

# MASTERING AS/400 CONTROL LANGUAGE

GEORGE LIN

*A complete text to learning and mastering  
AS/400 CL commands and CL programming*

**AS/400**

**MASTER**

**CL COMMANDS**

**CL PROGRAMMING**

**A COMPREHENSIVE CL REFERENCE BOOK**

*Tutorials, examples, and lab exercises  
guide readers through using CL commands  
and coding and developing CL programs*

**PRENTICE HALL**

# MASTERING AS/400 CONTROL LANGUAGE

**George Lin**

---

*For book and bookstore information*



<http://www.prenhall.com>

---



Prentice Hall PTR  
Upper Saddle River, NJ 07458

## Library of Congress Cataloging-in-Publication Data

Lin, George

Mastering AS/400 control language / George Lin.

p. cm.

Includes index.

ISBN 0-13-461955-2 (pbk.)

1. IBM AS/400 (Computer) 2. Job Control Language (Computer program language) I. Title.

QA76.8.I25919L58 1995

005.4'3--dc20

95-42162

CIP

Editorial/production supervision: *Patti Guerrieri*

Cover director: *Jerry Votta*

Cover designer: *Talar Agasyan*

Cover illustrator: *John Churchman*

Manufacturing buyer: *Alexis R. Heydt*

Acquisitions editor: *Mike Meehan*

Editorial assistant: *Dori Steinhauft*



©1996 by Prentice Hall PTR

Prentice-Hall, Inc.

A Simon & Schuster Company

Upper Saddle River, NJ 07458

The publisher offers discounts on this book when ordered in bulk quantities. For more information, contact: Corporate Sales Department, Prentice Hall PTR, One Lake Street, Upper Saddle River, NJ 07458, Phone: 800-382-3419, Fax: 201-236-7141, e-mail: [corpsales@prenhall.com](mailto:corpsales@prenhall.com)

All products or services mentioned in this document are the trademarks or service marks of their respective companies or organizations.

All rights reserved. No part of this book may be reproduced, in any form or by any means, without permission in writing from the publisher.

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

ISBN 0-13-461955-2

Prentice-Hall International (UK) Limited, *London*

Prentice-Hall of Australia Pty. Limited, *Sydney*

Prentice-Hall Canada Inc., *Toronto*

Prentice-Hall Hispanoamericana, S.A., *Mexico*

Prentice-Hall of India Private Limited, *New Delhi*

Prentice-Hall of Japan, Inc., *Tokyo*

Simon & Schuster Asia Pte. Ltd., *Singapore*

Editora Prentice-Hall do Brasil, Ltda., *Rio de Janeiro*

## ACKNOWLEDGMENTS

I am deeply grateful to executive editor Michael Meehan whose encouragement, inspiration, and support made it possible for me to complete this book. I want to offer my special thanks to production editor Patti Guerrieri who has been very proficient and patient in her editorial work and supervision of this book's production. I would also like to acknowledge copy editor Camie Goffi who has been very thorough in her editing and proofreading.

I would like to extend my gratitude to Dori Steinhauft who provided editorial assistance, to Jerry Votta, Talar Agasyan, and John Churchman who directed, designed, and illustrated the book's covers, to Alexis R. Heydt who managed the manufacturing of this book, to Donna Zwiegel and Jim Swann who edited my original manuscript, to Nancy Lewis and Daniel Weber who assisted me with the cover's original art work, and to all others who participated in preparing and producing this book.

Finally, I want to pay tribute to Gayla Stewart, the co-author of our critically acclaimed book, *AS/400: System, Utilities, Database, and Programming*. Professor Stewart offered me my first teaching position, encouraged and inspired me to write, reviewed and edited my original manuscripts, and provided me many valuable suggestions. For all these, I am profoundly grateful.

## DISCLAIMER

The author and publisher have made their best efforts in preparing this book. No warranty of any kind is expressed or implied with regard to the contents, adequacy, and accuracy of this book. This book is not intended to replace IBM product documentation. The author and publisher do no assume responsibility for information included in or omitted from this book and for consequences resulting from the use of this book and its contents.

## ABOUT THE AUTHOR

George Lin is a Software Engineer whose technical background spans all three major system platforms: AS/400, mainframe, and PC. For the last 16 years, he has worked on many system and application development projects that include client/server computing, object-oriented architecture, relational database, graphical user interface, event-driven programming, and other software applications. He has designed and implemented many business applications using various utilities, databases, system development tools, and programming languages including those on the AS/400.

George Lin holds an MBA from Southern Illinois University. He has taught various information systems courses at Washington University and St. Louis Community College including AS/400 Control Language, Introduction to the AS/400, SQL, C, C++, and Visual Basic. George Lin is the lead author of the best selling *AS/400: System, Utilities, Database, and Programming*. This highly acclaimed book is also published by Prentice Hall.

---

---

## Preface

---

---

Like most other control languages, such as Job Control Language (JCL) on the mainframe and DOS and OS/2 commands on a PC, the AS/400 Control Language (CL) provides a vital link between the system and users. AS/400 CL controls system operations, submits and controls jobs, facilitates application programming development, runs programs, processes database files, and performs system administration. Nearly everything you do on the AS/400 requires CL. A solid knowledge of CL is a prerequisite for all AS/400 professionals and users.

AS/400 CL offers a set of predefined *CL commands* that can be entered individually to perform certain functions. In addition, these commands can also be coded and grouped together as *CL programs*. Users can incorporate logic, variables, expressions, operators, and control structures into CL programs in a way that is similar to the coding and use of high-level languages such as COBOL, RPG, and C. AS/400 CL is truly unique in its versatility and flexibility. It combines the functionality and strengths of various operating system commands, job control languages, and high-level programming languages.

Mastering AS/400 CL requires the learning of two main topics: *CL commands* and *CL programming*. This book first introduces the fundamental concept and structure of *CL commands*. Discussion of more complex and advanced topics of *CL programming* follows. Other important subjects, which include command entry, command prompting, major command groups, command driver, Source Entry Utility (SEU), Programming Development Manager (PDM), calling and running programs, passing parameters, processing files, working with data areas, working with objects, libraries, and the library list, processing jobs, monitoring messages, and debugging programs, are also discussed. All of these topics are essential to full utilization of AS/400 CL.

### In This Book

This book is distinct in its breadth, depth, and ease of use. It employs a combination of text, tutorials, and lab exercises to engage readers in hands-on study. Detailed and step-by-step illustrations and instructions using displays, tables, diagrams, and examples are employed throughout the book.

Chapters of this book are organized into five major parts:

#### CL Commands

Part 1 introduces the AS/400 CL commands. It introduces the basic syntax and structure of a command. It also shows readers how and where

to enter CL commands by using free-form entry and command prompting. In addition, it presents two important features: major command groups and the command driver. These two features, coupled with the use of command prompting and Help text, are essentially the keys to mastering AS/400 CL. Tutorials, examples, and lab exercises are used to illustrate the AS/400 environment and to teach the use and entry of AS/400 CL commands.

## CL Programming Fundamentals

Part 2 discusses the fundamentals of CL programming, including the functions and structure of CL programs. It also teaches readers how to use the AS/400 utilities, Source Entry Utility (SEU) and Programming Development Manager (PDM), and how to enter and compile CL programs. In each chapter, tutorials, screen displays, examples, and lab exercises are used to maximize the reader's learning experience.

## CL Programming Elements

Part 3 addresses the essential elements that form CL programs. These elements include CL variables, expressions, operators, built-in functions, and control structures. Professional programming examples, tutorials, and lab exercises are employed to assist readers in coding and developing practical CL programs.

## Calling Programs and Processing Files

Part 4 discusses some of the most important functions of AS/400 CL: calling programs, passing parameters to called programs, submitting jobs, processing database files, and running interactive CL programs using display files. Charts and diagrams are used to illustrate the flow of active programs in a program stack when programs are called and controls are transferred. Readers can practice CL program coding and gain practical knowledge through various CL program examples and lab exercises.

## Advanced Topics

Part 5 provides an advanced guide that assists readers as they hone their CL knowledge and skills. Tutorials, examples, and step-by-step instructions walk readers through using some of the advanced CL features. They include working with data areas, working with objects, libraries, and the library list, processing jobs under work management, monitoring messages, and testing and debugging programs.

## Who Can Use This Book

This is a technical book written for both novice and experienced information systems professionals. AS/400 users and students can use this book to acquire basic and intermediate knowledge of AS/400 CL commands and CL programming. Programmers, operators, system analysts, and system administrators can use this book as a technical reference. Both beginning and experienced computer professionals will benefit from the detailed hands-on tutorials, graphical screen illustrations, step-by-step instructions, and lab exercises. The structured tutorials and practical knowledge offered by this book make it ideal for self-study, as well as classroom teaching and learning.



---

## Mastering AS/400 Control Language

---

### Brief Contents

Preface .....	xi
---------------	----

#### Part I: Control Language (CL) Commands

Chapter 1	CL Command Syntax and Structure .....	1
Chapter 2	Command Entry and Command Prompting - A Tutorial .....	17
Chapter 3	Major Command Groups and the Command Driver - A Tutorial .....	35

#### Part II: CL Programming Fundamentals

Chapter 4	The Functions and Structure of CL Programming .....	47
Chapter 5	Entering and Compiling CL Programs Using Source Entry Utility (SEU) and Programming Development Manager (PDM) - A Tutorial .....	63

#### Part III: CL Programming Elements

Chapter 6	CL Variables .....	89
Chapter 7	CL Expressions and Operators .....	109
Chapter 8	CL Built-in Functions .....	129
Chapter 9	Control Structures .....	143

#### Part IV: Calling Programs and Processing Files

Chapter 10	Calling Programs and Passing Parameters - A Tutorial .....	159
Chapter 11	Processing Database Files .....	183
Chapter 12	Processing Display Files in Interactive CL Programs - A Tutorial .....	227

#### Part V: Advanced Topics

Chapter 13	Working with Data Areas - A Tutorial .....	251
Chapter 14	Working with Objects, Libraries, and the Library List .....	273
Chapter 15	Processing Jobs Under Work Management .....	309
Chapter 16	Sending and Monitoring Messages .....	325
Chapter 17	Testing and Debugging Programs - A Tutorial .....	365

Answers to Even-numbered Questions .....	383
--	-----

Index .....	401
-------------	-----

---

## Mastering AS/400 Control Language

---

### Detailed Contents

#### Preface

#### Part I: Control Language (CL) Commands

Chapter 1	CL Command Syntax and Structure .....	1
	1.1 Control Language Overview .....	2
	1.2 Parameter Keywords and Values .....	6
	1.3 Required and Optional Parameters .....	9
	1.4 Sample CL Commands with Required and Optional Parameters ....	10
	1.5 System-defined and User-defined Parameter Values .....	12
	Review Questions .....	14
Chapter 2	Command Entry and Command Prompting - A Tutorial .....	17
	2.1 Using the Command Line .....	18
	2.2 Using the Command Entry Display .....	20
	2.3 Free-form Entry .....	24
	2.4 Command Prompting .....	25
	Lab Exercise .....	27
	Review Questions .....	33
Chapter 3	Major Command Groups and the Command Driver - A Tutorial .....	35
	3.1 Major Command Groups .....	36
	3.2 The Command Driver .....	41
	Lab Exercise .....	44
	Review Questions .....	46

#### Part II: CL Programming Fundamentals

Chapter 4	The Functions and Structure of CL Programming .....	47
	4.1 CL Programming Overview .....	48
	4.2 Major Functions of CL Programs .....	49
	4.3 CL program Structure .....	50
	4.4 A Sample CL Program .....	53
	4.5 A Typical Start-up Program .....	57
	Lab Exercise .....	60
	Review Questions .....	61
Chapter 5	Entering and Compiling CL Programs Using Source Entry Utility (SEU) and Programming Development Manager (PDM) - A Tutorial .....	63
	5.1 Batch Entry and Interactive Entry .....	64
	5.2 Source Creation .....	65
	5.3 Object Creation .....	67
	5.4 Entering a CL Program Using Source Entry Utility (SEU) - Lab Exercise .....	68
	5.5 Compiling a CL Program Using Programming Development Manager (PDM) - Lab Exercise .....	84
	Review Questions .....	87

## Part III: CL Programming Elements

Chapter 6	CL Variables .....	89
	6.1 Working with CL Program Variables .....	90
	6.2 Declaring CL Variables and Files .....	91
	6.3 Using and Modifying Variables .....	95
	6.4 CL Program Examples .....	97
	Lab Exercise .....	105
	Review Questions .....	108
Chapter 7	CL Expressions and Operators .....	109
	7.1 Concepts of CL Expressions and Operators .....	110
	7.2 Using Logical Operators .....	112
	7.3 Using Relational Operators .....	114
	7.4 Using Arithmetic Operators .....	116
	7.5 Using Character Operators .....	117
	7.6 CL Program Examples .....	119
	Review Questions .....	126
Chapter 8	CL Built-in Functions .....	129
	8.1 CL Special Built-in Functions .....	130
	8.2 Using the %Switch Built-in Function .....	131
	8.3 Using the %Substring Built-in Function .....	134
	8.4 CL Program Examples .....	137
	Review Questions .....	141
Chapter 9	Control Structures .....	143
	9.1 Controlling CL Program Processing .....	144
	9.2 Unconditional Branching .....	145
	9.3 Conditional Branching .....	147
	9.4 Using the DO Group .....	149
	9.5 CL Program Examples .....	151
	Lab Exercise .....	154
	Review Questions .....	157

## Part IV: Calling Programs and Processing Files

Chapter 10	Calling Programs and Passing Parameters - A Tutorial .....	159
	10.1 Processing Jobs .....	160
	10.2 Calling Programs .....	161
	10.3 Transferring Control .....	164
	10.4 Returning Control .....	168
	10.5 Submitting Jobs .....	169
	10.6 CL Program Examples .....	174
	Lab Exercise .....	178
	Review Questions .....	180
Chapter 11	Processing Database Files .....	183
	11.1 Working with Database Files .....	184
	11.2 Creating Physical and Logical Files .....	185
	11.3 Overriding Database Files .....	192
	11.4 Deleting Overrides .....	197
	11.5 Copying Files .....	200

## Mastering AS/400 Control Language

	11.6 Sorting Database Files .....	205
	11.7 Clearing Physical Files .....	212
	11.8 Deleting Files .....	214
	11.9 CL Program Examples .....	216
	Lab Exercise .....	221
	Review Questions .....	224
Chapter 12	Processing Display Files in Interactive CL Programs - A Tutorial.	227
	12.1 Processing Display Files .....	228
	12.2 Declaring a File .....	230
	12.3 Sending and Receiving Data with a Display File .....	233
	12.4 Sending Data with a Display File .....	236
	12.5 Receiving Data with a Display File .....	239
	12.6 CL Program Examples and Lab Exercises .....	242
	Review Questions .....	249
 <u>Part V: Advanced Topics</u>		
Chapter 13	Working with Data Areas - A Tutorial .....	251
	13.1 The Concept of a Data Area .....	252
	13.2 Creating a Data Area .....	253
	13.3 Changing a Data Area .....	256
	13.4 Displaying a Data Area .....	257
	13.5 Retrieving a Data Area .....	259
	13.6 Deleting a Data Area .....	261
	13.7 CL Program Examples .....	262
	Lab Exercise .....	266
	Review Questions .....	271
Chapter 14	Working with Objects, Libraries, and the Library List .....	273
	14.1 The Concept of an Object .....	274
	14.2 Object Types .....	275
	14.3 Retrieving Objects .....	276
	14.4 The Concept of a Library .....	277
	14.5 Library Types .....	278
	14.6 The Library List .....	280
	14.7 Manipulating the Library List .....	281
	14.8 Creating Objects .....	289
	14.9 Granting Object Authorities .....	294
	14.10 Checking Objects .....	295
	14.11 Changing Object Attributes .....	298
	14.12 Creating Duplicate Objects .....	301
	14.13 Moving Objects .....	302
	14.14 Clearing Physical File Members .....	303
	14.15 Deleting Files .....	304
	Review Questions .....	305
Chapter 15	Processing Jobs Under Work Management .....	309
	15.1 Work Management Concept and Structure .....	310
	15.2 Jobs and Subsystems .....	314
	15.3 Major Subsystem and Job Commands .....	316
	15.4 The Job Description .....	322
	Review Questions .....	323

## Mastering AS/400 Control Language

Chapter 16	Sending and Monitoring Messages .....	325
16.1	Using Messages in CL Programs .....	326
16.2	Sending Messages .....	327
16.3	Sending Break Messages .....	329
16.4	Sending User Messages .....	331
16.5	Sending Program Messages .....	334
16.6	Monitoring Messages .....	337
16.7	Selected Messages That Can Be Monitored .....	340
16.8	CL Program Examples .....	357
	Review Questions .....	362
Chapter 17	Testing and Debugging Programs - A Tutorial .....	365
17.1	Testing and Debugging Programs Using CL Commands .....	366
17.2	Starting Debug .....	367
17.3	Adding Break Points .....	368
17.4	Displaying and Changing Program Variables .....	370
17.5	Adding Traces .....	372
17.6	Ending Debug .....	374
17.7	A Debug Example .....	375
	Lab Exercise .....	378
	Review Questions .....	381
	Answers to Even-numbered Questions .....	383
	Index .....	401

---

---

Chapter 1

---

---

CL Command Syntax and Structure

---

---

1.1 Control Language Overview

1.2 Parameter Keywords and Values

1.3 Required and Optional Parameters

1.4 Sample CL Commands with Required and Optional Parameters

1.5 System-defined and User-defined Parameter Values

Review Questions

---

## 1.1 Control Language Overview

---

The AS/400 Control Language (CL) is a set of commands that provides the primary interface between users and the system. A single CL statement is called a *command*. CL commands can be grouped together to form a *CL program* that incorporates control structures and processing logic. CL commands and programs offer a flexible way to control many system activities and job processing. A working knowledge of CL is essential for AS/400 professionals and users who use the system to run jobs, develop application programs, and perform system and operating functions.

Collectively, CL has more than one thousand commands, each of which is designed to perform a specific system, operational, or programming task. All CL commands use a consistent syntax. Each command is made up of two parts: a command name and command parameters.

The two parts of a CL command:

1. A command name.
2. Command parameters.

### 1.1.1 CL Command Syntax

A CL command has two main components: a command name and command parameters. Consider the following example:

Command Entry Rules:

1. Free-form entry.
2. Use a blank or blanks to separate the command name and command parameters.
3. Use a blank or blanks to separate each individual parameter.
4. Use parentheses around parameter values that are entered in keyword specifications.
5. Do not use a blank to separate a parameter keyword from its value.
6. Use the plus sign (+) to indicate the continuation of a command entry.

<u>SNDDMSG</u>	<u>MSG('Hello World!') TOUSR(*ALLACT) MSGTYPE(*INFO)</u>
Command Name	<----- Command Parameters ----->

This SNDDMSG (Send Message) command sends an informational message to all active users. The first part of the command, SNDDMSG, is the command name. The second part, MSG('Hello World!') TOUSR(\*ALLACT) MSGTYPE(\*INFO), is the command parameters. These two parts of a CL command form the basic command structure.

There are a few *exceptions*, however, to this general syntax. Among the most notable exceptions are: Do (Do), EDTLIBL (Edit Library List), and ENDDDBG (End Debug). These commands have no parameters. They contain only one component, the command name.

### 1.1.2 Command Entry Rules

When entering CL commands, the following rules must be observed:

- CL commands are free-form. Blanks must be used as the basic separators between the parts of a command. In other words, there must be a blank or blanks between the command name and the parameters, and a

A CL command name is abbreviated by its significant characters.

The parts of CL command name are:

1. A verb, and a noun.
2. A verb, an adjective, and a noun.
3. A verb and multiple nouns.

blank or blanks between each parameter. Multiple blanks are treated as a single blank.

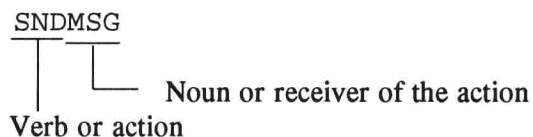
- Use parentheses on parameter values that are coded in keyword specifications, such as MSG('Test message') in the above example.
- Do not use blanks to separate a parameter keyword from its parameter value. For instance, there should not be a blank or blanks between MSG and ('Hello World').
- Use the plus sign (+) to indicate the continuation of a command when the entry of a command overflows into the next line.

### 1.1.3 Command Name

A CL command name is limited to a maximum of ten characters. It is formed by abbreviating significant characters from the words that describe the command action as well as the object of the action. A typical command name consists of a verb and a noun. In some instances, it may consist of a verb, an adjective, and a noun.

- **A Verb and a Noun**

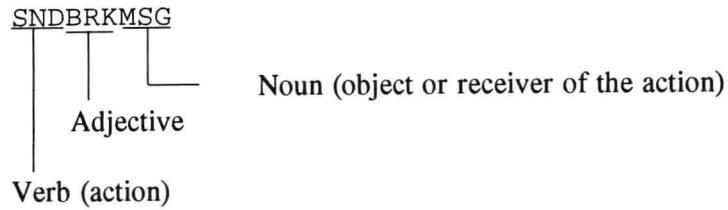
In many cases, CL command names are composed of a verb (action), followed by a noun (object or receiver of the action). The following command name, SNDMSG (Send Message), consists of a verb, "SND" and a noun, "MSG", in which "SND" is abbreviated from the word "Send" and "MSG" from "Message":



- **A Verb, an Adjective, and a Noun**

In other cases, CL command names are composed of a verb (action), an adjective, and a noun (object or receiver of the action). The command name, SNDBRKMSG (Send Break Message), for example, consists of a verb (SND), an adjective (BRK), and a noun (MSG), in which "SND" is abbreviated from the word "Send", "BRK" from "Break", and "MSG" from "Message":





The words that make up the verb of the command name are almost always abbreviated to three letters. This is not necessarily the case for the adjective or noun, each of which could be abbreviated with one to three characters. Consider the following commands:

**CPFY** - The Copy File command has a verb with three letters (CPY) and a noun with only one letter (F).

**CRTDUPOBJ** - The Create Duplicate Object command has a verb with three letters (CRT), an adjective with three letters (DUP), and a noun with three letters (OBJ).

**WRKSPLF** - The Work with Spooled Files command has a verb with three letters (WRK), an adjective with three letters (SPL), and a noun with only one letter (F).

**CLRPFM** - The Clear Physical File Member command has a verb with three letters (CLR), an adjective with one letter (P), and two nouns with one letter each (F) and (M).

**EDTLIBL** - The Edit library list command has a verb with three letters (EDT), and two nouns, one with three letters (LIB) and one with only one letter (L).

There are also *exceptions* to the general syntax of a command name. For example, the **CALL** command consists entirely of a verb, **CALL**, which has four letters and is not abbreviated. Similarly, the **GO** command is used without being followed by either an adjective or a noun. Its two letters are also not abbreviated. It must be pointed out, however, that these are the exceptions, not the norm.

#### 1.1.4 CL Command Name Abbreviation

As mentioned previously, the words that make up the verb of the command name are usually abbreviated to three significant letters. But for adjective or noun, the abbreviation can vary from one to three letters.

The following table shows a list of the common CL command name abbreviations: