Honours Project 1991.

Implementing a Datascope on a Macintosh.

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1. Introduction.

A datascope is used for monitoring serial communication lines, both for analysis of correctly functioning communication systems, and for diagnosis of systems that do not function as they should. The device is electrically connected to communication lines at a particular point in a system, and it monitors these lines to display the information that is being transmitted.

Broadly speaking, the format of data that a datascope analyzes may be divided into two major categories : asynchronous and synchronous data (each of which shall be discussed in more detail below). The uses of a datascope are many, largely depending on whether the data being monitored are transmitted synchronously or asynchronously.

This report documents the design and partial implementation of a datascope that can monitor synchronous data (as is transmitted when communicating via a wide-area network), and well as asynchronous data, up to a maximum line speed of 9600 bps for full-duplex communication. Figure 1 shows a somewhat simplified view of the device connections.

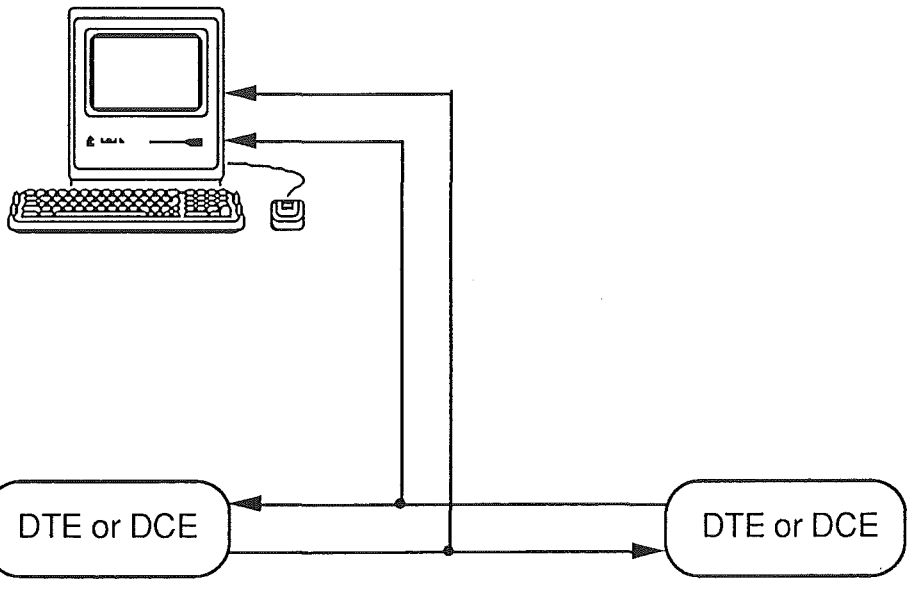

Figure 1. Simplified view of the basic connections

When a device is connected to a packet switching network, synchronous

communication is used for communicating with the network (as well as within the network itself). A typical use for a datascope in such instances would be to monitor the frames and packets being transmitted if such a communications system is not performing as expected.

When a computer is connected to a number of peripheral devices over a short distance (either directly or otherwise), where high speed communication is not necessary, and low cost is a more important factor, then it is more common for asynchronous communication to be used. Examples of such devices might be programmable controllers, printers, etc. Here, typical uses for a datascope are examining a communications protocol itself, or for inspecting the data that is being transmitted in the event that a device is not responding.

While this particular use of a datascope may seem somewhat contrived, it is in fact far from that. The task of getting two devices to communicate is often difficult due to poor documentation of a communications protocol, rather than the protocol itself. This is particularly the case for foreign products, when the documentation is written by designers who do not speak English as their native language. If performing a software upgrade for a device, and no source code for the existing software is available, it is often simplest to launch the old software, and monitor the line to see exactly how the protocol behaves.

Datascopes already exist to perform the tasks mentioned above, but their prohibitive price denies many potential users the opportunity of using one. At current prices, $5 000 would be a typical value of the peripherals and software for a fairly minimal system (not including the required computer); a stand-alone unit would cost considerably more.

The hardware required for this project is rather minimal, and the cost of such hardware is correspondingly low. For a one-off unit, using a Motorola MC68HC11 Universal Evaluation Board (discussed later), the cost is around $200. If a quantity of units were to be made, printed circuit boards could be constructed, and only the necessary components used, probably halving that cost again.

A major benefit of the hardware defined in this report is the fact that major upgrades can be performed, without the need for any hardware/firmware alteration. Any changes required are confined to the software for the Macintosh that controls the hardware. Additionally, the user interface of the software, being conformant to the Macintosh user interface guidelines, makes the software intuitive and simple to use, unlike many other systems.

2. Asynchronous Monitoring

2.1. The Format of Asynchronous Transmissions

Asynchronous communication is where communicating devices do not share a common timer, and no timing data are transmitted. The time interval between characters transmitted asynchronously can be of any length. Figure 2 shows the

format of asynchronous data communication.

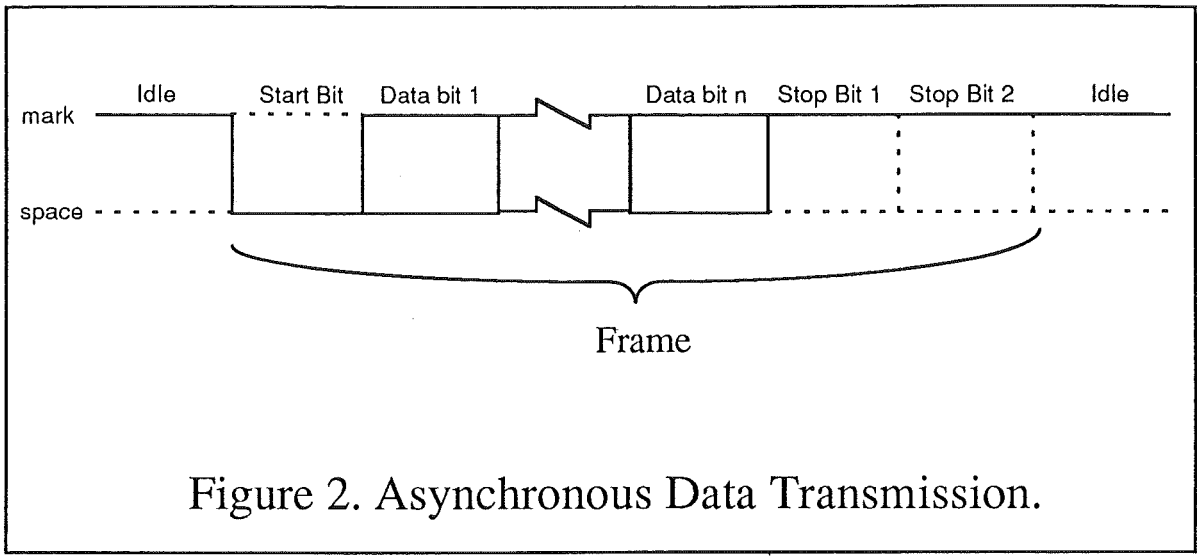

Figure 2. Asynchronous Data Transmission.

When a transmitting device is not transmitting, it maintains the transmission line in a continuous state. (This is referred to as the "mark" state, corresponding to binary '1'. Binary '0' is referred to as the "space" state.) The transmitting device may begin sending a character at any time by sending a *start bit*, which tells the receiving device to prepare to receive a character. The transmitting device then transmits 5, 6, 7 or 8 *data bits*, optionally followed by a *parity bit*. Finally, the device sends 1, 1.5, or 2 *stop bits*, indicating the end of the character.

The possible ways of calculating the parity bit are :

- Even parity - the number of marked data bits and the value of the parity bit add up to an even number
- Odd parity - the number of marked data bits and the value of the parity bit add up to an odd number
- Mark parity - the extra parity bit is always set to 1.
- Space parity - the extra parity bit is always set to 0.
- No parity - there is no extra parity bit.

2.2. The Main Lines used in RS-232C.

Figure 3 shows the lines used in RS232C, the most common asynchronous communications method.

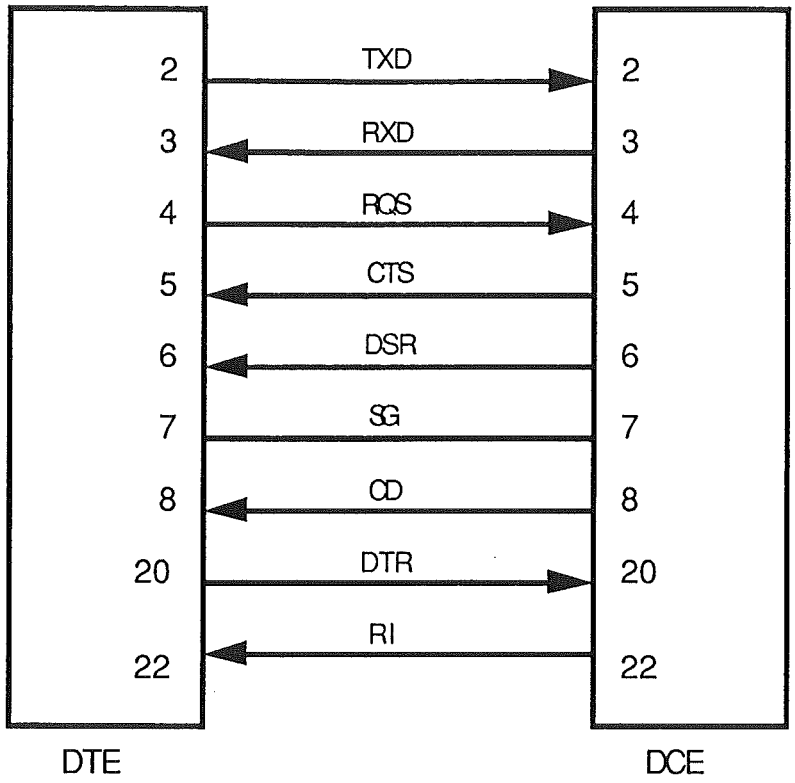

Figure 3. Standard RS-232 Connections

A brief description of these main lines follows :

TXD : Transmitted Data

RXD : Received Data

RQS : Request to Send
- Indicates DTE wants to send data

CTS : Clear to Send
- indicates DCE is prepared to accept data

DSR : Data Set Ready
- Asserted by DCE upon power-up.

SG : Signal Ground

CD : Line Detector

DTR : Data Terminal Ready
- Asserted by DTE upon power-up

RI : Ring Indicator
- Indicates that DCE is receiving a ringing signal

For the purposes of asynchronous line monitoring, only lines 2 an 3 (the Transmit Data and Receive Data) are monitored (with reference to line 7, Signal Ground).

2.3. Monitoring Using the Two Macintosh Serial Ports

The Macintosh has two serial ports : one modem port, and one printer port. Both ports are able to transmit and receive asynchronous data. Because of this, it is possible to use each of the two serial ports to monitor the information travelling in each of the two directions. That is, one port will monitor the "transmit" line, and the other port will monitor the "receive" line (only these two lines can be monitored here; any other handshaking lines are ignored).

2.3.1. Application #1 - A Software Perspective.

The first Macintosh application to be discussed is the version of the asynchronous datascope that needs no additional hardware. Figure 4 shows a screen dump of this application. Also presented in this section is a brief discussion about developing Macintosh applications in general, which differs somewhat from "traditional" programming.

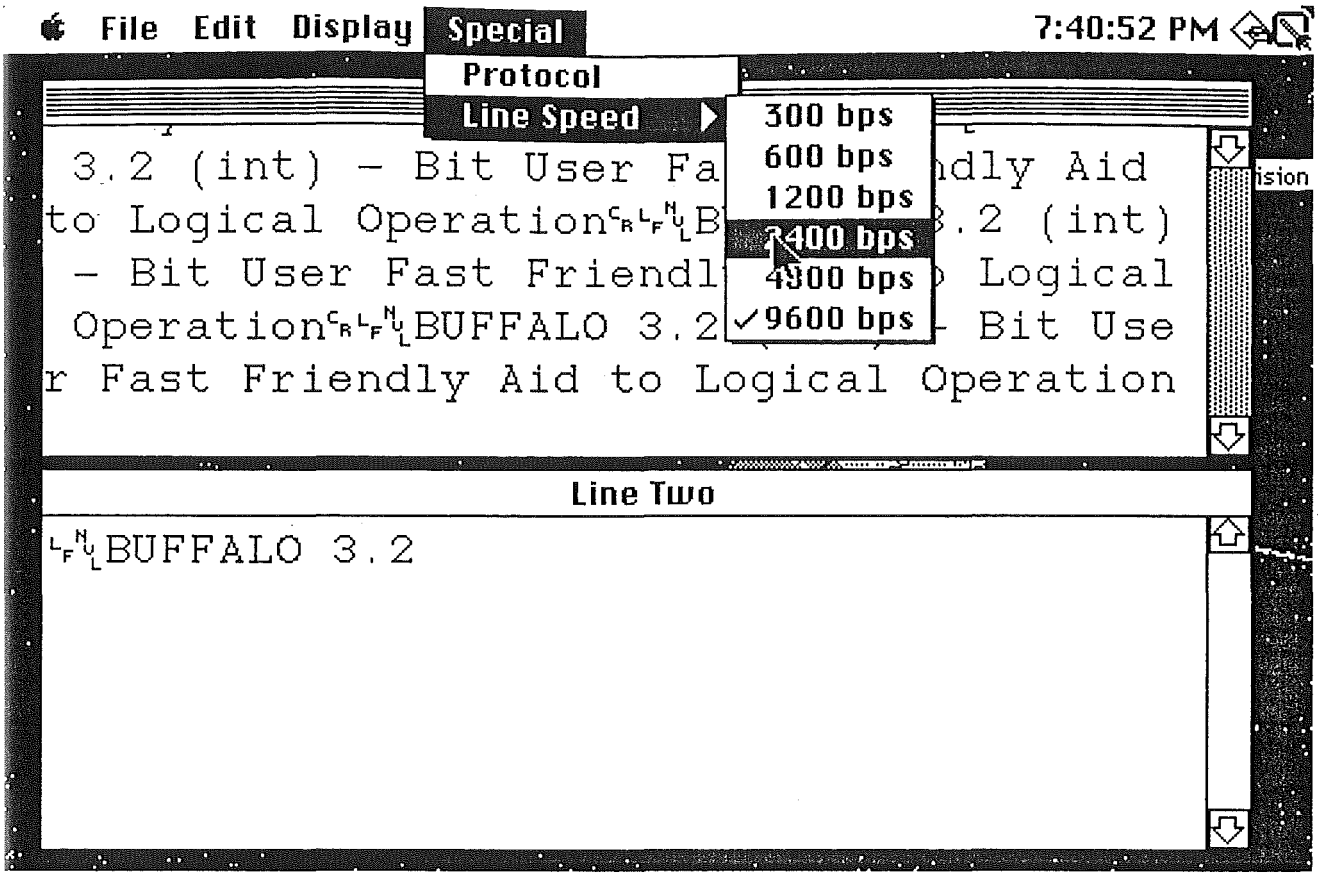

Figure 4. Asynchronous Application Screen Dump

In all the software developed for this project, *windows* perform an important part, as they are central to the idea of the Macintosh user interface.

Resources are also an important part of programming on the Macintosh. A program's resources contains various information that can be edited (normally using an application called a "resource editor") without necessarily changing the source code. Resources were originally invented to ease the conversion of software to foreign countries. They were conceived to isolate those aspects of a program's behaviour that could vary from country to country. However, resources were soon realized to be a more powerful, more general mechanism than just for foreign conversion. The standard practice is to separate objects such as menus, windows, dialogues, etc., from the rest of the program.

One result of resources being separate from the rest of the program is that a source listing does not contain all of the relevant information about a program. Therefore, all source listings in the appendices are followed by their corresponding resources, where possible.

Appendix A contains the source listing and resources of the Macintosh application presented in the *next* section (asynchronous monitoring using external hardware). The code to implement the two-port method is almost identical to this. The only significant differences are that the data are read in differently, and an extra window is supported in the version in the appendix. As mentioned above, the code is rather different to that of a more "traditional" program. The key difference is that Macintosh applications are, in general, *event driven*. Such an application basically iterates within a central loop, the *event loop*, that waits for *events*. Examples of events are a disk insertion, a keypress, the user clicking the button on the mouse, or the screen needing updating. Some events cause the system to generate other events. For example, a user clicking on a rear window to bring it into the foreground may cause an event saying that the screen needs updating in a particular region.

When an application receives an event, it then decides what type of event has occurred, calls an appropriate routine to handle that event, and returns to the event loop again. This method of operation means that the *user is controlling the program*, and not vice versa.

The *modus operandi* of the application is fairly straightforward, if not the required programming to achieve it. The main program sits in an event loop, and waits for an event it can act on.

At every iteration of the event loop, the serial ports are examined to see if any new data has arrived. If so, the data is read in and is stored in arrays. Indexes are also updated for keeping track of the data. The windows are then updated, and scroll up to make room for new data if necessary. At any time, the user can use the scrolling controls of the windows to view all data that may have scrolled off the screen previously.

The way each character is displayed can also be altered. The characters may be shown in hexadecimal, ASCII with all control characters shown in hexadecimal, or in ASCII with all control characters displayed by their mnemonic (e.g. STX, DEL, etc). For this last method of display, a font had to be edited, so that the mnemonic codes only take up one character "width" - otherwise, characters of different width would

occur, making the display unsightly and hard to follow. (The hex digits were also edited, so that two hex digits takes the space of just one ASCII character.)

The remainder of the software is fairly self-explanatory. The program features pull-down menus and submenus for setting the parameters (i.e. line speed, the number of data bits, display options, etc).

2.3.2. Evaluation Of the Two-Port Method.

The advantage of using this method is that it requires no external hardware. However, this method also has a number of disadvantages. One disadvantage is that *both* Macintosh serial ports need to be used. This means we cannot connect a printer or any other peripheral device while the application is running in this manner.

Another disadvantage is that if data arrives at both of the two serial ports, it is sometimes impossible to distinguish which message arrived first. To tell which port received data first, an application would have to iterate in a tight loop, continuously monitoring both ports. But when a user, for example, selects a menu option, the operating system takes over for the entire period that the mouse button is held down. Adding this to the fact the the Macintosh is really running a basic operating system means that it is often impossible to overcome this problem.

The *main* disadvantage, however, is that it is possible to *lose* data in certain circumstances. Most Macintosh models use the CPU to transfer data to and from the hardware device interfaces (e.g. the SCSI port, the floppy disk controller chip, etc.). During the time-critical portions of the transfers, the CPU temporarily disables interrupts, to ensure that the transfer loops are not interrupted.

The serial-port controller chip (SCC) has only a very small on-chip buffer. When data is being received at high speeds, and interrupts are disabled, the SCC can easily overflow, losing data.

The floppy disk controller has come special code which allows it to poll the SCC's *modem-port* input registers periodically during a floppy-disk transfer (when interrupts are disabled). If the modem port has data pending, the floppy driver removes it from the SCC and stores it in a buffer (just as the interrupt handler would do if it were able to function). Once the floppy-disk transfer is completed, and interrupts are re-enabled, further data transfers will take place via interrupts.

The floppy disk controller does *not* poll the *printer port*'s registers, however. The consequence of this is that if interrupts are disabled for more than the amount of time than it takes the printer port to receive two or three characters, then the SCC's on-chip buffer will overflow and data will be lost.

There are two ways of avoiding this happening. If the printer port is set up to allow for flow-control (either XON/XOFF or hardware handshaking), then a program can assert flow-control before performing disk I/O, and can then disassert flow control once the I/O is complete. This is not an acceptable method for a datascope application, however, as *interfering* with the communication lines may influence the observed results. Another method is simply not to allow any disk accesses during the period when the lines are being monitored. However, in a multi-process

environment (e.g. Multifinder or System 7), neither of these techniques are very reliable.

The main consequence of all this is that for a datascope application to read in data from the printer port, serious limitations are imposed upon the application itself. To produce a datascope that is free from such limitations, and that conforms to the Macintosh user interface guidelines, requires that all serial data reception be from the modem port. This implies that, to monitor two communication lines, we need some external hardware, performing multiplexing and other such functions that the Macintosh serial ports are not capable of.

2.4. Monitoring Using External Hardware

By using a small amount of additional hardware which is connected to the Macintosh's modem port, the problems inherent in the above method can be avoided. The hardware required for this method has been broadly designed (as will be discussed below), but has not as yet been implemented. Figure 5 shows a simplified view of this.

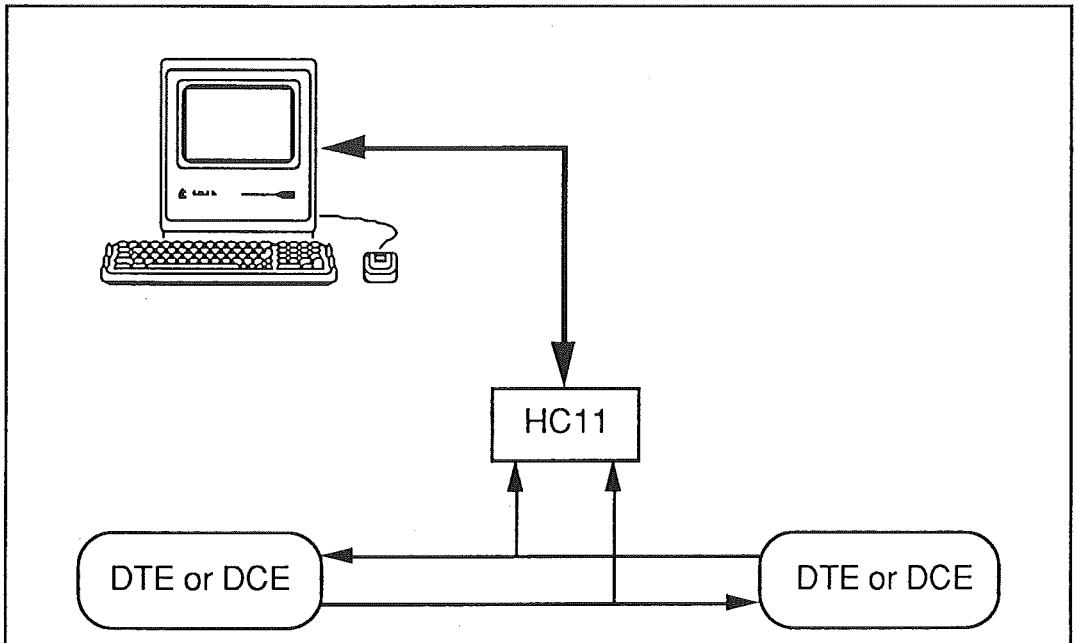

Figure 5. Simplified view of the basic connections with external hardware.

The advantages of using external hardware are :

- only one Macintosh serial port (the modem port) needs to be used, leaving the other port free for connecting to peripheral devices.

- No restrictions need to be placed on the user to maintain the integrity of data (i.e. there is no loss of data due to the reasons outlined above in the previous application).

- The hardware required for this method is identical to that required for the monitoring of *synchronous* data. Therefore, once the hardware is obtained, the user has the potential of a powerful line monitoring tool.

The hardware solution does in fact have one *disadvantage*, however. When using hardware, the data from the two lines is essentially multiplexed into one line for connection to the Macintosh. Due to this fact, and the existence of other overheads, the maximum line speed that can be monitored using hardware is 9600 bps. Using both Macintosh serial ports as in the application above, however, means that both serial ports are able to receive (and hence monitor) at their maximum speed of 57600 bps.

2.4.1. Hardware Required

The following discussion of the required hardware applies to the monitoring of both asynchronous and synchronous data, because, as mentioned above, the requirements are identical in both cases.

The hardware itself is built around the Motorola MC68HC11E9 Microcontroller Unit (MCU). This high-density complementary metal-oxide semiconductor (HCMOS) device is an 8-bit microcontroller unit, having a broad range of on-chip peripheral capabilities. The on-chip memory systems include 12K bytes of ROM, 512 bytes of electrically erasable programmable ROM (EEPROM), and 512 bytes of static RAM. It has a built-in serial communications interface (SCI), and it is through this interface that the device communicates with the Macintosh. The device is programmed using an enhanced M6800/M6801 instruction set.

To ease construction, Motorola produces a board called the 68HC11EBVU, known as a Universal Evaluation Board. This board is produced specifically for development and evaluation of the HC11 microcontroller.

In the HC11E9 microcontroller supplied with the universal evaluation board, the 12K bytes of ROM contain a monitor/debugging program. This program communicates with the user via the SCI; a user can interact with the monitor program simply by connecting a terminal to it (or connecting a Mac running a terminal emulation program).

Motorola also supplies a cross-assembler that runs on the Macintosh. HC11 assembly programs are entered on the Macintosh (and saved to disk if required), and are then cross-assembled to run on the HC11. The assembled code is then downloaded (using a facility of the monitor program) into the HC11's built-in EEPROM.

When the evaluation board is powered up (and a fabricated "jumper" is in a particular position), the monitor program automatically starts up. However, when the board is powered up with the jumper shifted so that it electrically connects a different pair of pins on the board, the user's program resident in the EEPROM is

automatically activated instead. Several small HC11 programs were written to test this facility.

The HC11 microcontroller does not have the advanced communications facilities required to directly receive dual synchronous/asynchronous transmissions. It needs to be interfaced with a specialized serial communications controller.

The communications chip to be used is the Signetics SCN26562 Dual Universal Serial Communications Controller (DUSCC). This is a single-chip MOS-LSI communications device that provides two independent, multi-protocol, full-duplex receiver/transmitter channels in a single package. This chip provides all of the communications facilities required for this project, being capable of supporting bit-oriented and character-oriented synchronous data-link protocols, as well as asynchronous protocols. Naturally, only the receivers of the DUSCC shall be used, since only monitoring of the lines is required, and interfering with the data in any way is not acceptable.

The DUSCC is a very versatile device, and includes such options as the monitoring of additional lines (which may be useful, say, for monitoring hardware handshaking lines as well as the transmitted data), as well as features for synchronous communication, such as automatic CRC generation and checking, bit stuffing, etc. There are also features for character-oriented protocols such as BISYNC, but these are not required for the purpose of this project (even though they can be used just by modifying the Macintosh software, should support of the BISYNC protocol be desired). The DUSCC has a large number of built-in registers, which can be written to for changing the operation of the device, or read from for obtaining status information.

The DUSCC reads data from the communication lines being monitored, and the HC11 continuously checks the DUSCC to see if any new data is pending, or if the DUSCC has any new status codes. If so, it passes these directly to the Macintosh. Additionally, the HC11 reads commands from the Macintosh, and passes them as required for the DUSCC to act upon.

2.4.2. HC11 Simulator Application

Since the required hardware has not as yet been constructed, a method was required to test that the application was working correctly. To solve this, another application was written to *simulate* the transmissions of the completed HC11 board. This application was launched while the datascope application was active, running simultaneously under Multifinder. This program simply sends out data via the printer port that the HC11 would have sent out (at a line speed of 57600 bps). A cable was constructed that simply connected the printer and the modem ports together, so that whatever is sent out of the serial port is returned directly back to the modem port, and vice versa. The two programs are unaware of each others' existence; there is no reason why the two applications couldn't run on different Macintoshes, connected directly by the same cable, except that using one Macintosh was more convenient. Using this strategy, the application was tested. A source listing of the sample generator is given in appendix B.

2.4.3 Application #2 - A Software Perspective.

As mentioned before, the source code for the two-port method and the external-hardware method is almost identical. The main differences here are the support of an extra window showing the order in which data arrives at the two ports, and a slightly different method for receiving the data.

Several modes are available for viewing the data. The data from the two communication lines can be displayed in separate windows so the user can immediately see which device sent which data, or they can be combined into one window so that the user can see how the two devices respond to each other. This latter method is not possible using the two Macintosh serial ports, for the reason that if data arrives at both of the serial ports, it is not always possible to calculate *which* message arrived first. As mentioned when discussing the two port method, a program would have to iterate a very tight loop to overcome this problem; this is *precisely* what the HC11 program actually does.

Each character, when transmitted from the HC11 to the Macintosh, is split up into two bytes. The first byte contains the 4 most significant bits, and the second byte contains the four least significant bits. One byte is not sufficient, as not only is it possible to have 9-bit characters (8 bits plus parity), but the Macintosh application also needs to be able to distinguish between data bytes and status bytes, as well as distinguishing which of the two channels the data byte was actually read from. The format of the data to be sent to the Macintosh from the HC11 (and hence the data format of the transmissions of the simulator application) are :

bit	meaning
7	set to 0 for first byte of the pair sent, or 1 for the second.
6	set to 0 if the byte is a data byte, or 1 if it is a status byte
5	If the byte is a data byte, set to line that byte is from. If it is a status byte, the value is undefined.
4	Extra parity value if the character length is 8 bits + parity. Undefined otherwise.
3	data bit 7/3
2	data bit 6/2
1	data bit 5/1
0	data bit 4/0

If, for a data byte, the line that the data was from (bit 5) is different for the two received bytes, an error occurs. It is assumed that the second byte of a pair is always sent immediately after the first byte (i.e. there is definitely no bytes in between). If the receiving Macintosh application, upon startup, receives a byte that is the second of a pair, the byte is just discarded, to synchronize the with HC11.

The HC11 communicates with the Macintosh at a rate of 57600 bps, which is the fastest rate at which the Macintosh serial drivers can receive data. Since each character monitored by the HC11 is transmitted to the Macintosh in two bytes, and since data can be received on two lines simultaneously when monitoring full-duplex communications, the maximum lines speed that can be monitored is under a quarter of 57600 bps, i.e. under 14400 bps. This means that 9600 bps is really the

maximum commonly used line speed that can be monitored.

A source listing of the second datascope application is given in appendix A. Figure 6 shows the relationship between the second datascope application and the message generator application.

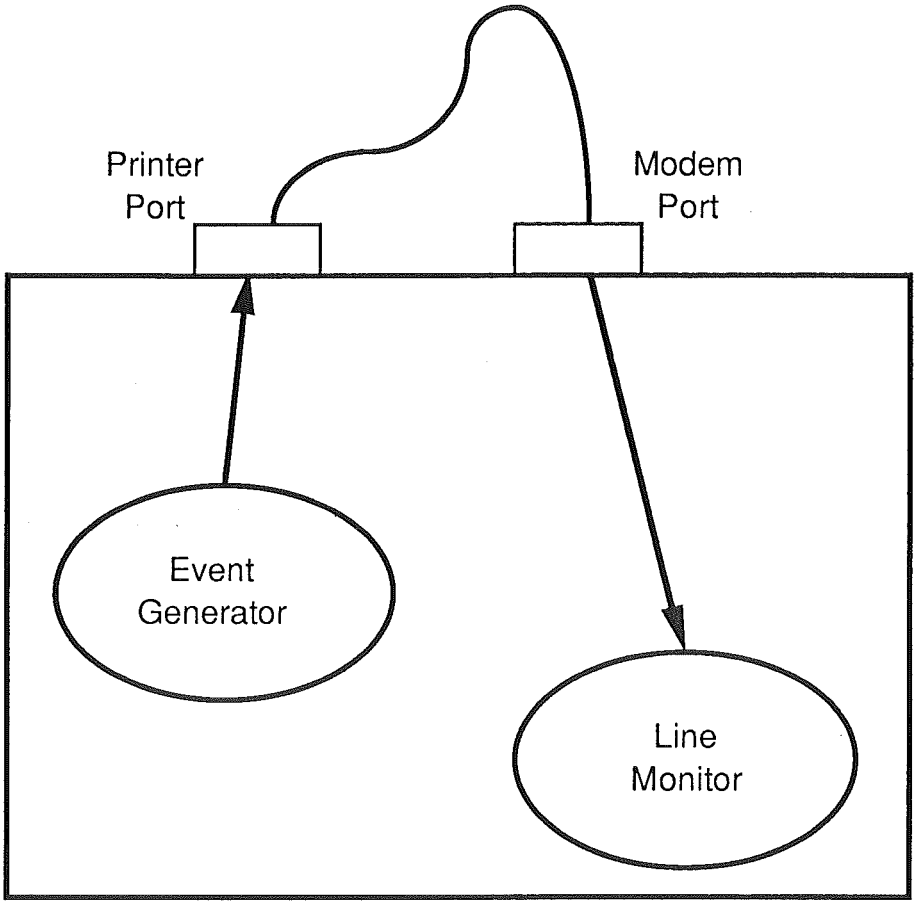

Figure 6 : Relationship of event generator to line monitor

3. Synchronous Monitoring

As mentioned before, the hardware required for this part of the project is identical to that of part I(b). When implemented, no changes will be required either to the external hardware itself, nor to the program resident in the HC11 microcontroller. The only changes required are concerning the software used on the Macintosh.

3.1. Specification of Software for Synchronous Monitoring

The row data is read from the serial port, and is composed into bytes (since again, each byte will have to be split into two to convey extra information such as which communications line the data actually came from). This data is then composed into *frames* (layer 2). These frames are then composed into *packets* (layer 3), and these packets are to be displayed on a window. The window needs controls so the user can scroll up and down, looking at all packets that have been received. By clicking on a packet (or a number of packets), the corresponding layer 2 information packets will be displayed in an adjacent window. This is shown conceptually in figure 7.

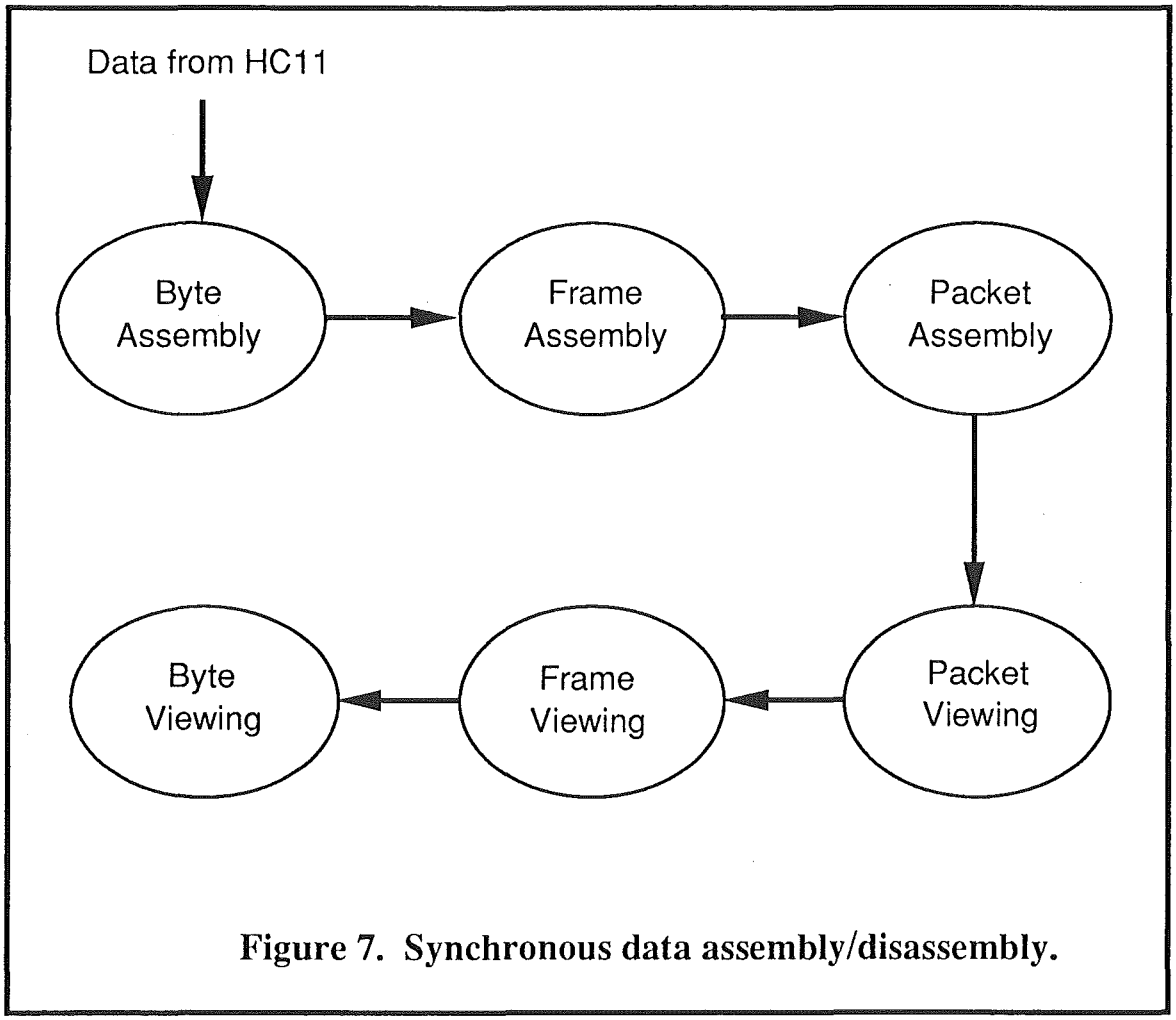

Figure 7. Synchronous data assembly/disassembly.

Similarly, by clicking on level 2 frames, the constituent bytes are displayed in yet another window. These may be displayed in ASCII, hexadecimal, or the frame could be more meaningfully decomposed by showing the value of certain fields of the frame format definition.

A view of what an actual implementation of this might look like is shown in Figure 8.

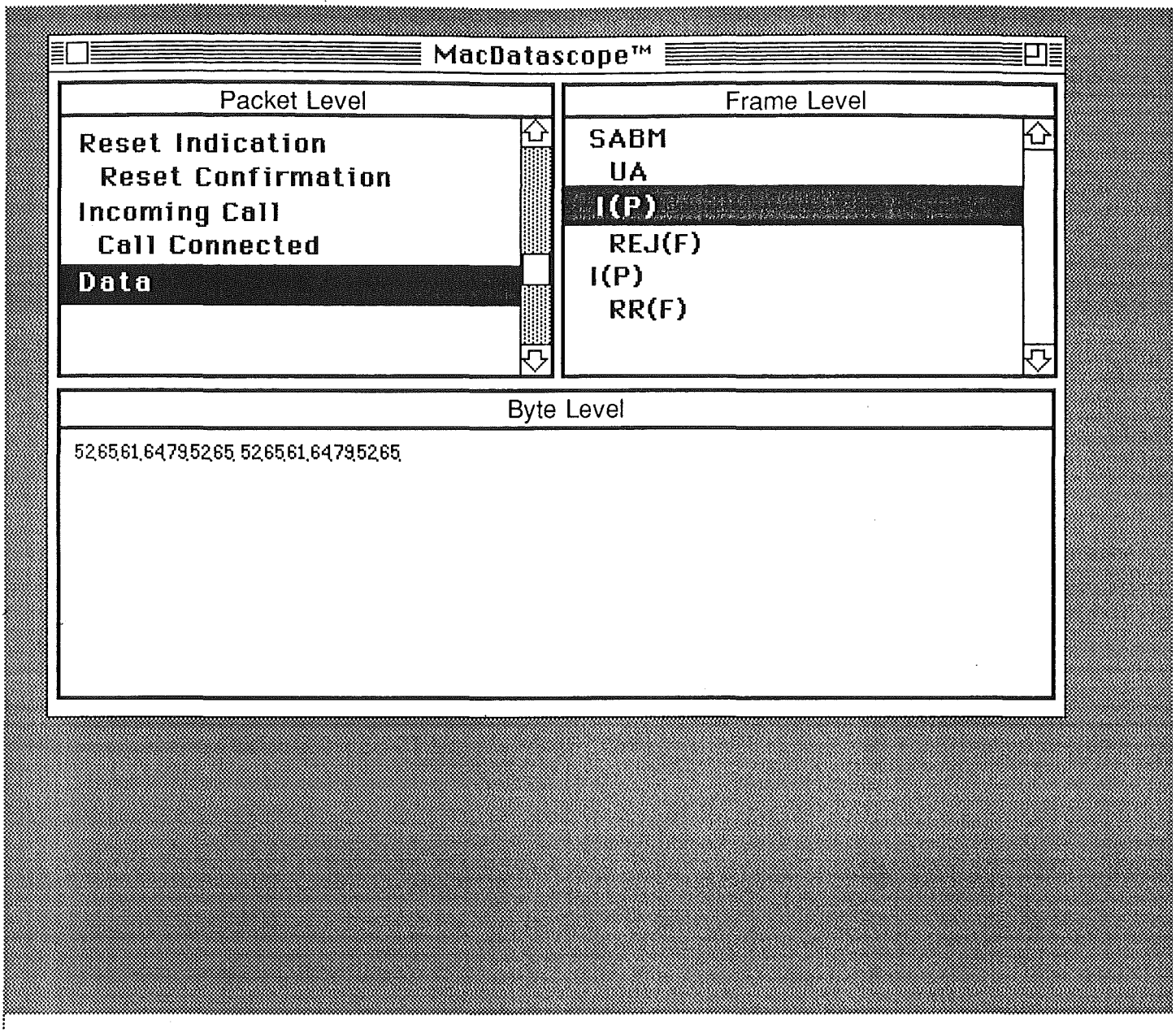

Figure 8. Possible Layout of Synchronous Application (Simplified).

Another thing that needs to be considered is the concept of *triggers*. Rather than have the user wait for a possibly distant event (e.g. a packet being a particular type, or having particular contents), the program needs to be able to wait for this event before storing data internally. This saves the user the frustration of searching vast amounts of data for a small number of important events. Constructing the program in a similar manner to the applications included with this report would enable this feature to be implemented fairly simply.

4. Summary

This report has documented the design of both asynchronous and synchronous datascopes. A simple asynchronous datascope using the two Macintosh serial ports has been implemented, and other versions requiring the external hardware have been partially implemented. The external hardware has been basically designed, but has not as yet been constructed.

It is seen that while using extra hardware for asynchronous monitoring adds extra versatility, the penalty suffered is that the maximum line speed able to be monitored is 9600 bps (as opposed to 57600 bps when just using the two Macintosh serial ports). When monitoring synchronous data, however, external hardware is obviously required, since the Macintosh serial ports only support asynchronous communications.

There are many future directions in which this project could develop. A main drawback with the applications presented here is the limitation of only being able to monitor lines that are communicating at speeds of 9600 bps or less. The external hardware itself is more than capable of monitoring lines communicating at speeds much higher than this, the bottleneck being the link from the HC11 to the Macintosh. Possibilities for overcoming this include using an Appletalk connection, or even a SCSI connection. The cost of SCSI support would increase the cost of the hardware considerably, but it would still be much less expensive than commercial units.

Alternatively, a card could be designed to slot into the computer. However, this would restrict the application to certain model Macintoshes such as the SE and Macintosh II series, since the other models do not have facilities for adding cards such as this.

There are many other features that could be implemented in a synchronous datascope, just as there are many improvements that could be performed on the asynchronous applications already presented here.

Examples of extra facilities that could be added but are not implemented yet are :

- saving of data to disk
- printing data
- searching data
- triggers
- allowing data to be copied to the Macintosh scrapboard.

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Appendix A.

Source listing and Resources for the external hardware method of line monitoring.

```
#include <stdio.h>
#include <string.h>

#include "CommonDefs.h"


/* pointers to the display windows
 * - used for performing system window operations
 */
WindowPtr           gWindow[ NUM_TEXT_WINDOWS ];


/*
 * exit flag
 */
Boolean             gDone;

/*
 * flag showing get system function WaitNextEvent
 * is present or not.
 */
Boolean             gWNEImplemented;

EventRecord         gTheEvent;


int                 gLastDisplayMode;   /* i.e. hex, ASCII, etc.    */

Rect                gDragRect, gSizeRect;


/*
 * references to scroll bars on windows (one in each window)
 */
ControlHandle       gScrollBar[ NUM_TEXT_WINDOWS ];

/*
 * handles to the various menus
 */
MenuHandle          gAppleMenu, gSpeedMenu, gDisplayMenu,
                    gDataBitsMenu, gParityMenu, gStopBitMenu,
                    gRunMenu;



/*
 * variables remembering various submenu options (parity, speed, etc.)
 */

int                 gSpeed;         /* bps                                  */
int                 gNumDataBits;   /* number of data bits in a character   */
int                 gParityBit;     /* type of parity bit, if any           */
int                 gStopBitLength; /* relative to a data bit               */
int                 gTerminalMode;  /* is terminal mode active ?            */
int                 gRunMode;       /* is program currently reading data ?  */

/*
```

```
 * references to the serial ports used
 */
int                 gPortRefIn, gPortRefOut;


/*
 * flag telling if more buffer space available to read in data
 */

Boolean gMoreBufferSpace;



/*
 * intermediate buffer into which data is read
 */
uchar               gInBuf[ IN_BUFF_LENGTH ];




/*
 * main program
 */

main()
{
    ToolBoxInit();

    WindowInit();
    SetUpDragRect();
    SetUpSizeRect();

    MenuBarInit();

    SerialDriverInit();
    SerialVarsInit();

    MainLoop();
}



/*
 * Initialize the various Macintosh toolboxes
 */

ToolBoxInit()
{
    InitGraf( &thePort );
    InitFonts();
    FlushEvents( everyEvent, REMOVE_ALL_EVENTS );
    InitWindows();
    InitMenus();
    TEInit();
    InitDialogs( NIL_POINTER );
    InitCursor();
```

```
}



/*
 * Set up the menu bar
 */

MenuBarInit()
{
    Handle      myMenuBar;

    myMenuBar = GetNewMBar( BASE_RES_ID );
    SetMenuBar( myMenuBar );

    /*
     * disable the entire EDIT menu.
     * (scrapboard functions are not support in this version.
     * The menu has to be present for the sake of desk accessories.
     */
    DisableItem( GetMenu( EDIT_MENU_ID ), 0 );


    /*
     * get submenus from resource fork
     */

    gSpeedMenu = GetMenu( SPEED_MENU_ID );
    gDataBitsMenu = GetMenu( DATA_BITS_MENU_ID );
    gParityMenu = GetMenu( PARITY_MENU_ID );
    gStopBitMenu = GetMenu( STOP_BIT_MENU_ID );


    /*
     * insert submenus
     */
    InsertMenu( gSpeedMenu, NOT_A_NORMAL_MENU );
    InsertMenu( gDataBitsMenu, NOT_A_NORMAL_MENU );
    InsertMenu( gParityMenu, NOT_A_NORMAL_MENU );
    InsertMenu( gStopBitMenu, NOT_A_NORMAL_MENU );



    /*
     * set up the initial parameters, and "tick" them
     * accordingly in the menus.
     */

    CheckItem( gSpeedMenu, M_SPEED_9600, TRUE );
    gSpeed = M_SPEED_9600;

    CheckItem( gDataBitsMenu, M_7_DATA_BITS, TRUE );
    gNumDataBits = M_7_DATA_BITS;

    CheckItem( gParityMenu, M_PARITY_EVEN, TRUE );
    gParityBit = M_PARITY_EVEN;
```

```
    CheckItem( gStopBitMenu, M_2_STOP_BITS, TRUE );
    gStopBitLength = M_2_STOP_BITS;



    gDisplayMenu = GetMenu( DISPLAY_MENU_ID );
    CheckItem( gDisplayMenu, M_DISPLAY_ASCII, TRUE );
    gLastDisplayMode = M_DISPLAY_ASCII;

    gTerminalMode = FALSE;

    gRunMenu = GetMenu( RUN_MENU_ID );
    CheckItem( gRunMenu, M_RUN_GO, TRUE );
    gRunMode = M_RUN_GO;


    gAppleMenu = GetMHandle( APPLE_MENU_ID );
    AddResMenu( gAppleMenu, 'DRVR' );

    DrawMenuBar();
}



/*
 * intialize the serial drivers
 */

SerialDriverInit()
{
    int         refNumIn, refNumOut;



    if( OpenDriver( "\p.AIn", &refNumIn ) != noErr )
            DrawEventString( LINE_ONE_WINDOW, "\p.AIn open error" );

    if( OpenDriver( "\p.AOut", &refNumOut ) != noErr )
            DrawEventString( LINE_ONE_WINDOW, "\p.AOut open error" );


    /*
     * Remember the reference to the serial port that we
     * will be communicating with.
     */

    gPortRefIn = refNumIn;
    gPortRefOut = refNumOut;


    /*
     * set the buffer where the data will be read into
     */

    if ( SerSetBuf ( gPortRefIn, gInBuf, IN_BUFF_LENGTH ) != noErr )
        DrawEventString( LINE_ONE_WINDOW, "\pSerSetBuf failed!" );
```

```
/*
 * constants for serial port configuration
 */

#define baud57600    0
#define stop20       -16384
#define noParity     0
#define data8        3072


    SerReset( gPortRefIn, baud57600 +  stop20 + noParity + data8 );
    SerReset( gPortRefOut,baud57600 +  stop20 + noParity + data8 );


}



/*
 * main loop
 */

MainLoop()
{

    /*
     * see if WaitNextEvent() is implemented
     */
    gWNEImplemented = ( NGetTrapAddress( WNE_TRAP_NUM, ToolTrap ) !=
                        NGetTrapAddress( UNIMPL_TRAP_NUM, ToolTrap ) );


    gDone = FALSE;  /* main loop exits when TRUE */


    while ( gDone == FALSE )
    {
        int newDataStatus;
        HandleEvent();

        if ( gRunMode == M_RUN_GO )
        {
            newDataStatus = DoSerialStuff();
            /*
             * if no more buffer space, alert user and pause monitoring.
             */
            if ( newDataStatus == NO_NEW_DATA && gMoreBufferSpace == FALSE )
            {
                StopAlert( BUFFER_FULL_ALERT, NIL_POINTER );
                ResetAlrtStage();

                gRunMode = M_RUN_PAUSE;
                /*
                 * ensure the "RUN" menu reflects the paused state
                 */
```

```
                CheckItem( gRunMenu, M_RUN_GO, FALSE );
                CheckItem( gRunMenu, M_RUN_PAUSE, TRUE );
            }

        }
        else
        /*
         * program is in "pause" mode
         * - just keep flushing the buffers
         */
        {
            FlushSerialBuffers();
            newDataStatus = NO_NEW_DATA;
        }

        /*
         * only update windows if new data has arrived.
         */
        if ( newDataStatus != NO_NEW_DATA )
            UpdateCombinedWindow();

        if ( newDataStatus == CH1_NEW_DATA
                ||  newDataStatus == BOTHCHANS_NEW_DATA )
            UpdateLineOneWindow();

        if ( newDataStatus == CH2_NEW_DATA
                ||  newDataStatus == BOTHCHANS_NEW_DATA )
            UpdateLineTwoWindow();


    }


    /*
     * before exiting, restore serial driver's buffer to the default
     * by specifying zero length parameter.
     * (Failure to do this may result in horrible crashes).
     */
    if ( SerSetBuf ( gPortRefIn, gInBuf, 0 ) != noErr )
        DrawEventString( LINE_ONE_WINDOW, "\pSerSetBuf restoration failed!" );

}



/*
 * handle event
 */

HandleEvent()
{
    char theChar;

    /*
     * get the next event from the event queue
     */
```

```
    if ( gWNEImplemented )
        WaitNextEvent( everyEvent, &gTheEvent, SLEEP,
            NIL_MOUSE_REGION );
    else
    {
        SystemTask();
        GetNextEvent( everyEvent, &gTheEvent );
    }


    /*
     * depending on what the event is, perform appropriate action(s)
     */
    switch ( gTheEvent.what )
    {
        case nullEvent:
            break;
        case mouseDown:
            HandleMouseDown();
            break;
        case mouseUp:
            break;
        case keyDown:
        case autoKey:
            /*
             * if a key is pressed that is equivalent to a
             * menu selection, handle it.
             */
            theChar = gTheEvent.message & charCodeMask;
            if (( gTheEvent.modifiers & cmdKey ) != 0 )
                HandleMenuChoice( MenuKey( theChar ) );
            break;
        case keyUp:
            break;
        case updateEvt:
            /*
             * update the window that requires it
             */
            BeginUpdate( gTheEvent.message );

            if( (WindowPtr)gTheEvent.message == gWindow[ LINE_ONE_WINDOW ])
                RefreshLineOneWindow();
            else
            if( (WindowPtr)gTheEvent.message == gWindow[ LINE_TWO_WINDOW ])
                RefreshLineTwoWindow();
            else
            if( (WindowPtr)gTheEvent.message == gWindow[ COMBINED_WINDOW ])
                RefreshCombinedWindow();

            EndUpdate( gTheEvent.message );
            break;
        case diskEvt:
            break;
        case activateEvt:
            break;
        case networkEvt:
        case driverEvt:
        case applEvt:
```

```
        case app2Evt:
        case app3Evt:
            break;
        case app4Evt:    /* suspend/resume event */
            break;
    }
}



/*
 * handle mouse down event
 */

HandleMouseDown()
{
    WindowPtr       whichWindow;
    short int       thePart, thePoint;
    long            windSize;
    GrafPtr         oldPort;
    long int menuChoice;

    /*
     * see where the mouse was pressed ...
     */
    thePart = FindWindow( gTheEvent.where, &whichWindow );

    /*
     * ... and perform action(s) accordingly
     */
    switch( thePart )
    {
        case inSysWindow:
            /*
             * if the mouse was pressed in a system window
             * (e.g. in a Desk Accessory), pass it on for the
             * system to handle
             */
            SystemClick( &gTheEvent, whichWindow );
            break;
        case inMenuBar:
            menuChoice = MenuSelect( gTheEvent.where );
            HandleMenuChoice( menuChoice );
            break;

        case inDrag:
            DragWindow( whichWindow, gTheEvent.where, &gDragRect );
            break;

        case inContent:
            SelectWindow( whichWindow );
            break;
        case inGrow:
            break;  /* windows are of fixed size */
        case inGoAway:
            HideWindow( whichWindow );
            break;
        case inZoomIn:
```

```
        case inZoomOut:
            break;  /* zooming not used */
    }
}



/*
 * see from what menu an item was chosen,
 * and pass on for more specific handling.
 */

HandleMenuChoice( menuChoice )
    long int menuChoice;
{
    int     theMenu;
    int     theItem;

    if( menuChoice != 0 )
    {
        theMenu = HiWord( menuChoice );
        theItem = LoWord( menuChoice );

        switch( theMenu )
        {
            case    APPLE_MENU_ID:
                HandleAppleChoice( theItem );
                break;
            case    FILE_MENU_ID:
                HandleFileChoice( theItem );
                break;
            case    EDIT_MENU_ID:
                HandleEditChoice( theItem );
                break;
            case    DISPLAY_MENU_ID:
                HandleDisplayChoice( theItem );
                break;
            case    SPECIAL_MENU_ID:
                HandleSpecialChoice( theItem );
                break;
            case    SPEED_MENU_ID:
                HandleSpeedChoice( theItem );
                break;
            case    DATA_BITS_MENU_ID:
                HandleDataBitsChoice( theItem );
                break;
            case    PARITY_MENU_ID:
                HandleParityChoice( theItem );
                break;
            case    STOP_BIT_MENU_ID:
                HandleStopBitChoice( theItem );
                break;
            case    WINDOW_MENU_ID:
                HandleWindowChoice( theItem );
                break;
            case    RUN_MENU_ID:
                HandleRunChoice( theItem );
                break;
```

```
        }
        HiliteMenu( 0 );
    }
}



HandleAppleChoice( theItem )
    int theItem;
{
    Str255      accName;
    int         accNumber;
    short int   itemNumber;
    DialogPtr   AboutDialog;

    switch( theItem )
    {
        case ABOUT_ITEM:
            Alert( ABOUT_ALERT, NIL_POINTER );
            ResetAlrtStage();
            break;
        defualt:
            GetItem( gAppleMenu, theItem, accName );
            accNumber = OpenDeskAcc( accName );
            break;
    }
}


HandleFileChoice( theItem )
    int theItem;
{
    switch( theItem )
    {
        case QUIT_ITEM:
            gDone = TRUE;
            break;
        defualt:
            break;
    }
}


HandleEditChoice( theItem )
    int theItem;
{
}

HandleDisplayChoice( theItem )
    int theItem;
{
    if ( theItem == M_DISPLAY_TERMINAL )
    {
        gTerminalMode = !gTerminalMode;
        CheckItem( gDisplayMenu, theItem, gTerminalMode );
    }
```

```
    else if ( theItem >= M_DISPLAY_ASCII && theItem <= M_DISPLAY_CTRL_HEX
            && theItem != gLastDisplayMode )
    {
        CheckItem( gDisplayMenu, gLastDisplayMode, FALSE );
        CheckItem( gDisplayMenu, theItem, TRUE );
        gLastDisplayMode = theItem;
        /*
         * here is the place to call a function
         * that re-draws a window that displays the parameters
         */
    }
}

HandleSpecialChoice( theItem )
    int theItem;
{
}


HandleSpeedChoice( theItem )
    int theItem;
{
    if ( theItem != gSpeed )
    {
        CheckItem( gSpeedMenu, gSpeed, FALSE );
        CheckItem( gSpeedMenu, theItem, TRUE );
        gSpeed = theItem;
        /*
         * here is the place to call a function
         * that re-draws a window that displays the parameters
         */
    }
}



HandleDataBitsChoice( theItem )
    int theItem;
{
    if ( theItem != gNumDataBits )
    {
        CheckItem( gDataBitsMenu, gNumDataBits, FALSE );
        CheckItem( gDataBitsMenu, theItem, TRUE );
        gNumDataBits = theItem;
        /*
         * here is the place to call a function
         * that re-draws a window that displays the parameters
         */
    }
}



HandleParityChoice( theItem )
    int theItem;
{
    if ( theItem != gParityBit )
    {
```

```
        CheckItem( gParityMenu, gParityBit, FALSE );
        CheckItem( gParityMenu, theItem, TRUE );
        gParityBit = theItem;
        /*
         * here is the place to call a function
         * that re-draws a window that displays the parameters
         */
    }
}



HandleStopBitChoice( theItem )
    int theItem;
{
    if ( theItem != gStopBitLength )
    {
        CheckItem( gStopBitMenu, gStopBitLength, FALSE );
        CheckItem( gStopBitMenu, theItem, TRUE );
        gStopBitLength = theItem;
        /*
         * here is the place to call a function
         * that re-draws a window that displays the parameters
         */
    }
}


HandleRunChoice( theItem )
    int theItem;
{
    if ( theItem == M_RUN_CLEARBUFFERS )
    {
        ClearBuffers();
    }
    else if ( theItem >= M_RUN_GO && theItem <= M_RUN_PAUSE
            && theItem != gRunMode )
    {
        CheckItem( gRunMenu, gRunMode, FALSE );
        CheckItem( gRunMenu, theItem, TRUE );
        gRunMode = theItem;
    }
}
```

```
#include <stdio.h>
#include "CommonDefs.h"


#define HIGH_MASK        0xf0
#define LOW_MASK         0x0f

#define FIRST_OF_PAIR_MASK  128
#define IS_DATA_MASK         64
#define LINE_TWO_MASK        32


extern int gPortRefIn;
extern int gLastDisplayMode;
extern Boolean gMoreBufferSpace;


/*
 * where the received bytes are stored
 */
char     gLineData[ NUM_CHANS ][ MAX_DATA ];

/*
 * indexes into the stored data blocks.
 * Used to find, say, the nth transmission along
 * a particular line.
 * Generally used for displaying the data
 * in the individual lines' windows
 */
int      gIndexes[ NUM_CHANS ][ MAX_INDEX ];

/*
 * total number of (data) bytes received along each line so far
 * (used for indexing)
 */

int      gCurrentByte[ NUM_CHANS ];


/*
 * Total number of blocks received on each line so far
 */

int      gCurrentIndex[ NUM_CHANS ];



/*
 * Initialize indexes, etc.
 */
SerialVarsInit()
{
    int i;
    for ( i=0; i<NUM_CHANS; i++ )
    {
        gCurrentIndex[ i ]  = 0;     /* no blocks rec'd yet  */
        gCurrentByte[ i ]   = 0;     /* no byted rec'd yet   */
```

```
        /*
         * need a 0 in index 0 (of all channels) to calculate
         * length of first block (since length = index[i][1] -index[i][0]
         */
        gIndexes[ i ][ 0 ]  = 0;

    }
    gMoreBufferSpace = TRUE;
}

/*
 * Read any < data1, data2 > pairs waiting in buffer,
 * and store in data arrays.
 * Return       NO_NEW_DATA,
 *              CH1_NEW_DATA,
 *              CH2_NEW_DATA,
 *          or  BOTHCHANS_NEW_DATA
 *      depending on data read.
 *
 */

DoSerialStuff()
{
    int count;
    long l, numToScan, numToRead, firstToRead;
    int startPos;
    uchar Cnumbuf[5];

    int NewCh1Data = FALSE,
        NewCh2Data = FALSE;

    uchar readBuf[ BUF_SIZE + 1 ];

    static Channel previousDataLine = LINE_ONE;

    /*
     * see how many bytes are to be read
     */

    SerGetBuf( gPortRefIn, &l );

    /*
     * Synchronisation strategy :
     * read the first byte.  If it is the first of a pair (as it should
     * be), then read the rest in, up to an EVEN number of bytes in total
     *(to ensure continued synchronisation).
     * If the first byte is the second of a pair, we are out of synch
     * (as could happen, for example, upon program startup).
     * Discard this byte, and read in an even number of further bytes,
     * to ensure continued synchronisation again.
     */

    /*
     * read no more than the size of the buffer, and ensure
     * that an EVEN number of bytes are read (to ensure continuation
     * of <byte1,byte2> pairs.
     */
    numToRead = ( l > BUF_SIZE ? BUF_SIZE : ( l / 2 ) * 2 );
```

```
    numToScan = numToRead;


    /*
     * check to see if buffers have room for data.
     */
    if ( gCurrentByte[ LINE_ONE ] + numToRead >= MAX_DATA
    ||   gCurrentByte[ LINE_TWO ] + numToRead >= MAX_DATA
    ||   gCurrentIndex[ LINE_ONE ] >= MAX_INDEX - 1 )
    {
        gMoreBufferSpace = FALSE;
        return( NO_NEW_DATA );
    }


    /*
     * only read if bytes waiting.
     */
    if (numToRead == 0)
        return NO_NEW_DATA;

    /*
     * read the first byte to decide further actions
     */

    firstToRead = 1;
    if ( FSRead( gPortRefIn, &firstToRead, readBuf ) != noErr
        || firstToRead != 1 )
    {
        DrawEventString( "\pFSRead error on first byte!" );
        sleep( 3 );
        exit( 1 );
    }

    /*
     * is the byte the first of a pair ?
     * (as it normally should be)
     */
    if ( readBuf[0] & FIRST_OF_PAIR_MASK )
    {
        /*
         * if so, read in the pairs starting from the next byte
         */
        if (numToRead <= 1)          /* only read if there is more data there ! */
            return NO_NEW_DATA;

        numToRead--;     /* subtract the first byte already read */
        if ( FSRead( gPortRefIn, &numToRead, &readBuf[1] ) != noErr )
        {
            DrawEventString( "\pFSRead error!" );
            sleep( 3 );
            exit( 1 );
        }

    }
    else
    /*
     * byte read was second of pair : discard,
```

```
     * and read subsequent pairs
     */
    {
        if (numToRead <= 2)          /* only read if there is more data there ! */
            return NO_NEW_DATA;

        numToRead -= 2; /* subtract the first byte already read,
                         * and subtract 1 again to ensure an even
                         * number of bytes are read in
                         */
        if ( FSRead( gPortRefIn, &numToRead, readBuf ) != noErr )
        {
            DrawEventString( "\pFSRead error!" );
            sleep( 3 );
            exit( 1 );
        }
    }


    /*
     * step through the data pairs, updating the stored data
     */
    for ( count = 0; count < numToScan; count += 2 )
        if( readBuf[ count ] & IS_DATA_MASK )
        {

                Channel dataLine;

                int dataByte =   (( readBuf[count] & LOW_MASK ) << 4)
                    |    ( readBuf[count+1] & LOW_MASK );


                if ( readBuf[ count ] & LINE_TWO_MASK )
                    dataLine = LINE_TWO;
                else
                    dataLine = LINE_ONE;


                if ( dataLine == LINE_ONE )
                    NewCh1Data = TRUE;
                else
                    NewCh2Data = TRUE;


                if ( dataLine != previousDataLine )
                {
                    previousDataLine = dataLine;
                    gIndexes[ dataLine ][ ++gCurrentIndex[ dataLine ] ]
                        = gCurrentByte[ dataLine ];
                }

                gLineData[ dataLine ][ gCurrentByte[ dataLine ] ++  ]
                    = dataByte;


        }
        else /* is HC11 STATUS - not handled as yet */
        {
```

```
            /* needs to be developed after construction of HC11 board */
        }

    if ( NewCh1Data && NewCh2Data )
        return BOTHCHANS_NEW_DATA;
    else if ( NewCh1Data )
        return CH1_NEW_DATA;
    else if ( NewCh2Data )
        return CH2_NEW_DATA;
    else
        return NO_NEW_DATA;

    return TRUE;

}



FlushSerialBuffers()
{
    long l;
    uchar readBuf[ BUF_SIZE + 1 ];

    for (;;)    /* keep reading until buffer empty */
    {
        /*
         * see how many bytes are to be read
         */
        SerGetBuf( gPortRefIn, &l );

        /*
         * ensure overflow doesn't occur
         */
        if (l>BUF_SIZE)
            l = BUF_SIZE;
        /*
         * exit when no data left to read
         */
        if (l == 0)
            return;

        if ( FSRead( gPortRefIn, &l, readBuf ) != noErr )
        {
            DrawEventString( "\pFSRead error!" );
            sleep( 3 );
            exit( 1 );
        }

    }

}
```

```
#include "CommonDefs.h"


extern WindowPtr    gWindow[ NUM_TEXT_WINDOWS ];

extern int          gLastDisplayMode;
extern Rect         gDragRect, gSizeRect;


/*
 * references to scroll bars on windows (one in each window)
 */

extern ControlHandle    gScrollBar[ NUM_TEXT_WINDOWS ];


/*
 * keep track of the last byte displayed in the window
 * (used for updataing screen if window is obscured
 * and then brought back into view.
 */

int gLastByteInWindow[ 2 ];


/* number of lines in window    */
int                 gLinesInWindow[ NUM_TEXT_WINDOWS ];


int                 gCurRow[ NUM_TEXT_WINDOWS ],

                    gMaxRow[ NUM_TEXT_WINDOWS ];
/*
 * horizontal position of next character to be printed on
 * each window
 */

int gCumPos[ NUM_TEXT_WINDOWS ];

/*
 * WindowInit
 */

WindowInit()
{
    /*
     * get windows from resource fork
     */
    gWindow[ LINE_ONE_WINDOW ] = GetNewWindow( BASE_RES_ID + 1,
                NIL_POINTER, MOVE_TO_FRONT );
    gWindow[ LINE_TWO_WINDOW ] = GetNewWindow( BASE_RES_ID + 2,
                NIL_POINTER, MOVE_TO_FRONT );
    gWindow[ COMBINED_WINDOW ] = GetNewWindow( BASE_RES_ID + 3,
                NIL_POINTER, MOVE_TO_FRONT );


    ShowWindow( gWindow[ LINE_ONE_WINDOW ] );
    ShowWindow( gWindow[ LINE_TWO_WINDOW ] );
```

```
    SetUpWindowStuff( LINE_ONE_WINDOW );
    SetUpWindowStuff( LINE_TWO_WINDOW );
    SetUpWindowStuff( COMBINED_WINDOW );

    SelectWindow( gWindow[ LINE_ONE_WINDOW ] );

    gLastByteInWindow[ LINE_ONE ] = 0;
    gLastByteInWindow[ LINE_TWO ] = 0;

}



/*
 * SetupWindowStuff
 */

SetUpWindowStuff( whichWin )
    DataWindow whichWin;
{
    Rect    scrollRect, eventRect;

    SetPort( gWindow[ whichWin ] );

    eventRect = gWindow[ whichWin ]->portRect;

    gMaxRow[ whichWin ] = eventRect.bottom - eventRect.top - ROWHEIGHT;
    gCurRow[ whichWin ] = STARTROW;

    /*
     * set up the rectangle that will contain the scroll bar
     */
    scrollRect = gWindow[ whichWin ]->portRect;
    scrollRect.left = scrollRect.right - 15;
    scrollRect.right++;
    scrollRect.bottom++;
    scrollRect.top--;

    gScrollBar[ whichWin ] = NewControl( gWindow[ whichWin ], &scrollRect,
         "\p", 1, 0, 0, 0, scrollBarProc, 0L );

    ShowControl( gScrollBar[ whichWin ] );

    DrawControls( gWindow[ whichWin ] );


    /*
     * switch to the special font that has been edited
     * and placed in the resource font.
     */

    TextFont( 151 );
    TextSize( TEXT_FONT_SIZE );

    MoveTo( LEFTMARGIN, gCurRow[ whichWin ] );

}
```

```
/*
 * Set up the screen area in which windows can be dragged.
 */
SetUpDragRect()
{
    gDragRect = screenBits.bounds;

    gDragRect.left += DRAG_THRESHOLD;
    gDragRect.right -= DRAG_THRESHOLD;
    gDragRect.bottom -= DRAG_THRESHOLD;
}

/***/
SetUpSizeRect()
{
    gSizeRect.top = MIN_WINDOW_HEIGHT;
    gSizeRect.left = MIN_WINDOW_WIDTH;

    gSizeRect.bottom = screenBits.bounds.bottom - screenBits.bounds.top;
    gSizeRect.right = screenBits.bounds.right - screenBits.bounds.left;
}
```

```
/*
 * draw event string - used for reporting any fatal errors
 */

DrawEventString( whichWin, s )
    DataWindow whichWin;
    Str255 s;
{
    SetPort( gWindow[ whichWin ] );
    NewLine( whichWin );
    MoveTo( LEFTMARGIN, gCurRow[ whichWin ] );
    DrawString( s );
}
```

```
/*
 * perform Newline in a specified window
 */

NewLine( whichWin )
    DataWindow whichWin;
{

    gLinesInWindow[ whichWin ]++;

    SetPort( gWindow[ whichWin ] );
```

```
    /*
     * do we need to scroll ?
     */
    if( gCurRow[ whichWin ] > gMaxRow[ whichWin ] )
    {
        /*
         * scroll, and make the scroll bar active.
         */
        ScrollWindow( whichWin );
        SetCtlMin( gScrollBar[ whichWin ], 0 );
        SetCtlMax( gScrollBar[ whichWin ], gLinesInWindow[ whichWin ]
            - gMaxRow[ whichWin ] );
        SetCtlValue( gScrollBar[ whichWin ], gLinesInWindow[ whichWin ]
            - gMaxRow[ whichWin ] );
        HiliteControl( gScrollBar[ whichWin ], 0);

        DrawControls( gWindow[whichWin] );
    }
    else /* just move cursor position down */
    {
        gCurRow[ whichWin ] += ROWHEIGHT;
    }
    MoveTo( LEFTMARGIN, gCurRow[ whichWin ] );
}



/*
 * scroll window
 */

ScrollWindow( whichWin )
    DataWindow whichWin;
{
    RgnHandle   tempRgn;

    tempRgn = NewRgn();

    /*
     * reduce size of window so that scrollbar is
     * not itself scrolled
     */
    gWindow[ whichWin ]->portRect.right -= 16;

    /*
     * perform scrolling
     */
    ScrollRect( &gWindow[ whichWin ]->portRect, HORIZONTAL_OFFSET,
                    -ROWHEIGHT, tempRgn );

    /*
     * Restore size of portRect
     */
    gWindow[ whichWin ]->portRect.right += 16;

    DisposeRgn( tempRgn );
}
```

```
HandleWindowChoice( theItem )
    int theItem;
{
    switch( theItem )
    {
        case M_WINDOW_ONE:
            ShowWindow( gWindow[ LINE_ONE_WINDOW ] );
            SelectWindow( gWindow[ LINE_ONE_WINDOW ] );
            DrawControls( gWindow[ LINE_ONE_WINDOW ] );
            break;
        case M_WINDOW_TWO:
            ShowWindow( gWindow[ LINE_TWO_WINDOW ] );
            SelectWindow( gWindow[ LINE_TWO_WINDOW ] );
            DrawControls( gWindow[ LINE_TWO_WINDOW ] );
            break;
        case M_WINDOW_COMBINED:
            ShowWindow( gWindow[ COMBINED_WINDOW ] );
            SelectWindow( gWindow[ COMBINED_WINDOW ] );
            DrawControls( gWindow[ COMBINED_WINDOW ] );
            break;
        defualt:
            break;
    }

}


extern  char    gLineData[ NUM_CHANS ][ MAX_DATA ];
extern  int     gIndexes[ NUM_CHANS ][ MAX_INDEX ];
extern  int     gCurrentIndex[ NUM_CHANS ];
extern  int     gCurrentByte[ NUM_CHANS ];


RefreshAllWindows()
{
    RefreshLineOneWindow();
    RefreshLineTwoWindow();
    RefreshCombinedWindow();
}

RefreshLineOneWindow()
{
    int rows = /*(gMaxRow[ LINE_ONE_WINDOW ] / ROWHEIGHT)+1;*/ 6;
    SetPort( gWindow[ LINE_ONE_WINDOW ] );
    DrawControls( gWindow[ LINE_ONE_WINDOW ] );

    if (gCurrentByte[ LINE_ONE_WINDOW ] <= NUM_COLUMNS * rows )
    /*
     * window has not scrolled yet - simply dump all data
     */
        DumpBytes( LINE_ONE_WINDOW,
        &gLineData[ LINE_ONE ][ 0 ],
        gCurrentByte[ LINE_ONE ]);
```

```
    else
    /*
     * window has scrolled. Just dump what will fit in window
     */
        DumpBytes( LINE_ONE_WINDOW,
        &gLineData[ LINE_ONE ]
        [ ( (gCurrentByte[ LINE_ONE ] / NUM_COLUMNS) * NUM_COLUMNS )
            - (NUM_COLUMNS * ( rows - 1 )) ],
        (NUM_COLUMNS * ( rows - 1 ) )
            + (gCurrentByte[ LINE_ONE ] % NUM_COLUMNS)  );

}

RefreshLineTwoWindow()
{
    int rows = /*(gMaxRow[ LINE_TWO_WINDOW ] / ROWHEIGHT)+1;*/ 6;
    SetPort( gWindow[ LINE_TWO_WINDOW ] );
    DrawControls( gWindow[ LINE_TWO_WINDOW ] );

    if (gCurrentByte[ LINE_TWO_WINDOW ] <= NUM_COLUMNS * rows )
    /*
     * window has not scrolled yet - simply dump all data
     */
        DumpBytes( LINE_TWO_WINDOW,
        &gLineData[ LINE_TWO ][ 0 ],
        gCurrentByte[ LINE_TWO ]);
    else
    /*
     * window has scrolled. Just dump what will fit in window
     */
        DumpBytes( LINE_TWO_WINDOW,
        &gLineData[ LINE_TWO ]
        [ ( (gCurrentByte[ LINE_TWO ] / NUM_COLUMNS) * NUM_COLUMNS )
            - (NUM_COLUMNS * ( rows - 1 )) ],
        (NUM_COLUMNS * ( rows - 1 ) )
            + (gCurrentByte[ LINE_TWO ] % NUM_COLUMNS)  );

}

RefreshCombinedWindow()
{
    SetPort( gWindow[ COMBINED_WINDOW ] );
    DrawControls( gWindow[ COMBINED_WINDOW ] );
}



UpdateLineOneWindow()
{

    SetPort( gWindow[ LINE_ONE_WINDOW ] );

    DisplayBytesAndWrap( LINE_ONE_WINDOW,
        &gLineData[ LINE_ONE ][ gLastByteInWindow[ LINE_ONE ] ],
        gCurrentByte[ LINE_ONE ] - gLastByteInWindow[ LINE_ONE ] );


    gLastByteInWindow[ LINE_ONE ] = gCurrentByte[ LINE_ONE ];
```

```
    DrawControls( gWindow[ LINE_ONE_WINDOW ] );
}



UpdateLineTwoWindow()
{

    SetPort( gWindow[ LINE_TWO_WINDOW ] );

    DisplayBytesAndWrap( LINE_TWO_WINDOW,
        &gLineData[ LINE_TWO ][ gLastByteInWindow[ LINE_TWO ] ],
        gCurrentByte[ LINE_TWO ] - gLastByteInWindow[ LINE_TWO ] );

    gLastByteInWindow[ LINE_TWO ] = gCurrentByte[ LINE_TWO ];

    DrawControls( gWindow[ LINE_TWO_WINDOW ] );

}



UpdateCombinedWindow()
{
    SetPort( gWindow[ COMBINED_WINDOW ] );


    if ( gCurrentIndex[ LINE_ONE ] )
    {
        DisplayBytes( COMBINED_WINDOW,
            &gLineData[ LINE_ONE ]
            [  gIndexes[ LINE_ONE ][ gCurrentIndex[ LINE_ONE ] ]  ],
            gCurrentByte[ LINE_ONE ]
             - gIndexes[  LINE_ONE ] [gCurrentIndex[ LINE_ONE ] ] );
        NewLine( COMBINED_WINDOW );

    }

    if ( gCurrentIndex[ LINE_TWO ] )
    {
        TextFace( italic );
        DisplayBytes( COMBINED_WINDOW,
            &gLineData[ LINE_TWO ]
            [  gIndexes[ LINE_TWO ][ gCurrentIndex[ LINE_TWO ] ]  ],
            gCurrentByte[ LINE_TWO ]
             - gIndexes[  LINE_TWO ] [gCurrentIndex[ LINE_TWO ] ] );
        TextFace( 0 );  /* revert to normal text */
        NewLine( COMBINED_WINDOW );

    }
    DrawControls( gWindow[ COMBINED_WINDOW ] );

}
```

```
/*
 * display bytes at current position, but don't worry about wrapping
 * around.  Caller should make sure number of bytes displayed will
 * fit in the window
 */

DisplayBytes( whichWin, buf, len )
    DataWindow whichWin;
    uchar *buf;
    int len;
{
    int i;

    int mod = NUM_COLUMNS;
    char outBuf[ 257 ];
    char extraBuf[ 257 ];
    char weeBuf[8];
    int Pos;

        /*
         * shouldn't really like this, as doesn't take
         * scrolling, etc. into account
         */
    SetPort( gWindow[ whichWin ] );
        /* should really keep current port for restoration */

    outBuf[0] = '\0';

    for ( i=0 ; i < len ; i ++ )
    {
        /*
         * add appropriate display representation of char
         * to end of string to be printed.
         */
        if ( gLastDisplayMode == M_DISPLAY_ASCII )
        {
            /*
             * ASCII display
             */
            outBuf[ strlen( outBuf ) + 1 ] = '\0';

            if( buf[ i ] < 32 ) /* ctrl-char */
                outBuf[ strlen( outBuf ) ] = 128 + buf[ i ];
            else if ( buf[ i ] == 127 ) /* DEL */
                outBuf[ strlen( outBuf ) ] = 128 + 33;
            else    /* normal char */
                outBuf[ strlen( outBuf ) ] = buf[ i ];

        }
        else if ( gLastDisplayMode == M_DISPLAY_HEX )
        /*
         * Hexadecimal display
         */
        {
            int p = strlen( outBuf );
            outBuf[ p ] = 161 + buf[i] / 16;
            outBuf[ p + 1 ] = 161 + buf[i] % 16;
            outBuf[ p + 2 ] = 177; /* a 'mini-seperator' */
```

```
            outBuf[ p + 3 ] = '\0';
        }
        else
        /*
         * CTRL_HEX display - ASCII display, but with
         * control chars shown in hex
         */
        {
            if ( buf[ i ] >= 32 && buf[i] != 127 )
            /*
             * display as ascii char
             */
             {
                outBuf[ strlen( outBuf ) + 1 ] = '\0';
                outBuf[ strlen( outBuf ) ] = buf[ i ];
             }
             else
             /*
              * display as hex
              */
             {
                int p = strlen( outBuf );
                outBuf[ p ] = 161 + buf[i] / 16;
                outBuf[ p + 1 ] = 161 + buf[i] % 16;
                outBuf[ p + 2 ] = 177; /* a 'mini-seperator' */
                outBuf[ p + 3 ] = '\0';
             }

        }

    }
    if (strlen( outBuf ))
    {
        DrawString( CtoPstr((char *)outBuf) );
        outBuf[0] = '\0';
    }

}

/*
 *  display bytes at current position, and, if the text would go out of the
 * bounds of the window, wrap around to the next line.
 */

DisplayBytesAndWrap( whichWin, buf, len )
    DataWindow whichWin;
    uchar *buf;
    int len;
{
    int i;

    int mod = NUM_COLUMNS;
    char outBuf[ 257 ];
    char extraBuf[ 257 ];
    char weeBuf[8];


    SetPort( gWindow[ whichWin ] );
```

```
        /* should really keep current port for restoration */

    outBuf[0] = '\0';

    for ( i=0 ; i < len ; i ++ )
    {
        if ( gCumPos[ whichWin ] == 0)
            NewLine( whichWin );

        /*
         * add appropriate display representation of char
         * to end of string to be printed.
         */
        if ( gLastDisplayMode == M_DISPLAY_ASCII )
        {
            /*
             * ASCII display
             */
            outBuf[ strlen( outBuf ) + 1 ] = '\0';

            if( buf[ i ] < 32 ) /* ctrl-char */
                outBuf[ strlen( outBuf ) ] = 128 + buf[ i ];
            else if ( buf[ i ] == 127 ) /* DEL */
                outBuf[ strlen( outBuf ) ] = 128 + 33;
            else    /* normal char */
                outBuf[ strlen( outBuf ) ] = buf[ i ];

        }
        else if ( gLastDisplayMode == M_DISPLAY_HEX )
        /*
         * Hexadecimal display
         */
        {
            int p = strlen( outBuf );
            outBuf[ p ] = 161 + buf[i] / 16;
            outBuf[ p + 1 ] = 161 + buf[i] % 16;
            outBuf[ p + 2 ] = 177; /* a 'mini-seperator' */
            outBuf[ p + 3 ] = '\0';
        }
        else
        /*
         * CTRL_HEX display - ASCII display, but with
         * control chars shown in hex
         */
        {
            if ( buf[ i ] >= 32 && buf[i] != 127 )
            /*
             * display as ASCII char
             */
             {
                outBuf[ strlen( outBuf ) + 1 ] = '\0';
                outBuf[ strlen( outBuf ) ] = buf[ i ];
             }
             else
             /*
              * display as hex
              */
             {
```

```
                int p = strlen( outBuf );
                outBuf[ p ] = 161 + buf[i] / 16;
                outBuf[ p + 1 ] = 161 + buf[i] % 16;
                outBuf[ p + 2 ] = 177; /* a 'mini-seperator' */
                outBuf[ p + 3 ] = '\0';
            }

        }

        if (++gCumPos[ whichWin ] == mod)
        {
            CtoPstr((char *)outBuf);
            DrawString( outBuf );
            gCumPos[ whichWin ] = 0;
            outBuf[0] = '\0';
        }
    }

    if (strlen( outBuf ))
    {
        DrawString( CtoPstr((char *)outBuf) );
        outBuf[0] = '\0';
    }

}


DumpBytes( whichWin, buf, len )
    DataWindow whichWin;
    uchar *buf;
    int len;
{
    int i;

    int mod = NUM_COLUMNS;
    char outBuf[ 257 ];
    char extraBuf[ 257 ];
    char weeBuf[8];
    int height = STARTROW;

    int htab = 0;

    SetPort( gWindow[ whichWin ] );

    outBuf[0] = '\0';

    for ( i=0 ; i < len ; i ++ )
    {
        if ( htab == 0)
        {
            height += ROWHEIGHT;
            MoveTo( LEFTMARGIN, height );
        }

        /*
         * add appropriate display representation of char
         * to end of string to be printed.
         */
```

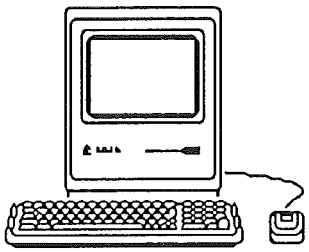
```
        if ( gLastDisplayMode == M_DISPLAY_ASCII )
        {
            /*
             * ASCII display
             */
            outBuf[ strlen( outBuf ) + 1 ] = '\0';

            if( buf[ i ] < 32 ) /* ctrl-char */
                outBuf[ strlen( outBuf ) ] = 128 + buf[ i ];
            else if ( buf[ i ] == 127 ) /* DEL */
                outBuf[ strlen( outBuf ) ] = 128 + 33;
            else    /* normal char */
                outBuf[ strlen( outBuf ) ] = buf[ i ];

        }
        else if ( gLastDisplayMode == M_DISPLAY_HEX )
        /*
         * Hexadecimal display
         */
        {
            int p = strlen( outBuf );
            outBuf[ p ] = 161 + buf[i] / 16;
            outBuf[ p + 1 ] = 161 + buf[i] % 16;
            outBuf[ p + 2 ] = 177; /* a 'mini-seperator' */
            outBuf[ p + 3 ] = '\0';
        }
        else
        /*
         * CTRL_HEX display - ASCII display, but with
         * control chars shown in hex
         */
        {
            if ( buf[ i ] >= 32 && buf[i] != 127 )
            /*
             * display as ASCII char
             */
             {
                outBuf[ strlen( outBuf ) + 1 ] = '\0';
                outBuf[ strlen( outBuf ) ] = buf[ i ];
             }
             else
             /*
              * display as hex
              */
             {
                int p = strlen( outBuf );
                outBuf[ p ] = 161 + buf[i] / 16;
                outBuf[ p + 1 ] = 161 + buf[i] % 16;
                outBuf[ p + 2 ] = 177; /* a 'mini-seperator' */
                outBuf[ p + 3 ] = '\0';
             }

        }

        if (++htab == mod)
        {
            CtoPstr((char *)outBuf);
            DrawString( outBuf );
```

```
            htab = 0;
            outBuf[0] = '\0';
        }
    }

    if (strlen( outBuf ))
    {
        DrawString( CtoPstr((char *)outBuf) );
        outBuf[0] = '\0';
    }

}



ClearBuffers()
{
    SerialVarsInit();

    ResetWindow( LINE_ONE_WINDOW );
    ResetWindow( LINE_TWO_WINDOW );
    ResetWindow( COMBINED_WINDOW );

    gLastByteInWindow[ LINE_ONE_WINDOW ] = 0;
    gLastByteInWindow[ LINE_TWO_WINDOW ] = 0;

}



ResetWindow( whichWin )
DataWindow whichWin;
{
    SetPort( gWindow[ whichWin ] );
    EraseRect( &gWindow[ whichWin]->portRect );
    gCurRow[ whichWin ] = STARTROW;
    MoveTo( LEFTMARGIN, gCurRow[ whichWin ] );
    gCumPos[ whichWin ] = 0;

    /*
     * make scroll bar inactive
     */
    HiliteControl( gScrollBar[ whichWin ], 255);

    /*
     * re-draw control
     */
    DrawControls( gWindow[ whichWin ] );
}
```

DITL "About ..." ID = 400 from DataScope Proj.Rsrc

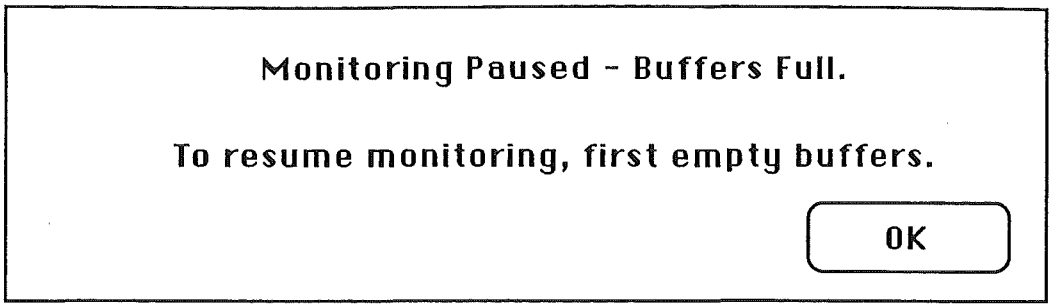
MacDataScope - Version 1.0a

Asynchronous Component

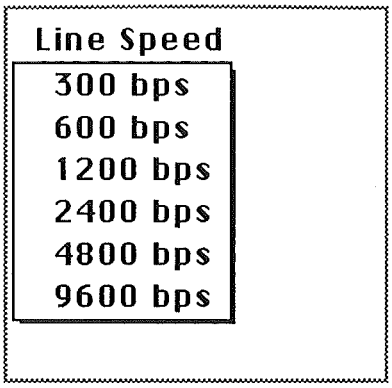


OK

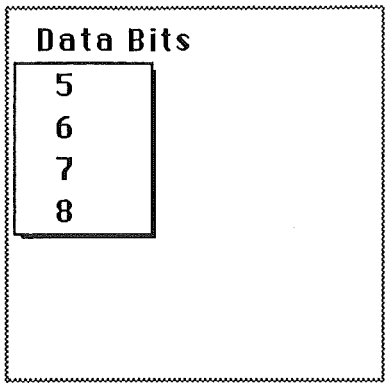
DITL ID = 401 from DataScope Proj.Rsrc



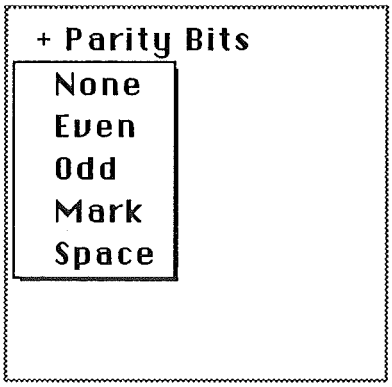
MENUs from DataScope Proj.Rsrc



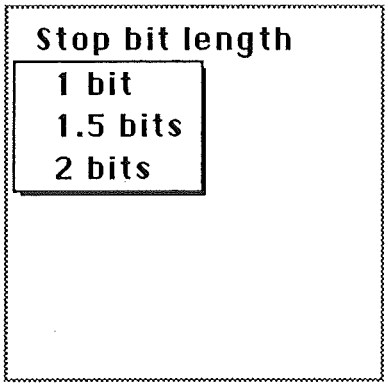
100



101



102

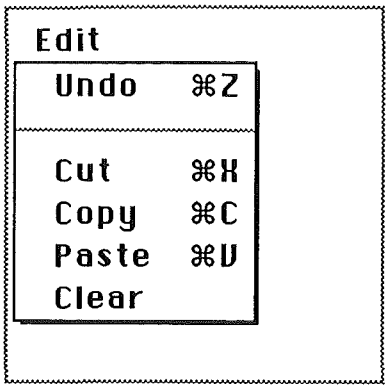


103

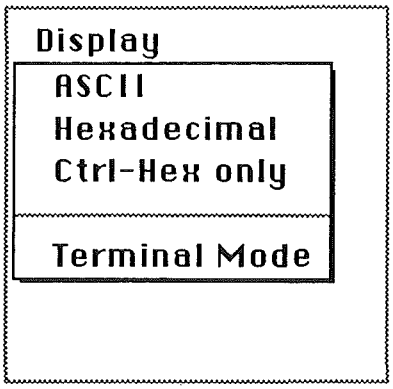
400

401

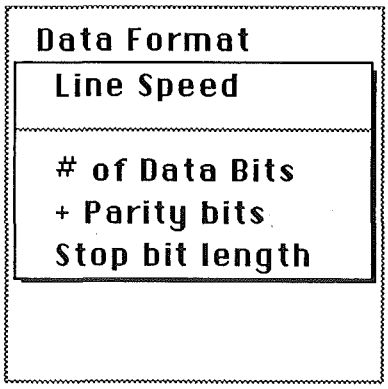
MENUs from DataScope Proj.Rsrc



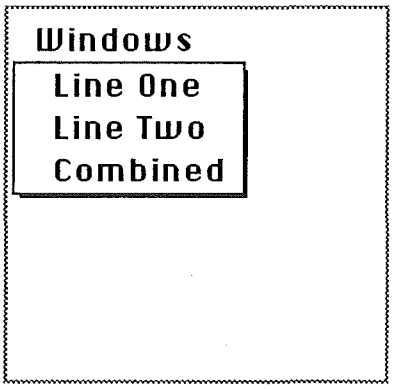
402



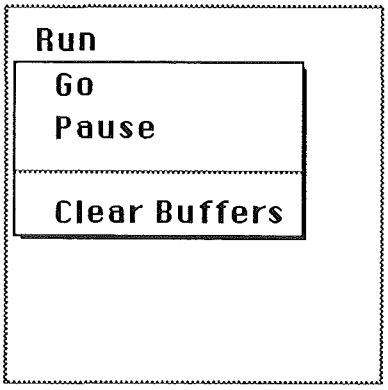
403



404



405



406

Appendix B.

Source Listing and Resources for the simulated transmission generator.

```
/*
 *
 * Generate simulated serial events, and transmit them
 * through the printer port at maximum speed (57600 bps).
 *
 */


/*
 * resources are numbers from 400
 */
#define BASE_RES_ID             400


/*
 * menu identifiers
 */

#define APPLE_MENU_ID           BASE_RES_ID
#define FILE_MENU_ID            BASE_RES_ID + 1
#define EDIT_MENU_ID            BASE_RES_ID + 2
#define DISPLAY_MENU_ID         BASE_RES_ID + 3
#define SPECIAL_MENU_ID         BASE_RES_ID + 4


/*
 * items within menus
 */

#define ABOUT_ITEM              1
#define QUIT_ITEM               1

#define ABOUT_ALERT             BASE_RES_ID


/*
 * various system constants
 */

#define NIL_POINTER             0L
#define MOVE_TO_FRONT           -1L
#define REMOVE_ALL_EVENTS       0

#define LEAVE_WHERE_IT_IS       FALSE
#define NORMAL_UPDATES          TRUE

#define NIL_MOUSE_REGION        0L
#define WNE_TRAP_NUM            0X60
#define UNIMPL_TRAP_NUM         0X9F
#define SUSPEND_RESUME_BIT      0X0001
#define ACTIVATING              1
#define RESUMING                1


/*
 * number of clock ticks the applications is willing to spend idle
 * between each transmission
 */
```

```
#define SLEEP                20L

#define TEXT_FONT_SIZE       12

#define DRAG_THRESHOLD       30
#define MIN_WINDOW_HEIGHT    50
#define MIN_WINDOW_WIDTH     50


/*
 * number of pixels between successive rows
 */
#define ROWHEIGHT            15
#define LEFTMARGIN           0
#define STARTROW             0
#define HORIZONTAL_OFFSET    0


WindowPtr            gEventWindow;
Boolean              gDone, gWNEImplemented;
EventRecord          gTheEvent;

int                  gCurRow, gMaxRow;
Rect                 gDragRect, gSizeRect;

MenuHandle           gAppleMenu;

int                  gPortRef;



/*
 * main
 */

main()
{
    ToolBoxInit();
    WindowInit();
    SetUpDragRect();
    SetUpSizeRect();

    MenuBarInit();
    SerialDriverInit();

    MainLoop();
}


/*
 * initialize the macintosh toolboxes
 */

ToolBoxInit()
{
    InitGraf( &thePort );
    InitFonts();
```

```
    FlushEvents( everyEvent, REMOVE_ALL_EVENTS );
    InitWindows();
    InitMenus();
    TEInit();
    InitDialogs( NIL_POINTER );
    InitCursor();
}


/*
 * WindowInit
 */

WindowInit()
{
    gEventWindow = GetNewWindow( BASE_RES_ID + 1, NIL_POINTER,
                                 MOVE_TO_FRONT );

    SetPort( gEventWindow );
    SetUpEventWindow();

    ShowWindow( gEventWindow );

    SelectWindow( gEventWindow );
}


/*
 * SetupEventWindow
 */

SetUpEventWindow()
{
    Rect    eventRect;

    eventRect = gEventWindow->portRect;
    gMaxRow = eventRect.bottom - eventRect.top - ROWHEIGHT;
    gCurRow = STARTROW;

    TextFont( monaco );
    TextSize( TEXT_FONT_SIZE );
}


/*
 * Set up drag rectangle
 */

SetUpDragRect()
{
    gDragRect = screenBits.bounds;

    gDragRect.left += DRAG_THRESHOLD;
    gDragRect.right -= DRAG_THRESHOLD;
    gDragRect.bottom -= DRAG_THRESHOLD;
}

/***/
```

```
SetUpSizeRect()
{
    gSizeRect.top = MIN_WINDOW_HEIGHT;
    gSizeRect.left = MIN_WINDOW_WIDTH;

    gSizeRect.bottom = screenBits.bounds.bottom - screenBits.bounds.top;
    gSizeRect.right = screenBits.bounds.right - screenBits.bounds.left;
}


/*
 * Set up the menu bar
 */

MenuBarInit()
{
    Handle      myMenuBar;

    myMenuBar = GetNewMBar( BASE_RES_ID );
    SetMenuBar( myMenuBar );

    gAppleMenu = GetMHandle( APPLE_MENU_ID );
    AddResMenu( gAppleMenu, 'DRVR' );

    DrawMenuBar();
}



SerialDriverInit()
{
    int         refNumIn, refNumOut;

    if( OpenDriver( "\p.BIn", &refNumIn ) != noErr )
            DrawEventString( "\p.AIn open error" );

    if( OpenDriver( "\p.BOut", &refNumOut ) != noErr )
            DrawEventString( "\p.AOut open error" );

    DrawEventString( "\pSerial Drivers Initialized" );

    gPortRef = refNumOut;

/*
 * constants for serial port configuration
 */
#define baud57600   0
#define stop20      -16384
#define noParity    0
#define data8       3072

    SerReset( gPortRef, baud57600 +  stop20 + noParity + data8 );


}
```

```
/*
 * main loop
 */

MainLoop()
{
    gDone = FALSE;
    gWNEImplemented = ( NGetTrapAddress( WNE_TRAP_NUM, ToolTrap ) !=
                        NGetTrapAddress( UNIMPL_TRAP_NUM, ToolTrap ) );
    if ( gWNEImplemented )
        DrawEventString( "\pWNE present" );
    else
        DrawEventString( "\pWNE absent" );

    while ( gDone == FALSE )
    {
        HandleEvent();
    }
}


/*
 * handle event
 */

HandleEvent()
{
    char theChar;

    if ( gWNEImplemented )
    {
        WaitNextEvent( everyEvent, &gTheEvent, SLEEP,
        NIL_MOUSE_REGION );
    }
    else
    {
        SystemTask();
        GetNextEvent( everyEvent, &gTheEvent );
    }



    switch ( gTheEvent.what )
    {
        case nullEvent:
            SendData();
            break;
        case mouseDown:
            HandleMouseDown();
            break;
        case mouseUp:
            break;
        case keyDown:
        case autoKey:
            theChar = gTheEvent.message & charCodeMask;
            if (( gTheEvent.modifiers & cmdKey ) != 0 )
                HandleMenuChoice( MenuKey( theChar ) );
```

```
            break;
        case keyUp:
            break;
        case updateEvt:
            BeginUpdate( gTheEvent.message );
            EndUpdate( gTheEvent.message );
            break;
        case diskEvt:
            break;
        case activateEvt:
            break;
        case networkEvt:
            break;
        case driverEvt:
            break;
        case app1Evt:
            break;
        case app2Evt:
            break;
        case app3Evt:
            break;
        case app4Evt:
            break;
    }
}

/*
 * draw event string
 */

DrawEventString( s )
    Str255 s;
{
    if( gCurRow > gMaxRow )
    {
        ScrollWindow();
    }
    else
    {
        gCurRow += ROWHEIGHT;
    }
    MoveTo( LEFTMARGIN, gCurRow );
    DrawString( s );
}


/*
 * scroll window
 */

ScrollWindow()
{
    RgnHandle   tempRgn;

    tempRgn = NewRgn();
    ScrollRect( &gEventWindow->portRect, HORIZONTAL_OFFSET,
                    -ROWHEIGHT, tempRgn );
    DisposeRgn( tempRgn );
```

```
}


/*
 * handle mouse down
 */

HandleMouseDown()
{
    WindowPtr       whichWindow;
    short int       thePart;
    long            windSize;
    GrafPtr         oldPort;
    long int menuChoice;

    thePart = FindWindow( gTheEvent.where, &whichWindow );
    switch( thePart )
    {
        case inSysWindow:
            SystemClick( &gTheEvent, whichWindow );
            break;
        case inMenuBar:
            menuChoice = MenuSelect( gTheEvent.where );
            HandleMenuChoice( menuChoice );
            break;

        case inDrag:
            DragWindow( whichWindow, gTheEvent.where, &gDragRect );
            break;
        case inContent:
            SelectWindow( whichWindow );
            break;
        case inGrow:
            windSize = GrowWindow( whichWindow, gTheEvent.where,
                &gSizeRect );
            if ( windSize != 0 )
            {
                GetPort( &oldPort );
                SetPort( whichWindow );
                EraseRect( &whichWindow->portRect );
                SizeWindow( whichWindow, LoWord( windSize ),
                    HiWord( windSize ), NORMAL_UPDATES );
                InvalRect( &whichWindow->portRect );
                SetPort( oldPort );
            }
            break;
        case inGoAway:
            gDone = TRUE;
            break;
        case inZoomIn:
        case inZoomOut:
            if ( TrackBox( whichWindow, gTheEvent.where, thePart ) )
            {
                GetPort( &oldPort );
                SetPort( whichWindow );
                EraseRect( &whichWindow->portRect );
                ZoomWindow( whichWindow, thePart, LEAVE_WHERE_IT_IS );
                InvalRect( &whichWindow->portRect );
```

```
                SetPort( oldPort );
            }
            break;
    }
}


/*
 *
 */

HandleMenuChoice( menuChoice )
    long int menuChoice;
{
    int     theMenu;
    int     theItem;

    if( menuChoice != 0 )
    {
        theMenu = HiWord( menuChoice );
        theItem = LoWord( menuChoice );

        switch( theMenu )
        {
            case    APPLE_MENU_ID:
                HandleAppleChoice( theItem );
                break;
            case    FILE_MENU_ID:
                HandleFileChoice( theItem );
                break;
            case    EDIT_MENU_ID:
                HandleEditChoice( theItem );
                break;
            case    DISPLAY_MENU_ID:
                HandleDisplayChoice( theItem );
                break;
            case    SPECIAL_MENU_ID:
                HandleSpecialChoice( theItem );
                break;
        }
        HiliteMenu( 0 );
    }
}



HandleAppleChoice( theItem )
    int theItem;
{
    Str255      accName;
    int         accNumber;
    short int   itemNumber;
    DialogPtr   AboutDialog;

    switch( theItem )
    {
        case ABOUT_ITEM:
```

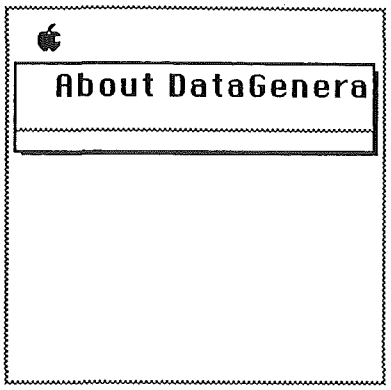
```
            Alert( ABOUT_ALERT, NIL_POINTER );
            ResetAlrtStage();
            break;
        defualt:
            GetItem( gAppleMenu, theItem, accName );
            accNumber = OpenDeskAcc( accName );
            break;
    }
}


HandleFileChoice( theItem )
    int theItem;
{
    switch( theItem )
    {
        case QUIT_ITEM:
            gDone = TRUE;
            break;
        defualt:
            break;
    }
}


HandleEditChoice( theItem )
    int theItem;
{
}

HandleDisplayChoice( theItem )
    int theItem;
{
}

HandleSpecialChoice( theItem )
    int theItem;
{
}


/*
 * specific ASCII codes used in transmission
 */

#define STX_CODE        0x02
#define ETX_CODE        0x03
#define TAB_CODE        0x09
#define CR_CODE         0x0d


#define PRINT_BUF_LEN       20
#define CONVERT_BUF_LEN     100
#define SEND_BUF_LEN        ( 2 * CONVERT_BUF_LEN )


#define HIGH_MASK       0xf0    /* upper 4 bits */
#define LOW_MASK        0x0f    /* lower 4 bits */
```

```
/*
 * various bit positions set to be interproted by datascope program
 */

#define FIRST_OF_PAIR_MASK  128
#define IS_DATA_MASK        64
#define LINE_TWO_MASK       32

#define MSG_LEN             21


SendData()
{

    char bufToPrint   [ PRINT_BUF_LEN ];
    char bufToConvert[ CONVERT_BUF_LEN ];

    static int block = 0;   /* for block count - inserted in block */


    /*
     * increment block, but keep modulus 100
     */
    block++;
    block %= 100;


    /*
     * set string that is printed in window
     */
    sprintf( bufToPrint, "Ch. %d Block %d" , block%2 ? 2 : 1, block );

    /*
     * even messages on line one,
     * odd messages on line two.
     */


    sprintf( bufToConvert, "%cPacket #%2d%cLine #%c%c%c",
       STX_CODE, block, TAB_CODE, block%2 ? '2':'1',CR_CODE, ETX_CODE );

    TransmitMsg( (block%2 ? 1 : 0), bufToConvert, (long)MSG_LEN );
    DrawEventString( CtoPstr( bufToPrint ) );


    /*
     * transmit a couple of messages of shorter length.
     * (just so that all messages are not the same length
     * - provides more thorough testing)
     */

    TransmitMsg( (block%2 ? 0 : 1), "Msg1\n", (long)5 );
    TransmitMsg( (block%2 ? 1 : 0), "Ack\n", (long)4 );

}
```

```
TransmitMsg( whichLine, msgBuf, msgLen )
int whichLine;
char *msgBuf;
long msgLen;
{

    long len, saveLen;
    int pos;
    char bufToSend   [ SEND_BUF_LEN ];

    /*
     * There are two bytes transmitted for each actual data byte.
     */
    saveLen = len = 2 * msgLen;
        /*
         * 2 * length of msgBuf
         * Can't use strlen(), as string may contain nulls.
         */

    /* convert printbuf into transmission format,
       just sending what is printed                */
    for ( pos=0 ; pos < msgLen ; pos++ )
    {
        bufToSend[ 2 * pos ] = 0;
        bufToSend[ 2 * pos + 1 ] = 0;

        bufToSend[ 2 * pos ]     |= FIRST_OF_PAIR_MASK;

        bufToSend[ 2 * pos ]     |= IS_DATA_MASK;
        bufToSend[ 2 * pos + 1 ] |= IS_DATA_MASK;

        if ( whichLine != 0) /* messages appear on alternating lines */
        {
            /* odd numbered message - line two */
            bufToSend[ 2 * pos ] +=     LINE_TWO_MASK;
            bufToSend[ 2 * pos + 1 ] += LINE_TWO_MASK;
        }


        /*
         * for each character to be transmitted,
         *  the 4 most significant bits are sent in the first byte, and
         *  the 4 least significant bits are sent in the second byte.
         */
        bufToSend[ 2 * pos ] +=     ( msgBuf[pos] & HIGH_MASK ) >> 4;
        bufToSend[ 2 * pos + 1 ] += ( msgBuf[pos] & LOW_MASK );


    }

    /*
     * send characters here.
     */

    FSWrite( gPortRef, &len, bufToSend );
```

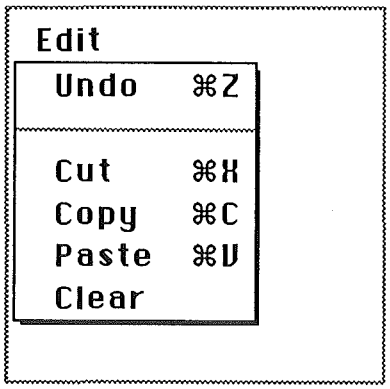
```
    if ( saveLen != len )
    {
        char b[20];
        sprintf( b, "Only %d bytes written", len);

        DrawEventString( CtoPstr( b ) );
    }
}
```

MENUs from EventGen Proj.Rsrc



400

401

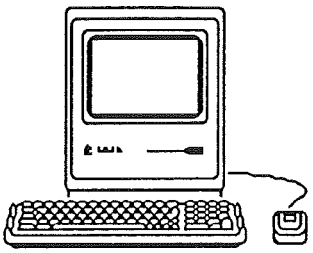


402

DITL "About ..." ID = 400 from EventGen Proj.Rsrc

Simulated Data Generator

For use with MacDataScope™



OK