HP 3852A Data Acquisition/Control Unit

HP 44789A
RS-232/422 Serial Interface Accessory

Configuration and Programming Manual

This is the HP 44789A RS-232/422 Serial Interface Accessory Configuration and Programming Manual. Insert this manual and tab page into the Plug-In Accessories Configuration and Programming Manuals Binder supplied with your HP 3852A Data Acquisition/Control Unit.

HEWLETT PACKARD

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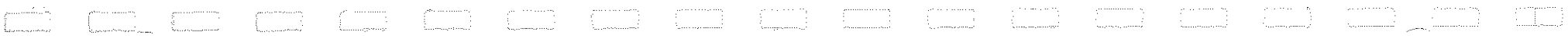

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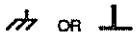
Indicates the field wiring terminal that must be connected to earth ground before operating the equipment—protects against electrical shock in case of fault.



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Indicates hazardous voltages.

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Introduction

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Introduction

Manual Contents

This Configuration and Programming Manual contains three chapters, an index and Appendix A. The contents of the chapters are the following:

Chapter 1 - Introduction summarizes the contents of the manual, gives a brief description of the RS-232C and RS-422 standards, and provides an overview of the HP 44789A RS-232C/RS-422 Serial Interface Accessory.

Chapter 2 - Installing the HP 44789A shows how to install the HP 44789A in the HP 3852 mainframe. A section on cables is included. Chapter 2 also contains sample programs for various configurations to ensure that a data link is established. The final section describes non-standard RS-232C configurations.

Chapter 3 - Using the HP 44789A provides the command set for the HP 44789A. Chapter 3 also provides data flow control diagrams which show the handshaking decision tree for the different PROTOCOLs. The final section is a troubleshooting guide for RS-232C interfaces.

Appendix A is a Command Summary quick reference.

The RS-232C Interface Standard

The RS-232C interface is a standard from the Electronic Industry Association (EIA) titled "Interface Between Data Terminal Equipment (DTE) and Data Communications Equipment (DCE) Employing Serial Binary Data Interchange". Briefly, the RS-232C provides a system whereby computers (DTEs) can communicate with other computers as well as modems, printers and other peripherals (DCEs).

The EIA RS-232C standard sets guidelines for the following four elements:

Electrical Signal Characteristics describes the electrical signals and levels which are allowed or required.
Interface Mechanical Characteristics (Connectors) describes the physical connection. The most common used connector is the DB-25 connector.
Functional Description of Interchange Circuits names and describes the electrical signal functions, as well as specifying which pin these functions will be on. There are 21 of these assigned pins, although most RS-232C implementations only use eight of them. The HP 44789A RS-232C interface uses up to 10 of these pins, depending on the application.
Standard Interfaces for Selected Communication System Configurations describes some common modem-to-terminal connections.

Any two devices which are "RS-232C compatible" should connect together and operate without any modifications. Unfortunately, the standard was designed specifically to connect terminals with modems, so using RS-232C to connect any other peripheral is in itself a deviation from the original purpose. The problem is further compounded because different manufacturers interpret the functions of the handshake lines differently. Fortunately there are many de facto standards for the RS-232C. The HP 44789A implements most of these de facto standards. If you are trying to connect any device other than those specifically listed in this manual, you may have to refer to Chapter 3, Troubleshooting RS-232C Connections. The Troubleshooting section also contains information on signal levels and the corresponding logic states. Table 1-1 shows the most commonly used pins in an RS-232C connection.

Table 1-1. RS-232C Standard

Pin	Input/Output	Description
2 TxD	O	Transmitted Data
3 RxD	I	Received Data
4 RTS	O	Request To Send
5 CTS	I	Clear To Send
6 DSR	I	Data Set Ready
7		Common
8 CD	I	Data Carrier Detect
20 DTR	O	Data Terminal Ready

The RS-422 Standard

The RS-422 interface uses two separate wires for each data signal. Each bit is defined according to the voltage difference between the two lines, rather than between a single line and ground. This minimizes the problems associated with varying ground potentials. This also means that any transmission-induced voltages affect both lines equally, so that the relative difference between the two lines is unchanged. This technique is called balanced transmission.

The major advantages of RS-422 connections are higher data rates and much longer transmission distances. There are no control lines for RS-422 interfaces, so therefore there is no hardware handshaking. Table 1-2 shows the RS-422 pin assignments. Some manufacturers reverse the logic state, and + and – are reversed. For those situations, you will have to use a cable which reverses pin 1 with pin 2 and pin 3 with pin 4.

Table 1-2. RS-422 Pin Assignments

Pin	Input/Output	Description
1	O	Transmitted Data –
2	O	Transmitted Data +
3	I	Received Data –
4	I	Received Data +
5		Ground

HP 44789A Accessory Description

The HP 44789A RS-232C/RS-422 Serial Interface Accessory allows the HP 3852 to communicate with a host computer, peripherals, or other instrumentation. It can be configured to operate a slave device or for full-duplex (two way data transfer) communication. The HP 44789A can also be configured to work with 9600 baud modems which use RTS as a reverse Clear To Send. The HP 44789A can serve as a programming port for the HP 3852. The HP 44789A can only be used with HP 3852 ROM set version 4.0 or later. To determine the ROM set on your HP 3852, use the IDN? command.

You can install multiple HP 44789A modules in your mainframe to allow serial communication with many devices; however, only one HP 44789A can serve as a programming port for the HP 3852. You can use the HP-IB and the HP 44789A as programming ports at the same time. This allows both a local host computer and a remote computer to send commands and receive data.

The HP 44789A allows both software and hardware handshaking to control the flow of data through the RS-232C port. Standard cables and connectors can be ordered from HP Direct Marketing (1-800-538-8787) for most applications. In addition, you can jumper the pin-outs on the RS-232C interface for non-standard connections. There is a constant high pin and a constant low pin which can be used to assert or deassert lines on a custom cable.

The 25 pin RS-232C connector and the 9 pin RS-422 connector are in logical parallel. It is not possible to communicate through both connectors at the same time. The RS-422 interface does not use hardware handshaking, so PROTOCOL must be set to NONE or XON; see Chapter 3. Table 1-3 lists the features of the HP 44789A.

Table 1-3. HP 44789A Features

One port	Operating either as an RS-232C interface through the 25 pin connector or an isolated RS-422 interface through the 9 pin connector.
Baud rate	Software selectable 300 baud to 19.2 Kbaud.
Parity	Software selectable (even, odd, none).
Byte length	Software selectable (7 or 8 bits).
Handshaking	XON/XOFF and Hardware (CTRL).
Buffering	Up to eight Kbytes on both input and output.
Interrupt	Buffer conditions, transmission errors, timing and/or user selected character.
EEPROM	Storage of selected settings. Settings stored in HP 44789A EEPROM (Electrically Erasable Program- mable Read Only Memory) are used at power on/reset.

Figure 1-1 shows a typical installation of the HP 44789A. The remote computer system can be used for monitoring or programming the HP 3852.

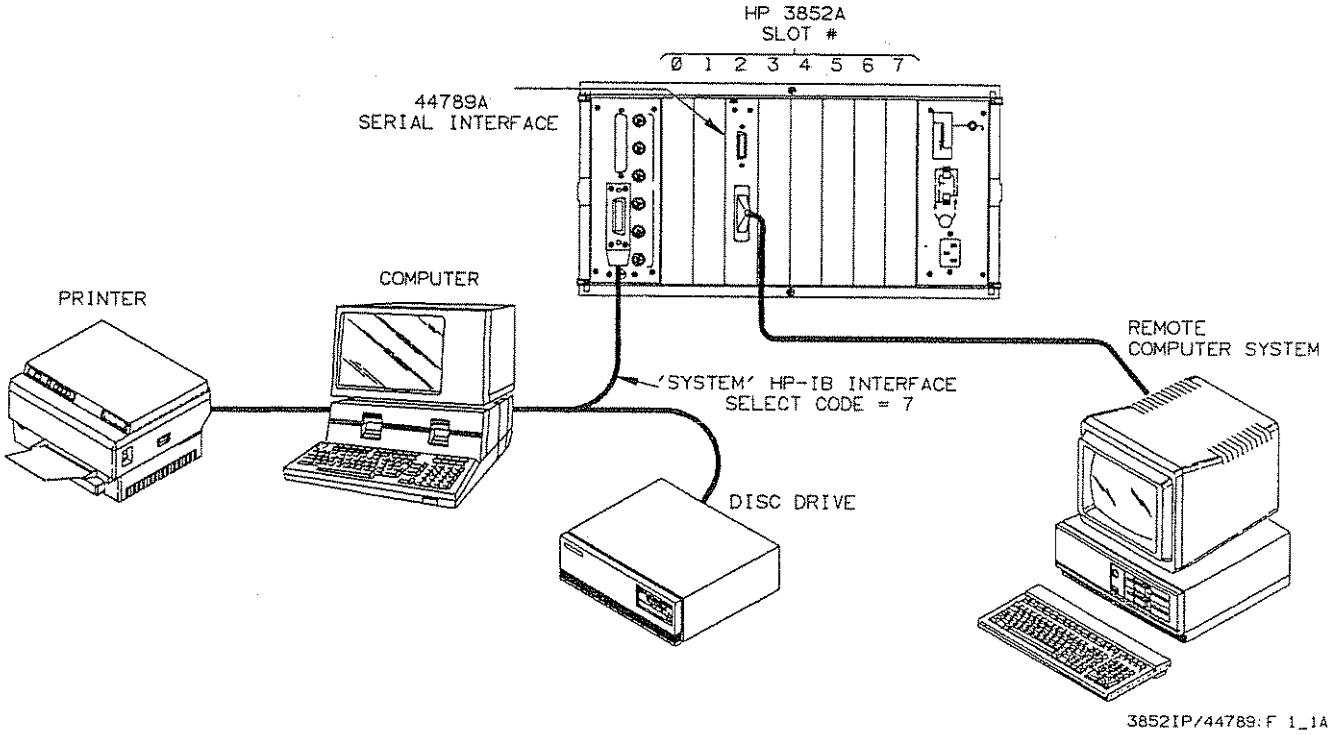


Figure 1-1. Typical Installation

2

Installing the HP 44789A

2

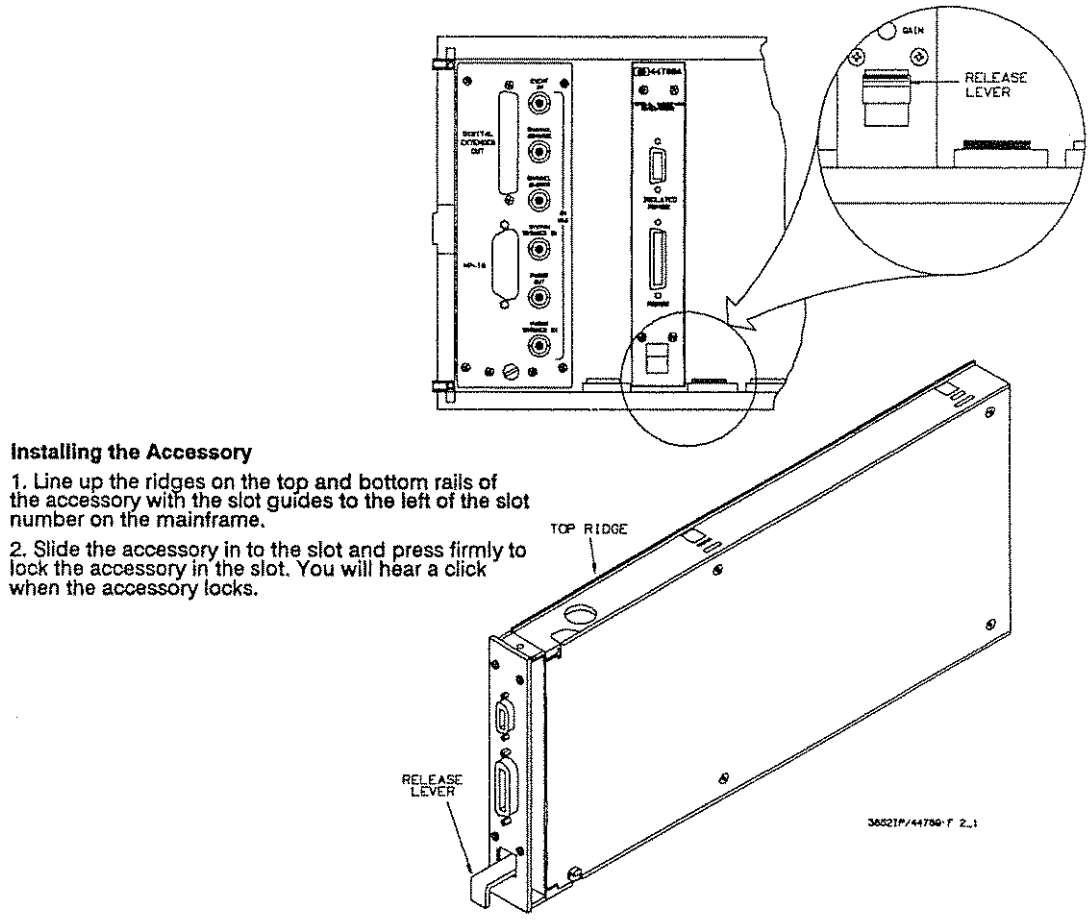
Installing the HP 44789A

Introduction

This chapter shows how to install the HP 44789A in the cardcage, and describes the cables which connect the RS-232C interface to the peripherals. Sample programs are provided so that you can verify the handshaking and data flow are working properly. The next section shows how to reconfigure the pins on the RS-232C connector for non-standard RS-232C interfaces. The final section describes how to use the RS-422 port.

Installation

Figure 2-1 shows how to install the HP 44789A module into the HP 3852 cardcage.



Installing the Accessory

1. Line up the ridges on the top and bottom rails of the accessory with the slot guides to the left of the slot number on the mainframe.
2. Slide the accessory in to the slot and press firmly to lock the accessory in the slot. You will hear a click when the accessory locks.

Figure 2-1. Installing the HP 44789A

Cables

To connect a peripheral device to the HP 44789A, you must have the proper cable. In addition to having connectors of the proper gender (male or female) on both ends of the cable, the internal wiring of the cable must be correct. For example, when the HP 44789A is connected to a modem (DTE to DCE), pin 2 is wired to pin 2 and pin 3 is wired to pin 3, whereas when the HP 44789A is connected to a PC (DTE to DTE) then pin 2 is wired to pin 3 and pin 3 is wired to pin 2. In most cases, if the gender of the connectors is correct for the desired connection then the wiring is also correct. If you are not certain you have the proper cable and problems occur, consider the cable as a possible source of the trouble.

The RS-232C port on the HP 44789A is almost identical to the DTE RS-232C port on a PC/XT/AT. If you are connecting a printer or other slave device, the same cable which is recommended for connecting it to a PC should work with the HP 44789A. You can also connect devices which use the 9 pin (DB9) connector if you use the proper 25 pin to 9 pin cable.

Table 2-1 lists cables, adapters and a reference book on RS-232C communications. If you do not have the necessary items available, you may purchase them from HP Direct Marketing (1-800-538-8787).

Table 2-1. RS-232C Products

Product	Description	Order Number
HP 98628 Cable	Modem (U.S.) 50M - 25M pin	13222N
HP Vectra PC HP 44789A Cable	Printer 25M - 25M pin	13242G
HP Vectra PC HP 44789A Cable	9FM - 25M pin	24542G
HP 9000 Series 200/300 HP 44789A Cable	Printer 25M-25M pin	13242G
	Micropatch Wiring Adapter (Male-Male)	92204J
	Micropatch Wiring Adapter (Male-Female)	92204K
	Micropatch Wiring Adapter (FM-FM)	92204L
Book	The RS-232C Solution[1]	92234X

1 Joe Campbell, **The RS-232C Solution** (SYBEX, Inc. 1984)

Table 2-2 shows the connector pin description for connecting a HP Vectra PC to the HP 44789A using a 13242G cable or a 24542G cable. Figure 2-3 shows the connector pin description for connecting a Hayes Smartmodem™ to the HP 44789A using a 13242N cable.

Table 2-2. Connector Pin Description – HP Vectra PC and HP 44789A

HP 44789A Name	Pin	Signal Description	PC/XT/AT Direction	Name	9 pin DB 9	25pin DB 25
TXD	2	data from HP 3852 to PC	→	RXD	2	3
RXD	3	data from PC to HP 3852	←	TXD	3	2
DTR	20	Data Terminal Ready	→	CTS	8	5
CTS	5	Clear To Send	←	DTR	4	20
RTS	4	Request To Send	→	DCD	1	8
DCD	8	Data Carrier Detect	←	RTS	7	4
GND	7	signal ground	NA	GND	5	7
RI	22	Ring Indicator	←	RI	9	22
DSR	6	Data Set Ready	←	DSR	6	6

Table 2-3. Connector Pin Description
Hayes Smartmodem™ and HP 44789A

HP 44789A Name	Pin	Signal Description	Direction	Hayes Modem Name	Pin
GND	1	Chassis ground	NA	GND	1
TXD	2	data from HP 3852	→	TXD	2
RXD	3	data from modem to HP 3852	←	RXD	3
DTR	20	Data Terminal Ready	→	DTR	20
CTS	5	Clear To Send	←	CTS	5
DCD	8	Data Carrier Detect	←	DCD	8
GND	7	signal ground	NA	NA	GND
RI	22	Ring Indicator (can interrupt HP 3852 on edge)	←	RI	22
DSR	6	Data Set Ready	←	DSR	6
RTS	5	Request To Send	→	RTS	5

Sample Programs

The following sample programs verify that the HP 44789A is properly installed, and that your computer is communicating through the HP 44789A. The first program is a simple test program for the HP 44789A. The second program is for an HP Vectra PC or other PC/XT/AT equipped with a serial data communications port. The third is for an HP 9000 Series 200/300 computer using the built-in RS-232C interface. The fourth program is for an HP 9000 Series 200/300 computer equipped with an HP 98628 Datacomm interface.

Before running the sample programs, you must verify that the MODE and PROTOCOL are the same for both the HP 44789A and the computer you want to connect. MODE sets the baud rate, parity, number of data bits and number of stop bits. PROTOCOL sets the handshaking for the control lines. The factory default settings for MODE and PROTOCOL are:

MODE — 300 baud, no parity, 7 data bits, 2 stop bits

PROTOCOL — NONE (Sends whenever bytes are in the output buffer. No overflow protection on the input buffer.)

These default settings are almost identical to those on most PC/XT/AT computers. To determine the settings on your computer, refer to the RS-232C Serial Interface section in your computer manual. If you have previously stored different MODE and PROTOCOL settings in the HP 44789A EEPROM, use the MODE, PROTOCOL and STORE CONF commands in Chapter 3 to reconfigure the settings.

HP 44789A Test Program

This program tests the HP 44789A. The HP 3852 transmits the data through pin 2 (TxD) on the RS-232C port, and receives it through pin 3 (RxD). The HP 3852 monitor then displays the data.

Connect pins 2 and 3 on the HP 44789A RS-232C connector. You can use any small wire to connect these pins on the connector panel of the HP 44789A. Enter the instructions from the HP 3852 front panel.

```
SERIAL IS NONE
RST                          ! Reset the card
PROTOCOL NONE USE 400        ! The HP 44789A in slot 4
INTEGER I                    ! Declare integer variable
OUTPUT 400 123               ! Output a number to slot 400
ENTER 400 I                  ! Enter data to variable I
DISP I                       ! Display variable I (123)
```

HP Vectra PC or PC/XT/AT Program

The following GWBASIC® program for the HP Vectra PC or a PC/XT/AT computer uses the internal HP 3852 clock to return the number of seconds past midnight. Enter the following commands on the HP 3852 front panel before running the program.

```
SERIAL IS USE <chan>         ! Sets HP 3852 for serial
                               communication through HP
                               44789A in designated slot
RST                          ! Reset HP 3852 with stored
                               configuration
```

When the HP 3852 is set up for serial communication, enter the following program in the PC:

```
10 OPEN "COM1:300,N,7,2" AS #1
20 PRINT #1,"TIME;"
30 INPUT #1,T
40 PRINT "HP 3852 SECONDS PAST MIDNIGHT ";T;" SECONDS"
50 END
```

HP 9000 Series 200/300 using the Built-in Serial Port

To use the HP 9000 Series 200/300 built-in serial port you must use the PACE option under the MODE command. PACE inserts delays between the data bytes coming from the HP 3852A so that the input buffer in the Series 200/300 does not overflow. This allows the Series 200/300 sufficient time to remove a byte of data from the serial interface and/or change handshake lines before the next byte is sent.

GW-BASIC is U.S. registered trademark of Microsoft Corperation.

Enter the following commands from the front panel of the HP 3852 before running the program.

```
USE 400                          ! HP 44789A is in slot 4
RTS ON                           ! Required for Series 200/300
DTR IN                           ! Control input to the HP 3852
MODE 19200 NONE 7 2 .OO1         ! Baud 19200 no parity 7 data bits 2 stop bits PACE 1 sec
PROTOCOL CTRL 10 15              ! Hardware handshaking, buffer limits 10 and 15
STORE CONF                       ! Store  in EEPROM
SERIAL IS USE 400                ! Sets HP 3852 for serial communication through HP 44789A in designated slot
RST                              ! Reset the HP 3852 with stored configuration
```

The following program is for the HP 9000 Series 200/300. It prints seconds after midnight and the Julian date and time from the HP 3852 real time clock. If an error occurs, the program prints the type of error detected.

```
10                               ! Program for HP 9000 Series 200/300 with built-in serial port
20 CONTROL 9,3;19200             ! Set baud rate
30 CONTROL 9,4;32 + 0 + 4 + 2 70 ! Set up data frame format
40 ON ERROR GOTO Error           ! Set up error checking
50 OUTPUT 9;"SET TIME 0;SUB A; TIME;TIMEDATE;SUBEND" ! A subroutine to reset clock and output data
60 WHILE 1                       ! Set up endless loop
70 OUTPUT 9;"CALL A"
80 ENTER 9;A
90 ENTER 9;B
100 PRINT A,B
110 END WHILE
120 GOTO End
130 ERROR:                       ! If ERROR then display cause
140 STATUS 9,10;ERR
150 IF BIT (ERR,1) THEN PRINT "OVERRUN"
160 IF BIT (ERR,2) THEN PRINT "PARITY"
170 IF BIT (ERR,4) THEN PRINT "BREAK"
180 IF BIT (ERR,3) THEN PRINT "FRAMING"
190 END:
200 END
```

HP 9000 Series 200/300 with the HP 98628A Datacomm Interface

The following program sets up the HP 9000 series 200/300 computer for communication with the HP 3852 through the HP 98628 Datacomm interface. The program first checks to see if there is data in the queue. Then it checks to see if there have been any errors since power on or reset. If there are no errors the program will print out the HP 3852 model number, the HP 3852 ROM revision number, and the HP 44789A slot number. There is more information on communications settings in the datacomm section of your HP 9000 Series 200/300 "BASIC Interfacing Techniques" manual.

Enter the following command from the front panel of the HP 3852.

```
SERIAL IS USE 400          ! Prepares HP 3852 for serial communication through the designated channel
RST                        ! Reset HP 3852 with stored configuration
```

Enter the following program in the HP 9000 Series 200/300.

```
10 CONTROL 20,0;1          ! Reset HP 98628 serial card
20 CONTROL 20,3;13         ! Set serial card for asyncronous communication
30 CONTROL 20,14;3         ! Set control block mask for EOL and Prompt
40 CONTROL 20,15;0         ! No modem line connection notification
50 CONTROL 20,16;0         ! Disable connection timeout
60 CONTROL 20,17;0         ! Disable no activity timeout
70 CONTROL 20,18;0         ! Disable lost carrier timeout
80 CONTROL 20,19;0         ! Disable transmit timeout limit
90 CONTROL 20,20;7         ! Set transmission speed to 300 baud
100 CONTROL 20,21;7        ! Set receive speed to 300 baud
110 CONTROL 20,22;0        ! Protocol handshake disabled
120 CONTROL 20,23;0        ! Hardware handshake off
130 CONTROL 20,24;66       ! Remove protocol characters except EOL. Change errors to underscores
140 CONTROL 20,26;17       ! Reset protocol handshake. Default DC1
150 CONTROL 20,27;19       ! Reset protocol handshake. Default DC3
160 CONTROL 20,28;2,13,10  ! Set EOL to 2 characters CR,LF
170 CONTROL 20,31;1,17     ! Set prompt sequence to 1 character DC1
180 CONTROL 20,34;2        ! Set data length to 7 bits per character
190 CONTROL 20,35;2        ! Set stop bits = 2
200 CONTROL 20,36;0        ! Set parity = none
210 CONTROL 20,37;0        ! Reset inter-character time gap. Default = 0
220 CONTROL 20,39;4        ! Set break time. Default = 4
```

```
230                                  ! All instructions to this point
                                     are to prepare the HP 98628
                                     for protocol none 7 data bits no
                                     parity and 2 stop bits.
240                                  !
250                                  ! The following routine checks
                                     serial communications.
                                     Variable A is status (either 1, 2,
                                     or 3). Variable B holds the
                                     number of errors received since
                                     power on or reset. A value of 0
                                     means no errors.
260                                  !
270 OUTPUT 20;"VREAD 1"
280 FOR I = 1 TO 30
290 STATUS 20,5;A
300 STATUS 20,25;B
310 PRINT I,A,B
320 WAIT .1
330 NEXT I
340 ENTER 20;A$
350 DISP A$
360 OUTPUT 20;"IDN?"                 ! Returns HP 3852 model
                                     number, ROM revision, and
                                     slot number
370 ENTER 20;A$
380 ENTER 20;X$
390 ENTER 20;Y$
400 ENTER 20;Z$
410 DISP A$,X$,Y$,Z$
420 END
```

Reconfiguring the RS-232C Port

You can change the pin out on the RS-232C port to work with any peripheral which uses an unusual or non-standard implementation of the RS-232C standard. Signals from the HP 44789A (RTS, CTS, etc.) can be routed to another pin. A pin can be connected to a pin, which effectively jumpers the RS-232C port on the peripheral. You can connect a constant high or a constant low to a pin to assert or deassert a line on a custom cable. Table 2-4 lists the HP 44789A RS-232C pin assignments.

Table 2-4. RS-232C Pin Assignments

Pin	I/O	Circuit
1	NA	Protective Ground
2	O	Transmitted Data
3	I	Received Data
4	O	Request To Send
5	I	Clear To Send
6	I	Data Set Ready
7	NA	Logic Ground
8	I	Carrier Detect
18	NA	RS-232C low (−12 V)
20	O	Data Terminal Ready
22	I	Ring Indicator
25	NA	RS-232C high (+12 V)

To change the pin out, first cut the jumper, bend the end up, and then wire-wrap to the desired pin. See Figure 2-2. It may be simpler to use a Micropatch™ wiring adapter, listed in Table 2-1.

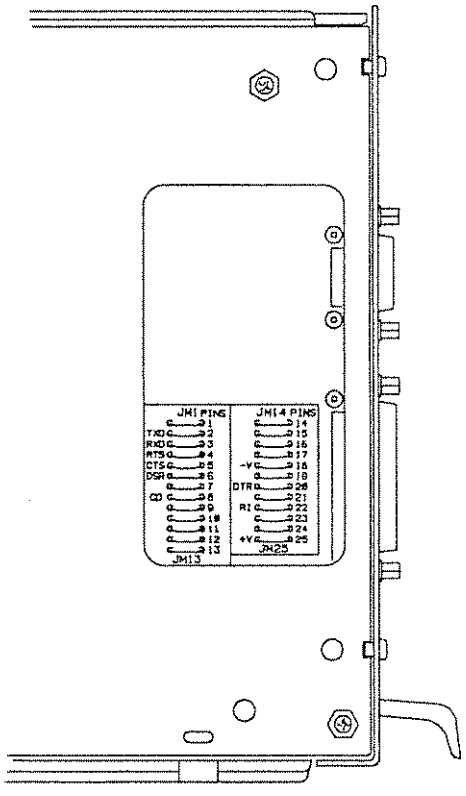


Figure 2-2. RS-232C Jumpers

Using the RS-422 Port

The 9 pin connector on the HP 44789A is for RS-422 communication. The data lines on the RS-422 port and the RS-232C port are in logical parallel, so you can not use both ports at the same time. Also, RS-422 communication does not use control lines, so you must set PROTOCOL to NONE or XON. Enter the following commands through the front panel of the HP 3852.

```
USE 400                                   ! HP 44789A is in slot 4
MODE <baud>,<parity>,<data bits>,<stop bits> ! Ensure these
                                          values are the same as the
                                          peripheral's RS-422 values
PROTOCOL NONE or XON                      ! See Chapter 3
STORE CONF                                ! Store configuration in
                                          EEPROM
SERIAL IS USE 400                         ! Identify the channel that is the
                                          serial port
RST                                       ! Resets the HP 3852 with
                                          stored values
```

The HP 3852 is now ready to communicate through the RS-422 port on the HP 44789A. Table 2-5 shows the RS-422 pin assignment.

Table 2-5. RS-422 Pin Assignments

Pin	Input/Output	Circuit
1	O	Transmitted Data –
2	O	Transmitted Data +
3	I	Received Data –
4	I	Received Data +
5		Ground

A common error in RS-422 cables is reversed + and – leads. If the peripheral you are connecting uses reverse polarity logic states, or the cable is for reverse logic but the peripheral is normal logic, you will have to reverse the leads. Change the lead for pin 1 with pin 2, and the lead for pin 3 with pin 4.

3

Using the HP 44789A

3

Using the HP 44789A

Introduction

This chapter begins with a description on how to program the HP 44789A. The default settings are listed next, followed by a section on setting SERIAL, MODE and PROTOCOL for the desired application. Next are sample programs which show how to use various types of computers to program the HP 3852 through the HP 44789A interface. The following section describes the commands, and the last section is a troubleshooting guide for RS-232C interfaces.

Programming the HP 44789A

There are four types of commands for the HP 44789A: Common Commands, Configuration Commands, Programming Commands and Multitasking Commands. Common Commands are not card specific. They can reset, test, select, or identify any card in the system. Configuration Commands set the data rate, data format, pacing protocol, and buffer size. Programming Commands concern data handling by the sender or receiver. Multi-tasking Commands are HP 3852 commands which can be used if the HP 44789A is used as a programming port for the HP 3852.

Program the HP 44789A the same as you would any other card in the HP 3852. Specify the slot number, then enter the commands. When you initially set up any of the Configuration Commands, use the STORE CONF to save the configuration in EEPROM. That way, if the HP 3852 should lose power or be reset the HP 44789A will be properly configured.

You can program the HP 44789A directly from a computer which is communicating through the HP 44789A with one exception. To change MODE and PROTOCOL you must first put the commands in a subroutine, then call the subroutine. Otherwise, as soon as the HP 44789A receives the MODE command it changes the settings and breaks the communication link. After you call the subroutine you must then change the settings on the computer to match the new settings before you can reestablish the communication link.

Default Settings

Table 3-1 shows the factory-set default settings for the HP 44789A. Once you use the STORE CONF command, the settings stored in EEPROM will be used at power on or reset. If you should lose the contents of EEPROM the HP 44789A will revert to the default settings at power on or reset.

Table 3-1. Default Settings

MODE	300 Baud, NO Parity, 7 Data Bits, 2 Stop Bits
PROTOCOL	NONE
INBUF	1024 Bytes
OUTBUF	1024 Bytes
RTS	ON
DTR	ON
THRESH IN	512 Bytes
THRESH OUT	512 Bytes
NPER	4 Character periods
ENABLE	XMIT
ENABLE	RCVR
INTR	0

Setting up SERIAL, MODE and PROTOCOL

To establish a communication link between the HP 3852 and a peripheral, you must designate where the link is located (SERIAL), what the data frames will look like (MODE), and how the data flow will be controlled (PROTOCOL). SERIAL is stored in non-volatile RAM in the mainframe and will be used at all subsequent resets or power-ons. MODE and PROTOCOL are stored in the HP 44789A EEPROM with the STORE CONF command.

MODE and PROTOCOL are set up at reset or power-on with the values stored in EEPROM. If there are no values in EEPROM, the default settings in Table 3-1 are used. These values must be the same as those used by the peripheral.

Programming the HP 3852 through the HP 44789A

You can use any terminal or computer with an RS-232C or an RS-422 interface to program the HP 3852 through the HP 44789A. Once you have established the communication link and designated a specific HP 44789A as a programming port, any programs or commands entered through that port go directly to the HP 3852.

Using a Terminal

A terminal or computer running terminal-emulation software acts as a remote extension of the keyboard for the HP 3852. Characters which are typed on the keyboard are accepted by the HP 3852. If those characters form programs or commands, those programs or commands are executed. BACKSPACE and RECALL are not implemented. Also, error messages are not automatically returned to the terminal. If you do not get a response from the HP 3852, then enter the error query command, ERRSTR?. The HP 3852 will send the contents of the error storage to the terminal.

Using the HP Vectra PC or PC/XT/AT

You can use the HP Vectra PC or any PC/XT/AT compatible to program the HP 3852 through the HP 44789A. The sample program in Chapter 2 shows how to establish the communication link. Use any BASIC that runs on a PC/XT/AT. The following program is written in GWBASIC®.

```
10 OPEN "COM1:300,N,7,2" AS #1          ! Sets the MODE for PC
20 PRINT #1,"ID? 400;"                  ! Queries slot 4 for ID
30 INPUT #1,A$                          ! Returns slot ID
40 PRINT "HP";A$                        ! Displays HP 44789A ID on CRT

50 END
```

Using a Modem

A modem allows you to communicate over long distances, generally with a telephone connection. Using a modem with a terminal or a computer with communication software is very similar to operating with a direct connection. The only difference is dialing and hanging up. Your modem manual will have information on how this is done.

The following program for the HP Vectra PC demonstrates the overhead required for a modem. Ensure that the MODE and PROTOCOL settings are equivalent for the computer, modem and HP 44789A. The print statement in line 50 is not required for operation, it is there for information only.

```
10 OPEN "COM2:1200,N,7,2" AS #1          ! Set COM parameters and open buffer
20 PRINT #1, "ATDT 123-4567"             ! Dial phone number
30 WHILE EOF (1):WEND                    ! Wait till something is in the buffer
40 SOUND 32565,30:SOUND 32565,1          ! Insert delay approx 1.5 seconds
50 PRINT LOC(1):ON ERROR GOTO 30         ! Print bytes in buffer: clear error
60 A$ = INPUT$ (LOC(1),#1)               ! Define A$ and set pointer
70 IF INSTR (A$, "CONNECT") = 0 THEN 30 ! Identify feedback from modem
```

```
80 PRINT "CARRIER DETECTED"
90 PRINT #1,"RST;"                          ! Reset HP 3852
100 SOUND 32565,30:SOUND 32565,1            ! Insert delay approx 1.5
                                              seconds
110 PRINT #1, "ID? 400;"                    ! Request ID of card in slot 4 of
                                              HP 3852
120 INPUT #1,A$                             ! Return response from line 110
130 PRINT "    HP ";A$                      ! Print ID appended to HP
140 PRINT #1, "~ ~ ~ + + + ~ ~ ~ ATH0"! Get modems' attention and
                                              hang up phone
150 END
```

Using the HP 9000 Series 200/300 Computers

The HP 9000 Series 200/300 built-in serial interface requires the use of the PACE option under MODE. The HP 98628A Datacomm interface provides full handshaking and communication without the need for the PACE option. The built-in serial interface requires eight lines of code to set up the HP 3852 and two lines of code to set up the Series 200/300. The HP 98628A Datacomm interface requires approximately 20 lines of code for the Series 200/300. The factory default settings for the HP 44789A are correct for communicating with the HP 98628A. You must specify SERIAL IS USE <*chan*> on the HP 3852.

HP-IB programs will work with the HP 98628A if you change the interface select code and address from 7XX (HP-IB) to 20 (Datacomm card). For more information see the datacomm section in the HP 9000 Series 200/300 "Basic Interfacing Techniques" manual.

The set-up codes for the built-in serial interface and the HP 98628A Datacomm card are listed in Chapter 2. The following program shows how to send commands using the HP 98628A Datacomm card.

```
10                                          ! Datacomm setup, requires 20
                                              to 25 lines of code, see Chapter
                                              2.
450                                         ! Datacomm card setup
                                              complete.
460                                         !
470 OUTPUT 20;"ADDR?"                       ! Requests HP-IB address
480 ENTER 20;"A                             ! Return address to computer
490 DISP A                                  ! Display address on CRT
500 END
```

Using the HP 44789A for Printers or other Slave Devices

You can use the HP 44789A to operate any device which has an RS-232C or RS-422 interface. The RS-232C interface on the HP 44789A is almost identical to that on a PC/XT/AT. You can use the same cable for the HP 44789A that is recommended for a PC. If the printer uses a non-standard implementation of the RS-232C interface, you may have to jumper the pins and/or use software handshaking. Refer to the Control Lines section in the printer manual.

Command Summary

The following is a summary description of the HP 44789A commands. The list is organized alphabetically in four functional groups: COMMON COMMANDS, CONFIGURATION COMMANDS, PROGRAMMING COMMANDS, and MULTITASKING COMMANDS.

Common Commands

Common Commands refer to the physical HP 44789A card and its location in the HP 3852 cardcage.

ID? Returns the accessory number (44789A).

Syntax: ID? *<slot>*

RST Resets the HP 44789A to its power-on state. All configuration settings are restored from EEPROM (MODE, PROTOCOL, INBUF, OUTBUF, RTS, DTR, THRESH, NPER, ENABLE/DISABLE XMIT/RCVR, and INTR), interrupts are disabled, and input and output buffers are cleared. When the HP 44789A is reset the HP 3852 waits until the card has passed its self-test or 2 seconds, whichever occurs first. If a timeout occurs then a self-test error is declared. In some cases the HP 44789A may still be used, but with risk. When the HP 44789A is an HP 3852 controller I/O, the RST *<slot>* command is not allowed if *<slot>* is the location of the HP 44789A.

If an EEPROM checksum error occurs, code E will be written to the HP 3852 display and the error buffer. Error messages stored in the error buffer may be recalled with the ERRSTR? command. If code E is detected it means the default values will be used. Set up the configuration and store it with the STORE CONF command.

Syntax: RST *<slot>*

TEST Initiates a pass/fail self-test of the accessory. It tests the backplane, interface registers, and microprocessor ROM/RAM/EEPROM, but not the RS-232C and RS-422 transceivers. Programmed state is preserved, but data received over the serial interface during the test is lost and/or causes an overrun error. If an error is noted then a failed self-test error is logged in the error buffer and on the HP 3852 display. You may view error messages from a remote location with the ERRSTR? command.

Syntax: TEST *<slot>*

USE Specifies the default USE channel for subsequent commands. The valid channel format is Extender, Slot number, Channel number, (ESCC). Refer to your HP 3852 "Configuration and Programming Manual" for more information.

Syntax: USE *<chan>*

Configuration Commands

Configuration commands refer to the identification and control of data passing through the interface.

DTR

Determines the function or state of the DTR line. DTR may be forced to either OFF or ON. It may be configured as the standard Data Terminal Ready (DTR OUT). It may also be used as an input-buffer-available flag for use with many HP products (DTR IN).

DTR state stored in the EEPROM is used at reset or power-on. If the EEPROM contents are lost, DTR ON is the default.

Syntax: **DTR** [{OFF|ON|OUT|IN}] [USE <*chan*>]

ENABLE/DISABLE RCVR

Enables or disables the reception of data. Upon execution of ENABLE RCVR the input UART is cleared and prepared to receive serial data.

At reset or power-on, the state stored in the EEPROM is used. If the EEPROM contents are lost, ENABLE RCVR is the default.

Syntax: **ENABLE RCVR** [USE <*chan*>]
DISABLE RCVR [USE <*chan*>]

ENABLE/DISABLE XMIT

Enables or disables the transmission of data from the output buffer. Up to four bytes may be sent after the DISABLE XMIT command is issued. This number depends on the baud rate and the current state of the bytes being output.

ENABLE/DISABLE XMIT state stored in the EEPROM is used at reset or power-on. If the EEPROM contents are lost, ENABLE XMIT is the default.

Syntax: **ENABLE XMIT** [USE <*chan*>]
DISABLE XMIT [USE <*chan*>]

INBUF

INBUF <*bytes*> with SERIAL or USE <*chan*> sets the size of the input buffer. Changing the input buffer size clears the input buffer and any pending interrupts. If the currently set PROTOCOL THRESH thresholds are greater than the new input buffer size, the lower and upper limits are set to 25% and 75% of the new buffer size. If the currently set input buffer THRESH threshold is greater than the new input buffer size, the threshold is set to 50% of the new buffer size. INBUF <*bytes*> with no USE <*chan*> defaults to the HP-IB input buffer size command.

The maximum INBUF size is eight Kbytes. The available sizes are 256, 512, 1024, 2048, 4096 and 80192. Input buffer size stored in the EEPROM is used at reset or power-on. If the EEPROM contents are lost, default INBUF 1024 is set.

Syntax: **INBUF** <*bytes*> [{HPIB|SERIAL|USE <*chan*>}]

INTR Sets the mask for the ENABLE/DISABLE INTR command. The <*mask*> is the sum of all the decimal values for the selected mask. A "1" in a bit enables that bit; a "0" disables it. All of the bits in the selected mask must be enabled before ENABLE INTR will generate an interrupt. You may also set a character to test all input bytes against.

Syntax: INTR <*mask*> [<*character*>] [USE <*chan*>]

Table 3-1. Bit Definition

Decimal Value	Bit	Definition
1	0	Input buffer not empty
2	1	Input buffer (THRESH IN) threshold reached
4	2	Input buffer full
8	3	Break received
16	4	Input NPER expired
32	5	Output buffer empty
64	6	Output buffer (THRESH OUT) threshold reached
128	7	Output buffer full
256	8	Input buffer overflow
512	9	Parity error detected
1024	10	Framing error
2048	11	Receiver overrun
4096	12	Carrier detect changed state
8192	13	Ring indicator changed state
16384	14	Character match detect
	15	-undefined-

MODE Selects the baud rate, parity, number of bits/character and stop bits.

Available baud rates: 300, 600, 1200, 4800, 9600, 19200

Note that 110 baud is not supported. Baud rate values within the range but not listed are rounded up to the next higher rate. Changing the MODE of the HP 44789A during transmission may cause an error.

Available data lengths are either 7 or 8 bits. The number of stop bits may be either 1 or 2. The UART (universal asynchronous receiver transmitter) limitations prevent the use of some combinations of parity, character bits and stop bits. Table 3-2 shows allowable parity and stop bit combinations.

Available parity types are:

NONE	no parity
IGNORE	parity bit is one for output, ignored on input
ZERO	parity bit is always zero
ONE	parity bit is always one
EVEN	even parity
ODD	odd parity

Table 3-2. Parity and Stop Bit Combinations

Parity	Data Bits	Stop Bits 1	2
NONE	7		ok
NONE	8	ok	ok
Parity	8	ok	
other	7	ok	ok

The PACE option inserts delay between the data frames in the sender. Use PACE when the input buffer of a serial port is small and can easily overflow. The <*period*> is from .001 to 60 seconds. See Figure 3-1.

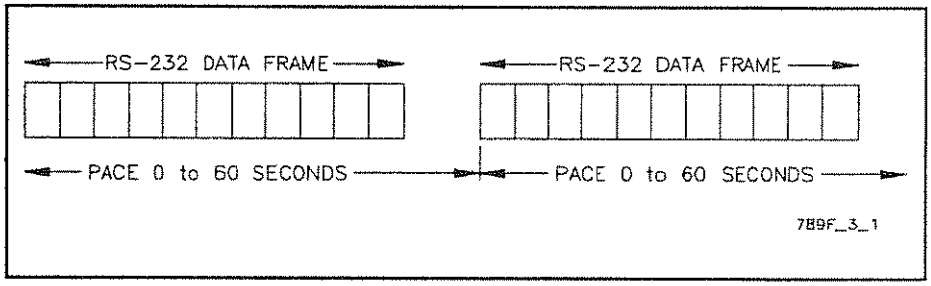


Figure 3-1. PACE

Syntax: MODE <*baud*>,<*parity*>,<*data bits*>,<*stop bits*>,[PACE <*period*>],[USE <*chan*>]

NPER Sets the Number of input character PERiods that must pass with no input received before an Input Buffer Timer interrupt will be generated. The valid range of <*periods*> is 1 to 65535. At reset or power-on, the value stored in the EEPROM is used. If the EEPROM contents are lost, NPER 4 is the default.

Syntax: NPER <*periods*> [USE <*chan*>]

OUTBUF OUTBUF <*bytes*> with no USE <*chan*> defaults to the HP-IB output buffer size command. OUTBUF <*bytes*> with SERIAL or USE <*chan*> sets the size of the output buffer. Changing the output buffer size will clear the output buffer. If the currently set output buffer THRESH threshold is greater than the new output buffer size, the threshold is set to 50% of the new buffer size.

Eight Kbytes is the maximum OUTBUF size. The available sizes are 256, 512, 1024, 2048, 4096 and 8192. Output buffer size stored in the EEPROM is used at reset and power-on. OUTBUF default size is 1024 bytes.

Syntax: OUTBUF <*bytes*> [{HPIB|SERIAL|USE <*chan*>}]

PROTOCOL Selects the protocol used to prevent buffer overflows, on both input and output of the serial interface. Available protocols are:

NONE	No protocol used. Sends whenever bytes are in the output buffer. Too much input will overflow the input buffer.
CTRL	DSR and CTS must be ON to send a character. If RTS IN is set then RTS is set OFF if the input buffer exceeds the upper threshold. RTS is set ON when the lower threshold is reached. If DTR IN is set then DTR is set OFF if the input buffer exceeds the upper threshold and ON when the lower threshold is reached.
XON/XOFF	XOFF received will halt output until XON is received. XOFF is sent if the input buffer upper threshold is exceeded. XON is sent when the lower threshold is reached.
BOTH	Combines CTRL and XON/XOFF modes.

Note To use the RS-422 interface or an RS-232C three-wire connection (Common, TXD, RXD), set PROTOCOL to NONE or XON/XOFF. Otherwise, no output will occur since the unconnected state of DSR and CTS is off.

When PROTOCOL CTRL, XON/XOFF, or BOTH is selected, the lower and upper input buffer thresholds must be specified. These thresholds determine when the control lines are enabled or disabled. When the input buffer upper threshold is reached, THRESH turns RTS OFF (RTS IN), DTR OFF (DTR IN), and/or sends XOFF. This tells the sending device to stop sending data. As the HP 3852 removes bytes from the input buffer the lower threshold limit is reached. This turns RTS ON (RTS IN), DTR ON (DTR IN) and/or sends XON, enabling the sending device to start transmitting data again.

The lower limit must be greater than or equal to zero and less than or equal to the upper limit. The upper limit must be greater than or equal to the lower limit and less than or equal to the input buffer size. Values stored in the EEPROM are used at reset or power-on. PROTOCOL NONE is the default value.

Syntax: **PROTOCOL** {NONE|{CTRL|XON/XOFF|BOTH}, <*lower limit*>, <*upper limit*>} [USE <*chan*>]

RTS Determines the function or state of the RTS line. RTS may be set to either OFF or ON. It may be configured as the standard Request To Send (RTS OUT). It is also used as an input-buffer-available flag for use with many 9600 baud modems (RTS IN). RTS mode stored in the EEPROM is used at reset or power-on. If the EEPROM contents are lost, RTS OUT is the default.

Syntax: **RTS** [{OFF|ON|OUT|IN}] [USE <*chan*>]

STORE CONF

Stores the currently programmed state into the EEPROM. At power-on or reset the conditions stored in the EEPROM will be set. STORE CONF requires about 1.5 seconds to run.

Syntax: STORE CONF [USE <*chan*>]

THRESH

Controls when bits 1 and 6 in the interrupt status are set (see INTR <*mask*> command). For input, the interrupt is asserted whenever the number of bytes in the input buffer is greater than or equal to the threshold. For output, the interrupt is asserted whenever the number of bytes in the output buffer is less than or equal to the threshold.

Thresholds stored in the EEPROM are used at reset or power-on. If the EEPROM contents are lost, THRESH IN 512 and THRESH OUT 512 are the defaults.

Syntax: THRESH {IN|OUT} <*bytes*> [USE <*chan*>]

Programming Commands

Programming commands concern what the sender or receiver do with the data. They also allow you to control the flow of data with other programs.

CLRIN/CLROUT

Clears the input or output buffer of the specified destination. HP-IB is the default destination (for backward compatibility). SERIAL specifies the currently selected SERIAL IS slot.

Syntax: CLRIN [{HPIB|SERIAL|USE <*chan*>}]
CLROUT [{HPIB|SERIAL|USE <*chan*>}]

BREAK

BREAK ON sends a continuous break until BREAK OFF. BREAK ONCE sends a single break character immediately after any byte already being transmitted is sent. This break is sent regardless of the protocol state, the associated lines, and XOFFs.

Syntax: BREAK {OFF|ON|ONCE} [USE <*chan*>]

DEST IS

Enables the output of a command to be directed to a desired destination.

Syntax: DEST IS {SERIAL|HPIB} [USE <*chan*>]

ENABLE/DISABLE SRQ BREAK

Enables/disables the sending of a break to the host computer to indicate SRQ. This command affects only the serial programming port.

Syntax: ENABLE SRQ BREAK
DISABLE SRQ BREAK

ENABLE/DISABLE DCL BREAK

Enables/disables the reception of a break from the host computer to indicate Device CLear. This command affects only the serial programming port.

Syntax: ENABLE DCL BREAK
DISABLE DCL BREAK

ENABLE/DISABLE INTR

Enables/disables the interrupts selected by the INTR command. All interrupt conditions except input/output buffer full/empty and thresholds reached are cleared.

Syntax: **ENABLE INTR** [USE <*chan*>]
DISABLE INTR [USE <*chan*>]

ENTER

Takes input data from a device or file and assigns the values to variables. Numeric characters, decimal point, +, -, e and E are valid characters for ENTER. For further information on ENTER, see your HP 3852 Mainframe "Command Reference Manual".

Syntax: **ENTER** <*path or chan*> <*list*>

INTR?

If <*chan*> is present, returns a 16-bit word indicating the state of all 15 of the interrupting conditions for the channel. This word is bit mapped the same as the INTR mask. INTR? clears the interrupt status for the serial card. Level-sensitive conditions will be set again when the card polls its internal status. Edge conditions (break received, character matched, error detected) will not be set unless the condition occurs again. If <*chan*> is omitted, the mainframe INTR? command is executed, returning the last channel to interrupt.

The HP 3852 BINAND and BINOR commands can be used with INTR? to check the state the state of individual bits.

Syntax: **INTR?** [<*chan*>]

ON INTR

Specifies a subroutine to be executed or run upon an interrupt from the specified channel (for information on subroutines see the HP 3852 Mainframe "Command Reference Manual").

Syntax: **ON INTR** [USE <*chan*>] {CALL <*sub*> | RUN <*sub*>, <*task*>}

OUTPUT

Outputs data to a specified destination. Destination can be an I/O path name or a device selector. For further information on OUTPUT, see your HP 3852 Mainframe "Command Reference Manual".

Syntax: **OUTPUT** <*path or chan*> <*list*>

READ

All of the connector lines are read and returned as a bit-mapped integer (the decimal sum of the bits set to "1"; a "1" means "set" or "on", a "0" means "off"). Table 3-3 shows the decimal bit values.

Table 3-3. Decimal Bit Values

Bit	Decimal Value	Line
0	1	DSR
1	2	DTR
2	4	CTS
3	8	RTS
4	16	DCD
5	32	RI
6	64	TXD
7	128	RXD

Syntax: READ <*chan*>

SERIAL

SERIAL OFF/ON eliminates wait time for certain commands sent to some multiplexer and switching accessories (see SERIAL command in the HP 3852 Mainframe "Command Reference Manual").

SERIAL IS USE <*chan*> selects the serial channel that will be used as a programming port after the next reset or power-on. SERIAL IS NONE deselects any serial channel. Only one serial channel may be selected at any time. Channel selected is stored in mainframe non-volatile RAM. It will be used for all succeeding resets or power-on.

Selecting a serial channel will leave the mainframe with approximately 1250 fewer bytes of available memory.

Syntax: SERIAL [OFF|ON|IS {NONE|USE<*chan*>}]

TIMEOUT

Timeout is the amount of time the HP 44789A will wait between receiving characters before declaring a timeout error. The HP 3852 timeout period is used. The allowable timeout periods are .001 sec to infinity. A 0 represents infinity. For further information see your HP 3852 Mainframe "Command Reference Manual".

Syntax: TIMEOUT <*time*>

WRITE

Allows you to send decimal equivalent of a desired ASCII bit pattern. The allowable range is 0 to 255. You can send the characters as a data list or an array. The WRITE command does not affect the index of an array. WRITE requires 300 μsec overhead plus 80 μsec per byte. Timeout used is the present overall system timeout. Timeouts which are an integer number allow the fastest WRITE. The following two examples WRITE decimal 75 (ASCII K).

```
WRITE 2300 75                    ! "K" sent to slot 23
```

```
INTEGER I(8)
MAT I = (75)
WRITE 2300 I                    ! "KKKKKKKKK" sent to slot 23
```

Syntax: WRITE <*slot*> [data list | array]

XRDGS

Allows you to transfer bytes from the HP 44789A into an array. The index of the array is automatically increased by the number of elements transferred.

The <*number of bytes*> determines how many bytes are sent. You can choose a positive integer, a negative integer or 0. A positive integer transfers that number of bytes. A negative integer transfers as many bytes as are found in the HP 44789A, up to the absolute value of the integer. A 0 transfers all the bytes in the HP 44789A. The default value is 1.

If the array is not large enough for all of the bytes, an error is declared and no bytes are transferred. The best way to transfer an unknown number of bytes is to use a negative integer whose absolute value is less than the number of empty spaces in the array. XRDGS requires 700 μsec overhead plus 180 μsec per

bytes. Timeout used is the present overall system timeout. Timeouts which are integer numbers allow the fastest XRDGS. The following examples show how to use XRDGS.

```
INTEGER I(199)
XRDGS 2300 0 INTO I             ! Transfers all bytes into I. If there are more than 200, an error is declared.

INTEGER I(8)
XRDGS 2300 -9 INTO I            ! Transfers up to 9 bytes into I
```

Syntax: XRDGS <*slot*> [number of bytes] INTO

Additional Programming Commands

There are six HP 3852 programming commands which affect the HP 44789A. These are: ASSIGN, ENTER, OUTPUT, PRINTER IS, PRINT and TIMEOUT. For a complete description of these commands, see your HP 3852 Mainframe "Command Reference Manual".

Multi-tasking Commands

There are four HP 3852 multi-tasking commands which affect the HP 44789A. These commands are ABORT SERIAL, PAUSE SERIAL, PROBE and SIGNAL SERIAL. For a complete description of these commands, see your HP 3852 Mainframe "Command Reference Manual".

Data Flow Control Diagrams

PROTOCOL commands determine which series of events will enable or disable data transmission. These sequences are called data flow control loops. Each PROTOCOL parameter has a different data flow control loop. These loops monitor input buffers, output buffers and control lines. Some PROTOCOL commands override control lines to enable or disable transmission.

There are four data flow control diagrams, one for each PROTOCOL parameter. The diagrams describe the continuous decision process which takes place every 0.5 milliseconds.

PROTOCOL NONE

This is the simplest control loop. There are no thresholds to compare the input data buffer count to and likewise there are no responses. SERIAL IS USE *<chan>* establishes a continuous communication link.

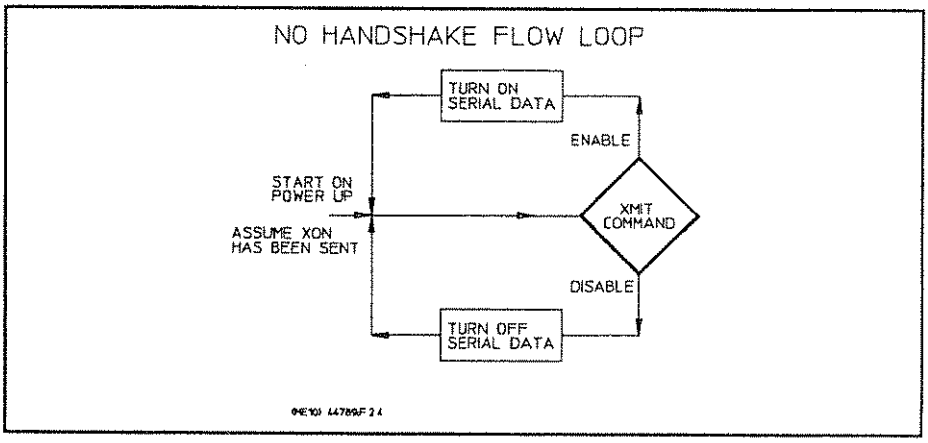


Figure 3-2. PROTOCOL NONE Flow Diagram

PROTOCOL XON/XOFF

The input data flow is controlled by sending XON or XOFF to the sender over the RS-232C interface. Likewise, outgoing data is controlled by receiving XON or XOFF from the other unit.

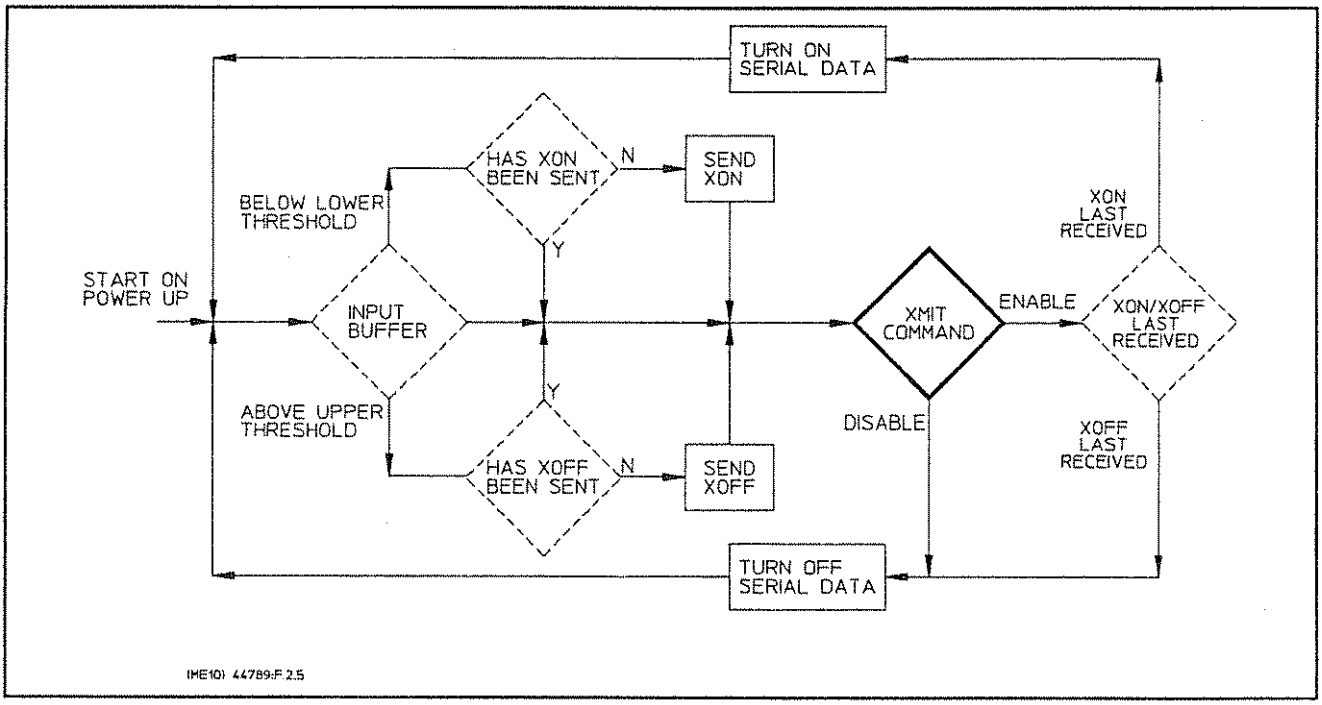


Figure 3-4. PROTOCOL XON/XOFF Flow Diagram

PROTOCOL CTRL (Hardware)

There are several ways the hardware handshake may be used. The hardware protocol is altered by how RTS and DTR are used. RTS and/or DTR may be controlled by the input buffer data count or look like a standard RTS and DTR.

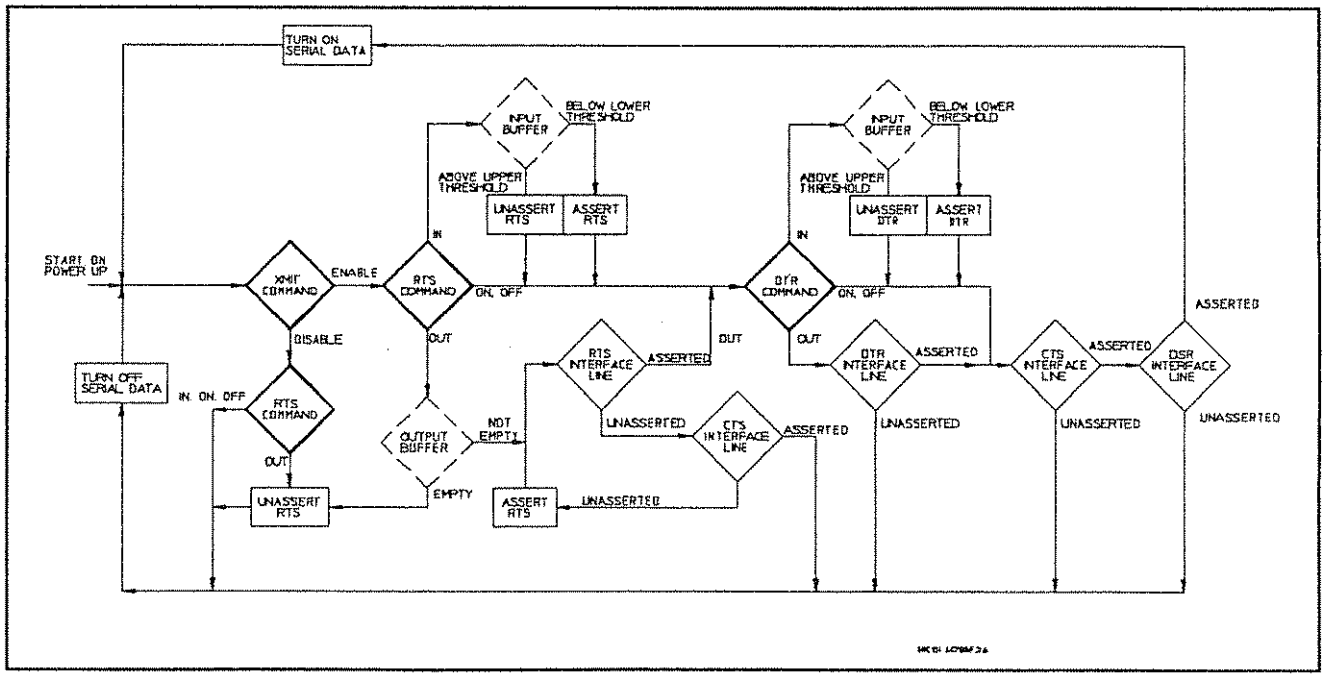


Figure 3-3. PROTOCOL CTRL (Hardware) Flow Diagram

PROTOCOL BOTH

When both XON/XOFF and CTRL protocols are used together, the two protocols are combined. When XON or XOFF needs to be sent to the other unit, the hardware protocol must be completed before XON or XOFF is sent. It is easiest to think of the XON or XOFF as being pushed into the front of the output buffer and, when allowed by the hardware handshake, they are sent out. DISABLE XMIT cannot stop an XON or XOFF from being sent.

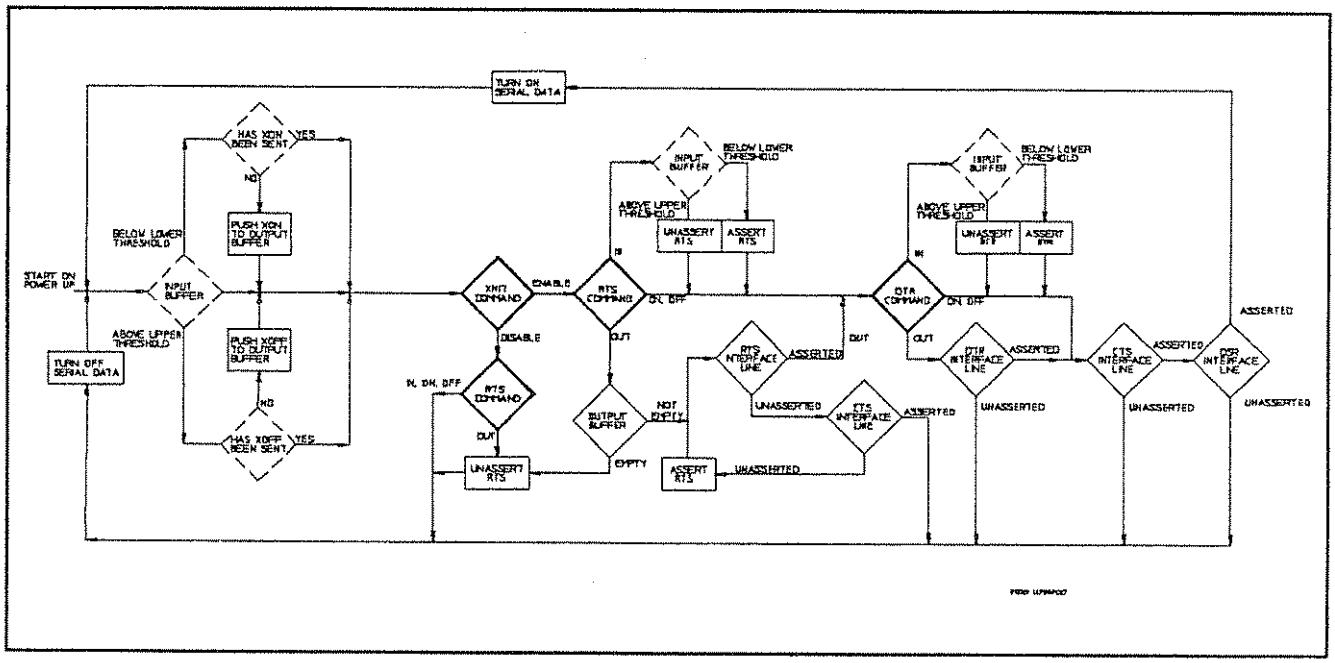


Figure 3-5. PROTOCOL BOTH Flow Diagram

Troubleshooting RS-232C Connections

There are four components of an RS-232C communication link through the HP 44789A Serial Interface Accessory. An error in any one of them will break the communication link. These four components, and the associated critical parameters, are:

HP 3852 (SERIAL IS USE <*chan*>)
HP 44789A (MODE, PROTOCOL)
Cable (Pins wired to proper pins)
Peripheral (<*baud*> <*parity*> <*data bits*> <*stop bits*> <*protocol*>)

If you are using one of the peripherals mentioned in this manual, and have verified the above four components, the communication link should work. If it does not, then one of the components is most likely defective. Change the components one at a time until you get the system to work. This will help you isolate the defective component. If you are using a peripheral other than those listed in this manual, see the following section.

Using the READ Command

The READ command returns a bit-mapped decimal value which reflects the state of the pins. You can use this command to determine which pins are asserted or deasserted. If you are trying to connect a terminal or computer, set PROTOCOL to NONE and transmit the command BEEP; from the terminal to the HP 3852. You should hear a beep. If you do not hear a beep, then one by one set the control lines to ON and transmit BEEP;. There are four control lines, so there are 16 possible combinations. Use the READ command between each change of settings to determine if the new settings cause the terminal to assert or deassert a line. You can also use the INTR? command to determine changes.

When you get a character to transmit, you know which control lines the terminal needs to transmit. You then need to find out which control lines it uses to receive and to signal that the buffer is full. One by one set the control lines to ON and transmit a character from the HP 3852. Use the READ command to find the state of the bits when the peripheral is receiving data. Then use the WRITE command to send a large array which should overflow the input buffer on the peripheral. Use the READ command again to determine which line the peripheral sets for input buffer full. The WRITE command will also verify full handshaking capability.

Once you have determined the necessary handshake for the peripheral, you can jumper the RS-232C port, use a Micropatch wiring adapter (see table 1-1), make a custom cable or use software handshaking.

If you still cannot get your peripheral to work, check to see if TxD and RxD are on the proper pins. The peripheral may also be using pins other than those supported by the HP 44789A. In that case you will need a breakout box. The book listed in Table 1-1 is an excellent reference for troubleshooting non-standard RS-232C interfaces.

Signal Levels and Logic States

Signal level refers to the magnitude and polarity of a signal on a line. Logic state refers to whether a given signal represents a 0 or 1 for data lines and asserted/enabled or deasserted/ disabled for control lines. Data lines and control lines do not use the same convention.

For an RS-232C data line, a logic 0 is represented by a voltage between +5 and +15 volts for output and between +3 and +15 volts on input. A logic 1 is represented by a voltage between -5 and -15 volts for output and between -3 and -15 volts for input. Voltages outside of those limits represent undefined logic states.

For RS-232C control lines, an assert/enable is represented by a voltage between +5 and +15 volts for output and between +3 and +15 volts on input. A deassert/disable is represented by a voltage between -5 and -15 volts for output and between -3 and -15 volts for input. Voltages outside of those limits represent undefined logic states.

Appendix A

A

Command Summary Quick Reference

Common Commands:

ID? <*slot*>
RST <*slot*>
TEST <*slot*>
USE <*chan*>

Configuration Commands:

DTR [{OFF|ON|OUT|IN}] [USE <*chan*>]
DISABLE RCVR [USE <*chan*>]
DISABLE XMIT [USE <*chan*>]
ENABLE RCVR [USE <*chan*>]
ENABLE XMIT [USE <*chan*>]
INBUF <*bytes*> [{HPIB|SERIAL|USE <*chan*>}]
INTR <*mask*> [<*character*>] [USE <*chan*>]
MODE <*baud*>, <*parity*>, <*data bits*>, <*stop bits*>,[PACE <*Period*>][USE<*chan*>]
NPER <*periods*> [USE <*chan*>]
OUTBUF <*bytes*> [{HPIB|SERIAL|USE <*chan*>}]
PROTOCOL [NONE|{CTRL|XON|BOTH}],<*llimit*>, <*ulimit*> [USE <*chan*>]
RTS [{OFF|ON|OUT|IN}] [USE <*chan*>]
STORE CONF [USE <*chan*>]
THRESH {IN|OUT} <*bytes*> [USE <*chan*>]

Programming Commands:

BREAK {OFF|ON|ONCE} [USE <*chan*>]
CLRIN/CLROUT [{HPIB|SERIAL|USE <*chan*>}]
DEST IS {SERIAL|HP-IB} [USE <*chan*>]
DISABLE DCL BREAK
DISABLE INTR [USE <*chan*>]
DISABLE SRQ BREAK
ENABLE DCL BREAK
ENABLE INTR [USE <*chan*>]
ENABLE SRQ BREAK
INTR? [<*chan*>]
ON INTR [USE <*chan*>] {CALL <*sub*> |RUN <*sub*>,<*task*>}
READ <*chan*>
SERIAL [OFF|ON|IS {NONE|USE <*chan*>}]
WRITE <*slot*> [data list|array]
XRDGS <*slot*> [number of bytes] INTO

Information on the following commands is in the HP 3852 mainframe programing Command Reference manual.

ASSIGN <*path*> TO {<*chan*>|*}
ENTER <*path or chan*> <list>
OUTPUT <*path or chan*> <*list*>
PRINTER IS <*chan*>

PRINT <*list*>
TIMEOUT <*time*>

Multitasking Commands:

Multi-tasking Commands are HP 3852 mainframe commands which also apply to the HP 44789A. For further information, see your HP 3852 manual.

ABORT SERIAL
PAUSE SERIAL
PROBE
SIGNAL SERIAL

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