

# *The Software Toolworks*

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REACH: Remote Access Computer - H89  
Computer Satellite System  
Release 1.3 - 4/24/81  
by Walt Bilofsky

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### 1. WHAT IS REACH?

REACH is a software system which turns the Heath H89 or Zenith Z89 computer into a powerful remote timesharing station, and allows the exchange of text data files between the H89 and another computer using a standard terminal connection. The H89, with built-in floppy disk and optional hard copy device, connects to the other computer through an RS-232 interface, perhaps using a modem and telephone line. Using REACH, the H89 can act as a terminal at speeds up to 9600 baud, and exchange files at speeds up to 4800 baud.

File transfer is straightforward and does not require complex protocols. The remote system treats the H89 as a terminal, and text that is output to it may be spooled by REACH to the H89 disk and printer. Files may be inserted from the H89 disk as if they had been typed. Except for special function keys f1-f5, all keys, including BREAK, are transmitted to the remote computer. REACH may be configured to operate with line protocols (XON-XOFF, DC1-DC3 or similar) for lossless data transfer to remote computers, such as some IBM machines, which employ such a protocol.

The minimum hardware required to run REACH is an H89 or Z89 and an H88-3 Serial Interface connected to a modem or another computer. REACH also supports an optional H14 or most other printers. REACH comes in versions for the HDOS and CP/M operating systems.

IMPORTANT: The LP and DTE interrupt jumpers on the H88-3 Serial Interface board must be set to select interrupt level 3 (or another interrupt level if you have patched REACH as described in Section 8 of this document). If the jumpers are set to OFF, as suggested in the H88 Operation Manual, REACH will not operate properly. Setting the jumpers to interrupt level 3 will not affect normal computer operation.

Note: The H89 and Z89 computers are identical as far as REACH is concerned. The term "H89" is used in this document to refer to either computer.

## 2. INTRODUCTION.

Making two computers "talk" to each other seems like a deceptively simple task, but it is really quite complex. First, the computers must be connected through hardware to allow them to exchange characters of data. Then one or both machines must be programmed, so that they both agree on when they expect to send and receive characters, and what the characters mean.

One standard hardware connection is an RS-232 serial line. The H88-3 Serial Interface provides two serial ports for RS-232 lines. REACH uses one of these ports (usually the DTE port at address 330), which is a connector on the rear apron of the H89. This port is usually connected to a modem, which is used with a telephone to dial into a remote computer - either a large timesharing computer, or another H89. Alternatively, the serial port may be connected directly to a serial line running to a computer in the same building. We will call the remote computer the host.

Computers go through all sorts of contortions to exchange data with other computers, but terminals are relatively simple and every host knows how to deal with them. So REACH makes the H89 look like a terminal. Most of the time, the H89 is used just as if it were a dumb terminal (an H19, for example). For transferring files or printing, REACH takes care of the operation, and the remote host never knows that anything special is going on.

## 3. OPERATION.

### 3.1. Setting Up and Running REACH

This section gives a quick summary of how to operate REACH. It assumes you have the following equipment:

- o An H89 with H88-3 serial interface.
- o A 300 baud modem, connected to the DTE serial connector on the H89 back panel (the connector at port address 330).
- o An optional H14 printer, connected to the Line Printer serial connector on the H89 back panel (port address 340), and configured to operate at 4800 baud

REACH can also be used with different hardware configurations. Refer to Section 8 of this document for instructions. (

To run REACH, copy the file REACH.ABS (REACH.COM on CP/M) from the distribution disk to your system disk, and type the command

REACH. REACH will start up, and type out the following function key summary:

- f1 = Printer On/Off
- f2 = Spool to Disk
- f3 = Spool from Disk
- f4 = Display Options Menu
- f5 = Display this Menu

Function key f5 will redisplay the function key summary at any time, for easy reference.

Once REACH is running, you may connect the H89 to a remote computer. With most modems, this is done by dialing the computer and placing the telephone handset into the modem unit. When the computer answers the phone, the H89 will act just like a terminal on the remote host computer. Everything typed on the keyboard (except function keys f1 through f5) will be sent to the host, and characters sent by the remote computer will appear on the H89 screen. Local echoing of typed characters (half duplex) may be selected (see Section 8).

REACH may also be used to allow two H89s to communicate with each other and to transfer files. This can be done with a direct cable connection between the serial ports of the two machines, or by telephone if one of the modems is capable of "answer" or "receive" operation. If a direct cable is used, it must connect pin 2 on each H89 to pin 3 on the other, and pin 7 to pin 7.

If a computer other than an H89 is on the other end of the cable, it may require jumpers on its connector between pins 4 and 5, and between pins 6, 8 and 20. In order to use REACH with the other computer, the H89 must be connected to the other computer as if the H89 were an external terminal. How to do this depends on the other computer; consult its manuals or technical assistance sources for more information.

### 3.2. Operating REACH

This section tells briefly how to use the major features of REACH, so you can get started without going through all the details of this manual. Sections 4 through 7 provide more information on each of the functions summarized here.

PRINTING. To print, press the f1 function key. Everything typed on the screen, by you or the remote computer, will also be printed out on the printer. To terminate printing, press f1 again.

DATA TRANSFER FROM REMOTE HOST. To copy data from the remote computer to your disk, press the f2 function key. REACH will ask for the name of the local disk file to be written. Type the name, terminated by the RETURN key. Everything typed on the screen from this point on will also be stored in the H89 and eventually written to the named disk file. To terminate this

mode and write the file out, press f2 again.

DATA TRANSFER TO REMOTE HOST. To copy data to the remote computer from a disk file, press the f3 function key. REACH will ask for the name of a disk file. Type the name, terminated by the RETURN key. REACH will send the contents of the named file to the remote computer just as if you had typed it on the keyboard (but faster!). REACH will terminate this mode when the file has been sent, but you can quit sooner by pressing f3 again.

If you want to store the file on the remote host, you will have to get the remote host ready to receive the file before you send it from REACH. How you do this depends on the particular remote host, but two possible ways are (1) first type a command for the remote host to copy from its terminal to a file, or (2) get into its editor in a text entry mode.

EXITING. To terminate REACH, press the f4 function key. Following this, typing either a 7 or an 8 will cause REACH to exit and return to system command level. Some modems allow the H89 to hang up the phone automatically. On these modems, exiting with a 7 will hang up, while exiting with an 8 will keep the line open and the remote host "on hold". This allows you to perform commands and run programs, then run REACH again and resume conversing with the remote host.

ERROR MESSAGES. Occasionally, error messages will appear on the bottom line of the screen. These messages will go away after about 20 characters of input have been typed from the keyboard.

#### 4. PRINTING.

##### 4.1. Normal Operation with H14 Printer.

If a printer is connected to the H89, REACH can be used to print the characters transmitted from the remote computer at the same time these characters appear on the H89 screen. REACH is set up for operation with an H14 printer connected to port 340, and running at 4800 baud. For other printers, see the following section.

When function key f1 is pressed, the line printer is enabled. The message "LP on" will appear at the bottom of the screen, along with the number of free bytes remaining in the buffer. When the printer is on, all characters sent to the screen by the remote computer will also be printed on the printer.

To turn printing off, press f1 again. The message will change to "LP off". If the printer is unable to keep up with the rate of transmission from the remote computer, REACH will buffer the data using the free memory area. The characters in the buffer will continue to be sent to the printer until it has caught up. When the printer has finished printing all the characters, it will eject a page and the "LP off" message will disappear.

Should you wish to abort the printout before the printer has caught up, press f4 (which will display a menu of options), followed by the letter A. The printer will eject a page and the remainder of the data in the buffer will be discarded.

To resume printing, press f1 again. It is not necessary to wait for the printer to catch up before doing this. The printer will still eject a page at every point at which printing was turned off.

#### 4.2. Using Other Printers.

Printers other than the H14 may be used with REACH, as long as they are capable of keeping up with the modem, or can function with an XOFF-XON type of line protocol. This protocol is simple. The H89 transmits data to the printer, which saves the characters in a buffer until it can print them. When the buffer is full, the printer sends the character XOFF (sometimes called ctrl-S, or DC1) to the H89. REACH then stops sending to the printer. When the buffer has room for more characters, the printer sends the character XON (sometimes called ctrl-Q, or DC3) to the H89. REACH then resumes transmission.

Many printers follow, or can be set with an internal switch to follow, this protocol. To find out if a particular printer can, check the printer's manual for instructions regarding XON-XOFF, or DC1-DC3.

Some printers send a signal over the RS-232 interface to indicate they are ready to accept a character. REACH can be configured to work with such printers; see Section 8.3.

If a printer can not follow either protocol, it may still be possible to use it with REACH provided it is capable of accepting continuous data transmission at some speed. Section 8.1 tells how to patch REACH to run the printer at a speed other than 4800 baud.

#### 4.3. Special Printer Characters.

When printing, REACH will automatically translate tabs into the required number of spaces for the printer, assuming tab stops every 8 columns. All other control characters are passed directly to the printer by REACH.

At the end of each line, REACH transmits a CR followed by an LF.

When the printer is turned off by the f1 key, REACH transmits a form feed (FF) control character.



## 5. DATA TRANSFER FROM REMOTE HOST

### 5.1. Normal Data Transfer.

To transfer data from the remote computer to a disk file, press f2. REACH will ask you to type a file name, followed by the RETURN key. After you have done this, all data sent to the screen by the remote computer will be stored in memory and eventually written to the file you have named. The bottom line displays the name of the file, the number of bytes left in the buffer, and the number of blocks that will be used in the file.

To terminate the transfer and cause the file to be written onto disk, press f2 again. At this time, the disk will be active for several seconds, and characters sent by the remote computer during this time may be lost.

If f2 is hit by accident, it is possible to get out by typing an illegal file name (such as "?") followed by RETURN. REACH will detect the illegal file name and ignore the f2 function.

If the buffer becomes full, REACH will have to ignore the incoming characters for a few seconds while it writes to the disk. It will first try to tell the remote computer to stop transmitting by sending it the XOFF character (ctrl-S). If the remote host does not recognize this signal, some data may be lost; this can be avoided by transmitting the data using a larger number of smaller files. If the remote host requires protocol characters other than XOFF and XON, see Section 8.2.

It is possible that data will be lost when running at a high speed (9600 baud or more). If this should occur, it can be avoided by forcing the remote host to insert a delay following the transmission of each line. Since many older terminals require such a delay, most operating systems have a command to provide it. Consult the manual for your remote host's operating system.

### 5.2. End of Line Considerations.

There are several ways for indicating the end of a line, depending on where data is being stored or which computer is transmitting to what kind of device. This can create problems in transferring data. Most of the time, REACH deals with these problems and the user can ignore them. However, occasionally it is useful to know what is really going on.

HDOS files are stored with a LF (12Q) at the end of each line; CP/M files terminate a line with a CR followed by an LF. When REACH transmits a file, the end of line is normally sent as a CR (15Q). This is the character which terminals transmit when the RETURN key is pressed, and since the remote host thinks the H89 is a terminal, it expects to see a CR.

Similarly, the remote host thinks it is sending data to a

terminal, so most remote hosts will send an end of line using CR followed by an LF. When receiving from the remote host, REACH deals with these characters in a slightly nonstandard way. A CR character sent by the remote host is taken as the end of line. It is echoed to the screen (and printer, if selected) as a CR followed by an LF, and, when transfer to disk is selected, it is stored as an LF on HDOS or CR-LF on CP/M. An LF character received from the remote host is ignored.

Using this method, REACH will correctly receive lines sent either by a computer (terminating in CR-LF) or by a terminal (terminating in CR) - including another H89 running REACH. So REACH may be used not only to dial up a remote timesharing system, but also to connect to another H89, or to any other personal computer running a program which makes it look like a terminal.

Occasionally, however, a remote host will transmit extra CR characters, or transmit several consecutive blank lines by LF characters with no intervening CRs. This would not be noticed on most terminals, but REACH will insert an extra blank line for each CR, and ignore multiple LFs. For situations where this causes a problem, REACH provides a Literal End-of-Line mode which can be selected either by menu (See Section 7) or by a patch (Section 8.2). In this mode, all bytes are transmitted to and from H89 files just as they were sent. (However, the eighth bit, or parity bit, is never transmitted or received as a data bit.)

## 6. TRANSFER FROM DISK.

To transfer data from the H89 disk to the remote computer, press function key f3. REACH will ask for a file name, terminated by a RETURN. After you press the RETURN, REACH will insert the contents of the named file, just as if you had typed it.

Data transmission will stop automatically when the file is completely sent. To stop transmission at any time, press f3 again.

If f3 is hit by accident, it is possible to get out by typing an illegal file name (such as "?") followed by RETURN. REACH will detect the illegal file name and ignore the f3 function.

Some remote computers may not be able to accept data as rapidly as REACH sends it. REACH attempts to accommodate most computers by inserting a delay of two character transmission times following the end of each line. Due to the delay in remote echoing, it may appear as if the delay occurs several characters before the end of the line, but this is not the case. Should a longer, fixed delay be required, REACH can be patched to provide it (see Section 8.2).

Sometimes a fixed delay is not sufficient. REACH provides two transmission protocols which will allow data transfer with most timesharing systems. Both protocols use the XOFF-XON type of

flow control.

Some computers will transmit an XOFF control character when unable to receive any more data. When REACH is transmitting a file, and receives an XOFF, it will cease transmission. When the remote host transmits an XON control character, transmission resumes.

Some computers expect that the terminal will stop transmitting at the end of each line, and automatically wait for the remote host to send an XON character before the terminal transmits the next line. Many IBM systems operate in this mode, which is sometimes called Teletype paper tape mode, XON-XOFF, or DC1-DC3 mode. REACH can be patched to operate in this mode; see Section 8.2. If the remote host requires it, REACH can also be patched to automatically transmit an XOFF character at the end of each transmitted line, and to use control characters other than XOFF and XON. (Note that DC1 and DC3 are alternate names for XOFF and XON.)

Occasionally, a locked state may arise, in which the remote host is waiting for the H89 to send data, and the H89 is waiting for the remote host to send an XON. In this case, the H89 may be unlocked by pressing the BREAK key. This will cause REACH to act as if it had received an XON from the remote host. (If the H89 is not waiting for an XON, the BREAK key will perform its normal function of transmitting a break signal.)

## 7. MENU-SELECTABLE FUNCTIONS.

REACH contains a number of special commands which may be executed from a menu. Pressing the f4 function key displays the following menu:

### REACH Options Menu:

- \* 0: Change the Diskette in SY0:.
- \* 1: Change the Diskette in SY1:.
- \* 2: Change the Diskette in SY2:.
- 3: Enter Normal Mode.
- 4: Enter Literal Mode.
- 5: Turn On Local Echoing of Typing.
- 6: Turn Off Local Echoing of Typing.
- 7: Hang up on MODEM and Exit.
- 8: Exit without Hanging Up.
- 9: Do Nothing; Continue REACH Operation.
- A: Abort Printer Operation.

(\* These functions for HDOS only; CP/M versions differ.)

When this menu is displayed, typing one of the characters listed will perform the designated function. To return to REACH operation without doing any function, type 9.



Under HDOS, typing 0, 1 or 2 allows the diskette (if any) in the corresponding drive to be removed and another one inserted. NOTE: The system will hang if an attempt is made to perform this operation on a drive that does not exist. If this is done accidentally, it will be necessary to reboot HDOS and run REACH again.

Under CP/M, you may insert a disk into a vacant drive without any special action. Selecting function 0 under CP/M will reset all disks, allowing you to remove the disk in any or all drives and insert a different disk.

Typing 4 enters Literal End-of-Line mode (Section 5.2). Typing 3 returns to Normal End-of-Line Mode.

Typing 5 enters half duplex operation (local echoing). In this mode, any character transmitted to the remote host is also treated as if it had been received from the remote host. Typing 6 enters full duplex operation (remote host echoing).

Typing either 7 or 8 causes REACH to exit to the operating system command level. Normally, it is possible to exit, run one or more commands or programs, and then run REACH again to continue with the remote host. Some modems will hang up if the H89 does not keep the interface active (DTR and RTS signals on). These modems will hang up if function 7 is selected. Function 8 will leave these signals on, thus keeping the remote host "on hold". Any data sent by the remote host while REACH is not running will be lost, and will not interfere with normal computer operation.

Typing A aborts any current output to the line printer. If the printer runs slower than the modem, it may still be printing to catch up on data that has already been transmitted. This function allows such catch up printing to be aborted.

## 8. CONFIGURATION.

When you receive it, REACH is configured to operate with the standard hardware configuration described in Section 3.1. You may patch the REACH program file to configure REACH to operate with many other hardware setups, to use different protocols for operation with different remote hosts, and to use different default modes of operation.

Section 8.4 gives directions for making patches to the REACH program. Patch addresses and values are given both in split octal notation, for HDOS systems, and in hexadecimal, for CP/M. Some values occupy two bytes or locations. In this case, the actual stored value is the sum of the value in the first location, and 256 times the value in the second location.

Since the address locations for patches may vary with the release of REACH, the patch locations for your version are given in the file PATCHES.DOC on your REACH distribution disk.

### 8.1. Peripheral Device Parameters

REACH may be used with any configuration of port assignments and baud rates. This is done by patching the peripheral device tables in the REACH executable file as explained in Section 8.4. The following table shows the default settings and meanings of the entries in the modem, printer and console device tables. File PATCHES.DOC gives the address of the first byte of each of these tables, and the addresses of the other flags referred to below.

<u>Table Entry</u>	<u>Modem</u>	<u>Printer</u>	<u>Console</u>	
			<u>Oct</u>	<u>Hex</u>
Port Address	330 D8	340 E0	350	E8
Baud Rate Div. - Low	200 80	030 18	014	0C
	High 001 01	000 00	000	00
Control Register	036 1E	036 1E	036	1E
Interrupt Level	003 03	003 03	003	03
CTS Test Flag	000 00	000 00	000	00
Interrupt Enable Reg.	001 01	001 01	005	05
Line Protocol: XOFF	023 13	023 13	000	00
	XON 021 11	021 11	000	00

Port Address and Baud Rate. For each peripheral device, the first byte in its table is the port address of the device. Next, the two Baud Rate bytes contain the Baud Rate Divisor Latch value, which determines the data rate of the device. The values for each baud rate are given in Table I (Section 8.5). This entry is ignored for the console terminal; REACH leaves its speed alone.

Control Register. The Control Register byte specifies the contents of the Line Control Register (Table II, Section 8.5) which determines the parity and stop bit parameters of the serial interface. All interfaces are initially set to send even parity and 2 stop bits. REACH does not check received data for parity or break conditions.

Interrupt Level. The Interrupt Level entry specifies the interrupt level at which the serial interface is configured by the programming jumpers on the H88-3 Serial Interface Board. The permissible values are 3, 4 or 5. REACH is initially configured to operate all devices at level 3. Some other modem programs use level 5, and if these programs are run on the same machine it may be desirable to patch REACH to operate the modem at level 5. If the jumpers are in the OFF position, REACH will not function.

The CTS flag controls printer hardware handshaking; see Section 8.3 for details. The Interrupt Enable entry is used to set the Interrupt Enable Register in the RS-232 driver. This value should not be changed.

Local Echoing. REACH is initially configured for full duplex operation (i.e., the remote host echos typed characters). To

configure for half-duplex operation (local echoing), set the Half-Duplex flag to a nonzero value. This option can also be changed while REACH is running; see Section 7.

The Break Duration location contains the duration of the break signal (line low condition) transmitted on the modem whenever the BREAK key is depressed (except when modem transmission is locked; see Section 6). The duration is in multiples of 2 msec., with the low order byte first. The default entry is 372, 000 octal (FA, 00 hex), corresponding to a 500 msec. duration.

## 8.2. Line Protocol Parameters

The Line Protocol bytes specify the protocol characters for output data flow control during transmission of a file from the H89 to the remote host.

In the modem and printer device tables, a flag is maintained which, when on, keeps REACH from transmitting data to the device. If the XON Line Protocol byte is nonzero, it specifies a character which, when received from the device, sets the flag off, permitting data flow. If the XOFF byte is also nonzero, it specifies a character which sets the flag on, halting data flow. These special characters are only used for data flow control and are not passed through with the other received data. Line protocol is operative on the modem line only when a file is being transmitted.

The Xmit Protocol flag is used to select a modem protocol in which REACH waits for an XON after every transmitted line. If the flag is set to 377 octal (FF hex), REACH, after sending each CR, waits for the remote host to send the XON character specified in the modem device table. If the flag is set to any other nonzero value, REACH will send that value following the CR, and wait for the XON character.

During data transmission from a disk file, REACH normally delays two character transmission times after transmitting each line. Should it be necessary to provide a larger fixed delay after each line, patch the four bytes at the line-transmission delay location given in file PATCHES.DOC. Replace the bytes 313, 054, 313, 035 (hex CB, 2C, CB, 1D) by 041, LLL, HHH, 000 (hex 21, LL, HH, 00); where HHHLLL is the delay desired, as a multiple of 2 msec.

The End-of-Line Mode flag determines whether REACH operates in Normal or Literal End-of-Line Mode, as described in Section 5.2. The flag is normally 1. To patch REACH to come up in Literal End-of-Line Mode, change it to 0.

### 8.3. Printer Control Signals.

Some printers prefer to use a control signal rather than an XON-XOFF protocol for data control. If the CTS flag is nonzero, REACH will not transmit data to the device unless it is asserting the ready signal.

There are two signals which the printer might use. Most printers use a signal called DTR (Data Terminal Ready). Some printers use a signal called CTS (Clear to Send). The value of the CTS flag determines which ready signal REACH checks for. If the CTS flag is 20 octal (10 hex), REACH tests for the CTS signal. If the CTS flag is 40 octal (20 hex), REACH tests the DTR signal.

If your printer's manual does not mention either of the above signals, but does refer to DSR (Data Set Ready), consider that to be the DTR signal. If RTS is referred to, but not CTS, try using RTS instead of CTS.

Some printers, such as the H14, may send the reverse of the control signal. For REACH to use hardware handshaking with such printers, it is necessary to patch the program to reverse the signal. At the location given in file PATCHES.DOC to reverse CTS/DTR, change 312 (CA hex) to 302 (C2 hex). Note, however, that this is not necessary when using REACH with the H14, since the H14 uses XON-XOFF and does not require hardware handshaking with REACH.

### 8.4. How to Patch REACH.

On HDOS: The PATCH program is included on the HDOS system disk. To patch REACH, copy PATCH.ABS onto the system disk in use, if necessary. Then type the command PATCH. When the program asks for a file name, type REACH. PATCH will then ask for an address; type the address you wish to change. PATCH types the present value. To insert a new value, type the value and a return; to leave the present value unchanged just type a return. PATCH will go on to the next location. Typing a Ctrl-D returns to the address prompt; typing another Ctrl-D closes the file; a third Ctrl-D exits to the HDOS monitor.

On CP/M: Make sure the files DDT.COM (included in your CP/M distribution) and REACH.COM are on your current working disk. Then type the command "DDT REACH.COM". When the "-" prompt appears, you may type the command "Snnnn", where nnnn is the hex address to be patched. The address and contents are displayed. You may type a hex value followed by RETURN to insert that new value, or a RETURN to leave the old value unchanged. Typing the character "." followed by RETURN will return to the "-" prompt. When you have made all desired patches, hold down the CTRL shift and press the "C" key. When the "A>" prompt appears, type the command "SAVE 17 REACH.COM".

## 8.5. Device Configuration Parameter Values

TABLE I. BAUD RATE PARAMETER VALUES

Speed (Baud)	Table Entry	
	Byte 1	Byte 2
	oct hex	oct hex
75	000 00	006 06
110	027 17	004 04
134.5	131 59	003 03
150	000 00	003 03
300	200 80	001 01
600	300 C0	000 00
1200	140 60	000 00
2400	060 30	000 00
4800	030 14	000 00
9600	014 0C	000 00
19200	006 06	000 00

TABLE II. LINE CONTROL REGISTER VALUES

Status	Value
	oct hex
5 Bit Characters	000 00
6 Bit Characters	001 01
7 Bit Characters	*002 02
8 Bit Characters	003 03
1 Stop Bit	000 00
2 Stop Bits	*004 04
Send Parity Bit = 0	000 00
Send Parity Bit = 1	050 28
Send Even Parity	*030 18
Send Odd Parity	020 10

\* = Default Setting. Add values for desired attributes together to get table entry value.

## 9. REAR PANEL SERIAL CONNECTORS

The cable from your modem may terminate in a male connector, which fits the female connector on the H89 rear apron. This connector is at port address 340, and is intended for a printer or other data terminal device. It is tempting to plug the modem into that connector and reconfigure REACH for a modem at port 340, but this will not work, as the data signal pins (pins 2 and 3) are reversed on that connector. The solution is to make an adaptor from two female RS-232 connectors by soldering wires between each pair of pins numbered 1 through 8 and 20. This can plug between your modem cable and the male rear apron connector for port 330.



## 10. IN CASE OF DIFFICULTY

Check to see that the interrupt jumpers on the H88-3 board are set to level 3 (or, if you have patched REACH for another level, set to that level).

Check to see that REACH is transmitting and receiving characters by connecting pins 2 and 3 of the serial connector on the rear apron with a bare wire. Characters typed on the keyboard should echo on the screen. If this does not happen, the serial interface may be at fault.

If typed characters do echo, REACH is operating correctly. Make sure REACH is configured to operate at the modem's baud rate (see Section 8.1).

Check the modem to make sure it is connected properly. If it has a loopback function, enable this function and see if characters typed on the keyboard are echoed on the screen. If not, the modem is bad or is not connected correctly to the H89. See the previous section for more information on connecting the modem.

If typed characters echo in loopback mode, REACH and the modem are operating correctly.

If your printer or MODEM still do not operate, it is possible that the cabling is incorrect. One common problem is the reversal of a signal pair. Most signals in an RS-232 cable are paired: one signal is sent from the H89 to the peripheral MODEM or printer, while the paired signal is sent from the peripheral to the H89. The pins used for the signal pairs are: pins 2 and 3 for data, pins 4 and 5 for RTS and CTS, and pins 6 and 20 for DSR and DTR.

Usually the connecting cable should just connect each pin on the H89 to the corresponding pin on the peripheral. However, sometimes the peripheral is configured differently and it is necessary to reverse the pairs, connecting pin 2 to 3 and 3 to 2, 4 to 5 and 5 to 4, and 6 to 20 and 20 to 6. Sometimes the 4/5 or 6/20 pairs are just missing. One simple approach is not to connect pins 4, 5, 6 and 20 at all, but to jumper a wire between pins 6, 8 and 20 on each end of the cable. This forces all ready signals on, and will work in many cases, although not where hardware handshaking is required.