

Draft Standard for Information Technology— Portable Operating System Interface (POSIX[®])

Prepared by the Austin Group
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1 / *Technical Standard*

2 **Base Definitions, Issue 6**

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Contents

18

19	Chapter 1	Introduction.....	1
20	1.1	Scope.....	1
21	1.2	Conformance	4
22	1.3	Normative References	4
23	1.4	Terminology	5
24	1.5	Portability	6
25	1.5.1	Codes.....	6
26	1.5.2	Margin Code Notation.....	14
27	Chapter 2	Conformance.....	15
28	2.1	Implementation Conformance.....	15
29	2.1.1	Requirements.....	15
30	2.1.2	Documentation.....	15
31	2.1.3	POSIX Conformance	16
32	2.1.3.1	POSIX System Interfaces.....	16
33	2.1.3.2	POSIX Shell and Utilities.....	18
34	2.1.4	XSI Conformance.....	19
35	2.1.4.1	XSI System Interfaces.....	19
36	2.1.4.2	XSI Shell and Utilities Conformance	20
37	2.1.5	Option Groups.....	20
38	2.1.5.1	Subprofiling Considerations	20
39	2.1.5.2	XSI Option Groups	21
40	2.1.6	Options.....	26
41	2.1.6.1	System Interfaces	26
42	2.1.6.2	Shell and Utilities.....	26
43	2.2	Application Conformance.....	28
44	2.2.1	Strictly Conforming POSIX Application.....	29
45	2.2.2	Conforming POSIX Application.....	29
46	2.2.2.1	ISO/IEC Conforming POSIX Application.....	29
47	2.2.2.2	<National Body> Conforming POSIX Application.....	29
48	2.2.3	Conforming POSIX Application Using Extensions	30
49	2.2.4	Strictly Conforming XSI Application	30
50	2.2.5	Conforming XSI Application Using Extensions.....	30
51	2.3	Language-Dependent Services for the C Programming Language..	31
52	2.4	Other Language-Related Specifications.....	31
53	Chapter 3	Definitions	33
54	3.1	Abortive Release	33
55	3.2	Absolute Pathname	33
56	3.3	Access Mode	33
57	3.4	Additional File Access Control Mechanism.....	33
58	3.5	Address Space	33

59	3.6	Advisory Information.....	33
60	3.7	Affirmative Response	33
61	3.8	Alert	34
62	3.9	Alert Character (<alert>).....	34
63	3.10	Alias Name.....	34
64	3.11	Alignment.....	34
65	3.12	Alternate File Access Control Mechanism	34
66	3.13	Alternate Signal Stack.....	34
67	3.14	Ancillary Data.....	35
68	3.15	Angle Brackets.....	35
69	3.16	Application.....	35
70	3.17	Application Address	35
71	3.18	Application Program Interface (API).....	35
72	3.19	Appropriate Privileges.....	35
73	3.20	Argument	35
74	3.21	Arm (a Timer)	36
75	3.22	Asterisk	36
76	3.23	Async-Cancel-Safe Function.....	36
77	3.24	Asynchronous Events	36
78	3.25	Asynchronous Input and Output.....	36
79	3.26	Async-Signal-Safe Function.....	36
80	3.27	Asynchronously-Generated Signal	36
81	3.28	Asynchronous I/O Operation.....	36
82	3.29	Asynchronous I/O Completion	37
83	3.30	Authentication.....	37
84	3.31	Authorization	37
85	3.32	Background Job	37
86	3.33	Background Process	37
87	3.34	Background Process Group (or Background Job)	37
88	3.35	Backquote	37
89	3.36	Backslash	37
90	3.37	Backspace Character (<backspace>).....	37
91	3.38	Barrier.....	38
92	3.39	Base Character	38
93	3.40	Basename	38
94	3.41	Basic Regular Expression (BRE).....	38
95	3.42	Batch Access List.....	38
96	3.43	Batch Administrator.....	38
97	3.44	Batch Client	38
98	3.45	Batch Destination.....	39
99	3.46	Batch Destination Identifier.....	39
100	3.47	Batch Directive	39
101	3.48	Batch Job	39
102	3.49	Batch Job Attribute	39
103	3.50	Batch Job Identifier	39
104	3.51	Batch Job Name	39
105	3.52	Batch Job Owner	40
106	3.53	Batch Job Priority	40

Contents

107	3.54	Batch Job State	40
108	3.55	Batch Name Service.....	40
109	3.56	Batch Name Space	40
110	3.57	Batch Node	40
111	3.58	Batch Operator	40
112	3.59	Batch Queue.....	40
113	3.60	Batch Queue Attribute	41
114	3.61	Batch Queue Position.....	41
115	3.62	Batch Queue Priority.....	41
116	3.63	Batch Rerunability	41
117	3.64	Batch Restart	41
118	3.65	Batch Server	41
119	3.66	Batch Server Name	41
120	3.67	Batch Service.....	42
121	3.68	Batch Service Request	42
122	3.69	Batch Submission.....	42
123	3.70	Batch System.....	42
124	3.71	Batch Target User.....	42
125	3.72	Batch User.....	42
126	3.73	Bind.....	42
127	3.74	Blank Character (<blank>).....	42
128	3.75	Blank Line	43
129	3.76	Blocked Process (or Thread)	43
130	3.77	Blocking	43
131	3.78	Block-Mode Terminal.....	43
132	3.79	Block Special File.....	43
133	3.80	Braces.....	43
134	3.81	Brackets.....	43
135	3.82	Broadcast	43
136	3.83	Built-In Utility (or Built-In).....	44
137	3.84	Byte	44
138	3.85	Byte Input/Output Functions.....	44
139	3.86	Carriage-Return Character (<carriage-return>).....	44
140	3.87	Character	44
141	3.88	Character Array.....	45
142	3.89	Character Class.....	45
143	3.90	Character Set.....	45
144	3.91	Character Special File.....	45
145	3.92	Character String	45
146	3.93	Child Process	45
147	3.94	Circumflex.....	45
148	3.95	Clock.....	45
149	3.96	Clock Jump.....	46
150	3.97	Clock Tick.....	46
151	3.98	Coded Character Set.....	46
152	3.99	Codeset.....	46
153	3.100	Collating Element	46
154	3.101	Collation	46

155	3.102	Collation Sequence	46
156	3.103	Column Position	47
157	3.104	Command.....	47
158	3.105	Command Language Interpreter.....	47
159	3.106	Composite Graphic Symbol	47
160	3.107	Condition Variable.....	47
161	3.108	Connection	48
162	3.109	Connection Mode.....	48
163	3.110	Connectionless Mode.....	48
164	3.111	Control Character	48
165	3.112	Control Operator.....	48
166	3.113	Controlling Process	48
167	3.114	Controlling Terminal.....	48
168	3.115	Conversion Descriptor.....	49
169	3.116	Core File	49
170	3.117	CPU Time (Execution Time).....	49
171	3.118	CPU-Time Clock	49
172	3.119	CPU-Time Timer	49
173	3.120	Current Job.....	49
174	3.121	Current Working Directory	49
175	3.122	Cursor Position.....	49
176	3.123	Datagram	49
177	3.124	Data Segment.....	50
178	3.125	Deferred Batch Service.....	50
179	3.126	Device.....	50
180	3.127	Device ID	50
181	3.128	Directory	50
182	3.129	Directory Entry (or Link).....	50
183	3.130	Directory Stream	50
184	3.131	Disarm (a Timer).....	50
185	3.132	Display	50
186	3.133	Display Line	51
187	3.134	Dollar Sign.....	51
188	3.135	Dot.....	51
189	3.136	Dot-Dot	51
190	3.137	Double-Quote	51
191	3.138	Downshifting.....	51
192	3.139	Driver.....	51
193	3.140	Effective Group ID.....	52
194	3.141	Effective User ID	52
195	3.142	Eight-Bit Transparency	52
196	3.143	Empty Directory.....	52
197	3.144	Empty Line	52
198	3.145	Empty String (or Null String).....	52
199	3.146	Empty Wide-Character String.....	52
200	3.147	Encoding Rule.....	52
201	3.148	Entire Regular Expression.....	52
202	3.149	Epoch.....	53

203	3.150	Equivalence Class	53
204	3.151	Era	53
205	3.152	Event Management.....	53
206	3.153	Executable File.....	53
207	3.154	Execute	53
208	3.155	Execution Time.....	54
209	3.156	Execution Time Monitoring.....	54
210	3.157	Expand	54
211	3.158	Extended Regular Expression (ERE).....	54
212	3.159	Extended Security Controls	54
213	3.160	Feature Test Macro	54
214	3.161	Field	54
215	3.162	FIFO Special File (or FIFO)	55
216	3.163	File	55
217	3.164	File Description	55
218	3.165	File Descriptor	55
219	3.166	File Group Class.....	55
220	3.167	File Mode	55
221	3.168	File Mode Bits	56
222	3.169	Filename.....	56
223	3.170	Filename Portability	56
224	3.171	File Offset.....	56
225	3.172	File Other Class	56
226	3.173	File Owner Class	56
227	3.174	File Permission Bits.....	56
228	3.175	File Serial Number	57
229	3.176	File System	57
230	3.177	File Type.....	57
231	3.178	Filter.....	57
232	3.179	First Open (of a File).....	57
233	3.180	Flow Control	57
234	3.181	Foreground Job.....	57
235	3.182	Foreground Process	57
236	3.183	Foreground Process Group (or Foreground Job).....	57
237	3.184	Foreground Process Group ID	58
238	3.185	Form-Feed Character (<form-feed>)	58
239	3.186	Graphic Character.....	58
240	3.187	Group Database	58
241	3.188	Group ID.....	58
242	3.189	Group Name	58
243	3.190	Hard Limit.....	59
244	3.191	Hard Link	59
245	3.192	Home Directory.....	59
246	3.193	Host Byte Order	59
247	3.194	Incomplete Line.....	59
248	3.195	Inf	59
249	3.196	Instrumented Application.....	59
250	3.197	Interactive Shell.....	59

251	3.198	Internationalization.....	60
252	3.199	Interprocess Communication.....	60
253	3.200	Invoke.....	60
254	3.201	Job.....	60
255	3.202	Job Control	60
256	3.203	Job Control Job ID.....	60
257	3.204	Last Close (of a File)	61
258	3.205	Line	61
259	3.206	Linger.....	61
260	3.207	Link	61
261	3.208	Link Count.....	61
262	3.209	Local Customs	61
263	3.210	Local Interprocess Communication (Local IPC)	61
264	3.211	Locale.....	61
265	3.212	Localization.....	62
266	3.213	Login.....	62
267	3.214	Login Name.....	62
268	3.215	Map	62
269	3.216	Marked Message	62
270	3.217	Matched	62
271	3.218	Memory Mapped Files.....	62
272	3.219	Memory Object.....	63
273	3.220	Memory-Resident	63
274	3.221	Message.....	63
275	3.222	Message Catalog	63
276	3.223	Message Catalog Descriptor.....	63
277	3.224	Message Queue	63
278	3.225	Mode.....	63
279	3.226	Monotonic Clock.....	64
280	3.227	Mount Point	64
281	3.228	Multi-Character Collating Element.....	64
282	3.229	Mutex.....	64
283	3.230	Name	64
284	3.231	Named STREAM.....	64
285	3.232	NaN (Not a Number).....	64
286	3.233	Native Language.....	64
287	3.234	Negative Response	65
288	3.235	Network.....	65
289	3.236	Network Address.....	65
290	3.237	Network Byte Order.....	65
291	3.238	Newline Character (<newline>)	65
292	3.239	Nice Value	65
293	3.240	Non-Blocking.....	65
294	3.241	Non-Spacing Characters	66
295	3.242	NUL	66
296	3.243	Null Byte.....	66
297	3.244	Null Pointer.....	66
298	3.245	Null String.....	66

Contents

299	3.246	Null Wide-Character Code	66
300	3.247	Number Sign	66
301	3.248	Object File	66
302	3.249	Octet	67
303	3.250	Offset Maximum	67
304	3.251	Opaque Address	67
305	3.252	Open File	67
306	3.253	Open File Description	67
307	3.254	Operand	67
308	3.255	Operator	67
309	3.256	Option	67
310	3.257	Option-Argument	67
311	3.258	Orientation	68
312	3.259	Orphaned Process Group	68
313	3.260	Page	68
314	3.261	Page Size	68
315	3.262	Parameter	68
316	3.263	Parent Directory	68
317	3.264	Parent Process	69
318	3.265	Parent Process ID	69
319	3.266	Pathname	69
320	3.267	Pathname Component	69
321	3.268	Path Prefix	69
322	3.269	Pattern	69
323	3.270	Period	69
324	3.271	Permissions	70
325	3.272	Persistence	70
326	3.273	Pipe	70
327	3.274	Polling	70
328	3.275	Portable Character Set	70
329	3.276	Portable Filename Character Set	70
330	3.277	Positional Parameter	70
331	3.278	Preallocation	71
332	3.279	Preempted Process (or Thread)	71
333	3.280	Previous Job	71
334	3.281	Printable Character	71
335	3.282	Printable File	71
336	3.283	Priority	71
337	3.284	Priority Band	71
338	3.285	Priority Inversion	72
339	3.286	Priority Scheduling	72
340	3.287	Priority-Based Scheduling	72
341	3.288	Privilege	72
342	3.289	Process	72
343	3.290	Process Group	72
344	3.291	Process Group ID	72
345	3.292	Process Group Leader	72
346	3.293	Process Group Lifetime	73

347	3.294	Process ID	73
348	3.295	Process Lifetime	73
349	3.296	Process Memory Locking	73
350	3.297	Process Termination	73
351	3.298	Process-To-Process Communication	74
352	3.299	Process Virtual Time	74
353	3.300	Program.....	74
354	3.301	Protocol	74
355	3.302	Pseudo-Terminal	74
356	3.303	Radix Character.....	74
357	3.304	Read-Only File System	74
358	3.305	Read-Write Lock.....	74
359	3.306	Real Group ID.....	75
360	3.307	Real Time.....	75
361	3.308	Realtime Signal Extension.....	75
362	3.309	Real User ID	75
363	3.310	Record	75
364	3.311	Redirection	75
365	3.312	Redirection Operator	75
366	3.313	Reentrant Function	75
367	3.314	Referenced Shared Memory Object	76
368	3.315	Refresh.....	76
369	3.316	Regular Expression.....	76
370	3.317	Region.....	76
371	3.318	Regular File	76
372	3.319	Relative Pathname	76
373	3.320	Relocatable File.....	76
374	3.321	Relocation.....	76
375	3.322	Requested Batch Service.....	76
376	3.323	(Time) Resolution	77
377	3.324	Root Directory	77
378	3.325	Runnable Process (or Thread)	77
379	3.326	Running Process (or Thread)	77
380	3.327	Saved Resource Limits.....	77
381	3.328	Saved Set-Group-ID	77
382	3.329	Saved Set-User-ID.....	77
383	3.330	Scheduling.....	77
384	3.331	Scheduling Allocation Domain.....	78
385	3.332	Scheduling Contention Scope	78
386	3.333	Scheduling Policy.....	78
387	3.334	Screen	78
388	3.335	Scroll	78
389	3.336	Semaphore.....	78
390	3.337	Session.....	78
391	3.338	Session Leader	79
392	3.339	Session Lifetime	79
393	3.340	Shared Memory Object	79
394	3.341	Shell.....	79

Contents

395	3.342	Shell, the.....	79
396	3.343	Shell Script.....	79
397	3.344	Signal.....	79
398	3.345	Signal Stack.....	80
399	3.346	Single-Quote.....	80
400	3.347	Slash.....	80
401	3.348	Socket.....	80
402	3.349	Socket Address.....	80
403	3.350	Soft Limit.....	80
404	3.351	Source Code.....	80
405	3.352	Space Character (<space>).....	81
406	3.353	Spawn.....	81
407	3.354	Special Built-In.....	81
408	3.355	Special Parameter.....	81
409	3.356	Spin Lock.....	81
410	3.357	Sporadic Server.....	81
411	3.358	Standard Error.....	81
412	3.359	Standard Input.....	81
413	3.360	Standard Output.....	81
414	3.361	Standard Utilities.....	82
415	3.362	Stream.....	82
416	3.363	STREAM.....	82
417	3.364	STREAM End.....	82
418	3.365	STREAM Head.....	82
419	3.366	STREAMS Multiplexor.....	82
420	3.367	String.....	82
421	3.368	Subshell.....	83
422	3.369	Successfully Transferred.....	83
423	3.370	Supplementary Group ID.....	83
424	3.371	Suspended Job.....	83
425	3.372	Symbolic Link.....	83
426	3.373	Synchronized Input and Output.....	83
427	3.374	Synchronized I/O Completion.....	83
428	3.375	Synchronized I/O Data Integrity Completion.....	84
429	3.376	Synchronized I/O File Integrity Completion.....	84
430	3.377	Synchronized I/O Operation.....	84
431	3.378	Synchronous I/O Operation.....	84
432	3.379	Synchronously-Generated Signal.....	84
433	3.380	System.....	84
434	3.381	System Crash.....	85
435	3.382	System Console.....	85
436	3.383	System Databases.....	85
437	3.384	System Documentation.....	85
438	3.385	System Process.....	85
439	3.386	System Reboot.....	86
440	3.387	System Trace Event.....	86
441	3.388	System-Wide.....	86
442	3.389	Tab Character (<tab>).....	86

443	3.390	Terminal (or Terminal Device)	86
444	3.391	Text Column.....	86
445	3.392	Text File	86
446	3.393	Thread	87
447	3.394	Thread ID.....	87
448	3.395	Thread List	87
449	3.396	Thread-Safe	87
450	3.397	Thread-Specific Data Key.....	87
451	3.398	Tilde	87
452	3.399	Timeouts	88
453	3.400	Timer	88
454	3.401	Timer Overrun.....	88
455	3.402	Token	88
456	3.403	Trace Analyzer Process.....	88
457	3.404	Trace Controller Process.....	88
458	3.405	Trace Event.....	88
459	3.406	Trace Event Type.....	88
460	3.407	Trace Event Type Mapping.....	88
461	3.408	Trace Filter	89
462	3.409	Trace Generation Version.....	89
463	3.410	Trace Log.....	89
464	3.411	Trace Point.....	89
465	3.412	Trace Stream.....	89
466	3.413	Trace Stream Identifier.....	89
467	3.414	Trace System	89
468	3.415	Traced Process	89
469	3.416	Tracing Status of a Trace Stream.....	89
470	3.417	Typed Memory Name Space	90
471	3.418	Typed Memory Object	90
472	3.419	Typed Memory Pool.....	90
473	3.420	Typed Memory Port	90
474	3.421	Unbind.....	90
475	3.422	Unit Data.....	90
476	3.423	Upshifting.....	90
477	3.424	User Database	90
478	3.425	User ID	91
479	3.426	User Name.....	91
480	3.427	User Trace Event	91
481	3.428	Utility.....	91
482	3.429	Variable	91
483	3.430	Vertical-Tab Character (<vertical-tab>)	91
484	3.431	White Space.....	92
485	3.432	Wide-Character Code (C Language)	92
486	3.433	Wide-Character Input/Output Functions.....	92
487	3.434	Wide-Character String.....	92
488	3.435	Word	92
489	3.436	Working Directory (or Current Working Directory)	92
490	3.437	Worldwide Portability Interface	92

491	3.438	Write	93
492	3.439	XSI	93
493	3.440	XSI-Conformant	93
494	3.441	Zombie Process	93
495	3.442	±0	93
496	Chapter 4	General Concepts.....	95
497	4.1	Concurrent Execution	95
498	4.2	Directory Protection	95
499	4.3	Extended Security Controls	95
500	4.4	File Access Permissions	95
501	4.5	File Hierarchy	96
502	4.6	Filenames.....	96
503	4.7	File Times Update.....	96
504	4.8	Host and Network Byte Orders.....	97
505	4.9	Measurement of Execution Time.....	97
506	4.10	Memory Synchronization.....	98
507	4.11	Pathname Resolution	98
508	4.12	Process ID Reuse	99
509	4.13	Scheduling Policy.....	99
510	4.14	Seconds Since the Epoch	100
511	4.15	Semaphore.....	100
512	4.16	Thread-Safety.....	101
513	4.17	Tracing.....	101
514	4.18	Treatment of Error Conditions for Mathematical Functions	103
515	4.18.1	Domain Error	103
516	4.18.2	Pole Error	104
517	4.18.3	Range Error	104
518	4.18.3.1	Result Overflows	104
519	4.18.3.2	Result Underflows.....	104
520	4.19	Treatment of NaN Arguments for the Mathematical Functions	104
521	4.20	Utility.....	105
522	4.21	Variable Assignment	105
523	Chapter 5	File Format Notation	107
524	Chapter 6	Character Set	111
525	6.1	Portable Character Set.....	111
526	6.2	Character Encoding.....	114
527	6.3	C Language Wide-Character Codes	115
528	6.4	Character Set Description File.....	115
529	6.4.1	State-Dependent Character Encodings	118
530	Chapter 7	Locale.....	119
531	7.1	General.....	119
532	7.2	POSIX Locale	120
533	7.3	Locale Definition.....	120
534	7.3.1	LC_CTYPE.....	122

535	7.3.1.1	LC_CTYPE Category in the POSIX Locale.....	126
536	7.3.2	LC_COLLATE.....	130
537	7.3.2.1	The collating-element Keyword.....	131
538	7.3.2.2	The collating-symbol Keyword.....	132
539	7.3.2.3	The order_start Keyword.....	132
540	7.3.2.4	Collation Order.....	133
541	7.3.2.5	The order_end Keyword.....	135
542	7.3.2.6	LC_COLLATE Category in the POSIX Locale.....	135
543	7.3.3	LC_MONETARY.....	138
544	7.3.3.1	LC_MONETARY Category in the POSIX Locale.....	140
545	7.3.4	LC_NUMERIC.....	141
546	7.3.4.1	LC_NUMERIC Category in the POSIX Locale.....	141
547	7.3.5	LC_TIME.....	142
548	7.3.5.1	LC_TIME Locale Definition.....	142
549	7.3.5.2	LC_TIME C-Language Access.....	144
550	7.3.5.3	LC_TIME Category in the POSIX Locale.....	145
551	7.3.6	LC_MESSAGES.....	148
552	7.3.6.1	LC_MESSAGES Category for the POSIX Locale.....	148
553	7.4	Locale Definition Grammar.....	149
554	7.4.1	Locale Lexical Conventions.....	149
555	7.4.2	Locale Grammar.....	150
556	Chapter 8	Environment Variables.....	157
557	8.1	Environment Variable Definition.....	157
558	8.2	Internationalization Variables.....	158
559	8.3	Other Environment Variables.....	161
560	Chapter 9	Regular Expressions.....	165
561	9.1	Regular Expression Definitions.....	165
562	9.2	Regular Expression General Requirements.....	166
563	9.3	Basic Regular Expressions.....	167
564	9.3.1	BREs Matching a Single Character or Collating Element.....	167
565	9.3.2	BRE Ordinary Characters.....	167
566	9.3.3	BRE Special Characters.....	167
567	9.3.4	Periods in BREs.....	168
568	9.3.5	RE Bracket Expression.....	168
569	9.3.6	BREs Matching Multiple Characters.....	170
570	9.3.7	BRE Precedence.....	171
571	9.3.8	BRE Expression Anchoring.....	171
572	9.4	Extended Regular Expressions.....	171
573	9.4.1	EREs Matching a Single Character or Collating Element.....	172
574	9.4.2	ERE Ordinary Characters.....	172
575	9.4.3	ERE Special Characters.....	172
576	9.4.4	Periods in EREs.....	173
577	9.4.5	ERE Bracket Expression.....	173
578	9.4.6	EREs Matching Multiple Characters.....	173
579	9.4.7	ERE Alternation.....	174
580	9.4.8	ERE Precedence.....	174

581	9.4.9	ERE Expression Anchoring.....	174
582	9.5	Regular Expression Grammar.....	175
583	9.5.1	BRE/ERE Grammar Lexical Conventions.....	175
584	9.5.2	RE and Bracket Expression Grammar	176
585	9.5.3	ERE Grammar.....	178
586	Chapter 10	Directory Structure and Devices	181
587	10.1	Directory Structure and Files	181
588	10.2	Output Devices and Terminal Types.....	181
589	Chapter 11	General Terminal Interface.....	183
590	11.1	Interface Characteristics.....	183
591	11.1.1	Opening a Terminal Device File	183
592	11.1.2	Process Groups.....	183
593	11.1.3	The Controlling Terminal.....	184
594	11.1.4	Terminal Access Control	184
595	11.1.5	Input Processing and Reading Data.....	185
596	11.1.6	Canonical Mode Input Processing	185
597	11.1.7	Non-Canonical Mode Input Processing.....	186
598	11.1.8	Writing Data and Output Processing	187
599	11.1.9	Special Characters.....	187
600	11.1.10	Modem Disconnect.....	188
601	11.1.11	Closing a Terminal Device File	188
602	11.2	Parameters that Can be Set	189
603	11.2.1	The termios Structure	189
604	11.2.2	Input Modes.....	189
605	11.2.3	Output Modes	190
606	11.2.4	Control Modes.....	192
607	11.2.5	Local Modes.....	193
608	11.2.6	Special Control Characters	194
609	Chapter 12	Utility Conventions.....	197
610	12.1	Utility Argument Syntax.....	197
611	12.2	Utility Syntax Guidelines.....	199
612	Chapter 13	Headers.....	201
613	13.1	Format of Entries.....	201
614		< aio.h>	202
615		< arpa/inet.h>	204
616		< assert.h>	205
617		< complex.h>	206
618		< cpio.h>	209
619		< ctype.h>	210
620		< dirent.h>.....	212
621		< dlfcn.h>	214
622		< errno.h>	215
623		< fcntl.h>	219
624		< fenv.h>.....	222

625	<float.h>	225
626	<fmtmsg.h>	229
627	<fnmatch.h>	231
628	<ftw.h>.....	232
629	<glob.h>.....	234
630	<grp.h>.....	236
631	<iconv.h>.....	237
632	<inttypes.h>.....	238
633	<iso646.h>	240
634	<langinfo.h>.....	241
635	<libgen.h>.....	244
636	<limits.h>.....	245
637	<locale.h>.....	260
638	<math.h>	262
639	<monetary.h>.....	269
640	<mqueue.h>.....	270
641	<ndbm.h>.....	272
642	<net/if.h>.....	273
643	<netdb.h>.....	274
644	<netinet/in.h>.....	278
645	<netinet/tcp.h>.....	282
646	<nl_types.h>.....	283
647	<poll.h>	284
648	<pthread.h>	286
649	<pwd.h>.....	291
650	<regex.h>.....	292
651	<sched.h>	294
652	<search.h>.....	296
653	<semaphore.h>.....	298
654	<setjmp.h>	299
655	<signal.h>	300
656	<spawn.h>.....	307
657	<stdarg.h>.....	309
658	<stdbool.h>.....	311
659	<stddef.h>.....	312
660	<stdint.h>.....	313
661	<stdio.h>.....	320
662	<stdlib.h>.....	324
663	<string.h>.....	328
664	<strings.h>	330
665	<stropts.h>.....	331
666	<sys/ipc.h>.....	336
667	<sys/mman.h>.....	338
668	<sys/msg.h>.....	341
669	<sys/resource.h>.....	343
670	<sys/select.h>.....	345
671	<sys/sem.h>.....	347
672	<sys/shm.h>.....	349

Contents

673	<sys/socket.h>.....	351	
674	<sys/stat.h>.....	356	
675	<sys/statvfs.h>.....	360	
676	<sys/time.h>.....	362	
677	<sys/timeb.h>.....	364	
678	<sys/times.h>.....	365	
679	<sys/types.h>.....	366	
680	<sys/uio.h>.....	369	
681	<sys/un.h>.....	370	
682	<sys/utsname.h>.....	371	
683	<sys/wait.h>.....	372	
684	<syslog.h>.....	374	
685	<tar.h>.....	376	
686	<termios.h>.....	378	
687	<tgmath.h>.....	384	
688	<time.h>.....	388	
689	<trace.h>.....	392	
690	<ucontext.h>.....	396	
691	<ulimit.h>.....	397	
692	<unistd.h>.....	398	
693	<utime.h>.....	418	
694	<utmpx.h>.....	419	
695	<wchar.h>.....	421	
696	<wctype.h>.....	425	
697	<wordexp.h>.....	427	

698	Index	429	
-----	--------------------	------------	--

699 **List of Tables**

700	3-1	Job Control Job ID Formats.....	61	
701	5-1	Escape Sequences and Associated Actions.....	108	
702	6-1	Portable Character Set.....	111	
703	6-2	Control Character Set.....	116	
704	7-1	Valid Character Class Combinations.....	126	
705	10-1	Control Character Names.....	182	

707

708 IEEE Std 1003.1-200x has been jointly developed by the IEEE and The Open Group. It is both an
709 IEEE standard and an Open Group Technical Standard.

710 **Background**

711 The developers of IEEE Std 1003.1-200x represent a cross-section of hardware manufacturers,
712 vendors of operating systems and other software development tools, software designers,
713 consultants, academics, authors, applications programmers, and others.

714 Conceptually, IEEE Std 1003.1-200x describes a set of fundamental services needed for the
715 efficient construction of application programs. Access to these services has been provided by
716 defining an interface, using the C programming language, a command interpreter, and common
717 utility programs that establish standard semantics and syntax. Since this interface enables
718 application writers to write portable applications—it was developed with that goal in mind—it
719 has been designated POSIX,¹ an acronym for Portable Operating System Interface.

720 Although originated to refer to the original IEEE Std 1003.1-1988, the name POSIX more correctly
721 refers to a *family* of related standards: IEEE Std 1003.*n* and the parts of ISO/IEC 9945. In earlier
722 editions of the IEEE standard, the term POSIX was used as a synonym for IEEE Std 1003.1-1988.
723 A preferred term, POSIX.1, emerged. This maintained the advantages of readability of the
724 symbol “POSIX” without being ambiguous with the POSIX family of standards.

725 **Audience**

726 The intended audience for IEEE Std 1003.1-200x is all persons concerned with an industry-wide
727 standard operating system based on the UNIX system. This includes at least four groups of
728 people:

- 729 1. Persons buying hardware and software systems
- 730 2. Persons managing companies that are deciding on future corporate computing directions
- 731 3. Persons implementing operating systems, and especially
- 732 4. Persons developing applications where portability is an objective

733 **Purpose**

734 Several principles guided the development of IEEE Std 1003.1-200x:

- 735 • **Application-Oriented**

736 The basic goal was to promote portability of application programs across UNIX system
737 environments by developing a clear, consistent, and unambiguous standard for the interface
738 specification of a portable operating system based on the UNIX system documentation.
739 IEEE Std 1003.1-200x codifies the common, existing definition of the UNIX system.

740

741 1. The name POSIX was suggested by Richard Stallman. It is expected to be pronounced *pahz-icks*, as in *positive*, not *poh-six*, or
742 other variations. The pronunciation has been published in an attempt to promulgate a standardized way of referring to a
743 standard operating system interface.

- 744 • Interface, Not Implementation
- 745 IEEE Std 1003.1-200x defines an interface, not an implementation. No distinction is made
746 between library functions and system calls; both are referred to as functions. No details of the
747 implementation of any function are given (although historical practice is sometimes
748 indicated in the RATIONALE section). Symbolic names are given for constants (such as
749 signals and error numbers) rather than numbers.
- 750 • Source, Not Object, Portability
- 751 IEEE Std 1003.1-200x has been written so that a program written and translated for execution
752 on one conforming implementation may also be translated for execution on another
753 conforming implementation. IEEE Std 1003.1-200x does not guarantee that executable (object
754 or binary) code will execute under a different conforming implementation than that for
755 which it was translated, even if the underlying hardware is identical.
- 756 • The C Language
- 757 The system interfaces and header definitions are written in terms of the standard C language
758 as specified in the ISO C standard.
- 759 • No Superuser, No System Administration
- 760 There was no intention to specify all aspects of an operating system. System administration
761 facilities and functions are excluded from IEEE Std 1003.1-200x, and functions usable only by
762 the superuser have not been included. Still, an implementation of the standard interface may
763 also implement features not in IEEE Std 1003.1-200x. IEEE Std 1003.1-200x is also not
764 concerned with hardware constraints or system maintenance.
- 765 • Minimal Interface, Minimally Defined
- 766 In keeping with the historical design principles of the UNIX system, the mandatory core
767 facilities of IEEE Std 1003.1-200x have been kept as minimal as possible. Additional
768 capabilities have been added as optional extensions.
- 769 • Broadly Implementable
- 770 The developers of IEEE Std 1003.1-200x endeavored to make all specified functions
771 implementable across a wide range of existing and potential systems, including:
- 772 1. All of the current major systems that are ultimately derived from the original UNIX
773 system code (Version 7 or later)
- 774 2. Compatible systems that are not derived from the original UNIX system code
- 775 3. Emulations hosted on entirely different operating systems
- 776 4. Networked systems
- 777 5. Distributed systems
- 778 6. Systems running on a broad range of hardware
- 779 No direct references to this goal appear in IEEE Std 1003.1-200x, but some results of it are
780 mentioned in the Rationale (Informative) volume of IEEE Std 1003.1-200x.
- 781 • Minimal Changes to Historical Implementations
- 782 When the original version of IEEE Std 1003.1 was published, there were no known historical
783 implementations that did not have to change. However, there was a broad consensus on a set
784 of functions, types, definitions, and concepts that formed an interface that was common to
785 most historical implementations.

786 The adoption of the 1988 and 1990 IEEE interface standards, the 1992 common standards, the
787 various Open Group (formerly X/Open) versions, and the subsequent revisions and addenda
788 to all of them have consolidated this consensus, and this revision reflects the significantly
789 increased level of consensus arrived at since the original versions. The earlier standards and
790 their modifications specified a number of areas where consensus had not been reached
791 before, and these are now reflected in this revision. The authors of the original versions tried,
792 as much as possible, to follow the principles below when creating new specifications:

- 793 1. By standardizing an interface like one in an historical implementation; for example,
794 directories
- 795 2. By specifying an interface that is readily implementable in terms of, and backwards
796 compatible with, historical implementations, such as the extended *tar* format defined in
797 the *pax* utility
- 798 3. By specifying an interface that, when added to an historical implementation, will not
799 conflict with it; for example, the *sigaction()* function

800 This revision tries to minimize the number of changes required to implementations which
801 conform to the earlier versions of the approved standards to bring them into conformance
802 with the current standard. Specifically, the scope of this work excluded doing any “new”
803 work, but rather collecting into a single document what had been spread across a number of
804 documents, and presenting it in what had been proven in practice to be a more effective way.
805 Some changes to prior conforming implementations were unavoidable, primarily as a
806 consequence of resolving conflicts found in prior revisions, or which became apparent when
807 bringing the various pieces together.

808 However, since it references the 1999 versions of the ISO C standard, and no longer supports
809 “Common Usage C”, there are a number of unavoidable changes. Applications portability is
810 similarly affected.

811 IEEE Std 1003.1-200x is specifically not a codification of a particular vendor’s product.

812 It should be noted that implementations will have different kinds of extensions. Some will
813 reflect “historical usage” and will be preserved for execution of pre-existing applications.
814 These functions should be considered “obsolescent” and the standard functions used for
815 new applications. Some extensions will represent functions beyond the scope of
816 IEEE Std 1003.1-200x. These need to be used with careful management to be able to adapt to
817 future IEEE Std 1003.1-200x extensions and/or port to implementations that provide these
818 services in a different manner.

819 • Minimal Changes to Existing Application Code

820 A goal of IEEE Std 1003.1-200x was to minimize additional work for the developers of
821 applications. However, because every known historical implementation will have to change
822 at least slightly to conform, some applications will have to change.

823 **IEEE Std 1003.1-200x**

824 IEEE Std 1003.1-200x defines the Portable Operating System Interface (POSIX) requirements and
825 consists of the following volumes:

- 826 • Base Definitions (this volume)
- 827 • Shell and Utilities
- 828 • System Interfaces

- 829 • Rationale (Informative)

830 **This Volume**

831 The Base Definitions volume of IEEE Std 1003.1-200x provides common definitions for
832 IEEE Std 1003.1-200x, therefore readers should be familiar with it before using the other
833 volumes.

834 This volume of IEEE Std 1003.1-200x is structured as follows:

- 835 • Chapter 1 is an introduction.
- 836 • Chapter 2 defines the conformance requirements for IEEE Std 1003.1-200x.
- 837 • Chapter 3 defines general terms used in IEEE Std 1003.1-200x.
- 838 • Chapter 4 describes general concepts used in IEEE Std 1003.1-200x.
- 839 • Chapter 5 describes the notation used to specify file input and output formats in this volume
840 of IEEE Std 1003.1-200x and the Shell and Utilities volume of IEEE Std 1003.1-200x.
- 841 • Chapter 6 describes the portable character set and the process of character set definition.
- 842 • Chapter 7 describes the syntax for defining internationalization locales as well as the POSIX
843 locale provided on all systems.
- 844 • Chapter 8 describes the use of environment variables for internationalization and other
845 purposes.
- 846 • Chapter 9 describes the syntax of pattern matching using regular expressions employed by
847 many utilities and matched by the *regcomp()* and *regexexec()* functions.
- 848 • Chapter 10 describes files and devices found on all systems.
- 849 • Chapter 11 describes the asynchronous terminal interface for many of the functions in the
850 System Interfaces volume of IEEE Std 1003.1-200x and the *stty* utility in the Shell and Utilities
851 volume of IEEE Std 1003.1-200x.
- 852 • Chapter 12 describes the policies for command line argument construction and parsing.
- 853 • Chapter 13 defines the contents of headers which declare constants, macros, and data
854 structures that are needed by programs using the services provided by the System Interfaces
855 volume of IEEE Std 1003.1-200x.

856 Comprehensive references are available in the index.

857 **Typographical Conventions**

858 The following typographical conventions are used throughout IEEE Std 1003.1-200x.

859 The typographical conventions listed here are for ease of reading only. Editorial inconsistencies
860 in the use of typography are unintentional and have no normative meaning in
861 IEEE Std 1003.1-200x.

Reference	Example	Notes
C-Language Data Structure	aiocb	
C-Language Data Structure Member	<i>aio_lio_opcode</i>	

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Reference	Example	Notes
C-Language Data Type	long	
C-Language Function	<i>system()</i>	
C-Language Function Family	<i>exec</i>	
C-Language Function Argument	<i>arg1</i>	
C-Language External Variable	<i>errno</i>	
C-Language Header	<sys/stat.h>	
C-Language Keyword	#define	
C-Language Macro with Argument	<i>assert()</i>	
C-Language Macro with No Argument	INET_ADDRSTRLEN	
Commands within a Utility	a, c	
Conversion Specification, Specifier/Modifier Character	%A, g, E	1
Environment Variable	<i>PATH</i>	
Error Number	[EINTR]	
Example Output	Hello, World	
Filename	/tmp	
Literal Character	'c'	2
Literal String	"abcde"	2
Optional Items in Utility Syntax	[]	
Parameter	<i><directory pathname></i>	
Special Character	<i><newline></i>	3
Symbolic Limit, Configuration Value	{LINE_MAX}	4
Symbolic Constant	_POSIX_VDISABLE	
Syntax	#include <sys/stat.h>	
User Input and Example Code	echo Hello, World	5
Utility Name	<i>awk</i>	
Utility Operand	<i>file_name</i>	
Utility Option	-c	
Utility Option with Option-Argument	-w width	

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Notes:

1. Conversion specifications, specifier characters, and modifier characters are used primarily in date-related functions and utilities and the *fprintf* and *scanf* formatting functions.
2. Unless otherwise noted, the quotes shall not be used as input or output. When used in a list item, the quotes are omitted.
3. The style selected for some of the special characters, such as *<newline>*, matches the form of the input given to the *localedef* utility. Generally, the characters selected for this special treatment are those that are not visually distinct, such as the control characters *<tab>* or *<newline>*.
4. Names surrounded by braces represent symbolic limits or configuration values which may be declared in appropriate headers by means of the C **#define** construct.
5. Brackets shown in this font, "[]", are part of the syntax and do *not* indicate optional items. In syntax the '| ' symbol is used to separate alternatives, and ellipses ("...") are used to show that additional arguments are optional.

Shading is used to identify extensions and options; see Section 1.5.1 (on page 6).

Footnotes and notes within the body of the normative text are for information only (informative).

Informative sections (such as Rationale, Change History, Application Usage, and so on) are denoted by continuous shading bars in the margins.

915 Ranges of values are indicated with parentheses or brackets as follows:

916 — (a,b) means the range of all values from a to b , including neither a nor b .

917 — $[a,b)$ means the range of all values from a to b , including a and b .

918 — $(a,b]$ means the range of all values from a to b , including a , but not b .

919 — $[a,b]$ means the range of all values from a to b , including b , but not a .

920 **Note:** A symbolic limit beginning with POSIX is treated differently, depending on context. In a C-
921 language header, the symbol `POSIXstring` (where *string* may contain underscores) is
922 represented by the C identifier `_POSIXstring`, with a leading underscore required to prevent
923 ISO C standard name space pollution. However, in other contexts, such as languages other
924 than C, the leading underscore is not used because this requirement does not exist.

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925

926 The following information is given for the convenience of users of IEEE Std 1003.1-200x and
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928 other products mentioned in the text that might be covered by trademark protection and readers
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939 /usr/group[®] is a registered trademark of UniForum, the International Network of UNIX System |
940 Users.

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- 946 • The SC22 WG14 Committees.

947 This document was prepared by the Austin Group, a joint working group of the IEEE, The Open
948 Group, and ISO SC22 WG15.

949 **Austin Group Common Standards Committee**

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Referenced Documents

1010

1011

Normative References

1012

Normative references for IEEE Std 1003.1-200x are defined in Section 1.3 (on page 4).

1013

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The following documents are referenced in IEEE Std 1003.1-200x:

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1984 /usr/group Standard

1016

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George S. Almasi and Allan Gottlieb, *Highly Parallel Computing*, The Benjamin/Cummings

1019

Publishing Company, Inc., 1989, ISBN: 0-8053-0177-1.

1020

ANSI C

1021

American National Standard for Information Systems: Standard X3.159-1989, Programming

1022

Language C.

1023

ANS X3.226-1994

1024

American National Standard for Information Systems: Standard X3.226-1994, Programming

1025

Language Common LISP.

1026

Brawer

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