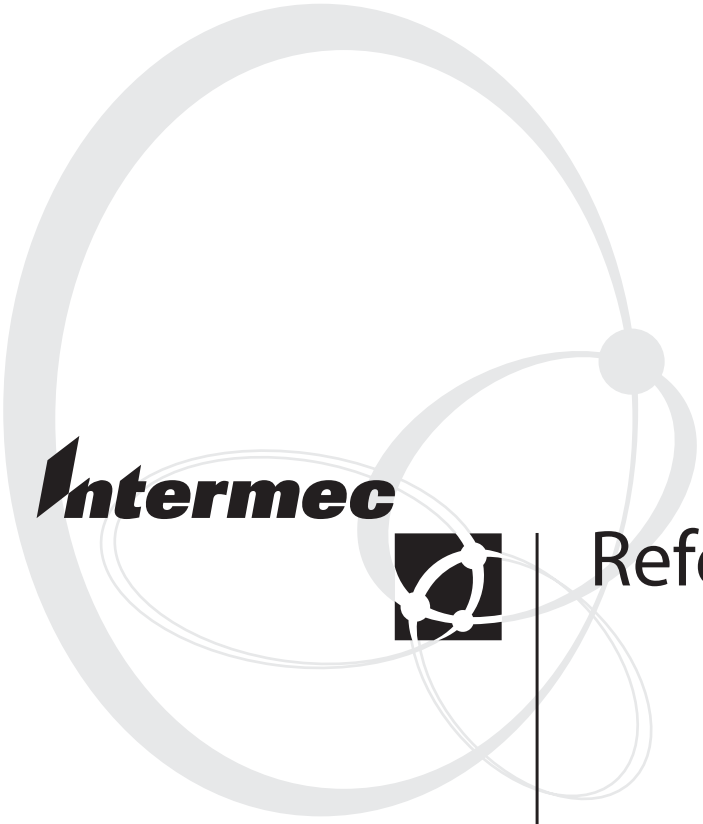

Intermec

Reference Manual

M90 Series Portable Data Entry Unit

Intermec Technologies Corporation

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Contents

Before You Begin

This section provides you with safety information, technical support information, and sources for additional product information.

Safety Summary

Your safety is extremely important. Read and follow all warnings and cautions in this document before handling and operating Intermec equipment. You can be seriously injured, and equipment and data can be damaged if you do not follow the safety warnings and cautions.

Do not repair or adjust alone

Do not repair or adjust energized equipment alone under any circumstances. Someone capable of providing first aid must always be present for your safety.

First aid

Always obtain first aid or medical attention immediately after an injury. Never neglect an injury, no matter how slight it seems.

Resuscitation

Begin resuscitation immediately if someone is injured and stops breathing. Any delay could result in death. To work on or near high voltage, you should be familiar with approved industrial first aid methods.

Energized equipment

Never work on energized equipment unless authorized by a responsible authority. Energized electrical equipment is dangerous. Electrical shock from energized equipment can cause death. If you must perform authorized emergency work on energized equipment, be sure that you comply strictly with approved safety regulations.

Safety Icons

This section explains how to identify and understand dangers, warnings, cautions, and notes that are in this manual. You may also see icons that tell you when to follow ESD procedures and when to take special precautions for handling optical parts.

A warning alerts you of an operating procedure, practice, condition, or statement that must be strictly observed to avoid death or serious injury to the persons working on the equipment.

Avertissement: Un avertissement vous avertit d'une procédure de fonctionnement, d'une méthode, d'un état ou d'un rapport qui doit être strictement respecté pour éviter l'occurrence de mort ou de blessures graves aux personnes manupulant l'équipement.

A caution alerts you to an operating procedure, practice, condition, or statement that must be strictly observed to prevent equipment damage or destruction, or corruption or loss of data.

Attention: Une précaution vous avertit d'une procédure de fonctionnement, d'une méthode, d'un état ou d'un rapport qui doit être strictement respecté pour empêcher l'endommagement ou la destruction de l'équipement, ou l'altération ou la perte de données.

Note: Notes either provide extra information about a topic or contain special instructions for handling a particular condition or set of circumstances.

Global Services and Support

Warranty Information

To understand the warranty for your Intermec product, visit the Intermec web site at http://www.intermec.com and click **Service & Support**. The Intermec Global Sales & Service page appears. From the **Service & Support** menu, move your pointer over **Support**, and then click **Warranty**.

Disclaimer of warranties: The sample code included in this document is presented for reference only. The code does not necessarily represent complete, tested programs. The code is provided "as is with all faults." All warranties are expressly disclaimed, including the implied warranties of merchantability and fitness for a particular purpose.

Web Support

Visit the Intermec web site at http://www.intermec.com to download our current manuals in PDF format. To order printed versions of the Intermec manuals, contact your local Intermec representative or distributor.

Visit the Intermec technical knowledge base (Knowledge Central) at http://intermec.custhelp.com to review technical information or to request technical support for your Intermec product.

Telephone Support

These services are available from Intermec Technologies Corporation.

Service	Description	In the U.S.A. and Canada call 1-800-755-5505 and choose this option
Factory Repair and On-site Repair	Request a return authorization number for authorized service center repair, or request an on-site repair technician.	1
Technical Support	Get technical support on your Intermec product.	2
Service Contract Status	Inquire about an existing contract, renew a contract, or ask invoicing questions.	3
Schedule Site Surveys or Installations	Schedule a site survey, or request a product or system installation.	4
Ordering Products	Talk to sales administration, place an order, or check the status of your order.	5

Outside the U.S.A. and Canada, contact your local Intermec representative. To search for your local representative, from the Intermec web site, click **Contact**.

Who Should Read this Manual?

This manual is a guide for the M90 System Software Project and provides a rich set of DOS functions and device drivers for application development, including bar code decoding, display, keypad, communications, real-time clock, calendar, and alarm.

Related Documents

This table contains a list of related Intermec documents and their part numbers.

Document Title	Part Number
M90 Series Portable Data Entry Unit User's Guide	M90901

The Intermec web site at http://www.intermec.com contains our documents that you can download in PDF format.

To order printed versions of the Intermec manuals, contact your local Intermec representative or distributor.

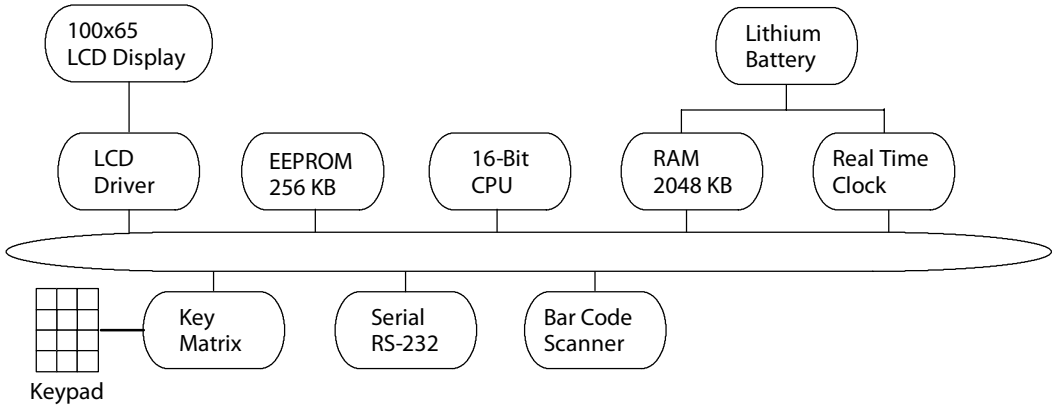
1 Introduction

This document is a guide for the M90 System Software Project. The M90 is a programmable and flexible data collection device that serves in data acquisition markets. The target market segments range from VAR, OEM, and end-user applications. The M90 can act as a portable data entry device and as a programmable dedicated computer receiving application programs from a host system.

The M90 Series Portable Data Entry (PDE) Unit or Computer contains 256 KB of ROM-based software or firmware. This provides a rich set of DOS functions and device drivers for application development, including bar code decoding, display, keypad, communications, real-time clock, calendar, and alarm.

System Block Diagram

An NEC V25 Microprocessor controls the M90. The following illustration shows the system block diagram. The system has a 256 KB EEPROM program. An M90 Kernel program fits in 128 KB of the EEPROM space. The remaining 128 KB is for special application software, allowing the M90 to run stand-alone applications.



System Block Diagram

The maximum memory available in the M90 is 2048 KB RAM for standard builds or 4608 KB for special order units. The minimum RAM requirement is 128 KB. The main battery powers all of the RAM memory present. Otherwise, there is a backup lithium battery in case the main battery is absent or depleted. The RAM stores data and programs.

The M90 has a 12-character and 4-line, or 16-character and 8-line LCD backlight display *(per setting)*. An RS-232 Serial Port communicates with a host system.

Programming

Use Microsoft C 4.0 or later, Borland C 3.0 or later, TURBO PASCAL 6.0 or later, or IBM PC macro assembler version 1.0 or later to program the M90.

The downloaded application program determines the intelligence level of the M90. Once started, the M90 operates as a stand-alone unit or can be combined with a host or personal computer.

Sufficient energy stays in the main or backup battery to retain the program and data even when the power is down. Transaction data transfers to the computer or stays in the M90 RAM area.

Application Program Interface

The M90 Kernel includes three basic modules: device driver, file manager, and DOS manager. The programmer can design application programs by calling those functions as in a PC DOS environment. The programs are in .EXE format.

For end-users who use the C/PASCAL compiler and assembler, the ROM-based, M90 hardware provides emulated MS-DOS function calls. The calling and parameter passing conventions are identical with MS-DOS. The following table describes several subsystems and related I/O interface functions, and the DOS and file manager functions. See Chapter 4, "*DOS System Calls*" for the detailed calling process.

Keypad Subsystem

The keypad subsystem scans the key matrix, converts the scan code to its associated key value, and stores the value in the input buffer of the keyboard. The following table lists scan code, default key ASCII value, and each key on the keypad. Keys are listed from left to right, starting at the upper left corner of the M90 keypad. Default ASCII values are from the English keypad.

Note: The table on page 6 contains ASCII values from Swedish, Finnish, Danish, Spanish, French, German, and Italian keypad subsystems.

English Keypad Subsystem

Shift	Key	Hex Value	ASCII Character
	[ENT SCAN]	0D	<CR>
[S1]	[ENT SCAN]	0D	<CR>
[S2]	[ENT SCAN]	0D	<CR>
[S3]	[ENT SCAN]	0D	<CR>
[FN]	[ENT SCAN]	0D	<CR>
	[S1]	00	
[S1]	[S1]	00	
[S2]	[S1]	00	
[S3]	[S1]	00	
[FN]	[S1]	00	
	[S2]	00	
[S1]	[S2]	00	
[S2]	[S2]	00	
[S3]	[S2]	00	
[FN]	[S2]	00	
	[S3]	00	
[S1]	[S3]	00	
[S2]	[S3]	00	
[S3]	[S3]	00	
[FN]	[S3]	00	

English Keypad Subsystem (continued)

Shift	Key	Hex Value	ASCII Character
	[FN]	00	
[S1]	[FN]	00	
[S2]	[FN]	00	
[S3]	[FN]	00	
[FN]	[FN]	00	
	[7]	37	“7”
[S1]	[7]	41	“A”
[S2]	[7]	42	“B”
[S3]	[7]	43	“C”
[FN]	[7]	00	
	[8]	38	“8”
[S1]	[8]	44	“D”
[S2]	[8]	45	“E”
[S3]	[8]	46	“F”
[FN]	[8]	00	
	[9]	39	“9”
[S1]	[9]	47	“J”
[S2]	[9]	48	“K”
[S3]	[9]	49	“L”
[FN]	[9]	00	
	[4]	34	“4”
[S1]	[4]	4A	“J”
[S2]	[4]	4B	“K”
[S3]	[4]	4C	“L”
[FN]	[4]	00	
	[5]	35	“5”
[S1]	[5]	4D	“M”
[S2]	[5]	4E	“N”
[S3]	[5]	4F	“O”
[FN]	[5]	00	
	[6]	36	“6”
[S1]	[6]	50	“P”
[S2]	[6]	51	“Q”
[S3]	[6]	52	“R”
[FN]	[6]	00	
	[1]	31	“1”
[S1]	[1]	53	“S”
[S2]	[1]	54	“T”
[S3]	[1]	55	“U”
[FN]	[1]	00	
	[2]	32	“2”
[S1]	[2]	56	“V”
[S2]	[2]	57	“W”
[S3]	[2]	58	“X”
[FN]	[2]	00	

English Keypad Subsystem (continued)

Shift	Key	Hex Value	ASCII Character
	[3]	33	"3"
[S1]	[3]	59	"Y"
[S2]	[3]	5A	"Z"
[S3]	[3]	20	Space
[FN]	[3]	00	
	[DEL]	08	BS
[S1]	[DEL]	08	BS *(see table on page 6)*
[S2]	[DEL]	08	BS *(see table on page 6)*
[S3]	[DEL]	08	BS *(see table on page 6)*
[FN]	[DEL]	08	BS
	[0]	30	"0"
[S1]	[0]	2A	"*"
[S2]	[0]	2B	"+"
[S3]	[0]	2C	"–"
[FN]	[0]	00	
	[.]	2E	"."
[S1]	[.]	2F	"/"
[S2]	[.]	3A	":"
[S3]	[.]	3D	"="
[FN]	[.]	00	
	◀	11	
[S1]	◀	11	
[S2]	◀	11	
[S3]	◀	11	
[FN]	◀		* *see footer on page 6*
	▼	12	
[S1]	▼	12	
[S2]	▼	12	
[S3]	▼	12	
[FN]	▼		** *see footer on page 6*
	▲	13	
[S1]	▲	13	
[S2]	▲	13	
[S3]	▲	13	
[FN]	▲		*** *see footer on page 6*
	▶	10	
[S1]	▶	10	
[S2]	▶	10	
[S3]	▶	10	
[FN]	▶	84	"ä" **** *see footer on page 6*
	[F1]	86	"å"
[S1]	[F1]	86	"å"
[S2]	[F1]	86	"å"
[S3]	[F1]	86	"å"
[FN]	[F1]	8A	"è"

English Keypad Subsystem (continued)

Shift	Key	Hex Value	ASCII Character
	[F2]	87	"è"
[S1]	[F2]	87	"è"
[S2]	[F2]	87	"è"
[S3]	[F2]	87	"è"
[FN]	[F2]	8B	"ç"
	[F3]	88	"ê"
[S1]	[F3]	88	"ê"
[S2]	[F3]	88	"ê"
[S3]	[F3]	88	"ê"
[FN]	[F3]	8C	"î"
	[F4]	89	"ë"
[S1]	[F4]	89	"ë"
[S2]	[F4]	89	"ë"
[S3]	[F4]	89	"ë"
[FN]	[F4]	8D	"ì"
*	*The [FN], A key combination turns the backlight on and off.*		
**	*The [FN], B keys adjust the contrast.*		
***	*The [FN], Y key combination adjusts the speaker volume.*		
****	*The [FN], " keys toggle between the "User Menu" and "Ready Mode." When simultaneously pressed, the M90 does a WARM START.*		

Non-English Keypad Subsystems

Shift	Key	Language	Hex Value	ASCII Character
[S1]	[DEL]	Swedish	8F	"Å"
		Finnish	8F	"Å"
		Danish	92	"Æ"
		Spanish	AD	"Ì"
		French	F8	"°"
		German	8E	"Ä"
		Italian	F9	
[S2]	[DEL]	Swedish	8E	"Ä"
		Finnish	8E	"Ä"
		Danish	9D	"Ø"
		Spanish	A5	"Ñ"
		French	87	"Ç"
		German	99	"Ö"
		Italian	5C	"\"
[S3]	[DEL]	Swedish	99	"Ö"
		Finnish	99	"Ö"
		Danish	8F	"Å"
		Spanish	A8	"¿"
		French	26	"&"
		German	9A	"Ü"
		Italian	82	"é"

System Variables

Shift Keys

S1 0000: 1B7E
S2 0000: 1B7F
S3 0000: 1B80

Values are "0" *(Not in shift mode)* and "255" *(in shift mode)*.

Key in Keyboard Buffer

0000:1BAF

Values are "0" *(Buffer is not empty)* and "1" *(Buffer is empty).*

File System

Directory address: 0000:3A64

Filename Address:

"0"	Name
"16"	Start address
"18"	Low word of size
"20"	High word of size
"26"	Used or not used, zero is not used
"32"	Next name

Subsystems

Display Subsystem

The M90 Display Subsystem supports a character-oriented 8-line by 16-character or 4-line by 12-character display with backlight control. The origin (0,0) is always at the upper left-hand corner.

Real-Time Clock Subsystem

The real-time clock subsystem keeps system time and date values for the M90. The subsystem also provides the alarm or wake-up functions.

Serial Port Subsystem

The M90 has an RS-232 Serial Port for data communication. Its communication system consists of point-to-point connection type for general processing. The operator may press the [**FN**] key, then the ▶ key to enter "User Mode," then select COM to invoke the built-in Kermit server for point-to-point communication. The RI signal of the port can turn on the M90.

Bar Code Input Port

There is one bar code input port plus an integrated bar code scanner on the M90. The bar code port is for bar code scanning devices such as bar code wand, wand-emulation CCD, or laser-diode scanners. Depending on its connection, the scanner may turn the unit on by scanning without pressing the ON or OFF keys.

M90 Port Usage

The M90 defines four ports. The following table shows the various port usages. See the Glossary for usage abbreviations. Port T (keyboard) Serial channel 1 (COM port)

M90 Port Usage

Port	Bit	Usage	I/O
0	0	RTS	OUT
	1	CTS	OUT
	2	DTR	OUT
	3	SHUT213	OUT
	4	KEY_OUT0	OUT
	5	KEY_OUT1	OUT
	6	KEY_OUT2	OUT
	7	KEY_OUT3	OUT
1	0	NMI/POWER FAIL	IN
	1	WAND	IN
	2	KEYBOARD	IN
	3	RTC	IN
	4	BACKLIGHT	OUT
	5	SPEAKER	OUT
	6	SOS	IN
	7	OUT0	OUT
2	0	GOOD READ	OUT
	1	CS	OUT
	2	No connection	N/A
	3	SCAN_EN	OUT
	4	LCD_VO	OUT
	5	CN6–2 (Laser/CCD control)	OUT
	6	No connection	N/A
	7	AUTOOFF	OUT
20h	0	BAT2_LOW	IN
	1	PF0	IN
	2	No connection	N/A
	3	No connection	N/A
	4	BAT1_LOW	IN
	5	Switch detect (Laser/CCD)	IN
	6	COLDSTART	IN
	7	DSR/RI	IN

M90 Memory Map

M90 Memory Map

Address	Chip
0 – 7FFFFh	Working RAM memory
80000h – BFFFFh	Bank switched RAM memory (RAM DISK)
C0000h – FFFFFh	EEPROM (disk and OS)

M90 Input and Output

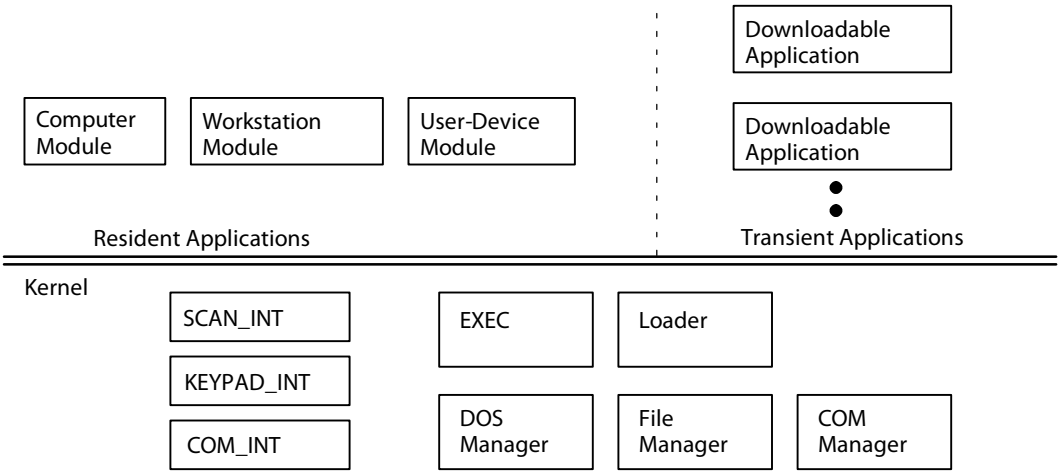
All M90 V25 Processor ports and registers are mapped to memory. The read-and-write-to ports act as memory that is moved to different memory pages. Read the Internal Data in Base register (IDB) to find the actual port address. The V25 Processor does not have the same interrupt vectors as an 8086 Processor. Below are vector numbers and their assigned use.

- "0" Divide error
- "1" Break flag
- "2" NMI
- "3" BRK3 instruction
- "4" BRKV instruction
- "5" CHKIND instruction
- "6" General purpose
- "7" FPO instructions
- "8" General purpose
- "9" General purpose
- "A" General purpose
- "B" General purpose
- "C" INTSER0 (serial channel 0)
- "D" INTSR0
- "E" INTST0
- "F" General purpose
- "10"INTSER1 (serial channel 1)
- "11"INTSR1
- "12"INTST1
- "13"I/O trap
- "14"INTD0 (DMA channel 0)
- "15"INTD1
- "16" General purpose
- "17" General purpose
- "18" INTP0 (peripheral 0)
- "19" INTP1
- "1A" INTP2
- "1B" General Purpose
- "1C" INTTU0 (timer 0)
- "1D" INTTU1
- "1E" INTTU2
- "1F" INTB (time base counter)
- "20–FF" General purpose

2 System Organization

The software organization consists of the kernel and application modules.

The kernel modules provide basic system services for the applications. The application program of an M90 may be either resident or transient. A resident application is an application stored in the M90 EEPROM. A transient application is an application that resides on the RAM. The host uses host file downloading commands to download the transient application.



Software Modules

An EXECutable program fundamentally controls the M90 Program. When the system powers up, EXEC performs the Power-On Test (POT). During a *cold start* process, the system restores all default configurations. A *warm start* process resets the system without erasing any RAM program or data files. Device configurations preserve these program or data values as they were before a warm boot.

Note: *Warm start* is referred to as *restart* in this document.

EXEC initializes all M90 Peripheral Devices respectively, according to their configuration parameters. M90 Peripherals include a bar code scanner and a serial communication port (RS-232).

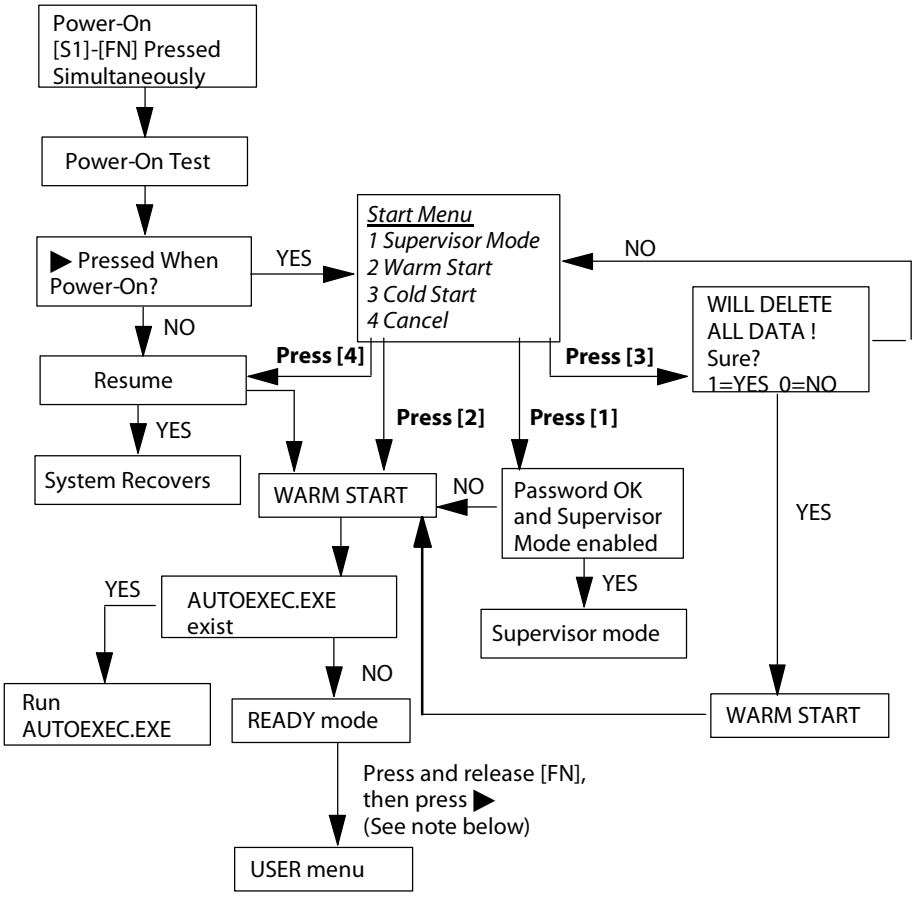
EXEC also creates and initializes all dynamic data structures during the start-up process, such as a keypad queue and a COM buffer. After the initialization procedure, EXEC checks for a request for a Supervisor Menu (▶ key pressed while the device turns on).

If there is an AUTOEXEC.EXE application in the M90, EXEC executes that application. Otherwise, the M90 enters the User Menu state, where the operator can execute M90 functions. A description of the EXEC function appears later.

Kernel

The M90 Kernel provides basic system services. The kernel modules include various interrupt service routines and DOS, File, and COM managers.

- **DOS Manager**:
  Emulates most MS-DOS function calls to control M90 Peripherals and Files.
- **File Manager**:
  Implements a DOS-like file subsystem to support file operations (read, write, open, close).
- **COM Manager**:
  Controls the communication link between the M90 and the host.
- **EXEC**:
  A job scheduler that manages top-level operation flow of the M90 System. The EXEC program is analogous to the COMMAND.COM program in MS-DOS operating systems:



EXEC Flow Chart *Press and release* ***[FN]****, then press ▶ to go from one mode to the other.*

When the M90 is on, the system performs a comprehensive POT. If the system passes the POT, EXEC determines whether the M90 is in Supervisor Mode or Ready Mode. The Supervisor Mode appears if the ▶ key is pressed while the M90 is turned on. M90 EXEC displays the supervisor menu while in Supervisor Mode. A supervisor password protects the M90 from unauthorized entry into supervisor state.

In normal operation M90 EXEC initializes all the input and output devices, according to the configuration. If there is an AUTOEXEC.EXE application in the unit, EXEC starts executing the application. Otherwise, EXEC displays a prompt and waits for the operator to enter further commands.

- **Loader**:
  The function is identical to the MS-DOS loader. The loader is an MS-DOS clone, except for the simplified memory allocation and deallocation scheme. The loader's operations are:
  - **a** Read *.EXE header.
  - **b** Find enough memory for .EXE.
  - **c** Read binary into RAM.
  - **d** Reallocate based on RAM allocation.
  - **e** Set up all registers.
  - **f** Jump to the entry point.
- **LCD Manager**:
  All displayable characters can appear on the LCD screen. The following table shows the special control sequences supported by the M90 Display Handler. See Chapter 4, "*DOS System Call*," for detailed LCD control commands.

LCD Manager Sequences

Key	Hex	Operation
BEL	0x07	Activate beeper for 500 ms (0.5 seconds)
LF	0x0A	New line
CR	0x0D	Cursor return

Workstation Mode Application

Although applications are classified into resident and transient categories, the M90 EXEC always loads the executable file from the RAM/ROM into the RAM executive area. It then begins execution.

Workstation mode is the default resident M90 Operation. In workstation mode, an M90 configures as a portable programmable device. The system receives transient application programs from the host using a download channel. The system also receives the resident application, from ROM.59 programs or data files, that can reside on an M90. Up to eight resident applications can reside on an M90. The operator can then select one of the applications using the keypad host command sequence.

The transient application operates as a file and purges when the M90 performs a *cold start.* While File Manager does not support the resident application, it is always in ROM.

Data files or recorded information collected from workstation applications are uploaded to the host when the host program decides to retrieve the collected data. Some applications may also require prepared data files, such as database information. These data files are loaded into the M90 in the same way that the program is downloaded.

When the M90 is in User Mode, the user menu is displayed. The operator may select one of the following functions:

- RUN Runs executable program
- TER Terminal mode operation
- COM Communicates in Kermit protocol
- DIR Displays M90 RAM disk directory
- ERA Erases file
- TYP Types file
- CPY Copies file
- SET Sets M90 Parameters

Use host communication commands to perform all keypad controls.

Note: If the M90 Communication Parameters are not set correctly, the host system cannot send any control commands.

3 Operation Modes

This chapter details the Ready Mode, the User Mode, and the Supervisor Mode menus, including screen illustrations.

Ready Mode

Turn on the M90 if it is not already on. Press and release [**FN**], then press ▶ to go from User Menu to Ready Mode. The following screen appears:

```
M90 Ver X.XX
MEM XXXX KB
>
```

The first line shows the model code and version number (such as 1.60). The second line shows the total installed RAM size (such as 2048 KB). The third line is the prompt ">," meaning that the M90 is in *Ready Mode.*

There are eight system commands. Input the command name at the Ready Mode prompt, or access the User Mode.

User Mode

Press and release [**FN**], then press ▶ to invoke the User Mode. Select the corresponding number, 1-8, or use ▲ or ▼ to move the cursor. Press [**ENT SCAN**] to select a function. Press and release [**FN**], then press ▶ to return to Ready Mode.

```
1. RUN      2. TER
3. COM      4. DIR
5. ERA      6. TYP
7. CPY      8. SET
```

1. RUN (Run Program)

Select option **1. RUN** from the User Mode menu for the Run Program screen. The Run Program function runs any program on the M90. Use ◀ or ▶ to scroll to the program you want run, then press [**ENT SCAN**] to start the program shown on the screen. ◀ scrolls until it reaches the first file on the disk. Press and release [**FN**], then press ▶ to invoke the User Mode.

```
< RUN PROGRAM >

PROGRAM.EXE
```

2. TER (Terminal Mode)

Note: The M90 has a combined SCANNER and ENTER key, thus the ENTER function is not active in Terminal Mode. Pressing [**ENT SCAN**] activates the scanner.

Select option **2. TER** from the User Mode menu for the Terminal Mode screen. With this function, M90 serves as a dumb computer that transmits data to or receives data from a host. Bar code label data, either scanned or keyed in, go out through the RS-232 port. Data received from the serial port appear on screen. Communication parameters must be compatible between Host and M90 to send data properly. Press and release [**FN**], then press ▶ to return to Ready Mode. Press and release [**FN**], then press ▶ again for the User Mode.

```
< TERMINAL MODE >
_
```

3. COM (Communications)

Select option **3. COM** from the User Mode menu for the Kermit Server Mode screen to enter the Kermit server mode. Press and release [**FN**], then press ▶ to go to the User Mode. Below are the available Kermit commands and their descriptions in the computer:

```
KERMIT
SERVER MODE
_
```

"SEND filename"	Send host or computer file to M90
"GET filename"	Send M90 file to host or computer disk.
"REMOTE DIR"	Display file directory stored in M90 RAM disk.
"REMOTE DEL filename"	Delete program or data file in M90 RAM disk.

4. DIR (Directory)

Select option **4. DIR** from the User Mode menu to list the directory of files on the M90. The file directory in the RAM disk appears with ROM disk filenames, RAM disk filenames, execution area size, and free RAM disk space.

```
ASET.EXE
AUTOEXEC.EXE
BATCHK.EXE
BCRTST2.EXE
```

Press [**ENT SCAN**] to see additional files. If at the end of the list, as indicated by the following screen, press [**ENT SCAN**] to go back to the User Mode. Press and release [**FN**], then ▶ to return to the Ready Mode.

"X" is the number of files on the disk, "YYY" is the size of the execution area in KB, and "ZZZZ" is the amount of free disk space in KB.

```
TEST.EXE
<<END>>
X Files(s)
ExecSize YYYKB
Free Disk ZZZZKB_
```

5. ERA (Erase File)

Select option **5. ERA** from the User Mode menu for the Erase File screen to erase files present on the M90. Use ◀ and ▶ to scroll to the file to be erased, then press [**ENT SCAN**]. ◀ scrolls until it reaches the first file on the disk.

When [**ENT SCAN**] is pressed, the following message appears to confirm whether to erase the selected file.

```
Are you sure ?
1=YES/0=NO
```

Press [**1**] to continue with the erase, or press [**0**] to abort. Press and release [**FN**], then press ▶ to go to the User Mode.

```
< ERASE FILE >

ERASEFIL.EXE_
```

6. TYP (Type File)

Select option **6. TYP** from the User Mode menu to display M90 file contents. Unintelligible characters may appear when attempting to view a program or binary file. Use ◀ and ▶ to scroll to the file to display, then press [**ENT SCAN**] to display it. ◀ scrolls until it reaches the first file on the disk. The file displays 128 (8 lines x 16) characters per screen. Press any key to show the next page. Press and release [**FN**], then press ▶ to go to the User Mode.

```
< TYPE FILE >
FILE.TXT_
```

7. CPY (Copy Setup)

Select option **7. CPY** from the User Mode menu for the Copy Setup screen. Use this screen to copy files:

```
< COPY SETUP >
SOURCE FILE :
_
```

Enter the source filename, then press [**ENT SCAN**] for the destination prompt. Enter the destination filename, then press [**ENT SCAN**] for the M90 to execute the copy, then return to the User Mode screen.

```
< COPY SETUP >
DESTINATION :
_
```

The **CPY** command allows you to copy data from a source and transfer the information to a different location or destination. The source and destination can be a file or device, such as "COM," "serial port," or "CON." "CON" specifies the LCD for the destination and the keyboard for the source.

CPY Source and Destination Files

Source	Destination	Function
File1	File2	Copy File1 to File2
File1	COM	Output content of File1 to serial port
File1	CON	Output content of File1 to LCD
COM	File2	Input data fro serial port and store in File2
CON	File2	Input data from keyboard and store in File2, press and release [**FN**], then press ▶ from the keyboard to end the data input.

8. SET (Setup Menu)

Select option **8. SET** from the User Mode to set system parameters. Press [**1**] or [**3**] to select a category. Press and release [**FN**], then ▶ to return to the User Mode. Press and release [**4**] or [**FN**], then ▶ to return without changes.

```
  <SYSTEM SETUP>
1.DATE & TIME
2.SCANNER
3.DISPLAY
4.EXIT
```

Note: Defaults are given in each screen, and are listed in *italic*.

1. DATE & TIME

Select option **1. DATE & TIME** for the Set Date&Time screen. If necessary, change the date in the month/day/year format, enter a zero before the single digit entries. Press [**ENT SCAN**] to bring up the time fields.

```
<SET DATE&TIME>
mm–dd–yyyy
08–09–1999
```

Press [**ENT SCAN**] if the time is correct, or change the time in the hour/minute/second 24-hour format, including zeros. Press ◀ and ▶ to toggle fields. Press and release [**FN**], then ▶ to return without changes.

```
<SET DATE&TIME>
mm–dd–yyyy
08–09–1999
hh–mm–ss
18:31:36
```

2. SCANNER

Select option **2.SCANNER** to enable or disable the internal bar code scanner. The M90 supports a bar code pen connected to its 10-pin modular connector. Some models have a built-in laser or CCD scanner.

```
<SYSTEM SETUP>

SCANNER
ENABLE
```

Press ▶ to toggle between "ENABLE" *(default)* or "DISABLE," then press [**ENT SCAN**] for the internal scanner. If enabled, the following screen appears:

```
<SYSTEM SETUP>

VERIFICATION
DISABLE
```

Press ▶ to toggle "ENABLE" or "DISABLE" for the internal scanner to decode the bar code twice before accepting data. Press [**ENT SCAN**] to return to System Setup, or press and release [**FN**], then ▶ to return without changes.

3. DISPLAY

Select option **3.DISPLAY** from the System Setup menu to dictate how the cursor is to appear on the display. With this screen, use ▶ to select either "BLOCK," such as "**▌**" *(default)* or "UNDERLINE," such as "_".

```
<SYSTEM SETUP>

CURSOR SHAPE
BLOCK
```

When ready, press [**ENT SCAN**] for the Display Format screen to set a display format for the M90:

```
<SYSTEM SETUP>

DISPLAY FORMAT
4*12 (LARGE)
```

4*12 (LARGE)	4 lines x 12 characters wide *(default)*
8*16 (SMALL)	8 lines x 16 characters wide
4*20 (M80)	4 lines x 20 characters wide virtual screen, last 4 characters truncated
6*20 (M80)	6 lines x 20 characters wide virtual screen, last 4 characters truncated

The "4*20" and "6*20" formats are M80-compatible. They display four or six lines with the first 16 characters visible and the last four characters (positions 17–20) truncated. An M80 program can run without problems as the system ignores characters found outside the physical screen.

Press ▶ to scroll between formats. When ready, press [**ENT SCAN**] for the "Power-On Logo" screen to dictate whether the initial power-on logo should appear. Press ▶ to toggle between "ENABLE" *(default)* and "DISABLE." When ready, press [**ENT SCAN**] to return to System Setup. Press and release [**FN**], then press ▶ to return to System Setup without changes.

```
<SYSTEM SETUP>

POWER-ON LOGO
ENABLE
```

Supervisor Mode

The M90 has a Supervisor Mode to set up system configurations and verify computer hardware. Do the following to enter the Supervisor Mode:

1 Turn off the M90. Press and hold ▶, then simultaneously press [**S1**] and [**FN**]. The M90 powers on with the following screen:

```
START MENU
1. Supervisor Mode
2. Warm Start
3. Cold Start
4. Cancel
```

2 Press [**1**] to access the Supervisor Mode:

```
 <SUPERVISOR>
PASSWORD:
■
```

Note: A supervisor password prevents unauthorized users from changing configuration parameters. The M90 system forces the user to enter Ready Mode after five unsuccessful attempts to enter a correct password. *"M90" is the default password.*

The Supervisor Mode menu appears with the following parameters:

```
1.DEV      2.TERM
3.MEM      4.ALRM
5.PWR      6.PSWD
7.SYS      8.DIAG
```

1. DEV (Device Configuration)

Select option **1.DEV** from the Supervisor Mode menu to configure the M90 device parameters:

```
 <DEVICE CONFIG>
1.KEYPAD
2.SERIAL
3.BARCODE _
```

1. KEYPAD

Select option **1.KEYPAD** from the Device Config menu to select one of seven languages for the keypad. Press ◀ or ▶ to toggle between "Italian," "English" *(default)*, "Sweden/Finland," "Danish," "Spanish," "French," and "German," then press [**ENT SCAN**]:

```
 <  KEYPAD SETUP  >

LANGUAGE
English      _
```

2. SERIAL

Select option **2.SERIAL** from the Device Config menu to send or receive data or programs using RS-232, and to set these and other M90 communication parameters. Press and release [**FN**], then press ▶ to return to the Device Config menu without changes. Press [**ENT SCAN**] to scroll through these parameter menus:

Baud Rate

Press ▶ to toggle between the "150," "300," "600," "1200," "2400," "4800," "9600," "19200" *(default)*, "38400," and "57600" baud rates, then press [**ENT SCAN**]:

```
< COM SETUP>

BAUD
 19200  _
```

Length

Press ▶ to toggle between the "7-BITS" and "8-BITS" *(default)* lengths, then press [**ENT SCAN**]:

```
< COM SETUP>

LENGTH
8 BITS  _
```

Parity

Press ▶ to toggle between the "NONE" *(default)*, "ODD," and "EVEN" parities, then press [**ENT SCAN**]:

```
< COM SETUP>

PARITY
NONE  _
```

Stop Bits

Press ▶ to toggle between "1" *(default)* and "2" stop bits, then press [**ENT SCAN**]:

```
   < COM SETUP>

STOP BITS
1        _
```

Flow Control

This controls the RS-232 port sending or receiving data in a character-by-character mode. Press ▶ to toggle between the "XON/XOFF," "CTS/RTS," and "NONE" *(default)* flow control options, then press [**ENT SCAN**]:

```
< COM SETUP >

FLOW CONTROL
NONE  _
```

3. BARCODE

Select option **3.BARCODE** from Device Config to enter the bar code symbology supported by the M90. Each symbology can be separately enabled or disabled. See Appendix C, "*Bar Code Symbologies*," for information.

Code 39

Press ◀ or ▶ to toggle this bar code symbology "ON" *(default)* or "OFF," then press [**ENT SCAN**].

```
 <BARCODE SETUP>

CODE 39
ON      _
```

Code 39 Full ASCII

Press ◀ or ▶ to toggle this bar code symbology "ON" or "OFF" *(default),* then press [**ENT SCAN**].

```
 <BARCODE SETUP>
CODE 39
FULL ASCII
OFF     _
```

Code 39 Start/Stop

Press ◀ or ▶ to toggle either "NO SEND" *(default)* or "SEND" to dictate whether to send the Code 39 start and stop character as part of the decoded data, then press [**ENT SCAN**].

```
 <BARCODE SETUP>
CODE 39
START/STOP
NO SEND    _
```

Code 39 Check Digit

Press ◀ or ▶ to select one of three verification types: "OFF" *(default)*, "ON & NO SEND," or "ON & SEND," then press [**ENT SCAN**].

```
 <BARCODE SETUP>
CODE 39
CHECK DIGIT
OFF     _
```

I 2 of 5

Press ◀ or ▶ to toggle this bar code symbology "ON" *(default)* or "OFF," then press [**ENT SCAN**].

```
 <BARCODE SETUP>

I 2 OF 5
ON       _
```

I 2 of 5 Check Digit

Press ◀ or ▶ to select one of three verification types: "OFF" *(default)*, "ON & NO SEND," or "ON & SEND," then press [**ENT SCAN**].

```
 <BARCODE SETUP>
I 2 OF 5
CHECK DIGIT
OFF      _
```

Codabar

Press ◀ or ▶ to toggle this bar code symbology "ON" *(default)* or "OFF," then press [**ENT SCAN**].

```
 <BARCODE SETUP>

CODABAR
ON       ▮
```

Codabar Start/Stop

Press ◀ or ▶ to toggle either "NO SEND" or "SEND" *(default)* to dictate whether to send the Codabar start and stop character as part of the decoded data, then press [**ENT SCAN**].

```
 <BARCODE SETUP>
CODABAR
START/STOP
SEND          _
```

Codabar Check Digit

Press ◀ or ▶ to select one of three verification types: "OFF" *(default)*, "ON & NO SEND," or "ON & SEND," then press [**ENT SCAN**].

```
 <BARCODE SETUP>
CODABAR
CHECK DIGIT
OFF     _
```

UPC-A

Press ◀ or ▶ to toggle this bar code symbology "ON" *(default)* or "OFF," then press [**ENT SCAN**].

```
 <BARCODE SETUP>

UPC–A
ON      _
```

UPC-A Leading Digit

Press ◀ or ▶ to toggle either "NO SEND" or "SEND" *(default)*, then press [**ENT SCAN**].

```
 <BARCODE SETUP>
UPC–A
LEADING DIGIT
SEND        _
```

UPC-A Check Digit

Press ◀ or ▶ to toggle either "NO SEND" or "SEND" *(default)*, then press [**ENT SCAN**].

```
 <BARCODE SETUP>
UPC–A
CHECK DIGIT
SEND   _
```

UPC-E

Press ◀ or ▶ to toggle this bar code symbology "ON" *(default)* or "OFF," then press [**ENT SCAN**].

```
 <BARCODE SETUP>

UPC–E
ON       _
```

UPC-E Leading Digit

Press ◀ or ▶ to toggle either "NO SEND" or "SEND" *(default)*, then press [**ENT SCAN**].

```
 <BARCODE SETUP>
UPC–E
LEADING DIGIT
SEND         _
```

UPC-E Check Digit

Press ◀ or ▶ to toggle either "NO SEND" or "SEND" *(default)*, then press [**ENT SCAN**].

```
 <BARCODE SETUP>
UPC–E
CHECK DIGIT
SEND    _
```

UPC-E Zero Expansion

Press ◀ or ▶ to toggle either "ON" or "OFF" *(default)*, then press [**ENT SCAN**].

```
 <BARCODE SETUP>
UPC–E
ZERO EXPANSION
OFF          _
```

EAN-13

Press ◀ or ▶ to toggle either "ON" *(default)* or "OFF," then press [**ENT SCAN**].

```
 <BARCODE SETUP>

EAN–13
ON       _
```

EAN-13 Leading Digit

Press ◀ or ▶ to toggle either "NO SEND" or "SEND" *(default)*, then press [**ENT SCAN**].

```
 <BARCODE SETUP>
EAN–13
LEADING DIGIT
SEND        _
```

EAN-13 Check Digit

Press ◀ or ▶ to toggle either "NO SEND" or "SEND" *(default)*, then press [**ENT SCAN**].

```
 <BARCODE SETUP>
EAN–13
CHECK DIGIT
SEND   _
```

EAN-8

Press ◀ or ▶ to toggle either "ON" *(default)* or "OFF," then press [**ENT SCAN**].

```
 <BARCODE SETUP>

EAN–8
ON      _
```

EAN-8 Check Digit

Press ◀ or ▶ to toggle either "NO SEND" or "SEND" *(default)*, then press [**ENT SCAN**].

```
 <BARCODE SETUP>
EAN–8
CHECK DIGIT
SEND   _
```

EAN/UPC Add-On

Press ◀ or ▶ to toggle among "DISABLE" *(default)*, "OPTIONAL," or "REQUIRED," then press [**ENT SCAN**].

```
 <BARCODE SETUP>

EAN/UPC ADD–ON
DISABLE     _
```

Code 128

Press ◀ or ▶ to toggle either "ON" *(default)* or "OFF," then press [ENT SCAN].

```
<BARCODE SETUP>

CODE 128
ON          _
```

EAN 128

Press ◀ or ▶ to toggle either "ON" *(default)* or "OFF," then press [ENT SCAN].

```
<BARCODE SETUP>

EAN 128
ON          _
```

Code 93

Press ◀ or ▶ to toggle either "ON" *(default)* or "OFF," then press [ENT SCAN].

```
<BARCODE SETUP>

CODE 93
ON          _
```

MSI

Press ◀ or ▶ to toggle either "ON" *(default)* or "OFF," then press [ENT SCAN].

```
<BARCODE SETUP>

MSI CODE
ON      _
```

MSI 2nd Check Digit

Press ◀ or ▶ to select one of five verification types: "OFF" *(default)*, "MOD 10/NO SEND," "MOD 10/SEND," "MOD 11/NO SEND," or "MOD 11/SEND," then press [**ENT SCAN**].

```
 <BARCODE SETUP>
2nd CHECK DIGIT
OFF      _
```

2. TERM (Terminal Configuration)

Select option **2.TERM** from the Supervisor Mode menu for the Terminal Setup menu. Parameters are set up in this menu like they are set up in the Device Config menu. The M90 supports a terminal emulator that acts as a dumb ASCII computer.

TERM I.D. (Terminal ID)

ASCII string IDs identify each M90 Computer. IDs take up to eight characters. The initial ID is "M90." Alphanumeric characters ("A"-"Z", "a"-"z", "0"-"9") are valid. Press [**ENT SCAN**] to continue.

```
<<  TERM SETUP  >>

TERM I.D.
M90
```

ONLINE

Press ▶ to toggle between "REMOTE" *(default)* or "LOCAL," then press [**ENT SCAN**]. "REMOTE" immediately transmits scanned bar code data or key data to the host or PC using the RS-232 port, "LOCAL" does not transmit data.

```
<<  TERM SETUP  >>

ONLINE
REMOTE    _
```

ECHO

Press ▶ to toggle between "ON" *(default)* or "OFF," then press [**ENT SCAN**]. Select "ON" to view any collected data.

```
<< TERM SETUP >>

ECHO
ON          _
```

AUTOLF

Press ▶ to toggle between "ON" *(default)* or "OFF," then press [**ENT SCAN**]. Select "ON" to append a linefeed (10 hex) character to the input data block.

```
<< TERM SETUP >>

AUTOLF
ON          _
```

MODE

Press ▶ to toggle between "BLOCK" or "CHAR" *(default)*, then press [**ENT SCAN**].

```
<< TERM SETUP >>

MODE
CHAR        _
```

LINE/PAGE

If "BLOCK" is selected under **Mode**, then **LINE/PAGE** is enabled. The **LINE/PAGE** entry designates the termination character set as "LINE" to terminate the line: CR (0D hex), "PAGE" to terminate the page: CTRL-Z (1A hex), or "BOTH" to terminates both the line and page. CR and CTRL-Z (0D and 1A hex). Press ▶ to toggle among "LINE" *(default)*, "PAGE," or "BOTH," then press [**ENT SCAN**].

```
<< TERM SETUP >>

LINE/PAGE
LINE        _
```

3. MEM (Memory Configuration)

Select option **3.MEM** from the Supervisor Mode menu to access the Execution Setup menu to enter the new Execution Program Area size, then press [**ENT SCAN**]. The M90 system RAM memory is in three sections:

- **System Variable Area**:
  Has about 29 KB reserved for system parameters
- **RAM Disk**:
  Stores programs and data files, like a physical PC disk
- **Execution Program Area**:
  Loads applications and data, like a the main memory on a PC

Allocate the available RAM between the Execution Program Area and RAM disk. RAM disk size decrements when the Execution Program area size increments, and vice versa.

```
  <EXEC SETUP>
16KB --          472KB
OLD:236             KB
NEW: _           KB
```

4. ALRM (Alarm)

Note: If an incorrect entry is made, the system puts the cursor back to the beginning of the field.

Select option **4.ALRM** from the Supervisor Mode menu to access the Alarm Set menu. Press ◀ or ▶ to toggle among "Disable" *(default)*, "Everyday/Time," or "Date/Time," then press [**ENT SCAN**].

```
 <  ALARM SET  >

ALARM FUNCTION
Disable                  _
```

Everyday/Time

Enter the daily time (24-hour format) to set for the alarm. Press [**ENT SCAN**] to save or press and release [**FN**], then ▶ to exit without changes.

```
< SET ALARM  >
hh:mm:ss
Date: Everyday
Time: 08:00:00
```

Date/Time

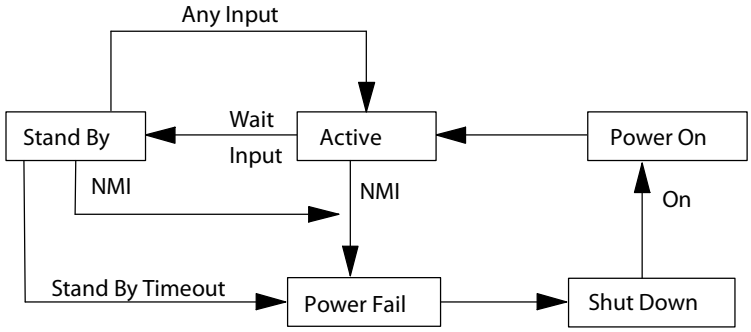
Enter the date and time (24-hour format) to set the alarm. Press [**ENT SCAN**] to save or press and release [**FN**], then ▶ to exit without changes.

```
< SET ALARM  >
mm–dd–yyyy
Date:     08–10–1999
Time:      08:00:00
```

5. PWR (Power)

Select option **5.PWR** from the Supervisor Mode menu to set the power management system. The power management system is in the M90 Hardware and Software to increase battery service time:

- **Active**:
  All system hardware and software continue to work if the M90 has no activity. The system may go to Stand-by mode after a timeout period.
- **Stand By**:
  If the keyboard, scanner, or RS-232 input are activated, the system returns to Active mode. Otherwise, the M90 waits for the specified setting timeout period, then shuts down the system.
- **Shut Down**:
  The M90 turns the main power off and disables all hardware devices. RAM is left on in retention mode.



M90 Power Transition Flow

Press [**1**] to enter the RESUME set up menu or [**2**] to go to the AUTO-OFF set up menu. Press and release [**FN**], then ▶ to return to Supervisor Mode.

```
 <SYSTEM ON/OFF>
1. RESUME
2. AUTO-OFF_
```

1. RESUME

This resumes processing from where it was when the M90 was shut down. If off, the M90 will perform a warm start each time it is powered on. Press ◀ or ▶ to toggle between "ON" *(default)* or "OFF," then press [**ENT SCAN**] to return to the System On/Off screen. Press and release [**FN**], then ▶ to return to this screen without changes.

```
< RESUME SET >

RESUME
ON          _
```

2. AUTO-OFF

This sets the timeout period from 1 to 9 MINS (minutes), or DISABLE. *Default is 3 MINS (3 minutes)*. The unit remains on until [**S1**] and [**FN**] are pressed (off). Press ◀ or ▶ to toggle among the values, then press [**ENT SCAN**] to return to the System On/Off screen. Press and release [**FN**], then ▶ to return to this screen without changes.

```
< AUTO-OFF SET >

AUTO-OFF
3 MINS      _
```

6. PSWD (Password Change)

Select option **6.PSWD** from the Supervisor Mode menu for the supervisor password which prevents unauthorized users from entering the Supervisor Mode and changing configuration parameters. Use up to ten alphanumeric characters ("A"-"Z", "a"-"z", "0"-"9") for the password. Press [**ENT SCAN**] to save or press and release [**FN**], then ▶ to exit without changes.

```
OLD PASSWORD:
M90
NEW PASSWORD:
_
```

7. SYS (System Initialization)

Note: Back up data or programs to the host or PC and connect the M90 to a charger before doing this 7.**SYS** function.

Select option 7.**SYS** from the Supervisor Mode menu for either the Cold Start screen or the Programming screen:

```
    < SYSTEM INITIAL   >
1.COLD START
2.PROGRAMMING
_
```

1. COLD START

Select option **1. COLD START** to activate the *cold start.* Press [**0**] to return to the Supervisor Mode menu, or press [**1**] to continue the *cold start.*

```
   <    SYS INIT    >

Will Flush RAM &
RAM Disk  !

Continue  ?_
 1=YES/0=NO
```

2. PROGRAMMING

Select option **2. PROGRAMMING** to access the following screen:

```
<  PROGRAMMING   >
1. ADD PROGRAM
2. DELETE ALL
3. UPDATE BIOS _
```

1. ADD PROGRAM

Press [**1**] to add a RAM disk program to the FLASH disk. Press ◀ or ▶ to toggle the available RAM disk programs, then press [**ENT SCAN**].

```
<  PROGRAMMING   >

127 KB FLASH Free
FILE1.EXE_
```

When programming is ready, press [**1**] to delete the program from the RAM disk, press [**0**] otherwise. The last screen shows the change in flash size, for example "116 KB" if an 11 KB file was added. Press any key to return to Programming.

```
<  PROGRAMMING   >
Delete program
in RAM Disk  ?_
1=YES/0=NO
```

2. DELETE ALL

Press [**2**] to remove all programs on the FLASH disk. Press [**1**] to delete all programs stored on the FLASH disk, press [**0**] to return to Programming without deleting programs.

```
Delete all PROGs
in FLASH memory!
Continue  ?_
1=YES/0=NO
```

If you pressed [**1**] to delete all programs, press [**1**] again to verify.

```
<  PROGRAMMING   >

Are you sure?
1=YES/0=NO
```

Two more screens appear, the first shows Erasing, the second displays the flash size after the programs are erased. Press a key to return to Programming.

```
<  PROGRAMMING   >
Done  !
127KB FLASH Free
Press any key.._
```

Note: Download a BIOS file onto the RAM disk before you update the BIOS. If there is no BIOS file, the update fails and the M90 performs a cold start.

3. UPDATE BIOS

Press [**3**] to update the BIOS. Press [**1**] to verify the update, or press [**0**] to return to the System Initialization menu.

```
Erase all data
in RAM & FLASH !
Continue  ?_
1=YES/0=NO
```

If you pressed [**1**] to erase all data, press [**1**] again to verify that the M90 update the BIOS. "Wait" appears briefly.

```
<  PROGRAMMING   >

Are you sure?
1=YES/0=NO
```

If a BIOS file is not found on the RAM disk per the following message, turn off the M90, then cold start it or wait for the Start Menu to cold start the unit. Set up the communications parameters and download the BIOS to the RAM disk. When done, return to the Programming menu.

```
<  PROGRAMMING   >
Please download
BIOS file . . . .
```

If BIOS is present on the RAM disk, press [**1**] to change the BIOS. The M90 displays a "Wait" message, then an "Erase" message.

```
<  PROGRAMMING   >
Change BIOS to
VX.XX  ?
1=YES/0=NO
```

After the "Erase" message, a status screen appears with the address count. "XXXXXX" counts from "0" to "1C0000:"

```
<  PROGRAMMING   >
Updating BIOS
ADDR=XXXXXX
```

After the count is complete, the final screen appears. Press any key to re-start the M90.

```
< PROGRAMMING   >
BIOS Update OK!
Press Any Key to
Restart. . .
```

8. DIAG (System Diagnostic)

Select option **8.DIAG** from the Supervisor Mode menu to access the M90 diagnostic program to verify the M90. The diagnostic routines run these tests: RAM, keypad, RS-232, LCD, real-time clock, scanner, and RAM backup.

Note: Execute this diagnostic program when there is a service process, such as maintenance, repair, or upgrade to verify that system. The diagnostic program **may** destroy data. Back up the M90 data.

```
 0.All          1.RAM
2.KEY           3.232
4.LCD           5.RTC
6.SCANNER
7.RAM BACKUP
8.EXIT

SELECT(0—8)    ?_
```

0. All (Run All Tests)

Select option **0. All** from the Diagnostic menu to run all of the following seven tests. This requires RS-232 loopback.

1. RAM (RAM Test)

Select option **1.RAM** from the Diagnostic menu to flush the M90 RAM. The first screen appears with a warning. Press [**0**] to return to the Diagnostic menu, or press [**1**] to continue with the memory flush.

- *Fixed pattern stuck at fault check (00, FF, 55, AA)*
  Writes a fixed pattern of data to the RAM chip, then verifies the data was stored properly.
- *Address Test:*
  Writes odd, even address data into corresponding memory location, then verifies it.

```
    ! ! WARNING ! !
Will Flush RAM &
RAM Disk  !

Continue  ?_
 1=YES/0=NO
```

2. KEY (Keypad Test)

Select option **2.KEY** from the Diagnostic menu for the Keypad Test:

```
KEYPAD TEST

Wait key  . . .■
```

Press any key and the ASCII symbol should appear. Press ▶ to exit, and the following prompt appears. Press [**1**] to return to the Diagnostic menu, or press [**0**] to continue with the keypad test.

```
KEYPAD TEST

Exit_?  ■
1=YES/0=NO
```

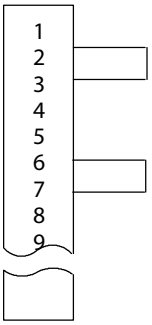
3. 232 (RS-232 Loopback Test)

Select option **3.232** from the Diagnostic menu for the RS-232 Test testing status screen. A signal is sent from the TXD pin through a loopback connector to the RXD pin. The received signal is verified to match the transmitted signal. A full ASCII table code (0-255) test pattern should be in each test cycle. Communication parameters should equal default values, except the baud rate.

```
RS232 TEST
Baud=  9600 PASS
Baud=19200 PASS
Baud=38400 PASS
Baud=57600 PASS

Press any key to
continue . . . _
```

The loopback plug is a 9-pin DSUB that can be made to connect either to the M90-to-PC communication cable or at the back of the M90 office dock. To connect it to the M90 PC cable, make it of a male DSUB. For connection to the M90 office dock, make it of a female DSUB.



Loopback Connector Wiring

If the loopback test fails, or the test connector is not plugged in, the following screen appears briefly after the testing status screen. Press any key to return to the Diagnostic menu.

```
RS232 TEST
Baud=  9600 FAIL
Baud=19200 FAIL
Baud=38400 FAIL
Baud=57600 FAIL

Press any key to
continue . . . _
```

4. LCD (LCD Screen Test)

Select option **4.LCD** from the Diagnostic menu for the LCD Test to see graphic patterns on the M90. The patterns start two sets of dark and light screens, followed by two sets of the following:

```
*     Backlight    ON  *
–
```

```
*    Backlight    OFF    *
–
```

The backlight is more noticeable if the M90 is tested in a dimly lit area. After two sets of "Backlight ON" and "Backlight OFF," the final screen appears. Press any key to return to the Diagnostic menu.

```
LCD TEST

Press any key to
continue . . . _
```

5. RTC (Real-Time Clock Test)

Select the **5.RTC** option from the Diagnostic menu for the RTC Test. The date and time given should be current. If not, exit the Supervisor Mode and access the User Mode. Select "1" from the Set option to reset the date or time. Press any key to return to the Diagnostic menu.

```
RTC TEST

08–10–1999   Tue.
11:01:37.32_
```

6. SCANNER (Scanner Test)

Select option **6.SCANNER** from the Diagnostic menu for the Scanner Test to test the M90 laser or CCD scanner on bar code labels. A successful scan gives the data, type, and scan information. When doing a test, aim the M90 at a bar code, then press [**ENT SCAN**] to start the scan. A red scanner beam should appear on the bar code to read, then if successful, the M90 emits a beep and lists the bar code information on the display. Press the [**ENT SCAN**] key to do another bar code, or press any key to exit.

```
SCANNER TEST

Wait scanning . . .
–
```

7. RAM BACKUP

Select option 7.**RAM BACKUP** from the Diagnostic menu for the RAM back up test screen. Press [**0**] to return to the Diagnostic menu, or press [**1**] to continue with the memory flush.

```
!!   WARNING    !!
Will Flush RAM &
RAM Disk !

Continue ?
1=YES/0=NO
```

If you pressed [**1**] to continue, the following instructions appear:

```
RAM Backup TEST
Wait 30 seconds
After power off,
Then turn it on
Again

Press any key to
Turn it off . . . _
```

Remove the battery pack from the M90 to turn the unit off, wait 30 seconds, reinsert the battery pack, then turn on the M90. A "Please Wait" message appears on the display, followed by this pass/fail screen:

```
RAM Backup TEST

PASS  !


Press any key to
Continue . . . _
```

8. EXIT (Return to Supervisor Mode)

Press option **8.EXIT** from the Diagnostic menu to return to the Ready Mode. The M90 then performs a warm start. If the M90 memory was tested, the M90 performs a cold start.

4 DOS System Call

This chapter describes the supported DOS calls of the M90 system kernel.

DOS Call (INT 21H)

This describes the supported DOS calls of the M90 System Kernel. All DOS calls are compatible with MS-DOS version 2.0 invoked by DOS INT 21H with functions defined in register AH.

00 Terminate Program
Entry Parameter: AH=0
Return Value: None

01 Read Stdin (wait if no key) and Write to Stdout Excluding Shift Keys
Entry Parameter: AH=1
Return Value: AL = 8-bit data ASCII code

02 Write Stdout
Entry Parameter: AH=2
DL = 8-bit data ASCII
Return Value: None

03 Read Stdaux (wait if no input) Excluding ESC Command
Entry Parameter: AH=3
Return Value: 8-bit data ASCII code

04 Write Stdaux
Entry Parameter: AH=4
DL= 8-bit data ASCII code
Return Value: None

06 Read/Write Stdin
Entry Parameter: AH=6
DL = 0x0FF Read
Other values Write
Return Value: If DL = 0x0FF
AL = 8-bit data ASCII code
Clear ZERO flag If char ready
Set ZERO flag If not ready
If DL = other values
None

07 Read Stdin (wait if no key) Excluding Shift Keys
Entry Parameter: AH=07
Return Value: AL=8-bit data ASCII code

08 Read Stdin (wait if no key) Excluding Shift Keys
Entry Parameter: AH=08
Return Value: AL=8-bit data ASCII code

09 Write Character String to Stdout
Entry Parameter: AH=09
DS:DX=Points to string buffer w/ “$” end
Return Value: None

0A Key Buffer Input
Entry Parameter: DS:DX = Points to an input buffer
Return Value: Buffer filled with CR as last character

(continued)

0B Keyhit Check

Entry Parameter:	AH=0B	
Return Value:	AL=0	If character is not ready
	AL=FF	If character is ready

1A LCD Backlight ON/OFF Control

Entry Parameter:	AH=0x1A	
	BH=0	
	AL=0	Set LCD backlight OFF
	AL=1–5	Set LCD backlight ON for 5 seconds
	AL=6–59	Set LCD backlight ON for 6–59 seconds
	AL=60–0xFF	Set LCD backlight ON for 59 seconds
Return Value:	None	

1A Buzzer ON/OFF Control

Entry Parameter:	AH=0x1A	
	BH=1	
	AL=0	Set Buzzer OFF
	AL=1	Set Buzzer ON
Return Value:	None	

1A Key Enable/Disable Setting

Entry Parameter:	AH=0x1A	
	BH=2	
	AL=0	All keys except ON, OFF, four function keys
	AL=1	Supervisor mode key
	AL=2	Cold start key
	AL=3	Warm start key
	AL=4	User menu key
	BL=5	Start menu key
	BL=0	Disable
	BL=1	Enable
Return Value:	None	

1A Beeper Volume

Entry Parameter:	AH=0x1A	
	BH=3	
	AL=0	Set low beeper volume
	AL=1	Set middle beeper volume
	AL=2	Set high beeper volume
Return Value:	None	

1A Battery Check

Entry Parameter:	AH=0x1A	
	BH=8	
Return Value:	AL=0	Main battery normal
	AL=1	Main battery low
	AH=0	Backup battery normal
	AH=1	Backup battery low

(continued)

1A Keypad Language Setting
Entry Parameter: AH=0x1A
BH=9
AL=0 English
AL=1 Swedish or Finnish
AL=2 Danish
AL=3 Spanish
AL=4 French
AL=5 German
AL=6 Italian
Return Value: None

1A Set Good-read LED (green light)
Entry Parameter: AH=1AH
BH=0AH
AL=0 Set Good-read LED OFF
AL=1 Set Good-read LED ON
AL=2 Set Good-read LED controlled by system
Note: If the **Set Good-read LED** function is called by AL=0 or AL=1, the system does not control **Good-read LED** ON/OFF when a bar code label is decoded successfully.

1A Buzzer Sound
Entry Parameter: AH=0x1A
BH=0x0B
Return Value: None

1A Enable/Disable Double Verification When Reading Bar Code Label
Entry Parameter: AH=1AH
BH=0CH
AL=0 Disable double verification
AL=1 Enable double verification
Return Value: None

1A Check Laser Scanner
Entry Parameter: AH=1AH
BH=0DH
Return Value: AL=0 Has no built-in laser scanner
AL=1 Has built-in laser scanner

1B Get Scanner Port Status
Entry Parameter: AH=1BH
BH=5
Return Value: AL=0 Scanner port is disabled
AL=1 Scanner port is enabled

(continued)

1C Communication Parameter Setting

Entry Parameter: AH=0x1C
BH=1
AL= Bits 4-7: 0001xxxx Baud 150
0010xxxx Baud 300
0011xxxx Baud 600
0100xxxx Baud 1200
0101xxxx Baud 2400
0110xxxx Baud 4800
0111xxxx Baud 9600
1000xxxx Baud 19200
1001xxxx Baud 38400
1010xxxx Baud 57600
Bits 2-3: 00 None parity
01 Odd parity
11 Even parity
Bit 1: 0 1 stop bit
1 2 stop bits
Bit 0: 0 7 data bits
1 8 data bits

Return Value: None

1C Communication Control Flow Setting

Entry Parameter: AH=0x1C
BH=2
AL=0 Null
AL=1 XON/XOFF control flow
AL=2 CTS/RTS control flow

Return Value: None

1D Set Terminal ID

Entry Parameter: AH=0x1D
BH=0
DS:DX=String of ASCIIZ

Return Value: None

1D Set Online/Local

Entry Parameter: AH=0x1D
BH=1
AL=0 Online
AL=1 Local

Return Value: None

1D Set Echo ON/OFF

Entry Parameter: AH=0x1D
BH=2
AL=0 Set echo ON
AL=1 Set echo OFF

Return Value: None

1D AutoLF ON/OFF

Entry Parameter: AH=0x1D
BH=3
AL=0 Set auto-line-feed ON
AL=1 Set auto-line-feed OFF

Return Value: None

(continued)

1D Mode Setup
Entry Parameter: AH=0x1D
BH=4
AL=0 Character
AL=1 Block
DX=0 Line
DX=1 Page
DX=2 Both
Return Value: None

1D Line Terminal Character
Entry Parameter: AH=0x1D
BH=5
AL = ASCII code
Return Value: None

1D Page Terminal Character
Entry Parameter: AH=0x1D
BH=6
AL = ASCII code
Return Value: None

1E Get Key Map Definition
Entry Parameter: AH=0x1E
BH=0
DS:DX = Pointer to 160 bytes buffer
Return Value: Buffer with keyboard map of 160 bytes in ASCII code corresponding to unshifted, shift 1, shift 2, shift 3, and function scan codes *(see Keypad Subsystem).*

1E Set Key Map Definition
Entry Parameter: AH=0x1E
BH=1
DS:DX = Keyboard map with 160 bytes in ASCII code corresponding to unshifted, shift 1, shift 2, shift 3, and function scan codes *(see Keypad Subsystem).*
Return Value: None

C array example of a Key Map Definition:

```
// define special keys
//
#define S1    0x0
#define S2    0x0
#define S3    0x0
#define FN    0x0

#define EXIT  0x84
#define F1    0x86
#define F2    0x87
#define F3    0x88
#define F4    0x89
#define F5    0x8A
#define F6    0x8B
#define F7    0x8C
#define F8    0x8D

#define RIGHT 0x10
#define LEFT  0x11
#define UP    0x13
#define DOWN  0x12

#define CLR   0x08
#define ENTER 0x0d

// define the actual M90 keyboard, replace all upper case with lower case
//
unsigned char keyboard[5][32] = {{
  S1,   FN,   '7',  '4',  '1',   CLR,  LEFT, F1, // none shifted
  S2,   0,    '8',  '5',  '2',   '0',  DOWN, F2,
  S3,   0,    '9',  '6',  '3',   '.',  UP,   F3,
  0,    0,    0,    0,    0,     ENTER,RIGHT,F4
  },{
  S1,   FN,   'a',  'j',  's',   CLR,  LEFT, F1, // shift 1
  S2,   0,    'd',  'm',  'v',   '*',  DOWN, F2,
  S3,   0,    'g',  'p',  'y',   '/',  UP,   F3,
  0,    0,    0,    0,    0,     ENTER,RIGHT,F4
  },{
  S1,   FN,   'b',  'k',  't',   CLR,  LEFT, F1, // shift 2
  S2,   0,    'e',  'n',  'w',   '+',  DOWN, F2,
  S3,   0,    'h',  'q',  'z',   ':',  UP,   F3,
  0,    0,    0,    0,    0,     ENTER,RIGHT,F4
  },{
  S1,   FN,   'c',  'l',  'u',   CLR,  LEFT, F1, // shift 3
  S2,   0,    'f',  'o',  'x',   '-',  DOWN, F2,
  S3,   0,    'i',  'r',  ' ',   '=',  UP,   F3,
  0,    0,    0,    0,    0,     ENTER,RIGHT,F4
  },{
  S1,   0,    0,    0,    0,     CLR,  0,    F5, // FN (shift 4)
  S2,   0,    0,    0,    0,     0,    0,    F6,
  S3,   0,    0,    0,    0,     0,    0,    F7,
  0,    0,    0,    0,    0,     ENTER,EXIT, F8
  }
};
```

1F Enable/Disable Decoding of All Bar Code Symbologies

Entry Parameter: AH=0x1F
AL=0 Disable all codes
AL=1 Enable all codes
BH=1
BL=0

Return Value: None

1F Enable/Disable the Decoding of a Bar Code Symbology

Entry Parameter: AH=0x1F
BH=1
AL=0 Disable
AL=1 Enable
BL=1 Code 39
BL=2 I 2 of 5
BL=3 Codabar
BL=4 EAN/UPC
BL=5 Code 128
BL=6 EAN 128
BL=7 Code 93
BL=9 MSI
CL *(See next note)*

Return Value: None

Note: If AL=1 and BL=1 (enable Code 39) when the **Enable/Disable the Decoding . . .** function is called, do CL=0 to disable Full ASCII decoding or CL=1 to enable Full ASCII decoding.

If AL=1 and BL=4 (enable EAN/UPC) when the **Enable/Disable the Decoding . . .** is called, do CL=0 to disable 2- or 5- digit add-on decoding; CL=1 to make 2- or 5-digit decoding optional; or CL=2 to require 2- or 5- digit decoding.

1F Get the Decoding Status of Bar Code Symbology

Entry Parameter: AH=0x1F
BH=2
BL=1 Code 39
BL=2 I 2 of 5
BL=3 Codabar
BL=4 EAN/UPC
BL=5 Code 128
BL=6 EAN 128
BL=7 Code 93
BL=9 MSI

Return Value: AL=0 Disable
AL=1 Enable
CL *(See next note)*

Note: If BL=1 (get Code 39 status) when the **Get the Decoding . . .** function is called, CL=1 is returned if Full ASCII decoding is enabled and CL=0 is returned if disabled.

If BL=4 (get EAN/UPC status) when the **Get the Decoding . . .** function is called, CL=0 (2- or 5-digit add-on) is off, CL=1 (2- or 5-digit add-on) is optional, and CL=2 (2 or 5 digits add-on) is required.

(continued)

1F Code 39 Settings

Entry Parameter:	AH=1FH		
	BH=7		
	BL=1		
	AL= Bit 0:	0	Disable Code 39 decoding
		1	Enable Code 39 decoding
	Bit 1:	0	Disable Check Digit verification
		1	Enable Check Digit verification
	Bit 2:	0	No-send Check Digit
		1	Send Check Digit
	Bit 3:	0	No-send Start/Stop characters
		1	Send Start/Stop characters
	Bit 4:	0	Full ASCII OFF
		1	Full ASCII ON
Return Value:	None		

1F Interleaved 2 of 5 Settings

Entry Parameter:	AH=1FH		
	BH=7		
	BL=2		
	AL= Bit 0:	0	Disable I 2 of 5 decoding
		1	Enable I 2 of 5 decoding
	Bit 1:	0	Disable Check Digit verification
		1	Enable Check Digit verification
	Bit 2:	0	No-send Check Digit
		1	Send Check Digit
Return Value:	None		

1F Codabar Settings

Entry Parameter:	AH=1FH		
	BH=7		
	BL=3		
	AL= Bit 0:	0	Disable Codabar decoding
		1	Enable Codabar decoding
	Bit 1:	0	Disable Check Digit verification
		1	Enable Check Digit verification
	Bit 2:	0	No-send Check Digit
		1	Send Check Digit
	Bit 3:	0	No-send Start/Stop characters
		1	Send Start/Stop characters
Return Value:	None		

1F Code 128 Setting

Entry Parameter:	AH=1FH		
	BH=7		
	BL=5		
	AL=Bit 0:	0	Disable Code 128 decoding
		1	Enable Code 128 decoding
Return Value:	None		

(continued)

1F EAN 128 Setting

Entry Parameter:	AH=1FH		
	BH=7		
	BL=6		
	AL=Bit 0:	0	Disable EAN 128 decoding
		1	Enable EAN 128 decoding
Return Value:	None		

1F Code 93 Setting

Entry Parameter:	AH=1FH		
	BH=7		
	BL=7		
	AL=Bit 0:	0	Disable Code 93 decoding
		1	Enable Code 93 decoding
Return Value:	None		

1F MSI Settings

Entry Parameter:	AH=0x1F		
	BH=7		
	BL=9		
	AL= Bit 0:	0	Disable MSI decoding
		1	Enable MSI decoding
	Bit 1:	0	Disable 2nd Check Digit
		1	Enable 2nd Check Digit
	Bit 2:	0	No-send Check Digit
		1	Send Check Digit
	Bit 4:	0	2nd Digit is MOD 10
		1	2nd Digit is MOD 11
Return Value:	None		

1F UPC-A Settings

Entry Parameter:	AH=1FH		
	BH=7		
	BL=11H		
	AL= Bit 0:	0	Disable UPC-A decoding
		1	Enable UPC-A decoding
	Bit 2:	0	No-send Check Digit
		1	Send Check Digit
	Bit 3:	0	No-send Leading Digit
		1	Send Leading Digit
Return Value:	None		

1F UPC-E Settings

Entry parameter:	AH=1FH		
	BH=7		
	BL=12H		
	AL= Bit 0:	0	Disable UPC-E decoding
		1	Enable UPC-E decoding
	Bit 2:	0	No-send Check Digit
		1	Send Check Digit
	Bit 3:	0	No-send Leading Digit
		1	Send Leading Digit
	Bit 4:	0	Disable Zero Expansion
		1	Enable Zero Expansion
Return Value:	None		

(continued)

1F EAN-13 Settings

Entry Parameter: AH=1FH
BH=7
BL=13H
AL= Bit 0: 0 Disable EAN-13 decoding
1 Enable EAN-13 decoding
Bit 2: 0 No-send Check Digit
1 Send Check Digit
Bit 3: 0 No-send Leading Digit
1 Send Leading Digit

Return Value: None

1F EAN-8 Settings

Entry Parameter: AH=1FH
BH=7
BL=14H
AL= Bit 0: 0 Disable EAN-8 decoding
1 Enable EAN-8 decoding
Bit 2: 0 No-send Check Digit
1 Send Check Digit

Return Value: None

1F Code 39 Settings

Entry parameter: AH=1FH
BH=8
BL=1

Return Value: AL=Bit 0: 0 Disable Code 39 decoding
1 Enable Code 39 decoding
Bit 1: 0 Disable Check Digit verification
1 Enable Check Digit verification
Bit 2: 0 No-send Check Digit
1 Send Check Digit
Bit 3: 0 No-send Start/Stop characters
1 Send Start/Stop characters
Bit 4: 0 Full ASCII OFF
1 Full ASCII ON

1F Interleaved 2 of 5 Settings

Entry Parameter: AH=1FH
BH=8
BL=2

Return Value: AL= Bit 0: 0 Disable I 2 of 5 decoding
1 Enable I 2 of 5 decoding
Bit 1: 0 Disable Check Digit verification
1 Enable Check Digit verification
Bit 2: 0 No-send Check Digit
1 Send Check Digit

(continued)

1F Codabar Settings

Entry Parameter: AH=1FH
BH=8
BL=3

Return Value: AL= Bit 0: 0 Disable Codabar decoding
1 Enable Codabar decoding
Bit 1: 0 Disable Check Digit verification
1 Enable Check Digit verification
Bit 2: 0 No-send Check Digit
1 Send Check Digit
Bit 3: 0 No-send Start/Stop characters
1 Send Start/Stop characters

1F Code 128 Setting

Entry Parameter: AH=1FH
BH=8
BL=5

Return Value: AL=Bit 0: 0 Disable Code 128 decoding
1 Enable Code 128 decoding

1F EAN 128 Setting

Entry Parameter: AH=1FH
BH=8
BL=6

Return Value: AL=Bit 0: 0 Disable EAN 128 decoding
1 Enable EAN 128 decoding

1F Code 93 Setting

Entry Parameter: AH=1FH
BH=8
BL=7

Return Value: AL=Bit 0: 0 Disable Code 93 decoding
1 Enable Code 93 decoding

1F UPC-A Settings

Entry Parameter: AH=1FH
BH=8
BL=11H

Return Value: AL= Bit 0: 0 Disable UPC-A decoding
1 Enable UPC-A decoding
Bit 2: 0 No-send Check Digit
1 Send Check Digit
Bit 3: 0 No-send Leading Digit
1 Send Leading Digit

1F UPC-E Settings

Entry parameter: AH=1FH
BH=8
BL=12H

Return Value: AL= Bit 0: 0 Disable UPC-E decoding
1 Enable UPC-E decoding
Bit 2: 0 No-send Check Digit
1 Send Check Digit
Bit 3: 0 No-send Leading Digit
1 Send Leading Digit
Bit 4: 0 Disable Zero Expansion
1 Enable Zero Expansion

(continued)

1F EAN-13 Settings

Entry Parameter: AH=1FH
BH=8
BL=13H

Return Value: AL= Bit 0: 0 Disable EAN-13 decoding
1 Enable EAN-13 decoding
Bit 2: 0 No-send Check Digit
1 Send Check Digit
Bit 3: 0 No-send Leading Digit
1 Send Leading Digit

1F EAN-8 Settings

Entry Parameter: AH=1FH
BH=8
BL=14H

Return Value: AL= Bit 0: 0 Disable EAN-8 decoding
1 Enable EAN-8 decoding
Bit 2: 0 No-send Check Digit
1 Send Check Digit

25 Set Interrupt Vector

Entry Parameter: AH=0x25
AL=Interrupt number
DS:DX=Address of interrupt routine

Return Value: None

2A Get System Date

Entry Parameter: AH=0x2A

Return Value: CX=Year (1980 through 2079)
DH=Month (1–12)
DL=Day (1–31)
AL=Day of week (0–6)

2B Set System Date

Entry Parameter: AH=0x2B
CX=Year (1980 through 2079)
DH=Month (1–12)
DL=Day (1–31)

Return Value: AL=0 OK
AL=FFH Input parameter error

2C Get System Time

Entry Parameter: AH=0x2C

Return Value: CH=Hour (0–23)
CL=Minutes (0–59)
DH=Seconds (0–59)
DL=1/100th of a second (0–99)

2D Set System Time

Entry Parameter: AH=0x2D
CH=Hour (0–23)
CL=Minutes (0–59)
DH =Seconds (0–59)

Return Value: AL=0 OK
AL=FFH Input parameter error

(continued)

2E Set Alarm Date

Entry Parameter: AH=0x2E
AL=0 Disable alarm
AL=1 Enable Every Day/Time type alarm
AL=2 Enable Specific Date/Time type alarm
If AL=2
CX=Year (1980 through 2079)
DH=Month (1–12)
Dl=Day (1–31)

Return Value: AL=0 OK
AL=FFH Setting error

2F Set Alarm Time

Entry Parameter: AH=0x2F
CH=Hour (0–23)
CL=Minutes (0–59)
DH=Seconds (0–59)

Return Value: AL=0 OK
AL=FFH Input parameter error

30 Get M90 DOS Version Number

Entry Parameter: AH=0x30

Return Value: AL=2
AH=0
CL=Major firmware version number
CH=Minor firmware version number

Note: "Major" indicates the prefix in the version number and "Minor" indicates the suffix in the version number (i.e. ".YY"). For example, "X.YY" has "X" for the major version number and "YY" for the minor version number.

35 Get Interrupt Vector

Entry Parameter: AH=0x35
AL=Interrupt number

Return Value: ES:BX=Address of interrupt routine

36 Get Free Disk Cluster

Entry Parameter: AH=0x36

Return Value: AX=1 (Number of sectors per cluster)
BX=Number of available clusters
CX=1024 (Number of bytes per sector)
DX=Number of total clusters in RAM disk

37 Set EXEC Memory Size

Entry Parameter: AH=0x37
AL=0
DX=size in KB 1-488

Return Value: AL=0 OK
AL=1 Error

37 Get EXEC Memory Size

Entry Parameter: AH=0x37
AL=1

Return Value: AX=Current EXEC memory size in KB
CX=Maximum KB EXEC memory size

(continued)

3C Create or Truncate a File

When a file is opened, the file manager searches the file table for a match. If a match is found, the corresponding file handle is returned and the current pointer resets to the beginning of the file. The actual file is reset to zero. If the file does not exist in the file table, a file entry is allocated and memory is assigned.

Entry Parameter: AH=0x3C
DS:DX=Segment:offset of filename

Return Value: 1) AX=Handle Clear carry flag if successful
2) AX=3 Set carry flag if failed

3D Open a File

Entry Parameter: AH=0x3D
AL=0 Open a file for read only
AL=1 Open a file for write only
AL=2 Open a file for read and write
DS:DX=Segment:offset of filename

Return Value: 1) AX=Handle Clear carry flag if successful
2) AX=2 Set carry flag if failed

3E Close a File

Entry Parameter: AH=0x3E
BX=File handle

Return Value: If successful, carry flag is cleared
If not successful, carry flag is set

3F Read a File

Copy (CX) bytes from current address to DS:DX. Advance the current address (CX) number of bytes.

Entry Parameter: AH=0x3F
BX=File handle
CX=Number of bytes to read
DS:DX=Segment: offset of buffer area

Return Value: 1) AX=Number of bytes read, 0 if EOF,
Clear carry flag if successful
2) AX=6 Set carry flag if failed

40 Write a File

Copy (CX) bytes from DS:DX to file (BX). Update BX current address and ending address.

Entry Parameter: AH=0x40
BX=File handle
CX=Number of bytes to write
DS:DX=Segment: offset of buffer area

Return Value: 1) AX=Number of bytes written, 0 if full,
Clear carry flag if successful
2) AX=6 Set carry flag if failed

41 Delete a File

Entry Parameter: AH=0x41
DS:DX=Segment: offset of filename

Return Value: 1) Clear carry flag if successful
2) AX=2 Set carry flag if failed

(continued)

42 Move File Pointer

Entry Parameter: AH=0x42
AL=0 Offset from beginning position
AL=1 Offset from current position
AL=2 Offset from end position
BX=File handle
CX=Most significant half of offset
DX=Least significant half of offset

Return Value: 1) AX= Least significant half of new current position
DX= Most significant half of new current position
Clear carry flag if successful
2) AX=6 Set carry flag if failed

42 Search Character Beginning at the Current File Position

Entry Parameter: AH=42H
AL= 3 Search forward (to end of file)
4 Search backward (to top of file)
BX=File handle
CX=n Search nth matched character
DL=Character

Return Value: 1) If character is found:
Carry flag=Clear
DX:AX=Pointer to current file position (at position of matched character)
2) If character is not found:
Carry flag=Set
CX=Total matched times
DX:AX=Pointer to current file position (not changed)

(continued)

42 Search String in Formatted Data File Beginning at Current Position

Entry Parameter: AH=42H
AL= 5 Search forward (to end of file)
6 Search backward (to beginning of file)
BX=File handle
CH=n Total field number in data record
CL=m Search mth field
DS:DX=Pointer to parameter block

Structure of parameter block for variable-length record:

String length:	1 byte
String without "\0" terminator:	N bytes
0x00	1 byte
Custom field separator character:	1 byte

Structure of data block for variable-length record:

Data field #1:	X1 bytes
0x00	1 byte
Custom field separator character:	1 byte
Data Field #2:	X2 bytes
0x00	1 byte
Custom field separator character:	1 byte
. .	
. .	
. .	
Data field #n:	Xn bytes
0x00	1 byte
0x0d	1 byte
0x0a	1 byte

Structure of parameter block for fixed-length record:

String length:	1 byte
String without "\0" terminator:	N bytes
Field #1 length:	1 byte
Field #2 length:	1 byte
. .	
. .	
. .	
Field #n length:	1 byte

Structure of data block for fixed-length record:

Field #1:	
Field #2:	
. .	
. .	
. .	
Field #n	
0x0d	1 byte
0x0a	1 byte

Return Value: 1) If string is found: Carry flag=Clear
DX:AX=Pointer to current file position (at beginning of matched string)
2) If string is not found: Carry flag=Set
DX:AX=Pointer to current file position (not changed)

Note: Both fixed and variable length records require a CR/LF record terminator as shown in the data record definitions.

(continued)

42 Insert/Delete Data Block to/from File at Current Position

Entry Parameter: AH=42H
AL=7 Insert
8 Delete
BX=File handle
CX=Block length in bytes

Return Value: 1) If the function is successful:
Carry flag=Clear
DX:AX=Pointer to current file position (not changed)
2) If the function fails:
Carry flag=Set
DX:AX=Pointer to current file position (not changed)

Note: For insertion, the content of the inserted data block is undefined.

43 Get File Attribute

Entry Parameter: AH=0x43
AL=0
DS:DX=Segment: offset of filename

Return Value: 1) CX=0 Clear carry flag if file found
2) AX=2 Set carry flag if file not found

44 Device-Driver Control IOCTL

Entry Parameter: AH=0x44
AL=0 Getting device information
AL=1 Setting device information
BX=Handle
DX=Device information

Return Value: 1) DX=Device information
Clear carry flag if successful
2) AX=6
Set carry flag if failed

44 Device-Driver Control IOCTL

Entry Parameter: AH=0x44
AL=2 Read to buffer
AL=3 Write buffer to device
BX=Handle
CX=Number of bytes to read or write
DS:DX=Segment: offset of buffer area

Return Value: 1) AX=Number of bytes transferred
Clear carry flag if successful
2) AX=6
Set carry flag if failed

44 Device-Driver Control IOCTL

Entry Parameter: AH=0x44
AL=6 Get input status
AL=7 Get output status
BX=Handle

Return Value: 1) AL=0 if not ready
AL=0xFF if ready
Clear carry flag if successful
2) AX=6
Set carry flag if failed

(continued)
48 Allocate Specified Number of Paragraphs in Memory Entry Parameter: AH=0x48 BX=Number of segments Return Value: AX=Segment address of allocate blocks, Error code, if carry flag BX=Largest available block (on failure)
49 Free Allocated Memory Entry Parameter: AH=0x49 ES=Segment of block to free Return Value: AX=Error code if carry flag set
4A Modify Allocated Block Entry Parameter: AH=0x4A ES=Segment of the block modified BX=New number of segments wanted Return Value: AX=Error code, if carry flag is set BX=Largest available block (on failure), if carry flag is set
4B Call Application Program Entry Parameter: AH=0x4B AL=0 DS:DX=String of ASCIIZ Return Value: Carry flag = 0 (Success) 1 (Fail)
4B Run Application Program Entry Parameter: AH=0x4B AL=3 DS:DX=String of ASCIIZ Return Value: Carry flag = 0 (Success) 1 (Fail)

(continued)

50 Get Bar Code Data from Scanner Port

Entry Parameter: AH=0x50
DS:DX=Buffer pointer

Return Value: 1) AL=0 Data in buffer

CH=	0	Scan from start to stop
	1	Scan from stop to start
CL=	1	Code 39
	2	I 2 of 5
	3	Codabar
	4	EAN/UPC
	5	Code 128
	6	EAN 128
	7	Code 93
	9	MSI
BL=	1	Code 39
	2	Interleaved 2 of 5
	3	Codabar
	4	EAN/UPC
	5	Code 128
	6	EAN 128
	7	Code 93
	9	MSI
	11H	UPC-A
	12H	UPC-E
	13H	EAN-13
	14H	EAN-8

2) AL=1 No data input
CL=0 No failed decoding since last function call
CL=1 Failed decoding since last function call

Note: If the M90 is equipped with a second-generation inbuilt CCD scanner, the return value of CH will always be a zero as bar code decoding is done within the CCD scanner and scan direction is not supplied to the bar code decoder in the M90.

51 Enable or Disable Scanner Port

Entry Parameter: AH=0x51
AL=0 Disable scanner port
AL=1 Enable scanner port

Return Value: None

56 Rename a File

Entry Parameter: AH=0x56
DS:DX=Pointer to a filename
ES:DI=Pointer to new filename

Return Value: Clear carry flag if successful
AH=2 if carry flag is set

5B Create New File

Entry Parameter: AH=5BH
DS:DX Pointer to file name string

Return Value: If successful: Carry flag is cleared
AX=File Handle
If not successful: Carry flag is set
AX=04H Too many open files
50H File exists

Note: If the specified file already exists, the **Create New File** function fails.

Implemented DOS Functions (INT 21h)

Function	Description	Comment
00h	Terminate Program	
01h	Read Stdin	
02h	Write Stdout	
03h	Read Stdaux	
04h	Write Stdaux	
06h	Write Stdout	
07h	Read Stdin	
08h	Read Stdin	
09h	Write Character String	
0Bh	Keyboard Hit	
1Ah	Device Configuration	M90 special
1Ch	Communication Configuration	M90 special
1Dh	Terminal Configuration	M90 special
1Eh	Keyboard Configuration	M90 special
1Fh	Bar Code Control	M90 special
25h	Set Interrupt Vector	
2Ah	Get System Date	
2Bh	Set System Date	
2Ch	Get System Time	
2Dh	Set System Time	
2Eh	Set Alarm Date	M90 special
2Fh	Set Alarm Time	M90 special
30h	Get M90 Version Number	
35h	Get Interrupt Vector	
36h	Get Free Disk Clusters	
37h	Get/Set EXEC size	M90 special
3Ch	Create File	
3Dh	Open File	
3Eh	Close File	
3Fh	Read File	
40h	Write File	
41h	Delete File	
42h	Move File Pointer	
43h	Get File Attribute	
44h	Device IOCTL	Only Console I/O supported
48h	Allocate Memory	
49h	Free Allocated Memory	

Implemented DOS Functions (INT 21h) (continued)

Function	Description	Comment
4Ah	Modify Allocated Memory	
4Bh	Execute or Call Program	
4Ch	Terminate Process	
50h	Get Bar Code Data	M90 special
51h	Bar Code Port ON or OFF	M90 special
56h	Rename File	
5Bh	Create New File	

Note: All of these INT 21h functions are compared to INT 21h functions in DOS 3.

Unsupported DOS Functions (INT 21h)

Function	Description
0Ch	Flush Buffer, Read Keyboard
0Dh	Disk Reset
0Eh	Select Disk
0Fh	Open File (FCB)
10h	Close File (FCB)
11h	Find First File (FCB)
12h	Find Next File (FCB)
13h	Delete File (FCB)
14h	Sequential Read (FCB)
15h	Sequential Write (FCB)
16h	Create File (FCB)
17h	Rename File (FCB)
19h	Get Current Disk
1Ah	Set DTA Address
1Bh	Get Default Drive Data
1Ch	Get Drive Data
21h	Random Read (FCB)
22h	Random Write (FCB)
23h	Get File Size (FCB)
24h	Set Relative Record (FCB)
26h	Create New PSP
27h	Random Block Read (FCB)
28h	Random Block Write (FCB)
29h	Parse Filename
2Fh	Get DTA Address

Unsupported DOS Functions (INT 21h) (continued)

Function	Description
31h	TSR
33h	Get or Set Ctrl-C Check
34h	Get Addr of InDOS Flag
38h	Get or Set Country
39h	Create Directory
3Ah	Remote Directory
3Bh	Change Current Directory
45h	Duplicate File Handle
46h	Force Duplicate File Handle
47h	Get Current Directory
4Dh	Get Return Code
4Eh	Find First File
4Fh	Find Next File
54h	Get Verify File
57h	Get or Set Date and Time of File

BIOS Call

Display Font Functions: INT 09H

0 Select Large Font
Entry Parameter: AH=0 8x16-dot character font (4-line x 12-column display)
Return Value: None

1 Select Small Font
Entry Parameter: AH=1 6x8-dot character font (8-line x 16-column display)
Return Value: None

2 Set Font Type
Entry Parameter: AH=2
AL=0 Set to large font
AL=1 Set to small font
Return Value: None

3 Get Font Type
Entry Parameter: AH=3
Return Value: AL=0 Large font
AL=1 Small font

4 Set User-Defined Font for All Characters
Entry Parameter: AH=4
AL=0 Large font
AL=1 Small font
DS:DX=Pointer to buffer with font data
(for large font: buffer size=16x256 =4096 bytes)
(for small font: buffer size= 6x256 =1536 bytes)
Return Value: None

(continued)
5 Get Font Data for All Characters Entry Parameter: AH=5 AL=0 Large font AL=1 Small font DS:DX=Pointer to the buffer (for large font: buffer size=16x256 =4096 bytes) (for small font: buffer size= 6x256 =1536 bytes) Return Value: Font data in the buffer
6 Set User-Defined Font for One Character Entry Parameter: AH=6 AL=0 Large font AL=1 Small font CL=0–255 character DS:DX=Pointer to buffer with font data (for large font: buffer size=16 bytes) (for small font: buffer size=6 bytes) Return Value: None
7 Get Font Data for One Character Entry Parameter: AH=7 AL=0 Large font AL=1 Small font CL =0–255 characters DS:DX=Pointer to the buffer (for large font: buffer size=16 bytes for small font: buffer size=6 bytes) Return Value: Font data in the buffer

Implemented BIOS Functions (INT 09h)

Function	Description	Comment
00h	Select Large Font	M90 special
01h	Select Small Font	M90 special
02h	Set Font Type	M90 special
03h	Get Font Type	M90 special
04h	Set User-Defined Font for All Characters	M90 special
05h	Get Font Data for All Characters	M90 special
06h	Set User-Defined Font for One Character	M90 special
07h	Get Font Data for One Character	M90 special

Kermit Function: INT 0x0F

0 Kermit Application Invoke
Entry Parameter: AH=0
Return Value: None
Note: To exit Kermit, send command "BYE" to M90 or press [4].

Implemented Kermit Functions (INT 0x0f)

Function	Description	Comment
00h	Kermit Application Invoke	M90 special

LCD Function: INT 10H

Use the following ESC command to save the screen to a buffer before the display is erased. This subsequently allows data to restore from the buffer.

ESC buffer-segment buffer-offset z [

To restore the screen from the buffer after the display is erased, use the following command:

ESC buffer-segment buffer-offset x [

Example

To save a screen to RAM address 4660 (hex 0x1234): 22135 (hex 0x5678), use the following C code. The buffer size is 65*17+8 bytes.

```
unsigned char cmd[8];
cmd[0]=0x1B;
cmd[1]=0x12;
cmd[2]=0x23;
cmd[3]=0x56;
cmd[4]=0x78;
cmd[5]='z';
cmd[6]='[';
cmd[7]='\0';
printf("%s", cmd);
```

0 Clear LCD Screen
Entry Parameter: AH=0
Return Value: None

1 Enable/Disable Scroll
Entry Parameter: AH=1
AL=0 Disable
AL=1 Enable
Return Value: None

2 Set Cursor Position
Entry Parameter: AH=2
DH=0-7 (Row)
DL=0-19 (Column)
Return Value: None

(continued)

3 Get Cursor Position
Entry Parameter: AH=3
Return Value: DH=0-7 (Row)
DL=0-19 (Column)

4 Display 5x8 Bit Map Pattern Font
Entry Parameter: AH=4
DH=0-7 (Row)
DL=0-19 (Column)
DS:BX=Pattern data (5 bytes)
Return Value: None

5 Enable/Disable Cursor
Entry Parameter: AH=5
AL=0 Disable
AL=1 Enable
Return Value: None

6 Set Cursor Shape
Entry Parameter: AH=6
AL=0 Block
AL=1 Underline
Return Value: None

7 Set Display Size
Entry Parameter: AH=7
AL=0 4x20 character display
AL=1 6x20 character display
Return Value: None
Note: Both the 4x20 character display and 6x20 character display are M80 compatible.

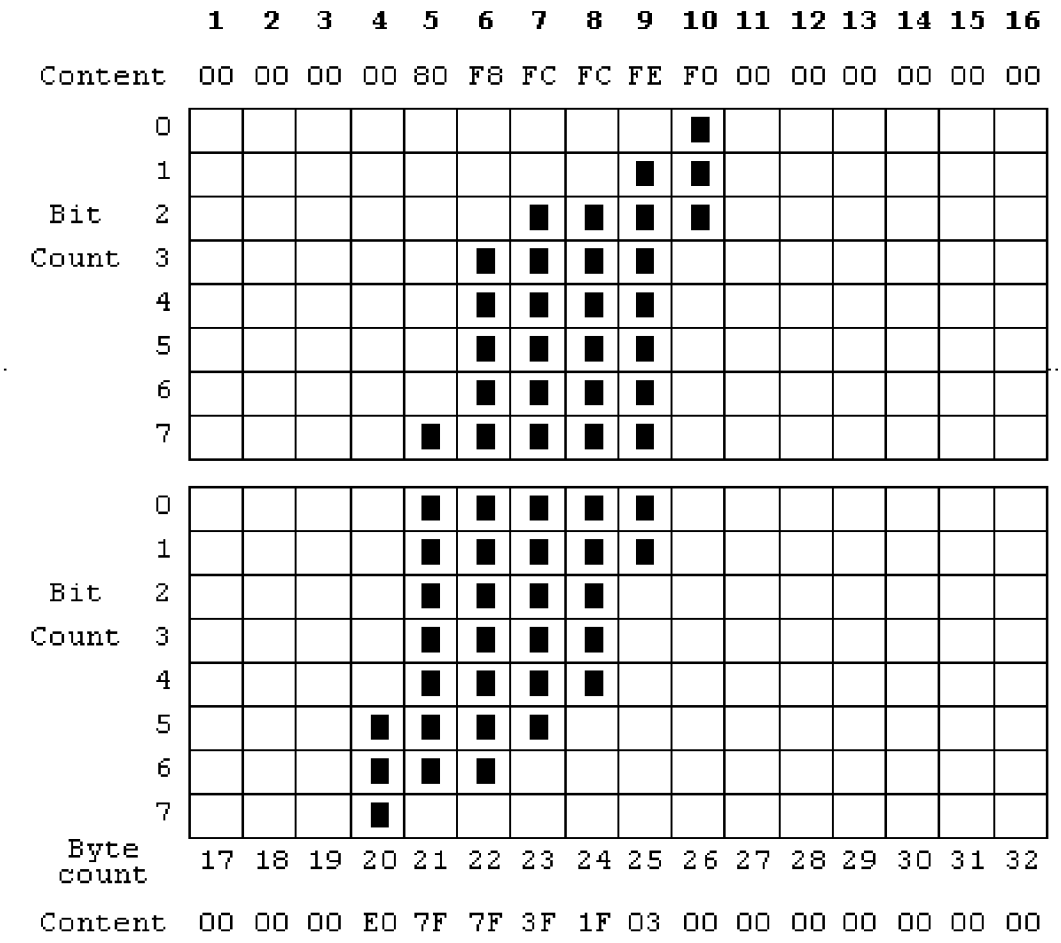
8 Get Display Size
Entry Parameter: AH=8
Return Value: AL=0 4x20 character display
AL=1 6x20 character display
Note: Both the 4x20 character display and 6x20 character display are M80 compatible.

9 Enable/Disable Power-on Logo Display
Entry Parameter: AH=9
AL=0 Disable
AL=1 Enable
Return Value: None

A Display Character
Entry Parameter: AH=0AH
AL=0–255 character to display
Return Value: None

4F Display 16x16 Bitmap at Current Cursor Position
Entry Parameter: AH=4FH
DS:BX=Pointer to bitmap (32-byte pattern data)
Return Value: None

Note: Function 4F is available only in large font, the bit map is twice as wide as two normal characters. Consider this when mixing bit maps and characters and when setting cursor positions.



Sample Bit Map

C string example of above bit map:

```
Unsigned char
logo[32]=  {0x00,0x00,0x00,0x00,0x80,0xf8,0xfc,0xfc,0xfe,0x0f,0x00,0x00,0x00,
0x00,0x00,
           0x00,0x00,0x00,0x00,0xe0,0x7f,0x7f,0x3f,0x1f,0x03,0x00,0x00,0x00,0
x00,0x00,
           0x00,0x00};
```

Note: User Menu/Set/Cursor also sets the cursor shape.

Implemented BIOS Functions (INT 10h)

Function	Description	Comment
00h	Clear LCD Screen	M90 special
01h	Enable or Disable Scroll	M90 special
02h	Set Cursor Position	
03h	Get Cursor Position	
04h	Display 8x5 bit font	M90 special
05h	Enable or Disable Cursor	M90 special
06h	Set Cursor Shape	M90 special
07h	Set Display Size	M90 special
08h	Get Display Size	M90 special
09h	Enable/Disable Power-on Logo	M90 special
0ah	Display Character	
4fh	Display 16x16 bit bitmap at Current Cursor	M90 special

Power Management Function: INT 22H

0 Power Off
Entry Parameter: AH=0
Return Value: None

1 Wait Interrupt — Input Data
Entry Parameter: AH=1
Return Value: AL=0 Keypad
AL=1 Scanner
AL=2 RS-232 receiver
AL=3 Other or user-defined interrupts
AL=4 Power-on

Note: This function does not check system input-data buffers. It waits for interrupts and new input data. M90 shuts off according to system settings if there is no data input during the auto-off time period.

2 Wait Interrupt — Input Data with Buffer Check
Entry Parameter: AH=2
Return Value: AL=(bit sets)
Bit 0: Keypad
Bit 1: Scanner
Bit 2: RS-232 receiver
Bit 3: Other or user-defined interrupts
Bit 4: Power-on

Note: If there is input data in the system buffers, this function returns directly. Otherwise, it waits for interrupts and new input data. M90 shuts off according to system settings if there is no data input during the auto-off time period.

(continued)

3 Wait Interrupt — Input Data with Timeout

Entry Parameter: AH=3
CX=Timeout 10-30,000 ms

Return Value:
- AL=0 Keypad
- AL=1 Scanner
- AL=2 RS-232 receiver
- AL=3 Other or user-defined interrupts
- AL=4 Power-on
- AL=5 Timeout

Note: This function does not check system input data buffers. It waits for interrupts and new input data. M90 shuts off according to system settings. The function returns after the specified timeout period if no data event has occurred within the timeout.

4 Wait Interrupt — Input Data with Buffer Check and Timeout

Entry Parameter: AH=4
CX=Timeout 10-30,000 ms

Return Value: AL=(bit sets)
- Bit 0: Keypad
- Bit 1: Scanner
- Bit 2: RS-232 receiver
- Bit 3: Other or user-defined interrupts
- Bit 4: Power-on
- Bit 5: Timeout

Note: This function does check system input data buffers. If there is input data in the system buffers, the function returns directly. Otherwise, it waits for interrupts and new input data. M90 shuts off according to system settings. The function returns after the specified timeout period if no data event has occurred within the timeout.

Beeper Frequency and Time Control: INT 31H

Entry Parameter: AX=Frequency
BX=Time duration

Return Value: None

AX	Frequency (Hz)	BX	Time Duration
0	200	0	10 ms
1	400	1	50 ms
2	600	2	100 ms
3	800	3	200 ms
4	1K	4	500 ms
5	2K	5	800 ms
6	2.5K	6	1 second
7	3K	7	1.5 seconds
8	5K	8	2 seconds

Implemented BIOS Functions (INT 31h)

Function	Description	Comment
(Not applicable)	Beeper fruequency and Time Control	Added function

RS-232 Function: INT 33H

0 Set Communication Parameters

Entry Parameter: AH=0

AL Bits 7–4: 0001xxxx Baud 150
0010xxxx Baud 300
0011xxxx Baud 600
0100xxxx Baud 1200
0101xxxx Baud 2400
0110xxxx Baud 4800
0111xxxx Baud 9600
1000xxxx Baud 19200
1001xxxx Baud 38400
1010xxxx Baud 57600

Bits 3–2: xxxx00xx No parity
xxxx01xx Odd parity
xxxx11xx Even parity

Bit 1: xxxxxx0x One stop bit
xxxxxx1x Two stop bits

Bit 0: xxxxxxx0 7 data bits
xxxxxxx1 8 data bits

Return Value: None

1 Input Character

Entry Parameter: AH=1

Return Value: If no character received:
AH=1
AL=Unpredictable
If a character received:
AH=0
AL=Character input

2 Output Character

Entry Parameter: AH=2
AL=Character output

Return Value: None

3 Enable RS-232 Port

Entry Parameter: AH=3

Return Value: None

4 Disable RS-232 Port

Entry Parameter: AH=4

Return Value: None

5 Set RTS/DTR

Entry Parameter: AH=5

AL= Bit 0: 0 Set RTS low level
1 Set RTS high level

Bit 1: 0 Set DTR low level
1 Set DTR high level

Return Value: None

(continued)

6 Get RS-232 Hardware Status

Entry Parameter: AH=6

Return Value: AL= Bit 0: 0 Get RTS low level
1 Get RTS high level
Bit 1: 0 Get DTR low level
1 Get DTR high level
Bit 2: 0 Get OUT0 low level
1 Get OUT0 high level
Bit 3: 0 Get CTS low level
1 Get CTS high level
Bit 4: 0 Get DSR low level
1 Get DSR high level
Bit 5: 0 Get RI low level
1 Get RI high level
Bit 6: 0 Get DCD low level
1 Get DCD high level

Note: Bit 4 (DSR) always returns high and Bit 6 (DCD) always returns low. If **Function 6** is called when the M90 is connected via the direct connect cable, Bit 5 (RI) is undefined as the RI signal is not present in the Modular connector at the bottom of the M90.

7 Set OUT0 Signal

Entry Parameter: AH=7
AL=0 Set OUT0 signal in Modular 10-pin connector to low
AL=1 Set OUT0 signal in Modular 10-pin connector to high

Return Value: None

Implemented BIOS Functions (INT 33h)

Function	Description	Comment
00h	Set Communication Parameters	Added function
01h	Input RS-232 character	Added function
02h	Output RS-232 character	Added function
03h	Enable RS-232 port	Added function
04h	Disable RS-232 port	Added function
05h	Set RTS/DTR	Added function
06h	Get RS-232 hardware status	Added function
07h	Set OUT0 signal in Modular 10-pin connector	Added function

A Connector Pin Assignments

This appendix includes a table for the 10-pin modular connector.

10-Pin Modular Connector

Pin#	Signal	Direction	Description
1	DC 9 V	Power	9-volt charge power
2	TXD	Output	Transmitted Data
3	RXD	Input	Receive Data
4	I/O 5 V	Power	Regulated 5-volt max 100 mA
5	GND	Power	Ground
6	DTR	Output	Data Terminal Ready
7	CTS	Input	Clear to Send
8	RTS	Output	Request to Send
9	WANDSIG1	Input	Wand input
10	OUT0	Output	Digital OUT0 signal

B Programming Applications

The M90 provides a utility for putting application programs into the system Read-Only Memory (ROM) area. Once in the ROM, the programs become user-resident applications in the M90 system. The advantage of the user-resident application is that they do not have to download from a host computer through M90 RS-232 port and cannot delete accidentally. It can also save the Random Access Memory (RAM) space for the system. Up to eight user-resident applications can be in the M90, with the total file size less than or equal to 128 KB.

The M90 system EXEC job scheduler supports the user-resident application. The ROM resident user applications must be of *.EXE type. The system does not allow data files. EXEC searches user-resident applications first when a RUN command executes. If there is an AUTOEXEC.EXE user-resident application, it runs after power-on when the M90 is in Ready Mode.

To add a program to the ROM disk, download the program to the RAM disk as described later in this appendix, then start the M90 in the Supervisor Mode. Select **System** > **Programming** > **Add Program**. Adding a program is fully described on page 38.

Note: As this requires reprogramming of the FLASH in the M90, make sure that either the M90 battery is fully charged or that the M90 is on charge (office dock). A power failure during flash programming could corrupt the FLASH. If this occurs, you must have the M90 FLASH EEPROM replaced at a service center.

Reprogramming the M90 Flash

The following steps explain how to update the existing flash program in the M90. You can update the M90 Flash to a new version.

Download the new flash to the M90 RAM disk, then start the M90 in Supervisor Mode. Select **System** > **Programming** > **Update Flash** (see page 40).

Note: As this requires reprogramming of the FLASH in the M90, make sure that either the M90 battery is fully charged or that the M90 is on charge (office dock). A power failure during flash programming could corrupt the FLASH. If this occurs, have the FLASH EEPROM replaced at a service center.

Download Application or BIOS to M90

Set Up M90

Downloading from Host Computer

Connect the host personal computer (PC) to the M90 unit with a serial null modem cable. Select "COM" in the User Mode and the M90 enters the Kermit server mode with default communication parameters 19200 bps, 8 bit, 1 stop, no parity, and no flow control.

Kermit Communications Program

To set up the PC to talk to the M90 unit using a Kermit communications program, consult your manual for the Kermit communications program.

Windows Hyper Terminal Method

If you are using Hyper Terminal on a Windows 2000 PC, do as follows to download a file to the M90. Hyper Terminal is not optimized for large files or for daily use in an application, but is an easier method of downloading files to the M90 as compared to the Kermit method.

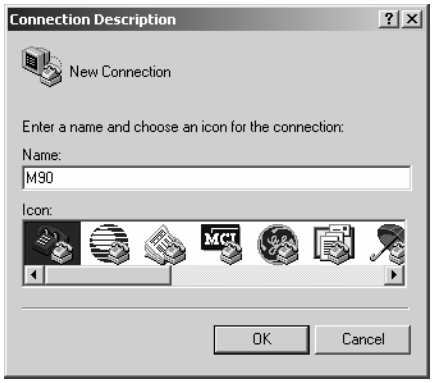
Note: Tool icons are shown to the left of related menu options.

Set Up Host Computer

To set up the host computer:

1 From the Windows desktop, select **Start** > **Programs** > **Accessories** > **Communications** > **HyperTerminal**.

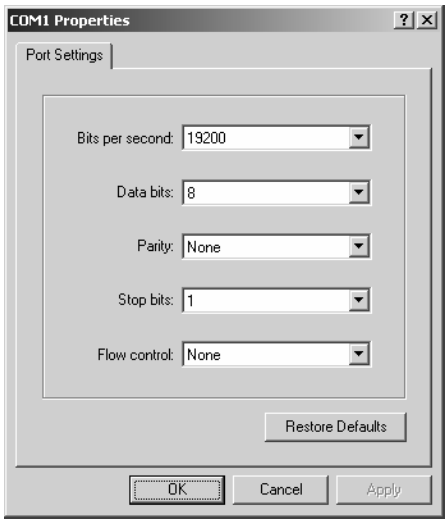
2 Enter a descriptive title for this connection in **Name**, such as "M90," and select an icon from **Icon** to illustrate this connection.



3 Click **OK** to continue to Connect To. Select the applicable COM option from **Connect using**, then click **OK** to continue.

4 Use the applicable COM Properties to set up the proper port settings.

- Set **Bits per second** to "19200."
- Set **Flow control** to "None."

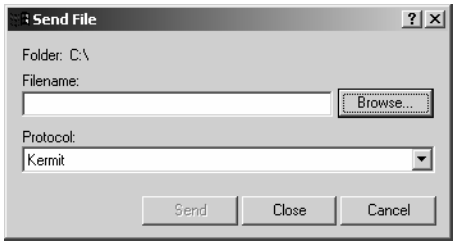


5 Click **OK**. A communications icon appears for this connection within the Hyper Terminal directory.

Set Up Protocol Via Hyper Terminal

Double-click the communications icon to access Hyper Terminal.

1 From the Hyper Terminal title bar, select **Transfer** > **Send File** to access Send File.



2 Select "Kermit" from **Protocol**, then click **Close** to exit.

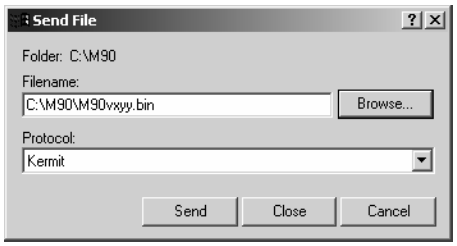
3 From Hyper Terminal, select **File** > **Save** to quit.

The host computer is now ready to send and receive files. Your connection is saved, for later use, under the name and icon created.

Download M90VXYY.BIN to the M90

Do the following to download files from the host computer to the M90. Repeat these steps for each file to download:

1. From Hyper Terminal, select **Transfer** > **Send File** to access Send File.
2. Click **Browse** to access Select File to Send and locate the directory that contains files for the M90.
3. Select M90VXYY.BIN, then click **Open** to access Send File.
4. M90VXYY.BIN should appear in **Filename** in Send File. If not, go back to the Select File to Send and select M90VXYY.BIN again.



5. Click **Send** to download M90VXYY.BIN to the M90. Kermit file send to M90 appears with the progress of the file transmission.
   - If the file is sent successfully, the status screen disappears.
   - If the transmission fails, the following Sending Files message appears. Click **OK** to quit, then try to send M90VXYY.BIN again. Likely problems could include faulty baud rate settings or cable connections.

6. From the M90, press and release [**FN**] and press ▶ to exit Server Mode and return to Ready Mode.
7. Type "DIR" at the prompt, then press [**ENT SCAN**] for a list of files. Ensure that M90VXYY.BIN is listed.

   If not listed, go to page 85 to download the program again.

   If listed, you may want to review the Hyper Terminal settings, instructions start on the next page.

Review Hyper Terminal Settings

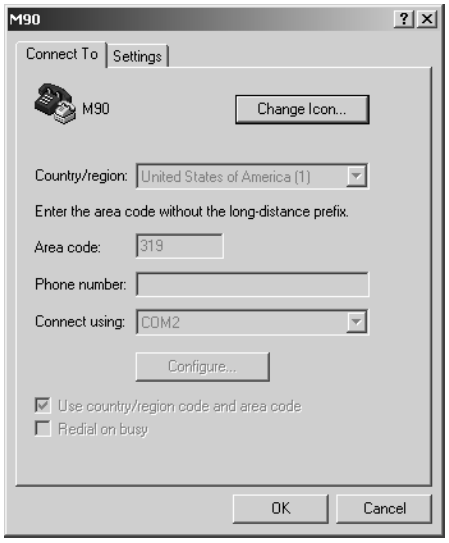
Do the following to change or view the Hyper Terminal settings:

1 From the Windows desktop, right-click the **My Computer** icon, then select **Explore**.

2 Select "C:\Document & Settings\<your computer>\Start Menu\Programs\Accessories\Communications\HyperTerminal."

3 Double-click the communications icon for Hyper Terminal.

4 From Hyper Terminal, select **File** > **Properties** to access the Properties.



5 Change the icon with **Change Icon**.

Click **OK** to save changes or click **Cancel** to quit this screen without saving changes.

C Bar Code Symbologies

This appendix contains a brief explanation of each bar code symbology that the M90 portable data entry unit decodes. It explains some of the general characteristics and uses of these bar code types.

Bar Code Algorithms

You can enable specific bar code algorithms using the setup menus or the host computer. Once the computer correctly decodes a bar code, the computer encodes data with descriptive information about the symbol. Response time is improved by limiting the computer to bar codes being used.

Bar Code Data String Formats

Bar Code Type Character	Symbology Type	Data Format	Data Length
"0"	UPC short (UPC-E)	ndddddddc	8
"1"	EAN short (EAN-8)	fnddddddc	8
"2"	UPC long (UPC-A)	nddddddddddc	12
"3"	EAN long (EAN-13)	fnddddddddddc	13
"4"	UPC short add-on 2	ndddddddcaa	10
"5"	EAN short add-on 2	fnddddddcaa	10
"6"	UPC long add-on 2	nddddddddddcaa	14
"7"	EAN long add-on 2	fnddddddddddcaa	15
"8"	UPC short add-on 5	ndddddddcaaaaa	13
"9"	EAN short add-on 5	fnddddddcaaaaa	13
":" (colon)	UPC long add-on 5	nddddddddddcaaaaa	17
";" (semicolon)	EAN long add-on 5	fnddddddddddcaaaaa	18
"<" (less than)	Interleaved 2 of 5	d.....d	Scan device dependent
">" (greater than)	MSI (Plessey)	d.....dc	Scan device dependent
"@" (ampersand)	Codabar	sd....ds	Scan device dependent
"P"	Code 39	d.....d	Scan device dependent
"R"	Code 93	d.....d	Scan device dependent
"J"	Code 128	d.....d	Scan device dependent
"J"	EAN 128	d.....d	Scan device dependent

Note: These bar code data definitions apply to the Data Format column in the previous table:

- a Add-on code digits
- c Check digits
- d Bar code digits
- f EAN flag 1 characters
- n Number system digits
- s Start and stop digits

If MOD 10 or MOD 11 check digits are enabled, the digit falls at the end of a bar code data string. Each check digit enabled extends the bar code data string length by one character.

The M90 unit recognizes eight of the most widely used bar code symbologies. With bar code symbologies, like languages, there are many different types. A bar code symbology provides the required flexibility for a particular inventory tracking system.

A symbology may be for particular industries, such as food and beverage, automotive, railroad, or aircraft. Some of these industries have established their own bar code symbology because other symbologies did not meet their needs.

Without going into great detail on the bar code structure, note that no two products use the same bar code. Each product gets a unique bar code.

Industries that use a particular type of bar code symbology have formed regulating committees or are members of national institutes that issue and keep track of bar codes. This ensures that each organization that contributes to a particular industry conforms to its standard. Without some form of governing body, bar coding would not work.

These are the bar codes described in this appendix:

- UPC (Universal Product Code) with/without add-ons
- EAN (European Article Numbering Code) with/without add-ons
- Codabar
- C39 (Code 39)
- C93 (Code 93)
- C128 (Code 128)
- I 2 of 5 (Interleaved 2 of 5 Code)
- MSI (a variant of Plessey)

UPC

The UPC (Universal Product Code) is the symbology used throughout the grocery and retail industries. This bar code symbology contains two pieces of numerical information encoded on the bar code, producer identification, and product identification information.

The UPC symbol is 12 characters long. The first character of the UPC symbol is a number system character, such as “0” for grocery items and “3” for drug- and health-related items.

The UPC symbology is for retail environments such as grocery stores, convenience stores, and general merchandise stores.

Some retail items are so small that a standard UPC bar code cannot fit on the packaging. When this occurs there is a permitted shorter version of the UPC symbology, referred to as UPC-E. UPC-E is six characters long (eight including number system and check digit), approximately half the size of a standard UPC bar code.

EAN

EAN (European Article Numbering) symbology is similar to UPC symbology, except that it contains 13 characters and uses the first two to identify countries.

The EAN symbology is used throughout most of Europe in the retail environment. Although similar to UPC symbology, the two are not interchangeable.

Codabar

Codabar was for retail price-labeling systems. Today it is widely accepted by libraries, medical industries, and photo finishing services.

Codabar is a discrete, self-checking code with each character represented by a stand-alone group of four bars and three intervening spaces.

Four different start or stop characters get defined and designated “a”, “b”, “c”, and “d”. These start and stop characters are constructed using one wide bar and two wide spaces. A complete Codabar symbol begins with one of the start or stop characters followed by some number of data characters and ending in one of the start or stop characters.

Any of the start or stop characters may be used on either end of the symbol. It is possible to use the 16 unique start or stop combinations to identify label type or other information.

Since Codabar is variable-length, discrete, and self-checking, it is a versatile symbology. The width of space between characters is not critical and may vary significantly within the same symbol. The character set consists of “0” through “9”, “-”, “$”, “:”, “/”, “.”, and “+”.

The specific dimensions for bars and spaces in Codabar optimize performance of certain early printing and reading equipment. Codabar has 18 different dimensions for bar and space widths. So many different dimensions often result in labels printed out of specification and cause Codabar printing equipment to be more expensive.

Code 39

Code 39 (C39) is the most widely used symbology among the industrial bar codes. Most major companies, trade associations, and the federal government find this code to fit their needs. The main feature of this symbology is the ability to encode messages using the full alphanumeric character set, seven special characters, and ASCII characters.

Programming for this symbology can be for any length that the application requires. The application program handles symbology that is at least one character but no more than 32 characters in length.

When programming the computer for Code 39, it is important to set the symbology limit as close as possible (minimum and maximum bar code lengths being scanned). Doing so keeps the computer bar code processing time to a minimum and conserves battery power.

Bar code readers can respond to Uniform Symbology Specification symbols in non-standard ways for particular applications. These methods are not for general applications, because of the extra programming required. Code 39 Full ASCII is one example of non-standard code.

Encoded Code 39 (Full ASCII)

If the bar code reader is programmed for the task, the entire ASCII character set (128 characters) could be coded. This is done using two character sequences made up of one of the symbols (“$”,“.”,“%”,“/”) followed by one of the 26 letters.

Code 93

The introduction of Code 93 provided a higher density alphanumeric symbology designed to supplement Code 39. The set of data characters in Code 93 is identical with that offered with Code 39. Each character consists of nine modules arranged into three bars and three spaces.

Code 93 uses 48 of the 56 possible combinations. One of these characters, represented by a square, is reserved for a start or stop character, four are used for control characters, and the remaining 43 data characters coincide with the Code 39 character set. An additional single module termination bar after the stop character concludes the final space.

Code 93 is a variable length, continuous code that is not self-checking. Bar and spaces widths may be one, two, three, or four modules wide. Its structure uses edge-to-similar-edge decoding. This makes the bar code immune to uniform ink spread, which allows liberal bar width tolerances.

Code 93 uses two check characters. Its supporters believes this makes it the highest density alphanumeric bar code. The dual check digit scheme provides for high data integrity. All substitution errors in a single character are detected for any message length.

Code 128

Code 128 (C128) is one of the newest symbologies used by the retail and manufacturing industries. It responds to the need for a compact alphanumeric bar code symbol that could encode complex product identification.

The fundamental requirement called for a symbology capable of being printed by existing data processing printers (primarily dot-matrix printers) that produce daily, work-in-progress, job, and product traceability documents. The ability to print identification messages between 10 and 32 characters long, on existing forms and labels deemed an important requirement.

Code 128 uniquely addresses this need as the most compact, complete, alphanumeric symbology available.

Additionally, the Code 128 design with geometric features, improves scanner read performance, does self-checking, and provides data message management function codes.

Code 128 encodes the complete set of 128 ASCII characters without adding extra symbol elements. Code 128 contains a variable-length symbology and the ability to link one message to another for composite message transmission. Code 128, being a double-density field, provides two numeric values in a single character.

Code 128 follows the general bar code format of start zone, data, check digit, stop code, and quiet zone. An absolute minimum bar or space dimension of nine mils (0.010 inch minimum nominal ± 0.001 inch tolerance) must be maintained.

Characters in Code 128 consist of three bars and three spaces so that the total character set includes three different start characters and a stop character.

UCC/EAN-128 Shipping Container Labeling is a versatile tool that can ease movement of products and information. The Shipping Container Labeling bar code can take any form and usually has meaning only within the company or facility where applied.

Because this *random* data can get mistaken later for an industry standard code format, the UCC and EAN chose a symbology uniquely identified from these other bar codes. This standard is for maximum flexibility, to handle the diversity of distribution in global markets by cost efficiency.

The UCC/EAN-128 Container Labeling specification calls for a FUNC1 to immediately follow the bar code's start character. FUNC1 also follows any variable-length application field. The specification also calls for the computer to send "]C1" for the first FUNC1. The specification requires that the computer send a "<GS>" (hex 1D) for subsequent FUNC1 codes in the bar code.

Because "<GS>" is not compatible with computer emulation data streams, the Uniform Code Council has been asked to change the specification. This change is made to send the same three character sequence "]C1" to identify the embedded FUNC1 codes.

This implementation should provide for clean application coding by identifying the same sequences for the same scanned codes. If the communication of Norand bar code types is enabled, the Shipping Container Label codes precede with a "J". These strings will appear on the computer display. The application may have to allow for strings longer than 48 characters (maximum length indicated in the specification). Actual length variance depends on the number of variable-length data fields. Allowing for 60 characters should be sufficient. Within the Code 128 specification, the computer can link bar codes together. If this is to happen, allow for more characters (computer limit is 100 characters).

The Application Identifier Standard, that is part of the UCC/EAN Shipping Label concept, complements, rather than replaces, other UCC/EAN standards. Most UCC/EAN standards primarily identify products.

Several industries expressed the need to standardize more than product identification. The UCC/EAN Code 128 Application Identifier Standard supplies this tool. The standard adds versatility for inter-enterprise exchanges of perishability dating, lot and batch identification, units of use measure, location codes, and several other information attributes.

For more detailed information on Code 128 UCC/EAN Shipping Label bar code and Application Identifier Standard, refer to the UCC/EAN-128 Application Identifier Standard specification.

I 2 of 5 (Interleaved)

I 2 of 5 (Interleaved 2 of 5 Code) is an all-numeric symbology, widely used for warehouse and heavy industrial applications. Its use has been particularly prevalent in the automobile industry. The I 2 of 5 symbology can be placed on smaller labels than what the standard UPC symbology requires.

I 2 of 5 also provides a little more flexibility on the type of material it can print on. Interleaved 2 of 5 Code has its name because of the way the bar code is configured.

I 2 of 5 bars and spaces both carry information. The bars represent the odd number position digits, while spaces represent the even number position digits. The two characters are interleaved as one. Messages encoded with this symbology have to use an even number of characters since two numeric characters always get interleaved together.

MSI Code (Variant of Plessey)

Plessey finds its origin in the pulse width modulated (PWM) code developed in England. It is widely used for shelf markings in grocery stores. Pulse width modulated codes represent each bit of information by a bar and space pair. A zero bit consists of a narrow bar followed by a wide space, while a one bit consists of a wide bar followed by a narrow space. It is mainly a numeric symbology (0–9) with six extra characters available for assigning any symbol or letter desired.

Plessey codes are not self-checking and employ a variety of check characters. Plessey employs a polynomial-based Cyclic Redundancy Check (CRC). For start and stop characters, Plessey employs a 1101 and previously used a 0101.

This symbology is very limited about what information can be encoded. It is not considered for new applications.

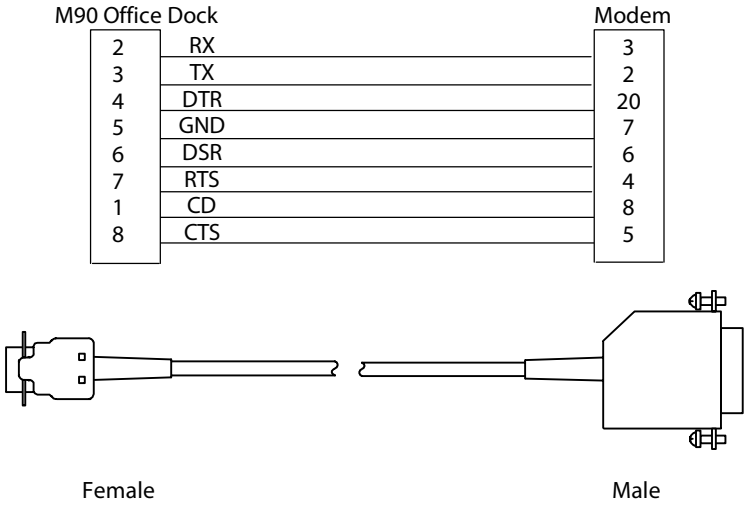
In addition to Plessey characteristics, the MSI Code employs a Modulus 10 Check. For start and stop checks, MSI employs a single bit pair of 1 as a start symbol and a single bit pair of 0 as a stop symbol. MSI reverses the 1-2-4-8 BCD pattern for bit pair weighting to 8-6-2-1.

D Cables

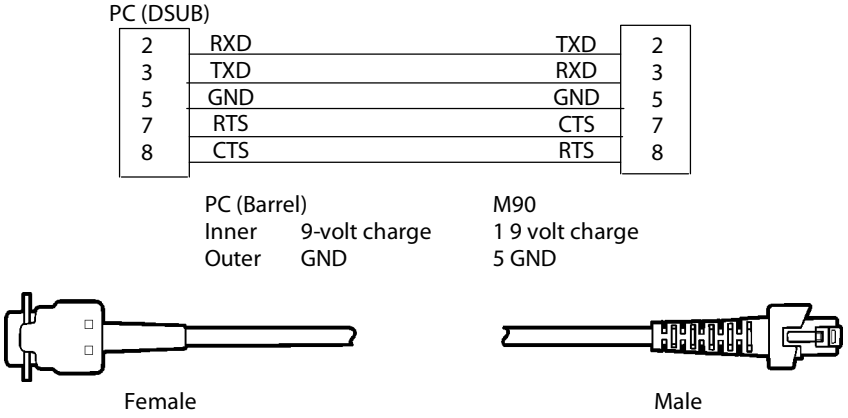
Cables that work with the M90 Computer appear in this appendix. They attach to modems, cradles, any serial printer, or a PC. None of these cables are standard.

M90 Office Dock to Modem Cable (M90503)

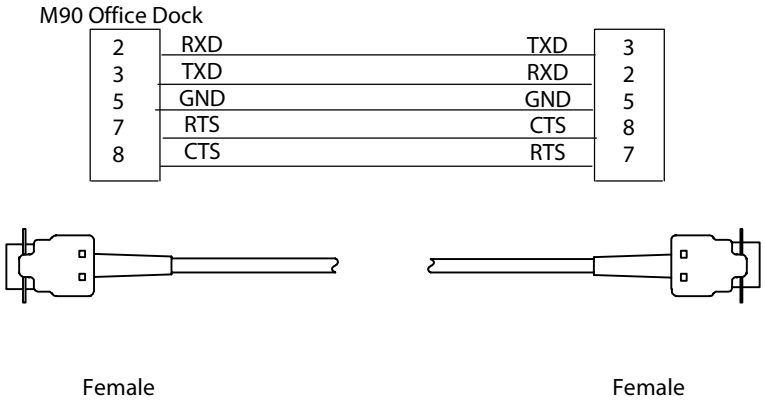
Note: This cable is *not* designed for Norand® or INTERMEC® printers.



M90 to PC Cable (M90403)



M90 Office Dock to PC Cable (M90504)



G Glossary

ACK (ACKnowledgement)
A type of message sent to show that a previous message arrived at its destination without error.

ANSI (American National Standards Institute)
A private organization that coordinates some United States (US) standards setting. It also approves some US standards that are often called ASNI standards. ANSI also represents the US to the International Organization for Standards (ISO).

ASCII (American Standard Code for Information Interchange)
A standard character set that typically assigns a 7-bit binary code to each letter, number, and selected control character. Erroneously used now to refer to 8-bit Extended ASCII. The other major encoding standard is EBCDIC.

BIOS (Basic Input and Output System)
A set of programs, usually in ROM, that lets each computer's central processing unit communicate with printers, disks, keyboards, consoles, and other attached input and output devices.

Bus
The main (multiple access) network cable or line that connects network stations. Also refers to a network topology of multiple stations communicating directly with the same cable with terminators at both ends, like an Ethernet or token bus.

CCITT (Comite Consultatif International de Telegraphique et Telephonique)
This organization is part of the United National International Telecommunications Union (ITU) and is responsible for making technical recommendations about telephone and data communications systems. It is best known for its "V" and "X" recommendations. X.25 is one such recommendation.

CD
Carrier detect.

Codabar
A discrete self-checking bar code symbology with each character represented by a stand alone group of four bars and three intervening spaces. It was developed for retail price-labeling systems and is currently accepted in libraries, medical industries, and photo finishing services. (See also: Self-checking and Discrete Code)

Code 39 (Code 3 of 9)
An alphanumeric bar code symbology with a set of 43 characters, including uppercase and seven special characters. The name comes from the idea that 3 of the 9 elements representing a character are wide while the remaining 6 are narrow.

It is the most widely used industrial bar code. This code fits the needs of most major companies, trade associations, and the federal government.

Code 93 (Code 3 of 9)
A bar code symbology compatible with Code 39 that offers a full ASCII character set and a higher coding density than Code 39.

Code 128
A high density bar code symbology, allowing encoding of all 128 ASCII characters without adding extra symbol elements. It is used by retail and manufacturing industries.

CPU
Central Processing Unit.

CR
Carriage Return.

CTS (Clear To Send)
A time delay inserted after a data terminal RTS to allow a modem to turn carrier on and establish equalization and synchronization; also known as RTS-CTS delay and turnaround delay.

DCD (Data Carrier Detect)
A signal in EIA RS-232-C specification.

DCE (Distributed Computing Environment)
An architecture of standard programming interfaces, conventions, and server functionality for distributing applications across networks of different computers.

DOS (Disk Operating System)
A program or set of programs that tells a disk-based computer system to schedule and supervise work, manage computer resources, and operate and control its peripheral devices.

DSR (Data Set Ready)
An RS-232 modem interface control signal (sent from the modem to the DTE on pin 6) that indicates the modem is connected to the telephone circuit.

DTE (Data Terminal Equipment)
The devices in a category that includes terminals and computers. Also refers to the interface to users' equipment as opposed to the DCE interface to the network.

DTR (Data Terminal Ready)
An RS-232 modem interface control signal (sent from the DTE to the modem on pin 20) that indicates the DTE is ready for data transmission and requests the modem be connected to the circuit.

EAN (European Article Numbering)
European Article Numbering Code. A bar code symbology similar to the UPC symbology except that EAN contains 13 characters and uses the first two to identify a country.

EBCDIC (Extended Binary Coded Decimal Interchange Code)
An 8-bit character code scheme used in IBM environments.

EEPROM (Electronically Erasable Programmable Read-Only Memory)
A special type of PROM that can be erased by exposing it to an electrical charge.

EIA (Electronics Industries Association)
A United States trade organization that issues its own standards and contributes to ASNI. Best known for its development RS-232 and the building wiring standard, 568. Membership includes US manufacturers.

ENQ
Enquiry or request for header block. A request for a response from another terminal. It obtains identification and an indication of the other station's status.

EOF (End Of File)
A constant following the last data in a file that signals its end.

EOT
End Of Transmission or End Of Tape.

ETX (End Of Text)
A control character used to indicate the conclusion of a message.

FAT
File Allocation Table.

FHT
File Handle Table.

Flash
A technology for nonvolatile memory storage. A special type of EEPROM that can be erased and reprogrammed.

Host Computer
A large computer that serves many users, such as a PC, minicomputer, or mainframe.

IBM (International Business Machines)
Developers of mainframe technologies, minicomputer technologies, cabling systems, and the IBM PC family of products.

Interleaved 2 of 5 (I 2of5 Code)
An all numeric bar code symbology, widely used for warehouse and heavy industrial applications, such as the automobile industry.

Interleaved Bar Code
A bar code that pairs characters together, where the bars represent the first character and the interleaving characters to represent the second character, providing greater density of information with no intercharacter spaces.

IOCTL (I/O Control)
UNIX function call used to control a device.

IP (Internet Protocol)
The network layer for the TCP/IP Protocol Suite. It is a connectionless, best-effort packet switching protocol that offers a common layer over dissimilar networks.

IRQ (Interrupt Request)
A method involving a set of special address lines in PCs, connecting peripherals (such as a serial port or network adapter) to the processor and other computer architectures so the peripherals can request service from the processor.

Kermit
A popular file transfer protocol developed by Columbia University. By running in most operating environments, it provides an easy method of file transfer. Kermit is *not* the same as FTP.

LAN (Local Area Network)
A group of network devices in which each device can communicate through a wired or wireless link. The wired link may have several segments joined by repeaters and bridges. The LAN is characterized by the relatively short distance it is designed to cover, a high speed of operation, and relatively low error rates. The geographic scope of LANs is limited to thousands of feet or closely-spaced building complexes.

LCD
Liquid Crystal Display.

LF (Line Feed)
Advancing the cursor or print head one line.

Loopback
A method of performing transmission tests on a circuit not requiring the assistance of personnel at the distant end. Usually involves physically connecting send lines to receive lines.

LRC (Longitudinal Redundancy Check)
A system of error detection and correction based on transmission of a block check character based on preset rules. The check character formation rule is applied in the same manner to each character on a bit by bit basis.

MS-DOS (Microsoft Disk Operating System)
A master control program for 16-bit, Intel-based system. One of the more common operating systems on PC systems.

NAK (Negative Acknowledgement)
Response to receipt of a corrupted packet of information.

PAD (Packet Assembler or Disassembler)
A protocol conversion device or program that lets devices access a packet switched network such as X.25.

PC (Personal Computer)
1. A desktop computer developed by IBM or a clone based on the same architecture developed by a third party vendor. 2. Sometimes used more generically to refer to other desktop systems, such as the Apple Macintosh. 3. The original IBM computer using an Intel 8088 CPU and an 8-bit internal bus.

RAM (Random-Access Memory)
Dynamic memory, sometimes known as main memory or core. When used by itself, "RAM" refers to read and write memory; you can both write data into RAM and read data from RAM. This is in contrast to ROM, which permits you only to read data. Most RAM is volatile, requiring a steady flow of electricity to maintain its contents. When power is turned off, data in RAM is lost.

RI
Ring Indicator.

ROM (Read-Only Memory)
Computers almost always contain a small amount of read-only memory that holds instructions for starting up the computer. Unlike RAM, ROM contains read–only information that is protected from being overwritten, such as BIOS.

Root Subnet
The Ethernet segment to which the access point super root connects, which is the distribution LAN. For Enterprise OWL, the root subnet is the Ethernet link of the access point that originates an IP tunnel, which is the super root.

RS-232 C (Recommended Standard 232)
An electrical interface standard approved by the Electronic Industries Association (EIA) for connecting serial devices. In 1987, the EIA released a new version of the standard and changed the name to EIA-323-D. And in 1991, the EIA teamed up with Telecommunications Industry Association (TIA) and issued a new version of the standard called EIA/TIA-232-E. Many people still refer to the standard RS-232C or just RS-232.

Almost all modems conform to the EIA-232 standard and most personal computers have an EIA-232 port for connecting a modem or other device. In addition to modems, many display screens, mice, and serial printers are designed to connect to a EIA-232 port. In EIA-232 parlance, the device that connects to the interface is called a Data Communications Equipment (DCE) and the device to which it connects (such as the computer) is called a Data Terminal Equipment (DTE).

RTS (Request To Send or Ready To Send)
A modem control signal on a standard RS-232-C connector that puts the modem in originate mode to start sending data.

RXD
Received Data.

SG (Signal Ground)
Signal ground pin (or signal) on the communications connectors.

SOH (Start Of Header)
A control character that identifies the beginning of the header field of a message block.

STX (Start Of Text)
A communication control character which precedes the text in the message block.

TCP/IP (Transmission Control Protocol, Internet Protocol)
Most networks combine IP with a higher-level protocol called Transport Control Protocol (TCP), which establishes a virtual connection between a destination an a source.

IP by itself is something like a postal system. It allows you to address a package and drop it in the system, but there is no direct link between you and the recipient. TCP/IP establishes a connection between two hosts so they can send messages back and forth for a period of time.

UNIX
A multiuser operating system developed by Bell Laboratories.

UPC (Universal Product Code)
A bar code symbology used throughout the grocery and retail industries.

X.25
A CCITT data communications interface specification to describe how data passes into and out of public data networks. The protocol suite defines layers 1 through 3.

Index

The General Index covers all topics. Those in italics are figures, those in bold are tables.

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D

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