

C O N T E N T S

Introduction	1
What's in this manual	1

Part 1 The Turbo Pascal standard

Chapter 1 Tokens and constants	5
Special symbols and reserved words	5
Identifiers	7
Labels	8
Numbers	9
Character strings	10
Constant declarations	12
Comments	13
Program lines	14

Chapter 2 Blocks, locality, and scope	15
Syntax	15
Rules of scope	17
Scope of interface and standard identifiers	18

Chapter 3 Types	21
Simple types	22
Ordinal types	22
Integer types	23
Boolean types	24
Char type	24
Enumerated types	25
Subrange types	25
Real types	26
Software floating point	27
8087 floating point	27
String types	27
Structured types	28
Array types	29
Record types	30

Object types	32
Components and scope	35
Methods	35
Virtual methods	36
Instantiating objects	36
Set types	38
File types	39
Pointer types	39
Procedural types	40
Identical and compatible types	41
Type identity	41
Type compatibility	42
Assignment compatibility	43
The type declaration part	44

Chapter 4 Variables	47
Variable declarations	47
The data segment	48
The stack segment	48
Absolute variables	49
Variable references	50
Qualifiers	50
Arrays, strings, and indexes	51
Records and field designators	52
Object component designators	52
Pointers and dynamic variables	53
Variable typecasts	53

Chapter 5 Typed constants	57
Simple-type constants	58
String-type constants	59
Structured-type constants	59
Array-type constants	59
Record-type constants	60
Object-type constants	61
Set-type constants	62
Pointer-type constants	62

Procedural-type constants	63
---------------------------------	----

Chapter 6 Expressions 65

Expression syntax	66
-------------------------	----

Operators 69

Arithmetic operators	69
----------------------------	----

Logical operators	70
-------------------------	----

Boolean operators	70
-------------------------	----

String operator	72
-----------------------	----

Set operators	72
---------------------	----

Relational operators	72
----------------------------	----

Comparing simple types	73
------------------------------	----

Comparing strings	73
-------------------------	----

Comparing packed strings	74
--------------------------------	----

Comparing pointers	74
--------------------------	----

Comparing sets	74
----------------------	----

Testing set membership	74
------------------------------	----

The @ operator	74
----------------------	----

@ with a variable	75
-------------------------	----

@ with a value parameter	75
--------------------------------	----

@ with a variable parameter	75
-----------------------------------	----

@ with a procedure or function	76
--------------------------------------	----

@ with a method	76
-----------------------	----

Function calls	76
----------------------	----

Set constructors	77
------------------------	----

Value typecasts	78
-----------------------	----

Procedural types in expressions	79
---------------------------------------	----

Chapter 7 Statements 81

Simple statements	81
-------------------------	----

Assignment statements	82
-----------------------------	----

Object type assignments	82
-------------------------------	----

Procedure statements	83
----------------------------	----

Method, constructor, and destructor	
-------------------------------------	--

calls	83
-------------	----

Goto statements	84
-----------------------	----

Structured statements	85
-----------------------------	----

Compound statements	85
---------------------------	----

Conditional statements	86
------------------------------	----

If statements	86
---------------------	----

Case statements	87
-----------------------	----

Repetitive statements	88
-----------------------------	----

Repeat statements	88
-------------------------	----

While statements	89
------------------------	----

For statements	90
----------------------	----

With statements	92
-----------------------	----

Chapter 8 Procedures and functions 95

Procedure declarations	95
------------------------------	----

Near and far declarations	97
---------------------------------	----

Interrupt declarations	97
------------------------------	----

Forward declarations	98
----------------------------	----

External declarations	99
-----------------------------	----

Assembler declarations	99
------------------------------	----

Inline declarations	99
---------------------------	----

Function declarations	100
-----------------------------	-----

Method declarations	102
---------------------------	-----

Constructors and destructors	103
------------------------------------	-----

Parameters	105
------------------	-----

Value parameters	106
------------------------	-----

Variable parameters	106
---------------------------	-----

Objects	107
---------------	-----

Untyped variable parameters	107
-----------------------------------	-----

Procedural types	108
------------------------	-----

Procedural variables	108
----------------------------	-----

Procedural-type parameters	111
----------------------------------	-----

Chapter 9 Programs and units 113

Program syntax	113
----------------------	-----

The program heading	113
---------------------------	-----

The uses clause	114
-----------------------	-----

Unit syntax	114
-------------------	-----

The unit heading	115
------------------------	-----

The interface part	115
--------------------------	-----

The implementation part	116
-------------------------------	-----

The initialization part	117
-------------------------------	-----

Indirect unit references	117
--------------------------------	-----

Circular unit references	118
--------------------------------	-----

Sharing other declarations	120
----------------------------------	-----

Part 2 The standard libraries

Chapter 10 The System unit 125

Standard procedures and functions	125
--	-----

Flow control procedures	125
-------------------------------	-----

Dynamic allocation procedures	125
------------------------------------	-----

Dynamic allocation functions	126
------------------------------------	-----

Transfer functions	126
--------------------------	-----

Arithmetic functions	127
----------------------------	-----

Ordinal procedures	127
Ordinal functions	127
String procedures	127
String functions	128
Pointer and address functions	128
Miscellaneous procedures	128
Miscellaneous functions	129
File input and output	129
An introduction to file I/O	129
I/O functions	130
I/O procedures	131
Text files	131
Procedures	132
Functions	132
Untyped files	133
Procedures	133
The FileMode variable	133
Devices in Turbo Pascal	134
DOS devices	134
The CON device	135
The LPT1, LPT2, and LPT3 devices	135
The COM1 and COM2 devices	136
The NUL device	136
Text file devices	136
Predeclared variables	136
Uninitialized variables	136
Initialized variables	137

Chapter 11 The Dos unit 141

Constants, types, and variables	141
Constants	141
Flag constants	141
File mode constants	142
File attribute constants	142
Types	143
File record types	143
The Registers type	143
The DateTime type	144
The SearchRec type	144
File-handling string types	144
Variables	145
The DosError variable	145
Procedures and functions	145
Date and time procedures	145

Interrupt support procedures	146
Disk status functions	146
File-handling procedures	146
File-handling functions	146
Process-handling procedures	146
Process-handling functions	147
Environment-handling functions	147
Miscellaneous procedures	147
Miscellaneous functions	147

Chapter 12 The Graph unit 149

Drivers	149
IBM 8514 support	150
Coordinate system	151
Current pointer	152
Text	152
Figures and styles	153
Viewports and bit images	153
Paging and colors	154
Error handling	154
Getting started	155
Heap management routines	156
Graph unit constants, types, and variables	159
Constants	159
SetPalette and SetAllPalette	160
SetRGBPalette	161
Line style constants	161
Font control constants	161
Justification constants	161
Clipping constants	162
Bar constants	162
Fill pattern constants	162
BitBlt operators	163
Palette constant	163
Types	163
Variables	165

Chapter 13 The Overlay unit 169

The overlay manager	170
Overlay buffer management	171
Constants and variables	173
OvrResult	174
OvrTrapCount	174

OvrLoadCount	174
OvrFileMode	174
OvrReadBuf	175
Result codes	177
Procedures and functions	177
OvrInit	177
OvrInitEMS	177
OvrSetBuf	178
OvrGetBuf	178
OvrClearBuf	178
OvrSetRetry	179
OvrGetRetry	179
Designing overlaid programs	179
Overlay code generation	180
The far call requirement	180
Initializing the overlay manager	181
Initialization sections	184
What not to overlay	185
Debugging overlays	185
External routines in overlays	185
Overlays in .EXE files	187

Chapter 14 Using the 8087 189

The 8087 data types	191
Extended range arithmetic	191
Comparing reals	193
The 8087 evaluation stack	193
Writing reals with the 8087	194
Units using the 8087	195
Detecting the 8087	195
Emulation in assembly language	197

Chapter 15 The Crt unit 199

The input and output files	199
Windows	200
Special characters	200
Line input	201
Constants, types, and variables	201
Constants	202
Crt mode constants	202
Text color constants	202
Variables	203
CheckBreak	203
CheckEOF	203

CheckSnow	203
DirectVideo	204
LastMode	204
TextAttr	204
WindMin and WindMax	205
Procedures and functions	205

Part 3 Inside Turbo Pascal

Chapter 16 Memory issues 209

The Turbo Pascal memory map	209
The heap manager	211
Disposal methods	212
The free list	215
The HeapError variable	217
Internal data formats	218
Integer types	218
Char types	218
Boolean types	218
Enumerated types	218
Floating-point types	219
The Real type	219
The Single type	219
The Double type	220
The Extended type	220
The Comp type	220
Pointer types	221
String types	221
Set types	221
Array types	221
Record types	222
File types	222
Procedural types	223
Direct memory access	223

Chapter 17 Objects 225

Internal data format of objects	225
Virtual method tables	226
The SizeOf function	228
The TypeOf function	228
Virtual method calls	229
Method calling conventions	229
Constructors and destructors	230
Extensions to New and Dispose	231
Assembly language methods	232

Constructor error recovery	236
----------------------------------	-----

Chapter 18 Control issues 241

Calling conventions	241
Variable parameters	242
Value parameters	242
Function results	243
NEAR and FAR calls	243
Nested procedures and functions	244
Entry and exit code	245
Register-saving conventions	246
Exit procedures	246
Interrupt handling	248
Writing interrupt procedures	248

Chapter 19 Input and output issues 251

Text file device drivers	251
The Open function	252
The InOut function	253
The Flush function	253
The Close function	253
Direct port access	253

Chapter 20 Automatic optimizations 255

Constant folding	255
Constant merging	256
Short-circuit evaluation	256
Order of evaluation	256
Range checking	257
Shift instead of multiply	257
Automatic word alignment	257
Dead code removal	258
Smart linking	258

Chapter 21 Compiler directives 261

Switch directives	262
Align data	262
Boolean evaluation	263
Debug information	264
Emulation	265
Force far calls	265
Generate 80286 code	266
Input/output checking	266
Local symbol information	267

Numeric processing	268
Overlay code generation	268
Range checking	269
Stack-overflow checking	269
Var-string checking	270
Extended syntax	270
Parameter directives	271
Include file	271
Link object file	271
Memory allocation sizes	272
Overlay unit name	272
Conditional compilation	273
Conditional symbols	274
The DEFINE directive	275
The UNDEF directive	276
The IFDEF directive	276
The IFNDEF directive	276
The IFOPT directive	276
The ELSE directive	277
The ENDIF directive	277

Part 4 Using Turbo Pascal with assembly language

Chapter 22 The inline assembler 281

The asm statement	282
Register use	283
Assembler statement syntax	283
Labels	283
Prefix opcodes	285
Instruction opcodes	285
RET instruction sizing	286
Automatic jump sizing	286
Assembler directives	287
Operands	289
Expressions	290
Differences between Pascal and	
Assembler expressions	290
Expression elements	291
Constants	291
Numeric constants	291
String constants	292
Registers	293
Symbols	294

Expression classes	297
Expression types	298
Expression operators	300
Assembler procedures and functions ...	303
Chapter 23 Linking assembler code	307
Turbo Assembler and Turbo Pascal ..	308
Examples of assembly language routines	309
Turbo Assembler example	313
Inline machine code	314
Inline statements	314
Inline directives	316

Part 5 Appendixes

Appendix A Error messages	321
Compiler error messages	321
Run-time errors	341
DOS errors	341
I/O errors	343
Critical errors	344
Fatal errors	344
Appendix B Reference materials	349
ASCII codes	349
Extended key codes	352
Keyboard scan codes	353
Index	355