Enable DPI Aware Executable (Windows only)

This option enable DPI awareness when creating an executable. That means than GUI created in PureBasic will scale automatically if the DPI of the screen is above 100%. Most of the process is seamless, but some case needs to be worked out, like pixel based gadgets (ImageGadget, CanvasGadget etc.).

Enable OnError lines support (Windows only)

Includes line numbers information with the executable for the OnError-Library .

Library Subsystem

Here you can select different subsystems for compilation. More than one subsystem can be specified, separated with a comma. For more information, see subsystems .

Executable format

This allows you to specify the created executable format:

Windows : a normal windows executable.

Console : an executable with a default console. This one still can create windows and such, but it always has a console open. When executed from a command prompt, this executable type uses the command terminal as its console and writes there, whereas the "Windows" executable would create a separate Console window when using OpenConsole() . This setting must be used to create a Console application that can have its input/output redirected with pipes.

Shared DLL : create a windows DLL. See Building a DLL for more info.

Note: When you do "Compile/Run" with a DLL source code, it is executed as a normal executable. A dll is only created when you use "create executable".

Cpu Optimisation (next to Executable format)

This setting allows to include Cpu optimised PB functions in your executable:

All CPU : The generic functions are included that run on all CPUs.

Dynamic CPU : The generic functions as well as any available CPU specific function are included. The function to execute is decided at runtime. This creates a bigger executable, but it will run as fast as possible on all CPUs.

All other options : Include only the functions for a specific CPU. The executable will not run on any Cpu that does not support this feature.

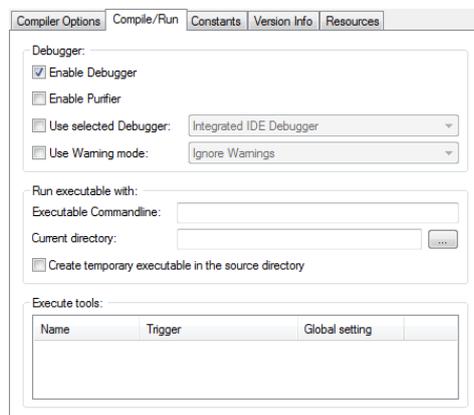
Note: No PB functions actually support this feature for now (it is ignored for them). However, some User Libraries include such optimisations.

Linker options file

A textfile can be specified here with further command-line options that should be passed to the linker when creating the executable. The file should contain one option per line.

Compile/Run

This section contains options that affect how the executable is run from the IDE for testing. Except for the tools option, they have no effect when the "Create executable" menu is used.



Enable Debugger

This sets the debugger state (on/off) for this source code, or if the main file option is used, for that file too. This can also be set from the debugger menu.

Enable Purifier

This enables purifier support for the debugger. The purifier can detect a certain type of programming errors such as writing past the end of an allocated memory buffer. See Included debugging tools for more details.

Use selected Debugger

This allows to choose a different debugger type for this file only. If this option is disabled, the default debugger is used; this can be specified in the preferences .

Use Warning mode

This allows to choose a different warning mode for this file only. If this option is disabled, the default

setting is used which can be specified in the preferences . The available options are:

Ignore Warnings: Warnings will be ignored without displaying anything.

Display Warnings: Warnings will be displayed in the error log and the source code line will be marked, but the program continues to run.

Treat Warnings as Errors: A warning will be treated like an error.

Executable command-line

The string given here will be passed as the command-line to the program when running it from the IDE. The content of this string can be got with ProgramParameter() .

Current directory

The directory specified here will be set as the current directory for the program when running it from the IDE.

Create temporary executable in the source directory

With this option turned on, the temporary executable file for running the program from the IDE will be placed inside the source directory. This can be useful if the program depends on files inside the source directory for testing. With this option turned off, the executable is created in the systems temporary directory.

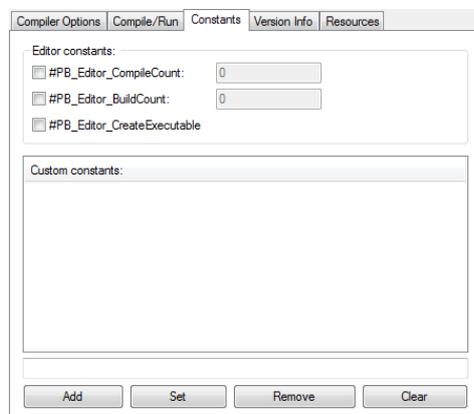
Execute tools

Here external tools can be enabled on a per-source basis. The "Global settings" column shows if the tool is enabled or disabled in the tools configuration . A tool will only be executed for the source if it is both enabled globally and for this source.

Note: For a tool to be listed here, it must have the "Enable Tool on a per-source basis" option checked in the tools configuration and be executed by a trigger that is associated with a source file (i.e. not executed by menu or by editor startup for example).

Constants

In this section, a set of special editor constants as well as custom constants can be defined which will be predefined when compiling this source.



#PB_Editor_CompileCount

If enabled, this constant holds the number of times that the code was compiled (both with "Compile/Run" and "Create Executable") from the IDE. The counter can be manually edited in the input field.

#PB_Editor_BuildCount

If enabled, this constant holds the number of times that the code was compiled with "Create Executable" only. The counter can be manually edited in the input field.

#PB_Editor_CreateExecutable

If enabled, this constant holds a value of 1 if the code is compiled with the "Create Executable" menu or 0 if "Compile/Run" was used.

Custom constants

Here, custom constants can be defined and then easily switched on/off through checkboxes. Constant definitions should be added as they would be written within the source code. This provides a way to enable/disable certain features in a program by defining a constant here and then checking in the source for it to enable/disable the features with CompilerIf/CompilerEndIf .

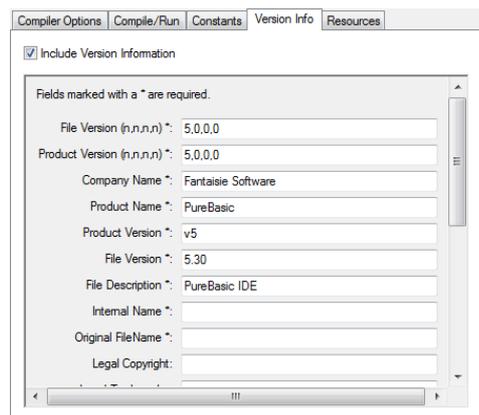
Inside the definition of these constants, environment variables can be used by specifying them in a "bash" like style with a "\$" in front. The environment variable will be replaced in the constant definition before compiling the source. This allows to pass certain options of the system that the code is compiled on to the program in the form of constants.

Example: #Creator=\$USERNAME

Here, the \$USERNAME will be replaced by the username of the logged in user on Windows systems. If an environment variable does not exist, it will be replaced by an empty string.

Note: To test within the source code if a constant is defined or not, the `Defined()` compiler function can be used.

Version Information



This is a Windows only feature. By enabling this, a resource is included in the executable with information about your program. It can be viewed by right-clicking on the executable in the windows explorer and selecting "Properties". Also it can be read by other programs such as setup tools. Fields marked with a * are required if you want to include the version info (if not all required fields are set, the information may not display correctly on some versions of Windows).

The first two fields MUST be composed of 4 numbers separated by commas. All other fields may be any string. In the 3 empty boxes, you can define your own fields to include in the Version info block.

In all the string fields, you may include special tokens that are replaced when compiling:

%OS : replaced with the version of Windows used to compile the program

%SOURCE : replaced with the filename (no path) of the source file.

%EXECUTABLE : replaced with the name of the created executable (this only works when "create executable" is used, not with "Compile/Run").

%COMPILECOUNT : replaced with the value of the `#PB_Editor_CompileCount` constant.

%BUILDCOUNT : replaced with the value of the `#PB_Editor_BuildCount` constant.

Furthermore, you can use any token listed with the `FormatDate()` command. These tokens will be replaced with their respective meaning in `FormatDate()` used with the date of the compilation (i.e. %yy gives the year of the compilation)

Meaning of the lower 3 fields:

File OS

Specifies the OS that this Program is compiled for (Using `VOS_DOS` or `VOS_WINDOWS16` makes little sense. They are only included for the sake of completeness).

File Type

Type of the executable (Here `VFT_UNKNOWN`, `VFT_APP` or `VFT_DLL` are the only ones that really make sense for PureBasic programs).

Language

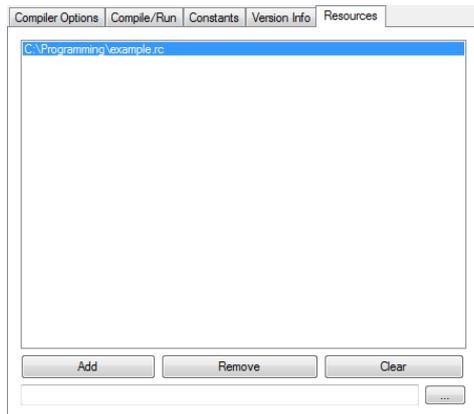
Specifies the language in which this version info is written.

The fields values can be accessed when compiling the program from the IDE using the following constants (same order):

```
#PB_Editor_FileVersionNumeric
#PB_Editor_ProductVersionNumeric
#PB_Editor_CompanyName
#PB_Editor_ProductName
```

```
#PB_Editor_ProductVersion
#PB_Editor_FileVersion
#PB_Editor_FileDescription
#PB_Editor_InternalName
#PB_Editor_OriginalFilename
#PB_Editor_LegalCopyright
#PB_Editor_LegalTrademarks
#PB_Editor_PrivateBuild
#PB_Editor_SpecialBuild
#PB_Editor_Email
#PB_Editor_Website
```

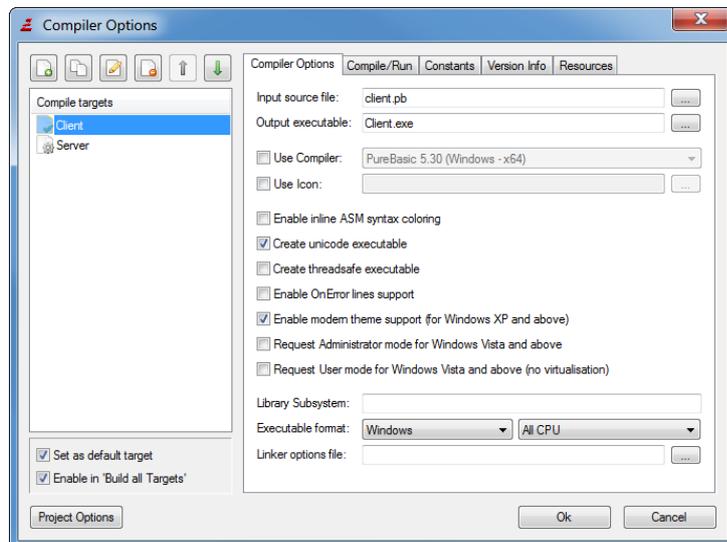
Resources



This is a Windows only feature. Here you can include as many Resource scripts (*.rc files) as you want. They will be compiled and included with the executable. You can use any resource editor (for example the [PellesC IDE](#)) to create such scripts.

Note: Since Resources are a specific to the Windows platform only, PB does not include a Library to manage them and they are not further documented here. See documentation on the [Windows API](#) and resources for more information.

Compiler options for projects



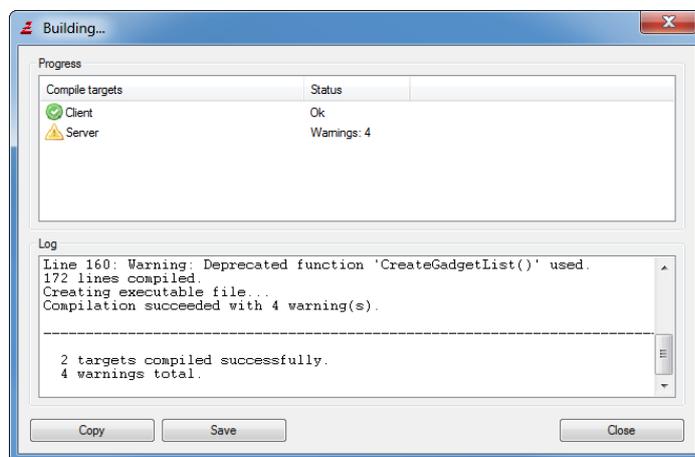
The compiler options for projects allow the definition of multiple compile targets. Each target is basically a set of compiler options with a designated source file and output executable. The left side of

the compiler options window is extended with the list of the defined compile targets. The toolbar on top of it allows to create, delete, copy, edit or move targets in the list.

The default target is the one which will be compiled when the "Compile/Run" menu entry is selected. It can be quickly switched with the "Set as default target" checkbox or from the compiler menu. The "Enable in 'Build all Targets'" option specifies whether or not the selected target will be built when the 'Build all Targets' menu entry is used.

The right side of the compiler options is almost the same as in the non-project mode and reflects the settings for the compile target that is currently selected on the left. The only difference are the "Input source file" and "Output executable" fields on the first tab. These fields have to be specified for all compile targets. Other than that, the compiler options are identical to the options described above. In project mode, the information about the compile target is stored in the project file and not in the individual source files. Information that belongs to the file (such as the folding state) are still saved for the individual source files in the location specified by the Preferences .

The Build progress window



When the 'Build all Targets' menu entry is selected on an open project, all targets that have the corresponding option set in the compiler options will be compiled in the order they are defined in the compiler options. The progress window shows the current compile progress as well as the status of each target. When the process is finished, the build log can be copied to the clipboard or saved to disk.

Chapter 13

Using the debugger

PureBasic provides a powerful debugger that helps you find mistakes and bugs in your source code. It lets you control the program execution, watch your variables, arrays or lists or display debug output of your programs. It also provides advanced features for assembly programmer to examine and modify the CPU registers or view the program stack, or the Memory of your program. It also provides the possibility to debug a program remotely over the network.

To enable the debugger for your program, you can select "Use Debugger" from the debugger menu, or set it in your programs Compiler options. By using the "Compile with Debugger" command from the Compiler menu, you can enable the debugger for just one compilation.

You can directly use debugger commands in your source, such as [CallDebugger](#), [Debug](#), [DebugLevel](#), [DisableDebugger](#) and [EnableDebugger](#).

The PureBasic debugger comes in 3 forms:

A Debugger integrated directly with the IDE, for an easy to use, quick way to debug your programs directly from the programming environment. This debugger also provides the most features.

A separate, standalone debugger, that is useful for some special purposes (for example, when the same program must be executed and debugged several times at once) or to be used with third party code Editors. It provides most of the features of the integrated IDE debugger, but because it is separate from the IDE, some of the efficiency of the direct access from the IDE is lost. The standalone debugger can be used to debug programs remotely through a network connection.

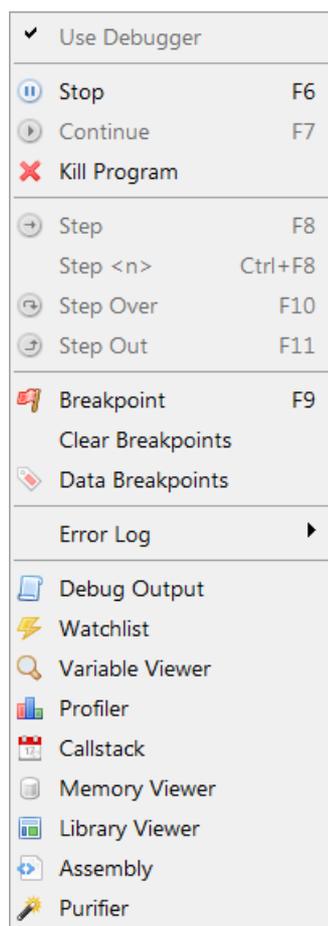
A console only debugger. This debuggers primary use is for testing non-graphical environment like on Linux systems without an X server, or to remotely develop through ssh.

The type of debugger that is used can be selected in the preferences .

All this debugging functionality however comes at a price. Running a program in debug mode is significantly slower in its execution than running it without the debugger. This should be no problem however, since this is for testing only anyway.

If you need to use the debugger, but have some parts in you program that require the full execution speed, you can disable the debugger in just that section with the [DisableDebugger](#) / [EnableDebugger](#) keywords.

The Debugger integrated into the IDE



You can access all the debugger features while the program is running from the debugger menu, or the corresponding toolbar buttons or shortcuts.

While you are debugging your program, all the source files that belong to that program (also included files) will be locked to read-only until the program has finished. This helps to ensure that the code that is marked as the currently executed one is has not actually been modified already without a recompilation. Note that a program can be run only one time at once in IDE debugger mode. If you try to executed it again, you are given the option to execute it with the standalone Debugger.

Tip:

The debugger menu is also added to the system-menu of the Main IDE window (the menu you get when clicking the PB icon in the left/top of the window). This allows you to access the debugger menu also from the Taskbar, by right-clicking on the Taskbar-Icon of the IDE.

Program Control

There are functions for basic control of the running program. You can halt the execution to examine variables and the code position or let the code execute line by line to follow the program flow. While the program is halted, the line that is currently being executed is marked in your source code (with very light-blue background color in the default colors).

The state of the program can be viewed in the IDE status bar, and in the Error log area.

Menu commands for program control:

Stop

Halts the Program and displays the current line.

Continue

Continues the program execution until another stop condition is met.

Kill Program

This forces the program to end, and closes all associated debugger windows.

Step

This executes one line of source code and then stops the execution again.

Step <n>

This will execute a number of steps that you can specify and then stop the execution again.

Step Over

This will execute the current line in the source and then stop again, just like the normal 'Step'. The difference is that if the current line contains calls to procedures, the execution will not stop inside these procedures like it does with the normal 'Step', but it will execute the whole procedure and stop after it returned. This allows to quickly skip procedures in step mode.

Step Out

This will execute the remaining code inside the current procedure and stop again after the procedure has returned. If the current line is not in any procedure, a normal 'Step' will be done.

Line Breakpoints

Breakpoints are another way to control the execution of your program. With the Breakpoint menu command, you mark the currently selected line as a breakpoint (or remove any breakpoint that exists in that line).

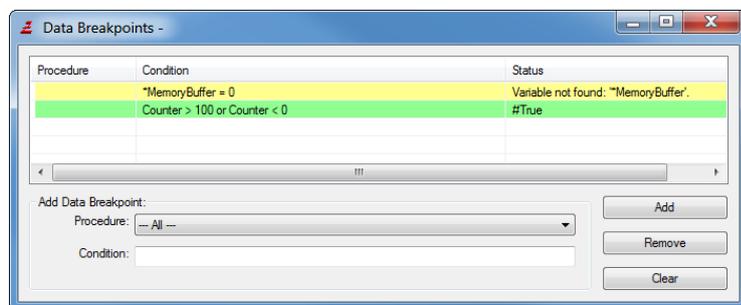
When the execution of the code reaches that line, it will stop at this point. Note that if you select a non-executable line (such as an empty line or a Structure definition), it will halt the execution on the next executable line after that.

After the execution of your program has stopped at a breakpoint, you can use any of the Program control commands to continue/end the execution.

Breakpoints can be set and removed dynamically, while your program is running, or while you are editing your source code. With the "Clear Breakpoints" command, you can clear all breakpoints in a source file.

Note: You can also set/remove Breakpoints by holding down the Alt Key and clicking on the border that contains the Breakpoint marks.

Data Breakpoints



In addition to the line specific breakpoints, the debugger also provides data breakpoints. Data breakpoints halt the program if a given condition is met. This way it is easy to find out when a variable or other value in the program changes and halt the program if that happens. The condition can be any PureBasic expression that can be evaluated to true or false. This can be anything that could be put after an **If** keyword, including logical operators such as **And**, **Or** or **Not**. Most functions of the Math, Memory and String libraries as well as all object validation functions in the form **IsXXX()** and the **XxxID** functions for getting the OS identifiers for an object are also available.

Example conditions:

```
1 MyVariable$ <> "Hello" Or Counter < 0 ; halt if MyVariable$ changes
   from "Hello" or if the Counter falls below zero
2 PeekL(*SomeAddress+500) <> 0 ; halt if the long value at
   the given memory location is not equal to zero
```

Data breakpoints can be added using the Data Breakpoint option from the Debugger menu. They can be limited to a specific procedure or they can be added for all code. The special "Main" entry of the

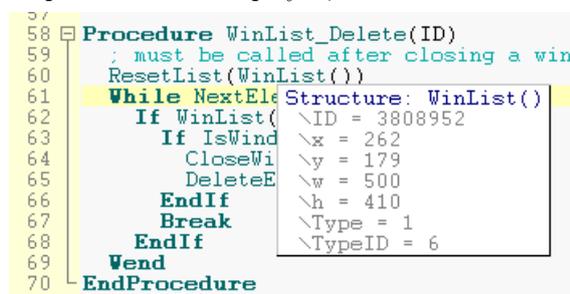
procedure selection specifies that the data breakpoint should only be checked when the execution is not in any procedure.

The status column shows the status of all breakpoint conditions on their last evaluation. This can be true, false or an error if the condition is not a valid expression. Once a condition is evaluated to true, the program execution will be halted. This condition is automatically removed from the list as soon as the program continues, so that it does not halt the program again immediately.

Note: Checking for data breakpoints slows down the program execution because the breakpoint conditions have to be re-evaluated for every executed line of code to check if the condition is met. So data breakpoints should only be added when needed to keep the program execution fast otherwise. Limiting a data breakpoint to a certain procedure also increases the speed because the check then only affects the given procedure and not the entire program.

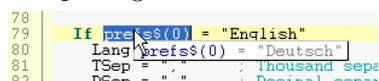
Examining variables during runtime

The value of a variable can be very quickly viewed while the program is running by placing the mouse cursor over a variable in the source code and waiting for a brief moment. If the variable is currently in scope and can be displayed, its value will be shown as a tool-tip on the mouse location.



```
58 Procedure WinList_Delete(ID)
59 ; must be called after closing a win
60 ResetList(WinList())
61 While NextElement Structure: WinList()
62   If WinList( \ID = 3808952
63     If IsWind \x = 262
64       CloseWi \y = 179
65       DeleteE \w = 500
66     EndIf \h = 410
67     Break \Type = 1
68   EndIf \TypeID = 6
69 Wend
70 EndProcedure
```

More complex expressions (for example array fields) can be viewed by selecting them with the mouse and placing the mouse cursor over the selection.



```
78
79 If prefs$(0) = "English"
80   Lang = prefs$(0) = "Deutsch"
81   TSep = " " ; Thousand sepa
82   DSep = " " ; Decimal comma
```

The debugger tools also offer a number of ways to examine the content of variables , arrays or lists .

Errors in the Program

If the debugger encounters an error in your program, it will halt the execution, mark the line that contains the error (red background in the default colors) and display the error-message in the error log and the status bar.

At this point, you can still examine the variables of your program, the callstack or the memory, however other features like the Register display or stack trace are not available after an error.

If the error is determined to be fatal (like an invalid memory access, or division by 0), you are not allowed to continue the execution from this point. If the error was reported by a PureBasic library, you are allowed to try to continue, but in many cases, this may lead to further errors, as simply continuing just ignores the displayed error.

After an error (even fatal ones), you have to use the "Kill Program" command to end the program and continue editing the source code. The reason why the program is not automatically ended is that this would not allow to use the other debugger features (like variable display) to find the cause of the error. Note: you can configure the debugger to automatically kill the program on any error. See Customizing the IDE for that.

Debugger warnings

In some cases the debugger cannot be sure whether a given parameter is actually an error in the program or was specified like that on purpose. In such a case, the debugger issues a warning. By default, a warning will be displayed with file and line number in the error log and the line will be marked (orange in the default colors). This way the warnings do not go unnoticed, but they do not interrupt the program flow. There is also the option of either ignoring all warnings or treating all warnings like errors (stopping the program). The handling of debugger warnings can be customized globally in the Preferences or for the current compiled program in the Compiler options .

The Error log

The error log is used to keep track of the compiler errors, as well as the messages from the debugging. Messages are always logged for the file they concern, so when an error happens in an included file , this file will be displayed, and a message logged for it.

The "Error log" submenu of the Debugger menu provides functions for that:

Show error log

Shows / hides the log for the current source.

Clear log

Clears the log for this file.

Copy log

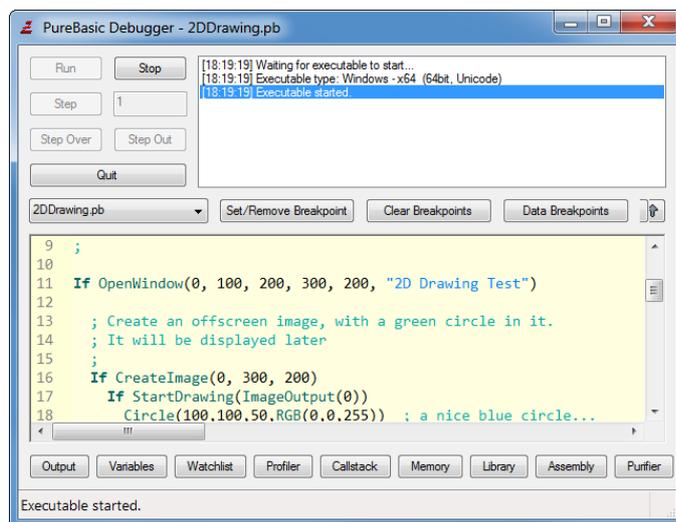
Copies the contents of the error log to the clipboard.

Clear Error marks

After you have killed the program, any error mark in the source file will remain. This is to help you identify the line that caused the problem and solve it. The "Clear error Marks" command can be used to remove these marks.

You can also configure the IDE to automatically clean the error marks when the program ends. See Configuring the IDE for that.

The Standalone Debugger



The standalone debugger is very similar to the one in the IDE, and will be explained here only briefly: On the Debugger window, you have control buttons to carry out the basic program control, as described above. The "Step" button carries out as many steps as are set in the edit field next to it. Closing the Debugger with "Quit" or the close button will also kill the debugged program.

The Error log area can be hidden by the up arrow button on the right side in order to make the debugger window smaller.

The code view is used to display the currently executed code line as well as any errors or breakpoints. Use the combo box above it to select the included file to view. The "Set Breakpoint", "Remove

Breakpoint” and ”Clear Breakpoints” can be used to manage breakpoints in the currently displayed source file. The code view also provides the mouse-over feature from the integrated debugger to quickly view the content of a variable.

The debugger tools can be accessed from the buttons below the code area. Their usage is the same as with the integrated IDE debugger.

Note: The Standalone Debugger has no configuration of its own. It will use the debugger settings and coloring options from the IDE. So if you use a third-party Editor and the standalone debugger, you should run the IDE at least once to customize the Debugger settings.

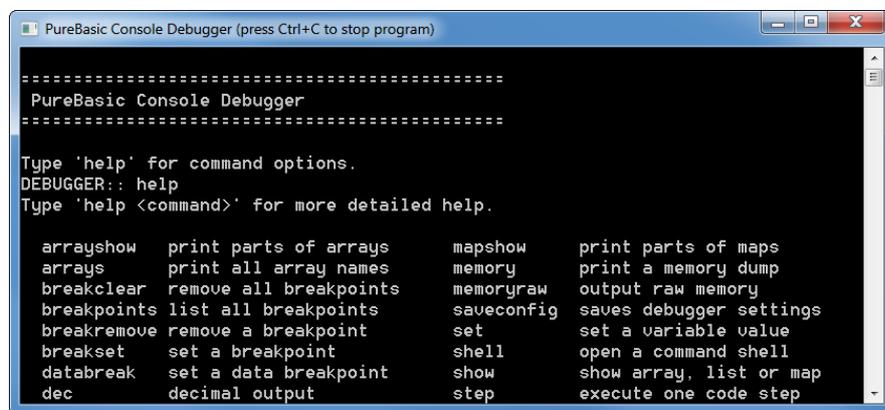
Executing the standalone debugger from the command-line:

To execute a program compiled on the command-line with enabled debugger (-d or /DEBUGGER switch), call the debugger like this:

```
pbdebugger <executable file> <executable command-line>
```

If you execute a debugger-enabled executable from the command-line directly, it will only use the command-line debugger.

The command-line debugger:



The command-line debugger is not a part of the IDE and therefore not explained in detail here.

While the program is running, hit Ctrl+C in the console to open a debugger console prompt. In this prompt type ”help” to get an overview of all available commands. Type ”help <commandname>” for a more detailed description of the command.

Debugging threaded programs:

To use the debugger with a program that creates threads , the 'Create thread-safe executable' Option must be set in the Compiler options , as otherwise the information displayed by the debugger concerning line numbers, errors, local variables and such could be wrong due to the multiple threads.

The following features and limitations should be considered when debugging a threaded program:

While the program is running, the variable viewer, callstack display or assembly debugger will display information on the main thread only. When the program is stopped, they display information on the thread they were stopped in. So to examine local variables or the callstack of a thread, the execution must be halted within that thread (by putting a breakpoint or a [CallDebugger](#) statement there). The various 'Step' options always apply to the thread where the execution was last stopped in.

If an error occurs, the execution is halted within that thread, so any information displayed by the variable viewer or callstack display is of the thread that caused the error.

The watchlist only watches local variables of the main thread, not those of any additional running threads.

While the execution is stopped within one thread, the execution of all other threads is suspended as well.

Chapter 14

Included debugging tools

These tools provide many features to inspect your program while it is running. They can not be used while you are editing the source code. These tools are available in both the integrated Debugger and the standalone debugger. The console debugger provides many of these features too, but through a debugger console.

Some of the tools include the viewing of variables. Here is an explanation of the common fields of all these variable displays:

Scope

The scope of a variable is the area in which it is valid. It can be global , local , shared , static or threaded , depending on how it is used in your source code. 'byref' ("by reference", i.e. using the address) is used to indicate an Array or List that was passed as parameter to a procedure.

Variable type

The variable type is indicated through a colored icon:

B : Byte

A : Ascii

C : Character

W : Word

U : Unicode

L : Long

I : Integer

Q : Quad

F : Float

D : Double

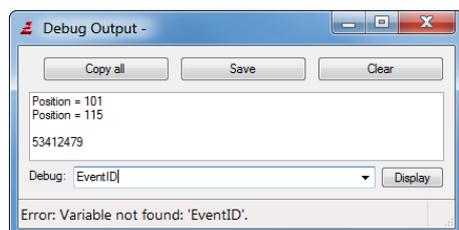
S : String

Sn : Fixed length string

A Structure is either marked as a dot, or with an arrow. If marked with an arrow, it can be expanded by double-clicking on it to view the members of this structure. A down arrow marks an expanded structure. A Structure marked with a dot cannot be expanded (usually because it is just a structure pointer).

Dynamic arrays inside structures are shown with the dimensions they are currently allocated with. Lists and maps inside structures are shown with their size and their current element (if any).

The Debug output window



In this window, the output of the [Debug](#) statement will be displayed. The Debug statement is a quick

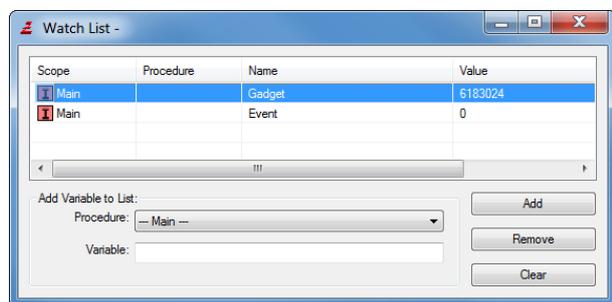
and simply way to print messages for debugging purposes.

The debug window will automatically open at the first output is produced by your program. If you then close it, it will not automatically open on subsequent messages, however they will still be logged. You can copy this output to the clipboard or save it to a file. There is also a button to clear the messages from the window.

The entry field at the bottom of the window allows an expression to be entered, which will be evaluated and the result printed in the output box. This allows to quickly check the state of variables or array fields without the need to look them up in one of the debugger tools. The evaluation is started by pressing Enter or clicking on the "Display" button. If the expression cannot be evaluated for some reason, an error-message is displayed in the statusbar.

The expression can be any valid PB expression (not including logical ones or containing PB keywords). It can contain variables , arrays , lists , constants and also some commands from the Math , Memory and String libraries.

The Watchlist



The watchlist can be used to track changes in variables of your program in real time, while the program is running. It can only display single variables (no full structures), however, these variables can be a part of structures. Elements of dynamic array, list or map inside structures can not be displayed in the watchlist.

To add a variable, select its procedure (if it is a local variable) or select "-- Main --" if it is a global variable or part of an array or list . Then type the variable name, as you would access it in your source code into the Variable field and press Add.

Examples :

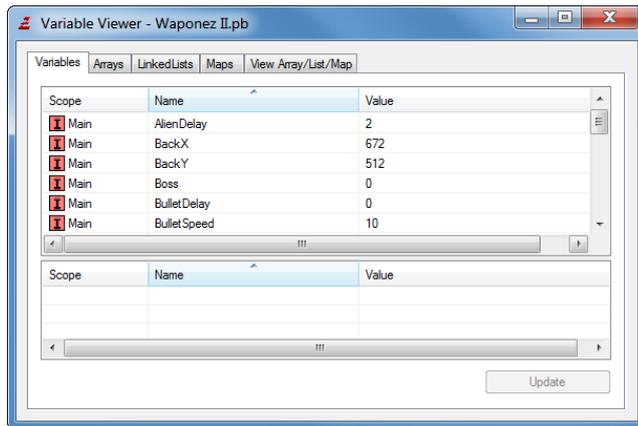
```
MyVariable$           - add a normal string variable
Array(1, 5)          - add an array field
Structure\subfield[5]\value - add a variable inside a structure
MyList()\structuresubfield - add a variable inside a structured list
```

You can also add new watched variables from the VariableViewer, by right-clicking on them and selecting "add to watchlist"

In the list you will see the values of the watched variables. If the value is displayed as "--", it means that this variable is not valid at the current point in the source code; for example, this will occur if you watch a local variable, or a list element and the list has no current element.

The watched variables are remembered between the debugging sessions, and even saved with the compiler options, so you do not need to repopulate this list all the time.

The Variable Viewer



The Variable viewer allows to examine the program's variables, arrays, lists and maps. The individual tabs show global and threaded items in the top part and local, shared and static items in the bottom part.

The "Update" Button can be used to get the most recent data from the program. If the program is halted or in step mode, the content is updated on each step automatically. By right-clicking on any variable or Array/List field, you can copy that variable, or add it to the watchlist for real-time tracking of its value. On Windows, the content of the Variable viewer can be sorted by name, scope or variable value by clicking on the header of the appropriate column.

The 'Variables' tab

This tab, shows the variables of the program. By right-clicking on a variable, it is possible to add it to the watchlist.

The 'Arrays' tab

This tab shows a list of all arrays in the program and the dimensions in which they are currently defined (-1 means that Dim was not called yet). By right-clicking on an array, the content of the array can be viewed in the "View Array/List/Map" tab.

The 'Lists' tab

This tab shows a list of all Lists, the number of elements they currently hold ("-" indicates that NewList was not called yet), as well as the index of the current element of the list ("-1" indicates that there is no current element). By right-clicking on a list, the content of the list can be viewed in the "View Array/List/Map" tab.

The 'Maps' tab

This tab shows a list of all maps, the number of elements they currently hold ("-1" indicates that NewMap was not called yet), as well as the key of the current element of the map ("-1" indicates that there is no current element). By right-clicking on a map, the content of the map can be viewed in the "View Array/List/Map" tab.

The 'View Array/List/Map' tab

This tab can be used to view individual entries of an array, a list or a map. This includes arrays, lists or maps inside structures as well. To do so enter the name of the array, map or list including a "(" at the end, select what kind of items to display and press "Display". Note that the content of the display is not automatically updated when the program is in step mode.

"Display all items" simply displays everything. "Display Non-zero items only" will only display those items that do not hold the value 0 or an empty string. This makes viewing large arrays/lists with only few valid items in them simpler. A structure is considered "zero" if all of its items either hold the value 0 or an empty string.

"Display Range" allows displaying only a specific range of an array, a list or a map. The range can be given for each Array dimension individually, separated by commas. If one dimension is not specified at all, all of its items will be displayed. Here are a few examples for valid range input:

```
"1-2, 2-5, 2" : first index between 1 and 2, a second index between 2
and 5 and a third index of 2.
"1, 2-5"      : first index of 1 and a second index between 2 and 5.
"1, , 5"     : first index of 1, any second index and a third index
of 5.
```

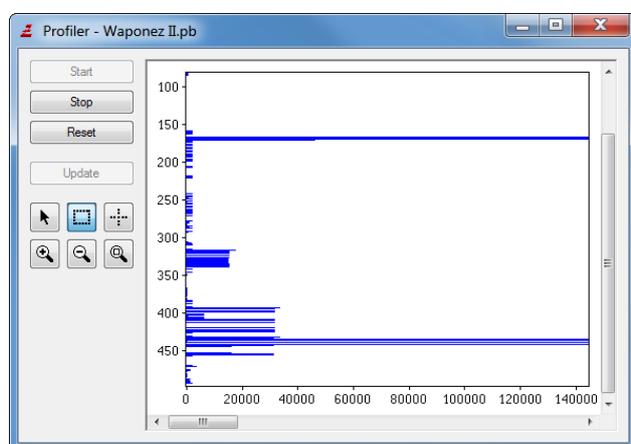
For list display, the "Display Range" option can be used to display a range of list elements by their index (zero based).

```
"0"      : first element
"1-3"    : second to the fourth element
```

For map display, the "Display Range" option can be used to filter the keys to be displayed. It has to contain a mask for the key string of the map elements (no quotation marks). A "?" matches one character, a "*" matches any number of characters. Here are a few examples for valid mask input:

```
"hat" : matches only the item with "hat" as key.
"?at" : matches items with "hat", "bat" etc as key.
"h*t" : matches items with keys that start with "h" and end with "t"
       and anything in between.
```

The Profiler



The profiler tool can count how often each line in the source code is executed. This collected data can be used to identify which portions of the code are used most often and where improvements make most sense. It also helps to identify problems where a piece of the code is executed too often as a result of an error.

Recording the data

The recording of the data can be controlled by the Start, Stop and Reset (to set all counts to 0) buttons in the profiler window. The Update button can be used to update the graph while the program is running. Each time the program is halted or in step mode, the data is updated automatically. By default, the profiler is recording data from the start of the program. This can be changed in the Preferences .

Examining the data

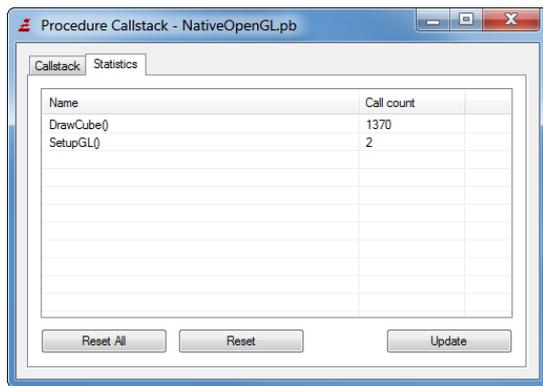
The recorded data is displayed as a graph, with the vertical axis showing the source line number and the horizontal axis showing how often the lines were executed. If the running program consists of more than one source file, a list of source files is presented below the graph. To display the graph for a file either select it, or check its checkbox. Multiple files can be shown in the graph at once to better compare them. Right-clicking on one of the filenames allows changing the color used to display that file in the graph.

Mouse modes in the graph

Right-clicking inside the graph brings up a popup menu which allows zooming in or out or to show the source line that was clicked on in the IDE or code display of the debugger. The action taken by a left-click can be controlled by the buttons on the left side:

- Arrow button: Left-clicking and dragging allows to scroll the graph display.
- Box button: Left-clicking and dragging allows to select an area which will be zoomed in.
- Cross button: While this button is activated, moving the mouse on the graph displays a crosshair to better identify the line and call count under the mouse.
- Zoom buttons: These buttons allow to zoom in/out and zoom out so all lines can be viewed.

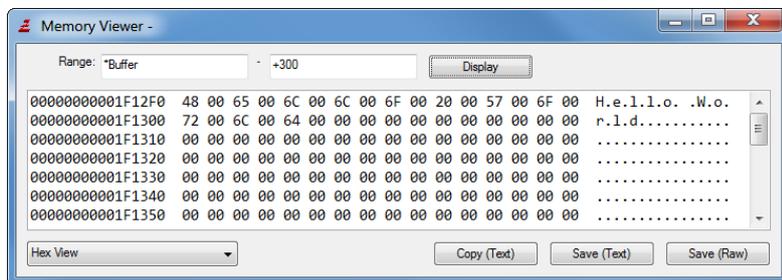
The Callstack viewer



The callstack viewer shows which nested procedure calls led to the current position in the code. Each entry in the list means one procedure that is currently open. It shows the line and file from which it was called, and the arguments used to call the procedure. By clicking on the Variables button for each procedure, you can look at the variables of that instance of the procedure.

This allows to easily trace, from which part of the code, a procedure was called. The callstack view does only automatically update when you stop the program, or use Step to execute single lines. While the program is running, you have to use the Update button to update the view for the current code position. The "Statistics" tab shows the number of times each procedure in the code was called. You can reset the count for all procedures with "Reset all", or for the currently marked entry with the "Reset" button. Like with the callstack, the updates are not automatic while the program is not stopped. Use the Update button for that.

The Memory Viewer



The memory viewer lets you view a memory area in your program. The range to view can be entered into the range fields as any valid PureBasic expression; this can be a normal decimal value, a hex number preceded by the \$ character or any other valid expression, including variables or pointers from the code. If the content of the second range field starts with a "+" sign, the content is interpreted as relative to the first field.

Example: "*"Buffer + 10" to "+30" will display the 30 bytes of memory starting at the location 10 bytes after what *Buffer points to.

If the memory area is valid for viewing, it will be displayed in the area below. If parts of the area are not valid for reading, you will get an error-message. The type of display can be changed with the combo box in the lower left corner. The following view modes are available:

Hex View

The memory will be displayed like in any hex viewer, giving the memory location in hex display on the left, followed by the hexadecimal byte values, and then the string representation in the right column.

Byte/Character/Word/Long/Quad/Float/Double table

The memory area will be shown as a table of the specified variable type. Whether or not this table is single-column or multi-column can be set in the Preferences (see Configuring the IDE). Datas will be shown as decimal, octal or hex via the next button that cycles the mode.

String view ascii, unicode or utf-8

This displays the memory area as a string, with any non-string characters displayed in [] (for example "[NULL]" for the 0 byte.) A linebreak is added after newline characters and [NULL] to improve the

readability of the output. The memory area can be interpreted as an Ascii, Unicode or Utf8 string.

Data

With the Data check box, you will export the table view formatted as a Data Section on copy or save.

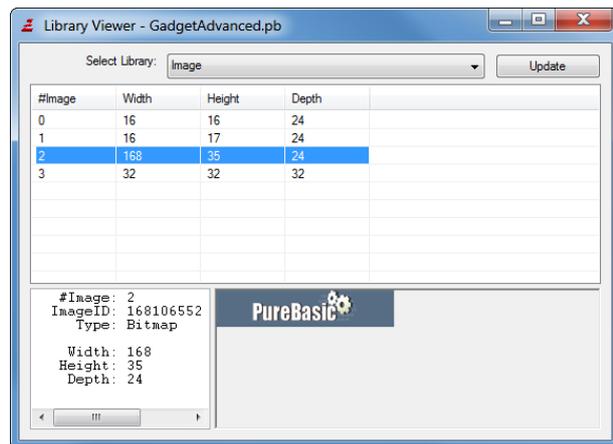
You can also export the viewed memory area from the memory viewer:

Copy (Text): Copies the displayed area as text to the clipboard.

Save (Text): Saves the displayed area as text to a file.

Save (Raw): Saves the memory area as raw binary to a file.

The Library Viewer



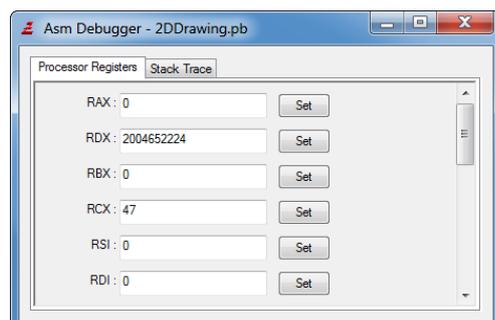
The Library Viewer provides information about the objects created by some libraries. For example, it allows to quickly check which images are currently loaded in the program, or which gadgets are created. Once the program is started, the combobox on top of the window can be used to select the library to view. The list below will then show all objects of the library that currently exist in the executable along with some additional information on each object. The "Update" button will update this list of objects. Selecting an object in the list will display more detailed information about it in the text area on the left, and if supported by the library also a visual display of the object on the right (for Images, Sprites, and so on).

If the combobox displays "No Information", this means that your executable has used no library that supports this feature.

Currently, the Library Viewer is supported by the following libraries:

- Thread
- Gadget
- Window
- File
- Image
- Sprite
- XML

The Assembly Debugger



The ASM debugger is provided for advanced programmers to examine and change the CPU register content and to examine the programs stack for debugging of inline ASM code.

The Processor Register view is only available while the program execution is halted. By changing any of the register values and clicking "Set", you can modify the value in that register.

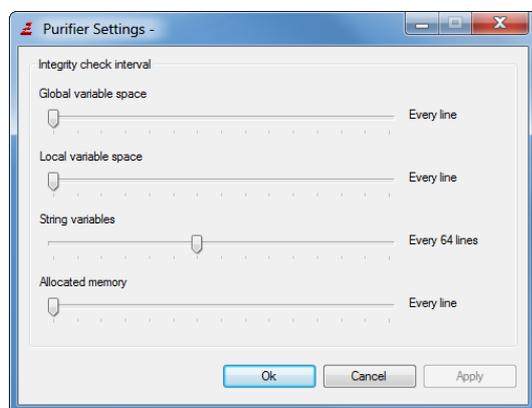
The Stack trace shows the content of the programs stack given in relation to the ESP register. If the current stack position is not aligned at a 4 byte boundary, there can be no information given about the content of the stack. In this case the stack is shown as a hex display.

If the stack pointer is properly aligned, the stack contents are displayed with comments about the meaning of the contained values (detailing the pushed registers and other values on a PureBasic procedure call).

The stack trace is updated automatically when you stop the execution or step through the program, unless you specify otherwise in the Preferences . If you disable the automatic update, there will be an "Update" button displayed to do so manually.

Note: The Assembly debugger is currently not available on MacOS X.

The Purifier



The purifier can detect memory errors such as writing past the end of an allocated memory buffer or string. Without the purifier some of these mistakes would lead to crashes and others would go unnoticed because the write operation overwrites some other valid memory.

The purifier requires special output from the compiler to work, which is why it is only available if the "Enable Purifier" option is set in the compiler options when the program is compiled.

The purifier detects these errors by placing a special 'salt'-value around global and local variables, strings and allocated memory buffers. These salt values are then checked at regular intervals and an error is displayed if they were changed. These checks slow down the program execution considerably especially for large programs, which is why the rate at which the checks are performed can be specified in the purifier window:

Global variable space

Defines the interval in source lines after which the global variables are checked.

Local variable space

Defines the interval in source lines after which the local variables are checked.

String variables

Defines the interval in source lines after which the memory used by string variables is checked.

Allocated memory

Defines the interval in source lines after which the memory allocated by AllocateMemory() is checked.

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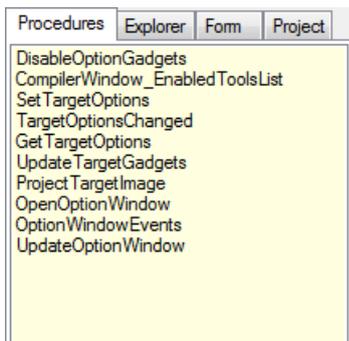
Using the built-in Tools

The PureBasic IDE comes with many building tools, to make programming tasks easier and increase your productivity. Many of them can be configured to be either accessible from the Menu as separate windows, or to be permanently displayed in the Panel on the side of the editing area.

For information on how to configure these tools and where they are displayed, see [Configuring the IDE](#) .

Tools for the Side Panel Area

Procedure Browser



This tool displays a list of all procedures and macros declared in the current source code. By double-clicking on an entry in that list, the cursor automatically jumps to that procedure.

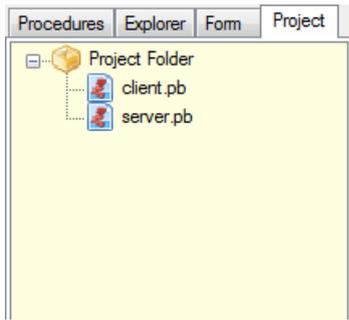
Macros will be marked in the list by a "+" sign before the name.

You can also place special comment marks in your code, that will be displayed in the list too. They look like this: ";- <description>". The ; starts a comment, the - that follows it immediately defines such a mark.

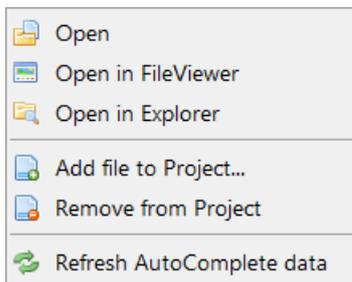
The description will be shown in the Procedure list, and clicking on it will jump to the line of this mark. Such a comment mark can be distinguished from a Procedure by the ">" that is displayed before it in the procedure list.

The list of procedures can be sorted, and it can display the procedure/macro arguments in the list. For these options, see [Configuring the IDE](#) .

Project Panel



This tool displays a tree of all files in the current project . A double-click on a file opens it in the IDE. This allows fast access to all files in the project. A right-click on a file opens a context menu which provides more options:



Open - Open the file in the IDE.

Open in FileViewer - Open the file in the FileViewer of the IDE.

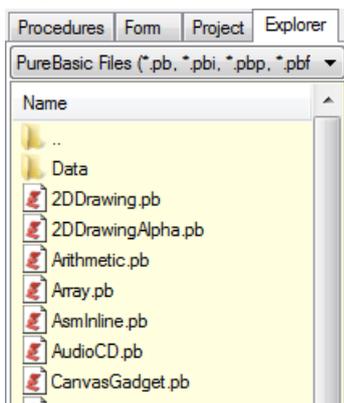
Open in Explorer - Open the file in the operating systems file manager.

Add File to Project - Add a new file to the project.

Remove File from Project - Remove the selected file(s) from the project.

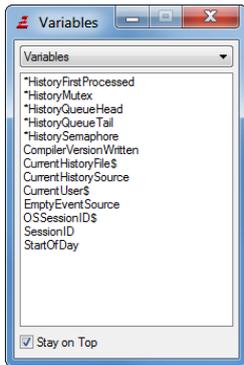
Refresh AutoComplete data - Rescan the file for AutoComplete items.

Explorer



The Explorer tool displays an explorer, from which you can select files and open them quickly with a double-click. PureBasic files (*.pb, *.pbi, *.pbp, *.pbf) will be loaded into the edit area and all other recognized files (text & binary) files will be displayed into the internal File Viewer.

Variable Viewer



The variable viewer can display variables , Arrays , lists , Constants , Structures and Interfaces defined in your source code, or any currently opened file. You can configure what exactly it should display in the preferences .

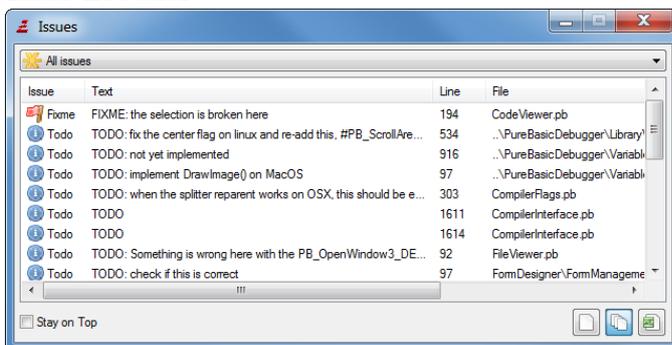
Note: The displaying of variables is somewhat limited for now. It can only detect variables explicitly declared with Define , Global , Shared , Protected or Static .

Code Templates



The templates tool allows you to manage a list of small code parts, that you can quickly insert into your source code with a double-click. It allows you to manage the codes in different directories, and put a comment to each code. This tool is perfect to manage small, often used code parts.

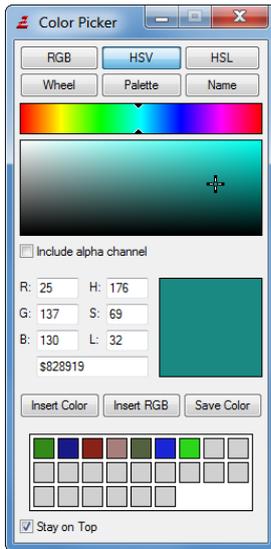
Issue Browser



The issue browser tool collects comments in the source code that fit a defined format and lists them ordered by priority. It can be used to track which areas of the source code still need to be worked on. Each displayed issue corresponds to one comment in the code. A double-click on the issue shows that code line. Issues can be displayed for the current file, or for multiple files (all open files, or all files that belong to the current project). The issue list can also be exported in CSV format.

To configure the collected issues, see the "Issues" section in the Preferences .

Color Picker



The color picker helps you to find the perfect color value for whatever task you need. The following methods of picking a color are available:

RGB: Select a color by choosing red, green and blue intensities.

HSV: Select a color by choosing hue, saturation and value.

HSL: Select a color by choosing hue, saturation and lightness.

Wheel: Select a color using the HSV model in a color wheel.

Palette: Select a color from a predefined palette.

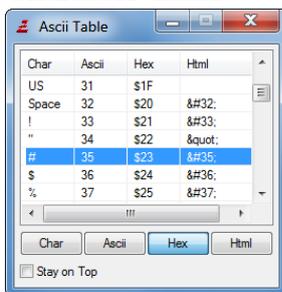
Name: Select a color from a palette by name.

The color selection includes an alpha component, if the "Include alpha channel" checkbox is activated.

The individual components (red/green/blue intensities or hue/saturation/lightness) as well as the hexadecimal representation of the current color can be seen and modified in the text fields.

The "Insert Color" button inserts the hexadecimal value of the current color in the source code. The "Insert RGB" button inserts the color as a call to the RGB() or RGBA() function into the code. The "Save Color" button saves the current color to the history area at the bottom. Clicking on a color in the history makes it the current color again.

Character Table



The character table tool displays a table showing the first 256 unicode characters, together with their index in decimal and hex, as well as the corresponding html notation. By double-clicking on any line, this character will be inserted into the source code. With the buttons on the bottom, you can select which column of the table to insert on a double-click.

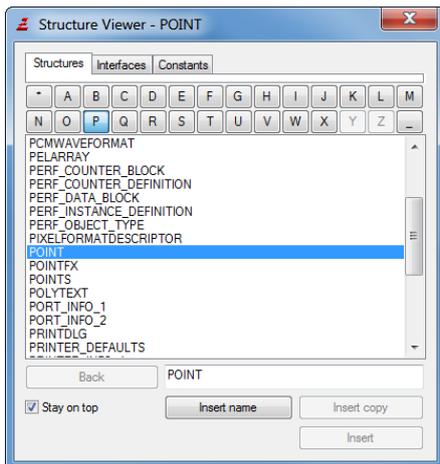
Help Tool



The Help Tool is an alternative viewer for the reference guide . It can be used to view the PureBasic manual side by side with the code. Whether or not the F1 shortcut opens the manual in the tool or as a separate window can be specified in the preferences .

Other built-in tools

Structure Viewer



The structure viewer allows you to view all the Structures, Interfaces and Constants predefined in PureBasic. Double-clicking on a Structure or Interface shows the declaration. On top of the list you can select a filter to display only entries that start with a given character.

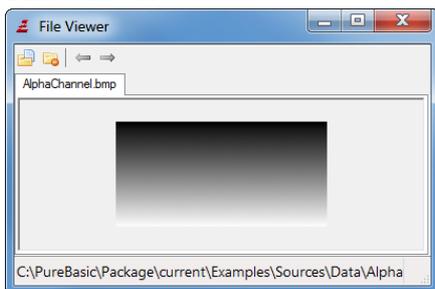
The "Back" button navigates back through the viewed entries.

"Insert name" inserts just the name of the selected entry.

"Insert copy" inserts a copy of the declaration of that entry.

"Insert" lets you enter a variable name and then inserts a definition of that variable and the selected entry and all elements of it.

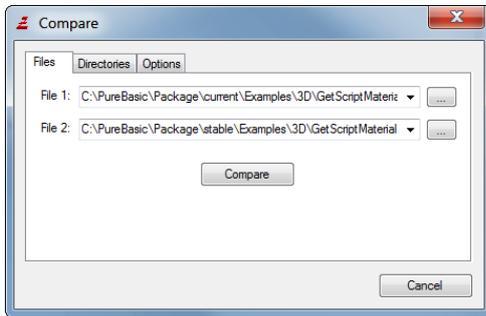
File Viewer



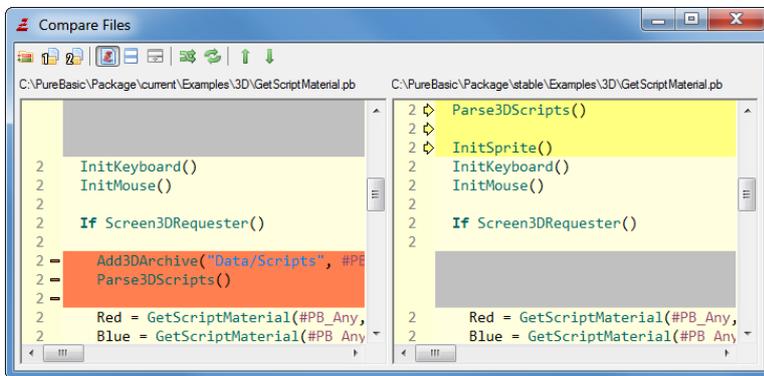
The internal file viewer allows you do display certain types of files. Text files, images and web pages

(windows only). Any unknown file type will be displayed in a hex-viewer. The "Open" button opens a new file, the "X button" closes it and the arrows can be used to navigate through the open files. Also any binary file that you attempt to open from the Explorer tool, or by double-clicking on an IncludeBinary keyword will be displayed in this file viewer.

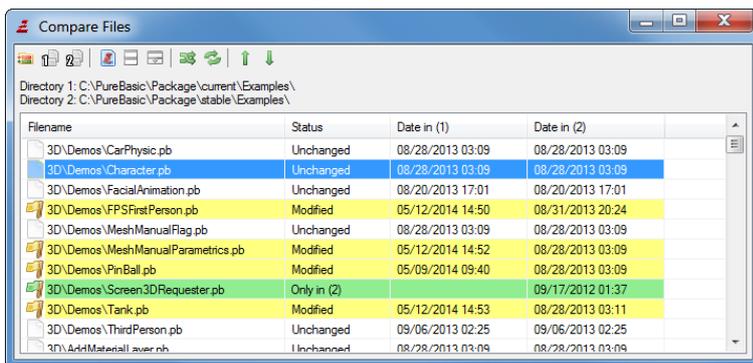
Compare Files/Folders



This tool can compare two (text-) files or two directories and highlight their differences. The "Options" tab can be used to ignore some differences such as spaces or upper/lowercase changes.



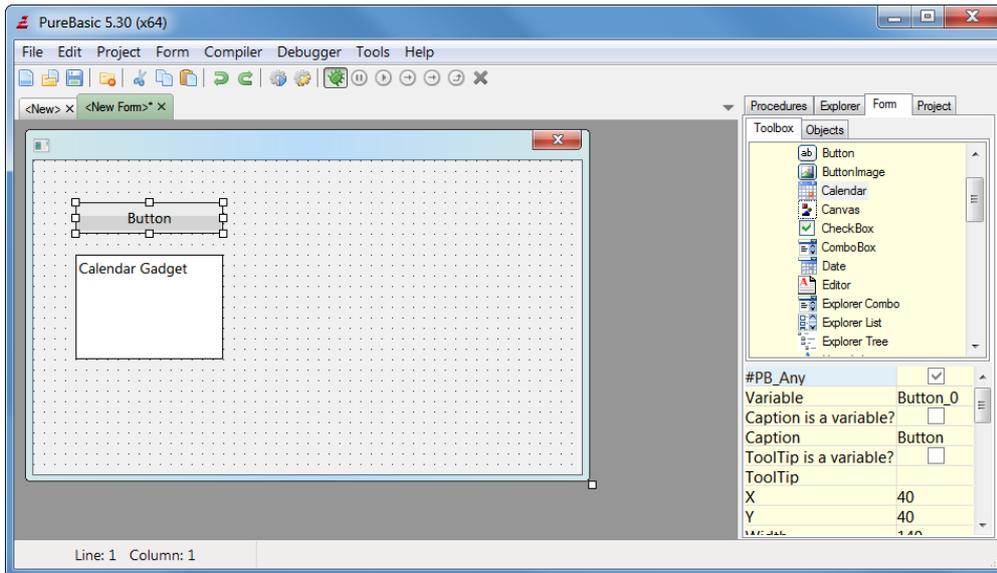
The files are shown side by side with the differences marked in the following way: Lines shown in red were removed in the file on the right, lines shown in green were added in the file on the right and lines shown in yellow were changed between the two files.



When comparing directories, the content of both directories is examined (with the option to filter the search by file extension and include subdirectories) and the files are marked in a similar way: Files in red do not exist in the second directory, files in green are new in the second directory and files in yellow were modified. A double-click on a modified file shows the modifications made to that file.

Other entries in the Tools menu

Form Designer



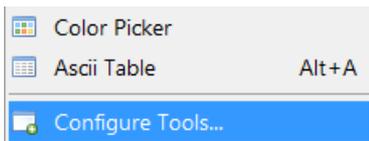
The Form Designer can be used to design the user interface for your application. For more information, see the form designer chapter.

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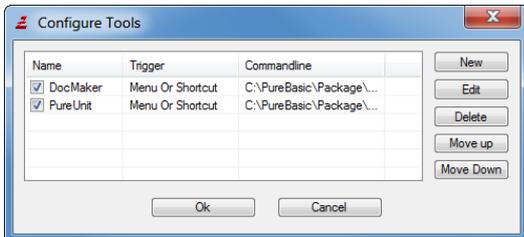
Using external tools

The PureBasic IDE allows you to configure external programs to be called directly from the IDE, through the Menu, Shortcuts, the Toolbar, or on special "triggers". The use of this is to make any other program you use while programming easily accessible.

You can also write your own little tools in PureBasic that will perform special actions on the source code you are currently viewing to automate common tasks. Furthermore, you can configure external file viewers to replace the internal File Viewer of the IDE for either specific file types or all files.



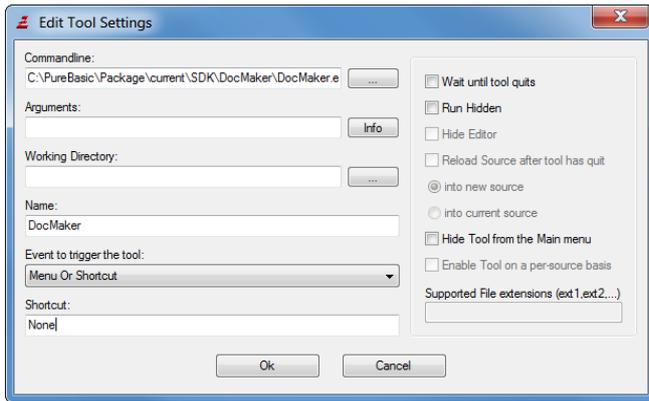
With the "Config tools" command in the Tools menu, you can configure such external tools. The list you will see displays all the configured tools in the order they appear in the Tools menu (if not hidden). You can add and remove tools here, or change the order by clicking "Move Up"/"Move Down " after selecting an item.



Any tool can be quickly enabled or disabled from the "Config tools" window with the checkbox before each tool entry. A checked checkbox means the tool is enabled, an unchecked one means it is currently disabled.

Configuring a tool

The basic things you need to set is the command-line of the program to run, and a name for it in the Tools list/Menu. Everything else is optional.



Command-line

Select the program name to execute here.

Arguments

Place command-line arguments that will be passed to the program here. You can place fixed options, as well as special tokens that will be replaced when running the program:

%PATH : will be replaced with the path of the current source code. Remains empty if the source was not saved.

%FILE : filename of the current source code. Remains empty if it has not yet been saved. If you configure the tool to replace the file viewer, this token represents the file that is to be opened. You should never modify the contents of the **%FILE** file. This file contains the state of the source code as the user last saved it. This could be much different from what is currently visible in the editor. If you overwrite this file, the user might lose data.

%TEMPFILE : When this option is given, the current source code is saved in a temporary file, and the filename is inserted here. You may modify or delete the file at will.

%COMPILEFILE : This token is only valid for the compilation triggers (see below). This is replaced with the temporary file that is sent to the compiler for compilation. By modifying this file, you can actually change what will be compiled.

%EXECUTABLE : This will be replaced by the name of the executable that was created in with the last "Create Executable". For the "After Compile/Run" trigger, this will be replaced with the name of the temporary executable file created by the compiler.

%CURSOR : this will be replaced by the current cursor position in the form of **LINExCOLUMN**.

%SELECTION : this will be replaced by the current selection in the form of **LINESTARTxCOLUMNSTARTxLINEENDxCOLUMNEND**. This can be used together with **%TEMPFILE**, if you want your tool to do some action based on the selected area of text.

%WORD : contains the word currently under the cursor.

%PROJECT : the full path to the directory containing the project file if a project is open.

%HOME : the full path to the purebasic directory

Note: for any filename or path tokens, it is generally a good idea to place them in "" (i.e.

"%TEMPFILE") to ensure also paths with spaces in them are passed correctly to the tool. These tokens and a description can also be viewed by clicking the "Info" button next to the Arguments field.

Working Directory

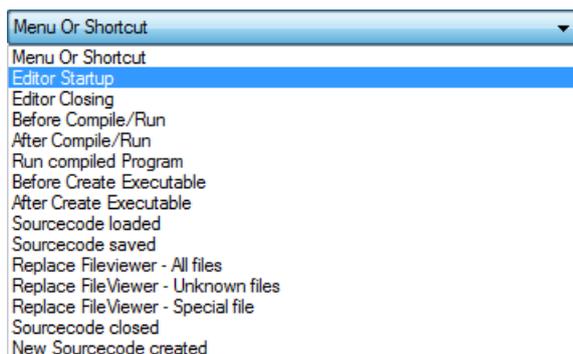
Select a directory in which to execute this tool. By specifying no directory here, the tool will be executed in the directory of the currently open source code.

Name

Select a name for the tool. This name will be displayed in the tools list, and if the tool is not hidden from the menu, also in the Tools menu.

Event to trigger the tool

Here you can select when the tool should be executed. Any number of tools can have the same trigger, they will all be executed when the trigger event happens. The order of their execution depends on the order they appear in the tools list.



Menu Or Shortcut

The tool will not be executed automatically. It will be run by a shortcut or from the Menu. Note: to execute a tool from the Toolbar, you have to add a button for it in the Toolbar configuration in the Preferences (see Configuring the IDE for more).

With this trigger set, the "Shortcut" option below becomes valid and lets you specify a shortcut that will execute this tool.

Editor Startup

The tool will be executed right after the IDE has been fully started.

Editor End

The tool will be executed right before the IDE ends. Note that all open sources have already been closed at this time.

Before Compile/Run

The tool will be executed right before the compiler is called to compile a source code. Using the %COMPILEFILE token, you can get the code to be compiled and modify it. This makes it possible to write a small pre-processor for the source code. Note that you should enable the "Wait until tool quits" option if you want your modifications to be given to the compiler.

After Compile/Run

The tool will be executed right after the compilation is finished, but before the executable is executed for testing. Using the %EXECUTABLE token, you can get access to the file that has just been created. Note that you can modify the file, but not delete it, as that results in an error-message when the IDE tries to execute the file.

Run compiled Program

The tool will be executed when the user selects the "Run" command from the compiler menu. The tool is executed before the executable is started. The %EXECUTABLE token is valid here too.

Before create Executable

The same as for the "Before Compile/Run" trigger applies here too, only that the triggering event is when the user creates the final executable.

After create Executable

The tool is executed after the compilation to create the final executable is complete. You can use the %EXECUTABLE token to get the name of the created file and perform any further action on it.

Source code loaded

The tool is executed after a source code has been loaded into the IDE. The %FILE and %PATH tokens are always valid here, as the file was just loaded from the disk.

Source code saved

The tool will be executed after a source code in the IDE has been saved successfully. The %FILE and %PATH tokens are always valid here, as the file has just been saved to disk.

Source code closed

The tool will be executed whenever a source file is about to be closed. At this point the file is still there, so you can still get its content with the %TEMPFILE token. %FILE will be empty if the file was never saved.

File Viewer All Files

The tool will completely replace the internal file viewer. If an attempt is made in the IDE to open a file that cannot be loaded into the edit area, the IDE will first try the tools that have a trigger set for the specific file type, and if none is found, the file will be directed to this tool. Use the %FILE token to get the filename of the file to be opened.

Note: Only one tool can have this trigger. Any other tools with this trigger will be ignored.

File Viewer Unknown file

This tool basically replaces the hex viewer, which is usually used to display unknown file types. It will be executed, when the file extension is unknown to the IDE, and if no other external tool is configured to handle the file (if a tool is set with the "File Viewer All Files" trigger, then this tool will never be called). Note: Only one tool can have this trigger set.

File Viewer Special file

This configures the tool to handle specific file extensions. It has a higher priority than the "File Viewer All files" or "File Viewer Unknown file" triggers and also higher than the internal file viewer itself.

Specify the extensions that the tool should handle in the edit box on the right. Multiple extensions can be given.

A common use for this trigger is for example to configure a program like Acrobat Reader to handle the "pdf" extension, which enables you to easily open pdf files from the Explorer, the File Viewer, or by double-clicking on an Includebinary statement in the source.

Open File with specific extension

This will be triggered for specific file extensions. It has a higher priority than the "Open File non-PB binary file" or "Open File non-PB text file" triggers. Specify the extensions that the tool should handle in the edit box on the right. Multiple extensions can be given.

Note: The Open File triggers will be active when you open a file via the File/Open menu and also, when you drag and drop a file to the IDE. They have higher priority for File/Open tasks. Only if there is no active tool, the File Viewer triggers will be handled.

Open File non-PB binary file

This one will be triggered for binary files, which are not part of PureBasic (more or less any)

Note: Only one tool can have this trigger. Any other tools with this trigger will be ignored.

Open File non-PB text file

This one will be triggered for text files, which are not part of PureBasic

Note: Only one tool can have this trigger set.

Other options on the right side

Wait until tool quits

The IDE will be locked for no input and cease all its actions until you tool has finished running. This option is required if you want to modify a source code and reload it afterwards, or have it passed on to the compiler for the compilation triggers.

Run hidden

Runs the program in invisible mode. Do not use this option for any program that might expect user input, as there will be no way to close it in that case.

Hide editor

This is only possible with the "wait until tool quits" option set. Hides the editor while the tool is running.

Reload Source after the tool has quit

This is only possible with the "wait until tool quits" option set, and when either the %FILE or %TEMPFILE tokens are used in the Arguments list.

After your program has quit, the IDE will reload the source code back into the editor. You can select whether it should replace the old code or be opened in a new code view.

Hide Tool from the Main menu

Hides the tool from the Tools menu. This is useful for tools that should only be executed by a special trigger, but not from the menu.

Enable Tool on a per-source basis

Tools with this option set will be listed in the "Execute tools" list in the compiler options, and only executed for sources where it is enabled there. Note that when disabling the tool with the checkbox here in the "Config tools" window, it will be globally disabled and not run for any source code, even if enabled there.

This option is only available for the following triggers:

- Before Compile/Run
- After Compile/Run
- Run compiled Program
- Before create Executable
- After create Executable
- Source code loaded
- Source code saved

- Source code closed

Supported File extensions

Only for the "File Viewer Special file" trigger. Enter the list of handled extensions here.

Tips for writing your own code processing tools

The IDE provides additional information for the tools in the form of environment variables. They can be easily read inside the tool with the commands of the Process library .

This is a list of provided variables. Note that those that provide information about the active source are not present for tools executed on IDE startup or end.

```
PB_TOOL_IDE          - Full path and filename of the IDE
PB_TOOL_Compiler     - Full path and filename of the Compiler
PB_TOOL_Preferences  - Full path and filename of the IDE's Preference
  file
PB_TOOL_Project      - Full path and filename of the currently open
  project (if any)
PB_TOOL_Language     - Language currently used in the IDE
PB_TOOL_FileList     - A list of all open files in the IDE, separated
  by Chr(10)

PB_TOOL_Debugger     - These variables provide the settings from the
  Compiler Options

PB_TOOL_InlineASM    - window for the current source. They are set to
  "1" if the option
PB_TOOL_Unicode      - is enabled, and "0" if not.
PB_TOOL_Thread
PB_TOOL_XPSkin
PB_TOOL_OnError

PB_TOOL_SubSystem    - content of the "Subsystem" field in the
  compiler options
PB_TOOL_Executable   - same as the %COMPILEFILE token for the
  command-line
PB_TOOL_Cursor       - same as the %CURSOR token for the command-line
PB_TOOL_Selection    - same as the %SELECTION token for the
  command-line
PB_TOOL_Word         - same as the %WORD token for the command-line

PB_TOOL_MainWindow   - OS handle to the main IDE window
PB_TOOL_Scintilla    - OS handle to the Scintilla editing component of
  the current source
```

When the %TEMPFILE or %COMPILEFILE tokens are used, the IDE appends the compiler options as a comment to the end of the created temporary file, even if the user did choose to not save the options there when saving a source code.

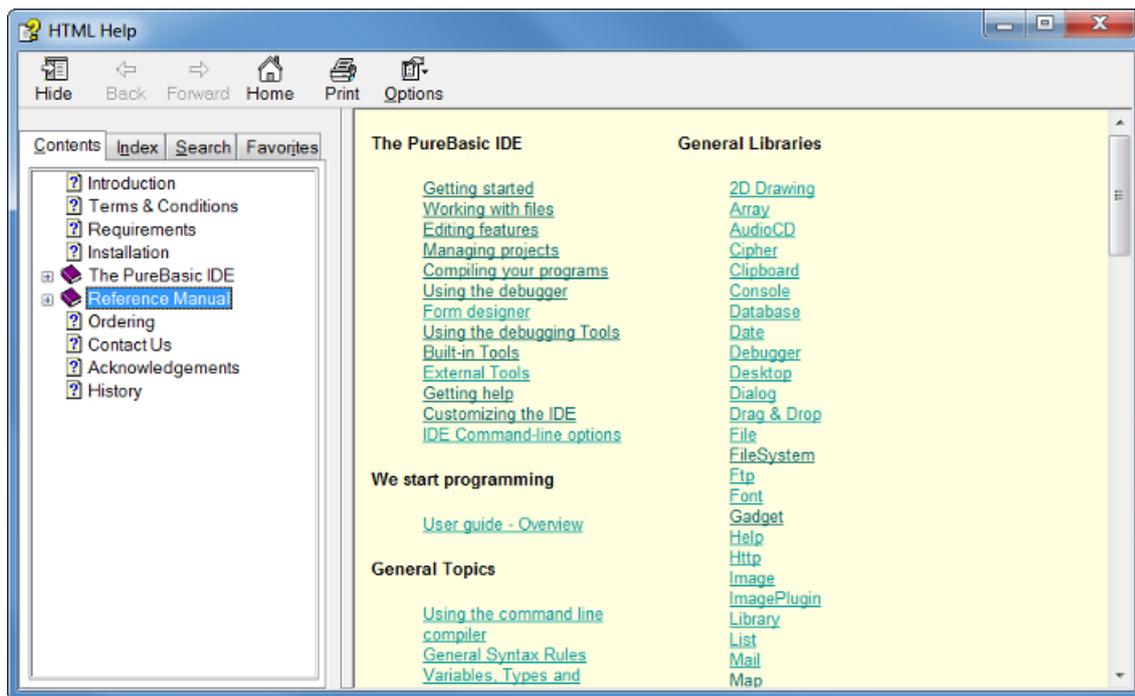
This enables your tool to read the compiler settings for this file, and take them into account for the actions your carries out.

Chapter 17

Getting Help

The PureBasic IDE provides ways to access the PureBasic help-file, as well as other files and documentation you want to view while programming.

Quick access to the reference guide



By pressing the help shortcut (F1 by default) or selecting the "Help..." command from the Help menu while the mouse cursor is over a PureBasic keyword or function, the help will be opened directly at the description of that keyword or function.

If the word at the cursor position has no help entry, the main reference page will be displayed.

The reference manual can also be viewed side by side with the source code using the Help Tool .

Quick access to Windows API help

There are two ways to get the same quick access as for the PureBasic functions (by pressing F1 with the cursor on the function) also for functions of the Windows API. To enable this feature you have to download additional help files for these functions:

Microsoft Platform SDK The Microsoft Platform SDK provides the most complete and up to date programming reference available for the windows platform. It provides information on all API functions, as well as overviews and introductions to the different technologies used when programming for the windows platform. It is however quite big (up to 400MB depending on the selected components). For the IDE help, you can either install the "February 2003" or the "Windows Server 2003 SP1" edition of the SDK.

It can be downloaded from here:

<https://www.microsoft.com/en-us/download/details.aspx?id=15656>

Note that the SDK can also be ordered on CD from this page. Also if you are the owner of any development products from Microsoft (such as Visual Studio), there might be a copy of the SDK included on one of the CDs that came with it.

The win32.hlp help-file There is a much smaller alternative to the complete SDK by Microsoft (7.5 MB download). This help is quite old (written for Windows95 in fact), so it does not provide any information on new APIs and technologies introduced since then.

However, it provides good information about commonly used API that is still valid today, as these mostly did not change. This download is recommended if you only need occasional help for API functions, but do not want to download the full SDK.

It can be downloaded from here:

<http://www.purebasic.com/download/WindowsHelp.zip>

To use it from the PureBasic IDE, just create a "Help" subdirectory in your PureBasic folder and copy the "win32.hlp" file into it.

Accessing external helpfiles from the IDE

If you have other helpfiles you wish to be able to access from the IDE, then create a "Help" subdirectory in your PureBasic folder and copy them to it. These files will appear in the "External Help" submenu of the Help menu, and in the popupmenu you get when right-clicking in the editing area. Chm and Hlp files will be displayed in the MS help viewer. The IDE will open the helpfiles in the internal fileviewer. So files like text files can be viewed directly like this. For other types, you can use the Config Tools menu to configure an external tool to handle the type of help-file you use. The help will then be displayed in that tool.

For example, if you have pdf helpfiles, configure an external tool to handle pdf files and put the files in the Help subdirectory of PureBasic. Now if you click the file in the "external help" menu, it will be opened in that external tool.

Chapter 18

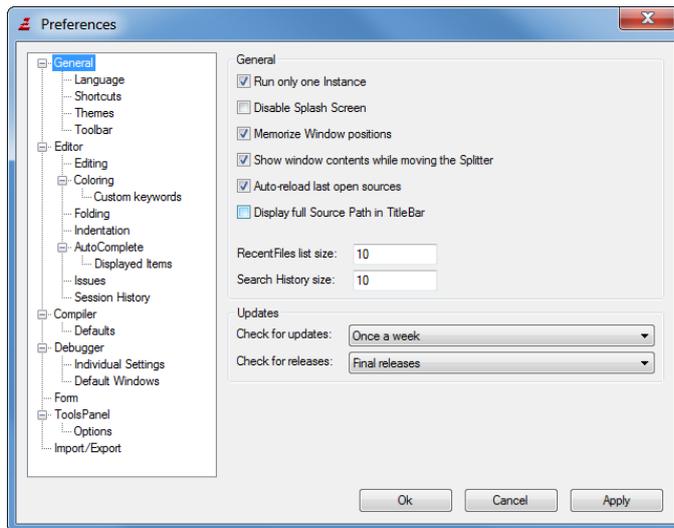
Customizing the IDE

The PureBasic IDE provides many options to customize or disable some of its features in order to become the perfect tool for you.

These options are accessible from the Preferences command in the File menu, and the meaning of each setting is described here.

Any changes made will only take effect once you click the "OK" button or "Apply".

General



Options that affect the general behavior of the IDE.

Run only one Instance

If set, prevents the IDE from being opened more than once. Clicking on a PB file in the explorer will open it in the already existing IDE instance instead of opening a new one.

Disable Splash screen

Disables the splash screen that is displayed on start-up.

Memorize Window positions

Remembers the position of all IDE windows when you close them. If you prefer to have all windows open at a specific location and size, enable this option, move all windows to the perfect position, then restart the IDE (to save all options) and then disable this option to always open all windows in the last saved position.

Show window contents while moving the Splitter

Enable this only if you have a fast computer. Otherwise moving the Splitter bar to the Error Log or Tools Panel may flicker a lot.

Auto-Reload last open sources

On IDE start-up, opens all the sources that were open when the IDE was closed the last time.

Display full Source Path in Title bar

If set, the IDE title bar will show the full path to the currently edited file. If not, only the filename is shown.

Enable Appearance Dark Mode

Is set, allows the appearance 'Dark Mode'.

Recent Files list

This setting specifies how many entries are shown in the "Recent Files" submenu of the File menu.

Search History size

This setting specifies how many recent search words are remembered for "Find/Replace" and "Find in Files"

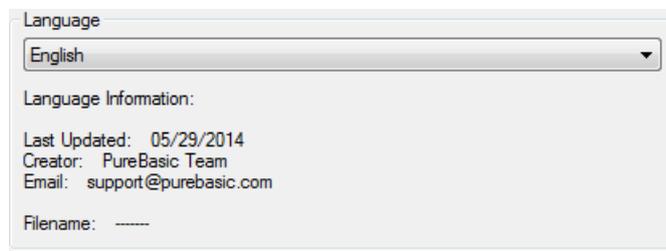
Check for updates

Specifies how often the IDE should check on the purebasic.com server for the availability of new updates. An update check can also be performed manually at any time from the "Help" menu.

Check for releases

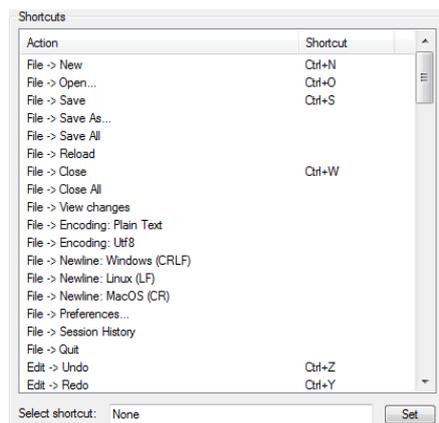
Specifies which kind of releases should cause a notification if they are available.

General - Language



This allows you to change the language of the IDE. The combo box shows the available languages, and you can view some information about the language file (for example who translated it and when it was last updated).

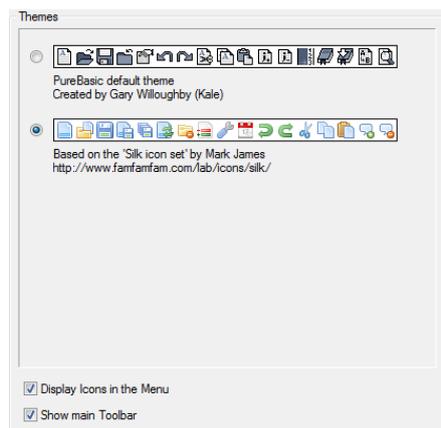
General - Shortcuts



Here you can fully customize all the shortcut commands of the IDE. Select an entry from the list, select the shortcut field, enter the new key combination and click "Set" to change the entry.

Note that Tab & Shift+Tab are reserved for block-indentation and un-indentation and cannot be changed. Furthermore some key combination might have a special meaning for the OS and should therefore not be used.

General - Themes



This section shows the available icon themes for the IDE and allows to select the theme to use. The IDE comes with two themes by default.

More themes can be easily added by creating a zip-file containing the images (in png format) and a "Theme.prefs" file to describe the theme. The zip-file has to be copied to the "Themes" folder in the PureBasic installation directory to be recognized by the IDE. The "SilkTheme.zip" file can be used as an example to create a new theme.

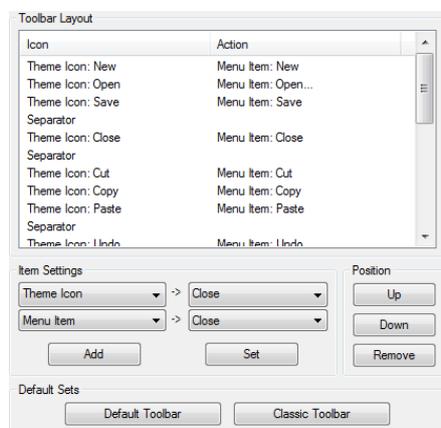
Display Icons in the Menu

Allows to hide/show the images in the IDE menus.

Show main Toolbar

Allows to hide/show the main toolbar in order to gain space for the editing area.

General - Toolbar



This allows to fully customize the main Toolbar. By selecting an entry and using the Buttons in the "Position" section, you can change the order. The "Item Settings" section can be used to modify the entry or add a new one. New ones are always added at the end of the list.

Types of items:

Separator : a vertical separator line.

Space : an empty space, the size of one toolbar icon.

Standard Icon : allows you to select a OS standard icon from the combo box on the right.

IDE Icon : allows you to select one of the IDE's own icons in the combo box on the right.

Icon File : allows you to specify your own icon file to use in the edit box on the right (PNG files are supported on all platforms, Windows additionally supports icon files).

If you do not select a separator or space, you can specify an action to carry out when the button is pressed:

Menu Item : carries out the menu command specified in the combo box on the right.

Run tool : executes the external tool specified in the combo box on the right.

The "Default Sets" section contains two standard toolbar sets which you can select, and later modify.

Editor

The screenshot shows the 'Editor' settings dialog box. It is divided into two sections: 'File selection' and 'Editor'.
In the 'File selection' section, there are three checkboxes: 'Display multiple rows' (unchecked), 'Display close buttons in each tab' (checked), and 'Add a tab to create a new source' (unchecked).
In the 'Editor' section, there are five checkboxes: 'Monitor open files for changes on disk' (checked), 'Auto-save before compiling' (checked), 'Save all sources with Auto-save' (checked), 'Memorize Cursor position' (checked), and 'Memorize Marker positions' (checked). There is also an unchecked checkbox for 'Always hide the error log (ignore the per-source setting)'.
Below the checkboxes, there is a 'Save Settings to:' dropdown menu set to 'A common file project.cfg for every directory'.
The 'Tab Length:' is set to '2', with an unchecked checkbox for 'Use real Tab (ASCII 9)'.
The 'Source Directory:' is set to 'C:\PureBasic\Libraries\current\json\'.
The 'Code file extensions:' field is empty.

Settings that affect the management of the source codes.

Monitor open files for changes on disk

Monitors all open files for changes that are made to the files on disk while they are edited in the IDE. If modifications are made by other programs, a warning is displayed with the choice to reload the file from disk.

Auto-save before compiling

Saves the current source code before each compile/run or executable creation. Note that any open include files are not automatically saved.

Save all sources with Auto-save

Saves all sources instead of just the current one with one of the Auto-save options.

Memorize cursor position

Saves the current cursor position, as well as the state of all folding marks with the compiler options for the source file.

Memorize Marker positions

Saves all the Markers with the options for the source file.

Always hide the error log

The error log can be shown/hidden on a per-source basis. This option provides a global setting to ignore the per-source setting and never display the error log. It also removes the corresponding menu entries from the IDE menu.

Save settings to

This option allows to specify where the compiler options of a source file are saved:

The end of the Source file

Saves the settings as a special comment block at the end of each source file.

The file <filename>.pb.cfg

Creates a .pb.cfg file for each saved source code that contains this information.

A common file project.cfg for every directory

Creates a file called project.cfg in each directory where PB files are saved. This one file will contain the options for all files in that directory.

Don't save anything

No options are saved. When reopening a source file, the defaults will always be used.

Tab Length

Allows to specify how many spaces are inserted each time you press the Tab key.

Use real Tab (Ascii 9)

If set, the tab key inserts a real tab character instead of spaces. If not set, there are spaces inserted when Tab is pressed.

Note that if real tab is used, the "Tab Length" option specifies the size of one displayed tab character.

Source Directory

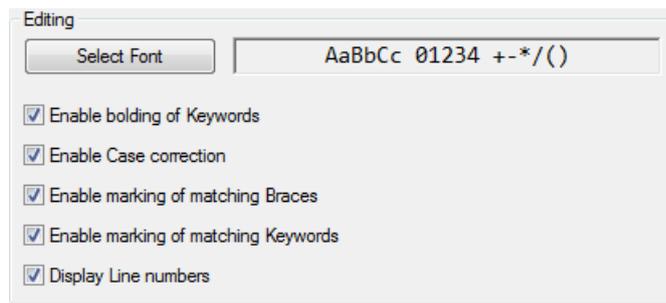
Specifies the default directory used in the Open and Save dialogs if no other files are currently open (if another file is open, its path will be used as default).

Set this to the path were you usually save the source codes.

Code file extensions

The IDE detects code files by their extension (pb, pbi or pbf by default). Non-code files are edited in a "plain text" mode in which code-related features are disabled. This setting causes the IDE to recognize further file extensions as code files. The field can contain a comma-separated list (i.e. "pbx, xyz") of extensions to recognize.

Editor - Editing



Use "Select Font" to change the font used to display the source code. To ensure a good view of the source code, it should be a fixed-size font, and possibly even one where bold characters have the same size as non-bold ones.

Enable bolding of keywords

If your font does not display bold characters in the same size as non-bold ones, you should disable this option. If disabled, the keywords will not be shown as bold.

Enable case correction

If enabled, the case of PureBasic keywords, PureBasic Functions as well as predefined constants will automatically be corrected while you type.

Enable marking of matching Braces

If enabled, the brace matching the one under the cursor will be highlighted.

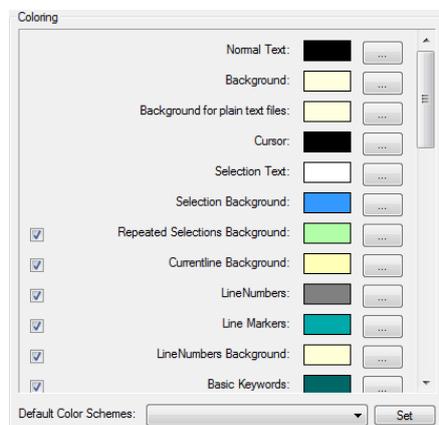
Enable marking of matching Keywords

If enabled, the keyword(s) matching the one under the cursor will be underlined.

Display line numbers

Shows or hides the line number column on the left.

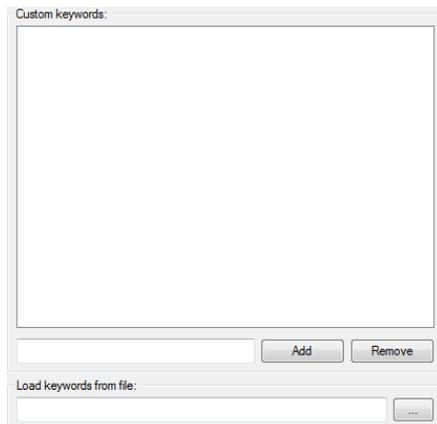
Editor - Coloring



Here you can change the color settings for the syntax coloring, as well as the debugger marks. Default

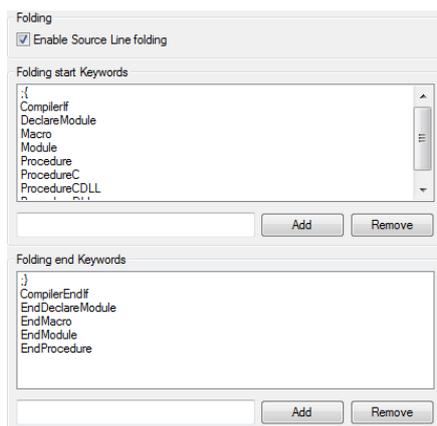
color schemes can be selected from the box on the bottom, and also modified after they have been set. Individual color settings can be disabled by use of the checkboxes.
 Note: The 'Accessibility' color scheme has (apart from high-contrast colors) a special setting to always use the system color for the selection in the code editor. This helps screen-reader applications to better detect the selected text.

Editor - Coloring - Custom Keywords



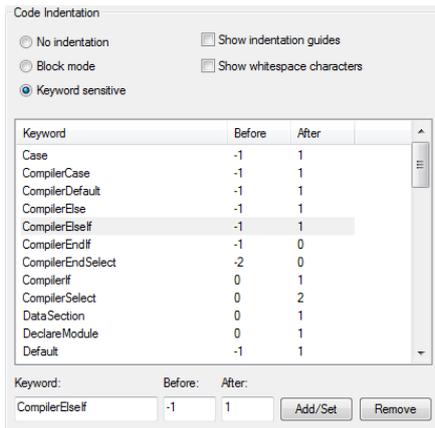
In this section, a list of custom keywords can be defined. These keywords can have a special color assigned to them in the coloring options and the IDE will apply case-correction to them if this feature is enabled. This allows for applying a special color to special keywords by preprocessor tools or macro sets, or to simply have some PB keywords colored differently.
 Note that these keywords take precedence above all other coloring in the IDE, so this allows to change the color or case correction even for PureBasic keywords.
 The keywords can be either entered directly in the preferences or specified in a text file with one keyword per line (or both).

Editor - Folding



Here you can set the keywords in the source code that start/end a foldable section of code. You can add any number of words that will mark such a sections. You can also choose to completely disable the folding feature.
 Words that are found inside comments are ignored, unless the defined keyword includes the comment symbol at the start (like the default ";" keyword).
 A keyword may not include spaces.

Editor - Indentation



Here you can specify how the editor handles code indentation when the return key is pressed.

No indentation

Pressing return always places the cursor at the beginning of the next line.

Block mode

The newly created line gets the same indentation as the one before it.

Keyword sensitive

Pressing the return key corrects the indentation of both the old line and the new line depending on the keywords on these lines. The rules for this are specified in the keyword list below. These rules also apply when the "Reformat indentation" item in the edit menu is used.

Show indentation guides

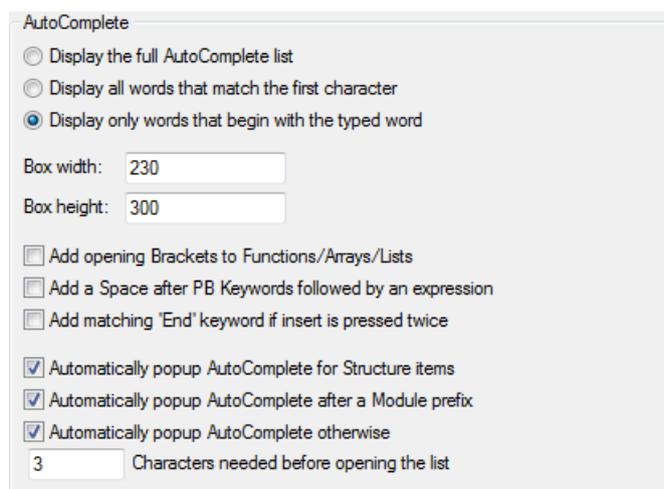
Causes vertical lines to be shown to visualize the indentation on each line. This makes it easier to see which source lines are on the same level of indentation.

Show whitespace characters

Causes whitespace characters to be visible as little dots (spaces) or arrows (tab characters).

The keyword list contains the keywords that have an effect on the indentation. The "Before" setting specifies the change in indentation on the line that contains the keyword itself while the "After" setting specifies the change that applies to the line after it.

Editor - Auto complete



Display the full Auto complete list

Always displays all keywords in the list, but selects the closest match.

Display all words that start with the first character

Displays only those words that start with the same character as you typed. The closest match is selected.

Display only words that start with the typed word

Does not display any words that do not start with what you typed. If no words match, the list is not

displayed at all.

Box width / Box height

Here you can define the size of the auto complete list (in pixel). Note that these are maximum values. The displayed box may become smaller if there are only a few items to display.

Add opening Brackets to Functions/Arrays/Lists

Will automatically add a "(" after any function/Array/List inserted by auto complete. Functions with no parameters or lists get a ")" added.

Add a Space after PB Keywords followed by an expression

When inserting PB keywords that cannot appear alone, a space is automatically added after them.

Add matching End' keyword if insert shortcut is pressed twice

When the selected keyword has a complementary end keyword, for example "EndSelect" to "Select" or "EndIF" to "IF", the insert shortcut (default Tab) can be repeated a second time to automatically add this text too. The end keyword will be inserted after the cursor, so you can continue typing after the first keyword that was inserted.

Automatically popup AutoComplete for Structure items

Displays the list automatically whenever a structured variable or interface is entered and the "\" character is typed after it to show the list of possible structure fields. If disabled, the list can still be displayed by pressing the keyboard shortcut to open the AutoComplete window (usually Ctrl+Space, this can be modified in the Shortcuts section of the Preferences).

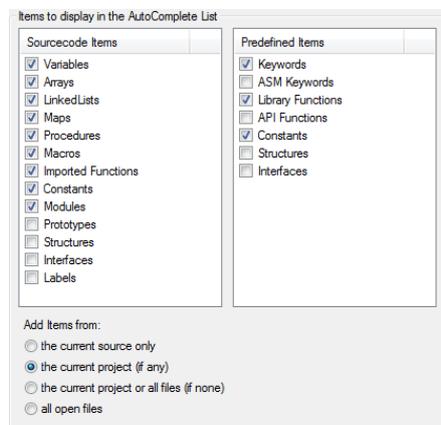
Automatically popup AutoComplete outside of Structures

Displays the list automatically when the current word is not a structure after a certain amount of characters has been typed, and a possible match in the list is found. If disabled, the list can still be displayed by pressing the assigned keyboard shortcut.

Characters needed before opening the list

Here you can specify how many characters the word must have minimum before the list is automatically displayed.

Editor - Auto complete - Displayed items



This shows a list of possible items that can be included with the possible matches in the AutoComplete list.

Source code Items

Items defined in the active source code, or other open sources (see below).

Predefined Items

Items that are predefined by PureBasic, such as the PureBasic keywords, functions or predefined constants.

Add Items from: the current source only

Source code items are only added from the active source code.

Add Items from: the current project (if any)

Source code items are added from the current project if there is one. The other source codes in the project do not have to be currently open in the IDE for this.

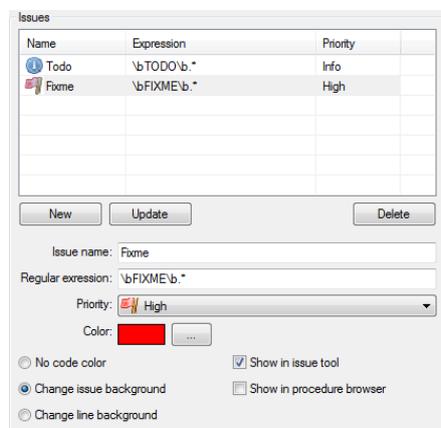
Add Items from: the current project or all files (if none)

Source code items are added from the current project. If the current source code does not belong to the open project then the items from all open source codes will be added.

Add Items from: all open files

Source code items are added from all currently open source codes.

Editor - Issues



Allows to configure the collection of 'issue' markers from comments in the source code. Issue markers can be displayed in the Issues or ProcedureBrowser tool, and they can be marked within the source code with a separate background color.

A definition for an issue consists of the following:

Issue name

A name for the type of issue.

Regular expression

A regular expression defining the pattern for the issue. This regular expression is applied to all comments in the source code. Each match of the expression is considered to match the issue type.

Two optional named groups (named "display" and "mark") can be included in the regex to control which part of the match is highlighted and which part is displayed in the tool.

Example: The default TODO pattern, but only display the part after the TODO in the tool

```
\bTODO\b(?<display>.*)
```

Example: Match everything in {}, but only highlight the inner part (display the full match in the tool)

```
{(?<mark>.*)}
```

Both named groups can also be used in a single regex for full control. If no groups with these names exist in the regex, the full match will be used.

Priority

Each issue type is assigned a priority. The priority can be used to order and filter the displayed issues in the issue tool.

Color

The color used to mark the issue in the source code (if enabled). The color will be used to mark the background of either only the issue text itself, or the entire code line depending on the coloring option.

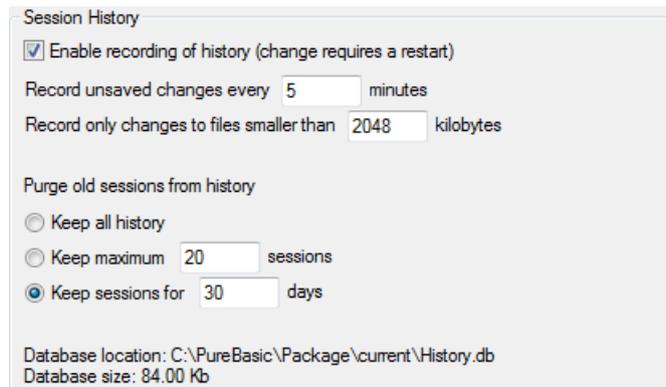
Show in issue tool

If enabled, any found issues of this type are listed in the issues tool. This option can be disabled to cause an issue to only be marked in the source code with a special background color if desired.

Show in procedure browser

If enabled, any found issues are shown as an entry in the procedure browser tool.

Editor - Session history



Allows to configure how the session history is recording changes.

Enable recording of history

Enable or disable the history session recording. When enabled, all the changes made to a file will be recorded in the background in a database. A session is created when the IDE launch, and is closed when the IDE quits. This is useful to rollback to a previous version of a file, or to find back a deleted or corrupted file. It's like a very powerful source backup tool, limited in time (by default one month of recording). It's not aimed to replace a real source versioning system like SVN or GIT. It's complementary to have finer change trace. The source code will be stored without encryption, so if you are working on sensitive source code, be sure to have this database file in a secure location, or disable this feature. It's possible to define the session history database location using an IDE command-line switch.

Record change every X minutes

Change the interval between each silent recording (when editing). A file will be automatically recorded when saving or closing it.

Record only changes to files smaller than X kilobytes

Change the maximum size (in kilobytes) of the files being recorded. This allow to exclude very big files which could make the database grow a lot.

Keep all history

Keep all the history, the database is never purged. It will always grows, so it should be watched.

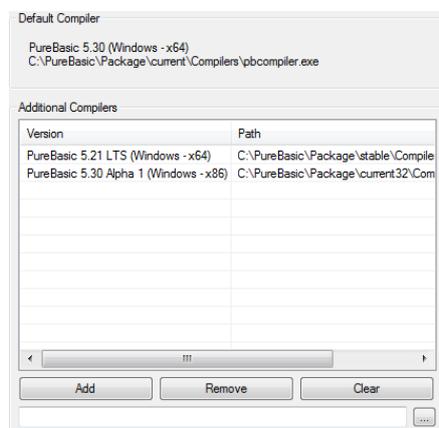
Keep maximum X sessions

After reaching the maximum number of sessions, the oldest session will be removed from the database.

Keep sessions for X days

After reaching the maximum number of days, the session will be removed from the database.

Compiler

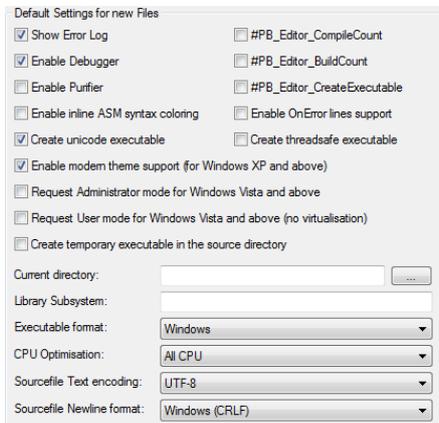


This page allows to select additional compilers which should be available for compilation in the Compiler Options . This allows switching between different compilers of the same version (like the x86 and x64 compilers) or even switching between different versions easily.

Any PureBasic compiler starting from Version 4.10 can be added here. The target processor of the

selected compilers does not have to match that of the default compiler, as long as the target operating system is the same. The list displays the compiler version and path of the selected compilers. The information used by the IDE (for code highlighting, auto complete, structure viewer) always comes from the default compiler. The additional compilers are only used for compilation.

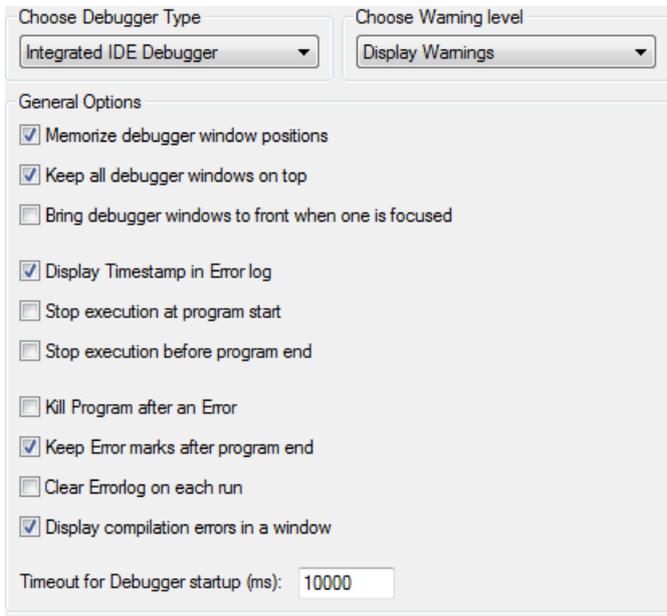
Compiler - Defaults



This page allows setting the default compiler options that will be used when you create a new source code with the IDE.

For an explanation of the meaning of each field, see the [Compiler Options](#) .

Debugger



Settings for the internal Debugger, or the Standalone Debugger. The command-line debugger is configured from the command-line only.

Debugger Type

Select the type of debugger you want to use when compiling from the IDE here.

Choose Warning level

Select the action that should be taken if the debugger issues a warning. The available options are:
Ignore Warnings: Warnings will be ignored without displaying anything.

Display Warnings: Warnings will be displayed in the error log and the source code line will be marked, but the program continues to run.

Treat Warnings as Errors: A warning will be treated like an error.
See Using the debugger for more information on debugger warnings and errors.

Memorize debugger window positions

The same as the "Memorize Window positions" for in the General section, but for all Debugger windows.

Keep all debugger windows on top

All debugger windows will be kept on top of all other windows, even from other applications.

Bring Debugger windows to front when one is focused

With this option set, focusing one window that belongs to the debugger of a file, all windows that belong to the same debugging session will be brought to the top.

Display Timestamp in error log

Includes the time of the event in the error log.

Stop execution at program start

Each program will be started in an already halted mode, giving you the opportunity to start moving step-by-step, right from the start of the program.

Stop execution before program end

Stops the program execution right before the executable would unload. This gives you a last chance to use the debugging tools to examine Variables or Memory before the program ends.

Kill Program after an Error

If a program encounters an error, it will be directly ended and all debugger windows closed. This gives the opportunity to directly modify the code again without an explicit "Kill Program", but there is no chance to examine the program after an error.

Keep Error marks after program end

Does not remove the lines marked with errors when the program ends. This gives the opportunity to still see where an error occurred while editing the code again.

The marks can be manually removed with the "Clear error marks" command in the "Error log" submenu of the debugger menu.

Clear error log on each run

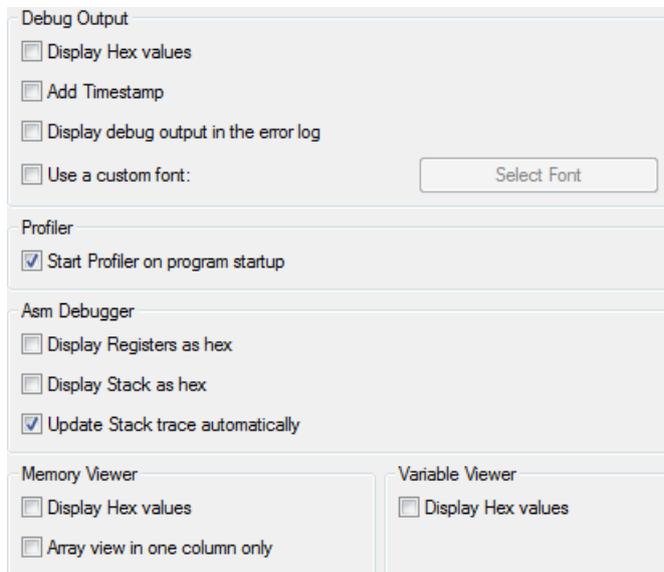
Clears the log window when you execute a program. This ensures that the log does not grow too big (this option is also available with the command-line debugger selected).

Timeout for Debugger startup

Specifies the time in milliseconds how long the debugger will wait for a program to start up before giving up. This timeout prevents the debugger from locking up indefinitely if the executable cannot start for some reason.

Debugger - Individual Settings

This allows setting options for the individual debugger tools. The "Display Hex values" options switch between displaying Byte, Long and Word as decimal or hexadecimal values.



Debug Output Add Timestamp

Adds a timestamp to the output displayed from the Debug command.

Debug Output - Display debug output in the error log

With this option enabled, a Debug command in the code will not open the Debug Output window , but instead show the output in the error log .

Debug Output Use custom font

A custom font can be selected here for the debug output window . This allows to specify a smaller font for much output or a proportional one if this is desired.

Profiler - Start Profiler on program startup

Determines whether the profiler tool should start recording data when the program starts.

ASM Debugger Update Stack trace automatically

Updates the stack trace automatically on each step/stop you do. If disabled, a manual update button will be displayed in the ASM window.

Memory Viewer Array view in one column only

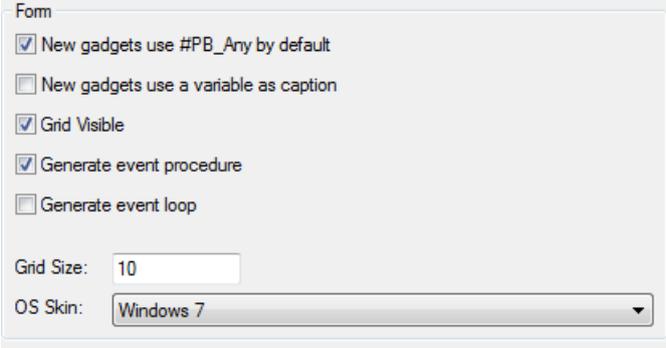
If the memory area is displayed in array view, this option selects whether it should be multi-column (with 16 bytes displayed in each column) or with only one column.

Debugger - Default Windows



The debugger tools you select on this page will automatically be opened each time you run a program with enabled debugger.

Form



Allows to customize the integrated form designer behavior.

New gadgets use #PB_Any by default

If enabled, new gadget creation will use #PB_Any instead of static enumeration numbering.

New gadgets use a variable as caption

If enabled, new gadget will use a variable instead of static text as caption. It can be useful to easily localize the form.

Grid visible

If enabled, the grid will be visible on the form designer, to ease gadget alignment.

Generate event procedure

If enabled, an event procedure will be automatically generated (and updated).

Generate event loop

If enabled, a basic event loop will be generated for the form.

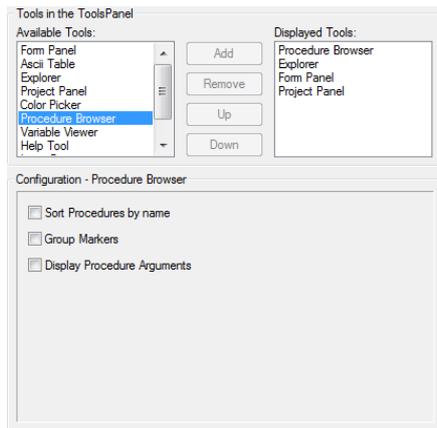
Grid size

Space between two grid points, in pixels.

OS skin

Skin to use for the form designer.

Tools Panel



This allows configuring the internal tools that can be displayed in the side panel. Each tool that is in the "Displayed Tools" list is displayed in the Panel on the side of the edit area. Each tool that is not listed there is accessible from the Tools menu as a separate window.

Put only those tools in the side panel that you use very frequently, and put the most frequently used first, as it will be the active one once you open the IDE.

By selecting a tool in either of the lists, you get more configuration options for that tool (if there are any) in the "Configuration" section below.

Here is an explanation of those tools that have special options:

Explorer

You can select between a Tree or List display of the file-system. You can also set whether the last displayed directory should be remembered, or if the Source Path should be the default directory when the IDE is started.

Procedure Browser

"Sort Procedures by Name" : sorts the list alphabetically (by default they are listed as they appear in the code).

"Group Markers" : groups the ";" markers together.

"Display Procedure Arguments" : Displays the full declaration of each procedure in the list.

Variable Viewer

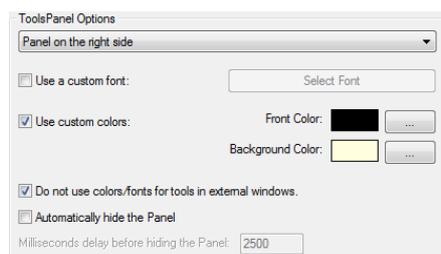
The "Display Elements from all open sources" option determines whether the list should only include items from this code, or from all open codes.

Furthermore you can select the type of items displayed in the Variable viewer.

Help Tool

"Open sidebar help on F1": specifies whether to open the help tool instead of the separate help viewer when F1 is pressed.

Tools panel - Options



Here you can customize the appearance of the Tools Panel a bit more. You can select the side on which it will be displayed, a Font for its text, as well as a foreground and background color for the displayed tools. The font and color options can be disabled to use the OS defaults instead.

Do not use colors/fonts for tools in external windows

If set, the color/font options only apply to the Tools displayed in the Panel, those that you open from the Tools menu will have the default colors.

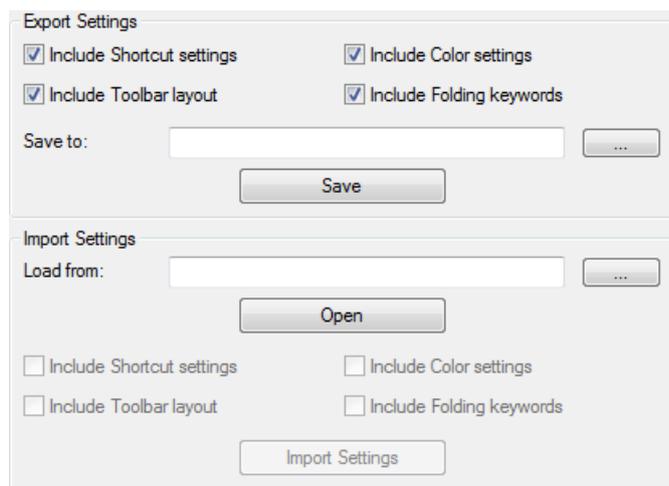
Automatically hide the Panel

To save space, the Panel will be hidden if the mouse is not over it. Moving the mouse to the side of the IDE will show it again.

Milliseconds delay before hiding the Panel

Sets a timeout in ms, after which the Panel is hidden if you leave it with the mouse.

Import/Export



This section allows you to export the layout settings of the IDE in a platform independent format, which allows you to import them again into the PureBasic IDE on another Operating System, or to share your options with other PB users.

To export your settings, select what types of settings you want to include, select a filename and press the "Save" button.

To import settings, select the filename and press "Open". You will then see the options that are included in this file as enabled checkboxes. After selecting what you want to import, click the "Import Settings" button.

For the new settings to take effect, you have to first click the apply button.

Note: You can import the style files from the jaPBe Editor, but only the color settings will be imported.

Chapter 19

Command-line options for the IDE

The PureBasic IDE allows you to modify the paths and files being used from the command-line. This allows you to create several shortcuts that start the IDE with different configurations for different users, or for different projects.

There are also options for compiling PureBasic projects directly from the command-line. Building a project from the command-line involves the same actions like at choosing the 'Build Target' or 'Build all Targets' from the compiler menu .

General options:

```
/VERSION                displays the IDE version and exits
/HELP or /?            displays a description of the command-line
                        arguments
```

Options for launching the IDE:

```
/P <Preferences file>  loads/saves all the configuration to/from
                        the given file
/T <Templates file>    loads/saves the code templates from/to the
                        given file
/A <tools file>        loads/saves the configuration of the
                        external tool from/to this file
/S <Source path>       overwrites the "Source path" setting from
                        the preferences
/E <Explorer path>     starts the Explorer tool with the given path
/L <Line number>       moves the cursor to the given line number in
                        the last opened file
/H <HistoryDatabase>   specify the file to use for the session
                        history database
/NOEXT                 disables the registering of the .pb
                        extension in the registry
/LOCAL                 puts all preferences in the PureBasic
                        directory instead of the user profile location
/PORTABLE              the same as /LOCAL and /NOEXT combined
```

Options for building projects:

```
/BUILD <file>          specifies the project file to build
/TARGET <target>       specifies the target to build (the default
                        is to build all targets)
/QUIET                 hides all build messages except errors
/READONLY              does not update the project file after
                        compiling (with new access time and build counters)
```

The default files for /P /T and /A are saved in the %APPDATA%\PureBasic\ directory on the system.

The /NOEXT command is useful when you have several different PB versions at once (for testing of beta versions for example), but want the .pb extension to be associated with only one of them. The /PORTABLE command can be used to keep all configuration inside the local directory to easily copy PureBasic to different computers (or run it from USB sticks for example).

Example:

```
1 PureBasic.exe Example.pb /PORTABLE
```

You can also put the filenames of source files to load on the command-line. You can even specify wildcards for them (so with "*.pb" you can load a whole directory).

Part III

Language Reference

Chapter 20

Working with different number bases

(Note: These examples use the ^ symbol to mean 'raised to the power of' - this is only for convenience in this document, PureBasic does not currently have a power-of operator! Use the PureBasic command Pow() from the "Math" Library instead.)

Introduction

A number base is a way of representing numbers, using a certain amount of possible symbols per digit. The most common you will know is base 10 (a.k.a. decimal), because there are 10 digits used (0 to 9), and is the one most humans can deal with most easily.

The purpose of this page is to explain different number bases and how you can work with them. The reason for this is that computers work in binary (base 2) and there are some cases where it is advantageous to understand this (for example, when using logical operators, bit masks, etc).

Overview of number bases

Decimal System

Think of a decimal number, and then think of it split into columns. We'll take the example number 1234. Splitting this into columns gives us:

1 2 3 4

Now think of what the headings for each column are. We know they are units, tens, hundreds and thousands, laid out like this:

1000 100 10 1
 1 2 3 4

We can see that the number 1234 is made up out of

```
1*1000=1000
+ 2* 100= 200
+ 3*  10=  30
+ 4*   1=   4
Total   =1234
```

If we also look at the column headings, you'll see that each time you move one column to the left we multiply by 10, which just so happens to be the number base. Each time you move one column to the right, you divide by 10. The headings of the columns can be called the weights, since to get the total

number we need to multiply the digits in each column by the weight. We can express the weights using indices. For example 10^2 means '10 raised to the power of two' or $1*10*10$ (=100). Similarly, 10^4 means $1*10*10*10*10$ (=10000). Notice the pattern that whatever the index value is, is how many times we multiply the number being raised. 10^0 means 1 (since we multiply by 10 no times). Using negative numbers shows that we need to divide, so for example 10^{-2} means $1/10/10$ (=0.01). The index values make more sense when we give each column a number - you'll often see things like 'bit 0' which really means 'binary digit in column 0'.

In this example, ^ means raised to the power of, so 10^2 means 10 raised to the power of 2.

Column number	3	2	1	0
Weight (index type)	10^3	10^2	10^1	10^0
Weight (actual value)	1000	100	10	1
Example number (1234)	1	2	3	4

A few sections ago we showed how to convert the number 1234 into its decimal equivalent. A bit pointless, since it was already in decimal but the general method can be shown from it - so this is how to convert from any number to its decimal value:

B = Value of number base

- 1) Separate the number in whatever base you have into it's columns.
For example, if we had the value 'abcde' in our fictional number base 'B', the columns would be: a b c d e

- 2) Multiply each symbol by the weight for that column (the weight being calculated by 'B' raised to the power of the column number):
 - a * B^4 = a * B * B * B * B
 - b * B^3 = b * B * B * B
 - c * B^2 = c * B * B
 - d * B^1 = d * B
 - e * B^0 = e

- 3) Calculate the total of all those values. By writing all those values in their decimal equivalent during the calculations, it becomes far easier to see the result and do the calculation (if we are converting into decimal).

Converting in the opposite direction (from decimal to the number base 'B') is done using division instead of multiplication:

- 1) Start with the decimal number you want to convert (e.g. 1234).
- 2) Divide by the target number base ('B') and keep note of the result and the remainder.
- 3) Divide the result of (2) by the target number base ('B') and keep note of the result and the remainder.
- 4) Keep dividing like this until you end up with a result of 0.
- 5) Your number in the target number base is the remainders written in the order most recently calculated to least recent. For example, your number would be

the remainders of the steps in this order 432.

More specific examples will be given in the sections about the specific number bases.

Binary System

Everything in a computer is stored in binary (base 2, so giving symbols of '0' or '1') but working with binary numbers follows the same rules as decimal. Each symbol in a binary number is called a bit, short for binary digit. Generally, you will be working with bytes (8-bit), words (16-bit) or longwords (32-bit) as these are the default sizes of PureBasic's built in types. The weights for a byte are shown:

(^ means 'raised to the power of', number base is 2 for binary)								
Bit/column number	7	6	5	4	3	2	1	0
Weight (index)	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰
Weight (actual value)	128	64	32	16	8	4	2	1

So, for example, if we had the number 00110011 (Base 2), we could work out the value of it like this:

```
0 * 128
+ 0 * 64
+ 1 * 32
+ 1 * 16
+ 0 * 8
+ 0 * 4
+ 1 * 2
+ 1 * 1
=      51
```

An example of converting back would be if we wanted to write the value 69 in binary. We would do it like this:

```
69 / 2 = 34 r 1    ^
34 / 2 = 17 r 0    /|\
17 / 2 = 8 r 1     |
8 / 2 = 4 r 0     |    Read remainders in this direction
4 / 2 = 2 r 0     |
2 / 2 = 1 r 0     |
1 / 2 = 0 r 1     |
(Stop here since the result of the last divide was 0)
```

Read the remainders backwards to get the value in binary = 1000101

Another thing to consider when working with binary numbers is the representation of negative numbers. In everyday use, we would simply put a negative symbol in front of the decimal number. We cannot do this in binary, but there is a way (after all, PureBasic works mainly with signed numbers, and so must be able to handle negative numbers). This method is called 'twos complement' and apart from all the good features this method has (and won't be explained here, to save some confusion) the simplest way to think of it is the weight of the most significant bit (the MSb is the bit number with the highest weight, in the case of a byte, it would be bit 7) is actually a negative value. So for a two's complement system, the bit weights are changed to:

(^ means 'raised to the power of', number base is 2 for binary)								
Bit/column number	7	6	5	4	3	2	1	0
Weight (index)	-2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰
Weight (actual value)	-128	64	32	16	8	4	2	1

and you would do the conversion from binary to decimal in exactly the same way as above, but using the new set of weights. So, for example, the number 10000000 (Base 2) is -128, and 10101010 (Base 2) is -86.

To convert from a positive binary number to a negative binary number and vice versa, you invert all the bits and then add 1. For example, 00100010 would be made negative by inverting -> 11011101 and adding 1 -> 11011110.

This makes converting from decimal to binary easier, as you can convert negative decimal numbers as their positive equivalents (using the method shown above) and then make the binary number negative at the end.

Binary numbers are written in PureBasic with a percent symbol in front of them, and obviously all the bits in the number must be a '0' or a '1'. For example, you could use the value %110011 in PureBasic to mean 51. Note that you do not need to put in the leading '0's (that number would really be %00110011) but it might help the readability of your source if you put in the full amount of bits.

Hexadecimal System

Hexadecimal (for base 16, symbols '0'-'9' then 'A'-'F') is a number base which is most commonly used when dealing with computers, as it is probably the easiest of the non-base 10 number bases for humans to understand, and you do not end up with long strings of symbols for your numbers (as you get when working in binary).

Hexadecimal mathematics follows the same rules as with decimal, although you now have 16 symbols per column until you require a carry/borrow. Conversion between hexadecimal and decimal follows the same patterns as between binary and decimal, except the weights are in multiples of 16 and divides are done by 16 instead of 2:

Column number	3	2	1	0
Weight (index)	16^3	16^2	16^1	16^0
Weight (actual value)	4096	256	16	1

Converting the hexadecimal value BEEF (Base 16) to decimal would be done like this:

```

B * 4096 = 11 * 4096
+ E * 256 = 14 * 256
+ E * 16 = 14 * 16
+ F * 1 = 15 * 1
=
48879

```

And converting the value 666 to hexadecimal would be done like this:

```

666 / 16 = 41 r 10 ^
41 / 16 = 2 r 9  /\
remembering to convert      Read digits in this direction,
2 / 16 = 0 r 2  |      to hex digits where required
(Stop here, as result is 0)
Hexadecimal value of 666 is 29A

```

The really good thing about hexadecimal is that it also allows you to convert to binary very easily. Each hexadecimal digit represents 4 bits, so to convert between hexadecimal and binary, you just need to convert each hex digit to 4 bits or every 4 bits to one hex digit (and remembering that 4 is an equal divisor of all the common lengths of binary numbers in a CPU). For example:

Hex number	5	9	D	F	4E
Binary value	0101	1001	1101	1111	01001110

When using hexadecimal values in PureBasic, you put a dollar sign in front of the number, for example \$BEEF.

Chapter 21

Break : Continue

Syntax

```
Break [Level]
```

Description

`Break` provides the ability to exit during any iteration, for the following loops: `Repeat` , `For` , `ForEach` and `While` . The optional 'level' parameter specifies the number of loops to exit from, given several nested loops. If no parameter is given, `Break` exits from the current loop.

Example: Simple loop

```
1 For k=0 To 10
2   If k=5
3     Break ; Will exit directly from the For/Next loop
4   EndIf
5   Debug k
6 Next
```

Example: Nested loops

```
1 For k=0 To 10
2   Counter = 0
3   Repeat
4     If k=5
5       Break 2 ; Will exit directly from the Repeat/Until and For/Next
        loops
6     EndIf
7     Counter+1
8   Until Counter > 1
9   Debug k
10 Next
```

Syntax

```
Continue
```

Description

`Continue` provides the ability to skip straight to the end of the current iteration (bypassing any code in between) in the following loops: Repeat , For , ForEach , and While .

Example

```
1 For k=0 To 10
2   If k=5
3     Continue ; Will skip the 'Debug 5' and go directly to the next
      iteration
4   EndIf
5   Debug k
6 Next
```

Chapter 22

Using the command line compiler

Introduction

The command line compiler is located in the subdirectory 'compilers' from the PureBasic folder. The easier way to access it is to add this directory in the PATH variable, which will give access to all the commands of this directory at all times.

There is two compilers for PureBasic:

- 'pbcompiler' which is generating assembly code (x86 and x64)
- 'pbcompilerc' (or 'pbcompiler' on platform which doesn't support the assembly backend) which is generating C code

The C backend compiler is available on all supported platforms, while the ASM backend compiler is only supported on Windows (x86, x64), Linux (x86, x64) and OS X (x64).

Cross-platform command switches

Note: All switches name which begin with '/' are only valid on Windows (ie: '/DEBUGGER'). If you need to write cross-plaform commandline, you can use the '-' or '~' format (ie: '-d' or '~debugger').

-h, -help, /?: displays a quick help about the compiler.

-d, -debugger, /DEBUGGER: enables the debugger support.

-pf, -purifier, /PURIFIER: enables the purifier. The debugger needs to be activated to have any effect.

-o, -output, /OUTPUT "filename": creates a standalone executable or DLL specified by the filename at the desired path location. On MacOS X it's possible to create an application bundle by adding '.app' to the name of the executable. This way the whole directory structure will be automatically created.

-r, -resident, /RESIDENT "filename": creates a resident file specified by the filename.

-i, -import, /IMPORT "filename": creates an import file to the given filename. Only one Import/EndImport block is allowed in the file. The imported functions will be loaded automatically for every PureBasic projects.

-l or -linenumbering, /LINENUMBERING: adds lines and files information to the executable, which can slow it considerably. This allows the OnError library to report the file and line-number of an error.

-q, -quiet, /QUIET: disables all unnecessary text output, very useful when using another editor.

-sb, -standby, /STANDBY: loads the compiler in memory and wait for external commands (editor, scripts...). More information about using this flag is available in the file 'CompilerInterface.txt' from the PureBasic 'SDK' directory.

-ir, -ignoreresident, /IGNORERESIDENT "filename": doesn't load the specified resident file when the compiler starts. It's mostly useful when updating a resident which already exists, so it won't load it.

-co, -constant, /CONSTANT name=value: creates the specified constant with the given expression.

Example: 'pbcompiler test.pb /CONSTANT MyConstant=10'. The constant #MyConstant will be created on the fly with a value of 10 before the program gets compiled.

-t, -thread, /THREAD: uses thread safe runtime for strings and general routines.

-s, -subsystem, /SUBSYSTEM "name": uses the specific subsystem to replace a set of internal functions.

For more information, see subsystems .

-k, -check, /CHECK: checks the syntax only, doesn't create or launch the executable.
 -z, -optimizer, /OPTIMIZER: enable the code optimizer.
 -c, -commented, /COMMENTED: creates a commented 'purebasic.asm' or 'purebasic.c' output file when creating an executable. This file can be re-assembled with the '-reasm' option later when the needed modifications have been made. This option is for advanced programmers only.
 -ra, -reasm, /REASM: re-assembles the 'purebasic.asm' or 'purebasic.c' file into an executable. This allow to use the '-commented' option, modify the generated output and creates the executable again. This option is for advanced programmers only.
 -pp, -preprocess, /PREPROCESS "filename": preprocess the source code and write the output in the specified "Filename". The processed file is a single file with all macro expanded, compiler directive handled and multiline resolved. This allows an easier parsing of a PureBasic source file, as all is expanded and is available in a flat file format. No comments are included by default, but the flag '-commented' can be used to have all untouched original source as comments and allow comments processing. The preprocessed file can be recompiled as any other PureBasic source file to create the final executable.
 -g, -language, /LANGUAGE "\"language\"": uses the specified language for the compiler error messages.
 -v, -version, /VERSION: displays the compiler version.

Examples:

```
CLI> pbcompiler sourcecode.pb
```

The compiler will compile the source code and execute it.

```
CLI> pbcompiler sourcecode.pb --debugger
```

The compiler will compile the source code and execute it with debugger.

Windows specific command switches

/ICON "IconName.ico" : add the specified icon to the executable.
 /CONSOLE: output file in Console format. Default format is Win32.
 /DLL: output file is a DLL .
 /XP: Add the Windows XP theme support to the executable.
 /MMX, /3DNOW, /SSE or /SSE2: Creates a processor specific executable. This means if a processor specific routine is available it will be used for this executable. Therefore, the executable will run correctly only on computer with this kind of CPU.
 /DYNAMICCPU: Creates a executable containing all the available processor specific routines. When the program is started, it looks for the processor type and then select the more appropriates routines to use. This makes a bigger executable, but result in the fastest possible program.
 /RESOURCE "Filename": Add a Windows resource file (.rc) to the created executable or DLL. This should be not a compiled resource file, but an ascii file with the directives in it. It's possible to specify only one resource, but this file can include other resource script if needed.
 /LINKER "ResponseFile": Specify a file which contains commands to be passed directly to the linker. On Windows, PureBasic use the PellesC linker (polink), more information about the possible options can be found in the related documentation.

The following two compiler options are needed for creating programs running on Microsoft Vista OS or above (Windows 7/8/10). They are both options for the included manifest, so they are ignored on older windows versions. With none of these switches, the exe will run as a normal user as well, but with virtualization turned on (i.e. registry and file redirection). It is recommended to use the /USER switch to turn of virtualization for all programs that comply to the standard user privileges, as it is only intended for compatibility for older programs. These options are also available in the IDE compiler options .

/ADMINISTRATOR: Will cause the program to request admin privileges at start. The program will not run without it. This option is needed. Note: You can also debug programs with this flag, but only with the standalone gui debugger (as it must run in elevated mode as well).

/USER: The program will run as the user who started it. Virtualization for the exe is turned off.

/DPIAWARE: Enable DPI support to the executable.

Examples:

```
CLI> pbcompiler "C:\Project\Source\DLLSource.pb" /EXE
      "C:\Project\project.dll" /DLL
```

The compiler will compile the source code (here with full path) and create the DLL "project.dll" in the given directory.

Linux specific command switches

-so or -sharedobject "filename": Create a dynamic library (shared object).

-mmx, -3dnow, -sse or -sse2: Creates a processor specific executable. This means if a processor specific routine is available it will be used for this executable. Therefore, the executable will run correctly only on computer with this kind of CPU.

-dc or -dynamiccpu: Creates a executable containing all the available processor specific routines. When the program is started, it looks for the processor type and then select the more appropriate routines to use. This makes a bigger executable, but result in the fastest possible program.

OS X specific command switches

-n or -icon "filename.icns" : add the specified icon to the executable.

-dl or -dylib "filename": Create a dynamic library (dylib object).

-f or -front: put the launched process to front.

-ibp or -ignorebundlepath: don't use the bundle path as current directory.

Chapter 23

Compiler Directives

Syntax

```
CompilerIf <constant expression>
...
[CompilerElseIf]
...
[CompilerElse]
...
CompilerEndIf
```

Description

If the <constant expression> result is true, the code inside the `CompilerIf` will be compiled, else it will be totally ignored. It's useful when building multi-OSes programs to customize some programs part by using OS specific functions. The `And` and `Or` Keywords can be used in <constant expression> to combine multiple conditions.

Example

```
1  CompilerIf #PB_Compiler_OS = #PB_OS_Linux And #PB_Compiler_Processor
   = #PB_Processor_x86
2      ; some Linux and x86 specific code.
3  CompilerEndIf
```

Syntax

```
CompilerSelect <numeric constant>
  CompilerCase <numeric constant>
  ...
  [CompilerDefault]
  ...
CompilerEndSelect
```

Description

Works like a regular `Select : EndSelect` except that only one numeric value is allowed per case. It will tell the compiler which code should be compiled. It's useful when building multi-OSes programs to customize some programs part by using OS specific functions.

Example

```
1  CompilerSelect  #PB_Compiler_OS
2      CompilerCase  #PB_OS_MacOS
3          ; some Mac OS X specific code
4      CompilerCase  #PB_OS_Linux
5          ; some Linux specific code
6  CompilerEndSelect
```

Syntax

```
CompilerError <string constant>
CompilerWarning <string constant>
```

Description

Generates an error or a warning, as if it was a syntax error and display the associated message. It can be useful when doing specialized routines, or to inform a source code is not available on an particular OS. Note: `CompilerWarning` displays warnings, but the compilation process continues, while the command `CompilerError` stops the compilation process.

Example: Generates an error

```
1  CompilerIf  #PB_Compiler_OS = #PB_OS_Linux
2      CompilerError  "Linux isn't supported, sorry."
3  CompilerElse
4      CompilerError  "OS supported, you can now comment me."
5  CompilerEndIf
```

Example: Generates a warning

```
1  CompilerIf  #PB_Compiler_OS = #PB_OS_Linux
2      CompilerWarning  "Linux isn't supported, sorry."
3  CompilerElse
4      CompilerWarning  "OS supported, you can now comment me."
5  CompilerEndIf
```

Syntax

```
EnableExplicit
DisableExplicit
```

Description

Enables or disables the explicit mode. When enabled, all the variables which are not explicitly declared with `Define` , `Global` , `Protected` or `Static` are not accepted and the compiler will raise an error. It can help to catch typo bugs.

Example

```
1 EnableExplicit
2
3 Define a
4
5 a = 20 ; Ok, as declared with 'Define'
6 b = 10 ; Will raise an error here
```

Syntax

```
EnableASM
DisableASM
```

Description

Enables or disables the inline assembler. When enabled, all the assembler keywords are available directly in the source code, see the inline assembler section for more information.

Example

```
1 ; x86 assembly example
2 ;
3 Test = 10
4
5 EnableASM
6 MOV dword [v_Test],20
7 DisableASM
8
9 Debug Test ; Will be 20
```

Reserved Constants

The PureBasic compiler has several reserved constants which can be useful to the programmer:

```
#PB_Compiler_OS : Determines on which OS the compiler is currently running. It can be one of the following values:
```

```
#PB_OS_Windows : The compiler is running on Windows
#PB_OS_Linux : The compiler is running on Linux
#PB_OS_MacOS : The compiler is running on Mac OS X
```

```
#PB_Compiler_Processor : Determines the processor type for which the program is created. It can be one of the following:
```

```
#PB_Processor_x86 : x86 processor architecture (also called IA-32 or x86-32)
#PB_Processor_x64 : x86-64 processor architecture (also called x64, AMD64 or Intel64)
#PB_Processor_arm32 : arm32 processor architecture
#PB_Processor_arm64 : arm64 processor architecture (also called M1 on Apple computers)
```

```
#PB_Compiler_Backend : Determines which kind of compiler is currently used. It can be one of the following:
```

```

#PB_Backend_Asm      : The compiler generating assembly code is used.
#PB_Backend_C       : The compiler generating C code is used.

#PB_Compiler_ExecutableFormat : Determines executable format. It can
be one of the following:
#PB_Compiler_Executable : Regular executable
#PB_Compiler_Console    : Console executable (have an effect only
on Windows, other act like a regular executable)
#PB_Compiler_DLL       : Shared DLL (dynlib on MacOS X and shared
object on Linux)

#PB_Compiler_Date      : Current date, at the compile time, in the
PureBasic date
format.
#PB_Compiler_File      : Full path and name of the file being
compiled, useful for debug
purpose.
#PB_Compiler_FilePath  : Full path of the file being compiled, useful
for debug
purpose.
#PB_Compiler_Filename  : Filename (without path) of the file being
compiled, useful for debug
purpose.
#PB_Compiler_Line      : Line number of the file being compiled,
useful for debug
purpose.
#PB_Compiler_Procedure : Current procedure name, if the line is inside
a procedure
.
#PB_Compiler_Module    : Current module name, if the line is inside a
module
.
#PB_Compiler_Version   : Compiler version, in integer format in the
form '420' for 4.20.
#PB_Compiler_Home      : Full path of the PureBasic directory, can be
useful to locate include files

#PB_Compiler_Debugger  : Set to 1 if the runtime debugger
is enabled, set to 0 else. When an executable
is created, the debugger is always disabled
(this constant will be 0).
#PB_Compiler_Thread    : Set to 1 if the executable is compiled in
thread safe mode, set to 0 else.
#PB_Compiler_Unicode   : Set to 1 if the executable is compiled in
unicode
mode, set to 0 else.
#PB_Compiler_LineNumbering : Set to 1 if the executable is compiled
with OnError line numbering
support, set to 0 else.
#PB_Compiler_InlineAssembly : Set to 1 if the executable is compiled
with inline assembly
support, set to 0 else.
#PB_Compiler_EnableExplicit : Set to 1 if the executable is compiled
with enable explicit support, set to 0 else.
#PB_Compiler_IsMainFile : Set to 1 if the file being compiled is
the main file, set to 0 else.
#PB_Compiler_IsIncludeFile : Set to 1 if the file being compiled has
been included by another file, set to 0 else.

```

#PB_Compiler_32Bit : Set to 1 if the compiler generates 32-bit code, set to 0 else.
#PB_Compiler_64Bit : Set to 1 if the compiler generates 64-bit code, set to 0 else.
#PB_Compiler_Optimizer: Set to 1 if the compiler generates optimized code, set to 0 else.
#PB_Compiler_DPIAware : Set to 1 if the compiler generates a DPI aware executable, set to 0 else.

Chapter 24

Compiler Functions

Syntax

```
Size = SizeOf(Type)
```

Description

`SizeOf` can be used to find the size of any complex Structure , built-in type (word, float, etc.), Interface or even ReferenceLink "variables" "variables" (Structures with same name as variable take precedence). This can be useful in many areas such as calculating memory requirements for operations, using API commands, etc.

As a compiler function, `SizeOf(x)` is assigned to a constant and does not require assignment to another variable if inside a loop or often called procedure.

As a compile time function `SizeOf` doesn't work with runtime Array, List or Map. `ArraySize()` , `ListSize()` or `MapSize()` can be used instead.

Note: A Character (.c) variable is unicode and uses 2 bytes. An Ascii variable (.a) is Ascii and uses 1 byte.

Example: 1

```
1 char.c='!'  
2 Debug SizeOf(char); display 2  
3  
4 ascii.a='!'  
5 Debug SizeOf(ascii); display 1
```

Example: 2

```
1 Structure Person  
2 Name.s  
3 ForName.s  
4 Age.w  
5 EndStructure  
6  
7 Debug "The size of my friend is "+Str(Sizeof(Person))+" bytes" ; will  
8 be 10 on 32-bit compiler as a string pointer is 4 bytes in memory  
; will  
be 18 on 64-bit compiler as a string pointer is 8 bytes in memory
```

```

9
10 John.Person\Name = "John"
11
12 Debug SizeOf(John) ; will be the same

```

Syntax

```

Index = OffsetOf(Structure\Field)
Index = OffsetOf(Interface\Function())

```

Description

`OffsetOf` can be used to find out the address offset of a Structure field or the address offset of an Interface function. When used with an Interface , the function index is the memory offset, so it will be `IndexOfTheFunction*SizeOf(Integer)`.

Example

```

1 Structure Person
2     Name.s
3     ForName.s
4     Age.w
5 EndStructure
6
7 Debug OffsetOf(Person\Age) ; will be 8 on 32-bit compiler as a
   string pointer is 4 bytes in memory
8                               ; will be 16 on 64-bit compiler as a
   string pointer is 8 bytes in memory
9
10 Interface ITest
11     Create()
12     Destroy(Flags)
13 EndInterface
14
15 Debug OffsetOf(ITest\Destroy()) ; will be 4 on 32-bit compiler as a
   pointer is 4 bytes in memory
16                               ; will be 8 on 64-bit compiler as a
   pointer is 8 bytes in memory

```

Syntax

```
Type = TypeOf(Object)
```

Description

`TypeOf` can be used to find out the type of a variable , or a structure field . The type can be one of the following values:

```

#PB_Byte
#PB_Word
#PB_Long
#PB_String
#PB_Structure

```

```
#PB_Float
#PB_Character
#PB_Double
#PB_Quad
#PB_List
#PB_Array
#PB_Integer
#PB_Map
#PB_Ascii
#PB_Unicode
#PB_Interface
```

Example

```
1  Structure Person
2      Name.s
3      ForName.s
4      Age.w
5  EndStructure
6
7  If TypeOf(Person\Age) = #PB_Word
8      Debug "Age is a 'Word'"
9  EndIf
10
11 Surface.f
12 If TypeOf(Surface) = #PB_Float
13     Debug "Surface is a 'Float'"
14 EndIf
```

Syntax

```
Result = Subsystem(<constant string expression>)
```

Description

`Subsystem` can be used to find out if a subsystem is in use for the program being compiled. The specified subsystem name is not case-sensitive.

Example

```
1  CompilerIf Subsystem("OpenGL")
2      Debug "Compiling with the OpenGL subsystem"
3  CompilerEndIf
```

Syntax

```
Result = Defined(Name, Type)
```

Description

`Defined` checks if a particular object of a code source like structure , interface , variables etc. is already defined or not. The 'Name' parameter has to be specified without any extra decoration (ie: without the '#' for a constant , without '()' for an array , a list or a map).

The 'Type' parameter can be one of the following values:

```
#PB_Constant
#PB_Variable
#PB_Array
#PB_List
#PB_Map
#PB_Structure
#PB_Interface
#PB_Procedure
#PB_Function
#PB_OSFunction
#PB_Label
#PB_Prototype
#PB_Module
#PB_Enumeration
```

Example

```
1  #PureConstant = 10
2
3  CompilerIf Defined(PureConstant , #PB_Constant)
4      Debug "Constant 'PureConstant' is declared"
5  CompilerEndIf
6
7  Test = 25
8
9  CompilerIf Defined(Test , #PB_Variable)
10     Debug "Variable 'Test' is declared"
11 CompilerEndIf
```

Syntax

```
InitializeStructure(*Pointer , Structure)
```

Description

`InitializeStructure` initialize the specified structured memory area. It initializes structure members of type Array, List and Map, other members are not affected (.s, .l, .i etc). 'Structure' is the name of the structure which should be used to perform the initialization. There is no internal check to ensures the structure match the memory area. Warning: multiple calls to `InitializeStructure` create a memory leak because the old members are not freed (`ClearStructure` has to be called before calling `InitializeStructure` once more). This function is for advanced users and should be used with care. To allocate dynamic structure, use `AllocateStructure()` ().

Example

```
1  Structure People
2      Name$
3      Age.l
4      List Friends.s()
```

```

5 EndStructure
6
7 *Student.People = AllocateMemory(SizeOf(People))
8 InitializeStructure(*Student, People)
9
10 ; Now the list is ready to use
11 ;
12 AddElement(*Student\Friends())
13 *Student\Friends() = "John"
14
15 AddElement(*Student\Friends())
16 *Student\Friends() = "Yann"
17
18 ; Print out the list content
19 ;
20 ForEach *Student\Friends()
21     Debug *Student\Friends()
22 Next

```

Syntax

```
CopyStructure(*Source, *Destination, Structure)
```

Description

`CopyStructure` copy the memory of a structured memory area to another. This is useful when dealing with dynamic allocations, through pointers . Every fields will be duplicated, even array , list , and map . The destination structure will be automatically cleared before doing the copy, it's not needed to call `ClearStructure` before `CopyStructure`. Warning: the destination should be a valid structure memory area, or a cleared memory area. If the memory area is not cleared, it could crash, as random values will be used by the clear routine. There is no internal check to ensures that the structure match the two memory area. This function is for advanced users and should be used with care.

Example

```

1 Structure People
2     Name$
3     LastName$
4     Map Friends$()
5     Age.l
6 EndStructure
7
8 Student.People\Name$ = "Paul"
9 Student\LastName$ = "Morito"
10 Student\Friends$("Tom") = "Jones"
11 Student\Friends$("Jim") = "Doe"
12
13 CopyStructure(@Student, @StudentCopy.People, People)
14
15 Debug StudentCopy\Name$
16 Debug StudentCopy\LastName$
17 Debug StudentCopy\Friends$("Tom")
18 Debug StudentCopy\Friends$("Jim")

```

Syntax

```
ClearStructure(*Pointer, Structure)
```

Description

`ClearStructure` clears a structured memory area. This is useful when the structure contains strings, array, list or map which have been allocated internally by PureBasic. 'Structure' is the name of the structure which should be used to perform the clearing. All the fields will be set to zero, even native type like long, integer etc. There is no internal check to ensures the structure match the memory area. This function is for advanced users and should be used with care.

Example

```
1 Structure People
2   Name$
3   LastName$
4   Age.l
5 EndStructure
6
7 Student.People\Name$ = "Paul"
8 Student\LastName$ = "Morito"
9 Student\Age = 10
10
11 ClearStructure(@Student, People)
12
13 ; Will print empty strings as the whole structure has been cleared.
14 ; All other fields have been reset to zero.
15 ;
16 Debug Student\Name$
17 Debug Student\LastName$
18 Debug Student\Age
```

Syntax

```
ResetStructure(*Pointer, Structure)
```

Description

`ResetStructure` clears a structured memory area and initialize it to be ready to use. This is useful when the structure contains strings, array, list or map which have been allocated internally by PureBasic. 'Structure' is the name of the structure which should be used to perform the clearing. This function is for advanced users and should be used with care.

Example

```
1 Structure Person
2   Map Friends.s()
3 EndStructure
4
5 Henry.Person\Friends("1") = "Paul"
6
7 ResetStructure(@Henry, Person)
```

```
8
9 ; Will print an empty string as the whole structure has been reseted.
   The map is still usable but empty.
10 ;
11 Debug Henry\Friends("1")
```

Syntax

```
Bool(<boolean expression>)
```

Description

`Bool` can be used to evaluate a boolean expression outside of regular conditional operator like `If`, `While`, `Until` etc. If the boolean expression is true, it will return `#True`, otherwise it will return `#False`.

Example

```
1 Hello$ = "Hello"
2 World$ = "World"
3
4 Debug Bool(Hello$ = "Hello") ; will print 1
5 Debug Bool(Hello$ <> "Hello" Or World$ = "World") ; will print 1
```

Chapter 25

Data

Introduction

PureBasic allows the use of `Data`, to store predefined blocks of information inside of your program. This is very useful for default values of a program (language string for example) or, in a game, to define the sprite way to follow (precalculated).

`DataSection` must be called first to indicate a data section follow. This means all labels and data component will be stored in the `data` section of the program, which has a much faster access than the code section. `Data` will be used to enter the data. `EndDataSection` must be specified if some code follows the data declaration. One of good stuff is you can define different `Data` sections in the code without any problem. `Restore` and `Read` command will be used to retrieve the data. These functions are not thread safe so don't use them inside a thread.

Commands

Syntax

`DataSection`

Description

Start a data section.

Example

```
1  DataSection
2      NumericData:
3      Data.w 120, 250, 645 ; 3 'word' sized numbers
4  EndDataSection
```

Syntax

`EndDataSection`

Description

End a data section.

Example

```
1  DataSection
2    NumericData:
3    Data.w 0, 1, 2
4  EndDataSection
```

Syntax

`Data.TypeName`

Description

Defines data. The type can only be a native basic type (integer, long, word, byte, ascii, unicode, float, double, quad, character, string). Any number of data can be put on the same line, each one delimited with a comma ','.

Example

```
1  DataSection
2    MixedData:
3    Data.l 100, 200, -250, -452, 145
4    Data.s "Hello", "This", "is ", "What ?"
5  EndDataSection
```

For advanced programmers: it's also possible to put a procedure address or a label address inside `Data` when its type is set to integer (.i). (Using the 'integer' type will store the (different) addresses accurate on both 32-bit and 64-bit environments.) This can be used to build easy virtual function tables for example.

Example

```
1  Procedure Max(Number, Number2)
2  EndProcedure
3
4  Label:
5
6  DataSection
7    MixedData:
8    Data.i ?Label, @Max()
9  EndDataSection
```

Example

```
1  Interface MyObject
2    DoThis()
3    DoThat()
4  EndInterface
5
6  Procedure This(*Self)
7    MessageRequester("MyObject", "This")
```

```

8   EndProcedure
9
10  Procedure That(*Self)
11      MessageRequester("MyObject", "That")
12  EndProcedure
13
14  m.MyObject = ?VTable
15
16  m\DoThis()
17  m\DoThat()
18
19
20  DataSection
21      VTable:
22          Data.i ?Procedures
23      Procedures:
24          Data.i @This(), @That()
25  EndDataSection

```

Syntax

```
Restore label
```

Description

This keyword is useful to set the start indicator for the [Read](#) to a specified label. All labels used for this purpose should be placed within the [DataSection](#) because the data is treated as a separate block from the program code when it is compiled and may become disassociated from a label if the label were placed outside of the DataSection.

Example

```

1   Restore StringData
2   Read.s MyFirstData$
3   Read.s MySecondData$
4
5   Restore NumericalData
6   Read.l a
7   Read.l b
8
9   Debug MyFirstData$
10  Debug a
11
12  End
13
14  DataSection
15      NumericalData:
16          Data.l 100, 200, -250, -452, 145
17
18      StringData:
19          Data.s "Hello", "This", "is ", "What ?"
20  EndDataSection

```

Syntax

```
Read[.<type>] <variable>
```

Description

Read the next available data. The next available data can be changed by using the [Restore](#) command. By default, the next available data is the first data declared. The type of data to read is determined by the type suffix. The default type will be used if it is not specified. It is however advisable to use the ad-hoc type in order to avoid the error message that will appear when you read data string and to avoid an integer type confusion which is a 'Long' type for 32-bit compilers and which is a 'Quad' type for 64-bit compilers.

Example

```
1  Restore StringData
2  Read.s MyFirstData$
3
4  Restore NumericalData
5  Read a ; Beware, it will read an Integer (Long in 32-bits or Quad
6      in 64-bits compilers)
7  Read.q b
8  Read c ; Beware, read a 'Quad' in a 64-bit compiler even if the
9      Data is a 'Long'!
10 Read.l d
11
12 Debug MyFirstData$ ; Display Hello
13 Debug a ; Display 100
14 Debug b ; Display 111111111111111111
15 Debug c ; Beware, the display depends of your compiler! : 200 in
16     32-bits or 1288490189000 in 64-bits
17 Debug d ; Idem : 300 in 32-bits or 400 in 64-bits
18
19 End
20
21 DataSection
22     NumericalData:
23         Data.i 100
24         Data.q 111111111111111111
25         Data.l 200, 300, 400
26
27     StringData:
28         Data.s "Hello", "This", "is ", "What ?"
29 EndDataSection
```

Chapter 26

Debugger keywords in PureBasic

Overview

A complete description of all functions of the powerful debugger you will find in the extra chapters Using the debugger or Using the debugging Tools .

Following is a list of special keywords to control the debugger from your source code. There is also a Debugger library which provides further functions to modify the behavior of the debugger should it be present. Several compiler constants useful also for debugging purposes you find in the Compiler directives section.

Syntax

```
CallDebugger
```

Description

This invokes the "debugger" and freezes the program immediately.

Syntax

```
Debug <expression> [, DebugLevel]
```

Description

Display the DebugOutput window and the result inside it. The expression can be any valid PureBasic expression, from numeric to string. An important point is the Debug command and its associated expression is totally ignored (not compiled) when the debugger is deactivated.

Note: This is also true, if you're using complete command lines after Debug (e.g. Debug LoadImage(1,"test.bmp")). They will not be compiled with disabled debugger!

This means this command can be used to trace easily in the program without having to comment all the debug commands when creating the final executable.

The 'DebugLevel' is the level of priority of the debug message. All normal debug message (without specifying a debug level) are automatically displayed. When a level is specified then the message will be only displayed if the current DebugLevel (set with the following [DebugLevel](#) command) is equals or above this number. This allows hierarchical debug mode, by displaying more and more precise information in function of the used DebugLevel.

Syntax

```
DebugLevel <constant expression>
```

Description

Set the current debug level for the 'Debug' message.

Note: The debug level is set at compile time, which means you have to put the `DebugLevel` command before any other Debug commands to be sure it affects them all.

Syntax

```
DisableDebugger
```

Description

This will disable the debugger checks on the source code which follow this command. It doesn't not fully turn off the debugger, so performance checks should not be done using `DisableDebugger` command, but by disabling the debugger before compiling the program.

Syntax

```
EnableDebugger
```

Description

This will enable the debugger checks on the source code which follow this command (if the debugger was previously disabled with `DisableDebugger`).

Note: `EnableDebugger` doesn't have an effect, if the debugger is completely disabled in the IDE (look at Compiler settings).

Chapter 27

Define

Syntax

```
Define.<type> [<variable> [= <expression>], <variable> [= <expression>], ...]
```

Description

Assign the same data type to a series of variables .

Without this keyword, variables are created with the default type of PureBasic which is the type INTEGER. As a reminder, the type INTEGER is:

4 bytes (with a 32-bit compiler) ranging from -2147483648 to + 2147483647

8 bytes (with a 64-bit compiler) ranging from -9223372036854775808 to +9223372036854775807

Example

```
1 Define.b a, b = 10, c = b*2, d ; these 4 variables will be byte
   typed (.b)
```

Define is very flexible because it also allows you to assign a type to a particular variable within a series.

Example

```
1 Define.q a, b.w, c, d ; a, c, and d are Quad (.q) whereas b is a
   Word (.w)
2
3 Debug SizeOf(a) ; will print 8
4 Debug SizeOf(b) ; will print 2, because it doesn't have the default
   type
5 Debug SizeOf(c) ; will print 8
6 Debug SizeOf(d) ; will print 8
```

Define can also be used with arrays , the lists and the maps .

Syntax

```
Define <variable>.<type> [= <expression>] [, <variable>.<type> [=
    <expression>], ...]
```

Description

Alternative possibility for the variable declaration using [Define](#).

Example

```
1  Define MyChar.c
2  Define MyLong.l
3  Define MyWord.w
4
5  Debug SizeOf(MyChar)    ; will print 2
6  Debug SizeOf(MyLong)   ; will print 4
7  Debug SizeOf(MyWord)   ; will print 2
```

Chapter 28

Dim

Syntax

```
Dim name.<type>(<expression>, [<expression>], ...)
```

Description

`Dim` is used to create new arrays (the initial value of each element will be zero). An array in PureBasic can be of any types, including structured , and user defined types. Once an array is defined it can be resized with `ReDim`. Arrays are dynamically allocated which means a variable or an expression can be used to size them. To view all commands used to manage arrays, see the Array library.

When you define a new array, please note that it will have one more element than you used as parameter, because the numbering of the elements in PureBasic (like in other BASIC's) starts at element 0. For example when you define `Dim(10)` the array will have 11 elements, elements 0 to 10. This behavior is different for static arrays in structures . Static arrays use brackets "[]" , for example `ArrayStatic[2]` has only 2 elements from 0 to 1 and library functions `Array` don't work with them. The new arrays are always locals, which means `Global` or `Shared` commands have to be used if an array declared in the main source need to be used in procedures. It is also possible to pass an array as parameter to a procedure - by using the keyword `Array`. It will be passed "by reference" (which means, that the array will not be copied, instead the functions in the procedure will manipulate the original array).

To delete the content of an array and release its used memory during program flow, call `FreeArray()` .

If `Dim` is used on an existing array, it will reset its contents to zero.

For fast swapping of array contents the `Swap` keyword is available.

Note: Array bound checking is only done when the runtime Debugger is enabled.

Example

```
1 Dim MyArray(41)
2 MyArray(0) = 1
3 MyArray(1) = 2
```

Example: Multidimensional array

```
1 Dim MultiArray.b(NbColumns, NbLines)
2 MultiArray(10, 20) = 10
3 MultiArray(20, 30) = 20
```

Example: Array as procedure parameter

```
1  Procedure fill(Array Numbers(1), Length) ; the 1 stays for the
   number of dimensions in the array
2      For i = 0 To Length
3          Numbers(i) = i
4      Next
5  EndProcedure
6
7  Dim Numbers(10)
8  fill(Numbers(), 10) ; the array Numbers() will be passed as
   parameter here
9
10 Debug Numbers(5)
11 Debug Numbers(10)
```

Syntax

```
ReDim name.<type>(<expression>, [<expression>], ...)
```

Description

ReDim is used to 'resize' an already declared array while preserving its content. The new size can be larger or smaller, but the number of dimension of the array can not be changed.

If ReDim is used with a multi-dimension array, only its last dimension can be changed.

Example

```
1  Dim MyArray.l(1) ; We have 2 elements
2  MyArray(0) = 1
3  MyArray(1) = 2
4
5  ReDim MyArray(4) ; Now we want 5 elements
6  MyArray(2) = 3
7
8  For k = 0 To 2
9      Debug MyArray(k)
10 Next
```

Example: Multi-dimension array

```
1  Dim MyTab.l(1,1,1)
2
3  ; ReDim MyTab(4,1,1) ; NO !
4  ; ReDim MyTab(1,4,1) ; NO !
5  ReDim MyTab(1,1,4) ; YES ! only its last dimension can be changed.
6  MyTab(1,1,4) = 3
```

Chapter 29

Building a DLL

PureBasic allows to create standard Microsoft Windows DLL (Dynamic Linked Library), shared objects (.so) on Linux, and dynamic libraries (.dylib) on MacOS X. The DLL code is like a PureBasic code excepts than no real code should be written outside of procedure.

When writing a DLL, all the code is done inside procedures. When a procedure should be public (ie: accessible by third programs which will use the DLL), the keyword `ProcedureDLL` (or `ProcedureCDLL` if the procedure needs to be in 'CDecl' format, which is not the case of regular Windows DLL) is used instead of `Procedure` (and `DeclareDLL` or `DeclareCDLL` if are used instead of `Declare`). This is the only change to do to a program.

When this is done, select 'Shared DLL' as output format ('Compiler Option' window in the PureBasic editor or /DLL switch in command line) and a DLL with the name you set (in the save-requester when using the IDE) will be created in the selected directory.

Example

```
1  ProcedureDLL MyFunction()
2      MessageRequester("Hello", "This is a PureBasic DLL !", 0)
3  EndProcedure
4
5      ; Now the client program, which use the DLL
6      ;
7      If OpenLibrary(0, "PureBasic.dll")
8          CallFunction(0, "MyFunction")
9          CloseLibrary(0)
10     EndIf
```

For advanced programmers: there is 4 special procedures which are called automatically by the OS when one of the following events happen:

- DLL is attached to a new process
- DLL is detached from a process
- DLL is attached to a new thread
- DLL is detached from a thread

To handle that, it's possible to declare 4 special procedures called: `AttachProcess`(Instance), `DetachProcess`(Instance), `AttachThread`(Instance) and `DetachThread`(Instance). This means these 4 procedures names are reserved and can't be used by the programmer for other purposes.

Notes about creating DLL's:

- The declaration of arrays, lists or map with `Dim` , `NewList` or `NewMap` must always be done inside the procedure `AttachProcess`.
- Don't write program code outside procedures. The only exception is the declaration of variables or structures.
- Default values in procedure parameters have no effect.

- DirectX initialization routines must not be written in the AttachProcess procedure.

Note about returning strings from DLL's:

If you want to return a string out of a DLL, the string has to be declared as Global before using it.

Example

```
1 Global ReturnString$
2
3 ProcedureDLL.s MyFunction(var.s)
4   ReturnString$ = var + " test"
5   ProcedureReturn ReturnString$
6 EndProcedure
```

Without declaring it as Global first, the string is local to the ProcedureDLL and can't be accessed from outside.

When using CallFunction() (or one of its similar CallXXX functions) on a DLL function you will get a pointer on the return string, which you could read with PeekS() .

Example

```
1 String.s = PeekS(CallFunction(0, "FunctionName", Parameter1,
   Parameter2))
```

Here a complete code example:

Chapter 30

Enumerations

Syntax

```
Enumeration [name] [<constant> [Step <constant>]]
    #Constant1
    #Constant2 [= <constant>]
    #Constant3
    ...
EndEnumeration
```

```
EnumerationBinary [name] [<constant>]
    #Constant1
    #Constant2 [= <constant>]
    #Constant3
    ...
EndEnumeration
```

Description

[Enumerations](#) are very handy to declare a sequence of constants quickly without using fixed numbers. The first constant found in the enumeration will get the number 0 and the next one will be 1 etc. It's possible to change the first constant number and adjust the step for each new constant found in the enumeration. If needed, the current constant number can be altered by affecting with '=' the new number to the specified constant. As [Enumerations](#) only accept integer numbers, floats will be rounded to the nearest integer.

A name can be set to identify an enumeration and allow to continue it later. It is useful to group objects altogether while declaring them in different code place.

For advanced user only: the reserved constant `#PB_Compiler_EnumerationValue` store the next value which will be used in the enumeration. It can be useful to get the last enumeration value or to chain two enumerations.

[EnumerationBinary](#) can be used to create enumerations suitable for flags. The first item value is 1.

Example: Simple enumeration

```
1 Enumeration
2     #GadgetInfo ; will be 0
3     #GadgetText ; will be 1
4     #GadgetOK   ; will be 2
5 EndEnumeration
```

Example: Enumeration with step

```
1 Enumeration 20 Step 3
2   #GadgetInfo ; will be 20
3   #GadgetText ; will be 23
4   #GadgetOK   ; will be 26
5 EndEnumeration
```

Example: Enumeration with dynamic change

```
1 Enumeration
2   #GadgetInfo ; will be 0
3   #GadgetText = 15 ; will be 15
4   #GadgetOK   ; will be 16
5 EndEnumeration
```

Example: Named enumeration

```
1 Enumeration Gadget
2   #GadgetInfo ; will be 0
3   #GadgetText ; will be 1
4   #GadgetOK   ; will be 2
5 EndEnumeration
6
7 Enumeration Window
8   #FirstWindow ; will be 0
9   #SecondWindow ; will be 1
10 EndEnumeration
11
12 Enumeration Gadget
13   #GadgetCancel ; will be 3
14   #GadgetImage ; will be 4
15   #GadgetSound ; will be 5
16 EndEnumeration
```

Example: Getting next enumeration value

```
1 Enumeration
2   #GadgetInfo ; will be 0
3   #GadgetText ; will be 1
4   #GadgetOK   ; will be 2
5 EndEnumeration
6
7 Debug "Next enumeration value: " + #PB_Compiler_EnumerationValue ;
   will print 3
```

Example: Binary enumeration

```
1 EnumerationBinary
2   #Flags1 ; will be 1
3   #Flags2 ; will be 2
```

```
4     #Flags3 ; will be 4
5     #Flags4 ; will be 8
6     #Flags5 ; will be 16
7     EndEnumeration
```

Chapter 31

For : Next

Syntax

```
For <variable> = <expression1> To <expression2> [Step <constant>]  
    ...  
Next [<variable>]
```

Description

For : Next is used to create a loop within a program with the given parameters. At each loop the **<variable>** value is increased by a 1, (or of the "Step value" if a **Step** value is specified) and when the **<variable>** value is above the **<expression2>** value, the loop stop.

With the **Break** command its possible to exit the **For : Next** loop at any moment, with the **Continue** command the end of the current iteration can be skipped.

The **For : Next** loop works only with integer values, at the expressions as well at the **Step** constant. The **Step** constant can also be negative.

Example

```
1 For k = 0 To 10  
2   Debug k  
3 Next
```

In this example, the program will loop 11, time (0 to 10), then quit.

Example

```
1 For k = 10 To 1 Step -1  
2   Debug k  
3 Next
```

In this example, the program will loop 10 times (10 to 1 backwards), then quit.

Example

```
1 a = 2  
2 b = 3
```

```
3 For k = a+2 To b+7 Step 2
4   Debug k
5 Next k
```

Here, the program will loop 4 times before quitting, (k is increased by a value of 2 at each loop, so the k value is: 4-6-8-10). The "k" after the "Next" indicates that "Next" is ending the "For k" loop. If another variable, is used the compiler will generate an error. It can be useful to nest several "For/Next" loops.

Example

```
1 For x=0 To 10
2   For y=0 To 5
3     Debug "x: " + x + " y: " + y
4   Next y
5 Next x
```

Note: Be aware, that in PureBasic the value of <expression2> ('To' value) can also be changed inside the For : Next loop. This can lead to endless loops when wrongly used.

Chapter 32

ForEach : Next

Syntax

```
ForEach List() Or Map()  
    ...  
Next [List() Or Map()]
```

Description

`ForEach` loops through all elements in the specified list or map starting from the first element up to the last. If the list or the map is empty, `ForEach : Next` exits immediately. To view all commands used to manage lists, please click [here](#) . To view all commands used to manage maps, please click [here](#) . When used with list, it's possible to delete or add elements during the loop. As well it's allowed to change the current element with `ChangeCurrentElement()` . After one of the mentioned changes the next loop continues with the element following the current element. With the `Break` command its possible to exit the `ForEach : Next` loop at any moment, with the `Continue` command the end of the current iteration can be skipped.

Example: list

```
1  NewList Number()  
2  
3  AddElement(Number())  
4  Number() = 10  
5  
6  AddElement(Number())  
7  Number() = 20  
8  
9  AddElement(Number())  
10 Number() = 30  
11  
12 ForEach Number()  
13     Debug Number() ; Will output 10, 20 and 30  
14 Next
```

Example: Map

```
1  NewMap Country.s()  
2
```

```
3 Country("US") = "United States"
4 Country("FR") = "France"
5 Country("GE") = "Germany"
6
7 ForEach Country()
8     Debug Country()
9 Next
```

Chapter 33

General Syntax Rules

PureBasic has established rules which never change. These are:

Comments

Example

```
1  If a = 10 ; This is a comment to indicate something.
```

Keywords

All **keywords** are used for general things inside PureBasic, like creating arrays (Dim) or lists (NewList), or controlling the program flow (If : Else : EndIf). They are not followed by the brackets '()', which are typically used for PureBasic **functions**.

Example

```
1  If a = 1          ; If, Else and EndIf are keywords; while 'a = 1'  
2      ...          ; is a variable used inside an expression.  
3  Else  
4      ...  
5  EndIf
```

Keywords are regularly described in the chapters on the left side of the index page in the reference manual.

Functions

Every **function** must be followed by an opening round bracket '(' character, otherwise it will not be considered a function (this applies also to functions without parameters).

Example

```
1   EventWindow() ; it is a function.
2   EventWindow  ; it is a variable.
```

Functions are regularly included in the PureBasic "Command libraries", described on the right side of the index page in the reference manual.

Constants

All constants are preceded by the hash # character. They can only be declared once in the source and always keep their predefined values. (The compiler replaces all constant names with their corresponding values when compiling the executable.)

Example

```
1   #Hello = 10 ; it is a constant.
2   Hello  = 10 ; it is a variable.
```

Literal strings

Literal strings are declared using the " character. Escape sequences are supported by prepending the ** character to the literal string. The supported escape sequences are:

\a: alarm	Chr(7)
\b: backspace	Chr(8)
\f: formfeed	Chr(12)
\n: newline	Chr(10)
\r: carriage return	Chr(13)
\t: horizontal tab	Chr(9)
\v: vertical tab	Chr(11)
\": double quote	Chr(34)
\\: backslash	Chr(92)

There are two special constants for strings:

```
#Empty$: represents an empty string (exactly the same as "")
#Null$ : represents a null string. This can be used for API
         functions requiring a null pointer to a string, or to really
         free a string.
```

Warning: On Windows, \t does not work with the graphical functions of the 2DDrawing and VectorDrawing libraries.

Example

```
1   a$ = "Hello world" ; standard string
2   b$ = ~"Escape\nMe !" ; string with escape sequences
```

Labels

All labels must be followed by a colon `:` character. Label names may not contain any operators (`+`,`-`,`...`) or special characters (`ß`,`ä`,`ö`,`ü`,`...`). Labels defined inside a procedure will be available only in that procedure.

Example

```
1 I_am_a_label :
```

Modules

Modules use a `::` (double colon) when referencing a module name. Be careful not to confuse these with the single colon used by labels.

Example

```
1 Debug CarModule :: NbCars
```

Expressions

An expression is something which can be evaluated. An expression can mix any variables, constants, or functions, of the same type. When using numbers in an expression, you can prefix them with the `$` symbol to indicate a hexadecimal number, or with the `%` symbol to indicate a binary number. Without either of those, the number will be treated as decimal. Strings must be enclosed within straight double quotes.

Example

```
1 a = a + 1 + (12 * 3)
2
3 a = a + WindowHeight(#Window) + b/2 + #MyConstant
4
5 If a <> 12 + 2
6     b + 2 >= c + 3
7 EndIf
8
9 a$ = b$ + "this is a string value" + c$
10
11 Foo = Foo + $69 / %1001 ; Hexadecimal and binary number usage
```

Concatenation of commands

Any number of commands can be added to the same line by using the `:` option.

Example

```
1  If IsCrazy = 0 : MessageRequester("Info", "Not Crazy") : Else :  
    MessageRequester("Info", "Crazy") : EndIf
```

Line continuation

Long expressions can be split across several lines. A split line has to end with one of the following operators: plus (+), comma (,), or (||), And, Or, Xor.

Example

```
1  Text$ = "Very very very very long text" + #LF$ +  
2      "another long text" + #LF$ +  
3      " and the end of the long text"  
4  
5  MessageRequester("Hello this is a very long title",  
6      "And a very long message, so we can use the  
    multiline" + #LF$ + Text$,  
7      #PB_MessageRequester_Ok)
```

Typical words in this manual

Words used in this manual:

- <variable> : a basic variable.
- <expression> : an expression as explained above.
- <constant> : a numeric constant.
- <label> : a program label.
- <type> : any type, (standard or structured).

Others

- In this guide, all topics are listed in alphabetical order to decrease any search time.
- **Return values** of commands are always Integer if no other type is specified in the Syntax line of the command description.
- In the PureBasic documentation, the terms "commands" and "functions" are used interchangeably, regardless of whether the function returns a value or not. To learn whether value is returned by a specific command or function, consult the description provided in the command's documentation.

Chapter 34

Global

Syntax

```
Global [.<type>] <variable[.<type>]> [= <expression>] [, ...]
```

Description

`Global` provides the ability for variables to be defined as global, i.e., variables defined as such may then be accessed within a Procedure . In this case the command `Global` must be called for the according variables, **before** the declaration of the procedure. This rule is true everywhere except in a single case: The modules do not have access to the global declared variables outside this module. Each variable may have a default value directly assigned to it. If a type is specified for a variable after `Global`, the default type is changed through the use of this declaration. `Global` may also be used with arrays , lists and maps .

In order to use local variables within a procedure, which have the same name as global variables, take a look at the Protected and Static keywords.

Example: With variables

```
1 Global a.l, b.b, c, d = 20
2
3 Procedure Change()
4     Debug a ; Will be 10 as the variable is global
5 EndProcedure
6
7 a = 10
8 Change()
```

Example: With array

```
1 Global Dim Array(2)
2
3 Procedure Change()
4     Debug Array(0) ; Will be 10 as the array is global
5 EndProcedure
6
7 Array(0) = 10
8 Change()
```

Example: With default type

```
1 ; 'Angle' and 'Position' will be a float, as they didn't have a
   specified type
2 ;
3 Global.f Angle, Length.b, Position
```

Example: Complex with a module

```
1 Global Var_GlobalOutsideModule = 12
2 Debug Var_GlobalOutsideModule ; Display 12
3
4 DeclareModule Ferrari
5 Global Var_GlobalModule = 308
6 #FerrariName$ = "458 Italia"
7 Debug #FerrariName$ ; Display "458 Italia"
8
9 ; Debug Var_GlobalOutsideModule ; Error, the variable already exists
10 Debug Var_GlobalModule ; Display 308
11
12 Declare CreateFerrari()
13 EndDeclareModule
14
15
16 ; Private
17 ;
-----
18 Module Ferrari
19 Debug Var_GlobalOutsideModule ; Display 0 <== Look !
20 Debug Var_GlobalModule ; Display 308
21
22 Global Initialized = 205
23 Debug Initialized ; Display 205
24
25 Procedure Init()
26 Debug Var_GlobalOutsideModule ; Display 0
27 Debug Var_GlobalModule ; Display 308
28 Debug "InitFerrari()"
29 EndProcedure
30
31 Procedure CreateFerrari() ; Public
32 Init()
33 Debug "CreateFerrari()"
34 Debug Var_GlobalOutsideModule ; Display 0
35 Debug Var_GlobalModule ; Display 308
36 EndProcedure
37
38 EndModule
39
40
41 ; Main Code
42 ;
-----
43 Procedure Init()
44
45 Debug " init() from main code."
46 Debug Var_GlobalOutsideModule ; Display 12
```

```

47     Debug Var_GlobalModule      ; Display 0
48 EndProcedure
49
50 Init()
51
52 Ferrari::CreateFerrari()
53 Debug Ferrari::#FerrariName$ ; Display 458 Italia
54 Debug Var_GlobalOutsideModule ; Display 12
55 ; Debug Var_GlobalModule      ; Error, the variable already exists
56
57
58 UseModule Ferrari
59
60 CreateFerrari()
61 Debug #FerrariName$           ; Display 458 Italia
62 Debug Var_GlobalOutsideModule ; Display 12
63 Debug Var_GlobalModule       ; Display 308 <== Look !
64
65 UnuseModule Ferrari
66 ; Debug #FerrariName$       ; Error, does not exist
67 Debug Var_GlobalOutsideModule ; Display 12
68 Debug Var_GlobalModule       ; Display 0 <== Look !

```

Chapter 35

Gosub : Return

Syntax

```
Gosub MyLabel  
  
MyLabel :  
    ...  
Return
```

Description

Gosub stands for 'Go to sub routine'. A label must be specified after **Gosub**, at that point the program execution continues immediately after the position defined by that label, and will do so until encountering a **Return**. When a return is reached, the program execution is then transferred immediately below the **Gosub**.

Gosub is useful when building fast structured code.

Another technique which may be used in order to insert a sub routine into a standalone program component is to use procedures . **Gosub** may only be used within the main body of the source code, and may not be used within procedures .

Example

```
1  a = 1  
2  b = 2  
3  Gosub ComplexOperation  
4  Debug a  
5  End  
6  
7  ComplexOperation :  
8      a = b*2+a*3+(a+b)  
9      a = a+a*a  
10 Return
```

Syntax

```
FakeReturn
```

Description

If the command `Goto` is used within the body of a sub routine, `FakeReturn` must be used. `FakeReturn` simulates a return without actually executing a return, and if it is not used, the program will crash.

Note: To exit a loop safely, `Break` should be used instead of `Goto`.

Example

```
1  Gosub SubRoutine1
2
3  SubRoutine1:
4    ...
5    If a = 10
6      FakeReturn
7      Goto Main_Loop
8    EndIf
9  Return
```

Chapter 36

Handles and Numbers

Numbers

All created objects are identified by an arbitrary number (which is not the object's handle, as seen below). In this manual, these numbers are marked as #Number (for example, each gadget created have a #Gadget number).

The numbers you assign to them do not need to be constants, but they need to be unique for each object in your program (an image can get the same number as a gadget, because these are different types of objects). These numbers are used to later access these objects in your program.

For example, the event handling functions return these numbers:

```
1  EventGadget ()
2  EventMenu ()
3  EventWindow ()
```

Handles

All objects also get a unique number assigned to them by the system. These identifiers are called handles. Sometimes, a PureBasic function doesn't need the number as argument, but the handle. In this manual, such things are mentioned, as an ID.

Example

```
1  ImageGadget(#Gadget, x, y, Width, Height, ImageID [, Flags])
2  ; #Gadget needs to be the number you want to assign to the Gadget
3  ; ImageID needs to a handle to the image.
```

To get the handle to an object, there are special functions like:

```
1  FontID ()
2  GadgetID ()
3  ImageID ()
4  ThreadID ()
5  WindowID ()
```

Also, most of the functions that create these objects also return this handle as a result, if they were successful. This is only the case if #PB_Any was not used to create the object. If #PB_Any is used, these commands return the object number that was assigned by PB for them, not the handle.

Example

```
1 GadgetHandle = ImageGadget(...)
```

Chapter 37

If : Else : EndIf

Syntax

```
If <expression>  
  ...  
[ElseIf <expression>]  
  ...  
[Else]  
  ...  
EndIf
```

Description

The **If** structure is used to achieve tests, and/or change the programmes direction, depending on whether the test is true or false. **ElseIf** optional command is used for any number of additional tests if the previous test was not true. The **Else** optional command is used to execute a part of code, if all previous tests were false. Any number of **If** structures may be nested together.

Short-circuit evaluations for expressions are supported, meaning if a test is true, all following tests will be ignored and not even run.

Example: Basic test

```
1  a = 5  
2  If a = 10  
3    Debug "a = 10 "  
4  Else  
5    Debug "a <> 10 "  
6  EndIf
```

Example: Multiple test

```
1  a = 10  
2  ; b = 15  
3  c = 20  
4  
5  If (a = 10) And (b >= 10) Or (c = 20)  
6    If b = 15  
7      Debug "b = 15 "  
8    Else
```

```
9     Debug "Other possibility"
10    EndIf
11    Else
12     Debug "Test failure"
13    EndIf
```

Example: Short-circuit test

```
1    Procedure DisplayHello()
2     Debug "Hello"
3     ProcedureReturn 1
4    EndProcedure
5
6    a = 10
7    If a = 10 Or DisplayHello() = 1 ; a is equal to 10, so the second
   test is fully ignored
8     Debug "Test success"
9    Else
10     Debug "Test failure"
11    EndIf
```

Chapter 38

Import : EndImport

Syntax

```
Import "Filename"  
  FunctionName.<type>(<parameter>, [, <parameter> [= DefaultValue]...])  
  [As "SymbolName"]  
  ...  
  VariableName.<type> [As "SymbolName"]  
EndImport
```

Description

For advanced programmers. `Import : EndImport` allows to easy declare external functions and variables from a library (.lib) or an object (.obj) file.

Once declared, the imported functions are directly available for use in the program, like any other commands. The compiler doesn't check if the functions really exists in the imported file, so if an error occurs, it will be reported by the linker.

This feature can replace the `OpenLibrary() / CallFunction()` sequence as it has some advantages: type checking is done, number of parameters is validated. Unlike `CallFunction()`, it can deal with double, float and quad without any problem.

The last parameters can have a default value (need to be a constant expression), so if these parameters are omitted when the function is called, the default value will be used.

By default the imported function symbol is 'decorated' in the following way: `_FunctionName@callsize`. That should work for most of the functions which use the standard call convention (`stdcall`). If the library is a C one, and the function are not `stdcall`, the `ImportC` variant should be used instead. In this case, the default function symbol is decorated like: `_FunctionName`.

The pseudotypes can be used for the parameters, but not for the returned value.

Remarks

On x64, there is only one calling convention, so `ImportC` will behave the same as `Import`.

Example

```
1  CompilerIf #PB_Compiler_OS <> #PB_OS_Windows  
2  CompilerError "This sample only works on Windows"  
3  CompilerEndIf  
4  
5  Import "User32.lib"
```

```

6
7     ; No need to use 'As' as PureBasic decorates the function correctly
8     ; We also define the 'Flags' as optional, with a default value of 0
    (when omitted)
9     ;
10    MessageBoxW(Window.i, Body$, Title$, Flags.i = 0)
11
12    EndImport
13
14    MessageBoxW(0, "Hello", "World") ; We don't specify the flags

```

Example: With pseudotypes

```

1    CompilerIf #PB_Compiler_OS <> #PB_OS_Windows
2        CompilerError "This sample only works on Windows"
3    CompilerEndIf
4
5    Import "User32.lib"
6
7        ; We use the 'p-unicode' pseudotype for the string parameters, as
8        ; MessageBoxW() is an unicode only function. The compiler will
9        ; automatically converts the strings to unicode when needed.
10       ;
11       MessageBoxA(Window.i, Body.p-ascii, Title.p-ascii, Flags.i = 0)
12
13    EndImport
14
15    MessageBoxA(0, "Hello", "World")

```

Chapter 39

Includes Functions

Syntax

```
IncludeFile "Filename"
```

Description

`IncludeFile` will always include the specified source file, at the current place in the code (even if `XIncludeFile` has been called for this file before).

Example

```
1 IncludeFile "Sources\myfile.pb" ; This file will be inserted in the
   current code.
```

This command is useful, if you want to split your source code into several files, to be able to reuse parts e.g. in different projects.

Syntax

```
XIncludeFile "Filename"
```

Description

`XIncludeFile` is similar to `IncludeFile` excepts it avoids to include the same file twice.

Example

```
1 XIncludeFile "Sources\myfile.pb" ; This file will be inserted.
2 XIncludeFile "Sources\myfile.pb" ; This file will be ignored along
   with all subsequent calls.
```

This command is useful, if you want to split your source code into several files, to be able to reuse parts e.g. in different projects.

Syntax

```
IncludeBinary "filename"
```

Description

`IncludeBinary` will include the named file at the current place in the code. Including should be done inside a Data block.

Example

```
1 DataSection
2   MapLabel:
3   IncludeBinary "Data\map.data"
4 EndDataSection
```

This command is especially useful in combination with the Catch-commands (currently there are `CatchImage()` , `CatchSound()` , `CatchSprite()`) to include images, sounds, sprites etc. into the executable.

Syntax

```
IncludePath "path"
```

Description

`IncludePath` will specify a default path for all files included after the call of this command. This can be very handy when you include many files which are in the same directory.

Example

```
1 IncludePath "Sources\Data"
2 IncludeFile "Sprite.pb"
3 XIncludeFile "Music.pb"
```

Chapter 40

Inline x86 ASM

Introduction

PureBasic allows you to include any x86 assembler commands (including MMX and FPU one) directly in the source code, as if it was a real assembler. And it gives you even more: you can use directly any variables or pointers in the assembler keywords, you can put any ASM commands on the same line, ... On Windows and Linux, PureBasic uses **fasm** (<http://flatassembler.net>), so if you want more information about the syntax, just read the **fasm** guide.

On OS X, PureBasic uses **yasm** (<http://yasm.tortall.net/>), so if you want more information about the syntax, just read the **yasm** guide.

To activate the inline assembler use the compiler directives `EnableASM` and `DisableASM` .

It's possible to enable the ASM syntax coloring in the IDE with the "enable inline ASM syntax coloring" compiler option .

Rules

You have several rules to closely follow if you want to include ASM in a BASIC code :

- The used variables or pointers must be declared **before** to use them in an assembler keyword. Their names in assembler are 'v_variablename' and 'p_pointername', and in a procedure their names are 'p.v_variablename' and 'p.p_pointername'.

- Labels: The labels need to be referenced in lowercase when using the in-line ASM. When you reference a label , you must put the prefix 'l_' before the name.

If the label is defined in a procedure , then its prefix is 'll_procedurename_', in lowercase.

When you reference a module item, you must put the prefix 'module_name.l_' all in lowercase before the item.

If the label is defined in a procedure inside a module, then its prefix is 'module_name.ll_procedurename_', in lowercase.

Example

```
1  DeclareModule MyModule
2      LabelDeclareModule: ;Its name is mymodule.l_labeldeclaremodule:
3      Declare Init()
4  EndDeclareModule
5
6  Module MyModule
7      Procedure Init()
8          LabelModuleProcedure: ; Its name is
          mymodule.ll_init_labelmoduleprocedure:
9          Debug "InitFerrari()"
```

```

10     EndProcedure
11
12     LabelModule1: ;Its name is mymodule.l_labelmodule1:
13 EndModule
14
15 Procedure Test (*Pointer, Variable)
16     TokiSTART: ;Its name is ll_test_tokistart:
17
18     ! MOV dword [p.p_Pointer], 20
19     ! MOV dword [p.v_Variable], 30
20     Debug *Pointer ;Its name is p.p_Pointer
21     Debug Variable ;Its name is p.v_Variable
22 EndProcedure
23
24 VAR=1 ;Its name is v_VAR
25 *Pointt=AllocateMemory(10) ;Its name is p_Pointt
26
27 MyModule::Init()
28 Test(0,0)
29
30 Label1: ;Its name is l_label1:
31
32 !jmp l_labelend ; An instruction in assembler has to use the rules
    above. Here it's l_namelabel
33 ;...
34 LabelEnd: ;Its name is l_labelend:

```

- The errors in an ASM part are not reported by PureBasic but by FASM. Just check your code if a such error happen.
- With enabled InlineASM you can't use ASM keywords as label names in your source.
- On x86 processors, the available volatile registers are: eax, ecx and edx, xmm0, xmm1, xmm2 and xmm3. All others must be always preserved.
- On x64 processors, the available volatile registers are: rax, rcx, rdx, r8, r9, xmm0, xmm1, xmm2 and xmm3. All others must be always preserved.
- Windows only: an ASM help-file could be downloaded [here](#). If you place the 'ASM.HLP' in the 'Help/' folder of PureBasic, you can also get help on ASM keywords with F1. (Note: this feature is only enabled, when InlineASM is enabled).

When using assembler in a procedure , you have to be aware of several important things:

- To return directly the 'eax' (or 'rax' on x64) register content, just use [ProcedureReturn](#), without any expression. It will let the 'eax' (or 'rax' on x64) register content untouched and use it as return-value.

Example

```

1 Procedure .l MyTest ()
2     MOV eax, 45
3     ProcedureReturn ; The returned value will be 45
4 EndProcedure

```

- Local variables in PureBasic are directly indexed by the stack pointer, which means if the stack pointer change via an ASM instruction (like PUSH, POP etc..) the variable index will be wrong and direct variable reference won't work anymore.
- It's possible to pass directly an assembly line to the assembler without being processed by the compiler by using the '!' character at the line start. This allow to have a full access to the assembler directives. When using this, it's possible to reference the local variables using the notation 'p.v_variablename' for a regular variable or 'p.p_variablename' for a pointer.

Example

```
1  Procedure Test(*Pointer, Variable)
2      ! MOV dword [p.p_Pointer], 20
3      ! MOV dword [p.v_Variable], 30
4      Debug *Pointer
5      Debug Variable
6  EndProcedure
7
8  Test(0, 0)
```

Chapter 41

Interfaces

Syntax

```
Interface <name> [Extends <name>]
    <Method [. <type>] () >
    ...
EndInterface
```

Description

Interfaces are used to access Object Oriented modules, such as COM (Component Object Model) or DirectX dynamic libraries (DLL). These types of libraries are becoming more and more common in Windows, and through the use of interfaces, the ability to access these modules easily (and without any performance hit) is realized. It also introduces the necessary basis for Object Oriented programming within PureBasic, but the use of interfaces requires some advanced knowledge. Most of the standard Windows interfaces have already been implemented within a resident file and this allows direct use of these objects.

The optional **Extends** parameter may be used to extend another interface with new functions (These functions are commonly called 'methods' in Object Oriented (OO) languages such as C++ or Java). All functions contained within the extended interface are then made available within the new interface and will be placed before the new functions. This is useful in order to do basic inheritance of objects.

Arrays can be passed as parameters using the **Array** keyword, lists using the **List** keyword and maps using the **Map** keyword.

A return type may be defined in the interface declaration by adding the type after the method.

SizeOf may be used with Interfaces in order to get the size of the interface and **OffsetOf** may be used to retrieve the index of the specified function.

The pseudotypes may be used for the parameters of the functions, but not for the return value.

Note: The concept of objects, and the capability provided within PureBasic for their use, has been developed for, and mainly targeted towards, experienced programmers. However, an understanding of these concepts and capabilities are in no way a prerequisite for creating professional software or games.

Example: Basic example of object call

```
1 ; In order to access an external object (within a DLL for example),
2 ; the objects' interface must first be declared:
3
4 Interface MyObject
5     Move(x,y)
6     MoveF(x.f,y.f)
7     Destroy()
8 EndInterface
```

```

9
10 ; CreateObject is the function which creates the object, from the DLL,
11 ; whose interface has just been defined.
12 ; Create the first object...
13 ;
14 Object1.MyObject = MyCreateObject()
15
16 ; And the second one.
17 ;
18 Object2.MyObject = MyCreateObject()
19
20 ; Then the functions which have just been defined, may
21 ; be used, in order to act upon the desired object.
22 ;
23 Object1.Move(10, 20)
24 Object1.Destroy()
25
26 Object2.MoveF(10.5, 20.1)
27 Object2.Destroy()

```

Example: Example with 'Extends'

```

1 ; Define a basic Cube interface object.
2 ;
3 Interface Cube
4     GetPosition()
5     SetPosition(x)
6     GetWidth()
7     SetWidth(Width)
8 EndInterface
9
10 Interface ColoredCube Extends Cube
11     GetColor()
12     SetColor(Color)
13 EndInterface
14
15 Interface TexturedCube Extends Cube
16     GetTexture()
17     SetTexture(TextureID)
18 EndInterface
19
20 ; The interfaces for 3 different objects have now been defined, these
21 ; objects include:
22 ; - 'Cube' which has the: Get/SetPosition() and Get/SetWidth()
23 ;   functions.
24 ; - 'ColoredCube' which has the: Get/SetPosition(), Get/SetWidth()
25 ;   and Get/SetColor() functions.

```

Chapter 42

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Component: AES

Optimized ANSI C code for the Rijndael cipher (now AES)

@authorVincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>

@authorAntoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>

@authorPaulo Barreto <paulo.barreto@terra.com.br>

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Component: SHA1

SHA-1 in C
By Steve Reid <steve@edmweb.com>
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Jean-loup Gailly Mark Adler
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- 1) PPMd var.H (2001): Dmitry Shkarin
- 2) SHA-256: Wei Dai (Crypto++ library)

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THE BASIC LIBRARY FUNCTIONS

Written by: Philip Hazel

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NeuQuant Neural-Net Quantization Algorithm Interface

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See "Kohonen neural networks for optimal colour quantization"
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Modified to quantize 32bit RGBA images for the pngnq program.
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Rewritten by Kornel Lesinski (2009)
Euclidean distance, color matching dependent on alpha channel
and with gamma correction. code refreshed for modern
compilers/architectures:
ANSI C, floats, removed pointer tricks and used arrays and structs.

Component: libmariadb

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Chapter 44

Macros

Syntax

```
Macro <name> [(Parameter [, ...])]  
    ...  
EndMacro
```

Description

Macros are a very powerful feature, mainly useful for advanced programmers. A macro is a placeholder for some code (one keyword, one line or even many lines), which will be directly inserted in the source code at the place where a macro is used. In this, it differs from procedures, as the procedures doesn't duplicate the code when they are called.

The `Macro : EndMacro` declaration must be done before the macro will be called for the first time. Because macros will be completely replaced by their related code at compile time, they are not local to a procedure.

A macro can not have a return type nor typed parameters. When a macro has some parameters, they are replaced in the macro code by the literal expression which is passed to the called macro. No evaluation is done at this stage, which is very important to understand: the evaluation of a line is started once all the macros found on this line are expanded.

Macros are divided into two categories: simple (without parameters) and complex (with parameters, needs the parentheses when calling it). When using no parameters, it's possible to replace any word with another word (or any expression). Macros can't be called recursively. Macro declaration can't be nested (it's not possible to define a macro inside another one).

Example: Simple macro

```
1 Macro MyNot  
2     Not  
3 EndMacro  
4  
5 a = 0  
6 If MyNot a ; Here the line will be expanded to : 'If Not a'  
7     Debug "Ok"  
8 EndIf
```

When using parameters, it's possible to do very flexible macros. The special concatenation character `'#'` can be used to create new labels or keyword by mixing the macro code and the parameter expression (spaces are not accepted between each words by the concatenation character). It's also possible to define default values for parameters, so they can be omitted when calling the macro.

Example: Macro with parameter

```
1 Macro UMsgBox(Title, Body)
2   MessageRequester(Title, UCase(Body), 0)
3 EndMacro
4
5 Text$ = "World"
6 UMsgBox("Hello", "-" + Text$ + "-") ; Here the line will be expanded like
   that:
7                                     ; 'MessageRequester("Hello",
   UCase("-" + Text$ + "-"), 0)'
```

Example: Macro with default parameter

```
1 Macro UMsgBox(Title, Body = "Ha, no body specified")
2   MessageRequester(Title, UCase(Body), 0)
3 EndMacro
4
5 UMsgBox("Hello") ; Here the line will be expanded like that:
6                 ; 'MessageRequester("Hello", UCase("Ha, no body
   specified"), 0)'
```

Example: Macro parameter concatenation

```
1 Macro XCase(Type, Text)
2   Type#Case(Text)
3 EndMacro
4
5 Debug XCase(U, "Hello")
6 Debug XCase(L, "Hello")
```

Example: Advanced multi-line macro

```
1 Macro DoubleQuote
2   "
3 EndMacro
4
5 Macro Assert(Expression)
6   CompilerIf #PB_Compiler_Debugger ; Only enable assert in debug mode
7   If Expression
8     Debug "Assert (Line " + #PB_Compiler_Line + "): " +
   DoubleQuote#Expression#DoubleQuote
9   EndIf
10  CompilerEndIf
11 EndMacro
12
13 Assert(10 <> 10) ; Will display nothing
14 Assert(10 <> 15) ; Should display the assert
```

Syntax

UndefineMacro <name>

Description

[UndefineMacro](#) allows to undefine a previously defined macro, and redefine it in a different manner. Once the macro has been undefined, it is no more available for use.

Example: Undefine macro

```
1 Macro Test
2   Debug "1"
3 EndMacro
4
5 Test ; Call the macro
6
7 UndefineMacro Test ; Undefine the macro, it no more exists
8
9 Macro Test ; Now we can redefine the macro
10  Debug "2"
11 EndMacro
12
13 Test ; Call the macro
```

Syntax

MacroExpandedCount

Description

[MacroExpandedCount](#) allows to get the expanded count (number of time the macro has been expanded/called). It can be useful to generate unique identifiers in the same macro for every expansion (like label, procedure name etc.).

Example: Expanded count

```
1 Macro Test
2   Debug MacroExpandedCount
3 EndMacro
4
5 Test ; Call the macro
6 Test ; Call the macro
7 Test ; Call the macro
```

Chapter 45

Pointers and memory access

Pointers

Example

```
1 *MyScreen.Screen = OpenScreen(0, 320, 200, 8, 0)
2 mouseX = *MyScreen\MouseX ; Assuming the Screen structure contains a
   MouseX field
```

There are only three valid methods to set the value of a pointer:

- Get the result from a function (as shown in the above example)
- Copy the value from another pointer
- Find the address of a variable, procedure or label (as shown below)

Note: unlike C/C++, in PureBasic the '*' is **always** part of the item name. Therefore '*ptr' and 'ptr' are two different variables. 'ptr' is a variable (regular one) storing a value, '*ptr' is another variable of pointer type storing an address.

Pointers and memory size

Because pointers receive only addresses as values, the memory size of a pointer is the space allowing to store an absolute address of the processor:

- On 32-bit processors the address space is limited to 32-bit, so a pointer takes 32-bit (4 bytes, like a 'long') in memory
- On 64-bit processors it takes 64-bit (8 bytes, like a 'quad') in memory, because the absolute address is on a 64-bit range.

As a consequence the type of a pointer depends of the CPU address mode, ('long' on 32-bit CPU and 'quad' on 64-bit one for example), so a pointer is a variable of type pointer.

It results from this that assigning a native type to a pointer (*Pointer.l, *Pointer.b ...) makes no sense.

Note:

- Every time a memory address needs to be stored in a variable, it should be done through a pointer. This guarantees address integrity at the compilation time whatever the CPU address mode is.
- PureBasic x86 does not generate 64-bit executables. For PureBasic programs compiled with this, the system grants them only an addressing with 32-bit pointers.

Pointers and structures

By assigning a structure to a pointer (for example *MyPointer.Point) it allows to access any memory address in a structured way (with the operator '\').

Example: Pointers and variables

```
1 Define Point1.Point, Point2.Point
2 *CurrentPoint.Point = @Point1 ; Pointer declaration, associated to a
   structure and initialized with Point1's address
```

```

3  *CurrentPoint \x = 10          ; Assign value 10 to Point1\x
4  *CurrentPoint.Point = @Point2 ; move to Point2's address
5  *CurrentPoint \x = 20          ; Assign value 20 to Point2\x
6  Debug Point1\x
7  Debug Point2\x

```

Example: Pointers and array

```

1  Define Point1.Point, Point2.Point
2  Dim *Points.Point(1) ; 2 slots array
3  *Points(0) = @Point1 ; Assign the first point variable to the first
   array slot
4  *Points(1) = @Point2 ; Same for second
5
6  *Points(0)\x = 10 ; Modify the variables through the pointers
7  *Points(1)\x = 20 ;
8
9  Debug Point1\x
10 Debug Point2\x

```

Pointers allow to move, to read and to write easily in memory. Furthermore they allow programmers to reach big quantities of data without supplementary cost further to data duplication. Copying a pointer is much faster.

Pointers are also available in structures, for more information see the structures chapter .

Pointers and character strings

All variables have a permanent size in memory (2 bytes for Word, 4 bytes for a Long, etc.) except for strings variables with lengths that can change. So string variables are managed by a different way of other variables.

Thus a structure field, that makes reference to a string, store only the memory address of the string instead of the string itself: a such structure field is a pointer towards a string.

Example

```

1  Text$ = "Hello"
2  *Text = @Text$          ; *Text store the address of the string in
   memory
3  *Pointer.String = @*Text ; *Pointer points on *Text
4  Debug *Pointer\s       ; Display the string living at the address
   stored in *Pointer (i.e. @Text$)

```

Pointers Arithmetic

Arithmetic operations on the pointers are possible and practical by using `SizeOf()` .

Example

```

1  Dim Array.Point(1)      ; Array of points
2
3  *Pointer.Point = @Array() ; Store the array address
4  *Pointer\x = 10         ; Change the first array element values
5  *Pointer\y = 15
6
7  *Pointer + SizeOf(Point) ; Move to the next array element
8

```

```

9   *Pointer\x = 7           ; Change the second array element values
10  *Pointer\y = 9
11
12  ; Display results
13  For i = 0 To 1
14     Debug Array(i)\x
15     Debug Array(i)\y
16  Next i

```

Addresses of variables

To get the address of a variable in your code, you use the at symbol (@). A common reason for using this is when you want to pass a structured type variable to a procedure . You must pass a pointer to this variable as you cannot pass structured variables directly.

Example

```

1   Structure astruct
2     a.w
3     b.l
4     c.w
5   EndStructure
6
7   Procedure SetB(*myptr.astruct)
8     *myptr\b = 69
9   EndProcedure
10
11  Define.astruct myvar
12
13  SetB(@myvar)
14
15  Debug myvar\b

```

Addresses of literal strings

To get the address of literal string, you can use the at symbol (@) in front of it. String constants are also supported.

Example

```

1   *String = @"Test"
2   Debug PeekC(*String) ; Will display 84, which is the value of 'T'

```

Addresses of procedures

For advanced programmers. The most common reason to get the address of a procedure is when dealing with the OS at a low-level. Some OSes allow you to specify callback or hook functions (for some operations) which get called by the OS and allows the programmer to extend the ability of the OS routine. The address of a procedure is found in a similar way to variables .

Example

```
1 Procedure WindowCB(WindowID.i, Message.i, wParam.i, lParam.i)
2   ; This is where the processing of your callback procedure would be
   performed
3 EndProcedure
4
5 ; A special callback for the Windows OS allowing you to process
   window events
6 SetWindowCallback( @WindowCB() )
```

Addresses of labels

It can also be useful to find the address of labels in your code. This can be because you want to access the code or data stored at that label, or any other good reason you can think of. To find the address of a label, you put a question mark (?) in front of the label name.

Example

```
1 Debug "Size of data file = " + Str(?endofmydata - ?mydata)
2
3 DataSection
4   mydata:
5     IncludeBinary "somefile.bin"
6   endofmydata:
7 EndDataSection
```

Chapter 46

Migration guide

Introduction

PureBasic is a modern programming language which evolves quickly to follow technologic changes and brings up-to-date commandset to the programmer. It sometimes involves to change or redesign some part of the language. While we try to keep these breaking changes to a minimum, it can happen and this migration guide will help to update your source from one version to another.

If you need stability instead of cutting edge features, we highly recommend to stick to 'LTS' (Long Term Support) version of PureBasic, which are released every 2 years, and are actively maintained for bug fixes.

Regular releases

migration from 5.50 to 5.60

migration from 5.40 to 5.50

migration from 5.30 to 5.40

LTS releases

migration from 5.60 to 5.72 LTS

migration from 5.20 LTS to 5.40 LTS

Chapter 47

Migration from PureBasic 5.20 LTS to 5.40 LTS

Billboard library

AddBillboard(): code change

```
1 ; Old
2 AddBillboard(Billboard, BillboardGroup, x, y, z)
3
4 ; New
5 Billboard = AddBillboard(BillboardGroup, x, y, z)
```

Cipher library

ExamineMD5Fingerprint(): code change

```
1 ; Old
2 ExamineMD5Fingerprint(#FingerPrint)
3
4 ; New
5 UseMD5Fingerprint()
6 StartFingerprint(#FingerPrint, #PB_Cipher_MD5)
```

ExamineSHA1Fingerprint(): code change

```
1 ; Old
2 ExamineSHA1Fingerprint(#FingerPrint)
3
4 ; New
5 UseSHA1Fingerprint()
6 StartFingerprint(#FingerPrint, #PB_Cipher_SHA1)
```

MD5FileFingerprint(): code change

```
1 ; Old
2 Result$ = MD5FileFingerprint(FileName$)
3
4 ; New
5 UseMD5Fingerprint()
6 Result$ = FileFingerprint(FileName$, #PB_Cipher_MD5)
```

MD5Fingerprint(): code change

```
1 ; Old
2 Result$ = MD5Fingerprint(*Buffer, Size)
3
4 ; New
5 UseMD5Fingerprint()
6 Result$ = Fingerprint(*Buffer, Size, #PB_Cipher_MD5)
```

SHA1FileFingerprint(): code change

```
1 ; Old
2 Result$ = SHA1FileFingerprint(Filename$)
3
4 ; New
5 UseSHA1Fingerprint()
6 Result$ = FileFingerprint(Filename$, #PB_Cipher_SHA1)
```

SHA1Fingerprint(): code change

```
1 ; Old
2 Result$ = SHA1Fingerprint(*Buffer, Size)
3
4 ; New
5 UseSHA1Fingerprint()
6 Result$ = Fingerprint(*Buffer, Size, #PB_Cipher_SHA1)
```

CRC32FileFingerprint(): code change

```
1 ; Old
2 Result = CRC32FileFingerprint(Filename$)
3
4 ; New
5 UseCRC32Fingerprint()
6 Result.l = Val("$"+FileFingerprint(Filename$, #PB_Cipher_CRC32))
```

CRC32Fingerprint(): code change

```
1 ; Old
2 Result = CRC32Fingerprint(*Buffer, Size)
3
4 ; New
5 UseCRC32Fingerprint()
6 Result.l = Val("$"+Fingerprint(*Buffer, Size, #PB_Cipher_CRC32))
```

NextFingerprint(): rename only

```
1 ; Old
2 NextFingerprint(#FingerPrint, *Buffer, Size)
3
4 ; New
5 AddFingerprintBuffer(#FingerPrint, *Buffer, Size)
```

Mail library

SendMail(): code change if the 'Asynchronous' parameter was used

```

1 ; Old
2 SendMail(#Mail, Sntp$, Port, 1)
3
4 ; New
5 SendMail(#Mail, Sntp$, Port, #PB_Mail_Aynchronous)

```

Packer library

RemovePackFile(): removed

PackerEntrySize(): #PB_Packer_CompandedSize support removed for ZIP and 7z archives

XML library

CreateXMLNode(): code change

```

1 ; Old
2 Node = CreateXMLNode(ParentNode)
3 SetXMLNodeName(Node, "Name")
4
5 ; New
6 Node = CreateXMLNode(ParentNode, "Name")

```

Screen library

AvailableScreenMemory() removed as new API doesn't support this info anymore. It was mostly returning '0' anyway.

Window library

#PB_Event_SizeWindow and #PB_Event_MoveWindow are no more realtime on Windows, use BindEvent() to get real time update.

Engine3D library

WorldCollisionAppliedImpulse() now returns a float about the applied impulse. GetX/Y/Z() are no more supported.

Various

DataSection label within Procedure are now local labels.

ASM local label prefix has been changed from "l_" to "ll_", to avoid possible clash with main labels.

#PB_LinkedList constant has been renamed to #PB_List for better consistency

Chapter 48

Migration from PureBasic 5.30 to 5.40

Cipher library

ExamineMD5Fingerprint(): code change

```
1 ; Old
2 ExamineMD5Fingerprint (#FingerPrint)
3
4 ; New
5 UseMD5FingerPrint ()
6 StartFingerprint (#FingerPrint , #PB_Cipher_MD5)
```

ExamineSHA1Fingerprint(): code change

```
1 ; Old
2 ExamineSHA1Fingerprint (#FingerPrint)
3
4 ; New
5 UseSHA1FingerPrint ()
6 StartFingerprint (#FingerPrint , #PB_Cipher_SHA1)
```

MD5FileFingerprint(): code change

```
1 ; Old
2 Result$ = MD5FileFingerprint (Filename$)
3
4 ; New
5 UseMD5FingerPrint ()
6 Result$ = FileFingerprint (Filename$ , #PB_Cipher_MD5)
```

MD5Fingerprint(): code change

```
1 ; Old
2 Result$ = MD5Fingerprint (*Buffer , Size)
3
4 ; New
5 UseMD5FingerPrint ()
6 Result$ = Fingerprint (*Buffer , Size , #PB_Cipher_MD5)
```

SHA1FileFingerprint(): code change

```
1 ; Old
```

```

2 |   Result$ = SHA1FileFingerprint(Filename$)
3 |
4 |   ; New
5 |   UseSHA1FingerPrint()
6 |   Result$ = FileFingerprint(Filename$, #PB_Cipher_SHA1)

```

SHA1Fingerprint(): code change

```

1 |   ; Old
2 |   Result$ = SHA1Fingerprint(*Buffer, Size)
3 |
4 |   ; New
5 |   UseSHA1FingerPrint()
6 |   Result$ = Fingerprint(*Buffer, Size, #PB_Cipher_SHA1)

```

CRC32FileFingerprint(): code change

```

1 |   ; Old
2 |   Result = CRC32FileFingerprint(Filename$)
3 |
4 |   ; New
5 |   UseCRC32FingerPrint()
6 |   Result.1 = Val("$"+FileFingerprint(Filename$, #PB_Cipher_CRC32))

```

CRC32Fingerprint(): code change

```

1 |   ; Old
2 |   Result = CRC32Fingerprint(*Buffer, Size)
3 |
4 |   ; New
5 |   UseCRC32FingerPrint()
6 |   Result.1 = Val("$"+Fingerprint(*Buffer, Size, #PB_Cipher_CRC32))

```

NextFingerprint(): rename only

```

1 |   ; Old
2 |   NextFingerprint(#FingerPrint, *Buffer, Size)
3 |
4 |   ; New
5 |   AddFingerprintBuffer(#FingerPrint, *Buffer, Size)

```

Mail library

SendMail(): code change if the 'Asynchronous' parameter was used

```

1 |   ; Old
2 |   SendMail(#Mail, Smtpp$, Port, 1)
3 |
4 |   ; New
5 |   SendMail(#Mail, Smtpp$, Port, #PB_Mail_Asynchronous)

```

Packer library

RemovePackFile(): removed

PackerEntrySize(): #PB_Packer_CompressedSize support removed for ZIP and 7z archives

Screen library

AvailableScreenMemory() removed as new API doesn't support this info anymore. It was mostly returning '0' anyway.

Engine3D library

WorldCollisionAppliedImpulse() now returns a float about the applied impulse. GetX/Y/Z() are no more supported.

Chapter 49

Migration from PureBasic 5.40 to 5.50

Particle library

ParticleVelocity(): code changed to support current velocity.

```
1 ; Old
2 ParticleVelocity(#ParticleEmitter, Minimum, Maximum)
3
4 ; New
5 ParticleVelocity(#ParticleEmitter, Mode, Value)
```

Others

PureBasic internal manipulation of strings is now unicode only.

ASCII mode is no longer supported internally. The function `*Result = Ascii(String$)` allows the manipulation of ASCII strings by the user.

Chapter 50

Migration from PureBasic 5.50 to 5.60

Cipher library

Base64Encoder: function renamed

```
1 ; Old
2 Base64Encoder ()
3
4 ; New
5 Base64EncoderBuffer ()
```

Base64Decoder: function renamed

```
1 ; Old
2 Base64Decoder ()
3
4 ; New
5 Base64DecoderBuffer ()
```

Others

'Define.b' standalone syntax, to change default type for untyped variables is now forbidden and will result in a 'Syntax error'. Removing the statement will solve this (ensure to type your untyped variables accordingly). Note: 'Define.b a, b, c' is still supported.

Chapter 51

Migration from PureBasic 5.60 to 5.72 LTS

Math library

Sign(): now returns an integer instead of a float.

```
1 ; Old
2 Var .d(f) = Sign(X)
3
4 ; New
5 Var .i = Sign(X)
```

Window library

PostEvent(): now returns a result as it could fail in some extrem case

Others

In MS WIndows, the default font changed from MS Shell Dlg to Segoe UI size 9.

Chapter 52

Module

Syntax

```
DeclareModule <name>
    ...
EndDeclareModule

Module <name>
    ...
EndModule

UseModule <name>
UnuseModule <name>
```

Description

Modules are an easy way to isolate code parts from the main code, allowing code reuse and sharing without risk of name conflict. In some other programming languages, modules are known as 'namespaces'. A module must have a [DeclareModule](#) section (which is the public interface) and an associated [Module](#) section (which is the implementation). Only items declared in the [DeclareModule](#) section will be accessible from outside the module. All the code put in the [Module](#) section will be kept private to this module. Items from main code like procedures, variables etc. won't be accessible inside the module, even if they are global. A module can be seen as a blackbox, an empty code sheet where item names can not conflict with the main code. It makes it easier to write specific code, as simple names can be reused within each module without risk of conflict.

Items allowed in the [DeclareModule](#) section can be the following: procedure (only procedure declaration allowed), structure, macro, variable, constant, enumeration, array, list, map and label.

To access a module item from outside the module, the module name has to be specified followed by the '::' separator. When explicitly specifying the module name, the module item is available everywhere in the code source, even in another module. All items in the [DeclareModule](#) section can be automatically imported into another module or in the main code using [UseModule](#). In the case of a module name conflict, the module items won't be imported and a compiler error will be raised. [UnuseModule](#) removes the module items. [UseModule](#) is not mandatory to access a module item, but the module name needs to be specified.

To share information between modules, a common module can be created and then used in every module which needs it. It's the common way have global data available for all modules.

Default items available in modules are all PureBasic commands, structure and constants. Therefore module items can not be named like internal PureBasic commands, structures or constants.

All code put inside [DeclareModule](#) and [Module](#) sections is executed like any other code when the program flow reaches the module.

When the statements [Define](#), [EnableExplicit](#), [EnableASM](#) are used inside a module, they have no effect outside the respective module, and vice versa.

Note: modules are not mandatory in PureBasic but are recommended when building big projects. They help to build more maintainable code, even if it is slightly more verbose than module-free code. Having a `DeclareModule` section make the module pretty much self-documented for use when reusing and sharing it.

Example

```
1
2 ; Every items in this sections will be available from outside
3 ;
4 DeclareModule Ferrari
5     #FerrariName$ = "458 Italia"
6
7     Declare CreateFerrari()
8 EndDeclareModule
9
10 ; Every items in this sections will be private. Every names can be
    used without conflict
11 ;
12 Module Ferrari
13
14     Global Initialized = #False
15
16     Procedure Init() ; Private init procedure
17         If Initialized = #False
18             Initialized = #True
19             Debug "InitFerrari()"
20         EndIf
21     EndProcedure
22
23     Procedure CreateFerrari()
24         Init()
25         Debug "CreateFerrari()"
26     EndProcedure
27
28 EndModule
29
30
31 Procedure Init() ; Main init procedure, doesn't conflict with the
    Ferrari Init() procedure
32     Debug "Main init()"
33 EndProcedure
34
35 Init()
36
37 Ferrari::CreateFerrari()
38 Debug Ferrari::#FerrariName$
39
40 Debug "-----"
41
42 UseModule Ferrari ; Now import all public item directly in the main
    program scope
43
44 CreateFerrari()
45 Debug #FerrariName$
```

Example: With a common module

```
1
2 ; The common module, which will be used by others to share data
3 ;
4 DeclareModule Cars
5     Global NbCars = 0
6 EndDeclareModule
7
8 Module Cars
9 EndModule
10
11 ; First car module
12 ;
13 DeclareModule Ferrari
14 EndDeclareModule
15
16 Module Ferrari
17     UseModule Cars
18
19     NbCars+1
20 EndModule
21
22 ; Second car module
23 ;
24 DeclareModule Porsche
25 EndDeclareModule
26
27 Module Porsche
28     UseModule Cars
29
30     NbCars+1
31 EndModule
32
33 Debug Cars::NbCars
```

Chapter 53

NewList

Syntax

```
NewList name.<type>()
```

Description

`NewList` allows to declare a new dynamic list. Each element of the list is allocated dynamically. There are no element limits, so there can be as many as needed. A list can have any Variables standard or structured type. To view all commands used to manage lists, see the List library.

The new list are always locals, which means Global or Shared commands have to be used if a list declared in the main source need to be used in procedures. It is also possible to pass a list as parameter to a procedure by using the keyword `List`.

For fast swapping of list contents the `Swap` keyword is available.

Example: Simple list

```
1  NewList MyList()
2
3  AddElement(MyList())
4  MyList() = 10
5
6  AddElement(MyList())
7  MyList() = 20
8
9  AddElement(MyList())
10 MyList() = 30
11
12 ForEach MyList()
13     Debug MyList()
14 Next
```

Example: List as procedure parameter

```
1  NewList Test()
2
3  AddElement(Test())
4  Test() = 1
5  AddElement(Test())
```

```
6 | Test() = 2
7 |
8 | Procedure DebugList(c, List ParameterList())
9 |
10 |     AddElement(ParameterList())
11 |     ParameterList() = 3
12 |
13 |     ForEach ParameterList()
14 |         MessageRequester("List", Str(ParameterList()))
15 |     Next
16 |
17 | EndProcedure
18 |
19 | DebugList(10, Test())
```

Chapter 54

NewMap

Syntax

```
NewMap name.<type>([Slots])
```

Description

[NewMap](#) allows to declare a new map, also known as hashtable or dictionary. It allows to quickly reference an element based on a key. Each key in the map are unique, which means it can't have two distinct elements with the same key. There are no element limits, so there can be as many as needed. A map can have any standard or structured type. To view all commands used to manage maps, see the [Map library](#).

When using a new key for an assignment, a new element is automatically added to the map. If another element with the same key is already in the map, it will be replaced by the new one. Once an element as been accessed or created, it becomes the current element of the map, and further access to this element can be done without specify the key. This is useful when using structured map, as no more element lookup is needed to access different structure field.

New maps are always locals by default, so Global or Shared commands have to be used if a map declared in the main source need to be used in procedures. It is also possible to pass a map as parameter to a procedure by using the keyword [Map](#).

For fast swapping of map elements the Swap keyword is available.

The optional 'Slots' parameter defines how much slots the map will have to store its elements. The more slots is has, the faster it will be to access an element, but the more memory it will use. It's a tradeoff depending of how many elements the map will ultimately contains and how fast the random access should be. The default value is 512. This parameter has no impact about the number of elements a map can contain.

Example: Simple map

```
1  NewMap Country.s()
2
3  Country("GE") = "Germany"
4  Country("FR") = "France"
5  Country("UK") = "United Kingdom"
6
7  Debug Country("FR")
8
9  ForEach Country()
10   Debug Country()
11  Next
```

Example: Map as procedure parameter

```
1  NewMap Country.s()
2
3  Country("GE") = "Germany"
4  Country("FR") = "France"
5  Country("UK") = "United Kingdom"
6
7  Procedure DebugMap(Map ParameterMap.s())
8
9      ParameterMap("US") = "United States"
10
11     ForEach ParameterMap()
12         Debug ParameterMap()
13     Next
14
15 EndProcedure
16
17 DebugMap(Country())
```

Example: Structured map

```
1  Structure Car
2      Weight.l
3      Speed.l
4      Price.l
5  EndStructure
6
7  NewMap Cars.Car()
8
9      ; Here we use the current element after the new insertion
10     ;
11     Cars("Ferrari F40")\Weight = 1000
12     Cars()\Speed = 320
13     Cars()\Price = 500000
14
15     Cars("Lamborghini Gallardo")\Weight = 1200
16     Cars()\Speed = 340
17     Cars()\Price = 700000
18
19     ForEach Cars()
20         Debug "Car name: "+MapKey(Cars())
21         Debug "Weight: "+Str(Cars()\Weight)
22     Next
```

Chapter 55

Others Commands

Syntax

```
Goto <label>
```

Description

This command is used to transfer the program directly to the labels position. Be cautious when using this function, as incorrect use could cause a program to crash...

Note: To exit a loop safely, you must always use Break instead of Goto, and never use it inside a Select/EndSelect block (unless you have the ability to correctly manage the stack yourself).

Syntax

```
End [ExitCode]
```

Description

Ends the program execution correctly. The 'ExitCode' optional parameter can be specified if the program need to returns an error code (widely used in console programs).

The 'ExitCode' can be further used e.g. with the ProgramExitCode() command.

Syntax

```
Swap <expression>, <expression>
```

Description

Swaps the value of the both expression, in an optimized way. The both <expression> have to be a variable , an array element, a list element or a map element (structured or not) and have to be one of the PureBasic native type like long (.l), quad (.q), string etc.

Example: Swapping of strings

```
1 Hello$ = "Hello"  
2 World$ = "World"  
3  
4 Swap Hello$, World$  
5  
6 Debug Hello$+" "+World$
```

Example: Swapping of multi-dimensional arrays elements

```
1 Dim Array1(5,5)  
2 Dim Array2(5,5)  
3 Array1(2,2) = 10 ; set initial contents  
4 Array2(3,3) = 20  
5  
6 Debug Array1(2,2) ; will print 10  
7 Debug Array2(3,3) ; will print 20  
8  
9 Swap Array1(2,2) , Array2(3,3) ; swap 2 arrays elements  
10  
11 Debug "Array contents after swapping:"  
12 Debug Array1(2,2) ; will print 20  
13 Debug Array2(3,3) ; will print 10
```

Chapter 56

Procedures

Syntax

```
Procedure[.<type>] name(<parameter1[.<type>]> [, <parameter2[.<type>]  
    [= DefaultValue]>, ...])  
    ...  
    [ProcedureReturn value]  
EndProcedure
```

Description

A **Procedure** is a part of code independent from the main code which can have any parameters and its own variables . In PureBasic, a recurrence is fully supported for the procedures and any procedure can call it itself. At each call of the procedure the variables inside will start with a value of 0 (null). To access main code variables, they have to be shared by using **Shared** or **Global** keywords (see also the **Protected** and **Static** keywords).

The last parameters can have a default value (needs to be a constant expression), so if these parameters are omitted when the procedure is called, the default value will be used.

Arrays can be passed as parameters using the **Array** keyword, lists using the **List** keyword and maps using the **Map** keyword.

A procedure can return a value or a string if necessary. You have to set the type after **Procedure** and use the **ProcedureReturn** keyword at any moment inside the procedure. A call of **ProcedureReturn** exits immediately the procedure, even when its called inside a loop.

ProcedureReturn can't be used to return an array , list or a map . For this purpose pass the array, the list or the map as parameter to the procedure.

If no value is specified for **ProcedureReturn**, the returned value will be undefined (see inline assembly for more information).

Note: To return strings from DLLs, see DLLs . For advanced programmers **ProcedureC** is available and will declare the procedure using 'CDecl' instead of 'StandardCall' calling convention.

Selected procedures can be executed asynchronously to the main program by using of threads .

Example: Procedure with a numeric variable as return-value

```
1  Procedure Maximum(nb1, nb2)  
2      If nb1 > nb2  
3          Result = nb1  
4      Else  
5          Result = nb2  
6      EndIf  
7  
8      ProcedureReturn Result
```

```

9   EndProcedure
10
11  Result = Maximum(15, 30)
12  Debug Result

```

Example: Procedure with a string as return-value

```

1   Procedure.s Attach(String1$, String2$)
2     ProcedureReturn String1$+" "+String2$
3   EndProcedure
4
5   Result$ = Attach("PureBasic", "Coder")
6   Debug Result$

```

Example: Parameter with default value

```

1   Procedure a(a, b, c=2)
2     Debug c
3   EndProcedure
4
5   a(10, 12)           ; 2 will be used as default value for 3rd parameter
6   a(10, 12, 15)

```

Example: List as parameter

```

1   NewList Test.Point()
2
3   AddElement(Test())
4   Test()\x = 1
5   AddElement(Test())
6   Test()\x = 2
7
8   Procedure DebugList(c.l, List ParameterList.Point())
9
10    AddElement(ParameterList())
11    ParameterList()\x = 3
12
13    ForEach ParameterList()
14      MessageRequester("List", Str(ParameterList()\x))
15    Next
16
17  EndProcedure
18
19  DebugList(10, Test())

```

Example: Array as parameter

```

1   Dim Table.Point(10, 15)
2
3   Table(0,0)\x = 1
4   Table(1,0)\x = 2

```

```

5
6 Procedure TestIt(c.l, Array ParameterTable.Point(2)) ; The table
  support 2 dimensions
7
8   ParameterTable(1, 2)\x = 3
9   ParameterTable(2, 2)\x = 4
10
11 EndProcedure
12
13 TestIt(10, Table())
14
15 MessageRequester("Table", Str(Table(1, 2)\x))

```

Example: Static, dynamic array and passing a Structure to a Procedure

```

1 Structure Whatever
2   a.l
3   b.l[2] ; Static array (Standard C) with 2 values b[0] and
  b[1], not resizable
4   Array c.l(3,3) ; Dynamic array with 16 values c(0,0) to c(3,3),
  resizable with ReDim()
5 EndStructure
6
7 MyVar.Whatever
8
9 Procedure MyProcedure(*blahblah.Whatever)
10  *blahblah\a = 5
11  *blahblah\b[0] = 1
12  *blahblah\b[1] = 2
13  *blahblah\c(3,3) = 33
14 EndProcedure
15
16 MyProcedure(@MyVar)
17 Debug MyVar\a
18 Debug MyVar\b[0]
19 Debug MyVar\b[1]
20 Debug MyVar\c(3,3)

```

Example: Call a function by its name

```

1 Prototype Function()
2
3 Runtime Procedure Function1()
4   Debug "I call Function1 by its name"
5 EndProcedure
6
7 Procedure LaunchProcedure(Name.s)
8   Protected ProcedureName.Function = GetRuntimeInteger(Name + "()")
9   ProcedureName()
10 EndProcedure
11
12 LaunchProcedure("Function1") ; Display "I call Function1 by its name"

```

Syntax

```
Declare [.<type>] name(<parameter1[.<type>]> [, <parameter2[.<type>] [=
    DefaultValue]>, ...])
```

Description

Sometimes a procedure need to call another procedure which isn't declared before its definition. This is annoying because the compiler will complain 'Procedure <name> not found'. [Declare](#) can help in this particular case by declaring only the header of the procedure. Nevertheless, the [Declare](#) and real [Procedure](#) declaration must be identical (including the correct type and optional parameters, if any). For advanced programmers [DeclareC](#) is available and will declare the procedure using 'CDecl' instead of 'StandardCall' calling convention.

Example

```
1  Declare Maximum(Value1, Value2)
2
3  Procedure Operate(Value)
4      Maximum(10, 2)      ; At this time, Maximum() is unknown.
5  EndProcedure
6
7  Procedure Maximum(Value1, Value2)
8      ProcedureReturn 0
9  EndProcedure
```

Chapter 57

Protected

Syntax

```
Protected[.<type>] <variable[.<type>]> [= <expression>] [, ...]
```

Description

`Protected` allows a variable to be accessed only in a Procedure even if the same variable has been declared as Global in the main program. `Protected` in its function is often known as 'Local' from other BASIC dialects. Each variable can have a default value directly assigned to it. If a type is specified after `Protected`, the default type is changed for this declaration. `Protected` can also be used with arrays, lists and maps.

The value of the local variable will be reinitialized at each procedure call. To avoid this, you can use the keyword `Static`, to separate global from local variables while keeping their values.

Example: With variable

```
1 Global a
2 a = 10
3
4 Procedure Change()
5     Protected a
6     a = 20
7 EndProcedure
8
9 Change()
10 Debug a ; Will print 10, as the variable has been protected.
```

Example: With array

```
1 Global Dim Array(2)
2 Array(0) = 10
3
4 Procedure Change()
5     Protected Dim Array(2) ; This array is protected, it will be local.
6     Array(0) = 20
7 EndProcedure
8
9 Change()
```

10 | `Debug Array(0) ; Will print 10, as the array has been protected.` |

Chapter 58

Prototypes

Syntax

```
Prototype.<type> name(<parameter>, [, <parameter> [= DefaultValue]...])
```

Description

For advanced programmers. [Prototype](#) allows to declare a type which will map a function. It's useful when used with a variable, to do a function pointer (the variable value will be the address the function to call, and can be changed at will).

This feature can replace the `OpenLibrary()` and `CallFunction()` sequence as it has some advantages: type checking is done, number of parameters is validated.

Unlike `CallFunction()`, it can deal with double, float and quad variables without any problem. To get easily the pointer of a library function, use `GetFunction()`.

The last parameters can have a default value (need to be a constant expression), so if these parameters are omitted when the function is called, the default value will be used.

By default the function will use the standard call convention (`stdcall` on x86, or `fastcall` on x64). If the function pointer will be a C one, the [PrototypeC](#) variant should be used instead.

The pseudotypes can be used for the parameters, but not for the returned value.

Example

```
1  CompilerIf #PB_Compiler_OS <> #PB_OS_Windows
2      CompilerError "This sample only works on Windows"
3  CompilerEndIf
4
5  Prototype.i ProtoMessageBox(Window.i, Body$, Title$, Flags.i = 0)
6
7  If OpenLibrary(0, "User32.dll")
8
9      ; 'MsgBox' is a variable with a 'ProtoMessageBox' type
10     ;
11     MsgBox.ProtoMessageBox = GetFunction(0, "MessageBoxW")
12
13     MsgBox(0, "Hello", "World") ; We don't specify the flags
14 EndIf
```

Example: With pseudotypes

```
1 CompilerIf #PB_Compiler_OS <> #PB_OS_Windows
2   CompilerError "This sample only works on Windows"
3 CompilerEndIf
4
5 ; We use the 'p-ascii' pseudotype for the string parameters, as
6 ; MessageBoxA() is an ascii only function. The compiler will
7 ; automatically converts the strings to unicode when needed.
8 ;
9 Prototype.i ProtoMessageBoxA(Window.i, Body.p-ascii, Title.p-ascii,
   Flags.i = 0)
10
11 If OpenLibrary(0, "User32.dll")
12
13   ; 'MsgBox' is a variable with a 'ProtoMessageBoxA' type
14   ;
15   MsgBox.ProtoMessageBoxA = GetFunction(0, "MessageBoxA")
16
17   MsgBox(0, "Hello", "World") ; We don't specify the flags
18 EndIf
```

Chapter 59

Pseudotypes

Description

For advanced programmers. The pseudotypes are a way to ease the programming when dealing with external libraries which need datatypes that are not internally supported by PureBasic. In this case, it is possible to use the predefined pseudotype which will do the appropriate conversion on the fly, without extra work. As they are not 'real' types, the chosen naming scheme is explicitly different: a 'p-' prefix (for 'pseudo') is part of the type name. The available pseudotypes are:

`p-ascii`: acts as a string type, but will always convert the string to `ascii` before calling the function, even when the program is compiled in `unicode mode`.

It is very useful when accessing a `shared` library which doesn't have `unicode` support in an `unicode` program for example.

`p-utf8`: acts as a string type, but will always convert the string to `utf8` before calling the function. It is very useful when accessing a shared library which needs its `unicode`

string be passed as `UTF8` instead of `ascii` or `unicode` strings.

`p-bstr`: acts as a string type, but will always convert the string to `bstr` before calling the function. It is very useful when accessing a shared library which needs `bstr` parameters, like `COM` components.

`p-unicode`: acts as a string type, but will always convert the string to `unicode` before calling the function, even when the program is compiled in `ascii mode`.

It is very useful when accessing a shared library which only supports `unicode` in an `ascii` program for example.

`p-variant`: acts as a numeric type, will adjust the function call to use the `variant` parameter

correctly. It is very useful when accessing a shared library which needs 'variant' parameters, like COM components.

The pseudotypes can only be used with prototypes, interfaces and imported functions. The pseudotypes does the appropriate conversion only if it is necessary.

Example

```
1  Import "User32.lib"
2
3      ; We use the 'p-ascii' pseudotype for the string parameters, as
4      ; MessageBoxA() is an ASCII only function. The compiler will
5      ; automatically converts the strings to ASCII when needed.
6      ;
7      MessageBoxA(Window.i, Body.p-ascii, Title.p-ascii, Flags.i = 0)
8
9  EndImport
10
11 ; It will work correctly even if the internal PureBasic strings are
12 ; in unicode
13 ; because the compiler will take care of the ASCII conversion
14 ; automatically.
15 ;
16 MessageBoxA(0, "Hello", "World")
```

Chapter 60

PureBasic objects

Introduction

The purpose of this section is to describe the behavior, creation, and handling of objects in PureBasic. For the demonstration, we will use the Image object, but the same logic applies to all other PureBasic objects. When creating an Image object, we can do it in two ways: indexed and dynamic.

I. Indexed numbering

The static, indexed way, allows you to reference an object by a predefined numeric value. The first available index number is 0 and subsequent indexes are allocated sequentially. This means that if you use the number 0 and then the number 1000, 1001 indexes will be allocated and 999 (from 1 to 999) will be unused, which is not an efficient way to use indexed objects. If you need a more flexible method, use the dynamic way of allocating objects, as described in section II. The indexed way offers several advantages:

- Easier handling, since no variables or arrays are required.
- 'Group' processing, without the need to use an intermediate array.
- Use the object in procedures without declaring anything in global (if using a constant or a number).
- An object that is associated with an index is automatically freed when reusing that index.

The maximum index number is limited to an upper bound, depending of the object type (usually from 5000 to 60000). Enumerations are strongly recommended if you plan to use sequential constants to identify your objects (which is also recommended).

Example

```
1 CreateImage(0, 640, 480) ; Create an image, the n°0
2 ResizeImage(0, 320, 240) ; Resize the n°0 image and change its
  @ReferenceLink "handles" "handle"
```

Example

```
1 CreateImage(2, 640, 480) ; Create an image, the n°2
```

```

2 | ResizeImage(2, 320, 240) ; Resize the n°2 image and change its
   | @ReferenceLink "handles" "handle"
3 | CreateImage(2, 800, 800) ; Create a new image in the n°2 index, the
   | old one is automatically free'ed

```

Example

```

1 | For k = 0 To 9
2 |   CreateImage(k, 640, 480) ; Create 10 different images, numbered
   | from 0 to 9
3 |   ResizeImage(k, 320, 240) ; Resize images into half width/height
   | and change its @ReferenceLink "handles" "handle"
4 | Next

```

Example

```

1 | #ImageBackground = 0
2 | #ImageButton     = 1
3 |
4 | CreateImage(#ImageBackground, 640, 480) ; Create an image (n°0)
5 | ResizeImage(#ImageBackground, 320, 240) ; Resize the background image
6 | CreateImage(#ImageButton, 800, 800) ; Create an image (n°1)

```

II. Dynamic numbering

Sometimes, indexed numbering isn't very handy to handle dynamic situations where we need to deal with an unknown number of objects. PureBasic provides an easy and complementary way to create objects in a dynamic manner. Both methods (indexed and dynamic) can be used together at the same time without any conflict. To create a dynamic object, you just have to specify the `#PB_Any` constant instead of the indexed number, and the dynamic number will be returned as result of the function. Then just use this number with the other object functions in the place where you would use an indexed number (except to create a new object). This way of object handling can be very useful when used in combination with a list, which is also a dynamic way of storage.

Example

```

1 | DynamicImage1 = CreateImage(#PB_Any, 640, 480) ; Create a
   | dynamic image
2 | ResizeImage(DynamicImage1, 320, 240) ; Resize the
   | DynamicImage1

```

A complete example of dynamic objects and lists can be found here:
 Further description and an example of dynamic numbering multiple windows and gadgets can be found in the related 'Beginners chapter'.

Overview of the different PureBasic objects

Different PureBasic objects (windows, gadgets, sprites, etc.) can use the same range of object numbers again. So the following objects can be enumerated each one starting at 0 (or other value) and PureBasic differs them by their type:

- Database
- Dialog
- Entity
- File
- FTP
- Gadget (including the ScintillaGadget())
- Gadget3D
- Image
- Library
- Light
- Mail
- Material
- Menu (not MenuItem() , as this is no object)
- Mesh
- Movie
- Music
- Network
- Node
- Particle
- RegularExpression
- SerialPort
- Sound
- Sound3D
- Sprite
- StatusBar
- Texture
- ToolBar
- Window
- Window3D
- XML

Chapter 61

Repeat : Until

Syntax

```
Repeat  
  ...  
Until <expression> [or Forever]
```

Description

This function will loop until the <expression> becomes true. The number of loops is unlimited. If an endless loop is needed then use the `Forever` keyword instead of `Until`. With the `Break` command, it is possible to exit the `Repeat : Until` loop during any iteration. With `Continue` command, the end of the current iteration may be skipped.

Example

```
1  a=0  
2  Repeat  
3    a=a+1  
4  Until a>100
```

This will loop until "a" takes a value > to 100, (it will loop 101 times).

Chapter 62

Residents

Description

Residents are precompiled files which are loaded when the compiler starts. They can be found in the 'residents' folder of the PureBasic installation path. A resident file must have the extension '.res' and can contain the following items: structures , interfaces , prototypes , macros and constants . It can not contain dynamic code or procedures .

When a resident is loaded, all its content is available for the program being compiled. That's why all built-in constants like `#PB_Event_CloseWindow` are available, they are in the 'PureBasic.res' file. All the API structures and constants are also in a resident file. Using residents is a good way to store the common macros, structure and constants so they will be available for every programs. When distributing an user library, it's also a nice solution to provide the needed constants and structures, as PureBasic does.

To create a new resident, the command-line compiler needs to be used, as there is no option to do it from the IDE. It is often needed to use `/IGNORERESIDENT` and `/CREATERESIDENT` at the same time to avoid duplicate errors, as the previous version of the resident is loaded before creating the new one.

Residents greatly help to have a faster compilation and compiler start, as all the information is stored in binary format. It is much faster to load than parsing an include file at every compilation.

Chapter 63

Runtime

Syntax

```
Runtime Variable
Runtime #Constant
Runtime Procedure() declaration
Runtime Enumeration declaration
```

Description

For advanced programmers. `Runtime` is used to create runtime accessible list of programming objects like variables, constants and procedures. Once compiled a program doesn't have variable, constant or procedure label anymore as everything is converted into binary code. `Runtime` enforces the compiler to add an extra reference for a specific object to have it available through the Runtime library. The objects can be manipulated using their string reference, even when the program is compiled.

To illustrate the use of `Runtime`: the Dialog library use it to access the event procedure associated to a gadget . The name of the procedure to use for the event handler is specified in the XML file (which is text format), and then the dialog library use `GetRuntimeInteger()` to resolve the procedure address at runtime. It's not needed to recompile the program to change it.

Another use would be adding a small realtime scripting language to the program, allowing easy modification of exposed variables, using runtime constants values. While it could be done manually by building a map of objects, the `Runtime` keyword allows to do it in a standard and unified way.

Example: Procedure

```
1 Runtime Procedure OnEvent()
2   Debug "OnEvent "
3 EndProcedure
4
5 Debug GetRuntimeInteger("OnEvent()") ; Will display the procedure
   address
```

Example: Enumeration

```
1 Runtime Enumeration
2   #Constant1 = 10
3   #Constant2
4   #Constant3
5 EndEnumeration
```

```
6
7 Debug GetRuntimeInteger("#Constant1")
8 Debug GetRuntimeInteger("#Constant2")
9 Debug GetRuntimeInteger("#Constant3")
```

Example: Variable

```
1 Define a = 20
2 Runtime a
3
4 Debug GetRuntimeInteger("a")
5 SetRuntimeInteger("a", 30)
6
7 Debug a ; the variable has been modified
```

Example: Call a function by its name

```
1 Prototype Function()
2
3 Runtime Procedure Function1()
4     Debug "I call Function1 by its name"
5 EndProcedure
6
7 Runtime Procedure Function2()
8     Debug "I call Function2 by its name"
9 EndProcedure
10
11 Procedure LaunchProcedure(Name.s)
12     Protected ProcedureName.Function = GetRuntimeInteger(Name + "()")
13     ProcedureName()
14 EndProcedure
15
16 LaunchProcedure("Function1") ; Display "I call Function1 by its name"
17 LaunchProcedure("Function2") ; Display "I call Function2 by its name"
```

Chapter 64

Select : EndSelect

Syntax

```
Select <expression1>  
  Case <expression> [, <expression> [<numeric expression> To <numeric  
    expression>]]  
    ...  
  [Case <expression>]  
    ...  
  [Default]  
    ...  
EndSelect
```

Description

`Select` provides the ability to determine a quick choice. The program will execute the `<expression1>` and retain its value in memory. It will then compare this value to all of the `Case <expression>` values and if a given `Case <expression>` value is true, it will then execute the corresponding code and quit the `Select` structure. `Case` supports multi-values and value ranges through the use of the optional `To` keyword (numeric values only). When using the `To` keyword, the range must be in ascending order (lower to higher). If none of the `Case` values are true, then the `Default` code will be executed (if specified). Note: `Select` will accept floats as `<expression1>` but will round them down to the nearest integer (comparisons will be done only with integer values).

Example: Simple example

```
1 Value = 2  
2  
3 Select Value  
4   Case 1  
5     Debug "Value = 1"  
6  
7   Case 2  
8     Debug "Value = 2"  
9  
10  Case 20  
11    Debug "Value = 20"  
12  
13  Default  
14    Debug "I don't know"  
15 EndSelect
```

Example: Multicase and range example

```
1 Value = 2
2
3 Select Value
4   Case 1, 2, 3
5     Debug "Value is 1, 2 or 3"
6
7   Case 10 To 20, 30, 40 To 50
8     Debug "Value is between 10 and 20, equal to 30 or between 40 and
9     50"
10
11  Default
12    Debug "I don't know"
13 EndSelect
```

Chapter 65

Using several PureBasic versions on Windows

Overview

It is possible to install several PureBasic versions on your hard disk at the same time. This is useful to finish one project with an older PureBasic version, and start developing a new project with a new PureBasic version.

How to do it

Create different folders like "PureBasic_v3.94" and "PureBasic_v4" and install the related PureBasic version in each folders.

When one "PureBasic.exe" is started, it will assign all ".pb" files with this version of PureBasic. So when a source code is loaded by double-clicking on the related file, the currently assigned PureBasic version will be started. Beside PureBasic will change nothing, which can affect other PureBasic versions in different folders.

To avoid the automatic assignment of ".pb" files when starting the IDE, a shortcut can be created from PureBasic.exe with "/NOEXT" as parameter. The command line options for the IDE are described here . **Note:** Since PureBasic 4.10, the settings for the IDE are no longer saved in the PureBasic directory but rather in the %APPDATA%\PureBasic directory. To keep the multiple versions from using the same configuration files, the /P /T and /A switches can be used. Furthermore there is the /PORTABLE switch which puts all files back into the PureBasic directory and disabled the creation of the .pb extension.

Chapter 66

Shared

Syntax

```
Shared <variable> [, ...]
```

Description

`Shared` allows a variable, an array, a list or a map to be accessed within a procedure. When `Shared` is used with an array, a list or a map, only the name followed by `()` must be specified.

Example: With variable

```
1  a = 10
2
3  Procedure Change()
4      Shared a
5      a = 20
6  EndProcedure
7
8  Change()
9  Debug a ; Will print 20, as the variable has been shared.
```

Example: With array and list

```
1  Dim Array(2)
2  NewList List()
3  AddElement(List())
4
5  Procedure Change()
6      Shared Array(), List()
7      Array(0) = 1
8      List() = 2
9  EndProcedure
10
11 Change()
12 Debug Array(0) ; Will print 1, as the array has been shared.
13 Debug List() ; Will print 2, as the list has been shared.
```

Chapter 67

Static

Syntax

```
Static [.<type>] <variable[.<type>]> [= <constant expression>] [, ...]
```

Description

Static allows to create a local persistent variable in a Procedure even if the same variable has been declared as Global in the main program. If a type is specified after **Static**, the default type is changed for this declaration. **Static** can also be used with arrays , lists and maps . When declaring a static array, the dimension parameter has to be a constant value.

The value of the variable isn't reinitialized at each procedure call, means you can use local variables parallel to global variables (with the same name), and both will keep their values. Each variable can have a default value directly assigned to it, but it has to be a constant value.

Beside **Static** you can use the keyword **Protected** , to separate global from local variables, but with **Protected** the local variables will not keep their values.

Example: With variable

```
1 Global a
2 a = 10
3
4 Procedure Change ()
5     Static a
6     a+1
7     Debug "In Procedure: "+Str(a) ; Will print 1, 2, 3 as the variable
8     increments at each procedure call.
9 EndProcedure
10
11 Change ()
12 Change ()
13 Change ()
14 Debug a ; Will print 10, as the static variable doesn't affect global
15 one.
```

Example: With array

```
1 Global Dim Array (2)
2 Array (0) = 10
```

```

3
4 Procedure Change()
5     Static Dim Array(2)
6     Array(0)+1
7     Debug "In Procedure: "+Str(Array(0)) ; Will print 1, 2, 3 as the
      value of the array field increments at each procedure call.
8 EndProcedure
9
10 Change()
11 Change()
12 Change()
13 Debug Array(0) ; Will print 10, as the static array doesn't affect
      global one.

```

Example: With multiple procedure

```

1 Procedure Foo()
2     Static x = 100 ; the declaration and the assignment is done only
      once at program start.
3
4     Debug x
5     x + 1
6 EndProcedure
7
8 Foo() ; Display 100
9 Foo() ; Display 101
10 Foo() ; Display 102
11
12 Debug "----"
13
14 Procedure Bar()
15     Static x ; the declaration is done only once at program start.
16     x = 100 ; the assignment is done on every Procedure call.
17
18     Debug x
19     x + 1
20 EndProcedure
21
22 Bar() ; Display 100
23 Bar() ; Display 100
24 Bar() ; Display 100

```

Chapter 68

Structures

Syntax

```
Structure <name> [Extends <name>] [Align <numeric constant expression>]  
    ...  
EndStructure
```

Description

Structure is useful to define user type, and access some OS memory areas. Structures can be used to enable faster and easier handling of data files. It is very useful as you can group into the same object the information which are common. Structures fields are accessed with the `\` option. Structures can be nested. Statics arrays are supported inside structures.

Structure fields must have an explicit type among all Basic Types supported by PureBasic, i.e. Byte (.b), Ascii (.a), Character (.c), Word (.w), Unicode (.u), Long (.l), Integer (.i), Float (.f), Quad (.q), Double (.d), String (.s) and Fixed String (.s{ Length}).

Dynamic objects like arrays, lists and maps are also supported inside structure and are automatically initialized when the object using the structure is created. To declare such field, use the following keywords: **Array**, **List** and **Map**.

Generally, structures are used in association with a variable, an array, a list, or a map. However, advanced users will be able to allocate a memory structure with `AllocateStructure()` and free it with `FreeStructure()`. It is also possible to initialize a structure in memory with `InitializeStructure()`, to copy it with `CopyStructure()`, reset it to zero with `ClearStructure()` and reinitialize it with `ResetStructure()`. It's possible to perform a full structure copy by using the equal affectation between two structure element of the same type.

The optional **Extends** parameter allows to extends another structure with new fields. All fields found in the extended structure will be available in the new structure and will be placed before the new fields.

This is useful to do basic inheritance of structures.

For advanced users only. The optional **Align** parameter allows to adjust alignment between every structure field. The default alignment is 1, meaning no alignment. For example, if the alignment is set to 4, every field offset will be on a 4 byte boundary. It can help to get more performance while accessing structure fields, but it can use more memory, as some space between each fields will be wasted. The special value `#PB_Structure_AlignC` can be used to align the structure as it would be done in language C, useful when importing C structures to use with API functions.

`SizeOf` can be used with structures to get the size of the structure and `OffsetOf` can be used to retrieve the index of the specified field.

Please note, that in structures a **static array[]** doesn't behave like the normal BASIC array (defined using `Dim`) to be conform to the C/C++ structure format (to allow direct API structure porting). This means that `a[2]` will allocate an array from 0 to 1 where `Dim a(2)` will allocate an array from 0 to 2. And library functions `Array` don't work with them.

When using pointers in structures, the `'*` has to be omitted when using the field, once more to ease API code porting. It can be seen as an oddity (and to be honest, it is) but it's like that since the very start of

PureBasic and many, many sources rely on that so it won't be changed.

When using a lot of structure fields you can use the With : EndWith keywords to reduce the amount of code to type and ease its readability.

Example

```
1  Structure Person
2      Name.s
3      ForName.s
4      Age.w
5  EndStructure
6
7  Dim MyFriends.Person(100)
8
9  ; Here the position '0' of the array MyFriend()
10 ; will contain one person and it's own information
11
12 MyFriends(0)\Name = "Andersson"
13 MyFriends(0)\Forname = "Richard"
14 MyFriends(0)\Age = 32
```

Example: A more complex structure (Nested and static array)

```
1  Structure Window
2      *NextWindow.Window ; Points to another window object
3      x.w
4      y.w
5      Name.s[10] ; 10 Names available (from 0 to 9)
6  EndStructure
```

Example: Extended structure

```
1  Structure MyPoint
2      x.l
3      y.l
4  EndStructure
5
6  Structure MyColoredPoint Extends MyPoint
7      color.l
8  EndStructure
9
10 ColoredPoint.MyColoredPoint\x = 10
11 ColoredPoint.MyColoredPoint\y = 20
12 ColoredPoint.MyColoredPoint\color = RGB(255, 0, 0)
```

Example: Structure copy

```
1  Structure MyPoint
2      x.l
3      y.l
4  EndStructure
5
```

```

6 LeftPoint.MyPoint\x = 10
7 LeftPoint\y = 20
8
9 RightPoint.MyPoint = LeftPoint
10
11 Debug RightPoint\x
12 Debug RightPoint\y

```

Example: Dynamic object

```

1 Structure Person
2 Name$
3 Age.l
4 List Friends$()
5 EndStructure
6
7 John.Person
8 John\Name$ = "John"
9 John\Age = 23
10
11 ; Now, add some friends to John
12 ;
13 AddElement(John\Friends$())
14 John\Friends$() = "Jim"
15
16 AddElement(John\Friends$())
17 John\Friends$() = "Monica"
18
19 ForEach John\Friends$()
20 Debug John\Friends$()
21 Next

```

Example: Static, dynamic array and passing a structure to a procedure

```

1 Structure Whatever
2 a.l
3 b.l[2] ; Static array (Standard C) with 2 values b[0] and
b[1], not resizable
4 Array c.l(3,3) ; Dynamic array with 16 values c(0,0) to c(3,3),
resizable with ReDim()
5 EndStructure
6
7 MyVar.Whatever
8
9 Procedure MyProcedure(*blahblah.Whatever)
10 *blahblah\a = 5
11 *blahblah\b[0] = 1
12 *blahblah\b[1] = 2
13 *blahblah\c(3,3) = 33
14 EndProcedure
15
16 MyProcedure(@MyVar)
17 Debug MyVar\a
18 Debug MyVar\b[0]
19 Debug MyVar\b[1]

```

```

20  Debug MyVar\c(3,3)
21
22  ;Debug MyVar\c(0,10) ; Out-of-bounds index error
23  ReDim MyVar\c(3,10) ; Beware, only the last dimension can be resized!
24  Debug MyVar\c(0,10) ; Cool, the array is bigger now!

```

Example: Nested structure(s)

```

1  Structure pointF
2  x.f
3  y.f
4  EndStructure
5
6  Structure Field
7  Field1.q
8  Field2.s{6}
9  Field3.s
10 Array Tab.pointF(3)
11 EndStructure
12
13 Define MyVar.Field
14
15 MyVar\Tab(3)\x = 34.67

```

Example: Alignment

```

1  Structure Type Align 4
2  Byte.b
3  Word.w
4  Long.l
5  Float.f
6  EndStructure
7
8  Debug OffsetOf(Type\Byte) ; will print 0
9  Debug OffsetOf(Type\Word) ; will print 4
10 Debug OffsetOf(Type\Long) ; will print 8
11 Debug OffsetOf(Type\Float) ; will print 12

```

Example: Pointers

```

1  Structure Person
2  *Next.Person ; Here the '*' is mandatory to declare a pointer
3  Name$
4  Age.b
5  EndStructure
6
7  Timo.Person\Name$ = "Timo"
8  Timo\Age = 25
9
10 Fred.Person\Name$ = "Fred"
11 Fred\Age = 25
12
13 Timo\Next = @Fred ; When using the pointer, the '*' is omitted

```

```
14
15 Debug Timo\Next\Name$ ; Will print 'Fred'
```

Syntax

```
StructureUnion
  Field1.Type
  Field2.Type
  ...
EndStructureUnion
```

Description

Structure union are only useful for advanced programmers who want to save some memory by sharing some fields inside the same structure. It's like the 'union' keyword in C/C++.

Note: Each field in the [StructureUnion](#) declaration can be of a different type .

Example

```
1 Structure Type
2   Name$
3   StructureUnion
4     Long.l      ; Each field (Long, Float and Byte) resides at the
5     Float.f     ; same address in memory.
6     Byte.b     ;
7   EndStructureUnion
8 EndStructure
```

Example: Extended example (date handling)

```
1 Structure date
2   day.s{2}
3   pk1.s{1}
4   month.s{2}
5   pk2.s{1}
6   year.s{4}
7 EndStructure
8
9 Structure date2
10  StructureUnion
11  s.s{10}
12  d.date
13 EndStructureUnion
14 EndStructure
15
16 Dim d1.date2(5)
17
18 d1(0)\s = "05.04.2008"
19 d1(1)\s = "07.05.2009"
20
21 Debug d1(0)\d\day
22 Debug d1(0)\d\month
23 Debug d1(0)\d\year
```

```
24
25 Debug d1(1)\d\day
26 Debug d1(1)\d\month
27 Debug d1(1)\d\year
28
29 d2.date2\s = "15.11.2010"
30
31 Debug d2\d\day
32 Debug d2\d\month
33 Debug d2\d\year
```

Chapter 69

Subsystems

Introduction

PureBasic integrated commandset relies on available OS libraries. Sometimes, there is different way to achieve the same goal and when it makes sense, PureBasic offers the possibility to change the used underlying libraries for specific commands, without changing one line of source code. For example, on Windows there is the 'DirectX11' subsystem available, which will use DirectX functions to render sprites, instead of OpenGL (which is the default subsystem). It can be useful to use DirectX instead of OpenGL when wanting a bit quicker rendering on Windows.

To enable a subsystem, its name has to be set in the IDE compiler options , or through the /SUBSYSTEM command-line switch. This is a compile time option, which means an executable can not embed more than one subsystem at once. If multiple support is needed (for example shipping an OpenGL and DirectX version of a game), two executables needs to be created.

The available subsystems are located in the PureBasic 'subsystems' folder. Any residents or libraries found in this drawer will have precedency over the default libraries and residents, when a subsystem is specified. Any number of different subsystems can be specified (as long it doesn't affect the same libraries). As a subsystem is a directory, the subsystem name is case-sensitive on Linux but not on Windows or OS X.

The [Subsystem](#) compiler function can be used to detect if a specific subsystem is used for the compilation.

Available subsystems

Here is a list of available subsystems, and the affected libraries:

Windows

```
DirectX9: use DirectX 9 instead of OpenGL. Affected libraries:
- Sprite
- Screen
- Note: 3D engine no more available as it uses OpenGL
DirectX11: use DirectX 11 instead of OpenGL. Affected libraries:
- Sprite
- Screen
- Note: 3D engine no more available as it uses OpenGL
```

Linux

```
gtk2: Affected libraries:
- 2D Drawing
- AudioCD
- Clipboard
- Desktop
```

- Drag & Drop
- Font
- Gadget
- Image
- Menu
- Movie
- Printer
- Requester
- Scintilla
- StatusBar
- SysTray
- Toolbar
- Window

qt: Affected libraries:

- 2D Drawing
- AudioCD
- Clipboard
- Desktop
- Drag & Drop
- Font
- Gadget
- Image
- Menu
- Movie
- Printer
- Requester
- Scintilla
- StatusBar
- SysTray
- Toolbar
- Window

MacOS X

None

Chapter 70

Threaded

Syntax

```
Threaded[.<type>] <variable[.<type>>] [= <constant expression>] [, ...]
```

Description

`Threaded` allows to create a thread based persistent variable, arrays (except multi-dimensional arrays), lists or maps. This means every thread will have its own version of the object. This is only useful when writing multithreaded programs. If a type is specified after `Threaded`, the default type is changed for this declaration.

Each variable can have a default value directly assigned to it, but it has to be a constant value.

`Threaded` initialization is done at thread first start. That implies when declaring and assigning a threaded variable in the same time, the variable is assigned for all threads. See example 2. When declaring a threaded array, the dimension parameter has to be a constant value.

A `Threaded` object can't be declared in a procedure, its scope is always global.

Example: 1 With variables

```
1  Threaded Counter
2
3  Counter = 128
4
5  Procedure Thread(Parameter)
6
7      Debug Counter ; Will display zero as this thread doesn't have used
      this variable for now
8      Counter = 256
9      Debug Counter ; Will display 256
10
11 EndProcedure
12
13 Thread = CreateThread(@Thread(), 0)
14 WaitThread(Thread) ; Wait for thread ending
15
16 Debug Counter ; Will display 128, even if Counter has been changed in
    the thread
```

Example: 2 All threads

```
1 Threaded Counter = 128 ; Defined for all threads
2
3 Procedure Thread(Parameter)
4
5     Debug Counter ; Will display 128 because a programme started,
        starts a thread too
6     Counter = 256
7     Debug Counter ; Will display 256
8
9 EndProcedure
10
11 Thread = CreateThread(@Thread(), 0)
12 WaitThread(Thread) ; Wait for thread ending
13
14 Debug Counter ; Will display 128, even if Counter has been changed in
        the thread
```

Chapter 71

UserGuide - Advanced functions

<empty for now>

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Chapter 72

UserGuide - Constants

In addition to variables PureBasic provides a method to define constants too. In fact it provides several. Well have a quick look at them now. Predefined constants - provided either by PureBasic itself (all begin with `#PB_`), or from the API for the operating system. The IDEs Structure Viewer tool has a panel which shows all the predefined constants. User defined constants - by defining a constant name with the prefix `#` you can provide your own constants to make code more readable.

```
1 #MyConstant1 = 10
2 #MyConstant2 = "Hello, World!"
```

Enumerations PureBasic will automatically number a series of constants sequentially in an Enumeration, by default enumerations will begin from zero but this can be altered, if desired.

```
1 Enumeration
2 #MyConstantA
3 #MyConstantB
4 #MyConstantC
5 EndEnumeration
6
7 Enumeration 10 Step 5
8 #MyConstantD
9 #MyConstantE
10 #MyConstantF
11 EndEnumeration
12
13 Debug #MyConstantA ; will be 0
14 Debug #MyConstantB ; will be 1
15 Debug #MyConstantC ; will be 2
16
17 Debug #MyConstantD ; will be 10
18 Debug #MyConstantE ; will be 15
19 Debug #MyConstantF ; will be 20
```

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Chapter 73

UserGuide - Storing data in memory

This example gathers information about the files in the logged on user's home directory into a structured list. For now the output isn't very exciting but we will come back to this example later on and make it a bit more friendly in several different ways.

```
1 ; This section describes the fields of a structure or record, mostly
2 ; integers in this case,
3 ; but notice the string for the file name and the quad for the file
4 ; size.
5 Structure FILEITEM
6 Name.s
7 Attributes.i
8 Size.q
9 DateCreated.i
10 DateAccessed.i
11 DateModified.i
12 EndStructure
13 ; Now we define a new list of files using the structure previously
14 ; specified
15 ; and some other working variables we'll use later on.
16 NewList Files.FILEITEM()
17 Define.s Folder
18 Define.l Result
19 ; This function gets the home directory for the logged on user.
20 Folder = GetHomeDirectory()
21 ; Open the directory to enumerate all its contents.
22 Result = ExamineDirectory(0, Folder, " *.*")
23 ; If this is ok, begin enumeration of entries.
24 If Result
25 ; Loop through until NextDirectoryEntry(0) becomes zero -
26 ; indicating that there are no more entries.
27 While NextDirectoryEntry(0)
28 ; If the directory entry is a file, not a folder.
29 If DirectoryEntryType(0) = #PB_DirectoryEntry_File
30 ; Add a new element to the list.
31 AddElement(Files())
32 ; And populate it with the properties of the file.
33 Files()\Name = DirectoryEntryName(0)
34 Files()\Size = DirectoryEntrySize(0)
```

```

35     Files()\Attributes = DirectoryEntryAttributes(0)
36     Files()\DateCreated = DirectoryEntryDate(0, #PB_Date_Created)
37     Files()\DateAccessed = DirectoryEntryDate(0, #PB_Date_Accessed)
38     Files()\DateModified = DirectoryEntryDate(0, #PB_Date_Modified)
39     EndIf
40     Wend
41     ; Close the directory.
42     FinishDirectory(0)
43 EndIf
44
45 ; Shows the results in the debug window (if there is no entry,
    nothing will be displayed)
46 ForEach Files()
47     Debug "Filename = " + Files()\Name
48     Debug "Size = " + Str(Files()\Size)
49     Debug "Attributes = " + StrU(Files()\Attributes)
50     Debug "Created = " + StrU(Files()\DateCreated)
51     Debug "Accessed = " + StrU(Files()\DateAccessed)
52     Debug "Modified = " + StrU(Files()\DateModified)
53 Next Files()

```

Ok, firstly, the dates in the output are just numbers - this isn't very helpful, so let's make them look a bit more familiar. Replace the last three Debug statements with these:

```

1     ...
2     Debug "Created = " + FormatDate("%dd/%mm/%yyyy",
    Files()\DateCreated)
3     Debug "Accessed = " + FormatDate("%dd/%mm/%yyyy",
    Files()\DateAccessed)
4     Debug "Modified = " + FormatDate("%dd/%mm/%yyyy",
    Files()\DateModified)

```

The FormatDate() function takes a date in PureBasic's own numeric date format and displays it in a format that we can specify. So now things should begin to look a bit more sensible. Finally, for now, the list isn't in any particular order, so let's sort the list before we display it. Add this line before the comment about showing the list and the ForEach loop.

```

1     ...
2
3     ; Sort the list into ascending alphabetical order of file name.
4     SortStructuredList(Files(), #PB_Sort_Ascending,
    OffsetOf(FILEITEM\Name), #PB_String)
5
6     ; If there are some entries in the list, show the results in the
    debug window.
7     ...

```

This command takes the structured list, and resorts it into ascending order (#PB_Sort_Ascending), of the Name field of the structure (OffsetOf(FILEITEM\Name)), which is a string value (#PB_String).

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Chapter 74

UserGuide - Decisions & Conditions

There are different ways of processing data obtained from user input or other way (loading from a file, ...). The common arithmetic functions (+, -, *, /, ...) can be combined with conditions. You can use the If : Else/ElseIf : EndIf set of keywords or the Select : Case/Default : EndSelect keywords, just use what is the best for your situation!

This example shows the use of If : ElseIf : Else : EndIf for creating a message, possibly for showing in the status bar of a form (GUI) or something similar, based upon the number of items and filtered items in an, imaginary, list. Note that unlike some other BASIC languages, PureBasic doesn't use the "Then" keyword and that there is no space in the ElseIf and EndIf keywords.

```
1 Define.l Items = 10, Filter = 6
2 Define.s Message
3
4 If Items = 0
5     Message = "List is empty."
6
7 ElseIf Items = 1 And Filter = 0
8     Message = "One item. Not shown by filter."
9
10 ElseIf Items > 1 And Filter = 0
11     Message = StrU(Items) + " items. All filtered."
12
13 ElseIf Items > 1 And Filter = 1
14     Message = StrU(Items) + " items. One shown by filter."
15
16 ElseIf Items = Filter
17     Message = StrU(Items) + " items. None filtered."
18
19 Else
20     ; None of the other conditions were met.
21     Message = StrU(Items) + " items. " + StrU(Filter) + " shown by
22     filter."
23
24 EndIf
25 Debug Message
```

This example shows the use of Select : Case : Default : EndSelect to categorize the first 127 ASCII characters into groups. The "For : Next" loop counts to 130 to demonstrate the Default keyword.

```
1 Define.c Char
2 Define.s Message
3
```

```

4 For Char = 0 To 130
5
6     Select Char
7
8         Case 0 To 8, 10 To 31, 127
9             Message = StrU(Char) + " is a non-printing control code."
10
11        Case 9
12            Message = StrU(Char) + " is a tab."
13
14        Case 32
15            Message = StrU(Char) + " is a space."
16
17        Case 36, 128
18            Message = StrU(Char) + " is a currency symbol. (" + Chr(Char) +
19                ")"
20
21        Case 33 To 35, 37 To 47, 58 To 64, 91 To 96
22            Message = StrU(Char) + " is a punctuation mark or math symbol.
23                (" + Chr(Char) + ")"
24
25        Case 48 To 57
26            Message = StrU(Char) + " is a numeral. (" + Chr(Char) + ")"
27
28        Case 65 To 90
29            Message = StrU(Char) + " is an upper case letter. (" +
30                Chr(Char) + ")"
31
32        Case 97 To 122
33            Message = StrU(Char) + " is a lower case letter. (" + Chr(Char)
34                + ")"
35
36        Default
37            ; If none of the preceding Case conditions are met.
38            Message = "Sorry, I don't know what " + StrU(Char) + " is!"
39
40    EndSelect
41
42    Debug Message
43
44 Next Char

```

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Chapter 75

UserGuide - Compiler directives (for different behavior on different OS)

This will be our last visit to the File Properties program. There is one limitation discussed previously to overcome and we've left it until now because it is a special case.

So far the Attributes column on the display has simply been an integer . This is because the return values of the GetFileAttributes() and DirectoryEntryAttributes() instructions have a different meaning on Windows systems compared with Mac and Linux systems.

We can't allow for this difference at run-time, however we can use Compiler Directives to have the program behave differently on the three different operating systems.

Add this new procedure declaration to that section.

```
1  Declare.s AttributeString(Attributes.l)
```

Add this new procedure to the implementation section.

```
1  Procedure.s AttributeString(Attributes.l)
2      ; Converts an integer attributes value into a string description.
3      ; Supports Linux, Mac and Windows system's attributes.
4
5      Protected.s Result
6
7      Result = ""
8
9      CompilerIf #PB_Compiler_OS = #PB_OS_Windows
10
11          ; These are the attributes for Windows systems.
12          ; A logical-and of the attribute with each constant filters
13          out that bit and can then be used for comparison.
14
15          If Attributes & #PB_FileSystem_Archive
16              Result + "A"
17          Else
18              Result + " "
19          EndIf
20
21          If Attributes & #PB_FileSystem_Compressed
22              Result + "C"
23          Else
24              Result + " "
25          EndIf
26
27          If Attributes & #PB_FileSystem_Hidden
```

```

27         Result + "H"
28     Else
29         Result + " "
30     EndIf
31
32     If Attributes & #PB_FileSystem_ReadOnly
33         Result + "R"
34     Else
35         Result + " "
36     EndIf
37
38     If Attributes & #PB_FileSystem_System
39         Result + "S"
40     Else
41         Result + " "
42     EndIf
43
44 CompilerElse
45
46     ; These are the attributes for Mac and Linux systems.
47
48     If Attributes & #PB_FileSystem_Link
49         Result + "L "
50     Else
51         Result + " "
52     EndIf
53
54     ; User attributes.
55     If Attributes & #PB_FileSystem_ReadUser
56         Result + "R"
57     Else
58         Result + " "
59     EndIf
60
61     If Attributes & #PB_FileSystem_WriteUser
62         Result + "W"
63     Else
64         Result + " "
65     EndIf
66
67     If Attributes & #PB_FileSystem_ExecUser
68         Result + "X "
69     Else
70         Result + " "
71     EndIf
72
73     ; Group attributes.
74     If Attributes & #PB_FileSystem_ReadGroup
75         Result + "R"
76     Else
77         Result + " "
78     EndIf
79
80     If Attributes & #PB_FileSystem_WriteGroup
81         Result + "W"
82     Else
83         Result + " "
84     EndIf
85

```

```

86     If Attributes & #PB_FileSystem_ExecGroup
87         Result + "X "
88     Else
89         Result + " "
90     EndIf
91
92     ; All attributes.
93     If Attributes & #PB_FileSystem_ReadAll
94         Result + "R"
95     Else
96         Result + " "
97     EndIf
98
99     If Attributes & #PB_FileSystem_WriteAll
100        Result + "W"
101    Else
102        Result + " "
103    EndIf
104
105    If Attributes & #PB_FileSystem_ExecAll
106        Result + "X"
107    Else
108        Result + " "
109    EndIf
110
111    CompilerEndIf
112
113    ; Return the result.
114    ProcedureReturn Result
115
116 EndProcedure

```

Finally, replace these two lines in the ListLoad procedure

```

1     ; Convert the attributes to a string, for now.
2     Attrib = StrU(Files()\Attributes)

```

with these,

```

1     ; Call AttributeString to convert the attributes to a string
    representation.
2     Attrib = AttributeString(Files()\Attributes)

```

Now when the program is executed a string display will be shown instead of the integer values. On a Windows system it would look something like this (assuming all attributes are set):

```

1     ACHRS

```

and on the other two systems:

```

1     L RWX RWX RWX

```

The CompilerIf instruction works much like an If instruction - however it is the compiler that makes the decision at compile-time, rather than the executable at run-time. This means that we can include different code to handle the file attributes on the different operating systems.

The lines between:

```

1     CompilerIf #PB_Compiler_OS = #PB_OS_Windows

```

and

```
1 CompilerElse
```

will be compiled on Windows systems. The constant `#PB_Compiler_OS` is automatically defined by PureBasic to allow this kind of program logic.

The other section will be used on Mac and Linux systems - which work the same way, conveniently. If these operating systems had different attribute values too, then we could use `CompilerSelect` and `CompilerCase` to make a three-way determination.

```
1 CompilerSelect #PB_Compiler_OS
2
3 CompilerCase #PB_OS_Linux
4     ; Code for Linux systems.
5
6
7 CompilerCase #PB_OS_MacOS
8     ; Code for Mac systems.
9
10
11 CompilerCase #PB_OS_Windows
12     ; Code for Windows systems.
13
14 CompilerEndSelect
```

The last compiler directive that we're going to discuss here is: `EnableExplicit` .

There is a good reason for using this directive. It requires that all variables must be defined explicitly before usage, in some way, (using `Define` , `Dim` , `Global` , `Protected` , `Static` etc.) Doing so eliminates the possibility of logic errors due to mistyped variable names being defined "on-the-fly". This type of subtle error will not affect a program's compilation but could well present as an inconvenient bug at run-time. Using this directive eliminates this kind of problem as a compiler error would occur.

For example:

```
1 EnableExplicit
2
3 Define.l Field, FieldMax
4
5     ; ...
6
7 If Field < FieldMax
8     ; If EnableExplicit is omitted this section of code may not execute
9     ; when intended because FieldMax will be zero.
10 EndIf
```

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Chapter 76

UserGuide - Reading and writing files

This example will write 100 random records each containing a byte , a floating-point number , a long integer and a string . It then reads all the records back and displays them in the debug window . It demonstrates the `GetTemporaryDirectory()` , `CreateFile()` , `OpenFile()` , `Eof()` and a number of `Read` and `Write` data instructions too.

It works fine as far as it goes, but has a drawback. As the string value has a variable length - you can't randomly access the records because you can't predict where each new record will start in the file. They must be all be read back in the same sequence as they were written. This isn't a problem with the small number of records created here but this could be an inconvenience with a larger file. PureBasic offers a way to handle this situation too - but an example would be too complex for this topic. See the Database sections of the help-file or reference manual to see how it could be done.

```
1 EnableExplicit
2 ; Define the constants:
3 #MAXBYTE = 255
4 #MAXLONG = 2147483647
5
6 ; Define some variables.
7 Define.f Float
8 Define.i Count, File
9 Define.s Folder, FileName, String
10
11 ; Create a temporary file name.
12 Folder = GetTemporaryDirectory()
13 FileName = Folder + "test.data"
14
15 ; Create the temporary file.
16 ; If #PB_Any is used, CreateFile returns the file's number.
17 ; Useful if you may have more than one file open simultaneously.
18 File = CreateFile(#PB_Any, FileName)
19
20 If File
21 ; If this was successful - write 100 random records.
22 For Count = 1 To 100
23
24 ; Write a random byte (0 - 255).
25 WriteByte(File, Random(#MAXBYTE))
26
27 ; Create and write a random float.
28 ; This calculation is there to make the number have a
floating-point component (probably).
29 Float = Random(#MAXLONG) / ((Random(7) + 2) * 5000)
30 WriteFloat(File, Float)
```

```

31
32     ; Write a random long.
33     WriteLong(File, Random(#MAXLONG))
34
35     ; Create and write a random string in Unicode format.
36     ; Note the use of WriteStringN to delimit the string with an end
of line marker.
37     String = "String " + StrU(Random(#MAXLONG))
38     WriteStringN(File, String, #PB_Unicode)
39
40     Next Count
41
42     ; Close the file.
43     CloseFile(File)
44
45 Else
46     ; If this was unsuccessful.
47     Debug "Could not create the file: " + FileName
48
49 EndIf
50
51 ; Open the file for reading this time.
52 File = ReadFile(#PB_Any, FileName)
53
54 If File
55     ; If this was successful - read and display records from the file.
56
57     ; Reset the counter.
58     Count = 1
59
60     ; Loop until the 'end of file' is reached.
61     ; This will read all of the records regardless of how many there
are.
62     While Eof(File) = 0
63
64         ; Print a header line.
65         Debug
"-----
66
67         Debug "[" + StrU(Count) + "]"
68         Count + 1
69         ; Read a byte value and print it.
70         Debug StrU(ReadByte(File), #PB_Byte)
71
72         ; Read a float value.
73         Debug StrF(ReadFloat(File))
74
75         ; Read a long value.
76         Debug StrU(ReadLong(File), #PB_Long)
77
78         ; Read a string value.
79         Debug ReadString(File, #PB_Unicode)
80
81     Wend
82
83     ; Print the trailing line.
84     Debug
"-----
85

```

```
86     ; Close the file.
87     CloseFile(File)
88
89     ; Tidy up.
90     DeleteFile(FileName)
91
92 Else
93     ; If this was unsuccessful.
94     Debug "Could not open the file: " + FileName
95
96 EndIf
```

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Chapter 77

UserGuide - First steps with the Debug output (variables & operators)

Normally we would present here the typical "Hello World". You want to see it? Ok here we go with two examples:

Debug output

"Hello World" in the Debug output window:

```
1  Debug "Hello World!"
```

MessageRequester

"Hello World" in a MessageRequester() :

```
1  MessageRequester("", "Hello World!")
```

Advanced Debug example

We now continue with a short example using the available variable types, arithmetic operators and displaying the result:

```
1  a = 5
2  b = 7
3  c = 3
4
5  d = a + b ; we use the values stored in variables 'a' and 'b' and
   save the sum of them in 'd'
6  d / c ; we directly use the value of 'd' (= 12) divided by the
   value of 'c' (= 3) and save the result in 'd'
7
8  Debug d ; will output 4
```

This way you have used variables "on the fly". To force the compiler always declaring variables before their first use, just use the keyword `EnableExplicit` .

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Chapter 78

UserGuide - Displaying graphics output & simple drawing

This example show how to create a simple drawing. It uses the 2D drawing commands to draw two sine waves at different frequencies and shows the harmonic produced by combining the two waves. It uses procedures , which we will discuss in more detail later on, to break the drawing tasks into three self-contained tasks:

Drawing the axes - demonstrates the Line() command.

Drawing the legend - demonstrates the Box() and DrawText() commands.

Drawing the wave forms - demonstrates the LineXY() command and shows how to use color.

```
1 ; Window
2 Enumeration
3     #WinHarmonic
4 EndEnumeration
5
6 ; Gadgets
7 Enumeration
8     #txtPlot1
9     #cboPlot1
10    #txtPlot2
11    #cboPlot2
12    #imgPlot
13 EndEnumeration
14
15 ; Image
16 Enumeration
17     #drgPlot
18 EndEnumeration
19
20 ; Image dimensions are used in several places so define constants.
21 #imgPlotX = 8
22 #imgPlotY = 40
23 #imgPlotW = 745
24 #imgPlotH = 645
25
26 ; Event variables
27 Define.l Event, EventWindow, EventGadget, EventType, EventMenu
28
29 ; Implementation
30 Procedure CreateWindow()
31     ; Creates the window and gadgets.
32
```

```

33   If OpenWindow(#WinHarmonic, 30, 30, #imgPlotW + 20, #imgPlotH + 55,
    "Harmonics", #PB_Window_SystemMenu | #PB_Window_MinimizeGadget |
    #PB_Window_TitleBar)
34
35       ; This is a non-visual gadget used to draw the image, later its
    contents will be displayed in #imgPlot.
36       CreateImage(#drgPlot, #imgPlotW - 5, #imgPlotH - 5, 24)
37
38       ; Label for the Plot 1 combo.
39       TextGadget(#txtPlot1, 2, 5, 50, 25, "Plot 1:")
40
41       ; The Plot 1 combo.
42       ComboBoxGadget(#cboPlot1, 55, 5, 150, 25)
43       AddGadgetItem(#cboPlot1, 0, "Sin(X)")
44       AddGadgetItem(#cboPlot1, 1, "Sin(X * 2)")
45       AddGadgetItem(#cboPlot1, 2, "Sin(X * 3)")
46       AddGadgetItem(#cboPlot1, 3, "Sin(X * 4)")
47       AddGadgetItem(#cboPlot1, 4, "Sin(X * 5)")
48       AddGadgetItem(#cboPlot1, 5, "Sin(X * 6)")
49
50       ; Select Sin(X)
51       SetGadgetState(#cboPlot1, 0)
52
53       ; Label for the Plot 2 combo.
54       TextGadget(#txtPlot2, 230, 5, 50, 25, "Plot 2:")
55
56       ; The Plot 2 combo.
57       ComboBoxGadget(#cboPlot2, 280, 5, 150, 25)
58       AddGadgetItem(#cboPlot2, 0, "Sin(X)")
59       AddGadgetItem(#cboPlot2, 1, "Sin(X * 2)")
60       AddGadgetItem(#cboPlot2, 2, "Sin(X * 3)")
61       AddGadgetItem(#cboPlot2, 3, "Sin(X * 4)")
62       AddGadgetItem(#cboPlot2, 4, "Sin(X * 5)")
63       AddGadgetItem(#cboPlot2, 5, "Sin(X * 6)")
64
65       ; Select Sin(X * 2), otherwise the initial display is a bit
    uninteresting.
66       SetGadgetState(#cboPlot2, 1)
67
68       ; The visual image gadget on the window.
69       ImageGadget(#imgPlot, #imgPlotX, #imgPlotY, #imgPlotW, #imgPlotH,
    0, #PB_Image_Border)
70
71   EndIf
72
73 EndProcedure
74
75 Procedure PlotAxes()
76     ; Draws the axes on the image #drgPlot.
77
78     ; Send drawing commands to #drgPlot.
79     StartDrawing(ImageOutput(#drgPlot))
80
81     ; Draw a white background.
82     Box(0, 0, ImageWidth(#drgPlot), ImageHeight(#drgPlot), RGB(255,
    255, 255))
83
84     ; Draw the axes in black.
85     Line(1, 1, 1, ImageHeight(#drgPlot) - 2, RGB(0, 0, 0))

```

```

86     Line(1, (ImageHeight(#drgPlot) - 2) / 2, ImageWidth(#drgPlot) - 2,
1, RGB(0, 0, 0))
87
88     ; Finished drawing.
89     StopDrawing()
90 EndProcedure
91
92 Procedure PlotLegend(alngPlot1, alngPlot2)
93     ; Draws the legend on the image #drgPlot.
94
95     Protected.s strFunc1, strFunc2, strLabel1, strLabel2, strLabel3
96
97     ; Set label text 1.
98     If alngPlot1 = 0
99         strFunc1 = "Sin(X)"
100    Else
101        strFunc1 = "Sin(X * " + StrU(alngPlot1 + 1) + ")"
102    EndIf
103
104    ; Set label text 2.
105    If alngPlot2 = 0
106        strFunc2 = "Sin(X)"
107    Else
108        strFunc2 = "Sin(X * " + StrU(alngPlot2 + 1) + ")"
109    EndIf
110
111    ; Set label text.
112    strLabel1 = "Y = " + strFunc1
113    strLabel2 = "Y = " + strFunc2
114    strLabel3 = "Y = " + strFunc1 + " + " + strFunc2
115
116    ; Draw legend.
117    StartDrawing(ImageOutput(#drgPlot))
118
119    ; Box.
120    DrawingMode(#PB_2DDrawing_Outlined)
121    Box(20, 10, TextWidth(strLabel3) + 85, 80, RGB(0, 0, 0))
122
123    ; Label 1.
124    Line(30, 30, 50, 1, RGB(0, 0, 255))
125    DrawText(95, 22, strLabel1, RGB(0, 0, 0), RGB(255, 255, 255))
126
127    ; Label 2.
128    Line(30, 50, 50, 1, RGB(0, 255, 200))
129    DrawText(95, 42, strLabel2, RGB(0, 0, 0), RGB(255, 255, 255))
130
131    ; Label 3.
132    Line(30, 70, 50, 1, RGB(255, 0, 0))
133    DrawText(95, 62, strLabel3, RGB(0, 0, 0), RGB(255, 255, 255))
134
135    StopDrawing()
136
137 EndProcedure
138
139 Procedure PlotFunction(alngPlot1, alngPlot2)
140     ; Draws the waveforms on the image #drgPlot.
141
142     Protected.l lngSX, lngEX
143     Protected.f fltRad1, fltRad2, fltSY1, fltEY1, fltSY2, fltEY2,

```

```

144 fltSY3, fltEY3
145 StartDrawing(ImageOutput(#drgPlot))
146
147 ; Set initial start points for each wave.
148 lngSX = 1
149 fltSY1 = ImageHeight(#drgPlot) / 2
150 fltSY2 = fltSY1
151 fltSY3 = fltSY1
152
153 ; Plot wave forms.
154 For lngEX = 1 To 720
155 ; Sine function works in radians, so convert from degrees and
calculate sine.
156
157 ; Function 1
158 If alngPlot1 = 0
159 fltRad1 = Sin(Radian(lngEX))
160 Else
161 ; If the function should have a multiplier, account for this.
162 fltRad1 = Sin(Radian(lngEX) * (alngPlot1 + 1))
163 EndIf
164
165 ; Function 2
166 If alngPlot2 = 0
167 fltRad2 = Sin(Radian(lngEX))
168 Else
169 fltRad2 = Sin(Radian(lngEX) * (alngPlot2 + 1))
170 EndIf
171
172 ; Plot function 1 in blue.
173 ; Calculate end Y point.
174 fltEY1 = (ImageHeight(#drgPlot) / 2) + (fltRad1 * 100)
175 ; Draw a line from the start point to the end point.
176 LineXY(lngSX, fltSY1, lngEX, fltEY1, RGB(0, 0, 255))
177 ; Update the next start Y point to be the current end Y point.
178 fltSY1 = fltEY1
179
180 ; Plot function 2 in green.
181 fltEY2 = (ImageHeight(#drgPlot) / 2) + (fltRad2 * 100)
182 LineXY(lngSX, fltSY2, lngEX, fltEY2, RGB(0, 255, 200))
183 fltSY2 = fltEY2
184
185 ; Plot harmonic in red.
186 fltEY3 = (ImageHeight(#drgPlot) / 2) + ((fltRad1 + fltRad2) *
100)
187 LineXY(lngSX, fltSY3, lngEX, fltEY3, RGB(255, 0, 0))
188 fltSY3 = fltEY3
189
190 ; Update the start X point to be the current end X point.
191 lngSX = lngEX
192 Next lngEX
193
194 StopDrawing()
195
196 EndProcedure
197
198 ;- Main
199 CreateWindow()

```

```

200 PlotAxes()
201 PlotLegend(GetGadgetState(#cboPlot1), GetGadgetState(#cboPlot2))
202 PlotFunction(GetGadgetState(#cboPlot1), GetGadgetState(#cboPlot2))
203
204 ; Reload the image gadget now drawing is complete.
205 ImageGadget(#imgPlot, #imgPlotX, #imgPlotY, #imgPlotW, #imgPlotH,
    ImageID(#drgPlot), #PB_Image_Border)
206
207 ;- Event loop
208 Repeat
209     Event = WaitWindowEvent()
210     EventWindow = EventWindow()
211     EventGadget = EventGadget()
212     EventType = EventType()
213
214     Select Event
215         Case #PB_Event_Gadget
216             If EventGadget = #txtPlot1 Or EventGadget = #txtPlot2
217                 ; Do nothing.
218             ElseIf EventGadget = #imgPlot
219                 ; Do nothing.
220             ElseIf EventGadget = #cboPlot1 Or EventGadget = #cboPlot2
221                 ; If one of the combo boxes changed, redraw the image.
222                 PlotAxes()
223                 PlotLegend(GetGadgetState(#cboPlot1),
    GetGadgetState(#cboPlot2))
224                 PlotFunction(GetGadgetState(#cboPlot1),
    GetGadgetState(#cboPlot2))
225                 ImageGadget(#imgPlot, #imgPlotX, #imgPlotY, #imgPlotW,
    #imgPlotH, ImageID(#drgPlot), #PB_Image_Border)
226             EndIf
227         Case #PB_Event_CloseWindow
228             If EventWindow = #WinHarmonic
229                 CloseWindow(#WinHarmonic)
230             Break
231         EndIf
232     EndSelect
233 ForEver

```

UserGuide Navigation

< Previous: Building a graphical user interface (GUI) || Overview || Next: Structuring code in Procedures >

Chapter 79

UserGuide - Building a graphical user interface (GUI)

In addition to the console window , PureBasic supports the creation of graphical user interfaces (GUI) too. So let's revisit the file properties example from previous items again and turn it into a GUI application.

Note that PureBasic provides a far easier way of getting this particular job done already - the ExplorerListGadget() ; but, as the example is intended to introduce managing GUI elements, using that gadget would defeat this object a bit.

```
1 ; The structure for file information as before.
2 Structure FILEITEM
3     Name.s
4     Attributes.i
5     Size.q
6     DateCreated.i
7     DateAccessed.i
8     DateModified.i
9 EndStructure
10
11 ; This is a constant to identify the window.
12 Enumeration
13     #WindowFiles
14 EndEnumeration
15
16 ; This is an enumeration to identify controls which will appear on
17 the window.
18 Enumeration
19     #Folder
20     #Files
21 EndEnumeration
22
23 ; Now we define a list of files using the structure previously
24 specified.
25 NewList Files.FILEITEM()
26
27 ; And some working variables to make things happen.
28 Define.s Access, Attrib, Create, Folder, Modify, Msg, Num, Size
29 Define.l Result, Flags
30
31 ; These variables will receive details of GUI events as they occur in
32 the program.
33 Define.l Event, EventWindow, EventGadget, EventType, EventMenu
```

```

31
32 ; This function gets the home directory for the logged on user.
33 Folder = GetHomeDirectory()
34
35 ; Open the directory to enumerate its contents.
36 Result = ExamineDirectory(0, Folder, "*.*")
37
38 ; If this is ok, begin enumeration of entries.
39 If Result
40     ; Loop through until NextDirectoryEntry(0) becomes zero -
    indicating that there are no more entries.
41     While NextDirectoryEntry(0)
42         ; If the directory entry is a file, not a folder.
43         If DirectoryEntryType(0) = #PB_DirectoryEntry_File
44
45             ; Add a new element to the list.
46             AddElement(Files())
47             ; And populate it with the properties of the file.
48             Files()\Name = DirectoryEntryName(0)
49             Files()\Size = DirectoryEntrySize(0)
50             Files()\Attributes = DirectoryEntryAttributes(0)
51             Files()\DateCreated = DirectoryEntryDate(0, #PB_Date_Created)
52             Files()\DateAccessed = DirectoryEntryDate(0, #PB_Date_Accessed)
53             Files()\DateModified = DirectoryEntryDate(0, #PB_Date_Modified)
54         EndIf
55     Wend
56     ; Close the directory.
57     FinishDirectory(0)
58 EndIf
59
60 ; Sort the list into ascending alphabetical order of file name.
61 SortStructuredList(Files(), #PB_Sort_Ascending,
    OffsetOf(FILEITEM\Name), #PB_String)
62
63 ; The interesting stuff starts to happen here...
64
65 ; This line defines a flag for the window attributes by OR-ing
    together the desired attribute constants.
66 Flags = #PB_Window_SystemMenu | #PB_Window_SizeGadget |
    #PB_Window_MinimizeGadget | #PB_Window_MaximizeGadget |
    #PB_Window_TitleBar
67
68 ; Open a GUI window.
69 OpenWindow(#WindowFiles, 50, 50, 450, 400, "File Properties", Flags)
70 ; A text gadget to show the name of the folder.
71 TextGadget(#Folder, 5, 40, 440, 25, Folder)
72 ; A list icon gadget to hold the file list and properties.
73 ListIconGadget(#Files, 5, 70, 440, 326, "#", 35)
74 ; Add columns to the ListIconGadget to hold each property.
75 AddGadgetColumn(#Files, 1, "Name", 200)
76 AddGadgetColumn(#Files, 2, "Created", 100)
77 AddGadgetColumn(#Files, 3, "Accessed", 100)
78 AddGadgetColumn(#Files, 4, "Modified", 100)
79 AddGadgetColumn(#Files, 5, "Attributes", 150)
80 AddGadgetColumn(#Files, 6, "Size", 100)
81
82 ; Load the files into the list view.
83 ForEach Files()
84     ; Display the item number and file name.

```

```

85     Num = StrU(ListIndex(Files()) + 1)
86
87     ; These lines convert the three date values to something more
familiar.
88     Create = FormatDate("%dd/%mm/%yyyy", Files()\DateCreated)
89     Access = FormatDate("%dd/%mm/%yyyy", Files()\DateAccessed)
90     Modify = FormatDate("%dd/%mm/%yyyy", Files()\DateModified)
91
92     ; Convert the file size to a padded string the same as with the
index value above,
93     ; but allow space for the maximum size of a quad.
94     Size = StrU(Files()\Size)
95
96     ; Convert the attributes to a string, for now.
97     Attrib = StrU(Files()\Attributes)
98
99     ; Build a row string.
100    ; The Line Feed character 'Chr(10)' tells the gadget to move to the
next column.
101    Msg = Num + Chr(10) + Files()\Name + Chr(10) + Create + Chr(10) +
Access + Chr(10) + Modify + Chr(10) + Attrib + Chr(10) + Size
102
103    ; Add the row to the list view gadget.
104    AddGadgetItem(#Files, -1, Msg)
105 Next Files()
106
107 ; This is the event loop for the window.
108 ; It will deal with all the user interaction events that we wish to
use.
109
110 Repeat
111     ; Wait until a new window or gadget event occurs.
112     Event = WaitWindowEvent()
113     ; In programs with more than one form, which window did the event
occur on.
114     EventWindow = EventWindow()
115     ; Which gadget did the event occur on.
116     EventGadget = EventGadget()
117     ; What sort of event occurred.
118     EventType = EventType()
119
120     ; Take some action.
121     Select Event
122
123         Case #PB_Event_Gadget
124             ; A gadget event occurred.
125             If EventGadget = #Folder
126                 ElseIf EventGadget = #Files
127                     EndIf
128
129             Case #PB_Event_CloseWindow
130                 ; The window was closed.
131                 If EventWindow = #WindowFiles
132                     CloseWindow(#WindowFiles)
133                     Break
134                 EndIf
135
136     EndSelect
137

```

```
138 |         ; Go round and do it again.  
139 |         ; In practice the loop isn't infinite because it can be stopped by  
      | clicking the window's Close button.  
140 | Forever
```

At this point the application already has some useful features. However, it has some problems too:

- 1) You can't choose a folder to show.
- 2) You can't update the list contents without closing and restarting the program.
- 3) If you resize the window, the gadgets don't resize with it.
- 4) The attributes column is still not very useful.

We will revisit this program again later on to fix all these issues.

UserGuide Navigation

< Previous: Displaying text output (Console) || Overview || Next: Displaying graphics output & simple drawing >

Chapter 80

UserGuide - Input & Output

Every PureBasic application can communicate and interact with the user on different ways.

Thereby we distinguish between

- a) the pure output of information
- b) the interaction of the PureBasic application with the user, when user-input will be taken and the results will be outputted again.

It's not possible anymore, to use a simple "PRINT" command to output some things on the screen, like it was possible on DOS operating systems (OS) without a graphical user interface (GUI) years ago.

Today such a GUI is always present, when you use an actual OS like Windows, Mac OSX or Linux.

For the output of information we have different possibilities:

- Debug window (only possible during programming with PureBasic)
- MessageRequester() (output of shorter text messages in a requester window)
- Files (for saving the results in a text-file, etc.)
- Console (for simple and almost non-graphic text output, most similar to earlier DOS times)
- Windows and gadgets (standard windows with GUI elements on the desktop of the OS, e.g. for applications)
- Screen (Output of text and graphics directly on the screen, e.g. for games)

To be able to **record and process input by the user** of the PureBasic application, the three last-mentioned output options have also the possibility to get user-input:

- in the console using Input()
- in the window using WaitWindowEvent() / WindowEvent() , which can get the events occurred in the window , like clicking on a button or the entered text in a StringGadget()
- in the graphics screen using the keyboard
- there is as well the possibility to get user-input using the InputRequester()

UserGuide Navigation

< Previous: Storing data in memory || Overview || Next: Displaying text output (Console) >

Chapter 81

UserGuide - Other Compiler keywords

<empty for now>

UserGuide Navigation

< Previous: Managing multiple windows || Overview || Next: Other Library functions >

Chapter 82

UserGuide - Other Library functions

<empty for now>

UserGuide Navigation

< Previous: Other Compiler keywords || Overview || Next: Advanced functions >

Chapter 83

UserGuide - Loops

Data, Events or many other things can also be processed using loops, which are always checked for a specific condition. Loops can be: Repeat : Until , Repeat : Forever , While : Wend , For : Next , ForEach : Next .

In this loop the counter A is increased by two each time, this loop will always perform the same number of iterations.

```
1 Define .i A
2 For A = 0 To 10 Step 2
3   Debug A
4 Next A
```

This loop will increment the variable B by a random amount between 0 and 20 each time, until B exceeds 100. The number of iterations actually performed in the loop will vary depending on the random numbers. The check is performed at the start of the loop - so if the condition is already true, zero iterations may be performed. Take the ; away from the second line to see this happen.

```
1 Define .i B
2 ; B = 100
3 While B < 100
4   B + Random(20)
5   Debug B
6 Wend
```

This loop is very similar to the last except that the check is performed at the end of the loop. So one iteration, at least, will be performed. Again remove the ; from the second line to demonstrate.

```
1 Define .i C
2 ; C = 100
3 Repeat
4   C + Random(20)
5   Debug C
6 Until C > 99
```

This loop is infinite. It won't stop until you stop it (use the red X button on the IDE toolbar).

```
1 Define .i D
2 Repeat
3   Debug D
4 ForEver
```

There is a special loop for working with lists and maps , it will iterate every member of the list (or map) in turn.

```
1  NewList Fruit.s()
2
3  AddElement(Fruit())
4  Fruit() = "Banana"
5
6  AddElement(Fruit())
7  Fruit() = "Apple"
8
9  AddElement(Fruit())
10 Fruit() = "Pear"
11
12 AddElement(Fruit())
13 Fruit() = "Orange"
14
15 ForEach Fruit()
16     Debug Fruit()
17 Next Fruit()
```

UserGuide Navigation

< Previous: Decisions & Conditions || Overview || Next: String Manipulation >

Chapter 84

UserGuide - Memory access

Some PureBasic instructions, for example those from the Cipher library and many operating system API calls, require a pointer to a memory buffer as an argument rather than the data directly itself.

PureBasic provides a number of instructions to manipulate memory buffers to facilitate this.

This example uses a buffer to read a file from disk into memory. It then converts the buffer content into a hexadecimal and text display in a ListIconGadget() as a simple hex viewer application.

An ExplorerListGadget() is used to display the contents of the user's home directory, initially, and to allow selection of a file. Two buttons are provided, one to display a file and another to clear the display. The ListIcon Gadget is divided into nine columns, the first shows the base offset of each line in the list, the next show eight byte values offset from the base value and the ninth shows the string equivalent of these eight values.

Two pointers are used - the first (*Buffer) contains the memory address of the complete file. The second (*Byte), in the procedure "FileDisplay", demonstrates the use of pointer arithmetic and the Peek instruction to obtain individual values from within the buffer.

Finally, the "FileClose" procedure demonstrates the use of the FillMemory() instruction to overwrite the buffer's contents and FreeMemory() to de-allocate the memory buffer.

```
1  ; - Compiler Directives
2  EnableExplicit
3
4  ; - Constants
5  ; Window
6  Enumeration
7      #WindowHex
8  EndEnumeration
9
10 ; Gadgets
11 Enumeration
12     #GadgetFiles
13     #GadgetOpen
14     #GadgetClose
15     #GadgetHex
16 EndEnumeration
17
18 ; - Variables
19 Define.l Event, EventWindow, EventGadget, EventType, EventMenu
20 Define.l Length
21 Define.s File
22 Define *Buffer
23
24 ; - Declarations
25 Declare WindowCreate()
26 Declare WindowResize()
```

```

27 Declare FileClose()
28 Declare FileDisplay()
29 Declare FileRead()
30
31 ; - Implementation
32 Procedure WindowCreate()
33     ; Create the window.
34
35     Protected.l Col
36     Protected.s Label
37
38     If OpenWindow(#WindowHex, 50, 50, 500, 400, "Hex View",
#PB_Window_SystemMenu | #PB_Window_SizeGadget |
#PB_Window_MinimizeGadget | #PB_Window_TitleBar)
39
40         ; Set minimum window size.
41         WindowBounds(#WindowHex, 175, 175, #PB_Ignore, #PB_Ignore)
42
43         ; Create Explorer List and set to user's home directory.
44         ExplorerListGadget(#GadgetFiles, 5, 5, 490, 175,
GetHomeDirectory())
45
46         ; Buttons.
47         ButtonGadget(#GadgetOpen, 5, 185, 80, 25, "Open")
48         ButtonGadget(#GadgetClose, 100, 185, 80, 25, "Close")
49
50         ; List Icon Gadget.
51         ListIconGadget(#GadgetHex, 5, 215, 490, 180, "Offset", 80,
#PB_ListIcon_AlwaysShowSelection | #PB_ListIcon_GridLines |
#PB_ListIcon_FullRowSelect)
52
53         ; Column Headings.
54         For Col = 0 To 7
55             Label = RSet(Hex(Col, #PB_Byte), 2, "0")
56             AddGadgetColumn(#GadgetHex, Col + 1, Label, 38)
57         Next Col
58         AddGadgetColumn(#GadgetHex, 9, "Text", 80)
59
60     EndIf
61
62 EndProcedure
63
64 Procedure WindowResize()
65     ; Resize gadgets to new window size.
66
67     Protected.l X, Y, W, H
68
69     ; Explorer List
70     W = WindowWidth(#WindowHex) - 10
71     H = (WindowHeight(#WindowHex) - 35) / 2
72     ResizeGadget(#GadgetFiles, #PB_Ignore, #PB_Ignore, W, H)
73
74     ; Buttons
75     Y = GadgetHeight(#GadgetFiles) + 10
76     ResizeGadget(#GadgetOpen, #PB_Ignore, Y, #PB_Ignore, #PB_Ignore)
77     ResizeGadget(#GadgetClose, #PB_Ignore, Y, #PB_Ignore, #PB_Ignore)
78
79     ; List Icon View
80     Y = (WindowHeight(#WindowHex) / 2) + 23

```

```

81     W = WindowWidth(#WindowHex) - 10
82     H = WindowHeight(#WindowHex) - (Y + 5)
83     ResizeGadget(#GadgetHex, #PB_Ignore, Y, W, H)
84
85 EndProcedure
86
87 Procedure FileClose()
88     ; Clear the list view and release the memory buffer.
89
90     Shared Length, *Buffer
91
92     ClearGadgetItems(#GadgetHex)
93     FillMemory(*Buffer, Length)
94     FreeMemory(*Buffer)
95
96 EndProcedure
97
98 Procedure FileDisplay()
99     ; Display the file buffer in the list view.
100
101     Shared Length, *Buffer
102
103     Protected *Byte
104     Protected Peek
105     Protected.l Rows, Cols, Offset
106     Protected.s OffsetString, Row, String
107
108     ; Clear current contents.
109     ClearGadgetItems(#GadgetHex)
110
111     ; Loop through rows.
112     For Rows = 0 To Length - 1 Step 8
113
114         ; Clear the text value for each row.
115         String = ""
116
117         ; Convert the offset value to a fixed length string.
118         Row = RSet(Hex(Rows, #PB_Long), 6, "0") + Chr(10)
119
120         ; Loop through columns.
121         For Cols = 0 To 7
122
123             ; Calculate the offset for the current column.
124             Offset = Rows + Cols
125
126             ; Compare the offset with the file length.
127             If Offset < Length
128                 ; The offset is less than the length of the file.
129
130                 ; Obtain the byte from the buffer.
131                 *Byte = *Buffer + Offset
132                 Peek = PeekB(*Byte)
133
134                 ; Convert the byte to text.
135                 Row + RSet(Hex(Peek, #PB_Byte), 2, "0") + Chr(10)
136
137                 ; Add the character to the text version.
138                 Select Peek
139

```

```

140         Case 0 To 31, 127
141             ; Unprintable characters.
142             String + Chr(129)
143
144         Default
145             ; Printable characters.
146             String + Chr(Peek)
147
148     EndSelect
149
150 Else
151     ; The offset is greater than the length of the file.
152
153     ; Add an empty column.
154     Row + Chr(10)
155
156 EndIf
157
158 Next Cols
159
160 ; Add the text version at the end of the hex columns.
161 Row + String
162
163 ; Add the completed row to the list view.
164 AddGadgetItem(#GadgetHex, -1, Row)
165
166 Next Rows
167
168 EndProcedure
169
170 Procedure FileRead()
171     ; Read the file into the memory buffer.
172
173     Shared Length, File, *Buffer
174
175     Protected.b ReadByte
176     Protected.l FileNumber, ReadLong, Size
177
178     ; Stop if file is empty.
179     If File = ""
180         ProcedureReturn
181     EndIf
182
183     ; Stop if file size is invalid.
184     Size = FileSize(File)
185     If Size < 1
186         ProcedureReturn
187     EndIf
188
189     ; Open the file.
190     FileNumber = OpenFile(#PB_Any, File)
191     Length = Lof(FileNumber)
192
193     If File And Length
194
195         ; Allocate a memory buffer to hold the file.
196         *Buffer = AllocateMemory(Length)
197
198         ; Read the file into the buffer.

```

```

199     Length = ReadData(FileNumber, *Buffer, Length)
200
201 EndIf
202
203 ; Close the file.
204 CloseFile(FileNumber)
205
206 EndProcedure
207
208 ;- Main
209 WindowCreate()
210
211 ;- Event Loop
212 Repeat
213
214     ; Obtain event parameters.
215     Event = WaitWindowEvent()
216     EventGadget = EventGadget()
217     EventType = EventType()
218     EventWindow = EventWindow()
219
220     ; Handle events.
221     Select Event
222
223     Case #PB_Event_Gadget
224         If EventGadget = #GadgetFiles
225             ; Do nothing.
226
227             ElseIf EventGadget = #GadgetOpen
228                 File = GetGadgetText(#GadgetFiles) +
229                 GetGadgetItemText(#GadgetFiles, GetGadgetState(#GadgetFiles))
230                 If FileSize(File) > 0
231                     FileRead()
232                     FileDisplay()
233                 EndIf
234
235             ElseIf EventGadget = #GadgetClose
236                 FileClose()
237
238             ElseIf EventGadget = #GadgetHex
239                 ; Do nothing.
240
241             EndIf
242
243     Case #PB_Event_CloseWindow
244         If EventWindow = #WindowHex
245             CloseWindow(#WindowHex)
246             Break
247         EndIf
248
249     Case #PB_Event_SizeWindow
250         WindowResize()
251
252     EndSelect
253
254 ForEver

```

UserGuide Navigation

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Chapter 85

UserGuide - Overview

We start programming... this part of the PureBasic manual should guide you through some basic stuff, which you should learn while starting to program with PureBasic.

The following topics in this chapter should give you some ideas, where to start with PureBasic. It shouldn't replace any larger tutorial or the massive information, which can be found on the popular PureBasic forums . So the following information texts are short, but they include some "keywords" and links to further information, which are included in this reference manual. This chapter covers only a small part of the 1500+ commands available in PureBasic!

Topics in this chapter:

- First steps
- Variables and Processing of variables
- Constants
- Decisions & Conditions
- Loops
- String Manipulation
- Storing data in memory
- Input & Output
- Displaying text output (Console)
- Building a graphical user interface (GUI)
- Displaying graphics output & simple drawing
- Structuring code in Procedures
- Compiler directives (for different behavior on different OS)
- Reading and writing files
- Memory access
- Dynamic numbering using #PB_Any
- Managing multiple windows with different content
- Other Compiler keywords
- Other Library functions
- Advanced functions
- Some Tips & Tricks

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Chapter 86

UserGuide - Dynamic numbering of windows and gadgets using #PB_Any

If you've looked at the help articles for the `OpenWindow` command or for any of the gadget creation commands (for example `ButtonGadget()`) or if you have experimented with the Form Designer tool, you may have noticed references to a special constant called `#PB_Any`. In this article we're going to look into this a little further to find out why it's so important.

So far all of our examples have used a group of constants, an enumeration, to identify a single window and each gadget on that window. This is fine in the simple programs we've demonstrated so far but presents a problem in more complex programs - only one of each of these windows can exist at the same time.

So what happens if a program needs to provide more than one copy of a window? Maybe to have several files open at once or possibly to provide several different views of the same file.

This is where the special `#PB_Any` constant comes in. When this constant is used as the argument to the functions that support it, a unique reference number is automatically generated and returned as a result of the function.

Providing we keep track of all these references we can use this to our advantage. Organising this is a little more complex than the examples we've seen so far but the increased flexibility that it can provide makes this well worth the effort.

This example program provides a window upon which a regular polygon is drawn in blue on a circumscribing grey circle. A combo box is provided to allow a selection of polygons to be drawn. A menu is provided to allow the creation of new windows or the closing of the current window.

There are several things to notice about this program:

In the Enumerations section, note that there are only enumerations for the menu items.

These will be shared on all the windows although each window will have its own menu bar.

In the Structures section, note that the `POLYGONWINDOW` structure contains four integer values and so provides a place to store references for a menu bar, a label, a combo box and an image plot.

In the Variables section note that in addition to the usual variables to receive event details, a map called `ActiveWindows` is created using the `POLYGONWINDOW` structure previously defined.

Look at the `CreatePolygonWindow` procedure.

When we create the window we capture the result of the `OpenWindow()` function in a variable called `ThisWindow`. We then convert this to a string value and use this as the key for a new map entry.

When we then create the menu, label, combo and image gadgets on the new window the references returned by these functions are stored in the map too.

Look at the `ResizePolygonWindow` procedure.

Notice how the value of `EventWindow` is passed in from the event loop into this procedure.

This value is then used to retrieve child control references from the map and these references are then used to resize the gadgets.

Look at the DestroyPolygonWindow procedure.

Here the child control references are removed from the map when a window is closed. If the map size reaches zero there are no more open windows and DestroyPolygonWindow sets an event flag to tell the program to end.

Start the program up.

- Use the New Window menu item to open up two or three new polygon windows.
- Use the combo box in each one to select a different shape notice that each window works independently of all the others.
- Resize some of the windows notice that they can all be resized independently of each other and that the polygon resizes with the window too.

Finally, note that a map isnt the only way to achieve this effect, a List or an Array could be used to do the job too, if you prefer, although the code to implement these alternatives would need to be slightly different to that presented here because of the differences in the way those collections work.

```
1 ; Compiler Directives
2 EnableExplicit
3
4 ; Constants
5 CompilerIf Defined(Blue, #PB_Constant) = #False
6     #Blue = 16711680
7     #Gray = 8421504
8     #White = 16777215
9 CompilerEndIf
10
11 ;- Enumerations
12 ; The menu commands will be the same on all the windows.
13 Enumeration
14     #MenuNew
15     #MenuClose
16 EndEnumeration
17
18 ;- Structures
19 ; This structure will hold references to the unique elements of a
    window.
20 Structure POLYGONWINDOW
21     Menu.i
22     LabelSides.i
23     ComboSides.i
24     ImagePlot.i
25 EndStructure
26
27 ;- Variables
28
29 ; This map uses the previously defined structure to hold references
    for all the open windows.
30 NewMap ActiveWindows.POLYGONWINDOW()
31
32 ; Event variables.
33 Define.i Event, EventWindow, EventGadget, EventType, EventMenu,
    EventQuit
34 Define.s EventWindowKey
35
36 ; Implementation.
37 Procedure.i CreatePolygonWindow()
38     ; Creates a new window and gadgets, adding it and its child gadgets
    to the tracking map.
39     Shared ActiveWindows()
40     Protected.i ThisWindow
41     Protected.s ThisKey
```

```

42
43   ThisWindow = OpenWindow(#PB_Any, 50, 50, 300, 300, "Polygon",
#PB_Window_SystemMenu | #PB_Window_SizeGadget |
#PB_Window_MinimizeGadget | #PB_Window_TitleBar)
44
45   WindowBounds(ThisWindow, 250, 250, #PB_Ignore, #PB_Ignore)
46
47   If ThisWindow
48       ; Maps take a string value as key so convert the integer
ThisWindow to a string.
49       ThisKey = StrU(ThisWindow)
50
51       ; Add a map element to hold the new gadget references.
52       AddMapElement(ActiveWindows(), ThisKey)
53
54       ; Create the menu bar.
55       ActiveWindows(ThisKey)\Menu = CreateMenu(#PB_Any,
WindowID(ThisWindow))
56       MenuItem("Window")
57       MenuItem(#MenuNew, "New Window")
58       MenuItem(#MenuClose, "Close Window")
59
60       ; Create the child gadgets and store their references in the map.
61       With ActiveWindows()
62           ; A label for the combo.
63           \LabelSides = TextGadget(#PB_Any, 5, 5, 150, 20, "Number of
Sides:")
64
65           ; The Sides combo.
66           \ComboSides = ComboBoxGadget(#PB_Any, 160, 5, 100, 25)
67           AddGadgetItem(\ComboSides, 0, "Triangle")
68           AddGadgetItem(\ComboSides, 1, "Diamond")
69           AddGadgetItem(\ComboSides, 2, "Pentagon")
70           AddGadgetItem(\ComboSides, 3, "Hexagon")
71           AddGadgetItem(\ComboSides, 4, "Heptagon")
72           AddGadgetItem(\ComboSides, 5, "Octagon")
73           AddGadgetItem(\ComboSides, 6, "Nonagon")
74           AddGadgetItem(\ComboSides, 7, "Decagon")
75
76           ; Select Triangle.
77           SetGadgetState(\ComboSides, 0)
78
79           ; The visual image gadget on the window.
80           \ImagePlot = ImageGadget(#PB_Any, 5, 35, 290, 240, 0,
#PB_Image_Border)
81           EndWith
82       EndIf
83
84       ; Return the reference to the new window.
85       ProcedureReturn ThisWindow
86   EndProcedure
87
88   Procedure DestroyPolygonWindow(Window.i)
89       ; Remove Window from the ActiveWindows map, close the window and
set the quit flag, if appropriate.
90       Shared EventQuit, ActiveWindows()
91       Protected.s ThisKey
92
93       ; Convert the integer Window to a string.

```

```

94     ThisKey = StrU(Window)
95
96     ; Delete the map entry.
97     DeleteMapElement(ActiveWindows(), ThisKey)
98
99     ; Close the window.
100    CloseWindow(Window)
101
102    ; Check if there are still open windows.
103    If MapSize(ActiveWindows()) = 0
104        EventQuit = #True
105    EndIf
106 EndProcedure

107
108 Procedure.i ResizePolygonWindow(Window.i)
109     ; Resize the child gadgets on Window.
110     ; In practice only the ImageGadget needs to be resized in this
111     example.
112     Shared ActiveWindows()
113     Protected.i ThisImage
114     Protected.i X, Y, W, H
115     Protected.s ThisKey
116
117     ; Obtain references to the affected gadgets from the map.
118     ThisKey = StrU(Window)
119     ThisImage = ActiveWindows(ThisKey)\ImagePlot
120
121     ; Resize gadgets.
122     W = WindowWidth(Window) - 15
123     H = WindowHeight(Window) - 70
124     ResizeGadget(ThisImage, #PB_Ignore, #PB_Ignore, W, H)
125 EndProcedure

126 Procedure PlotPolygon(Window.i)
127     ; Draw the polygon image and transfer it to the image gadget.
128     Shared ActiveWindows()
129     Protected.f Radius, OriginX, OriginY, StartX, StartY, EndX, EndY
130     Protected.i Sides, Vertex, Width, Height, ThisCombo, ThisImage,
131     ThisPlot
132     Protected.s ThisKey
133
134     ; Check if the event is for the right window.
135     If Not IsWindow(Window) : ProcedureReturn : EndIf
136
137     ; Obtain references to the affected gadgets from the map.
138     ThisKey = StrU(Window)
139     ThisCombo = ActiveWindows(ThisKey)\ComboSides
140     ThisImage = ActiveWindows(ThisKey)\ImagePlot
141
142     ; Calculate dimensions and origin.
143     Sides = GetGadgetState(ThisCombo) + 3
144     Width = GadgetWidth(ThisImage) - 4
145     Height = GadgetHeight(ThisImage) - 4
146     OriginX = Width/2
147     OriginY = Height/2
148     If Width < Height
149         Radius = OriginX - 50
150     Else
151         Radius = OriginY - 50

```

```

151     EndIf
152
153     ; Create a new image.
154     ThisPlot = CreateImage(#PB_Any, Width, Height)
155     StartDrawing(ImageOutput(ThisPlot))
156
157     ; Draw a white background.
158     Box(0, 0, Width, Height, #White)
159
160     ; Draw a gray circumscribing circle.
161     Circle(OriginX, OriginY, Radius, #Gray)
162
163     ; Draw the polygon.
164     For Vertex = 0 To Sides
165
166         ; Calculate side start point.
167         StartX = OriginX + (Radius * Cos(2 * #PI * Vertex/Sides))
168         StartY = OriginY + (Radius * Sin(2 * #PI * Vertex/Sides))
169
170         ; and end point.
171         EndX = OriginX + (Radius * Cos(2 * #PI * (Vertex + 1)/Sides))
172         EndY = OriginY + (Radius * Sin(2 * #PI * (Vertex + 1)/Sides))
173
174         ; Draw the side in blue.
175         LineXY(StartX, StartY, EndX, EndY, #Blue)
176
177     Next Vertex
178
179     ; Fill the polygon in blue
180     FillArea(OriginX, OriginY, #Blue, #Blue)
181
182     StopDrawing()
183
184     ; Transfer the image contents to the visible gadget.
185     SetGadgetState(ThisImage, ImageID(ThisPlot))
186
187     ; Destroy the temporary image.
188     FreeImage(ThisPlot)
189 EndProcedure
190
191 ;- Main
192
193 ; Create the first window.
194 EventWindow = CreatePolygonWindow()
195 ResizePolygonWindow(EventWindow)
196 PlotPolygon(EventWindow)
197
198 ;- Event loop
199 Repeat
200     Event = WaitWindowEvent()
201     EventWindow = EventWindow()
202     EventWindowKey = StrU(EventWindow)
203     EventGadget = EventGadget()
204     EventType = EventType()
205     EventMenu = EventMenu()
206
207     Select Event
208         Case #PB_Event_Gadget
209             ; A gadget event has occurred.

```

```

210     If EventGadget = ActiveWindows(EventWindowKey)\LabelSides
211         ; Do nothing.
212
213     ElseIf EventGadget = ActiveWindows(EventWindowKey)\ComboSides
214         ; If the combo box changes, redraw the image.
215         PlotPolygon(EventWindow)
216
217         ; Update the windows title to reflect the new shape.
218         SetWindowTitle(EventWindow,
GetGadgetText(ActiveWindows(EventWindowKey)\ComboSides))
219
220     ElseIf EventGadget = ActiveWindows(EventWindowKey)\ImagePlot
221         ; Do nothing.
222
223     EndIf
224
225     Case #PB_Event_Menu
226         ; A menu event has occurred.
227         If EventMenu = #MenuNew
228             EventWindow = CreatePolygonWindow()
229             ResizePolygonWindow(EventWindow)
230             PlotPolygon(EventWindow)
231
232         ElseIf EventMenu = #MenuClose
233             DestroyPolygonWindow(EventWindow)
234
235         EndIf
236
237     Case #PB_Event_Repaint
238         ; A window's content has been invalidated.
239         PlotPolygon(EventWindow)
240
241     Case #PB_Event_SizeWindow
242         ; A window has been resized.
243         ResizePolygonWindow(EventWindow)
244         PlotPolygon(EventWindow)
245
246     Case #PB_Event_CloseWindow
247         ; A window has been closed.
248         DestroyPolygonWindow(EventWindow)
249
250     EndSelect
251
252 Until EventQuit = #True

```

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Chapter 87

UserGuide - Managing multiple windows with different content

In the previous article we examined one way in which a program can support multiple instances of a single type of window . In this one we are going to extend this concept further developing a program that can support multiple instances of several different types of window, in this case three:

- The Button window contains a list view and two buttons labelled 'Add' and 'Remove'. When the 'Add' button is clicked a random integer is added to the list view, when the 'Remove' button is clicked the currently highlighted entry in the list view is removed.
- The Date window contains a list view and two buttons in the same way as the Button window but also contains a calendar gadget too, the window layout is altered to accommodate this additional control. When the 'Add' button is clicked, it is the currently selected date that is added to the list view.
- The Track window contains two track bars , with a value between 0 and 100, and a string gadget . When the track bars are moved the string gadget is updated with the value of the second track bar subtracted from the first.

Each window contains a menu bar with items to create a new instance of any of the three supported window types or to close the current window.

Things to notice about this program are:

In the Structures section 4 structures are defined. The first, BASEWINDOW, defines a WindowClass value and a Menu value these values are common to each window type.

The remaining structures extend the BASEWINDOW structure with values for each of the unique controls that they require and which are not provided for by the BASEWINDOW structure.

In the Variables section note that again a map called ActiveWindows is created, however this time it is of integer type, it doesnt use any of the defined structures. There is a good reason for this, we need to store three different structure types to make this program work and we cant do this in a single map.

Also notice that *EventGadgets is defined using the BASEWINDOW structure.

Now look at the CreateButtonWindow procedure . As before we use #PB_Any to create the window and all the gadgets .

However this time the results are not stored directly in the ActiveWindows map. Instead we use the AllocateMemory function to allocate memory for a BUTTONWINDOW structure, we then store a pointer to this memory allocation in the ActiveWindows map. This is how we get around the problem of not being able to store all three of the different structures in the same map.

We also set the WindowClass value in the structure to #WindowClassButton to indicate which type of window, and therefore which type of structure, has been created we will need to know this later on.

There are two more CreateWindow procedures this time one for each class of the other window types.

They work in a similar way to that described, differing only where the windows gadgets are different and setting a different value in WindowClass.

Similarly we provide DestroyWindow and ResizeWindow procedures to take care of these functions.

We also provide a new procedure EventsButtonWindow. This procedure knows what to do when any of the gadgets on the window are activated by the user. Similar procedures are provided for the other

window types too.

In all these procedures we use the ActiveWindows map to retrieve the pointer to the memory allocation. We can then use this pointer to retrieve the references to the actual controls that we need to work with in each of these procedures:

```
1 *ThisData = ActiveWindows(ThisKey)
2 *ThisData\ListView ...
```

Each procedure only knows how to handle one type of window so before we start work we check the WindowClass value to make sure that a window of the correct type has been supplied as the argument something like this:

```
1 If *ThisData\WindowClass <> #WindowClassButton
```

The event loop is a bit different too. For each event type there is a determination like this:

```
1 ; Use *EventGadgets\WindowClass to call the correct resize window
   procedure .
2 Select *EventGadgets\WindowClass ...
```

Although the memory allocations actually made by the CreateWindow procedures will be of the BUTTONWINDOW, DATEWINDOW or TRACKWINDOW type we can use *EventGadgets this way because it is defined as the BASEWINDOW type and BASEWINDOW is the ancestor structure to the other structures.

Providing we dont attempt to change any of the stored values using *EventGadgets and weve no reason to do so all should be well.

Finally, we despatch the recorded event values in EventWindow, EventGadget, EventType straight through to the event procedures and let them worry about getting the jobs done.

```
1 ;- Constants
2 #DateFormat = "%dd/%mm/%yyyy"
3
4 ;- Enumerations
5 Enumeration
6 #WindowClassButton = 1
7 #WindowClassDate
8 #WindowClassTrack
9 EndEnumeration
10
11 ; The menu commands will be the same on all the windows.
12 Enumeration
13 #MenuNewButton
14 #MenuNewDate
15 #MenuNewTrack
16 #MenuClose
17 EndEnumeration
18
19 ;- Structures
20 Structure BASEWINDOW
21 WindowClass.i
22 Menu.i
23 EndStructure
24
25 Structure BUTTONWINDOW Extends BASEWINDOW
26 ListView.i
27 AddButton.i
28 RemoveButton.i
29 EndStructure
30
```

```

31 Structure DATEWINDOW Extends BASEWINDOW
32     Calendar.i
33     AddButton.i
34     RemoveButton.i
35     ListView.i
36 EndStructure
37
38 Structure TRACKWINDOW Extends BASEWINDOW
39     TrackBar1.i
40     TrackBar2.i
41     Label.i
42     Difference.i
43 EndStructure
44
45 ;- Variables
46 ; This map will track all the active windows as before, however as
47 ; the structure for each window class
48 ; differs we will be storing pointers to structures in the map not
49 ; the gadget references directly.
50 NewMap ActiveWindows.i()
51
52 ; These values will be used to give new windows a unique label.
53 Define.i Buttons, Dates, Tracks
54
55 ; Event variables.
56 ; Notice the type of *EventGadgets.
57 Define.i Event, EventWindow, EventGadget, EventType, EventMenu,
58     EventQuit
59 Define.s EventWindowKey
60 Define *EventGadgets.BASEWINDOW
61
62 ;- Button Window
63 Procedure.i CreateButtonWindow()
64     ; Creates a new Button window and adds it to the tracking map,
65     ; allocates memory for gadget references, creates the gadgets
66     ; and stores these references in the memory structure.
67     Shared Buttons, ActiveWindows()
68     Protected *ThisData.BUTTONWINDOW
69     Protected.i ThisWindow
70     Protected.s ThisKey, ThisTitle
71
72     ; Set the window caption.
73     Buttons + 1
74     ThisTitle = "Button Window " + StrU(Buttons)
75
76     ; Open the window.
77     ThisWindow = OpenWindow(#PB_Any, 30, 30, 225, 300, ThisTitle,
78     #PB_Window_SystemMenu | #PB_Window_SizeGadget |
79     #PB_Window_MinimizeGadget | #PB_Window_TitleBar)
80
81     ; Check that the OpenWindow command worked.
82     If ThisWindow
83         ; Set minimum window dimensions.
84         WindowBounds(ThisWindow, 220, 100, #PB_Ignore, #PB_Ignore)
85
86         ; Convert the window reference to a string to use as the map key
87         ; value.
88         ThisKey = StrU(ThisWindow)
89
90

```

```

84     ; Allocate memory to store the gadget references in.
85     *ThisData = AllocateMemory(NumberOf(BUTTONWINDOW))
86 EndIf
87
88 ; Check that the memory allocation worked.
89 If *ThisData
90     ; Store the window reference and memory pointer values in the map.
91     ActiveWindows(ThisKey) = *ThisData
92
93     ; Set the window class.
94     *ThisData\WindowClass = #WindowClassButton
95
96     ; Create the menu bar.
97     *ThisData\Menu = CreateMenu(#PB_Any, WindowID(ThisWindow))
98
99     ; If the menu creation worked, create the menu items.
100    If *ThisData\Menu
101        MenuItem("Window")
102        MenuItem(#MenuNewButton, "New Button Window")
103        MenuItem(#MenuNewDate, "New Date Window")
104        MenuItem(#MenuNewTrack, "New Track Window")
105        MenuItem(#MenuClose, "Close Window")
106    EndIf
107
108    ; Create the window gadgets.
109    *ThisData\ListView = ListViewGadget(#PB_Any, 10, 10, 200, 225)
110    *ThisData\AddButton = ButtonGadget(#PB_Any, 15, 245, 90, 30,
111    "Add")
112    *ThisData\RemoveButton = ButtonGadget(#PB_Any, 115, 245, 90, 30,
113    "Remove")
114 Else
115     ; Memory allocation failed.
116     CloseWindow(ThisWindow)
117 EndIf
118
119 ; Set the return value.
120 If ThisWindow > 0 And *ThisData > 0
121     ; Return the reference to the new window.
122     ProcedureReturn ThisWindow
123 Else
124     ; Return 0
125     ProcedureReturn 0
126 EndIf
127 EndProcedure
128
129 Procedure.i DestroyButtonWindow(Window.i)
130     ; Remove Window from the ActiveWindows map, release the allocated
131     memory,
132     ; close the window and set the quit flag, if appropriate.
133     Shared EventQuit, ActiveWindows()
134     Protected *ThisData.BUTTONWINDOW
135     Protected.s ThisKey
136
137     ; Convert the integer Window to a string.
138     ThisKey = StrU(Window)
139
140     ; Obtain the reference structure pointer.
141     *ThisData = ActiveWindows(ThisKey)

```

```

140 ; Check that a valid pointer was obtained, if not stop.
141 If *ThisData = 0
142     ProcedureReturn #False
143 EndIf
144
145 ; Check that it is the correct window type, if not stop.
146 If *ThisData\WindowClass <> #WindowClassButton
147     ProcedureReturn #False
148 EndIf
149
150 ; Release the memory allocation.
151 FreeMemory(*ThisData)
152
153 ; Delete the map entry.
154 DeleteMapElement(ActiveWindows(), ThisKey)
155
156 ; Close the window.
157 CloseWindow(Window)
158
159 ; Check if there are still open windows.
160 If MapSize(ActiveWindows()) = 0
161     EventQuit = #True
162 EndIf
163
164 ; Set the successful return value.
165 ProcedureReturn #True
166 EndProcedure
167
168 Procedure.i ResizeButtonWindow(Window.i)
169 ; Resize the child gadgets on Window.
170 Shared ActiveWindows()
171 Protected *ThisData.BUTTONWINDOW
172 Protected.i X, Y, W, H
173 Protected.s ThisKey
174
175 ; Obtain the reference structure pointer.
176 ThisKey = StrU(Window)
177 *ThisData = ActiveWindows(ThisKey)
178
179 ; Check that a valid pointer was obtained, if not stop.
180 If *ThisData = 0
181     ProcedureReturn #False
182 EndIf
183
184 ; Check that it is the correct window type, if not stop.
185 If *ThisData\WindowClass <> #WindowClassButton
186     ProcedureReturn #False
187 EndIf
188
189 ; Resize list view.
190 W = WindowWidth(Window) - 25
191 H = WindowHeight(Window) - 85
192 ResizeGadget(*ThisData\ListView, #PB_Ignore, #PB_Ignore, W, H)
193
194 ; Recenter buttons.
195 X = WindowWidth(Window)/2 - 95
196 Y = WindowHeight(Window) - 65
197 ResizeGadget(*ThisData\AddButton, X, Y, #PB_Ignore, #PB_Ignore)
198

```

```

199     X = WindowWidth(Window)/2 + 5
200     ResizeGadget(*ThisData\RemoveButton, X, Y, #PB_Ignore, #PB_Ignore)
201
202     ProcedureReturn #True
203 EndProcedure
204
205 Procedure.i EventsButtonWindow(Window, Gadget, Type)
206     ; Handle events for a button window.
207     Shared Buttons, ActiveWindows()
208     Protected *ThisData.BUTTONWINDOW
209     Protected.i NewValue, Index
210     Protected.s ThisKey
211
212     ; Convert the integer Window to a string.
213     ThisKey = StrU(Window)
214
215     ; Obtain the reference structure pointer.
216     *ThisData = ActiveWindows(ThisKey)
217
218     ; Check that a valid pointer was obtained, if not stop.
219     If *ThisData = 0
220         ProcedureReturn #False
221     EndIf
222
223     ; Check that it is the correct window type, if not stop.
224     If *ThisData\WindowClass <> #WindowClassButton
225         ProcedureReturn #False
226     EndIf
227
228     Select Gadget
229         Case *ThisData\AddButton
230             NewValue = Random(2147483647)
231             AddGadgetItem(*ThisData\ListView, -1, StrU(NewValue))
232
233         Case *ThisData\RemoveButton
234             Index = GetGadgetState(*ThisData\ListView)
235             If Index >= 0 And Index <= CountGadgetItems(*ThisData\ListView)
236                 RemoveGadgetItem(*ThisData\ListView, Index)
237             EndIf
238
239         Case *ThisData\ListView
240             ; Do nothing.
241     EndSelect
242 EndProcedure
243
244 ;- Date Window
245 Procedure.i CreateDateWindow()
246     ; Creates a new Date window and adds it to the tracking map,
247     ; allocates memory for gadget references, creates the gadgets
248     ; and stores these references in the memory Structure.
249     Shared Dates, ActiveWindows()
250     Protected *ThisData.DATEWINDOW
251     Protected.i ThisWindow
252     Protected.s ThisKey, ThisTitle
253
254     Dates + 1
255     ThisTitle = "Date Window " + StrU(Dates)
256     ThisWindow = OpenWindow(#PB_Any, 30, 30, 310, 420, ThisTitle ,
#PB_Window_SystemMenu | #PB_Window_SizeGadget |

```

```

#PB_Window_MinimizeGadget | #PB_Window_TitleBar)
257
258 ; Check that the OpenWindow command worked.
259 If ThisWindow
260 ; Set minimum window dimensions.
261 WindowBounds(ThisWindow, 310, 245, #PB_Ignore, #PB_Ignore)
262
263 ; Convert the window reference to a string to use as the map key
value.
264 ThisKey = StrU(ThisWindow)
265
266 ; Allocate memory to store the gadget references in.
267 *ThisData = AllocateMemory(SizeOf(DATEWINDOW))
268 EndIf
269
270 ; Check that the memory allocation worked.
271 If *ThisData
272 ; Store the window reference and memory pointer values in the map.
273 ActiveWindows(ThisKey) = *ThisData
274
275 ; Set the window class.
276 *ThisData\WindowClass = #WindowClassDate
277
278 ; Create the menu bar.
279 *ThisData\Menu = CreateMenu(#PB_Any, WindowID(ThisWindow))
280
281 ; If the menu creation worked, create the menu items.
282 If *ThisData\Menu
283 MenuItem("Window")
284 MenuItem(#MenuNewButton, "New Button Window")
285 MenuItem(#MenuNewDate, "New Date Window")
286 MenuItem(#MenuNewTrack, "New Track Window")
287 MenuItem(#MenuClose, "Close Window")
288 EndIf
289
290 ; Create the window gadgets.
291 *ThisData\Calendar = CalendarGadget(#PB_Any, 10, 10, 182, 162)
292 *ThisData\AddButton = ButtonGadget(#PB_Any, 210, 10, 90, 30,
"Add")
293 *ThisData\RemoveButton = ButtonGadget(#PB_Any, 210, 45, 90, 30,
"Remove")
294 *ThisData\ListView = ListViewGadget(#PB_Any, 10, 187, 290, 200)
295 Else
296 ; Memory allocation failed.
297 CloseWindow(ThisWindow)
298 EndIf
299
300 ; Set the return value.
301 If ThisWindow > 0 And *ThisData > 0
302 ; Return the reference to the new window.
303 ProcedureReturn ThisWindow
304 Else
305 ; Return 0
306 ProcedureReturn 0
307 EndIf
308
309 EndProcedure
310
311 Procedure.i DestroyDateWindow(Window.i)

```

```

312 ; Remove Window from the ActiveWindows map, release the allocated
memory,
313 ; close the window and set the quit flag, if appropriate.
314 Shared EventQuit, ActiveWindows()
315 Protected *ThisData.DATEWINDOW
316 Protected.s ThisKey
317
318 ; Convert the integer Window to a string.
319 ThisKey = StrU(Window)
320
321 ; Obtain the reference structure pointer.
322 *ThisData = ActiveWindows(ThisKey)
323
324 ; Check that a valid pointer was obtained.
325 If *ThisData = 0
326     ProcedureReturn #False
327 EndIf
328
329 ; Check that it is the correct window type, if not stop as this
procedure can't destroy this window.
330 If *ThisData\WindowClass <> #WindowClassDate
331     ProcedureReturn #False
332 EndIf
333
334 ; Release the memory allocation.
335 FreeMemory(*ThisData)
336
337 ; Delete the map entry.
338 DeleteMapElement(ActiveWindows(), ThisKey)
339
340 ; Close the window.
341 CloseWindow(Window)
342
343 ; Check if there are still open windows.
344 If MapSize(ActiveWindows()) = 0
345     EventQuit = #True
346 EndIf
347
348 ; Set the successful return value.
349 ProcedureReturn #True
350 EndProcedure
351
352 Procedure.i ResizeDateWindow(Window.i)
353 ; Resize the child gadgets on Window.
354 Shared ActiveWindows()
355 Protected *ThisData.DATEWINDOW
356 Protected.i X, Y, W, H
357 Protected.s ThisKey
358
359 ; Obtain the reference structure pointer.
360 ThisKey = StrU(Window)
361 *ThisData = ActiveWindows(ThisKey)
362
363 ; Check that a valid pointer was obtained, if not stop.
364 If *ThisData = 0
365     ProcedureReturn #False
366 EndIf
367
368 ; Check that it is the correct window type, if not stop.

```

```

369     If *ThisData\WindowClass <> #WindowClassDate
370         ProcedureReturn #False
371     EndIf
372
373     ; Resize list view.
374     W = WindowWidth(Window) - 20
375     H = WindowHeight(Window) - 220
376     ResizeGadget(*ThisData\ListView, #PB_Ignore, #PB_Ignore, W, H)
377
378     ProcedureReturn #True
379 EndProcedure
380
381 Procedure.i EventsDateWindow(Window, Gadget, Type)
382     ; Handle events for a Date window.
383     Shared Buttons, ActiveWindows()
384     Protected *ThisData.DATEWINDOW
385     Protected.i NewValue, Index
386     Protected.s ThisKey
387
388     ; Convert the integer Window to a string.
389     ThisKey = StrU(Window)
390
391     ; Obtain the reference structure pointer.
392     *ThisData = ActiveWindows(ThisKey)
393
394     ; Check that a valid pointer was obtained, if not stop.
395     If *ThisData = 0
396         ProcedureReturn #False
397     EndIf
398
399     ; Check that it is the correct window type, if not stop.
400     If *ThisData\WindowClass <> #WindowClassDate
401         ProcedureReturn #False
402     EndIf
403
404     Select Gadget
405         Case *ThisData\AddButton
406             NewValue = GetGadgetState(*ThisData\Calendar)
407             AddGadgetItem(*ThisData\ListView, -1, FormatDate(#DateFormat,
408                 NewValue))
409
410             Case *ThisData\RemoveButton
411                 Index = GetGadgetState(*ThisData\ListView)
412                 If Index >= 0 And Index <= CountGadgetItems(*ThisData\ListView)
413                     RemoveGadgetItem(*ThisData\ListView, Index)
414                 EndIf
415
416             Case *ThisData\Calendar, *ThisData\ListView
417                 ; Do nothing.
418         EndSelect
419 EndProcedure
420
421 ; - Track Window
422 Procedure.i CreateTrackWindow()
423     ; Creates a new Track window and adds it to the tracking map,
424     ; allocates memory for gadget references, creates the gadgets
425     ; and stores these references in the memory Structure.
426     Shared Tracks, ActiveWindows()
427     Protected *ThisData.TRACKWINDOW

```

```

427 Protected.i ThisWindow, ThisSum
428 Protected.s ThisKey, ThisTitle
429
430 Tracks + 1
431 ThisTitle = "Track Bar Window " + StrU(Tracks)
432 ThisWindow = OpenWindow(#PB_Any, 30, 30, 398, 130, ThisTitle,
#PB_Window_SystemMenu | #PB_Window_SizeGadget |
#PB_Window_MinimizeGadget | #PB_Window_TitleBar)
433
434 ; Check that the OpenWindow command worked.
435 If ThisWindow
436 ; Set minimum window dimensions.
437 WindowBounds(ThisWindow, 135, 130, #PB_Ignore, 130)
438
439 ; Convert the window reference to a string to use as the map key
value.
440 ThisKey = StrU(ThisWindow)
441
442 ; Allocate memory to store the gadget references in.
443 *ThisData = AllocateMemory(SizeOf(TRACKWINDOW))
444 EndIf
445
446 ; Check that the memory allocation worked.
447 If *ThisData
448 ; Store the window reference and memory pointer values in the map.
449 ActiveWindows(ThisKey) = *ThisData
450
451 ; Set the window class.
452 *ThisData\WindowClass = #WindowClassTrack
453
454 ; Create the menu bar.
455 *ThisData\Menu = CreateMenu(#PB_Any, WindowID(ThisWindow))
456
457 ; If the menu creation worked, create the menu items.
458 If *ThisData\Menu
459 MenuItem("Window")
460 MenuItem(#MenuNewButton, "New Button Window")
461 MenuItem(#MenuNewDate, "New Date Window")
462 MenuItem(#MenuNewTrack, "New Track Window")
463 MenuItem(#MenuClose, "Close Window")
464 EndIf
465
466 ; Create the window gadgets.
467 *ThisData\TrackBar1 = TrackBarGadget(#PB_Any, 10, 10, 375, 25, 0,
100, #PB_TrackBar_Ticks)
468 *ThisData\TrackBar2 = TrackBarGadget(#PB_Any, 10, 40, 375, 25, 0,
100, #PB_TrackBar_Ticks)
469 *ThisData\Label = TextGadget(#PB_Any, 10, 75, 80, 25,
"Difference:")
470 *ThisData\Difference = StringGadget(#PB_Any, 90, 75, 290, 25,
"0", #PB_String_ReadOnly)
471 Else
472 ; Memory allocation failed.
473 CloseWindow(ThisWindow)
474 EndIf
475
476 ; Set the return value.
477 If ThisWindow > 0 And *ThisData > 0
478 ; Return the reference to the new window.

```

```

479     ProcedureReturn ThisWindow
480 Else
481     ; Return 0
482     ProcedureReturn 0
483 EndIf
484 EndProcedure
485
486 Procedure.i DestroyTrackWindow(Window.i)
487     ; Remove Window from the ActiveWindows map, release the allocated
memory,
488     ; close the window and set the quit flag, if appropriate.
489     Shared EventQuit, ActiveWindows()
490     Protected *ThisData.DATEWINDOW
491     Protected.s ThisKey
492
493     ; Convert the integer Window to a string.
494     ThisKey = StrU(Window)
495
496     ; Obtain the reference structure pointer.
497     *ThisData = ActiveWindows(ThisKey)
498
499     ; Check that a valid pointer was obtained.
500     If *ThisData = 0
501         ProcedureReturn #False
502     EndIf
503
504     ; Check that it is the correct window type, if not stop as this
procedure can't destroy this window.
505     If *ThisData\WindowClass <> #WindowClassTrack
506         ProcedureReturn #False
507     EndIf
508
509     ; Release the memory allocation.
510     FreeMemory(*ThisData)
511
512     ; Delete the map entry.
513     DeleteMapElement(ActiveWindows(), ThisKey)
514
515     ; Close the window.
516     CloseWindow(Window)
517
518     ; Check if there are still open windows.
519     If MapSize(ActiveWindows()) = 0
520         EventQuit = #True
521     EndIf
522
523     ; Set the successful return value.
524     ProcedureReturn #True
525 EndProcedure
526
527 Procedure.i ResizeTrackWindow(Window.i)
528     ; Resize the child gadgets on Window.
529     Shared ActiveWindows()
530     Protected *ThisData.TRACKWINDOW
531     Protected.i X, Y, W, H
532     Protected.s ThisKey
533
534     ; Obtain the reference structure pointer.
535     ThisKey = StrU(Window)

```

```

536 *ThisData = ActiveWindows(ThisKey)
537
538 ; Check that a valid pointer was obtained, if not stop.
539 If *ThisData = 0
540     ProcedureReturn #False
541 EndIf
542
543 ; Check that it is the correct window type, if not stop.
544 If *ThisData\WindowClass <> #WindowClassTrack
545     ProcedureReturn #False
546 EndIf
547
548 ; Resize track bars.
549 W = WindowWidth(Window) - 20
550 ResizeGadget(*ThisData\TrackBar1, #PB_Ignore, #PB_Ignore, W,
#PB_Ignore)
551 ResizeGadget(*ThisData\TrackBar2, #PB_Ignore, #PB_Ignore, W,
#PB_Ignore)
552
553 ; Resize string.
554 W = WindowWidth(Window) - 110
555 ResizeGadget(*ThisData\Difference, #PB_Ignore, #PB_Ignore, W,
#PB_Ignore)
556
557 ProcedureReturn #True
558 EndProcedure
559
560 Procedure.i EventsTrackWindow(Window, Gadget, Type)
561 ; Handle events for a Track window.
562 Shared Buttons, ActiveWindows()
563 Protected *ThisData.TRACKWINDOW
564 Protected.i NewValue
565 Protected.s ThisKey
566
567 ; Convert the integer Window to a string.
568 ThisKey = StrU(Window)
569
570 ; Obtain the reference structure pointer.
571 *ThisData = ActiveWindows(ThisKey)
572
573 ; Check that a valid pointer was obtained, if not stop.
574 If *ThisData = 0
575     ProcedureReturn #False
576 EndIf
577
578 ; Check that it is the correct window type, if not stop.
579 If *ThisData\WindowClass <> #WindowClassTrack
580     ProcedureReturn #False
581 EndIf
582
583 Select Gadget
584     Case *ThisData\TrackBar1, *ThisData\TrackBar2
585         NewValue = GetGadgetState(*ThisData\TrackBar1) -
GetGadgetState(*ThisData\TrackBar2)
586         SetGadgetText(*ThisData\Difference, Str(NewValue))
587
588     Case *ThisData\Label, *ThisData\Difference
589         ; Do nothing.
590 EndSelect

```

```

591 EndProcedure
592
593 ; - Main
594
595 ; Create the first window.
596 EventWindow = CreateButtonWindow()
597 ResizeButtonWindow(EventWindow)
598
599 ; - Event loop
600 Repeat
601     Event = WaitWindowEvent()
602     EventWindow = EventWindow()
603     EventWindowKey = StrU(EventWindow)
604     EventGadget = EventGadget()
605     EventType = EventType()
606     EventMenu = EventMenu()
607     *EventGadgets = ActiveWindows(EventWindowKey)
608
609     Select Event
610         Case #PB_Event_Gadget
611             ; Check that a valid pointer was obtained.
612             If *EventGadgets > 0
613                 ; Use *EventGadgets\WindowClass to despatch events to the
correct event procedure.
614                 Select *EventGadgets\WindowClass
615                     Case #WindowClassButton
616                         EventsButtonWindow(EventWindow, EventGadget, EventType)
617
618                     Case #WindowClassDate
619                         EventsDateWindow(EventWindow, EventGadget, EventType)
620
621                     Case #WindowClassTrack
622                         EventsTrackWindow(EventWindow, EventGadget, EventType)
623
624                     Default
625                         ; Do nothing
626                 EndSelect
627             EndIf
628
629         Case #PB_Event_Menu
630             Select EventMenu
631                 Case #MenuNewButton
632                     EventWindow = CreateButtonWindow()
633                     If EventWindow > 0
634                         ResizeButtonWindow(EventWindow)
635                     EndIf
636
637                 Case #MenuNewDate
638                     EventWindow = CreateDateWindow()
639                     If EventWindow > 0
640                         ResizeDateWindow(EventWindow)
641                     EndIf
642
643                 Case #MenuNewTrack
644                     EventWindow = CreateTrackWindow()
645                     If EventWindow > 0
646                         ResizeTrackWindow(EventWindow)
647                     EndIf
648

```

```

649         Case #MenuClose
650             ; Check that a valid pointer was obtained.
651             If *EventGadgets > 0
652                 ; Use *EventGadgets\WindowClass to call the correct
destroy window procedure.
653                 Select *EventGadgets\WindowClass
654                     Case #WindowClassButton
655                         DestroyButtonWindow(EventWindow)
656
657                     Case #WindowClassDate
658                         DestroyDateWindow(EventWindow)
659
660                     Case #WindowClassTrack
661                         DestroyTrackWindow(EventWindow)
662
663                     Default
664                         ; Do nothing
665                 EndSelect
666             EndIf
667         EndSelect
668
669         Case #PB_Event_CloseWindow
670             ; Check that a valid pointer was obtained.
671             If *EventGadgets > 0
672                 ; Use *EventGadgets\WindowClass to call the correct destroy
window procedure.
673                 Select *EventGadgets\WindowClass
674                     Case #WindowClassButton
675                         DestroyButtonWindow(EventWindow)
676
677                     Case #WindowClassDate
678                         DestroyDateWindow(EventWindow)
679
680                     Case #WindowClassTrack
681                         DestroyTrackWindow(EventWindow)
682
683                     Default
684                         ; Do nothing
685                 EndSelect
686             EndIf
687
688         Case #PB_Event_SizeWindow
689             If *EventGadgets > 0
690                 ; Use *EventGadgets\WindowClass to call the correct resize
window procedure.
691                 Select *EventGadgets\WindowClass
692                     Case #WindowClassButton
693                         ResizeButtonWindow(EventWindow)
694
695                     Case #WindowClassDate
696                         ResizeDateWindow(EventWindow)
697
698                     Case #WindowClassTrack
699                         ResizeTrackWindow(EventWindow)
700
701                     Default
702                         ; Do nothing
703                 EndSelect
704             EndIf

```

```
705 |
706 |     EndSelect
707 |
708 | Until EventQuit = #True
```

UserGuide Navigation

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>

Chapter 88

UserGuide - Structuring code in Procedures

We're going to revisit the file properties example again. This time to introduce procedures and to address some of the limitations identified in the program in previous items.

```
1 ; The structure for file information as before.
2 Structure FILEITEM
3     Name.s
4     Attributes.i
5     Size.q
6     DateCreated.i
7     DateAccessed.i
8     DateModified.i
9 EndStructure
10
11 ; This is a constant to identify the window.
12 Enumeration
13     #WindowFiles
14 EndEnumeration
15
16 ; This is an enumeration to identify controls that will appear on the
17 ; window.
18 Enumeration
19     #FolderButton
20     #UpdateButton
21     #FolderText
22     #FilesList
23 EndEnumeration
24
25 Procedure FilesExamine(Folder.s, List Files.FILEITEM())
26     ; Obtains file properties from Folder into Files.
27
28     Protected.l Result
29
30     ; Clear current contents.
31     ClearList(Files())
32
33     ; Open the directory to enumerate its contents.
34     Result = ExamineDirectory(0, Folder, "*.*")
35
36     ; If this is ok, begin enumeration of entries.
37     If Result
```

```

37     ; Loop through until NextDirectoryEntry(0) becomes zero -
indicating that there are no more entries.
38     While NextDirectoryEntry(0)
39         ; If the directory entry is a file, not a folder.
40         If DirectoryEntryType(0) = #PB_DirectoryEntry_File
41             ; Add a new element to the list.
42             AddElement(Files())
43             ; And populate it with the properties of the file.
44             Files()\Name = DirectoryEntryName(0)
45             Files()\Size = DirectoryEntrySize(0)
46             Files()\Attributes = DirectoryEntryAttributes(0)
47             Files()\DateCreated = DirectoryEntryDate(0, #PB_Date_Created)
48             Files()\DateAccessed = DirectoryEntryDate(0,
#PB_Date_Accessed)
49             Files()\DateModified = DirectoryEntryDate(0,
#PB_Date_Modified)
50         EndIf
51     Wend
52
53     ; Close the directory.
54     FinishDirectory(0)
55 EndIf
56
57     ; Sort the list into ascending alphabetical order of file name.
58     SortStructuredList(Files(), #PB_Sort_Ascending,
OffsetOf(FILEITEM\Name), #PB_String)
59 EndProcedure
60
61 Procedure.s FolderSelect(Folder.s)
62     ; Displays a path requester and returns the new path, or the old
one if the requester is cancelled.
63     Protected.s SelectedPath
64
65     SelectedPath = PathRequester("Choose a folder.", Folder)
66
67     If SelectedPath = ""
68         SelectedPath = Folder
69     EndIf
70
71     ProcedureReturn SelectedPath
72 EndProcedure
73
74 Procedure LabelUpdate(Folder.s)
75     ; Updates the folder label.
76     SetGadgetText(#FolderText, Folder)
77 EndProcedure
78
79 Procedure ListLoad(ListView.l, List Files.FILEITEM())
80     ; Load the files properties from list Files() into the list view
#FilesList.
81     Protected.s Access, Attrib, Create, Folder, Modify, Msg, Num, Size
82
83     ; Remove previous contents.
84     ClearGadgetItems(ListView)
85
86     ForEach Files()
87         ; Display the item number and file name.
88         Num = StrU(ListIndex(Files()) + 1)
89

```

```

90     ; These lines convert the three date values to something more
familiar.
91     Create = FormatDate("%dd/%mm/%yyyy", Files()\DateCreated)
92     Access = FormatDate("%dd/%mm/%yyyy", Files()\DateAccessed)
93     Modify = FormatDate("%dd/%mm/%yyyy", Files()\DateModified)
94
95     ; Convert the file size to a padded string the same as with the
index value above,
96     ; but allow space for the maximum size of a quad.
97     Size = StrU(Files()\Size)
98
99     ; Convert the attributes to a string, for now.
100   _ATTRIB = StrU(Files()\Attributes)
101
102    ; Build a row string.
103    ; The Line Feed character 'Chr(10)' tells the gadget to move to
the next column.
104    Msg = Num + Chr(10) + Files()\Name + Chr(10) + Create + Chr(10) +
Access + Chr(10) + Modify + Chr(10) + ATTRIB + Chr(10) + Size
105
106    ; Add the row to the list view gadget.
107    AddGadgetItem(#FilesList, -1, Msg)
108    Next Files()
109 EndProcedure
110
111 Procedure WindowCreate()
112     ; Creates the wdwFiles window.
113     Protected Flags
114
115     ; This line defines a flag for the window attributes by OR-ing
together the desired attribute constants.
116     Flags = #PB_Window_SystemMenu | #PB_Window_SizeGadget |
#PB_Window_MinimizeGadget | #PB_Window_MaximizeGadget |
#PB_Window_TitleBar
117
118     ; Open a window.
119     OpenWindow(#WindowFiles, 50, 50, 450, 400, "File Properties", Flags)
120     ; A button to choose a folder.
121     ButtonGadget(#FolderButton, 5, 5, 100, 30, "Select Folder")
122     ; A button to update the list.
123     ButtonGadget(#UpdateButton, 112, 5, 100, 30, "Update List")
124     ; A text gadget to show the name of the folder.
125     TextGadget(#FolderText, 5, 40, 400, 25, "")
126     ; A list icon gadget to hold the file list and properties.
127     ListIconGadget(#FilesList, 5, 70, 400, 326, "#", 35)
128     ; Add columns to the ListIconGadget to hold each property.
129     AddGadgetColumn(#FilesList, 1, "Name", 200)
130     AddGadgetColumn(#FilesList, 2, "Created", 100)
131     AddGadgetColumn(#FilesList, 3, "Accessed", 100)
132     AddGadgetColumn(#FilesList, 4, "Modified", 100)
133     AddGadgetColumn(#FilesList, 5, "Attributes", 150)
134     AddGadgetColumn(#FilesList, 6, "Size", 100)
135 EndProcedure
136
137 Procedure WindowDestroy()
138     ; Closes the window.
139     ; If necessary, you could do other tidying up jobs here too.
140     CloseWindow(#WindowFiles)
141 EndProcedure

```

```

142
143 Procedure WindowResize()
144     ; Resizes window gadgets to match the window size.
145     ResizeGadget(#FolderText, #PB_Ignore, #PB_Ignore,
146     WindowWidth(#WindowFiles) - 10, #PB_Ignore)
147     ResizeGadget(#FilesList, #PB_Ignore, #PB_Ignore,
148     WindowWidth(#WindowFiles) - 10, WindowHeight(#WindowFiles) - 74)
149 EndProcedure
150
151 ;- Main
152 ; Now we define a list of files using the structure previously
153 ; specified.
154 NewList Files.FILEITEM()
155
156 ; And some working variables to make things happen.
157 Define.s Folder
158 Define.l Event, EventWindow, EventGadget, EventType, EventMenu
159
160 ; This function gets the home directory for the logged on user.
161 Folder = GetHomeDirectory()
162
163 ; Create the window and set the initial contents.
164 WindowCreate()
165 WindowResize()
166 LabelUpdate(Folder)
167 FilesExamine(Folder, Files())
168 ListLoad(#FilesList, Files())
169
170 ;- Event Loop
171 Repeat
172     ; Wait until a new window or gadget event occurs.
173     Event = WaitWindowEvent()
174     EventWindow = EventWindow()
175     EventGadget = EventGadget()
176     EventType = EventType()
177
178     ; Take some action.
179     Select Event
180     Case #PB_Event_Gadget
181         ; A gadget event occurred.
182         If EventGadget = #FolderButton
183             ; The folder button was clicked.
184             Folder = FolderSelect(Folder)
185             LabelUpdate(Folder)
186             FilesExamine(Folder, Files())
187             ListLoad(#FilesList, Files())
188
189         ElseIf EventGadget = #UpdateButton
190             ; The update button was clicked.
191             FilesExamine(Folder, Files())
192             ListLoad(#FilesList, Files())
193
194         ElseIf EventGadget = #FolderText
195             ; Do nothing here.
196
197         ElseIf EventGadget = #FilesList
198             ; Do nothing here.
199
200     EndIf

```

```

198
199     Case #PB_Event_SizeWindow
200         ; The window was moved or resized.
201         If EventWindow = #WindowFiles
202             WindowResize()
203         EndIf
204
205     Case #PB_Event_CloseWindow
206         ; The window was closed.
207         If EventWindow = #WindowFiles
208             WindowDestroy()
209             Break
210
211         EndIf
212     EndSelect
213 ForEver

```

Previously, we mentioned four limitations to this program. This new version uses procedures to address three of them.

1) You couldn't choose a folder to show.

The "FolderSelect" procedure shows a path requester to allow the user to select a folder. The variable "Folder" is updated with the result of this procedure. The button also calls "LabelUpdate", "FilesExamine" and "ListLoad" to display the contents of the new folder in the window .

2) You can't update the list contents without closing and restarting the program.

Now, when the "Update List" button is clicked, "FilesExamine" and "ListLoad" are called again to update the display.

3) If you resize the window, the gadgets don't resize with it.

The "WindowResize" procedure is called in the event loop to resize the gadgets when the form is resized. Also, although this program didn't really need to, this procedure is called after calling "WindowCreate" to make sure the gadgets are the right size initially.

Notice how several of the procedures are called more than once to perform similar but not identical functions. This improves the efficiency of the program.

We have one final limitation to overcome in a later item.

UserGuide Navigation

< Previous: Displaying graphics output & simple drawing || Overview || Next: Compiler directives >

Chapter 89

UserGuide - String Manipulation

The following example shows step by step the different commands of the string library - their purpose and their correct use.

```
1  Define.s String1, String2, String3
2
3  String1 = "The quick brown fox jumps over the lazy dog."
4
5  ; Left returns a number of characters from the left hand end of a
   string.
6  ; Mid returns a number of characters from the given start location in
   the middle of a string.
7  ; Right returns a number of characters from the right hand end of a
   string.
8  ; Space returns the specified number of space characters as a string.
9  ; Shows "The brown dog."
10 Debug "* Left, Mid and Right"
11 String2 = Left(String1, 3) + Space(1) + Mid(String1, 11, 5) +
   Space(1) + Right(String1, 4)
12 Debug String2
13
14 ; CountString returns the number of instances of the second string in
   the first string, it is case sensitive.
15 ; Shows 1.
16 Debug "* CountString"
17 Debug CountString(String1, "the")
18
19 ; However the LCase (and UCase) functions can be used to switch a
   string to all lower (or upper) case
20 ; Shows 2
21 Debug "* CountString and LCase"
22 String2 = LCase(String1)
23 Debug CountString(String2, "the")
24
25 ; FindString can be used to find the location of one string within
   another.
26 ; Shows 17.
27 Debug "* FindString"
28 Debug FindString(String1, "fox")
29
30 ; RemoveString can be used to remove one string from within another.
31 ; Shows The quick fox jumps over the lazy dog.
32 Debug "* RemoveString"
```

```

33 String2 = RemoveString(String1, " brown")
34 Debug String2
35
36 ; ReplaceString can be used to change the occurrence of a substring
   within another string.
37 ; Shows The quick brown fox jumps over the sleeping dog.
38 Debug "* ReplaceString"
39 String2 = ReplaceString(String1, "lazy", "sleeping")
40 Debug String2
41
42 ; StringByteLength returns the length of a string in bytes in the
   specified format, or the current default
43 ; if one is not specified (excluding the terminating null).
44 Debug "* StringByteLength"
45 ; Shows 44.
46 Debug StringByteLength(String1, #PB_Ascii)
47 ; Shows 88.
48 Debug StringByteLength(String1, #PB_Unicode)
49
50 ; StringField can be used to obtain an indexed substring from a
   target string.
51 ; Useful for converting strings to lists for example.
52 ; StringField will work with space as a delimiter too
53 ; but hopefully this example makes the functions behaviour more
   apparent.
54 ; Shows jumps.
55 Debug "* StringField"
56 String2 = ReplaceString(String1, " ", "\")
57 Debug String2
58 String3 = StringField(String2, 5, "\")
59 Debug String3
60
61 ; Trim removes white space characters from the start and end of a
   given string.
62 ; Similarly, LTrim acts on the left hand end (start) of a string and
   RTrim the right hand end.
63 Debug "* Trim, LTrim and RTrim"
64 String2 = Space(10) + String1 + Space(8)
65 Debug #DQUOTE$ + String2 + #DQUOTE$
66 String3 = Trim(String2)
67 Debug #DQUOTE$ + String3 + #DQUOTE$
68 String3 = LTrim(String2)
69 Debug #DQUOTE$ + String3 + #DQUOTE$
70 String3 = RTrim(String2)
71 Debug #DQUOTE$ + String3 + #DQUOTE$
72
73 ; LSet sets a string to be a specific length from the left hand end,
   padding with spaces,
74 ; or other specified character, as necessary.
75 ; If the string is already longer than the specified length it will
   be truncated.
76 Debug "*LSet"
77 Debug LSet("Abc", 10, "*")
78 Debug LSet("Abcd", 10, "*")
79 Debug LSet("ABCDE", 10, "*")
80
81 ; Similarly RSet pads a string from its right hand end.
82 Debug "* RSet"
83 Debug RSet("1.23", 10, "0")

```

```
84 | Debug RSet("10.23", 10, "0")
85 | Debug RSet("100.23", 10, "0")
86 |
87 | ; Str converts a signed quad value to a string, similarly StrF
   |   converts floats,
88 | ; StrD converts doubles and StrU converts unsigned values, these two
   |   function have an optional
89 | ; parameter to specify the number of decimal places to show.
90 | Debug "* Str, StrF and StrD"
91 | Debug Str(100)
92 | Debug StrF(1.234, 3)
93 | Debug StrD(123456.789, 3)
94 |
95 | ; Val will convert a string value into its numeric (quad) equivalent.
96 | ; ValD and ValF perform the same function for floats and doubles.
97 | Debug "* Val"
98 | Debug Val("123")
99 |
100 | ; Bin will convert a numeric value into its binary equivalent.
101 | ; Hex will convert one into its hexadecimal equivalent.
102 | Debug "* Bin and Hex"
103 | Debug Bin(19)
104 | Debug Hex(19)
```

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Chapter 90

UserGuide - Displaying text output (Console)

In the previous topic Input & Output you already saw an overview about the different possibilities to output text to the user, and in the topic Storing Data in Memory , we started to build a small application to display the properties of files in a particular folder to the debug window .

Now we're going to revisit this example to improve the data output section to resolve some issues with using the debug window. Firstly, this window is only available in the PureBasic IDE which means its only useful to programmers, secondly it doesn't really give us much control over how our output looks. PureBasic provides a text mode window, or console window , which can be used in compiled programs. So let's update our example to use it instead.

First, we will need some extra working variables to make this work properly. Amend the variable definitions like this:

```
1   ...
2
3   ; Now we define a new list of files using the structure previously
   specified
4   NewList Files.FILEITEM()
5   Define.s Access, Attrib, Create, Folder, Modify, Msg, Num, Size
6   Define.l Result
7
8   ...
```

Next, remove the output section of code completely, from the comment line:

```
1   ; If there are some entries in the list, show the results in the
   debug window.
2   ...
```

Now replace this with:

```
1   ; Open a text mode screen to show the results.
2   OpenConsole()
3
4   ; Display a title.
5   ; PrintN displays the string given in the console window and moves
   the print position to the start of the next line afterwards.
6   ; Space(n) returns n spaces in a string.
7   PrintN("File list of " + Folder + ".")
8   PrintN("-----")
9   Msg = "Num Name "
10  PrintN(Msg)
```

```

11  Msg = Space(4) + "Create" + Space(5) + "Access" + Space(5) + "Modify"
    + Space(5) + "Attrib Size"
12  PrintN(Msg)
13
14  ; Loop through the list to display the results.
15  ForEach Files()
16
17      ; Tabulate the number of the list index.
18      ; ListIndex() returns the current position in the list, counting
    from zero.
19      ; StrU converts an unsigned number into a string.
20      ; RSet pads a string to a set length with the necessary number of a
    specified character at the front.
21      ; Here we use it to make sure all the index numbers are padded to 3
    characters in length.
22      Num = RSet(StrU(ListIndex(Files()) + 1), 3, " ")
23
24      ; Display the item number and file name.
25      Msg = Num + " " + Files()\Name
26      PrintN(Msg)
27
28      ; These lines convert the three date values to something more
    familiar.
29      Create = FormatDate("%dd/%mm/%yyyy", Files()\DateCreated)
30      Access = FormatDate("%dd/%mm/%yyyy", Files()\DateAccessed)
31      Modify = FormatDate("%dd/%mm/%yyyy", Files()\DateModified)
32
33      ; Convert the file size to a padded string the same as with the
    index value above,
34      ; but allow space for the maximum size of a quad.
35      Size = RSet(StrU(Files()\Size), 19)
36
37      ; Convert the attributes to a string, for now.
38      Attrib = RSet(StrU(Files()\Attributes), 6, " ")
39
40      ; Display the file's properties.
41      Msg = Space(4) + Create + " " + Access + " " + Modify + " " +
    Attrib + " " + Size
42      PrintN(Msg)
43
44      ; Display a blank line.
45      PrintN("")
46
47  Next Files()
48
49  ; Wait for the return key to be displayed, so the results can be
    viewed before the screen closes.
50  PrintN("")
51  PrintN("Press return to exit")
52  Input()

```

All being well the output should appear in a console window looking something like this:

```

1  File List of C:\Documents And Settings\user\.
2  -----
3  Num Name
4      Create      Access      Modify      Attrib Size
5      1 NTUSER.DAT
6      03/07/2008 04/04/2011 02/04/2011      34      18874368

```

```

7
8   2  kunzip.dll
9     14/07/2008 04/04/2011 14/07/2008    32          18432
10
11  3  ntuser.dat.LOG
12     03/07/2008 04/04/2011 04/04/2011    34          1024
13
14  4  ntuser.ini
15     03/07/2008 02/04/2011 02/04/2011     6           278
16
17  Press Return To exit

```

This output is from a Windows XP system, later versions of Windows and Linux or Mac OSX will show different files of course.

Note for Linux/MacOS: Please note, to select "Console" as executable format in the compiler options

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Chapter 91

UserGuide - Some Tips & Tricks

”Using a map to index a list”

lists provide a powerful way to build a structured storage system - however they have a disadvantage. If you aren't sure exactly where in the list a particular item is, you must examine each entry in the list to find the right one.

Maps also provide a similar function but are indexed by a key value instead - however they too have a disadvantage, they don't maintain the order elements are inserted into the list.

However by using a combination of the two, you can neatly avoid both of these issues...

This example loads a structured list of book data and builds an index of ISBN numbers using a map . It then demonstrates how to access the list using the index in the map.

```
1  EnableExplicit
2
3  ; A book catalog structure.
4  Structure BOOK
5      Title.s
6      Author.s
7      ISBN13.s
8      Price.d
9  EndStructure
10
11 ; Create a list to hold the catalog entries.
12 NewList Catalog.BOOK()
13 ; Create a map to hold the ISBN index.
14 NewMap ISBN13.1()
15 ; Working variables.
16 Define.l Count, Index
17 Define.s ISBN
18
19 ; Add an empty element at the top of the list.
20 ; The first element in a list is numbered zero, however the map will
    return zero if a requested entry isn't present.
21 ; This empty element avoids a potential problem with an incorrect
    reference to the first catalog item being returned.
22 AddElement(Catalog())
23
24 For Count = 1 To 5
25
26     ; Read the data from the table into the list.
27     AddElement(Catalog())
28     Read.s Catalog()\Title
29     Read.s Catalog()\Author
```

```

30     Read.s Catalog()\ISBN13
31     Read.d Catalog()\Price
32
33     ; Index the ISBN to the map.
34     ISBN13(Catalog()\ISBN13) = ListIndex(Catalog())
35
36 Next Count
37
38 ; Find an entry.
39 ISBN = "978-0340896983"
40 Index = ISBN13(ISBN)
41
42 If Index > 0
43     Debug "Book with ISBN13 " + ISBN + " is at list index " +
44     StrU(Index) + "."
45     Debug ""
46
47     ; We can now directly select the right list element without having
48     to perform a search.
49     SelectElement(Catalog(), Index)
50     Debug "" + Catalog()\Title + "' by " + Catalog()\Author
51     Debug "ISBN: " + Catalog()\ISBN13
52     Debug "Price: " + StrD(Catalog()\Price, 2)
53
54 Else
55     Debug "No book with that ISBN in the catalog."
56
57 EndIf
58
59 End
60
61 ; Some test data.
62 DataSection
63
64     BookData:
65
66     Data.s "Carte Blanche", "Jeffery Deaver", "978-1444716474"
67     Data.d 19.99
68
69     Data.s "One Day", "David Nicholls", "978-0340896983"
70     Data.d 7.99
71
72     Data.s "Madeleine", "Kate McCann", "978-0593067918"
73     Data.d 20.00
74
75     Data.s "The Dukan Diet", "Dr Pierre Dukan", "978-1444710335"
76     Data.d 8.99
77
78     Data.s "A Game of Thrones", "George R. R. Martin", "978-0006479888"
79     Data.d 9.99
80
81     Data.s "The Help", "Kathryn Stockett", "978-0141039282"
82     Data.d 8.99
83
84 EndDataSection

```

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Chapter 92

UserGuide - Variables and Processing of variables

A is an integer - but note that you can't declare variables this way if you use the `EnableExplicit` directive. Outside of a procedure **A** will exist at Main scope, within a procedure it will become local.

```
1 A = 0
```

B is a long integer, **C** is a floating-point number, they will be initialized to zero.

```
1 Define B.l, C.f
```

D and **E** are long integers too. However, they will be initialized to the stated constants. Notice too the alternative syntax of `Define` used.

```
1 Define.l D = 10, E = 20
```

F is a string.

```
1 Define.s F
```

So is **G\$**, however, if you declare strings this way, you must always use the `$` notation.

```
1 G$ = "Hello, "
```

This won't work. (**G** becomes a new integer variable and a compiler error occurs).

```
1 G = "Goodbye, World!"
```

H is an array of 20 strings, array indexing begins at zero.

```
1 Dim H.s(19)
```

Now **H** is an array of 25 strings. If the array is resized larger, its original contents will be preserved.

```
1 ReDim H.s(24)
```

J will appear at Global, rather than Main, scope. It will appear in all procedures, but maybe a better way would be to use the `Shared` keyword inside a procedure on a main scope variable, so that the chances of accidental changes are minimized.

```
1 Global.i J
```

K will be a new, empty, list of strings at main scope.

```
1 NewList K.s()
```

M will be a new, empty, map of strings at main scope.

```
1 NewMap M.s()
```

Note that you can't use the alternative syntax of the Define keyword with NewList or NewMap though. A compiler error will result.

Within a procedure:

```
1 Procedure TestVariables()  
2  
3 ; N and P will be local.  
4 Define.l N  
5 Protected.l P  
6  
7 ; Q will be a static local.  
8 Static.l Q  
9  
10 ; The main scope variable F and the string list K will be available  
    within this procedure.  
11 Shared F, K()  
12  
13 ; The global scope variable J will be available here implicitly.  
14  
15 EndProcedure
```

Using operators on variables:

```
1 ; Add two to A.  
2 A + 2  
3  
4 ; Bitwise Or with 21 (A will become 23)  
5 A | 21  
6  
7 ; Bitwise And with 1 (A will become 1)  
8 A & 1  
9  
10 ; Arithmetic shift left (A will become 2, that is 10 in binary).  
11 A << 1
```

String concatenation:

```
1 G$ + "World!"
```

Add an element to the K list:

```
1 AddElement(K())  
2 K() = "List element one"
```

Add an element to the M map:

```
1 M("one") = "Map element one"
```

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Chapter 93

Unicode

Introduction

Unicode is the term used for extended character sets which allows displaying text in many languages (including those with a lot of different characters like Japanese, Korean etc.). It solves the ASCII problem of having a lot of table dedicated for each language by having a unified table where each character has its own place.

To simplify, unicode can be seen as a big ascii table, which doesn't have 256 characters but up to 65536. Thus, each character in unicode will need 2 bytes in memory (this is important when dealing with pointers for example).

Here are some links to have a better understanding about unicode (must have reading):

[General unicode information](#)

[Unicode and BOM](#)

Unicode and Windows

PureBasic internally uses the UCS2 encoding which is also the format used by the Windows unicode API, so no conversions are needed at runtime when calling an OS function. When dealing with an API function, PureBasic will automatically use the unicode one if available (for example `MessageBox_()` will map to `MessageBoxW()`). All the API structures and constants supported by PureBasic are using unicode version.

UTF-8

UTF-8 is another unicode encoding, which is byte based. Unlike UCS2 which always takes 2 bytes per characters, UTF-8 uses a variable length encoding for each character (up to 4 bytes can represent one character). The biggest advantage of UTF-8 is the fact it doesn't includes null characters in its coding, so it can be edited like a regular text file. Also the ASCII characters from 1 to 127 are always preserved, so the text is kind of readable as only special characters will be encoded. One drawback is its variable length, so it all string operations will be slower due to needed pre-processing to locate a character is in the text.

PureBasic uses UTF-8 by default when writing string to files (File and Preference libraries), so all texts are fully cross-platform.

The PureBasic compiler also handles both Ascii and UTF-8 files (the UTF-8 files need to have the correct BOM header to be handled correctly). Both can be mixed in a single program without problem: an ascii file can include an UTF-8 file and vice-versa, as long as all string-literals (i.e. "x") and character-literals (i.e. 'x') in the ASCII files contain only characters with a code ≤ 127 . When developing, it's recommended to set the IDE in UTF-8 mode, so all the source files will be unicode ready.

Chapter 94

Variables and Types

Variables declaration

To declare a variable in PureBasic, simply type its name. You can also specify the type you want this variable to be. By default, when a data type is not indicated, the data is an integer. Variables do not need to be explicitly declared, as they can be used as "variables on-the-fly". The Define keyword can be used to declare multiple variables in one statement. If you don't assign an initial value to the variable, their value will be 0.

Example

```
1  a.b          ; Declare a variable called 'a' from byte (.b) type.
2  c.l = a*d.w ; 'd' is declared here within the expression and it's a
    word !
```

Notes:

Variable names must not start with a number (0,1,...), contain operators (+,-,...) or special characters (ß,ä,ö,ü,...).

The variables in PureBasic are not case sensitive, so "pure" and "PURE" are the same variable.

If you don't need to change the content of a variable during the program flow (e.g. you're using fixed values for ID's etc.), you can also take a look at constants as an alternative.

To avoid typing errors etc. it's possible to force the PureBasic compiler to always want a declaration of variables, before they are first used. Just use EnableExplicit keyword in your source code to enable this feature.

Basic types

PureBasic allows many type variables which can be standard integers, float, double, quad and char numbers or even string characters. Here is the list of the native supported types and a brief description :

Name	Extension	Memory consumption	Range
Byte +127	.b	1 byte	-128 to
Ascii +255	.a	1 byte	0 to
Character +65535	.c	2 bytes	0 to

Word		.w		2 bytes		-32768 to +32767
Unicode		.u		2 bytes		0 to +65535
Long		.l		4 bytes		-2147483648 to +2147483647
Integer		.i		4 bytes (using 32-bit compiler)		-2147483648 to +2147483647
Integer		.i		8 bytes (using 64-bit compiler)		-9223372036854775808 to +9223372036854775807
Float		.f		4 bytes		unlimited (see below)
Quad		.q		8 bytes		-9223372036854775808 to +9223372036854775807
Double		.d		8 bytes		unlimited (see below)
String		.s		string length + 1		unlimited
Fixed String		.s{Length}		string length		unlimited

Unsigned variables: Purebasic offers native support for unsigned variables with byte and word types via the ascii (.a) and unicode (.u) types. The character (.c) type is an unsigned word in unicode that may be used as an unsigned type.

Notation of string variables: it is possible to use the '\$' as last char of a variable name to mark it as string. This way you can use 'a\$' and 'a.s' as different string variables. Please note, that the '\$' belongs to the variable name and must be always attached, unlike the 's' which is only needed when the string variable is declared the first time.

```

1  a.s = "One string"
2  a$ = "Another string"
3  Debug a ; will give "One string"
4  Debug a$ ; will give "Another string"

```

Note: The floating numbers (floats + doubles) can also be written like this: 123.5e-20

```

1  value.d = 123.5e-20
2  Debug value ; will give 0.000000000000000001235

```

Operators

Operators are the functions you can use in expressions to combine the variables, constants, and whatever else. The table below shows the operators you can use in PureBasic, in no particular order (LHS = Left Hand Side, RHS = Right Hand Side).

Operator = (Equals)

This can be used in two ways. The first is to assign the value of the expression on the RHS to the variable on the LHS. The second way is when the result of the operator is used in an expression and is to test whether the values of the expressions on the LHS and RHS are the same (if they are the same this operator will return a true result, otherwise it will be false).

Example

```
1  a = b+c      ; Assign the value of the expression "b+c" to the
   variable "a"
2  If abc = def ; Test if the values of abc and def are the same, and
   use this result in the If command
```

Operator + (Plus)

Gives a result of the value of the expression on the RHS added to the value of the expression on the LHS. If the result of this operator is not used and there is a variable on the LHS, then the value of the expression on the RHS will be added directly to the variable on the LHS.

Example

```
1  number=something+2 ; Adds the value 2 to "something" and uses the
   result with the equals operator
2  variable+expression ; The value of "expression" will be added
   directly to the variable "variable"
```

Operator - (Minus)

Subtracts the value of the expression on the RHS from the value of the expression on the LHS. When there is no expression on the LHS this operator gives the negative value of the value of the expression on the RHS. If the result of this operator is not used and there is a variable on the LHS, then the value of the expression on the RHS will be subtracted directly from the variable on the LHS. This operator cannot be used with string type variables.

Example

```
1  var=#MyConstant-foo ; Subtracts the value of "foo" from "#MyConstant"
   and uses the result with the equals operator
2  another=another+ -var ; Calculates the negative value of "var" and
   uses the result in the plus operator
3  variable-expression ; The value of "expression" will be subtracted
   directly from the variable "variable"
```

Operator * (Multiplication)

Multiplies the value of the expression on the LHS by the value of the expression on the RHS. If the result of this operator is not used and there is a variable on the LHS, then the value of the variable is directly multiplied by the value of the expression on the RHS. This operator cannot be used with string type variables.

Example

```
1  total=price*count ; Multiplies the value of "price" by the value of
   "count" and uses the result with the equals operator
2  variable*expression ; "variable" will be multiplied directly by the
   value of "expression"
```

Operator / (Division)

Divides the value of the expression on the LHS by the value of the expression on the RHS. If the result of this operator is not used and there is a variable on the LHS, then the value of the variable is directly divided by the value of the expression on the RHS. This operator cannot be used with string type variables.

Example

```
1  count=total/price ; Divides the value of "total" by the value of
   "price" and uses the result with the equals operator
2  variable/expression ; "variable" will be divided directly by the
   value of "expression"
```

Operator & (Bitwise AND)

You should be familiar with binary numbers when using this operator. The result of this operator will be the value of the expression on the LHS anded with the value of the expression on the RHS, bit for bit. The value of each bit is set according to the table below. Additionally, if the result of the operator is not used and there is a variable on the LHS, then the result will be stored directly in that variable. This operator cannot be used with strings.

LHS		RHS		Result
0		0		0
0		1		0
1		0		0
1		1		1

Example

```
1  ; Shown using binary numbers as it will be easier to see the result
2  a.w = %1000 & %0101 ; Result will be 0
3  b.w = %1100 & %1010 ; Result will be %1000
4  bits = a & b ; AND each bit of a and b and use result in equals
   operator
5  a & b ; AND each bit of a and b and store result directly in variable
   "a"
```

Operator || (Bitwise OR)

You should be familiar with binary numbers when using this operator. The result of this operator will be the value of the expression on the LHS or'ed with the value of the expression on the RHS, bit for bit. The value of each bit is set according to the table below. Additionally, if the result of the operator is not used and there is a variable on the LHS, then the result will be stored directly in that variable. This operator cannot be used with strings.

LHS		RHS		Result
0		0		0
0		1		1
1		0		1
1		1		1

Example

```
1 ; Shown using binary numbers as it will be easier to see the result
2 a.w = %1000 | %0101 ; Result will be %1101
3 b.w = %1100 | %1010 ; Result will be %1110
4 bits = a | b ; OR each bit of a and b and use result in equals
  operator
5 a | b ; OR each bit of a and b and store result directly in variable
  "a"
```

Operator ! (Bitwise XOR)

You should be familiar with binary numbers when using this operator. The result of this operator will be the value of the expression on the LHS xor'ed with the value of the expression on the RHS, bit for bit. The value of each bit is set according to the table below. Additionally, if the result of the operator is not used and there is a variable on the LHS, then the result will be stored directly in that variable. This operator cannot be used with strings.

LHS		RHS		Result
0		0		0
0		1		1
1		0		1
1		1		0

Example

```
1 ; Shown using binary numbers as it will be easier to see the result
2 a.w = %1000 ! %0101 ; Result will be %1101
3 b.w = %1100 ! %1010 ; Result will be %0110
4 bits = a ! b ; XOR each bit of a and b and use result in equals
  operator
5 a ! b ; XOR each bit of a and b and store result directly in variable
  "a"
```

Operator * * (Bitwise NOT)

You should be familiar with binary numbers when using this operator. The result of this operator will be the not'ed value of the expression on the RHS, bit for bit. The value of each bit is set according to the table below. This operator cannot be used with strings.

RHS		Result
0		1
1		0

Example

```
1 ; Shown using binary numbers as it will be easier to see the result
2 a.w = ~%1000 ; Result will be %0111
3 b.w = ~%1010 ; Result will be %0101
```

Operator () (Brackets)

You can use sets of brackets to force part of an expression to be evaluated first, or in a certain order.

Example

```
1  a = (5 + 6) * 3 ; Result will be 33 since the 5+6 is evaluated first
2  b = 4 * (2 - (3 - 4)) ; Result will be 12 since the 3-4 is evaluated
   first, then the 2-result, then the multiplication
```

Operator < (Less than)

This is used to compare the values of the expressions on the LHS and RHS. If the value of the expression on the LHS is less than the value of the expression on the RHS this operator will give a result of true, otherwise the result is false.

Operator > (More than)

This is used to compare the values of the expressions on the LHS and RHS. If the value of the expression on the LHS is more than the value of the expression on the RHS this operator will give a result of true, otherwise the result is false.

Operator <=, =< (Less than or equal to)

This is used to compare the values of the expressions on the LHS and RHS. If the value of the expression on the LHS is less than or equal to the value of the expression on the RHS this operator will give a result of true, otherwise the result is false.

Operator >=, ==> (More than or equal to)

This is used to compare the values of the expressions on the LHS and RHS. If the value of the expression on the LHS is more than or equal to the value of the expression on the RHS this operator will give a result of true, otherwise the result is false.

Operator <> (Not equal to)

This is used to compare the values of the expressions on the LHS and RHS. If the value of the expression on the LHS is equal to the value of the expression on the RHS this operator will give a result of false, otherwise the result is true.

Operator And (Logical AND)

Can be used to combine the logical true and false results of the comparison operators to give a result shown in the following table.

LHS	RHS	Result
false	false	false

```

false | true | false
true  | false| false
true  | true  | true

```

Operator Or (Logical OR)

Can be used to combine the logical true and false results of the comparison operators to give a result shown in the following table.

LHS	RHS	Result
false	false	false
false	true	true
true	false	true
true	true	true

Operator XOr (Logical XOR)

Can be used to combine the logical true and false results of the comparison operators to give a result shown in the following table. This operator cannot be used with strings.

LHS	RHS	Result
false	false	false
false	true	true
true	false	true
true	true	false

Operator Not (Logical NOT)

The result of this operator will be the not'ed value of the logical on the RHS. The value is set according to the table below. This operator cannot be used with strings.

RHS	Result
false	true
true	false

Operator « (Arithmetic shift left)

Shifts each bit in the value of the expression on the LHS left by the number of places given by the value of the expression on the RHS. Additionally, when the result of this operator is not used and the LHS contains a variable, that variable will have its value shifted. It probably helps if you understand binary numbers when you use this operator, although you can use it as if each position you shift by is multiplying by an extra factor of 2.

Example

```

1  a=%1011 << 1 ; The value of a will be %10110. %1011=11, %10110=22
2  b=%111 << 4 ; The value of b will be %1110000. %111=7, %1110000=112
3  c.l=$80000000 << 1 ; The value of c will be 0. Bits that are shifted
    off the left edge of the result are lost.

```

Operator » (Arithmetic shift right)

Shifts each bit in the value of the expression on the LHS right by the number of places given by the value of the expression on the RHS. Additionally, when the result of this operator is not used and the LHS contains a variable, that variable will have its value shifted. It probably helps if you understand binary numbers when you use this operator, although you can use it as if each position you shift by is dividing by an extra factor of 2.

Example

```
1 d=16 >> 1 ; The value of d will be 8. 16=%10000, 8=%1000
2 e.w=%10101010 >> 4 ; The value of e will be %1010. %10101010=170,
  %1010=10. Bits shifted out of the right edge of the result are lost
  (which is why you do not see an equal division by 16)
3 f.b=-128 >> 1 ; The value of f will be -64. -128=%10000000,
  -64=%11000000. When shifting to the right, the most significant bit
  is kept as it is.
```

Operator % (Modulo)

Returns the remainder of the RHS by LHS integer division.

Example

```
1 a=16 % 2 ; The value of a will be 0 as 16/2 = 8 (no remainder)
2 b=17 % 2 ; The value of a will be 1 as 17/2 = 8*2+1 (1 is remaining)
```

Operators shorthands

Every math operators can be used in a shorthand form.

Example

```
1 Value + 1 ; The same as: Value = Value + 1
2 Value * 2 ; The same as: Value = Value * 2
3 Value << 1 ; The same as: Value = Value << 1
```

Note: this can lead to 'unexpected' results in some rare cases, if the assignment is modified before the affection.

Example

```
1 Dim MyArray(10)
2 MyArray(Random(10)) + 1 ; The same as: MyArray(Random(10)) =
  MyArray(Random(10)) + 1, but here Random() won't return the same
  value for each call.
```

Operators priorities

Priority Level	Operators
8 (high)	~, - (negative)
7	<<, >>, %, !
6	, &
5	*, /
4	+, - (subtraction)
3	>, >=, =>, <, <=, =<, =, <>
2	Not
1 (low)	And, Or, XOr

Structured types

Build structured types, via the [Structure](#) keyword. More information can be found in the structures chapter .

Pointer types

Pointers are declared with a '*' in front of the variable name. More information can be found in the pointers chapter .

Special information about Floats and Doubles

A floating-point number is stored in a way that makes the binary point "float" around the number, so that it is possible to store very large numbers or very small numbers. However, you cannot store very large numbers with very high accuracy (big and small numbers at the same time, so to speak). Another limitation of floating-point numbers is that they still work in binary, so they can only store numbers exactly which can be made up of multiples and divisions of 2. This is especially important to realize when you try to print a floating-point number in a human readable form (or when performing operations on that float) - storing numbers like 0.5 or 0.125 is easy because they are divisions of 2. Storing numbers such as 0.11 are more difficult and may be stored as a number such as 0.10999999. You can try to display to only a limited range of digits, but do not be surprised if the number displays different from what you would expect!

This applies to floating-point numbers in general, not just those in PureBasic.

Like the name says the doubles have double-precision (64-bit) compared to the single-precision of the floats (32-bit). So if you need more accurate results with floating-point numbers use doubles instead of floats.

The exact range of values, which can be used with floats and doubles to get correct results from arithmetic operations, looks as follows:

Float: +- 1.175494e-38 till +- 3.402823e+38

Double: +- 2.2250738585072013e-308 till +- 1.7976931348623157e+308

More information about the 'IEEE 754' standard you can get on [Wikipedia](#).

Chapter 95

While : Wend

Syntax

```
While <expression>  
    ...  
Wend
```

Description

Wend will loop until the <expression> becomes false. A good point to keep in mind with a **While** test is that if the first test is false, then the program will never enter the loop and will skip this part. A Repeat loop is executed at least once, (as the test is performed after each loop).

With the Break command it is possible to exit the **While : Wend** loop during any iteration, with the Continue command the end of the current iteration may be skipped.

Example

```
1  b = 0  
2  a = 10  
3  While a = 10  
4      b = b+1  
5      If b=10  
6          a=11  
7      EndIf  
8  Wend
```

This program loops until the 'a' value is <> 10. The value of 'a' becomes 11 when b=10, the program will loop 10 times.

Chapter 96

Windows Message Handling

Introduction

The messages for your program will be sent by Windows into a queue, which is worked off only if you want this. Windows sends thousand messages to your program without noticing this directly. For example if you change the status of a gadget (identical whether you add a new entry or change the image of an ImageGadget), a message is sent to the queue of your program. There are two possibilities to receive and to process the Windows messages in PureBasic: `WaitWindowEvent()` and `WindowEvent()`. The difference is, that `WaitWindowEvent()` waits till a message arrives and `WindowEvent()` continues to work also so. The messages in the queue will be processed however only, after you have called `WindowEvent()` or `WaitWindowEvent()`.

Specials of `WindowEvent()`

The command `WindowEvent()` don't wait, until a message arrives, but checks only whether one is in the queue. If yes, the message is processed and `WindowEvent()` gives back the number of the message. If no message lines up, then zero (0) is given back.

Example

```
1 While WindowEvent() : Wend
```

cause, that `WindowEvent()` becomes called as long till it gives back 0, i.e. until all messages of the queue are processed.

It doesn't reach, if you insert a simple '`WindowEvent()`' after a `SetGadgetState()` to process this 1 message. Firstly there still can be other messages in the queue, which have arrived before, and secondly Windows also sends quite a number of other messages, we don't have to take care of... which nevertheless are in the queue.

A simple call of

```
1 WindowEvent()
```

doesn't reach, the code then runs correct under circumstances on one Windows version, but on another version not. The different Windows versions are internally very different, so that one version only sends 1 message but another Windows version sends 5 messages for the same circumstance.

Because of this one always uses for updating:

```
1 While WindowEvent() : Wend
```

Of course there is also the alternative

```
1 Repeat : Until WindowEvent() = 0
```

possible, what isn't rather usual however.

The described method `While : WindowEvent() : Wend` is frequently useful in connection with the command `Delay()`, where the loop is inserted BEFORE the `Delay()`, e.g. to firstly wait for the update of an `ImageGadget` after changing an image with `SetGadgetState()`.

Chapter 97

With : EndWith

Syntax

```
With <expression>  
  ...  
EndWith
```

Description

`With : EndWith` blocks may be used with structure fields in order to reduce the quantity of code and to improve its' readability. This is a compiler directive, and works similarly to a macro , i.e., the specified expression is automatically inserted before any backslash '\ ' character which have a space or an operator preceding it. The code behaves identically to its' expanded version. `With : EndWith` blocks may not be nested, as this could introduce bugs which are difficult to track under conditions where several statements have been replaced implicitly.

Example

```
1  Structure Person  
2    Name$  
3    Age.l  
4    Size.l  
5  EndStructure  
6  
7  Friend.Person  
8  
9  With Friend  
10   \Name$ = "Yann "  
11   \Age   = 30  
12   \Size  = 196  
13  
14   Debug \Size+\Size  
15 EndWith
```

Example: Complex example

```
1  Structure Body  
2    Weight.l  
3    Color.l
```

```
4      Texture.1
5  EndStructure
6
7  Structure Person
8      Name$
9      Age.1
10     Body.Body[10]
11 EndStructure
12
13 Friend.Person
14
15 For k = 0 To 9
16     With Friend\Body[k]
17         \Weight = 50
18         \Color = 30
19         \Texture = \Color*k
20
21         Debug \Texture
22     EndWith
23 Next
```