INTERFACENOTES
FOR
DM/PL INTELLIGENT PLOTTERS
FROM
HOUSTON INSTRUMENT
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<td>1.3.2.1</td>
<td>Cable Specifications</td>
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<td>Cable Specifications</td>
<td>7</td>
</tr>
<tr>
<td>1.4.1.2</td>
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7.2.2 Two Way Communications

APPENDIX A
These interface notes are intended to give an example of a suggested serial interface card setup, a cable, and a program that verifies one way communication between the APPLE II computer and any of Houston Instrument's DMPL Intelligent Plotters using either mode 1 (xon/xoff, hardware) or mode 2 (programmed) handshake. Four serial interface cards are discussed.

The development system for these technical notes consists of an Apple II (48K minimum), two single sided/single density disk drives, Apple DOS version 3.3 operating system, Apple Serial Interface Card, Apple Communications Interface Card, Apple Super Serial Interface Card, California Computer Systems (CCS) Model 7710A Asynchronous Serial Interface Card, and Applesoft Basic.

For Apple II or II+, the serial interface card must be inserted in one of the unused connector slots (except 0 and 6) in the rear of the computer. The Language Card or RAM Card is located in Slot #0. The disk drive card is located in Slot #6.

For Apple IIe the connector slots are numbered 1-7. Any unused connector slot may hold the serial interface card except Slot #3 or #6. If you have the 80-column text card or the expanded memory card in the auxiliary slot do not use Slot #3. The disk drive card is located in Slot #6.

### 1.1 APPLE SERIAL INTERFACE CARD

#### 1.1.1 Mode 1 (Xon/Xoff, Hardware) Handshake

The Apple Serial Interface Card will not support mode 1 (xon/xoff, hardware) handshake.

#### 1.1.2 Mode 2 (Programmed) Handshake

#### 1.1.2.1 Cable Specifications

DMP-29 and DMP-4x plotters:

<table>
<thead>
<tr>
<th>Apple II</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
</tbody>
</table>

male connector | female connector
---|---
pin 2 | pin 2
pin 3 | pin 3
pin 7 | pin 7

A cable with these specifications is available from Houston Instrument under part number DMP-1401.
DMP-3, 4, 6, 7, 8 and 9 plotters

APPLE II
DB - 25P
male connector

Plotter
DB - 25S
female connector

<table>
<thead>
<tr>
<th>pin 2</th>
<th>pin 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>pin 3</td>
<td>pin 3</td>
</tr>
<tr>
<td>pin 7</td>
<td>pin 7 jumpered to pin 9</td>
</tr>
</tbody>
</table>

*Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.

1.1.2.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Apple Serial Interface Card will support mode 2 (programmed) handshake with all DMPL intelligent plotters if the card has PROM P8. Two PROMs are available with the Apple Serial Interface Card, PROM P8 (P/N 341-0018) and PROM P8A (P/N 341-0048). PROM P8A will only support output through the serial port making it unusable with DMPL intelligent plotters. PROM P8 will support both input and output through the serial port.

The Apple Serial Interface Card has four operating parameters which are set by dip switches on the card (baud rate, carriage return delay, line width, and line feed). The card automatically defaults to no parity, 1 start bit, 8 data bits, and 2 stop bits. The following example sets a baud rate of 2400. For other baud rates consult the Apple Serial Interface Card Manual. The baud rate selected on the card must correspond to the baud rate setting of the plotter (DMP -29, -4x) or with the cable if it has been hardwired for a baud rate (DMP-3, 4, 6, 7, 8, 9).

DIP SWITCH SETTINGS

<table>
<thead>
<tr>
<th>DIP SWITCHES</th>
<th>SETTING</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>on</td>
<td>baud rate = 2400</td>
</tr>
<tr>
<td>2</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>off</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>on</td>
<td>carriage return delay</td>
</tr>
<tr>
<td>5</td>
<td>off</td>
<td>line width = 132 characters</td>
</tr>
<tr>
<td>6</td>
<td>off</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>off</td>
<td>&lt;LF&gt; after &lt;CR&gt;</td>
</tr>
</tbody>
</table>

1.2 APPLE COMMUNICATIONS INTERFACE CARD

1.2.1 Mode 1 (Xon/Xoff, Hardware) Handshake

The Apple Communications Interface Card will not support mode 1 (xon/xoff, hardware) handshake.
1.2.2 Mode 2 (Programmed) Handshake

1.2.2.1 Cable Specifications

DMP-29 and DMP-4x plotters:

<table>
<thead>
<tr>
<th>APPLE II</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

- pin 2 ----------- pin 3
- pin 3 ----------- pin 2
- pin 7 ----------- pin 7

A cable with these specifications is available from Houston Instrument under part number DMP-1397.

DMP-3,4,6,7,8 and 9 plotters

<table>
<thead>
<tr>
<th>APPLE II</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

- pin 2 ----------- pin 3
- pin 3 ----------- pin 2
- pin 7 ----------- pin 7 jumpered to pin 9
  (Selects mode 2 handshaking)
- pin 6 jumpered to pin 15*
  (Selects baud rate -- 4800)

*Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.

1.2.2.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Apple Communications Interface Card will support mode 2 (programmed) handshake with all DMPL intelligent plotters. The Apple Communications Card comes set at 300 baud. The card may be modified to run at either 1200 or 4800 baud rate by following the instructions in the Apple Communications Interface Card Installation and Operating Manual. The baud rate of the card must correspond to the baud rate setting of the plotter (DMP -29, -4x) or with the cable if it has been hardwired for a baud rate (DMP-3,4,6,7,8,9). The card automatically defaults to 8 data bits and 2 stop bits.

1.3 APPLE SUPER SERIAL INTERFACE CARD

1.3.1 Mode 1 (Xon/Xoff, Hardware) Handshake
1.3.1.1 Cable Specifications

DMP-29 and DMP-4x plotters (xon/xoff):

<table>
<thead>
<tr>
<th>APPLE II</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

- pin 2 ------------------ pin 2
- pin 3 ------------------ pin 3
- pin 7 ------------------ pin 7

A cable with these specifications is available from Houston Instrument under part number DMP-1401.

DMP-3,4,6,7,8 and 9 plotters (xon/xoff):

<table>
<thead>
<tr>
<th>APPLE II</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

- pin 2 ------------------ pin 2
- pin 3 ------------------ pin 3
- pin 7 ------------------ pin 7
- pin 6 jumpered to pin 16*
  (Selects baud rate -- 2400)

*Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.

DMP-29 and DMP-4x plotters (hardware):

<table>
<thead>
<tr>
<th>APPLE II</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

- pin 2 ------------------ pin 3
- pin 5 ------------------ pin 4
- pin 7 ------------------ pin 7

A cable with these specifications is available from Houston Instrument under part number DMP-1400.

DMP-3,4,6,7,8 and 9 plotters (hardware):

DMP-3,4,6,7,8 and 9 plotters are not capable of mode 1 (hardware) handshaking under the mode 1 select because lines 4 and 20 (RTS, DTR) are held continually high and are not toggled.

1.3.1.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Apple Super Serial Card will support mode 1 (xon/xoff) handshaking with all DMPL intelligent plotters when the jumper block is installed with the arrow pointing down toward TERMINAL. The jumper block then acts as a modem eliminator (null modem) making the Apple Super Serial Card look like a DCE device. Either half or full duplex may be used.
The baud rate, data bits, stop bits, parity, line feed disable, interrupt disable and the mode (communications or printer) are selected through the dip switches on the card. The following example sets a baud rate of 2400. For other baud rates consult the Apple Super Serial Card Installation and Operating Manual or the Apple Super Serial Reference Card located in the back of the manual. The baud rate selected on the card must correspond to the baud rate setting of the plotter (DMP -29, -4x) or with the cable if it has been hardwired for a baud rate (DMP-3,4,6,7,8,9).

The Apple Super Serial Card will support mode 1 (hardware) handshaking when the jumper block is installed with the arrow pointing up toward MODEM. This makes the Super Serial Card look like a DTE device. DMP-29 and DMP-4x are capable of using mode 1 (hardware) handshake because lines 4 and 20 (RTS, DTR) are toggled and either of these lines may be used to indicate buffer status. Either half or full duplex may be used.

### DIP SWITCH SETTINGS

<table>
<thead>
<tr>
<th>DIP SWITCHES</th>
<th>SETTING</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch Box 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>off</td>
<td>baud rate = 2400</td>
</tr>
<tr>
<td>2</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>off</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>on</td>
<td>selects communications mode</td>
</tr>
<tr>
<td>6</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>Switch Box 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>off</td>
<td>8 data bits, 2 stop bits</td>
</tr>
<tr>
<td>2</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>on</td>
<td>no parity</td>
</tr>
<tr>
<td>4</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>off</td>
<td>&lt;LF&gt; after &lt;CR&gt;</td>
</tr>
<tr>
<td>6</td>
<td>off</td>
<td>interrupts</td>
</tr>
<tr>
<td>7</td>
<td>off</td>
<td>selects communications mode</td>
</tr>
</tbody>
</table>

1.3.2 Mode 2 (Programmed) Handshake

1.3.2.1 Cable Specifications

DMP-29 and DMP-4x plotters:

<table>
<thead>
<tr>
<th>APPLE II Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
</tr>
<tr>
<td>DB - 25S</td>
</tr>
</tbody>
</table>

male connector | female connector

- pin 2 ----------- pin 2
- pin 3 ----------- pin 3
- pin 7 ----------- pin 7

A cable with these specifications is available from Houston Instrument under part number DMP-1401.
DMP-3,4,6,7,8 and 9 plotters

APPLE II Plotter
DB - 25P male connector

Plotter DB - 25S female connector

- pin 2 ------------------ pin 2
- pin 3 ------------------ pin 3
- pin 7 ------------------ pin 7 jumpered to pin 9
  (Selects mode 2 handshaking)
- pin 6 jumpered to pin 16*
  (Selects baud rate -- 2400)

*Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.

1.3.2.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Apple Super Serial Card will support mode 2 (programmed) handshake with all DMPL intelligent plotters when the jumper block is installed with the arrow pointing down toward TERMINAL. The jumper block then acts as a modem eliminator (null modem) making the Super Serial Card look like a DCE device. Either half or full duplex may be used.

The baud rate, data bits, stop bits, parity, line feed disable, interrupt disable and the mode (communications or printer) are selected through the dip switches on the card. The following example sets a baud rate of 2400. For other baud rates consult the Apple Super Serial Card Installation and Operating Manual or the Apple Super Serial Reference Card located in the back of the manual. The baud rate selected on the card must correspond to the baud rate setting of the plotter (DMP -29,-4x) or with the cable if it has been hardwired for a baud rate (DMP-3,4,6,7,8,9).

**DIP SWITCH SETTINGS**

<table>
<thead>
<tr>
<th>DIP SWITCHES</th>
<th>SETTING</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch Box 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>off</td>
<td>baud rate = 2400</td>
</tr>
<tr>
<td>2</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>off</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>on</td>
<td>selects communications mode</td>
</tr>
<tr>
<td>6</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>Switch Box 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>off</td>
<td>8 data bits, 2 stop bits</td>
</tr>
<tr>
<td>2</td>
<td>on</td>
<td>no parity</td>
</tr>
<tr>
<td>3</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>on</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>off</td>
<td>&lt;LF&gt; after &lt;CR&gt;</td>
</tr>
<tr>
<td>6</td>
<td>off</td>
<td>interrupts</td>
</tr>
<tr>
<td>7</td>
<td>off</td>
<td>selects communications mode</td>
</tr>
</tbody>
</table>
1.4 CALIFORNIA COMPUTER SYSTEMS (CCS) ASYNCHRONOUS SERIAL INTERFACE
MODEL 7710A

1.4.1 Mode 1 (Xon/Xoff, Hardware) Handshake

1.4.1.1 Cable Specifications

There are "ROM-Paks" available for the CCS card which support xon/xoff
handshaking. Mode 1 (xon/xoff) handshaking is not recommended with this
card because of potential timing problems.

DMP-29 and DMP-4x plotters (hardware):

| APPLE II | Plotter |
| DB - 25P | DB - 25S |
| male connector | female connector |

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>pin 3</td>
<td>pin 3</td>
</tr>
<tr>
<td>pin 4</td>
<td>pin 4</td>
</tr>
<tr>
<td>pin 7</td>
<td>pin 7</td>
</tr>
</tbody>
</table>

A cable with these specifications is available from Houston
Instrument under part number DMP-1398.

DMP-3,4,6,7,8 and 9 plotters (hardware):

DMP-3,4,6,7,8 and 9 plotters are not capable of mode 1 (hardware)
handshaking under the mode 1 select because lines 4 and 20 (RTS,
DTR) are held continually high and are not toggled.

1.4.1.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The CCS card is full duplex and uses pin 4 (RTS) to mode 1 (hardware)
handshake. DMP-29 and DMP-4x will support hardware handshaking using
mode 1 select because lines 4 and 20 (RTS, DTR) are toggled and
either of these lines may be used to indicate buffer status.

The assembly language driver shipped with the CCS card defaults to no
parity, 8 data bits, and 2 stop bits. The baud rate is selected by
setting the four dip switches in the upper right hand corner. The
following example sets a baud rate of 2400. For other baud rate
selections consult the Owner's Manual for the CCS Asynchronous Serial
Interface Card. The baud rate selected on the card must correspond
to the baud rate setting of the plotter (DMP -29, -4x).
DIP SWITCH SETTINGS

<table>
<thead>
<tr>
<th>DIP SWITCHES</th>
<th>SETTING</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>off (down)</td>
<td>baud rate = 2400</td>
</tr>
<tr>
<td>2</td>
<td>off (down)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>off (down)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>on (up)</td>
<td></td>
</tr>
</tbody>
</table>

1.4.2  Mode 2 (Programmed) Handshake

1.4.2.1 Cable Specifications

DMP-29 or DMP-4x plotters:

<table>
<thead>
<tr>
<th>APPLE II Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P male connector</td>
</tr>
</tbody>
</table>

- pin 2 -------------- pin 2
- pin 3 -------------- pin 3
- pin 4 jumpered to pin 6
- pin 7 -------------- pin 7
- pin 8 jumpered to pin 20

A cable with these specifications is available from Houston Instrument under part number DMP-1399.

DMP-3,4,6,7,8 and 9 plotters:

<table>
<thead>
<tr>
<th>APPLE II Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P male connector</td>
</tr>
</tbody>
</table>

- pin 2 -------------- pin 2
- pin 3 -------------- pin 3
- pin 4 jumpered to pin 6
- pin 7 -------------- pin 7 jumpered to pin 9 (Selects mode 2 handshaking)
- pin 8 jumpered to pin 20

*Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.

1.4.2.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The CCS Card is a full duplex card that will support mode 2 (programmed) handshake with all DMPL Intelligent plotters.
The assembly language driver shipped with the CCS card defaults to no parity, 8 data bits, and 2 stop bits. The baud rate is selected by setting the four dip switches in the upper right hand corner. The following example sets a baud rate of 2400. For other baud rate selections consult the Owner's Manual for the CCS Asynchronous Serial Interface Card. The baud rate selected on the card must correspond to the baud rate setting of the plotter (DMP -29, -4x) or with the cable if it has been hardwired for a baud rate (DMP-3,4,6,7,8,9).

DIP SWITCH SETTINGS

<table>
<thead>
<tr>
<th>DIP SWITCHES</th>
<th>SETTING</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>off (down)</td>
<td>baud rate = 2400</td>
</tr>
<tr>
<td>2</td>
<td>off (down)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>off (down)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>on (up)</td>
<td></td>
</tr>
</tbody>
</table>

1.5 COMMUNICATIONS

1.5.1 One Way Communications

The following Basic programs test one way (computer to plotter) communications. The first program specifies the mode 1 (xon/xoff,hardware) handshake select and the second program shows the mode 2 (programmed) handshake select. Using the cable specifications and card set-up specifications for the desired handshake mode, enter and run one of the following programs:

mode 1 (xon/xoff,hardware) handshake select:

10 PRINT CHR$(4);"PR#n"
20 PRINT ";: T "
30 PRINT CHR$(4);"PR#0"
40 END

mode 2 (programmed) handshake select:

10 PRINT CHR$(4);"PR#n"
20 PRINT ";: I 0D 0 T "
30 PRINT CHR$(4);"PR#0"
40 END

Note: n in line 10 of each of these programs is the slot number (0-7) where the interface card is located.

Each of these programs will select the plotter and have it perform a self-test. If the plotter does not run a self-test, then some aspect of the computer/plotter communications link is incorrect. Double check the baud rate setting for the interface card and the plotter. The baud rates must agree. Also make sure that the interface card is setup to send 8 bits per character.
1.5.2 Two Way Communications

Listed below are some suggestions as to areas that need to be checked when problems arise in two way communications (computer to plotter and plotter to computer).

For DMP-3,4,6,7,8 and 9 plotters:

- The baud rate selected on the interface card and the cabled baud rate for the plotter must agree.
- The interface card should be able to accept no parity, 8 data bits and 2 stop bits to match plotter defaults.

For DMP-29 and DMP-4x plotters:

- Baud rate selected on the plotter and interface card must agree.
- Parity selected on the plotter and interface card must agree.
- Data bits selected on the plotter and interface card must agree.
- Stop bits selected on the plotter and interface card must agree.

For DMP-4x plotters the default for data sent from the plotter to the computer is no parity, 8 data bits with bit 8 being set to 0, and 2 stop bits. The UART setup command allows the user to select the type of parity and the number of data bits. The plotter setup must match the interface card setup for these factors. See plotter manual for instructions on using the UART setup command (EU).

For DMP-29 plotters data sent from the plotter to computer is switch selectable for the parity and data bits, with the stop bits being set at 2. Plotter switches need to agree with interface card settings for these items. See plotter manual for details on switch settings.

The self-test on DMP-29 and DMP-4x plotters prints parity, data bits, and UART setup information as well as the baud rate of the plotter. Running a self-test from Local Mode will help assure all of these parameters are correctly set. See plotter manual for details on the self-test information.
These interface notes are intended to give an example of a suggested cable, a I/O port setup, and a program that verifies one way communication between the IBM PC computer and any of Houston Instrument's DMPL Intelligent Plotters using either Mode 1 (hardware) or Mode 2 (programmed) handshake. Only one serial interface card, the IBM Asynchronous Communications Card, is discussed.

The development system for these technical notes consists of the IBM PC (64K minimum), two single sided/single density disk drives, PCDOS version 1.0, PCDOS version 1.1 or 2.0, IBM Asynchronous Communications Card and IBM PC Advanced Basic.

2.1 IBM ASYNCHRONOUS COMMUNICATIONS CARD

2.1.1 Mode 1 (Xon/Xoff, Hardware) Handshake

2.1.1.1 Cable Specifications

The IBM Asynchronous Communications Card does not support xon/xoff handshaking.

DMP-29 and DMP-4x plotters (hardware):

<table>
<thead>
<tr>
<th>IBM PC or Plotter</th>
<th>IBM PC or Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25S</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>female connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>pin 2</th>
<th>pin 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>pin 3</td>
<td>pin 2</td>
</tr>
<tr>
<td>pin 4</td>
<td>pin 5</td>
</tr>
<tr>
<td>pin 5</td>
<td>pin 4</td>
</tr>
<tr>
<td>pin 7</td>
<td>pin 7</td>
</tr>
</tbody>
</table>

jumpered together: jumpered together:

<table>
<thead>
<tr>
<th>pin 6 to pin 8 to</th>
<th>pin 6 to pin 8 to</th>
</tr>
</thead>
<tbody>
<tr>
<td>pin 20 to pin 22</td>
<td>pin 20 to pin 22</td>
</tr>
</tbody>
</table>

Note: This cable is constructed so either end can be connected to the plotter or computer.

A cable with these specifications is available from Houston Instrument under part number HR29-316.

DMP-3,4,6,7,8 and 9 plotters (hardware):

DMP-3,4,6,7,8 and 9 plotters are not capable of mode 1 (hardware) handshaking under the mode 1 select because lines 4 and 20 (RTS, DTR) are held continually high and are not toggled.
2.1.1.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The IBM Asynchronous Communications Card (serial) will support mode 1 (hardware) handshake with DMP-29 and DMP-4x intelligent plotters under the PCDOS 1.1 or 2.0 operating system. Lines 4 and 20 (RTS, DTR) are toggled on DMP-29 and DMP-4x plotters and either of these lines may be used to indicate buffer status. Hardware handshaking is not supported under PCDOS 1.0 operating system.

To configure the system for mode 1 (hardware) handshake the parallel printer output must be redirected to a serial device. The following procedure will set up the PCDOS 1.1 or 2.0 operating system for mode 1 (hardware) handshake.

1. Boot up PCDOS 1.1 or 2.0 operating system.

2. After the system prompt, issue the MODE command to select the baud rate, parity, data bits, and stop bits for Asynchronous Communications Adapters.

   Example - A> MODE COMn:baud,parity.databits,stopbits,P

   COMn - where n is 1 or 2 (Asynchronous Communications Adapter number)
   baud rate = 9600, 4800, 2400, 1200, 600, 300
   parity = N
   databits = 8
   stopbits = 2
   P - this allows timeout errors to be continuously retried.
   Retry loops can be stopped by Ctrl-Break.

   Note: The baud rate in the MODE statement must agree with the baud rate setting of the plotter (DMP-29,-4x).

3. After return message, issue the MODE command to redirect parallel printer output to a serial device.

   Example - A> MODE LPT#:COMn

   LPT# - where # = 1, 2, or 3 (printer number)
   COMn - where n = 1 or 2 (Asynchronous Communications Adapter number)

4. After return message load BASICA.

   Example - A> BASICA
2.1.2 Mode 2 (Programmed) Handshake

2.1.2.1 Cable Specifications

DMP-29 and DMP-4x plotters:

DMP-3, 4, 6, 7, 8 and 9 plotters

Note: This cable is constructed so either end can be connected to the plotter or computer.

A cable with these specifications is available from Houston Instrument under part number HR29-316.

2.1.2.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The IBM Asynchronous Interface Card will support mode 2 (programmed) handshaking with all levels of DMPL intelligent plotters using PCDOS 1.0, 1.1, or 2.0 operating system.

No special procedure is needed to setup PCDOS 1.0, 1.1 or 2.0 operating systems for mode 2 (programmed) handshaking.
2.2 COMMUNICATIONS

2.2.1 One Way Communications

The following Basic programs test one way (computer to plotter) communications. The first program specifies the mode 1 (xon/xoff, hardware) handshake select and the second program shows the mode 2 (programmed) handshake select. Using the cable specifications and card set-up specifications for the desired handshake mode, enter and run one of the following programs:

Mode 1 (hardware) handshake select:

10 LPRINT ";: T"
20 END

Mode 2 (programmed) handshake select:

10 OPEN "COM1:baud,N,8,2,CS,DS" AS #1
20 PRINT #1,";: I0D°T"
30 END

Note: The baud rate in line 10 of the Mode 2 Basic program must agree with the baud rate setting of the plotter (DMP-29, -4x) or with the cable if it has been hardwired for a baud rate (DMP-3,4,6,7,8).

Each of these programs will select the plotter and have it perform a self-test. If the plotter does not run a self-test, then some aspect of the computer/plotter communications link is incorrect. Double check the baud rate setting for the computer and the plotter. The baud rates must agree. Also make sure that 8 bits per character are being sent from the computer to the plotter.

2.2.2 Two Way Communications

Listed below are some suggestions as to areas that need to be checked when problems arise in two way communications (computer to plotter and plotter to computer).

For DMP-3,4,6,7,8 and 9 plotters:

The baud rate selected on the interface card and the cabled baud rate for the plotter must agree

The interface card should be able to accept no parity, 8 data bits and 2 stop bits to match plotter defaults

For DMP-29 and DMP-4x plotters:

Baud rate selected on the plotter and interface card must agree
Parity selected on the plotter and interface card must agree
Data bits selected on the plotter and interface card must agree
Stop bits selected on the plotter and interface card must agree
For DMP-4x plotters the default for data sent from the plotter to the computer is no parity, 8 data bits with bit 8 being set to 0, and 2 stop bits. The UART setup command allows the user to select the type of parity and the number of data bits. The plotter setup must match the interface card setup for these factors. See plotter manual for instructions on using the UART setup command (EU).

For DMP-29 plotters data sent from the plotter to computer is switch selectable for the parity and data bits, with the stop bits being set at 2. Plotter switches need to agree with interface card settings for these items. See plotter manual for details on switch settings.

The self-test on DMP-29 and DMP-4x plotters prints parity, data bits, and UART setup information as well as the baud rate of the plotter. Running a self-test from Local Mode will help assure all of these parameters are correctly set. See plotter manual for details on the self-test information.
3.0 NORTHSTAR HORIZON

These Interface Notes are intended to give an example of a suggested cable, an I/O port setup, and a program that verifies one way communication between the Northstar Horizon computer and any of Houston Instrument's DMPL Intelligent Plotters.

The development system for these technical notes consists of the Northstar Horizon (64k minimum), two double sided / double density disk drives, SAIL CP/M 2.2 operating system, and Microsoft Basic.

3.1 NORTHSTAR HORIZON SERIAL PORT

3.1.1 Mode 1 (Xon/Xoff, Hardware) Handshake

3.1.1.1 Cable Specifications

The North Star Horizon will not support xon/xoff handshaking without software modifications to its BIOS program.

DMP-29 and DMP-4x plotters (hardware):

<table>
<thead>
<tr>
<th>Northstar Horizon</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

- pin 3
- pin 7
- pin 20

A cable with these specifications is available from Houston Instrument under part number DMP-1396.

DMP-3,4,6,7,8 and 9 plotters (hardware):

DMP-3,4,6,7,8 and 9 plotters are not capable of mode 1 (hardware) handshake in mode 1 select because lines 4 and 20 (RTS,DTR) are held continually high and are not toggled.

3.1.1.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Northstar Horizon will support mode 1 (hardware) handshaking under its S.A.I.L. CP/M operating system with DMP-29 and DMP-4x plotters under the mode 1 select. Lines 4 and 20 (RTS, DTR) are toggled and either of these lines may be used to indicate buffer status.
After the system prompt, type SETSAIL. Select printer type as RS-232 serial. Note that other system related (but not plotter related) questions must be answered during this session. For further information consult the S.A.I.L. CP/M manual for documentation.

3.1.2 Mode 2 (Programmed) Handshake

3.1.2.1 Cable Specifications

DMP-29 and DMP-4x plotters:

<table>
<thead>
<tr>
<th>Northstar Horizon</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
<tr>
<td>pin 2 -----------</td>
<td>pin 2</td>
</tr>
<tr>
<td>pin 3 -----------</td>
<td>pin 3</td>
</tr>
<tr>
<td>pin 7 -----------</td>
<td>pin 7</td>
</tr>
</tbody>
</table>

A cable with these specifications is available from Houston Instrument under part number DMP-1401.

DMP-3,4,6,7,8 and 9 plotters:

<table>
<thead>
<tr>
<th>Northstar Horizon</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
<tr>
<td>pin 2 -----------</td>
<td>pin 2</td>
</tr>
<tr>
<td>pin 3 -----------</td>
<td>pin 3</td>
</tr>
<tr>
<td>pin 7 -----------</td>
<td>pin 7 -- pin 9</td>
</tr>
</tbody>
</table>

(Select Mode 2 handshaking)

*Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.

3.1.2.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Northstar Horizon will support mode 2 (programmed) handshake under its S.A.I.L. CP/M operating system for all DMPL plotters. After the system prompt, type SETSAIL. Select printer type as RS-232 serial. Note that other system related (but not plotter related) questions must be answered during this session. For further information consult the S.A.I.L. CP/M manual for documentation. The baud rate selected during the SETUP must correspond to the baud rate setting of the plotter (DMP -29, -4x) or with the cable if it has been hardwired for a baud rate DMP-3,4,6,7,8,9).
3.2 COMMUNICATIONS

3.2.1 One Way Communications

The following Basic programs test one way (computer to plotter) communications. The first program specifies the mode 1 (xon/xoff, hardware) handshake select and the second program shows the mode 2 (programmed) handshake select. Using the cable specifications and card set-up specifications for the desired handshake mode, enter and run one of the following programs:

Mode 1 (xon/xoff, hardware) handshake select:

10 LPRINT ";: T"
20 END

Mode 2 (programmed) handshake select:

10 LPRINT ";:I 0D 0 T"
20 END

Either of these programs will select the plotter and have it perform a self-test. If the plotter does not run a self-test, then some aspect in the computer/plotter communications link is incorrect. Double check the baud rate setting for the computer and the plotter. The baud rates must agree. Also check to make sure that 8 bits per character are being sent from the computer to the plotter.

3.2.2 Two Way Communications

Listed below are some suggestions as to areas that need to be checked when problems arise in two way communications (computer to plotter and plotter to computer).

For DMP-3, 4, 6, 7, 8 and 9 plotters:

Setup baud rate for the computer and cabled baud rate for the plotter must agree

Computer should be able to accept no parity, 8 data bits and 2 stop bits to match plotter defaults

For DMP-29 and DMP-4x plotters:

Baud rate selected on the plotter and interface card must agree
Parity selected on the plotter and interface card must agree
Data bits selected on the plotter and interface card must agree
Stop bits selected on the plotter and interface card must agree
For DMP-4x plotters the default for data sent from the plotter to the computer is no parity, 8 data bits with bit 8 being set to 0, and 2 stop bits. The UART setup command allows the user to select the type of parity and the number of data bits. The plotter setup must match the interface card setup for these factors. See plotter manual for instructions on using the UART setup command (EU).

For DMP-29 plotters data sent from the plotter to computer is switch selectable for the parity and data bits, with the stop bits being set at 2. Plotter switches need to agree with interface card settings for these items. See plotter manual for details on switch settings.

The self-test on DMP-29 and DMP-4x plotters prints parity, data bits, and UART setup information as well as the baud rate of the plotter. Running a self-test from Local Mode will help assure all of these parameters are correctly set. See plotter manual for details on the self-test information.

If buffering problems are encountered running Mode 1 (hardware) handshake, check the UART in the Northstar Horizon. It should be an Intel 8251A, NEC D8251 AC, or compatible chip for proper data transmission.

This chip is available from Houston Instrument under part number MW-560.
These Interface Notes are intended to give an example of a suggested cable, an I/O port setup, and a program that verifies one way communication between the Osborne 1 computer and any of Houston Instrument's DMPL Intelligent Plotters.

The development system for these technical notes consists of the Osborne 1 (64k minimum), two single sided / single density disk drives, CP/M 2.2 operating system, and MicroSoft Basic.

4.1 OSBORNE 1 SERIAL PORT

4.1.1 Mode 1 (Xon/Xoff, Hardware) Handshake

4.1.1.1 Cable Specifications

DMP-29 and DMP-4x plotters (xon/xoff):

<table>
<thead>
<tr>
<th>Osborne 1</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Male Connector</th>
<th>Female Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>pin 2</td>
<td>pin 2</td>
</tr>
<tr>
<td>pin 3</td>
<td>pin 3</td>
</tr>
<tr>
<td>pin 7</td>
<td>pin 7</td>
</tr>
</tbody>
</table>

A cable with these specifications is available from Houston Instrument under part number DMP-1401.

DMP-3, 4, 6, 7, 8 and 9 plotters (xon/xoff):

<table>
<thead>
<tr>
<th>Osborne 1</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Male Connector</th>
<th>Female Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>pin 2</td>
<td>pin 2</td>
</tr>
<tr>
<td>pin 3</td>
<td>pin 3</td>
</tr>
<tr>
<td>pin 7</td>
<td>pin 7</td>
</tr>
<tr>
<td>pin 6 jumpered to pin 17*</td>
<td></td>
</tr>
</tbody>
</table>

*(Selects baud rate -- 1200)*

*Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.*
DMP-29 and DMP-4x plotters (hardware):

<table>
<thead>
<tr>
<th>Osborne 1</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
<tr>
<td>pin 3 ----------- pin 3</td>
<td></td>
</tr>
<tr>
<td>pin 7 ----------- pin 7</td>
<td></td>
</tr>
<tr>
<td>pin 20 ----------- pin 20</td>
<td></td>
</tr>
</tbody>
</table>

A cable with these specifications is available from Houston Instrument under part number DMP-1396.

DMP-3,4,6,7,8 and 9 plotters (hardware):

DMP-3,4,6,7,8 and 9 plotters are not capable of mode 1 (hardware) handshaking using the mode 1 select on the plotter because lines 4 and 20 (RTS, DTR) are held continually high and are not toggled.

4.1.1.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Osborne I will support mode 1 (xon/xoff) handshake with all DMPL plotters. It will support mode 1 (hardware) handshake with DMP-29 and DMP-4x plotters since lines 4 and 20 (RTS, DTR) are toggled and either of these lines may be used to indicate buffer status.

Boot up the CP/M operating system. After the system prompt, issue the SETUP command and the setup chart will appear. Select the Diablo Xon/Xoff option for mode 1 handshake.

Choose either 300 baud or 1200 baud. The selected baud rate must agree with the baud rate setting of the plotter (DMP -29,-4x) or with the cable if it has been hardwired for a baud rate (DMP-3,4,6,7,8,9).

Exit from the setup chart by pressing X and configure the disk that will boot the system by pressing A for drive A or B for drive B. Press reset on the Osborne and boot up the system with the disk that you have just configured. The setup that you have configured is now in effect.
4.1.2 Mode 2 (Programmed) Handshake

4.1.2.1 Cable Specifications

**DMP-29 and DMP-4x plotters:**

<table>
<thead>
<tr>
<th>Osborne 1</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>pin 2</th>
<th>pin 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>pin 3</td>
<td>pin 3</td>
</tr>
<tr>
<td>pin 7</td>
<td>pin 7</td>
</tr>
</tbody>
</table>

A cable with these specifications is available from Houston Instrument under part number DMP-1401.

**DMP-3,4,6,7,8 and 9 plotters**

<table>
<thead>
<tr>
<th>Osborne 1</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>pin 2</th>
<th>pin 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>pin 3</td>
<td>pin 3</td>
</tr>
<tr>
<td>pin 7</td>
<td>pin 7</td>
</tr>
</tbody>
</table>

---

*Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.*

4.1.2.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Osborne 1 will support mode 2 (programmed) handshake with all DMPL plotters.

Boot up the CP/M operating system. After the system prompt, issue the SETUP command and the setup chart will appear. Select the Diablo Xon/Xoff option for programmed handshake.

Choose either 300 baud or 1200 baud. The selected baud rate must agree with the baud rate setting of the plotter (DMP -29,-4x) or with the cable if it has been hardwired for a baud rate (DMP-3,4,6,7,8,9).

Exit from the setup chart by pressing X and configure the disk that will boot the system by pressing A for drive A or B for drive B. Press reset on the Osborne and boot up the system with the disk that you have just configured. The setup that you have configured is now in effect.
4.2 COMMUNICATIONS

4.2.1 One Way Communications

The following Basic programs test one way (computer to plotter) communications. The first program specifies the mode 1 (xon/xoff, hardware) handshake select and the second program shows the mode 2 (programmed) handshake select. Using the cable specifications and card set-up specifications for the desired handshake mode, enter and run one of the following programs:

Mode 1 (xon/xoff, hardware) handshake select:

10 LPRINT ":: T "
20 END

Mode 2 (programmed) handshake select:

10 LPRINT "::I @D @ T ".
20 END

Either of these programs will select the plotter and have it perform a self-test. If the plotter does not run a self-test, then some aspect in the computer/plotter communications link is incorrect. Double check the baud rate setting for the computer and the plotter. The baud rates must agree. Also check to make sure that 8 bits per character are being sent from the computer to the plotter.

4.2.2 Two Way Communications

Listed below are some suggestions as to areas that need to be checked when problems arise in two way communications (computer to plotter and plotter to computer).

For DMP-3, 4, 6, 7, 8 and 9 plotters:

The baud rate selected on the interface card and the cabled baud rate for the plotter must agree

The interface card should be able to accept no parity, 8 data bits and 2 stop bits to match plotter defaults

For DMP-29 and DMP-4x plotters:

Baud rate selected on the plotter and interface card must agree

Parity selected on the plotter and interface card must agree

Data bits selected on the plotter and interface card must agree

Stop bits selected on the plotter and interface card must agree
For DMP-4x plotters the default for data sent from the plotter to the computer is no parity, 8 data bits with bit 8 being set to 0, and 2 stop bits. The UART setup command allows the user to select the type of parity and the number of data bits. The plotter setup must match the interface card setup for these factors. See plotter manual for instructions on using the UART setup command (EU).

For DMP-29 plotters data sent from the plotter to computer is switch selectable for the parity and data bits, with the stop bits being set at 2. Plotter switches need to agree with interface card settings for these items. See plotter manual for details on switch settings.

The self-test on DMP-29 and DMP-4x plotters prints parity, data bits, and UART setup information as well as the baud rate of the plotter. Running a self-test from Local Mode will help assure all of these parameters are correctly set. See plotter manual for details on the self-test information.
5.0 RADIO SHACK TRS-80 MODEL II

These Interface Notes are intended to give an example of a suggested cable, a I/O port setup, and a program that verifies one way communication between the TRS-80 Model II computer and any of Houston Instrument's DMPL Intelligent Plotters.

The development system for these technical notes consists of the Radio Shack TRS-80 Model II (64k minimum), one single sided / double density disk drive, Pickles and Trout CP/M 2.2e operating system, and MicroSoft Basic.

5.1 TRS-80 SERIAL PORT

5.1.1 Mode 1 (Xon/Xoff, Hardware) Handshake

5.1.1.1 Cable Specifications

<table>
<thead>
<tr>
<th>TRS-80 Model II</th>
<th>Plotter DMP-29 and DMP-4x plotters (xon/xoff):</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P male connector</td>
<td>DB - 25S female connector</td>
</tr>
<tr>
<td>pin 2 ----------- pin 3</td>
<td></td>
</tr>
<tr>
<td>pin 3 ----------- pin 2</td>
<td></td>
</tr>
<tr>
<td>pin 7 ----------- pin 7</td>
<td></td>
</tr>
</tbody>
</table>

A cable with these specifications is available from Houston Instrument under part number DMP-1397.

DMP-3,4,6,7,8 and 9 plotters (xon/xoff):

<table>
<thead>
<tr>
<th>TRS-80 Model II</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P male connector</td>
<td>DB - 25S female connector</td>
</tr>
<tr>
<td>pin 2 ----------- pin 3</td>
<td></td>
</tr>
<tr>
<td>pin 3 ----------- pin 2</td>
<td></td>
</tr>
<tr>
<td>pin 7 ----------- pin 7</td>
<td></td>
</tr>
</tbody>
</table>

pin 6 jumpered to pin 17

(Selects baud rate -- 1200)

Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.
DMP-29 and DMP-4x plotters (hardware):

<table>
<thead>
<tr>
<th>TRS-80 Model II</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

- pin 2 ----------- pin 3
- pin 5 ----------- pin 4
- pin 7 ----------- pin 7

A cable with these specifications is available from Houston Instrument under part number DMP-1400.

DMP-3, 4, 6, 7, 8 and 9 plotters (hardware):

DMP-3, 4, 6, 7, 8 and 9 plotters are not capable of mode 1 (hardware) handshaking using the mode 1 select on the plotters because lines 4 and 20 (RTS, DTR) are held continually high and are not toggled.

5.1.1.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The TRS 80 Model II will support mode 1 (xon/xoff) handshake with all models of DMP-29 plotters. It will support mode 1 (hardware) handshake on DMP-29 and DMP-4x plotters since lines 4 and 20 (RTS, DTR) are toggled and either of these lines may be used to indicate buffer status.

Boot up the CP/M operating system. After the system prompt, issue the SETUP command and the setup chart will appear. Select the following:

- Select the desired serial port (A or B).
- Select a baud rate. The selected baud rate must match the baud rate setting on the plotter (DMP-29,-4x) or with the cable if it has been hardwired for a baud rate (DMP-3, 4, 6, 7, 8, 9).
- Select 2 stop bits.
- Set DTR and RTS high.
- Set the word length at 8 bits.
- Set parity to off.
- Ignore the even and odd parity option.

For Xon/Xoff: Set X-MIT ON to 17. Set X-MIT OFF to 19.
For Hardware: Set X-MIT ON to 2. X-MIT OFF can be ignored.

Set CON: to CRT:
Set LST: to SIOA (for Serial Port A) or SIOB (for Serial Port B).
Ignore the PUN: and RDR: options.

Exit the SETUP utility, and after receiving the system prompt, load MBASIC.

5.1.2 Mode 2 (Programmed) Handshake

5.1.2.1 Cable Specifications

DMP-29 and DMP-4x plotters:

<table>
<thead>
<tr>
<th>TRS-80 Model 2</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P male connector</td>
<td>DB - 25S female connector</td>
</tr>
</tbody>
</table>

- Pin 2 ---- ----- Pin 3
- Pin 3 ---- ----- Pin 2
- Pin 7 ---- ----- Pin 7

A cable with these specifications is available from Houston Instrument under part number DMP 1397.

DMP-3,4,6,7,8 and 9 plotters

<table>
<thead>
<tr>
<th>TRS-80 Model 2</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P male connector</td>
<td>DB - 25S female connector</td>
</tr>
</tbody>
</table>

- Pin 2 ---- ----- Pin 3
- Pin 3 ---- ----- Pin 2
- Pin 7 ---- ----- Pin 7 jumpered to pin 9 (Select Mode 2 handshaking)
- Pin 6 jumpered to pin 16 (Selects baud rate -- 2400)

Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.

5.1.2.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The TRS 80 Model II will support mode 1 (xon/xoff) handshake with all models of DMPFL plotters. It will support mode 1 (hardware) handshake on DMP-29 and DMP-4x plotters since lines 4 and 20 (RTS, DTR) are toggled and either of these lines may be used to indicate buffer status.

Boot up the CP/M operating system. After the system prompt, issue the SETUP command and the setup chart will appear. Select the following:

Select the desired serial port (A or B).
Select a baud rate. The selected baud rate must match the baud rate setting on the plotter (DMP-29,-4x) or with the cable if it has been hardwired for a baud rate (DMP-3,4,6,7,8,9).

Select 2 stop bits.
Set DTR and RTS high.
Set the word length at 8 bits.
Set parity to off.
Ignore the even and odd parity option.
Set CON: to CRT:
Set LST: to SIOA (for Serial Port A) or SIOB (for Serial Port B).
Ignore the PUN: and RDR: options.

Exit the SETUP utility, and after receiving the system prompt, load MBASIC.

5.2 COMMUNICATIONS

5.2.1 One Way Communications

The following Basic programs test one way (computer to plotter) communications. The first program specifies the mode 1 (xon/xoff,hardware) handshake select and the second program shows the mode 2 (programmed) handshake select. Using the cable specifications and card set-up specifications for the desired handshake mode, enter and run one of the following programs:

Mode 1 (xon/xoff,hardware) handshake select:

10 LPRINT ";: T "
20 END

Mode 2 (programmed) handshake select:

10 LPRINT ";:I ØD Ø T. "
20 END

Either of these programs will select the plotter and have it perform a self-test. If the plotter does not run a self-test, then some aspect in the computer/plotter communications link is incorrect. Double check the baud rate setting for the computer and the plotter. The baud rates must agree. Also check to make sure that 8 bits per character are being sent from the computer to the plotter.
5.2.2 Two Way Communications

Listed below are some suggestions as to areas that need to be checked when problems arise in two way communications (computer to plotter and plotter to computer).

For DMP-3,4,6,7,8 and 9 plotters:

The baud rate selected on the interface card and the cabled baud rate for the plotter must agree

The interface card should be able to accept no parity, 8 data bits and 2 stop bits to match plotter defaults

For DMP-29 and DMP-4x plotters:

Baud rate selected on the plotter and interface card must agree

Parity selected on the plotter and interface card must agree

Data bits selected on the plotter and interface card must agree

Stop bits selected on the plotter and interface card must agree

For DMP-4x plotters the default for data sent from the plotter to the computer is no parity, 8 data bits with bit 8 being set to 0, and 2 stop bits. The UART setup command allows the user to select the type of parity and the number of data bits. The plotter setup must match the interface card setup for these factors. See plotter manual for instructions on using the UART setup command (EU).

For DMP-29 plotters data sent from the plotter to computer is switch selectable for the parity and data bits, with the stop bits being set at 2. Plotter switches need to agree with interface card settings for these items. See plotter manual for details on switch settings.

The self-test on DMP-29 and DMP-4x plotters prints parity, data bits, and UART setup information as well as the baud rate of the plotter. Running a self-test from Local Mode will help assure all of these parameters are correctly set. See plotter manual for details.

If buffering problems are encountered running Mode 1 (hardware handshake), check the UART in the TRS 80 Model II. It should be an INTEL 8251A, NEC D8251 AC or compatible chip for proper data transmission.

This chip is available from Houston Instrument under part number MW-560.
6.0 VICTOR 9000

These Interface Notes are intended to give an example of a suggested cable, a I/O port setup, and a program that verifies one way communication between the Victor 9000 computer and any of Houston Instrument's DMPL Intelligent Plotters.

Developmental system for these technical notes consists of the Victor 9000 (64k minimum), one single sided / double density disk drive, one hard disk, MSDOS ver. 1.25a/2.61 operating system, and MicroSoft Basic.

6.1 VICTOR 9000 SERIAL PORT

6.1.1 Mode 1 (xon/xoff, Hardware) Handshake

6.1.1.1 Cable Specifications

The Victor 9000 does not support xon/xoff handshaking.

DMP-29 and 4x plotters (hardware):

<table>
<thead>
<tr>
<th>VICTOR 9000</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>pin 2</td>
<td>pin 3</td>
</tr>
<tr>
<td>pin 5</td>
<td>pin 4</td>
</tr>
<tr>
<td>pin 7</td>
<td>pin 7</td>
</tr>
</tbody>
</table>

A cable with these specifications is available from Houston Instrument under part number DMP-1400.

DMP-3,4,6,7,8 and 9 plotters (hardware):

DMP-3,4,6,7,8 and 9 plotters are not capable of mode 1 (hardware) handshaking using the mode 1 select on the plotters because lines 4 and 20 (RTS, DTR) are held continually high and are not toggled.

6.1.1.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Victor 9000 will support mode 1 (hardware) handshake with DMP-29 and DMP-4x plotters. Plotter lines 4 and 20 (RTS, DTR) are toggled and either of these lines may be used to indicate buffer status.
Boot up the MSDOS operating system. After the system prompt, issue one of the following SETIO commands:

```
SETIO LST=TTY (for Serial Port A) or
SETIO LST=U11 (for Serial Port B)
```

After the system prompt, issue the PORTSET command and a setup chart will appear. Select the serial port you want to configure and then select the baud rate for that port. Selected baud rate must match the baud rate setting on the plotter (DMP -29,-4x).

After receiving the system prompt, load MSBASIC.

### 6.1.2 Mode 2 (Programmed) Handshake

#### 6.1.2.1 Cable Specifications

**DMP-29 and DMP-4x plotters:**

<table>
<thead>
<tr>
<th>VICTOR 9000</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
</tbody>
</table>

*male connector* | *female connector*

- pin 2 --------- pin 3
- pin 3 --------- pin 2
- pin 7 --------- pin 7

pin 4 jumpered to pin 5
pin 8 jumpered to pin 20

A cable with these specifications is available from Houston Instrument under part number DMP 1397.

**DMP-3,4,6,7,8 and 9 plotters:**

<table>
<thead>
<tr>
<th>VICTOR 9000</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
</tbody>
</table>

*male connector* | *female connector*

- pin 2 --------- pin 3
- pin 3 --------- pin 2
- pin 7 --------- pin 7 jumpered to pin 9

pin 4 jumpered to pin 5  
pin 8 jumpered to pin 20  

(Select Mode 2 handshaking)

Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.
6.1.2.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Victor 9000 will support mode 2 (programmed) handshake with all models of DMPL plotters.

Boot up the MSDOS operating system. After the system prompt, issue one of the following SETIO commands:

SETIO LST=TTY (for Serial Port A) or
SETIO LST=ULL (for Serial Port B)

After the system prompt, issue the PORTSET command and a setup chart will appear. Select the serial port you want to configure and then select the baud rate for that port. Selected baud rate must match the baud rate setting on the plotter (DMP-29,-4x) or with the cable if it has been hardwired for a baud rate (DMP-3,4,6,7,8,9).

After receiving the system prompt, load MSBASIC.

6.2 COMMUNICATIONS

6.2.1 One Way Communications

The following Basic programs test one way (computer to plotter) communications. The first program specifies the mode 1 (hardware) handshake select and the second program shows the mode 2 (programmed) handshake select. Using the cable specifications and card set-up specifications for the desired handshake mode, enter and run one of the following programs:

Mode 1 (hardware) handshake select:

10 LPRINT ";: T"
20 END

Mode 2 (programmed) handshake select:

10 LPRINT ";:I ØD Ø T"
20 END

Either of these programs will select the plotter and have it perform a self-test. If the plotter does not run a self-test, then some aspect in the computer/plotter communications link is incorrect. Double check the baud rate setting for the computer and the plotter. The baud rates must agree. Also check to make sure that 8 bits per character are being sent from the computer to the plotter.
6.2.2 Two Way Communications

Listed below are some suggestions as to areas that need to be checked when problems arise in two way communications (computer to plotter and plotter to computer).

For DMP-3,4,6,7,8 and 9 plotters:

- The baud rate selected on the interface card and the cabled baud rate for the plotter must agree.
- The interface card should be able to accept no parity, 8 data bits and 2 stop bits to match plotter defaults.

For DMP-29 and DMP-4x plotters:

- Baud rate selected on the plotter and interface card must agree.
- Parity selected on the plotter and interface card must agree.
- Data bits selected on the plotter and interface card must agree.
- Stop bits selected on the plotter and interface card must agree.

For DMP-4x plotters the default for data sent from the plotter to the computer is no parity, 8 data bits with bit 8 being set to 0, and 2 stop bits. The UART setup command allows the user to select the type of parity and the number of data bits. The plotter setup must match the interface card setup for these factors. See plotter manual for instructions on using the UART setup command (EU).

For DMP-29 plotters data sent from the plotter to computer is switch selectable for the parity and data bits, with the stop bits being set at 2. Plotter switches need to agree with interface card settings for these items. See plotter manual for details on switch settings.

The self-test on DMP-29 and DMP-4x plotters prints parity, data bits, and UART setup information as well as the baud rate of the plotter. Running a self-test from Local Mode will help assure all of these parameters are correctly set. See plotter manual for details.
These Interface Notes are intended to give an example of a suggested cable, a I/O port setup, and a program that verifies one way communication between the Zenith 89 computer and any of Houston Instrument's DMPL Intelligent Plotters.

Developmental system for these technical notes consists of the Zenith 89 (64k minimum), one single sided / double density disk drive, CP/M 2.2 operating system, and MicroSoft Basic.

7.1 ZENITH 89 SERIAL PORT

7.1.1 Mode 1 (xon/xoff, Hardware) Handshake

7.1.1.1 Cable Specifications

The Zenith 89 does not support xon/xoff handshaking.

DMP-29 and 4x plotters (hardware):

<table>
<thead>
<tr>
<th>ZENITH 89</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
<tr>
<td>pin 3 ------</td>
<td>pin 3</td>
</tr>
<tr>
<td>pin 4 -------</td>
<td>pin 4</td>
</tr>
<tr>
<td>pin 7 ------</td>
<td>pin 7</td>
</tr>
</tbody>
</table>

A cable with these specifications is available from Houston Instrument under part number DMP-1398.

DMP-3,4,6,7,8 and 9 plotters (hardware):

DMP-3,4,6,7,8 and 9 plotters are not capable of mode 1 (hardware) handshaking using the mode 1 select on the plotters because lines 4 and 20 (RTS, DTR) are held continually high and are not toggled.

7.1.1.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Zenith 89 will support mode 1 (hardware) handshake with DMP-29 and DMP-4x plotters. Plotter lines 4 and 20 (RTS, DTR) are toggled and either of these lines may be used to indicate buffer status.

Boot up the CP/M operating system. After the system prompt, issue CONFIGUR command. The CONFIGUR program will ask you if you want the standard system setup. Answer "NO" and a
menu will appear. Select "A" to "Set Terminal and Printer Characteristics." When the set up chart appears on your screen, select "C" and enter the baud rate and address of the serial port. The serial ports are labeled with their addresses (320, 340) on the back of the computer. The Print Ready Signal must be set to RTS and the Printer Ready Signal Polarity must be HIGH. If it is LOW, select "M" and the polarity will be toggled to HIGH. Save the changes you have made and exit the CONFIGUR utility.

After receiving the system prompt, load MBASIC.

7.1.2 Mode 2 (Programmed) Handshake

7.1.2.1 Cable Specifications

DMP-29 and DMP-4x plotters:

<table>
<thead>
<tr>
<th>ZENITH 89</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

pin 2 ----------- pin 2
pin 3 ----------- pin 3
pin 7 ----------- pin 7

A cable with these specifications is available from Houston Instrument under part number DMP 1401.

DMP-3, 4, 6, 7, 8 and 9 plotters:

<table>
<thead>
<tr>
<th>ZENITH 89</th>
<th>Plotter</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB - 25P</td>
<td>DB - 25S</td>
</tr>
<tr>
<td>male connector</td>
<td>female connector</td>
</tr>
</tbody>
</table>

pin 2 ----------- pin 2
pin 3 ----------- pin 3
pin 7 ----------- pin 7 jumpered to pin 9

(Select Mode 2 handshaking)

pin 6 jumpered to pin 16

(Selects baud rate -- 2400)

Note: Baud Rate is selected by jumpering Pin 6 to Pin 14, 15, 16, 17, 18 or 19 as desired.

7.1.2.2 Card/System Setup

We recommend powering up the plotter BEFORE powering up the computer.

The Zenith 89 will support mode 2 (programmed) handshake with all models of DMPL plotters.
Root up the CP/M operating system. After the system prompt, issue CONFIGUR command. The CONFIGUR program will ask you if you want the standard system setup. Answer "NO" and a menu will appear. Select "A" to "Set Terminal and Printer Characteristics." When the set up chart appears on your screen, select "C" and enter the baud rate and address of the serial port. The serial ports are labeled with their addresses (320,340) on the back of the computer. To do software handshaking the Print Ready Signal must be LOW. If it is HIGH, select "M" and the polarity will toggled to LOW. Save the changes you have made and exit the CONFIGUR utility.

After receiving the system prompt, load MBASIC.

7.2 COMMUNICATIONS

7.2.1 One Way Communications

The following Basic programs test one way (computer to plotter) communications. The first program specifies the mode 1 (hardware) handshake select and the second program shows the mode 2 (programmed) handshake select. Using the cable specifications and card set-up specifications for the desired handshake mode, enter and run one of the following programs:

Mode 1 (hardware) handshake select:

10 LPRINT ";: T 
20 END

Mode 2 (programmed) handshake select:

10 LPRINT ";:I ØD Ø T 
20 END

Either of these programs will select the plotter and have it perform a self-test. If the plotter does not run a self-test, then some aspect in the computer/plotter communications link is incorrect. Double check the baud rate setting for the computer and the plotter. The baud rates must agree. Also check to make sure that 8 bits per character are being sent from the computer to the plotter.

7.2.2 Two Way Communications

Listed below are some suggestions as to areas that need to be checked when problems arise in two way communications (computer to plotter and plotter to computer).

For DMP-3,4,6,7,8 and 9 plotters:

The baud rate selected on the interface card and the cabled baud rate for the plotter must agree.

The interface card should be able to accept no parity, 8 data bits and 2 stop bits to match plotter defaults
For DMP-29 and DMP-4x plotters:

- Baud rate selected on the plotter and interface card must agree.
- Parity selected on the plotter and interface card must agree.
- Data bits selected on the plotter and interface card must agree.
- Stop bits selected on the plotter and interface card must agree.

For DMP-4x plotters the default for data sent from the plotter to the computer is no parity, 8 data bits with bit 8 being set to 0, and 2 stop bits. The UART setup command allows the user to select the type of parity and the number of data bits. The plotter setup must match the interface card setup for these factors. See plotter manual for instructions on using the UART setup command (EU).

For DMP-29 plotters data sent from the plotter to computer is switch selectable for the parity and data bits, with the stop bits being set at 2. Plotter switches need to agree with interface card settings for these items. See plotter manual for details on switch settings.

The self-test on DMP-29 and DMP-4x plotters prints parity, data bits, and UART setup information as well as the baud rate of the plotter. Running a self-test from Local Mode will help assure all of these parameters are correctly set. See plotter manual for details.
The following listing summarizes cables that are available from Houston Instrument and that are described in the Houston Instrument Interface Notes. Each cable is listed by part number with a description that gives cable configuration, Houston Instrument product configuration and computer configuration.

The following cautions should apply to these cables:

1. The listed cables are for RS-232C serial communications only. To cable a plotter or digitizer using a centronics parallel or GPIB-IEEE interface refer to the plotter/digitizer Operation and Installation Manual and the computer's interface documentation.

2. These cables will not necessarily run the software packages listed in "The H. I. Connection" Software/Systems Directory or "The H. I. Connection" Software/Systems Abstract. Most software packages give cabling information in their manuals, and to assure proper operation, a user should always use the cable specifications defined by the software package.

3. The plotter cables listed below will work only with plotters that have DMP-4x or DMP-29 plotters. Cable configurations for DMP-3,4,5,7,8, and 9 plotters are described in the Houston Instrument Interface Notes but are not available from Houston Instrument.

4. XON/XOFF and hardware handshakes are selected with the Mode 1 select sequence. Programmed handshake is selected with the Mode 2 select sequence. Note that cable specifications are linked to the type of handshake mode.
<table>
<thead>
<tr>
<th>CABLE PART #</th>
<th>CABLE CONFIGURATION</th>
<th>H. I. DIGITIZER OR PLOTTER</th>
<th>COMPUTER CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DT11-320</td>
<td>4800 Baud Rate .01&quot; Resolution</td>
<td>DT-11 or DT-114</td>
<td>Apple II, II+, IIE</td>
</tr>
<tr>
<td>DT11-322</td>
<td>4800 Baud Rate .01&quot; Resolution</td>
<td>DT-11 or DT-114</td>
<td>Super Serial Card</td>
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