Serial Link Driver DVA47

Programming and Operating Manual

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PUBLICATION NOTICE

Changes in text to document software revisions subsequent to initial release are supplied in manual change notices or complete revisions to this manual. The history of any changes to this edition of the manual is given under "Publication History" below. The last change itemized reflects the software currently documented in the manual.

Any changed pages supplied in a change notice are identified by a change number adjacent to the page number. Changed information is specifically identified by a vertical line (change bar) on the outer margin of the page.

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SECTION I

GENERAL INFORMATION

1-1 GENERAL DESCRIPTION

This manual contains information and procedures that allow the user to write application programs using FORTRAN, ALGOL, or ASSEMBLY language and RTE Driver DVA47. Section V provides information required when configuring Driver DVA47 into a Real-Time Executive (RTE) Operating System. The Driver is entered through a FORTRAN, ALGOL, or ASSEMBLY language call to control:

- Data transmission to or from 3070A/B Terminals.
- The Hewlett-Packard Interface Bus (HP-IB)* attached to each 3070A/B Terminal.
- Data transmission to and from any HP-IB station (i.e. instrument, calculator) attached to the Terminal.

RTE Driver DVA 47 may control simultaneously up to 57-n Terminals where n is the number of Serial Links controlled by the driver. The Terminals can be distributed between as many Serial Link controllers as required, and up to 13 HP-IB devices can be attached to each Terminal through its HP-IB connector.

1-2 OPERATING ENVIRONMENT

The operating environment for this software must be an HP1000 Computer, an RTE Operating System, one 92900A/B Terminal Subsystem and one or more additional 40280A Serial Link Interface Kits. For hardware details refer to the 92900A/B Operating and Service Manual, to the 3070A/B Operating and Service Manuals and to the 40280A Operating and Service Manual.

1-3 COMPONENTS

The following components are included with the DVA47:

- This manual.
- Driver DVA47 binary tape, for non-mapped RTE II/RTE-M I/II HP Part Number 92900=16002 or the RTE III/RTE-M III/RTE IV, HP Part Number 92900-16003.

* The HP-IB is the Hewlett-Packard implementation of IEEE Standard 488-1975, "Digital Interface for Programmable Instrumentation."

1-4 SUBSYSTEM DESCRIPTION

The subsystem is composed of a Serial Link Controller, a Serial Link, and one Terminal. The Link is a multidrop line consisting of a single twisted-pair cable on which the Link Controller sends serial bit protocol. Either 3070A or 3070B Terminals may be connected to the same Link.

Each Terminal is composed of a Keyboard with numeric and Special Function Keys, a numeric Display, and a set of prompting lights. The 3070B can optionally have a thermal Printer and a multifunction Reader. Both versions are equipped with a standard HP-IB connector to drive up to 13 HP-IB devices.

1-5 CALLING SEQUENCES

The 3070 Terminals and their associated HP-IB stations are operated in the Real-Time Executive System through FORTRAN, ALGOL, and ASSEMBLY language programs using EXEC calls to enter Driver DVA47. The Driver forwards read, write, and control EXEC parameters to the Terminals and HP-IB Devices on the Link.

You address each EXEC call to a particular Terminal by using the Logical Unit Number (LU) of the Terminal in the call. In the documentation for your particular system is a list of the LU numbers for the Terminals on the Link.

Normal Mode of operation, described in Section II, permits the Terminal to be used as a simple input/output device, without knowledge of the HP-IB protocol.

Transparent Mode of operation, described in Section III, allows full control of the HP-IB. The Terminal itself is then considered as a set of HP-IB devices. In this mode, you include in the EXEC parameters device addresses as well as the LU number of the Terminal.

SECTION II

NORMAL MODE OF OPERATION

2-1 GENERAL

This section describes how to use the Terminal for data entry without having any HP-IB devices connected.

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+---------------+
| HP 3070A NOTE |
+---------------+
```

Operation of the HP 3070A differs in some respects from that of the HP 3070B. Notes under the above heading call attention to programming procedures that are different for the HP 3070A.

2-2 NORMAL MODE SELECT (FC=14)

The control request, function code FC=14, sets the driver for the addressed Terminal to the Normal Mode of operation. This mode of operation remains until the driver is set to Transparent Mode. This control request has no effect on other Terminals connected to the same serial link.

2-3 TIME OUT VALUE CHANGE (FC=22)

The control request, function code 22, allows the user to modify programmatically the Time-Out value of the Terminal EQT before a particular request is sent to the driver.

When the Time-Out value is non zero, a time-out occurs after the selected time if the initiated request has not been completed.

This time-out completes the read/write call, and all control requests except FC=6, FC=13, FC=14 and FC=22. Bit 15 of the B Register is set, both A Register and EQT5 indicate the error code with bit 0 indicating that the time-out caused the completion.

2-4 CLEAR TERMINAL (FC=0)

The control request, function code 0, completely resets the Terminal. Display is erased, all prompting lights are turned off, and Special Function Keys (SFK) reset to their normal state (Not Enabled as Input Terminator). The Service Request status is not reset by this call but by the Reset Service Request Status call.

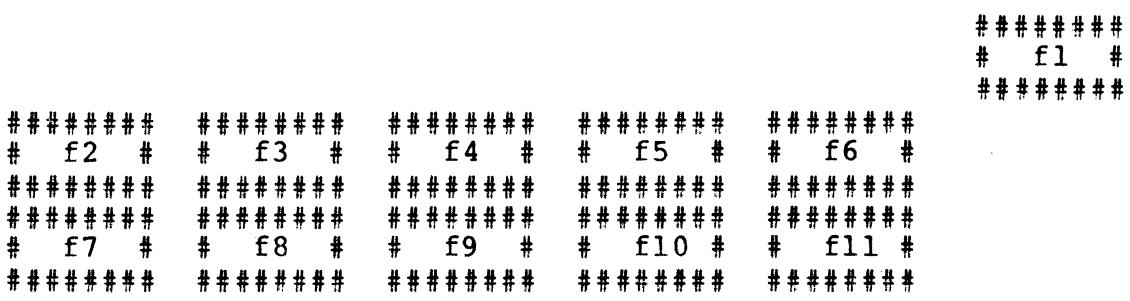
The Clear Terminal request does not modify the mode of operation. The Terminal Type is left unchanged and the Multifunction Reader control word is reset to 32B (see FC=6, paragraph 2-8). The Printer is set idle, and the Multifunction Reader is reset to its default configuration (as at power on).

2-5 ENABLE/DISABLE SPECIAL FUNCTION KEY AS INPUT TERMINATOR (FC=12)

The control request, function code 12, allows the user program to dynamically enable or disable one or several Special Function Keys, including the Service Request Key, as input terminator.

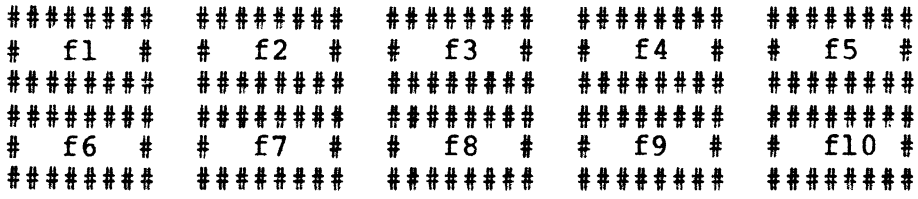
Optional parameter IPRAM of the control request call contains the number of the SFK to be enabled or disabled as input terminator. A key is enabled by a positive number from 1 to 11 and disabled by a negative number from -1 to -11.

Any SFK enabled as input terminator is automatically reset to the non-enabled condition by a Clear Terminal request. A list of the key codes is given in Appendix C. Each 3070B SFK has a number from 1 (Service Request Key) to 11 as shown below:



+---------------+
| HP 3070A NOTE |
+---------------+

For the 3070A, a key is enabled by a positive number from 1 to 10 and disabled by a negative number from -1 to -10. Each 3070A SFK has a number from 1 (Service Request Key) to 10 as shown below:



A key enabled as input terminator will complete a Keyboard Read request, but its code is not sent to the user buffer. Keys not enabled as input terminators will not complete the Keyboard Read but their codes are sent to the user buffer. Several of them can be pressed before completion of the Read request.

2-6 SERVICE REQUEST RECOGNITION (FC=7 or 10 or 5)

The Service Request Key does not generate an ASCII character; rather, it generates a Service Request signal. Enabled or not as an input terminator, this key can be used to attract attention as long as the application program is able to detect when the key has been pressed. This key can be used at any time. Software recognizes a Service Request signal in one of four ways:

a. AFTER NORMAL READ OR NORMAL WRITE CALL COMPLETION.

The Service Request condition is recorded in the completion status information in EQT5, and the RTE System software passes this information back to the user program through the A Register. A Service Request condition is recorded in bit 7 of EQT5. In addition, if the Service Request Key has been enabled as input terminator, bit 0 of EQT5 is set to "1".

b. CHECK FOR A SERVICE REQUEST (FC= 7)

The control request, function code 7, allows the user program to check the presence of a Service Request on the addressed Terminal during the next Serial Link polling cycle. On completion of this control request, the updated EQT5 is available in the A Register. Bit 7 set to "1" indicates a Service Request pending from the Terminal.

c. WAIT FOR A SERVICE REQUEST (FC=10).

The control request, function code 10, allows the user program to check the presence of a Service Request on the addressed Terminal during each Serial Link polling cycle. The call completes when a Service Request condition is detected. Bit 7 of EQT5 is set to "1". When a non Class I/O control request is used, the user program is placed in an I/O suspend state until the Service Request condition is detected.

d. WAIT AND CHECK FOR A SERVICE REQUEST (FC=5).

The control request, function code 5, causes the Driver to check the presence of a Service Request at user defined, fixed periods of time. The optional parameter of the control request sets the time period in multiples of 10 milliseconds.

The value should be between 31 and 32768. A value of 31 corresponds to 310 ms, which is the time taken by the longest polling cycle on the Serial Link. For a value between 1 and 30, the value is set to 31.

If the parameter value is not specified, or is equal to zero, the driver uses the last defined value or 400 if the value has never been defined. Other Terminals, specified in previous Wait and Check for Service Request control requests and not yet completed, are periodically checked to the new wait parameter value as soon as this call is issued.

The call completes when a Service Request is detected. In this case, the driver completes this function by a Reset SR request (FC=11, 35B) and the EQT5 status word is set accordingly. If a non Class I/O control request is used, the user program is placed in an I/O suspend state until the Service Request Key is pressed.

NOTE

This request is only available when the user program runs in a disc based RTE System. If it runs in an RTE-M environment, the request is rejected.

2-7 RESET SERVICE REQUEST STATUS (FC=11)

The control request, function code 11, allows the user to reset the Service Request status, enabling the Terminal user to use the Service Request Key again. If this call is not made, pressing the key has no effect on the program.

NOTE

It is good practice to issue this call along with the Clear Terminal call at the beginning of each user program. Until such a call is issued or until completion of a Wait and Check for SR request, the driver defaults the Terminal to an HP 3070A. That means that any read from the Multifunction Reader is defaulted to the Keyboard.

2-8 SET READER CONFIGURATION (FC=6)

This control request, function code 6, is required to give to the driver the Reader mode. This call does not send any information to the Terminal. It will be used by subsequent Reader Read calls. This configuration information will stay until another Set Reader Configuration request or Clear Terminal request is made. The optional parameter IPRAM of this control request will define the reader configuraton as shown on the following page.

IPRAM = XY with X first octal digit and Y second octal digit:

```
                          X Y

                            4...Marks only / 40 col. / No Clock
                            6...Marks only / 80 col. / No Clock
ASCII / Local-reject...3
ASCII / No reject .....1
                            0...Holes only / 40 col. / No Clock
                            2...Holes only / 80 col. / No Clock
                            7...Marks+Holes / Clock after data
                            3...Holes only  / Clock after data
Image / Local reject...2
Image / No reject   ...0
                            5...Marks+Holes / Clock on data
                            1...Holes only  / Clock on data
```

2-9 SET READER CONFIGURATION EXAMPLE

To set up the Reader to read a marked card with clock after data, local card reject, and ASCII mode, use:

```
CALL EXEC(3,600B+ILU,37B)
```

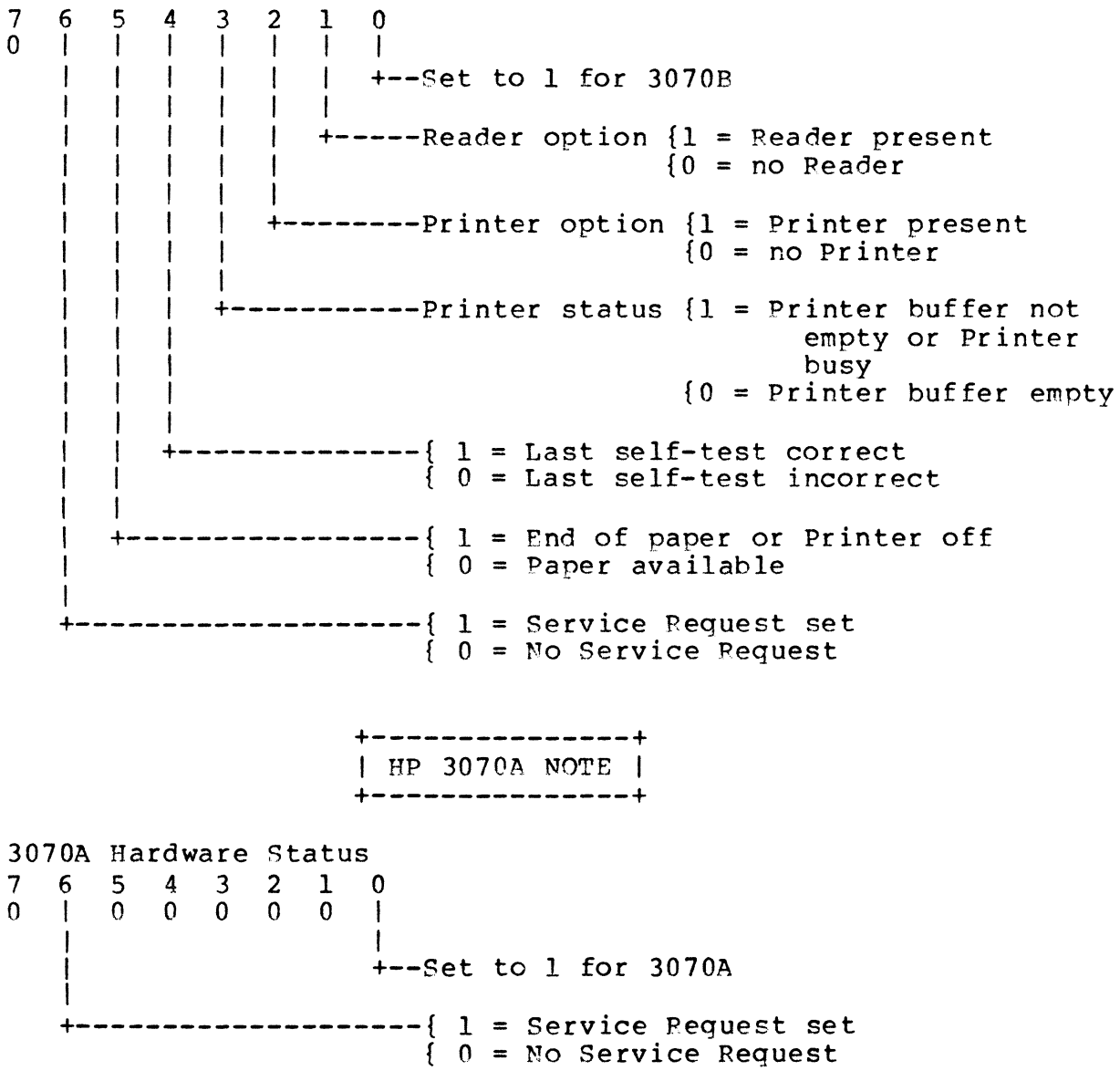
Where 3 is the Request Code, 600B expresses the Function Code, ILU is the Logical Unit Number of the Terminal, and 37B is the parameter IPRAM. The defaulted Reader configuration is ASCII 80-column holes only, local reject, no clock mark (IPRAM=32B).

2-10 CONTROL REQUEST COMPLETION STATUS

The status information in EQT5 is updated from any of the following control requests.

- Check for a Service Request.
- Wait for a Service Request.
- Wait and Check for Service Request.
- Reset Service Request Control.

On completion of any of these calls, the A Register contains the same information as EQT5. For the first two calls, bit 7 of EQT5 is set if a Service Request condition is detected. The Reset Service Request and the Wait and Check for Service Request calls puts the addressed terminal status into bits 0 through 7 of EQT5.



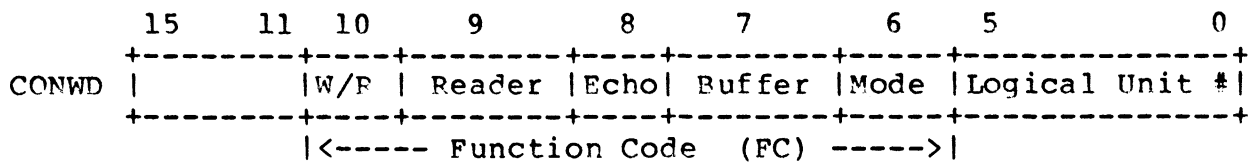
2-11 NORMAL READ REQUEST

The Normal Read request transfers information from the addressed 3070 Terminal to the user program.

Calling sequence:

```
CALL EXEC(RCODE,CONWD,IBUFR,IBUFL)
```

where: RCODE = 1
CONWD = FC00B+ILU
IBUFR = Buffer location
IBUFL = Buffer length



2-12 KEYBOARD ASCII READ (FC=0,4)

Without echo on the display: FC=0

With echo on the display: FC=4

Data in the Keyboard buffer is read until a read terminator is received. Terminator ASCII codes are not stored in the user buffer.

Valid read terminator keys are:

- The Enter Key, which generates a line-feed.
- A Special Function Key enabled as input terminator, which generates a character, as listed in Appendix C, followed by line-feed.
- A Service Request enabled as input terminator.

Completion status indicates the terminator origin. Refer to paragraph 2-18 for further details.

If a buffer-full condition occurs (more characters input than requested) the extra characters are lost. In this case, the only valid terminator keys are the Enter Key and the Service Request Key enabled as input terminator. Completion status (available in A Register and EQT5) indicates the input terminator. Any Special Function Key enabled as input terminator may also complete the read; however, note that the completion status indicates that this read has been completed from line-feed generated by the Enter Key.

NOTE

A Special Function Key enabled as a terminator does not complete a read when a buffer-full condition occurs.

2-13 KEYBOARD BINARY READ (FC=1,5)

Without echo on the Display FC=1

With echo on Display FC=5

Data in the Keyboard buffer is read until one of the following conditions occurs:

- Requested number of characters is reached: buffer full.
- Receipt of an input terminator: Enter Key or any SFK except the Service Request Key enabled as input terminator.

The Driver sends to the user buffer the Key code and line-feed generated by the SFK or the line-feed generated by the Enter Key.

Completion status indicates the terminator origin: see Paragraph 2-18.

```
+---------------+
| HP 3070A NOTE |
+---------------+
```

A 3070A Special Function Key enabled as input terminator does not complete the read.

2-14 KEYBOARD READ WITH SUBSEQUENT OFF-LINE INPUT (FC=2,3,6,7)

ASCII Read FC=6 } with echo ASCII Read FC=2 } without echo

Binary Read FC=7} on Display Binary Read FC=3} on Display

This is an ASCII read from the Keyboard as described in Paragraph 2-12. However, after a previous read the Keyboard is left enabled for the next input. In this case, the data entered on the Terminal is locally buffered until the next read is processed by the system.

The amount of data that can be buffered should not exceed one Display length. Hence the 3070B Terminal is used as a buffered keyboard/display unit where data can be entered while previous data is being processed by the system. This permits a greater throughput since no waiting time is required between inputs.

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+---------------+
| HP 3070A NOTE |
+---------------+
```

This read should not be used with a 3070A. If attempted, the Driver will default to a standard Read.

2-15 READER READ (FC=10,11)

ASCII Read: FC=10

Binary Read: FC=11

This read request will:

a. Set the Reader in the configuration requested by the last Set Reader Configuration request.

b. Transfer the data from the Reader buffer to the user buffer until a terminator condition occurs.

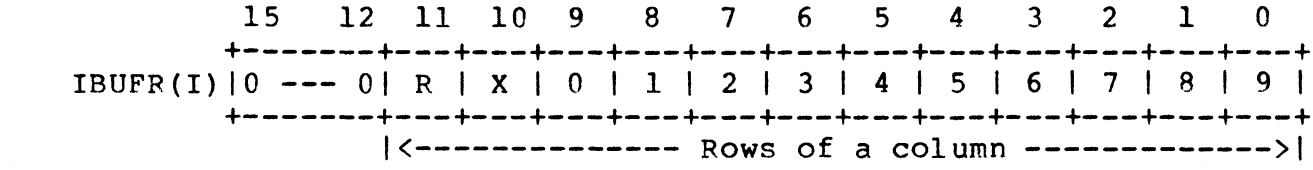
For an ASCII read, the terminator can be:

- A line-feed coded on the card or badge.
- The line-feed generated by the Reader as end of card or badge.
- An enabled SFK code, coded on the card or badge.
- A Service Request from the Service Request Key.

For a binary read, the terminator can be:

- A buffer-full condition.
- The end of the card or badge.

When the Reader is used in Image mode, the data returned to the user buffer is in the following format:



This call is automatically defaulted to a Read request from the Keyboard if the Terminal does not have a Reader. In this case, the read will be processed as a Normal Read, where FC = 0 through 7.

2-16 WRITE/READ (FC=2N,3N)

Read from the Keyboard: FC=2N

Read from the Reader: FC=3N

This is a special write/read call which can be used in interactive operations to enhance system performance and response time. In one call it allows the user program to send data to the Terminal Display and to receive data from the Terminal Keyboard or Reader according to the Function Code.

If N= 0, 2, 4 or 6 the write will be ASCII.

If N= 1, 3, 5 or 7 the write will be binary.

The read will be performed exactly as described for FC= 0 through 7.

2-17 WRITE/READ BUFFER FORMAT

Buffer IBUFR must be formatted as follows:

IBUFR(1)

Output buffer length	
Input buffer length	
Output byte# 1	Output byte #2
.....	.....
Output byte # n	Lost if n odd
Input byte # 1	Input byte # 2
.....	Input byte # m

The first input byte will be automatically stored in the left position. The buffer length IBUFL must specify the total length of the buffer IBUFR used by this call (output buffer length + input buffer length + 4 bytes +1 if the output buffer length is not an odd byte number). The buffer lengths are specified either as positive numbers (words) or as negative numbers (bytes).

The total buffer length specified by IBUFL must be greater than or equal to IBUFR(1)+IBUFR(2)+4 or 5 bytes (input + output buffer length + 4 or 5 bytes) otherwise the call is rejected. If IBUFL is equal to IBUFR(1)+IBUFR(2)+4 or 5 bytes, the call will only output the bytes contained in the output buffer and complete.

The transmission LOG returned by this call will follow the type of the input buffer length (IBUFR(2)): if IBUFR(2) defines a number of words (positive) the transmission LOG will be a word number, if IBUFR(2) defines a number of bytes (negative) the transmission LOG will be a byte number. The output buffer is not destroyed by this call and may be re-used as many times as required.

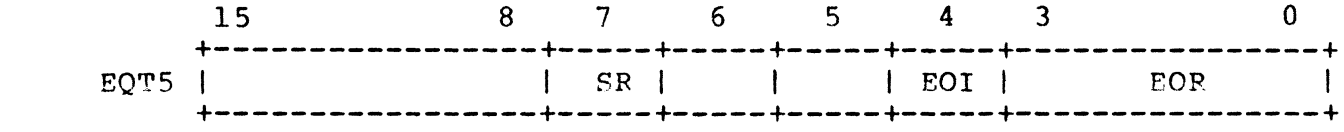
NOTE

The write/read call may be used under class I/O. The request code in this case must be 20. For example, the FORTRAN calling sequence will be:

```
CALL EXEC(20,2n00B+ILU,IBUFR,IBUFL,IPARM1,IPARM2,ICLAS)
CALL EXEC(20,3n00B+ILU,IBUFR,IBUFL,IPARM1,IPARM2,ICLAS)
```

2-18 NORMAL READ REQUESTS COMPLETION

Upon completion of a Normal Read (write/read) request the following information is available from word 5 of the equipment table (EQT5) and from the A Register if the EQT is unbuffered. The B Register contains the transmission LOG if the EQT is unbuffered.



EOR indicates which terminator caused the Read (write read) to complete:

EOI = 1 indicates end of binary Read, EOI line detected true.

EOR = 0 ASCII read completed on line-feed generated by Enter Key; binary read completed on buffer-full.

EOR = n (1<=n<=11) ASCII read completed on line-feed generated by SFK number n (n=1 indicates completion on an SR).

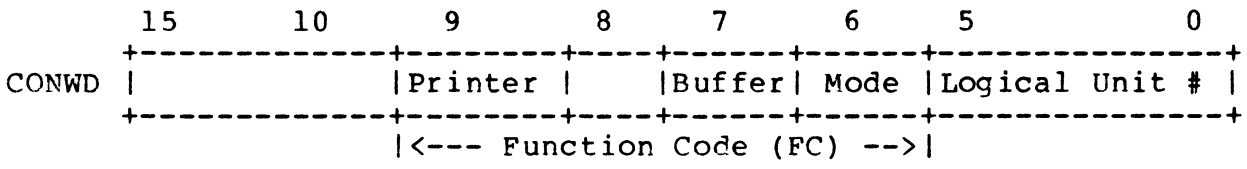
SR indicates a Service Request Key has been pressed during the read operation. This is redundant information in the case of a Service Request Key enabled as a terminator.

2-19 NORMAL WRITE REQUESTS.

Transfers information from the user program to the addressed 3070 Terminal. The calling sequence:

```
CALL EXEC(RCODE,CONWD,IBUFR,IBUFL)

     RCODE = 2
     CONWD = FC00B+ILU
     IBUFR = Buffer address
     IBUFL = Buffer length
```




```
Mode    = 0  ASCII write        Buffer = 0  Single write
        = 1  Binary write               = 1  Write with subsequent
                                               off-line input
Printer = 0  Write to display
        = 1  Write to printer
```

2-20 DISPLAY ASCII WRITE (FC=0)

ASCII write to the Display of the specified number of characters, followed by a line-feed. A buffer length of zero causes only the transmission of a line-feed.

2-21 DISPLAY BINARY WRITE (FC=1)

Binary write to the Display of the specified number of characters; no line-feed is sent with the last character transmitted.

2-22 DISPLAY WRITE WITH SUBSEQUENT OFF-LINE INPUT (FC=2,3)

ASCII Write: Function code FC=2

Binary Write: Function code FC=3

This is a write to the display, ASCII or binary according to the Function Code, which then enables the Keyboard for a local input. The amount of data that the user can enter should not exceed a full length display.

Data is locally buffered in the Terminal and then transmitted to the System when a Read request is issued. By use of this mode, a user may begin answering a question as soon as it has been prompted for. The Display automatically echoes the Keyboard input.

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+---------------+
| HP 3070A NOTE |
+---------------+
```

For a 3070A Terminal, function codes 2 and 3 default to FC=0 or FC=1.

2-23 PROMPTING LIGHTS

ASCII codes, when sent to the Terminal, will turn on or off the corresponding prompting lights (codes are listed in Appendix B). The user program may issue an ASCII Write request to the Display with the write buffer containing any combination of these characters.

2-24 PRINTER ASCII WRITE (FC=10)

ASCII write to the Printer of the specified number of characters followed by a line-feed. If more than 20 characters are sent to the Printer, the Printer automatically prints the first 20 characters; extra characters will be printed on the next line upon receipt of the line-feed, which is automatically issued by the Driver. Write to a terminal without a Printer is defaulted to the Display.

2-25 PRINTER BINARY WRITE (FC=11)

Binary write to the Printer of the specified number of characters. Automatic print is obtained if data characters are a multiple of 20 characters. Otherwise, printing will be executed upon the receipt of a line-feed, which is NOT issued by the driver.

2-26 PRINTER WRITE WITH SUBSEQUENT LOCAL INPUT (FC=12,13)

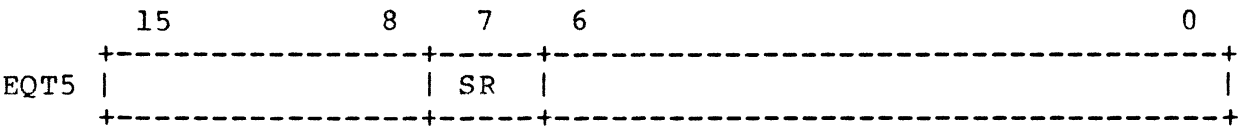
ASCII Write: FC=12

Binary Write: FC=13

This is a Write to the Printer, ASCII or binary according to the Function Code, followed by a local keyboard/display connection for off-line input. Data is locally buffered in the Terminal and then transmitted to the system when a Read request is issued. A Write to a Terminal without a Printer is defaulted to the Display.

2-27 NORMAL WRITE REQUEST COMPLETION.

Upon completion of a Normal Write request the following information is available from word 5 of the equipment table (EQT5) and from the A Register if the EQT is unbuffered:



Service Request (SR) indicates if a Service Request Key has been pressed during the Write operation.

SECTION III

TRANSPARENT MODE

3-1 INTRODUCTION

The HP 3070B Terminals are HP-IB devices composed of a Keyboard, Display and prompting light modules, an optional Printer module, and an optional Reader module. All of these modules are addressable HP-IB devices.

The purpose of the communication module is to make the transfer in both directions between serial-bit protocol on the Serial Link and parallel- bit serial-byte protocol on the HP-IB. The communication module, under remote control of the HP 1000 System through the Serial Link controller, acts as an HP-IB controller.

When the communication module is not configured as a listener it cannot send data on the Serial Link. This condition allows some other auxiliary controller to control the HP-IB. Since the communication module is always able to source handshake, one should take care that no two controllers (system and auxiliary controller) talk at the same time. To abort, the system controller must send HP-IB Interface Clear command IFC (more details in paragraph 3-4, FC=15).

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+--------------------+
|     IMPORTANT      |
+--------------------+
```

When using the driver in Transparent Mode, the user should be aware that the requests he is issuing to the driver will not generate any HP-IB commands to the bus that he has not specifically requested in a Write request or in a Write/Read request. The only exceptions to this rule are the following calls:

- Write Serial Poll (FC=20)
- Clear (FC=0)
- HP-IB Interface Clear IFC (FC=15)
- Get Status Byte (FC=11)
- Select Input Terminator (FC=12)
- Wait and Check SR Periodically (FC=5)

3-2 TRANSPARENT MODE SELECT (FC=13)

The control request, function code 13, sets the Driver into Transparent Mode of operation for the addressed Terminal. This mode, one of the two possible modes that the Driver senses, allows the Terminal to be used as the HP-IB controller of its own cluster. This mode of operation remains until the Driver is set to Normal Mode. This control request has no effect on other Terminals.

NOTE

> In this mode the EQT is never set down except for a malfunction; therefore, a Not Ready or Time Out message is never displayed on the system console. The user program is responsible for checking in EQT5 the status of the Terminal that is running in this mode and for taking the appropriate action.

3-3 TIME OUT VALUE CHANGE (FC=22)

The control request, function code 22, allows the user to modify the Time Out value of the Terminal EQT before a particular request is sent to the Driver.

When the Time Out value is non zero, a time-out occurs after the selected time if the initiated request has not been completed.

This time-out completes the Read or Write call and all control requests except FC=6, FC=13, FC=14 and FC=22. Bit 15 of the B Register is set, both A Register and EQT5 indicate the error code with bit 0 indicating that the time-out caused the completion.

3-4 CLEAR TERMINAL (FC=0)

The control request, function code 0, completely resets the Terminal. Display is erased, all prompting lights are turned off, and Special Function Keys reset to Not Enabled as Input Terminator.

The Service Request is not reset by this call but by a Get Status Byte or a serial poll request. Clear control request does not modify the mode of operation. Printer is set idle, and the multifunction Reader is reset to its default configuration.

On the completion of a Clear request, the Driver stores the completion status information in EQT5 and the RTE system software passes this information back to the user through the A Register. If Bit 15 of the B Register is set, then both the A Register and EQT5 will reflect the error code. A subsystem hardware malfunction may be detected from this call. See error handling (Error code 2).

Bus traffic generated by the clear request: IFC, NotIFC, DCL.

3-5 HP-IB INTERFACE CLEAR COMMAND (FC=15)

The control request, function code 15 only pulses the IFC line on the HP-IB, thus allowing all devices connected to the bus to be cleared.

3-6 ENABLE/DISABLE SPECIAL FUNCTION KEY AS INPUT TERMINATOR (FC=12)

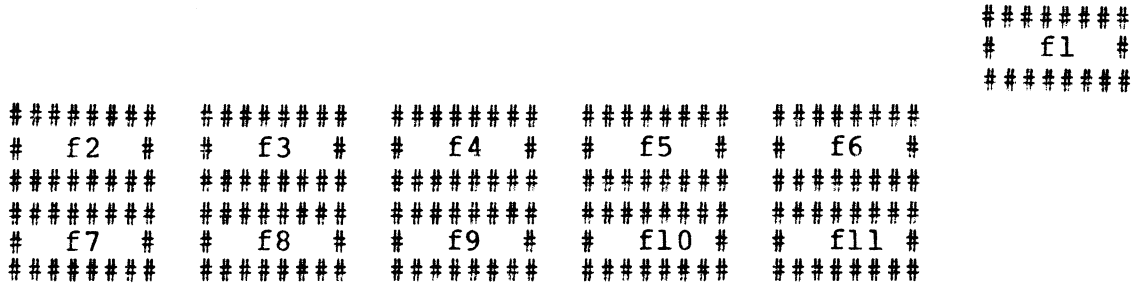
The control request, function code 12, allows the user program to dynamically enable or disable one or several Special Function Keys (SFK), including the Service Request Key, as input terminators.

Optional parameter IPRAM of the control request call contains the number of the SFK which is to be enabled or disabled as input terminator. A key is enabled by a positive number from 1 to 11 and disabled by a negative number from -1 to -11. Any SFK enabled as input terminator is automatically reset to the non-enable condition by a Clear Terminal request. Appendix C gives a list of the Key codes.

Bus traffic generated by this call:

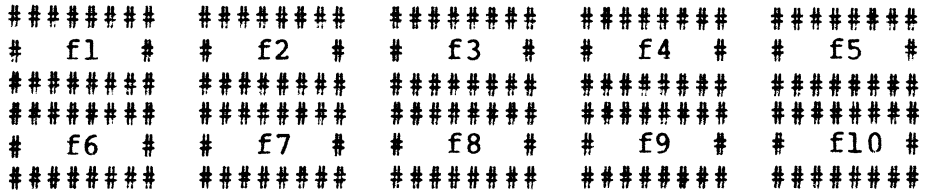
LSN35,MSAx with x between octal 0 and 11 to disable or 20 and 31 to enable.

Each 3070B SFK has a number from 1 (Service Request Key) to 11 as shown below:



+---------------+
| HP 3070A NOTE |
+---------------+

For a 3070A there is no bus traffic generated. An SFK is enabled by a positive number from 1 to 10 and disabled by a negative number from -1 to -10. Each 3070A SFK has a number from 1 (Service Request Key) to 10 as shown below:



A key that is enabled as input terminator will complete a Keyboard Read request, but its code is not sent to the user buffer. Keys which are not enabled as input terminators will not complete the Keyboard Read but their codes are sent to the user buffer. Several of them can be pressed before completion of the Read request.

3-7 SRQ LINE STATUS (FC=7 or 10 or 5)

The Service Request Key does not generate an ASCII character; enabled or not as an input terminator, this key allows the terminal user to set the SRQ line from the keyboard. Software recognizes SRQ in one of three ways:

a. CHECK FOR A SERVICE REQUEST (FC= 7)

The control request, function code 7, allows the user program to check the SRQ line on the addressed terminal during the next Serial Link polling cycle. On completion of this control request, the updated EQT5 is available in the A Register. Bit 7 set to "1" indicates the HP-IB SRQ line is set.

b. WAIT FOR A SERVICE REQUEST (FC=10).

The control request, function code 10, allows the user program to check the SRQ line on the addressed Terminal during each Serial Link polling cycle. The call completes when the SRQ line is set and bit 7 of EQT5 is set to "1". When a non Class I/O control request is used, the user program is placed in an I/O suspend state until the SRQ line is set.

c. WAIT AND CHECK FOR A SERVICE REQUEST (FC=5).

The control request, function code 5, causes the driver to check the SRQ line on the addressed terminal at user-defined fixed periods of time. Optional parameter IPRAM of the control request sets the time period in multiples of 10 milliseconds.

The IPRAM value should be between 31 and 32768. A value of 31 corresponds to 310ms, which is the time taken by the longest polling cycle on the Serial Link. For an IPRAM value between 1 and 30, IPRAM is set to 31.

If IPRAM is not specified, or equal to zero, the driver uses the last defined IPRAM value or 400 if IPRAM has never been defined. Other Terminals, specified in previous Wait and Check for Service Request control requests and which have not completed them, are periodically checked to the new IPRAM value as soon as this call is issued.

The call completes when an SRQ is detected on the terminal during a check. In this event, the driver completes the function by a Get Status Byte (FC= 11, 35B) and the EQT5 status word is set accordingly. If a non Class I/O control request is used, the user program is placed in an I/O suspend state until SRQ is set.

NOTE

This request is only available when the user program runs in a disc-based RTE System. If it runs in a RTE-M environment, the request is rejected.

NOTE

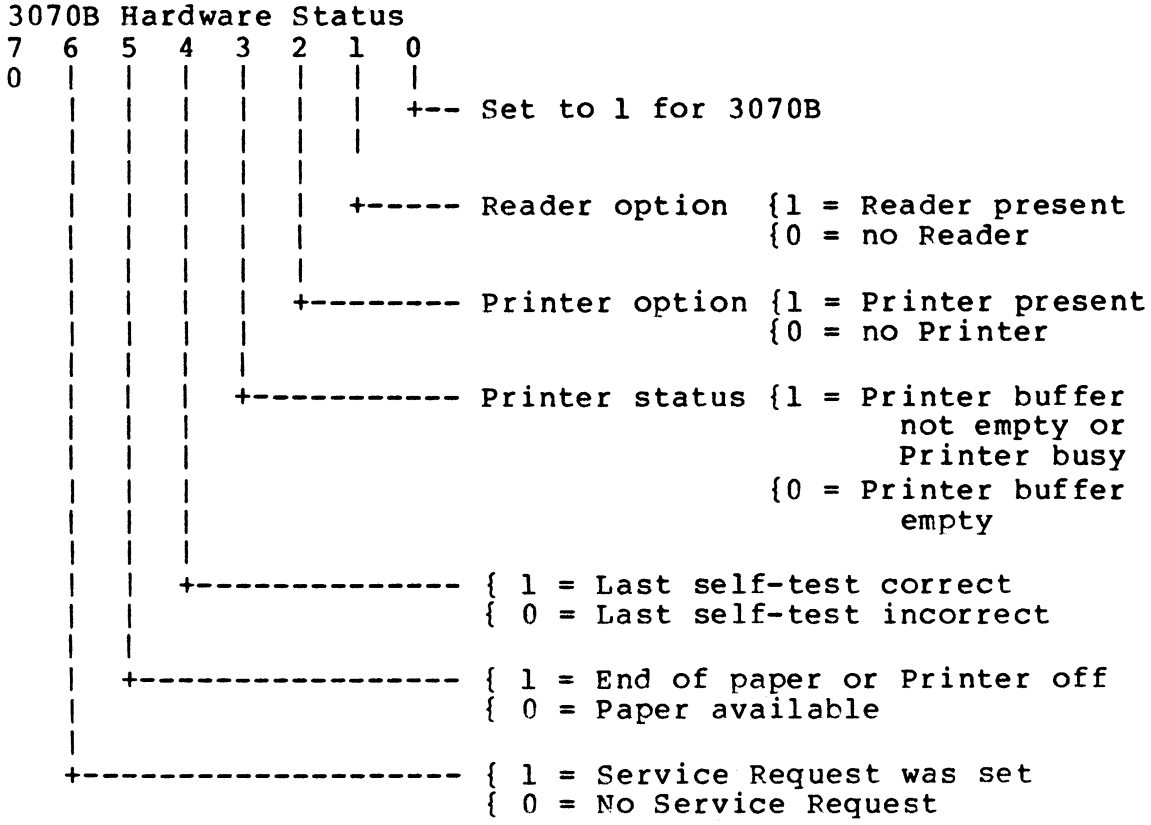
If a time-out has been initialized by directly writing in terminal EQT15, (through $LIBR and $LIBX RTE subroutines), the time-out will be processed as usual, thus allowing the user to make complete remotely a terminal I/O that has been suspended on such a call.

When SRQ is set, the user program must determine which HP-IB device set it. To do this, the program must perform a Serial Poll Special Write request. If the station is already known, a Get Status Byte control request can be used. These calls reset the SRQ line.

3-8 GET STATUS BYTE (FC=11)

The control request, function code 11, resets the SRQ line enabling other HP-IB devices to set it. The optional parameter of the control request, IPRAM, is the HP-IB address of the station to be polled.

It is good practice to issue this call along with the Clear Terminal call at the beginning of all user programs. Until such a call is issued, the driver considers the Terminal to be a 3070A. The hardware status byte, returned in EQT5 when the device is the Terminal Keyboard (IPARM=35B or defaulted), is shown on the next page.



Bus traffic generated by this call:

UNL, UNT, LSN36, SPE, TLK(IPRAM), UNT, SPD

3-9 ISSUE END OR IDENTIFY (FC=1)

This control request, function code 1, sets the End or Identify (EOI) HP-IB line allowing the end of record indication to be observed by all responding devices.

3-10 REMOTE ENABLE (FC=2)

The control request, functon code 2, sets Remote line REN. After execution of this control function, any ensuing command byte sent to the HP-IB of the Terminal contains a 'Set REN line' until a Remote Disable command or a Clear control request is made.

3-11 REMOTE DISABLE (FC=3)

The control request, function code 3, resets Remote line REN. All HP-IB devices connected to the Terminal revert to local control.

3-12 CONTROL REQUEST COMPLETION STATUS

The status information in EQT5 is updated from any of the following control requests.

- Check for a Service Request.
- Wait for a Service Request.
- Wait and Check for Service Request.
- Reset Service Request control.

On completion of any calls, the A Register contains the same information as EQT5. For the first two calls, bit 7 of EQT5 is set if a Service Request condition is detected. The Reset Service Request and the Wait and Check for Service request calls put the addressed terminal status into bits 0 to 7 of EQT5.

3-13 TRANSPARENT READ REQUESTS

The Transparent Read Request transfers information from the current configured talker connected to the 3070B HP-IB bus to the user buffer.

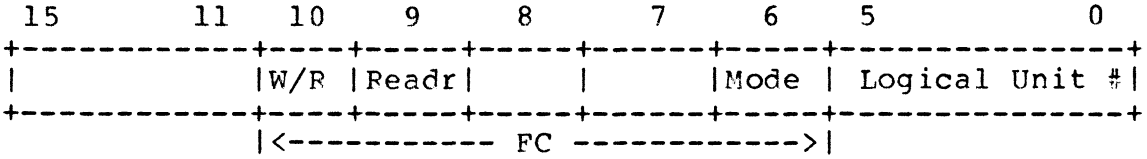
```
+---------+
| CAUTION |
+---------+
```

To transfer data from the HP-IB to the Serial Link, configure the communication module, addressed octal 36, as a listener.

Calling sequence:

```
CALL EXEC(RCODE,CONWD,IBUFR,IBUFL)
```

where: RCODE = 1
CONWD = FC00B+ILU
IBUFR = Buffer location
IBUFL = Buffer length



Mode = 0 ASCII read
= 1 Binary read

W/R = 0 Standard read
= 1 Write/read

Readr = 0 Standard
= 1 If the Terminal EQT18 content bit 14 specifies the Multifunction Reader is present and bits 0-4 specify an Image mode of reading, the received data will be processed as described in paragraph 2-15. To get correct information in the user buffer the user must be reading data from the Multifunction Reader, and the Read must be programmed to send data in Image mode.

3-14 ASCII READ FROM THE CURRENT TALKER (FC=0)

The valid read terminator codes are:

- A line-feed code (not stored in the user buffer).
- An SFK code if Key has been previously selected as an input terminator (not stored in the user buffer).
- An SRQ if the Service Request Key has been enabled as input terminator.
- Input of the requested number of bytes.
- An HP-IB command (HP-IB attention line true) in which case the command byte is the last byte stored in the user buffer.

If a buffer-full condition occurs (more characters input than requested) the extra characters are lost. In this case, the only valid terminators are the line-feed and an SRQ if the Service Request key has been enabled as an input terminator.

Completion status (available in A Register and EQT5) indicates the terminator origin. Any Special Function Key, enabled as input terminator, can also complete the read; however, the completion status indicates that this read has been completed from line-feed.

+---------------+
| HP 3070A NOTE |
+---------------+

A 3070A Special Function Key enabled as terminator does not complete the read when a buffer-full condition occurs.

3-15 BINARY READ FROM THE CURRENT TALKER (FC=1)

The valid read terminators are;

- o Input of the requested number of characters.
- o Detection of the End Or Identify line set.
- o An HP-IB command (HP-IB Attention line set, Enter Key and any SFK enabled as input terminator except SRQ) in which case the command byte is the last byte stored in the user buffer.

The driver sends to the user buffer the characters (Key code and line-feed) generated by the SFK, or the line-feed generated by the Enter Key completion status indicates terminator origin (refer to Paragraph 3-17).

+---------------+
| HP 3070A NOTE |
+---------------+

A 3070A SFK, enabled as input terminator, does not complete the read.

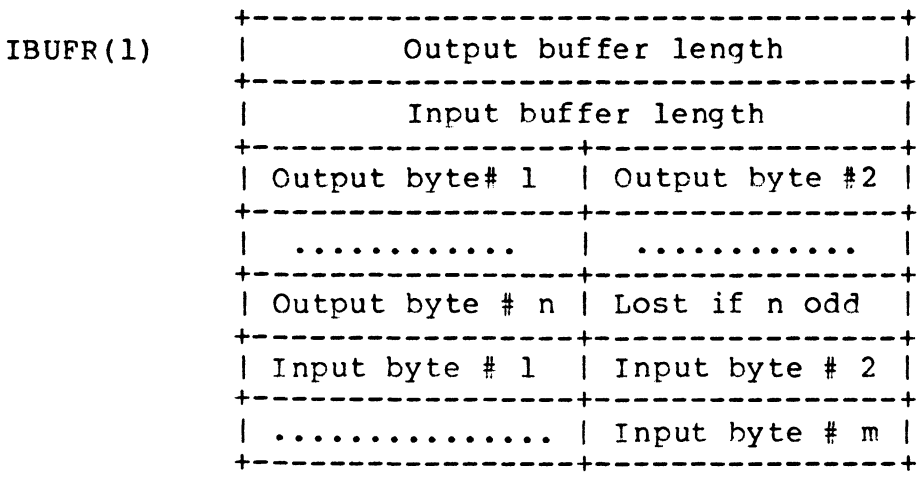
3-16 WRITE/READ (FC=20,21,30,31)

Binary read FC=21 or 31

ASCII write FC=20 or 30

This is a special Write/Read call for use in interactive operations to enhance system performance and response time. In one call it allows the user to send a mixture of HP-IB commands and HP-IB data, in binary mode, and to receive the data issued by the selected talker.

For the Write/Read call, buffer IBUFR must be formatted as follows:



The first input byte will be automatically stored in the left position. The buffer length IBUFL must specify the total length of buffer IBUFR used by this call (output buffer length + input buffer length + 4 bytes +1 if the output buffer length is not an even byte number).

The buffer lengths are specified either as positive numbers (words) or as negative numbers (bytes).

The total buffer length specified IBUFL must be greater than or equal to IBUFR(1)+IBUFR(2)+4 or 5 bytes (input + output buffer lengths+4 or 5 bytes) otherwise the call is rejected.

If IBUFL is equal to IBUFR(1)+IBUFR(2)+4 or 5 bytes, the call will only output the bytes contained in the output buffer and complete.

The transmission LOG returned by this call will follow the type of the input buffer length (IBUFR(2)): if IBUFR(2) defines a number of words (positive) the transmission LOG will be a word number, if IBUFR(2) defines a number of bytes (negative) the transmission LOG will be a byte number.

The output buffer is not destroyed by this call and may be re-used as many times as required.

NOTE

The write/read call may be used under Class I/O. The request code in this case must be 20. For example, the FORTRAN calling sequence is:

```
CALL EXEC(20,2n00B+ILU,IBUFR,IBUFL,IPARM1,IPARM2,ICLAS)
CALL EXEC(20,3n00B+ILU,IBUFR,IBUFL,IPARM1,IPARM2,ICLAS)
```

The eighth bit of an output byte defines whether or not the byte is a data or a command byte. Bit eight set to "1" signifies a command byte.

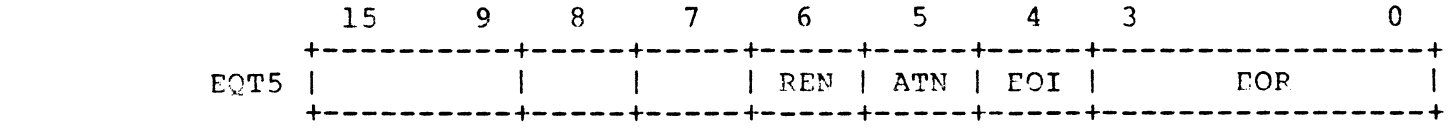
Example of use: Program the Multifunction Reader to read a 22-column punched badge in Hollerith with reject enabled (see 3070B users manual for details):

```
DIMENSION IBUFR(15)
IBUF=15
IBUFR(2)=5
IBUFR(3)=IOR(2H?<,100200B)
IBUFR(4)=IOR(2Hz>,100200B)
IBUFR(5)=IOR(2H\ ,100000B)
CALL EXEC(1,2000B+ILU,IBUFR,IBUFL)
```

Bus traffic generated: UNL,LSN34,MSAz,LSN36,TKL34

3-17 TRANSPARENT READ REQUESTS COMPLETION STATUS

Upon completion of a Transparent Read (write/read) request, the following information is available from EQT5 and from the A Register if the EQT is unbuffered. The B register contains the transmission LOG if the EQT is unbuffered.



EOR indicates which terminator caused the read (write/read) to complete:

EOR = 0: ASCII read completed on line-feed. Generated by Enter Key or any HP-IB device able to generate it. Binary read completed on buffer-full or EOI.

EOR = 15: ASCII read completed on buffer-full.

EOR = n: (1<=n<=11) ASCII read completed on line-feed, generated by SFK n (n=1 indicates completion on a Service Request), or any HP-IB device that generates the same character sequence as any one enabled SFK.

REN indicates the state of the HP-IB REN line (Remote Enable). REN = "1" if REN is set.

ATN indicates the state of the HP-IB ATN line (Attention). ATN = "1" if ATN is set (HP-IB command present on the bus).

EOI indicates the state of the HP-IB EOI line (End or Identity). EOI = "1" if EOI is set.

NOTE

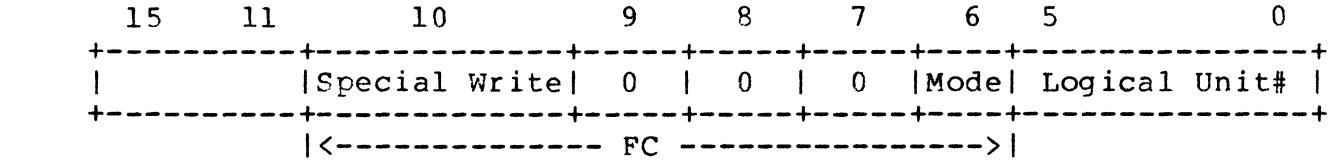
Bit 7 (SRQ indication) is meaningless unless EOR=1.

NOTE

For a Write/Read, the returned transmission LOG, if any, follows the input buffer length specified in IBUFR(2): if it is an input byte length the T.LOG will be expressed in bytes, if it is an input word length, the T.LOG will be expressed in words.

3-18 TRANSPARENT WRITE REQUESTS

The Transparent Write request transfers data or commands from the user program to the Serial Link addressed Terminal HP-IB.



Bit 10 = 0 Data transfer — MODE = 0 ASCII; = 1 Binary

Bit 10 = 1 Special write — MODE = 0 Serial Poll Request; = 1 Write Command Byte

3-19 ASCII WRITE TO CURRENT CONFIGURED LISTENER (FC=0)

This request, function code FC=0, allows the user program to send a specified number of ASCII characters followed by a Line-Feed on the HP-IB. A buffer length of zero causes the transmission of only a line-feed.

3-20 BINARY WRITE TO CURRENT CONFIGURED LISTENERS (FC=1)

This request, function code FC=1, allows the user program to send a specified number of characters on the HP-IB. The EOI line is set with the last character transmitted.

3-21 SERIAL POLL SPECIAL WRITE (FC=20)

This request, function code FC=20, is a special Write Request which may also be used in Normal Mode. It allows a user program to perform a serial poll on the HP-IB of the Terminal. This call is useful only when some devices are attached to the Terminal. Use it to identify the device that sets the SRQ line.

User buffer IBUFR must contain the addresses of the devices to be polled. The addresses can be in any order:

```
IBUFR OCT A1
        .          0=< Ai <=35B
        .
        .
      OCT Ai       Ai are HP-IB addresses of actual devices
        .          connected to the Terminal
        .
      OCT An
```

The user buffer length, in words, indicates the number of devices to be polled.

NOTE

It is good practice to set a Time Out on this request since a non-responding device will cause a hang-up.

Bus traffic generated by the call:

UNL,UNT,LSN36,SPE,TLKA1,TLKA2,...,TLKAi,...,UNT,SPD

The first answering device causes the request to complete. The Service Request of that device is reset.

The status word, EQT5 bits 7-0, is updated with the device address in bits 4-0, or is defaulted to 37B if SRQ line was not set. Bit 7 indicates whether or not other devices are still requesting service.

In order to clear bit 7 in the status word, as many poll requests as number of requesting devices must be issued.

3-22 HP-IB COMMAND BYTE WRITE

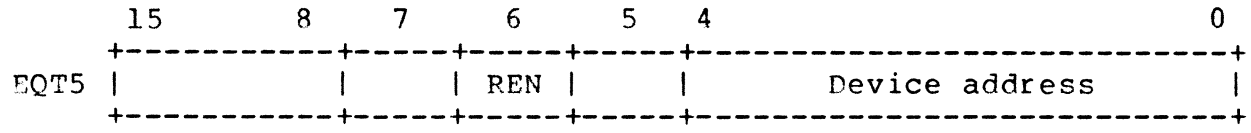
This special write request, function code FC=21, allows the user to send HP-IB commands on the HP-IB of the Terminal. A user should be proficient with HP-IB operations before using this call. A buffer IBUFR must be constructed by the user and may include any combination of HP-IB commands.

NOTE

This call may also be used in the Normal Mode of operation. It will usually be used to configure additional listeners which may have been connected to the Terminal.

3-23 TRANSPARENT WRITE REQUESTS COMPLETION

Upon completion of a Transparent Write request, the following information is available from EQT5 and from the A Register if the EQT is unbuffered.



REN indicates the status of the HP-IB REN line (Remote Enable).

REN = "1" if line is set.

Device address: Meaningful only at the end of a write serial poll. It indicates the address of the first polled device which has a service request pending. If none of the polled devices was requesting service, device address is set to 37B.

SECTION IV

ERROR HANDLING

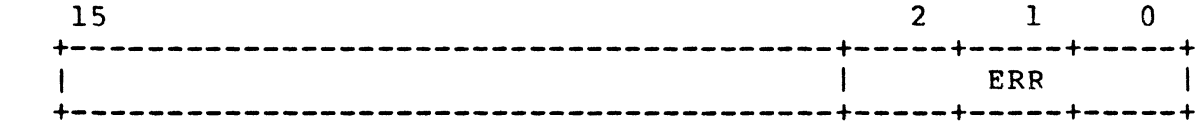
4-1 INFORMATION ON ERROR COMPLETION

In both Normal and Transparent modes the following information is returned to the user provided the requests are standard requests and are for unbuffered Terminals:

A Register = Status word (EQT5). (Refer to Paragraph 3-8 for details).

B Register = 100000B

When an error condition is detected the status word (EQT5) is updated as follows:



ERR = 1 Time Out occurred

ERR = 2 Hardware failure

- o Power OFF on Terminal
- o Terminal disconnected
- o Terminal physical address is mis-set or duplicate address
- o Failure on the Serial Link
- o Hardware failure on Terminal

This error is detectable only upon completion of a Clear request or a Send IFC request.

ERR = 3 Hardware failure on the controller.

ERR = 4 Bad system configuration.

ERR = 5 Illegal request.

The RTE system is notified of errors type 1, 2, 3, and 4 after completion in Normal mode, and for errors type 3 and 4 after completion in transparent mode.

ERROR HANDLING

The following messages are issued on the system console.

I/O ERR TO EQT# xx	(ERR = 1 For Normal mode only)
I/O ERR PE EQT# xx	(ERR = 2 For Normal mode only)
I/O ERR NR EQT# xx	(ERR = 3 or 4 For Normal and Transparent modes)

4-2 POWER FAIL HANDLING

Each controller EQT has its "I will handle power fail" bit (EQT4 bit 13) and busy bit (EQT5 bit 15) continuously set. Upon return from a system power fail, the driver entered through these controller EQT's will abort all executing requests and then restart all those for busy Terminal EQT entries.

SECTION V

CONFIGURATION INFORMATION

5-1 REAL TIME SYSTEM GENERATION

The driver is loaded into the RTE system at generation time and the following action must be taken by the operator to configure the HP 3070A/B Terminals into the system being generated.

5-2 PROGRAM INPUT PHASE

Driver DVA47 must be loaded during this phase.

5-3 TABLE GENERATION PHASE

Make the following entries:

a. EQUIPMENT TABLE

Make EQT entry for each HP 40280A controller, followed by an EQT entry for each HP 3070A/B Terminal attached to this controller Serial Link. The set of EQT entries, related to a particular controller, allow one to determine the number of Terminals that can be connected to the corresponding Link.

The first EQT of a set is allocated to a controller and the remainder are allocated to the terminals in ascending order, So that the second EQT from the set is allocated to the Terminal that has thew Link address 1, the third EQT to Link address 2, and so on. An example is shown below:

```
SC1,DVA47,T=t,X=3     Terminal Serial Link address m
    .
    .
    .
EQT#=z

SC2,DVA47,T=t,X=3     Controller EQT

EQT#=z+1

SC2,DVA47,T=t,X=3     Terminal Serial Link address 1
```

b. DEVICE REFERENCE TABLE

Make a DRT entry for each HP 40280A Serial Link Controller. For example:

```
xx = EQT # ?
y+n
...
xx = EQT#?
y+n+m-1
...
xx = EQT#?
z+c
```

Where xx is a Logical Unit number, and y+n, y+n+m-1, z+c are the corresponding EQT numbers. No Logical Unit number should be referred to a controller EQT entry.

c. INTERRUPT TABLE

Make an Interrupt Table entry for each HP 40280A Serial Link controller. For example:

```
scl, EQT, y

sc2, EQT, y
```

where y and z are the EQT numbers of the controller EQT's associated with each controller.

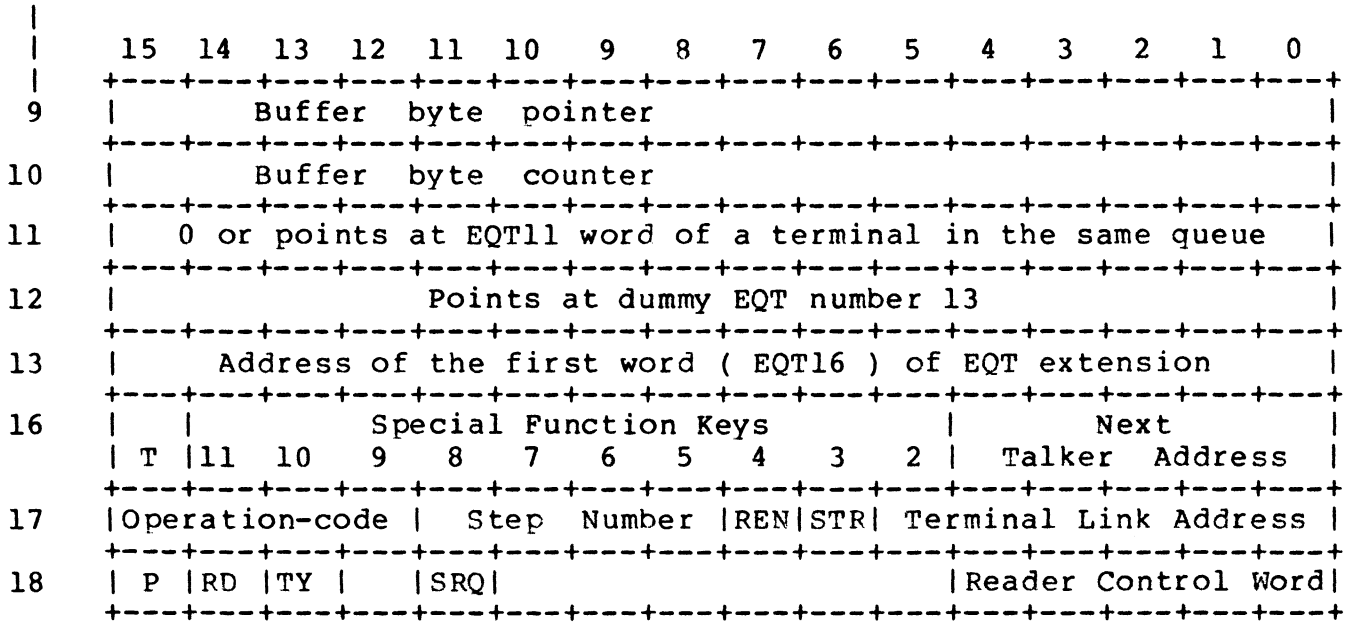
```
+---------+
| CAUTION |
+---------+
```

An RTE system allows a maximum of 64 EQT's and LU's.

APPENDIX A

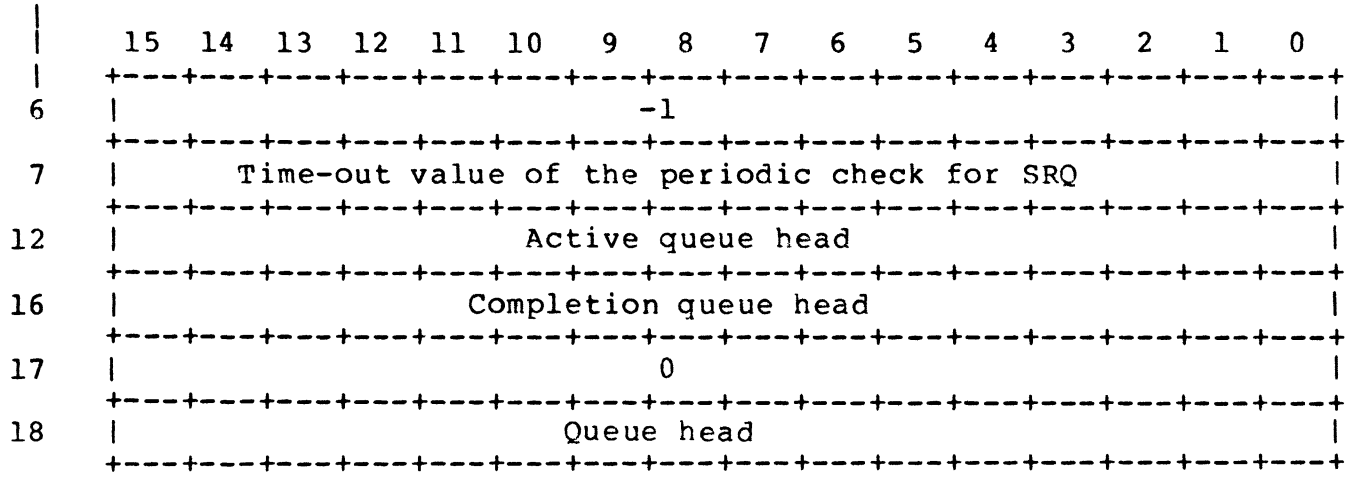
EQUIPMENT TABLE WORDS ASSIGNMENT

Word: for each Terminal.



T = Transparent mode
P = 0 if no Printer, 1 if there is a Printer.
RD = 0 if no Reader, 1 if there is a Multifunction Reader.
TY = 0 if the Terminal type is 3070A, 1 if it is a 3070B.

Word: for each Serial Link.



APPENDIX B

DATA BYTES TRANSMITTED TO THE PROMPTING LIGHTS

Light Number	ASCII Character	Turn On (Octal Code)	ASCII Character	Turn Off (Octal Code)
1	a	141	`	140
2	c	143	b	142
3	e	145	d	144
4	g	147	f	146
5	i	151	h	150
6	k	153	j	152
7	m	155	l	154
8	o	157	n	156
9	q	161	p	160
10	s	163	r	162
11	u	165	t	164
12	w	167	v	166
13	y	171	x	170
14		173	z	172
15		175		174

APPENDIX C

DATA BYTES TRANSMITTED FROM THE KEYBOARD

Key Cap Symbol	ASCII Character	Octal Code	
0	0	60	
1	1	61	
2	2	62	
3	3	63	
4	4	64	
5	5	65	
6	6	66	
7	7	67	
8	8	70	
9	9	71	
ENTER	Line Feed	12	
DEL	Delete	177	
f2	DLE	20	
f3	DC1	21	
f4	DC2	22	
f5	DC3	23	
f6	DC4	24	
f7	NAK	25	
f8	SYN	26	
f9	ETB	27	
f10	CAN	30	
f11	EM	31	(3070B only)

APPENDIX D

FUNCTION CODE SUMMARY

D-1 NORMAL READ FUNCTION CODES, MODES AND TERMINATORS

CONWD	Function	Mode	Terminator	Display on
0B+ILU	Keyboard Read	ASCII	LF,SFK,SRQ	no
100B+ILU	Keyboard Read	Binary	EOI,Buf.full,SFK	no
200B+ILU	Keyboard Read, buffered input	ASCII	LF,SFK,SRQ	no
300B+ILU	Keyboard Read, buffered input	Binary	EOI,Buf.full,SFK	no
400B+ILU	Keyboard Read	ASCII	LF,SFK,SRQ	yes
500B+ILU	Keyboard Read	Binary	EOI,Buf.full,SFK	yes
600B+ILU	Keyboard Read, buffered input	ASCII	LF,SFK,SRQ	yes
700B+ILU	Keyboard Read, buffered input	Binary	EOI,Buf.full,SFK	yes
1000B+ILU	Multifunction Reader Read	ASCII	LF,SFK code,SRQ	no
1100B+ILU	Multifunction Reader Read	Binary	EOI,Buf.full,SRQ	no

2N00B+ILU Write Display/Read Keyboard.
N even: ASCII write.
For Read, N processed as listed above (0,2,4,6)
N odd: Binary Write.
For Read, N processed as listed above (1,3,5,7)

3N00B+ILU Write Display/Read Multifunction Reader.
N even: ASCII Write, Read as for CONWD = 1000+ILU
N odd: Binary Write, Read as for CONWD = 1100+ILU

D-2 HP INTERFACE BUS NORMAL READ COMMANDS

Control Word	Traffic on HP=IB
0B+ILU	LSN36,TLK35,UNT
100B+ILU	LSN36,TLK35,UNT
200B+ILU	LSN36,TLK35,UNT,LSN35,MSAz,UNL
300B+ILU	LSN36,TLK35,UNT,LSN35,MSAz,UNL
400B+ILU	LSN35,LSN36,TLK35,UNT
500B+ILU	LSN35,LSN36,TLK35,UNT
600B+ILU	LSN35,LSN36,TLK35,UNT,LSN35,MSAz,UNL
700B+ILU	LSN35,LSN36,TLK35,UNT,LSN35,MSAz,UNL
1000B+ILU	UNT,LSN34,MSA-,LSN36,TLK34,UNT
1100B+ILU	UNT,LSN34,MSA-,LSN36,TLK34,UNT
2N00B+ILU	UNT,LSN35, See 0 through 700
3N00B+ILU	UNT,LSN35, See 0 through 700

Any Normal Read completes by an extra polling cycle to look at the SRQ bit.

D-3 TRANSPARENT READ FUNCTION CODES, MODES AND TERMINATORS

CONWD even ---> ASCII completes on LF,ATN,Buf.full,SFK,SRQ

CONWD odd ---> Binary completes on EOI,ATN,Buf.full,SFK

D-4 NORMAL WRITE CONTROL WORDS, MODES AND TERMINATORS

CONWD	Function	Mode	Terminator	Display on
0B+ILU	Display write	ASCII	LF	yes
100B+ILU	Display write	Binary	EOI	yes
200B+ILU	Display write, buffered input	ASCII	LF	yes
300B+ILU	Display write, buffered input.	Binary	EOI	yes
1000B+ILU	Printer write	ASCII	LF	no
1100B+ILU	Printer write	Binary	EOI	no
1200B+ILU	Printer write, buffered input	ASCII	LF	no
1300B+ILU	Printer write, buffered input	Binary	EOI	no

D-5 HP INTERFACE BUS NORMAL WRITE COMMANDS

Control Word	Traffic on HP=IB
0B+ILU	LSN35,UNT
100B+ILU	LSN35,UNT
200B+ILU	LSN35,UNT,LSN35,MSAz,UNL
300B+ILU	LSN35,UNT,LSN35,MSAz,UNL
1000B+ILU	UNT,LSN33
1000B+ILU	UNT,LSN33
1200B+ILU	UNT,LSN33,LSN35,MSAz,UNL
1300B+ILU	UNT,LSN33,LSN35,MSAz,UNL

Any normal write completes by an extra polling cycle to look at SRQ bit.

D-6 TRANSPARENT WRITE FUNCTION CODES, MODES AND TERMINATORS

CONWD even ---> ASCII completes by sending line-feed.

CONWD odd ---> Binary completes by setting EOI true with last byte.

D-7 SPECIAL WRITE (NORMAL OR TRANSPARENT)

CONWD	Function	Terminator	Traffic on HP-IB
2000B+ILU	Serial Poll	First SRQ, last byte	UNL,UNT,LSN36,SPE,TLKx,..,UNT,SPD
2100B+ILU	Write commands	Last byte	HP-IB commands user defined

READER COMMENT SHEET

SERIAL LINK DRIVER DVA47
PROGRAMMING AND OPERATING MANUAL

92900-90005 **APRIL 1978**

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