



RTE Driver DVS23 for HP 7974A Magnetic Tape Subsystem

Installation and Programming Manual

**Data Systems Division
11000 Wolfe Road
Cupertino, CA 95014-9974**

**Manual Part No. 92084-90040
E0186**

Printed in U.S.A. January, 1986

HP Computer Museum
www.hpmuseum.net

For research and education purposes only.

NOTICE

The information contained in this document is subject to change without notice.

HEWLETT-PACKARD MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this material.

Hewlett-Packard assumes no responsibility for the use or reliability of its software on equipment that is not furnished by Hewlett-Packard.

This document contains proprietary information which is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced or translated to another language without the prior written consent of Hewlett-Packard Company.

READER COMMENT SHEET

HP 1000 Computers

RTE Driver DVS23 for HP 7974A Magnetic Tape Subsystem
Installation and Programming Manual

92084-90040 January, 1986

We welcome your evaluation of this manual. Your comments and suggestions help us to improve our publications. Please explain your answers under comments, below, and use additional pages if necessary.

Is this manual technically accurate?

☐ YES ☐ NO

Are the concepts and wording easy to understand?

☐ YES ☐ NO

Is the format of this manual convenient in size, arrangement, and readability?

☐ YES ☐ NO

Comments:

This form requires no postage stamp if mailed in the U.S. For locations outside the U.S., your local HP representative will ensure that your comments are forwarded.

FROM:

Date _____

Name _____

Company _____

Address _____

FOLD

FOLD



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 0141 CUPERTINO, CA

POSTAGE WILL BE PAID BY ADDRESSEE

Publications Manager
Hewlett-Packard Company
Data Systems Division
11000 Wolfe Road
Cupertino, CA 95014-9974



FOLD

FOLD

Printing History

The Printing History below identifies the edition of this manual and any updates that are included. Periodically, update packages are distributed which contain replacement pages to be merged into the manual, including an updated copy of this printing history page. Also, the update may contain write-in instructions.

Each reprinting of this manual will incorporate all past updates; however, no new information will be added. Thus, the reprinted copy will be identical in content to prior printings of the same edition with its user-inserted update information. New editions of this manual will contain new information, as well as all updates.

To determine what manual edition and update is compatible with your current software revision code, refer to the appropriate Software Numbering Catalog, Software Product Catalog, or Diagnostic Configurator Manual.

First Edition January 1986



1

2



3

4



Table of Contents

Chapter 1 **General Information**

Introduction	1-1
Description	1-1
Operating Environment	1-1

Chapter 2 **Hardware Installation**

Introduction	2-1
HP-IB Interface Card, P/N 12821-60003	2-1
Absolute Loader ROM	2-2
Supplemental Loader ROMs	2-2

Chapter 3 **RTE Integration**

Introduction	3-1
System Generation	3-1
Table Generation	3-1
Program Loading	3-3
System Verification	3-3

Chapter 4 **Application Information**

Introduction	4-1
Overview of Operation	4-1
EXEC Call Structures	4-2
Read Data Call	4-2
Write Data Call	4-2
Control Call	4-3
Status Request Call	4-3
Read Extended Status	4-4
Special Forwardspace One Record Call	4-5

Appendix A	
Extended Status Word.	A-1

Appendix B	
Error Detail Code Definitions.	B-1

General Information



Introduction

This manual contains information that will allow you to install the HP 7974A Magnetic Tape Unit Interface Subsystem and prepare applications programs using standard Read, Write, and Control RTE EXEC calls.* Chapter 1 of the manual provides a general description of the product. Chapter 2 includes installation information and Chapter 3 contains operating system integration guidelines. The manual concludes with Chapter 4 which provides application program information.

Description

RTE driver DVS23 is entered through standard RTE EXEC calls to control the tape motion and data transfer of a 7974A Magnetic Tape Unit. The standard 7974A tape unit operates at a density of 1600 BPI (PE format). The 7974A unit with option 800 operates at a density of 800 BPI (NRZI format) in addition to 1600 BPI. An interface bus (HP-IB) card and cable are required to interface the magnetic tape unit to the computer. A loader ROM set is also available which allows the 7974A to be used as a boot device.

Operating Environment

The operating environment for RTE Driver DVS23 consists of an HP 1000 E/F-series computer (with the RTE-6/VM Operating System) and an HP-IB interface card (part no. 12821-60003) installed. One computer I/O slot is required. This operating environment is shown in Figure 1-1. See the restriction information in the Overview of Operation section of Chapter 4, when an HP 7974A and an HP 7906H are used in the same RTE Operating System.

* These calls are backward compatible with HP 7970 Magnetic Tape Unit calls.

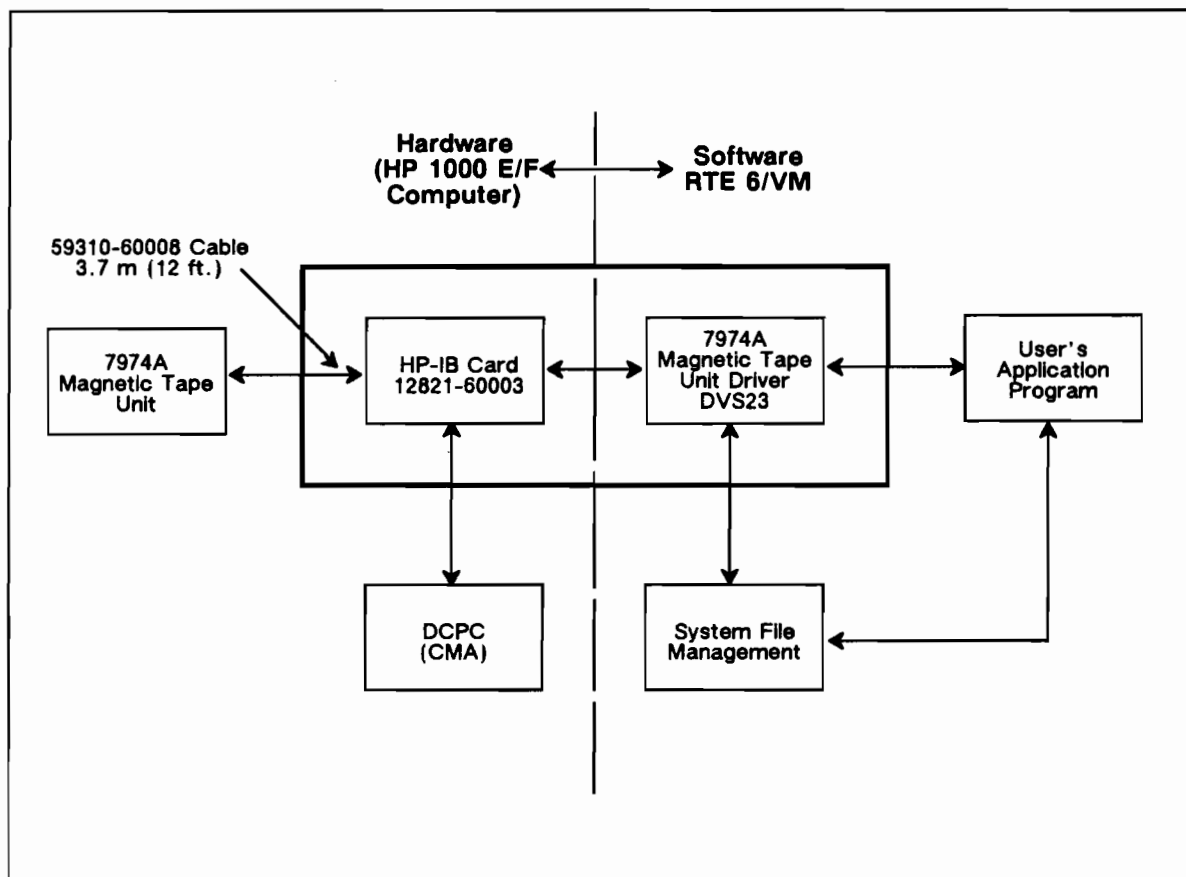


Figure 1-1. Typical Operating Environment

Hardware Installation

Introduction

This section provides instructions for installing the HP-IB card, absolute loader ROM, and supplemental loader ROMs.

HP-IB Interface Card, P/N 12821-60003

- a. Enable the System Controller function by setting U13-S8 (i.e., DIP switch position 8 at location U13) to "open". Set U13-S1 through S7 to "closed".
- b. Allow DCPC pacing by placing jumper W1 (above location U94) in the "A" position.
- c. Turn off power to the computer and magnetic tape unit.
- d. Insert the 12821-60003 HP-IB card in the computer I/O slot corresponding to the desired select code.
- e. Interconnect the HP-IB card edge connector and the HP 7974A Magnetic Tape Unit connector (HP-IB) on the rear panel with the 59310-60008 cable.
- f. Turn on power to the computer and magnetic tape unit.
- g. Refer to the operating section of the appropriate operating manual for the magnetic tape unit.

NOTE

Up to four HP 7974A Tape Units may be connected (i.e., chained) to a single HP-IB card. Each one must have a unique unit address which corresponds to a RTE system subchannel. The number of units is limited to four as a result of bus loading. A maximum cable length of 20 m (65.6 ft) is permissible per IEEE-488 specification.

Absolute Loader ROM

If the 7974A is used as a boot device, install absolute loader ROM (part no. 12992-80011) in any one of the four available ROM sockets on the main CPU board. See the HP 12992 Installation Manual (part no. 12992-90001) for detailed installation steps.

Supplemental Loader ROMs

Three 4K supplemental loader ROMs are required in addition to the absolute loader ROM. (This set of four loader ROMs is available as product number 12992L.) Install these ROMs on the 12791A Firmware Expansion Module (FEM) board by referring to HP 1000 M/E/F-Series Firmware Installation and Reference Manual (part no. 12781-90001) and the following steps.

- a. Install ROM #1 (part no. 91740-80070) in socket A1 (bits 0-7) of any available (A through H) position on the FEM.
- b. Install ROM #2 (part no. 91740-80071) in socket A2 (bits 8-15) of the same set.
- c. Install ROM #3 (part no. 91740-90072) in socket A3 (bits 16-23) of the same set.
- d. In the set selected for ROM installation, set the address DIP rocker switch (for 4K ROMs and control memory module 38) as follows:

SWITCH POSITION	1	2	3	4	5	6	7	8	9	10
SWITCH SETTING*	1	0	0	1	1	1	0	0	1	1

*0 = closed; 1 = open

RTE Integration

Introduction

This chapter provides the necessary information for including Driver DVS23 in the RTE-6/VM Operating System at generation time.



System Generation

Driver DVS23 is loaded into the RTE system during system generation. The following paragraphs describe the information which you must supply to configure the magnetic tape unit into the system generated.

Table Generation

- a. The Equipment Table entry is of the following form:

*EQUIPMENT TABLE ENTRY

·
·
·

EQT n?

sc,DVS23,D,X=26

·
·
·

where "n" is the EQT entry number, "sc" is the select code of the I/O card, "D" is the DCPC (DMA) option and "X" specifies extents.

Two extents are required plus three extents required for each subchannel used. Each magnetic tape unit requires one subchannel (subchannels are numbered from 0 through 7). It is recommended that the choice of subchannels start at 0 and be assigned sequentially. The formula to arrive at the number X (the number of extents) is 2 plus the number of mag tape units or subchannels you have, times 3, i.e., $2 + (\text{subchan} \times 3)$.

Normally, due to loading considerations there will be a maximum of four subchannels usable, thus the recommendation above to begin at subchannel 0 and assign sequentially so that there will not be areas wasted with unused extents (i.e., if you assign subchannel 7, 26 extents, $X=26$ must be used because subchannel 7 will use extents numbered 24, 25 and 26). An example of a normal case is $X=5$ with one mag tape unit assigned to subchannel 0.

CAUTION

If DVS23 is placed in the System Driver Area (SDA) with an "S" option in the EQT table, type 4 (large background) programs (i.e., most online disc backup utilities) will not work.

- b. The Device Reference Table (DRT) entry relating the desired logical unit number (lu) for the HP-IB card is as follows:

DEVICE REFERENCE TABLE

.
.
.
lu=EQT#?
n,m

where "lu" is the LU number to be assigned to the magnetic tape unit, "n" is the EQT entry number for the HP-IB card, and "m" is the subchannel (HP-IB address) for multiple mag tape units on the HP-IB bus.

As an example, if the EQT entry is the third in the EQT table, and 8 is the LU number for the magnetic tape unit (subchannel 0), then the correct entry would be:

8=EQT#?
3,0

Note: The magnetic tape "unit address" must correspond to the subchannel.

c. The Interrupt Table entry for the HP-IB card is as follows:

```
* INTERRUPT TABLE  
sc,EQT,Y
```

where "sc" is the select code of the HP-IB card and 'Y" is the EQT number of that card.

Program Loading

Refer to the section on program loading in the appropriate RTE system manual for information on loading your applications program(s).

System Verification



Verification program TXMT0 should be run to confirm that the driver was successfully and correctly loaded and is in working order. It is recommended that a new tape be installed in the tape unit before this is attempted. In order to prevent errors from occurring when using this verification program on an HP 7974A Magnetic Tape Unit, the tape must not have been written on previously. If it has been written on, at least 100 gaps must be written to erase any previous data. Refer to the Control Call section of this chapter. Note that TXMT0 is also the verification program for the HP 7970 Magnetic Tape Unit and is a part of the HP 91711 online diagnostics and verification package for E/F-series computers. Run the verification program by typing the following FMGR RUn command string:

```
:RU,TXMT0,,LU,n
```

where "LU" is the logical unit number of the magnetic tape unit and "n" is the number of repetitions to be made.

Any information which you will need to run the verification program, as well as the test results, will appear on the system console screen. Successful completion of the verification test indicates that the subsystem is ready to operate. For additional detailed information, refer to the 91711B Diagnostic and Verification Package Manual (part no. 91711-90006).



.

,



,

,



Application Information

Introduction

This section provides information that will allow you to prepare application programs to communicate with the HP 7974A Magnetic Tape Unit in an RTE system environment using EXEC calls.

Overview of Operation

Driver DVS23 requires the same EXEC calls as the HP 7970 Magnetic Tape Unit RTE Driver, DVR23, with an additional extended status and density call. All online utilities designed for the HP 7970 will also work with the HP 7974A units using driver DVS23 as well as the system file management package. When the transparent bit is set, DVS23 will sense "EOT" but will not terminate the transaction. The user must insure tape runoff does not occur.

The HP 7974A defaults to a density of 1600 BPI unless a prerecorded legal density is sensed. In addition, the HP 7974A mode is defaulted to START/STOP operation automatically if streaming cannot be maintained.

CAUTION

Note that a problem can occur (an I/O NOT READY error) when an HP 7974A Magnetic Tape Unit and an HP 7906H Disc Drive are operated simultaneously in the same RTE system. The computer backplane bandwidth may be exceeded and the 7906H subsystem does not provide for data transfer being held off (i.e., there is no data storage facility with a 7906H). Therefore, if a 7906H is present, it **MUST BE LOCKED OUT** when the 7974A is operating (i.e., no simultaneous operation is allowed).

EXEC Call Structures

RTE Driver DVS23 responds to standard Read, Write, and Control calls. All calls described below are in FORTRAN format and are of the general form:

CALL EXEC (ICODE,ICNWD,IBUFR,IBUFL)

The following paragraphs detail the specific calls.

Read Data Call

CALL EXEC (1,LU+IXPRT,IBUFR,IBUFL)

where: LU = Logical Unit assigned
IXPRT = Transparent mode
0B = No
2000B = Yes
IBUFR = Address of data buffer
IBUFL = Buffer length (+words,-characters)

Write Data Call

CALL EXEC (2,LU+IXPRT,IBUFR,IBUFL)

where: LU = Logical Unit assigned
IXPRT = Transparent mode
0B = No
2000B = Yes
IBUFR = Address of data buffer
IBUFL = Buffer length (+words,-characters)

Control Call

CALL EXEC (3,LU+IXPRT+ICNTL,IDENS)

where: LU = Logical Unit assigned
IXPRT = Logical Unit assigned
OB = No
2000B = Yes
ICNTL = 100B = Write end-of-file
200B = Backspace one record
300B = Forward space one record
400B = Rewind to load point
500B = Rewind and unload
600B = Dynamic status
1200B = Write gap
1300B = Forward space file
1400B = Backspace file
1500B = Set density
1600B = Set start/stop mode (7974A)
1700B = Set streaming mode (7974A)
IDENS = Density code (ICNTL = 1500B only)
0 or 6250 = 6250 bpi [GCR format]
1 or 1600 = 1600 bpi [PE format]
2 or 800 = 800 bpi [NRZI format]
(7974A—with Option 800)

Status Request Call

CALL EXEC (13,LU,ISTAT)

where: LU = Logical Unit assigned
ISTAT = DVS23 EQT Word 5
Bit 0 = Tape unit offline
1 = Parity error
2 = No write enable ring on reel
3 = I/O Request rejected
4 = Timing error
5 = End-of-tape (EOT) marker sensed
6 = Start-of-tape (BOT) marker sensed
7 = End-of-file (EOF) sensed

Read Extended Status

CALL EXEC (1,LU+1600B,IXSTA,3)

where: LU = Logical Unit assigned
IXSTA = Address of 3 word status buffer

Status Word 1:

- Bit 0 = Immediate response mode
- 1 = Reserved
- 2 = Door open
- 3 = Tape runaway
- 4 = Data timing error
- 5 = Data parity error
- 6 = Unknown tape density
- 7 = 6250 bpi mode (GCR)
- 8 = Online
- 9 = Unrecovered data/format error
- 10 = Write protected
- 11 = Command rejected
- 12 = Recovered error
- 13 = Beyond end-of-tape (EOT)
- 14 = Load point/beginning of tape (BOT)
- 15 = End-of-File (EOF)

Status Word 2:

- Bit 0 = Retry count LSB
- 1 = Retry count LSB
- 2 = Retry count LSB
- 3 = Retry count LSB
- 4 = Retry count MSB
- 5 = Error detail code LSB*
- 6 = Error detail code LSB*
- 7 = Error detail code MSB*
- 8 = Controller error
- 9 = Servo error
- 10 = Formatter error
- 11 = Position unrecovered
- 12 = HPIB command parity error
- 13 = Power has been restored
- 14 = 800 bpi mode (NRZI)
- 15 = 1600 bpi mode (PE)

*See Appendix B for Error Detail meanings.

Status Word 3:

The contents of this register are dependent on the particular error being reported. See Appendix A for details.

Special Forwardspace One Record Call

CALL EXEC (1,LU+IXPRT+100B,IDUMY,0)

where: LU = Logical Unit assigned
IXPRT = Transparent mode
0B = No
2000B = Yes
IDUMY= Dummy parameter



.

.



.

.



Extended Status Word 3

Status word 3, which is returned as a result of a read extended status EXEC call, contains binary coded information in bits 7-0. The definition of this information, which varies depending on the particular error being reported, is listed as follows:

- a. If command reject is asserted (extended status word 1, bit 11 and extended status word 2, bits 5,6,7 = 2), this status word will define the specific error condition as follows:
 - 5 = Device is write protected when a write-type command was initiated.
 - 6 = Tape was not tensioned when the command was received.
 - 7 = Write density command given but the requested density is not available (option not present).
 - 9 = The tape to be read was unidentifiable as to format. The density may not be available; the tape may have an unreadable identification field or may be blank.
 - 10 = The tape to be written on has not been identified as to format. A write record, write file mark, or write gap command was received but cannot be processed without a write format command if the tape was unidentified at load point.
 - 11 = Drive not online.
 - 16 = A write format command was issued but the tape is not positioned at BOT.
 - 19 = A backward type command (except a rewind) was just initiated but the tape was already positioned at BOT.
 - 23 = Protocol not synchronized.
 - 24 = The tape command byte received was unknown to the drive.
 - 31 = The length of a write record requested exceeded the size of the drive's data buffer.

33 = Self-test failure. Drive will not accept tape commands.

37 = Cannot write past 10 feet beyond end of tape.

40 = Door open reject. The door was opened during a long gap while the tape was beyond the end of tape marker. This condition cannot be retried to prevent unspooling of the tape.

b. If unrecovered data/format error is asserted (extended status word 1, bit 9), this status word will specify the particular error encountered as follows:

41 = The tape velocity was out of specification.

45 = Multiple tracks were in error. Either two or more tracks were in error for PE or NRZI write, or two or more tracks were in error for a GCR write.

47 = Failure to verify a tape mark or density ID just written.

48 = Noise on detect. Indistinguishable flux transitions were detected while attempting to detect a recorded block.

49 = Data format error. Flux transitions were found or were missing in the appropriate tracks for a block detect.

50 = Failure to identify tape following a rewind command.

51 = Gap detected before end of data. The read formatter detected a full tape width dropout within the data portion of a data block.

52 = Data block dropout. A full tape width dropout was detected within the preamble or postamble of a data block.

53 = Redundancy check error. The read formatter detected either a CRC, ACRC, LRC, or residual error while reading or verifying a data block.

54 = Read parity error. The read formatter detected an unrecovered parity error within a data block. For PE, this error could include multiple tracks in error. For GCR, this error could also include a redundancy check error.

55 = Abnormal command abort, door opened.

57 = Maximum skew exceeded.

58 = False preamble or postamble detected.

59 = Corrected data error on write.

- 60 = Buffer overrun. The record size exceeded the maximum record size supported on a read.
- 61 = Data block timeout. Could not detect the gap following a data block. Could be caused by a record length longer than what is supported on read.
- 62 = Tape mark dropout. A full tape width dropout was detected within a tape mark.
- 63 = Tape mark unverified. A tape mark was detected which does not meet ANSI specifications in terms of flux transitions and erasure in the appropriate tracks.
- 64 = Tape mark timeout. Could not detect the gap following a detected tape mark.

c. If position unrecovered or servo error is asserted (extended status word 2, bit 9 or 11), this status word will define the specific error as follows:

- 81 = Servo controller unresponsive. The servo will not take data from the master controller.
- 82 = Servo failed to reach the desired state requested by the master controller.
- 83 = Servo shutdown. The servo system lost tape tension unexpectedly.
- 84 = Servo controller hard failure. The servo controller has detected a hard failure within itself.
- 85 = Servo protocol error. An invalid byte was received by the servo from the master controller.
- 86 = A run time error was detected by the servo.
- 87 = In position interrupt not received. Master controller did not get the in position interrupt it expected.
- 88 = No gap detected by the servo after reading or writing a data block or tape mark.
- 89 = Safety shutdown of motor driver.
- 90 = No BOT detected on load or rewind.
- 91 = Speed out of specification.

92 = The desired state requested by the master controller was invalid for the current context.

94 = Tape positioning failure.

- d. If a formatter error is asserted (extended status word 2, bit 10), this status word will define the specific error condition as follows:

103 = Bad block type detected on a write operation.

104 = Erase failure. Flux transitions were detected in a portion of tape currently being erased.

105 = No data detected after write.

106 = Tracks out of sync on write verify.

107 = HP 7974A unit formatter hardware error.

108 = HP 7974A formatter unresponsive.

109 = No gap timeout. The gap timer did not count down, or was never started.

110 = Formatter byte count mismatch with data buffer.

- e. If a controller error is asserted (extended status word 2, bit 8), then this status word indicates the specific error condition as follows:

121 = Transaction ID mismatch between command sent to device program and the returned report.

122 = No pending command found for report received from device program.

123 = Invalid report message received from device program.

124 = Report queue overflow.

125 = Unknown command received by device program.

126 = Command queue overflow.

128 = Missing end of record flag in data buffer.

129 = Data buffer parity error.

131 = Byte count mismatch between putting a record into the data buffer and removing it.

- 133 = Processor handshake abort between HP-IB interface board and channel program.
 - 134 = Unknown HP-IB interface exception detected.
 - 137 = Illegal access to the servo controller registers detected.
 - 138 = Device program firmware error.
 - 139 = Hardware utilities firmware error.
 - 140 = Channel program firmware error.
- f. If command reject is asserted (extended status word 1, bit 11 and extended status word 2, bits 5,6,7 = 3), this status word will define the specific error condition as follows:
- 161 = Command queue not empty. Cannot accept new tape command or diagnostic request.
 - 162 = Request DSJ expected.
 - 163 = Request status expected.
 - 165 = Unknown unit select.
 - 166 = Tape command secondary expected.
 - 167 = Data byte expected.
 - 168 = Missing EOI on tape command data byte, self-test number, or END command data byte.
 - 170 = Command phase protocol error for write record.
 - 172 = Read record report phase protocol error.
 - 173 = Report phase protocol error.
 - 174 = Cold load sequence protocol error.
 - 176 = END "Complete" or "Complete-Idle" expected.
 - 178 = END "Data" expected.
 - 180 = Unknown interface secondary command.
 - 181 = Misplaced data byte.
 - 184 = Interface loopback protocol error.

- 185 = Run self-test protocol error.
- 188 = HP-IB command parity error.
- 189 = Reset by operator during a protocol sequence.
- 190 = Device clear received (internal error code only).

Error Detail Code Definitions

Error detail status bits indicate the reason for a command reject error (status word 2, bits 5,6,7) as follows:

- 0 = Null code (command reject bit is not set).
- 1 = Reserved.
- 2 = Device reject (register 5 contains the reject code).
- 3 = Protocol reject (register 5 contains the reject code).
- 4 = Reserved.
- 5 = Prior error reject.
- 6 = Reserved.
- 7 = Self-test failure.



