Configuration Guide to TurboDOS 1.2

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INTRODUCTION

This Configuration Guide to TurboDOS provides the information that OEMs, dealers, and sophisticated end-users need to generate various operating system configurations and to implement driver modules for various peripheral components.

A companion document, entitled User's Guide to TurboDOS, provides the information that users need to write and run programs under the TurboDOS operating system. It includes an overview of operating system features, a discussion of architecture and theory of operation, a description of each command, and a definition of each user-callable function.

Generating TurboDOS Configurations

TurboDOS is a modular operating system consisting of more than 40 separate functional modules. These modules are "building blocks" which can be combined in various ways to produce a family of compatible operating systems. TurboDOS configurations include single-task, spooling, network master and network slave, with numerous subtle variations possible in each of these broad categories.

Functional modules of TurboDOS are distributed in relocatable form. Hardware-dependent device drivers are packaged in the same fashion. The GEN command is a specialized linkage editor which may be used to combine the desired combination of modules into an executable version of TurboDOS configured with the desired set of functions and device drivers. The GEN command also includes a symbolic patch facility which may be used to alter a variety of operating system parameters.

Section 2 describes each functional module of TurboDOS in detail, illustrates how these modules can be combined in various configurations, and provides step-by-step system generation procedures.

Implementating Driver Modules

TurboDOS has been designed to run on any Z80-based microcomputer with at least 48K of RAM, a random-access mass storage device, and a full-duplex character-oriented console device (or on an interconnected network of such microcomputers). The functional modules of TurboDOS are not dependent upon the specific peripheral devices to be used. Rather, a set of hardware-dependent device driver modules must be included in each TurboDOS configuration in order to adapt the operating system to the specific hardware environment.

Typical hardware-dependent device driver modules include:

- Console driver
- Printer driver
- Disk driver
- Network circuit driver
- Real-time clock driver
- Communications driver

Although Software 2000 Inc. can supply TurboDOS pre-configured for certain specific hardware configurations, most OEMs and many dealers and end-users will want to implement their own hardware-dependent drivers. Driver modules may be readily written by any competant assembly-language programmer, using a relocating Z80 assembler such as Digital Research's RMAC, Microsoft's MACRO-80, or Phoenix Software Associates' PASM. Section 3 provides detailed instructions to programmers for implementing such driver modules, and the Appendix includes assembly listings of various sample drivers.

Licensing Requirements

TurboDOS is a proprietary software product of Software 2000 Inc. TurboDOS may be used only after the user has paid the required license fee, signed a copy of the TurboDOS software license agreement, and returned the signed agreement to Software 2000 Inc. Then it may be used only in strict conformance with the terms of the software license. Each TurboDOS software license agreement must be filled-out and signed by the end-user (not by an OEM or dealer on his customer's behalf).

Each software license permits the use of TurboDOS only on one specific computer system identified by make, model and serial number. A separate license fee must be paid and a separate license signed for each computer system on which TurboDOS is used. Network slave computers which are also capable of stand-alone operation under TurboDOS must each be licensed separately, but slave computers which cannot be used stand-alone (e.g., because they have no mass storage) do not.

Software 2000 Inc. intends to initiate vigorous legal action against anyone who uses or reproduces TurboDOS software in a manner which is not in strict conformance with the terms of the TurboDOS software license agreement.

Serialization

Each copy of TurboDOS is magnetically serialized with a unique serial number in order to facilitate tracing of unlicensed copies of TurboDOS.

Each relocatable TurboDOS module which is distributed to a dealer or end-user is magnetically serialized with a unique serial number. The serial number consists of two components: an origin number (which identifies the issuing OEM) and a unit number (which uniquely identifies each copy of TurboDOS issued by that OEM). The GEN command verifies that all functional modules which make up a TurboDOS configuration are serialized consistently, and magnetically serializes the resulting executable version of TurboDOS accordingly.

Each relocatable TurboDOS module which is distributed to an OEM is partially serialized with an origin number only. Each OEM is provided with a SERIAL command which must be used to add a unique unit number to the relocatable modules of each copy of TurboDOS issued by that OEM. The GEN command will not accept partially serialized modules that have not been uniquely serialized by the OEM. Conversely, the SERIAL command will not re-serialize modules which have already been fully serialized.

OEM Responsibilities

Each OEM is provided with a master copy of TurboDOS relocatable modules and command processors on diskette. An OEM is authorized to reproduce and distribute copies of TurboDOS to dealers and end-users for use on specifically authorized hardware configurations manufactured or distributed by the OEM. The OEM is required to serialize each copy of TurboDOS with a unique sequential magnetic serial number, and to register each serial number promptly by returning a registration card to Software 2000 Inc. This registration requirement for OEMs is in addition to (not in lieu of) the requirement for licensing of each end-user.

Each OEM is provided with a master copy of TurboDOS documentation either in camera-ready form or in ASCII files on diskette. The OEM is responsible for reproducing the documentation and providing it with each copy of TurboDOS issued by that OEM.

An OEM must require a dealer to sign the TurboDOS dealer agreement and return it to Software 2000 Inc. before the OEM may issue copies of TurboDOS to that dealer. An OEM must require an end-user to sign the TurboDOS software license and return it to Software 2000 Inc. before the OEM may issue a copy of TurboDOS directly to

that end-user.

Dealer Responsibilities

A TurboDOS dealer is permitted to purchase individual serialized copies of TurboDOS software and documentation from an authorized TurboDOS OEM, and to resell them to end-users. Dealers are not authorized to make copies of TurboDOS software or documentation for any purpose whatever.

A TurboDOS dealer must require each end-user to sign the TurboDOS software license and return it to Software 2000 Inc. before issuing a copy of TurboDOS software or documentation to the end-user.

TurboDOS Support

Software 2000 maintains a telephone "hot-line" to provide TurboDOS-related technical assistance to its OEMs. Authorized TurboDOS OEMs should feel free to take advantage of this service whenever technical questions arise concerning the use or configuration of TurboDOS.

It is the responsibility of each OEM to provide technical support to its dealers and end-user customers. Software 2000 cannot assist dealers or end-users directly. Where exceptional circumstances seem to require direct contact between Software 2000 technical personnel and a dealer or end-user, this must be handled strictly by prior arrangement with Software 2000 by the OEM.

SYSTEM GENERATION

TurboDOS is a modular operating system consisting of more than 40 separate functional modules. These modules are "building blocks" which can be combined in various ways to produce a family of compatible operating systems. TurboDOS configurations include single-task, spooling, time-sharing and networking, with numerous subtle variations possible in each of these broad categories. This section describes each functional module of TurboDOS in detail, illustrates how these modules can be combined in various configurations, and provides step-by-step system generation procedures.

Functional modules of TurboDOS are distributed in relocatable form. Hardware-dependent device drivers are packaged in the same fashion. The GEN command processor is a specialized linkage editor which may be used to bind together the desired combination of modules into an executable version of TurboDOS configured with the desired set of functions and device drivers. GEN also includes a symbolic patch facility which may be used to alter a variety of operating system parameters.

To simplify the the system generation process, the most commonly used combinations of TurboDOS functional modules are pre-packaged into several standard configurations. Most requirements for TurboDOS can be satisfied by linking the appropriate standard package together with the requisite hardware-dependent drivers.

Module Hierarchy

The flow diagram on the facing page illustrates the functional inter-relationship of TurboDOS modules. As the diagram shows, the software elements of TurboDOS can be viewed as a three-level hierarchy.

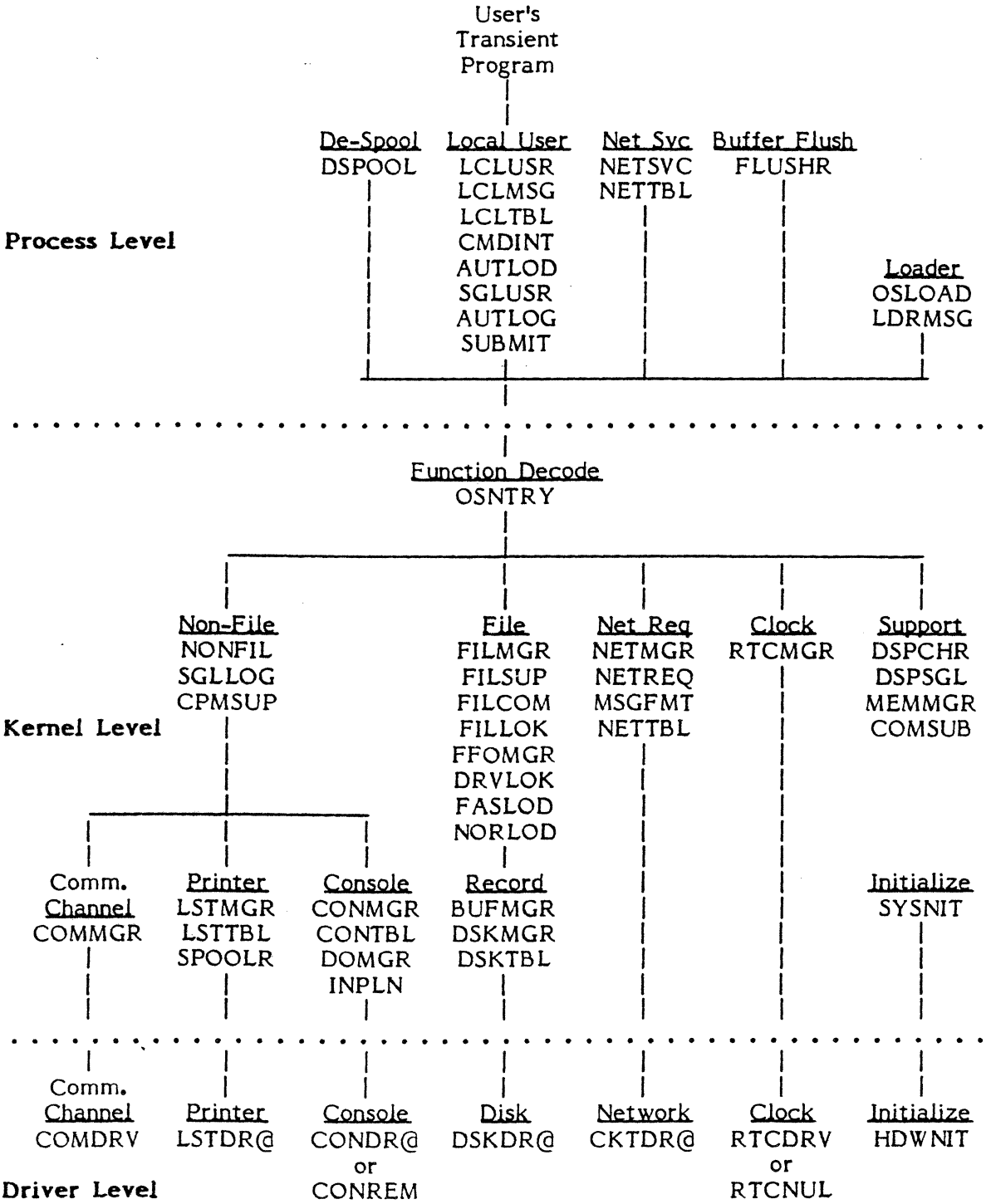
The highest level is known as the "process" level. TurboDOS can support many concurrent processes at this level, and can share the resources of the local computer among them. There are active processes for users who are executing commands and/or transient programs on the local computer. There are also processes for users who are running on remote computers but making network requests of the local computer. There are processes to support de-spooling on local printers. Finally, there is a process which periodically causes buffered disk records to be flushed (i.e., written out) to disk.

The intermediate level is known as the "kernel" level. The kernel supports the various numbered TurboDOS functions (about 100 of them), and controls the sharing of microcomputer resources such as processor time, memory, peripheral devices, and disk files. Processes make requests of the kernel through a single entrypoint (OSNTRY) which decodes each function by number and invokes the appropriate module in the kernel.

The lowest level is known as the "driver" level, and contains all of the device-dependent drivers necessary to interface TurboDOS to a particular configuration of microcomputer hardware. Drivers must be provided for each printer, console, disk controller, and network interface. A driver is also required for the real-time clock or other periodic interrupt source (used for time-slicing among processes and for timing of delays). TurboDOS operates most efficiently with interrupt-driven, buffered or DMA-type devices, but can also work satisfactorily with polled and programmed-I/O devices.

The TurboDOS loader OSLOAD.COM is a special program which contains an abbreviated version of the kernel and drivers. Its purpose is to load the full operating system into memory at each system start-up.

All TurboDOS process-level and kernel-level modules permit re-entrant execution in multi-process situations. Most driver-level modules are not re-entrantly coded, and must utilize a mutual-exclusion mechanism to prevent re-entrant execution.



TurboDOS Module Hierarchy

Process-Level Modules

LCLUSR -- Supports a transient program area for a user of the local microcomputer.

LCLMSG -- Contains all operating system messages, which are segregated into a separate module to facilitate adaptation to other languages.

LCLTBL -- Local user initialization tables.

CMDINT -- Command interpreter routine called by LCLUSR to process local user commands and multi-command strings.

AUTLOD -- Automatic program load routine called by LCLUSR to process COLDSTRT.AUT and WARMSTRT.AUT files if they are present.

SGLUSR -- Buffer flushing routine called by LCLUSR to flush and unlink all disk buffers at every console input. Included in single-user configurations only.

AUTLOG -- Automatic log-on routine called by LCLUSR to automatically log-on the local user in configurations where logon/logoff security is not desired. To activate this feature, use the symbolic patch facility to patch the public symbol AUTUSR to the desired user number, with the sign-bit set for a privileged log-on (typically AUTUSR = 80).

SUBMIT -- Optional module which emulates the processing by CP/M of $$$.SUB files (not recommended due to significant performance penalty).

NETSVC -- Network service process which receives and services network requests from other microcomputers.

NETTBL -- Tables which define the topology of the network as seen from a particular processor.

DSPOOL -- De-spool process which supports printing of spooled print jobs concurrent with other system activities. In multi-printer configurations, there is a separate re-entrant instance of the DSPOOL process for each printer.

FLUSHR -- Buffer flusher process which causes memory-resident disk buffers to be flushed (i.e., written out) to disk periodically.

Kernel-Level Modules

OSNTRY — Common kernel entrypoint which decodes each function by number and invokes the appropriate module in the kernel.

FILMGR — File manager which processes requests involving local files.

FILSUP -- File support routines used by FILMGR.

FILCOM — Processors for common file-oriented functions which are never sent over the network.

FILLOK — File- and record-level interlock routines called by FILMGR.

FFOMGR — FIFO management routines called by FILLOK.

DRVLOK -- Drive interlock routines.

FASLOD -- Program load optimizer.

NORLOD -- Non-optimized program load routine which may be used instead of FASLOD when memory space is at a premium.

BUFMGR -- Buffer manager called by FILMGR. It maintains a pool of memory-resident record buffers used for all record-oriented access to local disk storage.

DSKMGR -- Disk manager called by BUFMGR and FASLOD to perform physical accesses to local disk storage.

DSKTBL — Tables which define how drive letters are mapped into local and remote drives, and the location on the network of any remote drives.

NONFIL -- Non-file request manager which handles kernel requests which are not file-oriented.

CPMSUP -- Optional function processors for little-used functions (7, 8, 24, 28, 29, 31, 37, and 107) included in TurboDOS solely for compatibility with CP/M.

SGLLOG -- Optional module which may be included in multi-user configurations to prevent two or more non-privileged users from logging-on to the same user number concurrently.

CONMGR -- Console manager which handles local console input/output.

CONTBL -- Table which defines how the local console is interfaced.

DOMGR -- DO-file manager which handles activation of DO-files. When a DO-file is active, this module is called by CONMGR to satisfy console input requests from the DO-file.

INPLN -- Console input line editor used for buffered console input (function 10), and used by CMDINT.

LSTMGR -- List manager which handles printer-oriented functions.

LSTTBL -- Tables which define how printer and queue letters are mapped into local and remote printers and queues, and the location on the network of any remote printers and queues.

SPOOLR -- Spooler routine which diverts print output to spool files when the spooler is activated. Also handles direct printing to remote printers.

COMMGR -- Comm channel manager which handles the communications channel.

NETREQ -- Network request processor which creates network request messages to be passed to remote processors for service.

MSGFMT -- Network message format table used by NETREQ.

NETMGR -- Network message routing mechanism used by NETSVC and NETREQ.

NETTBL -- Tables which define the topology of the network as seen from a particular processor.

RTCMGR -- Real-time clock manager which maintains system date and time.

DSPCHR -- Multi-process dispatcher which controls the sharing of local processor time among multiple competing processes.

DSPSGL -- Null dispatcher used as an alternative to DSPCHR when only one process is required (e.g., in OSLOAD.COM and in minimal single-user configurations without spooling).

MEMMGR -- Memory manager which controls the dynamic allocation and deallocation of memory segments.

COMSUB -- Common subroutines utilized in all configurations.

SYSNIT -- System initialization routine which is executed at system start-up.

PATCH -- Optional module consisting of 64 bytes of zeroes which may be included to provide space for any required operating system patches.

Universal Driver-Level Modules

RTCNUL -- Null real-time clock driver for use in configurations in which there is no periodic interrupt source.

CONREM -- Remote console driver for network master to allow access from slave consoles by means of the MASTER command.

Hardware-Dependent Driver-Level Modules

Driver modules are hardware-dependent, and may vary significantly from one TurboDOS implementation to another. In general, the following drivers are required as a minimum:

CONDR@ -- Console driver allows character-by-character input from a console keyboard and output to a console display.

LSTDR@ -- Printer driver allows character-by-character output to a hardcopy peripheral. TurboDOS supports multiple printer drivers.

COMDRV -- Comm. channel driver allows character-by-character input and output over one or more communications channels.

DSKDR@ -- Disk controller driver allows input and output of physical-records on a random-access mass storage device (usually flexible or hard disk). TurboDOS supports multiple disk controller drivers, each of which may support multiple drives.

CKTDR@ -- Network circuit driver allows sending and receiving messages to or from remote processors. TurboDOS supports multiple network circuit drivers, each of which may communicate with multiple remote processors.

RTCDRV -- Real-time clock driver services interrupts from a periodic interrupt source, used for time-slicing, delay measurement, and updating the system date and time.

HDWNIT -- Hardware initialization routine called by SYSNIT. This module usually consists of calls to initialization entrypoints in other drivers.

Standard Configurations

To simplify the the system generation process, the most commonly used combinations of TurboDOS functional modules are pre-packaged into the standard configurations shown in the table on the facing page: STDLOADR, STDSINGL, STDSPOOL, STDMASTR, STDSLAVE and STDSLAVX. Most requirements for TurboDOS can be satisfied by linking the appropriate standard package together with the requisite driver modules.

Module	Size Kb	O/S Loader STDLOADR	Single User STDSINGL	Single User w/Spooling STDSPOOL	Network Master STDMASTR	Simple Slave STDSLAVE	Complex Slave STDSLAVX
LCLUSR	.9	-	LCLUSR	LCLUSR	LCLUSR	LCLUSR	LCLUSR
LCLMSG	.1	-	LCLMSG	LCLMSG	LCLMSG	LCLMSG	LCLMSG
LCLTBL	.0	-	LCLTBL	LCLTBL	LCLTBL	LCLTBL	LCLTBL
CMDINT	.9	-	CMDINT	CMDINT	CMDINT	CMDINT	CMDINT
AUTLOD	.2	-	AUTLOD	AUTLOD	AUTLOD	AUTLOD	AUTLOD
SGLUSR	.1	-	SGLUSR	SGLUSR	-	-	SGLUSR
AUTLOG	.0	-	AUTLOG	AUTLOG	AUTLOG	AUTLOG	AUTLOG
SUBMIT	.1	-	-	-	-	-	-
NETSVC	1.0	-	-	-	NETSVC	-	-
DSPOOL	.8	-	-	DSPOOL	DSPOOL	-	DSPOOL
FLUSHR	.2	-	-	-	FLUSHR	-	-
OSLOAD	1.4	OSLOAD	-	-	-	-	-
LDRMSG	.1	LDRMSG	-	-	-	-	-
OSNTRY	.4	OSNTRY	OSNTRY	OSNTRY	OSNTRY	OSNTRY	OSNTRY
FILMGR	1.4	FILMGR	FILMGR	FILMGR	FILMGR	-	FILMGR
FILSUP	1.9	FILSUP	FILSUP	FILSUP	FILSUP	-	FILSUP
FILCOM	.2	FILCOM	FILCOM	FILCOM	FILCOM	FILCOM	FILCOM
FILLOK	1.3	-	-	-	FILLOK	-	-
FFOMGR	.7	-	-	-	FFOMGR	-	-
DRVLOK	.2	-	-	-	DRVLOK	-	-
FASLOD	.3	-	FASLOD	FASLOD	FASLOD	-	FASLOD
NORLOD	.1	-	-	-	-	-	-
BUFMGR	1.0	BUFMGR	BUFMGR	BUFMGR	BUFMGR	-	BUFMGR
DSKMGR	.6	DSKMGR	DSKMGR	DSKMGR	DSKMGR	-	DSKMGR
DSKTBL	.0	DSKTBL	DSKTBL	DSKTBL	DSKTBL	DSKTBL	DSKTBL
NONFIL	.1	NONFIL	NONFIL	NONFIL	NONFIL	NONFIL	NONFIL
SGLLOG	.1	-	-	-	-	-	-
CPMSUP	.2	-	-	-	-	-	-
CONMGR	.3	CONMGR	CONMGR	CONMGR	CONMGR	CONMGR	CONMGR
CONTBL	.0	CONTBL	CONTBL	CONTBL	CONTBL	CONTBL	CONTBL
DOMGR	.3	-	DOMGR	DOMGR	DOMGR	DOMGR	DOMGR
INPLN	.1	-	INPLN	INPLN	INPLN	INPLN	INPLN
LSTMGR	.1	-	LSTMGR	LSTMGR	LSTMGR	LSTMGR	LSTMGR
LSTTBL	.1	-	LSTTBL	LSTTBL	LSTTBL	LSTTBL	LSTTBL
SPOOLR	.4	-	-	SPOOLR	SPOOLR	SPOOLR	SPOOLR
COMMGR	.1	-	COMMGR	COMMGR	COMMGR	COMMGR	COMMGR
NETREQ	.9	-	-	-	-	NETREQ	NETREQ
MSGFMT	.1	-	-	-	-	MSGFMT	MSGFMT
NETMGR	.3	-	-	-	NETMGR	NETMGR	NETMGR
NETTBL	.0	-	-	-	NETTBL	NETTBL	NETTBL
RTCMGR	.1	-	RTCMGR	RTCMGR	RTCMGR	-	RTCMGR
DSPCHR	.6	-	-	DSPCHR	DSPCHR	DSPCHR	DSPCHR
DSPSGL	.1	DSPSGL	DSPSGL	-	-	-	-
MEMMGR	.3	-	MEMMGR	MEMMGR	MEMMGR	MEMMGR	MEMMGR
COMSUB	.2	COMSUB	COMSUB	COMSUB	COMSUB	COMSUB	COMSUB
SYSNIT	.0	-	SYSNIT	SYSNIT	SYSNIT	SYSNIT	SYSNIT

Estimating Memory Requirements

To estimate memory requirements for a particular TurboDOS configuration, it is necessary to take into account the combined size of functional modules (see table on previous page), hardware-dependent driver modules, disk buffers and other dynamically allocated storage segments.

Hardware-dependent drivers typically require 1K to 3K of memory, depending on the complexity of the hardware involved. Disk buffer space should be as large as possible for optimum performance, especially in a network master. About 4K of disk buffer space is acceptable for a single-user system, although less can be used in a pinch. Other dynamic storage usually doesn't exceed 1K in a single-user system, 2K in a networking system.

The following table gives typical memory requirements of standard TurboDOS configurations:

	O/S Loader STDLOADR	Single User STDSINGL	Single User w/Spooling STDSPOOL	Network Master STDMASTR	Simple Slave STDSLAVE	Complex Slave STDSLAVX
TurboDOS	8K	10K	12K	15K	7K	14K
Drivers	2K	2K	2K	3K	1K	3K
Disk Buffers	4K	4K	4K	16K	0K	4K
Dynamic Space	±1K	±1K	±1K	±3K	±2K	±2K
Total Size	15K	17K	19K	37K	10K	23K
TPA (in 64K)	n/a	47K	45K	27K	54K	41K

Typical TurboDOS Memory Requirements

Linking and Loading

Functional modules of TurboDOS are distributed in relocatable form. Hardware-dependent device drivers are packaged in the same fashion. The GEN command processor is a specialized linkage editor which may be used to bind together the desired combination of modules into an executable version of TurboDOS configured with the desired set of functions and device drivers. GEN also includes a symbolic patch facility which may be used to alter a variety of operating system parameters.

To generate a TurboDOS system, the GEN command must be used to create both an executable loader OSLOAD.COM and an executable master operating system OSMASTER.SYS. In networking configurations, the GEN command must also be used to create a slave operating system OSSLAVE.SYS. The GEN command can also be used to generate the code for a start-up PROM (or boot track).

At system start-up, the start-up PROM (or boot track) loads the loader program OSLOAD.COM into the TPA of the master computer and executes it. OSLOAD loads the master operating system OSMASTER.SYS into the topmost portion of memory. In networking configurations, the master operating system down-loads the slave operating system OSSLAVE.SYS into the slave computers on the network.

GEN Command

The GEN command is used for TurboDOS system generation (and may also be used as a general purpose linker for Microsoft-format .REL modules). It links a collection of relocatable modules together into a single executable file. The command format is:

GEN filename1 filename2 ;options

where "filename1" specifies the name of the configuration file (type .GEN) and parameter file (type .PAR) to be used, and "filename2" specifies the name of the executable file (normally type .COM or .SYS) to be created. If "filename2" is omitted from the command line, then "filename1" is used for the executable file and should include an explicit file type (.COM or .SYS).

If the configuration file (type .GEN) is found, it must contain the list of relocatable files to be linked together. If the configuration file is not found, then the GEN command operates in an interactive mode, reading successive directives from the console until terminated by a null directive. The format of each directive (or each line of the configuration file) is:

relfile1, relfile2, ..., relfileN

The GEN command links together all of the specified modules, a two-pass process which displays the name of each module as it is encountered. At the end of the second pass, the GEN command looks for a parameter file (type .PAR) and processes it (if found). Finally, the executable file is written out to disk.

Each relocatable TurboDOS module is magnetically serialized with a unique serial number. The serial number consists of two components: an origin number (which identifies the issuing OEM) and a unit number (which uniquely identifies each copy of TurboDOS issued by that OEM). The GEN command verifies that all modules to be linked are serialized consistently, and serializes the executable file accordingly.

The ";options" argument may contain either ";Lxxxx" or ";Uxxxx" to define either the lower or upper boundary of the executable program ("xxxx" is a hexadecimal memory address). The default boundary is ";L0100" if the output file is of type .COM, and ";UFFFF" if the output file is of type .SYS.

The ";options" argument may also contain ";X" to display undefined symbol references (quite normal in TurboDOS system generation), ";M" to print a load map on the printer, and ";S" to print a full symbol table on the printer.

Example:

The following example uses the GEN command to link the modules listed in OSMASTER.GEN and the patch parameters in OSMASTER.PAR, creating the executable file OSMASTER.SYS.

```
0A}GEN OSMASTER.SYS :UBFFF
* STDSINGL, CON192, LSTCTS, SPD442
* SER480, BRT4420, RTC442
* DSK401, DSTBL8, HDWNIT
Pass 1.
LCLUSR    LCLTBL    CMDINT    AUTLOD    SGLUSR    AUTLOG
OSNTRY    FILMGR    FILSUP    FASLOD    BUFMGR    DSKMGR
DSKTBL    NONFIL    CONMGR    CONTBL    DOMGR     INPLN
LSTMGR    LSTTBL    COMMGR    RTCMGR    DSPSGL    MEMMGR
COMSUB    SYSNIT    CON192    LSTCTS    SPD442    SER480
BRT442    RTC442    DSK401    DSTBL8    HDWNIT
Pass 2.
LCLUSR    LCLTBL    CMDINT    AUTLOD    SGLUSR    AUTLOG
OSNTRY    FILMGR    FILSUP    FASLOD    BUFMGR    DSKMGR
DSKTBL    NONFIL    CONMGR    CONTBL    DOMGR     INPLN
LSTMGR    LSTTBL    COMMGR    RTCMGR    DSPSGL    MEMMGR
COMSUB    SYSNIT    CON192    LSTCTS    SPD442    SER480
BRT442    RTC442    DSK401    DSTBL8    HDWNIT
Processing parameter file:
AUTUSR = 80
NMBUFS = 8
PTRAST = 2
EOPCHR = 1A
SRHDRV = 1
Writing output file.
0A}
```

Symbolic Patch Facility

The GEN command supports a symbolic patch facility which may be used to override various operating system parameters as well as to effect necessary software corrections. Symbolic patches must be stored in a parameter file (type .PAR), which may be built using any ordinary file editor. The format of each .PAR file entry is:

```
location = value1, value2, ..., valueN   ;comments
```

where "value1" through "valueN" are to be loaded into consecutive memory locations starting with "location".

The argument "location" may be a public symbol name, a hexadecimal number, or an expression composed of names and hexadecimal numbers connected by "+" or "-". Hexadecimal numbers must begin with a decimal digit (e.g., "0FFFF"). The location expression must be followed by an equal-sign character.

The arguments "value1" through "valueN" may be expressions (as defined above) or quoted ASCII strings, and must be separated by commas. An expression is stored as a 16-bit word if its value exceeds 255 or if it is enclosed in parentheses; otherwise, an expression is stored as an 8-bit byte. A quoted ASCII string may be enclosed by either quotes or apostrophes, and is stored as a sequence of 8-bit bytes. Within a quoted string, ASCII control characters may be specified by using the circumflex (e.g., "^X" denotes CTRL-X).

Example:

```
CLBLEN = 9D        ;Command line buffer length (157)
CLSCHR = "\"       ;Command line separator character
ATNCHR = "^S"      ;Attention character
LOADFN = 0,"OSMASTER","SYS"  ;File name to load
DSKAST = 00,DSKDRA,01,DSKDRA,00,DSKDRB,80,(0000),81,(0000)
```

TurboDOS Patch Points

Public symbols in the hardware-independent portion of TurboDOS which may be useful to patch are shown below, together with their default (unpatched) values. (Other patchable symbols my exist in hardware-dependent drivers, and are beyond the scope of this document.)

In AUTLOD Module:

LDCOLD	= 0FF	Cold-start autoload enable flag (0 to disable)
LDWARM	= 0FF	Warm-start autoload enable flag (0 to disable)
COLDFN	= 0,"COLDSTRT","AUT"	Cold-start autoload file name (12 bytes)
WARMFN	= 0,"WARMSTRT","AUT"	Warm-start autoload file name (12 bytes)

In AUTLOG Module:

AUTUSR	= 0FF	Automatic log-on user number (sign-bit if privileged)

In BUFMGR Module:

BUFSIZ	= 3	Default buffer size (0=128, 1=256, 2=512,..., 7=16K)
NMBUFS	= 4	Default number of buffers

In CMDINT Module:

CLBLEN	= 9D	Command line buffer length (default 2*80-3 = 157)
CLSCHR	= "\"	Command line separator character
CLPCHR	= "}"	Command line prompt character
SRHDRV	= 0	Search drive (0=off, 1="A", 2="B",..., 0FF=sysdsk)

In CONTBL Module:

ATNCHR	= "^S"	Attention character
ATNBEL	= "^G"	Attention-received warning
RESCHR	= "^Q"	Resume character (attention response)
ABTCHR	= "^C"	Abort character (attention response)
ECOCHR	= "^P"	Echo character (attention response)
PRTCHR	= "^L"	End-print character (attention response)
CONAST	= 00,CONDRA	Console assignment table

In DSKTBL Module:

```
DSKAST  = 00,DSKDRA,01,DSKDRA,0FF,(0),0FF,(0)
          0FF,(0),0FF,(0),0FF,(0),0FF,(0)
          0FF,(0),0FF,(0),0FF,(0),0FF,(0)
          0FF,(0),0FF,(0),0FF,(0),0FF,(0)
                    Disk assignment table (master, 16 3-byte entries)
```

In FILCOM Module:

```
LOGUSR  = 1F        User number for log-off (standard is 31)
```

In FILLOK Module:

```
COMPAT  = 00        File/record locking compatibility flags
```

In FLUSHR Module:

```
BFLDLY  = (012C)    Buffer flush delay (in ticks, no flush if zero)
```

In LCLTBL Module:

```
PRTMOD  = 1         Default print mode (0=direct, 1=spooled, 2=console)
QUEPTR  = 1         Default queue/printer (0=off, 1="A", 2="B", ...)
SPLDRV  = 0FF       Default spool drive (0="A", 1="B", ..., 0FF=sysdsk)
```

In LCLUSR Module:

```
MEMRES  = (0100)    Reserved memory above TPA
```

In LSTTBL Module:

```
EOPCHR  = 0         End-of-print character (if nonzero)
DSPPAT  = 1,...,1   De-spool printer assignment table (16 bytes)
PTRAST  = 00,LSTDRA,0FF,(0),0FF,(0),0FF,(0)
          0FF,(0),0FF,(0),0FF,(0),0FF,(0)
          0FF,(0),0FF,(0),0FF,(0),0FF,(0)
          0FF,(0),0FF,(0),0FF,(0),0FF,(0)
                    Printer assignment table (master, 16 3-byte entries)
QUEAST  = 00,(0),0FF,(0),0FF,(0),0FF,(0)
          0FF,(0),0FF,(0),0FF,(0),0FF,(0)
          0FF,(0),0FF,(0),0FF,(0),0FF,(0)
          0FF,(0),0FF,(0),0FF,(0),0FF,(0)
                    Queue assignment table (master, 16 3-byte entries)
```

In MEMMGR Module:

```
MEMBLL  = (1103)        Memory base lower limit (standard assures 4K TPA)
```

In NETMGR Module:

```
NMBMBS  = 0             Number of pre-allocated message buffers
```

In NETSVC Module:

```
NMBSVC  = 2             Number of NETSVC server processes activated
SLVFN   = "OSSLAVE ","SYS"
                        Name of .SYS file to download
```

In NETTBL Module:

```
NMBCKT  = 1             Number of network circuits
DEFDID  = (0)           Default network destination ID
CKTAST  = (0000),CKTDRA,(0100),CKTDRB,(0200),CKTDRC,(0300),CKTDRD
                        Circuit assignment table (NMBCKT 4-byte entries)
FWDTBL  = 0FF,0FF,0FF,0FF,0FF,0FF,0FF,0FF,0FF
                        Forwarding table (2-byte entries)
```

In NONFIL Module:

```
CPMVER  = 30            CP/M BDOS version number (returned by function 12)
```

In OSLOAD Module:

```
LOADFN  = 0,"OSMASTER","SYS"
                        Default drive and filename for OSLOAD (12 bytes)
MEMTOP  = (0FFFF)       Top limit of OSLOAD RAM test (don't test if zero)
```

In SUBMIT Module:

```
SUBFN   = 0,"$$$    ","SUB"
                        Submit file name
```

NOTE: In slave configurations STDSLAVE and STDSLAVX, the following default values change:

In DSKTBL Module:

```
DSKAST  = 80,(0),81,(0),82,(0),83,(0)
          84,(0),85,(0),86,(0),87,(0)
          88,(0),89,(0),8A,(0),8B,(0)
          8C,(0),8D,(0),8E,(0),8F,(0)
                    Disk assignment table (slave, 16 3-byte entries)
```

In LSTTBL Module:

```
PTRAST  = 80,(0),81,(0),82,(0),83,(0)
          84,(0),85,(0),86,(0),87,(0)
          88,(0),89,(0),8A,(0),8B,(0)
          8C,(0),8D,(0),8E,(0),8F,(0)
                    Printer assignment table (slave, 16 3-byte entries)
QUEAST  = 80,(0),81,(0),82,(0),83,(0)
          84,(0),85,(0),86,(0),87,(0)
          88,(0),89,(0),8A,(0),8B,(0)
          8C,(0),8D,(0),8E,(0),8F,(0)
                    Queue assignment table (slave, 16 3-byte entries)
```

Explanations of Certain TurboDOS Patch Points

AUTUSR may be patched to cause an automatic log-on at cold-start time (rather than the usual password-protected log-on procedure). If automatic log-on is desired, patch AUTUSR to the desired user number (00...1F) and set the sign-bit if a privileged log-on is desired. The patch "AUTUSR = 80" should generally be included in single-user configurations to cause an automatic privileged log-on to user number zero.

SRHDRV may be patched to cause TurboDOS to automatically search another drive for a command processor (.COM file) if it is not found on the current default drive. Patch SRHDRV to 1 to search drive "A", 2 to search drive "B", etc. Alternatively, patch SRHDRV to 0FF to search the system disk drive (i.e., whichever drive was used to boot up TurboDOS).

ATNCHR defines the keyboard character interpreted by TurboDOS as an "attention" request. It should be patched if the usual "^S" conflicts with the needs of applications (such as WordStar). A common alternative choice is ATNCHR = "^@" which allows the BREAK key to be used for attention on many systems.

CONAST is a 3-byte entry which defines how console input/output is handled. The first byte is passed to the console driver module, and commonly defines the channel number (e.g., serial port) to be used for the console. The next word specifies the entrypoint address of the console driver to be used.

DSKAST is an array of sixteen 3-byte entries, one for each drive letter A...P, which define whether the corresponding drive is local, remote, or invalid.

- For a local drive, the first byte must not have the sign-bit set. That byte is passed to the disk driver module, and is commonly used to differentiate between multiple drives connected to a single controller. The next word specifies the entrypoint address of the disk driver to be used.

- For a remote drive, the first byte must have the sign-bit set. The low-order bits of that byte specifies the drive letter to be accessed on the remote processor. The next word specifies the network address of the remote processor.

- For an invalid drive, the first byte must be 0FF, and the next word should be zero.

DSPPAT is an array of sixteen bytes, one for each printer letter A...P, which defines the initial de-spool queue to which each printer is assigned. Byte values 1...16 correspond to queues A...P, and zero means that the corresponding printer is initialized to off-line.

PTRAST is an array of sixteen 3-byte entries, one for each printer letter A...P, which define whether the corresponding printer is local, remote, or invalid.

- For a local printer, the first byte must not have the sign-bit set. That byte is passed to the list driver module, and commonly defines the channel number (e.g., serial port) to be used for the printer. The next word specifies the entrypoint address of the list driver to be used.

- For a remote printer, the first byte must have the sign-bit set. The low-order bits of that byte specifies the printer letter to be accessed on the remote processor. The next word specifies the network address of the remote processor.

- For an invalid printer, the first byte must be 0FF, and the next word should be zero.

QUEAST is an array of sixteen 3-byte entries, one for each queue letter A...P, which define whether the corresponding queue is local, remote, or invalid.

- For a local queue, all three bytes must be set to zero.

- For a remote queue, the first byte must have the sign-bit set. The low-order bits of that byte specifies the queue letter to be accessed on the remote processor. The next word specifies the network address of the remote processor.

- For an invalid queue, the first byte must be 0FF, and the next word should be zero.

EOPCHR may be patched to any non-null ASCII character, in which case the presence of that character in the print output stream will automatically signal an end-of-print-job condition.

NMBMBS is a byte value that specifies the number of network message buffers to pre-allocate at cold-start time. This value may be left at zero, but memory fragmentation may be reduced by assigning a positive value (NMBCKT plus two is a good value to try).

NMBSVC is a byte value that specifies the number of NETSVC server processes to be created (the number of slave processors is a good value to try).

CKTAST is a table of 4-byte (2-word) entries. There are NMBCKT entries, one for each network circuit to which this processor is attached. The first word of each entry specifies the network address by which this processor is known on a particular circuit, and the second word specifies the entrypoint address of the circuit driver responsible for that circuit. (Possibly, several circuits may be handled by the same driver.)

FWDTBL is a table of 2-byte entries which define any explicit message forwarding routes which this processor may utilize. The first byte of each entry specifies a circuit number "N" which is not directly connected to this processor, and the second byte specifies a corresponding circuit number "C" which is directly-connected. Any network messages destined for circuit "N" will be routed via circuit "C". This table is variable length (possibly empty), and must be terminated with a byte 0FF.

Examples of Disk, Printer and Network Tables

Suppose we wish to generate a TurboDOS configuration in which disk drives A...E are to be defined as follows: Drive A is a local hard disk. Drives B and C are local floppies. Drives D and E are remote drives belonging to another processor whose network address is 05-09 (circuit 5, node 9), and are known to that processor as its drives A and B. The .GEN file would include disk driver modules for both hard disk and floppy controllers:

```
..., DSKHARD, DSKFLOP, ...
```

and the .PAR file would set up the disk assignment table for drives A...E as:

```
DSKAST    = 00,DSKDRA, 00,DSKDRB, 01,DSKDRB, 80,(0509), 81,(0509)
```

Furthermore, suppose printers A...E are to be defined as follows: Printers A and B are serial printers using XON/XOFF protocol and connected to serial channels 1 and 2. Printers C and D are serial printers using CTS handshaking and connected to serial channels 3 and 4. Printer E is a remote printer belonging to the processor at network address 02-01 (circuit 2, node 1) and known to that processor as printer B. The .GEN file would include printer drivers for both XON/XOFF and CTS:

```
..., LSTXON, LSTCTS, ...
```

and the .PAR file would set up the printer assignment table for printers A...E as:

```
PTRAST    = 01,LSTDRA, 02,LSTDRA, 03,LSTDRB, 04,LSTDRB, 81,(0201)
```

If de-spooled printing is desired on all five printers, with one queue defined per printer (four local queues and one remote queue), then the .PAR file might set up the queue and de-spool printer assignment tables as:

```
QUEAST    = 0,(0), 0,(0), 0,(0), 0,(0), 81,(0201)
DSPPAT    = 1,2,3,4,5
```

Finally, suppose this processor is connected to two network circuits, a high-speed circuit (#5) and a low-speed circuit (#2). Suppose further that this processor is known on the high-speed circuit as network address 05-07, and on the low-speed circuit as network address 02-06. Suppose also that one of the other processors on circuit #5 can forward messages to circuits #8 and #9. The .GEN file would include network circuit drivers for both high- and low-speed circuits:

```
..., CKTHIGH, CKTLOW, ...
```

and the .PAR file might set up the network tables as follows:

```
NMBCKT  = 2
CKTAST  = (0507),CKTDRA, (0206),CKTDRB
DEFDID  = (0509)
FWDTBL  = 08,05, 09,05, 0FF
```

Step-by-Step Procedure for System Generation

To generate a new version of TurboDOS, the following steps may be followed:

1. Bring up a single-user operating system, either CP/M or (preferably) a previous version of TurboDOS. If you are using CP/M, all diskettes will have to be in a format compatible with both CP/M and TurboDOS (e.g., eight-inch, one-sided, single-density, 128-byte sector size).

2. Make a working copy of your TurboDOS distribution diskette. Do not use the original diskette (in case something goes wrong). Insert the working diskette in a convenient disk drive.

3. Using an editor, create or revise the file OSMASTER.GEN containing the names of the relocatable files to be linked together. In most cases, this will consist of the appropriate STDxxxxx file plus all required device drivers.

4. Using an editor, create or revise the file OSMASTER.PAR containing any required patches. This may be omitted if no patches are desired.

5. Using the command "GEN OSMASTER.SYS", generate an executable system file. If the target machine has less than 64K of memory installed, don't forget to specify a ";Uxxxx" option on the GEN command.

6. If you need to generate a new O/S loader, create or revise the files OSLOAD.GEN and OSLOAD.PAR, and use the command "GEN OSLOAD.COM" to generate an executable loader file.

6. If you need to generate a new slave O/S for a networking configuration, create or revise the files OSSLAVE.GEN and OSSLAVE.PAR, and use the command "GEN OSSLAVE.SYS" to generate an executable down-load file.

7. To test the newly generated system, log onto your working diskette, eject all other diskettes, and enter the command "OSLOAD". If the new system fails to come up or to function properly, you will have to start over at step 1; there is most likely an error in one of your .GEN or .PAR files.

SERIAL Command

Each relocatable TurboDOS module which is distributed to an OEM is partially serialized with an origin number only. Each OEM is provided with a SERIAL command processor which must be used to add a unique unit number to the relocatable modules of each copy of TurboDOS issued by that OEM.

The format of the SERIAL command is:

```
SERIAL srcfile destfile ;Unnn options
```

where "srcfile", "destfile" and "options" have exactly the same meanings as in the COPY command, and "nnn" is the unit number expressed as a decimal integer. The SERIAL command works exactly like the COPY command, except that it has the additional function of magnetically serializing .REL files.

The GEN command will not accept partially serialized modules that have not been uniquely serialized by the OEM. Conversely, the SERIAL command will not re-serialize modules which have already been fully serialized.

Example:

```
0A}SERIAL  A:  B:  ;U289 N
A:ASSIGN.COM   copied to B:ASSIGN.COM
.
.
.
A:USER.COM   copied to B:USER.COM
0A}
```

Step-by-Step Procedure for OEM Re-Distribution

To generate a serialized copy of TurboDOS for re-distribution by an OEM to a dealer or end-user, the following steps must be followed:

1. Assign a unique sequential unit number for this copy of TurboDOS, and register it promptly by filling-out a serial number registration card and mailing it to Software 2000 Inc.

2. Initialize a new diskette, and label it with the TurboDOS version number, the origin and unit numbers, and the required notice "Copyright (C) 1982 by Software 2000, Inc.".

3. Using the SERIAL command, copy and serialize the following files from your OEM redistribution master to the new diskette:

   single-user without spooling: .REL files for STDLOADR and STDSINGL; .COM files for AUTOLOAD, BACKUP, BOOT, BUFFERS, COPY, DATE, DELETE, DIR, DO, DRIVE, DUMP, ERASEDIR, FIXMAP, FORMAT, GEN, LABEL, LOGOFF, LOGON, MONITOR, PRINT, RENAME, SET, SHOW, TYPE, USER, and VERIFY; and .REL files for all necessary driver modules.

   single-user with spooling: .REL files for STDLOADR, STDSINGL, and STDSPOOL; .COM files for AUTOLOAD, BACKUP, BOOT, BUFFERS, COPY, DATE, DELETE, DIR, DO, DRIVE, DUMP, ERASEDIR, FIXMAP, FORMAT, GEN, LABEL, LOGOFF, LOGON, MONITOR, PRINT, PRINTER, QUEUE, RENAME, SET, SHOW, TYPE, USER, and VERIFY; and .REL files for all necessary driver modules.

   multi-user networking: .REL files for STDLOADR, STDSINGL, STDSPOOL, STDMASTR, and STDSLAVE; .COM files for AUTOLOAD, BACKUP, BATCH, BOOT, BUFFERS, CHANGE, COPY, DATE, DELETE, DIR, DO, DRIVE, DUMP, ERASEDIR, FIFO, FIXMAP, FORMAT, GEN, LABEL, LOGOFF, LOGON, MASTER, MONITOR, PRINT, PRINTER, QUEUE, RECEIVE, RENAME, SEND, SET, SHOW, TYPE, USER, and VERIFY; and .REL files for all necessary driver modules.

   Important Note: Be certain that the new diskette does not contain unserialized modules or SERIAL.COM.

4. Using the new serialized diskette, generate an executable loader and operating system, using the system generation procedure described earlier in this section.

5. In addition to the serialized diskette, the dealer or end-user should receive a TurboDOS start-up PROM (if applicable) and copies of the User's Guide and Configuration Guide.

SYSTEM IMPLEMENTATION

TurboDOS has been designed to run on any Z80-based microcomputer with at least 48K of RAM, a random-access mass storage device, and a full-duplex character-oriented console device (or on an interconnected network of such microcomputers). The process-level and kernel-level modules of TurboDOS do not depend upon the specific peripheral devices to be used. Rather, a set of hardware-dependent device driver modules must be included in each TurboDOS configuration in order to adapt the operating system to a particular hardware environment. Device drivers are typically required for consoles, printers, disk controllers, network interfaces, real-time clock, and communications.

Although Software 2000 Inc. can supply TurboDOS pre-configured for certain specific hardware configurations, most OEMs and many dealers and end-users will want to implement their own hardware-dependent drivers. Driver modules may be readily written by any programmer competant in Z80 assembly-language. This section provides detailed instructions to programmers for implementing such driver modules, and the Appendix includes assembly listings of various sample drivers.

Assembler Requirements

Drivers must be written using a Z80 assembler capable of producing relocatable modules with symbolic linkage information in the industry-standard Microsoft relocatable module format. Both Microsoft's MACRO-80 and Digital Research's RMAC assemblers have these characteristics, and are well suited for implementing TurboDOS drivers.

Phoenix Software Associates' (PSA) assembler (formerly TDL and Xitan) is an excellent relocatable Z80 assembler, but it produces object modules in a non-standard format. To alleviate this problem, a conversion utility (RELCVT.COM) is available from Software 2000 Inc. for converting PSA-format object modules to standard Microsoft format. The command

```
RELCVT  filename
```

converts the PSA-format .REL file specified by "filename" into standard Microsoft .REL format. Wherever the characters "." and "%" appear in names in the PSA-format module, they are replaced by the characters "?" and "@" (respectively) in the Microsoft-format module.

Programming Conventions

Assembly-language examples in this section and in the Appendix are all coded for the PSA assembler. In the examples, the name suffix "#" is used to reference an external name that is defined in another module. The label suffix "::" is used to define a public name that is available for reference in other modules. Some assemblers require that such names be declared in an EXTERN or PUBLIC statement. Program, data, and common segments are introduced with a .LOC statement in the examples. Some assemblers use different statements (e.g., CSEG, DSEG, COMMON) to accomplish the same thing. Also, the symbol "." represents the current location counter value; some assemblers use "$" or "*" instead.

Dynamic Memory Allocation

The resident portion of TurboDOS resides in the topmost portion of system memory. TurboDOS uses a common memory management module (MEMMGR) to provide dynamic allocation and de-allocation of memory space required for disk buffers, de-spool requests, file interlocks, DO-file nesting, etc. Dynamic memory segments are allocated downward from the base of the TurboDOS resident area, thereby reducing the space available for the transient program area (TPA). Deallocated segments are concatenated with any neighbors and threaded on a free list. A best-fit algorithm is used to reduce memory fragmentation.

Allocation and de-allocation of memory segments is accomplished in this manner:

```
LXI     H,36        ;get size of requested segment in HL
CALL    ALLOC#      ;allocate segment
ORA     A           ;was segment allocated successfully?
JNZ     ERROR       ;if not, error
PUSH    H           ;else, segment base address in HL
.
.
.
POP     H           ;get address of memory segment in HL
CALL    DEALOC#     ;de-allocate segment
```

ALLOC# prefixes each dynamic memory segment with a word containing the segment length, so that DEALOC# can tell how much memory is to be de-allocated. ALLOC# does not zero the newly allocated segment.

Threaded Lists

All dynamic structures in TurboDOS are maintained as threaded lists with bidirectional linkages. This technique permits a node to be easily added or deleted anywhere in a threaded list without searching. The list head and each list node must contain a two-word linkage (forward pointer and backward pointer).

Manipulation of threaded lists is accomplished in this manner:

```
LSTHED:                         ;list head (initialized to empty)
        .WORD   .               ;forward pointer
        .WORD   .-2             ;backward pointer
;
LSTNOD:                         ;list node
        .WORD   0               ;forward pointer
        .WORD   0               ;backward pointer
        .BLKB   128             ;node body
          .
          .
          .
        LXI     H,LSTHED        ;get list head address in HL
        LXI     D,LSTNOD        ;get new node address in DE
        CALL    LNKEND#         ;link node to end of list
          .
          .
          .
        LXI     H,LSTNOD        ;get node address in HL
        CALL    UNLINK#         ;unlink node from list
          .
          .
          .
        LXI     H,LSTHED        ;get list head address in HL
        LXI     D,LSTNOD        ;get new node address in DE
        CALL    LNKBEG#         ;link node to beginning of list
```

Dispatching

TurboDOS incorporates an extremely efficient and flexible mechanism for dispatching the Z80 microprocessor among various competing processes. In writing device drivers for TurboDOS, the programmer must take extreme care to use the dispatcher correctly in order to attain maximum performance.

Basically, the dispatcher enables one process to wait for some event (e.g., character available, operation complete) while allowing other processes to utilize the microprocessor. For each such event, the programmer must define a three-word structure called an "event semaphore". A semaphore consists of a count-word followed by a two-word list head. The count-word is used by the dispacher to keep track of the status of the event, while the list head defines a threaded list of processes waiting for the event.

There are two fundamental operations which affect an event semaphore: waiting for the event to occur (WAIT#), and signalling that the event has occurred (SIGNAL#). These are coded in the following manner:

```
EVENT:                          ;event semaphore
        .WORD   0               ;semaphore count
        .WORD   .               ;semaphore list forward pointer
        .WORD   .-2             ;semaphore list backward pointer
          .
          .
          .
        LXI     H,EVENT         ;get event semaphore address
        CALL    WAIT#           ;wait until event occurs
          .
          .
          .
        LXI     H,EVENT         ;get event semaphore address
        CALL    SIGNAL#         ;signal that event has occured
```

Whenever a process waits on an event semaphore, WAIT# decrements the count-word of the semaphore. Thus, a negative count of -N signifies that there are N processes waiting for that event to occur. Whenever the occurrence of an event is signalled, SIGNAL# increments the count-word of the semaphore and awakens the process that has been waiting longest.

If the occurrence of an event is signalled but no process is waiting for it, then SIGNAL# simply increments the count-word to a positive value. Thus, a positive count N signifies that there have been N occurrences of the event for which no process was waiting. In this case, the next N calls to WAIT# on that semaphore will return immediately without waiting.

Sometimes it is necessary for a process to wait for a specific time interval (e.g., head-settle delay, carriage-return delay) rather than for the occurrence of a specific event. The TurboDOS dispatcher provides a delay facility (DELAY#) which permits other processes to use the microprocessor while one process is waiting for such a time interval to expire. Delay intervals are measured in an implementation-defined unit called a "tick"; in most implementations, ticks occur 50 or 60 times per second. Delays may be coded in the following manner:

```
    .
    .
    .
LXI     H,6         ;get number of ticks to delay
CALL    DELAY#      ;delay for specified interval
    .
    .
    .
```

A delay of zero ticks may be specified to effect a very short delay, or simply to relinquish the processor to other processes on a "courtesy" basis.

For best performance, all driver delays should be accomplished by means of WAIT# (wait for an event to be signalled) or DELAY# (wait for a given interval of time to elapse). Drivers should never be coded to spin in a wait loop.

Interrupt Service Routines

The TurboDOS dispatching mechanism is especially efficient when used with interrupt-driven peripheral devices. In most situations, the interrupt service routine simply calls SIGNAL# to indicate that the event associated with the interrupt has occurred.

Service routines for low-frequency interrupts (no more than 100 times per second) should exit by means of the standard interrupt service routine exit ISRXIT# in order to provide frequent time-slicing of processes. Service routines for high-frequency interrupts (occurring more than 100 times per second) should simply enable interrupts and return, in order to avoid excessive dispatch overhead.

It is good programming practice for interrupt service routines to set up an auxilliary stack, in order to avoid the possibility of overflowing the stack area of a user's program. TurboDOS provides a standard interrupt stack area (INTSTK#) and stack pointer save location (INTSP#) for this purpose.

A simple interrupt service routine for a low-frequency interrupt could be coded in this manner:

```
DEVISR:  SSPD     INTSP#      ;save user's stack pointer
         LXI      SP,INTSTK#  ;set up auxilliary stack
         PUSH     PSW         ;save all registers
         PUSH     B
         PUSH     D
         PUSH     H
         IN       STATUS      ;reset the interrupt condition
         LXI      H,EVENT     ;get event semaphore address
         CALL     SIGNAL#     ;signal that event has occured
         POP      H           ;restore all registers
         POP      D
         POP      B
         POP      PSW
         LSPD     INTSP#      ;restore user's stack pointer
         JMP      ISRXIT#     ;exit through dispacher
```

In more complex interrupt situations, it may be necessary for an interrupt service routine to determine which of several possible events occurred, and to signal one of several alternative semaphores. Sometimes it may be desirable for an interrupt service routine to perform a data buffering function (e.g., to provide keyboard type-ahead).

Poll Routines

Peripheral devices which are not capable of interrupting the processor must be polled by the device driver. To facilitate this, the TurboDOS dispatcher maintains a threaded list of poll routines, and executes the routines on the list at every dispatch. The function of each poll routine is to check the status of its peripheral device, and to signal the occurrence of an event (e.g., character available, operation complete) when it occurs. The routine LNKPOL# can be called at any time to link a new poll routine onto the poll list.

The only tricky thing about a poll routine is that it must be coded in such a fashion that it will not signal the occurrence a particular event more than once. This can be accomplished in various ways, but a most efficient method is for the poll routine to simply unlink itself from the dispatcher's poll list as soon as it has signalled the occurrence of an event. This can be accomplished in the following manner:

```
EVENT:                          ;event semaphore
        .WORD   0               ;semaphore count
        .WORD   .               ;semaphore list forward pointer
        .WORD   .-2             ;semaphore list backward pointer
          .
          .
          .
        LXI     D,POLNOD        ;get poll routine node address
        CALL    LNKPOL#         ;link poll routine onto poll list
        CALL    POLRTN          ;pre-test peripheral status (optional)
        LXI     H,EVENT         ;get event semaphore address
        CALL    WAIT#           ;wait until event occurs
          .
          .
          .
POLNOD: .WORD   0               ;poll routine node linkage
        .WORD   0
POLRTN: IN      STATUS          ;get peripheral status
        ANI     MASK            ;is input character available?
        RZ                      ;if not, exit
        LXI     H,EVENT         ;else, get event semaphore address
        CALL    SIGNAL#         ;signal that event has occurred
        LXI     H,POLNOD        ;get poll routine node address
        CALL    UNLINK#         ;unlink poll routine from poll list
        RET                     ;done
```

Re-Entrancy and Mutual Exclusion

All TurboDOS process-level and kernel-level modules permit re-entrant execution by multiple processes. However, most driver-level modules are not coded re-entrantly (since most peripheral devices can only do one thing at a time). Consequently, most drivers must make use of a mutual-exclusion interlock to prevent re-entrant execution.

Using the TurboDOS event semaphore mechanism, such a mutual-exclusion interlock can be implemented very simply in the following manner:

```
MXLOCK:                             ;mutual-exclusion interlock semaphore
        .WORD   1                   ;semaphore count (initialized to 1!)
        .WORD   .                   ;semaphore list head forward pointer
        .WORD   .-2                 ;semaphore list head backward pointer
;
DRIVER: LXI     H,MXLOCK            ;get interlock semaphore address
        CALL    WAIT#               ;wait if driver is already in use
          .
          .
          .
        LXI     H,MXLOCK            ;get interlock semaphore address
        CALL    SIGNAL#             ;signal driver no longer in use
        RET                         ;done
```

Note that the interlock semaphore count-word must be initialized to 1 (instead of 0) for this scheme to work properly.

Sample Interrupt-Driven Device Driver

The following is a simple device driver for an interrupt-driven serial input device. It illustrates the coding techniques described previously:

```
MXLOCK:                             ;mutual-exclusion interlock semaphore
        .WORD   1                   ;semaphore count (initialized to 1!)
        .WORD   .                   ;semaphore list head forward pointer
        .WORD   .-2                 ;semaphore list head backward pointer
;
EVENT:                              ;event semaphore
        .WORD   0                   ;semaphore count
        .WORD   .                   ;semaphore list forward pointer
        .WORD   .-2                 ;semaphore list backward pointer
;
CHRSAV: .BYTE   0                   ;input character save location
;
DRIVER: LXI     H,MXLOCK            ;get interlock semaphore address
        CALL    WAIT#               ;wait if driver is already in use
        EI                          ;ensure that interrupts are enabled
        LXI     H,EVENT             ;get event semaphore
        CALL    WAIT#               ;wait for event to occur
        LDA     CHRSAV              ;get input character
        PUSH    PSW                 ;save on stack
        LXI     H,MXLOCK            ;get interlock semaphore address
        CALL    SIGNAL#             ;signal driver no longer in use
        POP     PSW                 ;return input character in A-register
        RET                         ;done
;
DEVISR: SSPD    INTSP#              ;save user's stack pointer
        LXI     SP,INTSTK#          ;set up auxilliary stack
        PUSH    PSW                 ;save all registers
        PUSH    B
        PUSH    D
        PUSH    H
        IN      STATUS              ;get peripheral status
        ANI     MASK                ;is input character available?
        JRZ     ..X                 ;if not, exit
        IN      DATA                ;else, get input character
        STA     CHRSAV              ;save input character
        LXI     H,EVENT             ;get event semaphore address
        CALL    SIGNAL#             ;signal that event has occured
..X:    POP     H                   ;restore all registers
        POP     D
        POP     B
        POP     PSW
        LSPD    INTSP#              ;restore user's stack pointer
        JMP     ISRXIT#             ;exit through dispacher
```

Sample Polled Device Driver

The following is a simple device driver for a polled serial input device. It illustrates the coding techniques described previously:

```
MXLOCK:                         ;mutual-exclusion interlock semaphore
        .WORD   1               ;semaphore count (initialized to 1!)
        .WORD   .               ;semaphore list head forward pointer
        .WORD   .-2             ;semaphore list head backward pointer
;
EVENT:                          ;event semaphore
        .WORD   0               ;semaphore count
        .WORD   .               ;semaphore list forward pointer
        .WORD   .-2             ;semaphore list backward pointer
;
CHRSAV: .BYTE   0               ;input character save location
;
DRIVER: LXI     H,MXLOCK        ;get interlock semaphore address
        CALL    WAIT#           ;wait if driver is already in use
        LXI     D,POLNOD        ;get poll routine node address
        CALL    LNKPOL#         ;link poll routine onto poll list
        CALL    POLRTN          ;pre-test peripheral status (optional)
        LXI     H,EVENT         ;get event semaphore address
        CALL    WAIT#           ;wait until event occurs
        LDA     CHRSAV          ;get input character
        PUSH    PSW             ;save on stack
        LXI     H,MXLOCK        ;get interlock semaphore address
        CALL    SIGNAL#         ;signal driver no longer in use
        POP     PSW             ;return input character in A-register
        RET                     ;done
;
POLNOD: .WORD   0               ;poll routine node linkage
        .WORD   0
POLRTN: IN      STATUS          ;get peripheral status
        ANI     MASK            ;is input character available?
        RZ                      ;if not, exit
        IN      DATA            ;else, get input character
        STA     CHRSAV          ;save input character
        LXI     H,EVENT         ;else, get event semaphore address
        CALL    SIGNAL#         ;signal that event has occurred
        LXI     H,POLNOD        ;get poll routine node address
        CALL    UNLINK#         ;unlink poll routine from poll list
        RET                     ;done
```

Initialization Segments

In programming hardware-dependent driver modules, it is frequently necessary to include a considerable amount of initialization code which is executed only once (at system start-up) and never needed again. TurboDOS provides a space-saving mechanism whereby such initialization code may be loaded and executed in lower memory (TPA), instead of becoming part of the resident operating system. To use this feature, each initialization segment must be assembled under a special location counter (i.e., common block) named ?INIT? (or .INIT.# if PSA assembler and RELCVT are used):

```
            .LOC    .INIT.#         ;initialization segment follows
;
HDWNIT:: XRA        A               ;start of initialization code
              .
              .
              .
            RET                     ;end of initialization code
;
```

Page-Oriented Segments

Sometimes, a programmer must force a segment of code or data to begin on a 256-byte page boundary. Examples are interrupt vectors for Z80 IM2, and the simulated CP/M BIOS branch table. To do this, a page-oriented segment must be assembled under a special location counter (i.e., common block) named ?PAGE? (or .PAGE.# if PSA assembler and RELCVT are used). If several modules utilize the ?PAGE? location counter, then a separate page is allocated for each such module.

Inter-Process Messages

For passing messages from one process to another, TurboDOS makes use of a five-word structure called a "message node". A message node consists of a three-word event semaphore followed by a two-word message list head. Subroutines are provided for sending messages to a message node (SNDMSG#), and receiving messages from a message node (RCVMSG#). Typically, the sending process allocates a segment of dynamic memory in which to build the message, and the receiving process deallocates the segment after making use of the message:

```
MSGNOD:                         ;message node
        .WORD   0               ;semaphore count
        .WORD   .               ;semaphore list forward pointer
        .WORD   .-2             ;semaphore list backward pointer
        .WORD   .               ;message list forward pointer
        .WORD   .-2             ;message list backward pointer

SEND:   LXI     H,12            ;get size of message to send
        CALL    ALLOC#          ;allocate message packet
        PUSH    H               ;save message packet address
        .
        .                       ;build message in packet
        .
        POP     D               ;get address of message packet in DE
        LXI     H,MSGNOD        ;get address of message node in HL
        CALL    SNDMSG#         ;send inter-process message
        .
        .
        .

REC:    LXI     H,MSGNOD        ;get address of message node in HL
        CALL    RCVMSG#         ;receive inter-process message
        PUSH    H               ;save message packet address
        .
        .                       ;read message in packet
        .
        POP     H               ;get address of message packet in HL
        CALL    DEALOC#         ;deallocate message packet
        .
        .
        .
```

Console Subroutines

The following illustrates the use of various console-related subroutines which may be called from within driver modules:

```
        CALL    CONST#      ;returns console status in A-reg
        ORA     A           ;is console input available?
        RZ                  ;if not, exit
        CALL    CONIN#      ;returns console input in A-reg
        CALL    UPRCAS#     ;convert lower-case letters to upper-case
        MOV     C,A         ;move character to C-reg
        CALL    CONOUT#     ;displays character passed in C-reg

        CALL    DMS#        ;display following message
..MSG:  .ASCIS  "Message"   ;last byte of message has sign-bit set
        LXI     H,..MSG     ;HL -> sign-bit-terminated message
        CALL    DMSHL#      ;display message pointed-to by HL

        LXI     H,31416     ;HL has any 16-bit value
        CALL    DECOUT#     ;displays HL value in decimal
```

Creating a Resident Process

In some circumstances, it may be desirable to activate a resident process which runs in the background concurrent with other system activities. The create-process subroutine CRPROC# may be called to create such a process at system initialization time as illustrated below:

```
          .LOC    .INIT.#         ;initialization segment follows
;
HDWNIT::                          ;hardware-dependent initialization
          LXI     D,BACKGR        ;get process entrypoint address
          CALL    CRPROC#         ;create process
            .
            .
            .


          .LOC    .PROG.#         ;program segment follows
;
BACKGR:                           ;background process starts here
          LXI     D,60*60         ;number of ticks in one minute
          MVI     C,125           ;number of "delay process" function
          CALL    OSNTRY#         ;delay for one minute
          LXI     D,..FCB         ;get FCB address
          MVI     C,15            ;number of "open file" function
          CALL    OSNTRY#         ;open the file
          ORA     A               ;was file opened successfully?
          JRNZ    BACKGR          ;if not, try again in a minute
            .                     ;otherwise, ...
            .
            .
..FCB:    .BYTE   0               ;file control block
          .ASCII  "FILENAME"
          .ASCII  "TYP"
          .BYTE   [24]0
```

The CRPROC# routine automatically assigns a TurboDOS work area whose address appears to the new process in the X-register, and a 64-word stack area whose address appears in the SP-register. If the process requires a re-entrant work area (usually dynamically allocated), its address should be passed to CRPROC# in the HL-register and will appear to the new process in the Y-register.

Note that the resident process must make all its operating system requests in exactly the same fashion as a transient program would, except that the operating system entrypoint OSNTRY# is used instead of location 0005H. This is very important. A resident process must not make direct calls to kernel-level subroutines such as WAIT#, SIGNAL#, DELAY#, SNDMSG#, RCVMSG#, ALLOC#, DEALOC#, DMS#, etc. Also, a resident process is not attached to a console, so any console input/output operations it issues will be ignored.

A resident process must preserve index register X, but may use other registers as desired.

Driver Interface Specifications

The interface specifications for various kinds of device drivers are described below. Drivers may be packaged into as many or few separate modules as desired by the programmer. In general, it is easier to reconfigure TurboDOS for a wide variety of peripheral devices if the driver for each device is packaged as a separate module.

TurboDOS may be configured with multiple disk, console, printer and network drivers. The disk driver entrypoint table refers to disk driver entrypoints DSKDRA#, DSKDRB#, DSKDRC#, etc. Each disk driver should be coded with a public entrypoint DSKDR@:: (or DSKDR%:: if PSA assembler and RELCVT are used). The GEN command automatically maps successive definitions of such names by replacing the trailing @ by A, B, C, etc. The same technique should be used for console, printer, and network drivers.

To allow various TurboDOS modules to be included or omitted at will, the GEN command automatically resolves all undefined external references to the default symbol ?UND?#. The TurboDOS common subroutine module COMSUB contains the following stub routine:

```
?UND?::  NOP              ;single- or double-length load
         NOP              ;of undefined returns zero
         XRA     A        ;call of undefined returns A=0
         RET              ;done
```

Thus, it is always safe to load or call an external name, whether or not it is defined.

Driver routines must preserve the stack and the index registers X and Y, but may use other registers as desired.

Initialization

All necessary hardware initialization and interrupt vector setup should be performed by an initialization routine that begins with the public entry name HDWNIT::. This routine is called by TurboDOS at system start-up with interrupts disabled. The hardware initialization procedure must not enable interrupts or make calls to WAIT# or DELAY#. In most cases, the HDWNIT:: routine should contain a series of calls to individual driver initialization subroutines. All initialization code which is not needed again should be assembled under the location counter (i.e., common block) ?INIT?.

Console Drivers

Each console driver routine should begin with the public entry name CONDR@::, and should perform a console operation in accordance with the operation code (0, 1, 2, 8 or 9) passed by TurboDOS in the E-register. A console number is passed in the B-register (obtained from the least-significant nibble of the console assignment table entry CONAST#).

If E=0, the driver must determine if a console input character is available. It must return with A=-1 if a character is available, or with A=0 if no character is available. If a character is available, the driver must return it in the C-register, but must not "consume" the character. (This look-ahead capability is used by TurboDOS to detect attention requests.)

If E=1, the driver must obtain a console input character (waiting for one if necessary), and return it in the A-register.

If E=2, the driver must output to the console the character passed by TurboDOS in the C-register.

If E=8, the driver should prepare to display a TurboDOS error message; if E=9, the driver should revert to normal display. Error message displays issued by TurboDOS are always preceded by an E=8 call and followed by an E=9 call. This gives the console driver the opportunity to take special action for system error messages (e.g., 25th line, reverse video). For simple console devices, the driver should perform a carriage-return and line-feed in response to E=8 and E=9 calls.

Printer Drivers

Each printer driver routine should begin with the public entry name LSTDR@::, and should perform a printer operation in accordance with the operation code (2 or 7) passed by TurboDOS in the E-register. A printer number is passed in the B-register (obtained from the least-significant nibble of the printer assignment table entry LSTAST#).

If E=2, the driver must output to the printer the character passed by TurboDOS in the C-register.

If E=7, the driver should take any appropriate end-of-print-job action (e.g., re-align forms, drop ribbon, home print head).

Network Circuit Drivers

Each network circuit driver should begin with the public entry name CKTDR@::, and should send or receive a network message, according to the operation code (0 or 1) passed by TurboDOS in the C-register.

If C=0, the driver must receive a network message into the message buffer whose address is passed by TurboDOS in the DE-registers. If a message is received successfully, the driver must return with A=0. On the other hand, a malfunction of any remote processor is detected, the driver must return with A=-1 and must return the network address of the crashed processor in the DE-registers.

If C=1, the driver must send the network message from the message buffer whose address is passed by TurboDOS in the DE-registers. If a message is sent successfully, the driver must return with A=0. On the other hand, if the message could not be sent because of a malfunction of the destination processor, the driver must return with A=-1 and must return the network address of the crashed processor in the DE-registers.

The format of a network message buffer is:

```
Linkage:  .WORD   .          ;buffer linkage
          .WORD   .

Header:   .BYTE   MSGLEN     ;message length (excludes linkage)
          .WORD   MSGDID     ;network address of message destination
          .BYTE   MSGPID     ;process ID
          .WORD   MSGSID     ;network address of message source
          .WORD   MSGOID     ;network address of originator
          .BYTE   MSGOPR     ;process ID of originator
          .BYTE   MSGLVL     ;forwarding level number
          .BYTE   MSGFCD     ;message format code

Body:     .BLKB   7          ;registers: A,C,B,E,D,L,H
          .BLKB   38         ;FCB data and related info (optional)
          .BLKB   128        ;record data (optional)
```

The first four bytes of a message buffer contains a linkage used by TurboDOS, and should not be sent or received by the driver. The eleven-byte header and variable-length body should be passed over the network. The driver should only need to look at the message length and destination ID in order to do its job. On a receive request (C=0), TurboDOS presets the message length byte to the maximum allowable message length, and expects that byte to contain the actual message length upon return. On a send request (C=1), TurboDOS presets the message length byte to the actual length

of the message to be sent (header plus body).

In simple master-slave network situations, it is often desirable for the circuit driver in the master processor to periodically "poll" the slave processors on its circuit in order to detect any slave malfunctions in a timely fashion and to effect recovery. If the circuit driver reports that a slave has crashed (by returning A=-1 and DE=net-address), then the circuit driver must not accept any further messages from that slave until TurboDOS has completed its recovery for that slave. TurboDOS signals the driver that such recovery is complete by sending a dummy message destined for that slave with a length of zero. The driver should not actually send such a message to the slave, but could initiate whatever action is appropriate to reset the slave and initiate a new down-load of the slave operating system.

For a slave processor to have its operating system downloaded over the network, it must send a special download-request message consisting of a standard eleven-byte header (with MSGPID, MSGOID and MSGFCD set to zero) followed by a one-byte body containing a "download suffix" character. The master processor specified by MSGDID will return a reply message whose body contains the first 128-byte record of the file OSSLAVEx.SYS (where "x" is the specified download suffix). The slave should continue to send download-request messages and receive successive records of the .SYS file until it receives a "short" reply message signifying end-of-file. The first word of the OSSLAVEx.SYS file specifies the base address to which the system should be moved, and the second word specifies the total length of the system. The single byte passed as the body of the "short" reply message identifies the system disk, and should be passed to the system in the A-register.

Disk Drivers

Each disk driver routine should begin with the public entry name DSKDR@::, and should perform a physical disk operation as specified by the physical disk request packet whose address is passed by TurboDOS in the X-register. The format of the physical disk request packet is:

```
X+0:    .BYTE   OPCODE      ;disk operation code
X+1:    .BYTE   DRIVE       ;drive number on controller (base 0)
X+2:    .WORD   TRACK       ;physical track number (base 0)
X+4:    .WORD   SECTOR      ;physical sector number (base 0)
X+6:    .WORD   SECCNT      ;number of sectors to read or write
X+8:    .WORD   BYTCNT      ;number of bytes to read or write
X+10:   .WORD   DMAADR      ;DMA address for read or write
X+12:   .WORD   DSTADR      ;disk specification table address
;
;copy of disk specification table follows
;
X+14:   .BYTE   BLKSIZ      ;block size (3=1K, 4=2K,..., 7=16K)
X+15:   .WORD   NMBLKS      ;number of blocks, total
X+17:   .BYTE   NMBDIR      ;number of directory blocks
X+18:   .BYTE   SECSIZ      ;sector size (0=128, 1=256, 2=512,..., 7=16K)
X+19:   .WORD   SECTRK      ;sectors per track
X+21:   .WORD   TRKDSK      ;total tracks on disk
X+23:   .WORD   RESTRK      ;reserved tracks on disk
```

If OPCODE=0, then the driver must read SECCNT physical sectors (or BYTCNT bytes) into DMAADR, starting at TRACK and SECTOR on DRIVE. Return with A=-1 if an unrecoverable error occurs, otherwise return with A=0. Although TurboDOS may request many consecutive sectors to be read, it will never request an operation which extends past the end of the specified track.

If OPCODE=1, then the driver must write SECCNT physical sectors (or BYTCNT bytes) from DMAADR, starting at TRACK and SECTOR on DRIVE. Return with A=-1 if an unrecoverable error occurs, otherwise return with A=0. Although TurboDOS may request many consecutive sectors to be written, it will never request an operation which extends past the end of the specified track.

If OPCODE=2, then the driver must determine the type of disk mounted in the specified drive, and must return in DSTADR the address of an 11-byte disk specification table structured as follows:

```
DST:    .BYTE   BLKSIZ      ;block size (3=1K, 4=2K,..., 7=16K)
        .WORD   NMBLKS      ;number of blocks, total
        .BYTE   NMBDIR      ;number of directory blocks
        .BYTE   SECSIZ      ;sector size (0=128, 1=256, 2=512,..., 7=16K)
        .WORD   SECTRK      ;sectors per track
        .WORD   TRKDSK      ;total tracks on disk
        .WORD   RESTRK      ;reserved tracks on disk
```

On return, TurboDOS moves a copy of the disk specification table into X+14 through X+24, where it is available for subsequent read and write operations on that drive. If the drive is not ready or the type is unrecognizable, the driver must return A=0, otherwise it must return A=-1.

If OPCODE=3, then the driver must determine whether or not the specified drive is ready. Return A=-1 if the drive is ready, otherwise return A=0.

If OPCODE=4, then the driver must format (i.e., initialize) the specified TRACK on DRIVE. Hardware-dependent formatting information will be provided at DMAADR. Return with A=-1 if an unrecoverable error occurs, otherwise return with A=0.

Real-Time Clock Driver

The real-time clock driver normally consists of an interrupt service routine which responds to interrupts from a periodic interrupt source (preferably 50 to 60 times per second). The interrupt service routine should call DLYTIC# once per system tick to synchronize process delay requests. It should also call RTCSEC# once per second (i.e., every 50 or 60 ticks) to update the system time and date. Finally, it should exit through ISRXIT# to provide a periodic system time-slice.

Excluding necessary initialization code, a typical real-time clock driver might look like this:

```
RTCCNT: .BYTE   1           ;divide-by-60 counter
;
RTCISR: SSPD    INTSP#      ;save user's stack pointer
        LXI     SP,INTSTK#  ;set up auxilliary stack
        PUSH    PSW         ;save all registers
        PUSH    B
        PUSH    D
        PUSH    H
        IN      STATUS      ;reset the interrupt condition
        CALL    DLYTIC#     ;signal one tick elapsed time
        LXI     H,RTCCNT    ;get divide-by-60 counter
        DCR     M           ;decrement counter
        JRNZ    ..X         ;not 60 ticks yet, exit
        MVI     M,60        ;else, reset counter to 60 ticks
        CALL    RTCSEC#     ;signal one second elapsed time
..X:    POP     H           ;restore all registers
        POP     D
        POP     B
        POP     PSW
        LSPD    INTSP#      ;restore user's stack pointer
        JMP     ISRXIT#     ;exit through dispacher
```

If it is possible to determine the date and/or time-of-day at cold-start (e.g., by means of a battery-powered clock board), then the driver may initialize the following public symbols in RTCMGR:

```
SECS::  .BYTE   0           ;0...59
MINS::  .BYTE   0           ;0...59
HOURS:: .BYTE   0           ;0...23
JDATE:: .WORD   8001H       ;Julian date, based 31 Dec 47
```

Comm Channel Drivers

The comm channel driver supports the TurboDOS communications extensions (functions 87...93), and is not required if these functions are not used. The comm channel driver routine should begin with the public entry name COMDRV::, and should perform a comm channel operation in accordance with the operation code passed by TurboDOS in the E-register. A channel number is passed in the B-register.

If E=0, the driver must determine if an input character is available on the specified channel. It must return with A=-1 if a character is available, or with A=0 if no character is available.

If E=1, the driver must obtain an input character from the specified channel (waiting for one if necessary), and return it in the A-register.

If E=2, the driver must output to the specified channel the character passed by TurboDOS in the C-register.

If E=3, the driver must set the baud rate of the specified channel according to the baud rate code passed by TurboDOS in the C-register. (See function 90 in the User's Guide for definition of the codes.)

If E=4, the driver must obtain the current baud rate code for the specified channel, and return it in the A-register.

If E=5, the driver must set the modem controls of the specified channel according to the modem control vector passed by TurboDOS in the C-register. (See function 92 in the User's Guide for definition of the vector.)

If E=6, the driver must obtain the current modem status vector for the specified channel, and return it in the A-register. (See function 93 in the User's Guide for definition of the vector.)

Bootstrap ROM

Implementation of a TurboDOS bootstrap ROM involves linking the standard bootstrap module OSBOOT with a hardware-dependent driver OSBDRV. This should be accomplished with the GEN command, using the ";Lxxxx" option to establish the desired ROM base address. Since the OSBOOT module requires only 0.4K, the completed bootstrap can fit in a 1K ROM (e.g., 2708) if the driver is kept simple enough. The driver module OSBDRV must define five public entry names: INIT::, SELECT::, READ::, XFER::, and RAM::.

INIT:: is called at the beginning of the bootstrap process, and performs any required hardware initialization (e.g., of the disk controller). It must return with the load base address in the HL-registers. The load base address determines the RAM where loading of the file OSLOAD.COM will begin. It should normally be 0100H, but may have to be a higher address if low RAM cannot be written while the ROM is enabled.

SELECT:: selects the disk drive according to the drive number 0...15 passed in the A-register. If the selected drive is not ready or non-existent, then this routine must return A=0. Otherwise, it must return A=-1, and must return the address of an appropriate disk specification table in the HL-registers. The disk specification table is an 11-byte table whose format is the same as described earlier for the normal disk driver.

READ:: reads one physical sector from the last selected drive into RAM. On entry, the physical track is passed in the BC-registers, the physical sector is passed in the DE-registers, and the starting RAM address is passed in the HL-registers. The routine must return with A=0 if the operation was successful, or with A=-1 if an unrecoverable error occurred.

XFER:: is executed at the end of the bootstrap process, and transfers control to the loader program OSLOAD.COM which has been loaded into RAM. In most cases, this involves simply setting location 0080H to zero (to simulate a null command tail), and jumping to 0100H. However, if INIT returned a loader base other than 0100H, then XFER should move the loader program down to 0100H prior to execution.

RAM:: defines the beginning of a 64-byte area of RAM that OSBOOT can use as working storage. Obviously, it should not be located in the area in which OSLOAD.COM will be loaded!

APPENDIX — SAMPLE DRIVER LISTINGS

UATE - TURBODOS OPERATING SYSTEM --COMMON SYMBOLIC EQUATES FOR DRIVERS


```
                        ;
                        ; **********************************************************
                        ; *                                                        *
                        ; *  The following are common symbolic equates used in     *
                        ; *  the various drivers which follow.  They are refer-    *
                        ; *  enced by a .INSERT DREQUATE in each driver module.    *
                        ; *                                                        *
                        ; **********************************************************
                        ;
                        ; COPYRIGHT (C) 1982 BY SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  EQUATE          ;MODULE ID
                        ;
                        ; ASCII EQUIVALENCES
                        ;
0000                    ANUL    == 00H  ;NULL
0001                    ASOH    == 01H  ;SOH
0002                    ASTX    == 02H  ;STX
0003                    AETX    == 03H  ;ETX
0004                    AEOT    == 04H  ;EOT
0005                    AENQ    == 05H  ;ENQ
0006                    AACK    == 06H  ;ACK
0007                    ABEL    == 07H  ;BELL
0008                    ABS     == 08H  ;BS
0009                    AHT     == 09H  ;HT
000A                    ALF     == 0AH  ;LF
000B                    AVT     == 0BH  ;VT
000C                    AFF     == 0CH  ;FF
000D                    ACR     == 0DH  ;CR
000E                    ASO     == 0EH  ;SO
000F                    ASI     == 0FH  ;SI
0010                    ADLE    == 10H  ;DLE
0011                    ADC1    == 11H  ;DC1
0012                    ADC2    == 12H  ;DC2
0013                    ADC3    == 13H  ;DC3
0014                    ADC4    == 14H  ;DC4
0015                    ANAK    == 15H  ;NAK
0016                    ASYN    == 16H  ;SYN
0017                    AETB    == 17H  ;ETB
0018                    ACAN    == 18H  ;CAN
0019                    AEM     == 19H  ;EM
001A                    ASUB    == 1AH  ;SUB
001B                    AESC    == 1BH  ;ESC
001C                    AFS     == 1CH  ;FS
001D                    AGS     == 1DH  ;GS
001E                    ARS     == 1EH  ;RS
001F                    AUS     == 1FH  ;US
0020                    ASP     == 20H  ;SPACE
007F                    ARUB    == 7FH  ;RUBOUT (DEL)
```

EQUATE - TURBODOS OPERATING SYSTEM --COMMON SYMBOLIC EQUATES FOR DRIVERS


```
                        ;
0000                    WBOOT   == 0000H        ;WARM START ENTRYPOINT
0003                    IOBYTE  == 0003H        ;I/O CONFIGURATION BYTE
0004                    CURDRV  == 0004H        ;CURRENT DEFAULT DRIVE
0005                    OPSYS   == 0005H        ;OPERATING SYSTEM ENTRYPOINT
005C                    TFCB    == 005CH        ;DEFAULT FILE CONTROL BLOCK
0080                    TBUF    == 0080H        ;DEFAULT DISK BUFFER ADDRESS
0100                    TPA     == 0100H        ;TRANSIENT PROGRAM AREA BASE
                        ;
0000                            .LOC    0       ;WORKING STORAGE RELATIVE TO 0
                        ;
0000                    PDRDP:                  ;PD REQUEST DESCRIPTOR PACKET
0000                    PDRFCN: .BLKB   1       ;PD REQUEST FUNCTION NUMBER
0001                    PDRDRV: .BLKB   1       ;PD REQUEST DRIVE NUMBER
0002                    PDRTRK: .BLKW   1       ;PD REQUEST TRACK NUMBER
0004                    PDRSEC: .BLKW   1       ;PD REQUEST SECTOR NUMBER
0006                    PDRSC:  .BLKW   1       ;PD REQUEST SECTOR COUNT
0008                    PDRTC:  .BLKW   1       ;PD REQUEST TRANSFER COUNT
000A                    PDRDMA: .BLKW   1       ;PD REQUEST DMA ADDRESS
000C                    PDRDST: .BLKW   1       ;PD REQUEST DRIVE SPEC TABLE ADDR
000E                    PDRLEN  == .-PDRDP      ;PD REQUEST DESCRIPTOR PACKET LEN

000E                    DSKNFO:                 ;DISK TYPE INFORMATION
000E                    BLKSIZ: .BLKB   1       ;BLOCK SIZE
000F                    NMBLKS: .BLKW   1       ;NUMBER OF BLOCKS
0011                    NMBDIR: .BLKB   1       ;NUMBER OF DIRECTORY BLOCKS
0012                    SECSIZ: .BLKB   1       ;PHYSICAL SECTOR SIZE (2^N*128)
0013                    SECTRK: .BLKW   1       ;PHYSICAL SECTORS PER TRACK
0015                    TRKDSK: .BLKW   1       ;PHYSICAL TRACKS PER DISK
0017                    RESTRK: .BLKW   1       ;NUMBER OF RESERVED TRACKS
000B                    DNFOL   == .-DSKNFO     ;DISK INFO LENGTH
                        ;
                        .END
```

ENIT - TURBODOS OPERATING SYSTEM MEMORY PARITY INITIALIZATION


```
                        ;
                        ; ************************************************************
                        ; *                                                          *
                        ; *  This module initializes the parity of the RAM on        *
                        ; *  an IMS 64K RAM board or an IMS 740 slave proces-        *
                        ; *  sor board.  The procedure is to do a 64K block          *
                        ; *  move of all memory which causes parity generation       *
                        ; *  to take place in all memory locations.                  *
                        ; *                                                          *
                        ; ************************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  MPENIT          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000:04                         .LOC    .INIT.# ;LOCATE IN INITIALIZATION AREA
                        ;
0000:04 21 0000         MPENIT::LXI     H,0     ;INITIALIZE MEMORY PARITY
0003:04 11 0000                 LXI     D,0
0006:04 01 0000                 LXI     B,0
0009:04 EDB0                    LDIR
000B:04 AF                      XRA     A       ;CLEAR START-UP PARITY ERROR
000C:04 D300                    OUT     0
000E:04 C9                      RET             ;DONE
                        ;
                        .END
```

NITIMS - TURBODOS OPERATING SYSTEM HARDWARE INITIALIZATION (IMS)


```
                        ;
                        ; ********************************************************
                        ; *                                                      *
                        ; *  This is the hardware initialization routine for     *
                        ; *  an IMS 8000 master processor.  It consists only     *
                        ; *  of calls to the initialization entrypoints of       *
                        ; *  other driver modules.                               *
                        ; *                                                      *
                        ; ********************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  NITIMS          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000:04                         .LOC    .INIT.# ;LOCATE IN INITIALIZATION AREA
                        ;
0000:04 CD 0000:05      HDWNIT::CALL    MPENIT# ;INITIALIZE MEMORY PARITY
0003:04 CD .0000:06             CALL    SPINIT# ;INITIALIZE SERIAL/PARALLEL I/O
0006:04 CD 0000:07              CALL    RTCNIT# ;INITIALIZE REAL TIME CLOCK
0009:04 CD 0000:08              CALL    DSKINA# ;INITIALIZE DISK DRIVER A
000C:04 CD 0000:09              CALL    DSKINB# ;INITIALIZE DISK DRIVER B
000F:04 CD 0000:0A              CALL    DSKINC# ;INITIALIZE DISK DRIVER C
0012:04 CD 0000:0B              CALL    DSKIND# ;INITIALIZE DISK DRIVER D
0015:04 CD 0000:0C              CALL    CKTINA# ;INITIALIZE CIRCUIT DRIVER A
0018:04 CD 0000:0D              CALL    CKTINB# ;INITIALIZE CIRCUIT DRIVER B
001B:04 CD 0000:0E              CALL    CKTINC# ;INITIALIZE CIRCUIT DRIVER C
001E:04 C3 0000:0F              JMP     CKTIND# ;INITIALIZE CIRCUIT DRIVER D
                        ;
                        .END
```

SK401 - TURBODOS OPERATING SYSTEM IMS 8-INCH FLOPPY DISK DRIVER


```
                        ;
                        ; ********************************************************
                        ; *                                                      *
                        ; *  This is a disk driver for the IMS 401 eight-inch    *
                        ; *  floppy disk controller board.  This board makes     *
                        ; *  use of a NEC uPD-765 floppy disk controller chip    *
                        ; *  coupled with an Intel 8257 DMA controller chip.     *
                        ; *                                                      *
                        ; *  This driver is fairly long and complex because:     *
                        ; *                                                      *
                        ; *  (1) The NEC uPD-765 is not as easy to get along     *
                        ; *      with as other chips (such as the Western        *
                        ; *      Digital 1791 or 1793).                          *
                        ; *                                                      *
                        ; *  (2) The driver accomodates a wide variety of        *
                        ; *      disk formats, including both TurboDOS non-      *
                        ; *      interleaved and CP/M interleaved formats.       *
                        ; *      The various formats are defined in a separate   *
                        ; *      module DST8F.                                   *
                        ; *                                                      *
                        ; ********************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  DSK401          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0082                    CH1DMA  = 82H           ;CHANNEL 1 DMA REGISTER (FDC)
0083                    CH1TC   = 83H           ;CHANNEL 1 TERMINAL COUNT (FDC)
0088                    DMACTL  = 88H           ;DMA COMMAND AND STATUS REGISTERS
008A                    DSKSEL  = 8AH           ;DISK SELECT PORT
008C                    DSKCTL  = 8CH           ;STATUS AND INT MASK (BOARD)
008E                    FDCST   = 8EH           ;DISK CONTROLLER STATUS (uPD-765)
008F                    FDCDAT  = 8FH           ;DISK CONTROLLER DATA (uPD-765)
                        ;
0042                    CH1ENA  = 42H           ;DMA CHANNEL 1 ENABLE COMMAND
0000                    DMAVFY  = 00H           ;DMA VERIFY COMMAND
0040                    DMARD   = 40H           ;DMA READ COMMAND
0080                    DMAWR   = 80H           ;DMA WRITE COMMAND
                        ;
0003                    FDCSFY  = 03H           ;FDC SPECIFY COMMAND
0004                    FDCSDS  = 04H           ;FDC SENSE DRIVE STATUS COMMAND
0007                    FDCRCL  = 07H           ;FDC RECALIBRATE COMMAND
0008                    FDCSIS  = 08H           ;FDC SENSE INTERRUPT STATUS COMMAN
000A                    FDCRID  = 0AH           ;FDC READ ID COMMAND
000D                    FDCFMT  = 0DH           ;FDC FORMAT TRACK COMMAND
000F                    FDCSK   = 0FH           ;FDC SEEK COMMAND
0005                    FDCWR   = 05H           ;FDC WRITE COMMAND
```

DSK401 - TURBODOS OPERATING SYSTEM IMS 8-INCH FLOPPY DISK DRIVER


```
0006                    FDCRD   = 06H            ;FDC READ COMMAND
                        ;
0000                    DSKENI  = 0              ;DISK CONTROLLER ENABLE INTERRUPT
0007                    DSKDLC  = 7              ;DISK CONTROLLER DELAY COMPLETE
                        ;
0006                    FDCMFM  = 6              ;FDC DOUBLE-DENSITY BIT
0007                    FDCMT   = 7              ;FDC MULTI-TRACK BIT
                        ;
0004                    FDCBSY  = 4              ;FDC BUSY STATUS
0005                    FDCSE   = 5              ;FDC SEEK END
0006                    FDCOUT  = 6              ;FDC OUTPUT MODE
0007                    FDCRDY  = 7              ;FDC READY FOR DATA
                        ;
0003                    SRT8Q   = 3              ;8 INCH FDD STEP RATE (3 MS-QUME)
0008                    SRT8S   = 8              ;8 INCH FDD STEP RATE (8 MS-SHUG)
                        ;
0024                    HDLT    = 18*2           ;FDD HEAD LOAD TIME (36 MS)
0001                    HDUT    = 1              ;FDD HEAD UNLOAD TIME (16 MS)
                        ;
0003                    STONR   = 3              ;STATUS REGISTER 0 NOT READY
0004                    STOEC   = 4              ;STATUS REGISTER 0 EQUIP CHECK
0005                    STOSE   = 5              ;STATUS REGISTER 0 SEEK END
                        ;
0000                    ST1MA   = 0              ;STATUS REGISTER 1 MISSING ADDR M
0001                    ST1NW   = 1              ;STATUS REGISTER 1 NOT WRITABLE
0002                    ST1ND   = 2              ;STATUS REGISTER 1 NO DATA
0004                    ST1OR   = 4              ;STATUS REGISTER 1 OVER RUN
0005                    ST1DE   = 5              ;STATUS REGISTER 1 DATA ERROR
                        ;
0003                    ST3TS   = 3              ;STATUS REGISTER 3 TWO-SIDED
0004                    ST3T0   = 4              ;STATUS REGISTER 3 TRACK 0
0005                    ST3RDY  = 5              ;STATUS REGISTER 3 READY
0006                    ST3WP   = 6              ;STATUS REGISTER 3 WRITE PROTECTE
                        ;
000A                    MAXTRY  = 10             ;MAX DISK TRY COUNT
                        ;
0002                    TSD     = 2              ;TWO-SIDED DISK BIT (TYPE CODE)
0003                    DDD     = 3              ;DOUBLE DENSITY DISK BIT (TYPE CO

0004                    MINI    = 4              ;MINI-FLOPPY DISK BIT (TYPE CODE)
                        ;
0000"                           .LOC    .DATA.#  ;LOCATE IN DATA AREA
                        ;
0000"   08              SRT401::.BYTE   SRT8S    ;STEP RATE
0001"   00              TRYCNT: .BYTE   0        ;TRY COUNT
0002"   00              CALTBL: .BYTE   0        ;DRIVE CALIBRATED TABLE
0003"   00              FLAGS:  .BYTE   0        ;FLAGS
0004"   00              IORWC:  .BYTE   0        ;I/O READ/WRITE COMMAND
0005"   00              IODMAC: .BYTE   0        ;I/O DMA COMMAND
0006"   0000            RETSP:  .WORD   0        ;ERROR RETURN STACK POINTER
0008"   00              RIDDSK: .BYTE   0        ;READ ID DISK
0009"   00              CURSEC: .BYTE   0        ;CURRENT SECTOR NUMBER
000A"   0000            CURADR: .WORD   0        ;CURRENT DMA ADDRESS
000C"   00              CURSC:  .BYTE   0        ;CURRENT SECTOR COUNT
```

SK401 - TURBODOS OPERATING SYSTEM IMS 8-INCH FLOPPY DISK DRIVER


```
000D"   00              IOERR:  .BYTE   0       ;I/O ERROR STATUS
                        ;
000E"                   DMXSPH:                 ;MUTUAL EXCLUSION SEMAPHORE
000E"   0001                    .WORD   1       ;SEMAPHORE COUNT
0010"   0010"           ..DMXH: .WORD   ..DMXH  ;SEMAPHORE P/D HEAD
0012"   0010"                    .WORD   ..DMXH
                        ;
0014"                   DWTSPH:                 ;DISK WAIT SEMAPHORE
0014"   0000                    .WORD   0       ;SEMAPHORE COUNT
0016"   0016"           ..DWTH: .WORD   ..DWTH  ;SEMAPHORE P/D HEAD
0018"   0016"                    .WORD   ..DWTH
                        ;
001A"                   IDINFO:                 ;SECTOR ID INFO LIST
001A"   00              CYL:    .BYTE   0       ;DISK CYLINDER NUMBER
001B"   00              HEAD:   .BYTE   0       ;DISK HEAD NUMBER
001C"   00              REC:    .BYTE   0       ;DISK RECORD NUMBER
001D"   00              SIZE:   .BYTE   0       ;DISK SECTOR SIZE
001E"   00              EOT:    .BYTE   0       ;END OF TRACK SECTOR NUMBER
001F"   00              GPL:    .BYTE   0       ;DISK GAP 3 SIZE
0020"   00              DTL:    .BYTE   0       ;DISK SECTOR SIZE WHEN SIZE=0
                        ;
0021"                   RESULT:                 ;RESULT PHASE LIST
0021"   00              ST0:    .BYTE   0       ;STATUS REGISTER 0
0022"   00              ST1:    .BYTE   0       ;STATUS REGISTER 1
0023"   00              ST2:    .BYTE   0       ;STATUS REGISTER 2
0024"   00              RCYL:   .BYTE   0       ;DISK CYLINDER NUMBER
0025"   00              RHEAD:  .BYTE   0       ;DISK HEAD NUMBER
0026"   00              RREC:   .BYTE   0       ;DISK RECORD NUMBER
0027"   00              RSIZE:  .BYTE   0       ;DISK SECTOR SIZE
0028"   00              MAINST: .BYTE   0       ;MAIN STATUS REGISTER
0029"   00              ST3:    .BYTE   0       ;STATUS REGISTER 3
                        ;
0000:04                         .LOC    .INIT.# ;LOCATE IN INITIALIZATION AREA
                        ;
0000:04 DB8E            DSKIN%::IN      FDCST   ;GET FDC STATUS
0002:04 3C                      INR     A       ;CONTROLLER PRESENT?
0003:04 C8                      RZ              ;IF NOT, DONE
0004:04 3EC3                    MVI     A,JMP   ;ELSE, INITIALIZE INTERRUPT VECTOR
0006:04 32 0028                 STA     5*8     ;(VECTORED INTERRUPT-5)
0009:04 21 0303'                LXI     H,DSKISR
000C:04 22 0029                 SHLD    (5*8)+1
000F:04 AF                      XRA     A
0010:04 D388                    OUT     DMACTL  ;DISABLE DMA CONTROLLER
0012:04 3E03                    MVI     A,FDCSFY  ;GET FDC SPECIFY COMMAND
0014:04 CD 038E'                CALL    CMDRDY  ;OUTPUT COMMAND TO FDC
0017:04 3A 0000"                LDA     SRT401  ;GET STEP RATE
001A:04 ED44                    NEG             ;CALC FDC STEP RATE VALUE
001C:04 C610                    ADI     16
001E:04 87                      ADD     A
001F:04 87                      ADD     A
0020:04 87                      ADD     A
0021:04 87                      ADD     A
0022:04 F601                    ORI     HDUT    ;COMBINE STEP RATE WITH HEAD UNLOA
0024:04 CD 0394'                CALL    DATOUT  ;OUTPUT IT TO FDC
```

DSK401 - TURBODOS OPERATING SYSTEM IMS 8-INCH FLOPPY DISK DRIVER


```
0027:04 3E24                    MVI     A,HDLT  ;GET HEAD LOAD TIME/NON-DMA BIT
0029:04 CD 0394'                CALL    DATOUT  ;OUTPUT IT TO FDC
002C:04 3E01                    MVI     A,1<DSKENI
002E:04 D38C                    OUT     DSKCTL  ;ENABLE CONTROLLER INTERRUPTS
0030:04 C9                      RET             ;DONE
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   21 000E"        DSKDR%::LXI     H,DMXSPH  ;GET MUTUAL EXCLUSION SEMAPHORE
0003'   CD 0000:05              CALL    WAIT#   ;DISPATCH IF NECESSARY
0006'   CD 0012'                CALL    ..DD    ;CALL DISK DRIVER
0009'   F5                      PUSH    PSW     ;SAVE RETURN CODE
000A'   21 000E"                LXI     H,DMXSPH  ;GET MUTUAL EXCLUSION SEMAPHORE
000D'   CD 0000:06              CALL    SIGNAL# ;SIGNAL PROCESS AS READY
0010'   F1                      POP     PSW     ;RESTORE RETURN CODE
0011'   C9                      RET             ;DONE
                        ;
0012'   ED73 0006"      ..DD:   SSPD    RETSP   ;SAVE ERROR RETURN STACK POINTER
0016'   DD7E00                  MOV     A,PDRFCN(X)  ;GET PD REQ FUNCTION NUMBER
0019'   B7                      ORA     A       ;PD REQ FUNCTION NUMBER=0?
001A'   280F                    JRZ     RDDSK   ;IF SO, CONTINUE
001C'   3D                      DCR     A       ;PD REQ FUNCTION NUMBER=1?
001D'   281E                    JRZ     WRDSK   ;IF SO, CONTINUE
001F'   3D                      DCR     A       ;PD REQ FUNCTION NUMBER=2?
0020'   CA 0206'                JZ      RETDST  ;IF SO, CONTINUE
0023'   3D                      DCR     A       ;PD REQ FUNCTION NUMBER=3?
0024'   CA 027F'                JZ      RETRDY  ;IF SO, CONTINUE
0027'   3D                      DCR     A       ;PD REQ FUNCTION NUMBER=4?
0028'   282E                    JRZ     FMTDSK  ;IF SO, CONTINUE
002A'   C9                      RET             ;ELSE, DONE
                        ;
002B'   3E0A            RDDSK:  MVI     A,MAXTRY  ;GET MAX TRY COUNT
002D'   32 0001"                STA     TRYCNT  ;SET TRY COUNT
0030'   3E06            ..RD:   MVI     A,FDCRD ;GET FDC READ COMMAND
0032'   0E40                    MVI     C,DMARD ;GET DMA READ COMMAND
0034'   CD 00C4'                CALL    DSKCOM  ;CALL COMMON CODE
0037'   C8                      RZ              ;NO ERRORS, RET A=0
0038'   CD 011B'                CALL    RETRY   ;ERRORS, RECALIBRATE
003B'   18F3                    JMPR    ..RD    ;TRY AGAIN
                        ;
003D'   3E0A            WRDSK:  MVI     A,MAXTRY  ;GET MAX TRY COUNT
003F'   32 0001"                STA     TRYCNT  ;SET TRY COUNT
0042'   3E05            ..WR:   MVI     A,FDCWR ;GET FDC WRITE COMMAND
0044'   0E80                    MVI     C,DMAWR ;GET DMA WRITE COMMAND
0046'   CD 00C4'                CALL    DSKCOM  ;CALL COMMON CODE
0049'   2008                    JRNZ    ..RT    ;IF ERRORS, RETRY
004B'   3E06                    MVI     A,FDCRD ;ELSE, GET FDC READ COMMAND
004D'   0E00                    MVI     C,DMAVFY  ;GET DMA VERIFY COMMAND
004F'   CD 00C4'                CALL    DSKCOM  ;CALL COMMON CODE
0052'   C8                      RZ              ;NO ERRORS, RET A=0
0053'   CD 011B'        ..RT:   CALL    RETRY   ;ERRORS, RECALIBRATE
0056'   18EA                    JMPR    ..WR    ;TRY AGAIN
                        ;
0058'   DD7E02            FMTDSK: MOV     A,PDRTRK(X)  ;GET PD REQ TRACK NUMBER
```

;K401 - TURBODOS OPERATING SYSTEM IMS 8-INCH FLOPPY DISK DRIVER
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```
005B'  B7                    ORA     A       ;PD REQUEST TRACK NUMBER=0?
005C'  2006                  JRNZ    ..NTRO  ;IF NOT, CONTINUE
005E'  CD 02CC'              CALL    SELCUR  ;ELSE, SELECT I/O DISK
0061'  CD 01CB'              CALL    RECAL   ;RECALIBRATE DRIVE
0064'  3E0A          ..NTRO: MVI     A,MAXTRY  ;GET MAX TRY COUNT
0066'  32 0001"              STA     TRYCNT  ;SET TRY COUNT
0069'  CD 01A6'      ..FMT:  CALL    SEEK    ;SELECT DISK AND SEEK
006C'  3E80                  MVI     A,DMAWR ;GET DMA WRITE COMMAND
006E'  32 0005"              STA     IODMAC  ;SET DMA COMMAND
0071'  DD6E08                MOV     L,PDRTC(X)  ;GET PD REQ TRANSFER COUNT
0074'  DD6609                MOV     H,PDRTC+1(X)
0077'  DD5E0A                MOV     E,PDRDMA(X)  ;GET PD REQUEST DMA ADDRESS
007A'  DD560B                MOV     D,PDRDMA+1(X)
007D'  CD 013D'              CALL    DMANIT  ;INITIALIZE DMA CONTROLLER
0080'  3E0D                  MVI     A,FDCFMT  ;GET FORMAT TRACK COMMAND
0082'  DDCB047E              BIT     7,PDRSEC(X)  ;DOUBLE DENSITY FLAG SET?
0086'  2802                  JRZ     ..SD    ;IF NOT, CONTINUE
0088'  CBF7                  SET     FDCMFM,A  ;ELSE, SET DOUBLE DENSITY BIT
008A'  CD 038E'      ..SD:   CALL    CMDRDY  ;SEND FORMAT COMMAND TO FDC
008D'  DD7E01                MOV     A,PDRDRV(X)  ;GET PD REQUEST DRIVE NUMBER
0090'  DDCB057E              BIT     7,PDRSEC+1(X)  ;HEAD NUMBER ONE FLAG SET?
0094'  2802                  JRZ     ..HD0   ;IF NOT, CONTINUE
0096'  CBD7                  SET     2,A     ;ELSE, SET HEAD ONE BIT
0098'  CD 0394'      ..HD0:  CALL    DATOUT  ;OUTPUT UNIT NUMBER TO FDC
009B'  DD7E04                MOV     A,PDRSEC(X)  ;GET PD REQUEST SECTOR (LSB)
009E'  E603                  ANI     3       ;EXTRACT FORMAT SECTOR SIZE
00A0'  CD 0394'              CALL    DATOUT  ;OUTPUT FORMAT SECTOR SIZE TO FDC
00A3'  DD7E06                MOV     A,PDRSC(X)  ;GET PD REQUEST SECTOR COUNT
00A6'  CD 0394'              CALL    DATOUT  ;OUTPUT SECTORS/TRACK TO FDC
00A9'  DD7E05                MOV     A,PDRSEC+1(X)  ;GET PD REQUEST SECTOR (MSB
00AC'  E67F                  ANI     7FH     ;EXTRACT FORMAT GAP LENGTH
00AE'  CD 0394'              CALL    DATOUT  ;OUTPUT FORMAT GAP LENGTH TO FDC
00B1'  3EE5                  MVI     A,0E5H  ;GET FORMAT FILLER BYTE
00B3'  CD 0394'              CALL    DATOUT  ;OUTPUT FORMAT FILLER BYTE TO FDC
00B6'  CD 02FC'              CALL    WTINT   ;WAIT FOR INTERRUPT
00B9'  3A 0021"              LDA     ST0     ;GET STATUS REGISTER 0
00BC'  E6C0                  ANI     0C0H    ;ANY ERRORS?
00BE'  C8                    RZ              ;NO ERRORS, RET A=0
00BF'  CD 011B'              CALL    RETRY   ;ERRORS, RECALIBRATE
00C2'  18A5                  JMPR    ..FMT   ;TRY AGAIN
                     ;
00C4'  32 0004"      DSKCOM: STA     IORWC   ;SET FDC READ/WRITE COMMAND
00C7'  79                    MOV     A,C     ;GET DMA COMMAND
00C8'  32 0005"              STA     IODMAC  ;SET DMA COMMAND
00CB'  DD7E04                MOV     A,PDRSEC(X)  ;GET PD REQ SECTOR NUMBER
00CE'  32 0009"              STA     CURSEC  ;SET CURRENT SECTOR
00D1'  DD6E0A                MOV     L,PDRDMA(X)  ;GET PD REQUEST DMA ADDRESS
00D4'  DD660B                MOV     H,PDRDMA+1(X)
00D7'  22 000A"              SHLD    CURADR  ;SET CURRENT DMA ADDRESS
00DA'  DD7E06                MOV     A,PDRSC(X)  ;GET PD REQ SECTOR COUNT
00DD'  32 000C"              STA     CURSC   ;SET CURRENT SECTOR COUNT
00E0'  CD 01A6'              CALL    SEEK    ;SELECT DISK AND SEEK
00E3'  AF                    XRA     A
00E4'  32 000D"              STA     IOERR   ;CLEAR I/O ERROR STATUS
```

DSK401 - TURBODOS OPERATING SYSTEM IMS 8-INCH FLOPPY DISK DRIVER


```
00E7'  CD 0155'      ..RWL:  CALL    SETID    ;SET UP SECTOR ID INFO
00EA'  CD 012B'              CALL    SETUP    ;SETUP READ/WRITE DMA
00ED'  CD 035D'              CALL    CMDOUT   ;SEND SECTOR ID INFO TO FDC
00F0'  CD 02FC'              CALL    WTINT    ;WAIT FOR INTERRUPT
00F3'  21 000D"              LXI     H,IOERR  ;GET I/O ERROR STATUS
00F6'  3A 0021"              LDA     ST0      ;GET STATUS REGISTER 0
00F9'  B6                    ORA     M        ;ADD NEW STATUS
00FA'  77                    MOV     M,A      ;UPDATE I/O ERROR STATUS
00FB'  CD 03CF'              CALL    GETXLT   ;GET TRANSLATION TABLE ADDRESS
00FE'  2815                  JRZ     ..NI     ;IF TRANSLATION NOT REQUIRED, CO
0100'  21 0009"              LXI     H,CURSEC  ;ELSE, GET CURRENT SECTOR NUMB
0103'  34                    INR     M        ;INCREMENT CURRENT SECTOR
0104'  CD 03C4'              CALL    CALCSS   ;CALC SECTOR SIZE
0107'  EB                    XCHG             ;SECTOR SIZE TO DE-REG
0108'  2A 000A"              LHLD    CURADR   ;GET CURRENT DMA ADDRESS
010B'  19                    DAD     D        ;CALC NEXT DMA ADDRESS
010C'  22 000A"              SHLD    CURADR   ;UPDATE CURRENT DMA ADDRESS
010F'  21 000C"              LXI     H,CURSC  ;GET CURRENT SECTOR COUNT
0112'  35                    DCR     M        ;DECREMENT CURRENT SECTOR COUNT
0113'  20D2                  JRNZ    ..RWL    ;IF TRANSFER NOT COMPLETE, CONTI
0115'  3A 000D"      ..NI:   LDA     IOERR    ;GET I/O ERROR STATUS
0118'  E6C0                  ANI     0C0H     ;EXTRACT COMPLETION STATUS
011A'  C9                    RET              ;DONE
                     ;
011B'  0E07          RETRY:  MVI     C,ABEL   ;GET BELL CHARACTER
011D'  CD 0000:07            CALL    CONOUT#  ;OUTPUT TO CONSOLE
0120'  CD 01CB'              CALL    RECAL    ;RECALIBRATE DRIVE
0123'  21 0001"              LXI     H,TRYCNT  ;GET RETRY COUNT
0126'  35                    DCR     M        ;DECREMENT RETRY COUNT
0127'  C0                    RNZ              ;IF COUNT NOT EXHAUSTED, TRY AGA
0128'  C3 03EC'              JMP     FATAL    ;CONTINUE
                     ;
012B'  CD 03CF'      SETUP:  CALL    GETXLT   ;GET TRANSLATION TABLE ADDRESS
012E'  DD6E08                MOV     L,PDRTC(X)  ;GET PD REQ TRANSFER COUNT
0131'  DD6609                MOV     H,PDRTC+1(X)
0134'  2803                  JRZ     ..NI     ;IF NO TRANSLATION RQRD, CONTINU
0136'  CD 03C4'              CALL    CALCSS   ;ELSE, CALC SECTOR SIZE
0139'  ED5B 000A"    ..NI:   LDED    CURADR   ;GET CURRENT DMA ADDRESS
                     ;
013D'  AF            DMANIT: XRA     A
013E'  D388                  OUT     DMACTL   ;RESET DMA CONTROLLER
0140'  2B                    DCX     H        ;TERMINAL COUNT-1 FOR 8257
0141'  7D                    MOV     A,L      ;GET LSB OF TERMINAL COUNT
0142'  D383                  OUT     CH1TC    ;SEND LSB OF TERMINAL COUNT
0144'  3A 0005"              LDA     IODMAC   ;GET I/O DMA COMMAND
0147'  B4                    ORA     H        ;ADD TO MSB OF TERMINAL COUNT
0148'  D383                  OUT     CH1TC    ;SEND MSB OF TERMINAL COUNT
014A'  7B                    MOV     A,E      ;GET LSB
014B'  D382                  OUT     CH1DMA   ;OUTPUT IT TO DMA CONTROLLER
014D'  7A                    MOV     A,D      ;GET MSB
014E'  D382                  OUT     CH1DMA   ;OUTPUT IT TO DMA CONTROLLER
0150'  3E42                  MVI     A,CH1ENA  ;GET CHANNEL 1 ENABLE COMMAND
0152'  D388                  OUT     DMACTL   ;ENABLE DMA CONTROLLER
0154'  C9                    RET              ;DONE
```

;K401 - TURBODOS OPERATING SYSTEM IMS 8-INCH FLOPPY DISK DRIVER
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```
                        ;
0155'   DD7E02          SETID:  MOV     A,PDRTRK(X)  ;GET PD REQ TRACK NUMBER
0158'   32 001A"                STA     CYL     ;SET CYLINDER
015B'   3A 0009"                LDA     CURSEC  ;GET CURRENT SECTOR
015E'   4F                      MOV     C,A     ;SECTOR NUMBER TO C-REG
015F'   CD 03CF'                CALL    GETXLT  ;GET TRANSLATION TABLE ADDRESS
0162'   2804                    JRZ     ..NI    ;IF TRANSLATION NOT REQUIRED, CONT
0164'   0600                    MVI     B,0     ;ELSE, MAKE SECTOR DOUBLE LENGTH
0166'   09                      DAD     B       ;INDEX INTO TRANSLATION TABLE
0167'   4E                      MOV     C,M     ;GET TRANSLATED SECTOR NUMBER
0168'   0C              ..NI:   INR     C       ;CONVERT SECTOR TO BASE 1
0169'   DD4613                  MOV     B,SECTRK(X)  ;GET NUMBER OF SECTORS/TRACK
016C'   CD 03DD'                CALL    GETTCA  ;GET DISK TYPE CODE ADDRESS
016F'   CB56                    BIT     TSD,M   ;TWO SIDED DISK?
0171'   2802                    JRZ     ..SSD   ;IF NOT, CONTINUE
0173'   CB38                    SRLR    B       ;ELSE, CALC NUMBER OF SECTORS/SIDE
0175'   78              ..SSD:  MOV     A,B     ;GET NUMBER OF SECTORS/SIDE
0176'   32 001E"                STA     EOT     ;SET END OF TRACK SECTOR NUMBER
0179'   B9                      CMP     C       ;FRONT SIDE OF DISK?
017A'   3E00                    MVI     A,0     ;PRESET FOR FRONT SIDE
017C'   3005                    JRNC    ..FS    ;IF FRONT SIDE, CONTINUE
017E'   79                      MOV     A,C     ;GET SECTOR NUMBER
017F'   90                      SUB     B       ;SUBTRACT ONE SIDES WORTH
0180'   4F                      MOV     C,A     ;TO C-REG
0181'   3E01                    MVI     A,1     ;GET HEAD #1
0183'   32 001B"        ..FS:   STA     HEAD    ;SET HEAD NUMBER
0186'   79                      MOV     A,C     ;GET SECTOR NUMBER
0187'   32 001C"                STA     REC     ;SET RECORD NUMBER
018A'   DD7E12                  MOV     A,SECSIZ(X)  ;GET SECTOR SIZE
018D'   32 001D"                STA     SIZE    ;SET RECORD SIZE
0190'   B7                      ORA     A       ;N=0?
0191'   3E80                    MVI     A,128   ;PRESET DTL=128
0193'   2802                    JRZ     ..NO    ;IF N=0, CONTINUE
0195'   3EFF                    MVI     A,0FFH  ;ELSE, DTL=0FFH
0197'   32 0020"        ..NO:   STA     DTL     ;SET DATA LENGTH
019A'   CD 03E5'                CALL    GETDST  ;GET DST ADDRESS
019D'   11 0000:08              LXI     D,GAPLEN#  ;GET OFFSET TO GAP LENGTH
01A0'   19                      DAD     D       ;CALC GAP LENGTH ADDRESS
01A1'   7E                      MOV     A,M     ;GET GAP LENGTH
01A2'   32 001F"                STA     GPL     ;SET GAP LENGTH
01A5'   C9                      RET             ;DONE
                        ;
01A6'   CD 02CC'        SEEK:   CALL    SELCUR  ;SELECT I/O DISK
01A9'   DD7E01                  MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
01AC'   3C                      INR     A       ;INCREMENT IT
01AD'   47                      MOV     B,A     ;TO B-REG
01AE'   AF                      XRA     A       ;CLEAR DRIVE VECTOR
01AF'   37                      STC             ;SET CARRY FLAG
01B0'   8F              ..SL:   ADC     A       ;SHIFT CARRY FLAG LEFT
01B1'   10FD                    DJNZ    ..SL
01B3'   21 0002"                LXI     H,CALTBL  ;GET DRIVE CALIBRATED TABLE
01B6'   B6                      ORA     M       ;COMBINE VECTOR W/CALIBRATED TABLE
01B7'   BE                      CMP     M       ;DRIVE ALREADY CALIBRATED?
01B8'   77                      MOV     M,A     ;UPDATE DRIVE CALIBRATED TABLE
```

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```
01B9'  C4 01CB'          CNZ     RECAL   ;RE-CALIBRATE DRIVE, IF NECESSARY
01BC'  DD7E01            MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
01BF'  47                MOV     B,A     ;CONTROLLER DISK TO B-REG
01C0'  DD7E02            MOV     A,PDRTRK(X)  ;GET PD REQ TRACK NUMBER
01C3'  4F                MOV     C,A     ;CYLINDER TO C-REG
01C4'  CD 01EA'          CALL    SEKCMD  ;SEND SEEK COMMAND
01C7'  C8                RZ              ;IF NO ERRORS, DONE
01C8'  C3 03EC'          JMP     FATAL   ;CONTINUE
                         ;
01CB'  DD7E01    RECAL:  MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
01CE'  CD 01D5'          CALL    RECCMD  ;SEND RECALIBRATE COMMAND
01D1'  C8                RZ              ;IF NO ERRORS, DONE
01D2'  C3 03EC'          JMP     FATAL   ;CONTINUE
                         ;
01D5'  F5        RECCMD: PUSH    PSW     ;SAVE CONTROLLER DISK
01D6'  3E07              MVI     A,FDCRCL  ;GET FDC RECALIBRATE COMMAND
01D8'  CD 038E'          CALL    CMDRDY  ;OUTPUT COMMAND TO FDC
01DB'  F1                POP     PSW     ;RESTORE CONTROLLER DISK
01DC'  CD 0394'          CALL    DATOUT  ;OUTPUT IT TO FDC
01DF'  CD 02FC'          CALL    WTINT   ;WAIT FOR INTERRUPT
01E2'  3A 0021"          LDA     ST0     ;GET STATUS REGISTER 0
01E5'  E6E0              ANI     0C0H!1<FDCSE  ;EXTRACT COMPLETION STATUS
01E7'  FE20              CPI     1<FDCSE ;ANY ERRORS?
01E9'  C9                RET             ;DONE
                         ;
01EA'  C5        SEKCMD: PUSH    B       ;SAVE DISK/TRACK
01EB'  3E0F              MVI     A,FDCSK ;GET FDC SEEK COMMAND
01ED'  CD 038E'          CALL    CMDRDY  ;OUTPUT COMMAND TO FDC
01F0'  C1                POP     B       ;RESTORE DISK/TRACK
01F1'  C5                PUSH    B       ;SAVE DISK/TRACK
01F2'  78                MOV     A,B     ;GET CONTROLLER DISK
01F3'  CD 0394'          CALL    DATOUT  ;OUTPUT IT TO FDC
01F6'  C1                POP     B       ;RESTORE DISK/TRACK
01F7'  79                MOV     A,C     ;GET CYLINDER NUMBER
01F8'  CD 0394'          CALL    DATOUT  ;OUTPUT IT TO FDC
01FB'  CD 02FC'          CALL    WTINT   ;WAIT FOR INTERRUPT
01FE'  3A 0021"          LDA     ST0     ;GET STATUS REGISTER 0
0201'  E6E0              ANI     0C0H!1<FDCSE  ;EXTRACT COMPLETION STATUS
0203'  FE20              CPI     1<FDCSE ;ANY ERRORS?
0205'  C9                RET             ;DONE
                         ;
0206'  CD 027F'  RETDST: CALL    RETRDY  ;RETURN READY STATUS
0209'  B7                ORA     A       ;DRIVE READY?
020A'  C8                RZ              ;IF NOT, DONE
020B'  0E00              MVI     C,0     ;ELSE, GET INITIAL TYPE VALUE
020D'  3A 0029"          LDA     ST3     ;GET STATUS REGISTER 3
0210'  CB5F              BIT     ST3TS,A ;ONE-SIDED DISK?
0212'  2802              JRZ     ..OS    ;YES
0214'  CBD1              SET     TSD,C   ;SET TWO-SIDED DISK BIT
0216'  DD7E01    ..OS:   MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
0219'  32 0008"          STA     RIDDSK  ;SET READ ID DISK
021C'  CD 026A'          CALL    ..FD    ;FIND DISK DENSITY
021F'  280F              JRZ     ..DF    ;IF DENSITY FOUND, CONTINUE
0221'  C5                PUSH    B       ;ELSE, SAVE DISK TYPE CODE
```

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```
0222'   DD7E01              MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
0225'   CD 01D5'            CALL    RECCMD  ;RECALIBRATE DRIVE
0228'   C1                  POP     B       ;RESTORE DISK TYPE CODE
0229'   2032                JRNZ    ..NR    ;IF UNABLE TO RECALIBRATE, CONTINU
022B'   CD 026A'            CALL    ..FD    ;ELSE, ATTEMPT TO FIND DISK DENSIT
022E'   202D                JRNZ    ..NR    ;IF DENSITY NOT FOUND, CONTINUE
0230'   B1          ..DF:   ORA     C       ;ADD SECTOR SIZE TO TYPE CODE
0231'   4F                  MOV     C,A
0232'   CB51                BIT     TSD,C   ;TWO SIDED BIT SET?
0234'   2814                JRZ     ..FDI   ;IF NOT, CONTINUE
0236'   21 0008"            LXI     H,RIDDSK  ;GET READ ID DISK
0239'   CBD6                SET     2,M     ;SET HEAD BIT
023B'   3E4A                MVI     A,FDCRID!1<FDCMFM  ;GET READ ID CMD (DD)
023D'   CB59                BIT     DDD,C   ;DOUBLE DENSITY BIT SET?
023F'   2002                JRNZ    ..DD    ;IF SO, CONTINUE
0241'   CBB7                RES     FDCMFM,A  ;ELSE, RESET MFM BIT
0243'   CD 0279'    ..DD:   CALL    ..RID   ;ATTEMP TO READ ID ON BACK SIDE
0246'   2802                JRZ     ..FDI   ;IF READABLE, CONTINUE
0248'   CB91                RES     TSD,C   ;ELSE, RESET TWO SIDED BIT
024A'   11 0000:09  ..FDI:  LXI     D,DSTBLS#  ;GET DISK SPEC TABLES
024D'   79          ..SL2:  MOV .   A,C     ;GET DISK TYPE CODE
024E'   21 0000:0A          LXI     H,DTCO# ;GET OFFSET TO DISK TYPE CODE
0251'   19                  DAD     D       ;CALC DISK TYPE CODE ADDRESS
0252'   BE                  CMP     M       ;DISK SPEC TABLE FOUND?
0253'   280A                JRZ     ..DSTF  ;IF SO, CONTINUE
0255'   EB                  XCHG            ;DISK SPEC TABLE ADDRESS TO HL-REG
0256'   5E                  MOV     E,M     ;GET DISK SPEC TABLE LINK POINTER
0257'   23                  INX     H
0258'   56                  MOV     D,M
0259'   7A                  MOV     A,D
025A'   B3                  ORA     E       ;END OF LIST?
025B'   20F0                JRNZ    ..SL2   ;IF NOT, CONTINUE
025D'   AF          ..NR:   XRA     A       ;ELSE, SET RETURN CODE=0
025E'   C9                  RET             ;DONE
025F'   13          ..DSTF: INX     D       ;ADVANCE PAST LINK POINTER
0260'   13                  INX     D
0261'   DD730C              MOV     PDRDST(X),E  ;SET DISK SPEC TABLE ADDRESS
0264'   DD720D              MOV     PDRDST+1(X),D
0267'   3EFF                MVI     A,0FFH  ;SET RETURN CODE=0FFH
0269'   C9                  RET             ;DONE
026A'   3E0A        ..FD:   MVI     A,FDCRID  ;GET FDC READ ID COMMAND (SD)
026C'   CD 0279'            CALL    ..RID   ;ATTEMPT TO READ SINGLE-DENSITY
026F'   C8                  RZ              ;IF SINGLE-DENSITY, DONE
0270'   3E4A                MVI     A,FDCRID!1<FDCMFM  ;GET READ ID CMD (DD)
0272'   CD 0279'            CALL    ..RID   ;ATTEMPT TO READ DOUBLE-DENSITY
0275'   C0                  RNZ             ;IF UNABLE, DONE
0276'   CBD9                SET     DDD,C   ;SET DOUBLE-DENSITY DISK BIT
0278'   C9                  RET             ;DONE
0279'   C5          ..RID:  PUSH    B       ;SAVE BC
027A'   CD 02A2'            CALL    READID  ;READ DISK ID
027D'   C1                  POP     B       ;RESTORE BC
027E'   C9                  RET             ;DONE
                    ;
027F'   DD7E01      RETRDY: MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
```

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```
0282'   FE04                    CPI     4       ;TEST FOR VALID DRIVE NUMBER
0284'   3E00                    MVI     A,0     ;PRESET RETURN CODE=0
0286'   D0                      RNC             ;IF INVALID DRIVE, RETURN NOT REA
0287'   DB8E                    IN      FDCST   ;GET FDC STATUS
0289'   3C                      INR     A       ;CONTROLLER PRESENT?
028A'   C8                      RZ              ;IF NOT, DONE
028B'   CD 02CC'                CALL    SELCUR  ;ELSE, SELECT REQUESTED DRIVE
028E'   CD 0298'                CALL    ..RDY   ;CHECK IF DRIVE READY
0291'   C0                      RNZ             ;IF SO, DONE
0292'   21 0001                LXI     H,1     ;ELSE, DELAY ONE TICK...
0295'   CD 0000:0B              CALL    DELAY#  ;...SO 765 CAN SCAN
0298'   CD 02E9'       ..RDY:   CALL    SENSDS  ;SENSE DRIVE STATUS
029B'   CB6F                    BIT     ST3RDY,A  ;DRIVE READY?
029D'   3E00                    MVI     A,0     ;PRESET RETURN CODE=0
029F'   C8                      RZ              ;IF DRIVE NOT READY, DONE
02A0'   2F                      CMA             ;ELSE, SET RETURN CODE=0FFH
02A1'   C9                      RET             ;DONE
                        ;
02A2'   CD 038E'        READID: CALL    CMDRDY  ;OUTPUT COMMAND TO FDC
02A5'   3A 0008"                LDA     RIDDSK  ;GET READ ID DISK
02A8'   CD 0394'                CALL    DATOUT  ;OUTPUT IT TO FDC
02AB'   CD 02FC'                CALL    WTINT   ;WAIT FOR INTERRUPT
02AE'   3A 0021"                LDA     ST0     ;GET STATUS REGISTER 0
02B1'   E6C0                    ANI     0C0H    ;EXTRACT COMPLETION STATUS
02B3'   3A 0027"                LDA     RSIZE   ;RETURN SECTOR SIZE
02B6'   C9                      RET             ;DINE
                        ;
02B7'                   DLCPOL:                 ;DELAY COMPLETE POLL ROUTINE
02B7'   0000                    .WORD   0
02B9'   0000                    .WORD   0
                        ;
02BB'   DB8C            DLCPR:  IN      DSKCTL  ;GET DISK CONTROLLER STATUS
02BD'   CB7F                    BIT     DSKDLC,A  ;DELAY COMPLETE (MOTORS RUNNING
02BF'   C8                      RZ              ;IF NOT, DONE
02C0'   21 02B7'                LXI     H,DLCPOL  ;ELSE, GET POLL ROUTINE
02C3'   CD 0000:0C              CALL    UNLINK# ;UNLINK POLL ROUTINE FROM POLL LI
02C6'   21 0014"                LXI     H,DWTSPH  ;GET DISK WAIT SEMAPHORE
02C9'   C3 0000:06              JMP     SIGNAL# ;CONTINUE
                        ;
02CC'   DB8C            SELCUR: IN      DSKCTL  ;GET DISK CONTROLLEI STATUS
02CE'   0F                      RRC             ;EXTRACT SELECTED DRIVE
02CF'   E603                    ANI     3
02D1'   4F                      MOV     C,A     ;TO C-REG
02D2'   DD7E01                  MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
02D5'   B9                      CMP     C       ;DRIVE ALREADY SELECTED?
02D6'   2802                    JRZ     ..DAS   ;IF SO, CONTINUE
02D8'   D38A                    OUT     DSKSEL  ;ELSE, SELECT CONTROLLER DISK
02DA'   11 02B7'        ..DAS:  LXI     D,DLCPOL  ;GET POLL ROUTINE
02DD'   CD 0000:0D              CALL    LNKPOL# ;CREATE POLL ROUTINE
02E0'   CD 02BB'                CALL    DLCPR   ;EXECUTE POLL ROUTINE
02E3'   21 0014"                LXI     H,DWTSPH  ;GET DISK WAIT SEMAPHORE
02E6'   C3 0000:05              JMP     WAIT#   ;DISPATCH IF NECESSARY
                        ;
02E9'   3E04            SENSDS: MVI     A,FDCSDS  ;GET FDC SENSE DRIVE STATUS CMI
```

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```
02EB'   CD 038E'            CALL    CMDRDY  ;OUTPUT COMMAND TO FDC
02EE'   DD7E01              MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
02F1'   CD 0394'            CALL    DATOUT  ;OUTPUT IT TO FDC
02F4'   CD 039B'            CALL    DATAIN  ;GET STATUS REGISTER 3
02F7'   32 0029"            STA     ST3     ;SAVE STATUS REGISTER 3
02FA'   FB                  EI              ;ENABLE INTERRUPTS
02FB'   C9                  RET             ;DONE
                    ;
02FC'   FB          WTINT:  EI              ;ENABLE INTERRUPTS
02FD'   21 0014"            LXI     H,DWTSPH  ;GET DISK WAIT SEMAPHORE
0300'   C3 0000:05          JMP     WAIT#   ;DISPATCH IF NECESSARY
                    ;
0303'   ED73 0000:0E DSKISR: SSPD    INTSP#  ;SAVE INTERRUPT STACK PCINTER
0307'   31 0000:0F          LXI     SP,INTSTK#  ;SET UP AUX STACK
030A'   F5                  PUSH    PSW     ;SAVE REGISTERS
030B'   C5                  PUSH    B
030C'   D5                  PUSH    D
030D'   E5                  PUSH    H
030E'   DB8E        ..RQML: IN      FDCST   ;GET FDC STATUS
0310'   CB7F                BIT     FDCRDY,A  ;FDC READY FOR CONVERSATION?
0312'   28FA                JRZ     ..RQML  ;IF NOT, WAIT
0314'   32 0028"            STA     MAINST  ;SAVE MAIN STATUS REGISTER
0317'   CB77                BIT     FDCOUT,A  ;FDC IN OUTPUT MODE?
0319'   2020                JRNZ    ..RW    ;IF SO, PROCESS
031B'   3E08                MVI     A,FDCSIS  ;GET SENSE INTERRUPT STATUS CMD
031D'   D38F                OUT     FDCDAT  ;OUTPUT IT TO FDC DATA REGISTER
031F'   CD 039B'            CALL    DATAIN  ;GET STATUS REGISTER 0
0322'   4F                  MOV     C,A     ;SAVE IT IN C-REG
0323'   E6C0                ANI     0C0H    ;EXTRACT COMPLETION STATUS
0325'   FE80                CPI     80H     ;INTERRUPT STACK EMPTY?
0327'   2829                JRZ     ..X     ;IF SO, DONE
0329'   CD 039B'            CALL    DATAIN  ;GET PRESENT CYLINDER NUMBER
032C'   CB69                BIT     STOSE,C ;READY LINE CHANGE STATE?
032E'   28DE                JRZ     ..RQML  ;IF SO, IGNORE
0330'   32 0024"            STA     RCYL    ;ELSE, SAVE PCN
0333'   79                  MOV     A,C     ;GET STATUS REGISTER 0
0334'   32 0021"            STA     ST0     ;SAVE IT
0337'   3E01                MVI     A,1     ;SET INTERRUPT COMPLETION STATUS
0339'   180F                JMPR    ..SIGC  ;CONTINUE
033B'   21 0021"    ..RW:   LXI     H,RESULT  ;GET RESULT TABLE
033E'   0607                MVI     B,7     ;GET LENGTH OF RESULT PHASE
0340'   CD 039B'    ..RL:   CALL    DATAIN  ;GET RESULT BYTE FROM FDC
0343'   77                  MOV     M,A     ;STORE IN RESULT AREA
0344'   23                  INX     H       ;INCREMENT POINTER
0345'   10F9                DJNZ    ..RL    ;READ ALL SEVEN BYTES
0347'   AF                  XRA     A
0348'   D388                OUT     DMACTL  ;DISABLE DMA CONTROLLER
034A'   21 0014"    ..SIGC: LXI     H,DWTSPH  ;GET DISK WAIT SEMAPHORE
034D'   CD 0000:06          CALL    SIGNAL# ;SIGNAL PROCESS AS READY
0350'   18BC                JMPR    ..RQML  ;FLUSH ANY REMAINING INTERRUPTS
0352'   E1          ..X:    POP     H       ;REGISTERS
0353'   D1                  POP     D
0354'   C1                  POP     B
0355'   F1                  POP     PSW
```

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```
0356'   ED7B 0000:0E           LSPD    INTSP#  ;RESTORE STACK POINTER
035A'   C3 0000:10              JMP     ISRXIT# ;CONTINUE
                        ;
035D'   CD 03DD'        CMDOUT: CALL    GETTCA  ;GET DISK TYPE CODE ADDRESS
0360'   3A 0004"                LDA     IORWC   ;GET READ/WRITE COMMAND
0363'   CB5E                    BIT     DDD,M   ;DOUBLE DENSITY DISK?
0365'   2802                    JRZ     ..SD    ;IF NOT, SINGLE DENSITY
0367'   CBF7                    SET     FDCMFM,A  ;ELSE, SET DOUBLE DENSITY BIT
0369'   CB56            ..SD:   BIT     TSD,M   ;TWO-SIDED DISK?
036B'   2802                    JRZ     ..SS    ;IF NOT, SINGLE SIDED
036D'   CBFF                    SET     FDCMT,A  ;ELSE, SET MULTI-TRACK BIT
036F'   CD 038E'        ..SS:   CALL    CMDRDY  ;SEND COMMAND TO FDC
0372'   DD7E01                  MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
0375'   21 001B"                LXI     H,HEAD  ;GET HEAD NUMBER
0378'   CB46                    BIT     0,M     ;HEAD #0?
037A'   2802                    JRZ     ..FS    ;IF SO, CONTINUE
037C'   CBD7                    SET     2,A     ;ELSE, SET HEAD #1 BIT IN I/O DI
037E'   CD 0394'        ..FS:   CALL    DATOUT  ;OUTPUT IT TO FDC
0381'   21 001A"                LXI     H,IDINFO  ;GET SECTOR ID INFO
0384'   0607                    MVI     B,7     ;B=LENGTH OF ID INFO
0386'   7E              ..IDL:  MOV     A,M     ;GET BYTE FROM LIST
0387'   23                      INX     H       ;INCREMENT POINTER
0388'   CD 0394'                CALL    DATOUT  ;OUTPUT BYTE TO FDC
038B'   10F9                    DJNZ    ..IDL   ;SEND ENTIRE LIST
038D'   C9                      RET             ;DONE
                        ;
038E'   CD 03A6'        CMDRDY: CALL    OUTRDY  ;WAIT FOR FDC READY
0391'   F3                      DI              ;DISABLE INTERRUPTS
0392'   1803                    JMPR    OUTCOM  ;JOIN COMMON CODE
                        ;
0394'   CD 03A6'        DATOUT: CALL    OUTRDY  ;WAIT FOR FDC READY
                        ;
0397'   79              OUTCOM: MOV     A,C     ;RESTORE OUTPUT BUTE
0398'   D38F                    OUT     FDCDAT  ;OUTPUT BYTE TO FDC DATA REGISTE
039A'   C9                      RET             ;DONE
                        ;
039B'   DB8E            DATAIN: IN      FDCST   ;GET FDC STATUS
039D'   07                      RLC             ;TEST FDC FOR READY
039E'   30FB                    JRNC    DATAIN  ;IF NOT READY, WAIT
03A0'   07                      RLC             ;TEST FDC DIRECTION
03A1'   300B                    JRNC    FDCERR  ;IF WRONG DIRECTION, DIAGNOSE
03A3'   DB8F                    IN      FDCDAT  ;GET FDC DATA BYTE
03A5'   C9                      RET             ;DONE
                        ;
03A6'   4F              OUTRDY: MOV     C,A     ;SAVE OUTPUT BYTE
03A7'   DB8E            ..RW:   IN      FDCST   ;GET FDC STATUS
03A9'   07                      RLC             ;TEST FDC FOR READY
03AA'   30FB                    JRNC    ..RW    ;IF NOT READY, WAIT
03AC'   07                      RLC             ;TEST FDC DIRECTION
03AD'   D0                      RNC             ;IF DIRECTION CORRECT, DONE
                        ;
03AE'   CD 0000:11      FDCERR: CALL    DMS#    ;SOUND BELL
03B1'   87                      .ASCIS  [ABEL]
03B2'   CD 0000:12              CALL    CONSO#  ;SHIFT CONSOLE TO ERROR LINE
```

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```
03B5'   CD 0000:11              CALL    DMS#    ;DISPLAY ERROR MESSAGE
03B8'   464443204572            .ASCIS  "FDC Error"
03C1'   C3 03C1'                JMP     .       ;HALT
                        ;
03C4'   21 0080         CALCSS: LXI     H,128   ;GET 128 BYTE SECTOR LENGTH
03C7'   DD7E12                  MOV     A,SECSIZ(X)  ;GET SECTOR SIZE
03CA'   3D              ..SL:   DCR     A       ;DECREMENT SECTOR SIZE
03CB'   F8                      RM              ;IF UNDERFLOW, DONE
03CC'   29                      DAD     H       ;ELSE, SHIFT SECTOR SIZE LEFT
03CD'   18FB                    JMPR    ..SL    ;CONTINUE
                        ;
03CF'   CD 03E5'        GETXLT: CALL    GETDST  ;GET DST ADDRESS
03D2'   11 0000:13              LXI     D,XLTBL#  ;GET OFFSET TO TRANSLATION TABLE
03D5'   19                      DAD     D       ;CALC TRANSLATION TABLE ADDRESS
03D6'   5E                      MOV     E,M     ;GET TRANSLATION TABLE ADDRESS
03D7'   23                      INX     H
03D8'   56                      MOV     D,M
03D9'   EB                      XCHG            ;TRANSLATION TABLE ADDRESS TO HL-R

03DA'   7C                      MOV     A,H
03DB'   B5                      ORA     L       ;TRANSLATION REQUIRED?
03DC'   C9                      RET             ;DONE
                        ;
03DD'   CD 03E5'        GETTCA: CALL    GETDST  ;GET DST ADDRESS
03E0'   11 0000:14              LXI     D,TYPCOD#  ;GET OFFSET TO DISK TYPE CODE
03E3'   19                      DAD     D       ;CALC DISK TYPE CODE ADDRESS
03E4'   C9                      RET             ;DONE
                        ;
03E5'   DD6E0C          GETDST: MOV     L,PDRDST(X)  ;GET PD REQUEST DST ADDRESS
03E8'   DD660D                  MOV     H,PDRDST+1(X)
03EB'   C9                      RET             ;DONE
                        ;
03EC'   ED7B 0006"      FATAL:  LSPD    RETSP   ;RESTORE STACK POINTER
03F0'   3EFF                    MVI     A,0FFH  ;RETURN ERROR CODE
03F2'   C9                      RET             ;DONE
                        ;
                        .END
```

DSKFMT - TURBODOS OPERATING SYSTEM 8-INCH FLOPPY DISK SPECIFICATION TABLES


```
                        ;
                        ; ********************************************************
                        ; *
                        ; *  This is a list of disk specification tables for
                        ; *  all of the 8-inch floppy disk formats supported
                        ; *  by the DSK401 disk driver module and the MPB401
                        ; *  boot prom driver module.
                        ; *
                        ; ********************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  DSKFMT          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0002                    TSD     = 2             ;TWO-SIDED DISK BIT (TYPE CODE)
0003                    DDD     = 3             ;DOUBLE DENSITY DISK BIT (TYPE CO

                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
                        ;       1024 BYTE SECTOR, DOUBLE-DENSITY, TWO-SIDED
                        ;
0000'   0011'           DSTBLS::.WORD   .+DSTL  ;DISK SPEC TABLE LINK POINTER
0002'   04                      .BYTE   4       ;BLOCK SIZE
0003'   0268                    .WORD   (77*(16*(1<3)))/(1<4)  ;NUMBER OF BLOCKS
0005'   04                      .BYTE   4       ;NUMBER OF DIRECTORY BLOCKS
0006'   03                      .BYTE   3       ;PHYSICAL SECTOR SIZE (2^N*128)
0007'   0010                    .WORD   16      ;PHYSICAL SECTORS PER TRACK
0009'   004D                    .WORD   77      ;PHYSICAL TRACKS PER DISK
000B'   0000                    .WORD   0       ;NUMBER OF RESERVED TRACKS
000D'   0000                    .WORD   0       ;TRANSLATION TABLE ADDRESS
000F'   0F                      .BYTE   1<DDD!1<TSD!3  ;DISK TYPE CODE
0010'   35                      .BYTE   35H     ;GAP LENGTH
                        ;
                        ;       1024 BYTE SECTOR, DOUBLE-DENSITY, ONE-SIDED
                        ;
0011'   0022'                   .WORD   .+DSTL  ;DISK SPEC TABLE LINK POINTER
0013'   04                      .BYTE   4       ;BLOCK SIZE
0014'   0134                    .WORD   (77*(8*(1<3)))/(1<4)  ;NUMBER OF BLOCKS
0016'   03                      .BYTE   3       ;NUMBER OF DIRECTORY BLOCKS
0017'   03                      .BYTE   3       ;PHYSICAL SECTOR SIZE (2^N*128)
0018'   0008                    .WORD   8       ;PHYSICAL SECTORS PER TRACK
001A'   004D                    .WORD   77      ;PHYSICAL TRACKS PER DISK
001C'   0000                    .WORD   0       ;RESERVED TRACKS
001E'   0000                    .WORD   0       ;TRANSLATION TABLE ADDRESS
0020'   0B                      .BYTE   1<DDD!3 ;DISK TYPE CODE
0021'   35                      .BYTE   35H     ;GAP LENGTH
```

KFMT - TURBODOS OPERATING SYSTEM 8-INCH FLOPPY DISK SPECIFICATION TABLES


```
                        ;
                        ;       512 BYTE SECTOR, SINGLE-DENSITY, TWO-SIDED
                        ;
0022' 0033'                     .WORD   .+DSTL  ;DISK SPEC TABLE LINK POINTER
0024' 04                        .BYTE   4       ;BLOCK SIZE
0025' 0134                      .WORD   (77*(16*(1<2)))/(1<4)  ;NUMBER OF BLOCKS
0027' 03                        .BYTE   3       ;NUMBER OF DIRECTORY BLOCKS
0028' 02                        .BYTE   2       ;PHYSICAL SECTOR SIZE (2^N*128)
0029' 0010                      .WORD   16      ;PHYSICAL SECTORS PER TRACK
002B' 004D                      .WORD   77      ;PHYSICAL TRACKS PER DISK
002D' 0000                      .WORD   0       ;RESERVED TRACKS
002F' 0000                      .WORD   0       ;TRANSLATION TABLE ADDRESS
0031' 06                        .BYTE   1<TSD!2 ;DISK TYPE CODE
0032' 1B                        .BYTE   1BH     ;GAP LENGTH
                        ;
                        ;       512 BYTE SECTOR, SINGLE-DENSITY, ONE-SIDED
                        ;
0033' 0044'                     .WORD   .+DSTL  ;DISK SPEC TABLE LINK POINTER
0035' 04                        .BYTE   4       ;BLOCK SIZE
0036' 009A                      .WORD   (77*(8*(1<2)))/(1<4)  ;NUMBER OF BLOCKS
0038' 02                        .BYTE   2       ;NUMBER OF DIRECTORY BLOCKS
0039' 02                        .BYTE   2       ;PHYSICAL SECTOR SIZE (2^N*128)
003A' 0008                      .WORD   8       ;PHYSICAL SECTORS PER TRACK
003C' 004D                      .WORD   77      ;PHYSICAL TRACKS PER DISK
003E' 0000                      .WORD   0       ;RESERVED TRACKS
0040' 0000                      .WORD   0       ;TRANSLATION TABLE ADDRESS
0042' 02                        .BYTE   2       ;DISK TYPE CODE
0043' 1B                        .BYTE   1BH     ;GAP LENGTH
                        ;
                        ;       128 BYTE SECTOR, SINGLE-DENSITY, ONE-SIDED
                        ;
0044' 0000              DSTA:   .WORD   0       ;DISK SPEC TABLE LINK POINTER
0046' 03                DSTB:   .BYTE   3       ;BLOCK SIZE
0047' 00F3                      .WORD   (75*(26*(1<0)))/(1<3)  ;NUMBER OF BLOCKS
0049' 02                        .BYTE   2       ;NUMBER OF DIRECTORY BLOCKS
004A' 00                        .BYTE   0       ;PHYSICAL SECTOR SIZE (2^N*128)
004B' 001A                      .WORD   26      ;PHYSICAL SECTORS PER TRACK
004D' 004D                      .WORD   77      ;PHYSICAL TRACKS PER DISK
004F' 0002                      .WORD   2       ;RESERVED TRACKS
                        ;
000B                    XLTBL   =: .-DSTB       ;TRANSLATION TABLE ADDRESS OFFSET
                        ;
0051' 0055'                     .WORD   TRTBL   ;TRANSLATION TABLE ADDRESS
                        ;
000F                    DTCO    =: .-DSTA       ;DISK TYPE CODE OFFSET
000D                    TYPCOD  =: .-DSTB       ;DISK TYPE CODE OFFSET
                        ;
0053' 00                        .BYTE   0       ;DISK TYPE CODE
                        ;
000E                    GAPLEN  =: .-DSTB       ;GAP LENGTH OFFSET
                        ;
0054' 07                        .BYTE   7       ;GAP LENGTH
                        ;
0011                    DSTL    = .-DSTA        ;DISK SPEC TABLE LENGTH
```

DSKFMT - TURBODOS OPERATING SYSTEM 8-INCH FLOPPY DISK SPECIFICATION TABLES


```
                        ;
                        ; SINGLE-DENSITY/SINGLE-SIDED SECTOR TRANSLATION TABLE
                        ;
0055'   00060C121804    TRTBL:  .BYTE   0,6,12,18,24,4,10,16,22
005E'   02080E140107            .BYTE   2,8,14,20,1,7,13,19,25
0067'   050B11170309            .BYTE   5,11,17,23,3,9,15,21
                        ;
                        .END
```

ON192 - TURBODOS OPERATING SYSTEM 19.2KB CONSOLE DRIVER
OPYRIGHT (C) 1982, SOFTWARE 2000, INC.

```
                        ;
                        ; ***********************************************************
                        ; *                                                         *
                        ; *  This is a trivial console driver for a 19.2KB          *
                        ; *  console device connected to serial channel zero.       *
                        ; *  This module is hardware-independent.  All access       *
                        ; *  to the serial interface hardware is accomplished       *
                        ; *  via calls to the entrypoint SERIAL:: in the hard-      *
                        ; *  ware dependent serial driver modules SPD442 or         *
                        ; *  SPD740.                                                *
                        ; *                                                         *
                        ; ***********************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  CON192          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   8F              CONBR:: .BYTE   8FH     ;CONSOLE BAUD RATE CODE (19200 BAU

0001"   0C              FFCHR:: .BYTE   AFF     ;FORM FEED CHARACTER
0002"   00              INITC:  .BYTE   0       ;INITIALIZATION COMPLETE FLAG
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   21 0002"        CONDR%::LXI     H,INITC ;GET INITIALIZATION COMPLETE FLAG
0003'   7E                      MOV     A,M
0004'   B7                      ORA     A       ;INITIALIZATION COMPLETE FLAG SET?
0005'   CC 0013'                CZ      ..INIT  ;IF NOT, INITIALIZE CONSOLE BAUD R
                        E
0008'   7B              ..CDRV: MOV     A,E     ;GET FUNCTION NUMBER
0009'   D608                    SUI     8       ;FUNCTION NUMBER=8?
000B'   2823                    JRZ     CONSO   ;IF SO, ERROR SHIFT OUT
000D'   3D                      DCR     A       ;FUNCTION NUMBER=9?
000E'   2820                    JRZ     CONSI   ;IF SO, ERROR SHIFT IN
0010'   C3 0000:04              JMP     SERIAL# ;ELSE, CONTINUE
0013'   35              ..INIT: DCR     M       ;SET INITIALIZATION COMPLETE FLAG
0014'   D5                      PUSH    D       ;SAVE FUNCTION NUMBER
0015'   C5                      PUSH    B       ;SAVE CHANNEL NUMBER/CHARACTER
0016'   3A 0000"                LDA     CONBR   ;GET CONSOLE BAUD RATE CODE
0019'   4F                      MOV     C,A     ;TELEVIDEO BAUD RATE CODE TO C-REG
001A'   1E03                    MVI     E,3     ;SET FUNCTION NUMBER=3
001C'   CD 0000:04              CALL    SERIAL# ;SET CHANNEL BUAD RATE
001F'   3A 0001"                LDA     FFCHR   ;GET FORM FEED CHARACTER
0022'   B7                      ORA     A       ;FORM FEED CHARACTER=0?
0023'   2808                    JRZ     ..NITX  ;IF SO, CONTINUE
```

CON192 - TURBODOS OPERATING SYSTEM 19.2KB CONSOLE DRIVER


```
0025'  C1                      POP     B         ;ELSE, RESTORE CHANNEL NUMBER
0026'  C5                      PUSH    B         ;SAVE CHANNEL NUMBER
0027'  4F                      MOV     C,A       ;FORM FEED CHARACTER TO C-REG
0028'  1E02                    MVI     E,2       ;SET FUNCTION NUMBER=2
002A'  CD 0000:04              CALL    SERIAL#   ;OUTPUT FORM FEED
002D'  C1              ..NITX: POP     B         ;RESTORE CHANNEL NUMBER/CHARACTE
002E'  D1                      POP     D         ;RESTORE FUNCTION NUMBER
002F'  C9                      RET               ;DONE
                       ;
0030'                  CONSO:
0030'  CD 0000:05      CONSI:  CALL    DMS#      ;POSITION TO NEXT LINE
0033'  0D8A                    .ASCIS  [ACR] [ALF]
0035'  C9                      RET               ;DONE
                       ;
                       .END
```

;T300 - TURBODOS OPERATING SYSTEM 300 BAUD LIST DRIVER
)PYRIGHT (C) 1982 BY SOFTWARE 2000, INC.

```
                        ;
                        ; ***********************************************************
                        ; *                                                         *
                        ; *  This is a printer driver for a 300 baud TTY-like       *
                        ; *  printer device connected to a serial channel 0-15.     *
                        ; *  It is coded to support up to 16 channels at once.      *
                        ; *  This module is hardware-independent.  All access       *
                        ; *  to the serial interface hardware is accomplished       *
                        ; *  via calls to the entrypoint SERIAL:: in the hard-      *
                        ; *  ware dependent serial driver modules SPD442 or         *
                        ; *  SPD740.                                                *
                        ; *                                                         *
                        ; ***********************************************************
                        ;
                        ; COPYRIGHT (C) 1982 BY SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  LST300          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   25              LST3BR::.BYTE   25H     ;BAUD RATE CODE (300 BAUD)
0001"   0C              LST3FF::.BYTE   AFF     ;FORM FEED CHARACTER
0002"   000000000000    INITC:  .BYTE   [16]0   ;INITIALIZATION COMPLETE FLAGS
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   21 0002"        LSTDR%::LXI     H,INITC ;GET INITIALIZATION COMPLETE FLAGS
0003'   D5                      PUSH    D       ;SAVE FUNCTION NUMBER
0004'   58                      MOV     E,B     ;CHANNEL NUMBER TO DE-REG
0005'   1600                    MVI     D,0     ;DOUBLE LENGTH
0007'   19                      DAD     D       ;INDEX INTO FLAGS TABLE
0008'   D1                      POP     D       ;RESTORE FUNCTION NUMBER
0009'   7E                      MOV     A,M     ;GET INITIALIZATION COMPLETE FLAG
000A'   B7                      ORA     A       ;INITIALIZATION COMPLETE FLAG SET?
000B'   CC 0018'                CZ      ..INIT  ;IF NOT, INITIALIZE LIST CHANNEL
000E'   7B                      MOV     A,E     ;GET FUNCTION NUMBER
000F'   FE02                    CPI     2       ;FUNCTION NUMBER=2?
0011'   281A                    JRZ     LSTOUT  ;IF SO, CONTINUE
0013'   FE07                    CPI     7       ;FUNCTION NUMBER=7?
0015'   2810                    JRZ     LSTWSR  ;IF SO, CONTINUE
0017'   C9                      RET             ;ELSE, DONE
0018'   35              ..INIT: DCR     M       ;SET INITIALIZATION COMPLETE FLAG
0019'   D5                      PUSH    D       ;SAVE FUNCTION NUMBER
001A'   C5                      PUSH    B       ;SAVE CHANNEL NUMBER/CHARACTER
001B'   3A 0000"                LDA     LST3BR  ;GET BAUD RATE CODE
001E'   4F                      MOV     C,A     ;BAUD RATE CODE TO C-REG
001F'   1E03                    MVI     E,3     ;SET FUNCTION NUMBER=3
```

LST300 - TURBODOS OPERATING SYSTEM 300 BAUD LIST DRIVER


```
0021'   CD 0000:04             CALL    SERIAL# ;SET CHANNEL BUAD RATE
0024'   C1                     POP     B       ;RESTORE CHANNEL NUMBER/CHARACTEI
0025'   D1                     POP     D       ;RESTORE FUNCTION NUMBER
0026'   C9                     RET             ;DONE
                        ;
0027'   3A 0001"        LSTWSR: LDA     LST3FF  ;GET FORM FEED CHARACTER
002A'   4F                     MOV     C,A     ;FORM FEED CHARACTER TO C-REG
002B'   1E02                   MVI     E,2     ;SET FUNCTION NUMBER=2
                        ;
002D'   C3 0000:04      LSTOUT: JMP     SERIAL# ;CONTINUE
                        ;
                        .END
```

TCTS - TURBODOS OPERATING SYSTEM CLEAR-TO-SEND PRINTER DRIVER


```
                        ;
                        ; ***********************************************************
                        ; *                                                         *
                        ; *  This is a printer driver for 9600 baud printers        *
                        ; *  using clear-to-send handshaking (e.g. TI-810).         *
                        ; *  It is coded to support up to 16 channels at once.      *
                        ; *  This module is hardware-independent.  All access       *
                        ; *  to the serial interface hardware is accomplished       *
                        ; *  via calls to the entrypoint SERIAL:: in the hard-      *
                        ; *  ware dependent serial driver modules SPD442 or         *
                        ; *  SPD740.                                                *
                        ; *                                                         *
                        ; ***********************************************************
                        ;
                        ; COPYRIGHT (C) 1982 BY SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  LSTCTS          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   6E              CTSBR:: .BYTE   6EH     ;BAUD RATE CODE (9600 BAUD)
0001"   0C              CTSFF:: .BYTE   AFF     ;FORM FEED CHARACTER
0002"   000000000000    INITC:  .BYTE   [16]0   ;INITIALIZATION COMPLETE FLAGS
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   21 0002"        LSTDR%::LXI     H,INITC ;GET INITIALIZATION COMPLETE FLAGS
0003'   D5                      PUSH    D       ;SAVE FUNCTION NUMBER
0004'   58                      MOV     E,B     ;CHANNEL NUMBER TO DE-REG
0005'   1600                    MVI     D,0     ;DOUBLE LENGTH
0007'   19                      DAD     D       ;INDEX INTO FLAGS TABLE
0008'   D1                      POP     D       ;RESTORE FUNCTION NUMBER
0009'   7E                      MOV     A,M     ;GET INITIALIZATION COMPLETE FLAG
000A'   B7                      ORA     A       ;INITIALIZATION COMPLETE FLAG SET?
000B'   CC 0018'                CZ      ..INIT  ;IF NOT, INITIALIZE LIST CHANNEL
000E'   7B                      MOV     A,E     ;GET FUNCTION NUMBER
000F'   FE02                    CPI     2       ;FUNCTION NUMBER=2?
0011'   281A                    JRZ     LSTOUT  ;IF SO, CONTINUE
0013'   FE07                    CPI     7       ;FUNCTION NUMBER=7?
0015'   2810                    JRZ     LSTWSR  ;IF SO, CONTINUE
0017'   C9                      RET             ;ELSE, DONE
0018'   35              ..INIT: DCR     M       ;SET INITIALIZATION COMPLETE FLAG
0019'   D5                      PUSH    D       ;SAVE FUNCTION NUMBER
001A'   C5                      PUSH    B       ;SAVE CHANNEL NUMBER/CHARACTER
001B'   3A 0000"                LDA     CTSBR   ;GET BAUD RATE CODE
001E'   4F                      MOV     C,A     ;BAUD RATE CODE TO C-REG
001F'   1E03                    MVI     E,3     ;SET FUNCTION NUMBER=3
```

LSTCTS - TURBODOS OPERATING SYSTEM CLEAR-TO-SEND PRINTER DRIVER


```
0021'   CD 0000:04             CALL    SERIAL# ;SET CHANNEL BUAD RATE
0024'   C1                     POP     B       ;RESTORE CHANNEL NUMBER/CHARACTEI
0025'   D1                     POP     D       ;RESTORE FUNCTION NUMBER
0026'   C9                     RET             ;DONE
                        ;
0027'   3A 0001"        LSTWSR: LDA     CTSFF   ;GET FORM FEED CHARACTER
002A'   4F                     MOV     C,A     ;FORM FEED CHARACTER TO C-REG
002B'   1E02                   MVI     E,2     ;SET FUNCTION NUMBER=2
                        ;
002D'   C3 0000:04      LSTOUT: JMP     SERIAL# ;CONTINUE
                        ;
                        .END
```

TETX - TURBODOS OPERATING SYSTEM ETX/ACK PRINTER DRIVER


```
                        ;
                        ; ***********************************************************
                        ; *                                                         *
                        ; *  This is a printer driver for 1200 baud printers        *
                        ; *  using ETX/ACK protocol (e.g., Diablo or NEC daisy).    *
                        ; *  It is coded to support up to 16 channels at once.      *
                        ; *  This module is hardware-independent.  All access       *
                        ; *  to the serial interface hardware is accomplished       *
                        ; *  via calls to the entrypoint SERIAL:: in the hard-      *
                        ; *  ware dependent serial driver modules SPD442 or         *
                        ; *  SPD740.                                                *
                        ; *                                                         *
                        ; ***********************************************************
                        ;
                        ; COPYRIGHT (C) 1982 BY SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  LSTETX          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   07              ETXBR:: .BYTE   7       ;BAUD RATE CODE (1200 BAUD)
0001"   8C              ETXLEN::.BYTE   140     ;CHARACTER COUNT BETWEEN ETX'S
0002"   03              ETXSEQ::.BYTE   3       ;MAX ESCAPE SEQUENCE LENGTH
0003"   0C              ETXFF:: .BYTE   AFF     ;FORM FEED CHARACTER
0004"   000000000000    CHRCNT: .BYTE   [16]0   ;CHARACTER COUNT
0014"   000000000000    SEQCNT: .BYTE   [16]0   ;SEQUENCE COUNT
0024"   000000000000    INITC:  .BYTE   [16]0   ;INITIALIZATION COMPLETE FLAGS
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   21 0024"        LSTDR%::LXI     H,INITC ;GET INITIALIZATION COMPLETE FLAGS
0003'   CD 0084'                CALL    INDEX   ;INDEX INTO FLAGS TABLE
0006'   7E                      MOV     A,M     ;GET INITIALIZATION COMPLETE FLAG
0007'   B7                      ORA     A       ;INITIALIZATION COMPLETE FLAG SET?
0008'   CC 0015'                CZ      ..INIT  ;IF NOT, INITIALIZE LIST CHANNEL
000B'   7B                      MOV     A,E     ;GET FUNCTION NUMBER
000C'   FE02                    CPI     2       ;FUNCTION NUMBER=2?
000E'   281A                    JRZ     LSTOUT  ;IF SO, CONTINUE
0010'   FE07                    CPI     7       ;FUNCTION NUMBER=7?
0012'   2810                    JRZ     LSTWSR  ;IF SO, CONTINUE
0014'   C9                      RET             ;ELSE, DONE
0015'   35            ..INIT:   DCR     M       ;SET INITIALIZATION COMPLETE FLAG
0016'   D5                      PUSH    D       ;SAVE FUNCTION NUMBER
0017'   C5                      PUSH    B       ;SAVE CHANNEL NUMBER/CHARACTER
0018'   3A 0000"                LDA     ETXBR   ;GET BAUD RATE CODE
001B'   4F                      MOV     C,A     ;BAUD RATE CODE TO C-REG
001C'   1E03                    MVI     E,3     ;SET FUNCTION NUMBER=3
```

LSTETX - TURBODOS OPERATING SYSTEM ETX/ACK PRINTER DRIVER


```
001E'  CD 0000:04          CALL    SERIAL# ;SET CHANNEL BUAD RATE
0021'  C1                  POP     B       ;RESTORE CHANNEL NUMBER/CHARACTEI
0022'  D1                  POP     D       ;RESTORE FUNCTION NUMBER
0023'  C9                  RET             ;DONE
                    ;
0024'  3A 0003"     LSTWSR: LDA     ETXFF   ;GET FORM FEED CHARACTER
0027'  4F                  MOV     C,A     ;FORM FEED CHARACTER TO C-REG
0028'  1E02                MVI     E,2     ;SET FUNCTION NUMBER=2
                    ;
002A'  CD 007C'     LSTOUT: CALL    ..GCCA  ;GET CHARACTER COUNT ADDRESS
002D'  7E                  MOV     A,M     ;GET CHARACTER COUNT
002E'  21 0001"            LXI     H,ETXLEN  ;GET CHARACTER COUNT BETWEEN E1

0031'  B7                  CMP     M       ;MAX CHARACTER COUNT OUTSTANDING?
0032'  381B                JRC     ..OUT   ;IF NOT, CONTINUE
0034'  CD 0081'            CALL    ..GSCA  ;ELSE, GET SEQUENCE COUNT ADDRESS
0037'  7E                  MOV     A,M     ;GET SEQUENCE COUNT
0038'  B7                  ORA     A       ;IN ESCAPE SEQUENCE?
0039'  2014                JRNZ    ..OUT   ;IF SO, CONTINUE
003B'  C5                  PUSH    B       ;ELSE, SAVE OUTPUT CHARACTER
003C'  0E03                MVI     C,AETX  ;GET ETX CHARACTER
003E'  CD 0074'            CALL    ..SOUT  ;OUTPUT ETX CHARACTER
0041'  CD 006B'     ..WAIT: CALL    ..SIN   ;ELSE, GET SERIAL INPUT
0044'  E67F                ANI     7FH     ;STRIP SIGN BIT
0046'  D606                SUI     AACK    ;CHARACTER=ACK?
0048'  20F7                JRNZ    ..WAIT  ;IF NOT, WAIT
004A'  CD 007C'            CALL    ..GCCA  ;ELSE, GET CHARACTER COUNT ADDRES
004D'  77                  MOV     M,A     ;RESET CHARACTER COUNT
004E'  C1                  POP     B       ;RESTORE OUTPUT CHARACTER
004F'  79           ..OUT: MOV     A,C     ;GET OUTPUT CHARACTER
0050'  E67F                ANI     7FH     ;STRIP SIGN BIT
0052'  FE1B                CPI     AESC    ;CHARACTER=ESCAPE?
0054'  2007                JRNZ    ..NESC  ;IF NOT, CONTINUE
0056'  CD 0081'            CALL    ..GSCA  ;ELSE, GET SEQUENCE COUNT ADDRESS
0059'  3A 0002"            LDA     ETXSEQ  ;GET MAX ESCAPE SEQUENCE LENGTH
005C'  77                  MOV     M,A     ;SET SEQUENCE COUNT
005D'  CD 0074'     ..NESC: CALL    ..SOUT  ;OUTPUT CHARACTER
0060'  CD 007C'            CALL    ..GCCA  ;GET CHARACTER COUNT ADDRESS
0063'  34                  INR     M       ;INCREMENT CHARACTER COUNT
0064'  CD 0081'            CALL    ..GSCA  ;GET SEQUENCE COUNT ADDRESS
0067'  35                  DCR     M       ;DECREMENT SEQUENCE COUNT
0068'  F0                  RP              ;IF POSITIVE, DONE
0069'  34                  INR     M       ;ELSE, RESTORE COUNT TO 0
006A'  C9                  RET             ;DONE
006B'  C5           ..SIN: PUSH    B       ;SAVE CHANNEL NUMBER/CHARACTER
006C'  D5                  PUSH    D       ;SAVE FUNCTION NUMBER
006D'  1E01                MVI     E,1     ;SET FUNCTION NUMBER=1
006F'  CD 0000:04          CALL    SERIAL# ;GET SERIAL INPUT
0072'  1805                JMPR    ..SIOC  ;CONTINUE
0074'  C5           ..SOUT: PUSH   B       ;SAVE CHANNEL NUMBER/CHARACTER
0075'  D5                  PUSH    D       ;SAVE FUNCTION NUMBER
0076'  CD 0000:04          CALL    SERIAL# ;OUTPUT CHARACTER
0079'  D1           ..SIOC: POP    D       ;RESTORE FUNCTION NUMBER
007A'  C1                  POP     B       ;RESTORE CHANNEL NUMBER/CHARACTEI
```

STETX - TURBODOS OPERATING SYSTEM ETX/ACK PRINTER DRIVER


```
007B'   C9                      RET             ;DONE
007C'   21 0004"        ..GCCA: LXI     H,CHRCNT  ;GET CHARACTER COUNT TABLE
007F'   1803                    JMPR    INDEX   ;CONTINUE
0081'   21 0014"        ..GSCA: LXI     H,SEQCNT  ;GET SEQUENCE COUNT TABLE
                        ;
0084'   D5              INDEX:  PUSH    D       ;SAVE FUNCTION NUMBER
0085'   58                      MOV     E,B     ;CHANNEL NUMBER TO DE-REG
0086'   1600                    MVI     D,0     ;DOUBLE LENGTH
0088'   19                      DAD     D       ;INDEX INTO TABLE
0089'   D1                      POP     D       ;RESTORE FUNCTION NUMBER
008A'   C9                      RET             ;DONE
                        ;
                        .END
```

LSTXON - TURBODOS OPERATING SYSTEM XON/XOFF PRINTER DRIVER


```
                        ;
                        ; ***********************************************************
                        ; *
                        ; *  This is a printer driver for 1200 baud printers
                        ; *  using XON/XOFF protocol (e.g., Diablo, Okidata).
                        ; *  It is coded to support up to 16 channels at once.
                        ; *  This module is hardware-independent.  All access
                        ; *  to the serial interface hardware is accomplished
                        ; *  via calls to the entrypoint SERIAL:: in the hard-
                        ; *  ware dependent serial driver modules SPD442 or
                        ; *  SPD740.
                        ; *
                        ; ***********************************************************
                        ;
                        ; COPYRIGHT (C) 1982 BY SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  LSTXON          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   07              XONBR:: .BYTE   7       ;BAUD RATE CODE (1200 BAUD)
0001"   0C              XONFF:: .BYTE   AFF     ;FORM FEED CHARACTER
0002"   000000000000    INITC:  .BYTE   [16]0   ;INITIALIZATION COMPLETE FLAGS
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   21 0002"        LSTDR%::LXI     H,INITC ;GET INITIALIZATION COMPLETE FLAC
0003'   D5                      PUSH    D       ;SAVE FUNCTION NUMBER
0004'   58                      MOV     E,B     ;CHANNEL NUMBER TO DE-REG
0005'   1600                    MVI     D,0     ;DOUBLE LENGTH
0007'   19                      DAD     D       ;INDEX INTO FLAGS-TABLE
0008'   D1                      POP     D       ;RESTORE FUNCTION NUMBER
0009'   7E                      MOV     A,M     ;GET INITIALIZATION COMPLETE FLAC
000A'   B7                      ORA     A       ;INITIALIZATION COMPLETE FLAG SE1
000B'   CC 0018'                CZ      ..INIT  ;IF NOT, INITIALIZE LIST CHANNEL
000E'   7B                      MOV     A,E     ;GET FUNCTION NUMBER
000F'   FE02                    CPI     2       ;FUNCTION NUMBER=2?
0011'   281A                    JRZ     LSTOUT  ;IF SO, CONTINUE
0013'   FE07                    CPI     7       ;FUNCTION NUMBER=7?
0015'   2810                    JRZ     LSTWSR  ;IF SO, CONTINUE
0017'   C9                      RET             ;ELSE, DONE
0018'   35              ..INIT: DCR     M       ;SET INITIALIZATION COMPLETE FLAC
0019'   D5                      PUSH    D       ;SAVE FUNCTION NUMBER
001A'   C5                      PUSH    B       ;SAVE CHANNEL NUMBER/CHARACTER
001B'   3A 0000"                LDA     XONBR   ;GET BAUD RATE CODE
001E'   4F                      MOV     C,A     ;BAUD RATE CODE TO C-REG
001F'   1E03                    MVI     E,3     ;SET FUNCTION NUMBER=3
```

TXON - TURBODOS OPERATING SYSTEM XON/XOFF PRINTER DRIVER


```
0021'   CD 0000:04             CALL    SERIAL#  ;SET CHANNEL BUAD RATE
0024'   C1                      POP     B        ;RESTORE CHANNEL NUMBER/CHARACTER
0025'   D1                      POP     D        ;RESTORE FUNCTION NUMBER
0026'   C9                      RET              ;DONE
                        ;
0027'   3A 0001"        LSTWSR: LDA     XONFF    ;GET FORM FEED CHARACTER
002A'   4F                      MOV     C,A      ;FORM FEED CHARACTER TO C-REG
002B'   1E02                    MVI     E,2      ;SET FUNCTION NUMBER=2
                        ;
002D'   CD 0048'        LSTOUT: CALL    ..SST    ;GET SERIAL STATUS
0030'   B7                      ORA     A        ;CHARACTER AVAILABLE?
0031'   2812                    JRZ     ..OUT    ;IF NOT, CONTINUE
0033'   CD 0051'                CALL    ..SIN    ;ELSE, GET SERIAL INPUT
0036'   E67F                    ANI     7FH      ;STRIP SIGN BIT
0038'   FE13                    CPI     ADC3     ;CHARACTER=DC3 (XOFF)?
003A'   20F1                    JRNZ    LSTOUT   ;IF NOT, WAIT
003C'   CD 0051'        ..WAIT: CALL    ..SIN    ;GET SERIAL INPUT
003F'   E67F                    ANI     7FH      ;STRIP SIGN BIT
0041'   FE11                    CPI     ADC1     ;CHARACTER=DC1 (XON)?
0043'   20F7                    JRNZ    ..WAIT   ;IF NOT, WAIT
0045'   C3 0000:04      ..OUT:  JMP     SERIAL#  ;OUTPUT CHARACTER
0048'   C5              ..SST:  PUSH    B        ;SAVE CHANNEL NUMBER/CHARACTER
0049'   D5                      PUSH    D        ;SAVE FUNCTION NUMBER
004A'   1E00                    MVI     E,0      ;SET FUNCTION NUMBER=0
004C'   CD 0000:04              CALL    SERIAL#  ;GET SERIAL STATUS
004F'   1807                    JMPR    ..SSIC   ;CONTINUE
0051'   C5              ..SIN:  PUSH    B        ;SAVE CHANNEL NUMBER/CHARACTER
0052'   D5                      PUSH    D        ;SAVE FUNCTION NUMBER
0053'   1E01                    MVI     E,1      ;SET FUNCTION NUMBER=1
0055'   CD 0000:04              CALL    SERIAL#  ;GET SERIAL STATUS
0058'   D1              ..SSIC: POP     D        ;RESTORE FUNCTION NUMBER
0059'   C1                      POP     B        ;RESTORE CHANNEL NUMBER/CHARACTER
005A'   C9                      RET              ;DONE
                        ;
                        .END
```

MCD740 - TURBODOS OPERATING SYSTEM MASTER CIRCUIT DRIVER (IMS 740)


```
;
; ********************************************************
; *
; *  This is a fairly complex network circuit driver
; *  which runs in an IMS 8000 master processor and
; *  which communicates with a simple circuit driver
; *  (SCD740) running in an IMS 740 slave processor
; *  board.  This driver accomodates up to sixteen
; *  IMS 740 slave boards.
; *
; *  The IMS 740 slave communicates with the master
; *  processor over the S-100 bus via a byte-parallel
; *  transfer which is handled by programmed I/O by
; *  both processors.  The IMS 740 slave appears to the
; *  master processor as an ordinary port-addressed
; *  peripheral device.  The interface on the 740 board
; *  is an Intel 8255 parallel I/O controller chip,
; *  and coordination between the master and slave is
; *  handled by the status bits of the 8255.  The
; *  master processor may interrupt the slave to see
; *  if it is still healthy, and can also reset and
; *  download the slave.
; *
; *  This driver maintains a "watchdog timer" for each
; *  of the slave processors.  If it has not received
; *  any messages from a particular slave processor
; *  after a one-second interval, it polls that slave
; *  by interrupting it and looking for an acknowledge-
; *  ment from the slave's interrupt service routine.
; *  If no acknowledgement is received within a brief
; *  timeout interval, then this driver concludes that
; *  the slave has crashed.  The driver informs Turbo-
; *  DOS of the crash (so TurboDOS can take its re-
; *  covery action), and then the driver resets and
; *  downloads a fresh copy of the operating system
; *  into the failed slave.
; *
; *  The IMS 740 slave board has a start-up ROM which
; *  is programmed with the contents of the module
; *  SPB740 to handle the slave-end of the download
; *  procedure.  At the start of a download, this dri-
; *  ver sends (and the SPB740 slave ROM receives) a
; *  loader module LOD740 to the slave.  This loader
; *  module handles the remainder of the downloading
; *  task by making standard TurboDOS network download
; *  requests to load the full slave operating system
; *  from a file OSSLAVE.SYS on the master's disk.
; *
; ********************************************************
;
; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
;
; AUTHORS: RONALD E. RAIKES
;          MICHAEL D. BUSCH
```

CD740 - TURBODOS OPERATING SYSTEM MASTER CIRCUIT DRIVER (IMS 740)


```
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  MCD740          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0005                    IBF     = 5             ;INPUT BUFFER FULL BIT
0007                    OBFN    = 7             ;INPUT BUFFER FULL (NOT) BIT
                        ;
0000                    RESPC0  = 00H           ;RESET PC0 COMMAND
0001                    SETPC0  = 01H           ;SET PC0 COMMAND
0002                    RESPC1  = 02H           ;RESET PC1 COMMAND
0003                    SETPC1  = 03H           ;SET PC1 COMMAND
0008                    RESPC4  = 08H           ;RESET PC4 COMMAND
0009                    SETPC4  = 09H           ;SET PC4 COMMAND
000A                    RESPC5  = 0AH           ;RESET PC5 COMMAND
000B                    SETPC5  = 0BH           ;SET PC5 COMMAND
000C                    RESPC6  = 0CH           ;RESET PC6 COMMAND
000D                    SETPC6  = 0DH           ;SET PC6 COMMAND
000C                    RESPC7  = 0CH           ;RESET PC7 COMMAND
000D                    SETPC7  = 0DH           ;SET PC7 COMMAND
                        ;
00C0                    PPMODE  = 0C0H          ;PARALLEL PORT MODE WORD
                                                ;(MODE 2/MODE 0 OUT)
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   02              NMB740::.BYTE   2       ;NUMBER OF IMS 740 SLAVES
                        ;
0001"   00              CKT740::.BYTE   00H     ;IMS 740 CIRCUIT NUMBER
                        ;
0002"                   PAT740::                ;IMS 740 SLAVE PORT ADDRESS TABLE
0002"   40                      .BYTE   40H
0003"   44                      .BYTE   44H
0004"   48                      .BYTE   48H
0005"   4C                      .BYTE   4CH
0006"   50                      .BYTE   50H
0007"   54                      .BYTE   54H
0008"   58                      .BYTE   58H
0009"   5C                      .BYTE   5CH
000A"   60                      .BYTE   60H
000B"   64                      .BYTE   64H
000C"   68                      .BYTE   68H
000D"   6C                      .BYTE   6CH
000E"   70                      .BYTE   70H
000F"   74                      .BYTE   74H
0010"   78                      .BYTE   78H
0011"   7C                      .BYTE   7CH
                        ;
0012"                   SST740::                ;IMS 740 SLAVE SUFFIX LETTER TABLE
0012"   20                      .BYTE   ASP
0013"   20                      .BYTE   ASP
0014"   20                      .BYTE   ASP
```

MCD740 - TURBODOS OPERATING SYSTEM MASTER CIRCUIT DRIVER (IMS 740)


```
0015"  20                      .BYTE   ASP
0016"  20                      .BYTE   ASP
0017"  20                      .BYTE   ASP
0018"  20                      .BYTE   ASP
0019"  20                      .BYTE   ASP
001A"  20                      .BYTE   ASP
001B"  20                      .BYTE   ASP
001C"  20                      .BYTE   ASP
001D"  20                      .BYTE   ASP
001E"  20                      .BYTE   ASP
001F"  20                      .BYTE   ASP
0020"  20                      .BYTE   ASP
0021"  20                      .BYTE   ASP
                       ;
0022"  00              MAXLEN: .BYTE   0       ;MAXIMUM MESSAGE LENGTH
0023"  000F            CURSLV: .WORD   000FH   ;CURRENT SLAVE PROCESSOR NUMBER
                       ;
0025"  0000            RCVSPH: .WORD   0       ;RECEIVE MESSAGE SEMAPHORE
0027"  0027"           ..RCVH: .WORD   ..RCVH
0029"  0027"                   .WORD   ..RCVH
                       ;
002B"  000000000000    POLCNT: .BYTE   [16]0   ;POLL ROUTINE TICK COUNTS
                       ;
0000:04                        .LOC    .INIT.# ;LOCATE IN INITIALIZATION AREA
                       ;
0000:04 C9             CKTIN%::RET             ;DONE
                       ;
0000'                          .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                       ;
0000'  79              CKTDR%::MOV     A,C     ;GET FUNCTION NUMBER
0001'  B7                      ORA     A       ;FUNCTION NUMBER=0?
0002'  2805                    JRZ     RCVMSG  ;IF SO, CONTINUE
0004'  3D                      DCR     A       ;FUNCTION NUMBER=1?
0005'  CA 0060'                JZ      SNDMSG  ;IF SO, CONTINUE
0008'  C9                      RET             ;ELSE, DONE
                       ;
0009'  13              RCVMSG: INX     D       ;ADVANCE PAST LINK POINTERS
000A'  13                      INX     D
000B'  13                      INX     D
000C'  13                      INX     D
000D'  D5                      PUSH    D       ;SAVE MESSAGE BUFFER ADDRESS
000E'  1A                      LDAX    D       ;GET MAXIMUM MESSAGE LENGTH
000F'  32 0022"                STA     MAXLEN  ;SAVE MAXIMUM MESSAGE LENGTH
0012'  11 00F0'        ..RCVL: LXI     D,POL740  ;GET IMS 740 POLL ROUTINE
0015'  CD 0000:05              CALL    LNKPOL# ;LINK POLL ROUTINE ON POLL LIST
0018'  21 0025"                LXI     H,RCVSPH  ;GET RECEIVE MESSAGE SEMAPHORE
001B'  CD 0000:06              CALL    WAIT#   ;WAIT FOR REQUEST
001E'  CD 0170'                CALL    RMCOM   ;DO COMMON SETUP
0021'  D5                      PUSH    D       ;SAVE SLAVE PROCESSOR NUMBER
0022'  200C                    JRNZ    ..RIP   ;IF REQUEST IN PROGRESS, CONTINUE
0024'  CBC6                    SET     0,M     ;ELSE, SET REQUEST IN PROGRESS FL
0026'  0C                      INR     C       ;CALC CONTROL PORT
0027'  3E01                    MVI     A,SETPC0  ;SET PC0 (INTERRUPT)
0029'  ED79                    OUTP    A       ;ASSERT INTERRUPT
```

'740 - TURBODOS OPERATING SYSTEM MASTER CIRCUIT DRIVER (IMS 740)
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```
002B'  3E00                    MVI     A,RESPC0  ;RESET PC0 (INTERRUPT)
002D'  ED79                    OUTP    A         ;RELEASE INTERRUPT
002F'  0D                      DCR     C         ;CALC PORT C ADDRESS
0030'  CD 013A'        ..RIP:  CALL    INBYT     ;INPUT BYTE FROM SLAVE PROCESSOR
0033'  D1                      POP     D         ;RESTORE SLAVE PROCESSOR NUMBER
0034'  380D                    JRC     ..IERR    ;IF ERROR, CONTINUE
0036'  FE06                    CPI     AACK      ;RESPONSE=ACK?
0038'  280C                    JRZ     ..RCV     ;IF SO, CONTINUE
003A'  FE15                    CPI     ANAK      ;RESPONSE=NACK?
003C'  2005                    JRNZ    ..IERR    ;IF NOT, CONTINUE
003E'  CD 0168'                CALL    SETTC     ;ELSE, SET TICK COUNT
0041'  18CF                    JMPR    ..RCVL    ;CONTINUE
0043'  E1              ..IERR: POP     H         ;RESTORE MESSAGE BUFFER ADDRESS
0044'  1842                    JMPR    ERRCOM    ;CONTINUE
0046'  E1              ..RCV:  POP     H         ;RESTORE MESSAGE BUFFER ADDRESS
0047'  0601                    MVI     B,1       ;GET LENGTH OF MESSAGE LENGTH
0049'  CD 0130'                CALL    RCV740    ;RECEIVE MESSAGE LENGTH
004C'  383A                    JRC     ERRCOM    ;IF ERROR, CONTINUE
004E'  2B                      DCX     H         ;ELSE, BACK UP TO MESSAGE LENGTH
004F'  3A 0022"                LDA     MAXLEN    ;GET MAXIMUM MESSAGE LENGTH
0052'  BE                      CMP     M         ;MAXIMUM MESSAGE LENGTH EXCEEDED?
0053'  3833                    JRC     ERRCOM    ;IF SO, CONTINUE
0055'  46                      MOV     B,M       ;ELSE, GET MESSAGE LENGTH
0056'  23                      INX     H         ;RESTORE MESSAGE BUFFER ADDRESS
0057'  05                      DCR     B         ;DECREMENT MESSAGE LENGTH
0058'  282E                    JRZ     ERRCOM    ;IF MESSAGE LENGTH=0, CONTINUE
005A'  CD 0130'                CALL    RCV740    ;ELSE, RECEIVE REMAINDER OF MESSAG
005D'  D0                      RNC               ;IF NO ERROR, DONE
005E'  1828                    JMPR    ERRCOM    ;ELSE, CONTINUE
                       ;
0060'  EB              SNDMSG: XCHG              ;MESSAGE BUFFER ADDRESS TO HL-REG
0061'  23                      INX     H         ;ADVANCE PAST LINK POINTERS
0062'  23                      INX     H
0063'  23                      INX     H
0064'  23                      INX     H
0065'  E5                      PUSH    H         ;SAVE MESSAGE BUFFER ADDRESS
0066'  23                      INX     H         ;ADVANCE TO MESSAGE DESTINATION ID
0067'  5E                      MOV     E,M       ;GET MESSAGE DESTINATION ID
0068'  1600                    MVI     D,0       ;DOUBLE LENGTH
006A'  1D                      DCR     E         ;DECREMENT MESSAGE DESTINATION ID
006B'  CD 0174'                CALL    SMCOM     ;DO COMMON SETUP
006E'  E1                      POP     H         ;RESTORE MESSAGE BUFFER ADDRESS
006F'  7E                      MOV     A,M       ;GET MESSAGE LENGTH
0070'  B7                      ORA     A         ;MESSAGE LENGTH=0?
0071'  2810                    JRZ     ..X       ;IF SO, CONTINUE
0073'  D5                      PUSH    D         ;ELSE, SAVE SLAVE PROCESSOR NUMBER
0074'  46                      MOV     B,M       ;GET MESSAGE LENGTH
0075'  05                      DCR     B         ;DECREMENT MESSAGE LENGTH
0076'  C5                      PUSH    B         ;SAVE MESSAGE LENGTH
0077'  0601                    MVI     B,1       ;GET LENGTH OF MESSAGE LENGTH
0079'  CD 0126'                CALL    SND740    ;SEND MESSAGE LENGTH TO SLAVE
007C'  C1                      POP     B         ;RESTORE MESSAGE LENGTH
007D'  D4 0126'                CNC     SND740    ;IF NO ERROR, SEND MESSAGE
0080'  D1                      POP     D         ;RESTORE SLAVE PROCESSOR NUMBER
```

MCD740 - TURBODOS OPERATING SYSTEM MASTER CIRCUIT DRIVER (IMS 740)


```
0081'   3805                    JRC     ERRCOM  ;IF ERROR, CONTINUE
0083'   CD 0168'       ..X:    CALL    SETTC   ;ELSE, SET TICK COUNT
0086'   AF                      XRA     A       ;SET RETURN CODE=0
0087'   C9                      RET             ;DONE
                        ;
0088'   CD 0092'        ERRCOM: CALL    RESSLV  ;RESET SLAVE PROCESSOR
008B'   ED5B 0000:07            LDED    SID740# ;GET SLAVE PROCESSOR SOURCE ID
008F'   3EFF                    MVI     A,0FFH  ;SET RETURN CODE=0FFH
0091'   C9                      RET             ;DONE
                        ;
0092'   3A 0001"        RESSLV: LDA     CKT740  ;GET IMS 740 CIRCUIT NUMBER
0095'   67                      MOV     H,A     ;IMS 740 CIRCUIT NUMBER TO H-REG
0096'   2E00                    MVI     L,0     ;SET CIRCUIT NODE ADDRESS TO 0
0098'   22 0000:08              SHLD    DID740# ;SET SLAVE PROCESSOR DESTINATION
009B'   3A 0023"                LDA     CURSLV  ;GET CURRENT SLAVE PROCESSOR NUMB
009E'   3C                      INR     A       ;INCREMENT SLAVE PROCESSOR NUMBER
009F'   6F                      MOV     L,A     ;SLAVE PROCESSOR NUMBER TO L-REG
00A0'   22 0000:07              SHLD    SID740# ;SET SLAVE PROCESSOR SOURCE ID
00A3'   22 0000:09              SHLD    ORG740# ;SET SLAVE PROCESSOR ORIGIN
00A6'   2A 0023"                LHLD    CURSLV  ;GET CURRENT SLAVE PROCESSOR NUMB
00A9'   11 0012"                LXI     D,SST740  ;GET SLAVE SUFFIX LETTER TABLE
00AC'   19                      DAD     D       ;INDEX INTO SLAVE SUFFIX TABLE
00AD'   7E                      MOV     A,M     ;GET SLAVE O/S SUFFIX LETTER
00AE'   32 0000:0A              STA     SSL740# ;SET SLAVE SUFFIX LETTER
00B1'   0C                      INR     C       ;CALC CONTROL PORT ADDRESS
00B2'   3EC0                    MVI     A,PPMODE  ;GET PARALLEL PORT MODE WORD
00B4'   ED79                    OUTP    A       ;INITIALIZE 8255
00B6'   3E03                    MVI     A,SETPC1  ;SET PC1 (RESET)
00B8'   ED79                    OUTP    A       ;ASSERT RESET
00BA'   0D                      DCR     C       ;CALC PORT A ADDRESS
00BB'   0D                      DCR     C
00BC'   0D                      DCR     C
00BD'   ED78                    INP     A       ;CLEAR PORT A INPUT
00BF'   0C                      INR     C       ;CALC CONTROL PORT ADDRESS
00C0'   0C                      INR     C
00C1'   0C                      INR     C
00C2'   CD 00EB'                CALL    ..DLY   ;DELAY
00C5'   3E02                    MVI     A,RESPC1  ;RESET PC1 (RESET)
00C7'   ED79                    OUTP    A       ;RELEASE RESET
00C9'   CD 00EB'                CALL    ..DLY   ;DELAY
00CC'   0D                      DCR     C       ;CALC PORT C ADDRESS
00CD'   21 0000:0B              LXI     H,LAD740#  ;GET LOAD ADDRESS/LENGTH
00D0'   0604                    MVI     B,4     ;GET LENGTH OF LOAD ADDRESS/LENGT
00D2'   CD 0126'                CALL    SND740  ;SEND LOAD ADDRESS/LENGTH
00D5'   D8                      RC              ;IF ERROR, DONE
00D6'   ED5B 0000:0C            LDED    LEN740# ;GET LOAD LENGTH
00DA'   43                      MOV     B,E     ;LSB OF LOAD LENGTH TO B-REG
00DB'   7B                      MOV     A,E     ;GET LSB OF LOAD LENGTH
00DC'   B7                      ORA     A       ;LSB OF LOAD LENGTH=0?
00DD'   2001                    JRNZ    ..LDL   ;IF NOT, CONTINUE
00DF'   15                      DCR     D       ;ELSE, DECREMENT MSB OF LOAD LENG
00E0'   D5              ..LDL:  PUSH    D       ;SAVE LOAD LENGTH
00E1'   CD 0126'                CALL    SND740  ;SEND UP TO 256 BYTES OF BOOT COD
00E4'   D1                      POP     D       ;RESTORE LOAD LENGTH
```

CD740 - TURBODOS OPERATING SYSTEM MASTER CIRCUIT DRIVER (IMS 740)


```
00E5'   D8                      RC              ;IF ERROR, DONE
00E6'   15                      DCR     D       ;ELSE, DECREMENT LSB OF LOAD LENGT
00E7'   F2 00E0'                JP      ..LDL   ;IF MORE TO SEND, CONTINUE
00EA'   C9                      RET             ;ELSE, DONE
00EB'   0600            ..DLY:  MVI     B,0     ;INITIALIZE DELAY COUNT
00ED'   10FE            ..DLYL: DJNZ    ..DLYL  ;DELAY
00EF'   C9                      RET             ;DONE
                        ;
00F0'   0000            POL740: .WORD   0       ;SUCCESSOR LINK POINTER
00F2'   0000                    .WORD   0       ;PREDECESSOR LINK POINTER
                        ;
00F4'   3A 0000"                LDA     NMB740  ;GET NUMBER OF IMS 740 PROCESSORS
00F7'   B7                      ORA     A       ;NUMBER OF IMS 740 PROCESSORS=0?
00F8'   C8                      RZ              ;IF SO, DONE
00F9'   3D                      DCR     A       ;DECREMENT NUMBER OF PROCESSORS
00FA'   E60F                    ANI     0FH     ;LIMIT NUMBER OF PROCESSORS TO 16
00FC'   21 0023"                LXI     H,CURSLV  ;GET CURRENT SLAVE NUMBER
00FF'   34                      INR     M       ;INCREMENT CURRENT SLAVE NUMBER
0100'   BE                      CMP     M       ;VALID SLAVE PROCESSOR NUMBER?
0101'   3002                    JRNC    ..VSPN  ;IF SO, CONTINUE
0103'   3600                    MVI     M,0     ;ELSE, SET SLAVE PROCESSOR NUMBER=
0105'   CD 0170'        ..VSPN: CALL    RMCOM   ;DO COMMON SETUP
0108'   C0                      RNZ             ;IF REQUEST IN PROGRESS SET, DONE
0109'   ED78                    INP     A       ;ELSE, GET SLAVE PROCESSOR STATUS
010B'   CB6F                    BIT     IBF,A   ;INPUT BUFFER FULL SET?
010D'   2804                    JRZ     ..CTC   ;IF NOT, CONTINUE
010F'   CBC6                    SET     0,M     ;ELSE, SET REQUEST IN PROGRESS FLA
0111'   1807                    JMPR    ..SIG   ;CONTINUE
0113'   CD 0182'       ..CTC:  CALL    GETCTC  ;GET CURRENT TICK COUNT
0116'   96                      SUB     M       ;CALC ELAPSED NUMBER OF TICKS
0117'   FE3C                    CPI     60      ;MINIMUM NUMBER OF TICKS ELAPSED?
0119'   D8                      RC              ;IF NOT, DONE
011A'   21 00F0'       ..SIG:  LXI     H,POL740  ;ELSE, GET IMS 740 POLL ROUTINE
011D'   CD 0000:0D              CALL    UNLINK# ;UNLINK POLL ROUTINE FROM POLL LIS
0120'   21 0025"                LXI     H,RCVSPH  ;GET RECEIVE MESSAGE SEMAPHORE
0123'   C3 0000:0E              JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                        ;
0126'   7E              SND740: MOV     A,M     ;GET BYTE FROM BUFFER
0127'   23                      INX     H
0128'   CD 0151'                CALL    OUTBYT  ;OUTPUT BYTE
012B'   D8                      RC              ;IF TIME-OUT, DONE
012C'   10F8                    DJNZ    SND740  ;ELSE, CONTINUE
012E'   AF                      XRA     A       ;SET RETURN CODE=0
012F'   C9                      RET             ;DONE
                        ;
0130'   CD 013A'        RCV740: CALL    INBYT   ;INPUT BYTE
0133'   D8                      RC              ;IF TIME-OUT, DONE
0134'   77                      MOV     M,A     ;ELSE, STORE BYTE IN BUFFER
0135'   23                      INX     H
0136'   10F8                    DJNZ    RCV740  ;CONTINUE
0138'   AF                      XRA     A       ;SET RETURN CODE=0
0139'   C9                      RET             ;DONE
                        ;
013A'   1E00            INBYT:  MVI     E,0     ;INITIALIZE TIME OUT COUNTER
```

MCD740 - TURBODOS OPERATING SYSTEM MASTER CIRCUIT DRIVER (IMS 740)


```
013C'   ED50          ..WTL:  INP     D       ;GET SLAVE PROCESSOR STATUS
013E'   CB6A                  BIT     IBF,D   ;INPUT BUFFER FULL SET?
0140'   2007                 JRNZ    ..IBF   ;IF SO, CONTINUE
0142'   1D                    DCR     E       ;ELSE, DECREMENT TIME OUT COUNT
0143'   20F7                  JRNZ    ..WTL   ;CONTINUE
0145'   3EFF                  MVI     A,0FFH  ;SET RETURN CODE=0FFH
0147'   37                    STC             ;SET CARRY FLAG
0148'   C9                    RET             ;DONE
0149'   0D            ..IBF:  DCR     C       ;CALC PORT A ADDRESS
014A'   0D                    DCR     C
014B'   ED78                  INP     A       ;INPUT BYTE FROM PORT A
014D'   0C                    INR     C       ;CALC PORT C ADDRESS
014E'   0C                    INR     C
014F'   B7                    ORA     A       ;CLEAR CARRY FLAG
0150'   C9                    RET             ;DONE
                      ;
0151'   1E00          OUTBYT: MVI     E,0     ;INITIALIZE TIME OUT COUNTER
0153'   ED50          ..WTL:  INP     D       ;GET SLAVE PROCESSOR STATUS
0155'   CB7A                  BIT     OBFN,D  ;OUTPUT BUFFER FULL (NOT) SET?
0157'   2007                  JRNZ    ..NOBF  ;IF SO, CONTINUE
0159'   1D                    DCR     E       ;ELSE, DECREMENT TIME OUT COUNT
015A'   20F7                  JRNZ    ..WTL   ;CONTINUE
015C'   3EFF                  MVI     A,0FFH  ;SET RETURN CODE=0FFH
015E'   37                    STC             ;SET CARRY FLAG
015F'   C9                    RET             ;DONE
0160'   0D            ..NOBF: DCR     C       ;CALC PORT A ADDRESS
0161'   0D                    DCR     C
0162'   ED79                  OUTP    A       ;OUTPUT BYTE TO PORT A
0164'   0C                    INR     C       ;CALC PORT C ADDRESS
0165'   0C                    INR     C
0166'   B7                    ORA     A       ;CLEAR CARRY FLAG
0167'   C9                    RET             ;DONE
                      ;
0168'   CD 0174'       SETTC:  CALL    SMCOM   ;GET TICK COUNT ADDRESS
016B'   CD 0182'              CALL    GETCTC  ;GET CURRENT TICK COUNT
016E'   77                    MOV     M,A     ;SET TICK COUNT
016F'   C9                    RET             ;DONE
                      ;
0170'   ED5B 0023"    RMCOM:  LDED    CURSLV  ;GET CURRENT SLAVE PROCESSOR NUMB
                      ;
0174'   21 0002"      SMCOM:  LXI     H,PAT740  ;GET IMS 740 PORT ADDRESS TABLE
0177'   19                    DAD     D       ;CALC IMS 740 PORT ADDRESS
0178'   4E                    MOV     C,M     ;DATA PORT ADDRESS TO C-REG
0179'   0C                    INR     C       ;CALC PORT C ADDRESS
017A'   0C                    INR     C
017B'   21 002B"              LXI     H,POLCNT  ;GET POLL ROUTINE TICK COUNTS
017E'   19                    DAD     D       ;INDEX INTO TICK COUNTS
017F'   CB46                  BIT     0,M     ;REQUEST IN PROGRESS FLAG SET?
0181'   C9                    RET             ;DONE
                      ;
0182'   3A 0000:0F    GETCTC: LDA     TICCNT# ;GET CURRENT TICK COUNT
0185'   E6FE                  ANI     0FEH    ;STRIP BIT 0
0187'   C9                    RET             ;DONE
                      ;
```

'740 - TURBODOS OPERATING SYSTEM MASTER CIRCUIT DRIVER (IMS 740)
'YRIGHT (C) 1982. SOFTWARE 2000. INC.

```
.PRGEND
```

LOD740 - TURBODOS OPERATING SYSTEM INTERMEDIATE BOOTSTAP (IMS 740)


```
                        ;
                        ; ***********************************************************
                        ; *
                        ; *  At the start of a download of an IMS 740 slave
                        ; *  processor board, the master circuit driver MCD740
                        ; *  sends this loader to the slave.  It is loaded into
                        ; *  slave memory by the slave ROM module SPB740.  This
                        ; *  loader module handles the remainder of the down-
                        ; *  loading task by making standard TurboDOS network
                        ; *  download requests to load the full slave operating
                        ; *  system from a file OSSLAVE.SYS on the master's
                        ; *  disk.
                        ; *
                        ; ***********************************************************
                        ;
                        ; COPYRIGHT (C) 1982. SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  LOD740          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000                    PIOVEC  = 00H           ;PIO INTERRUPT VECTOR ADDRESS
                        ;
0020                    PORTAD  = 20H           ;8255 PORT A DATA REGISTER
0024                    PIOADR  = 24H           ;PIO PORT A DATA REGISTER
0025                    PIOBDR  = 25H           ;PIO PORT B DATA REGISTER
0026                    PIOACR  = 26H           ;PIO PORT A CONTROL REGISTER
0027                    PIOBCR  = 27H           ;PIO PORT B CONTROL REGISTER
                        ;
0004                    PORTC0  = 4             ;PORT C DATA BIT 0 (INT)
0005                    PORTC5  = 5             ;PORT C DATA BIT 5 (IBF)
0006                    PORTC7  = 6             ;PORT C DATA BIT 7 (OBF)
0007                    RAMPER  = 7             ;RAM PARITY ERROR
                        ;
0006                    ROMENA  = 6             ;ROM ENABLE BIT
0007                    PERRES  = 7             ;PARITY ERROR RESET
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   0A00            LAD740::.WORD   0A00H   ;SLAVE PROCESSOR BOOT LOAD ADDRES
0002'   00CF            LEN740::.WORD   SPBLEN  ;SLAVE PROCESSOR BOOT LOAD LENGTH
                        ;
                        .DEFINE RELOC[ADDR]=[(ADDR-SPB740)+0A00H] ;RELOCATION MAC
                        ;
0004'   F3              SPB740: DI              ;DISABLE INTERRUPTS
0005'   31 0900                LXI     SP,900H ;INITIALIZE STACK POINTER
0008'   3E09                   MVI     A,09H   ;GET INTERRUPT VECTOR PAGE
000A'   ED47                   STAI            ;SET INTERRUPT PAGE REGISTER
000C'   ED5E                   IM2             ;SET INTERRUPT MODE 2
```

740 - TURBODOS OPERATING SYSTEM INTERMEDIATE BOOTSTAP (IMS 740)


```
000E'   21 0A8E              LXI     H,RELOC[PIOISR]  ;GET PIO INT SERVICE ADDR
0011'   22 0900              SHLD    0900H    ;SET INTERRUPT VECTOR ADDRESS
0014'   3E00                 MVI     A,PIOVEC  ;GET PIO INTERRUPT SERVICE VECTO
0016'   D326                 OUT     PIOACR  ;OUTPUT INTERRUPT SERVICE VECTOR
0018'   3ECF                 MVI     A,0CFH  ;GET PIO A MODE WORD (MODE 3)
001A'   D326                 OUT     PIOACR  ;OUTPUT PIO A MODE WORD
001C'   3EFF                 MVI     A,0FFH  ;GET PIO A MODE 3 MODE WORD
001E'   D326                 OUT     PIOACR  ;OUTPUT PIO A MODE 3 MODE WORD
0020'   3EB7                 MVI     A,0B7H  ;GET PIO A INTERRUPT CONTROL WORD
0022'   D326                 OUT     PIOACR  ;OUTPUT INTERRUPT CONTROL WORD
0024'   3EEF                 MVI     A,0EFH  ;GET PIO A INTERRUPT MASK
0026'   D326                 OUT     PIOACR  ;OUTPUT INTERRUPT MASK
0028'   3EF0                 MVI     A,0F0H  ;GET PIO B DATA DATA WORD
002A'   D325                 OUT     PIOBDR  ;OUTPUT PIO B DATA WORD
002C'   3E0F                 MVI     A,0FH   ;GET PIO B MODE WORD (MODE 0)
002E'   D327                 OUT     PIOBCR  ;OUTPUT PIO B MODE WORD
0030'   DB20                 IN      PORTAD  ;CLEAR INPUT PORT A
0032'   FB                   EI              ;ENABLE INTERRUPTS
0033'   21 0000              LXI     H,0     ;INITIALIZE MEMORY PARITY
0036'   11 0000              LXI     D,0
0039'   01 0000              LXI     B,0
003C'   EDB0                 LDIR
003E'   3E30                 MVI     A,30H   ;GET PIO B DATA BYTE
0040'   D325                 OUT     PIOBDR  ;RELEASE PARITY ERROR RESET
0042'   3E06         ..SPBL: MVI     A,AACK  ;GET ACK
0044'   CD 0AB6              CALL    RELOC[OUTBYT]  ;OUTPUT ACK
0047'   21 0AC3              LXI     H,RELOC[REQMSG]  ;GET REQUEST MESSAGE
004A'   46                   MOV     B,M     ;GET MESSAGE LENGTH
004B'   CD 0A9D              CALL    RELOC[SND740]  ;SEND MESSAGE
004E'   21 0ACF              LXI     H;RELOC[REPMSG]  ;GET REPLY MESSAGE BUFFER
0051'   0601                 MVI     B,1     ;GET LENGTH OF MESSAGE LENGTH
0053'   CD 0AA5              CALL    RELOC[RCV740]  ;RECEIVE MESSAGE LENGTH
0056'   2B                   DCX     H       ;BACK UP TO MESSAGE LENGTH
0057'   46                   MOV     B,M     ;GET MESSAGE LENGTH
0058'   23                   INX     H       ;RESTORE MESSAGE BUFFER ADDRESS
0059'   05                   DCR     B       ;DECREMENT MESSAGE LENGTH
005A'   CD 0AA5              CALL    RELOC[RCV740]  ;RECEIVE MESSAGE
005D'   3A 0ACF              LDA     RELOC[REPMSG]  ;GET REPLY MESSAGE LENGTH
0060'   FE0C                 CPI     MSGHL+1 ;MESSAGE LENGTH=HEADER LENGTH+1?
0062'   2812                 JRZ     ..EOF   ;IF SO, CONTINUE
0064'   21 0ADA              LXI     H,RELOC[REPMSG+MSGHL]  ;GET DATA ADDRESS
0067'   ED5B 0AC1            LDED    RELOC[DMADDR]  ;GET DMA ADDRESS
006B'   01 0080              LXI     B,128   ;GET DATA RECORD LENGTH
006E'   EDB0                 LDIR            ;MOVE DOWNLOAD RECORD INTO DMA ADD
0070'   ED53 0AC1            SDED    RELOC[DMADDR]  ;UPDATE DMA ADDRESS
0074'   18CC                 JMPR    ..SPBL  ;CONTINUE
0076'   2B           ..EOF:  DCX     H       ;BACK UP TO O/S ID
0077'   7E                   MOV     A,M     ;GET SYSTEM DISK
0078'   21 0B5A              LXI     H,RELOC[OSLOAD]  ;GET SLAVE PROCESSOR O/S
007B'   5E                   MOV     E,M     ;GET O/S LOAD ADDRESS
007C'   23                   INX     H
007D'   56                   MOV     D,M
007E'   23                   INX     H
007F'   4E                   MOV     C,M     ;GET SLAVE PROCESSOR O/S LENGTH
```

LOD740 - TURBODOS OPERATING SYSTEM INTERMEDIATE BOOTSTAP (IMS 740)


```
0080'  23                  INX     H
0081'  46                  MOV     B,M
0082'  09                  DAD     B       ;CALC LAST BYTE OF O/S
0083'  EB                  XCHG            ;O/S LOAD ADDRESS TO HL-REG
0084'  09                  DAD     B       ;CALC LAST BYTE LOAD ADDRESS
0085'  2B                  DCX     H
0086'  EB                  XCHG            ;HL=END OF O/S-HL=LAST LOAD ADDRE
0087'  EDB8                LDDR            ;MOVE O/S INTO LOAD ADDRESS
0089'  13                  INX     D       ;ADVANCE TO O/S ENTRYPOINT
008A'  2A 0AC7             LHLD    RELOC[SID740]  ;GET IMS 740 SOURCE ID
008D'  22 0080             SHLD    TBUF    ;STORE ID IN DEFAULT BUFFER
0090'  EB                  XCHG            ;O/S ENTRYPOINT TO HL-REG
0091'  E9                  PCHL            ;TRANSFER TO SLAVE PROCESSOR O/S
                           ;
0092'  F5          PIOISR: PUSH    PSW     ;SAVE AF-REG
0093'  DB24                IN      PIOADR  ;GET PIO A DATA REGISTER
0095'  CB6F                BIT     PORTC5,A  ;PORT C BIT 5 SET? (IBF)
0097'  2004                JRNZ    ..X     ;IF SO, CONITNUE
0099'  3E15                MVI     A,ANAK  ;ELSE, GET NACK
009B'  D320                OUT     PORTAD  ;OUTPUT NACK TO PORT A
009D'  F1          ..X:    POP     PSW     ;RESTORE AF-REG
009E'  FB                  EI              ;ENABLE INTERRUPTS
009F'  ED4D                RETI            ;DONE
                           ;
00A1'  7E          SND740: MOV     A,M     ;GET BYTE FROM MESSAGE
00A2'  23                  INX     H
00A3'  CD 0AB6             CALL    RELOC[OUTBYT]  ;OUTPUT BYTE
00A6'  10F9                DJNZ    SND740  ;CONTINUE
00A8'  C9                  RET             ;DONE
                           ;
00A9'  CD 0AAD     RCV740: CALL    RELOC[INBYT]  ;INPUT BYTE
00AC'  77                  MOV     M,A     ;SAVE BYTE IN MESSAGE
00AD'  23                  INX     H
00AE'  10F9                DJNZ    RCV740  ;CONTINUE
00B0'  C9                  RET             ;DONE
                           ;
00B1'  DB24        INBYT:  IN      PIOADR  ;GET PIO A DATA REGISTER
00B3'  CB77                BIT     PORTC7,A  ;PORT C BIT 7 SET? (OBF)
00B5'  20FA                JRNZ    INBYT   ;IF NOT, WAIT
00B7'  DB20                IN      PORTAD  ;INPUT BYTE FROM PORT A
00B9'  C9                  RET             ;DONE
                           ;
00BA'  4F          OUTBYT: MOV     C,A     ;SAVE OUTPUT BYTE IN C-REG
00BB'  DB24        ..WTL:  IN      PIOADR  ;GET PIO A DATA REGISTER
00BD'  CB6F                BIT     PORTC5,A  ;PORT C BIT 5 SET? (IBF)
00BF'  20FA                JRNZ    ..WTL   ;IF SO, WAIT
00C1'  79                  MOV     A,C     ;GET OUTPUT BYTE
00C2'  D320                OUT     PORTAD  ;OUTPUT BYTE TO PORT A
00C4'  C9                  RET             ;DONE
                           ;
00C5'  0B5A        DMADDR: .WORD   RELOC[OSLOAD]  ;DMA ADDRESS
                           ;
00C7'              REQMSG:                 ;DOWNLOAD REQUEST MESSAGE
00C7'              MSGHDR:                 ;MESSAGE HEADER
```

D740 - TURBODOS OPERATING SYSTEM INTERMEDIATE BOOTSTAP (IMS 740)


```
00C7'  0C              MSGLEN: .BYTE   MSGHBL  ;MESSAGE LENGTH
00C8'                  DID740::                ;SLAVE PROCESSOR DESTINATION ID
00C8'  0000            MSGDID: .WORD   0       ;MESSAGE DESTINATION ID
00CA'  00              MSGPID: .BYTE   0       ;MESSAGE PROCESS ID
00CB'                  SID740::                ;SLAVE PROCESSOR SOURCE ID
00CB'  0000            MSGSID: .WORD   0       ;MESSAGE SOURCE ID
00CD'                  ORG740::                ;SLAVE PROCESSOR ORIGIN
00CD'  000000          MSGORG: .BYTE   [3]0    ;MESSAGE ORIGIN
00D0'  00              MSGLVL: .BYTE   0       ;MESSAGE LEVEL
00D1'  00              MSGFCD: .BYTE   0       ;MESSAGE FORMAT CODE
                       ;
000B                   MSGHL   = .-MSGHDR      ;MESSAGE HEADER LENGTH
                       ;
00D2'  20              SSL740::.BYTE   ASP     ;SLAVE PROCESSOR O/S SUFFIX LETTER
                       ;
000C                   MSGHBL  = .-MSGHDR      ;MESSAGE HEADER/BUFFER LENGTH
                       ;
00CF                   SPBLEN  = .-SPB740      ;SLAVE PROCESSOR BOOT CODE LENGTH
                       ;
00D3'                  REPMSG: .BLKB   MSGHL+128  ;REPLY MESSAGE BUFFER
                       ;
015E'                  OSLOAD  = .             ;O/S LOAD ADDRESS
                       ;
                       .END
```

CKTSER - TURBODOS OPERATING SYSTEM CIRCUIT DRIVER (SERIAL ASYNC)


```
                        ;
                        ; ********************************************************
                        ; *
                        ; *  This is a trivial network circuit driver which
                        ; *  may be used for master-to-master networking over
                        ; *  an ordinary RS232 serial channel.  It performs
                        ; *  absolutely no handshaking, error checking, or
                        ; *  error recovery, and consequently is suitable only
                        ; *  for very short links which are considered to be
                        ; *  completely error-free.  It could easily be en-
                        ; *  hanced to include such features, however.
                        ; *
                        ; ********************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  CKTSER          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   0F              CKTSBR::.BYTE   0FH      ;NETWORK BAUD RATE
0001"   01              CKTSCH::.BYTE   1        ;NETWORK SERIAL CHANNEL
                        ;
0000:04                         .LOC    .INIT.# ;LOCATE IN INITIALIZATION AREA
                        ;
0000:04 1E03            CKTIN%::MVI     E,3      ;E = SET BAUD RATE FCN
0002:04 ED4B 0000"              LBCD    CKTSBR   ;C = BAUD RATE, B = CHANNEL NUMBE
0006:04 C3 0000:05              JMP     SERIAL#  ;SET SERIAL CHANNEL BAUD RATE
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   79              CKTDR%::MOV     A,C      ;GET FUNCTION NUMBER
0001'   B7                      ORA     A        ;FUNCTION NUMBER=0?
0002'   2804                    JRZ     RCVMSG   ;IF SO, CONTINUE
0004'   3D                      DCR     A        ;FUNCTION NUMBER=1?
0005'   282E                    JRZ     SNDMSG   ;IF SO, CONTINUE
0007'   C9                      RET              ;ELSE, DONE
                        ;
0008'   EB              RCVMSG: XCHG             ;ADDRESS OF BUFFER IN HL-REGISTER
0009'   0603            ..L1:   MVI     B,3      ;LOOK FOR THREE SYNC CHARACTERS
000B'   CD 0027'        ..L2:   CALL    RCVA     ;RECEIVE SYNC BYTE (?)
000E'   FE16                    CPI     ASYN     ;SYNC?
0010'   20F7                    JRNZ    ..L1     ;NO, RESET COUNT
0012'   10F7                    DJNZ    ..L2     ;ELSE, CONTINUE FOR COUNT
0014'   23                      INX     H        ;ADVANCE PAST BUFFER LINKAGE
0015'   23                      INX     H
0016'   23                      INX     H
```

TSER - TURBODOS OPERATING SYSTEM CIRCUIT DRIVER (SERIAL ASYNC)


```
0017'   23                      INX     H
0018'   CD 0027'               CALL    RCVA    ;RECEIVE MESSAGE LENGTH BYTE
001B'   47                      MOV     B,A     ;B = ACTUAL MESSAGE LENGTH
001C'   1803                    JMPR    ..L4    ;JOIN COMMON
001E'   CD 0027'        ..L3:   CALL    RCVA    ;RECEIVE MESSAGE BYTE
0021'   77              ..L4:   MOV     M,A     ;STORE IN BUFFER
0022'   23                      INX     H       ;INCREMENT BUFFER POINTER
0023'   10F9                    DJNZ    ..L3    ;CONTINUE FOR THE COUNT
0025'   AF                      XRA     A       ;SET RETURN CODE = SUCCESS
0026'   C9                      RET             ;DONE
                        ;
0027'   E5              RCVA:   PUSH    H       ;SAVE REGISTERS
0028'   C5                      PUSH    B
0029'   3A 0001"                LDA     CKTSCH  ;B = GET CHANNEL NUMBER
002C'   47                      MOV     B,A
002D'   1E01                    MVI     E,1     ;E = SERIAL IN FCN
002F'   CD 0000:05              CALL    SERIAL# ;INPUT CHARACTER
0032'   C1                      POP     B       ;RESTORE REGISTERS
0033'   E1                      POP     H
0034'   C9                      RET             ;DONE
                        ;
0035'   EB              SNDMSG: XCHG            ;ADDRESS OF BUFFER IN HL-REGISTERS
0036'   01 0316                 LXI     B,3<8!ASYN  ;SEND THREE SYNC CHARACTERS FI
                        T
0039'   CD 004C'       ..L1:   CALL    SNDC
003C'   10FB                   DJNZ    ..L1
003E'   23                      INX     H       ;ADVANCE PAST BUFFER LINKAGE
003F'   23                      INX     H
0040'   23                      INX     H
0041'   23                      INX     H
0042'   46                      MOV     B,M     ;B = MESSAGE LENGTH
0043'   4E              ..L2:   MOV     C,M     ;GET NEXT MESSAGE BYTE
0044'   23                      INX     H       ;ADVANCE BUFFER POINTER
0045'   CD 004C'                CALL    SNDC    ;SEND MESSAGE BYTE
0048'   10F9                    DJNZ    ..L2    ;CONTINUE FOR THE COUNT
004A'   AF                      XRA     A       ;SET RETURN CODE = SUCCESS
004B'   C9                      RET             ;DONE
                        ;
004C'   E5              SNDC:   PUSH    H       ;SAVE REGISTERS
004D'   C5                      PUSH    B
004E'   3A 0001"                LDA     CKTSCH  ;B = GET CHANNEL NUMBER
0051'   47                      MOV     B,A
0052'   1E02                    MVI     E,2     ;E = SERIAL OUT FCN
0054'   CD 0000:05              CALL    SERIAL# ;OUTPUT CHARACTER
0057'   C1                      POP     B       ;RESTORE REGISTERS
0058'   E1                      POP     H
0059'   C9                      RET             ;DONE
                        ;
                        .END
```

SPD442 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL I/O DRIVER (IMS 442)


```
                        ;
                        ; ********************************************************
                        ; *
                        ; *  This module handles all serial and parallel I/O
                        ; *  for the IMS 442 I/O board.  Serial channels 0 and
                        ; *  1 are handled directly by this module, and cor-
                        ; *  respond to the two serial ports on the IMS 442
                        ; *  board.  Serial channels 2, 3, 4 and 5 are passed
                        ; *  to another module, SER480, and correspond to the
                        ; *  four serial ports on the IMS 480 four-channel
                        ; *  serial board.  Thus, six serial channels can be
                        ; *  supported if both boards are installed.
                        ; *
                        ; *  Serial input is handled via interrupts and buf-
                        ; *  fered in a separate circular buffer for each chan-
                        ; *  nel.  Serial output is handled on a polled basis
                        ; *  and is not buffered.
                        ; *
                        ; ********************************************************
                        ;
                        ; COPYRIGHT (C) 1982. SOFTWARE 2000. INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  SPD442          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0010                    IOBASE  = 10H           ;SERIAL/PARALLEL I/O PORT BASE
                        ;
0010                    SOCTRL  = IOBASE+00H    ;SERIAL 0 CONTROL/STATUS REGISTER
0011                    SODATA  = IOBASE+01H    ;SERIAL 0 DATA REGISTER
0012                    S1CTRL  = IOBASE+02H    ;SERIAL 1 CONTROL/STATUS REGISTER
0013                    S1DATA  = IOBASE+03H    ;SERIAL 1 DATA REGISTER
0014                    TIM0    = IOBASE+04H    ;TIMER 0 DATA REGISTER
0015                    TIM1    = IOBASE+05H    ;TIMER 1 DATA REGISTER
0016                    TIM2    = IOBASE+06H    ;TIMER 2 DATA REGISTER
0017                    TIMCTL  = IOBASE+07H    ;TIMER CONTROL REGISTER
0018                    SINTE   = IOBASE+08H    ;SERIAL INTERRUPT ENABLE REGISTER
0019                    T2RES   = IOBASE+09H    ;TIMER 2 INTERRUPT RESET
001C                    P0DATA  = IOBASE+0CH    ;PARALLEL 0 DATA REGISTER
001D                    P1DATA  = IOBASE+0DH    ;PARALLEL 1 DATA REGISTER
001E                    P2DATA  = IOBASE+0EH    ;PARALLEL 2 DATA REGISTER
001F                    PPCTL   = IOBASE+0FH    ;PARALLEL PORT CONTROL REGISTER
                        ;
0000                    RDA     = 0             ;RECEIVED DATA AVAILABLE BIT
0001                    TBE     = 1             ;TRANSMIT BUFFER EMPTY BIT
0007                    CTSN    = 7             ;CLEAR TO SEND (NOT) BIT
                        ;
0000                    ROMDIS  = 0             ;ROM DISABLE BIT
0001                    RTCENA  = 1             ;REAL TIME CLOCK ENABLE BIT
```

```
0002                    S1TXIE  = 2               ;SERIAL 1 TX INTERRUPT ENABLE BIT
0003                    S1RXIE  = 3               ;SERIAL 1 RX INTERRUPT ENABLE BIT
0004                    S1RTSN  = 4               ;SERIAL 1 REQ TO SEND (NOT) BIT
0005                    SOTXIE  = 5               ;SERIAL 0 TX INTERRUPT ENABLE BIT
0006                    SORXIE  = 6               ;SERIAL 0 RX INTERRUPT ENABLE BIT
0007                    SORTSN  = 7               ;SERIAL 0 REQ TO SEND (NOT) BIT
                        ;
0036                    T0CMD   = 36H             ;TIMER 0 COMMAND
0076                    T1CMD   = 76H             ;TIMER 1 COMMAND
00B6                    T2CMD   = 0B6H            ;TIMER 2 COMMAND
                        ;
0089                    PPMODE  = 89H             ;PARALLEL PORT MODE WORD
0019                    SPMODE  = 19H             ;SERIAL PORT MODE WORD
                                                  ;PARITY INHIBIT/1 STOP BIT/8 BITS
                        ;
0000"                           .LOC    .DATA.#   ;LOCATE IN DATA AREA
                        ;
0000"   0040            SOIBSZ::.WORD   64        ;SERIAL 0 INPUT BUFFER SIZE
0002"   0000            SOIBUF: .WORD   0         ;SERIAL 0 INPUT BUFFER ADDRESS
0004"   0000            SOIPTR: .WORD   0         ;SERIAL 0 INPUT POINTER
0006"   0000            SOOPTR: .WORD   0         ;SERIAL 0 OUTPUT POINTER
0008"   0000            SOICNT: .WORD   0         ;SERIAL 0 INPUT COUNT
000A"   00              SOOCHR: .BYTE   0         ;SERIAL 0 OUTPUT CHARACTER
000B"   00              SOBR:   .BYTE   0         ;SERIAL 0 BAUD RATE CODE
                        ;
000C"                   SOISPH:                   ;SERIAL 0 INPUT SEMAPHORE
000C"   0000                    .WORD   0         ;SEMAPHORE COUNT
000E"   000E"           ..SOIH: .WORD   ..SOIH    ;SEMAPHORE P/D HEAD
0010"   000E"                    .WORD   ..SOIH
                        ;
                                                  ;SERIAL 0 OUTPUT SEMAPHORE
0012"   0000            SOOSPH: .WORD   0         ;SEMAPHORE COUNT
0014"   0014"           ..SOOH: .WORD   ..SOOH    ;SEMAPHORE P/D HEAD
0016"   0014"                    .WORD   ..SOOH
                        ;
                                                  ;SERIAL 0 OUTPUT SEMAPHORE
0018"   0001            SOXSPH: .WORD   1         ;SEMAPHORE COUNT
001A"   001A"           ..SOXH: .WORD   ..SOXH    ;SEMAPHORE P/D HEAD
001C"   001A"                    .WORD   ..SOXH
                        ;
001E"   0010            S1IBSZ::.WORD   16        ;SERIAL 1 INPUT BUFFER SIZE
0020"   0000            S1IBUF: .WORD   0         ;SERIAL 1 INPUT BUFFER ADDRESS
0022"   0000            S1IPTR: .WORD   0         ;SERIAL 1 INPUT POINTER
0024"   0000            S1OPTR: .WORD   0         ;SERIAL 1 OUTPUT POINTER
0026"   0000            S1ICNT: .WORD   0         ;SERIAL 1 INPUT COUNT
0028"   00              S1OCHR: .BYTE   0         ;SERIAL 1 OUTPUT CHARACTER
0029"   00              S1BR:   .BYTE   0         ;SERIAL 1 BAUD RATE CODE
                        ;
                                                  ;SERIAL 1 INPUT SEMAPHORE
002A"   0000            S1ISPH: .WORD   0         ;SEMAPHORE COUNT
002C"   002C"           ..S1IH: .WORD   ..S1IH    ;SEMAPHORE P/D HEAD
002E"   002C"                    .WORD   ..S1IH
                        ;
                                                  ;SERIAL 1 OUTPUT SEMAPHORE
```

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```
0030"  0000          S1OSPH: .WORD   0       ;SEMAPHORE COUNT
0032"  0032"         ..S1OH: .WORD   ..S1OH  ;SEMAPHORE P/D HEAD
0034"  0032"                 .WORD   ..S1OH
                     ;
                                             ;SERIAL 1 OUTPUT SEMAPHORE
0036"  0001          S1XSPH: .WORD   1       ;SEMAPHORE COUNT
0038"  0038"         ..S1XH: .WORD   ..S1XH  ;SEMAPHORE P/D HEAD
003A"  0038"                 .WORD   ..S1XH
                     ;
003C"  49            INTMSK::.BYTE   1<ROMDIS!1<SORXIE!1<S1RXIE  ;INTERRUPT MAS
                     ;
0000:04                      .LOC    .INIT.# ;LOCATE IN INITIALIZATION AREA
                     ;
0000:04 3E89         SPINIT::MVI     A,PPMODE  ;INITIALIZE 8255
0002:04 D31F                 OUT     PPCTL
0004:04 3EFF                 MVI     A,0FFH  ;CLEAR PARALLEL PORTS
0006:04 D31C                 OUT     P0DATA
0008:04 D31D                 OUT     P1DATA
000A:04 3E19                 MVI     A,SPMODE  ;INITIALIZE UARTS
000C:04 D310                 OUT     S0CTRL
000E:04 D312                 OUT     S1CTRL
0010:04 3EC3                 MVI     A,JMP   ;SET UP SERIAL INTERRUPT VECTOR
0012:04 32 0018              STA     3*8
0015:04 21 0131'             LXI     H,SERISR
0018:04 22 0019              SHLD    (3*8)+1
001B:04 3A 003C"             LDA     INTMSK  ;GET INTERRUPT MASK
001E:04 D318                 OUT     SINTE   ;ENABLE INTERRUPT MASKS
0020:04 2A 0000"             LHLD    S0IBSZ  ;GET SERIAL 0 INPUT BUFFER SIZE
0023:04 CD 0000:05           CALL    ALLOC#  ;ALLOCATE PACKET FOR SERIAL BUFFER
0026:04 22 0002"             SHLD    S0IBUF  ;SAVE SERIAL 0 INPUT BUFFER ADDRES
0029:04 22 0004"             SHLD    S0IPTR  ;SET SERIAL 0 INPUT POINTER
002C:04 22 0006"             SHLD    S0OPTR  ;SET SERIAL 0 OUTPUT POINTER
002F:04 2A 001E"             LHLD    S1IBSZ  ;GET SERIAL 1 INPUT BUFFER SIZE
0032:04 CD 0000:05           CALL    ALLOC#  ;ALLOCATE PACKET FOR SERIAL BUFFER
0035:04 22 0020"             SHLD    S1IBUF  ;SAVE SERIAL 1 INPUT BUFFER ADDRES
0038:04 22 0022"             SHLD    S1IPTR  ;SET SERIAL 1 INPUT POINTER
003B:04 22 0024"             SHLD    S1OPTR  ;SET SERIAL 1 OUTPUT POINTER
003E:04 C3 0000:06           JMP     NIT480# ;INITIALIZE IMS 480 SERIAL PORTS
                     ;
0000'                        .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                     ;
0000'                SERIAL::
0000'  7B            COMDRV::MOV     A,E     ;GET FUNCTION NUMBER
0001'  B7                    ORA     A       ;FUNCTION NUMBER=0?
0002'  2818                  JRZ     SERST   ;IF SO, CONTINUE
0004'  3D                    DCR     A       ;FUNCTION NUMBER=1?
0005'  2834                  JRZ     SERIN   ;IF SO, CONTINUE
0007'  3D                    DCR     A       ;FUNCTION NUMBER=2?
0008'  CA 00A4'              JZ      SEROUT  ;IF SO, CONTINUE
000B'  3D                    DCR     A       ;FUNCTION NUMBER=3?
000C'  CA 0200'              JZ      SERSBR  ;IF SO, CONTINUE
000F'  3D                    DCR     A       ;FUNCTION NUMBER=4?
0010'  CA 0235'              JZ      SERRBR  ;IF SO, CONTINUE
0013'  3D                    DCR     A       ;FUNCTION NUMBER=5?
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```
0014'   CA 0246'            JZ      SERSMC  ;IF SO, CONTINUE
0017'   3D                  DCR     A       ;FUNCTION NUMBER=6?
0018'   CA 026A'            JZ      SERRMC  ;IF SO, CONTINUE
001B'   C9                  RET             ;ELSE, DONE
                    ;
001C'   78          SERST:  MOV     A,B     ;GET CHANNEL NUMBER
001D'   FE02                CPI     2       ;CHANNEL NUMBER=0/1?
001F'   D2 0000:07          JNC     ST480#  ;IF NOT, CONTINUE
                    ;
0022'   ED5B 0008"  ST442:  LDED    SOICNT  ;GET SERIAL 0 INPUT BUFFER COUNT
0026'   2A 0006"            LHLD    SOOPTR  ;GET SERIAL 0 OUTPUT POINTER
0029'   78                  MOV     A,B     ;GET CHANNEL NUMBER
002A'   B7                  ORA     A       ;CHANNEL NUMBER=0
002B'   2807                JRZ     ..STC   ;IF SO, CONTINUE
002D'   ED5B 0026"          LDED    S1ICNT  ;GET SERIAL 1 INPUT BUFFER COUNT
0031'   2A 0024"            LHLD    S1OPTR  ;GET SERIAL 1 OUTPUT POINTER
0034'   7A          ..STC:  MOV     A,D
0035'   B3                  ORA     E       ;SERIAL INPUT BUFFER COUNT=0?
0036'   C8                  RZ              ;IF SO, DONE
0037'   3EFF                MVI     A,0FFH  ;ELSE, SET RETURN CODE=0FFH
0039'   4E                  MOV     C,M     ;GET SERIAL INPUT CHARACTER
003A'   C9                  RET             ;DONE
                    ;
003B'   78          SERIN:  MOV     A,B     ;GET CHANNEL NUMBER
003C'   FE02                CPI     2       ;CHANNEL NUMBER=0/1?
003E'   D2 0000:08          JNC     IN480#  ;IF NOT, CONTINUE
0041'   CD 0022'    ..SINL: CALL    ST442   ;ELSE, GET SERIAL STATUS
0044'   B7                  ORA     A       ;CHARACTER AVAILABLE?
0045'   200F                JRNZ    ..SIN   ;IF SO, CONTINUE
0047'   78                  MOV     A,B     ;ELSE, GET CHANNEL NUMBER
0048'   21 000C"            LXI     H,SOISPH  ;GET SERIAL 0 INPUT SEMAPHORE
004B'   B7                  ORA     A       ;CHANNEL NUMBER=0?
004C'   2803                JRZ     ..INC   ;IF SO, CONTINUE
004E'   21 002A"            LXI     H,S1ISPH  ;GET SERIAL 1 INPUT SEMAPHORE
0051'   CD 0000:09  ..INC:  CALL    WAIT#   ;WAIT FOR CONSOLE INPUT
0054'   18EB                JMPR    ..SINL  ;CONTINUE
0056'   78          ..SIN:  MOV     A,B     ;GET CHANNEL NUMBER
0057'   B7                  ORA     A       ;CHANNEL NUMBER=0?
0058'   2025                JRNZ    ..S1I   ;IF NOT, CONTINUE
005A'   F3                  DI              ;ELSE, DISABLE INTERRUPTS
005B'   2A 0008"            LHLD    SOICNT  ;GET SERIAL 0 INPUT COUNT
005E'   2B                  DCX     H       ;DECREMENT SERIAL 0 INPUT COUNT
005F'   22 0008"            SHLD    SOICNT  ;UPDATE SERIAL 0 INPUT COUNT
0062'   2A 0006"            LHLD    SOOPTR  ;GET SERIAL 0 OUTPUT POINTER
0065'   7E                  MOV     A,M     ;GET CHARACTER FROM BUFFER
0066'   23                  INX     H       ;INCREMENT SERIAL 0 OUTPUT POINTER
0067'   EB                  XCHG            ;SERIAL 0 OUTPUT POINTER TO DE-REG
0068'   2A 0002"            LHLD    SOIBUF  ;GET SERIAL 0 INPUT BUFFER ADDRESS
006B'   ED4B 0000"          LBCD    SOIBSZ  ;GET SERIAL 0 INPUT BUFFER SIZE
006F'   0B                  DCX     B       ;DECREMENT INPUT BUFFER SIZE
0070'   09                  DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
0071'   ED52                DSBC    D       ;BUFFER WRAP-AROUND?
0073'   3004                JRNC    ..NWA0  ;IF NOT, CONTINUE
0075'   ED5B 0002"          LDED    SOIBUF  ;GET SERIAL 0 INPUT BUFFER ADDRESS
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```
0079'   ED53 0006"    ..NWA0: SDED    S0OPTR  ;UPDATE SERIAL 0 OUTPUT POINTER
007D'   FB                    EI              ;ENABLE INTERRUPTS
007E'   C9                    RET             ;DONE
007F'   F3            ..S1I:  DI              ;DISABLE INTERRUPTS
0080'   2A 0026"              LHLD    S1ICNT  ;GET SERIAL 1 INPUT COUNT
0083'   2B                    DCX     H       ;DECREMENT SERIAL 1 INPUT COUNT
0084'   22 0026"              SHLD    S1ICNT  ;UPDATE SERIAL 1 INPUT COUNT
0087'   2A 0024"              LHLD    S1OPTR  ;GET SERIAL 1 OUTPUT POINTER
008A'   7E                    MOV     A,M     ;GET CHARACTER FROM BUFFER
008B'   23                    INX     H       ;INCREMENT SERIAL 1 OUTPUT POINTE
008C'   EB                    XCHG            ;SERIAL 1 OUTPUT POINTER TO DE-RE
008D'   2A 0020"              LHLD    S1IBUF  ;GET SERIAL 1 INPUT BUFFER ADDRES
0090'   ED4B 001E"           LBCD    S1IBSZ  ;GET SERIAL 1 INPUT BUFFER SIZE
0094'   0B                    DCX     B       ;DECREMFNT INPUT BUFFER SIZE
0095'   09                    DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
0096'   ED52                  DSBC    D       ;BUFFER WRAP-AROUND?
0098'   3004                  JRNC    ..NWA1  ;IF NOT, CONTINUE
009A'   ED5B 0020"           LDED    S1IBUF  ;GET SERIAL 1 INPUT BUFFER ADDRES
009E'   ED53 0024"    ..NWA1: SDED    S1OPTR  ;UPDATE SERIAL 1 OUTPUT POINTER
00A2'   FB                    EI              ;ENABLE INTERRUPTS
00A3'   C9                    RET             ;DONE
                      ;
00A4'   78            SEROUT: MOV     A,B     ;GET CHANNEL NUMBER
00A5'   FE02                  CPI     2       ;CHANNEL NUMBER=0/1?
00A7'   D2 0000:0A            JNC     OUT480# ;IF NOT, CONTINUE
00AA'   B7                    ORA     A       ;CHANNEL NUMBER=1?
00AB'   201E                  JRNZ    ..S1O   ;IF SO, CONTINUE
00AD'   21 0018"              LXI     H,S0XSPH  ;GET SERIAL 0 OUT SEMAPHORE
00B0'   E5                    PUSH    H       ;SAVE SERIAL 0 OUT SEMAPHORE
00B1'   CD 0000:09            CALL    WAIT#   ;WAIT ON MUTUAL EXCLUSION
00B4'   21 000A"              LXI     H,S0OCHR  ;GET SERIAL 0 OUTPUT CHARACTER
00B7'   71                    MOV     M,C     ;SAVE OUTPUT CHARACTER
00B8'   11 00E9'              LXI     D,S0OPOL  ;GET SERIAL 0 OUT POLL ROUTINE
00BB'   CD 0000:0B            CALL    LNKPOL# ;CREATE POLL ROUTINE
00BE'   CD 00ED'              CALL    S0OPR   ;EXECUTE POLL ROUTINE
00C1'   21 0012"              LXI     H,S0OSPH  ;GET SERIAL 0 OUT SEMAPHORE
00C4'   CD 0000:09            CALL    WAIT#   ;DISPATCH IF NECESSARY
00C7'   E1                    POP     H       ;GET MUTUTAL EXCLUSION SEMAPHORE
00C8'   C3 0000:0C            JMP     SIGNAL# ;SIGNAL PROCESS AS READY
00CB'   21 0036"      ..S1O:  LXI     H,S1XSPH  ;GET MUTUAL EXCLUSION SEMAPHORE
00CE'   E5                    PUSH    H       ;SAVE MUTUAL EXCLUSION SEMAPHORE
00CF'   CD 0000:09            CALL    WAIT#   ;WAIT ON MUTUAL EXCLUSION
00D2'   21 0028"              LXI     H,S1OCHR  ;GET SERIAL 1 OUTPUT CHARACTER
00D5'   71                    MOV     M,C     ;SAVE OUTPUT CHARACTER
00D6'   11 010D'              LXI     D,S1OPOL  ;GET SERIAL 1 OUT POLL ROUTINE
00D9'   CD 0000:0B            CALL    LNKPOL# ;CREATE POLL ROUTINE
00DC'   CD 0111'              CALL    S1OPR   ;EXECUTE POLL ROUTINE
00DF'   21 0030"              LXI     H,S1OSPH  ;GET SERIAL 1 OUT SEMAPHORE
00E2'   CD 0000:09            CALL    WAIT#   ;DISPATCH IF NECESSARY
00E5'   E1                    POP     H       ;GET MUTUTAL EXCLUSION SEMAPHORE
00E6'   C3 0000:0C            JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                      ;
00E9'                 S0OPOL:                 ;SERIAL 0 OUTPUT POLL ROUTINE
00E9'   0000                  .WORD   0       ;SUCCESSOR LINK POINTER
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00EB'   0000                    .WORD   0       ;PREDECESSOR LINK POINTER
                        ;
00ED'   DB10            S0OPR:  IN      S0CTRL  ;GET SERIAL 0 STATUS
00EF'   CB4F                    BIT     TBE,A   ;TRANSMIT BUFFER EMPTY?
00F1'   C8                      RZ              ;IF NOT, DONE
00F2'   21 000B"                LXI     H,S0BR  ;ELSE, GET SERIAL 0 BAUD RATE CODE
00F5'   CB76                    BIT     6,M     ;CTS HANDSHAKING REQUESTED?
00F7'   2803                    JRZ     ..NCTS  ;IF NOT, CONTINUE
00F9'   CB7F                    BIT     CTSN,A  ;CHECK CLEAR TO SEND (NOT) STATUS
00FB'   C0                      RNZ             ;IF CLEAR TO SEND FALSE, DONE
00FC'   3A 000A"        ..NCTS: LDA     S0OCHR  ;GET SERIAL 0 OUTPUT CHARACTER
00FF'   D311                    OUT     S0DATA  ;OUTPUT CHARACTER
0101'   21 00E9'                LXI     H,S0OPOL  ;GET SERIAL 0 OUT POLL ROUTINE
0104'   CD 0000:0D              CALL    UNLINK# ;UNLINK POLL ROUTINE
0107'   21 0012"                LXI     H,S0OSPH  ;GET SERIAL 0 OUT SEMAPHORE
010A'   C3 0000:0C              JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                        ;
010D'                   S1OPOL:                 ;SERIAL 1 OUTPUT POLL ROUTINE
010D'   0000                    .WORD   0       ;SUCCESSOR LINK POINTER
010F'   0000                    .WORD   0       ;PREDECESSOR LINK POINTER
                        ;
0111'   DB12            S1OPR:  IN      S1CTRL  ;GET SERIAL 1 STATUS
0113'   CB4F                    BIT     TBE,A   ;TRANSMIT BUFFER EMPTY?
0115'   C8                      RZ              ;IF NOT, DONE
0116'   21 0029"                LXI     H,S1BR  ;ELSE, GET SERIAL 1 BAUD RATE CODE
0119'   CB76                    BIT     6,M     ;CTS HANDSHAKING REQUESTED?
011B'   2803                    JRZ     ..NCTS  ;IF NOT, CONTINUE
011D'   CB7F                    BIT     CTSN,A  ;CHECK CLEAR TO SEND (NOT) STATUS
011F'   C0                      RNZ             ;IF CLEAR TO SEND FALSE, DONE
0120'   3A 0028"        ..NCTS: LDA     S1OCHR  ;GET SERIAL 1 OUTPUT CHARACTER
0123'   D313                    OUT     S1DATA  ;OUTPUT CHARACTER
0125'   21 010D'                LXI     H,S1OPOL  ;GET SERIAL 1 OUT POLL ROUTINE
0128'   CD 0000:0D              CALL    UNLINK# ;UNLINK POLL ROUTINE
012B'   21 0030"                LXI     H,S1OSPH  ;GET SERIAL 1 OUT SEMAPHORE
012E'   C3 0000:0C              JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                        ;
0131'   ED73 0000:0E    SERISR: SSPD    INTSP#  ;SAVE STACK POINTER
0135'   31 0000:0F              LXI     SP,INTSTK#  ;SET UP AUX STACK POINTER
0138'   F5                      PUSH    PSW     ;SAVE REGISTERS
0139'   C5                      PUSH    B
013A'   D5                      PUSH    D
013B'   E5                      PUSH    H
013C'   CD 0150'                CALL    ..SOI   ;CHECK FOR SERIAL 0 INPUT
013F'   CD 01A6'                CALL    ..S1I   ;CHECK FOR SERIAL 1 INPUT
0142'   CD 0000:10              CALL    ISR480# ;CHECK FOR IMS 480 INPUT
0145'   E1                      POP     H       ;RESTORE REGISTERS
0146'   D1                      POP     D
0147'   C1                      POP     B
0148'   F1                      POP     PSW
0149'   ED7B 0000:0E            LSPD    INTSP#  ;RESTORE STACK POINTER
014D'   C3 0000:11              JMP     ISRXIT# ;CONTINUE
0150'   DB10            ..SOI:  IN      S0CTRL  ;GET SERIAL 0 STATUS
0152'   CB47                    BIT     RDA,A   ;CHARACTER AVAILABLE
0154'   C8                      RZ              ;IF NOT, DONE
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0155'  DB11                    IN      SODATA  ;ELSE, GET SERIAL 0 DATA CHARACTE
0157'  21 000B"                LXI     H,SOBR  ;GET SERIAL 0 BAUD RATE CODE
015A'  CB6E                    BIT     5,M     ;INHIBIT INPUT FLAG SET?
015C'  C0                      RNZ             ;IF SO, DONE
015D'  4F                      MOV     C,A     ;SERIAL 0 DATA CHARACTER TO C-REG
015E'  CB7E                    BIT     7,M     ;ATTENTION DETECTION FLAG SET?
0160'  2814                    JRZ     ..NADO  ;IF NOT, CONTINUE
0162'  CBB9                    RES     7,C     ;STRIP SIGN BIT ON INPUT CHARACTE
0164'  3A 0000:12              LDA     ATNCHR# ;GET ATTENTION CHARACTER
0167'  B9                      CMP     C       ;CHARACTER=ATTENTION CHARACTER?
0168'  200C                    JRNZ    ..NADO  ;IF NOT, CONTINUE
016A'  2A 0004"                LHLD    SOIPTR  ;ELSE, GET SERIAL 0 INPUT POINTER
016D'  22 0006"                SHLD    SOOPTR  ;RESET SERIAL 0 OUTPUT POINTER
0170'  21 0000                 LXI     H,0
0173'  22 0008"                SHLD    SOICNT  ;SET SERIAL 0 INPUT COUNT=0
0176'  2A 0000"        ..NADO: LHLD    SOIBSZ  ;GET SERIAL 0 INPUT BUFFER SIZE
0179'  ED5B 0008"              LDED    SOICNT  ;GET SERIAL 0 INPUT COUNT
017D'  13                      INX     D       ;INCREMENT SERIAL 0 INPUT COUNT
017E'  B7                      ORA     A       ;CLEAR CARRY FLAG
017F'  ED52                    DSBC    D       ;SERIAL 0 INPUT BUFFER FULL?
0181'  D8                      RC              ;IF SO, DONE
0182'  ED53 0008"              SDED    SOICNT  ;ELSE, UPDATE SERIAL 0 INPUT COUN
0186'  2A 0004"                LHLD    SOIPTR  ;GET SERIAL 0 INPUT POINTER
0189'  71                      MOV     M,C     ;STORE INPUT CHARACTER IN BUFFER
018A'  23                      INX     H       ;INCREMENT INPUT POINTER
018B'  EB                      XCHG            ;INPUT BUFFER POINTER TO DE-REG
018C'  2A 0000"                LHLD    SOIBSZ  ;GET SERIAL 0 INPUT BUFFER SIZE
018F'  2B                      DCX     H       ;DECREMENT INPUT BUFFER SIZE
0190'  ED4B 0002"              LBCD    SOIBUF  ;GET SERIAL 0 INPUT BUFFER ADDRES
0194'  09                      DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
0195'  ED52                    DSBC    D       ;BUFFER WRAP-AROUND?
0197'  3004                    JRNC    ..NWA0  ;IF NOT, CONTINUE
0199'  ED5B 0002"              LDED    SOIBUF  ;GET SERIAL 0 INPUT BUFFER ADDRES
019D'  ED53 0004"      ..NWA0: SDED    SOIPTR  ;UPDATE SERIAL 0 INPUT POINTER
01A1'  21 000C"                LXI     H,SOISPH  ;GET SERIAL 0 INPUT SEMAPHORE
01A4'  1854                    JMPR    ..X     ;CONTINUE
01A6'  DB12            ..S1I:  IN      S1CTRL  ;GET SERIAL 1 STATUS
01A8'  CB47                    BIT     RDA,A   ;CHARACTER AVAILABLE
01AA'  C8                      RZ              ;IF NOT, DONE
01AB'  DB13                    IN      S1DATA  ;ELSE, GET SERIAL 1 DATA CHARACTE
01AD'  21 0029"                LXI     H,S1BR  ;GET SERIAL 1 BAUD RATE CODE
01B0'  CB6E                    BIT     5,M     ;INHIBIT INPUT FLAG SET?
01B2'  C0                      RNZ             ;IF SO, DONE
01B3'  4F                      MOV     C,A     ;SERIAL 1 DATA CHARACTER TO C-REG
01B4'  CB7E                    BIT     7,M     ;ATTENTION DETECTION FLAG SET?
01B6'  2814                    JRZ     ..NAD1  ;IF NOT, CONTINUE
01B8'  CBB9                    RES     7,C     ;STRIP SIGN BIT ON INPUT CHARACTE
01BA'  3A 0000:12              LDA     ATNCHR# ;GET ATTENTION CHARACTER
01BD'  B9                      CMP     C       ;CHARACTER=ATTENTION CHARACTER?
01BE'  200C                    JRNZ    ..NAD1  ;IF NOT, CONTINUE
01C0'  2A 0022"                LHLD    S1IPTR  ;ELSE, GET SERIAL 1 INPUT POINTER
01C3'  22 0024"                SHLD    S1OPTR  ;RESET SERIAL 1 OUTPUT POINTER
01C6'  21 0000                 LXI     H,0
01C9'  22 0026"                SHLD    S1ICNT  ;SET SERIAL 1 INPUT COUNT=0
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01CC'  2A 001E"      ..NAD1: LHLD    S1IBSZ  ;GET SERIAL 1 INPUT BUFFER SIZE
01CF'  ED5B 0026"            LDED    S1ICNT  ;GET SERIAL 1 INPUT COUNT
01D3'  13                    INX     D       ;INCREMENT SERIAL 1 INPUT COUNT
01D4'  B7                    ORA     A       ;CLEAR CARRY FLAG
01D5'  ED52                  DSBC    D       ;SERIAL 1 INPUT BUFFER FULL?
01D7'  D8                    RC              ;IF SO, DONE
01D8'  ED53 0026"            SDED    S1ICNT  ;ELSE, UPDATE SERIAL 1 INPUT COUNT
01DC'  2A 0022"              LHLD    S1IPTR  ;GET SERIAL 1 INPUT POINTER
01DF'  71                    MOV     M,C     ;STORE INPUT CHARACTER IN BUFFER
01E0'  23                    INX     H       ;INCREMENT INPUT POINTER
01E1'  EB                    XCHG            ;INPUT BUFFER POINTER TO DE-REG
01E2'  2A 001E"              LHLD    S1IBSZ  ;GET SERIAL 1 INPUT BUFFER SIZE
01E5'  2B                    DCX     H       ;DECREMENT INPUT BUFFER SIZE
01E6'  ED4B 0020"            LBCD    S1IBUF  ;GET SERIAL 1 INPUT BUFFER ADDRESS
01EA'  09                    DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
01EB'  ED52                  DSBC    D       ;BUFFER WRAP-AROUND?
01ED'  3004                  JRNC    ..NWA1  ;IF NOT, CONTINUE
01EF'  ED5B 0020"            LDED    S1IBUF  ;GET SERIAL 1 INPUT BUFFER ADDRESS
01F3'  ED53 0022"    ..NWA1: SDED    S1IPTR  ;UPDATE SERIAL 1 INPUT POINTER
01F7'  21 002A"              LXI     H,S1ISPH  ;GET SERIAL 1 INPUT SEMAPHORE
01FA'  7E            ..X:    MOV     A,M     ;GET SEMAPHORE COUNT
01FB'  B7                    ORA     A       ;SEMAPHORE COUNT=0?
01FC'  C8                    RZ              ;IF SO, DONE
01FD'  C3 0000:0C            JMP     SIGNAL# ;ELSE, SIGNAL PROCESS AS READY
                     ;
0200'  78            SERSBR: MOV     A,B     ;GET CHANNEL NUMBER
0201'  FE02                  CPI     2       ;CHANNEL NUMBER=0/1?
0203'  D2 0000:13            JNC     SBR480# ;IF NOT, CONTINUE
0206'  21 000B"              LXI     H,S0BR  ;ELSE, GET SERIAL 0 BAUD RATE CODE
0209'  B7                    ORA     A       ;CHANNEL NUMBER=0?
020A'  2803                  JRZ     ..COM1  ;IF SO, CONTINUE
020C'  21 0029"              LXI     H,S1BR  ;ELSE, GET SERIAL 1 BAUD RATE CODE
020F'  71            ..COM1: MOV     M,C     ;SAVE BAUD RATE CODE
0210'  CD 0226'              CALL    GETBTV  ;GET BAUD RATE TIMER VALUE
0213'  78                    MOV     A,B     ;GET CHANNEL NUMBER
0214'  B7                    ORA     A       ;CHANNEL NUMBER=0?
0215'  3E36                  MVI     A,T0CMD ;GET TIMER 0 COMMAND
0217'  0E14                  MVI     C,TIM0  ;GET TIMER 0 DATA REGISTER
0219'  2804                  JRZ     ..COM2  ;IF CHANNEL NUMBER=0, CONTINUE
021B'  3E76                  MVI     A,T1CMD ;ELSE, GET TIMER 1 COMMAND
021D'  0E15                  MVI     C,TIM1  ;GET TIMER 1 DATA REGISTER
021F'  D317          ..COM2: OUT     TIMCTL  ;SELECT TIMER
0221'  ED59                  OUTP    E       ;OUTPUT LSB OF TIMER VALUE
0223'  ED51                  OUTP    D       ;OUTPUT MSB OF TIMER VALUE
0225'  C9                    RET             ;DONE
                     ;
0226'  79            GETBTV::MOV     A,C     ;GET REQUESTED BAUD RATE CODE
0227'  E60F                  ANI     0FH     ;EXTRACT RELEVANT BITS
0229'  87                    ADD     A       ;X2
022A'  5F                    MOV     E,A     ;TO E-REG
022B'  1600                  MVI     D,0     ;MAKE IT DOUBLE LENGTH
022D'  21 0000:14            LXI     H,BRTBL#  ;GET BAUD RATE TABLE
0230'  19                    DAD     D       ;INDEX INTO TABLE
0231'  5E                    MOV     E,M     ;GET TIMER VALUE
```

SPD442 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL I/O DRIVER (IMS 442)


```
0232'  23                      INX     H
0233'  56                      MOV     D,M
0234'  C9                      RET             ;DONE
                       ;
0235'  78              SERRBR: MOV     A,B     ;GET CHANNEL NUMBER
0236'  FE02                    CPI     2       ;CHANNEL NUMBER=0/1?
0238'  D2 0000:15              JNC     RBR480# ;IF NOT, CONTINUE
023B'  21 000B"                LXI     H,S0BR  ;ELSE, GET SERIAL 0 BAUD RATE COD
023E'  B7                      ORA     A       ;CHANNEL NUMBER=0?
023F'  2803                    JRZ     ..COM   ;IF SO, CONTINUE
0241'  21 0029"                LXI     H,S1BR  ;ELSE, GET SERIAL 1 BAUD RATE COD
0244'  7E              ..COM:  MOV     A,M     ;GET CURRENT BAUD RATE CODE
0245'  C9                      RET             ;DONE
                       ;
0246'  78              SERSMC: MOV     A,B     ;GET CHANNEL NUMBER
0247'  FE02                    CPI     2       ;CHANNEL NUMBER=0/1?
0249'  D2 0000:16              JNC     SMC480# ;IF NOT, CONTINUE
024C'  B7                      ORA     A       ;CHANNEL NUMBER=0?
024D'  3A 003C"                LDA     INTMSK  ;GET INT MASK
0250'  200A                    JRNZ    ..CH1   ;IF CHANNEL NUMBER NOT=0, CONTINU
0252'  CBBF                    RES     SORTSN,A  ;CLEAR SERIAL 0 REQ TO SEND (NO
0254'  CB79                    BIT     7,C     ;SERIAL 0 REQ TO SEND TO BE ON?
0256'  200C                    JRNZ    ..COM   ;IF SO, CONTINUE
0258'  CBFF                    SET     SORTSN,A  ;ELSE, SET SERIAL 0 RTS (NOT)
025A'  1808                    JMPR    ..COM   ;CONTINUE
025C'  CBA7            ..CH1:  RES     S1RTSN,A  ;CLEAR SERIAL 1 REQ TO SEND (NO
025E'  CB79                    BIT     7,C     ;SERIAL 1 REQ TO SEND TO BE ON?
0260'  2002                    JRNZ    ..COM   ;IF SO, CONTINUE
0262'  CBE7                    SET     S1RTSN.A  ;ELSE, SET SERIAL 1 RTS (NOT)
0264'  32 003C"        ..COM:  STA     INTMSK  ;UPDATE INT MASK
0267'  D318                    OUT     SINTE   ;SET SERIAL 1 REQUEST TO SEND
0269'  C9                      RET             ;DONE
                       ;
026A'  78              SERRMC: MOV     A,B     ;GET CHANNEL NUMBER
026B'  FE02                    CPI     2       ;CHANNEL NUMBER=0/1?
026D'  D2 0000:17              JNC     RMC480# ;IF NOT, CONTINUE
0270'  B7                      ORA     A       ;CHANNEL NUMBER=0?
0271'  DB12                    IN      S1CTRL  ;GET SERIAL 0 STATUS
0273'  2802                    JRZ     ..COM   ;IF CHANNEL NUMBER=0, CONTINUE
0275'  DB12                    IN      S1CTRL  ;ELSE, GET SERIAL 1 STATUS
0277'  E680            ..COM:  ANI     1<CTSN  ;EXTRACT CLEAR TO SEND (NOT)
0279'  EE80                    XRI     1<CTSN  ;COMPLIMENT IT
027B'  C9                      RET             ;DONE
                       ;
027C'  D31C            POOUT:: OUT     PODATA  ;OUTPUT BYTE TO PARALLEL 0
027E'  C9                      RET             ;DONE
                       ;
027F'  D31D            P1OUT:: OUT     P1DATA  ;OUTPUT BYTE TO PARALLEL 1
0281'  C9                      RET             ;DONE
                       ;
0282'  DB1E            P2IN::  IN      P2DATA  ;INPUT BYTE FROM PARALLEL 2
0284'  C9                      RET             ;DONE
                       ;
                       .END
```

R480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
                        ;
                        ; ************************************************************
                        ; *                                                          *
                        ; *  This module is called by SPD442, and handles the        *
                        ; *  four serial ports on the IMS 480 four-port serial       *
                        ; *  board.  Input is handled on an interrupt-driven         *
                        ; *  basis and buffered via a circular buffer.  Output       *
                        ; *  is handled on a polled basis and not buffered.          *
                        ; *                                                          *
                        ; *                                                          *
                        ; ************************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  SER480          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
00E0                    IOBASE  = 0E0H          ;I/O PORT BASE
                        ;
00E0                    S2DATA  = IOBASE+00H    ;SERIAL 2 DATA REGISTER
00E1                    S2IER   = IOBASE+01H    ;SERIAL 2 INTERRUPT ENABLE REGISTE
00E2                    S2IIDR  = IOBASE+02H    ;SERIAL 2 INTERRUPT ID REGISTER
00E3                    S2LCR   = IOBASE+03H    ;SERIAL 2 LINE CONTROL REGISTER
00E4                    S2MCR   = IOBASE+04H    ;SERIAL 2 MODEM CONTROL REGISTER
00E5                    S2LSR   = IOBASE+05H    ;SERIAL 2 LINE STATUS REGISTER
00E6                    S2MSR   = IOBASE+06H    ;SERIAL 2 MODEM STATUS REGISTER
                        ;
00E8                    S3DATA  = IOBASE+08H    ;SERIAL 3 DATA REGISTER
00E9                    S3IER   = IOBASE+09H    ;SERIAL 3 INTERRUPT ENABLE REGISTE
00EA                    S3IIDR  = IOBASE+0AH    ;SERIAL 3 INTERRUPT ID REGISTER
00EB                    S3LCR   = IOBASE+0BH    ;SERIAL 3 LINE CONTROL REGISTER
00EC                    S3MCR   = IOBASE+0CH    ;SERIAL 3 MODEM CONTROL REGISTER
00ED                    S3LSR   = IOBASE+0DH    ;SERIAL 3 LINE STATUS REGISTER
00EE                    S3MSR   = IOBASE+0EH    ;SERIAL 3 MODEM STATUS REGISTER
                        ;
00F0                    S4DATA  = IOBASE+10H    ;SERIAL 4 DATA REGISTER
00F1                    S4IER   = IOBASE+11H    ;SERIAL 4 INTERRUPT ENABLE REGISTE
00F2                    S4IIDR  = IOBASE+12H    ;SERIAL 4 INTERRUPT ID REGISTER
00F3                    S4LCR   = IOBASE+13H    ;SERIAL 4 LINE CONTROL REGISTER
00F4                    S4MCR   = IOBASE+14H    ;SERIAL 4 MODEM CONTROL REGISTER
00F5                    S4LSR   = IOBASE+15H    ;SERIAL 4 LINE STATUS REGISTER
00F6                    S4MSR   = IOBASE+16H    ;SERIAL 4 MODEM STATUS REGISTER
                        ;
00F8                    S5DATA  = IOBASE+18H    ;SERIAL 5 DATA REGISTER
00F9                    S5IER   = IOBASE+19H    ;SERIAL 5 INTERRUPT ENABLE REGISTE
00FA                    S5IIDR  = IOBASE+1AH    ;SERIAL 5 INTERRUPT ID REGISTER
00FB                    S5LCR   = IOBASE+1BH    ;SERIAL 5 LINE CONTROL REGISTER
00FC                    S5MCR   = IOBASE+1CH    ;SERIAL 5 MODEM CONTROL REGISTER
```

SER480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
00FD                    S5LSR   = IOBASE+1DH    ;SERIAL 5 LINE STATUS REGISTER
00FE                    S5MSR   = IOBASE+1EH    ;SERIAL 5 MODEM STATUS REGISTER
                        ;
0001                    IERCW   = 01H           ;INT ENABLE REGISTER CONTROL WORD
0003                    LCRCW   = 03H           ;LINE CONTROL REGISTER CONTROL WO
0003                    MCRCW   = 03H           ;MODEM CONTROL REGISTER CTRL WORD
                        ;
0000                    RDA     = 0             ;RECEIVED DATA AVAILABLE BIT
0005                    TBE     = 5             ;TRANSMIT BUFFER EMPTY BIT
0004                    CTS     = 4             ;CLEAR TO SEND BIT
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   0010           S2IBSZ::.WORD   16      ;SERIAL 2 INPUT BUFFER SIZE
0002"   0000           S2IBUF: .WORD   0       ;SERIAL 2 INPUT BUFFER ADDRESS
0004"   0000           S2IPTR: .WORD   0       ;SERIAL 2 INPUT POINTER
0006"   0000           S2OPTR: .WORD   0       ;SERIAL 2 OUTPUT POINTER
0008"   0000           S2ICNT: .WORD   0       ;SERIAL 2 INPUT COUNT
000A"   00             S2OCHR: .BYTE   0       ;SERIAL 2 OUTPUT CHARACTER
000B"   00             S2BR:   .BYTE   0       ;SERIAL 2 BAUD RATE CODE
                        ;
000C"                   S2ISPH:                 ;SERIAL 2 INPUT SEMAPHORE
000C"   0000                    .WORD   0       ;SEMAPHORE COUNT
000E"   000E"           ..S2IH: .WORD   ..S2IH  ;SEMAPHORE P/D HEAD
0010"   000E"                   .WORD   ..S2IH
                        ;
                                                ;SERIAL 2 OUTPUT SEMAPHORE
0012"   0000           S2OSPH: .WORD   0       ;SEMAPHORE COUNT
0014"   0014"           ..S2OH: .WORD   ..S2OH  ;SEMAPHORE P/D HEAD
0016"   0014"                   .WORD   ..S2OH
                        ;
                                                ;SERIAL 2 OUTPUT SEMAPHORE
0018"   0001           S2XSPH: .WORD   1       ;SEMAPHORE COUNT
001A"   001A"           ..S2XH: .WORD   ..S2XH  ;SEMAPHORE P/D HEAD
001C"   001A"                   .WORD   ..S2XH
                        ;
001E"   0010           S3IBSZ::.WORD   16      ;SERIAL 3 INPUT BUFFER SIZE
0020"   0000           S3IBUF: .WORD   0       ;SERIAL 3 INPUT BUFFER ADDRESS
0022"   0000           S3IPTR: .WORD   0       ;SERIAL 3 INPUT POINTER
0024"   0000           S3OPTR: .WORD   0       ;SERIAL 3 OUTPUT POINTER
0026"   0000           S3ICNT: .WORD   0       ;SERIAL 3 INPUT COUNT
0028"   00             S3OCHR: .BYTE   0       ;SERIAL 3 OUTPUT CHARACTER
0029"   00             S3BR:   .BYTE   0       ;SERIAL 3 BAUD RATE CODE
                        ;
                                                ;SERIAL 3 INPUT SEMAPHORE
002A"   0000           S3ISPH: .WORD   0       ;SEMAPHORE COUNT
002C"   002C"           ..S3IH: .WORD   ..S3IH  ;SEMAPHORE P/D HEAD
002E"   002C"                   .WORD   ..S3IH
                        ;
                                                ;SERIAL 3 OUTPUT SEMAPHORE
0030"   0000           S3OSPH: .WORD   0       ;SEMAPHORE COUNT
0032"   0032"           ..S3OH: .WORD   ..S3OH  ;SEMAPHORE P/D HEAD
0034"   0032"                   .WORD   ..S3OH
                        ;
```

R480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
                                                    ;SERIAL 3 OUTPUT SEMAPHORE
0036"   0001            S3XSPH: .WORD   1           ;SEMAPHORE COUNT
0038"   0038"           ..S3XH: .WORD   ..S3XH      ;SEMAPHORE P/D HEAD
003A"   0038"                   .WORD   ..S3XH
                        ;
003C"   0010            S4IBSZ::.WORD   16          ;SERIAL 4 INPUT BUFFER SIZE
003E"   0000            S4IBUF: .WORD   0           ;SERIAL 4 INPUT BUFFER ADDRESS
0040"   0000            S4IPTR: .WORD   0           ;SERIAL 4 INPUT POINTER
0042"   0000            S4OPTR: .WORD   0           ;SERIAL 4 OUTPUT POINTER
0044"   0000            S4ICNT: .WORD   0           ;SERIAL 4 INPUT COUNT
0046"   00              S4OCHR: .BYTE   0           ;SERIAL 4 OUTPUT CHARACTER
0047"   00              S4BR:   .BYTE   0           ;SERIAL 4 BAUD RATE CODE
                        ;
0048"                   S4ISPH:                     ;SERIAL 4 INPUT SEMAPHORE
0048"   0000                    .WORD   0           ;SEMAPHORE COUNT
004A"   004A"           ..S4IH: .WORD   ..S4IH      ;SEMAPHORE P/D HEAD
004C"   004A"                   .WORD   ..S4IH
                        ;
                                                    ;SERIAL 4 OUTPUT SEMAPHORE
004E"   0000            S4OSPH: .WORD   0           ;SEMAPHORE COUNT
0050"   0050"           ..S4OH: .WORD   ..S4OH      ;SEMAPHORE P/D HEAD
0052"   0050"                   .WORD   ..S4OH
                        ;
                                                    ;SERIAL 4 OUTPUT SEMAPHORE
0054"   0001            S4XSPH: .WORD   1           ;SEMAPHORE COUNT
0056"   0056"           ..S4XH: .WORD   ..S4XH      ;SEMAPHORE P/D HEAD
0058"   0056"                   .WORD   ..S4XH
                        ;
005A"   0010            S5IBSZ::.WORD   16          ;SERIAL 5 INPUT BUFFER SIZE
005C"   0000            S5IBUF: .WORD   0           ;SERIAL 5 INPUT BUFFER ADDRESS
005E"   0000            S5IPTR: .WORD   0           ;SERIAL 5 INPUT POINTER
0060"   0000            S5OPTR: .WORD   0           ;SERIAL 5 OUTPUT POINTER
0062"   0000            S5ICNT: .WORD   0           ;SERIAL 5 INPUT COUNT
0064"   00              S5OCHR: .BYTE   0           ;SERIAL 5 OUTPUT CHARACTER
0065"   00              S5BR:   .BYTE   0           ;SERIAL 5 BAUD RATE CODE
                        ;
                                                    ;SERIAL 5 INPUT SEMAPHORE
0066"   0000            S5ISPH: .WORD   0           ;SEMAPHORE COUNT
0068"   0068"           ..S5IH: .WORD   ..S5IH      ;SEMAPHORE P/D HEAD
006A"   0068"                   .WORD   ..S5IH
                        ;
                                                    ;SERIAL 5 OUTPUT SEMAPHORE
006C"   0000            S5OSPH: .WORD   0           ;SEMAPHORE COUNT
006E"   006E"           ..S5OH: .WORD   ..S5OH      ;SEMAPHORE P/D HEAD
0070"   006E"                   .WORD   ..S5OH
                        ;
                                                    ;SERIAL 5 OUTPUT SEMAPHORE
0072"   0001            S5XSPH: .WORD   1           ;SEMAPHORE COUNT
0074"   0074"           ..S5XH: .WORD   ..S5XH      ;SEMAPHORE P/D HEAD
0076"   0074"                   .WORD   ..S5XH
                        ;
                        ;
0000:04                         .LOC    .INIT.#     ;LOCATE IN INITIALIZATION AREA
                        ;
```

SER480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
0000:04 3E03          NIT480::MVI     A,LCRCW ;GET LINE CONTROL REGISTER VALUE
0002:04 D3E3                  OUT     S2LCR   ;SET LINE CONTROL REGISTER 0
0004:04 D3EB                  OUT     S3LCR   ;SET LINE CONTROL REGISTER 1
0006:04 D3F3                  OUT     S4LCR   ;SET LINE CONTROL REGISTER 2
0008:04 D3FB                  OUT     S5LCR   ;SET LINE CONTROL REGISTER 3
000A:04 3E03                  MVI     A,MCRCW ;GET MODEM CONTROL REGISTER VALUI
000C:04 D3E4                  OUT     S2MCR   ;SET MODEM CONTROL REGISTER 0
000E:04 D3EC                  OUT     S3MCR   ;SET MODEM CONTROL REGISTER 1
0010:04 D3F4                  OUT     S4MCR   ;SET MODEM CONTROL REGISTER 2
0012:04 D3FC                  OUT     S5MCR   ;SET MODEM CONTROL REGISTER 3
0014:04 3E01                  MVI     A,IERCW ;GET INT ENABLE REGISTER VALUE
0016:04 D3E1                  OUT     S2IER   ;SET INT ENABLE REGISTER 0
0018:04 D3E9                  OUT     S3IER   ;SET INT ENABLE REGISTER 1
001A:04 D3F1                  OUT     S4IER   ;SET INT ENABLE REGISTER 2
001C:04 D3F9                  OUT     S5IER   ;SET INT ENABLE REGISTER 3
001E:04 2A 0000"              LHLD    S2IBSZ  ;GET SERIAL 2 INPUT BUFFER SIZE
0021:04 CD 0000:05            CALL    ALLOC#  ;ALLOCATE PACKET FOR SERIAL BUFFI
0024:04 22 0002"              SHLD    S2IBUF  ;SAVE SERIAL 2 INPUT BUFFER ADDRI
0027:04 22 0004"              SHLD    S2IPTR  ;SET SERIAL 2 INPUT POINTER
002A:04 22 0006"              SHLD    S2OPTR  ;SET SERIAL 2 OUTPUT POINTER
002D:04 2A 001E"              LHLD    S3IBSZ  ;GET SERIAL 3 INPUT BUFFER SIZE
0030:04 CD 0000:05            CALL    ALLOC#  ;ALLOCATE PACKET FOR SERIAL BUFFI
0033:04 22 0020"              SHLD    S3IBUF  ;SAVE SERIAL 3 INPUT BUFFER ADDRI
0036:04 22 0022"              SHLD    S3IPTR  ;SET SERIAL 3 INPUT POINTER
0039:04 22 0024"              SHLD    S3OPTR  ;SET SERIAL 3 OUTPUT POINTER
003C:04 2A 003C"              LHLD    S4IBSZ  ;GET SERIAL 4 INPUT BUFFER SIZE
003F:04 CD 0000:05            CALL    ALLOC#  ;ALLOCATE PACKET FOR SERIAL BUFFI
0042:04 22 003E"              SHLD    S4IBUF  ;SAVE SERIAL 4 INPUT BUFFER ADDRI
0045:04 22 0040"              SHLD    S4IPTR  ;SET SERIAL 4 INPUT POINTER
0048:04 22 0042"              SHLD    S4OPTR  ;SET SERIAL 4 OUTPUT POINTER
004B:04 2A 005A"              LHLD    S5IBSZ  ;GET SERIAL 5 INPUT BUFFER SIZE
004E:04 CD 0000:05            CALL    ALLOC#  ;ALLOCATE PACKET FOR SERIAL BUFFI
0051:04 22 005C"              SHLD    S5IBUF  ;SAVE SERIAL 5 INPUT BUFFER ADDRI
0054:04 22 005E"              SHLD    S5IPTR  ;SET SERIAL 5 INPUT POINTER
0057:04 22 0060"              SHLD    S5OPTR  ;SET SERIAL 5 OUTPUT POINTER
005A:04 C9                    RET             ;DONE
                      ;
0000'                         .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                      ;
0000'   78            ST480::  MOV    A,B     ;GET CHANNEL NUMBER
0001'   D602                   SUI     2       ;CHANNEL NUMBER=2?
0003'   2808                   JRZ     ..ST2   ;IF SO, CONTINUE
0005'   3D                     DCR     A       ;CHANNEL NUMBER=3?
0006'   280E                   JRZ     ..ST3   ;IF SO, CONTINUE
0008'   3D                     DCR     A       ;CHANNEL NUMBER=4?
0009'   2814                   JRZ     ..ST4   ;IF SO, CONTINUE
000B'   181B                   JMPR    ..ST5   ;CONTINUE
                      ;
000D'   ED5B 0008"    ..ST2:   LDED    S2ICNT  ;GET SERIAL 2 INPUT BUFFER COUNT
0011'   2A 0006"               LHLD    S2OPTR  ;GET SERIAL 2 OUTPUT POINTER
0014'   1819                   JMPR    ..COM   ;CONTINUE
0016'   ED5B 0026"    ..ST3:   LDED    S3ICNT  ;GET SERIAL 3 INPUT BUFFER COUNT
001A'   2A 0024"               LHLD    S3OPTR  ;GET SERIAL 3 OUTPUT POINTER
001D'   1810                   JMPR    ..COM   ;CONTINUE
```

R480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
001F'   ED5B 0044"    ..ST4:  LDED    S4ICNT  ;GET SERIAL 4 INPUT BUFFER COUNT
0023'   2A 0042"              LHLD    S4OPTR  ;GET SERIAL 4 OUTPUT POINTER
0026'   1807                  JMPR    ..COM   ;CONTINUE
0028'   ED5B 0062"    ..ST5:  LDED    S5ICNT  ;GET SERIAL 5 INPUT BUFFER COUNT
002C'   2A 0060"              LHLD    S5OPTR  ;GET SERIAL 5 OUTPUT POINTER
002F'   7A             ..COM:  MOV     A,D
0030'   B3                     ORA     E       ;SERIAL INPUT BUFFER COUNT=0?
0031'   C8                     RZ              ;IF SO, DONE
0032'   3EFF                   MVI     A,0FFH  ;ELSE, SET RETURN CODE=0FFH
0034'   4E                     MOV     C,M     ;GET SERIAL INPUT CHARACTER
0035'   C9                     RET             ;DONE
                       ;
0036'   CD 0000'       IN480:: CALL    ST480   ;GET SERIAL STATUS
0039'   B7                     ORA     A       ;CHARACTER AVAILABLE?
003A'   201C                   JRNZ    ..SIN   ;IF SO, CONTINUE
003C'   78                     MOV     A,B     ;ELSE, GET CHANNEL NUMBER
003D'   21 000C"               LXI     H,S2ISPH  ;GET SERIAL 2 INPUT SEMAPHORE
0040'   D602                   SUI     2       ;CHANNEL NUMBER=2?
0042'   280F                   JRZ     ..INC   ;IF SO, CONTINUE
0044'   21 002A"               LXI     H,S3ISPH  ;GET SERIAL 3 INPUT SEMAPHORE
0047'   3D                     DCR     A       ;CHANNEL NUMBER=3?
0048'   2809                   JRZ     ..INC   ;IF SO, CONTINUE
004A'   21 0048"               LXI     H,S4ISPH  ;GET SERIAL 4 INPUT SEMAPHORE
004D'   3D                     DCR     A       ;CHANNEL NUMBER=4?
004E'   2803                   JRZ     ..INC   ;IF SO, CONTINUE
0050'   21 0066"              LXI     H,S5ISPH  ;GET SERIAL 5 INPUT SEMAPHORE
                       ;
0053'   CD 0000:06    ..INC:  CALL    WAIT#   ;WAIT FOR INPUT CHARACTER
0056'   18DE                  JMPR    IN480   ;CONTINUE
0058'   78             ..SIN:  MOV     A,B     ;GET CHANNEL NUMBER
0059'   D602                   SUI     2       ;CHANNEL NUMBER=2?
005B'   2808                   JRZ     ..IN2   ;IF SO, CONTINUE
005D'   3D                     DCR     A       ;CHANNEL NUMBER=3?
005E'   282A                   JRZ     ..IN3   ;IF SO, CONTINUE
0060'   3D                     DCR     A       ;CHANNEL NUMBER=4?
0061'   284C                   JRZ     ..IN4   ;IF SO, CONTINUE
0063'   186F                   JMPR    ..IN5   ;ELSE, CONTINUE
                       ;
0065'   F3             ..IN2:  DI              ;DISABLE INTERRUPTS
0066'   2A 0008"               LHLD    S2ICNT  ;GET SERIAL 2 INPUT COUNT
0069'   2B                     DCX     H       ;DECREMENT SERIAL 2 INPUT COUNT
006A'   22 0008"               SHLD    S2ICNT  ;UPDATE SERIAL 2 INPUT COUNT
006D'   2A 0006"               LHLD    S2OPTR  ;GET SERIAL 2 OUTPUT POINTER
0070'   7E                     MOV     A,M     ;GET CHARACTER FROM BUFFER
0071'   23                     INX     H       ;INCREMENT SERIAL 2 OUTPUT POINTER
0072'   EB                     XCHG            ;SERIAL 2 OUTPUT POINTER TO DE-REG
0073'   2A 0002"               LHLD    S2IBUF  ;GET SERIAL 2 INPUT BUFFER ADDRESS
0076'   ED4B 0000"             LBCD    S2IBSZ  ;GET SERIAL 2 INPUT BUFFER SIZE
007A'   0B                     DCX     B       ;DECREMENT INPUT BUFFER SIZE
007B'   09                     DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
007C'   ED52                   DSBC    D       ;BUFFER WRAP-AROUND?
007E'   3004                   JRNC    ..NWA2  ;IF NOT, CONTINUE
0080'   ED5B 0002"             LDED    S2IBUF  ;GET SERIAL 2 INPUT BUFFER ADDRESS
0084'   ED53 0006"    ..NWA2: SDED    S2OPTR  ;UPDATE SERIAL 2 OUTPUT POINTER
```

SER480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
0088'   FB                      EI              ;ENABLE INTERRUPTS
0089'   C9                      RET             ;DONE
                        ;
008A'   F3              ..IN3:  DI              ;DISABLE INTERRUPTS
008B'   2A 0026"                LHLD    S3ICNT  ;GET SERIAL 3 INPUT COUNT
008E'   2B                      DCX     H       ;DECREMENT SERIAL 3 INPUT COUNT
008F'   22 0026"                SHLD    S3ICNT  ;UPDATE SERIAL 3 INPUT COUNT
0092'   2A 0024"                LHLD    S3OPTR  ;GET SERIAL 3 OUTPUT POINTER
0095'   7E                      MOV     A,M     ;GET CHARACTER FROM BUFFER
0096'   23                      INX     H       ;INCREMENT SERIAL 3 OUTPUT POINTE
0097'   EB                      XCHG            ;SERIAL 3 OUTPUT POINTER TO DE-RE
0098'   2A 0020"                LHLD    S3IBUF  ;GET SERIAL 3 INPUT BUFFER ADDRES
009B'   ED4B 001E"              LBCD    S3IBSZ  ;GET SERIAL 3 INPUT BUFFER SIZE
009F'   0B                      DCX     B       ;DECREMENT INPUT BUFFER SIZE
00A0'   09                      DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
00A1'   ED52                    DSBC    D       ;BUFFER WRAP-AROUND?
00A3'   3004                    JRNC    ..NWA3  ;IF NOT, CONTINUE
00A5'   ED5B 0020"              LDED    S3IBUF  ;GET SERIAL 3 INPUT BUFFER ADDRES
00A9'   ED53 0024"      ..NWA3: SDED    S3OPTR  ;UPDATE SERIAL 3 OUTPUT POINTER
00AD'   FB                      EI              ;ENABLE INTERRUPTS
00AE'   C9                      RET             ;DONE
                        ;
00AF'   F3              ..IN4:  DI              ;DISABLE INTERRUPTS
00B0'   2A 0044"                LHLD    S4ICNT  ;GET SERIAL 4 INPUT COUNT
00B3'   2B                      DCX     H       ;DECREMENT SERIAL 4 INPUT COUNT
00B4'   22 0044"                SHLD    S4ICNT  ;UPDATE SERIAL 4 INPUT COUNT
00B7'   2A 0042"                LHLD    S4OPTR  ;GET SERIAL 4 OUTPUT POINTER
00BA'   7E                      MOV     A,M     ;GET CHARACTER FROM BUFFER
00BB'   23                      INX     H       ;INCREMENT SERIAL 4 OUTPUT POINTE
00BC'   EB                      XCHG            ;SERIAL 4 OUTPUT POINTER TO DE-RE
00BD'   2A 003E"                LHLD    S4IBUF  ;GET SERIAL 4 INPUT BUFFER ADDRES
00C0'   ED4B 003C"              LBCD    S4IBSZ  ;GET SERIAL 4 INPUT BUFFER SIZE
00C4'   0B                      DCX     B       ;DECREMENT INPUT BUFFER SIZE
00C5'   09                      DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
00C6'   ED52                    DSBC    D       ;BUFFER WRAP-AROUND?
00C8'   3004                    JRNC    ..NWA4  ;IF NOT, CONTINUE
00CA'   ED5B 003E"              LDED    S4IBUF  ;GET SERIAL 4 INPUT BUFFER ADDRES
00CE'   ED53 0042"      ..NWA4: SDED    S4OPTR  ;UPDATE SERIAL 4 OUTPUT POINTER
00D2'   FB                      EI              ;ENABLE INTERRUPTS
00D3'   C9                      RET             ;DONE
                        ;
00D4'   F3              ..IN5:  DI              ;DISABLE INTERRUPTS
00D5'   2A 0062"                LHLD    S5ICNT  ;GET SERIAL 5 INPUT COUNT
00D8'   2B                      DCX     H       ;DECREMENT SERIAL 5 INPUT COUNT
00D9'   22 0062"                SHLD    S5ICNT  ;UPDATE SERIAL 5 INPUT COUNT
00DC'   2A 0060"                LHLD    S5OPTR  ;GET SERIAL 5 OUTPUT POINTER
00DF'   7E                      MOV     A,M     ;GET CHARACTER FROM BUFFER
00E0'   23                      INX     H       ;INCREMENT SERIAL 5 OUTPUT POINTE
00E1'   EB                      XCHG            ;SERIAL 5 OUTPUT POINTER TO DE-RE
00E2'   2A 005C"                LHLD    S5IBUF  ;GET SERIAL 5 INPUT BUFFER ADDRES
00E5'   ED4B 005A"              LBCD    S5IBSZ  ;GET SERIAL 5 INPUT BUFFER SIZE
00E9'   0B                      DCX     B       ;DECREMENT INPUT BUFFER SIZE
00EA'   09                      DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
00EB'   ED52                    DSBC    D       ;BUFFER WRAP-AROUND?
```

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```
00ED'   3004                    JRNC    ..NWA5  ;IF NOT, CONTINUE
00EF'   ED5B 005C"              LDED    S5IBUF  ;GET SERIAL 5 INPUT BUFFER ADDRESS
00F3'   ED53 0060"      ..NWA5: SDED    S5OPTR  ;UPDATE SERIAL 5 OUTPUT POINTER
00F7'   FB                      EI              ;ENABLE INTERRUPTS
00F8'   C9                      RET             ;DONE
                        ;
00F9'   D602            OUT480::SUI     2       ;CHANNEL NUMBER=2?
00FB'   2808                    JRZ     ..OUT2  ;IF SO, CONTINUE
00FD'   3D                      DCR     A       ;CHANNEL NUMBER=3?
00FE'   2823                    JRZ     ..OUT3  ;IF SO, CONTINUE
0100'   3D                      DCR     A       ;CHANNEL NUMBER=4?
0101'   283E                    JRZ     ..OUT4  ;IF SO, CONTINUE
0103'   185A                    JMPR    ..OUT5  ;ELSE, CONTINUE
                        ;
0105'   21 0018"       ..OUT2: LXI     H,S2XSPH  ;GET SERIAL 2 OUT SEMAPHORE
0108'   E5                      PUSH    H       ;SAVE SERIAL 2 OUT SEMAPHORE
0109'   CD 0000:06              CALL    WAIT#   ;WAIT ON MUTUAL EXCLUSION
010C'   21 000A"               LXI     H,S2OCHR  ;GET SERIAL 2 OUTPUT CHARACTER
010F'   71                      MOV     M,C     ;SAVE OUTPUT CHARACTER
0110'   11 017D'               LXI     D,S2OPOL  ;GET SERIAL 2 OUT POLL ROUTINE
0113'   CD 0000:07             CALL    LNKPOL# ;CREATE POLL ROUTINE
0116'   CD 0181'               CALL    S2OPR   ;EXECUTE POLL ROUTINE
0119'   21 0012"               LXI     H,S2OSPH  ;GET SERIAL 2 OUT SEMAPHORE
011C'   CD 0000:06             CALL    WAIT#   ;DISPATCH IF NECESSARY
011F'   E1                      POP     H       ;GET MUTUTAL EXCLUSION SEMAPHORE
0120'   C3 0000:08             JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                        ;
0123'   21 0036"       ..OUT3: LXI     H,S3XSPH  ;GET SERIAL 3 OUT SEMAPHORE
0126'   E5                      PUSH    H       ;SAVE SERIAL 3 OUT SEMAPHORE
0127'   CD 0000:06              CALL    WAIT#   ;WAIT ON MUTUAL EXCLUSION
012A'   21 0028"               LXI     H,S3OCHR  ;GET SERIAL 3 OUTPUT CHARACTER
012D'   71                      MOV     M,C     ;SAVE OUTPUT CHARACTER
012E'   11 01A3'               LXI     D,S3OPOL  ;GET SERIAL 3 OUT POLL ROUTINE
0131'   CD 0000:07             CALL    LNKPOL# ;CREATE POLL ROUTINE
0134'   CD 01A7'               CALL    S3OPR   ;EXECUTE POLL ROUTINE
0137'   21 0030"               LXI     H,S3OSPH  ;GET SERIAL 3 OUT SEMAPHORE
013A'   CD 0000:06             CALL    WAIT#   ;DISPATCH IF NECESSARY
013D'   E1                      POP     H       ;GET MUTUTAL EXCLUSION SEMAPHORE
013E'   C3 0000:08             JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                        ;
0141'   21 0054"       ..OUT4: LXI     H,S4XSPH  ;GET SERIAL 4 OUT SEMAPHORE
0144'   E5                      PUSH    H       ;SAVE SERIAL 4 OUT SEMAPHORE
0145'   CD 0000:06              CALL    WAIT#   ;WAIT ON MUTUAL EXCLUSION
0148'   21 0046"               LXI     H,S4OCHR  ;GET SERIAL 4 OUTPUT CHARACTER
014B'   71                      MOV     M,C     ;SAVE OUTPUT CHARACTER
014C'   11 01C9'               LXI     D,S4OPOL  ;GET SERIAL 4 OUT POLL ROUTINE
014F'   CD 0000:07             CALL    LNKPOL# ;CREATE POLL ROUTINE
0152'   CD 01CD'               CALL    S4OPR   ;EXECUTE POLL ROUTINE
0155'   21 004E"               LXI     H,S4OSPH  ;GET SERIAL 4 OUT SEMAPHORE
0158'   CD 0000:06             CALL    WAIT#   ;DISPATCH IF NECESSARY
015B'   E1                      POP     H       ;GET MUTUTAL EXCLUSION SEMAPHORE
015C'   C3 0000:08             JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                        ;
015F'   21 0072"       ..OUT5: LXI     H,S5XSPH  ;GET SERIAL 5 OUT SEMAPHORE
```

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```
0162'  E5                      PUSH   H          ;SAVE SERIAL 5 OUT SEMAPHORE
0163'  CD 0000:06              CALL   WAIT#      ;WAIT ON MUTUAL EXCLUSION
0166'  21 0064"                LXI    H,S5OCHR   ;GET SERIAL 5 OUTPUT CHARACTER
0169'  71                      MOV    M,C        ;SAVE OUTPUT CHARACTER
016A'  11 01EF'                LXI    D,S5OPOL   ;GET SERIAL 5 OUT POLL ROUTINE
016D'  CD 0000:07              CALL   LNKPOL#    ;CREATE POLL ROUTINE
0170'  CD 01F3'                CALL   S5OPR      ;EXECUTE POLL ROUTINE
0173'  21 006C"                LXI    H,S5OSPH   ;GET SERIAL 5 OUT SEMAPHORE
0176'  CD 0000:06              CALL   WAIT#      ;DISPATCH IF NECESSARY
0179'  E1                      POP    H          ;GET MUTUTAL EXCLUSION SEMAPHORE
017A'  C3 0000:08              JMP    SIGNAL#    ;SIGNAL PROCESS AS READY
                        ;
017D'                  S2OPOL:                   ;SERIAL 2 OUTPUT POLL ROUTINE
017D'  0000                    .WORD  0          ;SUCCESSOR LINK POINTER
017F'  0000                    .WORD  0          ;PREDECESSOR LINK POINTER
                        ;
0181'  DBE5            S2OPR:  IN     S2LSR      ;GET SERIAL 2 LINE STATUS REGISTE
0183'  CB6F                    BIT    TBE,A      ;TRANSMIT BUFFER EMPTY?
0185'  C8                      RZ                ;IF NOT, DONE
0186'  21 000B"                LXI    H,S2BR     ;ELSE, GET SERIAL 2 BAUD RATE COD
0189'  CB76                    BIT    6,M        ;CLEAR TO SEND HANDSHAKING?
018B'  2805                    JRZ    ..NCTS     ;IF NOT, CONTINUE
018D'  DBE6                    IN     S2MSR      ;GET SERIAL 2 MODEM STATUS REGIST
018F'  CB67                    BIT    CTS,A      ;CLEAR TO SEND STATUS TRUE?
0191'  C8                      RZ                ;IF NOT, DONE
0192'  3A 000A"        ..NCTS: LDA    S2OCHR     ;GET SERIAL 2 OUTPUT CHARACTER
0195'  D3E0                    OUT    S2DATA     ;OUTPUT CHARACTER
0197'  21 017D'                LXI    H,S2OPOL   ;GET SERIAL 2 OUT POLL ROUTINE
019A'  CD 0000:09              CALL   UNLINK#    ;UNLINK POLL ROUTINE
019D'  21 0012"                LXI    H,S2OSPH   ;GET SERIAL 2 OUT SEMAPHORE
01A0'  C3 0000:08              JMP    SIGNAL#    ;SIGNAL PROCESS AS READY
                        ;
01A3'                  S3OPOL:                   ;SERIAL 3 OUTPUT POLL ROUTINE
01A3'  0000                    .WORD  0          ;SUCCESSOR LINK POINTER
01A5'  0000                    .WORD  0          ;PREDECESSOR LINK POINTER
                        ;
01A7'  DBED            S3OPR:  IN     S3LSR      ;GET SERIAL 3 LINE STATUS REGISTE
01A9'  CB6F                    BIT    TBE,A      ;TRANSMIT BUFFER EMPTY?
01AB'  C8                      RZ                ;IF NOT, DONE
01AC'  21 0029"                LXI    H,S3BR     ;ELSE, GET SERIAL 3 BAUD RATE COD
01AF'  CB76                    BIT    6,M        ;CLEAR TO SEND HANDSHAKING?
01B1'  2805                    JRZ    ..NCTS     ;IF NOT, CONTINUE
01B3'  DBEE                    IN     S3MSR      ;GET SERIAL 3 MODEM STATUS REGIST
01B5'  CB67                    BIT    CTS,A      ;CLEAR TO SEND STATUS TRUE?
01B7'  C8                      RZ                ;IF NOT, DONE
01B8'  3A 0028"         ..NCTS: LDA    S3OCHR     ;GET SERIAL 3 OUTPUT CHARACTER
01BB'  D3E8                    OUT    S3DATA     ;OUTPUT CHARACTER
01BD'  21 01A3'                LXI    H,S3OPOL   ;GET SERIAL 3 OUT POLL ROUTINE
01C0'  CD 0000:09              CALL   UNLINK#    ;UNLINK POLL ROUTINE
01C3'  21 0030"                LXI    H,S3OSPH   ;GET SERIAL 3 OUT SEMAPHORE
01C6'  C3 0000:08              JMP    SIGNAL#    ;SIGNAL PROCESS AS READY
                        ;
01C9'                  S4OPOL:                   ;SERIAL 4 OUTPUT POLL ROUTINE
01C9'  0000                    .WORD  0          ;SUCCESSOR LINK POINTER
```

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```
01CB'   0000                    .WORD   0       ;PREDECESSOR LINK POINTER
                        ;
01CD'   DBF5            S4OPR:  IN      S4LSR   ;GET SERIAL 4 LINE STATUS REGISTER
01CF'   CB6F                    BIT     TBE,A   ;TRANSMIT BUFFER EMPTY?
01D1'   C8                      RZ              ;IF NOT, DONE
01D2'   21 0047"                LXI     H,S4BR  ;ELSE, GET SERIAL 4 BAUD RATE CODE
01D5'   CB76                    BIT     6,M     ;CLEAR TO SEND HANDSHAKING?
01D7'   2805                    JRZ     ..NCTS  ;IF NOT, CONTINUE
01D9'   DBF6                    IN      S4MSR   ;GET SERIAL 4 MODEM STATUS REGISTE
01DB'   CB67                    BIT     CTS,A   ;CLEAR TO SEND STATUS TRUE?
01DD'   C8                      RZ              ;IF NOT, DONE
01DE'   3A 0046"        ..NCTS: LDA     S4OCHR  ;GET SERIAL 4 OUTPUT CHARACTER
01E1'   D3F0                    OUT     S4DATA  ;OUTPUT CHARACTER
01E3'   21 01C9'                LXI     H,S4OPOL  ;GET SERIAL 4 OUT POLL ROUTINE
01E6'   CD 0000:09              CALL    UNLINK# ;UNLINK POLL ROUTINE
01E9'   21 004E"                LXI     H,S4OSPH  ;GET SERIAL 4 OUT SEMAPHORE
01EC'   C3 0000:08              JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                        ;
01EF'                   S5OPOL:                 ;SERIAL 5 OUTPUT POLL ROUTINE
01EF'   0000                    .WORD   0       ;SUCCESSOR LINK POINTER
01F1'   0000                    .WORD   0       ;PREDECESSOR LINK POINTER
                        ;
01F3'   DBFD            S5OPR:  IN      S5LSR   ;GET SERIAL 5 LINE STATUS REGISTER
01F5'   CB6F                    BIT     TBE,A   ;TRANSMIT BUFFER EMPTY?
01F7'   C8                      RZ              ;IF NOT, DONE
01F8'   21 0065"                LXI     H,S5BR  ;ELSE, GET SERIAL 5 BAUD RATE CODE
01FB'   CB76                    BIT     6,M     ;CLEAR TO SEND HANDSHAKING?
01FD'   2805                    JRZ     ..NCTS  ;IF NOT, CONTINUE
01FF'   DBFE                    IN      S5MSR   ;GET SERIAL 5 MODEM STATUS REGISTE
0201'   CB67                    BIT     CTS,A   ;CLEAR TO SEND STATUS TRUE?
0203'   C8                      RZ              ;IF NOT, DONE
0204'   3A 0064"        ..NCTS: LDA     S5OCHR  ;GET SERIAL 5 OUTPUT CHARACTER
0207'   D3F8                    OUT     S5DATA  ;OUTPUT CHARACTER
0209'   21 01EF'                LXI     H,S5OPOL  ;GET SERIAL 5 OUT POLL ROUTINE
020C'   CD 0000:09              CALL    UNLINK# ;UNLINK POLL ROUTINE
020F'   21 006C"                LXI     H,S5OSPH  ;GET SERIAL 5 OUT SEMAPHORE
0212'   C3 0000:08              JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                        ;
0215'   CD 0222'       ISR480::CALL    ..S2I   ;CHECK FOR SERIAL 2 INPUT
0218'   CD 0276'               CALL    ..S3I   ;CHECK FOR SERIAL 3 INPUT
021B'   CD 02CA'               CALL    ..S4I   ;CHECK FOR SERIAL 4 INPUT
021E'   CD 0319'               CALL    ..S5I   ;CHECK FOR SERIAL 5 INPUT
0221'   C9                    RET             ;DONE
                        ;
0222'   DBE5              ..S2I: IN      S2LSR   ;GET SERIAL 2 STATUS
0224'   CB47                    BIT     RDA,A   ;CHARACTER AVAILABLE
0226'   C8                      RZ              ;IF NOT, DONE
0227'   DBE0                    IN      S2DATA  ;ELSE, GET SERIAL 2 DATA CHARACTER
0229'   21 000B"                LXI     H,S2BR  ;GET SERIAL 2 BAUD RATE CODE
022C'   CB6E                    BIT     5,M     ;INHIBIT INPUT FLAG SET?
022E'   C0                      RNZ             ;IF SO, DONE
022F'   4F                      MOV     C,A     ;SERIAL 2 DATA CHARACTER TO C-REG
0230'   CB7E                    BIT     7,M     ;ATTENTION DETECTION FLAG SET?
0232'   2814                    JRZ     ..NAD2  ;IF NOT, CONTINUE
```

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```
0234'   CBB9                    RES     7,C     ;STRIP SIGN BIT ON INPUT CHARACTE
0236'   3A 0000:0A              LDA     ATNCHR# ;GET ATTENTION CHARACTER
0239'   B9                      CMP     C       ;CHARACTER=ATTENTION CHARACTER?
023A'   200C                    JRNZ    ..NAD2  ;IF NOT, CONTINUE
023C'   2A 0004"                LHLD    S2IPTR  ;ELSE, GET SERIAL 2 INPUT POINTEF
023F'   22 0006"                SHLD    S2OPTR  ;RESET SERIAL 2 OUTPUT POINTER
0242'   21 0000                 LXI     H,0
0245'   22 0008"                SHLD    S2ICNT  ;SET SERIAL 2 INPUT COUNT=0
0248'   2A 0000"        ..NAD2: LHLD    S2IBSZ  ;GET SERIAL 2 INPUT BUFFER SIZE
024B'   ED5B 0008"              LDED    S2ICNT  ;GET SERIAL 2 INPUT COUNT
024F'   13                      INX     D       ;INCREMENT SERIAL 2 INPUT COUNT
0250'   B7                      ORA     A       ;CLEAR CARRY FLAG
0251'   ED52                    DSBC    D       ;SERIAL 2 INPUT BUFFER FULL?
0253'   D0                      RNC             ;IF SO, DONE
0254'   ED53 0008"              SDED    S2ICNT  ;ELSE, UPDATE SERIAL 2 INPUT COUN
0258'   2A 0004"                LHLD    S2IPTR  ;GET SERIAL 2 INPUT POINTER
025B'   71                      MOV     M,C     ;STORE INPUT CHARACTER IN BUFFER
025C'   23                      INX     H       ;INCREMENT INPUT POINTER
025D'   EB                      XCHG            ;INPUT BUFFER POINTER TO DE-REG
025E'   2A 0000"                LHLD    S2IBSZ  ;GET SERIAL 2 INPUT BUFFER SIZE
0261'   2B                      DCX     H       ;DECREMENT INPUT BUFFER SIZE
0262'   ED4B 0002"              LBCD    S2IBUF  ;GET SERIAL 2 INPUT BUFFER ADDRES
0266'   09                      DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
0267'   ED52                    DSBC    D       ;BUFFER WRAP-AROUND?
0269'   3004                    JRNC    ..NWA2  ;IF NOT, CONTINUE
026B'   ED5B 0002"              LDED    S2IBUF  ;GET SERIAL 2 INPUT BUFFER ADDRES
026F'   ED53 0004"      ..NWA2: SDED    S2IPTR  ;UPDATE SERIAL 2 INPUT POINTER
0273'   C3 036D'                JMP     ..X     ;CONTINUE
                        ;
0276'   DBED            ..S3I:  IN      S3LSR   ;GET SERIAL 3 STATUS
0278'   CB47                    BIT     RDA,A   ;CHARACTER AVAILABLE
027A'   C8                      RZ              ;IF NOT, DONE
027B'   DBE8                    IN      S3DATA  ;ELSE, GET SERIAL 3 DATA CHARACTE
027D'   21 0029"                LXI     H,S3BR  ;GET SERIAL 3 BAUD RATE CODE
0280'   CB6E                    BIT     5,M     ;INHIBIT INPUT FLAG SET?
0282'   C0                      RNZ             ;IF SO, DONE
0283'   4F                      MOV     C,A     ;SERIAL 3 DATA CHARACTER TO C-REG
0284'   CB7E                    BIT     7,M     ;ATTENTION DETECTION FLAG SET?
0286'   2814                    JRZ     ..NAD3  ;IF NOT, CONTINUE
0288'   CBB9                    RES     7,C     ;STRIP SIGN BIT ON INPUT CHARACTE
028A'   3A 0000:0A              LDA     ATNCHR# ;GET ATTENTION CHARACTER
028D'   B9                      CMP     C       ;CHARACTER=ATTENTION CHARACTER?
028E'   200C                    JRNZ    ..NAD3  ;IF NOT, CONTINUE
0290'   2A 0022"                LHLD    S3IPTR  ;ELSE, GET SERIAL 3 INPUT POINTER
0293'   22 0024"                SHLD    S3OPTR  ;RESET SERIAL 3 OUTPUT POINTER
0296'   21 0000                 LXI     H,0
0299'   22 0026"                SHLD    S3ICNT  ;SET SERIAL 3 INPUT COUNT=0
029C'   2A 001E"        ..NAD3: LHLD    S3IBSZ  ;GET SERIAL 3 INPUT BUFFER SIZE
029F'   ED5B 0026"              LDED    S3ICNT  ;GET SERIAL 3 INPUT COUNT
02A3'   13                      INX     D       ;INCREMENT SERIAL 3 INPUT COUNT
02A4'   B7                      ORA     A       ;CLEAR CARRY FLAG
02A5'   ED52                    DSBC    D       ;SERIAL 3 INPUT BUFFER FULL?
02A7'   D0                      RNC             ;IF SO, DONE
02A8'   ED53 0026"              SDED    S3ICNT  ;ELSE, UPDATE SERIAL 3 INPUT COUN
```

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```
02AC'  2A 0022"            LHLD   S3IPTR  ;GET SERIAL 3 INPUT POINTER
02AF'  71                  MOV    M,C     ;STORE INPUT CHARACTER IN BUFFER
02B0'  23                  INX    H       ;INCREMENT INPUT POINTER
02B1'  EB                  XCHG           ;INPUT BUFFER POINTER TO DE-REG
02B2'  2A 001E"            LHLD   S3IBSZ  ;GET SERIAL 3 INPUT BUFFER SIZE
02B5'  2B                  DCX    H       ;DECREMENT INPUT BUFFER SIZE
02B6'  ED4B 0020"          LBCD   S3IBUF  ;GET SERIAL 3 INPUT BUFFER ADDRESS
02BA'  09                  DAD    B       ;CALC LAST INPUT BUFFER ADDRESS
02BB'  ED52                DSBC   D       ;BUFFER WRAP-AROUND?
02BD'  3004                JRNC   ..NWA3  ;IF NOT, CONTINUE
02BF'  ED5B 0020"          LDED   S3IBUF  ;GET SERIAL 3 INPUT BUFFER ADDRESS
02C3'  ED53 0022"  ..NWA3: SDED   S3IPTR  ;UPDATE SERIAL 3 INPUT POINTER
02C7'  C3 036D'            JMP    ..X     ;CONTINUE
                   ;
02CA'  DBF5        ..S4I:  IN     S4LSR   ;GET SERIAL 4 STATUS
02CC'  CB47                BIT    RDA,A   ;CHARACTER AVAILABLE
02CE'  C8                  RZ             ;IF NOT, DONE
02CF'  DBF0                IN     S4DATA  ;ELSE, GET SERIAL 4 DATA CHARACTER
02D1'  21 0047"            LXI    H,S4BR  ;GET SERIAL 4 BAUD RATE CODE
02D4'  CB6E                BIT    5,M     ;INHIBIT INPUT FLAG SET?
02D6'  C0                  RNZ            ;IF SO, DONE
02D7'  4F                  MOV    C,A     ;SERIAL 4 DATA CHARACTER TO C-REG
02D8'  CB7E                BIT    7,M     ;ATTENTION DETECTION FLAG SET?
02DA'  2814                JRZ    ..NAD4  ;IF NOT, CONTINUE
02DC'  CBB9                RES    7,C     ;STRIP SIGN BIT ON INPUT CHARACTER
02DE'  3A 0000:0A          LDA    ATNCHR# ;GET ATTENTION CHARACTER
02E1'  B9                  CMP    C       ;CHARACTER=ATTENTION CHARACTER?
02E2'  200C                JRNZ   ..NAD4  ;IF NOT, CONTINUE
02E4'  2A 0040"            LHLD   S4IPTR  ;ELSE, GET SERIAL 4 INPUT POINTER
02E7'  22 0042"            SHLD   S4OPTR  ;RESET SERIAL 4 OUTPUT POINTER
02EA'  21 0000             LXI    H,0
02ED'  22 0044"            SHLD   S4ICNT  ;SET SERIAL 4 INPUT COUNT=0
02F0'  2A 003C"    ..NAD4: LHLD   S4IBSZ  ;GET SERIAL 4 INPUT BUFFER SIZE
02F3'  ED5B 0044"          LDED   S4ICNT  ;GET SERIAL 4 INPUT COUNT
02F7'  13                  INX    D       ;INCREMENT SERIAL 4 INPUT COUNT
02F8'  B7                  ORA    A       ;CLEAR CARRY FLAG
02F9'  ED52                DSBC   D       ;SERIAL 4 INPUT BUFFER FULL?
02FB'  D0                  RNC            ;IF SO, DONE
02FC'  ED53 0044"          SDED   S4ICNT  ;ELSE, UPDATE SERIAL 4 INPUT COUNT
0300'  2A 0040"            LHLD   S4IPTR  ;GET SERIAL 4 INPUT POINTER
0303'  71                  MOV    M,C     ;STORE INPUT CHARACTER IN BUFFER
0304'  23                  INX    H       ;INCREMENT INPUT POINTER
0305'  2B                  DCX    H       ;DECREMENT INPUT BUFFER SIZE
0306'  ED4B 003E"          LBCD   S4IBUF  ;GET SERIAL 4 INPUT BUFFER ADDRESS
030A'  09                  DAD    B       ;CALC LAST INPUT BUFFER ADDRESS
030B'  ED52                DSBC   D       ;BUFFER WRAP-AROUND?
030D'  3004                JRNC   ..NWA4  ;IF NOT, CONTINUE
030F'  ED5B 003E"          LDED   S4IBUF  ;GET SERIAL 4 INPUT BUFFER ADDRESS
0313'  ED53 0040"  ..NWA4: SDED   S4IPTR  ;UPDATE SERIAL 4 INPUT POINTER
0317'  1854                JMPR   ..X     ;CONTINUE
                   ;
0319'  DBFD        ..S5I:  IN     S5LSR   ;GET SERIAL 5 STATUS
031B'  CB47                BIT    RDA,A   ;CHARACTER AVAILABLE
031D'  C8                  RZ             ;IF NOT, DONE
```

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```
031E'  DBF8                    IN      S5DATA  ;ELSE, GET SERIAL 5 DATA CHARACTE
0320'  21 0065"                LXI     H,S5BR  ;GET SERIAL 5 BAUD RATE CODE
0323'  CB6E                    BIT     5,M     ;INHIBIT INPUT FLAG SET?
0325'  C0                      RNZ             ;IF SO, DONE
0326'  4F                      MOV     C,A     ;SERIAL 5 DATA CHARACTER TO C-REG
0327'  CB7E                    BIT     7,M     ;ATTENTION DETECTION FLAG SET?
0329'  2814                    JRZ     ..NAD5  ;IF NOT, CONTINUE
032B'  CBB9                    RES     7,C     ;STRIP SIGN BIT ON INPUT CHARACTE
032D'  3A 0000:0A              LDA     ATNCHR# ;GET ATTENTION CHARACTER
0330'  B9                      CMP     C       ;CHARACTER=ATTENTION CHARACTER?
0331'  200C                    JRNZ    ..NAD5  ;IF NOT, CONTINUE
0333'  2A 005E"                LHLD    S5IPTR  ;ELSE, GET SERIAL 5 INPUT POINTER
0336'  22 0060"                SHLD    S5OPTR  ;RESET SERIAL 5 OUTPUT POINTER
0339'  21 0000                 LXI     H,0
033C'  22 0062"                SHLD    S5ICNT  ;SET SERIAL 5 INPUT COUNT=0
033F'  2A 005A"        ..NAD5: LHLD    S5IBSZ  ;GET SERIAL 5 INPUT BUFFER SIZE
0342'  ED5B 0062"              LDED    S5ICNT  ;GET SERIAL 5 INPUT COUNT
0346'  13                      INX     D       ;INCREMENT SERIAL 5 INPUT COUNT
0347'  B7                      ORA     A       ;CLEAR CARRY FLAG
0348'  ED52                    DSBC    D       ;SERIAL 5 INPUT BUFFER FULL?
034A'  D0                      RNC             ;IF SO, DONE
034B'  ED53 0062"              SDED    S5ICNT  ;ELSE, UPDATE SERIAL 5 INPUT COUN
034F'  2A 005E"                LHLD    S5IPTR  ;GET SERIAL 5 INPUT POINTER
0352'  71                      MOV     M,C     ;STORE INPUT CHARACTER IN BUFFER
0353'  23                      INX     H       ;INCREMENT INPUT POINTER
0354'  EB                      XCHG            ;INPUT BUFFER POINTER TO DE-REG
0355'  2A 005A"                LHLD    S5IBSZ  ;GET SERIAL 5 INPUT BUFFER SIZE
0358'  2B                      DCX     H       ;DECREMENT INPUT BUFFER SIZE
0359'  ED4B 005C"              LBCD    S5IBUF  ;GET SERIAL 5 INPUT BUFFER ADDRES
035D'  09                      DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
035E'  ED52                    DSBC    D       ;BUFFER WRAP-AROUND?
0360'  3004                    JRNC    ..NWA5  ;IF NOT, CONTINUE
0362'  ED5B 005C"              LDED    S5IBUF  ;GET SERIAL 5 INPUT BUFFER ADDRES
0366'  ED53 005E"      ..NWA5: SDED    S5IPTR  ;UPDATE SERIAL 5 INPUT POINTER
036A'  21 0066"                LXI     H,S5ISPH  ;GET SERIAL 5 INPUT SEMAPHORE
                       ;
036D'  7E              ..X:    MOV     A,M     ;GET SEMAPHORE COUNT
036E'  B7                      ORA     A       ;SEMAPHORE COUNT=0?
036F'  C8                      RZ              ;IF SO, DONE
0370'  C3 0000:08              JMP     SIGNAL# ;ELSE, SIGNAL PROCESS AS READY
                       ;
0373'  CD 0000:0B      SBR480::CALL    GETBTV# ;GET BAUD RATE TIMER VALUE
0376'  78                      MOV     A,B     ;GET CHANNEL NUMBER
0377'  D602                    SUI     2       ;REMOVE CHANNEL NUMBER BIAS
0379'  F5                      PUSH    PSW     ;SAVE CHANNEL NUMBER
037A'  C5                      PUSH    B       ;SAVE BAUD RATE CODE
037B'  87                      ADD     A       ;X2
037C'  87                      ADD     A       ;X2=X4
037D'  87                      ADD     A       ;X2=X8
037E'  F6E3                    ORI     IOBASE+3  ;CALC LINE CONTROL REGISTER
0380'  4F                      MOV     C,A     ;LINE CONTROL REGISTER TO C-REG
0381'  3E83                    MVI     A,LCRCW!80H  ;GET DIVISOR LATCH ACCESS BI
0383'  ED79                    OUTP    A       ;SELECT DIVISOR LATCH
0385'  0D                      DCR     C       ;CALC DATA REGISTER
```

R480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
0386'   0D                      DCR     C
0387'   0D                      DCR     C
0388'   ED59                    OUTP    E       ;OUTPUT LSB OF TIMER VALUE
038A'   0C                      INR     C       ;CALC DATA REGISTER+1
038B'   ED51                    OUTP    D       ;OUTPUT MSB OF TIMER VALUE
038D'   0C                      INR     C       ;CALC LINE CONTROL REGISTER
038E'   0C                      INR     C
038F'   3E03                    MVI     A,LCRCW ;GET LINE CONTROL REGISTER VALUE
0391'   ED79                    OUTP    A       ;DE-SELECT DIVISOR LATCH
0393'   C1                      POP     B       ;RESTORE BAUD RATE CODE
0394'   F1                      POP     PSW     ;RESTORE CHANNEL NUMBER
0395'   2808                    JRZ     ..SBR2  ;IF CHANNEL NUMBER=2, CONTINUE
0397'   3D                      DCR     A       ;CHANNEL NUMBER=3?
0398'   280A                    JRZ     ..SBR3  ;IF SO, CONTINUE
039A'   3D                      DCR     A       ;CHANNEL NUMBER=4?
039B'   280C                    JRZ     ..SBR4  ;IF SO, CONTINUE
039D'   180F                    JMPR    ..SBR5  ;ELSE, CONTINUE
                        ;
039F'   79              ..SBR2: MOV     A,C     ;GET SERIAL 2 BAUD RATE CODE
03A0'   32 000B"                STA     S2BR    ;SET SERIAL 2 BAUD RATE CODE
03A3'   C9                      RET             ;DONE
                        ;
03A4'   79              ..SBR3: MOV     A,C     ;GET SERIAL 3 BAUD RATE CODE
03A5'   32 0029"                STA     S3BR    ;SET SERIAL 3 BAUD RATE CODE
03A8'   C9                      RET             ;DONE
                        ;
03A9'   79              ..SBR4: MOV     A,C     ;GET SERIAL 4 BAUD RATE CODE
03AA'   32 0047"                STA     S4BR    ;SET SERIAL 4 BAUD RATE CODE
03AD'   C9                      RET             ;DONE
                        ;
03AE'   79              ..SBR5: MOV     A,C     ;GET SERIAL 5 BAUD RATE CODE
03AF'   32 0065"                STA     S5BR    ;SET SERIAL 5 BAUD RATE CODE
03B2'   C9                      RET             ;DONE
                        ;
03B3'   D602            RBR480::SUI     2       ;CHANNEL NUMBER=2?
03B5'   2808                    JRZ     ..RBR2  ;IF SO, CONTINUE
03B7'   3D                      DCR     A       ;CHANNEL NUMBER=3?
03B8'   2809                    JRZ     ..RBR3  ;IF SO, CONTINUE
03BA'   3D                      DCR     A       ;CHANNEL NUMBER=4?
03BB'   280A                    JRZ     ..RBR4  ;IF SO, CONTINUE
03BD'   180C                    JMPR    ..RBR5  ;ELSE, CONTINUE
                        ;
03BF'   3A 000B"        ..RBR2: LDA     S2BR    ;GET SERIAL 2 BAUD RATE CODE
03C2'   C9                      RET             ;DONE
                        ;
03C3'   3A 0029"        ..RBR3: LDA     S3BR    ;GET SERIAL 3 BAUD RATE CODE
03C6'   C9                      RET             ;DONE
                        ;
03C7'   3A 0047"        ..RBR4: LDA     S4BR    ;GET SERIAL 4 BAUD RATE CODE
03CA'   C9                      RET             ;DONE
                        ;
03CB'   3A 0065"        ..RBR5: LDA     S5BR    ;GET SERIAL 5 BAUD RATE CODE
03CE'   C9                      RET             ;DONE
                        ;
```

SER480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
03CF'   78          SMC480::MOV     A,B       ;GET CHANNEL NUMBER
03D0'   D602                SUI     2         ;REMOVE CHANNEL NUMBER BIAS
03D2'   87                  ADD     A         ;X2
03D3'   87                  ADD     A         ;X2=X4
03D4'   87                  ADD     A         ;X2=X8
03D5'   F6E4                ORI     IOBASE+4  ;CALC MODEM CONTROL REGISTER
03D7'   4F                  MOV     C,A       ;MODEM CONTROL REGISTER TO C-REG
03D8'   79                  MOV     A,C       ;GET REQUESTED MODEM CONTROLS
03D9'   0F                  RRC               ;SHIFT MODEM CONTROLS INTO BITS 6/
03DA'   0F                  RRC
03DB'   ED79                OUTP    A         ;OUTPUT MODEM CONTROLS
03DD'   C9                  RET               ;DONE
                    ;
03DE'   78          RMC480::MOV     A,B       ;GET CHANNEL NUMBER
03DF'   D602                SUI     2         ;REMOVE CHANNEL NUMBER BIAS
03E1'   87                  ADD     A         ;X2
03E2'   87                  ADD     A         ;X2=X4
03E3'   87                  ADD     A         ;X2=X8
03E4'   F6E6                ORI     IOBASE+6  ;CALC MODEM STATUS REGISTER
03E6'   4F                  MOV     C,A       ;MODEM STATUS REGISTER TO C-REG
03E7'   ED50                INP     D         ;GET MODEM STATUS REGISTER
03E9'   AF                  XRA     A         ;PRESET RETURN CODE=0
03EA'   CB62                BIT     4,D       ;CLEAR TO SEND BIT SET?
03EC'   2802                JRZ     ..NCTS    ;IF NOT, CONTINUE
03EE'   CBFF                SET     7,A       ;ELSE, SET CLEAR TO SEND BIT
03F0'   CB6A        ..NCTS: BIT     5,D       ;DATA SET READY BIT SET?
03F2'   2802                JRZ     ..NDSR    ;IF NOT, CONTINUE
03F4'   CBF7                SET     6,A       ;ELSE, SET DATA SET READY BIT
03F6'   CB7A        ..NDSR: BIT     7,D       ;DATA CARRIER DETECT BIT SET?
03F8'   2802                JRZ     ..NDCD    ;IF NOT, CONTINUE
03FA'   CBEF                SET     5,A       ;ELSE, SET DATA CARRIER DETECT BI1
03FC'   CB72        ..NDCD: BIT     6,D       ;RING INDICATOR BIT SET?
03FE'   C8                  RZ                ;IF NOT, DONE
03FF'   CBE7                SET     4,A       ;ELSE, SET RING INDICATOR BIT
0401'   C9                  RET               ;DONE
                    ;
                    .END
```

T442 - TURBODOS OPERATING SYSTEM BAUD RATE TABLE (IMS 442 OPTIONAL OSC)


```
                        ;
                        ; ************************************************************
                        ; *                                                          *
                        ; *  This module contains the table of baud-rate divi-       *
                        ; *  sor values used by the IMS 442 and IMS 480 I/O          *
                        ; *  boards.  It is used by the SPD442, SER480, and          *
                        ; *  RTC442 modules.                                         *
                        ; *                                                          *
                        ; ************************************************************
                        ;
                        ; COPYRIGHT (C) 1982 BY SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE2
                        ;
                        .IDENT  BRT442          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0600                    BR50    = 1536          ;50 BAUD TIMER VALUE
0400                    BR75    = 1024          ;75 BAUD TIMER VALUE
02BA                    BR110   = 698           ;110 BAUD TIMER VALUE
023B                    BR1345  = 571           ;134.5 BAUD TIMER VALUE
0200                    BR150   = 512           ;150 BAUD TIMER VALUE
0100                    BR300   = 256           ;300 BAUD TIMER VALUE
0080                    BR600   = 128           ;600 BAUD TIMER VALUE
0040                    BR1200  = 64            ;1200 BAUD TIMER VALUE
002B                    BR1800  = 43            ;1800 BAUD TIMER VALUE
0026                    BR2000  = 38            ;2000 BAUD TIMER VALUE
0020                    BR2400  = 32            ;2400 BAUD TIMER VALUE
0015                    BR3600  = 21            ;3600 BAUD TIMER VALUE
0010                    BR4800  = 16            ;4800 BAUD TIMER VALUE
000B                    BR7200  = 11            ;7200 BAUD TIMER VALUE
0008                    BR9600  = 8             ;9600 BAUD TIMER VALUE
0004                    BR192K  = 4             ;19200 BAUD TIMER VALUE
                        ;
5000                    RTCCNT  =: 20480        ;RTC COUNT (1/60 SECOND TICK)
003C                    TICSEC  =: 60           ;RTC TICKS PER SECOND
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   0600            BRTBL:: .WORD   BR50    ;50 BAUD TIMER VALUE
0002'   0400                    .WORD   BR75    ;75 BAUD TIMER VALUE
0004'   02BA                    .WORD   BR110   ;110 BAUD TIMER VALUE
0006'   023B                    .WORD   BR1345  ;134.5 BAUD TIMER VALUE
0008'   0200                    .WORD   BR150   ;150 BAUD TIMER VALUE
000A'   0100                    .WORD   BR300   ;300 BAUD TIMER VALUE
000C'   0080                    .WORD   BR600   ;600 BAUD TIMER VALUE
000E'   0040                    .WORD   BR1200  ;1200 BAUD TIMER VALUE
0010'   002B                    .WORD   BR1800  ;1800 BAUD TIMER VALUE
0012'   0026                    .WORD   BR2000  ;2000 BAUD TIMER VALUE
0014'   0020                    .WORD   BR2400  ;2400 BAUD TIMER VALUE
```

BRT442 - TURBODOS OPERATING SYSTEM BAUD RATE TABLE (IMS 442 OPTIONAL OSC)


```
0016'  0015                .WORD   BR3600  ;3600 BAUD TIMER VALUE
0018'  0010                .WORD   BR4800  ;4800 BAUD TIMER VALUE
001A'  000B                .WORD   BR7200  ;7200 BAUD TIMER VALUE
001C'  0008                .WORD   BR9600  ;9600 BAUD TIMER VALUE
001E'  0004                .WORD   BR192K  ;19200 BAUD TIMER VALUE
                    ;
                    .END
```

TC442 - TURBODOS OPERATING SYSTEM IMS REAL TIME CLOCK ROUTINES


```
                        ;
                        ; ************************************************************
                        ; *                                                          *
                        ; *  This is a real-time clock driver, which utilizes        *
                        ; *  a counter on the IMS 442 I/O board to provide a         *
                        ; *  periodic "tick" interrupt at 60 hertz.                  *
                        ; *                                                          *
                        ; ************************************************************
                        ;
                        ; COPYRIGHT (C) 1982 BY SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  RTC442          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0010                    IOBASE  = 10H           ;SERIAL/PARALLEL I/O PORT BASE
                        ;
0016                    TIM2    = IOBASE+06H    ;TIMER 2 DATA REGISTER
0017                    TIMCTL  = IOBASE+07H    ;TIMER CONTROL REGISTER
0018                    SINTE   = IOBASE+08H    ;SERIAL INTERRUPT ENABLE REGISTER
0019                    T2RES   = IOBASE+09H    ;TIMER 2 INTERRUPT RESET
                        ;
0001                    RTCENA  = 1             ;REAL TIME CLOCK ENABLE BIT
                        ;
00B6                    T2CMD   = 0B6H          ;TIMER 2 COMMAND
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   00              TICCTR: .BYTE   0       ;TICK COUNTER
                        ;
0000:04                         .LOC    .INIT.# ;LOCATE IN INITIALIZATION AREA
                        ;
0000:04 3EC3            RTCNIT::MVI     A,JMP   ;INIT RTC INTERRUPT VECTOR ADDR
0002:04 32 0008                 STA     1*8
0005:04 21 0000'                LXI     H,RTCISR
0008:04 22 0009                 SHLD    (1*8)+1
000B:04 3EB6                    MVI     A,T2CMD ;GET TIMER 2 COMMAND
000D:04 D317                    OUT     TIMCTL  ;SELECT TIMER 2
000F:04 21 0000:05              LXI     H,RTCCNT#  ;GET RTC COUNTER VALUE
0012:04 7D                      MOV     A,L     ;GET LSB OF TIMER VALUE
0013:04 D316                    OUT     TIM2    ;OUTPUT IT TO TIMER 2 DATA REGISTE
0015:04 7C                      MOV     A,H     ;GET MSB OF TIMER VALUE
0016:04 D316                    OUT     TIM2    ;OUTPUT IT TO TIMER 2 DATA REGISTE
0018:04 21 0000:06              LXI     H,INTMSK#  ;GET INTERRUPT MASK
001B:04 CBCE                    SET     RTCENA,M  ;SET RTC INTERRUPT ENABLE BIT
001D:04 3A 0000:06              LDA     INTMSK  ;GET INTERRUPT MASK
0020:04 D318                    OUT     SINTE   ;ENABLE RTC INTERRUPT MASK
0022:04 C9                      RET             ;DONE
                        ;
```

RTC442 - TURBODOS OPERATING SYSTEM IMS REAL TIME CLOCK ROUTINES


```
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                          ;
0000'   ED73 0000:07    RTCISR: SSPD    INTSP#  ;SAVE STACK POINTER
0004'   31 0000:08              LXI     SP,INTSTK#  ;SET UP AUX STACK POINTER
0007'   F5                      PUSH    PSW     ;SAVE REGISTERS
0008'   C5                      PUSH    B
0009'   D5                      PUSH    D
000A'   E5                      PUSH    H
000B'   D319                    OUT     T2RES   ;RESET RTC INTERRUPT
000D'   21 0000"                LXI     H,TICCTR  ;GET TICK COUNTER
0010'   34                      INR     M       ;INCREMENT TICK COUNTER
0011'   7E                      MOV     A,M     ;GET TICK COUNT
0012'   01 0000:09              LXI     B,TICSEC#  ;GET NUMBER OF TICKS PER SECONI
0015'   B9                      CMP     C       ;SECONDS COUNT REACHED?
0016'   3805                    JRC     ..NSEC  ;IF NOT, CONTINUE
0018'   3600                    MVI     M,0     ;ELSE, RESET TICK COUNTER
001A'   CD 0000:0A             CALL    RTCSEC# ;SERVICE REAL TIME CLOCK MANAGER
001D'   CD 0000:0B      ..NSEC: CALL    DLYTIC# ;SERVICE DISPATCHER DELAY MANAGER
0020'   E1                      POP     H       ;RESTORE REGISTERS
0021'   D1                      POP     D
0022'   C1                      POP     B
0023'   F1                      POP     PSW
0024'   ED7B 0000:07            LSPD    INTSP#  ;RESTORE STACK POINTER
0028'   C3 0000:0C              JMP     ISRXIT# ;CONTINUE
                          ;
                          .END
```

IT740 - TURBODOS OPERATING SYSTEM HARDWARE INITIALIZATION (IMS 740)


```
                        ;
                        ; ***********************************************************
                        ; *                                                         *
                        ; *  This is the hardware initialization routine for        *
                        ; *  an IMS 740 slave processor board.  It consists         *
                        ; *  of calls to the initialization entrypoints of          *
                        ; *  other driver modules.                                  *
                        ; *                                                         *
                        ; ***********************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  NIT740          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000:04                         .LOC    .INIT.# ;LOCATE IN INITIALIZATION AREA
                        ;
0000:04 CD 0000:05      HDWNIT::CALL    SPINIT# ;INITIALIZE SERIAL/PARALLEL I/O
0003:04 C3 0000:06              JMP     CKTINA# ;INITIALIZE CIRCUIT DRIVER A
                        ;
                        .END
```

SCD740 - TURBODOS OPERATING SYSTEM SLAVE CIRCUIT DRIVER (IMS 740)


```
                        ;
                        ; ********************************************************
                        ; *
                        ; *  This is a simple network circuit driver which runs
                        ; *  in an IMS 740 slave processor board, and communi-
                        ; *  cates with a similar but more complex driver
                        ; *  MCD740 running in the master processor.
                        ; *
                        ; *  The IMS 740 slave communicates with the master
                        ; *  processor over the S-100 bus via a byte-parallel
                        ; *  transfer, using programmed I/O at both ends.  The
                        ; *  IMS 740 board appears to the master as an ordinary
                        ; *  port-addressed peripheral device.  The interface
                        ; *  is accompished using an Intel 8255 PIO (on the
                        ; *  master side) connected to a Zilog Z80 PIO (on the
                        ; *  slave side).  The master can interrupt the 740
                        ; *  slave processor to see if it is still healthy, and
                        ; *  this driver must service the interrupt and send an
                        ; *  acknowledgement to the master.
                        ; *
                        ; ********************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  SCD740          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0010                    PIOVEC  = 10H           ;PIO INTERRUPT VECTOR ADDRESS
                        ;
0020                    PORTAD  = 20H           ;8255 PORT A DATA REGISTER
0024                    PIOADR  = 24H           ;PIO PORT A DATA REGISTER
0025                    PIOBDR  = 25H           ;PIO PORT B DATA REGISTER
0026                    PIOACR  = 26H           ;PIO PORT A CONTROL REGISTER
0027                    PIOBCR  = 27H           ;PIO PORT B CONTROL REGISTER
                        ;
0004                    PORTC0  = 4             ;PORT C DATA BIT 0 (INT)
0005                    PORTC5  = 5             ;PORT C DATA BIT 5 (IBF)
0006                    PORTC7  = 6             ;PORT C DATA BIT 7 (OBF)
0007                    RAMPER  = 7             ;RAM PARITY ERROR
                        ;
0006                    ROMENA  = 6             ;ROM ENABLE BIT
0007                    PERRES  = 7             ;PARITY ERROR RESET
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   0000            RCVSPH: .WORD   0       ;RECEIVE MESSAGE SEMAPHORE
0002"   0002"           ..RCVH: .WORD   ..RCVH
0004"   0002"                   .WORD   ..RCVH
```

CD740 - TURBODOS OPERATING SYSTEM SLAVE CIRCUIT DRIVER (IMS 740)


```
                                ;
0000:04                         .LOC    .INIT.# ;LOCATE IN INITIALIZATION AREA
                                ;
0000:04 21 0041'        CKTIN%::LXI     H,PIOISR  ;GET PIO A INTERRUPT SERVICE ADD
0003:04 22 0010                 SHLD    PIOVEC  ;SET INTERRUPT VECTOR ADDRESS
0006:04 3E10                    MVI     A,PIOVEC  ;GET PIO A INTERRUPT VECTOR
0008:04 D326                    OUT     PIOACR  ;OUTPUT INTERRUPT SERVICE VECTOR
000A:04 3ECF                    MVI     A,0CFH  ;GET PIO A MODE WORD (MODE 3)
000C:04 D326                    OUT     PIOACR  ;OUTPUT PIO A MODE WORD
000E:04 3EFF                    MVI     A,0FFH  ;GET PIO A MODE 3 MODE WORD
0010:04 D326                    OUT     PIOACR  ;OUTPUT PIO A MODE 3 MODE WORD
0012:04 3EB7                    MVI     A,0B7H  ;GET PIO A INTERRUPT CONTROL WORD
0014:04 D326                    OUT     PIOACR  ;OUTPUT INTERRUPT CONTROL WORD
0016:04 3EEF                    MVI     A,0EFH  ;GET PIO A INTERRUPT MASK
0018:04 D326                    OUT     PIOACR  ;OUTPUT INTERRUPT MASK
001A:04 3E30                    MVI     A,30H   ;GET PIO B DATA DATA WORD
001C:04 D325                    OUT     PIOBDR  ;OUTPUT PIO B DATA WORD
001E:04 3E0F                    MVI     A,0FH   ;GET PIO B MODE WORD (MODE 0)
0020:04 D327                    OUT     PIOBCR  ;OUTPUT PIO B MODE WORD
0022:04 DB20                    IN      PORTAD  ;CLEAR INPUT PORT A
0024:04 3A 0000:05              LDA     NMBCKT# ;GET NUMBER OF CIRCUITS
0027:04 47                      MOV     B,A     ;NUMBER OF CIRCUITS TO B-REG
0028:04 21 0001:06              LXI     H,CKTAST#+1  ;GET CIRCUIT ASSIGNMENT TABLE
002B:04 3A 0081                 LDA     TBUF+1  ;GET MSB OF PASSED DESTINATION ID
002E:04 BE              ..SL:   CMP     M       ;CIRCUIT NUMBERS EQUAL?
002F:04 2807                    JRZ     ..DIDF  ;IF SO, CONTINUE
0031:04 23                      INX     H       ;ELSE, ADVANCE TO NEXT TABLE ENTRY
0032:04 23                      INX     H
0033:04 23                      INX     H
0034:04 23                      INX     H
0035:04 10F7                    DJNZ    ..SL    ;CONTINUE
0037:04 C9                      RET             ;DONE
0038:04 2B              ..DIDF: DCX     H       ;BACK UP TO LSB OF DESTINATION ID
0039:04 3A 0080                 LDA     TBUF    ;GET LSB OF PASSED DESTINATION ID
003C:04 77                      MOV     M,A     ;SET LSB OF DESTINATION ID
003D:04 C9                      RET             ;DONE
                                ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                                ;
0000'   79              CKTDR%::MOV     A,C     ;GET FUNCTION NUMBER
0001'   B7                      ORA     A       ;FUNCTION NUMBER=0?
0002'   2804                    JRZ     SLVRCV  ;IF SO, CONTINUE
0004'   3D                      DCR     A       ;FUNCTION NUMBER=1?
0005'   281C                    JRZ     SLVSND  ;IF SO, CONTINUE
0007'   C9                      RET             ;ELSE, DONE
                                ;
0008'   21 0000"         SLVRCV: LXI     H,RCVSPH  ;GET RECEIVE MESSAGE SEMAPHORE
000B'   CD 0000:07              CALL    WAIT#   ;WAIT FOR RECEIVE MESSAGE
000E'   CD 003B'                CALL    SRMCOM  ;DO COMMON SETUP
0011'   0601                    MVI     B,1     ;GET LENGTH OF MESSAGE LENGTH
0013'   CD 001A'                CALL    ..RCVL  ;RECEIVE MESSAGE LENGTH
0016'   2B                      DCX     H       ;BACK UP TO MESSAGE LENGTH
0017'   46                      MOV     B,M     ;GET MESSAGE LENGTH
0018'   23                      INX     H       ;RESTORE MESSAGE BUFFER ADDRESS
```

SCD740 - TURBODOS OPERATING SYSTEM SLAVE CIRCUIT DRIVER (IMS 740)


```
0019'  05                    DCR     B         ;DECREMENT MESSAGE LENGTH
001A'  CD 005B'      ..RCVL: CALL    INBYT     ;INPUT BYTE
001D'  77                    MOV     M,A       ;SAVE BYTE IN MESSAGE
001E'  23                    INX     H
001F'  10F9                  DJNZ    ..RCVL    ;CONTINUE
0021'  AF                    XRA     A         ;SET RETURN CODE=0
0022'  C9                    RET               ;DONE
                     ;
0023'  CD 003B'      SLVSND: CALL    SRMCOM    ;DO COMMON SETUP
0026'  3E06                  MVI     A,AACK    ;GET ACK
0028'  CD 0064'              CALL    OUTBYT    ;OUTPUT ACK
002B'  46                    MOV     B,M       ;GET MESSAGE LENGTH
002C'  7E            ..SNDL: MOV     A,M       ;GET BYTE FROM MESSAGE
002D'  23                    INX     H
002E'  CD 0064'              CALL    OUTBYT    ;OUTPUT BYTE
0031'  10F9                  DJNZ    ..SNDL    ;CONTINUE
0033'  21 0000"              LXI     H,RCVSPH  ;GET RECEIVE MESSAGE SEMAPHORE
0036'  CD 0000:08            CALL    SIGNAL#   ;SIGNAL RECEIVE MESSAGE
0039'  AF                    XRA     A         ;SET RETURN CODE=0
003A'  C9                    RET               ;DONE
                     ;
003B'  EB            SRMCOM: XCHG              ;MESSAGE PACKET ADDRESS TO HL-REG
003C'  23                    INX     H         ;ADVANCE PAST LINK POINTERS
003D'  23                    INX     H
003E'  23                    INX     H
003F'  23                    INX     H
0040'  C9                    RET               ;DONE
                     ;
0041'  ED73 0000:09  PIOISR: SSPD    INTSP#    ;SAVE STACK POINTER
0045'  31 0000:0A            LXI     SP,INTSTK#  ;SET UP AUX STACK POINTER
0048'  F5                    PUSH    PSW       ;SAVE AF-REG
0049'  DB24                  IN      PIOADR    ;GET PIO A DATA REGISTER
004B'  CB6F                  BIT     PORTC5,A  ;PORT C BIT 5 SET? (IBF)
004D'  2004                  JRNZ    ..X       ;IF SO, CONTINUE
004F'  3E15                  MVI     A,ANAK    ;ELSE, GET NACK
0051'  D320                  OUT     PORTAD    ;OUTPUT NACK TO PORT A
0053'  F1            ..X:    POP     PSW       ;RESTORE AF-REG
0054'  ED7B 0000:09          LSPD    INTSP#    ;RESTORE STACK POINTER
0058'  FB                    EI                ;ENABLE INTERRUPTS
0059'  ED4D                  RETI              ;DONE
                     ;
005B'  DB24          INBYT:  IN      PIOADR    ;GET PIO A DATA REGISTER
005D'  CB77                  BIT     PORTC7,A  ;PORT C BIT 7 SET? (OBF)
005F'  20FA                  JRNZ    INBYT     ;IF NOT, WAIT
0061'  DB20                  IN      PORTAD    ;INPUT BYTE FROM PORT A
0063'  C9                    RET               ;DONE
                     ;
0064'  4F            OUTBYT: MOV     C,A       ;SAVE OUTPUT BYTE IN C-REG
0065'  DB24          ..WTL:  IN      PIOADR    ;GET PIO A DATA REGISTER
0067'  CB6F                  BIT     PORTC5,A  ;PORT C BIT 5 SET? (IBF)
0069'  20FA                  JRNZ    ..WTL     ;IF SO, WAIT
006B'  79                    MOV     A,C       ;GET OUTPUT BYTE
006C'  D320                  OUT     PORTAD    ;OUTPUT BYTE TO PORT A
006E'  C9                    RET               ;DONE
```

CD740 - TURBODOS OPERATING SYSTEM SLAVE CIRCUIT DRIVER (IMS 740)


```
;
.END
```

SPD740 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL DRIVER (IMS 740)


```
                        ;
                        ; ********************************************************
                        ; *                                                      *
                        ; *  This module handles all serial and parallel I/O     *
                        ; *  for the IMS 740 slave processor board.  The IMS     *
                        ; *  has two serial ports.  One is generally used for    *
                        ; *  a console, and the other can be used for a local    *
                        ; *  printer or a modem.                                 *
                        ; *                                                      *
                        ; *  Serial input is handled via interrupts and buf-     *
                        ; *  fered in a separate circular buffer for each chan-  *
                        ; *  nel.  Serial output is handled on a polled basis    *
                        ; *  and is not buffered.                                *
                        ; *                                                      *
                        ; ********************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  SPD740          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0010                    PIOVEC  = 10H           ;PIO INTERRUPT VECTOR ADDRESS
0012                    SIOVEC  = 12H           ;SIO INTERRUPT VECTOR ADDRESS
                        ;
0020                    PORTAD  = 20H           ;8255 PORT A DATA REGISTER
0024                    PIOADR  = 24H           ;PIO PORT A DATA REGISTER
0025                    PIOBDR  = 25H           ;PIO PORT B DATA REGISTER
0026                    PIOACR  = 26H           ;PIO PORT A CONTROL REGISTER
0027                    PIOBCR  = 27H           ;PIO PORT B CONTROL REGISTER
0028                    CTCCH0  = 28H           ;CTC CHANNEL 0 REGISTERS
0029                    CTCCH1  = 29H           ;CTC CHANNEL 1 REGISTERS
002A                    CTCCH2  = 2AH           ;CTC CHANNEL 2 REGISTERS
002B                    CTCCH3  = 2BH           ;CTC CHANNEL 3 REGISTERS
002C                    SIOADR  = 2CH           ;SIO PORT A DATA REGISTER
002D                    SIOBDR  = 2DH           ;SIO PORT B DATA REGISTER
002E                    SIOACR  = 2EH           ;SIO PORT A CONTROL REGISTER
002F                    SIOBCR  = 2FH           ;SIO PORT B CONTROL REGISTER
                        ;
0004                    PORTC0  = 4             ;PORT C DATA BIT 0 (INT)
0005                    PORTC5  = 5             ;PORT C DATA BIT 5 (IBF)
0006                    PORTC7  = 6             ;PORT C DATA BIT 7 (OBF)
0007                    RAMPER  = 7             ;RAM PARITY ERROR
                        ;
0006                    ROMENA  = 6             ;ROM ENABLE BIT
0007                    PERRES  = 7             ;PARITY ERROR RESET
                        ;
0000                    RDA     = 0             ;RECEIVED DATA AVAILABLE BIT
0002                    TBE     = 2             ;TRANSMIT BUFFER EMPTY BIT
```

PD740 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL DRIVER (IMS 740)


```
0003                    DCD     = 3             ;DATA CARRIER DETECT BIT
0005                    CTS     = 5             ;CLEAR TO SEND BIT
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   0040            SOIBSZ::.WORD   64      ;SERIAL 0 INPUT BUFFER SIZE
0002"   0000            SOIBUF: .WORD   0       ;SERIAL 0 INPUT BUFFER ADDRESS
0004"   0000            SOIPTR: .WORD   0       ;SERIAL 0 INPUT POINTER
0006"   0000            SOOPTR: .WORD   0       ;SERIAL 0 OUTPUT POINTER
0008"   0000            SOICNT: .WORD   0       ;SERIAL 0 INPUT COUNT
000A"   00              SOOCHR: .BYTE   0       ;SERIAL 0 OUTPUT CHARACTER
000B"   00              SOBR:   .BYTE   0       ;SERIAL 0 BAUD RATE CODE
                        ;
000C"                   SOISPH:                 ;SERIAL 0 INPUT SEMAPHORE
000C"   0000                    .WORD   0       ;SEMAPHORE COUNT
000E"   000E"           ..SOIH: .WORD   ..SOIH  ;SEMAPHORE P/D HEAD
0010"   000E"                   .WORD   ..SOIH
                        ;
                                                ;SERIAL 0 OUTPUT SEMAPHORE
0012"   0000            SOOSPH: .WORD   0       ;SEMAPHORE COUNT
0014"   0014"           ..SOOH: .WORD   ..SOOH  ;SEMAPHORE P/D HEAD
0016"   0014"                   .WORD   ..SOOH
                        ;
                                                ;SERIAL 0 OUTPUT SEMAPHORE
0018"   0001            SOXSPH: .WORD   1       ;SEMAPHORE COUNT
001A"   001A"           ..SOXH: .WORD   ..SOXH  ;SEMAPHORE P/D HEAD
001C"   001A"                   .WORD   ..SOXH
                        ;
001E"   0010            S1IBSZ::.WORD   16      ;SERIAL 1 INPUT BUFFER SIZE
0020"   0000            S1IBUF: .WORD   0       ;SERIAL 1 INPUT BUFFER ADDRESS
0022"   0000            S1IPTR: .WORD   0       ;SERIAL 1 INPUT POINTER
0024"   0000            S1OPTR: .WORD   0       ;SERIAL 1 OUTPUT POINTER
0026"   0000            S1ICNT: .WORD   0       ;SERIAL 1 INPUT COUNT
0028"   00              S1OCHR: .BYTE   0       ;SERIAL 1 OUTPUT CHARACTER
0029"   00              S1BR:   .BYTE   0       ;SERIAL 1 BAUD RATE CODE
                        ;
                                                ;SERIAL 1 INPUT SEMAPHORE
002A"   0000            S1ISPH: .WORD   0       ;SEMAPHORE COUNT
002C"   002C"           ..S1IH: .WORD   ..S1IH  ;SEMAPHORE P/D HEAD
002E"   002C"                   .WORD   ..S1IH
                        ;
                                                ;SERIAL 1 OUTPUT SEMAPHORE
0030"   0000            S1OSPH: .WORD   0       ;SEMAPHORE COUNT
0032"   0032"           ..S1OH: .WORD   ..S1OH  ;SEMAPHORE P/D HEAD
0034"   0032"                   .WORD   ..S1OH
                        ;
                                                ;SERIAL 1 OUTPUT SEMAPHORE
0036"   0001            S1XSPH: .WORD   1       ;SEMAPHORE COUNT
0038"   0038"           ..S1XH: .WORD   ..S1XH  ;SEMAPHORE P/D HEAD
003A"   0038"                   .WORD   ..S1XH
                        ;
0000:04                         .LOC    .INIT.# ;LOCATE IN INITIALIZATION AREA
                        ;
0000:04 AF              SPINIT::XRA     A
```

SPD740 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL DRIVER (IMS 740)


```
0001:04 ED47                    STAI            ;SET INTERRUPT PAGE REGISTER=0
0003:04 ED5E                    IM2             ;SET INTERRUPT MODE 2
0005:04 3ECF                    MVI     A,0CFH  ;GET PIO A MODE WORD (MODE 3)
0007:04 D326                    OUT     PIOACR  ;OUTPUT PIO A MODE WORD
0009:04 3EFF                    MVI     A,0FFH  ;GET PIO A MODE 3 MODE WORD
000B:04 D326                    OUT     PIOACR  ;OUTPUT PIO A MODE 3 MODE WORD
000D:04 3E30                    MVI     A,30H   ;GET PIO B DATA BYTE
000F:04 D325                    OUT     PIOBDR  ;OUTPUT PIO B DATA BYTE
0011:04 3E0F                    MVI     A,0FH   ;GET PIO B MODE WORD (MODE 0)
0013:04 D327                    OUT     PIOBCR  ;OUTPUT PIO B MODE WORD
0015:04 21 0127'                LXI     H,SIOISR  ;GET SIO INTERRUPT SERVICE ADDR
0018:04 22 0012                 SHLD    SIOVEC  ;SET SIO INTERRUPT VECTOR ADDRESS
001B:04 21 004A:04              LXI     H,SIOPGM  ;GET SIO PROGRAM LIST
001E:04 01 092E                 LXI     B,SIOAPL<8!SIOACR  ;B=LENGTH/C=CONTROL RE
0021:04 EDB3                    OUTIR           ;PROGRAM SIO PORT A
0023:04 21 004A:04              LXI     H,SIOPGM  ;GET SIO PROGRAM LIST
0026:04 01 0B2F                 LXI     B,SIOBPL<8!SIOBCR  ;B=LENGTH/C=CONTROL RE
0029:04 EDB3                    OUTIR           ;PROGRAM SIO PORT B
002B:04 2A 0000"                LHLD    S0IBSZ  ;GET SERIAL 0 INPUT BUFFER SIZE
002E:04 CD 0000:05              CALL    ALLOC#  ;ALLOCATE PACKET FOR SERIAL BUFFE
0031:04 22 0002"                SHLD    S0IBUF  ;SAVE SERIAL 0 INPUT BUFFER ADDRE
0034:04 22 0004"                SHLD    S0IPTR  ;SET SERIAL 0 INPUT POINTER
0037:04 22 0006"                SHLD    S0OPTR  ;SET SERIAL 0 OUTPUT POINTER
003A:04 2A 001E"                LHLD    S1IBSZ  ;GET SERIAL 1 INPUT BUFFER SIZE
003D:04 CD 0000:05              CALL    ALLOC#  ;ALLOCATE PACKET FOR SERIAL BUFFE
0040:04 22 0020"                SHLD    S1IBUF  ;SAVE SERIAL 1 INPUT BUFFER ADDRE
0043:04 22 0022"                SHLD    S1IPTR  ;SET SERIAL 1 INPUT POINTER
0046:04 22 0024"                SHLD    S1OPTR  ;SET SERIAL 1 OUTPUT POINTER
0049:04 C9                      RET             ;DONE
                        ;
004A:04 18              SIOPGM: .BYTE   18H     ;RESET CHANNEL
004B:04 04                      .BYTE   4       ;SELECT WR4
004C:04 C4                      .BYTE   0C4H    ;WRITE REGISTER 4 CONTROL WORD
004D:04 05                      .BYTE   5       ;SELECT WR5
004E:04 EA                      .BYTE   0EAH    ;WRITE REGISTER 5 CONTROL WORD
004F:04 03                      .BYTE   3       ;SELECT WR3
0050:04 C1                      .BYTE   0C1H    ;WRITE REGISTER 3 CONTROL WORD
0051:04 01                      .BYTE   1       ;SELECT WR1
0052:04 10                      .BYTE   10H     ;WRITE REGISTER 1 CONTROL WORD
                        ;
0009                    SIOAPL  = .-SIOPGM      ;SIO PORT A PROGRAM LENGTH
                        ;
0053:04 02                      .BYTE   2       ;SELECT WR2
0054:04 12                      .BYTE   SIOVEC  ;WRITE REGISTER 1 CONTROL WORD
                        ;
000B                    SIOBPL  = .-SIOPGM      ;SIO PORT B PROGRAM LENGTH
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'                   SERIAL::
0000'   7B              COMDRV::MOV     A,E     ;GET FUNCTION NUMBER
0001'   B7                      ORA     A       ;FUNCTION NUMBER=0?
0002'   2818                    JRZ     SERST   ;IF SO, CONTINUE
0004'   3D                      DCR     A       ;FUNCTION NUMBER=1?
```

PD740 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL DRIVER (IMS 740)


```
0005'   282E                    JRZ     SERIN   ;IF SO, CONTINUE
0007'   3D                      DCR     A       ;FUNCTION NUMBER=2?
0008'   CA 0097'                JZ      SEROUT  ;IF SO, CONTINUE
000B'   3D                      DCR     A       ;FUNCTION NUMBER=3?
000C'   CA 01F9'                JZ      SERSBR  ;IF SO, CONTINUE
000F'   3D                      DCR     A       ;FUNCTION NUMBER=4?
0010'   CA 022B'                JZ      SERRBR  ;IF SO, CONTINUE
0013'   3D                      DCR     A       ;FUNCTION NUMBER=5?
0014'   CA 0237'                JZ      SERSMC  ;IF SO, CONTINUE
0017'   3D                      DCR     A       ;FUNCTION NUMBER=6?
0018'   CA 0257'                JZ      SERRMC  ;IF SO, CONTINUE
001B'   C9                      RET             ;ELSE, DONE
                        ;
001C'   ED5B 0008"      SERST:  LDED    SOICNT  ;GET SERIAL 0 INPUT BUFFER COUNT
0020'   2A 0006"                LHLD    SOOPTR  ;GET SERIAL 0 OUTPUT POINTER
0023'   78                      MOV     A,B     ;GET CHANNEL NUMBER
0024'   B7                      ORA     A       ;CHANNEL NUMBER=0
0025'   2807                    JRZ     ..COM   ;IF SO, CONTINUE
0027'   ED5B 0026"              LDED    S1ICNT  ;GET SERIAL 1 INPUT BUFFER COUNT
002B'   2A 0024"                LHLD    S1OPTR  ;GET SERIAL 1 OUTPUT POINTER
002E'   7A              ..COM:  MOV     A,D
002F'   B3                      ORA     E       ;SERIAL INPUT BUFFER COUNT=0?
0030'   C8                      RZ              ;IF SO, DONE
0031'   3EFF                    MVI     A,0FFH  ;ELSE, SET RETURN CODE=0FFH
0033'   4E                      MOV     C,M     ;GET SERIAL INPUT CHARACTER
0034'   C9                      RET             ;DONE
                        ;
0035'   CD 001C'        SERIN:  CALL    SERST   ;GET SERIAL STATUS
0038'   B7                      ORA     A       ;CHARACTER AVAILABLE?
0039'   78                      MOV     A,B     ;GET CHANNEL NUMBER
003A'   200E                    JRNZ    ..SIN   ;IF CHARACTER AVAILABLE, CONTINUE
003C'   21 000C"                LXI     H,SOISPH  ;GET SERIAL 0 INPUT SEMAPHORE
003F'   B7                      ORA     A       ;CHANNEL NUMBER=0?
0040'   2803                    JRZ     ..INC   ;IF SO, CONTINUE
0042'   21 002A"                LXI     H,S1ISPH  ;GET SERIAL 1 INPUT SEMAPHORE
0045'   CD 0000:06    ..INC:  CALL    WAIT#   ;WAIT FOR INPUT CHARACTER
0048'   18EB                    JMPR    SERIN   ;CONTINUE
004A'   B7              ..SIN:  ORA     A       ;CHANNEL NUMBER=0?
004B'   2025                    JRNZ    ..S1I   ;IF NOT, CONTINUE
004D'   F3                      DI              ;DISABLE INTERRUPTS
004E'   2A 0008"                LHLD    SOICNT  ;GET SERIAL 0 INPUT COUNT
0051'   2B                      DCX     H       ;DECREMENT SERIAL 0 INPUT COUNT
0052'   22 0008"                SHLD    SOICNT  ;UPDATE SERIAL 0 INPUT COUNT
0055'   2A 0006"                LHLD    SOOPTR  ;GET SERIAL 0 OUTPUT POINTER
0058'   7E                      MOV     A,M     ;GET CHARACTER FROM BUFFER
0059'   23                      INX     H       ;INCREMENT SERIAL 0 OUTPUT POINTER
005A'   EB                      XCHG            ;SERIAL 0 OUTPUT POINTER TO DE-REG
005B'   2A 0002"                LHLD    SOIBUF  ;GET SERIAL 0 INPUT BUFFER ADDRESS
005E'   ED4B 0000"              LBCD    SOIBSZ  ;GET SERIAL 0 INPUT BUFFER SIZE
0062'   0B                      DCX     B       ;DECREMENT INPUT BUFFER SIZE
0063'   09                      DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
0064'   ED52                    DSBC    D       ;BUFFER WRAP-AROUND?
0066'   3004                    JRNC    ..NWA0  ;IF NOT, CONTINUE
0068'   ED5B 0002"              LDED    SOIBUF  ;GET SERIAL 0 INPUT BUFFER ADDRESS
```

SPD740 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL DRIVER (IMS 740)


```
006C'   ED53 0006"    ..NWA0: SDED    SOOPTR  ;UPDATE SERIAL 0 OUTPUT POINTER
0070'   FB                    EI              ;ENABLE INTERRUPTS
0071'   C9                    RET             ;DONE
0072'   F3            ..S1I:  DI              ;DISABLE INTERRUPTS
0073'   2A 0026"              LHLD    S1ICNT  ;GET SERIAL 1 INPUT COUNT
0076'   2B                    DCX     H       ;DECREMENT SERIAL 1 INPUT COUNT
0077'   22 0026"              SHLD    S1ICNT  ;UPDATE SERIAL 1 INPUT COUNT
007A'   2A 0024"              LHLD    S1OPTR  ;GET SERIAL 1 OUTPUT POINTER
007D'   7E                    MOV     A,M     ;GET CHARACTER FROM BUFFER
007E'   23                    INX     H       ;INCREMENT SERIAL 1 OUTPUT POINTE
007F'   EB                    XCHG            ;SERIAL 1 OUTPUT POINTER TO DE-RE
0080'   2A 0020"              LHLD    S1IBUF  ;GET SERIAL 1 INPUT BUFFER ADDRES
0083'   ED4B 001E"            LBCD    S1IBSZ  ;GET SERIAL 1 INPUT BUFFER SIZE
0087'   0B                    DCX     B       ;DECREMENT INPUT BUFFER SIZE
0088'   09                    DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
0089'   ED52                  DSBC    D       ;BUFFER WRAP-AROUND?
008B'   3004                  JRNC    ..NWA1  ;IF NOT, CONTINUE
008D'   ED5B 0020"            LDED    S1IBUF  ;GET SERIAL 1 INPUT BUFFER ADDRES
0091'   ED53 0024"    ..NWA1: SDED    S1OPTR  ;UPDATE SERIAL 1 OUTPUT POINTER
0095'   FB                    EI              ;ENABLE INTERRUPTS
0096'   C9                    RET             ;DONE
                      ;
0097'   78            SEROUT: MOV     A,B     ;GET CHANNEL NUMBER
0098'   B7                    ORA     A       ;CHANNEL NUMBER=1?
0099'   201E                  JRNZ    ..S1O   ;IF SO, CONTINUE
009B'   21 0018"              LXI     H,SOXSPH  ;GET SERIAL 0 OUT SEMAPHORE
009E'   E5                    PUSH    H       ;SAVE SERIAL 0 OUT SEMAPHORE
009F'   CD 0000:06            CALL    WAIT#   ;WAIT ON MUTUAL EXCLUSION
00A2'   21 000A"              LXI     H,SOOCHR  ;GET SERIAL 0 OUTPUT CHARACTER
00A5'   71                    MOV     M,C     ;SAVE OUTPUT CHARACTER
00A6'   11 00D7'              LXI     D,SOOPOL  ;GET SERIAL 0 OUT POLL ROUTINE
00A9'   CD 0000:07            CALL    LNKPOL# ;CREATE POLL ROUTINE
00AC'   CD 00DB'              CALL    SOOPR   ;EXECUTE POLL ROUTINE
00AF'   21 0012"              LXI     H,SOOSPH  ;GET SERIAL 0 OUT SEMAPHORE
00B2'   CD 0000:06            CALL    WAIT#   ;DISPATCH IF NECESSARY
00B5'   E1                    POP     H       ;GET MUTUTAL EXCLUSION SEMAPHORE
00B6'   C3 0000:08            JMP     SIGNAL# ;SIGNAL PROCESS AS READY
00B9'   21 0036"      ..S1O:  LXI     H,S1XSPH  ;GET MUTUAL EXCLUSION SEMAPHORE
00BC'   E5                    PUSH    H       ;SAVE MUTUAL EXCLUSION SEMAPHORE
00BD'   CD 0000:06            CALL    WAIT#   ;WAIT ON MUTUAL EXCLUSION
00C0'   21 0028"              LXI     H,S1OCHR  ;GET SERIAL 1 OUTPUT CHARACTER
00C3'   71                    MOV     M,C     ;SAVE OUTPUT CHARACTER
00C4'   11 00FF'              LXI     D,S1OPOL  ;GET SERIAL 1 OUT POLL ROUTINE
00C7'   CD 0000:07            CALL    LNKPOL# ;CREATE POLL ROUTINE
00CA'   CD 0103'              CALL    S1OPR   ;EXECUTE POLL ROUTINE
00CD'   21 0030"              LXI     H,S1OSPH  ;GET SERIAL 1 OUT SEMAPHORE
00D0'   CD 0000:06            CALL    WAIT#   ;DISPATCH IF NECESSARY
00D3'   E1                    POP     H       ;GET MUTUTAL EXCLUSION SEMAPHORE
00D4'   C3 0000:08            JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                      ;
00D7'                 SOOPOL:                 ;SERIAL 0 OUTPUT POLL ROUTINE
00D7'   0000                  .WORD   0       ;SUCCESSOR LINK POINTER
00D9'   0000                  .WORD   0       ;PREDECESSOR LINK POINTER
                      ;
```

'D740 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL DRIVER (IMS 740)
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```
00DB'  3E10           SOOPR:  MVI     A,10H    ;GET RESET EXTERNAL STATUS COMMAND
00DD'  D32E                   OUT     SIOACR   ;RESET EXTERNAL STATUS
00DF'  DB2E                   IN      SIOACR   ;GET SIO PORT A STATUS
00E1'  CB57                   BIT     TBE,A    ;TRANSMIT BUFFER EMPTY?
00E3'  C8                     RZ               ;IF NOT, DONE
00E4'  21 000B"               LXI     H,SOBR   ;ELSE, GET SERIAL 0 BAUD RATE CODE
00E7'  CB76                   BIT     6,M      ;CTS HANDSHAKING REQUESTED?
00E9'  2803                   JRZ     ..NCTS   ;IF NOT, CONTINUE
00EB'  CB6F                   BIT     CTS,A    ;ELSE, CHECK CLEAR TO SEND STATUS
00ED'  C8                     RZ               ;IF CLEAR TO SEND FALSE, DONE
00EE'  3A 000A"       ..NCTS: LDA     SOOCHR   ;GET SERIAL 0 OUTPUT CHARACTER
00F1'  D32C                   OUT     SIOADR   ;OUTPUT CHARACTER
00F3'  21 00D7'               LXI     H,SOOPOL  ;GET SERIAL 0 OUT POLL ROUTINE
00F6'  CD 0000:09             CALL    UNLINK#  ;UNLINK POLL ROUTINE
00F9'  21 0012"               LXI     H,SOOSPH  ;GET SERIAL 0 OUT SEMAPHORE
00FC'  C3 0000:08             JMP     SIGNAL#  ;SIGNAL PROCESS AS READY
                      ;
00FF'                 S1OPOL:                  ;SERIAL 1 OUTPUT POLL ROUTINE
00FF'  0000                   .WORD   0        ;SUCCESSOR LINK POINTER
0101'  0000                   .WORD   0        ;PREDECESSOR LINK POINTER
                      ;
0103'  3E10           S1OPR:  MVI     A,10H    ;GET RESET EXTERNAL STATUS COMMAND
0105'  D32F                   OUT     SIOBCR   ;RESET EXTERNAL STATUS
0107'  DB2F                   IN      SIOBCR   ;GET SIO PORT B STATUS
0109'  CB57                   BIT     TBE,A    ;TRANSMIT BUFFER EMPTY?
010B'  C8                     RZ               ;IF NOT, DONE
010C'  21 0029"               LXI     H,S1BR   ;ELSE, GET SERIAL 1 BAUD RATE CODE
010F'  CB76                   BIT     6,M      ;CTS HANDSHAKING REQUESTED?
0111'  2803                   JRZ     ..NCTS   ;IF NOT, CONTINUE
0113'  CB6F                   BIT     CTS,A    ;ELSE, CHECK CLEAR TO SEND STATUS
0115'  C8                     RZ               ;IF CLEAR TO SEND FALSE, DONE
0116'  3A 0028"       ..NCTS: LDA     S1OCHR   ;GET SERIAL 1 OUTPUT CHARACTER
0119'  D32D                   OUT     SIOBDR   ;OUTPUT CHARACTER
011B'  21 00FF'               LXI     H,S1OPOL  ;GET SERIAL 1 OUT POLL ROUTINE
011E'  CD 0000:09             CALL    UNLINK#  ;UNLINK POLL ROUTINE
0121'  21 0030"               LXI     H,S1OSPH  ;GET SERIAL 1 OUT SEMAPHORE
0124'  C3 0000:08             JMP     SIGNAL#  ;SIGNAL PROCESS AS READY
                      ;
0127'  ED73 0000:0A   SIOISR: SSPD    INTSP#   ;SAVE STACK POINTER
012B'  31 0000:0B             LXI     SP,INTSTK#  ;SET UP AUX STACK POINTER
012E'  F5                     PUSH    PSW      ;SAVE REGISTERS
012F'  C5                     PUSH    B
0130'  D5                     PUSH    D
0131'  E5                     PUSH    H
0132'  CD 0143'               CALL    ..SOI    ;CHECK FOR SERIAL 0 INPUT
0135'  CD 019C'               CALL    ..S1I    ;CHECK FOR SERIAL 1 INPUT
0138'  E1                     POP     H        ;RESTORE REGISTERS
0139'  D1                     POP     D
013A'  C1                     POP     B
013B'  F1                     POP     PSW
013C'  ED7B 0000:0A           LSPD    INTSP#   ;RESTORE STACK POINTER
0140'  C3 0000:0C             JMP     ISRXIT#  ;CONTINUE
0143'  DB2E           ..SOI:  IN      SIOACR   ;GET SIO PORT A STATUS
0145'  CB47                   BIT     RDA,A    ;CHARACTER AVAILABLE
```

SPD740 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL DRIVER (IMS 740)


```
0147'   C8                      RZ              ;IF NOT, DONE
0148'   DB2C                    IN      SIOADR  ;GET SIO PORT A DATA CHARACTER
014A'   21 000B"                LXI     H,SOBR  ;GET SERIAL 0 BAUD RATE CODE
014D'   CB6E                    BIT     5,M     ;INHIBIT INPUT FLAG SET?
014F'   C0                      RNZ             ;IF SO, DONE
0150'   4F                      MOV     C,A     ;SERIAL 0 DATA CHARACTER TO C-REG
0151'   CB7E                    BIT     7,M     ;SIGN BIT ON BAUD RATE CODE?
0153'   2817                    JRZ     ..NADO  ;IF NOT, CONTINUE
0155'   CBB9                    RES     7,C     ;ELSE, STRIP SIGN BIT ON CHARACTE
0157'   CD 0000:0D              CALL    SLVRES# ;CHECK FOR SLAVE RESET
015A'   3A 0000:0E              LDA     ATNCHR# ;GET ATTENTION CHARACTER
015D'   B9                      CMP     C       ;CHARACTER=ATTENTION CHARACTER?
015E'   200C                    JRNZ    ..NADO  ;IF NOT, CONTINUE
0160'   2A 0004"                LHLD    SOIPTR  ;ELSE, GET SERIAL 0 INPUT POINTER
0163'   22 0006"                SHLD    SOOPTR  ;RESET SERIAL 0 OUTPUT POINTER
0166'   21 0000                 LXI     H,0
0169'   22 0008"                SHLD    SOICNT  ;SET SERIAL 0 INPUT COUNT=0
016C'   2A 0000"        ..NADO: LHLD    SOIBSZ  ;GET SERIAL 0 INPUT BUFFER SIZE
016F'   ED5B 0008"              LDED    SOICNT  ;GET SERIAL 0 INPUT COUNT
0173'   13                      INX     D       ;INCREMENT SERIAL 0 INPUT COUNT
0174'   B7                      ORA     A       ;CLEAR CARRY FLAG
0175'   ED52                    DSBC    D       ;SERIAL 0 INPUT BUFFER FULL?
0177'   D8                      RC              ;IF SO, DONE
0178'   ED53 0008"              SDED    SOICNT  ;ELSE, UPDATE SERIAL 0 INPUT COUN
017C'   2A 0004"                LHLD    SOIPTR  ;GET SERIAL 0 INPUT POINTER
017F'   71                      MOV     M,C     ;STORE INPUT CHARACTER IN BUFFER
0180'   23                      INX     H       ;INCREMENT INPUT POINTER
0181'   EB                      XCHG            ;INPUT POINTER TO DE-REG
0182'   2A 0000"                LHLD    SOIBSZ  ;GET SERIAL 0 INPUT BUFFER SIZE
0185'   2B                      DCX     H       ;DECREMENT INPUT BUFFER SIZE
0186'   ED4B 0002"              LBCD    SOIBUF  ;GET SERIAL 0 INPUT BUFFER ADDRES
018A'   09                      DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
018B'   ED52                    DSBC    D       ;BUFFER WRAP-AROUND?
018D'   3004                    JRNC    ..NWAO  ;IF NOT, CONTINUE
018F'   ED5B 0002"              LDED    SOIBUF  ;GET SERIAL 0 INPUT BUFFER ADDRES
0193'   ED53 0004"      ..NWAO: SDED    SOIPTR  ;UPDATE SERIAL 0 INPUT POINTER
0197'   21 000C"                LXI     H,SOISPH  ;GET SERIAL 0 INPUT SEMAPHORE
019A'   1857                    JMPR    ..X     ;CONTINUE
019C'   DB2F            ..S1I: IN      SIOBCR  ;GET SIO PORT B STATUS
019E'   CB47                    BIT     RDA,A   ;CHARACTER AVAILABLE
01A0'   C8                      RZ              ;IF NOT, DONE
01A1'   DB2D                    IN      SIOBDR  ;GET SIO PORT B DATA CHARACTER
01A3'   21 0029"                LXI     H,S1BR  ;GET SERIAL 1 BAUD RATE CODE
01A6'   CB6E                    BIT     5,M     ;INHIBIT INPUT FLAG SET?
01A8'   C0                      RNZ             ;IF SO, DONE
01A9'   4F                      MOV     C,A     ;SERIAL 1 DATA CHARACTER TO C-REG
01AA'   CB7E                    BIT     7,M     ;ATTENTION DETECTION FLAG SET?
01AC'   2817                    JRZ     ..NAD1  ;IF NOT, CONTINUE
01AE'   CBB9                    RES     7,C     ;ELSE, STRIP SIGN BIT ON CHARACTE
01B0'   CD 0000:0D              CALL    SLVRES# ;CHECK FOR SLAVE RESET
01B3'   3A 0000:0E              LDA     ATNCHR# ;GET ATTENTION CHARACTER
01B6'   B9                      CMP     C       ;CHARACTER=ATTENTION CHARACTER?
01B7'   200C                    JRNZ    ..NAD1  ;IF NOT, CONTINUE
01B9'   2A 0022"                LHLD    S1IPTR  ;ELSE, GET SERIAL 1 INPUT POINTER
```

```
01BC'   22 0024"            SHLD    S1OPTR  ;RESET SERIAL 1 OUTPUT POINTER
01BF'   21 0000             LXI     H,0
01C2'   22 0026"            SHLD    S1ICNT  ;SET SERIAL 1 INPUT COUNT=0
01C5'   2A 001E"    ..NAD1: LHLD    S1IBSZ  ;GET SERIAL 1 INPUT BUFFER SIZE
01C8'   ED5B 0026"          LDED    S1ICNT  ;GET SERIAL 1 INPUT COUNT
01CC'   13                  INX     D       ;INCREMENT SERIAL 1 INPUT COUNT
01CD'   B7                  ORA     A       ;CLEAR CARRY FLAG
01CE'   ED52                DSBC    D       ;SERIAL 1 INPUT BUFFER FULL?
01D0'   D8                  RC              ;IF SO, DONE
01D1'   ED53 0026"          SDED    S1ICNT  ;ELSE, UPDATE SERIAL 1 INPUT COUNT
01D5'   2A 0022"            LHLD    S1IPTR  ;GET SERIAL 1 INPUT POINTER
01D8'   71                  MOV     M,C     ;STORE INPUT CHARACTER IN BUFFER
01D9'   23                  INX     H       ;INCREMENT INPUT POINTER
01DA'   EB                  XCHG            ;INPUT POINTER TO DE-REG
01DB'   2A 001E"            LHLD    S1IBSZ  ;GET SERIAL 1 INPUT BUFFER SIZE
01DE'   2B                  DCX     H       ;DECREMENT INPUT BUFFER SIZE
01DF'   ED4B 0020"          LBCD    S1IBUF  ;GET SERIAL 1 INPUT BUFFER ADDRESS
01E3'   09                  DAD     B       ;CALC LAST INPUT BUFFER ADDRESS
01E4'   ED52                DSBC    D       ;BUFFER WRAP-AROUND?
01E6'   3004                JRNC    ..NWA1  ;IF NOT, CONTINUE
01E8'   ED5B 0020"          LDED    S1IBUF  ;GET SERIAL 1 INPUT BUFFER ADDRESS
01EC'   ED53 0022"  ..NWA1: SDED    S1IPTR  ;UPDATE SERIAL 1 INPUT POINTER
01F0'   21 002A"            LXI     H,S1ISPH  ;GET SERIAL 1 INPUT SEMAPHORE
01F3'   7E          ..X:    MOV     A,M     ;GET SEMAPHORE COUNT
01F4'   B7                  ORA     A       ;SEMAPHORE COUNT=0?
01F5'   C8                  RZ              ;IF SO, DONE
01F6'   C3 0000:08          JMP     SIGNAL# ;ELSE, SIGNAL PROCESS AS READY
                    ;
01F9'   51          SERSBR: MOV     D,C     ;REQUESTED BAUD RATE TO D-REG
01FA'   21 000B"            LXI     H,S0BR  ;GET SERIAL 0 BAUD RATE
01FD'   0E28                MVI     C,CTCCH0  ;GET CTC CHANNEL 0 REGISTERS
01FF'   78                  MOV     A,B     ;GET CHANNEL NUMBER
0200'   B7                  ORA     A       ;CHANNEL NUMBER=0?
0201'   2805                JRZ     ..COM   ;IF SO, CONTINUE
0203'   21 0029"            LXI     H,S1BR  ;ELSE, GET SERIAL 1 BAUD RATE
0206'   0E29                MVI     C,CTCCH1  ;GET CTC CHANNEL 1 REGISTERS
0208'   72          ..COM:  MOV     M,D     ;SAVE BAUD RATE CODE
0209'   3E47                MVI     A,47H   ;GET CTC CHANNEL CONTROL WORD
020B'   ED79                OUTP    A       ;INITIALIZE CTC CHANNEL
020D'   7A                  MOV     A,D     ;GET REQUESTED BAUD RATE CODE
020E'   E60F                ANI     0FH     ;LIMIT TO 16 BAUD RATES
0210'   5F                  MOV     E,A     ;TO E-REG
0211'   1600                MVI     D,0     ;MAKE IT DOUBLE LENGTH
0213'   21 021B'            LXI     H,BRTBL  ;GET BAUD RATE TABLE
0216'   19                  DAD     D       ;INDEX INTO TABLE
0217'   7E                  MOV     A,M     ;GET TIMER VALUE
0218'   ED79                OUTP    A       ;SET CTC CHANNEL TIME CONSTANT
021A'   C9                  RET             ;DONE
                    ;
021B'   00          BRTBL:  .BYTE   0       ;50 BAUD TIMER VALUE
021C'   00                  .BYTE   0       ;75 BAUD TIMER VALUE
021D'   AF                  .BYTE   175     ;110 BAUD TIMER VALUE
021E'   8F                  .BYTE   143     ;134.5 BAUD TIMER VALUE
021F'   80                  .BYTE   128     ;150 BAUD TIMER VALUE
```

SPD740 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL DRIVER (IMS 740)


```
0220'  40                      .BYTE   64      ;300 BAUD TIMER VALUE
0221'  20                      .BYTE   32      ;600 BAUD TIMER VALUE
0222'  10                      .BYTE   16      ;1200 BAUD TIMER VALUE
0223'  0B                      .BYTE   11      ;1800 BAUD TIMER VALUE
0224'  0A                      .BYTE   10      ;2000 BAUD TIMER VALUE
0225'  08                      .BYTE   8       ;2400 BAUD TIMER VALUE
0226'  05                      .BYTE   5       ;3600 BAUD TIMER VALUE
0227'  04                      .BYTE   4       ;4800 BAUD TIMER VALUE
0228'  03                      .BYTE   3       ;7200 BAUD TIMER VALUE
0229'  02                      .BYTE   2       ;9600 BAUD TIMER VALUE
022A'  01                      .BYTE   1       ;19200 BAUD TIMER VALUE
                       ;
022B'  78              SERRBR: MOV     A,B     ;GET CHANNEL NUMBER
022C'  21 000B"                LXI     H,SOBR  ;GET SERIAL 0 BAUD RATE
022F'  B7                      ORA     A       ;CHANNEL NUMBER=0?
0230'  2803                    JRZ     ..COM   ;IF SO, CONTINUE
0232'  21 0029"                LXI     H,S1BR  ;ELSE, GET SERIAL 1 BAUD RATE
0235'  7E              ..COM:  MOV     A,M     ;GET CURRENT BAUD RATE CODE
0236'  C9                      RET             ;DONE
                       ;
0237'  3EEA            SERSMC: MVI     A,0EAH  ;GET WRITE REGISTER 5 CONTROL WORI
0239'  E67D                    ANI     #82H    ;STRIP RTS/CTS CONTROL BITS
023B'  CB79                    BIT     7,C     ;RTS REQUESTED?
023D'  2802                    JRZ     ..NRTS
023F'  CBCF                    SET     1,A     ;IF SO, SET RTS BIT
0241'  CB71            ..NRTS: BIT     6,C     ;DTR REQUESTED?
0243'  2802                    JRZ     ..NDTR
0245'  CBFF                    SET     7,A     ;IF SO, SET DTR BIT
0247'  57              ..NDTR: MOV     D,A     ;REQUESTED MODEM CONTROLS TO D-REC
0248'  0E2E                    MVI     C,SIOACR  ;GET SIO PORT A CONTROL REGISTEI
024A'  78                      MOV     A,B     ;GET CHANNEL NUMBER
024B'  B7                      ORA     A       ;CHANNEL NUMBER=0?
024C'  2802                    JRZ     ..COM   ;IF SO, CONTINUE
024E'  0E2F                    MVI     C,SIOBCR  ;GET SIO PORT B CONTROL REGISTEI
0250'  3E05            ..COM:  MVI     A,5     ;SELECT WRITE REGISTER 5
0252'  ED79                    OUTP    A
0254'  ED51                    OUTP    D       ;OUTPUT WRITE REGISTER 5 CONTROL V
                       D
0256'  C9                      RET             ;DONE
                       ;
0257'  0E2E            SERRMC: MVI     C,SIOACR  ;GET SIO PORT A CONTROL REGISTEI
0259'  78                      MOV     A,B     ;GET CHANNEL NUMBER
025A'  B7                      ORA     A       ;CHANNEL NUMBER=0?
025B'  2802                    JRZ     ..COM   ;IF SO, CONTINUE
025D'  0E2F                    MVI     C,SIOBCR  ;GET SIO PORT B CONTROL REGISTEI
025F'  3E10            ..COM:  MVI     A,10H   ;GET RESET EXTERNAL STATUS COMMANI
0261'  ED79                    OUTP    A       ;RESET EXTERNAL STATUS
0263'  ED50                    INP     D       ;GET SIO MODEM STATUS
0265'  AF                      XRA     A       ;CLEAR RETURN VECTOR
0266'  CB6A                    BIT     CTS,D   ;CTS SET?
0268'  2802                    JRZ     ..NCTS  ;IF NOT, CONTINUE
026A'  CBFF                    SET     7,A     ;ELSE, SET CTS BIT
026C'  CB5A            ..NCTS: BIT     DCD,D   ;DCD SET?
026E'  C8                      RZ              ;IF NOT, DONE
```

'D740 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL DRIVER (IMS 740)
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```
026F'   CBEF                    SET     5,A     ;ELSE, SET DCD BIT
0271'   C9                      RET             ;DONE
                        ;
                        .END
```

SLVRES - TURBODOS OPERATING SYSTEM SLAVE RESET PROCESSOR


```
                        ;
                        ; ***********************************************************
                        ; *                                                         *
                        ; *  This is a subroutine called by SPD740 which de-        *
                        ; *  tects two consecutive slave reset characters from      *
                        ; *  the console keyboard, and forces a crash which         *
                        ; *  ultimately causes the slave to be reset by the         *
                        ; *  master.                                                *
                        ; *                                                         *
                        ; ***********************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  SLVRES          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   1F              SLRCHR::.BYTE   AUS     ;SLAVE RESET CHARACTER
0001"   FE              RCCNT:  .BYTE   -2      ;RESET CHARACTER COUNT
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   21 0001"        SLVRES::LXI     H,RCCNT ;GET RESET CHARACTER COUNT
0003'   3A 0000"                LDA     SLRCHR  ;GET SLAVE RESET CHARACTER
0006'   B9                      CMP     C       ;CHARACTER=SLAVE RESET CHARACTER?
0007'   2803                    JRZ     ..RC    ;IF SO, CONTINUE
0009'   36FE                    MVI     M,-2    ;ELSE, RESET CHARACTER COUNT
000B'   C9                      RET             ;DONE
000C'   34              ..RC:   INR     M       ;INCREMENT RESET CHARACTER COUNT
000D'   C0                      RNZ             ;IF CHARACTER COUNT NOT=0, DONE
000E'   F3                      DI              ;ELSE, DISABLE INTERRUPTS
000F'   76                      HLT             ;HALT
                        ;
                        .END
```

PB401 - TURBODOS OPERATING SYSTEM MASTER PROCESSOR BOOT FOR IMS 401


```
                        ;
                        ; ********************************************************
                        ; *                                                      *
                        ; *  This is a boot ROM driver module which interfaces   *
                        ; *  with the IMS 401 eight-inch floppy disk controller  *
                        ; *  board.  This driver is linked together with two     *
                        ; *  other modules, OSBOOT.REL and DST8F.REL, to create  *
                        ; *  a boot ROM for an IMS 8000 system.                  *
                        ; *                                                      *
                        ; ********************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  MPB401          ;MODULE ID
                        ;
                        .INSERT EQUATE          ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0080                    RAM     =: TBUF         ;WORKING STORAGE ADDRESS
0040                    RAMLEN  = 64            ;WORKING STORAGE LENGTH
                        ;
0082                    CH1DMA  = 82H           ;CHANNEL 1 DMA REGISTER (FDC)
0083                    CH1TC   = 83H           ;CHANNEL 1 TERMINAL COUNT (FDC)
0088                    DMACTL  = 88H           ;DMA COMMAND AND STATUS REGISTERS
008A                    DSKSEL  = 8AH           ;DISK SELECT PORT
008C                    DSKCTL  = 8CH           ;STATUS AND INT MASK (BOARD)
008E                    FDCST   = 8EH           ;DISK CONTROLLER STATUS (uPD-765)
008F                    FDCDAT  = 8FH           ;DISK CONTROLLER DATA (uPD-765)
                        ;
0042                    CH1ENA  = 42H           ;DMA CHANNEL 1 ENABLE COMMAND
0000                    DMAVFY  = 00H           ;DMA VERIFY COMMAND
0040                    DMARD   = 40H           ;DMA READ COMMAND
0080                    DMAWR   = 80H           ;DMA WRITE COMMAND
                        ;
0003                    FDCSFY  = 03H           ;FDC SPECIFY COMMAND
0004                    FDCSDS  = 04H           ;FDC SENSE DRIVE STATUS COMMAND
0007                    FDCRCL  = 07H           ;FDC RECALIBRATE COMMAND
0008                    FDCSIS  = 08H           ;FDC SENSE INTERRUPT STATUS COMMAN
000A                    FDCRID  = 0AH           ;FDC READ ID COMMAND
000F                    FDCSK   = 0FH           ;FDC SEEK COMMAND
0085                    FDCWR   = 85H           ;FDC WRITE COMMAND
0086                    FDCRD   = 86H           ;FDC READ COMMAND
                        ;
0000                    DSKENI  = 0             ;DISK CONTROLLER ENABLE INTERRUPTS
0007                    DSKDLC  = 7             ;DISK CONTROLLER DELAY COMPLETE
                        ;
0006                    FDCMFM  = 6             ;FDC DOUBLE-DENSITY BIT
                        ;
0004                    FDCBSY  = 4             ;FDC BUSY STATUS
0005                    FDCSE   = 5             ;FDC SEEK END
```

MPB401 - TURBODOS OPERATING SYSTEM MASTER PROCESSOR BOOT FOR IMS 401


```
0006                    FDCOUT  = 6             ;FDC OUTPUT MODE
0007                    FDCRDY  = 7             ;FDC READY FOR DATA
                        ;
00C0                    SRT5    = (16-4)<4      ;5 INCH FDD STEP RATE (4 MS-MINI)
00A0                    SRT8S   = (16-6)<4      ;8 INCH FDD STEP RATE (6 MS-SHUGAI

00D0                    SRT8R   = (16-3)<4      ;8 INCH FDD STEP RATE (3 MS-REMEX)
00F0                    SRT8P   = (16-1)<4      ;8 INCH FDD STEP RATE (1 MS-PERSCI
                        ;
0024                    HLT     = 18*2          ;FDD HEAD LOAD TIME (36 MS)
0001                    HUT     = 1             ;FDD HEAD UNLOAD TIME (16 MS)
                        ;
0003                    STONR   = 3             ;STATUS REGISTER 0 NOT READY
0004                    STOEC   = 4             ;STATUS REGISTER 0 EQUIP CHECK
0005                    STOSE   = 5             ;STATUS REGISTER 0 SEEK END
                        ;
0000                    ST1MA   = 0             ;STATUS REGISTER 1 MISSING ADDR MK
0001                    ST1NW   = 1             ;STATUS REGISTER 1 NOT WRITABLE
0002                    ST1ND   = 2             ;STATUS REGISTER 1 NO DATA
0004                    ST1OR   = 4             ;STATUS REGISTER 1 OVER RUN
0005                    ST1DE   = 5             ;STATUS REGISTER 1 DATA ERROR
                        ;
0003                    ST3TS   = 3             ;STATUS REGISTER 3 TWO-SIDED
0004                    ST3T0   = 4             ;STATUS REGISTER 3 TRACK 0
0005                    ST3RDY  = 5             ;STATUS REGISTER 3 READY
0006                    ST3WP   = 6             ;STATUS REGISTER 3 WRITE PROTECTED
                        ;
0002                    TSD     = 2             ;TWO-SIDED DISK BIT (TYPE CODE)
0003                    DDD     = 3             ;DOUBLE DENSITY DISK BIT (TYPE COD

                        ;
000A                    MAXTRY  = 10            ;MAX TRY COUNT
                        ;
00C0                            .LOC    RAM+RAMLEN  ;LOCATE IN WORKING STORAGE ARE
                        ;
00C0                    IODSK:  .BLKB   1       ;DISK NUMBER
00C1                    IOTRK:  .BLKW   1       ;TRACK NUMBER
00C3                    IOSEC:  .BLKW   1       ;SECTOR NUMBER
00C5                    IODMA:  .BLKW   1       ;DMA ADDRESS
00C7                    ST3REG: .BLKB   1       ;STATUS REGISTER 3
00C8                    TRYCNT: .BLKB   1       ;TRY COUNT
                        ;
00C9                    DSKNFO:                 ;DISK TYPE INFORMATION
00C9                    BLKSIZ: .BLKB   1       ;BLOCK SIZE
00CA                    NMBLKS: .BLKW   1       ;NUMBER OF BLOCKS
00CC                    NMBDIR: .BLKB   1       ;NUMBER OF DIRECTORY BLOCKS
00CD                    SECSIZ: .BLKB   1       ;PHYSICAL SECTOR SIZE (2^N*128)
00CE                    SECTRK: .BLKW   1       ;PHYSICAL SECTORS PER TRACK
00D0                    TRKDSK: .BLKW   1       ;PHYSICAL TRACKS PER DISK
00D2                    RESTRK: .BLKW   1       ;NUMBER OF RESERVED TRACKS
00D4                    XLTBL:  .BLKW   1       ;TRANSLATION TABLE ADDRESS
00D6                    TYPCOD: .BLKB   1       ;DISK TYPE CODE
00D7                    GAPLEN: .BLKB   1       ;GAP LENGTH
000F                    DNFOL   = .-DSKNFO      ;DISK INFO LENGTH
```

?B401 - TURBODOS OPERATING SYSTEM MASTER PROCESSOR BOOT FOR IMS 401
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```
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   3E03            INIT::  MVI     A,FDCSFY  ;GET FDC SPECIFY COMMAND
0002'   CD 01B3'                CALL    DATOUT  ;OUTPUT FDC SPECIFY COMMAND
0005'   3EA1                   MVI     A,SRT8S!HUT  ;GET STEP RATE/HEAD UNLD TIME
0007'   CD 01B3'                CALL    DATOUT  ;OUTPUT STEP RATE/HEAD UNLD TIME
000A'   3E24                   MVI     A,HLT   ;GET HEAD LOAD TIME/NON-DMA BIT
000C'   CD 01B3'                CALL    DATOUT  ;OUTPUT HEAD LOAD TIME/NON-DMA BIT
000F'   21 0100                 LXI     H,TPA   ;GET LOAD BASE ADDRESS
0012'   C9                      RET             ;DONE
                        ;
0013'   FE04            SELECT::CPI     4       ;TEST FOR VALID DRIVE
0015'   3061                   JRNC    ..NR    ;IF INVALID DRIVE, CONTINUE
0017'   32 00C0                STA     IODSK   ;ELSE, SET DISK NUMBER
001A'   4F                      MOV     C,A     ;DISK NUMBER TO C-REG
001B'   DB8C                    IN      DSKCTL  ;GET DISK CONTROLLER STATUS
001D'   0F                      RRC             ;EXTRACT SELECTED DRIVE
001E'   E603                    ANI     3
0020'   B9                      CMP     C       ;DRIVE ALREADY SELECTED?
0021'   2803                    JRZ     ..DS    ;IF SO, CONTINUE
0023'   79                      MOV     A,C     ;ELSE, GET DISK NUMBER
0024'   D38A                    OUT     DSKSEL  ;SELECT DISK NUMBER
0026'   01 0014          ..DS:  LXI     B,20    ;DELAY 10 MILLISECONDS
0029'   10FE            ..DLY: DJNZ    ..DLY
002B'   0D                      DCR     C
002C'   20FB                    JRNZ    ..DLY
002E'   3E04                    MVI     A,FDCSDS  ;GET FDC SENSE DRIVE STATUS CMD
0030'   CD 01B3'                CALL    DATOUT  ;OUTPUT COMMAND TO FDC
0033'   3A 00C0                LDA     IODSK   ;GET DISK NUMBER
0036'   CD 01B3'                CALL    DATOUT  ;OUTPUT IT TO FDC
0039'   CD 01A7'                CALL    DATAIN  ;GET STATUS REGISTER 3
003C'   CB6F                    BIT     ST3RDY,A  ;DRIVE READY?
003E'   2838                    JRZ     ..NR    ;IF NOT READY, CONTINUE
0040'   32 00C7                STA     ST3REG  ;ELSE, SAVE STATUS REGISTER 3
0043'   CD 0165'                CALL    RECAL   ;RECALIBRATE DRIVE
0046'   2030                   JRNZ    ..NR    ;IF ERRORS, CONTINUE
0048'   0E00                    MVI     C,0     ;ELSE, GET INITIAL TYPE VALUE
004A'   21 00C7                 LXI     H,ST3REG  ;GET STATUS REGISTER 3
004D'   CB5E                    BIT     ST3TS,M ;ONE-SIDED DISK?
004F'   2802                    JRZ     ..OSD   ;YES
0051'   CBD1                    SET     TSD,C   ;SET TWO-SIDED DISK BIT
0053'   3E0A            ..OSD:  MVI     A,FDCRID  ;GET FDC READ ID COMMAND (SD)
0055'   CD 0089'                CALL    ..RID   ;ATTEMPT TO READ SINGLE-DENSITY
0058'   2809                   JRZ     ..TPC   ;IF SINGLE-DENSITY, DONE
005A'   3E4A                    MVI     A,FDCRID!1<FDCMFM  ;GET READ ID CMD (DD)
005C'   CD 0089'                CALL    ..RID   ;ATTEMPT TO READ DOUBLE-DENSITY
005F'   2017                    JRNZ    ..NR    ;IF NOT DOUBLE-DENSITY, DONE
0061'   CBD9                    SET     DDD,C   ;SET DOUBLE-DENSITY DISK BIT
0063'   B1              ..TPC:  ORA     C       ;ADD SECTOR SIZE TO TYPE CODE
0064'   4F                      MOV     C,A     ;SAVE TYPE CODE IN C-REG
0065'   11 0000:04              LXI     D,DSTBLS#  ;GET DST BASE ADDRESS
0068'   79              ..SL:   MOV     A,C     ;GET DISK TYPE CODE
0069'   21 0000:05              LXI     H,DTCO# ;GET OFFSET TO DISK TYPE CODE
```

MPB401 - TURBODOS OPERATING SYSTEM MASTER PROCESSOR BOOT FOR IMS 401


```
006C'   19                      DAD     D       ;CALC DISK TYPE CODE ADDRESS
006D'   BE                      CMP     M       ;DST FOUND?
006E'   EB                      XCHG            ;DST ADDRESS TO HL-REG
006F'   2809                    JRZ     ..DSTF  ;IF DST FOUND, CONTINUE
0071'   5E                      MOV     E,M     ;ELSE, GET NEXT DST ADDRESS
0072'   23                      INX     H
0073'   56                      MOV     D,M
0074'   7A                      MOV     A,D
0075'   B3                      ORA     E       ;END OF LIST?
0076'   20F0                    JRNZ    ..SL    ;IF NOT, CONTINUE
0078'   AF              ..NR:   XRA     A       ;SET RETURN CODE=0
0079'   C9                      RET             ;DONE
007A'   23              ..DSTF: INX     H       ;ADVANCE PAST LINK POINTER
007B'   23                      INX     H
007C'   E5                      PUSH    H       ;SAVE DST ADDRESS
007D'   11 00C9                 LXI     D,DSKNFO  ;GET DISK INFO WORK AREA
0080'   01 000F                 LXI     B,DNFOL ;GET DISK INFO LENGTH
0083'   EDB0                    LDIR            ;COPY DST INTO WORK AREA
0085'   E1                      POP     H       ;RESTORE DST ADDRESS
0086'   3EFF                    MVI     A,0FFH  ;SET RETURN CODE=0FFH
0088'   C9                      RET             ;DONE
0089'   C5              ..RID:  PUSH    B       ;SAVE BC-REG
008A'   CD 01B3'                CALL    DATOUT  ;OUTPUT COMMAND TO FDC
008D'   3A 00C0                 LDA     IODSK   ;GET DISK NUMBER
0090'   CD 01B3'                CALL    DATOUT  ;OUTPUT IT TO FDC
0093'   CD 0170'                CALL    WTINT   ;WAIT FOR INTERRUPT
0096'   78                      MOV     A,B     ;RETURN SECTOR SIZE
0097'   C1                      POP     B       ;RESTORE BC-REG
0098'   C9                      RET             ;DONE
                        ;
0099'   ED43 00C1       READ::  SBCD    IOTRK   ;SAVE TRACK NUMBER
009D'   ED53 00C3               SDED    IOSEC   ;SAVE SECTOR NUMBER
00A1'   22 00C5                 SHLD    IODMA   ;SAVE DMA ADDRESS
00A4'   21 00C8                 LXI     H,TRYCNT  ;GET TRY COUNT
00A7'   360A                    MVI     M,MAXTRY  ;INITIALIZE TRY COUNT
00A9'   CD 0152'        ..RR:   CALL    SEEK    ;SEEK TO REQUESTED TRACK
00AC'   C2 0143'                JNZ     ..ERR   ;IF ERRORS, CONTINUE
00AF'   AF                      XRA     A
00B0'   D388                    OUT     DMACTL  ;RESET DMA CONTROLLER
00B2'   21 0080                 LXI     H,128   ;GET SECTOR SIZE=0 SECTOR LENGTH
00B5'   3A 00CD                 LDA     SECSIZ  ;GET PHYSICAL SECTOR SIZE
00B8'   B7                      ORA     A       ;PHYSICAL SECTOR SIZE=0?
00B9'   2804                    JRZ     ..NO1   ;IF SO, CONTINUE
00BB'   29              ..SL:   DAD     H       ;ELSE, SHIFT HL-REG LEFT
00BC'   3D                      DCR     A       ;SECTOR SIZE TIMES
00BD'   20FC                    JRNZ    ..SL
00BF'   2B              ..NO1:  DCX     H       ;COUNT -1 FOR 8257
00C0'   7D                      MOV     A,L     ;GET LSB OF TERMINAL COUNT
00C1'   D383                    OUT     CH1TC   ;OUTPUT LSB OF TERMINAL COUNT
00C3'   7C                      MOV     A,H     ;GET MSB OF TERMINAL COUNT
00C4'   F640                    ORI     DMARD   ;ADD DMA READ COMMAND
00C6'   D383                    OUT     CH1TC   ;OUTPUT MSB OF TERMINAL COUNT
00C8'   2A 00C5                 LHLD    IODMA   ;GET DMA ADDRESS
00CB'   7D                      MOV     A,L     ;GET LSB OF DMA ADDRESS
```

B401 - TURBODOS OPERATING SYSTEM MASTER PROCESSOR BOOT FOR IMS 401
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```
00CC'  D382                    OUT     CH1DMA  ;OUTPUT LSB OF DMA ADDRESS
00CE'  7C                      MOV     A,H     ;GET MSB OF DMA ADDRESS
00CF'  D382                    OUT     CH1DMA  ;OUTPUT MSB OF DMA ADDRESS
00D1'  3E42                    MVI     A,CH1ENA  ;GET CHANNEL 1 ENABLE COMMAND
00D3'  D388                    OUT     DMACTL  ;ENABLE DMA CONTROLLER
00D5'  3E86                    MVI     A,FDCRD ;GET FDC READ COMMAND
00D7'  21 00D6                 LXI     H,TYPCOD  ;GET DISK TYPE CODE
00DA'  CB5E                    BIT     DDD,M   ;SINGLE DENSITY DISK?
00DC'  2802                    JRZ     ..SD    ;IF SO, CONTINUE
00DE'  CBF7                    SET     FDCMFM,A  ;ELSE, SET FDC MFM BIT
00E0'  CD 01B3'        ..SD:   CALL    DATOUT  ;OUTPUT FDC READ COMMAND
00E3'  3A 00C3                 LDA     IOSEC   ;GET SECTOR NUMBER
00E6'  5F                      MOV     E,A     ;SECTOR NUMBER TO E-REG
00E7'  2A 00D4                 LHLD    XLTBL   ;GET TRANSLATION TABLE ADDRESS
00EA'  7C                      MOV     A,H
00EB'  B5                      ORA     L       ;SECTOR TRANSLATION REQUIRED?
00EC'  2804                    JRZ     ..NI    ;IF NOT, CONTINUE
00EE'  1600                    MVI     D,0     ;ELSE, MAKE SECTOR DOUBLE LENGTH
00F0'  19                      DAD     D       ;INDEX INTO TRANSLATION TABLE
00F1'  5E                      MOV     E,M     ;GET TRANSLATED SECTOR NUMBER
00F2'  1C              ..NI:   INR     E       ;CONVERT SECTOR TO BASE 1
00F3'  3A 00CE                 LDA     SECTRK  ;GET NUMBER OF SECTORS/TRACK
00F6'  21 00D6                 LXI     H,TYPCOD  ;GET DISK TYPE CODE ADDRESS
00F9'  CB56                    BIT     TSD,M   ;TWO SIDED DISK?
00FB'  2802                    JRZ     ..SSD   ;IF NOT, CONTINUE
00FD'  CB3F                    SRLR    A       ;ELSE, CALC NUMBER OF SECTORS/SIDE
00FF'  57              ..SSD:  MOV     D,A     ;SAVE NUMBER OF SECTORS/SIDE
0100'  0600                    MVI     B,0     ;PRESET FOR FRONT SIDE
0102'  BB                      CMP     E       ;FRONT SIDE OF DISK?
0103'  3004                    JRNC    ..FS1   ;IF SO, CONTINUE
0105'  7B                      MOV     A,E     ;ELSE, GET SECTOR NUMBER
0106'  92                      SUB     D       ;SUBTRACT ONE SIDES WORTH
0107'  5F                      MOV     E,A     ;SECTOR NUMBER TO C-REG
0108'  04                      INR     B       ;SET HEAD NUMBER=1
0109'  3A 00C0         ..FS1:  LDA     IODSK   ;GET DISK NUMBER
010C'  04                      INR     B
010D'  05                      DCR     B       ;HEAD=0?
010E'  2802                    JRZ     ..FS2   ;IF SO, CONTINUE
0110'  CBD7                    SET     2,A     ;ELSE, SET HEAD BIT
0112'  CD 01B3'        ..FS2:  CALL    DATOUT  ;OUTPUT UNIT NUMBER
0115'  3A 00C1                 LDA     IOTRK   ;GET TRACK NUMBER
0118'  CD 01B3'                CALL    DATOUT  ;OUTPUT TRACK NUMBER
011B'  78                      MOV     A,B     ;GET HEAD NUMBER
011C'  CD 01B3'                CALL    DATOUT  ;OUTPUT HEAD NUMBER
011F'  7B                      MOV     A,E     ;GET SECTOR NUMBER
0120'  CD 01B3'                CALL    DATOUT  ;OUTPUT SECTOR NUMBER
0123'  3A 00CD                 LDA     SECSIZ  ;GET SECTOR SIZE
0126'  F5                      PUSH    PSW     ;SAVE SECTOR SIZE
0127'  CD 01B3'                CALL    DATOUT  ;OUTPUT SECTOR SIZE
012A'  7A                      MOV     A,D     ;GET EOT
012B'  CD 01B3'                CALL    DATOUT  ;OUTPUT EOT
012E'  3A 00D7                 LDA     GAPLEN  ;GET GAP LENGTH
0131'  CD 01B3'                CALL    DATOUT  ;OUTPUT GAP LENGTH
0134'  F1                      POP     PSW     ;RESTORE SECTOR SIZE
```

MPB401 - TURBODOS OPERATING SYSTEM MASTER PROCESSOR BOOT FOR IMS 401


```
0135'  B7                    ORA     A         ;SECTOR SIZE=0?
0136'  3E80                  MVI     A,128     ;PRESET DTL=128
0138'  2802                  JRZ     ..NO      ;IF SECTOR SIZE=0, CONTINUE
013A'  3EFF                  MVI     A,0FFH    ;ELSE, DTL=0FFH
013C'  CD 01B3'      ..NO:   CALL    DATOUT    ;OUTPUT DTL
013F'  CD 0170'              CALL    WTINT     ;WAIT FOR INTERRUPT
0142'  C8                    RZ                ;IF NO ERRORS, DONE
0143'  CD 0165'      ..ERR:  CALL    RECAL     ;RECALIBRATE DRIVE
0146'  2007                  JRNZ    ..X       ;IF ERRORS, CONTINUE
0148'  21 00C8               LXI     H,TRYCNT  ;ELSE, GET TRY COUNT
014B'  35                    DCR     M         ;DECREMENT TRY COUNT
014C'  C2 00A9'              JNZ     ..RR      ;IF COUNT NOT EXH, TRY AGAIN
014F'  3EFF          ..X:    MVI     A,0FFH    ;ELSE, SET RETURN CODE=0FFH
0151'  C9                    RET               ;DONE
                     ;
0152'  3E0F          SEEK:   MVI     A,FDCSK   ;SET FDC SEEK COMMAND
0154'  CD 01B3'              CALL    DATOUT    ;OUTPUT FDC SEEK COMMAND
0157'  3A 00C0               LDA     IODSK     ;GET DISK NUMBER
015A'  CD 01B3'              CALL    DATOUT    ;OUTPUT DISK NUMBER
015D'  3A 00C1               LDA     IOTRK     ;GET TRACK NUMBER
0160'  CD 01B3'              CALL    DATOUT    ;OUTPUT TRACK NUMBER
0163'  180B                  JMPR    WTINT     ;WAIT FOR INTERRUPT
                     ;
0165'  3E07          RECAL:  MVI     A,FDCRCL  ;SET FDC RECALIBRATE COMMAND
0167'  CD 01B3'              CALL    DATOUT    ;OUTPUT FDC RECALIBRATE COMMAND
016A'  3A 00C0               LDA     IODSK     ;GET DISK NUMBER
016D'  CD 01B3'              CALL    DATOUT    ;OUTPUT DISK NUMBER
                     ;
0170'  DB8C          WTINT:  IN      DSKCTL    ;GET DISK CONTROLLER STATUS
0172'  0F                    RRC               ;TEST FOR FDC INTERRUPT
0173'  30FB                  JRNC    WTINT     ;IF NO INTERRUPT, WAIT
0175'  DB8E          ..RQML: IN      FDCST     ;GET FDC STATUS
0177'  07                    RLC               ;FDC READY TO COMMUMICATE?
0178'  30FB                  JRNC    ..RQML    ;IF NOT, WAIT
017A'  07                    RLC               ;TEST FDC DIRECTION
017B'  3818                  JRC     ..RW      ;IF FDC OUTPUT AVAILABLE, PROCESS
017D'  3E08                  MVI     A,FDCSIS  ;GET SENSE INTERRUPT STATUS CMI
017F'  D38F                  OUT     FDCDAT    ;OUTPUT BYTE TO FDC DATA REGISTEF
0181'  CD 01A7'              CALL    DATAIN    ;GET STATUS REGISTER 0
0184'  4F                    MOV     C,A       ;SAVE IT IN C-REG
0185'  E6C0                  ANI     0C0H      ;EXTRACT COMPLETION STATUS
0187'  FE80                  CPI     80H       ;INTERRUPT STACK EMPTY?
0189'  2818                  JRZ     ..X       ;IF SO, DONE
018B'  CD 01A7'              CALL    DATAIN    ;GET PRESENT CYLINDER NUMBER
018E'  CB69                  BIT     STOSE,C   ;READY LINE CHANGE STATE?
0190'  28E3                  JRZ     ..RQML    ;IF SO, IGNORE
0192'  51                    MOV     D,C       ;GET STATUS REGISTER 0 IN D-REG
0193'  18E0                  JMPR    ..RQML    ;FLUSH ANY REMAINING INTERRUPTS
0195'  CD 01A7'      ..RW:   CALL    DATAIN    ;GET STATUS REGISTER 0
0198'  57                    MOV     D,A       ;TO D-REG
0199'  0606                  MVI     B,6       ;B=LENGTH OF REMAINING RESULT PH/
019B'  CD 01A7'      ..RL:   CALL    DATAIN    ;GET RESULT BYTE FROM FDC
019E'  10FB                  DJNZ    ..RL      ;READ ALL SEVEN BYTES
01A0'  47                    MOV     B,A       ;SAVE SECTOR SIZE IN B-REG
```

PB401 - TURBODOS OPERATING SYSTEM MASTER PROCESSOR BOOT FOR IMS 401


```
01A1'   18D2                    JMPR    ..RQML  ;FLUSH ANY REMAINING INTERRUPTS
01A3'   7A              ..X:    MOV     A,D     ;GET STATUS REGISTER 0
01A4'   E6C0                    ANI     0C0H    ;EXTRACT COMPLETION STATUS
01A6'   C9                      RET             ;DONE
                        ;
01A7'   DB8E            DATAIN: IN      FDCST   ;GET FDC STATUS
01A9'   07                      RLC             ;TEST FDC FOR READY
01AA'   30FB                    JRNC    DATAIN  ;IF NOT READY, WAIT
01AC'   07                      RLC             ;TEST FDC DIRECTION
01AD'   D2 0000:06              JNC     .BEG.#  ;IF WRONG DIRECTION, CONTINUE
01B0'   DB8F                    IN      FDCDAT  ;GET FDC DATA BYTE
01B2'   C9                      RET             ;DONE
                        ;
01B3'   4F              DATOUT: MOV     C,A     ;SAVE OUTPUT BYTE
01B4'   DB8E            ..RW:   IN      FDCST   ;GET FDC STATUS
01B6'   07                      RLC             ;TEST FDC FOR READY
01B7'   30FB                    JRNC    ..RW    ;IF NOT READY, WAIT
01B9'   07                      RLC             ;TEST FDC DIRECTION
01BA'   DA 0000:06              JC      .BEG.#  ;IF WRONG DIRECTION, CONTINUE
01BD'   79                      MOV     A,C     ;RESTORE OUTPUT BUTE
01BE'   D38F                    OUT     FDCDAT  ;OUTPUT BYTE TO FDC DATA REGISTER
01C0'   C9                      RET             ;DONE
                        ;
01C1'   AF              XFER::  XRA     A
01C2'   32 0080                 STA     TBUF    ;MAKE DEFAULT BUFFER EMPTY
01C5'   C3 0100                 JMP     TPA     ;TRANSFER TO O/S LOADER
                        ;
                        .END
```

```
                        ;
                        ;*****************************************************
                        ;*
                        ;*  This is a boot ROM for the IMS 740 slave processor
                        ;*  board.  It downloads and executes a block of code
                        ;*  sent by the master.  Normally, the master sends
                        ;*  the network loader module LOD740, which handles
                        ;*  the actual downloading of the slave operating sys-
                        ;*  tem.
                        ;*
                        ;*****************************************************
                        ;
                        ; COPYRIGHT (C) 1982, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: EXAMPLE
                        ;
                        .IDENT  SPB740          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0020                    PORTAD  = 20H           ;8255 PORT A DATA REGISTER
0024                    PIOADR  = 24H           ;PIO PORT A DATA REGISTER
0025                    PIOBDR  = 25H           ;PIO PORT B DATA REGISTER
0026                    PIOACR  = 26H           ;PIO PORT A CONTROL REGISTER
0027                    PIOBCR  = 27H           ;PIO PORT B CONTROL REGISTER
                        ;
0005                    PORTC5  = 5             ;PORT C DATA BIT 5 (IBF)
0006                    PORTC7  = 6             ;PORT C DATA BIT 7 (OBF)
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   F3              SPBOOT: DI              ;DISABLE INTERRUPTS
0001'   31 0900                 LXI     SP,900H ;INITIALIZE STACK POINTER
0004'   3ECF                   MVI     A,0CFH  ;GET PIO A MODE WORD (MODE 3)
0006'   D326                   OUT     PIOACR  ;OUTPUT PIO A MODE WORD
0008'   3EFF                   MVI     A,0FFH  ;GET PIO A MODE 3 MODE WORD
000A'   D326                   OUT     PIOACR  ;OUTPUT PIO A MODE 3 MODE WORD
000C'   3EF0                   MVI     A,0F0H  ;GET PIO B DATA DATA WORD
000E'   D325                   OUT     PIOBDR  ;OUTPUT PIO B DATA WORD
0010'   3E0F                   MVI     A,0FH   ;GET PIO B MODE WORD (MODE 0)
0012'   D327                   OUT     PIOBCR  ;OUTPUT PIO B MODE WORD
0014'   DB20                   IN      PORTAD  ;CLEAR INPUT PORT A
0016'   21 0900                LXI     H,0900H ;GET INTERMEDIATE BOOT LOAD ADI
0019'   11 0004                LXI     D,4     ;GET LENGTH OF LOAD ADDRESS/LEN
001C'   CD 003B'               CALL    RCV740  ;RECEIVE LOAD ADDRESS/LENGTH
001F'   2A 0900                 LHLD    0900H   ;GET LOAD ADDRESS
0022'   ED5B 0902              LDED    0902H   ;GET LENGTH
0026'   E5                     PUSH    H       ;SAVE LOAD ADDRESS
0027'   CD 003B'               CALL    RCV740  ;RECEIVE INTERMEDIATE BOOT LOAI
002A'   E5                     PUSH    H       ;PUSH TRANSFER CODE ADDR ONTO S
002B'   EB                     XCHG            ;TRANSFER CODE ADDRESS TO DE-RE
```

```
3740 - TURBODOS OPERATING SYSTEM SLAVE PROCESSOR BOOTSTRAP (IMS 740)
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002C'   21 0035'          LXI     H,XFRCOD  ;GET TRANSFER CODE
002F'   01 0006           LXI     B,XFRLEN  ;GET TRANSFER CODE LENGTH
0032'   EDB0              LDIR              ;MOVE TRANSFER CODE TO DMA ADDRESS
0034'   C9                RET               ;TRANSFER TO TRANSFER CODE
                ;
0035'   F3        XFRCOD: DI                ;DISABLE INTERRUPTS
0036'   3EB0              MVI     A,0B0H    ;GET PIO B DATA BYTE
0038'   D325              OUT     PIOBDR    ;DIABLE BOOTSTRAP EPROM
003A'   C9                RET               ;DONE
                ;
0006            XFRLEN  = .-XFRCOD        ;TRANSFER CODE LENGTH
                ;
003B'   CD 0046'  RCV740: CALL    INBYT     ;INPUT BYTE
003E'   77                MOV     M,A       ;SAVE BYTE IN MESSAGE
003F'   23                INX     H
0040'   1B                DCX     D         ;DECREMENT COUNT
0041'   7A                MOV     A,D
0042'   B3                ORA     E         ;COUNT=0?
0043'   20F6              JRNZ    RCV740    ;IF NOT, CONTINUE
0045'   C9                RET               ;ELSE, DONE
                ;
0046'   DB24      INBYT:  IN      PIOADR    ;GET PIO A DATA REGISTER
0048'   CB77              BIT     PORTC7,A  ;PORT C BIT 7 SET? (OBF)
004A'   20FA              JRNZ    INBYT     ;IF NOT, WAIT
004C'   DB20              IN      PORTAD    ;INPUT BYTE FROM PORT A
004E'   C9                RET               ;DONE
                ;
0000'           .END    SPBOOT
```