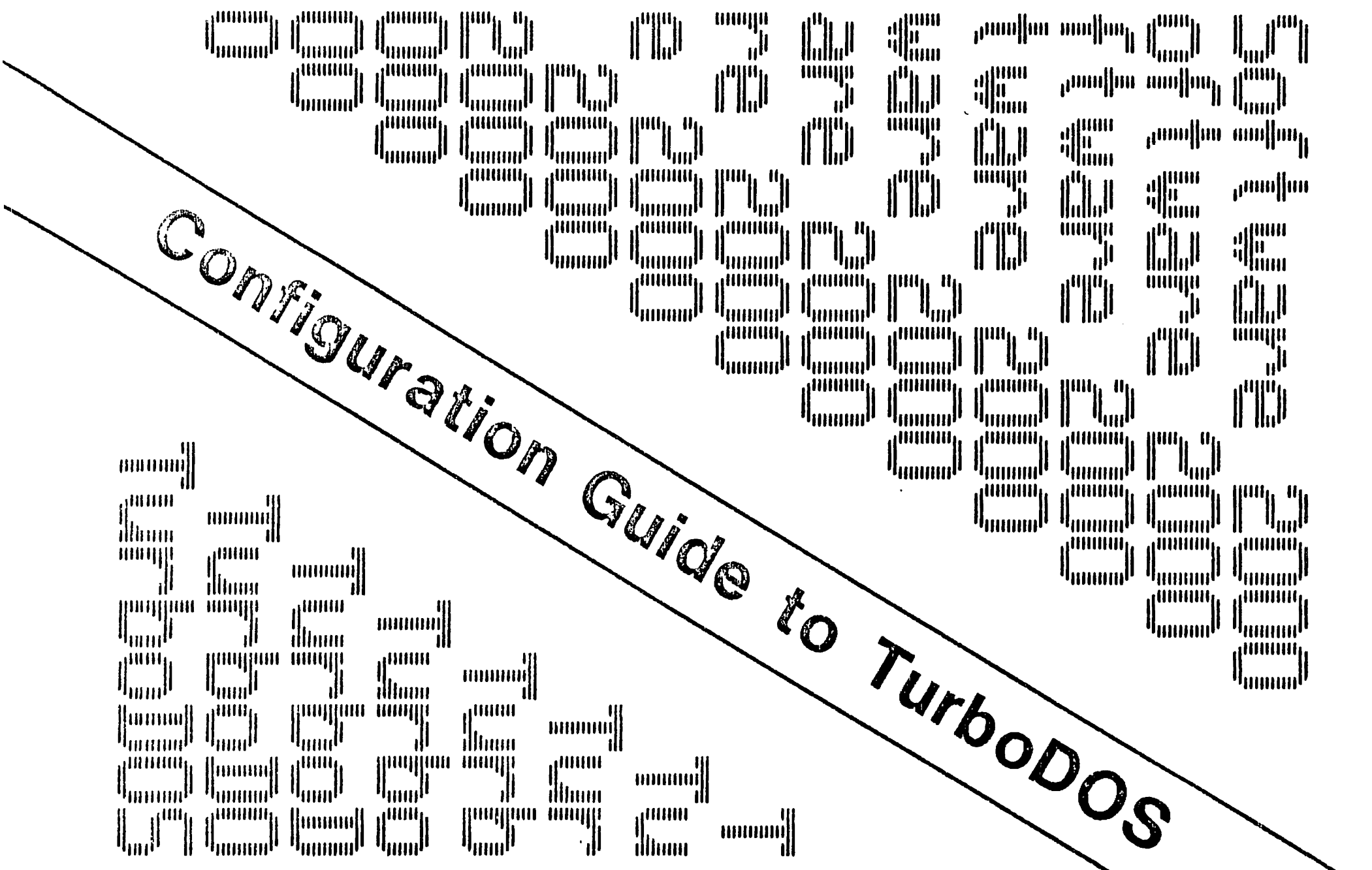
Configuration Guide to TurboDOS

# Configuration Guide to TurboDOS

September, 1981

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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, time-sharing and networking, 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. 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:

- o Console driver
- o Printer driver
- o Disk driver
- o Network interface driver
- o Real-time clock driver
- o 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 in both camera-ready form and 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 Software 2000 Inc. or from an authorized 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 technical assistance in the use of TurboDOS to its customers. OEMs and dealers 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 and dealer to provide technical support to its end-user customers. Software 2000 cannot assist end-users directly. Where exceptional circumstances seem to require direct contact between Software 2000 technical personnel and an end-user, this must be handled strictly by prior arrangement with Software 2000 by the OEM or dealer.

# 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.

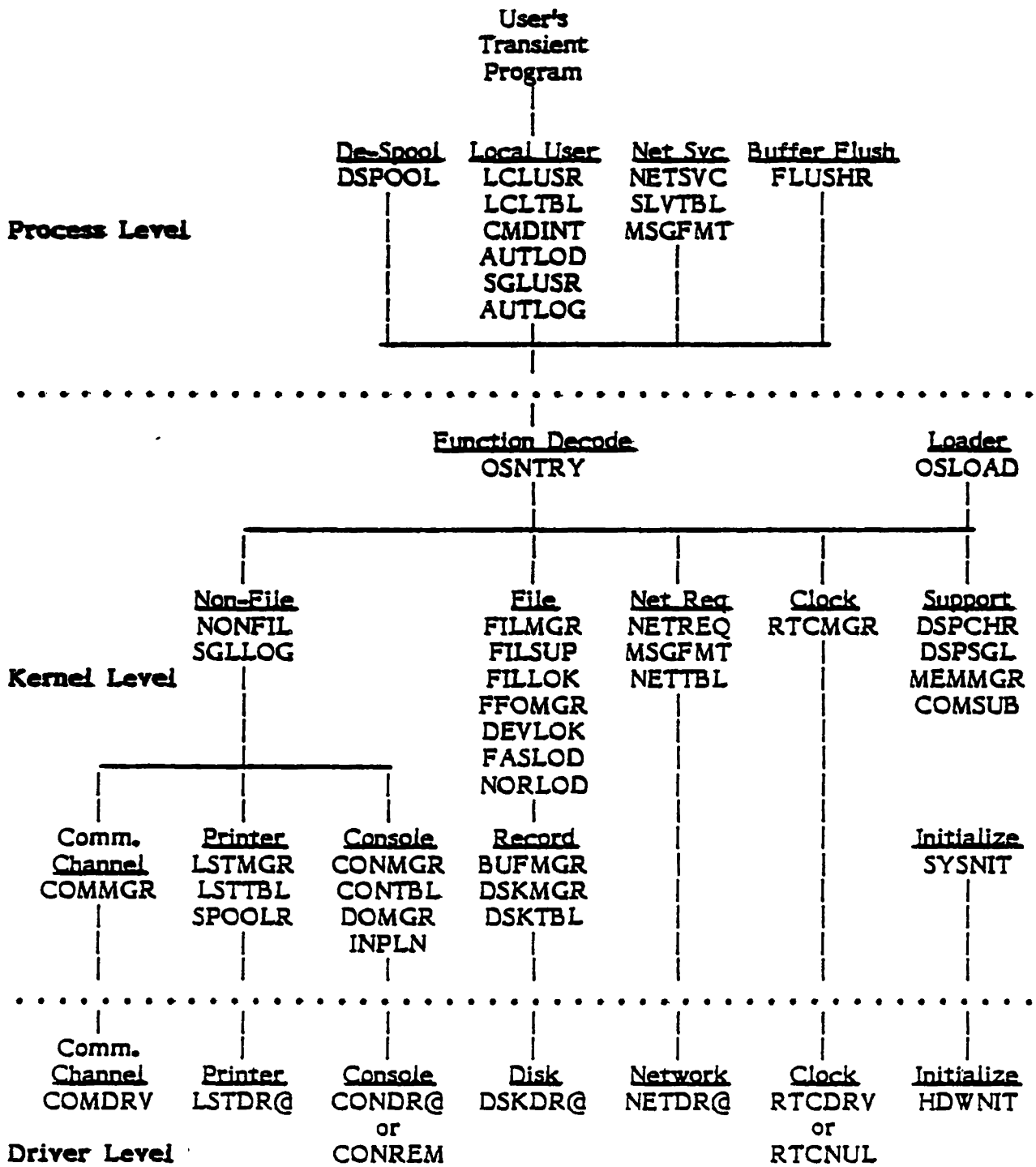
The highest level is known as the "process" level. TurboDOS can support many concurrent processes at this level, and can share the resources of the local computer among them. There are active processes for users who are executing commands and/or transient programs on the local computer. There are also 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 each local printer. 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 (more than 80 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. In multi-user configurations, there is a separate re-entrant instance of the LCLUSR process for each local user. This module may be omitted from a network master configuration where only remote (i.e., slave) users are desired.

**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).

**NETSVC** — Network service process which receives and services network requests from slave microcomputers. In network master configurations, there is a separate re-entrant instance of the NETSVC process for each attached slave.

**SLVTBL** — Table which controls down-loading of network slaves.

**MSGFMT** — Network message format tables used by NETSVC and NETREQ modules.

**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. Not required in single-user configurations in which SGLUSR is present.

## 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. Not required in slave configurations which lack local disk storage.

**FILSUP** — File support routines required by FILMGR.

**FILLOK** — Multi-user file interlock routines called by FILMGR. Not required in single-user configurations.

**FFOMGR** — FIFO management routines called by FILLOK. Not required in single-user configurations.

**DEVLOK** — Multi-user device interlock routines called by FILMGR. Not required in single-user configurations.

**FASLOD** — Program load optimizer routine called by FILMGR.

**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** — Table of disk driver entrypoints and drive-letter-to-disk-number equivalences.

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

**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 of console driver entrypoints.

**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 required by CMDINT.

**LSTMGR** — List manager which handles local printed output.

**LSTTBL** — Table of printer driver entrypoints.

**SPOOLR** — Spooler routine which diverts print output to spool files when the spooler is activated.

**COMMGR** — Comm channel manager which handles the communications channel.

**NETREQ** — Network request manager which passes appropriate kernel requests to the network to be satisfied by a network master. Required in network slave configurations.

**MSGFMT** — Network message format tables used by NETSVC and NETREQ modules. Required in both master and slave network configurations.

**NETTBL** — Table of network driver entrypoints.

**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 required 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:

**CONDRV** -- Console driver allows character-by-character input from a console keyboard and output to a console display. TurboDOS supports multiple console drivers.

**LSTDRV** -- 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.

**DSKDRV** -- 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.

**NETDRV** -- Network interface driver allows sending and receiving messages to or from a remote microcomputer. TurboDOS supports multiple network interface drivers, each of which may communicate with multiple remote computers.

**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 and STDSLAVE. Most requirements for TurboDOS can be satisfied by linking the appropriate standard package together with the requisite driver modules.

| Module | Approx. Size (K) | O/S Loader STDLOADR | Single User STDSINGL | Single User w/Spooling STDSPOOL | Network Master STDMASTR | Network Slave STDSLAVE |
|---|---|---|---|---|---|---|
| LCLUSR | .9 | - | LCLUSR | LCLUSR | LCLUSR | LCLUSR |
| LCLTBL | .0 | - | LCLTBL | LCLTBL | LCLTBL | LCLTBL |
| CMDINT | .9 | - | CMDINT | CMDINT | CMDINT | CMDINT |
| AUTLOD | .2 | - | AUTLOD | AUTLOD | AUTLOD | AUTLOD |
| SGLUSR | .1 | - | SGLUSR | SGLUSR | - | - |
| AUTLOG | .0 | - | AUTLOG | AUTLOG | - | - |
| NETSVC | 1.1 | - | - | - | NETSVC | - |
| SLVTBL | .0 | - | - | - | SLVTBL | - |
| DSPOOL | .4 | - | - | DSPOOL | DSPOOL | - |
| FLUSHR | .1 | - | - | - | FLUSHR | - |
| OSLOAD | 1.2 | OSLOAD | - | - | - | - |
| OSNTRY | .3 | - | OSNTRY | OSNTRY | OSNTRY | OSNTRY |
| FILMGR | 1.2 | FILMGR | FILMGR | FILMGR | FILMGR | - |
| FILSUP | 2.1 | FILSUP | FILSUP | FILSUP | FILSUP | - |
| FILLOK | .6 | - | - | - | FILLOK | - |
| FFOMGR | .7 | - | - | - | FFOMGR | - |
| DEVLOK | .2 | - | - | - | DEVLOK | - |
| FASLOD | .3 | - | FASLOD | FASLOD | FASLOD | - |
| NORLOD | .1 | - | - | - | - | - |
| BUFMGR | 1.0 | BUFMGR | BUFMGR | BUFMGR | BUFMGR | - |
| DSKMGR | .5 | DSKMGR | DSKMGR | DSKMGR | DSKMGR | - |
| DSKTBL | .0 | DSKTBL | DSKTBL | DSKTBL | DSKTBL | DSKTBL |
| NONFIL | .2 | - | NONFIL | NONFIL | NONFIL | NONFIL |
| SGLLOG | .1 | - | - | - | - | - |
| CONMGR | .1 | CONMGR | CONMGR | CONMGR | CONMGR | CONMGR |
| CONTBL | .0 | CONTBL | CONTBL | CONTBL | CONTBL | CONTBL |
| DOMGR | .5 | - | DOMGR | DOMGR | DOMGR | DOMGR |
| INPLN | .1 | - | INPLN | INPLN | INPLN | INPLN |
| LSTMGR | .1 | - | LSTMGR | LSTMGR | LSTMGR | LSTMGR |
| LSTTBL | .0 | - | LSTTBL | LSTTBL | LSTTBL | LSTTBL |
| SPOOLR | .5 | - | - | SPOOLR | SPOOLR | - |
| COMMGR | .1 | - | COMMGR | COMMGR | COMMGR | - |
| NETREQ | 1.4 | - | - | - | - | NETREQ |
| MSGFMT | .5 | - | - | - | MSGFMT | MSGFMT |
| RTCMGR | .1 | - | RTCMGR | RTCMGR | RTCMGR | - |
| RTCNUL | .1 | RTCNUL | - | - | - | RTCNUL |
| DSPCHR | .6 | - | - | DSPCHR | DSPCHR | - |
| DSPSGL | .1 | DSPSGL | DSPSGL | - | - | DSPSGL |
| MEMMGR | .3 | - | MEMMGR | MEMMGR | MEMMGR | MEMMGR |
| COMSUB | .3 | COMSUB | COMSUB | COMSUB | COMSUB | COMSUB |
| SYSNIT | .1 | - | SYSNIT | SYSNIT | SYSNIT | SYSNIT |

## Standard TurboDOS Configurations

## 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.

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 | Network Slave STDSLAVE |
|---|---|---|---|---|---|
| Functional Modules | 7K | 10K | 11K | 13K | 6K |
| Device Drivers | 2K | 2K | 2K | 3K | 1K |
| Disk Buffer Space | 4K | 4K | 4K | 16K | 0K |
| Dynamic Storage | ±1K | ±1K | ±1K | ±1K | ±1K |
| Total Memory Req'd | 14K | 17K | 18K | 33K | 8K |
| TPA (in 64K system) | n/a | 47K | 46K | 31K | 56K |

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.

At system start-up, the start-up PROM 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. 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 magnetically serializes the resulting 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, SP442
* SER480, BRT4420, RTC442
* DSK401, DSKFMT8, HDWNIT
Pass 1.
LCLUSR    LCLTBL    CMDINT    AUTLOD    SGLUSR    PRVUSR
OSNTRY    FILMGR    FILSUP    FASLOD    BUFMGR    DSKMGR
DSKTBL    NONFIL    CONMGR    CONTBL    DOMGR     INPLN
LSTMGR    LSTTBL    COMMGR    RTCMGR    DSPSGL    MEMMGR
COMSUB    SYSNIT    CON192    LSTCTS    SP442     SER480
BRT442    RTC442    DSK401    DSKFMT    HDWNIT
Pass 2.
LCLUSR    LCLTBL    CMDINT    AUTLOD    SGLUSR    PRVUSR
OSNTRY    FILMGR    FILSUP    FASLOD    BUFMGR    DSKMGR
DSKTBL    NONFIL    CONMGR    CONTBL    DOMGR     INPLN
LSTMGR    LSTTBL    COMMGR    RTCMGR    DSPSGL    MEMMGR
COMSUB    SYSNIT    CON192    LSTCTS    SP442     SER480
BRT442    RTC442    DSK401    DSKFMT    HDWNIT
Processing parameter file:
AUTLOG = 80
NMBUFS = 8
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
NMBUFS = 4
BUFSIZ = 3
CBFCHR = "^F"
CLSCHR = "\"
ATNCHR = "^S"
RESCHR = "^Q"
ABTCHR = "^C"
DSKAST = 00,01,02,03,10,11,12,13,20,21,22,23,30,31,32,33
```

## TurboDOS Patch Points

Parameters in TurboDOS which may be useful to patch include the following, shown with their standard values:

In AUTLOD Module:

```
COLDFN  = 0,"COLDSTRTAUT"
                        Cold-start autoload file (12 bytes)
WARMFN  = 0,"WARMSTRTAUT"
                        Warm-start autoload file (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
CLSCHR  = "\"           Command line separator character
```

In CONTBL Module:

```
ATNCHR  = "^S"          Attention character
ATNBEL  = "^G"          Attention-received response
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            Console assignment table
CONTBL  = CONDRA        Console driver table
```

In DSKTBL Module:

```
DSKAST  = 00,01,02,03,10,11,12,13,20,21,22,23,30,31,32,33
                        Disk assignment table (16 bytes)
DSKTBL  = DSKDRA,DSKDRB,DSKDRC,DSKDRD
                        Disk driver table (4 words)
```

In FLUSHR Module:

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

In LCLTBL Module:

| | | |
|---|---|---|
| SPLMOD | = 1 | Default spool mode |
| QUEPTR | = 1 | Default spool queue assignment |
| SPLDRV | = 0FF | Default spool drive 00...0F (system drive if 0FF) |

In LCLUSR Module:

| | | |
|---|---|---|
| MEMRES | = (0100) | Reserved memory between O/S and TPA |
| SOMSG | = "TurboDOS 1.xx, Copyright (C) 1981, Software 2000, Inc. $" | Sign-on message (56 bytes, must end with "$") |

In LSTTBL Module:

| | | |
|---|---|---|
| LSTAST | = 00,10,20,30 | List assignment table (4 bytes) |
| LSTTBL | = LSTDRA,LSTDRB,LSTDRC,LSTDRD | List driver table (4 words) |
| NMBQUE | = 1 | Number of de-spool queues |
| DSPPAT | = 1,...,1 | De-spool printer assignment table (16 bytes) |
| NMBPTR | = 1 | Number of printers |
| LSTREM | = 0FF | Default print site (0=local, 0FF=remote) |
| EOPCHR | = 0 | End-of-print character (if nonzero) |

In MEMMGR Module:

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

In NONFIL Module:

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

In OSLOAD Module:

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

In SLVTBL Module:

| | | |
|---|---|---|
| NMBSLV | = 2 | Number of network slaves |
| SLVTBL | = " " | OSSLAVEx.SYS suffix letters (16 bytes) |

**Explanatory Notes**

The patch "AUTUSR = 80" should generally be included in single-user configurations to cause an automatic privileged log-on to user number zero.

The disk assignment table DSKAST contains an array of byte entries corresponding to drives A...P. The high-order nibble of each entry specifies which disk driver (in DSKTBL) to use, while the low order nibble is a drive number passed to the selected driver. In network slaves, the high-order nibble should be set to 15 to indicate a remote drive.

The list assignment table LSTAST contains an array of byte entries corresponding to printers A...P. The high-order nibble of each entry specifies which printer driver (in LSTTBL) to use, while the low order nibble is a printer number passed to the selected driver in the B-register. The console assignment table CONAST works the same way.

If EOPCHR is patched to any non-null ASCII character, then the presence of that character in the print output stream will automatically signal an end-of-print-job condition.

The slave suffix table SLVTBL contains an array of byte entries corresponding to slaves A...P. Each slave operating system is down-loaded from the file "OSSLAVEx.SYS", where "x" is the proper SLVTBL entry. SLVTBL normally contains all spaces, so that all slaves are down-loaded from "OSSLAVE.SYS".

## 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 CP/M-compatible format (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) 1981, Software 2000 Inc.".

3. Using the SERIAL command, copy and serialize the following files from your OEM redistribution master to the new diskette: the appropriate STDxxxxx files, all necessary driver modules, and plus .COM files for AUTOLOAD, BACKUP, BUFFERS, CHANGE, COPY, DATE, DELETE, DIR, DO, DRIVE, DUMP, ERASEDIR, FIFO, FIXMAP, FORMAT, GEN, LABEL, LOGOFF, LOGON, MASTER, PRINT, PRINTER, QUEUE, RECEIVE, RENAME, RESET, SEND, SET, SHOW, TYPE, USER, and VERIFY. 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 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. 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 denote an external name that is defined in another module. The label suffix "::" is used to denote 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. 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
```

Note that ALLOC/ clears each newly-allocated segment to zeroes. Note also that ALLOC/ prefixes each dynamic memory segment with a word containing the segment length (including the prefix word itself), so that DEALOC/ can tell how much memory is to be de-allocated.

## 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
```

## 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.

## 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
```

## 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).

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.

## 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.

## 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
```

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. Using DEALOC#, the memory space occupied by such initialization code can be made available to satisfy subsequent dynamic memory requirements. To do this, the code segment must be prefixed with a word containing the segment length:

```
          .WORD   LENGTH+2    ;length to be de-allocated
;
HDWNIT:: XRA      A           ;start of initialization code
           .
           .
           .
          LXI     H,HDWNIT    ;get beginning of segment
          JMP     DEALOC#     ;de-allocate segment
;
LENGTH    =       $-HDWNIT    ;length of segment
```

## 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
```

## 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.

**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 Drivers

(To be supplied in a future revision.)

## 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 A — IMPLEMENTATION ON IMS EQUIPMENT

## Drivers furnished for IMS Equipment

| | |
|---|---|
| BRT442O | Baud-rate tables for IMS 442/480 with baud-rate oscillator. |
| BRT442S | Baud-rate tables for IMS 442 without baud-rate oscillator. |
| BRT740 | Baud-rate tables for IMS 740 slave board. |
| CON192 | Console driver for ASCII CRT at 19,200 baud. |
| CON96 | Console driver for ASCII CRT at 9,600 baud. |
| DSK401 | Disk driver for IMS 401 8-inch floppy disk controller. |
| DSK431 | Disk driver for IMS 431 5-inch floppy disk controller. |
| DSK490 | Disk driver for IMS 490 hard disk controller. |
| DSKIMS58 | Disk driver for both IMS 401 and 431 floppy disk controllers. |
| DSKM10 | Disk driver for Morrow 10 Mb Winchester. |
| DSKM20 | Disk driver for Morrow 20 Mb Winchester. |
| DSKM26 | Disk driver for Morrow 26 Mb Winchester. |
| DSKFMT5 | Disk specification tables for 5-inch floppy disks. |
| DSKFMT8 | Disk specification tables for 8-inch floppy disks. |
| DSKFMTA | Disk specification tables for both 5-inch and 8-inch floppy disks. |
| HDWNIT | Hardware initialization. |
| LST300 | Printer driver for no handshaking, 300 baud (e.g., Teletype 43). |
| LSTCTS | Printer driver for CTS handshaking, 9600 baud (e.g., TI-810). |
| LSTETX | Printer driver for ETX/ACK handshaking, 1200 baud (e.g., NEC 5510). |
| LSTXON | Printer driver for XON/XOFF handshaking, 1200 baud (e.g., Diablo 630). |
| LSTIMS | Printer driver for Centronics parallel. |
| LSTNEC | Printer driver for parallel NEC 5500D. |
| MPENIT | Memory parity initialization for IMS 461 64K RAM board. |
| N740M | Network driver for master, using IMS 740 slave boards. |
| N740S | Network driver for slaves, using IMS 740 slave boards. |
| NET80M | Network driver for master, using MuSYS NET/80 slave boards. |
| NET80S | Network driver for slaves, using MuSYS NET/80 slave boards. |
| RTC442 | Real-time clock driver for IMS 442 ROM-I/O board. |

| | |
|---|---|
| SER480 | Serial subroutines for IMS 480 4-port serial board. |
| SP442 | Serial and parallel subroutines for IMS 442 ROM-I/O board. |
| SP740 | Serial and parallel subroutines for IMS 740 slave board. |
| SPN80 | Serial and parallel subroutines for MuSYS NET/80. |

## Symbolic Patch Points in IMS Driver Modules

Parameters in the IMS hardware-dependent driver modules which may be useful to patch include the following, shown with their standard values:

In CON96 Module:

| | | |
|---|---|---|
| CONBR | = 8E | Baud rate code (9,600 baud w/attention detect) |
| FFCHR | = 0C | Clear-the-screen character at cold-start |

In CON192 Module:

| | | |
|---|---|---|
| CONBR | = 8F | Baud rate code (19,200 baud w/attention detect) |
| FFCHR | = 0C | Clear-the-screen character at cold-start |

In LST300 Module:

| | | |
|---|---|---|
| LST3BR | = 25 | Baud rate code (300 baud, output-only) |
| LST3FF | = 0C | Top-of-form character at end-of-print |

In LSTCTS Module:

| | | |
|---|---|---|
| CTSBR | = 6E | Baud rate code (9,600 baud, CTS handshaking) |
| CTSFF | = 0C | Top-of-form character at end-of-print |

In LSTETX Module:

| | | |
|---|---|---|
| ETXBR | = 07 | Baud rate code (1,200 baud, input/output) |
| ETXFF | = 0C | Top-of-form character at end-of-print |
| ETXLEN | = 8C | Length of output between ETXs |
| ETXSEQ | = 03 | Length of maximal escape sequence |

In LSTIMS Module:

| | | |
|---|---|---|
| IMSFF | = 0C | Top-of-form character at end-of-print |

In LSTXON Module:

| | | |
|---|---|---|
| XONBR | = 07 | Baud rate code (1,200 baud, input/output) |
| XONFF | = 0C | Top-of-form character at end-of-print |

In NZ40M Module:

SLVPAT = 40,44,48,4C,50,54,58,5C,60,64,68,6C,70,74,78,7C
Slave board port assignment table

In NET80M Module:

N80PAT = 20,22,24,26,28,2A,2C,2E,30,32,34,36,38,3A,3C,3E
Slave board port assignment table

In SP442 Module:

| | | |
|---|---|---|
| SERBSZ | = 40 | Type-ahead buffer size |

In SP740 Module:

| | | |
|---|---|---|
| SERBSZ | = 40 | Type-ahead buffer size |

## IMS Logic Board Set-Up for TurboDOS

### 401 8" Floppy Disk Controller

Shunt JA Address to port 80-8F hex (standard etch)
JB Install horizontal shunt at "5" (interrupts)
JC Install two horizontal shunts at top and bottom (precomp)
JD Install horizontal shunt (delay complete)

### 431 5" Floppy Disk Controller

Shunt JA Address to port C0-CF hex (cut trace, install jumper)
JB Install horizontal shunt at "5" (interrupts)
JC Install vertical shunt (two-sided) if MPI 52 drives installed

Remove IC at "5-B" (74LS74), lift pin 13 clear of socket, connect to pin 12 on the IC itself, and reinstall in socket (ready logic modification).

### 442 I/O Board

Shunt JA Install horizontal shunt on topmost pair
JB Install vertical shunt
JC For parallel NEC printer, install horizontal shunts on all 16 pairs
JD Standard etch
JE Standard etch
JF Standard etch
JG Install only 1 horizontal shunt on bottom pair (ROM enable at FC00 hex)
JH Cut trace between top pair, jumper bottom pair (timer enable)
JJ Install horizontal shunt at "VI1"
JK Install horizontal shunt at "VI3"
JL Install horizontal shunt at "VI3"
JM No shunt
JN No shunt
JP Install 3 horizontal shunts at "A7", "A6", and "A5" (not "A4")

Install oscillator at "13-D" and install 74LS161 IC at "13-C". Install TurboDOS boot PROM at "6.5-B". For parallel NEC printer, install 220/330 resistor pack at IC "12-A".

### 450 Z80 CPU Board

Shunt JA No shunt (wait states)
JB Install 2 horizontal shunts on bottom (Jump to FC00 hex)
JC Standard etch (4 MHz)
JD Standard etch

For accurate real-time clock performance, add 10 pf capacitor (mica or NPO) in series with one leg of 16 Mhz crystal.

## 461 64K Dynamic RAM Board

Shunt
- JA Install vertical shunt on top pair (high-speed RAM)
- JB Install horizontal shunt (I/O port enabled)
- JC Install 8 horizontal shunts (port 00)
- JD Install shunt (phantom)
- JE No shunt (unmapped)
- JF No shunt (Z80 timing)
- JG No shunt (vectored interrupt)
- JH Install horizontal shunt on left pair (no front panel)

## 480 Four-Port Serial Board

Shunt
- JA No shunts (port address E0-FF hex)
- JB Install horizontal shunt on bottom pair (use oscillator)
- JC Install horizontal shunt at "VI3" (vectored interrupt)
- JD Install horizontal shunt at "VI3" (vectored interrupt)
- JE Install horizontal shunt at "VI3" (vectored interrupt)
- JF Install horizontal shunt at "VI3" (vectored interrupt)

## 490 Cartridge Module Drive Controller

Shunt
- JA Standard etch (DMA channel 2)
- JC Standard etch (address port 90-97 hex)
- JD Install vertical shunt at "VI4" (vectored interrupt)

## 740 I/O Processor Board (Slave uP)

Shunt
- JA Address boards to hex 40, 44, 48, 4C, etc.
- JB No shunt (disable vectored interrupt)

# APPENDIX B — IMPLEMENTATION ON TRS-80 MODEL II

## Drivers furnished for TRS-80 Model II

| | |
|---|---|
| CONTRS | Console driver for TRS-80 keyboard/display. |
| DSKTRS | Disk driver for TRS-80 8-inch floppy disk controller. |
| DSKFMT8 | Disk specification tables for 8-inch floppy disks. |
| HDWNIT | Hardware initialization. |
| LSTTRS | Printer driver for TRS-80 Centronics parallel interface. |
| LST300 | Printer driver for no handshaking, 300 baud (e.g., Teletype 43). |
| LSTCTS | Printer driver for CTS handshaking, 9600 baud (e.g., TI-810). |
| LSTETX | Printer driver for ETX/ACK handshaking, 1200 baud (e.g., NEC 5510). |
| LSTXON | Printer driver for XON/XOFF handshaking, 1200 baud (e.g., Diablo 630). |
| RTCTRS | Real-time clock driver for TRS-80 CTC. |
| SPTRS | Serial and parallel subroutines for TRS-80. |

## Symbolic Patch Points in TRS-80 Model II Driver Modules

Parameters in the TRS-80 Model II hardware-dependent driver modules which may be useful to patch include the following, shown with their standard values:

In LSTTRS Module:

| | | |
|---|---|---|
| TRSFF | = 0C | Top-of-form character at end-of-print |

In LST300 Module:

| | | |
|---|---|---|
| LST3BR | = 25 | Baud rate code (300 baud, output-only) |
| LST3FF | = 0C | Top-of-form character at end-of-print |

In LSTCTS Module:

| | | |
|---|---|---|
| CTSBR | = 6E | Baud rate code (9,600 baud, CTS handshaking) |
| CTSFF | = 0C | Top-of-form character at end-of-print |

In LSTETX Module:

| | | |
|---|---|---|
| ETXBR | = 07 | Baud rate code (1,200 baud, input/output) |
| ETXFF | = 0C | Top-of-form character at end-of-print |
| ETXLEN | = 8C | Length of output between ETXs |
| ETXSEQ | = 03 | Length of maximal escape sequence |

In LSTXON Module:

| | | |
|---|---|---|
| XONBR | = 07 | Baud rate code (1,200 baud, input/output) |
| XONFF | = 0C | Top-of-form character at end-of-print |

In SPTRS Module:

| | | |
|---|---|---|
| SERBSZ | = 40 | Type-ahead buffer size |

# APPENDIX C — SAMPLE DRIVER LISTINGS

QUATE - TURBODOS OPERATING SYSTEM SYMBOLIC EQUIVALENCES


```
                        ;
                        .IDENT  EQUATE
                        ;
                        ; 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 SYMBOLIC EQUIVALENCES


```
                        ;
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 A
                        DDR
000E                    PDRLEN  == .-PDRDP      ;PD REQUEST DESCRIPTOR PACKET
                        LENGTH
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
```

)WNIT - TURBODOS OPERATING SYSTEM HARDWARE INITIALIZATION


```
                        ;
                        ; COPYRIGHT (C) 1981, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: 09/08/81
                        ;
                        .IDENT  HDWNIT          ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   0020                    .WORD   NITLEN+2  ;INITIALIZATION CODE LENGTH
                        ;
0002'   CD 0000:04      HDWNIT::CALL    MPENIT# ;INITIALIZE MEMORY PARITY
0005'   CD 0000:05              CALL    SPINIT# ;INITIALIZE SERIAL/PARALLEL I/O
0008'   CD 0000:06              CALL    RTCNIT# ;INITIALIZE REAL TIME CLOCK
000B'   CD 0000:07              CALL    DSKINA# ;INITIALIZE DISK DEVICE A
000E'   CD 0000:08              CALL    DSKINB# ;INITIALIZE DISK DEVICE B
0011'   CD 0000:09              CALL    DSKINC# ;INITIALIZE DISK DEVICE C
0014'   CD 0000:0A              CALL    DSKIND# ;INITIALIZE DISK DEVICE D
0017'   CD 0000:0B              CALL    NETNIT# ;INITIALIZE NETWORK DRIVER
001A'   21 0002'                LXI     H,HDWNIT  ;GET INITIALIZATION CODE ADDRESS
001D'   C3 0000:0C              JMP     DEALOC# ;DE-ALLOCATE INITIALIZATION CODE
                        ;
001E                    NITLEN  = .-HDWNIT      ;INITIALIZATION CODE LENGTH
                        ;
                        .END
```

CON96 - TURBODOS OPERATING SYSTEM NULL CONSOLE DRIVER


```
                        ;
                        ; COPYRIGHT (C) 1981, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: 09/08/81
                        ;
                        .IDENT  CON96           ;MODULE ID
                        ;
                        .INSERT DREQUATE        ;DRIVER SYMBOLIC EQUIVALENCES
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
0000"   8E              CONBR:: .BYTE   0EH!80H ;CONSOLE BAUD RATE CODE (9600 BAUD)
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 SE1
0005'   CC 0013'                CZ      ..INIT  ;IF NOT, INITIALIZE CONSOLE BAUD RA1
                        E
0008'   7B              ..CDRV: MOV     A,E     ;GET FUNCTION NUMBER
0009'   D608                    SUI     8       ;FUNCTION NUMBER=8?
000B'   2821                    JRZ     CONSO   ;IF SO, ERROR SHIFT OUT
000D'   3D                      DCR     A       ;FUNCTION NUMBER=9?
000E'   281E                    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'   C5                      PUSH    B       ;SAVE CHANNEL NUMBER/CHARACTER
0015'   D5                      PUSH    D       ;SAVE FUNCTION NUMBER
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'   2806                    JRZ     ..NITX  ;IF SO, CONTINUE
0025'   4F                      MOV     C,A     ;ELSE, FORM FEED CHARACTER TO C-REG
0026'   1E02                    MVI     E,2     ;SET FUNCTION NUMBER=2
0028'   CD 0008'                CALL    ..CDRV  ;OUTPUT FORM FEED
002B'   D1              ..NITX: POP     D       ;RESTORE FUNCTION NUMBER
002C'   C1                      POP     B       ;RESTORE CHANNEL NUMBER/CHARACTER
002D'   C9                      RET             ;DONE
                        ;
002E'                   CONSO:
002E'   CD 0000:05      CONSI:  CALL    DMS#    ;POSITION TO NEXT LINE
0031'   0D8A                    .ASCIS  [ACR] [ALF]
0033'   C9                      RET             ;DONE
                        ;
                        .END
```

STXON - TURBODOS OPERATING SYSTEM XON/XOFF PRINTER DRIVER


```
                        ;
                        ; COPYRIGHT (C) 1981 BY SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: 09/08/81
                        ;
                        .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 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     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
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
```

SP442 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL I/O DRIVER (IMS 442)


```
                        ;
                        ; COPYRIGHT (C) 1981, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: 09/08/81
                        ;
                        .IDENT  SP442           ;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
                        ;
FC00                    BOOTPR  = 0FC00H        ;BOOTSTRAP LOADER EPROM BASE
                        ;
0000"                           .LOC    .DATA.# ;LOCATE IN DATA AREA
                        ;
```

STXON - TURBODOS OPERATING SYSTEM XON/XOFF PRINTER DRIVER


```
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
```

SP442 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL I/O DRIVER (IMS 442)


```
0000"  0040          SERBSZ::.WORD   64       ;SERIAL BUFFER SIZE
0002"  49            INTMSK::.BYTE   1<ROMDIS!1<SORXIE!1<S1RXIE  ;INTERRUPT MASK
0003"  00            S0BR:   .BYTE   0        ;SERIAL 0 BAUD RATE
0004"  00            S1BR:   .BYTE   0        ;SERIAL 1 BAUD RATE
0005"  0000          SERBUF: .WORD   0        ;SERIAL BUFFER ADDRESS
0007"  0000          SERPTR: .WORD   0        ;SERIAL BUFFER POINTER
0009"  00            S0OCHR: .BYTE   0        ;SERIAL 0 OUTPUT CHARACTER
000A"  00            S1OCHR: .BYTE   0        ;SERIAL 1 OUTPUT CHARACTER
                     ;
000B"                S0ISPH:                  ;SERIAL 0 INPUT SEMAPHORE
000B"  0000                  .WORD   0        ;SEMAPHORE COUNT
000D"  000D"         ..S0IH: .WORD   ..S0IH   ;SEMAPHORE P/D HEAD
000F"  000D"                 .WORD   ..S0IH
                     ;
                                              ;SERIAL 1 INPUT SEMAPHORE
0011"  0000          S1ISPH: .WORD   0        ;SEMAPHORE COUNT
0013"  0013"         ..S1IH: .WORD   ..S1IH   ;SEMAPHORE P/D HEAD
0015"  0013"                 .WORD   ..S1IH
                     ;
                                              ;SERIAL 0 OUTPUT SEMAPHORE
0017"  0000          S0OSPH: .WORD   0        ;SEMAPHORE COUNT
0019"  0019"         ..S0OH: .WORD   ..S0OH   ;SEMAPHORE P/D HEAD
001B"  0019"                 .WORD   ..S0OH
                     ;
                                              ;SERIAL 1 OUTPUT SEMAPHORE
001D"  0000          S1OSPH: .WORD   0        ;SEMAPHORE COUNT
001F"  001F"         ..S1OH: .WORD   ..S1OH   ;SEMAPHORE P/D HEAD
0021"  001F"                 .WORD   ..S1OH
                     ;
0000'                        .LOC    .PROG.#  ;LOCATE IN PROGRAM AREA
                     ;
0000'  0038                  .WORD   NITLEN+2  ;INITIALIZATION CODE LENGTH
                     ;
0002'  3E89          SPINIT::MVI     A,PPMODE  ;INITIALIZE 8255
0004'  D31F                  OUT     PPCTL
0006'  3EFF                  MVI     A,0FFH   ;CLEAR PARALLEL PORTS
0008'  D31C                  OUT     P0DATA
000A'  D31D                  OUT     P1DATA
000C'  3E19                  MVI     A,SPMODE  ;INITIALIZE UARTS
000E'  D310                  OUT     S0CTRL
0010'  D312                  OUT     S1CTRL
0012'  3EC3                  MVI     A,JMP    ;SET UP SERIAL 0 INTERRUPT VECTOR
0014'  32 0018               STA     3*8
0017'  21 0107'              LXI     H,SERISR
001A'  22 0019               SHLD    (3*8)+1
001D'  3A 0002"              LDA     INTMSK   ;GET INTERRUPT MASK
0020'  D318                  OUT     SINTE    ;ENABLE INTERRUPT MASKS
0022'  2A 0000"              LHLD    SERBSZ   ;GET SERIAL BUFFER SIZE
0025'  29                    DAD     H        ;X2
0026'  CD 0000:04            CALL    ALLOC#   ;ALLOCATE PACKET FOR SERIAL BUFFER
0029'  22 0005"              SHLD    SERBUF   ;SAVE SERIAL BUFFER ADDRESS
002C'  22 0007"              SHLD    SERPTR   ;SET SERIAL BUFFER POINTER
002F'  CD 0000:05            CALL    NIT480#  ;INITIALIZE IMS 480 SERIAL PORTS
0032'  21 0002'              LXI     H,SPINIT  ;GET INITIALIZATION CODE ADDRESS
```

P442 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL I/O DRIVER (IMS 442)


```
0035'  C3 0000:06          JMP     DEALOC#  ;DE-ALLOCATE INITIALIZATION CODE
                           ;
0036                       NITLEN  = .-SPINIT       ;INITIALIZATION CODE LENGTH
                           ;
0038'  7B                  SERIAL::MOV     A,E      ;GET FUNCTION NUMBER
0039'  B7                          ORA     A        ;FUNCTION NUMBER=0?
003A'  2817                        JRZ     SERST    ;IF SO, CONTINUE
003C'  3D                          DCR     A        ;FUNCTION NUMBER=1?
003D'  282A                        JRZ     SERIN    ;IF SO, CONTINUE
003F'  3D                          DCR     A        ;FUNCTION NUMBER=2?
0040'  284A                        JRZ     SEROUT   ;IF SO, CONTINUE
0042'  3D                          DCR     A        ;FUNCTION NUMBER=3?
0043'  CA 01A2'                    JZ      SERSBR   ;IF SO, CONTINUE
0046'  3D                          DCR     A        ;FUNCTION NUMBER=4?
0047'  CA 01D5'                    JZ      SERRBR   ;IF SO, CONTINUE
004A'  3D                          DCR     A        ;FUNCTION NUMBER=5?
004B'  CA 01E4'                    JZ      SERSMC   ;IF SO, CONTINUE
004E'  3D                          DCR     A        ;FUNCTION NUMBER=6?
004F'  CA 0208'                    JZ      SERRMC   ;IF SO, CONTINUE
0052'  C9                          RET              ;ELSE, DONE
                           ;
0053'  2A 0005"            SERST:  LHLD    SERBUF   ;GET SERIAL BUFFER ADDRESS
0056'  ED5B 0007"                  LDED    SERPTR   ;GET SERIAL BUFFER POINTER
005A'  E5                  ..STL:  PUSH    H        ;SAVE SERIAL BUFFER ADDRESS
005B'  AF                          XRA     A        ;CLEAR CARRY/PRESET RETURN CODE=0
005C'  ED52                        DSBC    D        ;END OF SERIAL BUFFER?
005E'  E1                          POP     H        ;RESTORE SERIAL BUFFER ADDRESS
005F'  C8                          RZ               ;IF END OF SERIAL BUFFER, DONE
0060'  78                          MOV     A,B      ;ELSE, GET CHANNEL NUMBER
0061'  96                          SUB     M        ;NEXT CHARACTER=REQUESTED CHANNEL
0062'  23                          INX     H        ;ADVANCE TO CHARACTER
0063'  4E                          MOV     C,M      ;GET CHARACTER FROM BUFFER
0064'  23                          INX     H        ;ADVANCE TO NEXT CHANNEL NUMBER
0065'  2F                          CMA              ;PRESET RETURN CODE=0FFH
0066'  C8                          RZ               ;IF REQUESTED CHANNEL, DONE
0067'  18F1                        JMPR    ..STL    ;CONTINUE
                           ;
0069'  78                  SERIN:  MOV     A,B      ;GET CHANNEL NUMBER
006A'  FE02                        CPI     2        ;CHANNEL NUMBER=0/1?
006C'  3805                        JRC     ..S01I   ;IF SO, CONTINUE
006E'  CD 0000:07                  CALL    IN480#   ;ELSE, GET IMS 480 IN SEMAPHORE
0071'  1809                        JMPR    ..ICOM   ;CONTINUE
0073'  21 000B"            ..S01I: LXI     H,S0ISPH  ;GET SERIAL 0 IN SEMAPHORE
0076'  B7                          ORA     A        ;CHANNEL NUMBER=0?
0077'  2803                        JRZ     ..ICOM   ;IF SO, CONTINUE
0079'  21 0011"                    LXI     H,S1ISPH  ;ELSE, GET SERIAL 1 IN SEMAPHORE
007C'  CD 0000:08          ..ICOM: CALL    WAIT#    ;WAIT FOR CONSOLE INPUT
007F'  CD 0053'                    CALL    SERST    ;GET SERIAL CHANNEL STATUS
0082'  B7                          ORA     A        ;CHARACTER AVAILABLE?
0083'  28E4                        JRZ     SERIN    ;IF NOT, CONTINUE
0085'  79                          MOV     A,C      ;ELSE, GET INPUT CHARACTER
0086'  F3                          DI               ;DISABLE INTERRUPTS
0087'  CD 018C'                    CALL    MOVBUF   ;MOVE BUFFER TAIL DOWN
008A'  FB                          EI               ;ENABLE INTERRUPTS
```

SP442 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL I/O DRIVER (IMS 442)


```
008B'  C9                      RET             ;DONE
                       ;
008C'  78              SEROUT: MOV     A,B     ;GET CHANNEL NUMBER
008D'  FE02                    CPI     2       ;CHANNEL NUMBER=0/1?
008F'  3805                    JRC     ..SO1O  ;IF SO, CONTINUE
0091'  CD 0000:09              CALL    OUT480# ;ELSE, GET IMS 480 OUT SEMAPHORE
0094'  1817                    JMPR    ..OCOM  ;CONTINUE
0096'  21 0009"        ..SO1O: LXI     H,SOOCHR  ;GET SERIAL 0 OUTPUT CHARACTER
0099'  B7                      ORA     A       ;CHANNEL NUMBER=0?
009A'  2801                    JRZ     ..SO1C  ;IF SO, CONTINUE
009C'  23                      INX     H       ;GET SERIAL 1 OUTPUT CHARACTER
009D'  71              ..SO1C: MOV     M,C     ;SAVE OUTPUT CHARACTER
009E'  21 0017"                LXI     H,SOOSPH  ;GET SERIAL 0 OUT SEMAPHORE
00A1'  11 00BF'                LXI     D,SOOPOL  ;GET SERIAL 0 OUT POLL ROUTINE
00A4'  B7                      ORA     A       ;CHANNEL NUMBER=0?
00A5'  2806                    JRZ     ..OCOM  ;IF SO, CONTINUE
00A7'  21 001D"                LXI     H,S1OSPH  ;GET SERIAL 1 OUT SEMAPHORE
00AA'  11 00E3'                LXI     D,S1OPOL  ;GET SERIAL 1 OUT POLL ROUTINE
00AD'  E5              ..OCOM: PUSH    H       ;SAVE SEMAPHORE ADDRESS
00AE'  D5                      PUSH    D       ;SAVE POLL ROUTINE ADDRESS
00AF'  CD 0000:0A              CALL    LNKPOL# ;CREATE POLL ROUTINE
00B2'  21 00BB'                LXI     H,..RET ;GET RETURN ADDRESS
00B5'  E3                      XTHL            ;SIMULATE CALL/GET POLL ROUTINE
00B6'  23                      INX     H       ;ADVANCE PAST LINK POINTERS
00B7'  23                      INX     H
00B8'  23                      INX     H
00B9'  23                      INX     H
00BA'  E9                      PCHL            ;EXECUTE POLL ROUTINE
00BB'  E1              ..RET:  POP     H       ;RESTORE SEMAPHORE ADDRESS
00BC'  C3 0000:08              JMP     WAIT#   ;DISPATCH IF NECESSARY
                       ;
00BF'                  SOOPOL:                 ;SERIAL 0 OUTPUT POLL ROUTINE
00BF'  0000                    .WORD   0       ;SUCCESSOR LINK POINTER
00C1'  0000                    .WORD   0       ;PREDECESSOR LINK POINTER
                       ;
00C3'  DB10                    IN      SOCTRL  ;GET SERIAL 0 STATUS
00C5'  CB4F                    BIT     TBE,A   ;TRANSMIT BUFFER EMPTY?
00C7'  C8                      RZ              ;IF NOT, DONE
00C8'  21 0003"                LXI     H,SOBR  ;ELSE, GET SERIAL 0 BAUD RATE CODE
00CB'  CB76                    BIT     6,M     ;CTS HANDSHAKING REQUESTED?
00CD'  2803                    JRZ     ..NCTS  ;IF NOT, CONTINUE
00CF'  CB7F                    BIT     CTSN,A  ;CHECK CLEAR TO SEND (NOT) STATUS
00D1'  C0                      RNZ             ;IF CLEAR TO SEND FALSE, DONE
00D2'  3A 0009"        ..NCTS: LDA     SOOCHR  ;GET SERIAL 0 OUTPUT CHARACTER
00D5'  D311                    OUT     SODATA  ;OUTPUT CHARACTER
00D7'  21 00BF'                LXI     H,SOOPOL  ;GET SERIAL 0 OUT POLL ROUTINE
00DA'  CD 0000:0B              CALL    UNLINK# ;UNLINK POLL ROUTINE
00DD'  21 0017"                LXI     H,SOOSPH  ;GET SERIAL 0 OUT SEMAPHORE
00E0'  C3 0000:0C              JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                       ;
00E3'                  S1OPOL:                 ;SERIAL 1 OUTPUT POLL ROUTINE
00E3'  0000                    .WORD   0       ;SUCCESSOR LINK POINTER
00E5'  0000                    .WORD   0       ;PREDECESSOR LINK POINTER
                       ;
```

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


```
00E7'  DB12                    IN      S1CTRL  ;GET SERIAL 1 STATUS
00E9'  CB4F                    BIT     TBE,A   ;TRANSMIT BUFFER EMPTY?
00EB'  C8                      RZ              ;IF NOT, DONE
00EC'  21 0004"                LXI     H,S1BR  ;ELSE, GET SERIAL 1 BAUD RATE CODE
00EF'  CB76                    BIT     6,M     ;CTS HANDSHAKING REQUESTED?
00F1'  2803                    JRZ     ..NCTS  ;IF NOT, CONTINUE
00F3'  CB7F                    BIT     CTSN,A  ;CHECK CLEAR TO SEND (NOT) STATUS
00F5'  C0                      RNZ             ;IF CLEAR TO SEND FALSE, DONE
00F6'  3A 000A"        ..NCTS: LDA     S1OCHR  ;GET SERIAL 1 OUTPUT CHARACTER
00F9'  D313                    OUT     S1DATA  ;OUTPUT CHARACTER
00FB'  21 00E3'                LXI     H,S1OPOL  ;GET SERIAL 1 OUT POLL ROUTINE
00FE'  CD 0000:0B              CALL    UNLINK# ;UNLINK POLL ROUTINE
0101'  21 001D"                LXI     H,S1OSPH  ;GET SERIAL 1 OUT SEMAPHORE
0104'  C3 0000:0C              JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                       ;
0107'  ED73 0000:0D    SERISR: SSPD    INTSP#  ;SAVE STACK POINTER
010B'  31 0000:0E              LXI     SP,INTSTK#  ;SET UP AUX STACK POINTER
010E'  F5                      PUSH    PSW     ;SAVE REGISTERS
010F'  C5                      PUSH    B
0110'  D5                      PUSH    D
0111'  E5                      PUSH    H
0112'  CD 0126'                CALL    ..SOI   ;CHECK FOR SERIAL 0 INPUT
0115'  CD 013D'                CALL    ..S1I   ;CHECK FOR SERIAL 1 INPUT
0118'  CD 0000:0F              CALL    ISR480# ;CHECK FOR IMS 480 INPUT
011B'  E1                      POP     H       ;RESTORE REGISTERS
011C'  D1                      POP     D
011D'  C1                      POP     B
011E'  F1                      POP     PSW
011F'  ED7B 0000:0D            LSPD    INTSP#  ;RESTORE STACK POINTER
0123'  C3 0000:10              JMP     ISRXIT# ;CONTINUE
0126'  DB10            ..SOI:  IN      SOCTRL  ;GET SERIAL 0 STATUS
0128'  CB47                    BIT     RDA,A   ;CHARACTER AVAILABLE
012A'  C8                      RZ              ;IF NOT, DONE
012B'  21 000B"                LXI     H,SOISPH  ;GET SERIAL 0 INPUT SEMAPHORE
012E'  E5                      PUSH    H       ;SAVE SERIAL 0 INPUT SEMAPHORE
012F'  CD 0000:0C              CALL    SIGNAL# ;SIGNAL PROCESS AS READY
0132'  D1                      POP     D       ;RESTORE SERIAL 0 INPUT SEMAPHORE
0133'  DB11                    IN      SODATA  ;GET SERIAL 0 DATA CHARACTER
0135'  4F                      MOV     C,A     ;SERIAL 0 DATA CHARACTER TO C-REG
0136'  0600                    MVI     B,0     ;SET CHANNEL NUMBER=0
0138'  21 0003"                LXI     H,SOBR  ;GET SERIAL 0 BAUD RATE
013B'  1815                    JMPR    SERISC  ;CONTINUE
013D'  DB12            ..S1I:  IN      S1CTRL  ;GET SERIAL 1 STATUS
013F'  CB47                    BIT     RDA,A   ;CHARACTER AVAILABLE
0141'  C8                      RZ              ;IF NOT, DONE
0142'  21 0011"                LXI     H,S1ISPH  ;GET SERIAL 1 INPUT SEMAPHORE
0145'  E5                      PUSH    H       ;SAVE SERIAL 1 INPUT SEMAPHORE
0146'  CD 0000:0C              CALL    SIGNAL# ;SIGNAL PROCESS AS READY
0149'  D1                      POP     D       ;RESTORE SERIAL 1 INPUT SEMAPHORE
014A'  DB13                    IN      S1DATA  ;GET SERIAL 1 DATA CHARACTER
014C'  4F                      MOV     C,A     ;SERIAL 1 DATA CHARACTER TO C-REG
014D'  0601                    MVI     B,1     ;SET CHANNEL NUMBER=1
014F'  21 0004"                LXI     H,S1BR  ;GET SERIAL 1 BAUD RATE
                       ;
```

SP442 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL I/O DRIVER (IMS 442)


```
0152'  CB7E          SERISC::BIT   7,M      ;SIGN BIT ON BAUD RATE CODE?
0154'  281C                JRZ     ..NCC    ;IF NOT, CONTINUE
0156'  CBB9                RES     7,C      ;ELSE, STRIP SIGN BIT ON CHARACTER
0158'  CD 0000:11          CALL    SLVRES#  ;CHECK FOR SLAVE RESET
015B'  3A 0000:12          LDA     ATNCHR#  ;GET ATTENTION CHARACTER
015E'  91                  SUB     C        ;CHARACTER=ATTENTION CHARACTER?
015F'  2011                JRNZ    ..NCC    ;IF NOT, CONTINUE
0161'  3C                  INR     A        ;ELSE, GET SEMAPHORE COUNT=1
0162'  12                  STAX    D        ;SET SEMAPHORE COUNT=1
0163'  C5            ..FBL:  PUSH    B        ;SAVE CHARACTER/CHANNEL NUMBER
0164'  CD 0053'             CALL    SERST    ;GET SERIAL CHANNEL STATUS
0167'  C1                  POP     B        ;RESTORE CHARACTER/CHANNEL NUMBER
0168'  B7                  ORA     A        ;CHARACTER AVAILABLE?
0169'  2807                JRZ     ..NCC    ;IF NOT, CONTINUE
016B'  C5                  PUSH    B        ;SAVE CHARACTER/CHANNEL NUMBER
016C'  CD 018C'            CALL    MOVBUF   ;MOVE BUFFER TAIL DOWN
016F'  C1                  POP     B        ;RESTORE CHARACTER/CHANNEL NUMBER
0170'  18F1                JMPR    ..FBL    ;CONTINUE
0172'  2A 0000"      ..NCC:  LHLD    SERBSZ   ;GET SERIAL BUFFER SIZE
0175'  29                  DAD     H        ;X2
0176'  ED5B 0005"          LDED    SERBUF   ;GET SERIAL BUFFER ADDRESS
017A'  19                  DAD     D        ;CALC END OF SERIAL BUFFER ADDRESS
017B'  ED5B 0007"          LDED    SERPTR   ;GET SERIAL BUFFER POINTER
017F'  B7                  ORA     A        ;CLEAR CARRY FLAG
0180'  ED52                DSBC    D        ;SERIAL BUFFER FULL?
0182'  C8                  RZ               ;IF SO, DONE
0183'  EB                  XCHG             ;SERIAL BUFFER POINTER TO HL-REG
0184'  70                  MOV     M,B      ;STORE CHANNEL NUMBER IN BUFFER
0185'  23                  INX     H
0186'  71                  MOV     M,C      ;STORE INPUT CHARACTER IN BUFFER
0187'  23                  INX     H
0188'  22 0007"            SHLD    SERPTR   ;UPDATE SERIAL BUFFER POINTER
018B'  C9                  RET              ;DONE
                    ;
018C'  EB            MOVBUF: XCHG            ;SOURCE ADDRESS TO DE-REG
018D'  2A 0007"            LHLD    SERPTR   ;GET SERIAL BUFFER POINTER
0190'  ED52                DSBC    D        ;CALC LENGTH OF TAIL TO MOVE DOWN
0192'  4D                  MOV     C,L      ;LENGTH OF TAIL TO BC-REG
0193'  44                  MOV     B,H
0194'  EB                  XCHG             ;SOURCE ADDRESS TO HL-REG
0195'  5D                  MOV     E,L      ;COPY SOURCE ADDRESS INTO DE-REG
0196'  54                  MOV     D,H
0197'  1B                  DCX     D        ;CALC DESTINATION ADDRESS
0198'  1B                  DCX     D
0199'  2802                JRZ     ..X      ;IF LENGTH OF TAIL=0, CONTINUE
019B'  EDB0                LDIR             ;ELSE, MOVE TAIL DOWN
019D'  ED53 0007"     ..X:     SDED    SERPTR   ;UPDATE SERIAL BUFFER POINTER
01A1'  C9                  RET              ;DONE
                    ;
01A2'  78            SERSBR: MOV     A,B      ;GET CHANNEL NUMBER
01A3'  FE02                CPI     2        ;CHANNEL NUMBER=0/1?
01A5'  D2 0000:13          JNC     SBR480#  ;IF NOT, CONTINUE
01A8'  21 0003"            LXI     H,SOBR   ;ELSE, GET SERIAL 0 BAUD RATE
01AB'  B7                  ORA     A        ;CHANNEL NUMBER=0?
```

```
442 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL I/O DRIVER (IMS 442)
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01AC' 2801                    JRZ     ..COM1  ;IF SO, CONTINUE
01AE' 23                      INX     H       ;ELSE, GET SERIAL 1 BAUD RATE
01AF' 71              ..COM1: MOV     M,C     ;SAVE BAUD RATE CODE
01B0' CD 01C6'                CALL    GETBTV  ;GET BAUD RATE TIMER VALUE
01B3' 78                      MOV     A,B     ;GET CHANNEL NUMBER
01B4' B7                      ORA     A       ;CHANNEL NUMBER=0?
01B5' 3E36                    MVI     A,T0CMD ;GET TIMER 0 COMMAND
01B7' 0E14                    MVI     C,TIM0  ;GET TIMER 0 DATA REGISTER
01B9' 2804                    JRZ     ..COM2  ;IF CHANNEL NUMBER=0, CONTINUE
01BB' 3E76                    MVI     A,T1CMD ;ELSE, GET TIMER 1 COMMAND
01BD' 0E15                    MVI     C,TIM1  ;GET TIMER 1 DATA REGISTER
01BF' D317            ..COM2: OUT     TIMCTL  ;SELECT TIMER
01C1' ED59                    OUTP    E       ;OUTPUT LSB OF TIMER VALUE
01C3' ED51                    OUTP    D       ;OUTPUT MSB OF TIMER VALUE
01C5' C9                      RET             ;DONE
                      ;
01C6' 79              GETBTV::MOV     A,C     ;GET REQUESTED BAUD RATE CODE
01C7' E60F                    ANI     0FH     ;EXTRACT RELEVANT BITS
01C9' 87                      ADD     A       ;X2
01CA' 5F                      MOV     E,A     ;TO E-REG
01CB' 1600                    MVI     D,0     ;MAKE IT DOUBLE LENGTH
01CD' 21 0000:14              LXI     H,BRTBL#  ;GET BAUD RATE TABLE
01D0' 19                      DAD     D       ;INDEX INTO TABLE
01D1' 5E                      MOV     E,M     ;GET TIMER VALUE
01D2' 23                      INX     H
01D3' 56                      MOV     D,M
01D4' C9                      RET             ;DONE
                      ;
01D5' 78              SERRBR: MOV     A,B     ;GET CHANNEL NUMBER
01D6' FE02                    CPI     2       ;CHANNEL NUMBER=0/1?
01D8' D2 0000:15              JNC     RBR480# ;IF NOT, CONTINUE
01DB' 21 0003"                LXI     H,SOBR  ;ELSE, GET SERIAL 0 BAUD RATE
01DE' B7                      ORA     A       ;CHANNEL NUMBER=0?
01DF' 2801                    JRZ     ..COM   ;IF SO, CONTINUE
01E1' 23                      INX     H       ;ELSE, GET SERIAL 1 BAUD RATE
01E2' 7E              ..COM:  MOV     A,M     ;GET CURRENT BAUD RATE CODE
01E3' C9                      RET             ;DONE
                      ;
01E4' 78              SERSMC: MOV     A,B     ;GET CHANNEL NUMBER
01E5' FE02                    CPI     2       ;CHANNEL NUMBER=0/1?
01E7' D2 0000:16              JNC     SMC480# ;IF NOT, CONTINUE
01EA' B7                      ORA     A       ;CHANNEL NUMBER=0?
01EB' 3A 0002"                LDA     INTMSK  ;GET INT MASK
01EE' 200A                    JRNZ    ..CH1   ;IF CHANNEL NUMBER NOT=0, CONTINUE
01F0' CBBF                    RES     SORTSN,A  ;CLEAR SERIAL 0 REQ TO SEND (NOT)
01F2' CB79                    BIT     7,C     ;SERIAL 0 REQ TO SEND TO BE ON?
01F4' 200C                    JRNZ    ..COM   ;IF SO, CONTINUE
01F6' CBFF                    SET     SORTSN,A  ;ELSE, SET SERIAL 0 RTS (NOT)
01F8' 1808                    JMPR    ..COM   ;CONTINUE
01FA' CBA7            ..CH1:  RES     S1RTSN,A  ;CLEAR SERIAL 1 REQ TO SEND (NOT)
01FC' CB79                    BIT     7,C     ;SERIAL 1 REQ TO SEND TO BE ON?
01FE' 2002                    JRNZ    ..COM   ;IF SO, CONTINUE
0200' CBE7                    SET     S1RTSN,A  ;ELSE, SET SERIAL 1 RTS (NOT)
0202' 32 0002"        ..COM:  STA     INTMSK  ;UPDATE INT MASK
```

SP442 - TURBODOS OPERATING SYSTEM SERIAL/PARALLEL I/O DRIVER (IMS 442)


```
0205'  D318                OUT     SINTE   ;SET SERIAL 1 REQUEST TO SEND
0207'  C9                  RET             ;DONE
                    ;
0208'  78          SERRMC: MOV     A,B     ;GET CHANNEL NUMBER
0209'  FE02                CPI     2       ;CHANNEL NUMBER=0/1?
020B'  D2 0000:17          JNC     RMC480# ;IF NOT, CONTINUE
020E'  B7                  ORA     A       ;CHANNEL NUMBER=0?
020F'  DB12                IN      S1CTRL  ;GET SERIAL 0 STATUS
0211'  2802                JRZ     ..COM   ;IF CHANNEL NUMBER=0, CONTINUE
0213'  DB12                IN      S1CTRL  ;ELSE, GET SERIAL 1 STATUS
0215'  E680        ..COM:  ANI     1<CTSN  ;EXTRACT CLEAR TO SEND (NOT)
0217'  EE80                XRI     1<CTSN  ;COMPLIMENT IT
0219'  C9                  RET             ;DONE
                    ;
021A'  D31C        P0OUT:: OUT     P0DATA  ;OUTPUT BYTE TO PARALLEL 0
021C'  C9                  RET             ;DONE
                    ;
021D'  D31D        P1OUT:: OUT     P1DATA  ;OUTPUT BYTE TO PARALLEL 1
021F'  C9                  RET             ;DONE
                    ;
0220'  DB1E        P2IN::  IN      P2DATA  ;INPUT BYTE FROM PARALLEL 2
0222'  C9                  RET             ;DONE
                    ;
0223'  21 0002"    EBPROM::LXI     H,INTMSK  ;GET INTERRUPT MASK
0226'  CB86                RES     ROMDIS,M  ;RESET ROM DISABLE BIT
0228'  7E                  MOV     A,M     ;GET INTERRUPT MASK
0229'  D318                OUT     SINTE   ;TURN ON BOOTSTRAP ROM
022B'  21 FC00             LXI     H,BOOTPR  ;RETURN BOOT PROM ADDR
022E'  C9                  RET             ;DONE
                    ;
022F'  21 0002"    DBPROM::LXI     H,INTMSK  ;GET INTERRUPT MASK
0232'  CBC6                SET     ROMDIS,M  ;SET ROM DISABLE BIT
0234'  7E                  MOV     A,M     ;GET INTERRUPT MASK
0235'  D318                OUT     SINTE   ;TURN OFF BOOTSTRAP ROM
0237'  C9                  RET             ;DONE
                    ;
                    .END
```

```
 ;R480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)
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                        ;
                        ; COPYRIGHT (C) 1981, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: 09/08/81
                        ;
                        .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 REGISTER
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 REGISTER
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 REGISTER
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 REGISTER
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
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 WORD
0003                    MCRCW   = 03H           ;MODEM CONTROL REGISTER CONTROL WORI

                        ;
0000                    RDA     = 0             ;RECEIVED DATA AVAILABLE BIT
0005                    TBE     = 5             ;TRANSMIT BUFFER EMPTY BIT
0004                    CTS     = 4             ;CLEAR TO SEND BIT
```

SER480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
                        ;
0000"                           .LOC    .DATA.#  ;LOCATE IN DATA AREA
                        ;
0000"   00              S2BR:   .BYTE   0        ;SERIAL 2 BAUD RATE
0001"   00              S3BR:   .BYTE   0        ;SERIAL 3 BAUD RATE
0002"   00              S4BR:   .BYTE   0        ;SERIAL 4 BAUD RATE
0003"   00              S5BR:   .BYTE   0        ;SERIAL 5 BAUD RATE
0004"   00              S2OCHR: .BYTE   0        ;SERIAL 2 OUTPUT CHARACTER
0005"   00              S3OCHR: .BYTE   0        ;SERIAL 3 OUTPUT CHARACTER
0006"   00              S4OCHR: .BYTE   0        ;SERIAL 4 OUTPUT CHARACTER
0007"   00              S5OCHR: .BYTE   0        ;SERIAL 5 OUTPUT CHARACTER
                        ;
0008"                   S2ISPH:                  ;SERIAL 2 INPUT SEMAPHORE
0008"   0000                    .WORD   0        ;SEMAPHORE COUNT
000A"   000A"           ..S2IH: .WORD   ..S2IH   ;SEMAPHORE P/D HEAD
000C"   000A"                   .WORD   ..S2IH
                        ;
                                                 ;SERIAL 3 INPUT SEMAPHORE
000E"   0000            S3ISPH: .WORD   0        ;SEMAPHORE COUNT
0010"   0010"           ..S3IH: .WORD   ..S3IH   ;SEMAPHORE P/D HEAD
0012"   0010"                   .WORD   ..S3IH
                        ;
0014"                   S4ISPH:                  ;SERIAL 4 INPUT SEMAPHORE
0014"   0000                    .WORD   0        ;SEMAPHORE COUNT
0016"   0016"           ..S4IH: .WORD   ..S4IH   ;SEMAPHORE P/D HEAD
0018"   0016"                   .WORD   ..S4IH
                        ;
                                                 ;SERIAL 5 INPUT SEMAPHORE
001A"   0000            S5ISPH: .WORD   0        ;SEMAPHORE COUNT
001C"   001C"           ..S5IH: .WORD   ..S5IH   ;SEMAPHORE P/D HEAD
001E"   001C"                   .WORD   ..S5IH
                        ;
                                                 ;SERIAL 2 OUTPUT SEMAPHORE
0020"   0000            S2OSPH: .WORD   0        ;SEMAPHORE COUNT
0022"   0022"           ..S2OH: .WORD   ..S2OH   ;SEMAPHORE P/D HEAD
0024"   0022"                   .WORD   ..S2OH
                        ;
                                                 ;SERIAL 3 OUTPUT SEMAPHORE
0026"   0000            S3OSPH: .WORD   0        ;SEMAPHORE COUNT
0028"   0028"           ..S3OH: .WORD   ..S3OH   ;SEMAPHORE P/D HEAD
002A"   0028"                   .WORD   ..S3OH
                        ;
                                                 ;SERIAL 4 OUTPUT SEMAPHORE
002C"   0000            S4OSPH: .WORD   0        ;SEMAPHORE COUNT
002E"   002E"           ..S4OH: .WORD   ..S4OH   ;SEMAPHORE P/D HEAD
0030"   002E"                   .WORD   ..S4OH
                        ;
                                                 ;SERIAL 5 OUTPUT SEMAPHORE
0032"   0000            S5OSPH: .WORD   0        ;SEMAPHORE COUNT
0034"   0034"           ..S5OH: .WORD   ..S5OH   ;SEMAPHORE P/D HEAD
0036"   0034"                   .WORD   ..S5OH
                        ;
0000'                           .LOC    .PROG.#  ;LOCATE IN PROGRAM AREA
                        ;
```

ER480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
0000'  0026                    .WORD   NITLEN+2  ;INITIALIZATION CODE LENGTH
                               ;
0002'  3E03            NIT480::MVI     A,LCRCW# ;GET LINE CONTROL REGISTER VALUE
0004'  D3E3                    OUT     S2LCR    ;SET LINE CONTROL REGISTER 0
0006'  D3EB                    OUT     S3LCR    ;SET LINE CONTROL REGISTER 1
0008'  D3F3                    OUT     S4LCR    ;SET LINE CONTROL REGISTER 2
000A'  D3FB                    OUT     S5LCR    ;SET LINE CONTROL REGISTER 3
000C'  3E03                    MVI     A,MCRCW  ;GET MODEM CONTROL REGISTER VALUE
000E'  D3E4                    OUT     S2MCR    ;SET MODEM CONTROL REGISTER 0
0010'  D3EC                    OUT     S3MCR    ;SET MODEM CONTROL REGISTER 1
0012'  D3F4                    OUT     S4MCR    ;SET MODEM CONTROL REGISTER 2
0014'  D3FC                    OUT     S5MCR    ;SET MODEM CONTROL REGISTER 3
0016'  3E01                    MVI     A,IERCW  ;GET INT ENABLE REGISTER VALUE
0018'  D3E1                    OUT     S2IER    ;SET INT ENABLE REGISTER 0
001A'  D3E9                    OUT     S3IER    ;SET INT ENABLE REGISTER 1
001C'  D3F1                    OUT     S4IER    ;SET INT ENABLE REGISTER 2
001E'  D3F9                    OUT     S5IER    ;SET INT ENABLE REGISTER 3
0020'  21 0002'                LXI     H,NIT480 ;GET INITIALIZATION CODE ADDRESS
0023'  C3 0000:04              JMP     DEALOC#  ;DE-ALLOCATE INITIALIZATION CODE
                               ;
0024                   NITLEN  = .-NIT480       ;INITIALIZATION CODE LENGTH
                               ;
0026'  21 0008"        IN480:: LXI     H,S2ISPH ;GET SERIAL 2 IN SEMPAHORE
0029'  D602                    SUI     2        ;REMOVE CHANNEL NUMBER BIAS
002B'  C8                      RZ              ;IF CHANNEL NUMBER=2, DONE
002C'  21 000E"                LXI     H,S3ISPH ;ELSE, GET SERIAL 3 IN SEMPAHORE
002F'  3D                      DCR     A        ;CHANNEL NUMBER=3?
0030'  C8                      RZ              ;IF SO, DONE
0031'  21 0014"                LXI     H,S4ISPH ;ELSE, GET SERIAL 4 IN SEMPAHORE
0034'  3D                      DCR     A        ;CHANNEL NUMBER=4?
0035'  C8                      RZ              ;IF SO, DONE
0036'  21 001A"                LXI     H,S5ISPH ;ELSE, GET SERIAL 5 IN SEMPAHORE
0039'  C9                      RET             ;DONE
                               ;
003A'  21 0004"        OUT480::LXI     H,S2OCHR ;GET SERIAL 2 OUTPUT CHARACTER
003D'  CD 01B7'                CALL    CHNMBC   ;DO COMMON SETUP
0040'  71                      MOV     M,C      ;SAVE OUTPUT CHARACTER
0041'  21 0020"                LXI     H,S2OSPH ;GET SERIAL 2 OUT SEMAPHORE
0044'  11 005F'                LXI     D,S2OPOL ;GET SERIAL 2 OUT POLL ROUTINE
0047'  C8                      RZ              ;IF CHANNEL NUMBER=2, DONE
0048'  21 0026"                LXI     H,S3OSPH ;ELSE, GET SERIAL 3 OUT SEMAPHORE
004B'  11 0085'                LXI     D,S3OPOL ;GET SERIAL 3 OUT POLL ROUTINE
004E'  3D                      DCR     A        ;CHANNEL NUMBER=3?
004F'  C8                      RZ              ;IF SO, DONE
0050'  21 002C"                LXI     H,S4OSPH ;ELSE, GET SERIAL 4 OUT SEMAPHORE
0053'  11 00AB'                LXI     D,S4OPOL ;GET SERIAL 4 OUT POLL ROUTINE
0056'  3D                      DCR     A        ;CHANNEL NUMBER=4?
0057'  C8                      RZ              ;IF SO, DONE
0058'  21 0032"                LXI     H,S5OSPH ;ELSE, GET SERIAL 5 OUT SEMAPHORE
005B'  11 00D1'                LXI     D,S5OPOL ;GET SERIAL 5 OUT POLL ROUTINE
005E'  C9                      RET             ;DONE
                               ;
005F'                  S2OPOL:                  ;SERIAL 2 OUTPUT POLL ROUTINE
005F'  0000                    .WORD   0        ;SUCCESSOR LINK POINTER
```

SER480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
0061'  0000                    .WORD   0       ;PREDECESSOR LINK POINTER
                       ;
0063'  DBE5                    IN      S2LSR   ;GET SERIAL 2 LINE STATUS REGISTER
0065'  CB6F                    BIT     TBE,A   ;TRANSMIT BUFFER EMPTY?
0067'  C8                      RZ              ;IF NOT, DONE
0068'  21 0000"                LXI     H,S2BR  ;ELSE, GET SERIAL 2 BAUD RATE
006B'  CB76                    BIT     6,M     ;CLEAR TO SEND HANDSHAKING REQUESTEI
                       ?
006D'  2805                    JRZ     ..NCTS  ;IF NOT, CONTINUE
006F'  DBE6                    IN      S2MSR   ;GET SERIAL 2 MODEM STATUS REGISTER
0071'  CB67                    BIT     CTS,A   ;CLEAR TO SEND STATUS TRUE?
0073'  C8                      RZ              ;IF NOT, DONE
0074'  3A 0004"        ..NCTS: LDA     S2OCHR  ;GET SERIAL 2 OUTPUT CHARACTER
0077'  D3E0                    OUT     S2DATA  ;OUTPUT CHARACTER
0079'  21 005F'                LXI     H,S2OPOL  ;GET SERIAL 2 OUT POLL ROUTINE
007C'  CD 0000:05              CALL    UNLINK# ;UNLINK POLL ROUTINE
007F'  21 0020"                LXI     H,S2OSPH  ;GET SERIAL 2 OUT SEMAPHORE
0082'  C3 0000:06              JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                       ;
0085'                  S3OPOL:                 ;SERIAL 3 OUTPUT POLL ROUTINE
0085'  0000                    .WORD   0       ;SUCCESSOR LINK POINTER
0087'  0000                    .WORD   0       ;PREDECESSOR LINK POINTER
                       ;
0089'  DBED                    IN      S3LSR   ;GET SERIAL 3 LINE STATUS REGISTER
008B'  CB6F                    BIT     TBE,A   ;TRANSMIT BUFFER EMPTY?
008D'  C8                      RZ              ;IF NOT, DONE
008E'  21 0001"                LXI     H,S3BR  ;ELSE, GET SERIAL 3 BAUD RATE
0091'  CB76                    BIT     6,M     ;CLEAR TO SEND HANDSHAKING REQUESTEI
                       ?
0093'  2805                    JRZ     ..NCTS  ;IF NOT, CONTINUE
0095'  DBEE                    IN      S3MSR   ;GET SERIAL 3 MODEM STATUS REGISTER
0097'  CB67                    BIT     CTS,A   ;CLEAR TO SEND STATUS TRUE?
0099'  C8                      RZ              ;IF NOT, DONE
009A'  3A 0005"        ..NCTS: LDA     S3OCHR  ;GET SERIAL 3 OUTPUT CHARACTER
009D'  D3E8                    OUT     S3DATA  ;OUTPUT CHARACTER
009F'  21 0085'                LXI     H,S3OPOL  ;GET SERIAL 3 OUT POLL ROUTINE
00A2'  CD 0000:05              CALL    UNLINK# ;UNLINK POLL ROUTINE
00A5'  21 0026"                LXI     H,S3OSPH  ;GET SERIAL 3 OUT SEMAPHORE
00A8'  C3 0000:06              JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                       ;
00AB'                  S4OPOL:                 ;SERIAL 4 OUTPUT POLL ROUTINE
00AB'  0000                    .WORD   0       ;SUCCESSOR LINK POINTER
00AD'  0000                    .WORD   0       ;PREDECESSOR LINK POINTER
                       ;
00AF'  DBF5                    IN      S4LSR   ;GET SERIAL 4 LINE STATUS REGISTER
00B1'  CB6F                    BIT     TBE,A   ;TRANSMIT BUFFER EMPTY?
00B3'  C8                      RZ              ;IF NOT, DONE
00B4'  21 0002"                LXI     H,S4BR  ;ELSE, GET SERIAL 4 BAUD RATE
00B7'  CB76                    BIT     6,M     ;CLEAR TO SEND HANDSHAKING REQUESTEI
                       ?
00B9'  2805                    JRZ     ..NCTS  ;IF NOT, CONTINUE
00BB'  DBF6                    IN      S4MSR   ;GET SERIAL 4 MODEM STATUS REGISTER
00BD'  CB67                    BIT     CTS,A   ;CLEAR TO SEND STATUS TRUE?
00BF'  C8                      RZ              ;IF NOT, DONE
```

```
;R480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)
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00C0'  3A 0006"      ..NCTS: LDA     S4OCHR  ;GET SERIAL 4 OUTPUT CHARACTER
00C3'  D3F0                  OUT     S4DATA  ;OUTPUT CHARACTER
00C5'  21 00AB'              LXI     H,S4OPOL  ;GET SERIAL 4 OUT POLL ROUTINE
00C8'  CD 0000:05            CALL    UNLINK# ;UNLINK POLL ROUTINE
00CB'  21 002C"              LXI     H,S4OSPH  ;GET SERIAL 4 OUT SEMAPHORE
00CE'  C3 0000:06            JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                     ;
00D1'                S5OPOL:                 ;SERIAL 5 OUTPUT POLL ROUTINE
00D1'  0000                  .WORD   0       ;SUCCESSOR LINK POINTER
00D3'  0000                  .WORD   0       ;PREDECESSOR LINK POINTER
                     ;
00D5'  DBFD                  IN      S5LSR   ;GET SERIAL 5 LINE STATUS REGISTER
00D7'  CB6F                  BIT     TBE,A   ;TRANSMIT BUFFER EMPTY?
00D9'  C8                    RZ              ;IF NOT, DONE
00DA'  21 0003"              LXI     H,S5BR  ;ELSE, GET SERIAL 5 BAUD RATE
00DD'  CB76                  BIT     6,M     ;CLEAR TO SEND HANDSHAKING REQUESTEI
                     ?
00DF'  2805                  JRZ     ..NCTS  ;IF NOT, CONTINUE
00E1'  DBFE                  IN      S5MSR   ;GET SERIAL 5 MODEM STATUS REGISTER
00E3'  CB67                  BIT     CTS,A   ;CLEAR TO SEND STATUS TRUE?
00E5'  C8                    RZ              ;IF NOT, DONE
00E6'  3A 0007"      ..NCTS: LDA     S5OCHR  ;GET SERIAL 5 OUTPUT CHARACTER
00E9'  D3F8                  OUT     S5DATA  ;OUTPUT CHARACTER
00EB'  21 00D1'              LXI     H,S5OPOL  ;GET SERIAL 5 OUT POLL ROUTINE
00EE'  CD 0000:05            CALL    UNLINK# ;UNLINK POLL ROUTINE
00F1'  21 0032"              LXI     H,S5OSPH  ;GET SERIAL 5 OUT SEMAPHORE
00F4'  C3 0000:06            JMP     SIGNAL# ;SIGNAL PROCESS AS READY
                     ;
00F7'  CD 0104'      ISR480::CALL    ..S2I   ;CHECK FOR SERIAL 2 INPUT
00FA'  CD 0116'              CALL    ..S3I   ;CHECK FOR SERIAL 3 INPUT
00FD'  CD 0128'              CALL    ..S4I   ;CHECK FOR SERIAL 4 INPUT
0100'  CD 013A'              CALL    ..S5I   ;CHECK FOR SERIAL 5 INPUT
0103'  C9                    RET             ;DONE
                     ;
0104'  DBE5          ..S2I:  IN      S2LSR   ;GET SERIAL 2 STATUS
0106'  CB47                  BIT     RDA,A   ;CHARACTER AVAILABLE
0108'  C8                    RZ              ;IF NOT, DONE
0109'  21 0008"              LXI     H,S2ISPH  ;GET SERIAL 2 INPUT SEMAPHORE
010C'  E5                    PUSH    H       ;SAVE SERIAL 2 INPUT SEMPAHORE
010D'  CD 0000:06            CALL    SIGNAL# ;SIGNAL PROCESS AS READY
0110'  DBE0                  IN      S2DATA  ;GET SERIAL 2 DATA CHARACTER
0112'  0602                  MVI     B,2     ;SET CHANNEL NUMBER=2
0114'  1834                  JMPR    ..SIC   ;CONTINUE
0116'  DBED          ..S3I:  IN      S3LSR   ;GET SERIAL 3 STATUS
0118'  CB47                  BIT     RDA,A   ;CHARACTER AVAILABLE
011A'  C8                    RZ              ;IF NOT, DONE
011B'  21 000E"              LXI     H,S3ISPH  ;GET SERIAL 3 INPUT SEMAPHORE
011E'  E5                    PUSH    H       ;SAVE SERIAL 3 INPUT SEMPAHORE
011F'  CD 0000:06            CALL    SIGNAL# ;SIGNAL PROCESS AS READY
0122'  DBE8                  IN      S3DATA  ;GET SERIAL 3 DATA CHARACTER
0124'  0603                  MVI     B,3     ;SET CHANNEL NUMBER=3
0126'  1822                  JMPR    ..SIC   ;CONTINUE
0128'  DBF5          ..S4I:  IN      S4LSR   ;GET SERIAL 4 STATUS
012A'  CB47                  BIT     RDA,A   ;CHARACTER AVAILABLE
```

SER480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
012C'  C8                      RZ              ;IF NOT, DONE
012D'  21 0014#                LXI     H,S4ISPH  ;GET SERIAL 4 INPUT SEMAPHORE
0130'  E5                      PUSH    H       ;SAVE SERIAL 4 INPUT SEMPAHORE
0131'  CD 0000:06              CALL    SIGNAL# ;SIGNAL PROCESS AS READY
0134'  DBF0                    IN      S4DATA  ;GET SERIAL 4 DATA CHARACTER
0136'  0604                    MVI     B,4     ;SET CHANNEL NUMBER=4
0138'  1810                    JMPR    ..SIC   ;CONTINUE
013A'  DBFD            ..S5I:  IN      S5LSR   ;GET SERIAL 5 STATUS
013C'  CB47                    BIT     RDA,A   ;CHARACTER AVAILABLE
013E'  C8                      RZ              ;IF NOT, DONE
013F'  21 001A#                LXI     H,S5ISPH  ;GET SERIAL 5 INPUT SEMAPHORE
0142'  E5                      PUSH    H       ;SAVE SERIAL 5 INPUT SEMPAHORE
0143'  CD 0000:06              CALL    SIGNAL# ;SIGNAL PROCESS AS READY
0146'  DBF8                    IN      S5DATA  ;GET SERIAL 5 DATA CHARACTER
0148'  0605                    MVI     B,5     ;SET CHANNEL NUMBER=5
014A'  4F              ..SIC:  MOV     C,A     ;SERIAL DATA CHARACTER TO C-REG
014B'  78                      MOV     A,B     ;GET CHANNEL NUMBER
014C'  21 0000#                LXI     H,S2BR  ;GET SERIAL 2 BAUD RATE
014F'  CD 01B7'                CALL    CHNMBC  ;DO COMMON SETUP
0152'  D1                      POP     D       ;RESTORE SERIAL INPUT SEMAPHORE
0153'  C3 0000:07             JMP     SERISC# ;CONTINUE
                       ;
0156'  21 0000#        SBR480::LXI     H,S2BR  ;GET SERIAL 2 BAUD RATE
0159'  CD 01B7'                CALL    CHNMBC  ;DO COMMON SETUP
015C'  F5                      PUSH    PSW     ;SAVE CHANNEL NUMBER
015D'  71                      MOV     M,C     ;SAVE BAUD RATE CODE
015E'  CD 0000:08              CALL    GETBTV# ;GET BAUD RATE TIMER VALUE
0161'  F1                      POP     PSW     ;RESTORE CHANNEL NUMBER
0162'  87                      ADD     A       ;X2
0163'  87                      ADD     A       ;X2=X4
0164'  87                      ADD     A       ;X2=X8
0165'  F6E3                    ORI     IOBASE+3  ;CALC LINE CONTROL REGISTER
0167'  4F                      MOV     C,A     ;LINE CONTROL REGISTER TO C-REG
0168'  3E83                    MVI     A,LCRCW!80H  ;GET DIVISOR LATCH ACCESS BIT
016A'  ED79                    OUTP    A       ;SELECT DIVISOR LATCH
016C'  0D                      DCR     C       ;CALC DATA REGISTER
016D'  0D                      DCR     C
016E'  0D                      DCR     C
016F'  ED59                    OUTP    E       ;OUTPUT LSB OF BAUD RATE TIMER VALUE

0171'  0C                      INR     C       ;CALC DATA REGISTER+1
0172'  ED51                    OUTP    D       ;OUTPUT MSB OF BAUD RATE TIMER VALUE

0174'  0C                      INR     C       ;CALC LINE CONTROL REGISTER
0175'  0C                      INR     C
0176'  3E03                    MVI     A,LCRCW ;GET LINE CONTROL REGISTER VALUE
0178'  ED79                    OUTP    A       ;DE-SELECT DIVISOR LATCH
017A'  C9                      RET             ;DONE
                       ;
017B'  21 0000#        RBR480::LXI     H,S2BR  ;GET SERIAL 2 BAUD RATE
017E'  CD 01B7'                CALL    CHNMBC  ;DO COMMON SETUP
0181'  7E                      MOV     A,M     ;GET CURRENT BAUD RATE
0182'  C9                      RET             ;DONE
                       ;
```

ER480 - TURBODOS OPERATING SYSTEM SERIAL DRIVER (IMS 480)


```
0183' 79          SMC480::MOV   A,C      ;GET REQUESTED MODEM CONTROLS
0184' 0F                RRC             ;SHIFT MODEM CONTROLS INTO BITS 6/7
0185' 0F                RRC
0186' 57                MOV   D,A       ;MODEM CONTROL REGISTER VALUE TO D-R
                  EG
0187' 78                MOV   A,B       ;GET CHANNEL NUMBER
0188' D602              SUI   2         ;REMOVE CHANNEL NUMBER BIAS
018A' 87                ADD   A         ;X2
018B' 87                ADD   A         ;X2=X4
018C' 87                ADD   A         ;X2=X8
018D' F6E4              ORI   IOBASE+4  ;CALC MODEM CONTROL REGISTER
018F' 4F                MOV   C,A       ;MODEM CONTROL REGISTER TO C-REG
0190' ED51              OUTP  D         ;OUTPUT MODEM CONTROLS
0192' C9                RET             ;DONE
                  ;
0193' 78          RMC480::MOV   A,B      ;GET CHANNEL NUMBER
0194' D602              SUI   2         ;REMOVE CHANNEL NUMBER BIAS
0196' 87                ADD   A         ;X2
0197' 87                ADD   A         ;X2=X4
0198' 87                ADD   A         ;X2=X8
0199' F6E6              ORI   IOBASE+6  ;CALC MODEM STATUS REGISTER
019B' 4F                MOV   C,A       ;MODEM STATUS REGISTER TO C-REG
019C' ED50              INP   D         ;GET MODEM STATUS REGISTER
019E' AF                XRA   A         ;SET RETURN CODE=0
019F' CB62              BIT   4,D       ;CLEAR TO SEND BIT SET?
01A1' 2802              JRZ   ..NCTS    ;IF NOT, CONTINUE
01A3' CBFF              SET   7,A       ;ELSE, SET CLEAR TO SEND BIT
01A5' CB6A        ..NCTS: BIT   5,D     ;DATA SET READY BIT SET?
01A7' 2802              JRZ   ..NDSR    ;IF NOT, CONTINUE
01A9' CBF7              SET   6,A       ;ELSE, SET DATA SET READY BIT
01AB' CB7A        ..NDSR: BIT   7,D     ;DATA CARRIER DETECT BIT SET?
01AD' 2802              JRZ   ..NDCD    ;IF NOT, CONTINUE
01AF' CBEF              SET   5,A       ;ELSE, SET DATA CARRIER DETECT BIT
01B1' CB72        ..NDCD: BIT   6,D     ;RING INDICATOR BIT SET?
01B3' C8                RZ              ;IF NOT, DONE
01B4' CBE7              SET   4,A       ;ELSE, SET RING INDICATOR BIT
01B6' C9                RET             ;DONE
                  ;
01B7' D602        CHNMBC: SUI   2       ;REMOVE CHANNEL NUMBER BIAS
01B9' 5F                MOV   E,A       ;CHANNEL NUMBER TO DE-REG
01BA' 1600              MVI   D,0       ;DOUBLE LENGTH
01BC' 19                DAD   D         ;INDEX INTO CHARACTER SAVE AREA
01BD' C9                RET             ;DONE
                  ;
                  .END
```

BRT442 - TURBODOS OPERATING SYSTEM IMS SERIAL PORT BAUD RATE TABLE (OPTIONAL)


```
                        ;
                        ; COPYRIGHT (C) 1980 BY SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: 09/08/81
                        ;
                        .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
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
```

3K401 - TURBODOS OPERATING SYSTEM IMS FLOPPY DISK DRIVER


```
                        ;
                        ; COPYRIGHT (C) 1981, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: 09/10/81
                        ;
                        .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 COMMAND
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
0006                    FDCRD   = 06H           ;FDC READ COMMAND
                        ;
0000                    DSKENI  = 0             ;DISK CONTROLLER ENABLE INTERRUPTS
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
                        ;
00D0                    SRT8R   = (16-3)<4      ;8 INCH FDD STEP RATE (3 MS-REMEX)
00A0                    SRT8S   = (16-6)<4      ;8 INCH FDD STEP RATE (6 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
```

DSK401 - TURBODOS OPERATING SYSTEM IMS FLOPPY DISK DRIVER


```
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
                        ;
000A                    MAXTRY  = 10            ;MAX DISK TRY COUNT
                        ;
0000                    SLOWSR  = 0             ;SLOW STEP RATE (FLAGS)
                        ;
0002                    TSD     = 2             ;TWO-SIDED DISK BIT (TYPE CODE)
0003                    DDD     = 3             ;DOUBLE DENSITY DISK BIT (TYPE CODE)

0004                    MINI    = 4             ;MINI-FLOPPY DISK BIT (TYPE CODE)
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000' 21 0000"          DSKDR%::LXI     H,DMXSPH  ;GET MUTUAL EXCLUSION SEMAPHORE
0003' CD 0000:04                CALL    WAIT#   ;DISPATCH IF NECESSARY
0006' CD 0012'                  CALL    ..DD    ;CALL DISK DRIVER
0009' F5                        PUSH    PSW     ;SAVE RETURN CODE
000A' 21 0000"                  LXI     H,DMXSPH  ;GET MUTUAL EXCLUSION SEMAPHORE
000D' CD 0000:05                CALL    SIGNAL# ;SIGNAL PROCESS AS READY
0010' F1                        POP     PSW     ;RESTORE RETURN CODE
0011' C9                        RET             ;DONE
                        ;
0012' ED73 0012"        ..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' 283D                      JRZ     RDDSK   ;IF SO, CONTINUE
001C' 3D                        DCR     A       ;PD REQ FUNCTION NUMBER=1?
001D' 284C                      JRZ     WRDSK   ;IF SO, CONTINUE
001F' 3D                        DCR     A       ;PD REQ FUNCTION NUMBER=2?
0020' CA 028A'                  JZ      RETDST  ;IF SO, CONTINUE
0023' 3D                        DCR     A       ;PD REQ FUNCTION NUMBER=3?
0024' CA 0303'                  JZ      RETRDY  ;IF SO, CONTINUE
0027' 3D                        DCR     A       ;PD REQ FUNCTION NUMBER=4?
0028' 285C                      JRZ     FMTDSK  ;IF SO, CONTINUE
002A' C9                        RET             ;ELSE, DONE
                        ;
002B' 002E                      .WORD   NITLEN+2  ;INITIALIZATION CODE LENGTH
                        ;
002D' DB8E              DSKIN%::IN      FDCST   ;GET FDC STATUS
002F' 3C                        INR     A       ;CONTROLLER PRESENT?
0030' 2821                      JRZ     ..X     ;IF NOT, CONTINUE
0032' 3EC3                      MVI     A,JMP   ;ELSE, INITIALIZE INTERRUPT VECTOR
0034' 32 0028                   STA     5*8     ;(VECTORED INTERRUPT-5)
```

3K401 - TURBODOS OPERATING SYSTEM IMS FLOPPY DISK DRIVER


```
0037' 21 0387'            LXI   H,DSKISR
003A' 22 0029             SHLD  (5*8)+1
003D' AF                  XRA   A
003E' D388                OUT   DMACTL  ;DISABLE DMA CONTROLLER
0040' 3E03                MVI   A,FDCSPY  ;GET FDC SPECIFY COMMAND
0042' CD 0412'            CALL  CMDRDY  ;OUTPUT COMMAND TO FDC
0045' 3ED1                MVI   A,SRT8R!HDUT  ;GET REMEX STEP RT/HEAD UNLD
0047' CD 0418'            CALL  DATOUT  ;OUTPUT IT TO FDC
004A' 3E24                MVI   A,HDLT  ;GET HEAD LOAD TIME/NON-DMA BIT
004C' CD 0418'            CALL  DATOUT  ;OUTPUT IT TO FDC
004F' 3E01                MVI   A,1<DSKENI
0051' D38C                OUT   DSKCTL  ;ENABLE CONTROLLER INTERRUPTS
0053' 21 002D'     ..X:   LXI   H,DSKIN%  ;GET INITIALIZATION CODE ADDRESS
0056' C3 0000:06          JMP   DEALOC# ;DE-ALLOCATE INITIALIZATION CODE
                   ;
002C               NITLEN = .-DSKIN%      ;INITIALIZATION CODE LENGTH
                   ;
0059' 3E0A         RDDSK: MVI   A,MAXTRY  ;GET MAX TRY COUNT
005B' 32 000C"            STA   TRYCNT  ;SET TRY COUNT
005E' 3E06         ..RD:  MVI   A,FDCRD ;GET FDC READ COMMAND
0060' 0E40                MVI   C,DMARD ;GET DMA READ COMMAND
0062' CD 00F2'            CALL  DSKCOM  ;CALL COMMON CODE
0065' C8                  RZ            ;NO ERRORS, RET A=0
0066' CD 0149'            CALL  RETRY   ;ERRORS, RECALIBRATE
0069' 18F3                JMPR  ..RD    ;TRY AGAIN
                   ;
006B' 3E0A         WRDSK: MVI   A,MAXTRY  ;GET MAX TRY COUNT
006D' 32 000C"            STA   TRYCNT  ;SET TRY COUNT
0070' 3E05         ..WR:  MVI   A,FDCWR ;GET FDC WRITE COMMAND
0072' 0E80                MVI   C,DMAWR ;GET DMA WRITE COMMAND
0074' CD 00F2'            CALL  DSKCOM  ;CALL COMMON CODE
0077' 2008                JRNZ  ..RT    ;IF ERRORS, RETRY
0079' 3E06                MVI   A,FDCRD ;ELSE, GET FDC READ COMMAND
007B' 0E00                MVI   C,DMAVFY  ;GET DMA VERIFY COMMAND
007D' CD 00F2'            CALL  DSKCOM  ;CALL COMMON CODE
0080' C8                  RZ            ;NO ERRORS, RET A=0
0081' CD 0149'     ..RT:  CALL  RETRY   ;ERRORS, RECALIBRATE
0084' 18EA                JMPR  ..WR    ;TRY AGAIN
                   ;
0086' DD7E02       FMTDSK: MOV  A,PDRTRK(X)  ;GET PD REQ TRACK NUMBER
0089' B7                  ORA   A       ;PD REQUEST TRACK NUMBER=0?
008A' 2006                JRNZ  ..NTRO  ;IF NOT, CONTINUE
008C' CD 0350'            CALL  SELCUR  ;ELSE, SELECT I/O DISK
008F' CD 024F'            CALL  RECAL   ;RECALIBRATE DRIVE
0092' 3E0A         ..NTRO: MVI  A,MAXTRY  ;GET MAX TRY COUNT
0094' 32 000C"            STA   TRYCNT  ;SET TRY COUNT
0097' CD 01D4'     ..FMT: CALL  SEEK    ;SELECT DISK AND SEEK
009A' 3E80                MVI   A,DMAWR ;GET DMA WRITE COMMAND
009C' 32 0011"            STA   IODMAC  ;SET DMA COMMAND
009F' DD6E08              MOV   L,PDRTC(X)  ;GET PD REQ TRANSFER COUNT
00A2' DD6609              MOV   H,PDRTC+1(X)
00A5' DD5E0A              MOV   E,PDRDMA(X)  ;GET PD REQUEST DMA ADDRESS
00A8' DD560B              MOV   D,PDRDMA+1(X)
00AB' CD 016B'            CALL  DMANIT  ;INITIALIZE DMA CONTROLLER
```

DSK401 - TURBODOS OPERATING SYSTEM IMS FLOPPY DISK DRIVER


```
00AE' 3E0D              MVI   A,FDCFMT  ;GET FORMAT TRACK COMMAND
00B0' DDCB047E          BIT   7,PDRSEC(X)  ;DOUBLE DENSITY FLAG SET?
00B4' 2802              JRZ   ..SD    ;IF NOT, CONTINUE
00B6' CBF7              SET   FDCMFM,A  ;ELSE, SET DOUBLE DENSITY BIT
00B8' CD 0412'    ..SD: CALL  CMDRDY  ;SEND FORMAT COMMAND TO FDC
00BB' DD7E01            MOV   A,PDRDRV(X)  ;GET PD REQUEST DRIVE NUMBER
00BE' DDCB057E          BIT   7,PDRSEC+1(X)  ;HEAD NUMBER ONE FLAG SET?
00C2' 2802              JRZ   ..HD0   ;IF NOT, CONTINUE
00C4' CBD7              SET   2,A     ;ELSE, SET HEAD ONE BIT
00C6' CD 0418'    ..HD0: CALL DATOUT  ;OUTPUT UNIT NUMBER TO FDC
00C9' DD7E04            MOV   A,PDRSEC(X)  ;GET PD REQUEST SECTOR (LSB)
00CC' E603              ANI   3       ;EXTRACT FORMAT SECTOR SIZE
00CE' CD 0418'          CALL  DATOUT  ;OUTPUT FORMAT SECTOR SIZE TO FDC
00D1' DD7E06            MOV   A,PDRSC(X)  ;GET PD REQUEST SECTOR COUNT
00D4' CD 0418'          CALL  DATOUT  ;OUTPUT SECTORS/TRACK TO FDC
00D7' DD7E05            MOV   A,PDRSEC+1(X)  ;GET PD REQUEST SECTOR (MSB)
00DA' E67F              ANI   7FH     ;EXTRACT FORMAT GAP LENGTH
00DC' CD 0418'          CALL  DATOUT  ;OUTPUT FORMAT GAP LENGTH TO FDC
00DF' 3EE5              MVI   A,0E5H  ;GET FORMAT FILLER BYTE
00E1' CD 0418'          CALL  DATOUT  ;OUTPUT FORMAT FILLER BYTE TO FDC
00E4' CD 0380'          CALL  WTINT   ;WAIT FOR INTERRUPT
00E7' 3A 0021"          LDA   ST0     ;GET STATUS REGISTER 0
00EA' E6C0              ANI   0C0H    ;ANY ERRORS?
00EC' C8                RZ            ;NO ERRORS, RET A=0
00ED' CD 0149'          CALL  RETRY   ;ERRORS, RECALIBRATE
00F0' 18A5              JMPR  ..FMT   ;TRY AGAIN
                ;
00F2' 32 0010"  DSKCOM: STA   IORWC   ;SET FDC READ/WRITE COMMAND
00F5' 79                MOV   A,C     ;GET DMA COMMAND
00F6' 32 0011"          STA   IODMAC  ;SET DMA COMMAND
00F9' DD7E04            MOV   A,PDRSEC(X)  ;GET PD REQ SECTOR NUMBER
00FC' 32 0015"          STA   CURSEC  ;SET CURRENT SECTOR
00FF' DD6E0A            MOV   L,PDRDMA(X)  ;GET PD REQUEST DMA ADDRESS
0102' DD660B            MOV   H,PDRDMA+1(X)
0105' 22 0016"          SHLD  CURADR  ;SET CURRENT DMA ADDRESS
0108' DD7E06            MOV   A,PDRSC(X)  ;GET PD REQ SECTOR COUNT
010B' 32 0018"          STA   CURSC   ;SET CURRENT SECTOR COUNT
010E' CD 01D4'          CALL  SEEK    ;SELECT DISK AND SEEK
0111' AF                XRA   A
0112' 32 0019"          STA   IOERR   ;CLEAR I/O ERROR STATUS
0115' CD 0183'    ..RWL: CALL SETID   ;SET UP SECTOR ID INFO
0118' CD 0159'          CALL  SETUP   ;SETUP READ/WRITE DMA
011B' CD 03E1'          CALL  CMDOUT  ;SEND SECTOR ID INFO TO FDC
011E' CD 0380'          CALL  WTINT   ;WAIT FOR INTERRUPT
0121' 21 0019"          LXI   H,IOERR ;GET I/O ERROR STATUS
0124' 3A 0021"          LDA   ST0     ;GET STATUS REGISTER 0
0127' B6                ORA   M       ;ADD NEW STATUS
0128' 77                MOV   M,A     ;UPDATE I/O ERROR STATUS
0129' CD 0453'          CALL  GETXLT  ;GET TRANSLATION TABLE ADDRESS
012C' 2815              JRZ   ..NI    ;IF TRANSLATION NOT REQUIRED, CON
012E' 21 0015"          LXI   H,CURSEC  ;ELSE, GET CURRENT SECTOR NUMBE
0131' 34                INR   M       ;INCREMENT CURRENT SECTOR
0132' CD 0448'          CALL  CALCSS  ;CALC SECTOR SIZE
0135' EB                XCHG          ;SECTOR SIZE TO DE-REG
```

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```
0136' 2A 0016"            LHLD    CURADR  ;GET CURRENT DMA ADDRESS
0139' 19                  DAD     D       ;CALC NEXT DMA ADDRESS
013A' 22 0016"            SHLD    CURADR  ;UPDATE CURRENT DMA ADDRESS
013D' 21 0018"            LXI     H,CURSC ;GET CURRENT SECTOR COUNT
0140' 35                  DCR     M       ;DECREMENT CURRENT SECTOR COUNT
0141' 20D2                JRNZ    ..RWL   ;IF TRANSFER NOT COMPLETE, CONTINUE
0143' 3A 0019"      ..NI: LDA     IOERR   ;GET I/O ERROR STATUS
0146' E6C0                ANI     0C0H    ;EXTRACT COMPLETION STATUS
0148' C9                  RET             ;DONE
                    ;
0149' 0E07          RETRY: MVI    C,ABEL  ;GET BELL CHARACTER
014B' CD 0000:07          CALL    CONOUT# ;OUTPUT TO CONSOLE
014E' CD 024F'            CALL    RECAL   ;RECALIBRATE DRIVE
0151' 21 000C"            LXI     H,TRYCNT  ;GET RETRY COUNT
0154' 35                  DCR     M       ;DECREMENT RETRY COUNT
0155' C0                  RNZ             ;IF COUNT NOT EXHAUSTED, TRY AGAIN
0156' C3 0470'            JMP     FATAL   ;CONTINUE
                    ;
0159' CD 0453'      SETUP: CALL   GETXLT  ;GET TRANSLATION TABLE ADDRESS
015C' DD6E08              MOV     L,PDRTC(X)  ;GET PD REQ TRANSFER COUNT
015F' DD6609              MOV     H,PDRTC+1(X)
0162' 2803                JRZ     ..NI    ;IF NO TRANSLATION RQRD, CONTINUE
0164' CD 0448'            CALL    CALCSS  ;ELSE, CALC SECTOR SIZE
0167' ED5B 0016"    ..NI: LDED    CURADR  ;GET CURRENT DMA ADDRESS
                    ;
016B' AF            DMANIT: XRA   A
016C' D388                OUT     DMACTL  ;RESET DMA CONTROLLER
016E' 2B                  DCX     H       ;TERMINAL COUNT-1 FOR 8257
016F' 7D                  MOV     A,L     ;GET LSB OF TERMINAL COUNT
0170' D383                OUT     CH1TC   ;SEND LSB OF TERMINAL COUNT
0172' 3A 0011"            LDA     IODMAC  ;GET I/O DMA COMMAND
0175' B4                  ORA     H       ;ADD TO MSB OF TERMINAL COUNT
0176' D383                OUT     CH1TC   ;SEND MSB OF TERMINAL COUNT
0178' 7B                  MOV     A,E     ;GET LSB
0179' D382                OUT     CH1DMA  ;OUTPUT IT TO DMA CONTROLLER
017B' 7A                  MOV     A,D     ;GET MSB
017C' D382                OUT     CH1DMA  ;OUTPUT IT TO DMA CONTROLLER
017E' 3E42                MVI     A,CH1ENA  ;GET CHANNEL 1 ENABLE COMMAND
0180' D388                OUT     DMACTL  ;ENABLE DMA CONTROLLER
0182' C9                  RET             ;DONE
                    ;
0183' DD7E02        SETID: MOV    A,PDRTRK(X)  ;GET PD REQ TRACK NUMBER
0186' 32 001A"            STA     CYL     ;SET CYLINDER
0189' 3A 0015"            LDA     CURSEC  ;GET CURRENT SECTOR
018C' 4F                  MOV     C,A     ;SECTOR NUMBER TO C-REG
018D' CD 0453'            CALL    GETXLT  ;GET TRANSLATION TABLE ADDRESS
0190' 2804                JRZ     ..NI    ;IF TRANSLATION NOT REQUIRED, CONT
0192' 0600                MVI     B,0     ;ELSE, MAKE SECTOR DOUBLE LENGTH
0194' 09                  DAD     B       ;INDEX INTO TRANSLATION TABLE
0195' 4E                  MOV     C,M     ;GET TRANSLATED SECTOR NUMBER
0196' 0C            ..NI: INR     C       ;CONVERT SECTOR TO BASE 1
0197' DD4613              MOV     B,SECTRK(X)  ;GET NUMBER OF SECTORS/TRACK
019A' CD 0461'            CALL    GETTCA  ;GET DISK TYPE CODE ADDRESS
019D' CB56                BIT     TSD,M   ;TWO SIDED DISK?
```

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```
019F'  2802                    JRZ     ..SSD    ;IF NOT, CONTINUE
01A1'  CB38                    SRLR    B        ;ELSE, CALC NUMBER OF SECTORS/SIDE
01A3'  78              ..SSD:  MOV     A,B      ;GET NUMBER OF SECTORS/SIDE
01A4'  32 001E"                STA     EOT      ;SET END OF TRACK SECTOR NUMBER
01A7'  B9                      CMP     C        ;FRONT SIDE OF DISK?
01A8'  3E00                    MVI     A,0      ;PRESET FOR FRONT SIDE
01AA'  3005                    JRNC    ..FS     ;IF FRONT SIDE, CONTINUE
01AC'  79                      MOV     A,C      ;GET SECTOR NUMBER
01AD'  90                      SUB     B        ;SUBTRACT ONE SIDES WORTH
01AE'  4F                      MOV     C,A      ;TO C-REG
01AF'  3E01                    MVI     A,1      ;GET HEAD #1
01B1'  32 001B"        ..FS:   STA     HEAD     ;SET HEAD NUMBER
01B4'  79                      MOV     A,C      ;GET SECTOR NUMBER
01B5'  32 001C"                STA     REC      ;SET RECORD NUMBER
01B8'  DD7E12                  MOV     A,SECSIZ(X)  ;GET SECTOR SIZE
01BB'  32 001D"                STA     SIZE     ;SET RECORD SIZE
01BE'  B7                      ORA     A        ;N=0?
01BF'  3E80                    MVI     A,128    ;PRESET DTL=128
01C1'  2802                    JRZ     ..NO     ;IF N=0, CONTINUE
01C3'  3EFF                    MVI     A,0FFH   ;ELSE, DTL=0FFH
01C5'  32 0020"        ..NO:   STA     DTL      ;SET DATA LENGTH
01C8'  CD 0469'                CALL    GETDST   ;GET DST ADDRESS
01CB'  11 0000:08              LXI     D,GAPLEN#  ;GET OFFSET TO GAP LENGTH
01CE'  19                      DAD     D        ;CALC GAP LENGTH ADDRESS
01CF'  7E                      MOV     A,M      ;GET GAP LENGTH
01D0'  32 001F"                STA     GPL      ;SET GAP LENGTH
01D3'  C9                      RET              ;DONE
                       ;
01D4'  CD 0350'        SEEK:   CALL    SELCUR   ;SELECT I/O DISK
01D7'  DD7E01                  MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
01DA'  3C                      INR     A        ;INCREMENT IT
01DB'  47                      MOV     B,A      ;TO B-REG
01DC'  37                      STC              ;SET CARRY FLAG
01DD'  21 0000                 LXI     H,0      ;INITIALIZE MASK
01E0'  ED6A            ..SL:   DADC    H        ;GET DRIVE MASK
01E2'  10FC                    DJNZ    ..SL
01E4'  ED5B 000D"              LDED    CALTBL   ;GET DRIVE CALIBRATED TABLE
01E8'  2C                      INR     L
01E9'  2D                      DCR     L        ;DRIVE 0-7?
01EA'  2006                    JRNZ    ..D07    ;IF SO, CONTINUE
01EC'  7A                      MOV     A,D      ;GET CALIBRATED MAP
01ED'  B4                      ORA     H        ;SET CALIBRATED BIT
01EE'  BA                      CMP     D        ;WAS IT CALIBRATED?
01EF'  57                      MOV     D,A      ;UPDATE MAP
01F0'  1804                    JMPR    ..UM
01F2'  7B              ..D07:  MOV     A,E      ;GET CALIBRATED MAP
01F3'  B5                      ORA     L        ;SET CALIBRATED BIT
01F4'  BB                      CMP     E        ;WAS IT CALIBRATED?
01F5'  5F                      MOV     E,A      ;UPDATE MAP
01F6'  ED53 000D"      ..UM:   SDED    CALTBL   ;UPDATE TABLE
01FA'  2844                    JRZ     ..NRR    ;IF DRIVE CALIBRATED, CONTINUE
01FC'  3A 000F"                LDA     FLAGS    ;ELSE, GET FLAGS
01FF'  CB47                    BIT     SLOWSR,A  ;SLOW STEP RATE SET?
0201'  203A                    JRNZ    ..RD     ;IF SO, CONTINUE
```

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```
0203' DD7E01            MOV   A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
0206' CD 0259'          CALL  RECCMD  ;SEND RECALIBRATE COMMAND
0209' 201D              JRNZ  ..SSSR  ;IF ERRORS, CONTINUE
020B' DD7E01            MOV   A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
020E' 47                MOV   B,A     ;CONTROLLER DISK TO B-REG
020F' 0E4C              MVI   C,76    ;CYLINDER 76 TO C-REG
0211' CD 026E'          CALL  SEKCMD  ;SEND SEEK COMMAND
0214' 2012              JRNZ  ..SSSR  ;IF ERRORS, CONTINUE
0216' CD 028A'          CALL  RETDST  ;ELSE, READ DISK ID
0219' 3A 0024*          LDA   RCYL    ;GET PRESENT CYLINDER NUMBER
021C' FE4C              CPI   76      ;DRIVE STEP TO CYLINDER 76?
021E' 2008              JRNZ  ..SSSR  ;IF NOT, CONTINUE
0220' DD7E01            MOV   A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
0223' CD 0259'          CALL  RECCMD  ;SEND RECALIBRATE COMMAND
0226' 2818              JRZ   ..NRR   ;IF NO ERRORS, CONTINUE
0228' 3E03      ..SSSR: MVI   A,FDCSFY  ;GET FDC SPECIFY COMMAND
022A' CD 0412'          CALL  CMDRDY  ;OUTPUT COMMAND TO FDC
022D' 3EA1              MVI   A,SRT8S!HDUT  ;GET SHUGHART STEP RATE/HEAD U
                NLOAD
022F' CD 0418'          CALL  DATOUT  ;OUTPUT IT TO FDC
0232' 3E24              MVI   A,HDLT  ;GET HEAD LOAD TIME/NON-DMA BIT
0234' CD 0418'          CALL  DATOUT  ;OUTPUT IT TO FDC
0237' FB                EI            ;ENABLE INTERRUPTS
0238' 21 000F*          LXI   H,FLAGS ;GET FLAGS
023B' CBC6              SET   SLOWSR,M  ;SET SLOW STEP RATE BIT
023D' CD 024F'  ..RD:   CALL  RECAL   ;RE-CALIBRATE DRIVE
0240' DD7E01    ..NRR:  MOV   A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
0243' 47                MOV   B,A     ;CONTROLLER DISK TO B-REG
0244' DD7E02            MOV   A,PDRTRK(X)  ;GET PD REQ TRACK NUMBER
0247' 4F                MOV   C,A     ;CYLINDER TO C-REG
0248' CD 026E'          CALL  SEKCMD  ;SEND SEEK COMMAND
024B' C8                RZ            ;IF NO ERRORS, DONE
024C' C3 0470'          JMP   FATAL   ;CONTINUE
                ;
024F' DD7E01    RECAL:  MOV   A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
0252' CD 0259'          CALL  RECCMD  ;SEND RECALIBRATE COMMAND
0255' C8                RZ            ;IF NO ERRORS, DONE
0256' C3 0470'          JMP   FATAL   ;CONTINUE
                ;
0259' F5        RECCMD: PUSH  PSW     ;SAVE CONTROLLER DISK
025A' 3E07              MVI   A,FDCRCL  ;GET FDC RECALIBRATE COMMAND
025C' CD 0412'          CALL  CMDRDY  ;OUTPUT COMMAND TO FDC
025F' F1                POP   PSW     ;RESTORE CONTROLLER DISK
0260' CD 0418'          CALL  DATOUT  ;OUTPUT IT TO FDC
0263' CD 0380'          CALL  WTINT   ;WAIT FOR INTERRUPT
0266' 3A 0021"          LDA   ST0     ;GET STATUS REGISTER 0
0269' E6E0              ANI   0C0H!1<FDCSE  ;EXTRACT COMPLETION STATUS
026B' FE20              CPI   1<FDCSE ;ANY ERRORS?
026D' C9                RET           ;DONE
                ;
026E' C5        SEKCMD: PUSH  B       ;SAVE DISK/TRACK
026F' 3E0F              MVI   A,FDCSK ;GET FDC SEEK COMMAND
0271' CD 0412'          CALL  CMDRDY  ;OUTPUT COMMAND TO FDC
0274' C1                POP   B       ;RESTORE DISK/TRACK
```

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```
0275' C5                    PUSH  B         ;SAVE DISK/TRACK
0276' 78                    MOV   A,B       ;GET CONTROLLER DISK
0277' CD 0418'              CALL  DATOUT    ;OUTPUT IT TO FDC
027A' C1                    POP   B         ;RESTORE DISK/TRACK
027B' 79                    MOV   A,C       ;GET CYLINDER NUMBER
027C' CD 0418'              CALL  DATOUT    ;OUTPUT IT TO FDC
027F' CD 0380'              CALL  WTINT     ;WAIT FOR INTERRUPT
0282' 3A 0021'              LDA   ST0       ;GET STATUS REGISTER 0
0285' E6E0                  ANI   0C0H!1<FDCSE  ;EXTRACT COMPLETION STATUS
0287' FE20                  CPI   1<FDCSE ;ANY ERRORS?
0289' C9                    RET             ;DONE
                ;
028A' CD 0303'  RETDST:     CALL  RETRDY    ;RETURN READY STATUS
028D' B7                    ORA   A         ;DRIVE READY?
028E' C8                    RZ              ;IF NOT, DONE
028F' 0E00                  MVI   C,0       ;ELSE, GET INITIAL TYPE VALUE
0291' 3A 0029'              LDA   ST3       ;GET STATUS REGISTER 3
0294' CB5F                  BIT   ST3TS,A   ;ONE-SIDED DISK?
0296' 2802                  JRZ   ..0S      ;YES
0298' CBD1                  SET   TSD,C     ;SET TWO-SIDED DISK BIT
029A' DD7E01        ..0S:   MOV   A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
029D' 32 0014'              STA   RIDDSK    ;SET READ ID DISK
02A0' CD 02EE'              CALL  ..FD      ;FIND DISK DENSITY
02A3' 280F                  JRZ   ..DF      ;IF DENSITY FOUND, CONTINUE
02A5' C5                    PUSH  B         ;ELSE, SAVE DISK TYPE CODE
02A6' DD7E01                MOV   A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
02A9' CD 0259'              CALL  RECCMD    ;RECALIBRATE DRIVE
02AC' C1                    POP   B         ;RESTORE DISK TYPE CODE
02AD' 2032                  JRNZ  ..NR      ;IF UNABLE TO RECALIBRATE, CONTINUE
02AF' CD 02EE'              CALL  ..FD      ;ELSE, ATTEMPT TO FIND DISK DENSITY
02B2' 202D                  JRNZ  ..NR      ;IF DENSITY NOT FOUND, CONTINUE
02B4' B1            ..DF:   ORA   C         ;ADD SECTOR SIZE TO TYPE CODE
02B5' 4F                    MOV   C,A
02B6' CB51                  BIT   TSD,C     ;TWO SIDED BIT SET?
02B8' 2814                  JRZ   ..FDI     ;IF NOT, CONTINUE
02BA' 21 0014'              LXI   H,RIDDSK  ;GET READ ID DISK
02BD' CBD6                  SET   2,M       ;SET HEAD BIT
02BF' 3E4A                  MVI   A,FDCRID!1<FDCMFM  ;GET READ ID CMD (DD)
02C1' CB59                  BIT   DDD,C     ;DOUBLE DENSITY BIT SET?
02C3' 2002                  JRNZ  ..DD      ;IF SO, CONTINUE
02C5' CBB7                  RES   FDCMFM,A  ;ELSE, RESET MFM BIT
02C7' CD 02FD'      ..DD:   CALL  ..RID     ;ATTEMP TO READ ID ON BACK SIDE
02CA' 2802                  JRZ   ..FDI     ;IF READABLE, CONTINUE
02CC' CB91                  RES   TSD,C     ;ELSE, RESET TWO SIDED BIT
02CE' 11 0000:09    ..FDI:  LXI   D,DSTBLS#  ;GET DISK SPEC TABLES
02D1' 79            ..SL2:  MOV   A,C       ;GET DISK TYPE CODE
02D2' 21 0000:0A            LXI   H,DTCO#   ;GET OFFSET TO DISK TYPE CODE
02D5' 19                    DAD   D         ;CALC DISK TYPE CODE ADDRESS
02D6' BE                    CMP   M         ;DISK SPEC TABLE FOUND?
02D7' 280A                  JRZ   ..DSTF    ;IF SO, CONTINUE
02D9' EB                    XCHG            ;DISK SPEC TABLE ADDRESS TO HL-REG
02DA' 5E                    MOV   E,M       ;GET DISK SPEC TABLE LINK POINTER
02DB' 23                    INX   H
02DC' 56                    MOV   D,M
```

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```
02DD'   7A                      MOV     A,D
02DE'   B3                      ORA     E       ;END OF LIST?
02DF'   20F0                    JRNZ    ..SL2   ;IF NOT, CONTINUE
02E1'   AF              ..NR:   XRA     A       ;ELSE, SET RETURN CODE=0
02E2'   C9                      RET             ;DONE
02E3'   13              ..DSTF: INX     D       ;ADVANCE PAST LINK POINTER
02E4'   13                      INX     D
02E5'   DD730C                  MOV     PDRDST(X),E  ;SET DISK SPEC TABLE ADDRESS
02E8'   DD720D                  MOV     PDRDST+1(X),D
02EB'   3EFF                    MVI     A,0FFH  ;SET RETURN CODE=0FFH
02ED'   C9                      RET             ;DONE
02EE'   3E0A            ..FD:   MVI     A,FDCRID  ;GET FDC READ ID COMMAND (SD)
02F0'   CD 02FD'                CALL    ..RID   ;ATTEMPT TO READ SINGLE-DENSITY
02F3'   C8                      RZ              ;IF SINGLE-DENSITY, DONE
02F4'   3E4A                    MVI     A,FDCRID!1<FDCMFM  ;GET READ ID CMD (DD)
02F6'   CD 02FD'                CALL    ..RID   ;ATTEMPT TO READ DOUBLE-DENSITY
02F9'   C0                      RNZ             ;IF UNABLE, DONE
02FA'   CBD9                    SET     DDD,C   ;SET DOUBLE-DENSITY DISK BIT
02FC'   C9                      RET             ;DONE
02FD'   C5              ..RID:  PUSH    B       ;SAVE BC
02FE'   CD 0326'                CALL    READID  ;READ DISK ID
0301'   C1                      POP     B       ;RESTORE BC
0302'   C9                      RET             ;DONE
                        ;
0303'   DD7E01          RETRDY: MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
0306'   FE04                    CPI     4       ;TEST FOR VALID DRIVE NUMBER
0308'   3E00                    MVI     A,0     ;PRESET RETURN CODE=0
030A'   D0                      RNC             ;IF INVALID DRIVE, RETURN NOT READY
030B'   DB8E                    IN      FDCST   ;GET FDC STATUS
030D'   3C                      INR     A       ;CONTROLLER PRESENT?
030E'   C8                      RZ              ;IF NOT, DONE
030F'   CD 0350'                CALL    SELCUR  ;ELSE, SELECT REQUESTED DRIVE
0312'   CD 031C'                CALL    ..RDY   ;CHECK IF DRIVE READY
0315'   C0                      RNZ             ;IF SO, DONE
0316'   21 0001                 LXI     H,1     ;ELSE, DELAY ONE TICK...
0319'   CD 0000:0B              CALL    DELAY#  ;...SO 765 CAN SCAN
031C'   CD 036D'       ..RDY:  CALL    SENSDS  ;SENSE DRIVE STATUS
031F'   CB6F                    BIT     ST3RDY,A  ;DRIVE READY?
0321'   3E00                    MVI     A,0     ;PRESET RETURN CODE=0
0323'   C8                      RZ              ;IF DRIVE NOT READY, DONE
0324'   2F                      CMA             ;ELSE, SET RETURN CODE=0FFH
0325'   C9                      RET             ;DONE
                        ;
0326'   CD 0412'        READID: CALL    CMDRDY  ;OUTPUT COMMAND TO FDC
0329'   3A 0014"                LDA     RIDDSK  ;GET READ ID DISK
032C'   CD 0418'                CALL    DATOUT  ;OUTPUT IT TO FDC
032F'   CD 0380'                CALL    WTINT   ;WAIT FOR INTERRUPT
0332'   3A 0021"                LDA     ST0     ;GET STATUS REGISTER 0
0335'   E6C0                    ANI     0C0H    ;EXTRACT COMPLETION STATUS
0337'   3A 0027"                LDA     RSIZE   ;RETURN SECTOR SIZE
033A'   C9                      RET             ;DINE
                        ;
033B'                   DLCPOL:                 ;DELAY COMPLETE POLL ROUTINE
033B'   0000                    .WORD   0
```

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```
033D'  0000                    .WORD   0
                        ;
033F'  DB8C             DLCPR:  IN      DSKCTL  ;GET DISK CONTROLLER STATUS
0341'  CB7F                     BIT     DSKDLC,A  ;DELAY COMPLETE (MOTORS RUNNING)?
0343'  C8                       RZ              ;IF NOT, DONE
0344'  21 033B'                LXI     H,DLCPOL  ;ELSE, GET POLL ROUTINE
0347'  CD 0000:0C               CALL    UNLINK# ;UNLINK POLL ROUTINE FROM POLL LIST
034A'  21 0006"                 LXI     H,DWTSPH  ;GET DISK WAIT SEMAPHORE
034D'  C3 0000:05               JMP     SIGNAL# ;CONTINUE
                        ;
0350'  DB8C             SELCUR: IN      DSKCTL  ;GET DISK CONTROLLER STATUS
0352'  0F                       RRC             ;EXTRACT SELECTED DRIVE
0353'  E603                     ANI     3
0355'  4F                       MOV     C,A     ;TO C-REG
0356'  DD7E01                   MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
0359'  B9                       CMP     C       ;DRIVE ALREADY SELECTED?
035A'  2802                     JRZ     ..DAS   ;IF SO, CONTINUE
035C'  D38A                     OUT     DSKSEL  ;ELSE, SELECT CONTROLLER DISK
035E'  11 033B'         ..DAS:  LXI     D,DLCPOL  ;GET POLL ROUTINE
0361'  CD 0000:0D               CALL    LNKPOL# ;CREATE POLL ROUTINE
0364'  CD 033F'                 CALL    DLCPR   ;EXECUTE POLL ROUTINE
0367'  21 0006"                 LXI     H,DWTSPH  ;GET DISK WAIT SEMAPHORE
036A'  C3 0000:04               JMP     WAIT#   ;DISPATCH IF NECESSARY
                        ;
036D'  3E04             SENSDS: MVI     A,FDCSDS  ;GET FDC SENSE DRIVE STATUS CMD
036F'  CD 0412'                 CALL    CMDRDY  ;OUTPUT COMMAND TO FDC
0372'  DD7E01                   MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
0375'  CD 0418'                 CALL    DATOUT  ;OUTPUT IT TO FDC
0378'  CD 041F'                 CALL    DATAIN  ;GET STATUS REGISTER 3
037B'  32 0029"                 STA     ST3     ;SAVE STATUS REGISTER 3
037E'  FB                       EI              ;ENABLE INTERRUPTS
037F'  C9                       RET             ;DONE
                        ;
0380'  FB               WTINT:  EI              ;ENABLE INTERRUPTS
0381'  21 0006"                 LXI     H,DWTSPH  ;GET DISK WAIT SEMAPHORE
0384'  C3 0000:04               JMP     WAIT#   ;DISPATCH IF NECESSARY
                        ;
0387'  ED73 0000:0E     DSKISR: SSPD    INTSP#  ;SAVE INTERRUPT STACK POINTER
038B'  31 0000:0F               LXI     SP,INTSTK#  ;SET UP AUX STACK
038E'  F5                       PUSH    PSW     ;SAVE REGISTERS
038F'  C5                       PUSH    B
0390'  D5                       PUSH    D
0391'  E5                       PUSH    H
0392'  DB8E             ..RQML: IN      FDCST   ;GET FDC STATUS
0394'  CB7F                     BIT     FDCRDY,A  ;FDC READY FOR CONVERSATION?
0396'  28FA                     JRZ     ..RQML  ;IF NOT, WAIT
0398'  32 0028"                 STA     MAINST  ;SAVE MAIN STATUS REGISTER
039B'  CB77                     BIT     FDCOUT,A  ;FDC IN OUTPUT MODE?
039D'  2020                     JRNZ    ..RW    ;IF SO, PROCESS
039F'  3E08                     MVI     A,FDCSIS  ;GET SENSE INTERRUPT STATUS CMD
03A1'  D38F                     OUT     FDCDAT  ;OUTPUT IT TO FDC DATA REGISTER
03A3'  CD 041F'                 CALL    DATAIN  ;GET STATUS REGISTER 0
03A6'  4F                       MOV     C,A     ;SAVE IT IN C-REG
03A7'  E6C0                     ANI     0C0H    ;EXTRACT COMPLETION STATUS
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03A9'  FE80                    CPI     80H       ;INTERRUPT STACK EMPTY?
03AB'  2829                    JRZ     ..X       ;IF SO, DONE
03AD'  CD 041F'                CALL    DATAIN    ;GET PRESENT CYLINDER NUMBER
03B0'  CB69                    BIT     STOSE,C   ;READY LINE CHANGE STATE?
03B2'  28DE                    JRZ     ..RQML    ;IF SO, IGNORE
03B4'  32 0024"                STA     RCYL      ;ELSE, SAVE PCN
03B7'  79                      MOV     A,C       ;GET STATUS REGISTER 0
03B8'  32 0021"                STA     ST0       ;SAVE IT
03BB'  3E01                    MVI     A,1       ;SET INTERRUPT COMPLETION STATUS
03BD'  180F                    JMPR    ..SIGC    ;CONTINUE
03BF'  21 0021"        ..RW:   LXI     H,RESULT  ;GET RESULT TABLE
03C2'  0607                    MVI     B,7       ;GET LENGTH OF RESULT PHASE
03C4'  CD 041F'        ..RL:   CALL    DATAIN    ;GET RESULT BYTE FROM FDC
03C7'  77                      MOV     M,A       ;STORE IN RESULT AREA
03C8'  23                      INX     H         ;INCREMENT POINTER
03C9'  10F9                    DJNZ    ..RL      ;READ ALL SEVEN BYTES
03CB'  AF                      XRA     A
03CC'  D388                    OUT     DMACTL    ;DISABLE DMA CONTROLLER
03CE'  21 0006"        ..SIGC: LXI     H,DWTSPH  ;GET DISK WAIT SEMAPHORE
03D1'  CD 0000:05              CALL    SIGNAL#   ;SIGNAL PROCESS AS READY
03D4'  18BC                    JMPR    ..RQML    ;FLUSH ANY REMAINING INTERRUPTS
03D6'  E1              ..X:    POP     H         ;REGISTERS
03D7'  D1                      POP     D
03D8'  C1                      POP     B
03D9'  F1                      POP     PSW
03DA'  ED7B 0000:0E            LSPD    INTSP#    ;RESTORE STACK POINTER
03DE'  C3 0000:10              JMP     ISRXIT#   ;CONTINUE
                       ;
03E1'  CD 0461'        CMDOUT: CALL    GETTCA    ;GET DISK TYPE CODE ADDRESS
03E4'  3A 0010"                LDA     IORWC     ;GET READ/WRITE COMMAND
03E7'  CB5E                    BIT     DDD,M     ;DOUBLE DENSITY DISK?
03E9'  2802                    JRZ     ..SD      ;IF NOT, SINGLE DENSITY
03EB'  CBF7                    SET     FDCMFM,A  ;ELSE, SET DOUBLE DENSITY BIT
03ED'  CB56            ..SD:   BIT     TSD,M     ;TWO-SIDED DISK?
03EF'  2802                    JRZ     ..SS      ;IF NOT, SINGLE SIDED
03F1'  CBFF                    SET     FDCMT,A   ;ELSE, SET MULTI-TRACK BIT
03F3'  CD 0412'        ..SS:   CALL    CMDRDY    ;SEND COMMAND TO FDC
03F6'  DD7E01                  MOV     A,PDRDRV(X)  ;GET PD REQ DISK NUMBER
03F9'  21 001B"                LXI     H,HEAD    ;GET HEAD NUMBER
03FC'  CB46                    BIT     0,M       ;HEAD #0?
03FE'  2802                    JRZ     ..FS      ;IF SO, CONTINUE
0400'  CBD7                    SET     2,A       ;ELSE, SET HEAD #1 BIT IN I/O DISK
0402'  CD 0418'        ..FS:   CALL    DATOUT    ;OUTPUT IT TO FDC
0405'  21 001A"                LXI     H,IDINFO  ;GET SECTOR ID INFO
0408'  0607                    MVI     B,7       ;B=LENGTH OF ID INFO
040A'  7E              ..IDL:  MOV     A,M       ;GET BYTE FROM LIST
040B'  23                      INX     H         ;INCREMENT POINTER
040C'  CD 0418'                CALL    DATOUT    ;OUTPUT BYTE TO FDC
040F'  10F9                    DJNZ    ..IDL     ;SEND ENTIRE LIST
0411'  C9                      RET               ;DONE
                       ;
0412'  CD 042A'        CMDRDY: CALL    OUTRDY    ;WAIT FOR FDC READY
0415'  F3                      DI                ;DISABLE INTERRUPTS
0416'  1803                    JMPR    OUTCOM    ;JOIN COMMON CODE
```

DSK401 - TURBODOS OPERATING SYSTEM IMS FLOPPY DISK DRIVER


```
                        ;
0418'  CD 042A'         DATOUT: CALL    OUTRDY  ;WAIT FOR FDC READY
                        ;
041B'  79               OUTCOM: MOV     A,C     ;RESTORE OUTPUT BUTE
041C'  D38F                     OUT     FDCDAT  ;OUTPUT BYTE TO FDC DATA REGISTER
041E'  C9                       RET             ;DONE
                        ;
041F'  DB8E             DATAIN: IN      FDCST   ;GET FDC STATUS
0421'  07                       RLC             ;TEST FDC FOR READY
0422'  30FB                     JRNC    DATAIN  ;IF NOT READY, WAIT
0424'  07                       RLC             ;TEST FDC DIRECTION
0425'  300B                     JRNC    FDCERR  ;IF WRONG DIRECTION, DIAGNOSE
0427'  DB8F                     IN      FDCDAT  ;GET FDC DATA BYTE
0429'  C9                       RET             ;DONE
                        ;
042A'  4F               OUTRDY: MOV     C,A     ;SAVE OUTPUT BYTE
042B'  DB8E             ..RW:   IN      FDCST   ;GET FDC STATUS
042D'  07                       RLC             ;TEST FDC FOR READY
042E'  30FB                     JRNC    ..RW    ;IF NOT READY, WAIT
0430'  07                       RLC             ;TEST FDC DIRECTION
0431'  D0                       RNC             ;IF DIRECTION CORRECT, DONE
                        ;
0432'  CD 0000:11       FDCERR: CALL    DMS#    ;SOUND BELL
0435'  87                       .ASCIS  [ABEL]
0436'  CD 0000:12               CALL    CONSO#  ;SHIFT CONSOLE TO ERROR LINE
0439'  CD 0000:11               CALL    DMS#    ;DISPLAY ERROR MESSAGE
043C'  464443204572             .ASCIS  "FDC Error"
0445'  C3 0445'                 JMP     .       ;HALT
                        ;
0448'  21 0080          CALCSS: LXI     H,128   ;GET 128 BYTE SECTOR LENGTH
044B'  DD7E12                   MOV     A,SECSIZ(X)  ;GET SECTOR SIZE
044E'  3D               ..SL:   DCR     A       ;DECREMENT SECTOR SIZE
044F'  F8                       RM              ;IF UNDERFLOW, DONE
0450'  29                       DAD     H       ;ELSE, SHIFT SECTOR SIZE LEFT
0451'  18FB                     JMPR    ..SL    ;CONTINUE
                        ;
0453'  CD 0469'         GETXLT: CALL    GETDST  ;GET DST ADDRESS
0456'  11 0000:13               LXI     D,XLTBL#  ;GET OFFSET TO TRANSLATION TABLE
0459'  19                       DAD     D       ;CALC TRANSLATION TABLE ADDRESS
045A'  5E                       MOV     E,M     ;GET TRANSLATION TABLE ADDRESS
045B'  23                       INX     H
045C'  56                       MOV     D,M
045D'  EB                       XCHG            ;TRANSLATION TABLE ADDRESS TO HL-REC

045E'  7C                       MOV     A,H
045F'  B5                       ORA     L       ;TRANSLATION REQUIRED?
0460'  C9                       RET             ;DONE
                        ;
0461'  CD 0469'         GETTCA: CALL    GETDST  ;GET DST ADDRESS
0464'  11 0000:14               LXI     D,TYPCOD#  ;GET OFFSET TO DISK TYPE CODE
0467'  19                       DAD     D       ;CALC DISK TYPE CODE ADDRESS
0468'  C9                       RET             ;DONE
                        ;
0469'  DD6E0C           GETDST: MOV     L,PDRDST(X)  ;GET PD REQUEST DST ADDRESS
```

```
3K401 - TURBODOS OPERATING SYSTEM IMS FLOPPY DISK DRIVER
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046C'  DD660D                    MOV     H,PDRDST+1(X)
046F'  C9                        RET                     ;DONE
                         ;
0470'  ED7B 0012"        FATAL:  LSPD    RETSP   ;RESTORE STACK POINTER
0474'  3EFF                      MVI     A,0FFH  ;RETURN ERROR CODE
0476'  C9                        RET             ;DONE
                         ;
0000"                            .LOC    .DATA.# ;LOCATE IN DATA AREA
                         ;
0000"                    DMXSPH:                 ;MUTUAL EXCLUSION SEMAPHORE
0000"  0001                      .WORD   1       ;SEMAPHORE COUNT
0002"  0002"             ..DMXH: .WORD   ..DMXH  ;SEMAPHORE P/D HEAD
0004"  0002"                      .WORD   ..DMXH
                         ;
0006"                    DWTSPH:                 ;DISK WAIT SEMAPHORE
0006"  0000                      .WORD   0       ;SEMAPHORE COUNT
0008"  0008"             ..DWTH: .WORD   ..DWTH  ;SEMAPHORE P/D HEAD
000A"  0008"                      .WORD   ..DWTH
                         ;
000C"  00                TRYCNT: .BYTE   0       ;TRY COUNT
000D"  0000              CALTBL: .WORD   0       ;DRIVE CALIBRATED TABLE
000F"  00                FLAGS:  .BYTE   0       ;FLAGS
0010"  00                IORWC:  .BYTE   0       ;I/O READ/WRITE COMMAND
0011"  00                IODMAC: .BYTE   0       ;I/O DMA COMMAND
0012"  0000              RETSP:  .WORD   0       ;ERROR RETURN STACK POINTER
0014"  00                RIDDSK: .BYTE   0       ;READ ID DISK
0015"  00                CURSEC: .BYTE   0       ;CURRENT SECTOR NUMBER
0016"  0000              CURADR: .WORD   0       ;CURRENT DMA ADDRESS
0018"  00                CURSC:  .BYTE   0       ;CURRENT SECTOR COUNT
0019"  00                IOERR:  .BYTE   0       ;I/O ERROR STATUS
                         ;
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
                         ;
                         .END
```

DSKFMT - TURBODOS OPERATING SYSTEM DRIVE SPECIFICATION TABLES


```
                        ;
                        ; COPYRIGHT (C) 1981, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: 09/08/81
                        ;
                        .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 CODE)
0004                    MINI    = 4             ;MINI-FLOPPY DISK BIT (TYPE CODE)
                        ;
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, TWO-SIDED (MINI)
                        ;
                        ;       .WORD   .+DSTL  ;DISK SPEC TABLE LINK POINTER
                        ;       .BYTE   4       ;BLOCK SIZE
                        ;       .WORD   (40*(10*(1<3)))/(1<4)  ;NUMBER OF BLOCKS
                        ;       .BYTE   2       ;NUMBER OF DIRECTORY BLOCKS
                        ;       .BYTE   3       ;PHYSICAL SECTOR SIZE (2^N*128)
                        ;       .WORD   10      ;PHYSICAL SECTORS PER TRACK
                        ;       .WORD   40      ;PHYSICAL TRACKS PER DISK
                        ;       .WORD   0       ;NUMBER OF RESERVED TRACKS
                        ;       .WORD   0       ;TRANSLATION TABLE ADDRESS
                        ;       .BYTE   1<MINI!1<DDD!1<TSD!3  ;DISK TYPE CODE
                        ;       .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)
```

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;SKFMT - TURBODOS OPERATING SYSTEM DRIVE SPECIFICATION TABLES
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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
                       ;
                       ;       1024 BYTE SECTOR, DOUBLE-DENSITY, ONE-SIDED (MINI)
                       ;
                       ;       .WORD   .+DSTL  ;DISK SPEC TABLE LINK POINTER
                       ;       .BYTE   3       ;BLOCK SIZE
                       ;       .WORD   (40*(5*(1<3)))/(1<3)  ;NUMBER OF BLOCKS
                       ;       .BYTE   2       ;NUMBER OF DIRECTORY BLOCKS
                       ;       .BYTE   3       ;PHYSICAL SECTOR SIZE (2^N*128)
                       ;       .WORD   5       ;PHYSICAL SECTORS PER TRACK
                       ;       .WORD   40      ;PHYSICAL TRACKS PER DISK
                       ;       .WORD   0       ;RESERVED TRACKS
                       ;       .WORD   0       ;TRANSLATION TABLE ADDRESS
                       ;       .BYTE   1<MINI!1<DDD!3  ;DISK TYPE CODE
                       ;       .BYTE   35H     ;GAP LENGTH
                       ;
                       ;       512 BYTE SECTOR, DOUBLE-DENSITY, TWO-SIDED
                       ;
                       ;       .WORD   .+DSTL  ;DISK SPEC TABLE LINK POINTER
                       ;       .BYTE   4       ;BLOCK SIZE
                       ;       .WORD   (77*(30*(1<2)))/(1<4)  ;NUMBER OF BLOCKS
                       ;       .BYTE   4       ;NUMBER OF DIRECTORY BLOCKS
                       ;       .BYTE   2       ;PHYSICAL SECTOR SIZE (2^N*128)
                       ;       .WORD   30      ;PHYSICAL SECTORS PER TRACK
                       ;       .WORD   77      ;PHYSICAL TRACKS PER DISK
                       ;       .WORD   0       ;RESERVED TRACKS
                       ;       .WORD   0       ;TRANSLATION TABLE ADDRESS
                       ;       .BYTE   1<DDD!1<TSD!2  ;DISK TYPE CODE
                       ;       .BYTE   1BH     ;GAP LENGTH
                       ;
                       ;       512 BYTE SECTOR, DOUBLE-DENSITY, ONE-SIDED
                       ;
                       ;       .WORD   .+DSTL  ;DISK SPEC TABLE LINK POINTER
                       ;       .BYTE   4       ;BLOCK SIZE
                       ;       .WORD   (77*(15*(1<2)))/(1<4)  ;NUMBER OF BLOCKS
                       ;       .BYTE   3       ;NUMBER OF DIRECTORY BLOCKS
                       ;       .BYTE   2       ;PHYSICAL SECTOR SIZE (2^N*128)
                       ;       .WORD   15      ;PHYSICAL SECTORS PER TRACK
                       ;       .WORD   77      ;PHYSICAL TRACKS PER DISK
                       ;       .WORD   0       ;RESERVED TRACKS
                       ;       .WORD   0       ;TRANSLATION TABLE ADDRESS
                       ;       .BYTE   1<DDD!2  ;DISK TYPE CODE
                       ;       .BYTE   1BH     ;GAP LENGTH
                       ;
                       ;       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
```

DSKFMT - TURBODOS OPERATING SYSTEM DRIVE SPECIFICATION TABLES


```
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
                       ;
                       ;       256 BYTE SECTOR, DOUBLE-DENSITY, TWO-SIDED
                       ;
                       ;       .WORD   .+DSTL    ;DISK SPEC TABLE LINK POINTER
                       ;       .BYTE   4         ;BLOCK SHZET
                       ;       .WORD   (77*(52*(1<1)))/(1<4)  ;NUMBER OF BLOCKS
                       ;       .BYTE   4         ;NUMBER OF DIRECTORY BLOCKS
                       ;       .BYTE   1         ;PHYSICAL SECTOR SIZE (2^N*128)
                       ;       .WORD   52        ;PHYSICAL SECTORS PER TRACK
                       ;       .WORD   77        ;PHYSICAL TRACKS PER DISK
                       ;       .WORD   0         ;RESERVED TRACKS
                       ;       .WORD   0         ;TRANSLATION TABLE ADDRESS
                       ;       .BYTE   1<DDD!1<TSD!1  ;DISK TYPE CODE
                       ;       .BYTE   0EH       ;GAP LENGTH
                       ;
                       ;       256 BYTE SECTOR, DOUBLE-DENSITY, ONE-SIDED
                       ;
                       ;       .WORD   .+DSTL    ;DISK SPEC TABLE LINK POINTER
                       ;       .BYTE   4         ;BLOCK SIZE
                       ;       .WORD   (77*(26*(1<1)))/(1<4)  ;NUMBER OF BLOCKS
                       ;       .BYTE   2         ;NUMBER OF DIRECTORY BLOCKS
                       ;       .BYTE   1         ;PHYSICAL SECTOR SIZE (2^N*128)
                       ;       .WORD   26        ;PHYSICAL SECTORS PER TRACK
                       ;       .WORD   77        ;PHYSICAL TRACKS PER DISK
                       ;       .WORD   0         ;RESERVED TRACKS
                       ;       .WORD   0         ;TRANSLATION TABLE ADDRESS
                       ;       .BYTE   1<DDD!1   ;DISK TYPE CODE
                       ;       .BYTE   0EH       ;GAP LENGTH
                       ;
                       ;       256 BYTE SECTOR, SINGLE-DENSITY, TWO-SIDED
                       ;
                       ;       .WORD   .+DSTL    ;DISK SPEC TABLE LINK POINTER
```

'SKFMT - TURBODOS OPERATING SYSTEM DRIVE SPECIFICATION TABLES


```
;       .BYTE   4       ;BLOCK SIZE
;       .WORD   (77*(30*(1<1)))/(1<4)  ;NUMBER OF BLOCKS
;       .BYTE   3       ;NUMBER OF DIRECTORY BLOCKS
;       .BYTE   1       ;PHYSICAL SECTOR SIZE (2^N*128)
;       .WORD   30      ;PHYSICAL SECTORS PER TRACK
;       .WORD   77      ;PHYSICAL TRACKS PER DISK
;       .WORD   0       ;RESERVED TRACKS
;       .WORD   0       ;TRANSLATION TABLE ADDRESS
;       .BYTE   1<TSD!1 ;DISK TYPE CODE
;       .BYTE   0EH     ;GAP LENGTH
;
;       256 BYTE SECTOR, SINGLE-DENSITY, ONE-SIDED
;
;       .WORD   .+DSTL  ;DISK SPEC TABLE LINK POINTER
;       .BYTE   4       ;BLOCK SIZE
;       .WORD   (77*(15*(1<1)))/(1<4)  ;NUMBER OF BLOCKS
;       .BYTE   2       ;NUMBER OF DIRECTORY BLOCKS
;       .BYTE   1       ;PHYSICAL SECTOR SIZE (2^N*128)
;       .WORD   15      ;PHYSICAL SECTORS PER TRACK
;       .WORD   77      ;PHYSICAL TRACKS PER DISK
;       .WORD   0       ;RESERVED TRACKS
;       .WORD   0       ;TRANSLATION TABLE ADDRESS
;       .BYTE   1       ;DISK TYPE CODE
;       .BYTE   0EH     ;GAP LENGTH
;
;       128 BYTE SECTOR, SINGLE-DENSITY, TWO-SIDED (OLD)
;
;       .WORD   .+DSTL  ;DISK SPEC TABLE LINK POINTER
;       .BYTE   4       ;BLOCK SIZE
;       .WORD   (76*(52*(1<0)))/(1<4)  ;NUMBER OF BLOCKS
;       .BYTE   2       ;NUMBER OF DIRECTORY BLOCKS
;       .BYTE   0       ;PHYSICAL SECTOR SIZE (2^N*128)
;       .WORD   52      ;PHYSICAL SECTORS PER TRACK
;       .WORD   77      ;PHYSICAL TRACKS PER DISK
;       .WORD   1       ;RESERVED TRACKS
;       .WORD   0       ;TRANSLATION TABLE ADDRESS
;       .BYTE   1<TSD   ;DISK TYPE CODE
;       .BYTE   7       ;GAP LENGTH
;
;       128 BYTE SECTOR, SINGLE-DENSITY, TWO-SIDED
;
;       .WORD   .+DSTL  ;DISK SPEC TABLE LINK POINTER
;       .BYTE   4       ;BLOCK SIZE
;       .WORD   (77*(52*(1<0)))/(1<4)  ;NUMBER OF BLOCKS
;       .BYTE   2       ;NUMBER OF DIRECTORY BLOCKS
;       .BYTE   0       ;PHYSICAL SECTOR SIZE (2^N*128)
;       .WORD   52      ;PHYSICAL SECTORS PER TRACK
;       .WORD   77      ;PHYSICAL TRACKS PER DISK
;       .WORD   0       ;RESERVED TRACKS
;       .WORD   0       ;TRANSLATION TABLE ADDRESS
;       .BYTE   1<TSD   ;DISK TYPE CODE
;       .BYTE   7       ;GAP LENGTH
;
;       128 BYTE SECTOR, SINGLE-DENSITY, ONE-SIDED
```

DSKFMT - TURBODOS OPERATING SYSTEM DRIVE SPECIFICATION TABLES


```
                        ;
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
                        ;
                        ; 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
```

TC442 - TURBODOS OPERATING SYSTEM IMS REAL TIME CLOCK ROUTINES


```
                        ;
                        ; COPYRIGHT (C) 1981 BY SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: 09/08/81
                        ;
                        .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              TICCNT: .BYTE   0       ;TICK COUNTER
                        ;
0000'                           .LOC    .PROG.# ;LOCATE IN PROGRAM AREA
                        ;
0000'   002A                    .WORD   NITLEN+2  ;INITIALIZATION CODE LENGTH
                        ;
0002'   3EC3            RTCNIT::MVI     A,JMP   ;INIT RTC INTERRUPT VECTOR ADDR
0004'   32 0008                STA     1*8
0007'   21 002A'                LXI     H,RTCISR
000A'   22 0009                 SHLD    (1*8)+1
000D'   3EB6                    MVI     A,T2CMD ;GET TIMER 2 COMMAND
000F'   D317                    OUT     TIMCTL  ;SELECT TIMER 2
0011'   21 0000:04              LXI     H,RTCCNT#  ;GET RTC COUNTER VALUE
0014'   7D                      MOV     A,L     ;GET LSB OF TIMER VALUE
0015'   D316                    OUT     TIM2    ;OUTPUT IT TO TIMER 2 DATA REGISTER
0017'   7C                      MOV     A,H     ;GET MSB OF TIMER VALUE
0018'   D316                    OUT     TIM2    ;OUTPUT IT TO TIMER 2 DATA REGISTER
001A'   21 0000:05              LXI     H,INTMSK#  ;GET INTERRUPT MASK
001D'   CBCE                    SET     1,M     ;SET RTC INTERRUPT ENABLE BIT
001F'   3A 0000:05              LDA     INTMSK  ;GET INTERRUPT MASK
0022'   D318                    OUT     SINTE   ;ENABLE RTC INTERRUPT MASK
0024'   21 0002'                LXI     H,RTCNIT  ;GET INITIALIZATION CODE ADDRESS
0027'   C3 0000:06              JMP     DEALOC# ;DE-ALLOCATE INITIALIZATION CODE
                        ;
0028                    NITLEN  = .-RTCNIT      ;INITIALIZATION CODE LENGTH
                        ;
002A'   ED73 0000:07    RTCISR: SSPD    INTSP#  ;SAVE STACK POINTER
002E'   31 0000:08              LXI     SP,INTSTK#  ;SET UP AUX STACK POINTER
0031'   F5                      PUSH    PSW     ;SAVE REGISTERS
```

RTC442 - TURBODOS OPERATING SYSTEM IMS REAL TIME CLOCK ROUTINES


```
0032'  C5                      PUSH    B
0033'  D5                      PUSH    D
0034'  E5                      PUSH    H
0035'  D319                    OUT     T2RES    ;RESET RTC INTERRUPT
0037'  21 0000'                LXI     H,TICCNT  ;GET TICK COUNTER
003A'  34                      INR     M        ;INCREMENT TICK COUNTER
003B'  7E                      MOV     A,M      ;GET TICK COUNT
003C'  01 0000:09              LXI     B,TICSEC#  ;GET NUMBER OF TICKS PER SECOND
003F'  B9                      CMP     C        ;SECONDS COUNT REACHED?
0040'  3805                    JRC     ..NSEC   ;IF NOT, CONTINUE
0042'  3600                    MVI     M,0      ;ELSE, RESET TICK COUNTER
0044'  CD 0000:0A              CALL    RTCSEC# ;SERVICE REAL TIME CLOCK MANAGER
0047'  CD 0000:0B      ..NSEC: CALL    DLYTIC# ;SERVICE DISPATCHER DELAY MANAGER
004A'  E1                      POP     H        ;RESTORE REGISTERS
004B'  D1                      POP     D
004C'  C1                      POP     B
004D'  F1                      POP     PSW
004E'  ED7B 0000:07            LSPD    INTSP#  ;RESTORE STACK POINTER
0052'  C3 0000:0C              JMP     ISRXIT# ;CONTINUE
                       ;
                       .END
```

BPD401 - TURBODOS OPERATING SYSTEM BOOT PROM DRIVER FOR IMS 401


```
                        ;
                        ; COPYRIGHT (C) 1981, SOFTWARE 2000, INC.
                        ;
                        ; AUTHORS: RONALD E. RAIKES
                        ;          MICHAEL D. BUSCH
                        ;
                        ; VERSION: 07/21/81
                        ;
                        .IDENT  BPD401          ;MODULE ID
                        ;
                        .INSERT EQUATE          ;O/S 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 COMMAND
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
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-SHUGART)

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)
```

```
BPD401 - TURBODOS OPERATING SYSTEM BOOT PROM DRIVER FOR IMS 401
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0001                    HUT     = 1             ;FDD HEAD UNLOAD TIME (16 MS)
                        ;
0003                    ST0NR   = 3             ;STATUS REGISTER 0 NOT READY
0004                    ST0EC   = 4             ;STATUS REGISTER 0 EQUIP CHECK
0005                    ST0SE   = 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 CODE)

                        ;
000A                    MAXTRY  = 10            ;MAX TRY COUNT
                        ;
00C0                            .LOC    RAM+RAMLEN  ;LOCATE IN WORKING STORAGE AREA
                        ;
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
                        ;
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 TIMF
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
```

```
PD401 - TURBODOS OPERATING SYSTEM BOOT PROM DRIVER FOR IMS 401
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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
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
```

BPD401 - TURBODOS OPERATING SYSTEM BOOT PROM DRIVER FOR IMS 401


```
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
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
```

`PD401 - TURBODOS OPERATING SYSTEM BOOT PROM DRIVER FOR IMS 401


```
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
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
```

BPD401 - TURBODOS OPERATING SYSTEM BOOT PROM DRIVER FOR IMS 401


```
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 CMD
017F'  D38F                  OUT     FDCDAT    ;OUTPUT BYTE TO FDC DATA REGISTER
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 PHASE
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
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
```

BPD401 - TURBODOS OPERATING SYSTEM BOOT PROM DRIVER FOR IMS 401


```
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
```

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