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CONCEPT INFORMATION UPDATE

NUMBER: 7

SUBJECT: Networking

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The device network word allows the *concept* user to specify the terminal's communications network. This is useful in three primary areas:

- communications mode settings (full duplex, e.g.);
- auxiliary device interface (printer port, e.g.); and
- multiple input/output device access (multiple computers, e.g.)

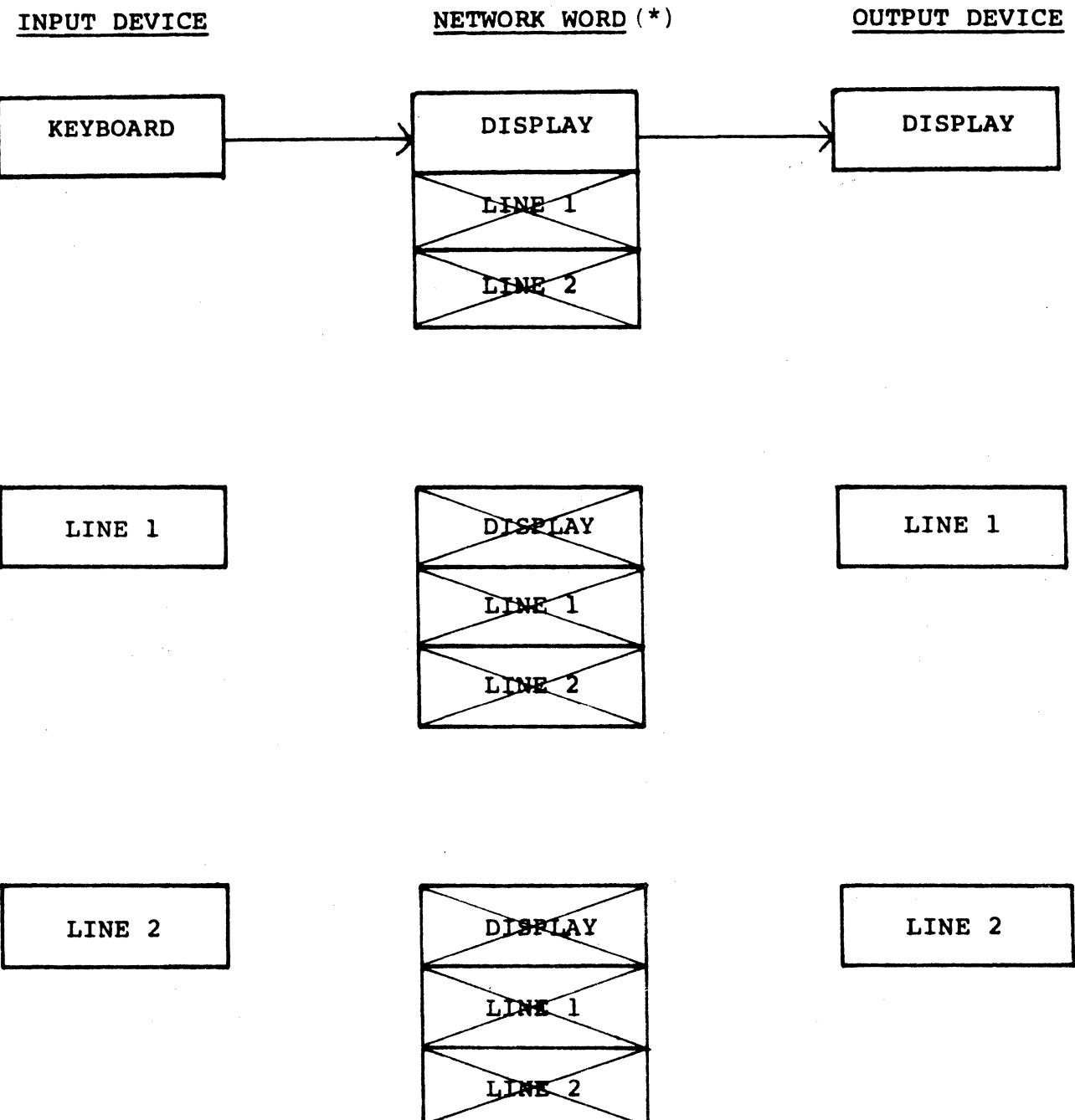
Consider the *concept* system to consist of the following three devices:

- keyboard/video display;
- primary communications line (line 1); and
- "printer" port (line 2)

Each of these terminal input devices has a unique network word associated with it. When input data is received over that device, the network word specifies which output devices are to be sent that data. Figure 1, for example, shows the following simple "network": data received from the keyboard (input) is transmitted to the video display (output). The input data is not transmitted out either communications line (that is, it is in "local" mode). Also, since the network words for lines 1 and 2 are totally "off", any data received over those lines will be ignored.

FIGURE 1

NETWORK SAMPLE



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- (*) specifies which output devices are "on" for the given input device. An 'x' drawn through the box in the network word indicates the device is "off" and will not receive data.

Figure 1 is, of course, a very simple example. In the remainder of this update we will show how the network word is used as the key mechanism for implementing a number of important terminal applications.

Communications Mode Settings

The following primary line (line 1) communications mode settings are implemented through the network word:

- Remote/local mode;
- Half/full duplex; and
- Block/character mode.

Using the multi-code sequence to change the above modes actually changes the required device network words.

The default keyboard network words for these modes are shown in Appendix D of the Reference Manual (Also, please refer to Section III for the definitions of these modes). The following figures present the network words for the various mode setting combinations. Since these modes apply only to the primary line the line 2 network word is not affected:

- Local mode (Figure 2): Data typed on the keyboard is displayed and all line 1 data is ignored. Half/full duplex and block/character mode do not apply since the terminal is not in remote mode.
- Remote/Block mode (Figure 3): Data typed on the keyboard is displayed, as well as data received over line 1. Keyboard data is not sent to line 1 as it is typed (block mode). Since data is always displayed as it is typed, the half/full duplex modes are identical. Data will be sent out to line 1 only when one of the block transmission functions is executed.
- Remote/half duplex/character mode (Figure 4): Data typed on the keyboard is displayed (half duplex "echo") and sent directly to line 1 (remote character mode). Data received over line 1 is also sent to the video display.

FIGURE 2

LOCAL MODE

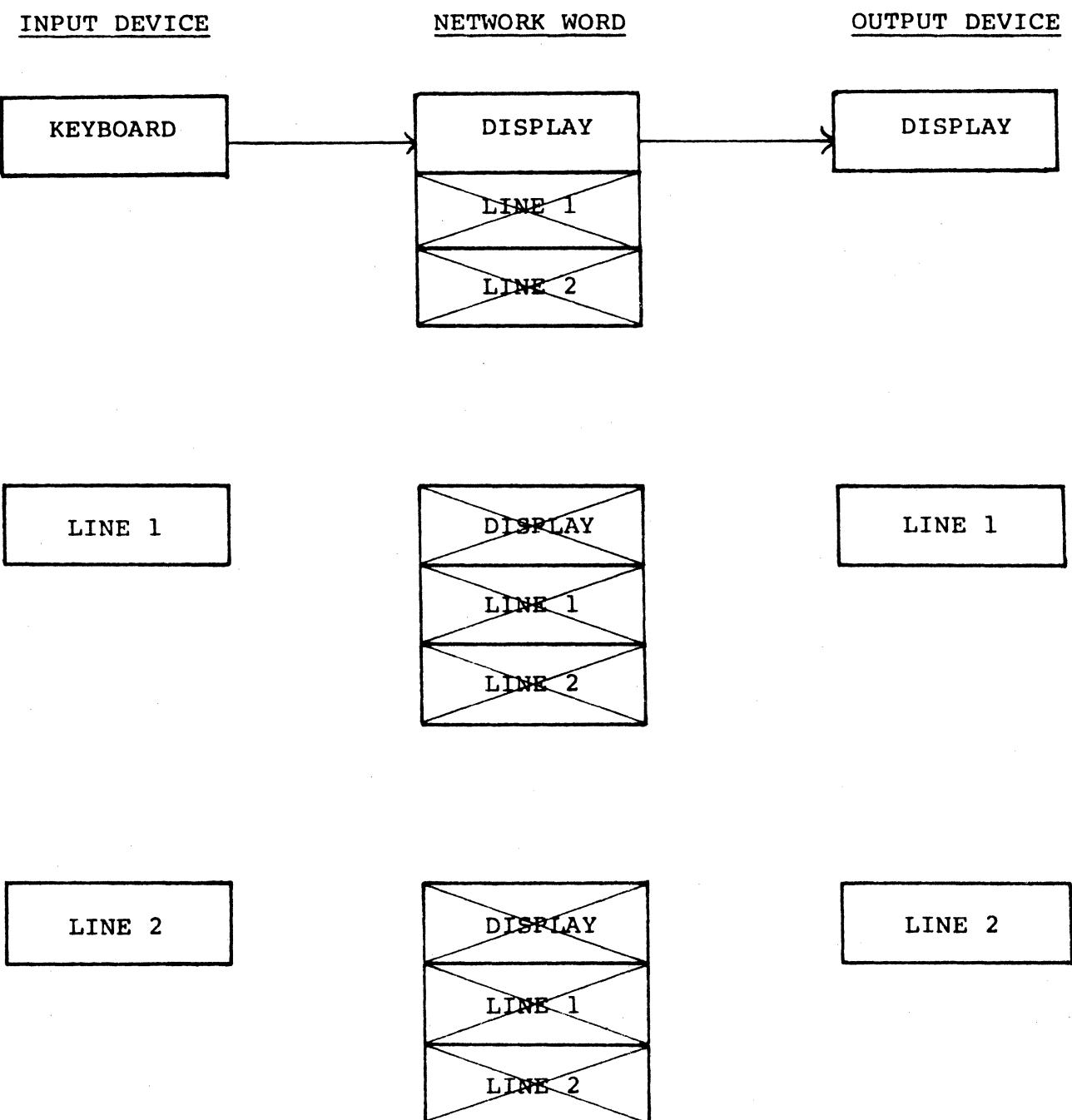


FIGURE 3
REMOTE/BLOCK MODE

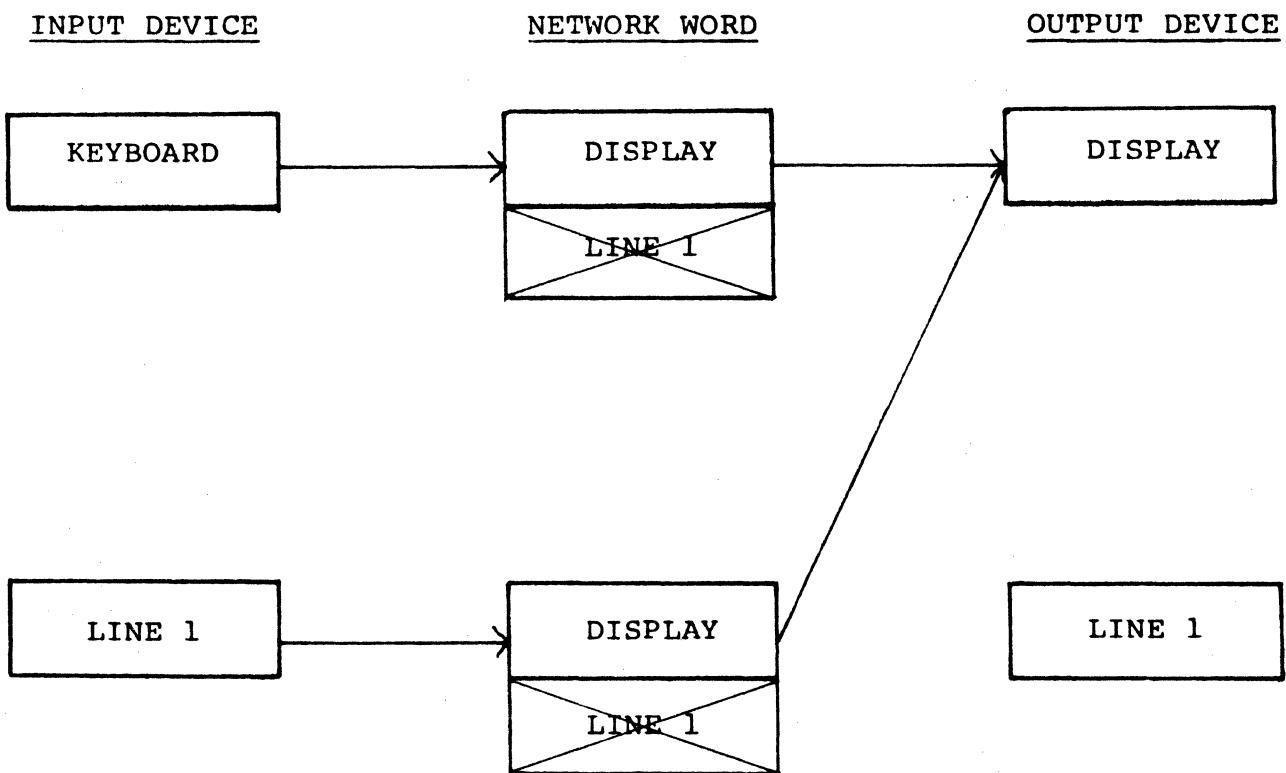
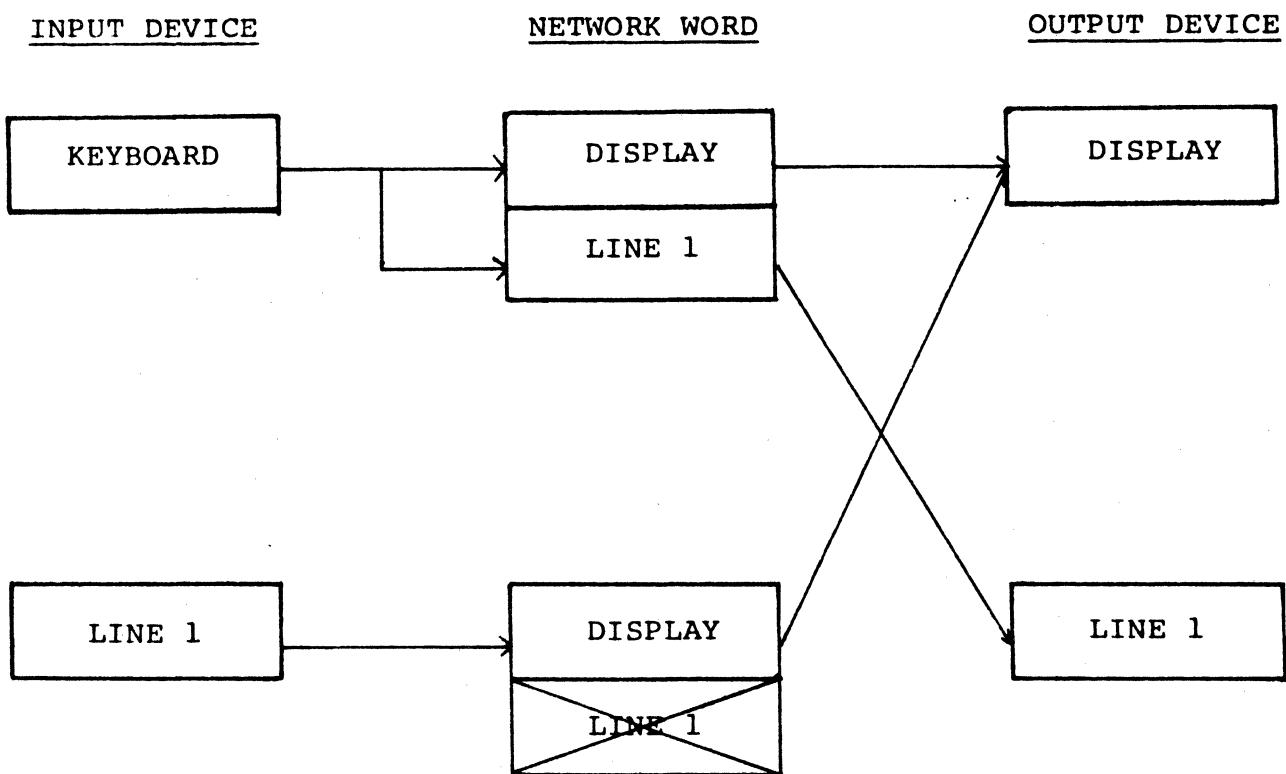


FIGURE 4
REMOTE/HALF DUPLEX/CHARACTER MODE



- Remote/full duplex/character mode (Figure 5): Data typed on the keyboard is sent to line 1, but not displayed directly by the terminal (full duplex). Data received over line 1 is sent to the video display.

Auxiliary Device Interface

Line 2 is often used as an auxiliary port to provide direct interface with a printer or tape unit. The printer, for example, is typically used in one of three ways:

- Data Logging: As data is sent to the display (by the keyboard or line 1), it is also sent to the printer. Assuming the terminal is in remote/half duplex/character mode (see Figure 4), Figure 6 shows the networking to accomplish the above. This is effected at the keyboard by depressing the control and PRINT keys together (Attach Printer).
- Remote Printing: The host computer (line 1) wishes to print data directly on the printer, without echoing the data on the video display. Figure 7 shows this network. (This example turns the keyboard "off" during the printing sequence)
- Local Copy: Data on the video display is copied locally on the printer, using the PRINT key. This function does not use the network word, since data is being transferred from display memory to line 2, and not from input devices to output devices as it is received.

Multiple Input/Output Device Access

The previous examples have either not dealt directly with line 2 or assumed it was a uni-directional (output only) port to a printer. However, it is fully bi-directional and allows the concept user to easily access two I/O devices (simultaneous access of multiple computers, for example). The following is an example of how networking is used to provide multiple computer access.

Assume we have the following requirements and restrictions:

- Two-port terminal (lines 1 and 2);
- Multiple-page terminal;
- Line 1 will communicate in half duplex;

FIGURE 5
REMOTE/FULL DUPLEX/CHARACTER MODE

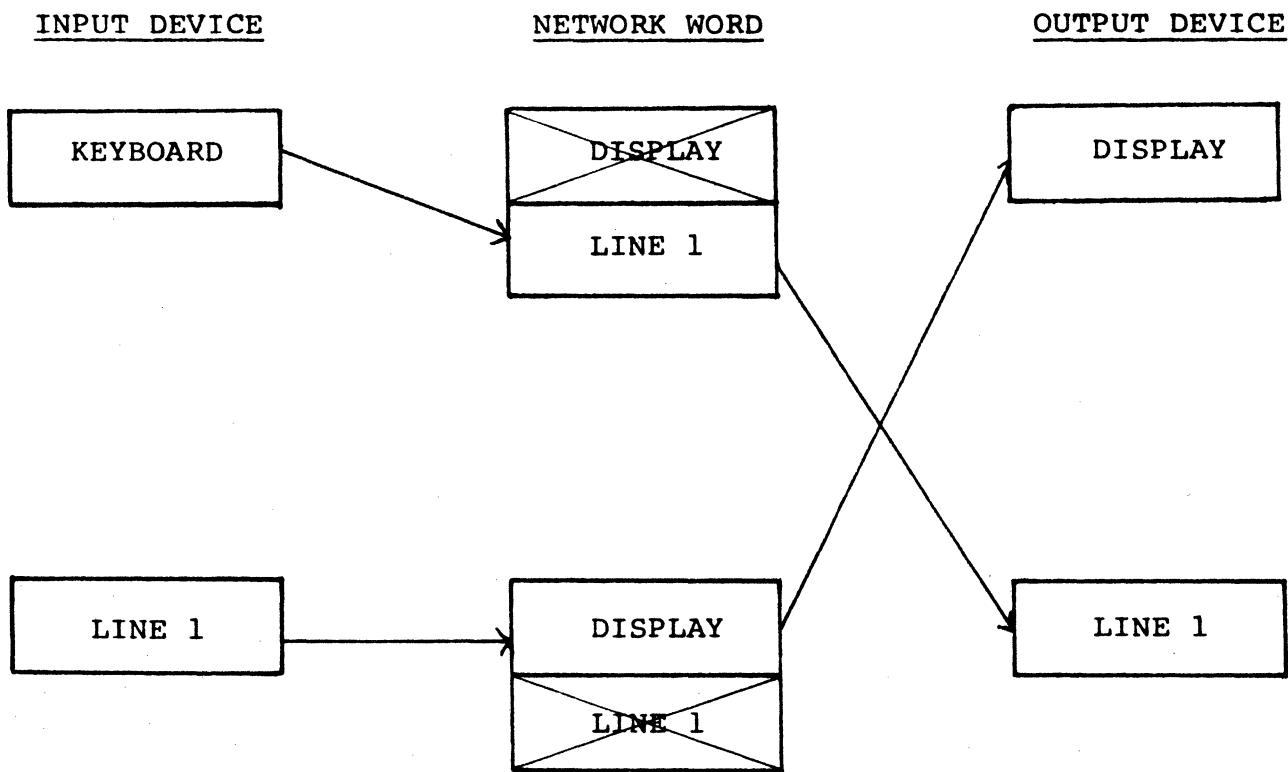
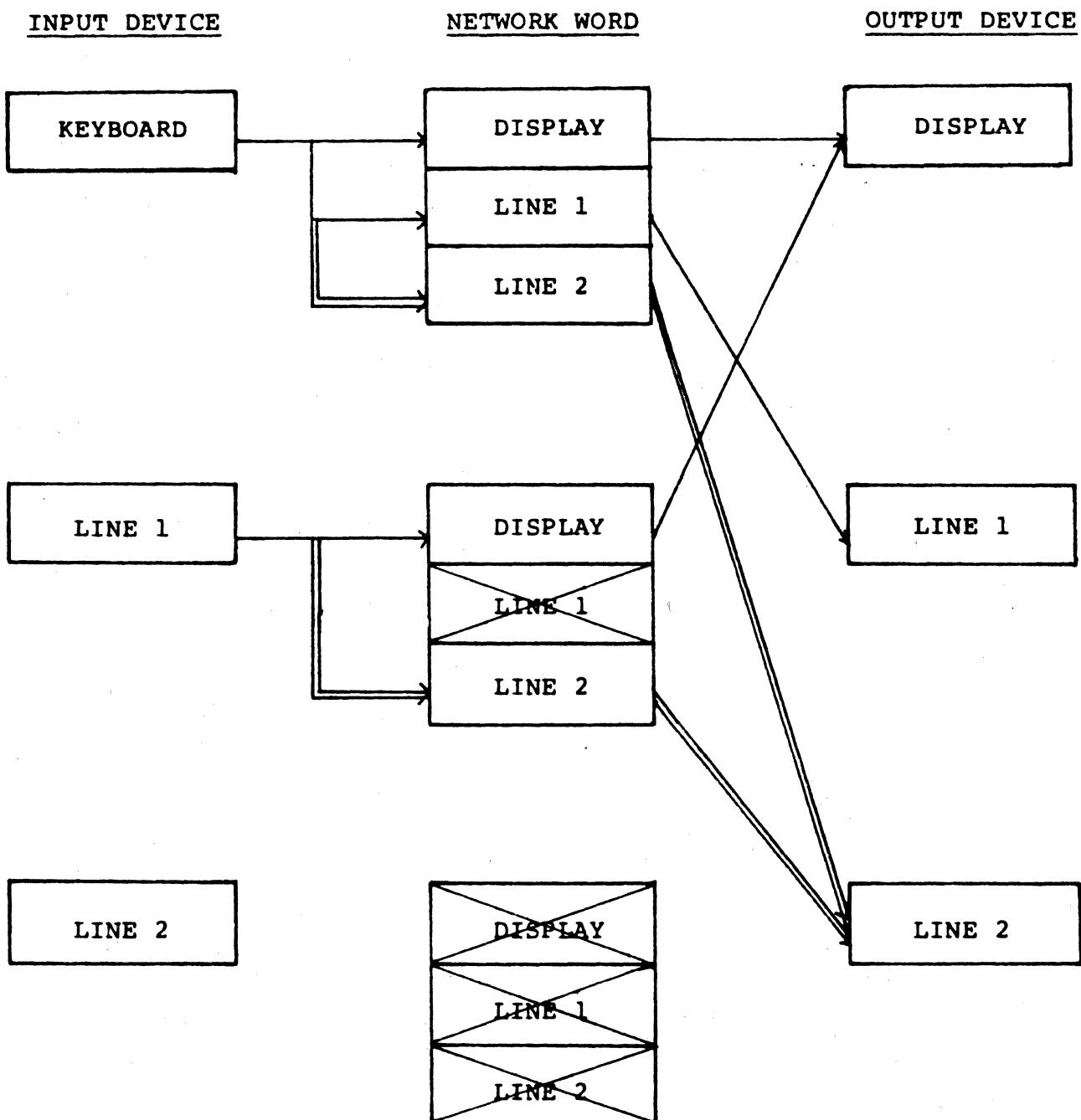
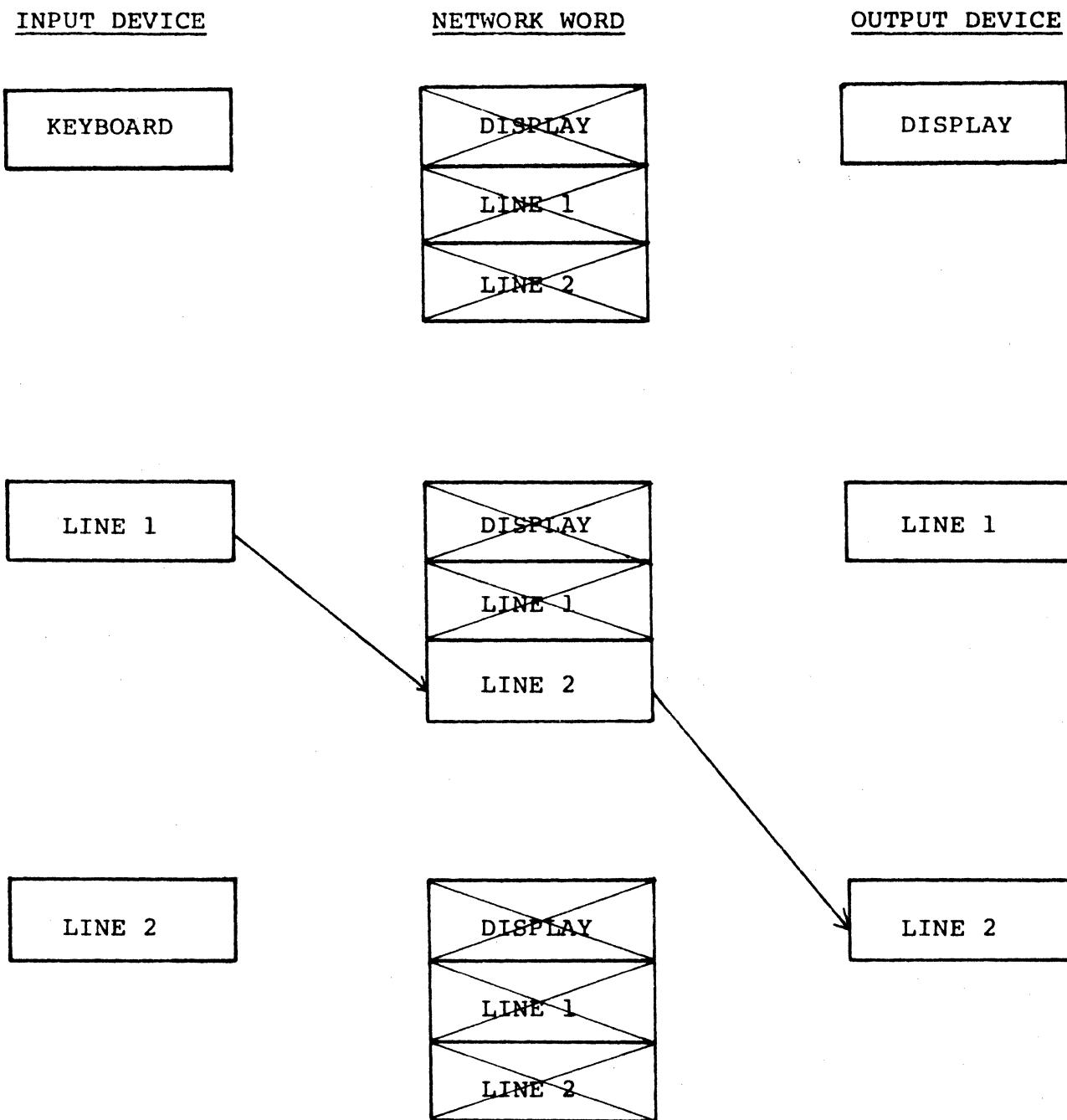


FIGURE 6
DATA LOGGING (*)



(*) single line represents "normal" network. Double line represents additional networking to implement data logging.

FIGURE 7
REMOTE PRINTING



- Line 2 will communicate in full duplex; and
- Access will be simultaneous; that is, while interacting with line 1, line 2 could be sending additional data to the terminal.

Note that line 2 of the terminal is normally wired to provide output to a printer. This means that the printer must provide request/clear to send (pins 4 and 5) and transmitted/received data are on pins 3 and 2, respectively (see Appendix E of the Reference Manual). Therefore, in most cases, the following changes must be made to the line 2 connectors to communicate with most computers:

- Jumper pins 4 and 5; and
- Reverse pins 2 and 3.

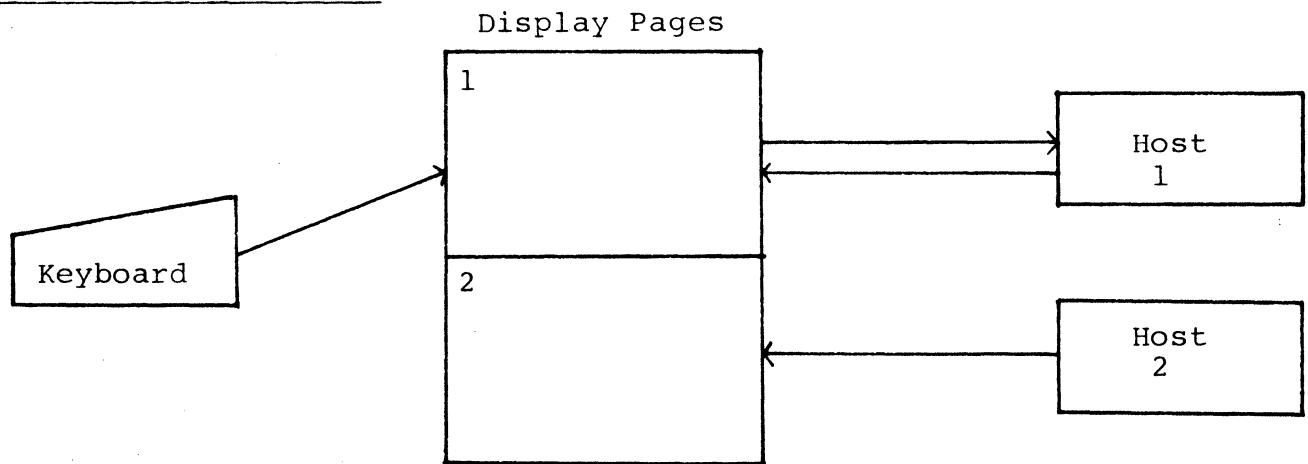
Figure 8 presents the overall configuration assumed. Basically, line 1 will interface with the user on page 1, and line 2 will interface on page 2. Figures 9 and 10 show respectively the required network words for line 1 access (half duplex) and line 2 access (full duplex). Note that both lines always are networked to the display (that is, access is simultaneous), and the keyboard network word alternates between lines 1 and 2.

Figure 11 shows the multi-code sequences used. This sequence will program function key F1 to communicate with line 1, with a window equal to the first page. Similarly, key F2 will access line 2 in the second page. In both cases, the following basic sequence occurs:

- The line is tied to the keyboard window;
- The keyboard window (and hence the line) is defined to be the first or second page;
- The other line is untied from the keyboard window and its window defined to be the other page; and
- The output network for the keyboard is set to be the display and line 1 (line 1, half duplex) or just line 2 (line 2, full duplex).

FIGURE 8
MULTIPLE COMPUTER ACCESS CONFIGURATION

Line 1 Communications



Line 2 Communications

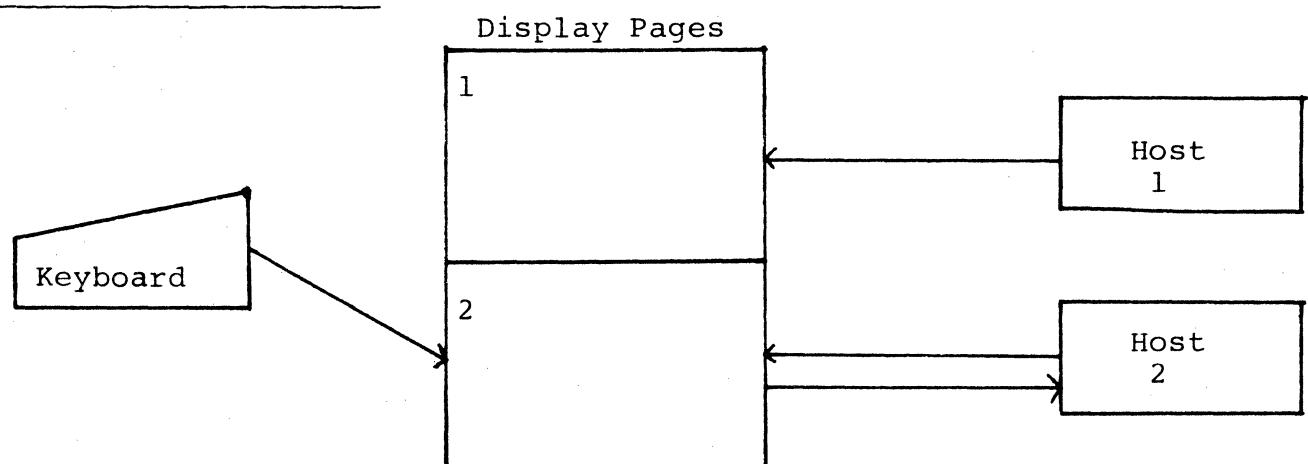


FIGURE 9
LINE 1 NETWORKING (HALF DUPLEX)

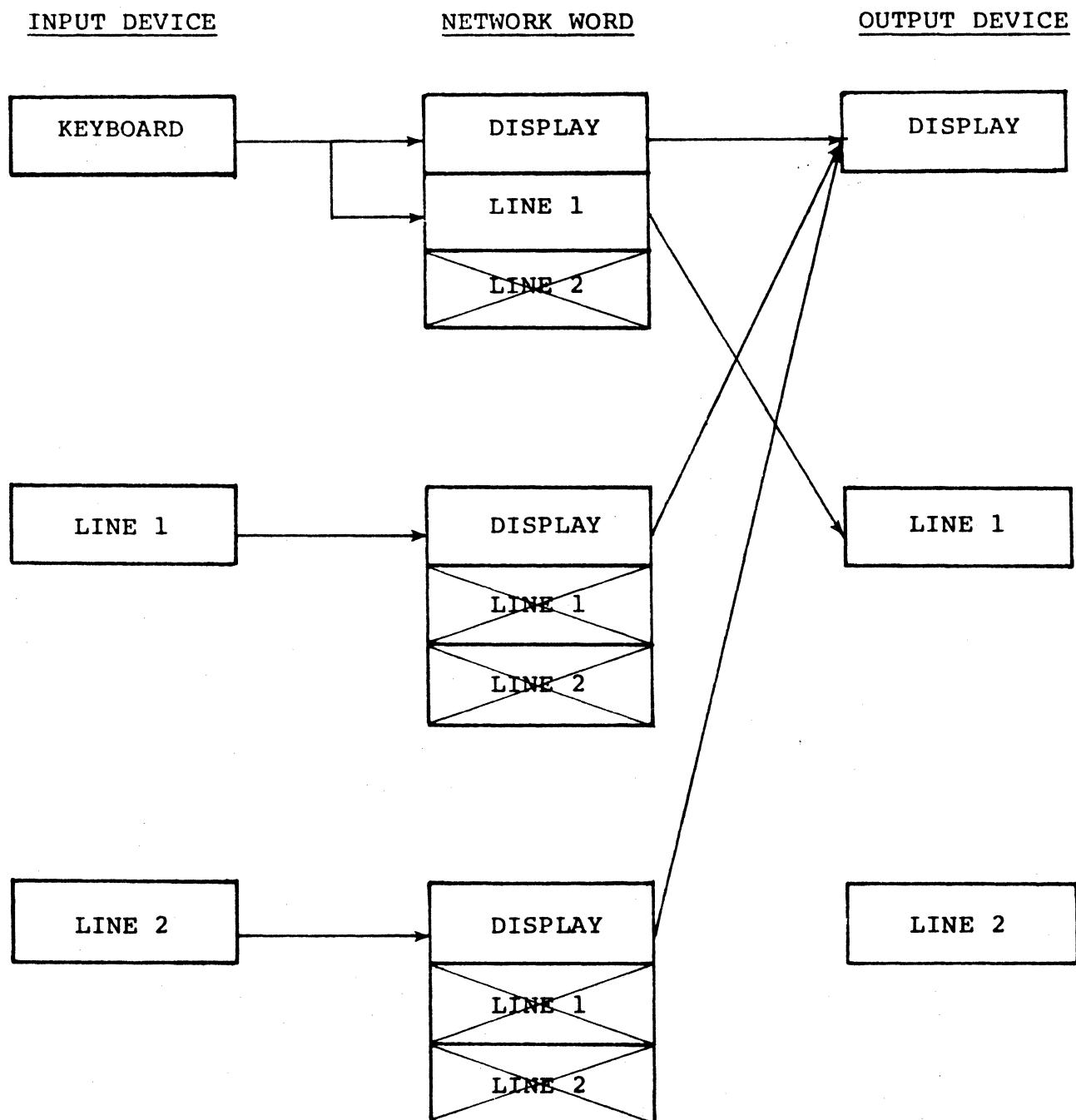
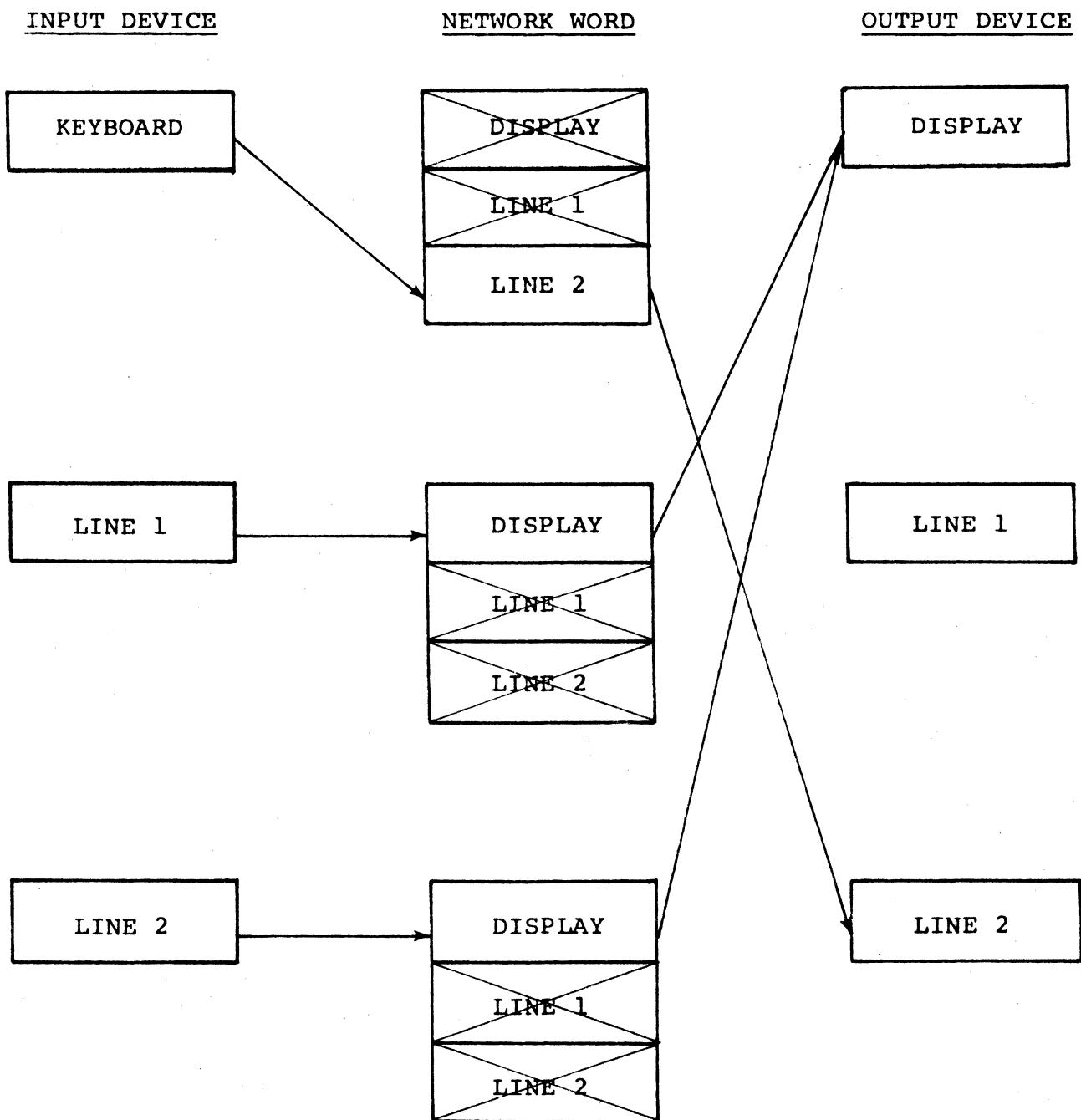


FIGURE 10
LINE 2 NETWORKING (FULL DUPLEX)





MULTIPLE COMPUTER ACCESS (SIMULTANEOUS)

<u>Multi-code Sequence</u>	<u>Decimal Equivalent</u>	<u>Meaning</u>
14. MC Q ! MC v ¶ ¶ 8 p ↑W	27 81 33 27 118 32 32 56 112 23	Define the line 1 window to be the first page (function route)
15. MC Y \$	27 89 36	Keyboard network to line 2 only
16. MC V 8	27 86 56	Set the start of screen to be the top of the second page (line 2 window) - end of F2 programming

This is only one example of establishing simultaneous access. Potential changes could include:

- When lines are switched, the user may need to have the cursor positioned at the next available space. In this case each function key should be programmed with the addition of the End of Text and Cursor Right commands (MC p MC =).
- If the Break or Send keys are used, other function keys can be programmed to function route these commands to line 2 (since the keyboard will normally send them only to line 1).

Figure 12 presents a different approach which can be used on single page terminals. It assumes that both hosts will not be transmitting simultaneously. That is, the user/keyboard "controls" the access. While line 1 is being interacted with, line 2 is assumed to be idle, and vice versa. In this method both lines (by default) are tied to the keyboard window, which alternates between the top (line 1) and bottom (line 2) halves of the screen. Again, the example assumes line 1 is in half duplex and line 2 is in full duplex. The keyboard network word is then used to control transmission to the appropriate lines.

Potential changes could include those mentioned above. Also, the function keys could be programmed to reset the network word for the alternate device to not affect the display (that is, F1 would set line 2's network word entirely "off", and vice-versa).

FIGURE 12
MULTIPLE COMPUTER ACCESS (ALTERNATING)

<u>Multi-code Sequence</u>	<u>Decimal Equivalent</u>	<u>Meaning</u>
1. MC U	27 85	Keyboard in Programmer Mode
2. MC Q ! MC Y Ø ↑W	27 81 33 27 89 48 23	Line 1 network to display (function route)
3. MC Q " MC Y Ø ↑W	27 81 34 27 89 48 23	Line 2 network to display (function route)
4. MC 4) 5 #	27 56 41 53 35	Program F1 in execute mode
5. MC v Ø Ø , p	27 118 32 32 44 112	Define the keyboard window to be the top half of the screen
6. MC Y 8	27 89 56	Keyboard network to the display and line 1 - end of F1 programming
7. MC 4) 6 #	27 56 41 54 35	Program F2 in execute mode
8. MC v , Ø , p	27 118 44 32 44 112	Define the keyboard window to be the bottom half of the screen
9. MC Y \$	27 85 36	Keyboard network to line 2 only - end of F2 programming