Serial Link Driver DVA47

Programming and Operating Manual

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PRINTING HISTORY

New editions are complete revisions of the manual. Update packages contain replacement pages or write-in instructions to be merged into the manual by the customer. Manuals will be reprinted as necessary to incorporate all prior updates. A reprinted manual is identical in content (but not in appearance) to the previous edition with all updates incorporated. No information is incorporated into a reprinting unless it appears as a prior update. The edition does not change.

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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 used with a FORTRAN, ALGOL, or ASSEMBLY language call to control, via the HP 3070A or HP 3070B Serial Link:

- 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 DVA47 can 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 with an RTE Operating System and one or more HP 92900A/B Terminal Subsystems. For hardware details refer to the 92900A/B Operating and Service Manual, to the 3070A/B Operating and Service Manual, 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(I/O card), 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 a serial-bit protocol. HP 3070A and HP 3070B Terminals can 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 also has a thermal Printer and a multifunction card/badge 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 use 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. For this purpose you need a list of the LU numbers for the terminals on the Link.

EXEC calls to terminals on the Serial Link follow the form described in your RTE Programmer's Reference Manual. For example:

Control Request calling sequence in FORTRAN:

```
CALL EXEC(ICODE,ICNWD,IPRAM)
```

where:
- ICODE = Request Code = 3 for any Control Request
- ICNWD = Control Word = FC00B+ILU for any Request
- IPRAM = Optional Parameter of the Control Request
- FC00B = Function Code with "00B" appended
- ILU = Logical Unit Number of the addressed Terminal

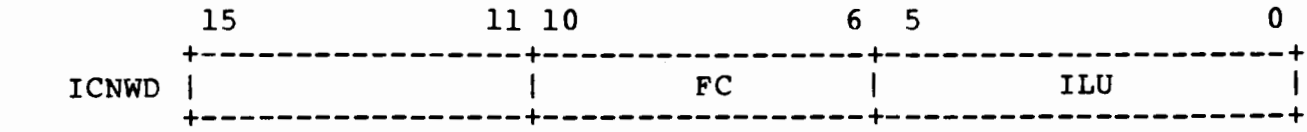
Function Code FC is the number given in Sections II and III for the particular Control Request you want to make. For example, when ICODE=3 Function Code 6 is the Set Reader Configuration Control Request. For FC=6, FC00B=600B. The suffix "B" signifies the number is expressed in octal form. All Function Codes in this manual are given in the form of significant octal digits, usually without showing the "00B" appended.

Logical Unit Number ILU is the LU number of the addressed terminal. Each name in the EXEC call is shown starting with the letter "I" to affirm that all parameters are integer. The "+" sign in "FC00B+ILU" adds the LU number to "FC00B". When your program assigns the LU number to the variable ILU, the LU number can be written in either decimal or octal form. For example if FC=6 and ILU=8, equivalent to ILU=10B, then ICNWD=600B+ILU, and ICNWD=610B.

The definition of ICNWD given on the previous page is not intended to imply that any particular procedure must be used to arrive at the desired number. Depending on the source of the constants in a program that you may write, you can use any method of assembling the word, as long as the correct binary number is stored in ICNWD.

The name "ICNWD" is used in the RTE manuals, in this manual, and in application programs for ready identification. The Control Word can be any name, however; the name "ICNWD" has no particular significance.

What is significant is that RTE treats the second parameter in the EXEC call as the Control Word, and expects it to have the following format:



The numbers above represent the bit weights, 0 through 15, in the 16-bit integer data word.

The EXEC call example on the previous page shows the form of the Control Request; the forms of the Read Request and Write Request are given in Sections II and III. Request Code ICODE distinguishes one type of request from the other; for a Read Request, ICODE=1; for a Write Request, ICODE=2.

The meaning of Function Code FC depends upon which value is specified for ICODE, and also, to a lesser extent, upon whether the Terminal is in Normal Mode or in Transparent Mode.

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, with Keyboard, Display, Printer, and Reader, is then considered as a set of HP-IB devices. In this mode, you include device addresses in EXEC parameters, as well as the LU number of the Terminal in Control Word ICNWD.

HP 3070A NOTE

Operation of the HP 3070A differs in some respects from that of the HP 3070B. In the text that follows, you will see notes under the above heading that call attention to programming procedures that are different for the HP 3070A

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.

2-2 NORMAL MODE SELECT (FC=14)

The Control Request, Function Code 14, sets the driver, with respect to the addressed Terminal, to the Normal Mode of operation. The driver remains in this mode until set to Transparent. 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.

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 aborts the Write call and all Control Requests except FC=6, FC=22, and the Mode Select Control Request. Bit 15 of the B Register is set, and both the 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 are reset to Not Enabled as Input Terminator. The Clear Terminal request does not modify the mode of operation. The Terminal hardware status in EQT5 is left unchanged, the Printer is set idle, and the Reader is reset to its default configuration.

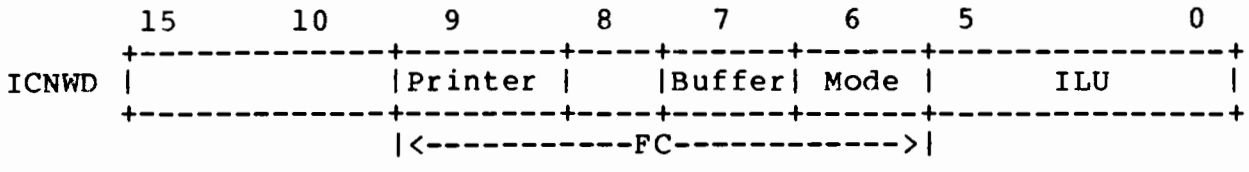
The Service Request status is not reset by this call, but instead by the Reset Service Request Status call (FC=11).

2-19 NORMAL WRITE REQUESTS.

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

```
CALL EXEC(ICODE,ICNWD,IBUFR,IBUFL)

     ICODE = Request Code = 2 for a Write Request
     ICNWD = Control Word = FC00B+ILU
     IBUFR = Buffer contents
     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:   FC=2
Binary Write:  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.

```
+---------------+
| 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 can 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, which will display only numeric data.

2-25 PRINTER BINARY WRITE (FC=11)

Binary write to the Printer of the specified number of characters. Automatic print takes place if data consists of 20 characters or a multiple of 20 characters. Otherwise, printing will be executed upon the receipt of a line-feed, which is NOT issued by the driver. This line-feed should be the last data character.

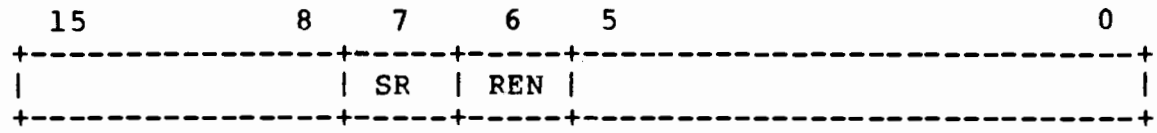
2-26 PRINTER WRITE WITH SUBSEQUENT LOCAL INPUT (FC=12/13)

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 REQUESTS COMPLETION STATUS

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:



SR (Service Request) indicates if a Service Request Key has been pressed during the Write operation. REN (Remote Enable) indicates the status of the REN line of the HP-IB. REN is "1" for REN line set.

SECTION III
TRANSPARENT MODE

3-1 INTRODUCTION

The HP 3070B Terminal is an HP-IB device, composed of four modules. Three of these modules, the Display, Printer, and Reader, are addressable HP-IB devices.

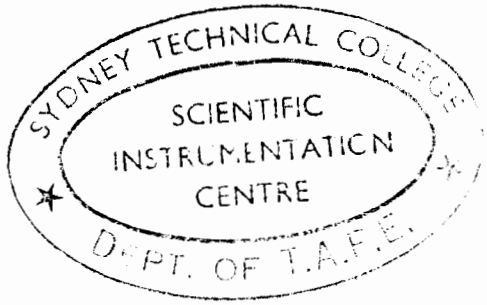
The Terminal also has a Communication Interface module, which acts as HP-IB controller under remote control of the HP 1000 System through the Serial Link I/O card. While data on the Serial Link follows a serial-bit protocol, that on the HP-IB is serial-byte.

When the Communication Interface 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 Interface module is always able to take control, 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 Control Request, FC=15.

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

When you are using the Driver in Transparent Mode, you should be aware that the requests you issue to the Driver do not generate any HP-IB commands to the Bus that you have 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 SRQ Periodically (FC=5)



where the HP-IB address of the Keyboard is defaulted to 35B.

3-2 TRANSPARENT MODE SELECT (FC=13)

The Control Request, Function Code 13, sets the Driver to the 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. The Driver remains in this mode of operation until set to Normal. This Control Request has no effect on other Terminals.

NOTE

> In this mode, the EQT is set down only for a malfunction; therefore, a Not Ready or Time Out message is never displayed on the system console. In your programs, check the EQT5 status of any Terminal running in this mode, and take appropriate action.

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

The Control Request, Function Code 22, allows you to modify the Time-Out value of the Terminal. This Control Request, and its description, are the same as that given for Normal Mode in Section II.

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 aborts the Write call and all Control Requests except FC=6, FC=22, and the Mode Select Control Request. Bit 15 of the B Register is set, and both the 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 Clear Terminal request does not modify the mode of operation. The Terminal hardware status in EQT5 is left unchanged, the Printer is set idle, and the Reader is reset to its default configuration. To this point, the Clear Terminal request is the same for Transparent Mode as for Normal Mode.

The Service Request is not reset by this call but instead, in Transparent Mode, by a Get Status Byte (FC=11) or serial poll request.

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: IFC, Not IFC, DCL.

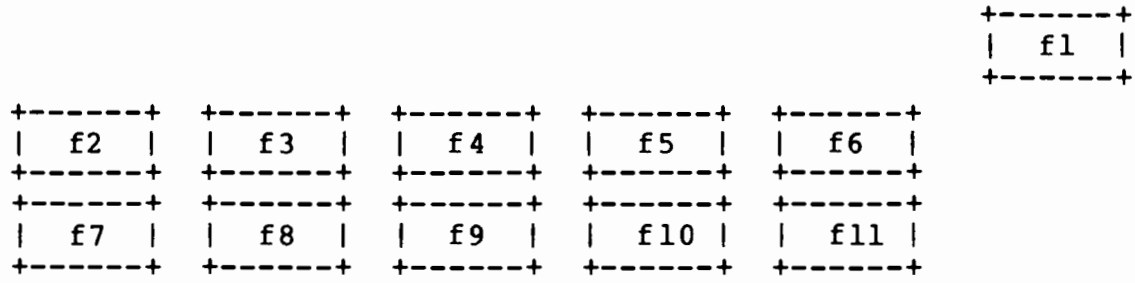
3-5 HP-IB INTERFACE CLEAR COMMAND (FC=15)

The Control Request, Function Code 15, only pulses the IFC line on the HP-IB, clearing the device interfaces.

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

The Control Request, Function Code 12, allows the user program to enable or disable dynamically one or several Special Function Keys including the Service Request Key, as input terminators. The function is the same in Transparent Mode as in Normal Mode, except for "bus traffic generated." The description is repeated here for your convenience.

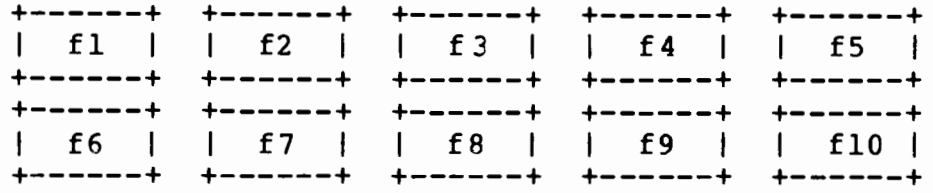
The optional parameter of the Control Request call contains the number of the Special Function Key (SFK) to be enabled or disabled as input terminator. A key is enabled by a positive number from 1 to 11 and disabled by a negative number from -1 to -11. Any SFK enabled as input terminator is automatically reset to the non-enable condition by a Clear Terminal request. Appendix C gives a list of the Key codes. Each 3070B SFK has a number from 1 (Service Request Key) to 11 as shown below:



Bus traffic generated: LSN35,MSAx with x between octal 0 and 11 to disable or 20 and 31 to enable keys f2 through f11.

HP 3070A NOTE

For a 3070A there is no bus traffic generated, since keys are enabled at driver level only. 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=7/10/5)

SRQ Line Status in Transparent Mode is similar to Service Request Recognition in Normal Mode, except that there is no automatic SRQ after Transparent Mode read and write requests. The following descriptions are therefore similar to those for Normal Mode.

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. The optional parameter of the Control Request sets the time period in multiples of 10 milliseconds.

The parameter value should be between 31 and 32767. A value of 31 corresponds to 310ms, 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 value is not specified, or 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 which have not completed them, are periodically checked against the new wait parameter 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 program to free the call completion.

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 two calls reset the SRQ line.

3-8 GET STATUS BYTE (FC=11)

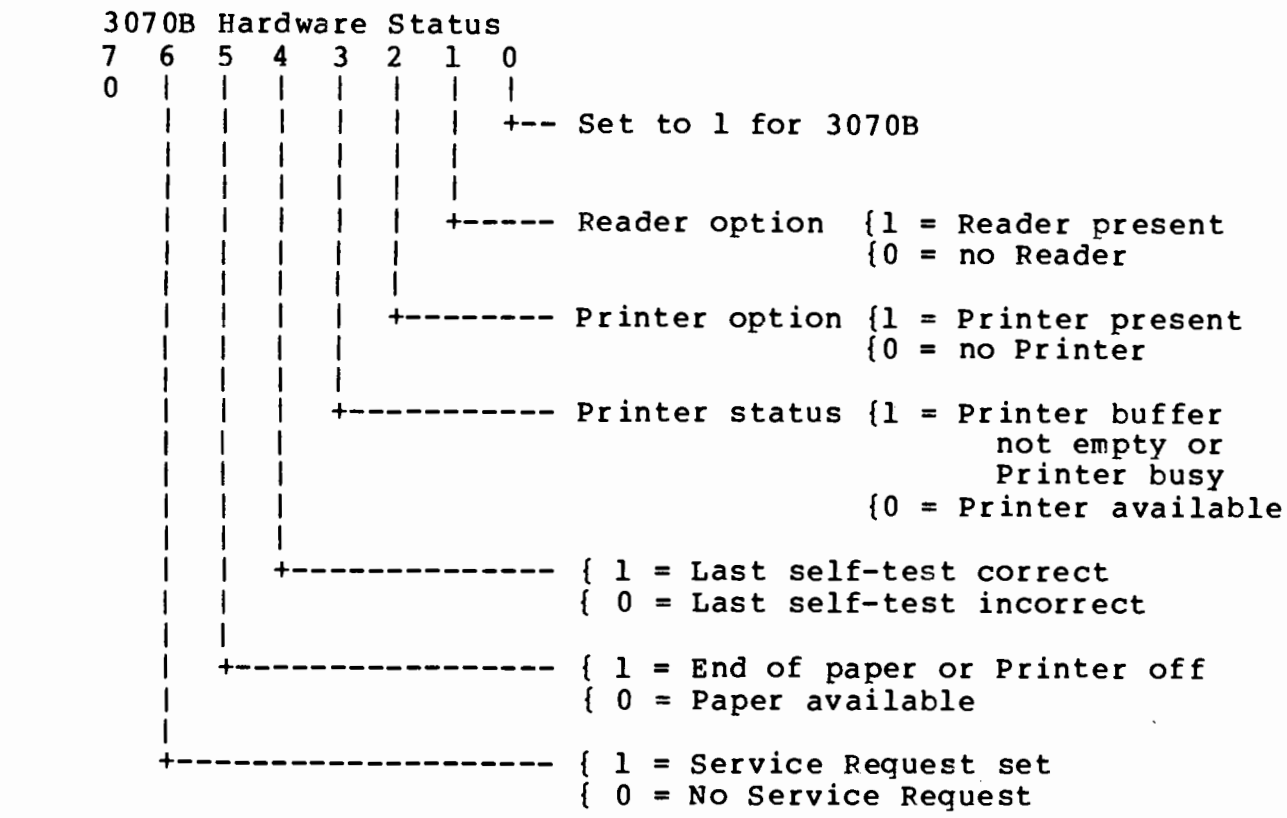
The Control Request, Function Code 11, resets the SRQ line, enabling other HP-IB devices to set it. The optional parameter of the Control Request is the HP-IB address of the station to be polled. If the address is not specified, or set to "0", the default assumed address is 35B.

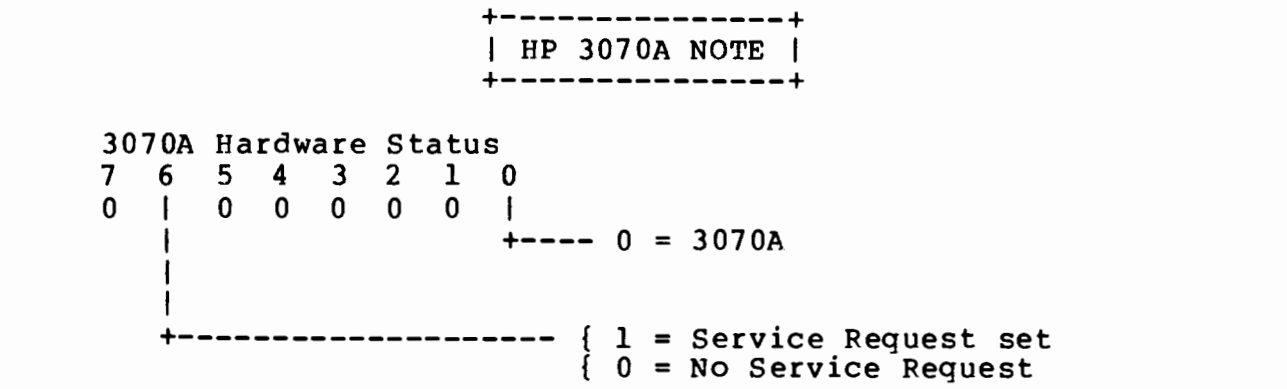
The Transparent Mode Get Status Byte request is similar to the Normal Mode Reset Service Request Status request, except that in Normal Mode the Service Request Key is the only originator of a Service Request, whereas in Transparent Mode any device on the HP-IB can originate SRQ.

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 (address=35B or defaulted), is shown on the next page. This diagram is identical to that shown for Normal Mode under "Control Request Completion Status."

TRANSPARENT MODE





Bus traffic generated:

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. This request is used principally in Transparent Mode.

3-10 REMOTE ENABLE (FC=2)

The Control Request, Function Code 2, sets Remote Enable 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 Terminal Control Request is made. This request is used principally in Transparent Mode.

3-11 REMOTE DISABLE (FC=3)

The Control Request, Function Code 3, resets Remote Enable line REN. All HP-IB devices connected to the Terminal revert to local control. This request is used principally in Transparent Mode.

3-12 SET READER CONFIGURATION (FC=6)

This Control Request, Function Code 6, is required to give the Reader reading mode to the Driver. These specifications and the example that follows are identical to the Set Reader Configuration details given in Section II. 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 configuration:

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

	X	Y	
		4	...Marks only, 40 column, no clock
Hollerith, local-reject....	3		
Hollerith, no reject.....	1		
		2	...Holes only, 80 column, 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

Bus traffic generated: None.

3-13 SET READER CONFIGURATION EXAMPLE

To set up the Reader to read a marked card with clock after data, local card reject, and Hollerith 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 Hollerith 80-column holes only, local reject, no clock mark (IPRAM=32B).

3-14 CONTROL REQUEST COMPLETION STATUS

As in Normal Mode, 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 put the addressed terminal status into bits 0 through 7 of EQT5.

3-15 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.

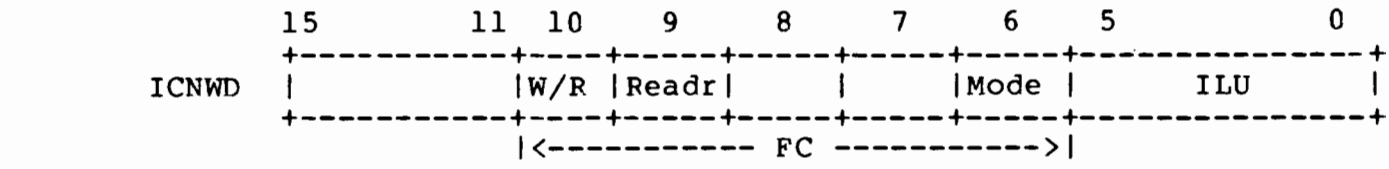
```
+----------+
| CAUTION |
+----------+
```

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(ICODE,ICNWD,IBUFR,IBUFL)
```

where: ICODE = Request Code = 1 for a Read Request
ICNWD = Control Word = FC00B+ILU
IBUFR = Buffer contents
IBUFL = Buffer length



Mode = 0 ASCII read
= 1 Binary read

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

Reader = 0 Read from current talker.
1 The current talker must be the Reader, configured by a previous Set Reader Configuration Control Request. Care must be taken when using this call, because the Driver will interpret the data as coming from the Reader, whatever the current talker may be. This call is particularly useful to get formatted data when using the Reader in Image mode, as described for Normal Reader Read in Section II.

3-16 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 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.

3-17 BINARY READ FROM THE CURRENT TALKER (FC=1)

The valid read terminators are:

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

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.

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

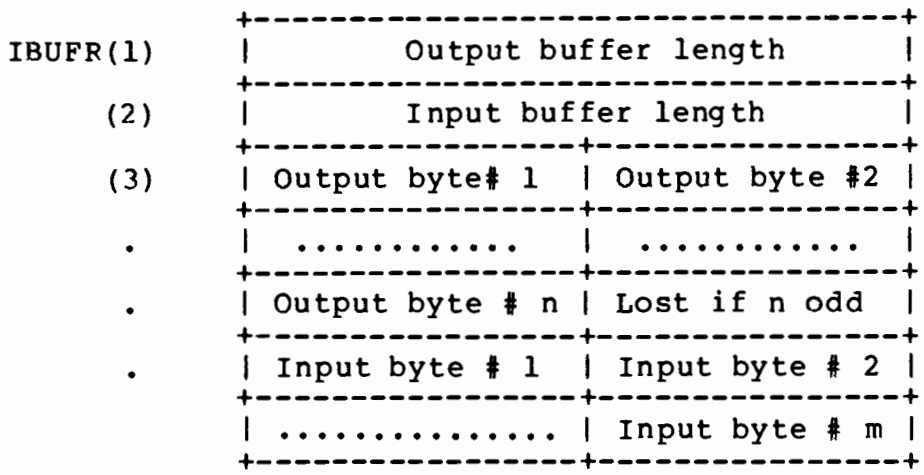
Neither a 3070A SFK, enabled as input terminator, nor the Enter Key complete the Read.

3-18 WRITE/READ (FC=20/21/30/31)

ASCII Write/Read: FC=20 or 30
Binary Write/Read: FC=21 or 31

This is a special Write/Read call 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 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.

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 and + 1 byte 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 IBUFR(2) is equal to zero, the call will only output the bytes contained in the output buffer and complete.

The output buffer is not destroyed by this call and can be 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,IPRM1,IPRM2,ICLAS)
CALL EXEC(20,3N00B+ILU,IBUFR,IBUFL,IPRM1,IPRM2,ICLAS)
```

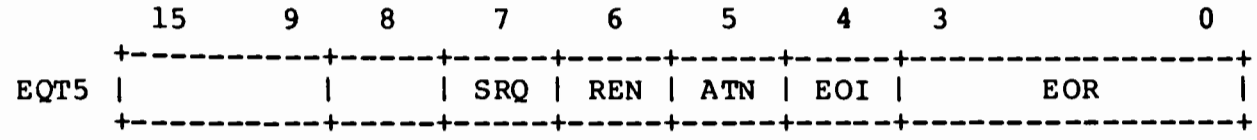
Example of use: Program the Multifunction Reader to read a 22-column punched badge in Hollerith with reject enabled:

```
DIMENSION IBUFR(16)                    IBUFL=-31
IBUFR(1)=-5
IBUFR(2)=-22
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

When the EQT is unbuffered, upon completion of a Transparent Read or Write/Read request, the B-Register contains the transmission log, while EQT5 and the A-Register contain:



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. EOR=1 can also mean a time-out. Check bit 7 of the A-Register to find out which terminator caused the completion.

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).

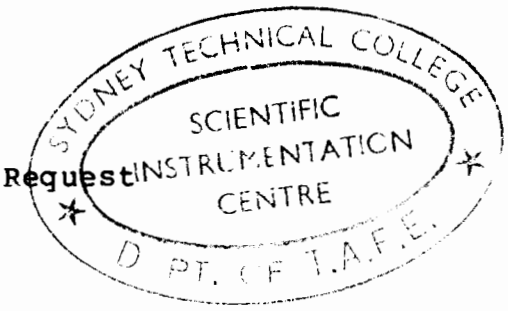
EOI indicates the state of the HP-IB EOI line (End or Identity). EOI = "1" if EOI is set.

NOTE

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

3-20 TRANSPARENT WRITE REQUESTS

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



Calling sequence:

```
CALL EXEC(ICODE,ICNWD,IBUFR,IBUFL)
```

where: ICODE = Request Code = 2 for a Write Request
ICNWD = Control Word = FC00B+ILU
IBUFR = Buffer contents
IBUFL = Buffer length

	15	11	10	9	8	7	6	5	0
ICNWD			Special Write	0	0	0	Mode	ILU	
			<---------- FC ---------->						

Special Write Bit = 0, data transfer: Mode = 0 ASCII transfer
= 1 Binary transfer

Special Write Bit = 1, Special Write: Mode = 0 Serial Poll Request
= 1 Write Command Byte

3-21 ASCII WRITE TO CURRENT CONFIGURED LISTENERS (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.

3-22 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.

3-23 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, useful only when devices are attached to the Terminal, allows you to identify the device that set 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:

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.

3-24 HP-IB COMMAND BYTE WRITE (FC=21)

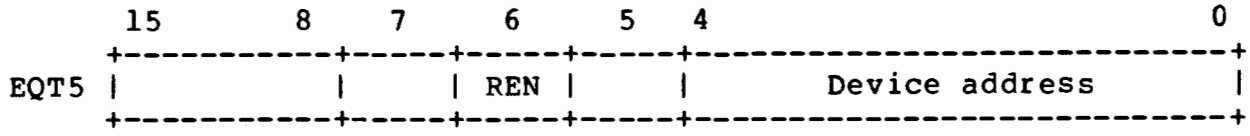
This special write request, Function Code FC=21, allows the user to send HP-IB commands on the HP-IB of the Terminal. A user should be proficient with HP-IB operations before using this call. A buffer IBUFR must be constructed by the user and may include any combination of HP-IB commands.

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.

3-25 TRANSPARENT WRITE REQUESTS COMPLETION STATUS

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

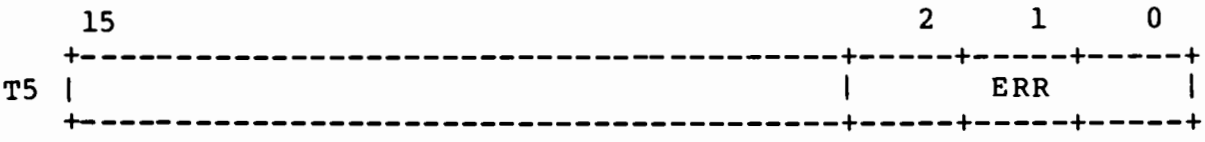
4-1 INFORMATION ON ERROR COMPLETION

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)

B Register = 100000B

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



ERR = 2 Hardware failure

- Power OFF on Terminal
- Terminal disconnected
- Terminal physical address is mis-set or duplicate address
- Failure on the Serial Link
- 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 following messages are issued on the system console.

I/O ERR TO EQT# xx	(only if Normal mode)
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. The size of DVA47 is on the order of 3500 words (octal). Unless you are loading a larger driver, load DVA47 first. In RTE-IV, load DVA47 in the System Drive Area in the manner as described in paragraph 5-3A below.

5-3 TABLE GENERATION PHASE

Make the following table entries:

a. EQUIPMENT TABLE

Make an EQT entry for each HP 40280A controller, followed by an EQT entry for each HP 3070A/B Terminal attached to the controller Serial Link. The set of EQT entries related to each particular controller allows you 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 the Link address 1, the third EQT to Link address 2, and so on. An example is shown on the next page.

```
EQT#y?
SC1,DVA47,X=3,S        Controller EQT
     .
     .
EQT#=y+n
SC1,DVA47,T=t,X=3,S    Terminal Serial Link address 1
EQT#=y+n+m-1
SC1,DVA47,T=t,X=3,S    Terminal Serial Link address m
     .
     .
EQT#=z
SC2,DVA47,X=3,S        Controller EQT
EQT#=z+1
SC2,DVA47,T=t,X=3,S    Terminal Serial Link address 1
```

where n = the number of EQT entries between the link controller and the first terminal specified in the equipment table. n may be greater than or equal to 1, meaning that the terminal's EQTs need not be contiguous with the EQT of the controller. The terminal associated with any single controller must be contiguous within the EQT.

SCn = HP 40280 Select Code,

X = length of EQT extensions,

S = system Driver Area: does not apply for RTE-M, RTE-II, RTE-III,

T = Time-Out value in tens of milliseconds.

D. CALCULATIONS

If m=3:

```
EQT=10                    controller     y=10
  .
  .                       n=5
  .
EQT=15                    Terminal Serial Link Address  m=1
EQT=16                    Terminal Serial Link Address  m=2
EQT=17                    Terminal Serial Link Address  m=3


y+n+m-1=EQT#              10+5+3-1=17
```

c. EXAMPLE OF AN EQUIPMENT TABLE

```
EQT 10?
11,DVA47,S,X=3,T=12000          * EQT 10 - 1ST LINK CONT. LINK EQT

EQT 11?
11,DVA47,S,X=3,T=12000          * EQT 11 - 1ST LINK CONT. 1ST 3070

EQT 12?
11,DVA47,S,X=3,T=12000          * EQT 12 - 1ST LINK CONT. 2ND 3070


EQT 13?
11,DVA47,S,X=3,T=12000          * EQT 13 - 1ST LINK CONT. 3RD 3070
```

d. DEVICE REFERENCE TABLE

Make a DRT entry for each 3070 Terminal example:

```
xx=EQT#?                        Controller EQT y
y+n                             Terminal Serial Link address 1
...
xy=EQT#?                        Controller EQT y
y+n+m-1                         Terminal Serial Link address m
...
xz=EQT#?                        Controller EQT Z
z+1                             Terminal Serial Link address 1
```

where xx, xy, and xz are different Logical Unit numbers, and y+n, y+n+m-1, z+1 are the corresponding EQT numbers. No Logical Unit number should be referred to a controller EQT entry.

e. EXAMPLE OF A DEVICE REFERENCE TABLE

```
028 = EQT #?                    * LU 28 - 1ST LINK 1ST 3070
11

029 = EQT #?                    * LU 29 - 1ST LINK 2ND 3070
12

030 = EQT #?                    * LU 30 - 1ST LINK 3RD 3070
13

031 = EQT #?                    * LU 31 - 1ST LINK 4TH 3070
14

032 = EQT #?                    * LU 32 - 1ST LINK 5TH 3070
15

033 = EQT #?                    * LU 33 - 1ST LINK 6TH 3070
16

034 = EQT #?                    * LU 34 - 1ST LINK 7TH 3070
17
```

f. INTERRUPT TABLE

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

```
SC1,EQT,y

SC2,EQT,z
```

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

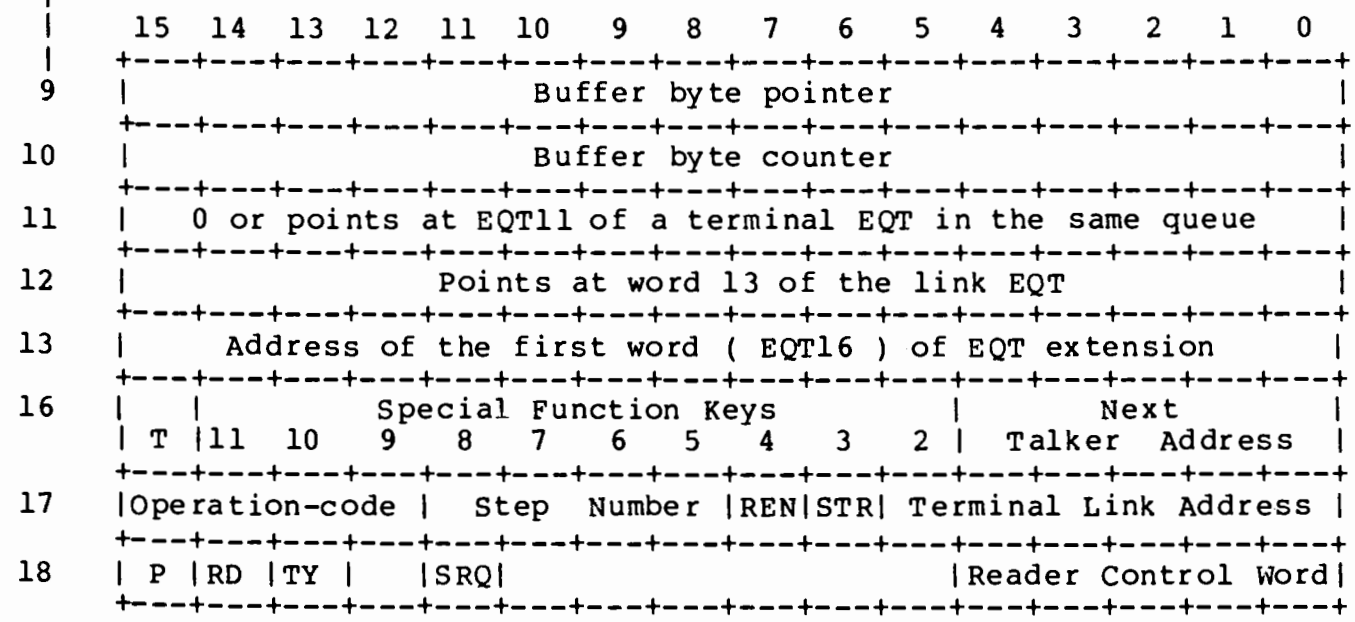
```
+---------+
| CAUTION |
+---------+
```

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

APPENDIX A

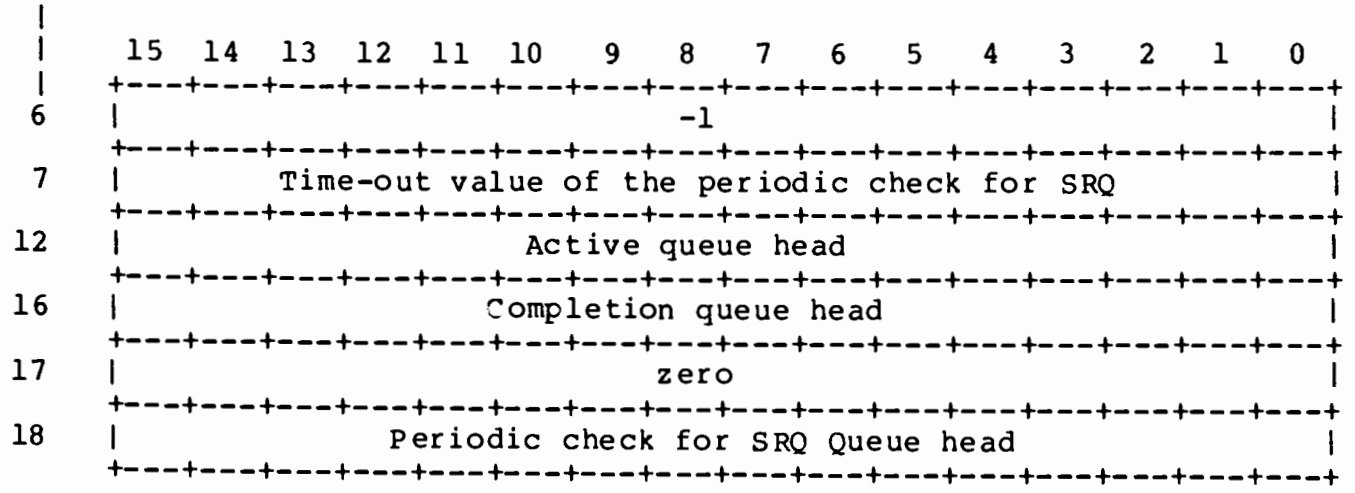
EQUIPMENT TABLE WORDS ASSIGNMENT

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.
SRQ = 0 if SRQ is not enabled as Read terminator, 1 if enabled as Read terminator.

Word: for each Serial Link.



APPENDIX B

DATA BYTES TRANSMITTED TO THE PROMPTING LIGHTS

Light Number	Turn On		Turn Off	
	Character	Octal Code	Character	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
All Off			~	176

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 (3070B only)	31

APPENDIX D

FUNCTION CODE SUMMARY

D-1 NORMAL READ FUNCTION CODES, MODES AND TERMINATORS

ICNWD	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/Read. N odd: Binary Write/Read.			
3N00B+ILU	Write Display/Read Multifunction Reader. N even: ASCII Write/Read. N odd: Binary Write/Read.			

D-2 HP INTERFACE BUS NORMAL READ COMMANDS

ICNWD	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 0B through 700B
3N00B+ILU	UNT,LSN35, See 0B through 700B

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

D-3 TRANSPARENT READ FUNCTION CODES, MODES AND TERMINATORS

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

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

Traffic on HP-IB: HP-IB Command, User defined.

D-4 NORMAL WRITE CONTROL WORDS, MODES AND TERMINATORS

ICNWD	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

ICNWD	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

Normal Write completes by an extra polling cycle to look at SRQ bit.

D-6 TRANSPARENT WRITE FUNCTION CODES, MODES AND TERMINATORS

ICNWD even ---> ASCII completes by sending line-feed.
ICNWD odd ---> Binary completes by setting EOI true with last byte.
Traffic on HP-IB: HP-IB Commands, User defined.

D-7 SPECIAL WRITE (NORMAL OR TRANSPARENT)

ICNWD	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

A

B

C

D

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

W

READER COMMENT SHEET

SERIAL LINK DRIVER DVA47
Programming and Operating Manual

92900-90005 **February 1980**

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