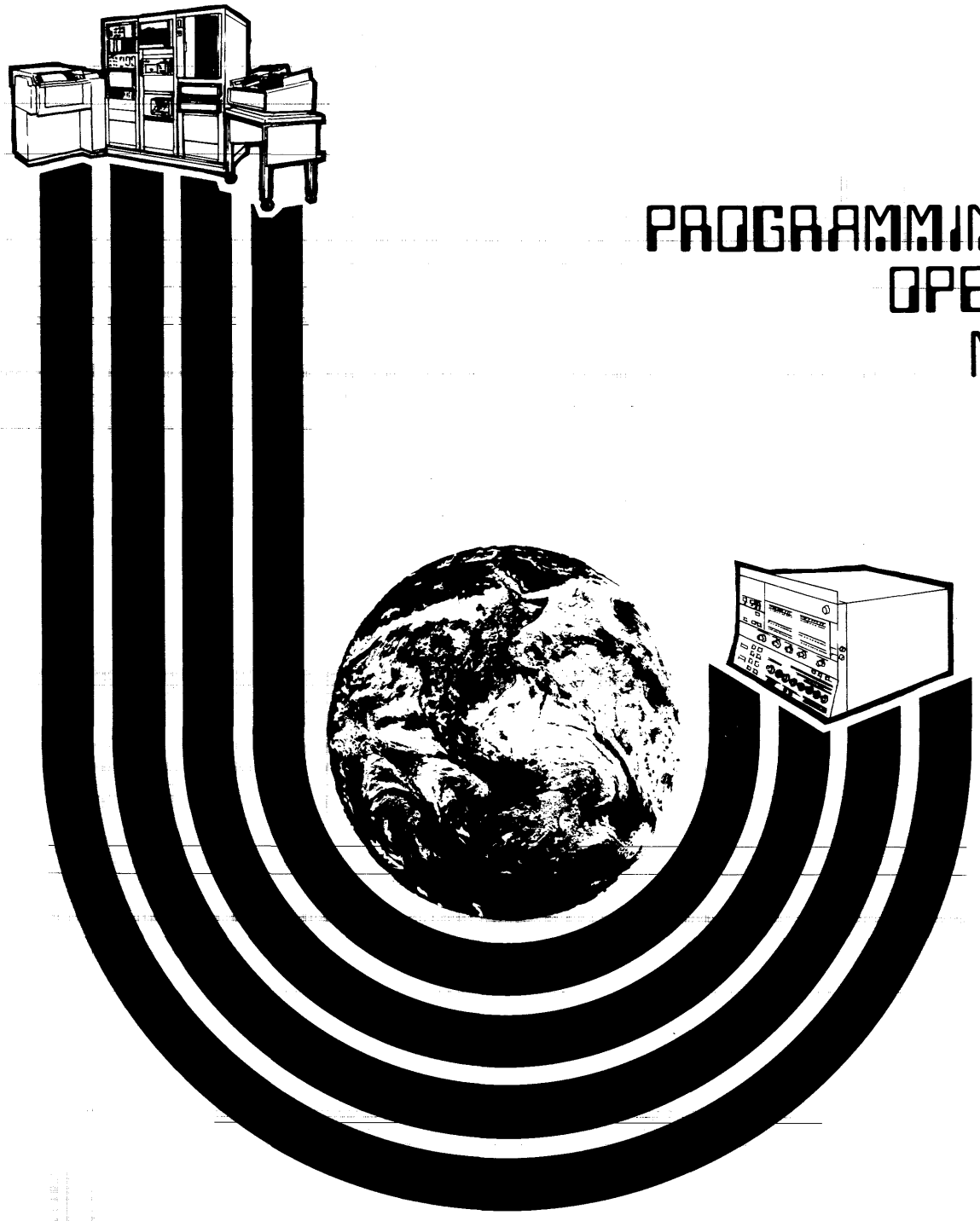
HP 91780A

HEWLETT hp PACKARD

REMOTE DATA TRANSMISSION SUBSYSTEM



PROGRAMMING AND OPERATING MANUAL

HEWLETT-PACKARD COMPANY

Sunnyvale, California

First Edition

PROGRAMMING AND OPERATING MANUAL

REMOTE DATA TRANSMISSION SUBSYSTEM

1 MAY 1974

PRINTED IN U.S.A.
Part No. 91780-93001
Microfiche No. 91780-93003

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PREFACE

This manual contains operating and programming information for the Remote Data Transmission Subsystem. The reader is assumed to be familiar with the material presented in the following publications:

Real-Time Executive Software System Manual (P/N 02005-90001)

Real-Time Executive File Manager Manual (P/N 29033-98000)

Real-Time Executive Core-Based Software System Manual (P/N 29101-93001)

Operating and Service Manual for the HP 12618A Synchronous Data Set Interface Kit (P/N 12618-90001, P/N 12621-90001, P/N 12622-90001)

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GENERAL DESCRIPTION

INTRODUCTION

The Remote Data Transmission Subsystem (RDTS), is an interface subsystem which may operate in either RTE-C or RTE environments. Its function is to facilitate data transfers between HP 2100 computers and IBM 360/370 computers by emulating the operation of an IBM 2780 Data Transmission Terminal. The data transfers are made using Binary Synchronous Communications protocol.

RDTS FEATURES

- IBM 2780 Emulation which includes support for such options as ASCII or EBCDIC code sets, Transparency, Multiple Record Blocking, Horizontal Tab, End of Media, Auto Turnaround, Auto Answer, and Vertical Format Control.
- Operation with other RDTS subsystems.
- Operation in either RTE-C or RTE systems.
- File accesses by logical unit number, or by file name.
- Concurrent communications activity and real-time processing.
- Auto answer or manual dial support.
- Support for both 80 and 132 column printers.

SOFTWARE

RDTS software consists of the modules shown in Table 1-1. Only a subset of the total is used to build any specific system. Not shown in the table, but also required for RDTS to operate are: either the RTE, or RTE-C operating systems. The File Management Package (FMP) and the HP Distributed System Interface Kit may also be included. The user should consult the appropriate Programming and Operating manual for these additional software descriptions.

HP RTE software modules compatible with RDTS:

RTIOC 29016-60003 Revision E or later for RTE Operating Systems and 29101-60003 Revision B or later for RTE-C Operating Systems.

Table 1-1. RDTS Software Modules

DESCRIPTION	BINARY TAPE NUMBER
DVR50 System Resident Bisync Driver	91780-60001
#RDTS Device Emulator (ASCII, No FMP)	91780-60002
#INRP Operator Interrupt Program	91780-60003
#BSC Library Resident Bisync Driver	91780-60004
#DIAL Manual Dialing Program	91780-60005
#TIME Bisync Timeout Parameter Module	91780-60006
#RDTS Device Emulator (EBCDIC, No FMP)	91780-60007
#INXT Operator Interrupt Privileged Library Subroutine	91780-60008
#RDTS Device Emulator (ASCII, with FMP)	91780-60009
#RDTS Device Emulator (EBCDIC, with FMP)	91780-60010
#CORE Program for Making #BSC Core-Resident	91780-60011
#JP50 Interrupt Linkage for DVR50	91780-60012

DVR12 29028-60001 Revision B or later for HP 2610A/2614A Line Printers and 29028-60002 Revision A or later for the HP 2767A Line Printer.

DVR00 29029-60001 Revision B or later version of the RTE Multiple Device System Control Driver.

HARDWARE

The minimum hardware required for RDTS is as follows:

HP 2100 Computer
- 12K memory with RTE-C
- 16K memory with RTE
- 24K memory for RTE with FMP

HP 12618 Modem Interface Kit (included in the RDTS subsystem)

HP 12620 Privileged Interrupt Board (Option P23 of 9600C/E system)

SUBSYSTEM DESCRIPTION

RDTS OPERATION

The IBM 2780 is a combination card reader, card punch and line printer. It contains a 400-byte buffer, and sufficient hardware to converse over synchronous modem lines to IBM 360's, IBM 370's and IBM 2780's.

The RDTS subsystem appears to IBM 360's and IBM 370's as though it is an IBM 2780. In fact, however, RDTS has access to all of the resources of RTE/RTE-C and all of the file manipulation capabilities of the File Manager, including the remote processing capabilities of the Distributed System Interface Kit. Paper tape punches and readers, card readers, line printers, magnetic tape units, CRT's and disc files can be accessed with RDTS and still appear as though they are the standard IBM 2780 list, punch and print devices.

RDTS operates as an independent program in either RTE or RTE-C. It is scheduled to operate using the normal RTE/RTE-C scheduling procedures. The five schedule parameters included in the call are used to specify modes of operation, and source/destination for inputs/outputs.

Console commands can be used to schedule RDTS to operate or to interrupt an output stream from the 360/370.

Input stream commands are recognized in non-transparent mode as control records for the local environment. Through the use of these records the user may change I/O devices, cause a line turnaround, listen for data, send data, enable transparency, or initiate the system console as a temporary input device.

Console messages are output by RDTS to report errors, issue warnings, provide information and request inputs. Error messages are grouped to isolate sources of communications problems.

IBM OPERATING SYSTEMS

RDTS is capable of communicating with IBM OS and DOS operating systems, and with HASP, BTAM and TCAM access methods. Under standard IBM operation, communications between BTAM or TCAM and an IBM 2780 are accomplished by treating the 2780 as a system peripheral. RDTS makes the RTE/RTE-C system appear to the IBM system like such a peripheral. The 360/370 programmer continues to utilize read/write type calls to BTAM or TCAM to access RDTS.

Under HASP, RDTS allows Remote Job Entry in addition to real-time processing. HASP allows the job to specify local 360/370 peripherals or files for I/O, in addition to the remote Hewlett-Packard equipment.

RDTS SUPPORT OF IBM 2780 FEATURES

RDTS provides support for the following IBM 2780 special features: transparency, multiple record blocking, horizontal tab, end of media, auto answer, auto turnaround, ASCII or EBCDIC code sets, and vertical format control. Complete descriptions of each of these features are contained in the *IBM 2780 Data Transmission Terminal* Manual (GA27-3005).

TRANSPARENCY–This feature allows all possible bit combinations in the code to be used as data. RDTS supports EBCDIC transparency in a manner compatible with actual 2780's. ASCII transparency is supported in RDTS to RDTS transmissions.

MULTIPLE RECORD BLOCKING–RDTS supports this feature in such a way that any number of records up to 400 bytes can be transmitted before a line turnaround occurs. The specific number of records depends upon the length of each record.

HORIZONTAL TAB–This feature provides an electronic tab function for the printer which is identical to the tab

function on a typewriter. RDTS use of the horizontal tab increases throughput by eliminating the need to send spaces within the text to format a record.

END OF MEDIA (EM)–This control character is inserted by RDTS in non-transparent text to indicate the end of a record when transmitting records of variable length.

AUTO ANSWER–RDTS automatically answers incoming calls from a 360/370 if the modem used is properly equipped for auto answer.

AUTO TURNAROUND–RDTS automatically switches to receive mode, and readies the "punch device" without operator intervention.

CODE SETS–Both ASCII and EBCDIC code sets are supported across the transmission link and ASCII is supported within the RTE/RTE-C system.

VERTICAL FORMAT CONTROL–This feature allows the 360/370 program to control the vertical spacing on output sent to the HP line printer.

SECTION II
RDTS OPERATION

INTRODUCTION

This section describes the program call and operator commands used to communicate with the Remote Data Transmission Subsystem. It also describes the data formats, modes of operation, and system conventions assumed by RDTS.

The RDTS schedule call, input either at the system console or from a user-written program, sets the initial operating parameters for the subsystem. These parameters include the logical unit for the communications channel, the mode of operation, and the logical unit selections for the list, print, and punch streams.

The input stream commands are used for on-line control of RDTS processing functions. They include such things as changing the initial I/O configuration within the RTE/RTE-C complex, causing auto turnaround, or causing RDTS to listen for data.

RDTS accepts input from files or logical units within the RTE/RTE-C system until an end-of-file delimiter appropriate to the device is reached. Data transmissions are by buffer. All binary bit patterns can be sent across the communications line if transparent mode is enabled. HP ASCII code is assumed for the RTE/RTE-C input/output devices.

RDTS operates in several modes: among them, transparent and non-transparent; normal and diagnostic. RDTS deletes BSC control characters in data received from the remote and automatically inserts these characters in transmissions to the remote. It also provides automatic translation of the code set used over the communication line if different from the HP ASCII used within the RTE/RTE-C system. Transparent mode operation allows the insertion of BSC control characters in the text and assumes that all data is binary. Translation is suppressed for certain devices in transparent mode. Diagnostic mode operation is used by software maintenance personnel to trace software module operation and isolate problems in the communications network, the operating system, and in the subsystem. Normal mode operation is the same as diagnostic mode operation with the diagnostic trace capability suppressed.

SCHEDULE CALL AND PARAMETERS

RDTS is scheduled to operate with a normal RTE/RTE-C EXEC call.

SCHEDULE RDTS

Purpose:

To schedule RDTS to operate, and optionally, to transfer up to five parameters.

Assembly Language:

```
        EXT   EXEC
        :
        JSB   EXEC      Transfer control to RTE or RTE-C
        DEF   *+3+n     Return point, where n is the number of parameters.
        DEF   ICODE     Request code
        DEF   INAME     Name of program to schedule
        DEF   ICMLU  )
        DEF   IMODE  |
        DEF   INLU   } Optional parameters
        DEF   IPRLU  |
        DEF   IPNLU  )
        return point    Continue execution
          .
          .
ICODE   DEC   9 or 10   9 = schedule RDTS with wait
                        10 = no wait; see text
INAME   ASC   3,#RDTS   To schedule RDTS, the ASCII name of the main module is used
ICMLU                   Logical unit number of the 12618A Modem Interface Kit; see text
IMODE                   Mode parameter; see text
INLU    )
IPRLU   } I/O device assignments or configuration file name; see text
IPNLU   )
```

FORTRAN:

```
CALL EXEC (ICODE,INAME,ICMLU,INLU,IPRLU,IPNLU)
```

COMMENTS

A schedule EXEC call with wait (ICODE=9) guarantees that RTE will put the calling program into waiting status and that the original program will not resume execution until RDTS completes. RDTS runs at its own priority, which may be greater than, less than, or equal to, that of the calling program.

NOTE

When RDTS is configured into a system as Background Disc Resident, another Background Disc Resident program may not schedule it with wait. RTE will abort the calling program and output an "SC03" error message.

A schedule EXEC call with no waiting (ICODE=10) causes RDTS to be scheduled for execution according to its priority.

COMMUNICATIONS LU PARAMETER

This parameter contains the logical unit number of the 12618A Interface Kit. If no value is specified, RDTS searches the EQT table in order of increasing logical unit values for an entry which points to DVR50 (the driver for the 12618A Interface Kit). If more than one EQT entry points to DVR50, the first encountered will be used.

MODE PARAMETER

The following modes can be specified by the bits of IMODE as shown in Table 2-1.

Table 2-1. Mode Parameter Bit Settings

BIT	"0"	"1"
0	Input Data Available	No Input
1	Local Dial	Local Answer
2*	Translate Input	Do Not Translate
14	Normal Operate	Diagnostic

*Bit 2 also enables transparent mode transmission.

INPUT DATA–RDTS assumes that input data is available and accesses the appropriate device or file. If no data is available, RDTS accepts output from the remote.

LOCAL DIAL–When scheduled with this option, RDTS attempts to become the transmitter, but will postpone being so if the remote wishes to transmit. Once the remote has finished transmission and is willing to receive, RDTS becomes the transmitter. If input is available, it is transmitted; otherwise, the line is dropped.

The standard RDTS subsystem contains a module called #DIAL. When this module is configured into the system, it causes RDTS to schedule #DIAL without wait when a Local Dial is encountered in the Mode Parameter. The program outputs a message requesting a manual dial. Section IV contains a description of #DIAL and Appendix F contains a listing of it.

LOCAL ANSWER–When scheduled with this option, RDTS allows the remote to be the transmitter. Once the remote has finished transmitting, RDTS becomes the transmitter if input is available; otherwise, the line is dropped.

TRANSLATE–RDTS translates from HP ASCII, in the RTE/RTE-C system to the code chosen, USASCII, or EBCDIC over the communications line. In transparent mode, no translation takes place in the data being passed to or from the remote except when receiving a punch stream from the remote and directing it to a line printer or CRT through local RDTS commands (e.g. #C).

DIAGNOSTIC MODE–This mode is used by system maintenance personnel. It causes additional console messages to be generated during RDTS operation. When 16384 is added to any of the values shown in Table 2-2, it causes the generation of diagnostic mode messages, in addition to the other functions shown in the table.

The bit configurations of the mode parameter result in the value and function combinations shown in Table 2-2.

INPUT/OUTPUT DEFINITIONS

RDTS assumes a list, print, and punch stream for I/O. These streams can operate on devices or files (if the File Manager version of RDTS is used). The optional parameters INLU, IPRLU, and IPNLU are used to point the streams to any of the standard devices supported by RTE/RTE-C. The values for these parameters are defined as shown in Table 2-3.

Table 2-2. Mode Parameter Functions

PARAMETER VALUE	MEANING		
0	INPUT DATA AVAILABLE	LOCAL DIAL	TRANSLATE
1	NO INPUT DATA AVAILABLE	LOCAL DIAL	TRANSLATE
2	INPUT DATA AVAILABLE	LOCAL ANSWER	TRANSLATE
3	NO INPUT DATA AVAILABLE	LOCAL ANSWER	TRANSLATE
4	INPUT DATA AVAILABLE	LOCAL DIAL	NO TRANSLATE
5	NO INPUT DATA AVAILABLE	LOCAL DIAL	NO TRANSLATE
6	INPUT DATA AVAILABLE	LOCAL ANSWER	NO TRANSLATE
7	NO INPUT DATA AVAILABLE	LOCAL ANSWER	NO TRANSLATE

Table 2-3. I/O Definition Parameters

PARAMETER	CASE 1	CASE 2	CASE 3
INLU	Input LU	Confile LU + 100	Configuration File Name
IPRLU	List LU	–	
IPNLU	Punch LU	–	

CASE 1–If INLU is set to a value less than decimal 100, it is the logical unit number (LU) of the input stream. In this case, IPRLU, and IPNLU are assumed to be the logical unit numbers for the list and punch streams (see Case 1 Example).

If INLU = 0, or if no value is supplied for this parameter, the standard input device (LU5) is assumed. The complete list of standard logical unit assignments for the RTE and RTE-C systems are shown in Table 2-4.

Table 2-4. RTE/RTE-C Standard Logical Unit Assignments

LOGICAL UNIT NUMBER	DEVICE
1	System Teleprinter
2	System Mass Storage (Reserved in RTE-C for Upward Compatibility)
3	Auxiliary Mass Storage (Reserved in RTE-C for Upward Compatibility)
4	Standard Punch Device
5	Standard Input Device
6	Standard List Device

CASE 1 EXAMPLE

Assembly Language:

```
                JSB     EXEC
                DEF     *+8
                DEF     ICODE
                DEF     INAME
                DEF     ICMLU
                DEF     IMODE
                DEF     INLU
                DEF     IPRLU
                DEF     IPNLU
                 :
ICODE           DEC     10      EXEC Call with no wait
INAME           ASC     3,#RDTS
ICMLU           DEC     13      LU of Communications driver
IMODE           DEC     0       Input data available, local dial, translate
INLU            DEC     5       Input stream on paper tape
IPRLU           DEC     1       Print stream points to TTY
IPNLU           DEC     8       Punch stream points to non standard device
```

FORTRAN:

```
CALL EXEC (ICODE,INAME,ICMLU,IMODE,INLU,IPRLU,IPNLU)
```

CASE 2–If INLU contains a value between decimal 100 and 200, 100 is subtracted from the value to obtain the logical unit number of the device containing the configuration file. In this case IPRLU and IPNLU are ignored.

In the File Manager version of RDTS a configuration file may be used to pass input, print and punch file names. This file is used because insufficient space is available for passing names as parameters in a schedule call.

The configuration file contains one record in the format:

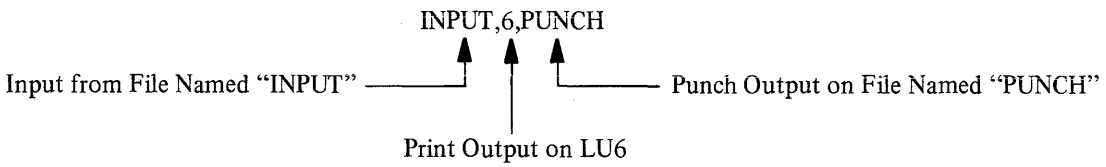
[LU or Name [,LU or Name [,LU or Name]]].

NOTE

Non File Manager versions of RDTS may specify a configuration file. It must, however, contain LUs and not file names.

CASE 2 EXAMPLE

Contents of Paper Tape on LU5:
(Configuration File)



Assembly Language:

```
        JSB     EXEC
        DEF     *+6
        DEF     ICODE
        DEF     INAME
        DEF     ICMLU
        DEF     IMODE
        DEF     INLU
        :
ICODE   DEC     10
INAME   ASC     3,#RDTS
ICMLU   DEC     13
IMODE   DEC     0
INLU    DEC     105
```

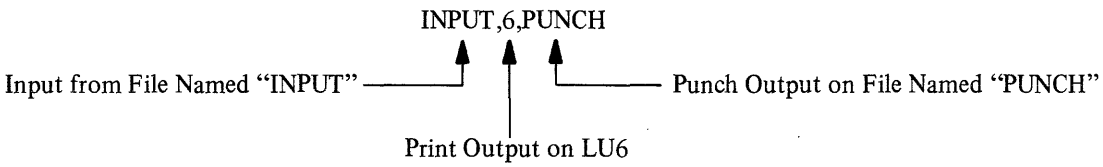
FORTRAN:

```
CALL EXEC (ICODE,INAME,ICMLU,IMODE,INLU)
```

CASE 3–This case is supported only if the FMP version of RDTS is installed. If INLU contains a value greater than 200, INLU, IPRLU, and IPNLU are assumed to contain the HP ASCII file name of the configuration file. RDTS will access this file for the names of the input and output files, or logical units.

CASE 3 EXAMPLE

Contents of File Named "CONFLE":



Assembly Language:

```
                JSB     EXEC
                DEF     *+8
                DEF     ICODE
                DEF     INAME
                DEF     ICMLU
                DEF     IMODE
                DEF     INLU
                DEF     IPRLU
                DEF     IPNLU
                 :
ICODE   DEC     10
INAME   ASC     3,#RDTS
ICMLU   DEC     13
IMODE   DEC     0
INLU    ASC     2,CO
IPRLU   ASC     2,NF
IPNLU   ASC     2,LE
```

FORTRAN:

```
CALL EXEC (ICODE,INAME,ICMLU,IMODE,INLU,IPRLU,IPNLU)
```

INPUT STREAM COMMANDS

The input stream commands that follow are recognized by RDTS as local control records in non-transparent mode. Through these records, the user may change the I/O file or logical unit selection at the local computer, terminate RDTS, cause an auto turnaround, listen for data, enable transparency, or use the system console as a temporary insert device. The user should note that if transparency is enabled, through the schedule call or by a #T [,*xx*] record, these commands no longer function as controls; they are transmitted as binary data. This condition remains in effect until an end-of-file is reached.

#E — Causes auto turnaround to occur. This record causes the local computer to transmit an end-of-transmission (EOT) control character. The remote computer must reply within thirty seconds (if applicable). Following this, the local computer again gains control of the communications line and becomes the transmitter.

#R — Similar to the #E (auto turnaround), and provides extended listen time. RDTS waits for about ninety seconds after transmitting an EOT, before attempting to gain control of the line. If, however, the remote computer gains control of the line during the first thirty seconds of wait, RDTS permits data reception from the remote until it receives an EOT. When the EOT is received, RDTS again goes into a ninety-second wait cycle.

#D or CONTROL-D — Causes a disconnect sequence (DLE EOT) to be transmitted to the remote and results in immediate termination of RDTS.

#I — The system console is temporarily used as the input stream. If the original input stream was from a file, the file remains open while the insert is in effect. An EOF causes the insert to be terminated (auto turnaround takes place as in #E and input is resumed from the original input stream).

#C[,*p*1[,*p*2[,*p*3]]] — Allows the local I/O devices or files used by RDTS for the list, print, and punch streams to be changed. *p*1, *p*2, or *p*3 may be logical unit numbers or file names. If a file name is specified, the file must have been previously created. Default for any missing parameter, (indicated by a ",") is the last device/file assigned for that stream. This record does not affect the system console as an insert device. Note that existing input/output files are closed as the first step of this operation. Any attempt to return to a previously used disc file will cause the file to reposition to zero. If the device specified is not legal for RDTS operation, an error message is output and the existing configuration remains in effect.

#T[,*xx*] — Subsequent data on the current input device/file is regarded as transparent binary data. This condition remains in effect until an end-of-file applicable to the input device/file is encountered. RDTS reverts back to nontransparent mode, following the end-of-file and expects input either from the device whose LU is "xx" or from the file whose file name is "*xx*." If "*xx*" is not specified, RDTS transmits a disconnect sequence and terminates.

Processing of certain control records varies somewhat when the system console is being used for input during insert mode. An EOF causes the insert to be terminated, and generates an auto turnaround, but does not cause termination of #RDTS. A #C to change the input device causes the original input device (where #I was read) to be affected once insert mode is terminated (by EOF). The system console is the only device that can be used for input while in insert mode. All other records are processed as described previously. When an EOF is encountered (except in insert mode), it is equivalent to a #D record (causing immediate termination).

End-of-file delimiters for various RTE/RTE-C peripherals are shown in Table 2-5.

Table 2-5. End-of-File Delimeters

DEVICE	DELIMETER
Cards	Blank Card
Magnetic Tape, Disc	End of File Mark
Paper Tape	Twenty (20) Blank Feed Frames
TTY	CONTROL-D

SYSTEM CONSOLE INPUT

Input is accepted from the console to schedule RDTS to operate, to perform any of the input stream command functions, or to interrupt reception from the remote computer to send data from the local computer. The attention of the system is gained by hitting any key on the control device.

To schedule RDTS to operate from the system console, the command is entered in the following format:

ON,#RDTS[,NOW] [,*P*1,*p*2,...*p*5]

where: NOW–schedules a program immediately normally scheduled by the clock time as described in the RTE Programming and Operating Manual.

*p*1–the logical unit number of the HP 12618A Synchronous Modem Interface Kit.

*p*2–mode parameter which is set as shown in Table 2-2. Diagnostic mode operations require the addition of decimal 16384 to any of the values shown in the table.

*p*3 < 100 — *p*3 contains the LU of the input stream. It is assumed that *p*4 and *p*5 contain the LU's for the list and punch streams. If *p*3 is zero or no value is supplied, the standard input device (LU=5) is assumed. *p*4 and *p*5 also default to standard logical unit numbers.

*p*3 > 100 — The logical unit number of the device containing the configuration file is found by subtracting 100 from the *p*3 value. *p*4 and *p*5 are ignored, i.e. if the TTY (LU1) is to be used to input the RDTS configuration, *p*3 is set to a value of 101.

Input data should be placed in the appropriate device or file prior to scheduling RDTS.

If a configuration file is specified in the schedule call from the system console, the operator will be asked to enter the file by a prompt (#). The operator should enter the configuration data in the format shown below.

[,LU or Name [,LU or Name [,LU or Name]]]

Parameters are assumed to be logical unit numbers unless they begin with an alphabetic character, in which case, they are assumed to be file names. Parameters may be defaulted to standard, LU's, but their positions must be indicated by double commas.

INPUT,,OUTPUT

INPUT STREAM COMMANDS

When the input stream is read from the system console RDTS issues a prompt (#) to solicit input records. Since some of the input records also contain prompts, the appearance of a double prompt (##C,,) can result from legal inputs.

INTERRUPT COMMAND

An operator interrupt command is accepted by RDTS if entered in the following format:

ON,#INRP

An interrupt is accepted only when RDTS is receiving output from the remote computer. The remote output stream is interrupted and the system console is used as an insert device. There is a noticeable delay between the time that the #INRP command is scheduled and the appearance of the prompt at the system console. This delay is due to the time required to send an end-of-transmission character and to gain control of the line.

To terminate the interrupt and continue the original processing, CONTROL-D is entered at the console. The discussion of the #I record under Input Stream Commands should be consulted for more details.

DATA FORMATS

No special control characters are required in data sent to, or received from, RDTS. Each transaction is on a per file basis, which means that input from a file or logical unit is accepted until the end-of-file delimiter applicable to that file/L.U. is reached or until a #C is received to change the input source. The end-of-file delimiters for the various devices supported by RTE/RTE-C are shown in Table 2-4. Output data appears in the same format as the input data. HP ASCII is always assumed within the RTE/RTE-C system unless transparency is specified. In that case, data is assumed to be binary. If transparency is not specified, binary transmission is not allowed.

RDTS requires input records of no more than eighty characters. In non-transparent mode, the first record from the input device, following an auto turnaround or initial scheduling of RDTS, is transmitted as eighty characters.

Subsequent records are truncated to the appropriate length (less than eighty characters) and an end-of-media character is inserted following the last character in each record. This method of automatic end-of-media insertion inhibits the transmission of trailing blanks and allows better line utilization.

In transparent mode, trailing blanks are not suppressed since a blank can be a valid binary sequence. In this mode, therefore, all binary records must be eighty characters long and comply with the buffer format shown in Figure 2-1.

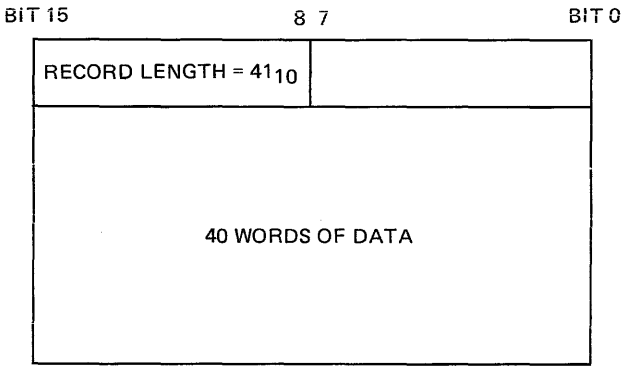


Figure 2-1. Binary Data Format

It should be noted that the record length includes the length word in its count. When RDTS reads a transparent buffer from the input stream, the first word of the buffer is automatically stripped off and interpreted as the length word. This buffer format not only provides transportability across a variety of pheripherals, but also allows null characters from paper tape to be correctly interpreted.

SYSTEM INTERFACE

RTE/RTE-C SYSTEM

Within the RTE/RTE-C system, three commands should be used with caution during RDTS operation: UP, DN, and OF.

CAUTION

An attempt to up or down (UP, DN) the DVR50 EQT while RDTS is operating may result in a system crash. This is because DVR50 dynamically uses the up/down feature as part of its operation.

Termination of RDTS is accomplished by a local input stream command rather than the RTE/RTE-C operator command. The OF command terminates RDTS operation, but does not necessarily complete transactions across the communications line, or with the disc file. This can result in the communications line remaining in data mode indefinately, or in the disc file being left exclusively open. Note that for a dial up line, this could result in unnecessary connect time and toll charges.

The local RDTS input stream commands (#D, or EOF) provide orderly termination and include the exchange of termination sequences between the remote computer and RDTS.

In the receive mode, the #INRP command can be used to insert a #D record to cause termination.

In transmit mode, and in cases of emergency where RDTS has to be terminated and it is not possible to cause #D to be read from the input stream, the following techniques can be used. The device being used for the input stream is downed (DN). After the RTE/RTE-C system outputs an I/O error of the device (RDTS will be in I/O suspension on that device),

OF,#RDTS,1

is entered. This sequence will not cause an orderly shutdown, but will cause line activity to terminate and the line will not be left in data mode.

DIFFERENCES BETWEEN RDTS AND THE IBM 2780

END OF MEDIA–RDTS automatically inserts End of Media (EM) control characters into all non-transparent records with fewer than eighty characters. End of Media characters may be inserted, but are not required in records received by RDTS from the remote.

HORIZONTAL TAB–The number of horizontal tab positions accepted by RDTS is limited to fifteen.

DATA BLOCK CHECKS–Although the IBM 2780 does not support ASCII transparency RDTS does provide this support. The block check scheme is LRC.

CODE SETS–The code sets supported by RDTS are determined by the RTE/RTE-C drivers installed in the system. The user should consult the RTE Small Program Manual for descriptions of appropriate drivers.

VERTICAL FORMAT CONTROL–Appendix E contains a description of the differences between HP and IBM printer functions.

UNSUPPORTED IBM 2780 FEATURES

Terminal ID
Multipoint Operation
Bell Character

SECTION III
RDTS MESSAGES AND ERROR RECOVERY

The Remote Data Transmission Subsystem provides three kinds of features to aid in the detection of errors: console messages, data block checks, and timeouts.

CONSOLE MESSAGES

RDTS outputs console messages in five formats:

```
#RDTS:ON
#RDTS:TERMINATED
#RDTS:DIAL REMOTE
ENTER CONFILE
#RDTS:XX
```

The first format is for information only and is output when #RDTS begins execution. The second format is printed prior to termination and is also an information message. The third format is printed to request a manual dial to the remote computer. The fourth format is used to request entry of the external configuration file specified in the schedule call. The last format is used to output error messages in normal mode operation, information messages in diagnostic mode, extended status error conditions, and irrecoverable File Manager errors.

FILE MANAGEMENT PACKAGE ERROR MESSAGES

The error conditions shown in Table 3-1 can only occur when the File Manager version of #RDTS is operational. These errors are considered irrecoverable by RDTS. Error recovery procedures for these messages can be found in the Real Time Executive File Manager Programming and Operating Manual.

Table 3-1. File Management Errors

RDTS MESSAGE NUMBER	FMGR MESSAGE NUMBER	MEANING
01	−1	Disc down.
02	−2	Duplicate name.
03	−3	Backspace not legal for type 0 file.
04	−4	File too long or record size error.
05	−5	Attempt to read or position to a record not written, or on update, write an illegal record length.
06	−6	Cartridge not found, or file not found, or no room.
07	−7	Invalid security code.
08	−8	File currently open to eight programs, or exclusively, or lock rejected.
09	−9	Attempt to open type 0 as type 1, or to use APOSN on type 0.
10	−10	Not enough parameters.
11	−11	DCB not open.
12	−12	SOF or EOF read or sensed.
13	−13	Cartridge locked.
14	−14	Directory full.
15	−15	Illegal name.
16	−16	Illegal type, or size = 0 (CREAT).
17	−17	Attempt to read or write on type 0 which does not support the operation.

COMMUNICATION LINE MESSAGES

When a problem occurs on the communication line, or between modules of RDTS, one or more of the messages in Table 3-2 are output by RDTS.

Messages 20-23, should only occur if the RDTS software modules have been improperly installed, or there is an error in the configuration of the operating system. Message 20 usually indicates that the #BSC module has been illegally swapped from core. Message 21, results when more than one program is calling DVR50 for I/O. Messages 22 and 23 are primarily for field support personnel. Message 22 may

Table 3-2. Communication Line Messages

NUMBER	MEANING
20	Security code violation.
21	Password violation.
22	Illegal mode for request issued to driver.
23	Illegal buffer format given to driver.
24	Illegal Bisync sequence received repeatedly.
25	Loss of Clear-to-Send.
26	Seven NAK characters sent (unrecognizable sequence received).
27	Eight NAK characters received from remote (unrecognizable sequence transmitted).
30	Receive timeout occurred repeatedly.
31	Long timeout failure.
32	Line Termination sequence sent (DLE/EOT).
33	Line Termination sequence received (DLE/EOT).
34	Loss of Data Set Ready signal.
35	Loss of character detect during receive (repeatedly).
36	TTD or WACK limit exceeded.
37	Request Timeout During Control Mode.
40	NAK Read Request issued three times.
41	Remote does not respond to a bid for the line (Handshake Request).
43	I/O configuration parameter error.
44	Logical Unit number invalid.
45	DVR50 not available.
46	I/O request rejected by DVR50.

occur in conjunction with other error conditions. If this should happen, it should be ignored because it means that the driver terminated the communications line between I/O requests to DVR50.

Messages 24-41, refer to communications line activity, but do not always indicate an error. When the remote computer sends a termination sequence, for example message 33; the message indicates the reason for termination, but there is no error as the remote computer may legally terminate the line. If no other messages are output with message 41, it indicates that the remote terminal is not ready, or unable to respond to communication requests.

Messages 43, 44, 45, and 46 usually result from invalid parameters during scheduling, entering a configuration file, or from executing a #C record in the input stream.

DIAGNOSTIC MODE MESSAGES

When RDTS is operating in the diagnostic mode, each request to the driver is reported and the standard status returned for that request. Messages that may result while operating in this mode are shown in Table 3-3.

Table 3-3. Diagnostic Mode Messages

NUMBER	MEANING
50	Initialization request issued to driver.
51	#DIAL scheduled.
52	Handshake request issued to the communication line.
53	Answer or control-to-receive request issued.
54	Write request issued.
55	Read request issued.
56	Send EOT request issued.
57	Control to send request issued.
58	Disconnect request issued.
59	Extended status request issued.
60	Irrecoverable line error.
61	Terminal on line.
62	Transmit mode.
63	Receive mode.
64	RVI received.
65	Buffer overflowed.

Messages 50-59 indicate the kind of current I/O request made to the RDTS bisync driver. Messages 60-65 indicate the current status of the bisync protocol. These messages will only appear when RDTS is running in diagnostic mode. They are used by system maintenance personnel as part of the fault isolation procedure of the subsystem.

GENERAL ERROR RECOVERY PROCEDURES

When one or more error messages occur, they are usually followed by a message indicating that #RDTS terminated.

The recovery procedure is to repeat the previous sequence of #RDTS operations back to the last valid auto turnaround (initiated by a #E or #R). File Manager errors, however, usually require additional work with FMGR to prevent recurrance of the file error.

In any communications network, errors occasionally appear with no apparent reason. If the error is not readily reproducible the cost incurred to diagnose and fix the problem may be difficult to justify, especially in switched systems where the same connection path is seldom obtained twice. These messages should be ignored unless they appear with sufficient frequency to indicate a recurring problem.

TIMEOUTS

Timeouts are defined as fixed periods of time within which any particular operation must occur. They are used in BSC protocol to enable error recovery procedures. RDTS allows the user to vary the lengths of four types of timeouts: Receive Timeout, Transmit Timeout, Long Timeout, and the maximum number of TTD/WACK sequences. The value of a timeout parameter is determined by such things as the IBM operating environment and the access method of the particular configuration, the type of modem and communication line, the RTE/RTE-C priority given to #RDTS, and whether or not swapping is supported.

All of the timeout parameters are contained in the RDTS module, #TIME. This module must be coded exactly as shown except for variations in parameter values. If the user wishes to change any of the #TIME parameters, a new version of the program must be written and installed in the system. The format for the module is shown in Figure 3-1.

Receive timeout is used by the a) transmitting terminal to limit waiting time to receive a recognizable Bisync response sequence, or b) permit the receiving terminal to check the line for sync idle characters indicating that the transmission is continuing.

The value of the receive timeout parameter must be greater than the value of the transmit timeout. Receive timeout is reset and restarted when the first sync-idle character is detected. The value of this parameter is generally three seconds.

Sync-idles are inserted into messages for timing purposes only, and have no effect on the message format. In normal data, two consecutive sync-idle characters (SYN) are inserted every 300 bytes. In transparent data, one transparent sync-idle sequence (DLE SYN) is inserted every 300 bytes.

Transmit timeout limits the amount of time for a receiving terminal to send an acknowledgement to received text. If the transmit timeout value is exceeded, a Delayed Acknowledgement (WACK) is transmitted. Transmit time-out also limits the amount of time a transmitting terminal can wait (after receiving acknowledgment for the previous buffer from remote) before sending the next text buffer or a Temporary Text Delay (TTD) sequence. The value of the transmit timeout parameter is normally two seconds, but can be varied by ten percent without impact.

Long timeout is used during data or text transmission, or during auto turnaround to prevent a terminal from holding a connection during a prolonged period of inactivity. In receive mode, having responded to the last buffer (TTD sequence or text buffer), RDTS waits for a long timeout to receive the next buffer. If no buffer is received, a line termination sequence is sent. Also, while receiving text, RDTS allows line inactivity for a maximum of 'transmit timeout.' Should line inactivity (within text buffer), persist for more than a 'transmit timeout,' a negative acknowledg-ment (NAK) is transmitted to the remote right away.

```
ASMB,R,B,L
       NAM #TIME,6
       ENT #TIME
#TIME  DEF *+1
       DEC -3Ø1       RECEIVE TIMEOUT = 3.Ø1 SEC
       DEC -19Ø       XMIT TIMEOUT = 1.9Ø SEC
       DEC -295Ø      LONG TIMEOUT = 29.5 SEC
       DEC -15ØØ      MAX NUM OF TTD/WACK SEQUENCES
       END
```

Figure 3-1. #TIME Listing

Long timeout is also used following the transmission or reception of an EOT which sets the line in control mode. The line remains in control mode for a long timeout during which the remote may bid for the line and become the transmitter. If the remote does not bid for the line, the bisync driver leaves the line in control mode and allows RDTS a long timeout to make the next request which may either result in leaving the line in control mode for another long timeout, bidding for the line and attempting to become the transmitter, or dropping the line. A request timeout during control mode (message 37) and a dropped line may result if RDTS fails to call the driver with one of these decisions.

The maximum number of TTD/WACK sequences indirectly specifies the maximum length of time the line will be held between read and write requests to the communications driver. The total TTD/WACK sequence time should exceed the maximum amount of time required to read I/O requests equivalent to four hundred bytes. Note that in the case of TTY input, this is the time required for the user to type in several lines of information.

Each transmission of a TTD or WACK sequence maintains the line for approximately two seconds. If swapping is supported, it is advisable to increase this parameter. When the value of this timeout is reached, the terminal disconnects.

SECTION IV
SYSTEM GENERATION AND INSTALLATION

INTRODUCTION

The Remote Data Transmission Subsystem (RDTS) consists of three programs, a driver, and subroutines which can be generated in a standard configuration or in one of three optional configurations: RDTS in RTE Foreground, RDTS in RTE Background, or RDTS in RTE-C. These configurations can include ASCII or EBCDIC line codes, with or without the File Manager (RTE only).

RDTS SOFTWARE MODULES

The RDTS software package consists of the following modules of which only a subset is used to build any one configuration. All software, however, is shipped with each system.

91780-60001	DVR50
91780-60002	#RDTS/ASCII (without FMP)
91780-60003	#INRP
91780-60004	#BSC
91780-60005	#DIAL
91780-60006	#TIME
91780-60007	#RDTS/EBCDIC (without FMP)
91780-60008	#INXT
91780-60009	#RDTS/ASCII (with FMP)
91780-60010	#RDTS/EBCDIC (with FMP)
91780-60011	#CORE
91780-60012	#JP50

#RDTS–The main program in the RDTS subsystem, it controls parameter decoding, dialing and answering functions, and provides interfacing and buffering between I/O devices/files and the communications line. #RDTS also accesses the other RDTS modules to output information and error messages.

DVR50–The system resident module of the Binary Synchronous Communications driver, DVR50 is not complete in itself, but requires #BSC.

#JP50–This module allows the necessary base page links to be created. This routine is used by DVR50 to set up the interrupt trap cell locations with appropriate 'JSB' instructions.

#BSC–#BSC is the library resident Binary Synchronous Communications driver which interfaces with DVR50. It formats input/output user data according to BSC protocol procedures, controls the operation of the I/O boards, exchanges control sequences with the remote, transmits and receives user data at appropriate times, and performs error recovery on the communications line.

#TIME–contains the parameters for the duration of Receive Timeout, Transmit Timeout, and Long Timeout as well as the Maximum Number of TTD/WACK sequences. These time-dependent features vary with a given configuration and are dependent upon such factors as the type of access method or IBM Network Control Program being used, the types of modems and communication lines being used, and the core placement of RDTS modules.

#DIAL–is scheduled to: 1) cause a line to be dialed, or 2) cause a line to be put "on-hook" (deactivated). Parameters are passed to #DIAL during the schedule operation. The address of these parameters is contained in the B-register when #DIAL executes. The p1 parameter indicates the logical unit of the current system console device. p2 indicates the function to be performed where: p2=−1 for disconnect, and p2=0 for dial.

The version of this program supplied with the RDTS software outputs the message: DIAL REMOTE on the system LU when p2=0, but performs no function when p2=−1. FORTRAN programs may retrieve these parameters through RAMPAR.

Since #DIAL is a type 2 program in RTE (disc resident), user-written versions of the program may be inserted on-line with the RTE Relocating Loader. A similar operation is possible in RTE-C. The user should consult the appropriate programming/operating manual for directions.

#DIAL may be rewritten for a variety of purposes, among them: 1) to write more complete dialing or disconnect instructions to the operator, 2) to call a user-written driver to automatically dial a number, or 3) to perform a null function for leased-line operation. The user should consult Appendix F for a listing of #DIAL.

#CORE–is a zero length program which makes it possible to place the #BSC and #TIME programs in the core resident library during system generation. This program is used only in RTE Foreground configurations.

#INXT–is a privileged subroutine used by #INRP. It allows an interrupt flag to be passed from #INRP to #RDTS.

#INRP–is a program scheduled by the operator to interrupt an output stream from the IBM computer to send a message from RDTS.

It is assumed that the user is familiar with the RTE/RTE-C system generation processes described in the Real Time Executive Software System Programming and Operating Manual or the Real-Time Executive Core Based Software System Programming and Operating Manual.

RDTS MODULE PRIORITIES

The RDTS program modules can be configured in a variety of ways in both systems. Table 4-1 shows both recommended and optional placement of the modules for RTE and RTE-C Systems.

Table 4-1. RDTS Module Configurations

MODULE	RECOMMENDED CONFIGURATION FOR RTE	RECOMMENDED CONFIGURATION FOR RTE-C	ALLOWABLE OPTIONS FOR RTE	ALLOWABLE OPTIONS FOR RTE-C
#DIAL	a	SYSGEN	a,b,d	ON-LINE
#RDTS	c	ON-LINE	a,b,c,d	SYSGEN
#BSC	c with #RDTS	ON-LINE with #RDTS	e	e
#INRP	b	SYSGEN	b,d	SYSGEN
#INXT	e	SYSGEN	e	e
#CORE	b or d – Needed if Option 5 is selected for #BSC			
#TIME	Must be with #BSC			
#JP50	Must be system (Type 0) program			
DVR50	Must be system (Type 0) program			
where: a = Foreground Disc Resident; b = Foreground Core Resident; c = Background Disc Resident; d = Background Core Resident; e = Library Core Resident				

HARDWARE INSTALLATION

INSTALLATION SEQUENCE

The following hardware priorities should be observed in installing I/O boards into the HP 2100 Computer:

1. HP 12618A Modem Interface Kit (slots 10, 11)
2. Other privileged device boards
3. Privileged Interrupt Board
4. Time Based Generator, disc and other peripherals.

MODEM REQUIREMENTS

The HP 12618A Synchronous Modem Interface Kit includes a fifty foot cable for connecting to synchronous modems. The modems may operate at speeds up to 9600 bits per second, on dial up or private lines. Private lines may be ordered full-duplex to eliminate line turnaround time and improve throughput. Half-duplex lines and modems may be used, however, since the Bisync line protocol is half-duplex.

The modem chosen must meet the following requirements to be used with RDTS:

- Synchronous
- Timing internal to the modem
- EIA RS232B or CCITT V.24 compatible
- Do not use New Sync
- Do not use Reverse Channel
- Unattended Answering (optional)
- Alternate voice (optional, but is recommended for coordination)

More detailed information on modems and ordering information on specific modems is contained in the HP 91780 Remote Data Transmission Subsystem General Information Manual.

RTE-C GENERATION PROCESS

The subset of the RDTS software package shown in Table 4-2 is used in all RTE-C generations and should be gathered together with the rest of the RTE-C modules.

An overview of the RTE-C generation process together with its required inputs and resulting outputs is shown in Figure 4-1.

Table 4-2. RDTS Modules Required for RTE-C Generation

PART	NAME	TYPE
91780-60001	DVR50	I/O Driver
91780-60012	#JP50	System Program
91780-60008	#INXT	Resident Library Module
91780-60003	#INRP	Core Resident User Program
91780-60005	#DIAL	Core Resident User Program
91780-600xx	#RDTS	ON-LINE Resident Program
91780-60004	#BSC	Utility Program (added as subroutine to #RDTS)
91780-60006	#TIME	Utility Program (added as subroutine to #RDTS)

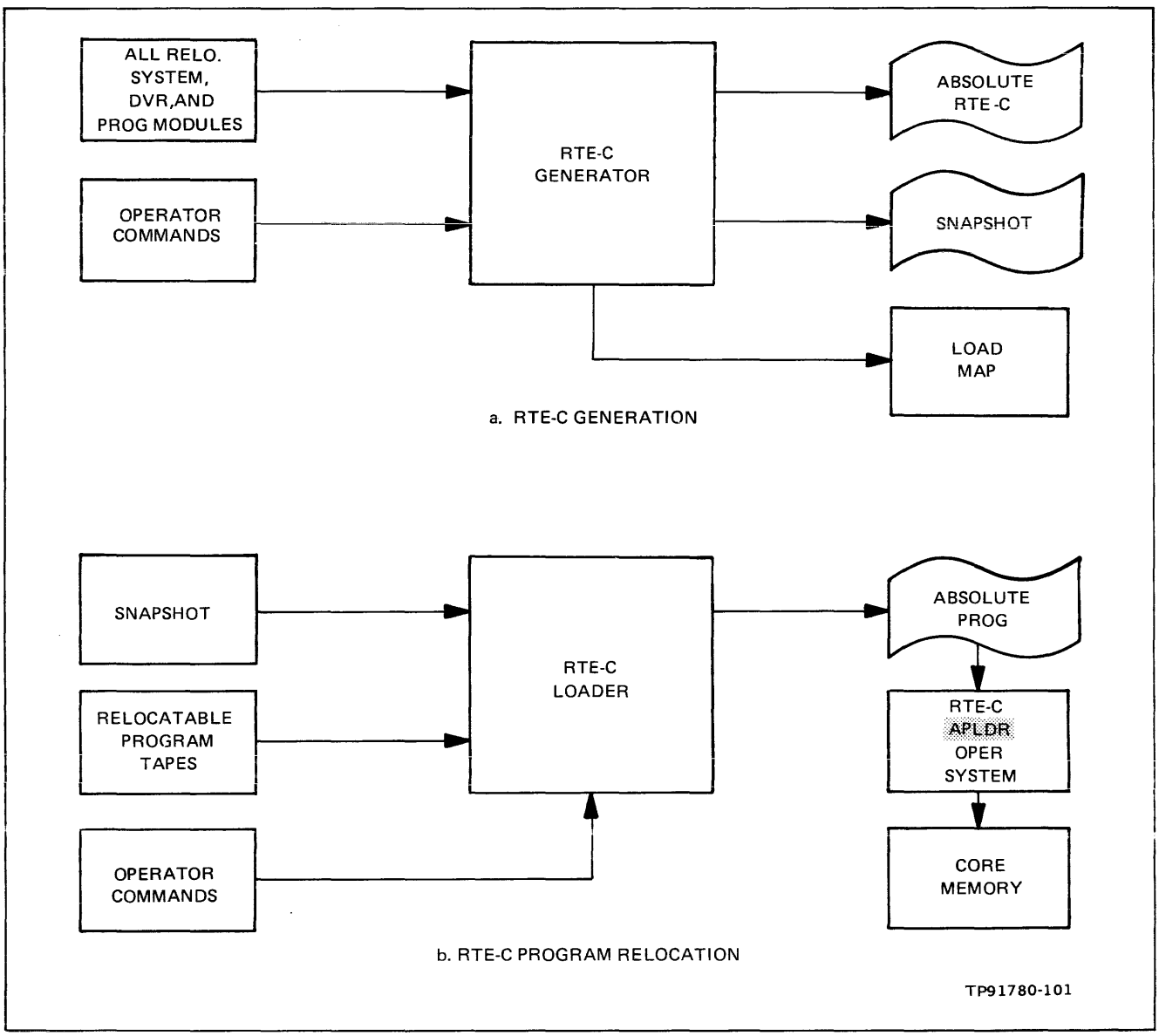


Figure 4-1. RTE-C Generation/Installation Overview

GENERATION PROCEDURE

If the EBCDIC code set is specified, the 91780-60007 version of #RDTS is loaded. If the ASCII Code set is specified, the 91780-60002 version of #RDTS is loaded.

DVR50 and #JP50 are loaded during the Program Input Phase.

DVR50 is entered in the equipment table as the driver for RDTS during the Table Generation Phase. DMA, I/O buffering and timeout parameters MUST NOT be included for this driver. The Interrupt Table locations for the HP 12618A Interface Kit entries should both point to the one EQT entry for DVR50. DVR50 should have a low numbered EQT to maintain the required timing sequence.

The number of ID segments reserved during the Program/Parameter Input Phase, should include one entry for each of the following: #INRP, #DIAL, and #RDTS.

#INXT should be loaded as part of the Resident Library.

RDTS requires no words of common.

#INRP and #DIAL should be loaded as User Programs without parameter changes.

Since #RDTS will be added on-line, APLDR (Absolute Program Loader, HP 29101-60004) must be included as a User Program and a system snapshot must be created.

When the RTE-C generation is complete, the RTE-C relocating loader is used to construct an absolute version of #RDTS. Operating instructions for the loader are contained in Section VII of the RTE-C Operating and Programming Manual. The pages following the RTE-C generation output show an example of the output from the Relocating Loader used to relocate RDTS under RTE-C.

The absolute version of #RDTS can be loaded into the RTE-C system by placing the tape in the photoreader and entering the system command

*LO

RTE-C GENERATION EXAMPLE

The following pages show the construction of an RTE-C system with RDTS. This system is configured for a 2100 computer with 12K of core, a TTY/CRT, a photoreader, a line printer, a card reader and a paper tape punch. Only the part of the generation pertinent to RDTS is shown here. The Real-Time Executive Core-Based Software system manual should be consulted for an example of a complete RTE-C generation and sample worksheets.

RTE-C GENERATION OUTPUT

```
RTSGN

PRAM INPT?
1

TBG CHNL?
13

PRIV. INT?                          Specify Privileged Interrupt Card.
12

FWA BP?
25

LWA MEN?
27677

FWA SYS MEM                         I/O Buffer of 400₈ words.
27400

REL SYS MODS
-
```

RTE-C GENERATION OUTPUT (Continued)

```
MAP GLOBALS,MODULES,LINKS
 PROGRAM  ENTRY    LOW     HIGH     LOW     HIGH
  MODULE  POINT    MAIN    MAIN     BASE    BASE


-
RELOCATE
  RTIOC            Ø2ØØØ   Ø4462    ØØØ25   ØØØ77
           $CIC    Ø2ØØØ
           $XSIO   Ø2723
           $SYMG   Ø3547
           $IORQ   Ø2214
```

```
-
RELOCATE
  DVR11            12150   13130    ØØ3Ø4   ØØ3Ø3    2892A Cardreader Driver.
           C.11    12632
           I.11    12150
-
RELOCATE
  DVR12            13131   13764    ØØ3Ø4   ØØ3Ø3    2767A Lineprinter Driver.
           I.12    13146
           C.12    13472
-
RELOCATE
  DVR5Ø            13765   14334    ØØ3Ø4   ØØ312    Add DVR50 as an I/O Driver.
           I.5Ø    13765
           C.5Ø    14152
           P.5Ø    14222

RELOCATE
  #JP5Ø            14335   14335    ØØ313   ØØ313    Add #JP50 as a System Module.
           #JP5Ø   14335
-
END

STARTING ADDRESS ØØØØ2
NO UNDEFS
```

```
EQT TBL

EQT  1 = ?                                          Teletype /CRT
15,DVRØØ,B

EQT  2 = ?                                          12618A Interface Kit
1Ø,DVR5Ø
```

RTE-C GENERATION OUTPUT (Continued)

```
EQT  3 = ?                                    Photoreader
16,DVRØ1,T=5ØØ

EQT  4 = ?                                    Paper Tape Punch
17,DVRØ2,B,T=5ØØ

EQT  5 = ?                                    2767A Lineprinter
2Ø,DVR12

EQT  6 = ?                                    2892A Cardreader
14,DVR11,B,T=5ØØ

EQT  7 = ?
END

DRT TBL
LU#

 1 = EQT #?                                   System Control Device
1

 2 = EQT #?                                   ---
Ø

 3 = EQT #?                                   ---
Ø

 4 = EQT #?                                   Standard Punch Device
4

 5 = EQT #?                                   Standard Input Device
3

 6 = EQT #?                                   Standard List Device
5

 7 = EQT #?                                   Modems
2

 8 = EQT #?                                   Cardreader
6

 9 = EQT #?
END
```

RTE-C GENERATION OUTPUT (Continued)

```
INT TBL
10,EQT,2
11,EQT,2
14,EQT,6
15,EQT,1
16,EQT,3
17,EQT,4
20,EQT,5
```

```
STRT-UP PROG?
Ø

REL RES LIB
-
RELOCATE
  #INXT            14737   14756   ØØ315   ØØ316    Add #INXT to the System Library as
           #INPT   14737                             a type 6 program.
           #INGT   14747
-
END
```

```
# WDS IN COMM?                                       No words of COMMON are required.
Ø

REL USER PROGS
-
RELOCATE
  #INRP            14757   14764   ØØ317   ØØ32Ø    Set up #INRP as a User Program.
           #INRP   14757
-
END

STARTING ADDRESS 14757
NO UNDEFS
```

RTE-C GENERATION OUTPUT (Continued)

```
ENTER PRAMS
Ø
 REL USER PROGS
-
RELOCATE            14765   15Ø13   ØØ321   ØØ32Ø    Set up #DIAL as a User Program.
  #DIAL             14765


-
END

STARTING ADDRESS 14765
NO UNDEFS
```

```
ENTER PRAMS
Ø

REL USER PROGS
-
RELOCATE                                              Include APLDR as a User Program in
  APLDR             15Ø14   1655Ø   ØØ321   ØØ431    order to add #RDTS.
          APLDR     15Ø14
-
END

STARTING ADDRESS 15Ø14
NO UNDEFS
```

```
REL USER PROGS
-
END

SNAPSHOT?                                             A snapshot is required for LOADR to
YES                                                   relocate #RDTS.

RTSGN FINISHED
```

RELOCATION OF #RDTS USING THE RTE-C RELOCATING LOADER

```
LOADER STARTED
-
TRANSFER                                    Load the RTE-C Resident Snapshot.
-BOUNDS FWABP = ØØ432
-BOUNDS LWABP = Ø1647
-BOUNDS FWAM= 16551
-BOUNDS LWAM= 27377
-BOUNDS FWAC= ØØØØØ
-BOUNDS LWAC= ØØØØØ
- SET $CIC   TO Ø2ØØØ
-LINKS START AT ØØ314,Ø2ØØØ
- SET $XSIO  TO.02723
-LINKS START AT ØØ1ØØ,Ø2723
- SET $SYMG  TO Ø3547
-LINKS START AT ØØ1Ø6,Ø3547
- SET $IORG  TO Ø2214
-LINKS START AT ØØ241,Ø2214
- SET $IOUP  TO Ø3526
-LINKS START AT ØØ1Ø1,Ø3526
- SET $IODN  TO Ø3466
-LINKS START AT ØØ1Ø2,Ø3466
- SET $IRT   TO Ø2146
-LINKS START AT ØØ1Ø7,Ø2146
- SET $XCTC  TO Ø2Ø14
- SET $DEVT  TO Ø34Ø2
-LINKS START AT ØØ11Ø,Ø34Ø2
- SET $CVEC  TO Ø3644
- SET $IOCL  TO Ø3733
-LINKS START AT ØØ1Ø5,Ø3733
- SET $LUPR  TO Ø4Ø51
-LINKS START AT ØØ1Ø3,Ø4Ø51
- SET $EQST  TO Ø4224
-LINKS START AT ØØ1Ø4,Ø4224
- SET $CHTO  TO Ø4321
-LINKS START AT ØØ111,Ø4321
- SET $ROST  TO 1ØØ26
-LINKS START AT ØØØ25,1ØØ26
- SET $CLCK  TO ØØ463
-LINKS START AT ØØØ26,Ø4463
- SET $XEQ   TO Ø51ØØ
-LINKS START AT ØØØ27,Ø51ØØ
- SET $TYPE  TO Ø76Ø2
-LINKS START AT ØØØ3Ø,Ø76Ø2
- SET $LIST  TO Ø534Ø
-LINKS START AT ØØØ31,Ø534Ø
- SET $ALC   TO 1Ø443
-LINKS START AT ØØØ32,1Ø443
- SET $RTN   TO 1Ø54Ø
```

RELOCATION OF #RDTS USING THE RTE-C RELOCATING LOADER (Continued)

```
-LINKS START AT ØØØ33,1Ø54Ø
- SET $CVT3  TO Ø7435
-LINKS START AT ØØØ34,Ø7435
- SET $ERMG  TO 1Ø7Ø6
-LINKS START AT ØØØ35,1Ø7Ø6
- SET $MESS  TO Ø5633
-LINKS START AT ØØØ36,Ø5633
- SET $ARBT  TO 1Ø763
-LINKS START AT ØØØ37,1Ø763
- SET $STRT  TO Ø7521
- SET $MPT1  TO Ø7651
-LINKS START AT ØØ242,Ø7651
- SET $MPT2  TO Ø7657
-LINKS START AT ØØ243,Ø7657
- SET $MPT4  TO Ø7665
-LINKS START AT ØØ244,Ø7665
- SET $MPT5  TO Ø7676
-LINKS START AT ØØ245,Ø7676
- SET $MPT6  TO Ø7745
-LINKS START AT ØØ246,Ø7745
- SET $MPT7  TO Ø7766
-LINKS START AT ØØ247,Ø7766
- SET $IADD  TO Ø5Ø25
- SET $TREM  TO Ø5Ø47
-LINKS START AT ØØ164,Ø5Ø47
- SET $LIBR  TO 1Ø231
-LINKS START AT ØØ315,1Ø231
- SET $LIBX  TO 1Ø34Ø
-LINKS START AT ØØ316,1Ø34Ø
- SET EXEC   TO 1ØØ24
-LINKS START AT ØØ32Ø,1ØØ24
- SET I.ØØ   TO 11Ø47
- SET C.ØØ   TO 1145Ø
- SET I.Ø1   TO 11Ø47
- SET C.Ø1   TO 1145Ø
- SET I.Ø2   TO 11Ø47
- SET C.Ø2   TO 1145Ø
- SET C.11   TO 12632
- SET I.11   TO 1215Ø
- SET I.12   TO 13146
- SET C.12   TO 13472
- SET I.5Ø   TO 13765
- SET C.5Ø   TO 14152
- SET P.5Ø   TO 14222
-LINKS START AT ØØ313,14222
- SET #JP5Ø  TO 14335
-LINKS START AT ØØ3Ø4,14335
- SET #INPT  TO 14737
```

RELOCATION OF #RDTS USING THE RTE-C RELOCATING LOADER (Continued)

```
-LINKS START AT ØØ317,14737
- SET #INGT  TO 14747
- SET BPLOCC TO ØØ432
- SET LOCC   TO 16551
-
MAP MODULES, GLOBALS,LINKS
 PROGRAM  ENTRY    LOW    HIGH    LOW    HIGH
  MODULE  POINT    MAIN   MAIN    BASE   BASE

-
RELOCATE
  #RDTS            16551  225Ø6   ØØ432  ØØ652      Load #RDTS.
           #RDTS   16551
-
RELOCATE
  #BSC             225Ø7  27266   ØØ653  Ø1166      Add #BSC as a subroutine.
           #BSC    225Ø7
-
RELOCATE
  #TIME            27267  27273   Ø1167  Ø1166      Add #TIME as a subroutine.
           #TIME   27267
-
DISPLAY UNDEFS
NO UNDEFS
-
END

STARTING ADDRESS 16551
NO UNDEFS
 LINKS TABLE
$CIC   ØØ314
$XSIO  ØØ1ØØ
$SYMG  ØØ1Ø6
$IORG  ØØ241
$IOUP  ØØ1Ø1
$IODN  ØØ1Ø2
$IRT   ØØ1Ø7
$DEVT  ØØ11Ø
$IOCL  ØØ1Ø5
$LUPR  ØØ1Ø3
$EQST  ØØ1Ø4
$CHTO  ØØ111
$RQST  ØØØ25
$CLCK  ØØØ26
$XEQ   ØØØ27
$TYPE  ØØØ3Ø
$LIST  ØØØ31
$ALC   ØØØ32
```

RELOCATION OF #RDTS USING THE RTE-C RELOCATING LOADER (Continued)

```
$RTN   ØØØ33
$CVT3  ØØØ34
$ERMG  ØØØ35
$MESS  ØØØ36
$ABRT  ØØØ37
$MPT1  ØØ242
$MPT2  ØØ243
$MPT4  ØØ244
$MPT5  ØØ245
$MPT6  ØØ246
$MPT7  ØØ247
$TREM  ØØ164
$LIBR  ØØ315
$LIBX  ØØ316
EXEC   ØØ32Ø
P.5Ø   ØØ313
#JP5Ø  ØØ3Ø4
#INPT  ØØ317
#INGT  ØØ433
#BSC   ØØ432
#TIME  ØØ653
```

RTE GENERATION PROCESS

The subset of the RDTS software package shown in Table 4-3 is used in all RTE generations and should be gathered together with the rest of the RTE modules for loading during the Program Input Phase of RTGEN.

Table 4-3. RDTS Modules Required for RTE Generation

PART	NAME	TYPE
91780-60001	DVR50	I/O Driver
91780-60012	#JP50	System Program
91780-60003	#INRP	Foreground Core Resident Program
91780-60005	#DIAL	Foreground Disc Resident Program
91780-600xx	#RDTS	Background Disc Resident Program
91780-60008	#INXT	Library Program
91780-60004	#BSC	Utility Program
91780-60006	#TIME	Utility program
91780-60011	#CORE	Foreground Core Resident Program

An overview of the RTGEN process together with the required inputs and resulting outputs is shown in Figure 4-2.

GENERATION PROCEDURE

The #RDTS version used in the generation is determined by whether the system uses ASCII or EBCDIC line code and whether or not the system contains the File Manager Package (FMP).

ASCII	91780-60009 #RDTS (with FMP) 91780-60002 #RDTS (without FMP)
EBCDIC	91780-60010 #RDTS (with FMP) 91780-60007 #RDTS (without FMP)

If #RDTS is specified as Foreground Resident the following additional module and procedures must be added to the generation:

1) 91780-60011 #CORE Foreground Core Resident Program
2) Swapping question is answered YES during Initialization Phase
3) #RDTS Program type is changed during the Parameter input phase

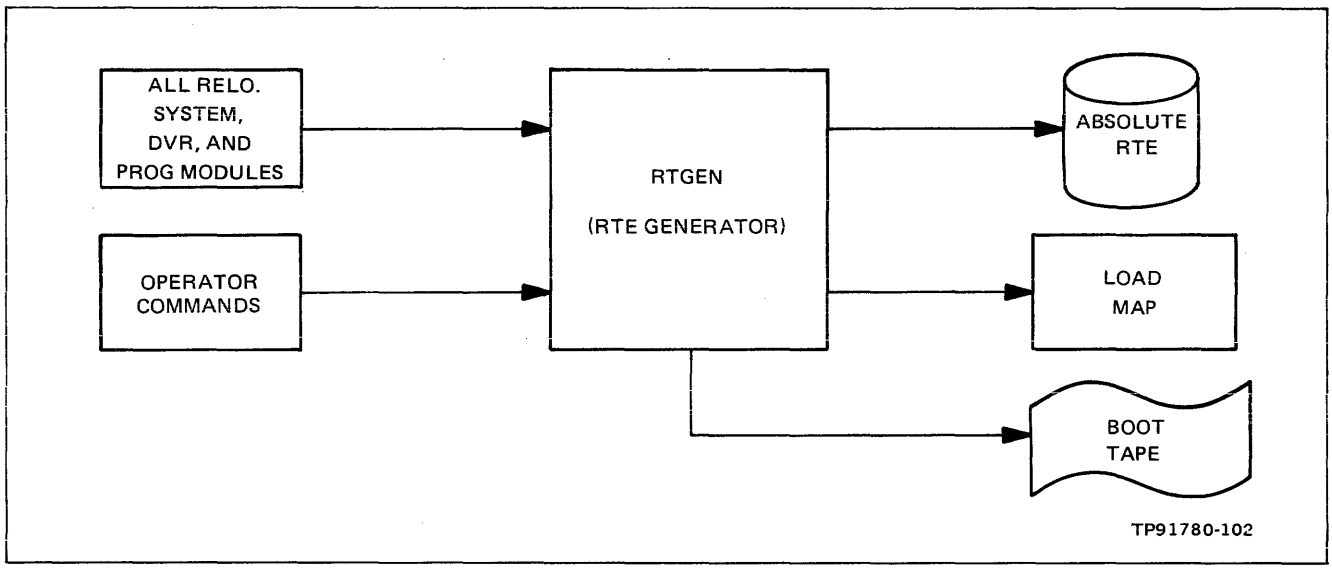


Figure 4-2. RTE Generation Overview

Input Phase by entering the following instruction at the system console

#RDTS, 2

DMA, I/O buffering and timeout parameters MUST NOT be specified for DVR50 when setting up the Equipment Table. Both Interrupt Table locations for the 12618A Interface Kit should point to the single Equipment Table (EQT) entry for DVR50.

RTE GENERATION EXAMPLE

The maps which follow show construction of an RTE system which includes RDTS. This system is configured on an HP 2100 Computer with 32K of core, a CRT, TTY line printer and card reader. The maps are abbreviated to show parts relevant to the construction of RDTS. The Real-Time Executive Disc Based software system manual should be consulted for complete load maps, instructions and worksheet examples.

RTE GENERATION OUTPUT

```
MH DISC CHNL?
21

TRKS, FIRST TRK ON SUBCHNL?
  Ø?
Ø
  1?
2Ø3,Ø
  2?
/E

START SCRATCH?
Ø

# 128 WORD SECTORS/TRACK?
48
```

RTE GENERATION OUTPUT (Continued)

```
TBG CHNL?
13

PRIV. INT. CARD ADDR?                    Specify Privileged Interrupt Card.
12

SWAPPING?
YES

LWA MEM?
77677

PRGM INPT?
PT

LIBR INPT?
MT

PRAM INPT?
TY

PUNCH BOOT?
YES
```

```
SYSTEM                                   Relocatable programs load sequence.

EXEC (ØØ)  Ø2ØØØ                         EXEC control

SCHED(ØØ)  Ø3533                         Scheduler

RTIOC(ØØ)  11Ø24                         I/O control

DVRØØ(ØØ)  14115                         TTY/CRT driver

DVR11(ØØ)  15266                         2892A Card reader driver

DVR12(ØØ)  16256                         2767A Line Printer Driver

DVR23(ØØ)  17112                         7970 Magnetic Tape Unit Driver

DVR31(ØØ)  17723                         Moving Head Disc Driver

DVR5Ø(ØØ)  21122                         Add DVR50 as an I/O Driver
  #JP5Ø    21457                         Add JP50 as a System Module

DVR62(ØØ)  21475                         2313B Subsystem Driver
```

RTE GENERATION OUTPUT (Continued)

```
PFAIL(ØØ)  22363

DVR7Ø(ØØ)  2247Ø

F4D.C(ØØ)  22474

F2F.B(ØØ)  22474

BP LINKAGE ØØ354

* EQUIPMENT TABLE ENTRY

21,DVR31,D,T                          Moving Head Disc
 T =
1ØØØ

1Ø,DVR5Ø                              12618A Interface Kit

15,DVRØØ,B,T                          Teletype/CRT
 T =
```

```
12,DVR7Ø

27,DVR62

/E


* DEVICE REFERENCE TABLE

 1 = EQT #?                           System Control Device
3

 2 = EQT #?                           System Mass Storage – Moving Head Disc
1,1

 3 = EQT #?                           Auxiliary Mass Storage – None
Ø

 4 = EQT #?                           Standard Punch Unit
5,6

 5 = EQT #?                           Input Device
6,4
```

RTE GENERATION OUTPUT (Continued)

```
 6 = EQT #?                                  List Device
7

 7 = EQT #?
Ø

 8 = EQT #?
8,Ø

 9 = EQT #?
8,1

1Ø = EQT #?
8,2

11 = EQT #?
8,3

12 = EQT #?
4

13 = EQT #?                                  12618A Synchronous Modem
2                                            Interface Kit

14 = EQT #?
/E


* INTERRUPT TABLE

4,ENT,PFAIL

1Ø,EQT,2                                     Entries for the 12618A Synchronous Modem
                                             Interface Kit.
11,EQT,2

12,EQT,9

14,EQT,4

15,EQT,3

16,EQT,6

17,EQT,5

2Ø,EQT,7
```

RTE GENERATION OUTPUT (Continued)

```
21,EQT,1

22,EQT,1

23,EQT,8

24,EQT,8

27,EQT,1Ø

/E


LIBRARY

   #INXT   263Ø4
    PPTN   26324

BP LINKAGE ØØ36Ø

RT COM     26427

RT RESIDENTS

#INRP(Ø2)  2715Ø

MEM  (99)  27156

D.RTR(Ø1)  27312
  P.PAS    31221

BP LINKAGE ØØ365

RT DISC RESIDENTS

#DIAL(Ø2)  3125Ø

A23  (8Ø)  3125Ø
  FMTIO    317Ø4
  CLRIO    317Ø4
  RMPAR    332Ø1
```

RTE GENERATION OUTPUT (Continued)

```
BG DISC RESIDENTS

#RDTS(5Ø)    5Ø7ØØ      EBCDIC/FMP Version of #RDTS.
  OPEN       55731
  CLOSE      56114
  READF      56223
  #BSC       57Ø1Ø
  RMPAR      63564
  $OPEN      636Ø7
  .ENTR      63764
  R/W$       64Ø54
  P.PAS      64133
  RW#UB      64162
  #TIME      6443Ø
  GETAD      64435
  RWND$      64453

FMGR (9Ø)    5Ø7ØØ      File Management Package.
  FM.CM      51543
  .ENTR      53351
  .EQU.      53441
  .DRCT      53511
  READF      5352Ø
  CLOSE      543Ø5
```

SECTION V
RDTS EXAMPLES

The material in this section consists of examples of procedures for using the Remote Data Transmission Subsystem. Use of RDTS in RTE/RTE-C environments is straightforward since no special programming is required. IBM installations, however, require appropriate applications programs to process in either BTAM or TCAM environments. HASP provides Remote Job Entry (RJE) functions without user-written programs. Techniques for writing the applications programs are described in the following:

General Information, Binary Synchronous Protocol, GA27-3004

OS BTAM GC30-2004

OS TCAM Programmers Guide and Reference Manual GC30-2024

IBM 2780 Data Transmission Terminal GA27-3005

OS/VS2 HASP II Version 4 Operating Guide GC27-6993

The examples which follow show some of the kinds of programming environments in which RDTS can be used. The examples are not intended to be definitive, but rather to serve as pointers.

EXAMPLE NO. 1: HASP RJE

If RDTS is used with HASP, the 360/370 jobs are prepared with the same Job Control Language (JCL) required for local 360/370 jobs. The HASP and JCL manuals should be consulted for information on preparing and submitting jobs.

Some of the ways in which RDTS can be used with HASP include: default operation in which all standard I/O devices are used, operations in which non-standard devices are used for input and output, disc file I/O, the change device command used to redirect streams, and interrupt output stream operations to submit HASP commands.

DEFAULT OPERATION

It is assumed that the user has n-jobs to submit to HASP and that the Hewlett-Packard and IBM systems are connected by dial-up lines. The jobs (assumed to be on cards) are packed as shown in Figure 5-1.

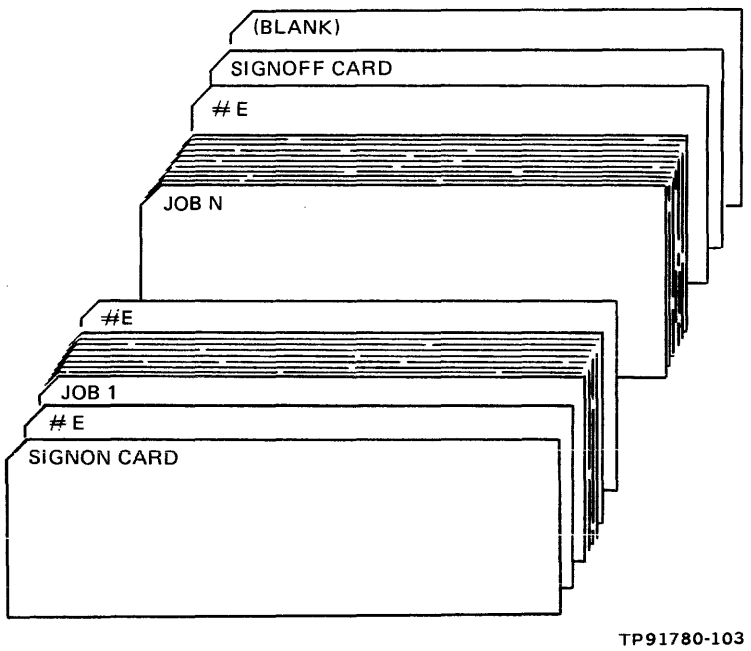


Figure 5-1. HASP Job Deck

The first and last cards are the HASP sign-on and sign-off cards (required by the dial-up connection). Each job is separated by a #E card; the card deck is terminated by a blank card.

The user places the cards in the reader, gains a system prompt (*) and types:

ON,#RDTS,10

The 10 is the logical unit number of the communication line in this case. Default occurs for the mode parameter, standard input, list, and punch devices. RDTS will next print the command:

#RDTS:DIAL REMOTE

The user then dials the 360/370, and when the tone appears, presses the DATA button on the data set.

RDTS begins reading the job stream and continues until the work is finished. 360/370 output is accepted after each job.

If an error occurs, RDTS prints one or more error messages of the form:

#RDTS:XX

where XX is a two digit error code. When RDTS is finished, the message

#RDTS:TERMINATED

will inform the operator that execution is complete.

NON-STANDARD DEVICE OPERATION

If input or output is required from a non-standard device or standard devices in unusual arrangements, the schedule command becomes:

ON,#RDTS,10,,12,1

where:

10 indicates the communications line is on logical unit 10.

12 indicates that the input device is logical unit 12 (magnetic tape).

1 the list device is logical unit 1 (TTY).

The mode parameter and punch device in the example are defaulted by commas.

The operating procedure continues as indicated under "Default Operation."

INTERRUPT OUTPUT STREAM TO SUBMIT HASP COMMAND

Assuming that several jobs have been submitted to HASP and the user wishes to abort the job currently printing, the interrupt feature of RDTS allows the user to interrupt the output processing and enter HASP and/or local RDTS commands as follows:

ON,#INRP

A noticable delay will occur while RDTS clears the communication line and effects auto turnaround with the 360/370. When RDTS returns the prompt, the following is input:

[HASP COMMAND]
CTRL-D

The CTRL-D is equivalent to an end of file for the TTY, and causes the original processing to resume.

DISC FILE I/O

The File Management Package version of RDTS allows disc files to be specified for input and output. If the job stream such as the one shown in Figure 5-1 has been placed (by FMGR) into a file called INPUT, and the output has been placed into a file called OUTPUT, the following operating sequence is used:

ON,#RDTS,10,,101

where 101 represents logical unit 1 plus a constant (100), to indicate a configuration file on the standard system console. RDTS outputs the message:

ENTER CONFILE

and issues a prompt character. The command is entered specifying the names of the input and output files:

INPUT,OUTPUT

In this example, the punch is defaulted to the standard punch device.

RDTS precedes with the dialing message, and operation continues as in the default operation example.

CHANGE DEVICE COMMAND

If there is data to be sent from several devices, the #C record may be placed as a record in the input stream. If the program is scheduled to use cards on input, but a program in the disc file "NAME" is also to be sent, a record:

#C,NAME

would be the last record in the card reader. The input stream would then transfer to the disc. Output devices remain unchanged.

EXAMPLE NO. 2: HASP JOB DECK

This example shows the card input formats used to load a FORTRAN program at the local computer and execute it at a remote IBM 370 computer under HASP. The purpose of the job is to print a list of prime numbers from 1-1000, calculated at the remote and output on a local printer.

```
ØØØ1   /*SIGNON       REMOTE12
ØØØ2   #E
ØØØ3   //MSØØ2ØAT JOB '6438  Ø6563Ø',SHATZER',TIME=2,CLASS=R
ØØØ4   //*  BOB SHATZER     AMD/SSG (Ø6-563Ø)     BLDG 7Ø
ØØØ5   // EXEC FORTGCLG
ØØØ6   C     PRIME NUMBER PROBLEM
ØØØ7     1ØØ WRITE (6,8)
ØØØ8       8 FORMAT (52H FOLLOWING IS A LIST OF PRIME NUMBERS FROM 1 TO 1ØØØ/
ØØØ9        119X,1H1/19X,1H2/19X,1H3)
ØØ1Ø     101 I=5
ØØ11       3 A=I
ØØ12     1Ø2 A=SQRT(A)
ØØ13     103 J=A
ØØ14     104 DO 1 K=3,J,2
ØØ15     105 L=I/K
ØØ16     106 IF(L*K-I)1,2,4
ØØ17       1 CONTINUE
ØØ18     107 WRITE (6,5)I
ØØ19       5 FORMAT (I2Ø)
ØØ2Ø       2 I=I+2
ØØ21     108 IF(1ØØØ-I)7,4,3
ØØ22       4 WRITE (6,9)
ØØ23       9 FORMAT (14H PROGRAM ERROR)
ØØ24       7 WRITE (6,6)
ØØ25       6 FORMAT (31H THIS IS THE END OF THE PROGRAM)
ØØ26     109 STOP
ØØ27         END
ØØ28   /*
ØØ29   #E
ØØ3Ø   /*SIGNOFF
```

The numbers which follow refer to the card numbers in the HASP job deck:

0001 A SIGNON card is required by HASP for a dial up line

0002 The #E is used to effect the auto turnaround required by HASP after sign on. It causes a wait for acknowledgement from the remote and then returns control to the local computer

0003 A standard OS job card

0004 A comment card identifying the programmer and location

0005 A standard JCL execute statement for level G FORTRAN with Load and Go

0028 JCL data delimiter to end the program

0029 The #E is used here to cause auto turnaround to listen for output from the remote

0030 A SIGNOFF card is required by HASP for a dial up line

0031 This card is not shown because it is a blank card required to cause an end of file condition on the card reader

EXAMPLE NO. 3: RDTS IN A MEASUREMENT ENVIRONMENT

In this example, a FORTRAN program and data are sent from the Hewlett-Packard system to a remote IBM 360/370 computer. The data is processed at the remote and the results are output on local peripherals.

The data in the example consists of instrument readings taken on-line from an experiment. The experiment was run under the RTE system and the results were stored on magnetic tape. The readings, in volts, were taken at intervals of three seconds. A total of fifty readings were taken from each of two channels. The raw data is identified by time, file number, and block number.

The processing program is written in FORTRAN IV. The execute statement, contained in the JCL transmitted with the program, is for a FORTRAN compile with LOAD and GO processing. The control statements consist of a SIGNON statement, data definition statements, and data delimiters. The entire package, i.e. program and JCL, are stored on disc by RTE. The program is executed on an IBM 370/158 with OS/HASP.

The function of the program is to process the data by time and by channel. The data from each channel at each reading is totaled, averaged, the standard deviation and the root square mean are calculated, and the maximum and minimum values are identified.

The sequence of operations include entering commands at the system console to schedule RDTS and read the program from disc. A #C at the end of the file on disc causes the input stream to shift to magnetic tape where the data is read. The shaded lines are input at the system console:

```
ON,#RDTS,,101
ENTER CONFILE
#C23360
#RDTS: ON
#RDTS: DIAL REMOTE
```

As soon as the modem connection is established, RDTS begins reading the source file from disc.

When #RDTS reads line 0079 of the input file, C23360, LU8 (magnetic tape) becomes the input device. An example of the input data format is shown on page 5-7. The data output results are shown on page 5-8.

It should be noted that an OS/JCL delimeter, #R (to listen for output) and a SIGNOFF are included at the end of the magnetic tape.

DISC SOURCE FILE, C23360

```
0001  /*SIGNON        REMOTE12
0002  #E
0003  //MS0020AT JOB '6438  06563Ø','SHATZER',TIME=2,CLASS=R
0004  //*  BOB SHATZER     AMD SSG (Ø6-563Ø)     BLDG 7Ø
0005  // EXEC FORTGCLG
0006  C
0007  C   IBM 37Ø PROGRAM TO LIST B23C DATA OUTPUT MAG TAPES
0008      AND ANALYZE RESULTS
0009  C
0010        DIMENSION ITIME(5),VOLT1(1ØØ),VOLT2(1ØØ)
0010  C
0012        NO=5Ø
0013  C
0014   1ØØ  READ (5,9Ø1) NFILE,NBLOC,(ITIME(K),K=1,5)
0015   9Ø1  FORMAT (I5,I4,4I2,I3)
0016        READ (5,9Ø2) (VOLT1(K),K=1,NO),(VOLT2(K),K=1,NO)
0017   9Ø2  FORMAT (8F1Ø.6)
0018  C
0019        CALL TALLY (VOLT1,TOTL1,AVER1,SD1,RMS1,VMIN1,VMAX1,NO)
0020        CALL TALLY (VOLT2,TOTL2,AVER2,SD2,RMS2,VMIN2,VMAX2,NO)
0021        ITIME(1)=ITIME(1)*1Ø
0022  C
```

DISC SOURCE FILE,C23360 (Continued)

```
ØØ23          WRITE (6,9Ø3) NBLOC,NFILE,NBLOC,ITIME(5),ITIME(4)
ØØ24         1ITIME(3),ITIME(2),ITIME(1)
ØØ25    9Ø3   FORMAT (1H1,12X,'EXPERIMENTAL DATA OUTPUT AND ANALYSIS",
ØØ26         112X,'PAGE',I5/////IH ,'FILE',I8,17X,'BLOCK',I6,16X,
ØØ27         2'TIME ',I3,':',I2,':',I2,':',I2,':',I3/////)
ØØ28  C
ØØ29          WRITE (6,9Ø4) (VOLT1(K),K=1,NO)
ØØ3Ø    9Ø4   FORMAT (1H ,18X,F1Ø.6,2X,F1Ø.6,2X,F1Ø.6,2X,F1Ø.6,2X,F1Ø.6)
ØØ31  C
ØØ32          WRITE (6,9Ø5) TOTL1,VMIN1,VMAX1,AVER1,RMS1,SD1
ØØ33    9Ø5   FORMAT (/1H ,9X,'TOTAL',E15.6,6X,'MIN',E15,6,6X,
ØØ34         1'MAX',E15.6/1H ,9X,'AVRGE',E15.6,6X,'RMS',E15.6,
ØØ35         26X'SDEV',E14.6////)
ØØ36  C
ØØ37          WRITE (6,9Ø4) (VOLT2(K),K=1,NO)
ØØ38  C
ØØ39          WRITE (6,9Ø5) TOTL2,VMIN2,VMAX2,AVER2,RMS2,SD2
ØØ4Ø  C
ØØ41          GO TO 1ØØ
ØØ42          END
ØØ43  C
ØØ44  C
ØØ45  C
ØØ46  C
ØØ47  C
ØØ48          SUBROUTINE TALLY (ARRAY,TOTAL,AVER,SD,RMS,VMIN,
ØØ49         1VMAX,NO)
ØØ5Ø  C
ØØ51          DIMENSION ARRAY(1ØØ)
ØØ52  C
ØØ53          SNO=NO
ØØ54          TOTAL=Ø.Ø
ØØ55          AVER=Ø.Ø
ØØ56          SD=Ø.Ø
ØØ57          RMS=Ø.Ø
ØØ58          VMIN=1.ØE35
ØØ59          FMAX=-1.ØE35
ØØ6Ø  C
ØØ61          DO 7Ø I=1,NO
ØØ62          TOTAL=TOTAL+ARRAY(I)
ØØ63          IF (ARRAY(I)-VMIN) 3Ø,4Ø,4Ø
ØØ64    3Ø    VMIN=ARRAY(I)
ØØ65    4Ø    IF (ARRAY(I)-VMAX) 6Ø,6Ø,5Ø
ØØ66    5Ø    VMAX=ARRAY(I)
ØØ67    6Ø    SD=SD+ARRAY(I)*ARRAY(I)
ØØ68    7Ø    CONTINUE
ØØ69  C
ØØ7Ø          RMS=2.Ø*SQRT(SD/SNO)
ØØ71          AVER=TOTAL/SNO
ØØ72          SD=SQRT(ABS((SD-TOTAL*TOTAL/SNO)/(SNO-1.Ø)))
ØØ73  C
```

DISC SOURCE FILE, C23360 (Continued)

```
0074          RETURN
0075  C
0076          END
0077  /*
0078  //STP3.SYSIN DD *
0079  #C,8
```

INPUT DATA FORMATS ON MAGNETIC TAPE

```
0001    2435   1 0 934 0  0
0002    -1.220000 -1.105000  -.915000  -.700000  -.595000  -.595000  -.655000
0003     -.490000  -.340000  -.300000  -.350000  -.430000  -.400000  -.290000
0004     -.175000  -.255000  -.330000  -.295000  -.185000  -.105000  -.115000
0005     -.280000  -.240000  -.125000  -.060000  -.095000  -.215000  -.260000
0006     -.285000  -.040000  -.090000  -.220000  -.250000  -.185000  -.055000
0007     -.890000  -.220000  -.235000  -.160000  -.050000  -.030000  -.110000
0008      -.2150   -.135000  -.865000  -.660000  -.940000  -.420000 -1.110000
0009     -.625000   .905000  1.705000   .185000 -1.350000 -1.915000  -.390000
0010     1.470000  -.060000 -1.590000 -1.680000  -.155000  1.370000  1.230000
0011    -1.825000 -1.445000   .085000  1.610000   .990000  -.535000 -2.065000
0012      .325000  1.845000   .755000  -.775000 -2.300000  -.970000   .560000
0013      .520000 -1.010000 -2.260000  -.730000   .795000  1.805000   .285000
0014    -2.020000  -.495000  1.035000  1.570000
0015    2435   2991134 0  0
0016     -.393000  -.350000  -.230000  -.125000  -.125000  -.220000  -.285000
0017     -.140000  -.065000  -.085000  -.195000  -.255000  -.210000  -.090000
0018     -.675000  -.200000  -.240000  -.185000  -.060000  -.025000  -.075000
0019     -.235000  -.170000  -.045000  -.025000  -.090000  -.210000  -.220000
0020     -.635000  -.030000  -.110000  -.215000  -.210000  -.125000  -.030000
0021     -.130000  -.220000  -.200000  -.100000  -.025000  -.045000  -.150000
```

```
0122    -2.215000 -1.060000   .465000  1.985000   .610000  -.920000 -2.345000  -
0123      .705000  1.895000   .370000 -1.155000 -2.110000  -.580000   .945000  1
0124      .135000 -1.395000 -1.870000  -.340000  1.185000  1.425000  -.100000 -1
0125    -1.635000  -.105000  1.420000  1.190000  -.335000 -1.865000 -1.390000
0126     1.660000   ,955000  -.575000 -2.105000
0127    2435  10973534 0  0
0128     -.330000  -.240000  -.265000  -.370000  -.365000  -.275000  -.140000  -
0129     -.160000  -.270000  -.265000  -.180000  -.070000  -.060000  -.140000  -
0130     -.220000  -.125000  -.035000  -.045000  -.140000  -.220000  -.195000  -
0131     -.015000  -.040000  -.155000  -.215000  -.175000  -.065000  -.010000  -
0132     -.175000  -.215000  -.165000  -.045000  -.005000  -.055000  -.190000  -
0133     -.150000  -.030000   .000000  -.070000  -.190000  -.205000  -.130000  -
0134     -.010000  -.090000   .610000  -.915000 -2.345000  -.820000   .710000  1
0135      .375000 -1.155000 -2.110000  -.580000   .945000  1.665000   .135000 -1
0136    -1.870000  -.340000  1.185000  1.425000  -.100000 -1.630000 -1.630000  -
0137     1.420000  1.190000  -.340000 -1.870000 -1.395000   .135000  1.655000
0138     -.575000 -2.105000 -1.155000   .370000  1.890000   .720000  -.815000 -2
0139     -.915000   .610000  2.000000   .475000 -1.055000 -2.210000  -.680000
0140     1.765000   .245000 -1.285000 -1.970000
0141  /*
0142  #R
0143  /*SIGNOFF
```

EXPERIMENTAL DATA OUTPUT AND ANALYSIS

```
FILE    2435              BLOCK     1                TIME   Ø: Ø:34: 9:  Ø


              -1.219999   -1.1Ø5ØØØ   -Ø.915ØØØ   -Ø.7ØØØØØ   -Ø.595ØØØ
              -Ø.595ØØØ   -Ø.655ØØØ   -Ø.61ØØØØ   -Ø.49ØØØØ   -Ø.34ØØØØ
              -Ø.3ØØØØØ   -Ø.35ØØØØ   -Ø.43ØØØØ   -Ø.4ØØØØØ   -Ø.29ØØØØ
              -Ø.185ØØØ   -Ø.175ØØØ   -Ø.255ØØØ   -Ø.33ØØØØ   -Ø.295ØØØ
              -Ø.185ØØØ   -Ø.1Ø5ØØØ   -Ø.115ØØØ   -Ø.22ØØØØ   -Ø.28ØØØØ
              -Ø.24ØØØØ   -Ø.125ØØØ   -Ø.Ø6ØØØØ   -Ø.Ø95ØØØ   -Ø.215ØØØ
              -Ø.26ØØØØ   -Ø.21ØØØØ   -Ø.Ø85ØØØ   -Ø.Ø4ØØØØ   -Ø.Ø9ØØØØ
              -Ø.22ØØØØ   -Ø.25ØØØØ   -Ø.185ØØØ   -Ø.Ø55ØØØ   -Ø.Ø3ØØØØ
              -Ø.Ø9ØØØØ   -Ø.22ØØØØ   -Ø.235ØØØ   -Ø.16ØØØØ   -Ø.Ø5ØØØØ
              -Ø.Ø3ØØØØ   -Ø.11ØØØØ   -Ø.215ØØØ   -Ø.215ØØØ   -Ø.135ØØØ

        TOTAL -Ø.1476ØØE Ø2      MIN  -Ø.122ØØØE Ø1      MAX  -Ø.3ØØØØØE-Ø1
        AVRGE -Ø.295199E ØØ      RMS   Ø.786248E ØØ      SDEV  Ø.262258E ØØ

FILE    2435              BLOCK    1Ø                TIME   Ø: Ø:34:35:97Ø


              -Ø.33ØØØØ   -Ø.24ØØØØ   -Ø.265ØØØ   -Ø.37ØØØØ   -Ø.365ØØØ
              -Ø.275ØØØ   -Ø.14ØØØØ   -Ø.1ØØØØØ   -Ø.16ØØØØ   -Ø.27ØØØØ
              -Ø.265ØØØ   -Ø.18ØØØØ   -Ø.Ø7ØØØØ   -Ø.Ø6ØØØØ   -Ø.14ØØØØ
              -Ø.235ØØØ   -Ø.22ØØØØ   -Ø.125ØØØ   -Ø.Ø35ØØØ   -Ø.Ø45ØØØ
              -Ø.14ØØØØ   -Ø.22ØØØØ   -Ø.195ØØØ   -Ø.Ø95ØØØ   -Ø.Ø15ØØØ
              -Ø.Ø4ØØØØ   -Ø.155ØØØ   -Ø.215ØØØ   -Ø.175ØØØ   -Ø.Ø65ØØØ
              -Ø.Ø1ØØØØ   -Ø.Ø45ØØØ   -Ø.175ØØØ   -Ø.215ØØØ   -Ø.165ØØØ
              -Ø.Ø45ØØØ   -Ø.ØØ5ØØØ   -Ø.Ø55ØØØ   -Ø.19ØØØØ   -Ø.215ØØØ
              -Ø.15ØØØØ   -Ø.Ø3ØØØØ    Ø.ØØØØØØ   -Ø.Ø7ØØØØ   -Ø.19ØØØØ
              -Ø.2Ø5ØØØ   -Ø.13ØØØØ   -Ø.Ø2ØØØØ   -Ø.Ø1ØØØØ   -Ø.Ø9ØØØØ

        TOTAL  -Ø.722498E Ø1      MIN  -Ø.37ØØØØE ØØ      MAX   Ø.Ø
        AVRGE  -Ø.144499E ØØ      RMS   Ø.347829E ØØ      SDEV  Ø.977611E-Ø1


               Ø.61ØØØØ   -Ø.915ØØØ   -2.344999   -Ø.82ØØØØ    Ø.71ØØØØ
               1.895ØØØ    Ø.375ØØØ   -1.155ØØØ   -2.11ØØØØ   -Ø.58ØØØØ
               Ø.945ØØØ    1.665ØØØ    Ø.135ØØØ   -1.389999   -1.87ØØØØ
              -Ø.34ØØØØ    1.184999    1.424999   -Ø.1ØØØØØ   -1.629999
              -1.629999   -Ø.1ØØØØØ    1.419999    1.19ØØØØ   -Ø.34ØØØØ
              -1.87ØØØØ   -1.395ØØØ    Ø.135ØØØ    1.655ØØØ    Ø.95ØØØØ
              -Ø.575ØØØ   -2.1Ø5ØØØ   -1.155ØØØ    Ø.37ØØØØ    1.889999
               Ø.72ØØØØ   -Ø.815ØØØ   -2.344999   -Ø.915ØØØ    Ø.61ØØØØ
               2.ØØØØØØ    Ø.475ØØØ   -1.Ø54999   -2.2Ø9999   -Ø.68ØØØØ
               Ø.845ØØØ    1.764999    Ø.245ØØØ   -1.285ØØØ   -1.969999

        TOTAL -Ø.1Ø485ØE Ø2      MIN  -Ø.2345ØØE Ø1      MAX   Ø.2ØØØØØE Ø1
        AVRGE -Ø.2Ø97ØØE ØØ      RMS   Ø.262584E Ø1      SDEV  Ø.13Ø923E Ø1
```

EXAMPLE NO. 4: RDTS IN AN OS/BTAM ENVIRONMENT

The example which follows is coded to be run on an IBM 370 155 with OS Version 21 and BTAM. It should be remembered that while the code below shows general coding sequences, every BTAM application program is unique to its host machine configuration. The reader is referred to the appropriate IBM publications for details concerning applicable operations for specific requirements. Of particular interest to the BTAM user is the IBM System/360 Operating System Basic Telecommunication Access Method, Manual Number GC30-2004. Also, since there is no high level language support for BTAM, any 360/370 application software must be coded in IBM Basic Assembly Language (BAL).

The purpose of the example is to answer a remote computer using Automatic Answering and then to read text from the remote. The second part of the code calls a remote computer and writes text to it. The program at the 360 performs a restricted subset of the BSC switched line READ, WRITE and Terminal List Options. The functions and calls illustrated in the example are shown in Table 5-1.

Table 5-1. BTAM Example Sequence of Operations

FUNCTION	CALL
ANSWER (with Automatic Answering)	READ INITIAL
READ TEXT (with ID Verification Suppressed	READ CONTINUE
CALL REMOTE COMPUTER	WRITE CONNECT
WRITE TEXT (where ID Verification is Suppressed	WRITE CONTINUE

The terminal answer list is coded to specify a line connection over a switched network:

```
ANSRLIST DFTRMLSTDIALST,Ø
```

The terminal dial list is coded for manual dialing of the remote with the expanded ID verification feature suppressed:

```
DIALLIST DFTRMLST WTLIST,02,      *
                  1070,1,2D
```

The telephone connection is broken between the answer and call functions to conserve line time and to separate the READ and WRITE functions.

Initialization consists of issuing the standard SAVE macro, loading the program tape register, and establishing DCB and DECB addressability with the following:

```
START   SAVE  (14,12)
        BALR  BASEREG,Ø
        USING *,BASEREG
        USING IHADCB,DCBREG
        STST  13,SAVE+4
        LA    13,SAVE
        LA    DCBREG,MYDCB
        LA    DECBREG,MYDECB
```

The Data Control Block for the communication line is opened by:

```
        OPEN  (MYDCB)
```

The formats of the READ and WRITE macros are:

```
READ INITIAL
        READ  MYDECB,TI,MYDCB  *
              ,,,ANSRLIST,1,
              MF=E

READ CONTINUE
        READ  MYDECB,TT,,,,,   *
              1,MF=E

WRITE CONNECT
        WRITE MYDECB,TC,MYDCB  *
              ,(AREAREG),58,   *
              DIALIST,1,MF=E

WRITE CONTINUE
        WRITE MYDECB
              (AREAREG),27,,   *
              1,MF=E

DISCONNECT
        WRITE MYDECB,TD,MF=E
```

The code sequence below closes the Data Control Block and releases control back to OS:

```
        CLOSE (MYDCB)
        L     13,SAVE+4
        RETURN (14,12)
```

The control blocks are created using the DCB and READ macros:

```
MYDCB   DCB   DSORG=CX,DEVD=    *
              BS,MACRF=(R,W),   *
              DDNAME=AMDRTE,    *
              CODE=EBCDIC
        READ  MYDECB,TT,MYDCB   *
              ,INAREA,400,1,    *
              MF=L
```

A DSECT (Dummy Control Section) for referencing the DCB is generated by:

```
DCBD  DEVD=BS,DSORG=BX
```

and for the DECB by:

```
IECTDECB
```

The flowchart in Figure 5-2 shows the functions performed by the code in the sample.

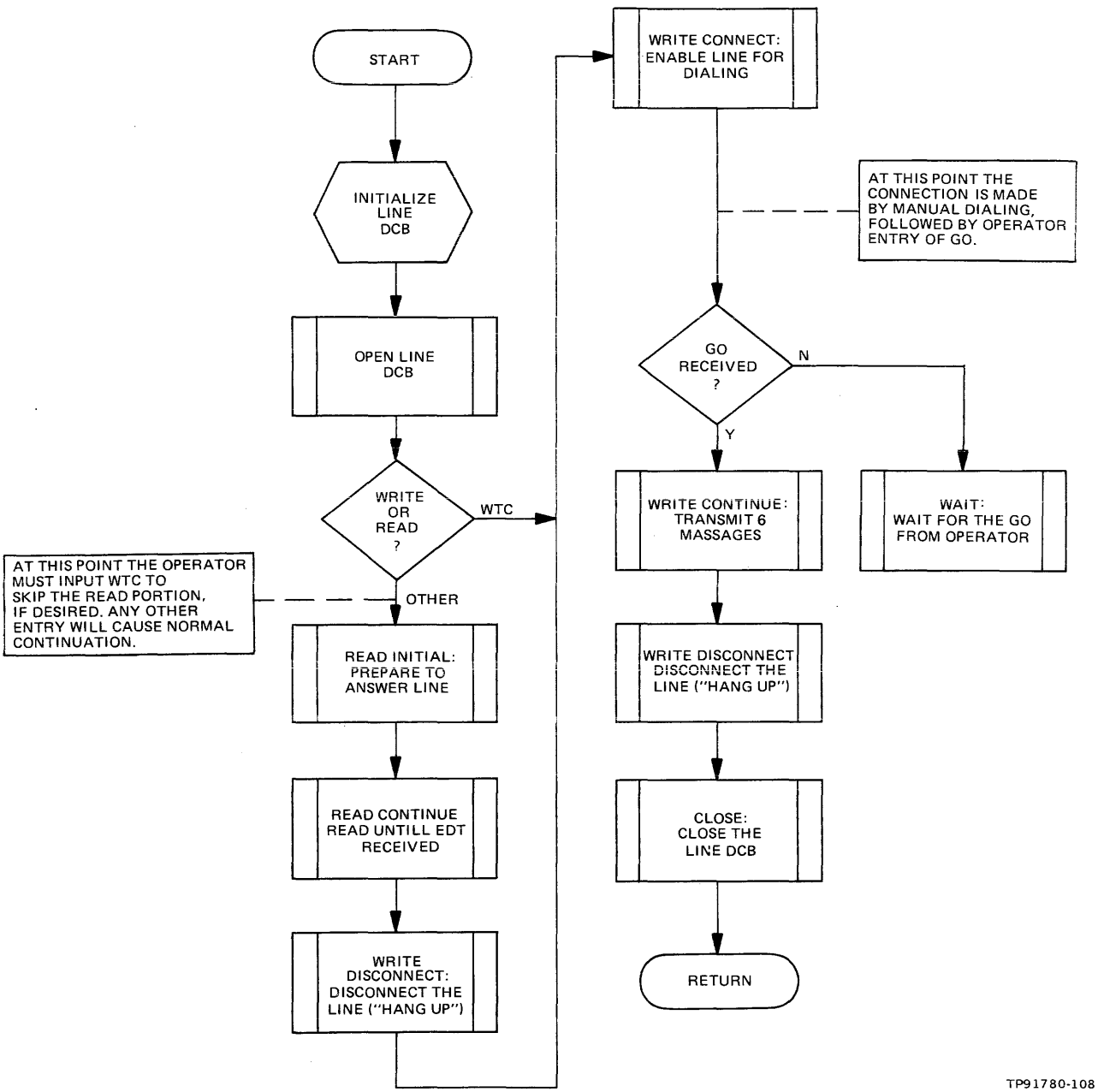


Figure 5-2. Sequence of Operations in BTAM Example

APPENDIX A
TABLES

EQUIPMENT TABLE

The Equipment Table (EQT) has an entry for each device recognized by RTE, or RTE-C. These 15-word EQT entries reside in permanent core in both RTE and RTE-C. The Equipment Table is constructed at system generation and has the format shown in Table A-1.

Table A-1. EQT Entry Format

WORD	CONTENTS														
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	Device Suspended List Pointer															
2	Driver "Initiation" Section Address															
3	Driver "Completion" Section Address															
4	D	B	S		T	Unit #						Channel #				
5	AV		EQUIP TYPE CODE					STATUS								
6	CONWD (Current I/O Request Word)															
7	Request Buffer Address															
8	Request Buffer Length															
9	Temporary Storage for Optional Parameter															
10	Temporary Storage for Optional Parameter															
11	Temporary Storage for Driver															
12	Temporary Storage for Driver															
13	Temporary Storage for Driver															
14	Device Time-Out Reset Value															
15	Device Time-Out Clock															

Where:

D = 1 if DMA required.

B = 1 if automatic output buffering used.

S = 1 if driver is to process time-out.

T = 1 if device timed out (system sets to zero before each I/O request).

Unit # = Last sub-channel addressed.

Channel # = I/O select code for device (lower number if a multi-board interface).

AV = availability indicator:
- 0 = available for use.
- 1 = disabled (down).
- 2 = busy (currently in operation).
- 3 = waiting for an available DMA channel.

STATUS = the actual physical status or simulated status at the end of each operation. For paper tape devices, two status conditions are simulated: Bit 5 = 1 means end-of-tape on input, or tape supply low on output.

EQUIP. TYPE CODE = type of device. When this octal number is linked with "DVR", it identifies the device's software driver routine as follows:
- 00 to 07 = paper tape devices (or system control devices)
- 00 = teleprinter (or system keyboard control device)
- 01 = photoreader
- 02 = paper tape punch
- 10 to 17 = unit record devices
- 20 to 37 = magnetic tape/mass storage devices
- 30 = fixed head or disc or drum
- 31 = moving head disc
- 40 to 77 = instruments

CONWD = user control word supplied in the I/O EXEC Call

STANDARD EQT STATUS VALUES

The standard status values shown in Table A-2 are found in bits 0-7 of the fifth word (EQT5 of Table A-1), of the EQT entry for the Binary Synchronous Communications Driver (DVR50). They are static values which reflect the current state of the Bisync protocol following the last request serviced by the driver.

Table A-2. Standard EQT Status

Device Status	7	6	5	4	3	2	1	0
Binary Synchronous Driver (DVR50)			BO	RVI	TRM	TTM	TFL/TOL	RS/ILE

Where:

RS = Request serviced (bit 0 set to 0)
ILE = Irrecoverable line error (bit 0 set to 1)
TFL = Terminal off-line (bit 1 set to 0)
TOL = Terminal on-line (bit 1 set to 1)
TTM = Local Terminal in Transmit mode
TRM = Local Terminal in Receive mode
RVI = RVI BSC Control Character received
BO = Buffer overflow

EXTENDED EQT STATUS

Extended status values are placed in EQT 12 for DVR50. These additional sixteen bits of dynamic status, shown in Table A-3, are used to provide additional information about irrecoverable line errors. A zero in any bit position implies the absence of that condition.

Table A-3. EQT12 Extended Status Information

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CTO	TTD	LCD	LDR	DSR	DST	LTO	RTO	TNK	RNK	CTS	BSC	IB	IM	PV	SCV

Where:

SCV = Security Code violation
PV = Password violation
IM = Illegal mode for request issued to driver
IB = Illegal buffer format specified
BSC = Illegal BSC sequence received repeatedly (eight times)
CTS = Loss of "clear-to-send" in modem
RNK = Received buffer NAK'ed seven times
TNK = Transmitted buffer NAK'ed by the remote computer eight times
RTO = "Receive time-out" occurred eight times
LTO = "Long time-out" failure
DST = Disconnect sequence (DLE EOT) sent to the remote computer and the communication line dropped
LDR = Loss of "Data Set Ready"
LCD = Loss of carrier detect
TTD = "TTD" or "WACK" limit exceeded
CTO = "Control time-out" failure. #RDTS failed to make a request to DVR50 and left the line in control mode for a period longer than the "long-time-out" value. The communication line is disconnected when this condition occurs.

APPENDIX B
SUMMARY OF RDTS CONSOLE MESSAGES

01 Disc down
02 Duplicate name
03 Backspace not legal for type 0 file
04 File too long or Rec size error
05 Attempt to read or position to a record not written, or on update, write an illegal record length
06 Cartridge not found or file not found, or no room
07 Invalid security code
08 File currently open: eight programs, or exclusively, or lock rejected
09 Attempt to open type 0 as type 1 or to use APOSN on type 0
10 Not enough parameters
11 DCB not open
12 SOF or EOF read or sensed
13 Cartridge locked
14 Directory full
15 Illegal name
16 Illegal type, or size - 0 (CREAT)
17 Attempt to read or write on type 0 which does not support the operation
20 Security code violation (#BSC not found in core)
21 Password violation (another program has initialized the driver)
22 Illegal mode for a request issued to the driver
23 Illegal buffer format given to the driver
24 Illegal Bisync sequence received repeatedly
25 Loss of Clear-to-send
26 Seven NAK characters sent (unrecognizable sequence)
27 Eight NAK characters received (unrecognizable sequence transmitted)
30 Receive timeout occurred repeatedly
31 Long timeout failure
32 Line termination sequence sent (DLE/EOT)
33 Line termination sequence received (DLE/EOT)
34 Loss of Data Set Ready signal
35 Loss of Carrier Detect during receive (repeatedly)
36 TTD or WACK limit exceeded
37 Request timeout in Control Mode
40 NAK Read Request issued three times
41 Remote does not respond to bid for line (Handshake request)
43 I/O Configuration parameter error
44 Invalid logical unit number
45 DVR50 not available (device down, or in use by another program)
46 I/O request rejected
50 Initialization request issued to driver
51 #Dial scheduled
52 Bid for line (Handshake request) issued
53 Answer or control-to-receive request issued
54 Write request issued
55 Read request issued
56 Send EOT request issued
57 Receive-to-send request issued
58 Disconnect request issued
59 Extended status request issued
60 Irrecoverable line error
61 Terminal on line
62 Transmit mode
63 Receive mode
64 RVI received
65 Buffer overflowed

APPENDIX C
BSC CONTROL CHARACTERS USED WITH RDTS

HP RDTS can receive all fifteen characters, but does not ordinarily send SOH or RVI.

DATA LINK CHARACTER	EBCDIC	USASCII	MEANING
SYN	SYN	SYN	Synchronous Idle – Used to establish and maintain synchronization.
SOH	SOH	SOH	Start of Heading – Precedes a block of heading characters. Received but not transmitted by RDTS.
STX	STX	STX	Start of Text – Precedes a block of text characters.
ETB	EOB (ETB)	ETB	End of Transmission Block – Indicates the end of a block of characters begun with SOH or STX.
ETX	ETX	ETX	End of Text – Terminates a block of characters begun with STX or SOH and transmitted as an entity. It requires a reply indicating receiving station status.
EOT	EOT	EOT	End of Transmission – can also be used to signal an abort. Causes reset of all terminals on the line.
ENQ	ENQ	ENQ	Enquiry – Bid for line, or used to ask for retransmission of a response.
ACK0	DLE '70'	DLE 0	Affirmative Acknowledgment – ACK0 – Positive response to line bid.
ACK1	DLE/	DLE 1	ACK0/ACK1 – In sequence indicate previous block accepted with no errors and receiver ready to accept next block.
NAK	NAK	NAK	Negative Acknowledgment – Previous block received in error and receiver ready to receive retransmission.
DLE	DLE	DLE	Data Link Escape – Used only in conjunction with other control characters and transparent mode control characters.
ETB	IUS	US	End of Intermediate Transmission Block – Divides a message (heading or text) for error checking without causing a transmission reversal.
WACK	DLE,	DLE;	Wait-Before-Transmit Positive Acknowledgment – Receiving terminal temporarily not ready to receive. Can be used as positive response to received data block or line bid.
RVI	DLE@	DLE<	Reverse Interrupt – Positive response, used instead of ACK or ACK1.
TTD	STX ENQ	STX ENQ	Temporary Text Delay – Sending terminal in message transfer state and wishes to retain line but not ready to transmit.

APPENDIX D
COMPOSITE CODE CHARTS

CODE SETS

OCTAL	HEX	EBCDIC	USASCII	HP ASCII
00	00	NULL	NULL	NULL
01	01	SOH	SOH	SOM
02	02	STX	STX	EOA
03	03	ETX	ETX	EOM
04	04	PF	EOT	EOT
05	05	HT	ENQ	WRU
06	06	LC	ACK	RU
07	07	DEL	BEL	BELL
10	08		BS	FE
11	09	RLF	HT	HT/SK
12	0A	SMM	LF	LF
13	0B	VT	VT	V_{TAB}
14	0C	FF	FF	FF
15	0D	CR	CR	CR
16	0E	SO	SO	SO
17	0F	SI	SI	SI
20	10	DLE	DLE	DC_0
21	11	DC_1	DC_1	DC_1
22	12	DC_2	DC_2	DC_2
23	13	DC_3	DC_3	DC_3
24	14	RES	DC_4	DC_4(STOP)
25	15	NL	NAK	ERR
26	16	BS	SYN	SYNC
27	17	IL	ETB	LEM
30	18	CAN	CAN	S^0
31	19	EM	EM	S_1
32	1A	CC	SUB	S_2
33	1B		ESC	S_3
34	1C	IFS	FS	S_4
35	1D	IGS	GS	S_5
36	1E	IRS	RS	S_6
37	1F	IUS	US	S_7
40	20	DS	SPACE	b
41	21	SOS	!	!
42	22	FS	"	"
43	23		#	#
44	24	BYP	$	$
45	25	LF	%	%
46	26	ETB/EOB	&	&
47	27	ESC/PRE	'	'(APOS)
50	28		(	(

OCTAL	HEX	EBCDIC	USASCII	HP ASCII
51	29		)	)
52	2A	SM	*	*
53	2B		+	+
54	2C		,	,
				(COMMA)
55	2D	ENQ	–	–
56	2E	ACK	.	.
57	2F	BEL	/	/
60	30		0	0
61	31		1	1
62	32	SYN	2	2
63	33		3	3
64	34	PN	4	4
65	35	RS	5	5
66	36	UC	6	6
67	37	EOT	7	7
70	38		8	8
71	39		9	9
72	3A		:	:
73	3B		;	;
74	3C	DC4	<	<
75	3D	NAK	=	=
76	3E		>	>
77	3F	SUB	?	?
100	40	SPACE	@	@
101	41		A	A
102	42		B	B
103	43		C	C
104	44		D	D
105	45		E	E
106	46		F	F
107	47		G	G
110	48		H	H
111	49		I	I
112	4A	¢	J	J
113	4B	.	K	K
114	4C	<	L	L
115	4D	(	M	M
116	4E	+	N	N
117	4F	|	O	O
120	50	&	P	P

Code Sets (Continued)

OCTAL	HEX	EBCDIC	USASCII	HP ASCII
121	51		Q	Q
122	52		R	R
123	53		S	S
124	54		T	T
125	55		U	U
126	56		V	V
127	57		W	W
130	58		X	X
131	59		Y	Y
132	5A	!	Z	Z
133	5B	$	[	[
134	5C	*	\	\
135	5D	)	]	]
136	5E	;	¬	↑
137	5F	¬	–	←
140	60	–	\	
141	61	/	a	
142	62		b	
143	63		c	
144	64		d	
145	65		e	
146	66		f	
147	67		g	
150	68		h	
151	69		i	
152	6A	¦	j	
153	6B	,	k	
154	6C	%	l	
155	6D	–	m	
156	6E	>	n	
157	6F	?	o	
160	70		p	
161	71		q	
162	72		r	
163	73		s	
164	74		t	
165	75		u	
166	76		v	
167	77		w	
170	78		x	
171	79	\	y	
172	7A	:	z	
173	7B	#	{	
174	7C	@	:	ACK
175	7D	'	}	ⓘ
176	7E	=	~	ESC
177	7F	"	DEL	DEL
200	80			
201	81	a		
202	82	b		
203	83	c		
204	84	d		

OCTAL	HEX	EBCDIC	USASCII	HP ASCII
205	85	e		
206	86	f		
207	87	g		
210	88	h		
211	89	i		
212	8A			
213	8B			
214	8C			
215	8D			
216	8E			
217	8F			
220	90			
221	91	j		
222	92	k		
223	93	l		
224	94	m		
225	95	n		
226	96	o		
227	97	p		
230	98	q		
231	99	r		
232	9A			
233	9B			
234	9C			
235	9D			
236	9E			
237	9F			
240	A0			
241	A1	~		
242	A2	s		
243	A3	t		
244	A4	u		
245	A5	v		
246	A6	w		
247	A7	x		
250	A8	y		
251	A9	z		
252	AA			
253	AB			
254	AC			
255	AD			
256	AE			
257	AF			
260	B0			
261	B1			
262	B2			
263	B3			
264	B4			
265	B5			
266	B6			
267	B7			
270	B8			

Code Sets (Continued)

OCTAL	HEX	EBCDIC	USASCII	HP ASCII
271	B9			
272	BA			
273	BB			
274	BC			
275	BD			
276	BE			
277	BF			
300	C0	{		
301	C1	A		
302	C2	B		
303	C3	C		
304	C4	D		
305	C5	E		
306	C6	F		
307	C7	G		
310	C8	H		
311	C9	I		
312	CA			
313	CB			
314	CC			
315	CD			
316	CE			
317	CF			
320	D0	}		
321	D1	J		
322	D2	K		
323	D3	L		
324	D4	M		
325	D5	N		
326	D6	O		
327	D7	P		
330	D8	Q		
331	D9	R		
332	DA			
333	DB			

OCTAL	HEX	EBCDIC	USASCII	HP ASCII
334	DC			
335	DD			
336	DE			
337	DF			
340	E0			
341	E1	\		
342	E2			
343	E3	S		
344	E4	T		
345	E5	U		
346	E6	V		
347	E7	W		
350	E8	X		
351	E9	Y		
352	EA	Z		
353	EB			
354	EC			
355	ED			
356	EE			
357	EF			
360	F0			
361	F1	0		
362	F2	1		
363	F3	2		
364	F4	3		
365	F5	4		
366	F6	5		
367	F7	6		
370	F8	7		
371	F9	8		
372	FA	9		
373	FB			
374	FC			

CARD CODES

Graphic	Card Code		Octal Value
	EBCDIC	USASCII	
0	0		360
		0	60
1	1		361
		1	61
2	2		362
		2	62
3	3		363
		3	63
4	4		364
		4	64
5	5		365
		5	65
6	6		366
		6	66
7	7		367
		7	67
8	8		370
		8	70
9	9		371
		9	71
A	12-1		301
		12-1	101
B	12-2		302
		12-2	102

Graphic	Card Code		Octal Value
	EBCDIC	USASCII	
C	12-3		303
		12-3	103
D	12-4		304
		12-4	104
E	12-5		305
		12-5	105
F	12-6		306
		12-6	106
G	12-7		307
		12-7	107
H	12-8		310
		12-8	110
I	12-9		311
		12-9	111
J	11-1		321
		11-1	112
K	11-2		322
		11-2	113
L	11-3		323
		11-3	114
M	11-4		324
		11-4	115
N	11-5		325
		11-5	116

Card Codes (Continued)

Graphic	Card Code		Octal Value
	EBCDIC	USASCII	
O	11-6		326
		11-6	117
P	11-7		327
		11-7	120
Q	11-8		330
		11-8	121
R	11-9		331
		11-9	122
S	0-2		342
		0-2	123
T	0-3		343
		0-3	124
U	0-4		344
		0-4	125
V	0-5		345
		0-5	126
W	0-6		346
		0-6	127
X	0-7		347
		0-7	130
Y	0-8		350
		0-8	131
Z	0-9		351
		0-9	132

Graphic	Card Code		Octal Value
	EBCDIC	USASCII	
a	12-0-1		201
		12-0-1	141
b	12-0-2		202
		12-0-2	142
c	12-0-3		203
		12-0-3	143
d	12-0-4		204
		12-0-4	144
e	12-0-5		205
		12-0-5	145
f	12-0-6		206
		12-0-6	146
g	12-0-7		207
		12-0-7	147
h	12-0-8		210
		12-0-8	150
i	12-0-9		211
		12-0-9	151
j	12-11-1		221
		12-11-1	152
k	12-11-2		222
		12-11-2	153
l	12-11-3		223
		12-11-3	154
m	12-11-4		224
		12-11-4	155

Card Codes (Continued)

Graphic	Card Code		Octal Value
	EBCDIC	USASCII	
n	12-11-5		225
		12-11-5	156
o	12-11-6		226
		12-11-6	157
p	12-11-7		227
		12-11-7	160
q	12-11-8		230
		12-11-8	161
r	12-11-9		231
		12-11-9	162
s	11-0-2		242
		11-0-2	163
t	11-0-3		243
		11-0-3	164
u	11-0-4		244
		11-0-4	165
v	11-0-5		245
		11-0-5	166
w	11-0-6		246
		11-0-6	167
x	11-0-7		247
		11-0-7	170
y	11-0-8		250
		11-0-8	171
z	11-0-9		251
		11-0-9	172

Graphic	Card Code		Octal Value
	EBCDIC	USASCII	
.	12-3-8		113
		12-3-8	56
&	12		120
		12	46
SPACE	BLANK		100
		BLANK	40
$	11-3-8		133
		11-3-8	44
*	11-4-8		134
		11-4-8	52
–	11		140
		11	55
/	0-1		141
		0-1	57
'	0-3-8		153
		0-3-8	54
%	0-4-8		154
		0-4-8	45
@	4-8		174
		4-8	100
#	3-8		173
		3-8	43
¢	12-2-8		112
<	12-4-8		114
		12-4-8	74

Card Codes (Continued)

Graphic	Card Code		Octal Value
	EBCDIC	USASCII	
(	12-5-8		115
		12-5-8	50
+	12-6-8		116
		12-6-8	53
|	12-7-8		117
		12-7-8	41
¦		12-11	174
!	11-2-8		132
)	11-5-8		135
		11-5-8	51
;	11-6-8		136
		11-6-8	73
¬	11-7-8		137
		11-7-8	136
–	0-5-8		155
		0-5-8	137
>	0-6-8		156
		0-6-8	76
?	0-7-8		157
		0-7-8	77
:	2-8		172
		2-8	72
¦	5-8	5-8	175 72

Graphic	Card Code		Octal Value
	EBCDIC	ASASCII	
=	6-8		176
		6-8	75
"	7-8	7-8	177 42
[		12-8-2	133
\		0-8-2	134
]		11-8-2	135
\		1-8	140
{		12-0	173
}		11-0	175
~		11-0-1	176
NUL	12-0-1-8-9		0
		12-0-1-89	0
SOH	12-1-9		1
		12-1-9	1
STX	12-2-9		2
		12-2-9	2
ETX	12-3-9		3
		12-3-9	3
PF	12-4-9		4

Card Codes (Continued)

Graphic	Card Code		Octal Value
	EBCDIC	ASASCII	
HT	12-5-9	12-5-9	5 11
LC	12-6-9		6
DEL	12-7-9		7
		12-7-9	177
SMM	12-2-8-9		12
VT	12-3-8-9		13
		12-3-8-9	13
FF	12-4-8-9		14
		12-4-8-9	14
CR	12-5-8-9		15
		12-5-8-9	15
SO	12-6-8-9		16
		12-6-8-9	16
SI	12-7-8-9		17
		12-7-8-9	17
DLE	12-11-1-8-9		20
		12-11-1-8-9	20
DC1	11-1-9		21
		11-1-9	21
DC2	11-2-9		22
		11-2-9	22
DC3 (TMX)	11-3-9		23
		11-3-9	23

Graphic	Card Code		Octal Value
	EBCDIC	USASCII	
RES	11-4-9		24
NL	11-5-9		25
BS	11-6-9		26
		11-6-9	10
IL	11-7-9		27
CAN	11-8-9		30
		11-8-9	30
EM	11-1-8-9		31
		11-1-8-9	31
CC	11-2-8-9		32
IFS	11-4-8-9		34
IGS	11-5-8-9		35
RS	5-9	11-6-8-9	65 36
US		11-7-8-9	37
DS	11-0-1-8-9		40
SOS	0-1-9		41
FS	0-2-9		42
		11-4-8-9	34

Card Codes (Continued)

Graphic	Card Code		Octal Value
	EBCDIC	USASCII	
BYP	0-4-9		44
LF	0-5-9	0-5-9	45 12
ETB (EOB)	0-6-9	0-6-9	46 27
ESC (PRE)	0-7-9	0-7-9	47 33
SM	0-2-8-9		52
ENQ	0-5-8-9	0-5-8-9	55 5
ACK	0-6-8-9		56
		0-6-8-9	6
BEL	0-7-8-9		57
		0-7-8-9	7
SYN	2-9		62
		2-9	26
PN	4-9		64
IRS	11-6-8-9		36
UC	6-9		66
EOT	7-9	7-9	67 4
DC4	4-8-9		74
		4-8-9	24
NAK	5-8-9		75
		5-8-9	25

Graphic	Card Code		Octal Value
	EBCDIC	USASCII	
SUB	7-8-9		77
		7-8-9	32
GS		11-5-8-9	35
IUS	11-7-8-9		37

APPENDIX E
PRINTER CARRIAGE CONTROL FUNCTIONS

2 CHARACTER SEQUENCE CODE		IBM CARRIAGE OPERATION AFTER PRINTING	HP 2610 CARRIAGE OPERATION AFTER PRINTING	HP 2767A CARRIAGE OPERATION AFTER PRINTING
USASCII	EBCDIC			
ESC Q	ESC /	SINGLE SPACE	SINGLE SPACE	SINGLE SPACE
ESC R	ESC S	DOUBLE SPACE	DOUBLE SPACE	DOUBLE SPACE
ESC S	ESC T	TRIPLE SPACE	TRIPLE SPACE	TRIPLE SPACE
ESC A	ESC A	SKIP TO CHANNEL 1	SKIP TO CHANNEL 8	SKIP TO TOP OF NEXT PAGE
ESC B	ESC B	SKIP TO CHANNEL 2	SKIP TO CHANNEL 6	SKIP TO NEXT 1/6 PAGE BOUNDRY
ESC C	ESC C	SKIP TO CHANNEL 3	SKIP TO CHANNEL 5	SKIP TO NEXT 1/4 PAGE BOUNDRY
ESC D	ESC D	SKIP TO CHANNEL 4	SKIP TO CHANNEL 4	SKIP TO NEXT 1/2 PAGE BOUNDRY
ESC E	ESC E	SKIP TO CHANNEL 5	SKIP TO CHANNEL 6	SKIP TO NEXT 1/6 PAGE BOUNDRY
ESC F	ESC F	SKIP TO CHANNEL 6	SKIP TO CHANNEL 5	SKIP TO NEXT 1/4 PAGE BOUNDRY
ESC G	ESC G	SKIP TO CHANNEL 7	SKIP TO CHANNEL 4	SKIP TO NEXT 1/2 PAGE BOUNDRY
ESC H	ESC H	SKIP TO CHANNEL 8	SKIP TO CHANNEL 7	SKIP TO BOTTOM OF PAGE

APPENDIX F
#DIAL LISTING

```
0001  ASMB,R,B,L
0002        NAM #DIAL,2,2
0003        ENT #DIAL
0004        EXT EXEC
0005  *
0006  *
0007  *  #DIAL PRINTS A MESSAGE FOR MANUAL DIALING
0008  *
0009  *
0010  #DIAL NOP          ENTRY
0011        LDA 1,I      GET AND SAVE SYSTEM LU
0012        STA SYSLU
0013        INB
0014        LDA 1,I      GET PARAMETER
0015        SSA          IF NEGATIVE, FORGET MESSAGE
0016        JMP DISC.
0017        JSB EXEC      PRINT MESSAGE
0018        DEF *+5
0019        DEF C2
0020        DEF SYSLU
0021        DEF MESSA
0022        DEF MESSL
0023  *
0024  DISC. JSB EXEC     TERMINATE
0025        DEF *+2
0026        DEF C6
0027  *
0028  *   CONSTANTS
0029  *
0030  SYSLU OCT 1
0031  C2    OCT 2
0032  C6    OCT 6
0033  MESSA ASC 9,#RDTS: DIAL REMOTE
0034  MESSL DEC -18
0035  *
0036        END #DIAL
```

PRINTED IN U.S.A.

91780-93001