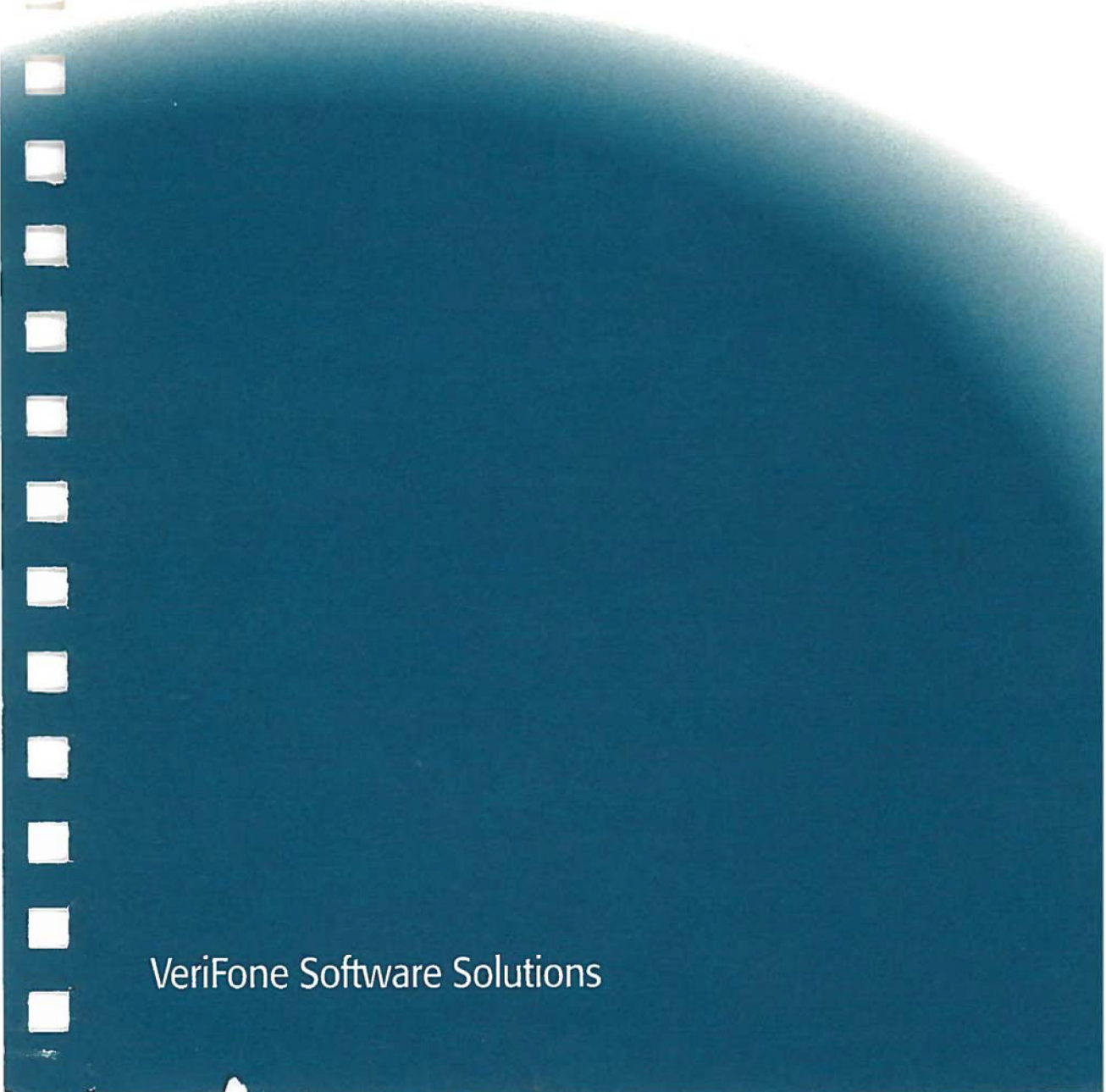


# OMNI 300 Series Terminal

Programmer's Manual, Volume I

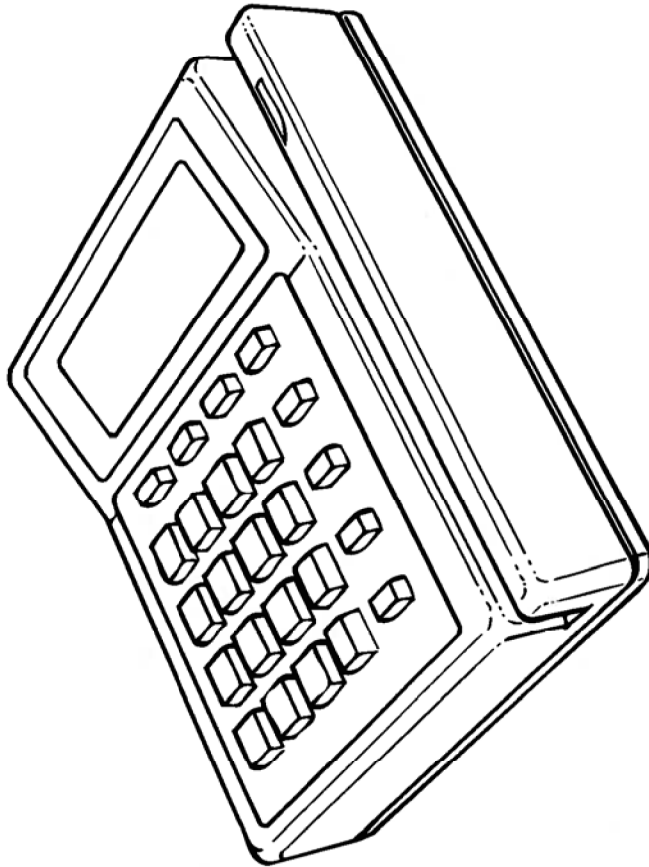


VeriFone Software Solutions

# ***OMNI 300 Series Terminal Programmer's Manual, Volume I***

---

VeriFone Manual Part Number 12941, Revision B  
Manual Revision 1.0  
Included in software package, VeriFone Part Number 12860-02



**IMPORTANT NOTICE**

**NO WARRANTY.** ALTHOUGH VERIFONE HAS ATTEMPTED TO ENSURE THE ACCURACY OF THE CONTENTS OF THIS MANUAL, THIS MANUAL MAY CONTAIN ERRORS OR OMISSIONS. THIS MANUAL, INCLUDING WITHOUT LIMITATION THE SOFTWARE PROGRAM EXAMPLES CONTAINED HEREIN, IS SUPPLIED "AS-IS," WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

**LIMITED LIABILITY.** IN NO EVENT SHALL VERIFONE BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING DAMAGES FOR LOSS OF BUSINESS, PROFITS OR THE LIKE) EVEN IF VERIFONE OR ITS REPRESENTATIVES HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

**PRODUCT CHANGES.** VERIFONE RESERVES THE RIGHT TO CHANGE, UPDATE, OR MAKE OBSOLETE ANY OMNI 300 SERIES DIAL TERMINAL AT ANY TIME AND WITHOUT NOTICE.

**OMNI 300 Series Terminal Programmer's Manual, Volume I**

VeriFone Part Number 12941, Revision B  
Manual Revision Number 1.0  
Included in software package, VeriFone Part Number 12860-02

PRINTED: September, 1994

VeriFone, Inc.  
Three Lagoon Drive  
Redwood City, CA 94065  
TELEX: 5106007959 VERIFONE

Copyright 1994 VeriFone, Inc. All rights reserved.

No part of this publication may be copied, distributed, stored in a retrieval system, translated into any human or computer language, transmitted, in any form or by any means, without the prior written consent of VeriFone, Inc.

VeriFone, TXO and PinStripe are registered trademarks of VeriFone, Incorporated. OMNI, ZAPD, Terminal Control Language (TCL) and ZONTALK 2000 are trademarks of VeriFone, Inc. Hypercom is a registered trademark of HyperCom, Inc. Hayes is a registered trademark of Hayes MicroComputer Products, Inc. IBM is a registered trademark of International Business Machines. VISA is a registered trademark of VISA USA, Inc. All other brand names and trademarks appearing in this manual are the property of their respective holders.

# C O N T E N T S

## CHAPTER 1 Overview

The OMNI 300 Series .....	1-2
Terminology .....	1-2
Features .....	1-3
The TXO Operating System .....	1-3
Programming Requirements .....	1-4
300 Series Reference Manuals .....	1-4
TXO Programming Products and Manuals .....	1-5
OMNI Terminal Direct Download Cables .....	1-5
TXO Application Development Support .....	1-6
Programmer's Manual Typographic Conventions .....	1-6

## CHAPTER 2 System Operation

Terminal Setup .....	2-1
Application and File Downloading .....	2-3
Direct Download .....	2-3
ZONTALK 2000 Download .....	2-3
Terminal-to-Terminal Download .....	2-3
LAN Download .....	2-4
Application-Initiated Download .....	2-4
Terminal Startup Sequence .....	2-5
Startup Sequence If No Errors .....	2-5
Flowcharts of Startup Sequence .....	2-6
Error Messages Overview .....	2-18
Startup Sequence If Errors .....	2-18
System Mode .....	2-23
Accessing System Mode .....	2-23
System Mode Functions .....	2-24

## CHAPTER 3 Programming Notes

Standard C for TXO.....	3-1
Header Files.....	3-2
Null-Terminated Strings .....	3-4
Counted Strings.....	3-4
Use of <code>errno</code> Facility .....	3-5
Volatile vs. Non-volatile Memory .....	3-8
Handling Large Applications .....	3-8
R-module Applications .....	3-9
R-module Requirements and Specifications .....	3-9
Version and Compatibility Requirements .....	3-10
Performance Considerations .....	3-10
R-module Benchmarks Table.....	3-10
Optimizing R-module Performance .....	3-11
Makefile Building .....	3-11
TXO and R-module Makefile Rules .....	3-11
Makefile Examples.....	3-12
Basic Makefile.....	3-12
Recommended Construction .....	3-13
Increased Stack Size .....	3-14
Makefile Troubleshooting.....	3-15
TXO Command Line Options for R-module Compiling.....	3-16
Using Component Programs to Create R-modules .....	3-18
EM_ASLD.EXE.....	3-19
EM_CNV22.EXE .....	3-20
Component File Compile/Link/Convert/Download Process .....	3-20
Converting Chained Applications to R-module Applications .....	3-21
Chained Application Startup Rules .....	3-22
Code File Chaining.....	3-22
Using <code>argc</code> and <code>argv</code> .....	3-23
Chaining Example.....	3-24
TXO Programming Tips and Guidelines.....	3-26

**CHAPTER 4  
System Configuration File**

Environment Variables ..... 4-2

\*B - Communication Device Buffers ..... 4-3

CHKSUM - Checksum Control ..... 4-4

\*CHN - Speed Up Application Restarts ..... 4-5

\*CL - Billing Support ..... 4-5

\*D - Debugging Control ..... 4-6

\*FONT, \*GRID - Changing Initial Font/Grid ..... 4-6

\*GO - Startup Executable Code File ..... 4-7

\*L Series - LAN Control ..... 4-8

\*MI - Modem Control ..... 4-10

\*PTO - Password Timeout ..... 4-11

\*S - Increasing Stack Size ..... 4-11

\*T - Remote Diagnostics Host Telephone Number ..... 4-11

\*Z Series - ZONTALK 2000 Control ..... 4-12

\*ZX - Start Application Following Download ..... 4-12

Application CONFIG.SYS Control ..... 4-13

CONFIG.SYS Example ..... 4-14

**CHAPTER 5  
Memory Management**

Using Terminal Memory ..... 5-1

Volatile Memory Management ..... 5-2

DATA.EM ..... 5-2

SYSTEM.BIN ..... 5-2

Non-volatile Memory Management ..... 5-3

Tips on Managing Application Data ..... 5-4

Managing Application Code ..... 5-5

Calculating Available File Space ..... 5-5

Communications Buffers ..... 5-6

Code and Data File Space ..... 5-6

Managing Code Size ..... 5-7

Literal Strings ..... 5-8

Managing Data Structures ..... 5-9

Initializing Global Data ..... 5-9

Restoring Variable Data ..... 5-10

General Considerations ..... 5-10

Integration and Testing ..... 5-11

## CHAPTER 6 File Management

File Conventions .....	6-2
File Storage .....	6-2
File Naming .....	6-2
Default System Files .....	6-2
File Handles .....	6-2
File Types and Access Methods .....	6-3
Generic Files .....	6-3
Generic File Example .....	6-4
Variable Length Record (VLR) Files .....	6-6
Compressed Variable Length Record (CVLR) Files .....	6-6
Keyed Files .....	6-7
File Manager .....	6-7
File Access Functions .....	6-9
Opening Files .....	6-10
Creating New Files .....	6-11
Opening Files For Writing .....	6-11
File Positioning .....	6-12
Reading Data .....	6-13
Writing Data .....	6-14
File Positioning .....	6-15
Inserting Data .....	6-16
Deleting Data .....	6-17
Tips on Inserting and Deleting Data .....	6-17
File Utility Functions .....	6-18
ioctl() .....	6-18
Closing Files .....	6-19
close() .....	6-19
Example of open(), ioctl(), close() .....	6-20
Keyed File Reading and Writing .....	6-21
Keyed Access Example .....	6-22
getkey() .....	6-23
putkey() .....	6-23
Using Variable Length Records .....	6-24
Variable Length Records Example .....	6-25
Using Compressed Variable Length Records .....	6-28
Compressed Variable Length Records Example .....	6-30
File Directory Functions .....	6-33
dir_get_sizes() .....	6-33

dir\_get\_first() ..... 6-34  
 dir\_get\_next() ..... 6-34  
 remove() ..... 6-35  
 Directory Function Example ..... 6-36

**CHAPTER 7**  
***TXO Exception Handling***

Traps ..... 7-1  
 Trap Numbers ..... 7-2  
 Guards ..... 7-4  
 Take Mask ..... 7-4  
 Hide Mask ..... 7-4  
 Guard Function ..... 7-4  
 Slot Number ..... 7-4  
 Guard List Management Example ..... 7-5  
 Pending Events ..... 7-5  
 Trap Mask Functions ..... 7-7  
 Creating Guard Functions ..... 7-8  
 Tips for Writing Guard Functions ..... 7-9  
 Keep it Simple ..... 7-9  
 Arming Guards ..... 7-9  
 Disarming Guards ..... 7-10  
 Avoid Setjmp() and Longjmp() ..... 7-11  
 Use Device Traps Sparingly ..... 7-11  
 Clear Key Processing ..... 7-12  
 Trap Functions ..... 7-14  
 arm\_guard() ..... 7-14  
 disarm\_guard() ..... 7-14  
 pending\_traps() ..... 7-14  
 dispatch\_guard() ..... 7-15  
 which\_guard() ..... 7-15  
 Using dispatch\_guard() ..... 7-15  
 Using which\_guard() ..... 7-16  
 Exception Handling Examples ..... 7-17



## CHAPTER 8 System Devices

Keyboard .....	8-3
4x4-key Core Keypad Key Coding .....	8-4
Function Keys .....	8-5
Keyboard Function Calls .....	8-6
open() .....	8-6
read() .....	8-6
write() .....	8-7
ioctl() .....	8-7
close() .....	8-8
CLEAR Key Handling .....	8-9
Keyboard Example .....	8-9
Segment-type Display .....	8-11
Segment Display Function Calls .....	8-12
open() .....	8-12
write() .....	8-12
read() .....	8-13
close() .....	8-13
Related Display Functions .....	8-14
Segment-type Display Example .....	8-15
Pixel-type Display .....	8-17
Font Basics .....	8-17
Display Data .....	8-17
ASCII Control Codes .....	8-18
Character Spacing .....	8-18
Using Display Windows .....	8-19
Creating Custom Graphics and Characters .....	8-19
Fonts and Grids .....	8-19
Font Definition Files .....	8-21
Default Font Definition File .....	8-22
Raw Mode Character Selection .....	8-23
Translation Tables .....	8-24
Character Font Codes .....	8-24
Selecting a New Font .....	8-25
Double-wide Characters .....	8-25
Pixel Display Functions .....	8-26
open() .....	8-26
read() .....	8-27
write() .....	8-27

close() ..... 8-28

window() (*parameters restricted on pixel display*) ..... 8-28

gotoxy() (*parameters restricted on pixel display*) ..... 8-29

setfont() (*pixel display only*) ..... 8-30

getfont() (*pixel display only*) ..... 8-30

resetdisplay() (*pixel display only*) ..... 8-31

getgrid() (*pixel display only*) ..... 8-31

getfontinfo() (*pixel display only*) ..... 8-31

setcontrast() (*pixel display only*) ..... 8-32

getcontrast() (*pixel display only*) ..... 8-33

putpixelcol() (*pixel display only*) ..... 8-33

Related Pixel-Display Functions ..... 8-34

Tips for Common Uses of the Pixel Display ..... 8-35

Displaying Two Lines ..... 8-35

Displaying Three Lines ..... 8-36

Displaying Four Lines ..... 8-37

Displaying Characters from Various Font Pages ..... 8-38

Display Font Upon Power Up ..... 8-38

Display Font with Same Grid Size ..... 8-38

Display Any Character in Font ROM ..... 8-39

Using Windows ..... 8-41

Creating a Custom Logo ..... 8-43

Beeper Device ..... 8-45

Beeper Function Calls ..... 8-46

open() ..... 8-46

ioctl() ..... 8-46

sound() ..... 8-47

close() ..... 8-48

Sound Function Example ..... 8-48

Card Reader ..... 8-50

Card Reader Functions ..... 8-50

open() ..... 8-50

read() ..... 8-50

write() ..... 8-52

ioctl() ..... 8-52

close() ..... 8-53

Card Reader Example ..... 8-53

Bar Code Reader ..... 8-55

Bar Code Reader Functions ..... 8-55

open() ..... 8-55

read() .....8-56  
write() .....8-56  
ioctl() .....8-57  
close() .....8-58  
Bar Code Example .....8-59  
Real Time Clock.....8-60  
Real Time Clock Functions .....8-60  
open() .....8-60  
read() .....8-61  
write() .....8-61  
ioctl() .....8-62  
close() .....8-63  
Clock Example .....8-63  
Clock Timing Example .....8-65

## CHAPTER 9 Communication Devices

Accessing Devices ..... 9-2  
Device Overview ..... 9-3  
Serial Async Port (COM1)..... 9-3  
Serial Sync/Async Port (COM3) ..... 9-3  
PIN Pad/Bar Code Port ..... 9-4  
Internal Modem (COM4)..... 9-4  
LAN Port (COM4)..... 9-4  
Modes of Operation..... 9-4  
Character Mode ..... 9-5  
Packet Mode..... 9-5  
Initializing Device Settings ..... 9-7  
Setting Baud Rate ..... 9-8  
Setting Data Bits and Parity ..... 9-8  
Setting Protocol (Mode of Operation) ..... 9-9  
Visa First Generation ..... 9-9  
SDLC Initializatoion .....9-11  
Serial Port.....9-12  
Serial Communications Function Calls .....9-12  
open() .....9-12  
read() .....9-13  
write() .....9-13  
close() .....9-14  
ioctl() .....9-14

- SetCtrl | 0 Port Initialization..... 9-15
- SetCtrl | 1 Reset Error Conditions..... 9-15
- SetCtrl | 2 Control Signal Set/Reset..... 9-16
- GetCtrl | 0 Obtain Port Status..... 9-16
- GetCtrl | 1 Obtain the Current Opn\_Blk..... 9-17
- Serial Communications Example..... 9-18
- Sync/Async Serial Port (COM3)..... 9-21
- PIN Pad Port..... 9-22
- PIN Pad Port Function Calls..... 9-22
- open()..... 9-22
- read()..... 9-23
- write()..... 9-23
- close()..... 9-24
- ioctl()..... 9-24
- SetCtrl | 0 Port Initialization..... 9-25
- SetCtrl | 1 Reset Error Conditions..... 9-25
- GetCtrl | 0 Retrieve Port Status..... 9-25
- GetCtrl | 1 Get Current Opn\_Blk..... 9-26
- PIN Pad Example..... 9-26
- Modem Interface..... 9-28
- Modem Async/Sync Modes..... 9-29
- SDLC Support..... 9-29
- Supervisor Format..... 9-29
- Information Format..... 9-29
- Unnumbered Format..... 9-29
- Modem Functions..... 9-30
- open()..... 9-30
- read()..... 9-31
- write()..... 9-31
- read\_cmd()..... 9-32
- write\_cmd()..... 9-33
- close()..... 9-33
- ioctl()..... 9-33
- SetCtrl | 0 Modem Initialization..... 9-34
- SetCtrl | 1 Reset Error Conditions..... 9-35
- SetCtrl | 2 Start/Stop Break Signal..... 9-35
- SetCtrl | 3 Send a Command..... 9-35
- GetCtrl | 0 Check Modem Status..... 9-35
- GetCtrl | 1 Get Opn\_Blk Structure..... 9-36
- GetCtrl | 2 Read Reject Queue..... 9-36

GetCtrl | 3 Read a Command .....9-37

Modem Host Communications Example .....9-38

Modem VISA Example .....9-41

Modem Command Example.....9-43

Hayes-Compatible Modem Control .....9-44

Sending Commands .....9-44

Receiving Responses.....9-45

Notes .....9-45

Hayes-compatible Commands .....9-46

Notes.....9-46

Character and Command Rules .....9-46

(-) Check Line Presence.....9-47

Bn Set Bell/CCITT Mode.....9-47

Dnnn-nnnn Go Off-hook, Dial.....9-47

H Disconnect or Hang up.....9-48

O Go Back On-line.....9-48

Sr=nnn/Sr? Set/Read S-register Values .....9-48

Xn Enable Call Progress .....9-49

Dial Tone Detect .....9-49

Busy Tone Detect.....9-49

&G Enable CCITT Guard Tones.....9-50

&P Set Pulse Dial Ratio.....9-50

Off-Hook and Dialing Commands.....9-51

0-9, A-D, \* Dialing Digits .....9-52

; Pause Character .....9-52

; Eliminate Handshake .....9-52

P/T Pulse/Tone.....9-52

V Verify Answer Tone.....9-52

W Wait For Secondary Dial Tone .....9-53

Modem EPROM Initialization .....9-53

Modem CONFIG.SYS Initialization .....9-53

Setting the \*MI Parameter .....9-54

Hayes-compatible Modem Registers.....9-54

S0 Rings Before Answering.....9-56

S6 Wait Time Before Blind Dialing.....9-56

S7 Wait Time For Carrier/Dial Tone.....9-56

S8 Pause Time.....9-56

S9 Carrier Tone Validation.....9-57

S11 DTMF Tone Duration.....9-57

S50 Select Relay Use .....9-57

**Contents**

S51 Auxiliary Relay Switch in Time..... 9-58  
S52 Auxiliary Relay Switch Out Time ..... 9-58  
S53 Modem Type ..... 9-58  
S54 Pulse-Dialing "Make" Time..... 9-58  
S55 Pulse-Dialing "Break" Time..... 9-58  
S56 Pulse-Dialing "Gap" Time..... 9-59  
S57 Ring Cycle, Minimum Frequency ..... 9-59  
S58 Ring Cycle, Maximum Frequency ..... 9-59  
S59 Dial Type ..... 9-59  
S60 Dial Tone Check ..... 9-60  
S61 Busy Signal Check..... 9-60  
S62 Line Check..... 9-60  
S63 Guard Tone ..... 9-60  
S64 Threshold Value for DCD Loss..... 9-61  
S65 Answer Tone Checking for V.21 ..... 9-61  
S66 Unscrambled Marks Checking for V.22..... 9-62  
S67 Dialing Complete Checking..... 9-62  
Auxiliary Relay Uses (International versions) ..... 9-62  
    A/A1 Support ..... 9-62  
    Spark Suppression..... 9-62  
    Line Termination ..... 9-63

**Index, Volume I and Volume II**



# Overview

The OMNI™ 300 Series is a family of dial-type and LAN-type transaction automation systems that are compact and efficient microcomputers capable of gathering and transferring information at high speed. Dial-type transaction automation systems are typically used as stand-alone devices which connect to host networks via modem communications. In contrast, by utilizing a single LAN gateway terminal (of the OMNI 400 Series), LAN-type transaction automation systems only require a single modem connection to the host.

❖ *The OMNI 460 terminal, an 8-bit terminal, is a member of the 300 Series terminal family.*

OMNI 300 Series terminals are 8-bit machines running the VeriFone® TXO® operating system. These terminals are ideal for a multitude of applications, including:

- ♦ Point of Sale/Service (POS)
- ♦ Electronic payment transfer and authorization
- ♦ Time and attendance tracking
- ♦ Balance reporting
- ♦ Inventory control
- ♦ Electronic reordering



## The OMNI 300 Series Terminals

OMNI 300 Series terminals are complete microcomputer-based systems, known as Transaction Automation Systems. They have the processing power and communications speed necessary for today's advanced Point of Sale/Service transaction requirements. Their hardware and software design, tailored to transaction processing, enables these systems to perform both transaction input/output and communications better than many machines with far more "computing horsepower." All system software is stored in either EPROM (firmware) or battery-backed RAM.

### Terminology

Since Transaction Automation Systems generally connect to a host authorization network, they are commonly referred to as *terminals*. However, one should bear in mind that any OMNI 300 Series terminal is a stand-alone microcomputer system. For convenience, this manual will frequently refer to the OMNI 300 Series system as a *terminal*.

Also for convenience, this manual may use the phrase *OMNI 300 Series terminal* to refer to the entire family of OMNI 300 Series terminals—including the OMNI 460. See *Appendix C, Models Specifications* for a complete list of current terminals within this series.

*OMNI 300 Series dial* (or *Telco terminals*, or simply *dial* or *dial-type models*) refer to those models with an internal modem, thus capable of dialing out via telephone lines.

*OMNI 300 Series LAN terminals* refer to those terminals with internal VeriFone Peer-to-Peer LAN support.

Telco and LAN models are presently mutually exclusive—no OMNI 300 Series model contains both internal modem and LAN support.

*TXO terminal* or *OMNI terminal* refers to any system running the TXO operating system.

## Features

All OMNI 300 Series terminals incorporate the following standard features:

- ◆ Z180 CPU running at 6.144 MHz and the Z80 family of I/O devices
- ◆ 64K of EPROM firmware
- ◆ CMOS battery-backed RAM
- ◆ Card reader capable of reading IATA Track 1 and ABA Track 2 data, or ABA Track 2 and THRIFT (ISO 3554) Track 3 data
- ◆ Data entry keyboard (most models offer telco-style or calculator-style options)
- ◆ Display (segment type or LCD backlit, depending on model)
- ◆ Beeper
- ◆ PIN pad/bar code communications port
- ◆ Asynchronous serial communications port

In addition, various models offer one or more of the following communication features:

- ◆ Bell 212A/103 CCITT V.21/V.22 internal modem
- ◆ LAN port supporting VeriFone peer-to-peer protocol CSMA/CA
- ◆ Synchronous/asynchronous serial communications port

See Appendix C for a list of the current OMNI 300 Series terminal models and their basic features.

## The TXO Operating System

OMNI 300 Series terminals run VeriFone's Transaction eXpress Option (TXO) operating system. TXO terminals cannot and were not designed to run applications written in VeriFone proprietary languages such as ZAPD™ and Terminal Control Language™ (TCL). TXO source code is

usually written in the industry-standard C Programming Language (K & R version and ANSI C).

TXO applications are generally faster and more portable than proprietary applications, plus they allow the programmer to write code in a familiar and flexible language.

## **Programming Requirements**

The programming requirements of OMNI 300 Series terminals are:

- ◆ TXO Workbench development environment package
- ◆ IBM AT or compatible computer with at least 2 megabytes of RAM
- ◆ Familiarity with the C Programming Language (K & R version and ANSI C)

TXO Workbench provides all the tools necessary to edit, compile, download and debug TXO applications. Contact your VeriFone representative for details on the TXO Workbench Package, Version 3.00, VeriFone part number P006-211-02. Your *Reference Manual* includes instructions for cabling your development PC to a target terminal.

## **300 Series Reference Manuals**

For terminal-specific information, such as display type, programmable keys, RAM, and other features, consult the companion *Reference Manual* created for your target terminal. Contact your VeriFone representative for order information.

Each *Reference Manual* includes:

- ◆ Installation instructions
- ◆ Downloading instructions
- ◆ Terminal operations
- ◆ Terminal maintenance/remote diagnostics instructions
- ◆ Terminal specifications

<b>TXO Programming Products and Manuals</b>	
<b>Product/Manual</b>	<b>Part Number</b>
<b>TXO Workbench Kit, Version 3.00</b>	P006-212-02
<i>Includes Standard C Programming Language for TXO Reference Manual</i>	11469
<i>TXO Workbench User's Guide</i>	11468
<b>ZONTALK 2000</b>	P014-104-00
<i>Includes ZONTALK 2000 Reference Manual</i>	10361
<b>Application Construction Toolkit</b>	P006-212-01
<i>Includes AC Toolkit User's Guide</i>	12124
<i>OMNI 380 Reference Manual</i>	11630
<i>OMNI 385 LAN Reference Manual</i>	12798
<i>OMNI 390 Reference Manual</i>	12679
<i>OMNI 395 LAN Reference Manual</i>	12849
<i>OMNI 395 Reference Manual</i>	12874
<i>OMNI 480 Reference Manual</i>	12012
<i>OMNI 490 Reference Manual</i>	12659

<b>OMNI Terminal Direct Download Cables</b>			
<i>Direct Download Cables connect the development PC running the TXO Workbench Kit to a target terminal.</i>			
<b>Part Number</b>	<b>Terminal</b>	<b>Type</b>	<b>Length</b>
00446-04	OMNI 330/380/390	DB-9	1M
00446-05	OMNI 330/380/390	DB-25	1M
03018-00	OMNI 480/490	DB-9	1M
03017-00	OMNI 480/490	DB-25	1M

## TXO Application Development Support

To assist the TXO programmer, VeriFone offers the *Application Construction Toolkit*, referred to as the "AC Toolkit." The AC Toolkit includes a collection of library functions designed to reduce the effort required to develop applications for VeriFone TXO terminals.

Written and tested by VeriFone, these functions are highly efficient in both size and speed. Functions in the library leverage on each other to help minimize code size. In addition to the library functions, the AC Toolkit includes a series of code engines to assist the programmer in data capture, ISO 8583 packet handling, modem routines, printing and report generation.

The *Application Construction Toolkit* may be ordered from your VeriFone representative. Order part number P006-212-01.

## Programmer's Manual Typographic Conventions

This manual uses the following typographic conventions:

Example	Description
<code>char *strg;</code>	The Prestige Elite typeface
<code>int n;</code>	is used for source code, program examples, variable names, identifiers, or any C language token in general.
<code>FILE *strm;</code>	
<code>%[*][width]</code>	Items in braces note optional usage, such as an optional function parameter or a command line option.

## Overview

(stream, format [ , argument... ] ); either in a column, or in a line) signifies that an item may be repeated any number of times.

**0x7F** Hexadecimal values are normally denoted with a leading 0x (zero, lower-case "x").

**CONFIG.SYS** Terminal file system or terminal-related object is shown in the Helvetica typeface.

**[CLEAR]** Keys on OMNI 300 Series terminal keyboards appear between square brackets.

**P R E S S E N T E R** OMNI terminal display characters are shown in an LCD-style typeface.

All C language source code characters are case sensitive. For example, `print()` and `FPRINT()` are probably different functions. All source code punctuation must be included as shown.



*"Note" paragraph marker. When you see this graphic next to a paragraph, it indicates that the paragraph contains important information relevant to the topic under discussion. Frequently, failure to follow this text will result in a programming error or other problem.*



*This is an example of a "tip" paragraph marker. When you see this graphic next to a paragraph, it indicates that the following information is a useful programming tip.*



# System Operation

OMNI 300 Series terminals support system functions contained in EPROM. These functions include terminal diagnostics, application downloading, setting the system date and time, and other terminal setup operations. These functions are always available and may be invoked even while an application is running.

## Terminal Setup

While there are different methods to set up your terminals, the TXO system is designed to make setup extremely easy. Follow these steps to set up an uninitialized terminal:

1. Apply power to the target terminal. The operating system will detect that none of the required system files exist and display the message "DOWNLOAD NEEDED." Any key press will then cause the terminal to enter into its System Mode.
2. Connect the terminal to the serial port of an IBM or IBM-compatible AT (also referred to as the "development PC"). Download the application to the terminal



using ZONTALK 2000 software, TXO Workbench, or Direct Load. Refer to the next section regarding downloading types. Refer to the downloading software manual for information on the following:

- ◆ Creating or changing CONFIG.SYS entries. Allows you to create or change keyed file entries in the terminal's CONFIG.SYS area.
- ◆ Time zone correction. Allows you to offset the target terminal's time relative to the PC's time stamp; for example if the programming PC resides in the Pacific time zone while the terminal is to be deployed in the Central time zone.
- ◆ Change the terminal's system password. Lets you change the target terminal's current password during the downloading session.

3. Press [#] on the terminal keypad to prepare the terminal for downloading.

4a. If you are sending a full download, start the download on the PC side.

4b. If you are sending a partial download, press the [\*] key to indicate a partial download. Start the download on the PC side.

5. When completed, the terminal will show the results of the download:

```

DOWNLOAD DONE      Neither password nor
                    clock was set
DOWNLOAD DONE C    Clock was set
DOWNLOAD DONE P    Password was set
DOWNLOAD DONE CP   Both clock and password
                    were set

```

or

```
DOWNLOAD FAILED
```

6. If the download is successful, press the [CLEAR] key to exit the System Mode. If the download failed, any key press will reset the terminal to receive another download.

## Application and File Downloading

OMNI 300 Series firmware supports several methods of downloading application, data and configuration files to the terminal. These methods are described below.

### Direct Download

A direct download uses a cabled RS-232 communications link between the development PC and a target terminal. The PC program Direct Load (DL.EXE, included in TXO Workbench), controls the download. Direct Load can be initiated from within the Workbench environment or from the DOS prompt. Consult the TXO Workbench manual for instructions.

Direct Load supports full or partial downloading and CONFIG.SYS manipulation. The date, time, and system password may be set via download.

### ZONTALK 2000 Download

ZONTALK 2000 enables telephone-initiated downloading via asynchronous dial communications (for dial-type models) or direct connection. You must first install the ZONTALK 2000 download software (using Version 2.0 or newer) on your PC. Refer to the *ZONTALK 2000 Reference Manual*, VeriFone Part Number 10361, for installation and download instructions.

ZONTALK 2000 supports both full and partial downloading and setting CONFIG.SYS file entries. The date, time, and system password may be set via ZONTALK 2000 downloading. ZONTALK 2000 downloads are capable of successively downloading identical applications to several terminals in a short period of time without end user action.

### Terminal-to-Terminal Download

OMNI 300 Series firmware supports terminal-to-terminal downloads, in which the memory image of the sending

terminal is copied to a receiving terminal. In addition, the date, time, and system password are set in the receiving terminal. Consult your terminal's *Reference Manual* for complete information on terminal-to-terminal downloading.

❖ *Terminal-to-terminal downloads may only be made between identical terminals having the same firmware and RAM size.*

### **LAN Download**

OMNI 300 Series LAN terminals support application downloads via the LAN port. Prior to beginning the download, each terminal must have a particular set of parameters present in its CONFIG.SYS file. LAN downloading is covered in detail in *Chapter 10, OMNI Peer-to-Peer LAN*. Also, consult your terminal's *Reference Manual* for more information on LAN downloads.

### **Application-Initiated Download**

Terminal applications may be programmed to initiate ZONTALK 2000 downloads (full or partial) by using the following service call:

```
result = SVC_ZONTALK(x);
```

where x is "F" for FULL download and "p" or "p" for PARTIAL. The FULL and PARTIAL (uppercase "P") downloads, when successful, force a restart of the application; the PARTIAL download specified by a lowercase "p" allows the application to resume execution. This "download and resume" feature allows partial downloads which are transparent to the end user.

If the download fails, the terminal displays a message indicating that the user must manually enter System Mode and initiate the download.

## Terminal Startup Sequence

This section describes the events that occur during terminal startup. First the normal startup sequence is presented, second a flowchart of startup events including error handling is presented, third an overview of error messages is given, and lastly a detailed description of the startup sequence with errors is provided.

When you have a problem:

1. Check the "Error Messages Overview" on page 2-18 for a list of startup error messages with brief explanations.
2. Look at the flowchart. Error messages are usually located to the right of the main flow sequence.
3. See "Startup Sequence If Errors" on page 2-18 for detailed information.

### Startup Sequence If No Errors

When the terminal is started (on power up or system restart), the operating system executes the following startup sequence:

1. Check RAM
2. If graphic display terminal, display font ROM ID
3. Display EPROM ID
4. Perform EPROM checksum
5. Check file system initialization
6. Check file system "links" (Version 11 or newer)
7. Check CONFIG.SYS CHECKSUM entry
8. Verify any downloaded device driver(s)
9. Check CONFIG.SYS \*CHN application restart entry (only Version 11 or earlier can set this)
10. Check CONFIG.SYS \*GO application startup entry
11. Validate application header and checksum
12. Validate file checksums (conditional)
13. Check if application code file size is greater than zero
14. Display EPROM ID and application ID
15. Check application EM version

- 16. Validate application stack size and CONFIG.SYS \*S entry
- 17. Initialize data region, clear it to zeros, start the application

This sequence is interrupted if the firmware detects an error during startup.

Use the following flowcharts as a quick visual guide.

Flowcharts of Startup Sequence

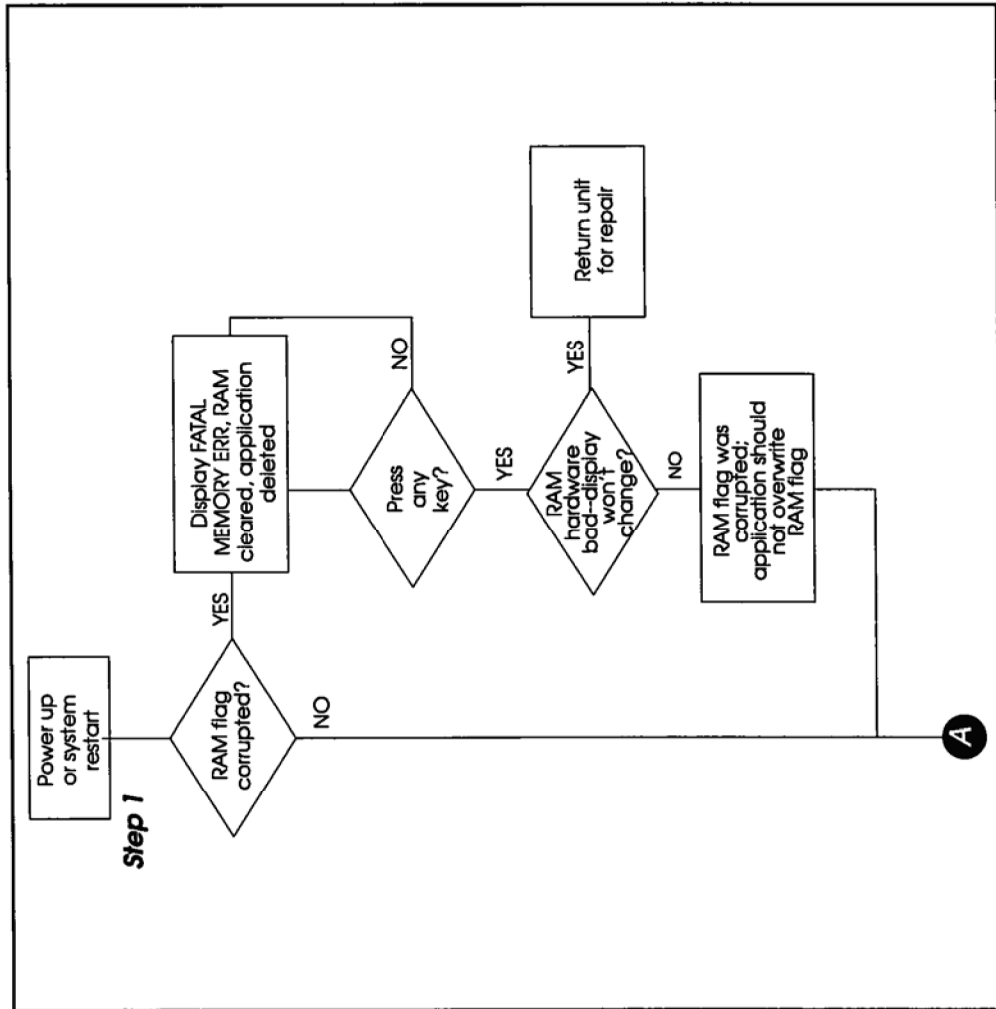


Figure 2-1. Flowchart of Startup Sequence (1 of 10)

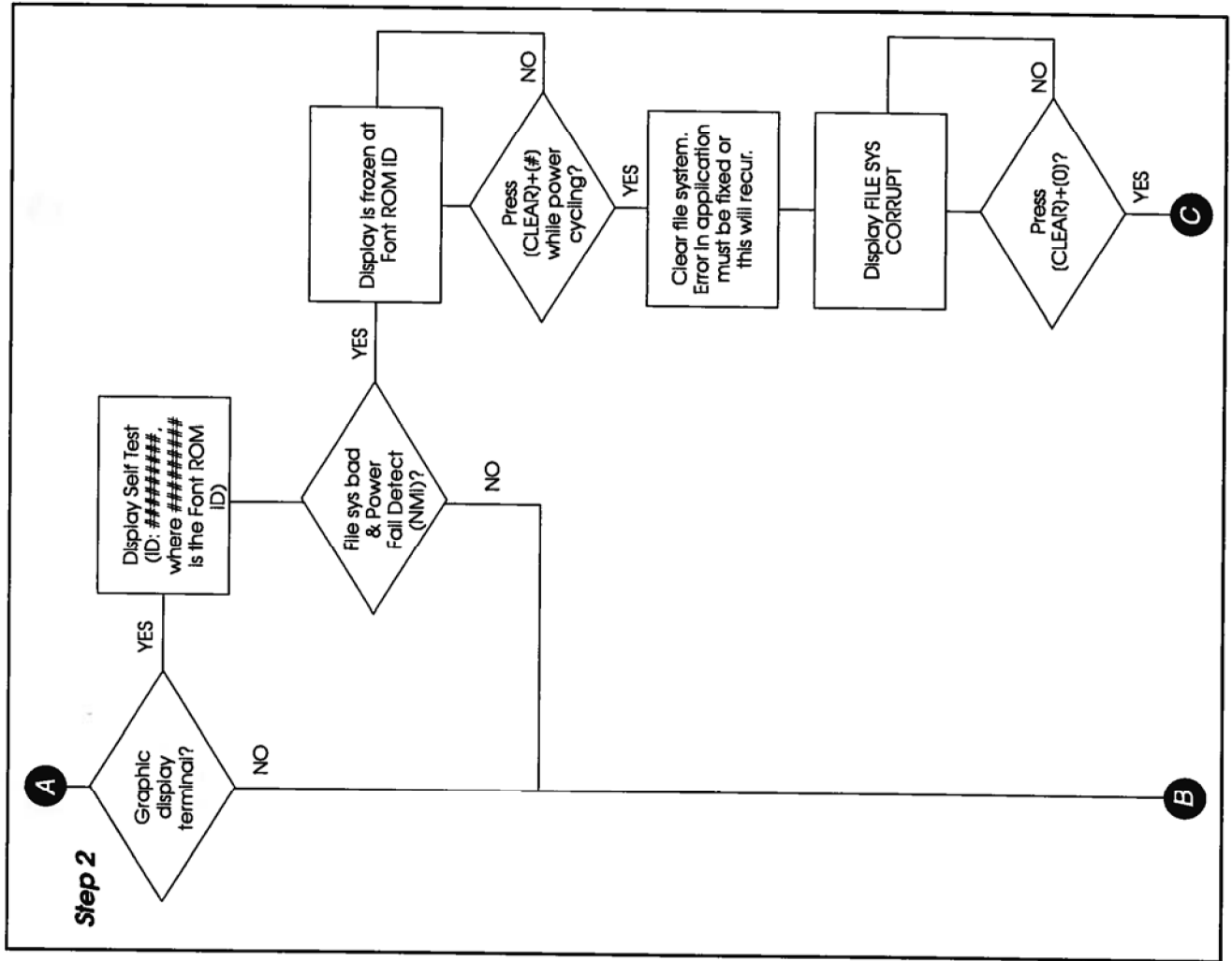


Figure 2-1. Flowchart of Startup Sequence (2 of 10)

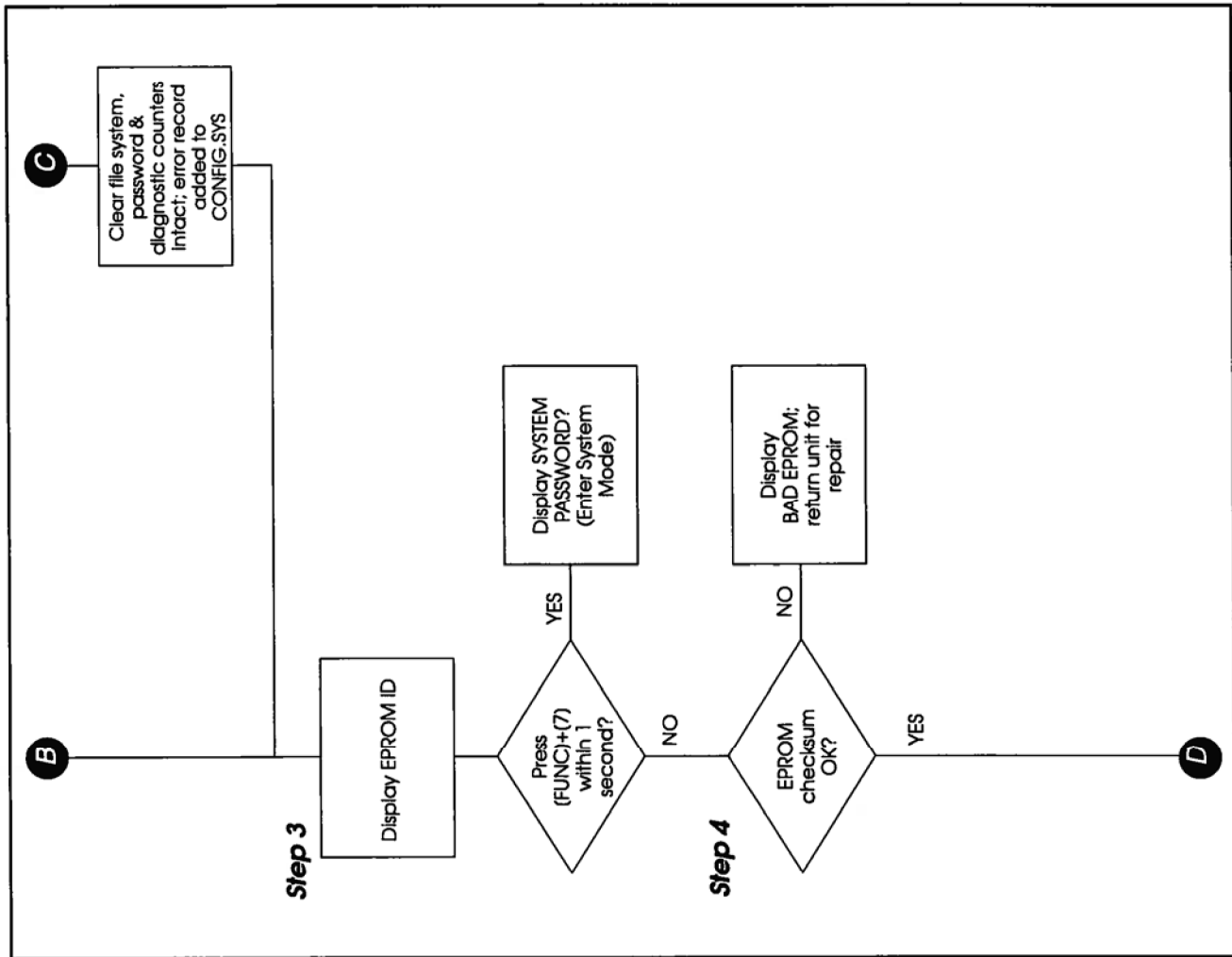


Figure 2-1. Flowchart of Startup Sequence (3 of 10)

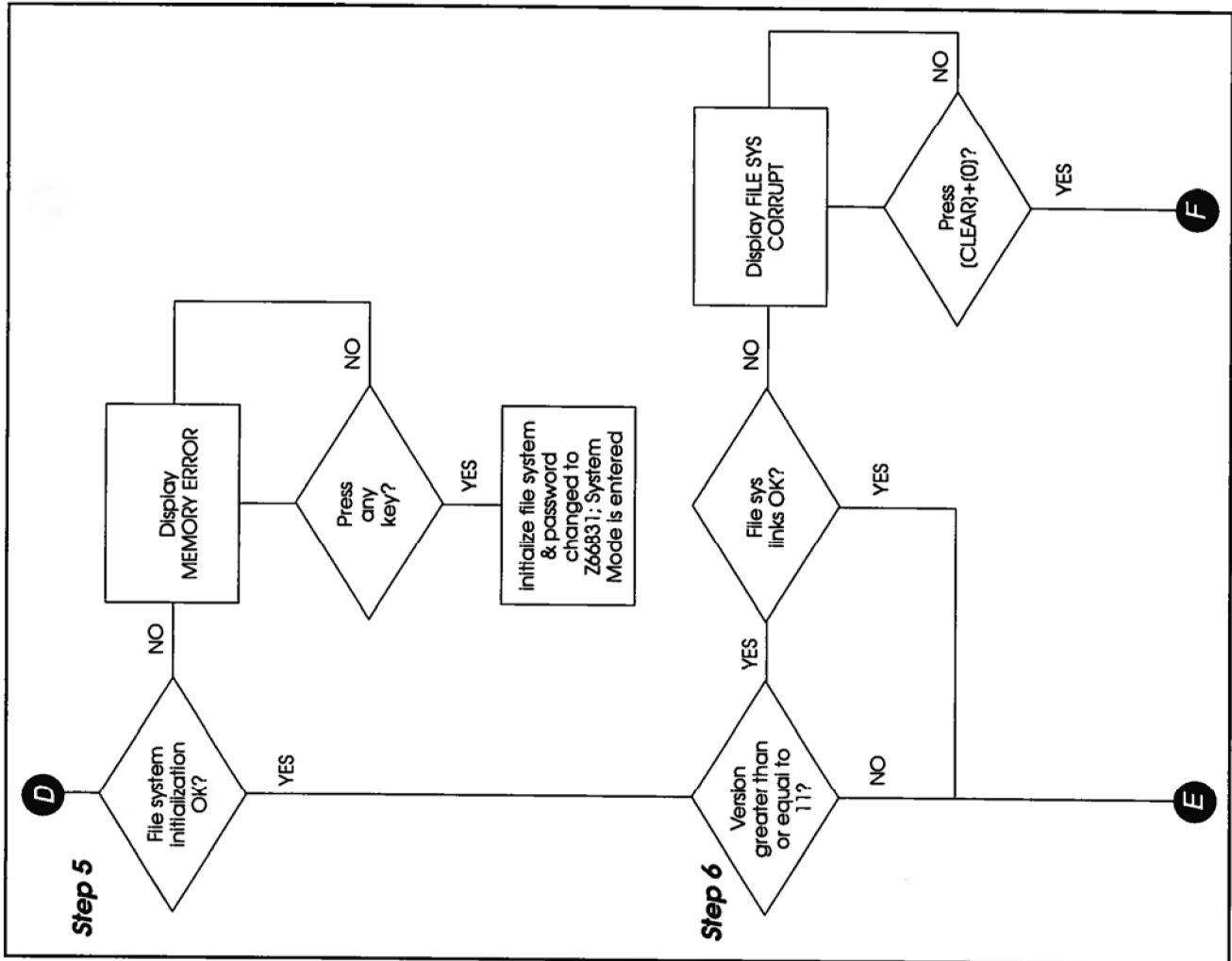


Figure 2-1. Flowchart of Startup Sequence (4 of 10)



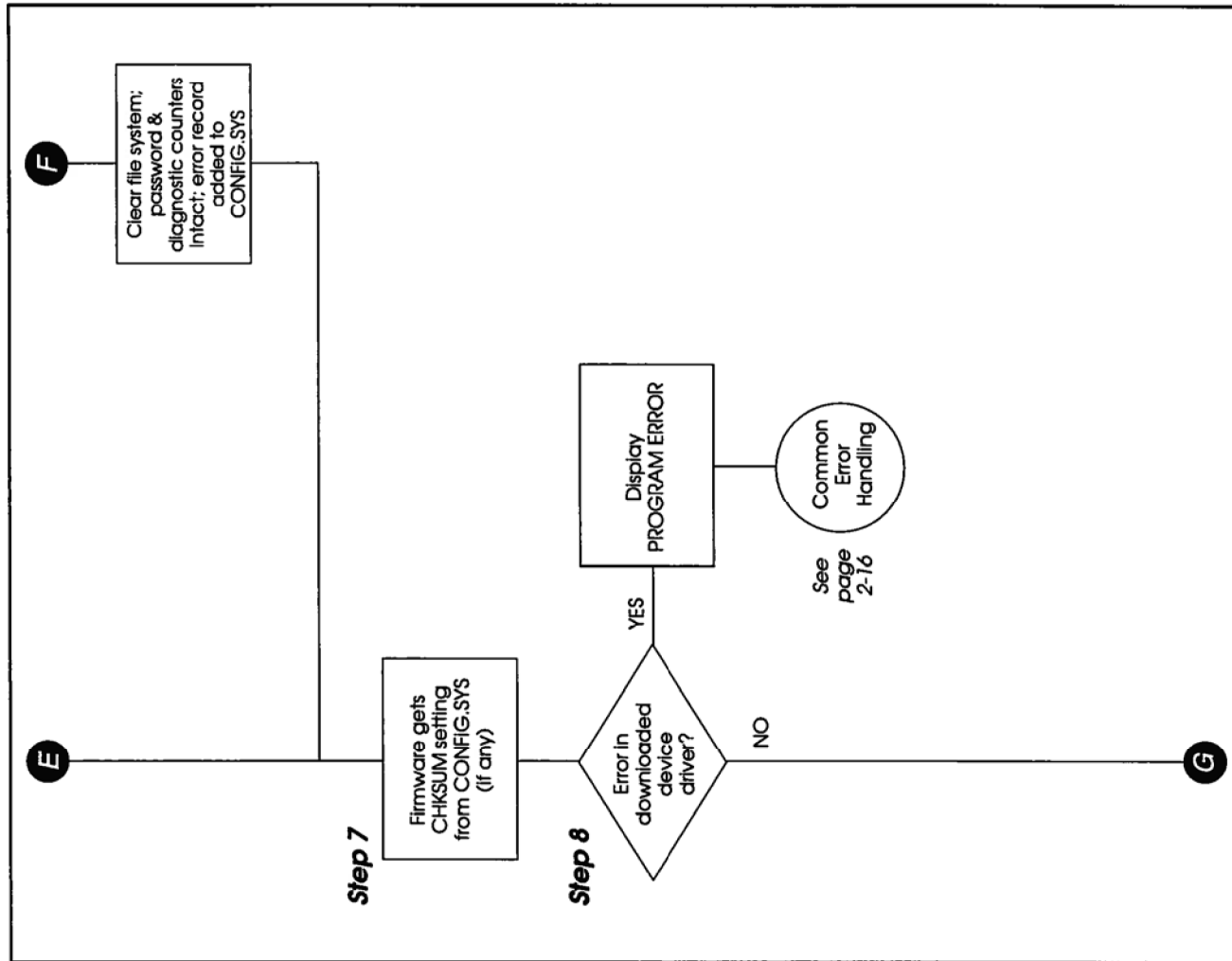


Figure 2-1. Flowchart of Startup Sequence (5 of 10)

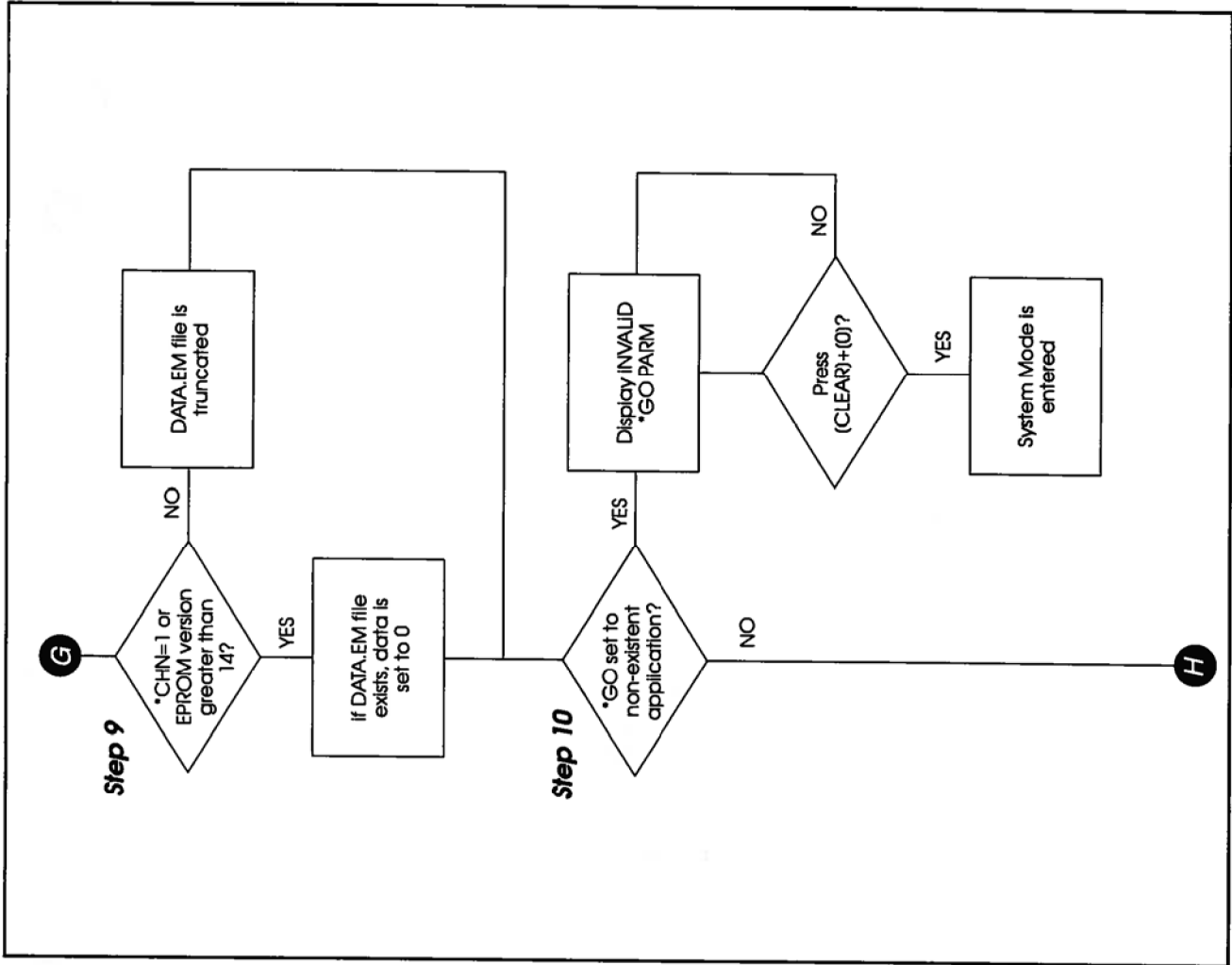


Figure 2-1.1. Flowchart of Startup Sequence (6 of 10)

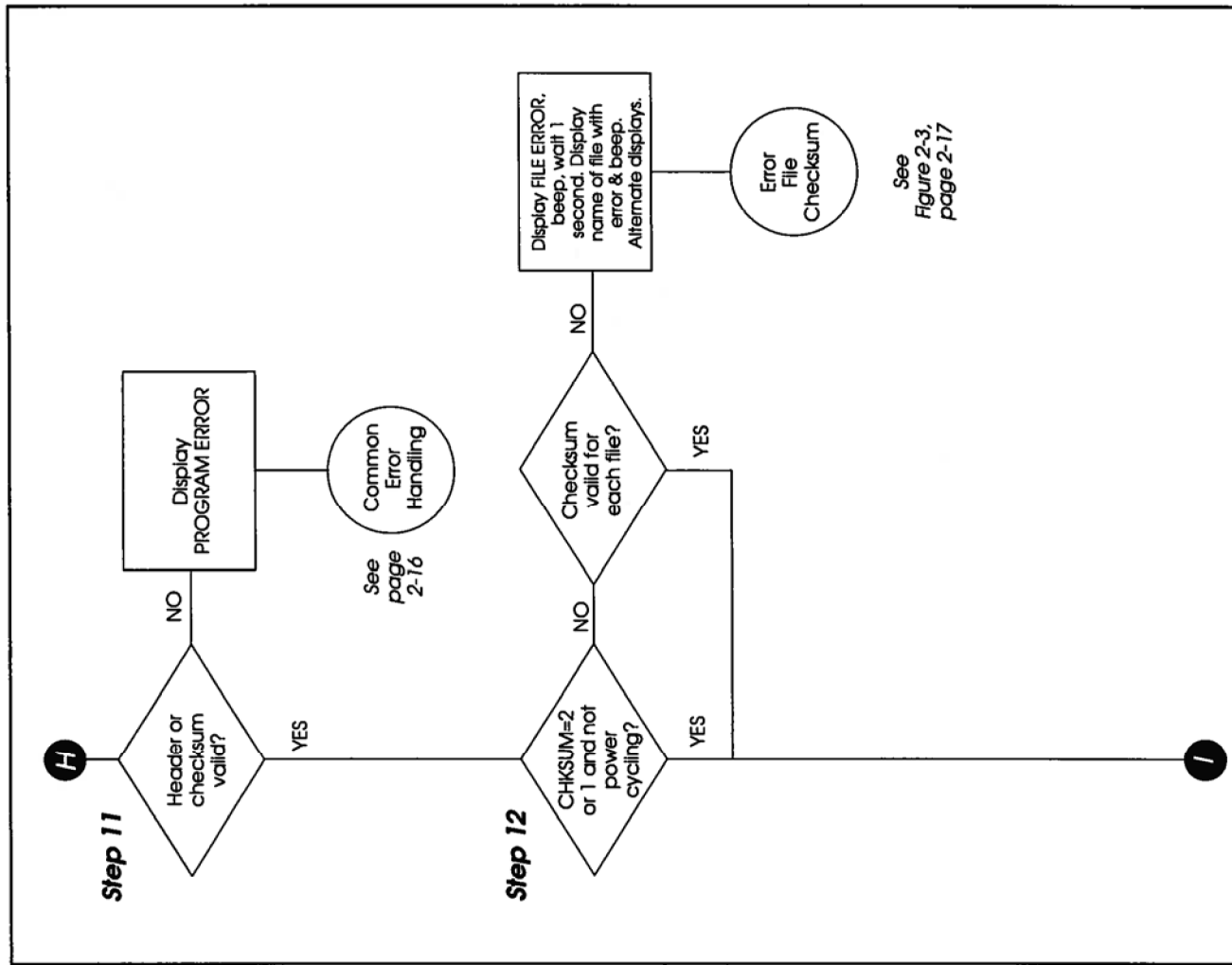


Figure 2-1. Flowchart of Startup Sequence (7 of 10)

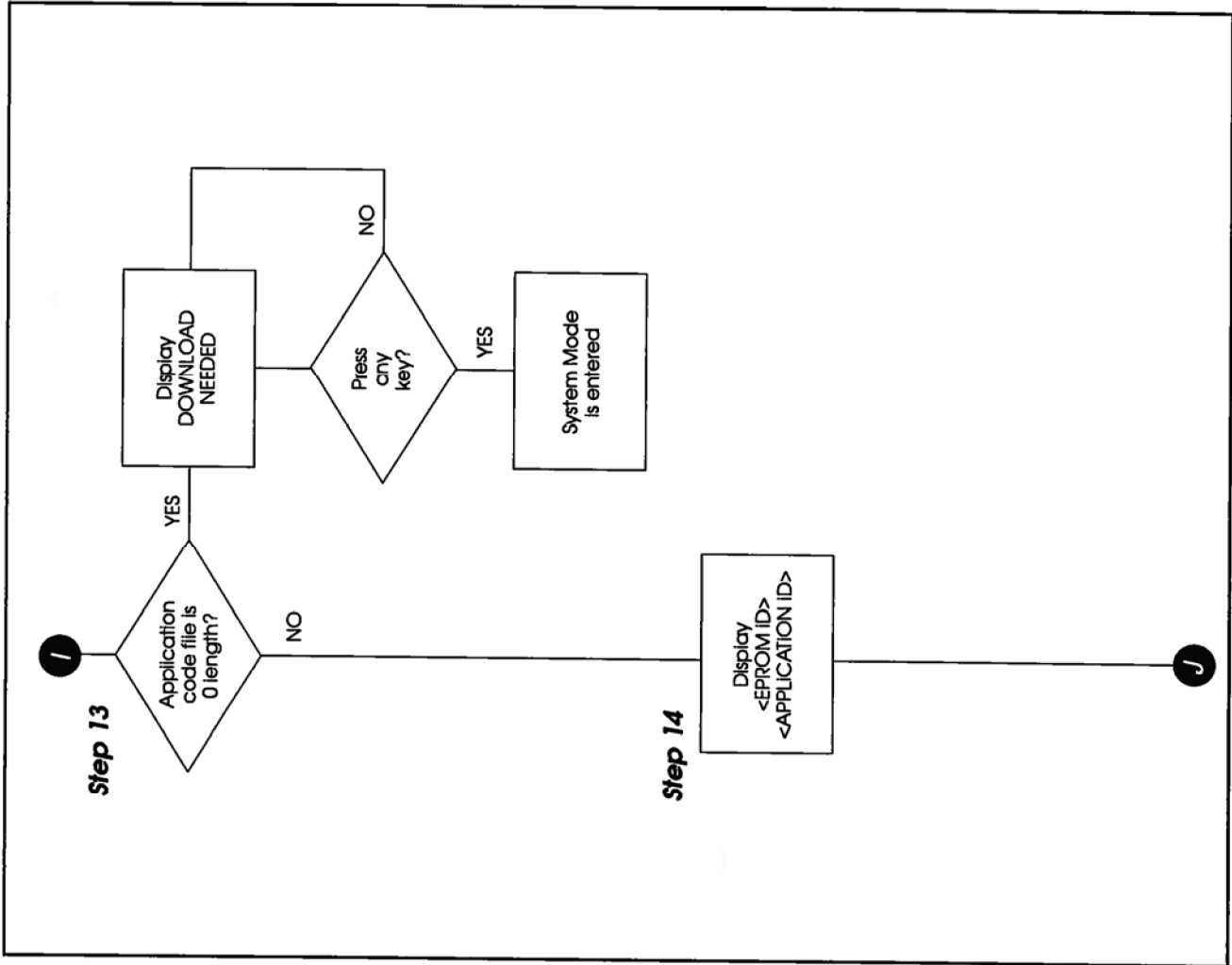


Figure 2-1. Flowchart of Startup Sequence (8 of 10)

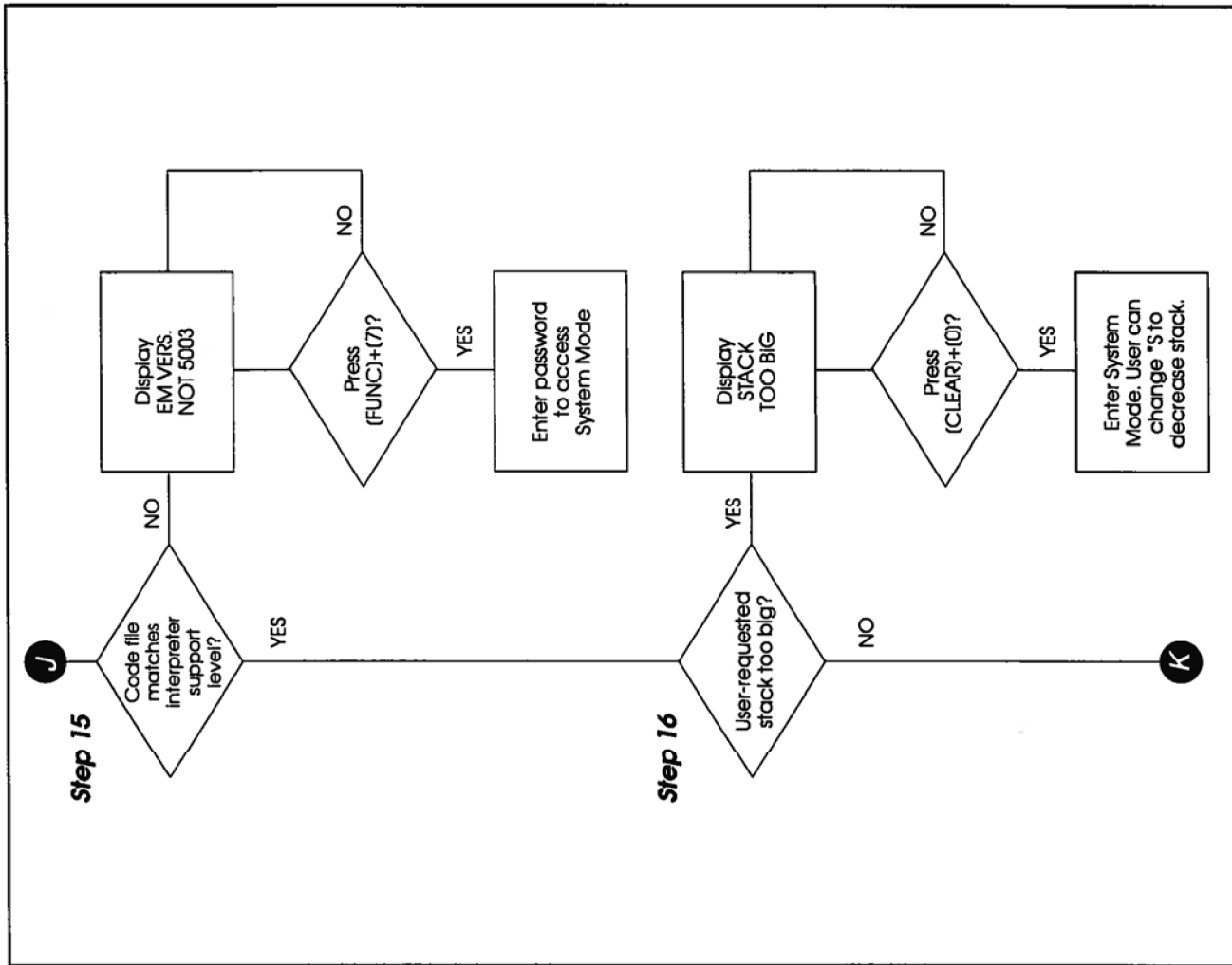


Figure 2-1. Flowchart of Startup Sequence (9 of 10)