

TABLE of CONTENTS

Volume 1 - Lanuage Reference

1. Introduction	1
2. Litatoms (Symbols)	2-1
Using Symbols as Variables	2-1
Function Definition Cells.....	2-3
Property Lists	2-4
Print Names.....	2-5
Characters and Character Codes	2-9
3. Lists	3-1
Creating Lists.....	3-3
Building Lists from Left to Right.....	3-4
Copying Lists	3-6
Extracting Tails of Lists.....	3-6
Counting List Cells	3-8
Logical Operations	3-9
Searching Lists	3-10
Substitution Functions	3-10
Association Lists and Property Lists.....	3-11
Sorting Lists	3-13
Other List Functions.....	3-15
4. Strings	4-1
5. Arrays	5-1
6. Hash Arrays	6-1
Hash Overflow	6-3
User-Specified Hashing Functions.....	6-3
7. Numbers and Arithmetic Functions	7-1
Generic Arithmetic	7-2
Integer Arithmetic	7-3
Logical Arithmetic Functions.....	7-6
Floating-Point Arithmetic.....	7-8
Other Arithmetic Functions	7-10
8. Record Package	8-1
FETCH and REPLACE.....	8-1

CREATE.....	8-2
TYPE?	8-3
WITH.....	8-4
Record Declarations	8-4
Record Types.....	8-5
Optional Record Specifications	8-10
Defining New Record Types	8-12
Record Manipulation Functions.....	8-12
Changetran	8-13
Built-in and User Data Types	8-15
9. Conditionals and Iterative Statements	9-1
Data Type Predicates	9-1
Equality Predicates.....	9-2
Logical Predicates.....	9-3
COND Conditional Function.....	9-3
The IF Statement.....	9-4
Selection Functions.....	9-5
PROG and Associated Control Functions	9-6
The Iterative Statement.....	9-7
I.s. Types	9-8
Iterative Variable I.s.oprs	9-9
Condition I.s.oprs	9-12
Other I.s.oprs.....	9-13
Miscellaneous Hints on I.s.oprs	9-13
Errors in Iterative Statements	9-15
Defining New Iterative Statement Operators	9-15
10. Function Definition, Manipulation, and Evaluation	10-1
Function Types	10-2
Lambda-Spread Functions.....	10-2
Nlambda-Spread Functions.....	10-3
Lambda-Nospread Functions.....	10-4
Nlambda-Nospread Functions.....	10-4
Compiled Functions.....	10-5
Function Type Functions.....	10-5
Defining Functions.....	10-7
Function Evaluation.....	10-1
Iterating and Mapping Functions	10-1
Function Arguments	10-1
Macros.....	10-1
DEFMACRO.....	10-15
Interpreting Macros	10-15

11. Variable Binds and the Interlisp Stack	11-1
Spaghetti Stack	11-2
Stack Functions	11-3
Searching the Stack	11-4
Variable Binds in Stack Frames	11-5
Evaluating Expressions in Stack Frames	11-6
Altering Flow of Control	11-6
Releasing and Reusing Stack Pointers	11-7
Backtrace Functions	11-8
Other Stack Functions	11-10
The Stack and the Interpreter	11-10
Generators	11-12
Coroutines	11-14
Possibilities Lists	11-15
12. Miscellaneous	12-1
Greeting and Initialization Files	12-1
Idle Mode	12-3
Saving Virtual Memory State	12-5
System Version Information	12-9
Date and Time Functions	12-11
Timers and Duration Functions	12-13
Resources	12-15
A Simple Example	12-16
Trade-offs in More Complicated Cases	12-18
Macros for Accessing Resources	12-18
Saving Resources in a File	12-19
Pattern Matching	12-19
Pattern Elements	12-20
Element Patterns	12-20
Segment Patterns	12-21
Assignments	12-23
Place-Markers	12-23
Replacements	12-24
Reconstruction	12-24
Examples	12-25

Volume 2 - Environment Reference

13. Interlisp Executive	13-1
Input Formats	13-3
Programmer's Assistant Commands	13-4
Event Specification	13-4

Commands	13-6
P.A. Commands Applied to P.A. Commands.....	13-15
Changing the Programmer's Assistant	13-16
Undoing	13-19
Undoing Out of Order	13-20
SAVESET	13-21
UNDONLSETQ and RESETUNDO	13-22
Format and Use of the History List	13-23
Programmer's Assistant Functions.....	13-26
The Editor and the Programmer's Assistant	13-32
14. Errors and Breaks	14-1
Breaks.....	14-1
Break Windows.....	14-2
Break Commands	14-3
Controlling When to Break	14-10
Break Window Variables.....	14-11
Creating Breaks with BREAK1	14-12
Signalling Errors.....	14-14
Catching Errors.....	14-16
Changing and Restoring System State	14-18
Error List.....	14-20
15. Breaking, Tracing, and Advising	15-1
Breaking Functions and Debugging.....	15-1
Advising	15-7
Implementation of Advising	15-7
Advise Functions.....	15-8
16. List Structure Editor	16-1
SEdit	16-1
Local Attention-Changing Commands.....	16-10
Commands That Search	16-14
Search Algorithm.....	16-15
Search Commands.....	16-16
Location Specification.....	16-18
Commands That Save and Restore the Edit Chain	16-21
Commands That Modify Structure.....	16-22
Implementation	16-23
The A, B, and : Commands	16-24
Form Oriented Editing and the Role of UP	16-26
Extract and Embed	16-26
The MOVE Command	16-28
Commands That Move Parentheses.....	16-30
TO and THRU	16-31

The R Command	16-34
Commands That Print.....	16-35
Commands for Leaving the Editor.....	16-37
Nested Calls to Editor	16-39
Manipulating the Characters of an Atom or String.....	16-39
Manipulating Predicates and Conditional Expressions.....	16-40
History Commands in the Editor	16-41
Miscellaneous Commands	16-41
Commands That Evaluate	16-43
Commands That Test	16-45
Edit Macros.....	16-46
Undo	16-48
EDITDEFAULT	16-50
Editor Functions.....	16-51
Time Stamps	16-57

17. File Package 17-1

Loading Files	17-3
Storing Files	17-8
Remaking a Symbolic File	17-12
Loading Files in a Distributed Environment	17-13
Marking Changes.....	17-13
Noticing Files.....	17-15
Distributing Change Information.....	17-16
File Package Types	17-16
Functions for Manipulating Typed Definitions	17-19
Defining New File Package Types	17-23
File Package Commands.....	17-25
Functions and Macros	17-26
Variables.....	17-27
Litatom Properties	17-29
Miscellaneous File Package Commands	17-30
DECLARE:	17-31
Exporting Definitions.....	17-33
FileVars.....	17-34
Defining New File Package Commands	17-35
Functions for Manipulating File Command Lists.....	17-37
Symbolic File Format.....	17-38
Copyright Notices.....	17-40
Functions Used Within Source Files	17-42
File Maps.....	17-42

18. Compiler 18-1

Compiler Printout.....	18-2
Global Variables.....	18-3

Local Variables and Special Variables.....	18-4
Constants	18-5
Compiling Function Calls	18-6
FUNCTION and Functional Arguments	18-7
Open Functions.....	18-8
COMPILETYPELST	18-8
Compiling CLISP.....	18-9
Compiler Functions.....	18-9
Block Compiling.....	18-12
Block Declarations.....	18-13
Block Compiling Functions.....	18-15
Compiler Error Messages.....	18-16
19. DWIM	20-1
Spelling Correction Protocol.....	20-3
Parentheses Errors Protocol.....	20-4
Undefined Function T Errors.....	20-4
DWIM Operation.....	20-5
DWIM Correction: Unbound Atoms.....	20-6
Undefined CAR of Form	20-7
Undefined Function in APPLY.....	20-8
DWIMUSERFORMS	20-8
DWIM Functions and Variables.....	20-10
Spelling Correction.....	20-11
Synonyms	20-12
Spelling Lists	20-12
Generators for Spelling Correction.....	20-14
Spelling Corrector Algorithm.....	20-14
Spelling Corrector Functions and Variables.....	20-15
20. CLISP	21-1
CLISP Interaction with User	21-4
CLISP Character Operators.....	21-5
Declarations.....	21-9
CLISP Operation.....	21-10
CLISP Translations.....	21-12
DWIMIFY	21-13
CLISPIFY	21-16
Miscellaneous Functions and Variables.....	21-18
CLISP Internal Conventions	21-20
21. Performance Issues	22-1
Storage Allocation and Garbage Collection	22-1
Variable Bindings	22-4
Performance Measuring	22-5

BREAKDOWN	22-7
GAINSPACE	22-9
Using Data Types Instead of Records.....	22-9
Using Incomplete File Names.....	22-10
Using "Fast" and "Destructive" Functions.....	22-10

22. Processes	23-1
Creating and Destroying Processes	23-1
Process Control Constructs	23-4
Events	23-5
Monitors.....	23-7
Global Resources.....	23-8
Typein and the TTY Process.....	23-9
Switing the TTY Process	23-9
Handling of Interrupts.....	23-11
Keeping the Mouse Alive	23-12
Process Status Window.....	23-12
Non-Process Compatibility	23-14

Volume 3 - I/O Reference

23. Streams and Files	24-1
Opening and Closing File Streams.....	24-1
File Names	24-4
Incomplete File Names	24-7
Version Recognition	24-9
Using File Names Instead of Streams	24-10
File Name Efficiency Considerations.....	24-11
Obsolete File Opening Functions	24-11
Converting Old Programs	24-11
Using Files with Processes	24-12
File Attributes.....	24-12
Closing and Reopening Files	24-15
Local Hard Disk Device	24-16
Floppy Disk Device	24-18
I/O Operations To and From Strings	24-22
Temporary Files and the CORE Device.....	24-23
NULL Device.....	24-24
Deleting, Copying, and Renaming Files.....	24-24
Searching File Directories	24-24
Listing File Directories	24-25
File Servers.....	24-28
PUP File Server Protocols.....	24-28

	Xerox NS File Server Protocols.....	24-28
	Operating System Designations.....	24-29
	Logging In	24-30
	Abnormal Conditions	24-31
24.	Input/Output Functions	25-1
	Specifying Streams for Input/Output Functions	25-1
	Input Functions.....	25-2
	Output Functions	25-6
	PRINTLEVEL.....	25-8
	Printing Numbers.....	25-10
	User Defined Printing.....	25-12
	Printing Unusual Data Structures.....	25-13
	Random Access File Operations	25-14
	Input/Output Operations with Characters and Bytes	25-17
	PRINTOUT	25-17
	Horizontal Spacing Commands	25-19
	Vertical Spacing Commands	25-20
	Special Formatting Controls	25-20
	Printing Specifications.....	25-20
	Paragraph Format	25-21
	Right-Flushing	25-21
	Centering	25-22
	Numbering	25-22
	Escaping to Lisp.....	25-23
	User-Defined Commands	25-23
	Special Printing Functions	25-24
	READFILE and WRITEFILE.....	25-25
	Read Tables	25-25
	Read Table Functions.....	25-26
	Syntax Classes.....	25-26
	Read Macros.....	25-29
25.	User Input/Output Packages	26-1
	Inspector	26-1
	Calling the Inspector.....	26-1
	Multiple Ways of Inspecting.....	26-2
	Inspect Windows.....	26-3
	Inspect Window Commands	26-3
	Interaction with Break Windows	26-4
	Controlling the Amount Displayed During Inspection.....	26-4
	Inspect Macros	26-4
	INSPECTWs	26-5
	PROMPTFORWARD	26-7
	ASKUSER	26-9

Format of KEYLST	26-10
Options	26-12
Operation	26-13
Completing a Key	26-14
Special Keys	26-15
Startup Protocol and Typeahead	26-16
TTYIN Typein Editor	26-17
Entering Input with TTYIN	26-17
Mouse Commands (Interlisp-D Only)	26-19
Display Editing Commands	26-19
Using TTYIN for Lisp Input	26-22
Useful Macros	26-23
Programming with TTYIN	26-23
Using TTYIN as a General Editor	26-25
?= Handler	26-26
Read Macros	26-27
Assorted Flags	26-28
Special Responses	26-29
Display Types	26-30
Prettyprint	26-31
Comment Feature	26-33
Comment Pointers	26-34
Converting Comments to Lowercase	26-35
Special Prettyprint Controls	26-36

26. Graphics Output Operations 27-1

Primitive Graphics Concepts	27-1
Positions	27-1
Regions	27-1
Bitmaps	27-2
Textures	27-5
Opening Image Streams	27-6
Accessing Image Stream Fields	27-8
Current Position of an Image Stream	27-10
Moving Bits Between Bitmaps with BITBLT	27-11
Drawing Lines	27-13
Drawing Curves	27-14
Miscellaneous Drawing and Printing Operations	27-15
Drawing and Shading Grids	27-17
Display Streams	27-18
Fonts	27-19
Font Files and Font Directories	27-24
Font Profiles	27-24
Image Objects	27-27
IMAGEFNS Methods	27-28

Registering Image Objects.....	27-30
Reading and Writing Image Objects on Files.....	27-31
Copying Image Objects Between Windows.....	27-31
Implementation of Image Streams.....	27-32
27. Windows and Menus	28-1
Using the Window System.....	28-1
Changing the Window System.....	28-6
Interactive Display Functions.....	28-7
Windows.....	28-9
Window Properties	28-10
Creating Windows	28-10
Opening and Closing Windows.....	28-11
Redisplaying Windows	28-12
Reshaping Windows.....	28-13
Moving Windows.....	28-14
Exposing and Burying Windows.....	28-16
Shrinking Windows into Icons.....	28-16
Coordinate Systems, Extents, and Scrolling.....	28-18
Mouse Activity in Windows.....	28-21
Terminal I/O and Page Holding.....	28-22
TTY Process and the Caret.....	28-23
Miscellaneous Window Functions.....	28-24
Miscellaneous Window Properties.....	28-25
Example: A Scrollable Window	28-26
Menus.....	28-28
Menu Fields.....	28-29
Miscellaneous Menu Functions.....	28-32
Examples of Menu Use.....	28-32
Attached Windows	28-34
Attaching Menus to Windows.....	28-37
Attached Prompt Windows.....	28-38
Window Operations and Attached Windows.....	28-39
Window Properties of Attached Windows	28-41
28. Hardcopy Facilities	29-1
Hardcopy Functions	29-1
Low-Level Hardcopy Variables	29-4
29. Terminal Input/Output	30-1
Interrupt Characters.....	30-1
Terminal Tables	30-4
Terminal Syntax Classes.....	30-4
Terminal Control Functions.....	30-5
Line-Buffering.....	30-7

Dribble Files.....	30-10
Cursor and Mouse	30-10
Changing the Cursor Image.....	30-11
Flashing Bars on the Cursor.....	30-13
Cursor Position	30-13
Mouse Button Testing	30-14
Low-Level Mouse Functions.....	30-15
Keyboard Interpretation	30-15
Display Screen.....	30-18
Miscellaneous Terminal I/O	30-19

30. Ethernet 31-1

Ethernet Protocols.....	31-1
Protocol Layering	31-1
Level Zero Protocols.....	31-2
Level One Protocols.....	31-2
Higher Level Protocols	31-3
Connecting Networks: Routers and Gateways	31-3
Addressing Conflicts with Level Zero Mediums.....	31-3
References	31-4
Higher-Level PUP Protocol Functions	31-4
Higher-Level NS Protocol Functions.....	31-5
Name and Address Conventions	31-5
Clearinghouse Functions.....	31-7
NS Printing	31-9
SPP Stream Interface	31-9
Courier Remote Procedure Call Protocol.....	31-11
Defining Courier Programs	31-11
Courier Type Definitions	31-12
Pre-defined Types	31-13
Constructed Types	31-13
User Extensions to the Type Language.....	31-15
Performing Courier Transactions	31-16
Expedited Procedure Call	31-17
Expanding Ring Broadcast.....	31-18
Using Bulk Data Transfer	31-18
Courier Subfunctions for Data Transfer.....	31-19
Level One Ether Packet Format	31-20
PUP Level One Functions.....	31-21
Creating and Managing Pups	31-21
Sockets.....	31-22
Sending and Receiving Pups.....	31-23
Pup Routing Information	31-23
Miscellaneous PUP Utilities	31-24
PUP Debugging Aids.....	31-24

NS Level One Functions.....	31-28
Creating and Managing XIPs.....	31-28
NS Sockets	31-28
Sending and Receiving XIPs.....	31-29
NS Debugging Aids	31-29
Support for Other Level One Protocols.....	31-29
The SYSQUEUE Mechanism	31-31
Glossary	GLOSSARY-1
Index	INDEX-1

[This page intentionally left blank]