

When RTE has been configured onto the moving head disc, it is loaded into core and initiated by using the small paper tape bootstrap that was punched during RTGEN. Once RTE has been loaded and initiated, it is ready to process user tasks.

Operating Instructions

- a. Turn on all equipment.
- b. Load the bootstrap tape into core using the basic binary loader (BBL). Starting addresses are:
 037700_g for 16K
 057700_g for 24K
 077700_g for 32K
- c. Go to starting address 100_g (starting address of the bootstrap).
- d. Clear the switch register and push RUN.
- e. When RTE has been loaded into core, it prints the following message:
 SET TIME
- f. The operator either sets the clock to current day time using the TM operator request, or types any other request (the system starts at time zero).

INITIATING RTE FROM FIXED-HEAD DISC

(Excerpt from publication 02005-90001, p. 20)

The basic binary disc loader (BBDL), a modified version of the standard basic binary loader, resides in the highest, protected 64 words of core and loads either absolute format paper tapes or disc-based systems, such as RTE System.

Loading the RTE System

- a. The operator goes to the starting address of the BBDL:
 037760_g for 16K
 057760_g for 24K
 077760_g for 32K

and pushes RUN.

- b. When the computer halts with 102077_g in the memory data register, the operator clears switch register and presses RUN. When RTE is loaded, it will type:
 SET TIME

- c. The operator either sets the clock to current day time using the TM operator request, or types any other request (the system starts at time zero).

OPERATOR REQUESTS

(An expanded section appears in publication 02005-90001, pp. 2-1 to 2-8)

DN Purpose: To declare an I/O device down (i.e., unavailable for use by the RTE system).

Format: DN, *n*

Where: *n* is the EQT entry number of the I/O device to be set down

EQ, *n* Purpose: To print the description and status of an I/O device, as recorded in EQT entry.

Format: EQ, *n*

Where: *n* is the EQT entry number of the I/O device
EQ, *n, p* Purpose: To change the automatic output buffering designation for a particular I/O device.

Format: EQ, *n, p*

Where: *n* is the EQT entry number of the I/O device, and
p is 0 to delete buffering, or
p is 1 to specify buffering

GO

Purpose: To reschedule a program that has been suspended by an SS operator request or a Suspend EXEC call.

Format: GO, *name* [*p1*, ..., *p5*]

Where: *name* is the name of an operator suspended program to be scheduled for execution
p1 through *p5* is a list of parameters to be passed to *name*. Note, these parameters should be used only when the program has suspended itself.

IT

Purpose: To set time values for a program so that the program executes automatically at selected times when turned on with the ON operator request.

Format: IT, *name, r, mpt* [*h, min* [*s* [*ms*]]]

Where: *name* is the name of the program,
r is the resolution code:
 1 -- tens of milliseconds
 2 -- seconds
 3 -- minutes
 4 -- hours

mpt is a number from 0 to 999 which is used with *r* to give the actual time interval for scheduling
h hours
min minutes
s seconds
ms tens of ms } sets an initial start time

LG

Purpose: To allocate or release a group of disc tracks for load-and-go operations.

Format: LG, *n*

Where: *n* = 0 (zero) release the allocated load-and-go area
n > 0 allocate *n* contiguous tracks for a load-and-go area; set flags for load-and-go operation

LS

Purpose: To designate the disc logical unit number and starting track number of an existing source file before operating on it with EDIT, FTN, FTN4, ALGOL, or ASMB.

Format: LS, *p1, p2*

Where: *p1* is the logical unit number of the disc containing the source file
p1 = 2 or 3 system or auxiliary disc units
p1 = 0 eliminate the current source file designation
p2 is the starting track number of the source file (in decimal)

LU

Purpose: To print or change a logical unit number assignment.

Format: LU, *n1, m1, p1*

Where: *n* is a logical unit number from 1 to 63, *m*, if present, is an EQT entry number to assign to *n*
m, if zero (0), releases logical unit number *p*, if present, is a subchannel number (0-7) to assign to *n*
 If *m* and *p* are absent the assignment of logical unit *n* is printed.

OF

Purpose: To terminate a program or to remove a background program which was loaded on-line but not permanently incorporated into the protected RTE system.

Format: OF, *name, p*

Where: *name* is the name of a program
p = 0 terminates and removes from the time list any executing, scheduled, or operator suspended program; terminates programs which are I/O, memory, or disc suspended the next time they are scheduled. In neither case are disc tracks released.

p > 0, #8 terminates immediately the program named, removes it from time list, and releases all disc tracks. If suspended for I/O, the device and channel are cleared by a CLC. same as for *p* > 0, plus, if the program is not I/O suspended, the program is completely removed from the core RTE system. If the request is treated as if *p* were greater than 0, but not equal to 8. OF, *name*, 8 must be entered again to permanently remove *name* from the RTE system. Should be used only on programs loaded on-line, but not permanently incorporated into the system. The ID segment is blanked, and the tracks containing the program (if not protected) are released. The blank ID segment is then available for loading another program with LOADR.

p = 8

ON

Purpose: To schedule a program for execution. Up to five parameters may be passed to the program.

Format: ON, *name* [, *NOW*] [*p1, p2*, ..., *p5*]

Where: *name* is the name of a program
NOW schedules a program immediately that is normally scheduled by the clock time (see IT), and
p1 through *p5* are parameters passed to the program when it is scheduled (must be positive integers less than 32767)

PR

Purpose: To change the priority of a program.

Format: PR, *name, n*

Where: *name* is the name of the program
n is the new priority

RT

Purpose: To release all disc tracks assigned to a program.

Format: RT, *name*

Where: *name* is the name of the program that is to have its tracks released

SS Purpose: To suspend a program from execution.

Format: SS, name
Where: name is the name of the program to be suspended

Purpose: To request the status (priority, current list, time values) of a program.

Format: ST, name
Where: name is the name of the program whose status is to be printed

The status is printed on one line in a fixed format:
PR S r mpt h min s ms t

Where PR is the priority, a value from 1 to 9910;
S is the current list in which the program is located:

- 0 - Dormant
- 1 - Scheduled
- 2 - I/O suspend
- 3 - Not used
- 4 - Unavailable memory suspend
- 5 - Disc allocation suspend
- 6 - Operator suspend or programmed suspend (EXEC 7 Call)

r, mpt, h, min, s, and ms are all zero (0) unless the program is scheduled by the clock (see IT, this section, for the meaning of these items).

The letter "r" appears when the program is currently in the time list (as the result of an ON operator request).

TI Purpose: To print the current time of day and day of the year, as recorded in the real-time clock.

Format: TI
Purpose: To set the real-time clock.

Format: TM, day, h, min, s
Where: day is a three-digit day of the year

h, min, and s is the current time on a 24-hour clock

Purpose: To print or change the time-out parameter of an I/O device.

Format: TO, n1, m1
Where: n is the EOT entry number of the I/O device, and

m is the number of 10 ms intervals to be used as the time-out value. (m cannot be less than 500 (5 sec) for the system input device.)
If m is absent the time-out value of EOT n is printed.

UP Purpose: To declare an I/O device up (i.e., available for use by the RTE system).

Format: UP, n
Where: n is the EOT entry number of the device to be set up

OPERATOR REQUEST ERROR MESSAGES

RTE rejects operator requests for various reasons. When a request is in error, RTE prints one of the messages below. The operator enters the request again, correctly.

Message	Meaning
OP CODE ERROR	Illegal operator request word
NO SUCH PROG	The name given is not a main program in the system
INPUT ERROR	A parameter is illegal
ILLEGAL STATUS	Program is not in appropriate state

SYSTEM DIAGNOSTICS

General form: type, name, address
where: type is a 2 or 4 character error code
name is the program that contains the error
address is the address of an incorrect call to EXEC, or the address of a Memory Protect violation

Defined error conditions are:

Type	Meaning
MP	Memory Protect Error (not a system request)
RQ	Illegal system request or request code not present, request code is zero or undefined parameter list longer than maximum length
Schedule Requests	
SC01	Missing parameter
SC02	Illegal parameter
SC03	Referenced program cannot be scheduled
SC04	Not used
SC05	Referenced program is not defined
SC06	No resolution code in 'TIMER' request
Input/Output Requests	
IO01	Insufficient number of parameters
IO02	Illegal logical unit number
IO03	Logical unit not assigned
IO04	User buffer violates system boundaries
IO05	Illegal disc track or sector number in disc request
IO06	Reference to protected track (not assigned to caller) or using LGO before assigning LGO tracks
IO08	Disc transfer length exceeds track boundary
IO09	Overflow of load-and-go area
Disc Allocation/Release Requests	
DR01	Insufficient number of parameters
DR02	Illegal track number in release call
DR03	Track not assigned to caller in release call

I/O DEVICE ERRORS

I/O ERR nm EOT XX

where: nm = NR - I/O Device "Not Ready"
ET - End of input tape
PE - Parity error (Transmission error)
TO - I/O Device "Timed Out"

Note: Illegal interrupts are recorded by the diagnostic "IL INT XX" where XX is the interrupt source code in octal. The interrupt flag is cleared and control is returned to the point of interruption. The diagnostic "SC03 INT XXXXX" will be issued when an external interrupt attempts to schedule a program which is already scheduled. The user program is not aborted; the result is that the interrupt is ignored.

TRAK nm EOT # uu S (or U)
Irrecoverable disc read parity error
S = System program, U = User program

LOADER DIAGNOSTICS

Recoverable errors - record can be re-read by repositioning tape and "GO, LOADR" statement.

- L01 Checksum error
- L02 Illegal record
- L03 Memory Overflow
- L04 Linkage Area Overflow
- L05 Symbol Table Area Overflow
- L06 Common Block Error - in a normal background load (first program declaring Common did not declare largest block) or exceeding allocation in a replacement or addition
- L07 Duplicate Entry Points
- L09 Record out of sequence

Diagnostic L08 is printed if no transfer address is present for a program after end-of-loading is indicated. Another user program may be input with the "GO" statement.

Diagnostic L10 is printed if an error is detected in an operator statement. If an error is detected in an "ON" statement, the Loader terminates. If an error occurs in a "GO" statement, the Loader suspends and the "GO" may be typed again.

Note: When a program is input with a name duplicating one previously existing in the system, the following message is printed:
/LOADR: DUPLICATE PROC NAME - XXXXX
The Loader will change the name by replacing the first two characters with "##".

Location	Contents	Description
01727	XPENT	Primary Entry Point*
01730	XSUSP	'Point of Suspension'
01731	XA	'A Register' at suspension
01732	XB	'B Register' at suspension
01733	XEO	'E and Overflow' at suspension
01734	OPATN	Operator/Keyboard attention flag
01735	OPFLG	Operator communication flag
01736	SWAP	RT disc resident swapping flag
01737	DUMMY	I/O address of dummy int. card
01740	IDSDA	Disc address of first ID segment
01741	IDSDD	Position within sector
01742	BPAL	FWA R/T disc resident BP link area
01743	BPA2	LWA R/T disc resident BP link area
01744	BPA3	FWA background disc res. BP link area
01745	LBORG	FWA of resident library area
01746	RTORG	FWA of Real-Time area
01747	RTCOM	Length of Real-Time common area
01750	RTDRA	FWA of R/T disc resident area
01751	AVMEM	FWA of system available memory
01752	BKGRG	FWA of background area
01753	BKCOM	Length of background common area
01754	BKDBA	FWA of background disc resident area
01755	TATLG	Length of track assignment table
01756	TATSD	No. of tracks on system disc
01757	SECT2	No. sectors/track on LU 2 (SYS.)
01760	SECT3	No. sectors/track on LU 3 (AUX.)
01761	DISCLB	Disc address of res. lib. entry points
01762	DISCLN	No. of res. lib. entry points
01763	DISCLT	Disc address of reloc. utility program
01764	DSCUN	No. of reloc. utility programs
01765	LGOTK	Load-N-Go: LU, sig tik, no. of trks.
01766	LGOC	Current LGO track/sector address
01767	MPTUN	Source file LU and disc address
01770	MPTUL	Memory protect on/off flag (0/1)
01771	EQT12	Address of last 4 words
01772	EQT13	of current EQT entry
01773	EQT14	
01774	EQT15	
01775	FENCE	Memory protect fence address
01777	BKLWA	LWA of memory in background

EQUIPMENT TABLE ENTRY DIAGRAM

(See publication 02005-90001, p. A1)

Word	Contents
1	Device Suspended List Pointer
2	Driver "Initiation" Section Address
3	Driver "Completion" Section Address
4	ID B Not Used
5	AV FQIUP: IYPE CODE
6	CONRD (Current I/O Request Word)
7	Request Buffer Address
8	Request Buffer Length
9	Temporary Disc Track # of Control Word
10	Temporary Disc Sector # of Control Word
11	Temporary Storage for Driver
12	Temporary Storage for Driver
13	Temporary Storage for Driver
14	Device Time-Out Value
15	Device Time-Out Clock

(See publication 02005-90001, p. A3)

Word*	Label	Size	Start	End	Use
1	XLINK	1	d	d	List linkage
2-6	XIUSP	5	d	d	Temporary storage
7	XPRIO	1	s	(id on-line)	Priority
8	XPRN1	1	d	d	Primary entry point
9	XRSISP	1	d	d	Point of suspension
10	XA	1	d	d	A-Register
11	XB	1	d	d	B-Register
12	XEO	1	d	d	E- and O-Registers
13-15	XAVM	3	s	s	Program name and type
16	XIAT	1	d	d	Status
17	XLINK	1	d	d	Time linkage
18	XISI	1	d	d	Resolution code
19	XMSI4	1	d	d	Terms of milliseconds
20	XSIIC	1	d	d	Seconds
21	XMIN	1	d	d	Minutes
22	XTIOR	1	d	d	Hours
23-26	M M	4	s	s	For Disc Resident Programs Only: Ment(1) = Low base; M(3) = Low base; M(2) = Hl main; M(4) = Hl base; Source disc address (L.L./tr/sect)
27	PMAN	1	s	s	Swap location
28	SMAN	1	d	d	Swap location

*Addresses of words 1-2 are banded into base page. All F area during execution of a program.

ASCII/OCTAL TABLE

ASCII Character	First Character Octal Equivalent	Second Character Octal Equivalent	ASCII Character	First Character Octal Equivalent	Second Character Octal Equivalent
A	040400	000101	(control)	027000	000056
B	041000	000102	/	027400	000057
C	041400	000103	:	035000	000072
D	042000	000104	;	035400	000073
E	042400	000105	<	036000	000074
F	043000	000106	=	036400	000075
G	043400	000107	>	037000	000076
H	044000	000110	? *	037400	000077
I	044400	000111	0	040000	000100
J	045000	000112	1	055400	000133
K	045400	000113	2	056000	000134
L	046000	000114	3	056400	000135
M	046400	000115	4	057000	000136
N	047000	000116	5	057400	000137
O	047400	000117	6	036400	000174
P	050400	000120	7	036800	000175
Q	050800	000121	8	037200	000176
R	051000	000122	9	037600	000177
S	051400	000123	DEL	037400	000177
T	052000	000124	NULL	000000	000000
U	052400	000125	SIM	000400	000001
V	053000	000126	EOA	001400	000002
W	053400	000127	EQM	002400	000003
X	054000	000128	EOT	003000	000004
Y	054400	000129	WRT	003400	000005
Z	055000	000132	REL	003800	000006
space	020000	000040	RLI	003400	000007
1	020400	000041	LL	003000	000010
2	021000	000042	HL	003400	000011
3	021400	000043	HL*	003800	000012
4	022000	000044	LL	003000	000013
5	022400	000045	V-A8	005400	000014
6	023000	000046	FL	006400	000015
7	023400	000047	CR	006400	000016
8	024000	000050	SO	007400	000016
9	024400	000051	SI	007400	000017
(control)	025000	000052	DK	010000	000020
+	025400	000053	DK*	010400	000021
.	026000	000054	DK	011000	000022
0	026400	000055	DK*	011400	000023
(control)			DK	012000	000024
			DK*	012400	000025
			LR	013000	000026
			LR*	013400	000027
			SYM	014000	000031
			SYM*	014400	000031
			SP	015000	000031
			SP*	015400	000033
			S1	016000	000034
			S1*	016400	000035
			S2	017000	000036
			S2*	017400	000036
			S3		000037

MULTIPROGRAMMING
REAL-TIME-EXECUTIVE
SYSTEM

QUICK REFERENCE GUIDE

HEWLETT-PACKARD

6982-1555
PRINTED IN U.S.A. (001) 0772

EXEC CALLS

(Excerpted from publication 02005-90001, pp. 3-1 to 3-14)

An EXEC call is a block of words consisting of a JSB EXEC instruction and a list of parameters defining the request. The execution of the instruction causes a memory protect violation interrupt and transfers control into RTE. RTE then determines the type of request (from the parameter list) and, if it is legally specified, initiates processing of the request.

READ/WRITE: Transfers input or output
ICODE DEC 1 (or 2) 1 = READ, 2 = WRITE
ICNWD OCT *comwd* See Note 1
IBUTR BSS *n* Buffer of *n* words
IBUFL DEC *n* (or -2*n*) Same *n*; words (+) or characters (-)
IPRM1 DEC *f* Optional parameter or decimal track number if disc transfer
IPRM2 DEC *q* Optional parameter or decimal sector number if disc transfer

Note 1 (comwd):

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
----	----	----	----	----	----	---	---	---	---	---	---	---	---	---	---

0 0 0 0 0 0 X A K V M Logical Unit #

X = 1 for moving head disc write with cyclic checking
 A = 1 designates punching ASCII characters on the teletypewriter (M = 0). (If A = 0, M determines mode of transfer.)
 K = 1 causes keyboard input to be printed as received. If K = 0 input from the keyboard is not printed.
 V = 1, and M = 1, causes the length of punched tape input to be determined by the word count in the first non-zero character read from the tape.
 V = 0, and M = 1, the length of the punched tape input is determined by the buffer length specified in the EXEC call.
 M determines the mode of data transfer (if applicable).
 M = 0 for ASCII
 M = 1 for binary

I/O CONTROL: Carry out control operations
ICODE DEC 3 Request code = 3
ICNWD OCT *comwd* See Note 2
IPRAM DEC *n* Required for some control functions

Note 2 (comwd):

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
----	----	----	----	----	----	---	---	---	---	---	---	---	---	---	---

0 0 0 0 0 0 Function Code Logical Unit #

Function Code (Octal) **Action**

00 Unused
 01 Write end-of-file (magnetic tape)
 02 Backspace one record (magnetic tape)
 03 Forward space one record (magnetic tape)
 04 Rewind (magnetic tape)
 05 Rewind standby (magnetic tape)
 06 Dynamic status (magnetic tape)
 07 Set end-of-paper tape
 10 Generate paper tape leader
 11 List output line spacing

Function Code 11_g (list output line spacing), requires the optional parameter IPRAM. IPRAM must designate the number of lines to be spaced on the specified logical unit. A negative parameter specifies a page eject on a line printer.

I/O STATUS: Request device status

ICODE DEC 13 Request code = 13
ICNWD DEC *n* Logical unit number.
ISTAI NOP Word 5 of EOT entry returned here
ISTA2 NOP Word 4 returned here, optional

DISC ALLOCATION: Request allocation of contiguous tracks

ICODE DEC 4 or 15 4 = allocate track to program
 15 = allocate track globally
ITRAK DEC *n* *n* = number of contiguous tracks with-
 in the same disc unit requested. If
 bit 15 of ITRAK = 1 the program is
 not suspended if tracks are not avail-
 able; if bit 15 = 0, the program is sus-
 pended until the tracks are available.
ISTRK NOP RTE stores starting track number here,
 or -1 if the tracks are not available.
IDISC NOP RTE stores disc logical unit number
 here.
ISECT NOP RTE stores number of 64 word sec-
 tors/track here.

DISC RELEASE-PROGRAM TRACKS: Release some disc tracks assigned to the program

ICODE DEC 5 Release program's tracks
ITRAK DEC *n* If *n* = -1, release all tracks assigned
 to program. ISTRK and IDISC are un-
 necessary, so the return point is +3.
 Otherwise, *n* is the number of conti-
 guous tracks to be released starting at
 ISTRK.

ISTRK DEC *m* Starting track number
IDISC DEC *p* Mass storage logical unit

DISC RELEASE-GLOBAL TRACKS: To release some contiguous mass storage tracks which were previously assigned globally.

ICODE DEC 16 Release global tracks
ITRAK DEC *n* The number of contiguous tracks to
 be released starting at ISTRK.
ISTRK DEC *m* Starting track number
IDISC DEC *p* Mass storage logical unit

PROGRAM COMPLETION: Signal end of program
ICODE DEC 6 Request code = 6

PROGRAM SUSPEND: Suspend calling program
ICODE DEC 7 Request code = 7

PROGRAM SEGMENT LOAD: Load segment of calling program
ICODE DEC 8 Request code = 8
INAME ASC 3,xxxxx xxxxxx is the segment name

PROGRAM SCHEDULE: To schedule another program

ICODE DEC 9 or 10 9 = schedule with wait, 10 = no wait
INAME ASC 3,xxxxx xxxxxx is the name of the program to
 schedule
**IPRM1 } Up to five optional parameters
 IPRM5 }**

TIME REQUEST: Request the 24-hour time and day
ICODE DEC 11 Request code = 11
ITIME BSS 5 Time value array

EXECUTION TIME: Schedule a program by time

Initial Offset Version
ICODE DEC 12 Request code = 12
**IPROG { DEC 0 Put calling program in time list
 or
 ASC 3,xxxxx xxxxxx is the program to put in the
 time list**

IRESL DEC *x* *x* is the resolution code
MTPLE DEC *y* *y* is the execution multiple
IOFST DEC -z *z* (units set by *x*) gives the initial off-
 set; the negative sign signals initial off-
 set version to RTE

Absolute Start-Time Version

ICODE (same)
IPROG (same)
IRESL (same)
MTPLE (same)
HIRS DEC *a*
MINs DEC *b*
ISECS DEC *c*
MSECS DEC *e*

Defines absolute start time

BASE PAGE COMMUNICATION AREA

(From publication 02005-90001, pp. A1, A2)

Octal	Location	Contents	Description
01650	EOTA	EOT#	FWA of equipment table
01651	EOT#	DRT	No. of EOT entries
01652	DRT	LUMAX	FWA of device reference table
01653	LUMAX	INTBA	No. of logical units (in DRT)
01654	INTBA	INTLG	FWA of interrupt table
01655	INTLG	TAT	No. of interrupt table entries
01656	TAT	KEYWD	FWA of track assignment table
01657	KEYWD	EQT1	FWA of keyword block
01660	EQT1	EQT2	
01661	EQT2	EQT3	
01662	EQT3	EQT4	
01663	EQT4	EQT5	
01664	EQT5	EQT6	
01665	EQT6	EQT7	
01666	EQT7	EQT8	
01667	EQT8	EQT9	
01670	EQT9	EQT10	
01671	EQT10	EQT11	
01672	EQT11	CHAN	
01673	CHAN	TBG	
01674	TBG	SYSTY	
01675	SYSTY	ROCNT	
01676	ROCNT	RORTN	
01677	RORTN	ROP1	
01700	ROP1	ROP2	
01701	ROP2	ROP3	
01702	ROP3	ROP4	
01703	ROP4	ROP5	
01704	ROP5	ROP6	
01705	ROP6	ROP7	
01706	ROP7	ROP8	
01707	ROP8	DORMT	
01710	DORMT	SKEDD	
01711	SKEDD	SUSP3	
01714	SUSP3	SUSP4	
01715	SUSP4	SUSP5	
01716	SUSP5	XEOT	
01717	XEOT	XLINK	
01720	XLINK	XPRIO	
01726	XPRIO		

Current DMA channel no. (6 or 7)
 I/O address of time-base card
 EOT entry address of system TTY
 No. of request parameters - 1
 Return point address

Addresses of request parameters (set for maximum of 8 parameters)

Address of 'Dormant' list
 Schedule list
 'Available Memory' list
 'Disc Allocation' list
 'Operator Suspend' list
 ID segment address of current program
 'Linkage'
 'Priority' word