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SCSI BUS ANALYZER

Model # Ultra-2080

USER-S MANUAL

Revision 2.1

June 1999

Ancot Corporation
115 Constitution Drive
Menlo Park, California 94025
(650) 322-5322

COMPANY PROFILE

Ancot Corporation designs and manufactures SCSI and Fibre Channel development and test equipment, and other computer products for OEM markets, based on the SCSI, Fibre Channel, and Gigabit Ethernet protocols. Ancot-s instruments are used worldwide by leading computer companies. Applications include development, manufacturing, and repair. Ancot-s policy is to provide quality products, and to support its customers with qualified engineering support to maximize the return on their investment.

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S E C T I O N 1

DESCRIPTION OF EQUIPMENT

1.1 INTRODUCTION

The Ultra-2080 is a portable, advanced, versatile, user-configurable SCSI Bus Analyzer. This instrument was designed for the following applications:

- development work in the laboratory
- production test
- field service applications

The Ultra-2080 Analyzer provides a comprehensive SCSI event tracer, a debugger with powerful triggering capability, and an optional SCSI initiator emulator. It provides displays of SCSI bus activity in a variety of formats for easy interpretation.

The Analyzer comes in the following configurations:

The Ultra-2080/Bxx is the briefcase model, and the Ultra-2080/Lxx which uses an external PC host for control. The /Lxx models do not have a screen nor keyboard. Both versions come with a circular trace buffer holding up to 128k events standard, and optional 256k or 512k events.

The model numbers used for the Ultra-2080 are as follows:

Ultra-2080/mse where:

m = Model
- B - briefcase version
- L - ALite@ version (no screen or keyboard)

s = Memory Size
- D - standard 128k trace events
- K - optional 256k trace events
- X - optional 512k trace events

e = Emulator option
- E - emulator is installed
- <blank> - no emulator is installed

An optional external floppy disk is also available (OP-XFL).

Examples:

Ultra-2080/BD - Standard briefcase model with 128k trace events.
Ultra-2080/BX - Briefcase model with optional 512k trace events.
Ultra-2080/BXE - Briefcase model with optional 512k trace events and emulator

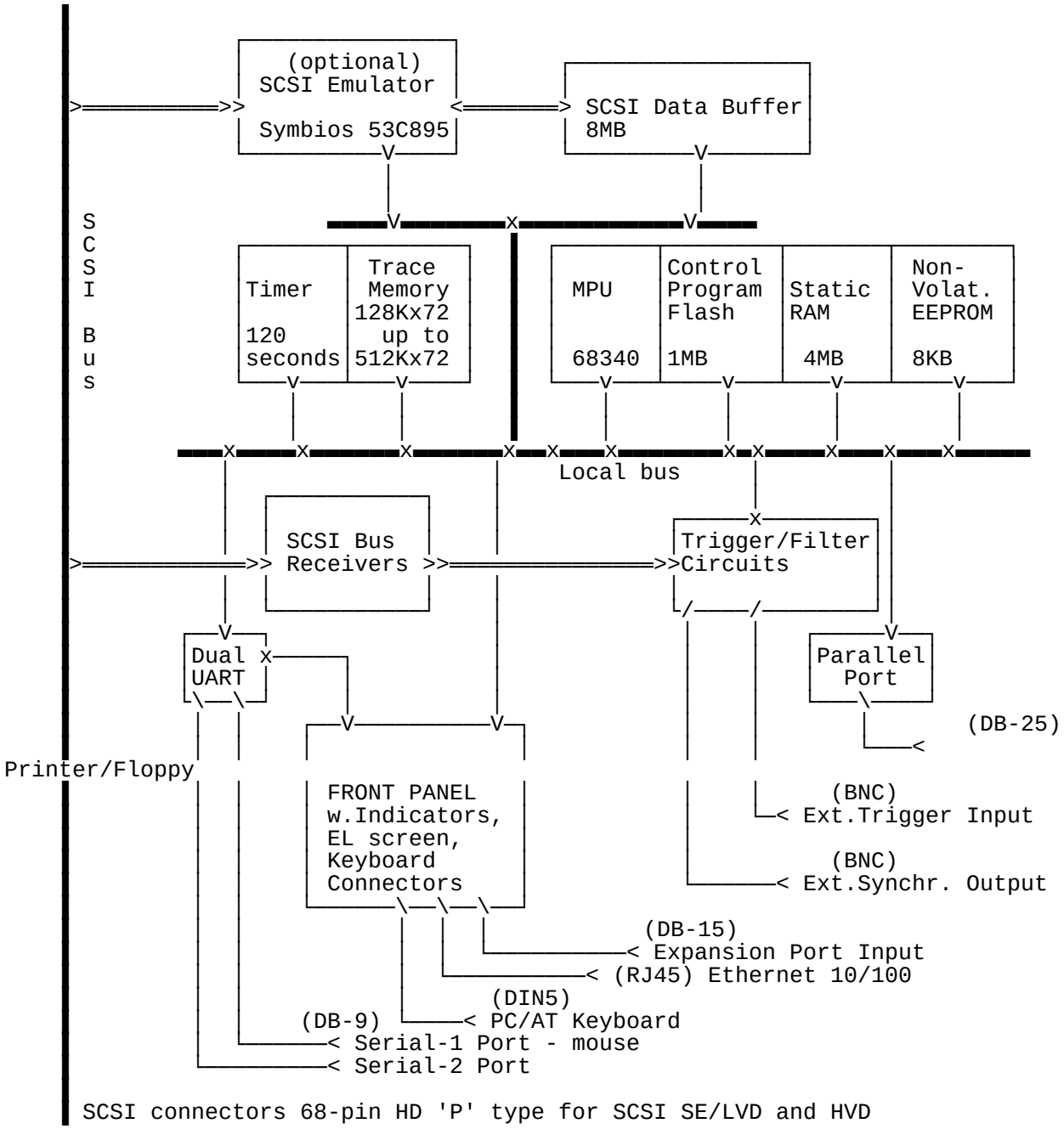
1.2 GENERAL DESCRIPTION

The SCSI Bus Analyzer is used for recording activity on the SCSI Bus to which it is connected non-intrusively. Its circular buffer can hold up to 128k events (standard for Ultra-2080/BDx), 256k or 512k events (optional). The recording method is event driven; only valid data or transitions on certain SCSI signals are recorded. At the time of recording, each event is time-stamped. The recording can later be played back in several forms. It can be displayed on a built-in LCD flat screen, or sent to a printer to provide a hard copy. Recorded data can be uploaded to a host computer, and saved on a disk to build a data base for post processing.

The display of recorded SCSI bus activity can be in several forms: "binary" format similar to a time-domain form of logic analyzers, "structured" format which is an interpreted "SCSI-English" form, easily understandable, Acompact@ showing one SCSI command per line, etc.

1.3 SYSTEM OVERVIEW

A simplified block diagram of the Ultra-2080 SCSI Bus Analyzer is shown below:



The system carries out several major functions:
The Analyzer is connected to the SCSI bus by its line receivers. Note that the Analyzer is a non-intrusive device, which merely senses activity on the SCSI bus through isolating receivers. The load on the tested SCSI Bus is less than 25 pF.

From line receivers, the signals are directed to separate circuits: to trace memory, to the trigger/filter circuitry, and to the front panel to be displayed using LED indicators. All parts of the Ultra-2080 are internally controlled by the local MPU (Motorola's MC68340). The control program for the MPU is saved in EPROM with 64KB capacity, and flash memory with 1MB capacity.

Communication with the operator is by a built-in keyboard, and an LCD flat color screen display. A parallel printer may be connected for hard copy output. In addition, a PC/AT type keyboard and a mouse can be attached. The Analyzer can also be placed in 'Remote Control' mode, controlled by an external PC or VT-100 type monitor.

Non-volatile EEPROM memory provides for storage of setup parameters, and user option settings.

1.4 TIMING CONDITIONS IN RECORDING

Recording in the Trace Memory is event-driven. This means that only transitions on the SCSI bus are recorded. A valid change (event) is determined by the tracing options, and is defined as follows:

- a positive or negative transition on the BSY, SEL, ATN, and RST lines,

- during Information Transfer Phases, a SCSI event can be

  a) qualified by the valid edge of REQ or ACK signals:
  During READ operations (Data from Target to Initiator), the status of SCSI bus signals is recorded in Trace Memory following the leading edge of the REQ signal. During WRITE operations (Data from Initiator to Target), the status of SCSI bus signals is recorded following the leading edge of the ACK signal.

  b) recorded during any transition of the REQ or ACK signals, e.g., following all 4 edges of REQ and ACK.

c) recording of data during a Data-In or Data-Out phase can be skipped after the leading bytes, up to 255. Note that all bytes transferred are counted, and the total count will appear in the trace if the command completes successfully.
d) any transition on the MSG, C/D, or I/O SCSI Control lines can be recorded.

- the status of the SCSI bus and 3 external signals can be recorded on every negative transition of bit 0 of the expansion port.

- certain changes on data lines when tracing the SCAM protocol and during the Arbitration phase.

For more on trace recording modes read Section 2.4.6.

1.5 FRONT PANEL

The front panel of the Ultra-2080 contains a flat panel display screen, a keyboard, two push-button switches, and 36 LED indicator lights. Several connectors, a cooling fan, and the main power switch module also share the front panel.


ANCOT
SCSI bus Analyzer
Ultra2080
Data
D0 D8
D1 D9
D2 D10
D3 D11
D4 D12
D5 D13
D6 D14
D7 D15
DPL DPH
Control
BSY
SEL
C/D
I/O
MSG
REQ
ACK
RST
ATN
Power
Tracing
Disk Active
System Reset
SCSI Reset
10/100 Base-T
Mouse Port
Serial Port
Parallel / Floppy
Exp Port
Ext Trig-In
Ext Trig-Out
KBD
S-E
LVD
Term. Pwr
DIFF
Term. Pwr
J1
J2
J3
J4
Caps Lock
Enter
Shift
Ctrl
Alt

Figure 1.

The **DISPLAY SCREEN** is a high-visibility LCD flat panel, capable of displaying 25 lines of 80 characters.

The **SYSTEM RESET** switch restarts the system.

The **SCSI RESET** switch generates the RESET condition on the SCSI bus.

The **LED indicators** are:

POWER
TRACING
DISK ACTIVE
SCSI Control Signals: BUSY, SEL, C/D, I/O, MSG, REQ, ACK, RST and ATN
SCSI Data Signals: D0 - D15, and Data-Parity (2)
Single-Ended/LVD and Differential interface
TERMINATOR POWER (2)
CAPS LOCK

CONNECTORS located on the front panel are:

- Parallel Printer/Floppy (DB-25 female)
- Expansion 3-bit port Input (DB-15 female)
- two Serial I/O ports (DB-9 male for the mouse, DB-9 female for communication)
- 5-pin connector for PC/AT keyboard (DIN female)
- External Trigger Input (BNC connector)
- External Synch Output (BNC connector)
- J1,J2 - SCSI connectors (68-pin, female) for S-E/LVD interface
- J3,J4 - SCSI connectors (68-pin, female) for Diff HVD interface
-10/100 Mbit Ethernet (RJ-45)

EXTERNAL TRIGGER INPUT - The coaxial BNC type connector on the right side of the front panel serves for input of an external trigger signal. The Ultra-2080 will trigger on positive to negative transition if enabled from the trigger menu. External Trigger Input expects TTL level signal.
The basic trigger functions, which most users would need, have been implemented in the system. Additional unique trigger functions may be added by using this external trigger.

EXTERNAL SYNCH OUTPUT - The coaxial BNC type connector on the right side of the front panel provides a trigger signal, which may be used for triggering external instruments such as oscilloscopes, logic analyzers, etc. When a trigger occurs, this output generates positive to negative transition. External Synch uses a TTL level.

EXPANSION 3-BIT PORT INPUT - There is often a need to compare the relationship of external signals with the SCSI bus signals. For this purpose, the "Expansion" connector is

available. This input port allows for up to 3 signals to be recorded together with the SCSI trace. This additional data, after being recorded, will be displayed as three "0" or "1" digits, in the BINARY display mode. Pin 1 can be used as a clocking signal if "external clock" is enabled from the recording mode menu.
See Appendix A for the Expansion connector pinout. Note that on this connector there are two pins for Vcc (+5V, available up to 100mA), and two pins for GND. The Vcc and GND may be used to power external devices such as AD converters, or other adapters.

AC POWER MODULE - consists of the AC main switch, fuse, and a three-pin receptacle for the AC line cord. The fuse is accessible under a cover in the body of the module.

KEYBOARD - Note that the built-in keyboard and the external keyboard can be used inter-changeably. You can be using both at the same time: press a key on the built-in keyboard, press several keys on the external keyboard, go back to the built-in keyboard, etc.

The top row of keys on the built-in keyboard, corresponding to F1-F8 on the external keyboard, have been labeled for the most common functions of the Ultra-2080. Use these keys for shortcuts to common commands: Run, Stop, Display, etc.

10/100 Mbit ETHERNET PORT - This is a standard Ethernet port using an RJ-45 connector. The hardware detects the proper speed when an Ethernet cable is connected. If you use 100 Mbit, make sure the cable is rated for 100 Mbit operation.

1.6 NOTATIONAL CONVENTIONS

The primary operator interface with the Ultra-2080 is through the keyboard on the front panel, through the PC/AT keyboard, or through a mouse.. In this manual the following notation is used when referring to keys and key sequences:

Keys are referred to by their legend, enclosed in angle brackets "<" and ">". Examples: **< Esc >**, **< Enter >**, **< Run >**, **< R >**, **< SP >** (for "space") etc.

Keys to be depressed together (the "control combinations") are shown with a "^" (Up-Arrow) preceding the other character. For example <^C> or <Ctrl-C> means that you type the "C" key while the Ctrl key is depressed. Other combinations may also appear, as e.g., **<Alt-C>**, which means type the "C" key while the <Alt> key is being depressed.

In menus or in various prompts, the optional suggested selections are displayed in parentheses. Current selections or defaults are displayed in brackets "[", and "]".

1.7 USER INTERFACE

The Ultra2080 was designed to be controlled by the user in two ways: either locally or remotely.

In the LOCAL mode, the user uses the built-in screen, keypad or external keyboard and other controls on the front panel of the unit.

In REMOTE mode, the user can connect an external (PC) host over the serial port and use terminal emulation program (like PROCOM) in the host. He/she can also connect to a LAN (using the RJ45 10/100baseT on the front panel) and control the Ultra2080 remotely using a browser.

Both methods are described below.

1.7.1 LOCAL MODE OPERATION

The following controls are available to the user:
Flat 8.4" color flat panel screen, 73-key AT-compatible built-in keyboard, external keyboard, switches and indicators listed below.

The operator interface from the keyboard is completely menu-driven. The main menu at the root of the Ultra-2080 firmware system serves for selection of functions related to tracing, trigger selection, and display of recorded data.

Most of the functions are actuated by a single key stroke; selection is recognized by the system, and the rest of the word is filled in automatically. If the function doesn-t execute, more input is needed, and a menu or prompt will appear on the screen. If a wrong key is pressed, the system will either beep, and give the operator a second chance, or in some situations will abort and exit that function. The type of each individual operation will determine which of the two actions will be taken.

Several keys have characteristic functions:

Pressing **<Enter>, <Space>**, or **<Yes>** while at the root level, will re-display the main menu.

<Q> or **<q>** keys will cause exit from a current function, or exit the current menu, and stepping one level back. By repeating the **<Q>** or **<q>**, eventually you will return to the main menu at the root.

<Ctrl-C> There may be several prompts to be answered before a selected function is started. If you change your mind in the middle of this selection process, then by pressing the **<Ctrl-C>** key

you can quit that selection sequence and exit immediately to the root. You can also use the **<Ctrl-C>** to exit any selection and return directly to the root menu level.

<Pause> or **<Ctrl-S>** causes the system to pause. Press **<Ctrl-Q>** to continue.

<Ctrl-P> is a toggle switch that will turn "parallel printing" ON or OFF. The printing mode is indicated by a message at the bottom of the main menu. "Parallel printing" means sending all data displayed on the screen also to the printer port. Note that only the trace data will be printed, not the menus, etc.

Note that the keys **<Ctrl-C>, <Ctrl-S>**, and **<Ctrl-P>** work the same as on any PC system.

1.7.2 REMOTE MODE OPERATION USING THE SERIAL PORT

Connect the external terminal (VT100 type terminal, PC, or other host running terminal emulation program) to the DB-9 serial port connector on the front panel of the Ultra2080 using a straight serial cable. You also may use a modem connection. We recommend that you follow directions described in Appendix E. Once a serial connection has been established, you are able to control the Ultra2080 through your remote terminal=s keyboard. Menu items may be selected by using the highlighted letter or number or by using the arrow keys. Other sections in this manual describe how to control tracing and display a trace.

1.7.3 REMOTE MODE OPERATION OVER ETHERNET USING A BROWSER

Configuring For The First Time
When starting your unit for the first time, you must use the serial interface. You may set up the Ethernet port IP address and server options by using the Utilities menu (see section 2.5.6) if you chose using the Ethernet interface.

Control Over the Ethernet Port using a Browser
After you have configured the Ethernet port (see section 2.5.6) as mentioned in the previous paragraph, by assigning an IP address to the Ultra2080 and starting the web server, you may control the Ultra2080 by using a web browser such as Netscape or Internet Explorer.
In Netscape=s ALocation:@ field or Internet Explorer=s AAddress:@ field, type Ahttp://@ followed by the IP address which you have assigned to the Ultra2080. For instance if you assigned the IP address 192.168.1.1 to the Ultra2080, type Ahttp://192.168.1.1" in the location or address field and your browser will access the main page of the Ultra2080.

If you need to access files on the Ultra2080, start the FTP server and use and FTP client on your computer (such as WS_FTP from Ipswitch). Choose the AC@ drive and a file/directory tree should be displayed by your FTP program.

Do not delete any files in the Ahttp@ directory. These files are the web pages for the Ultra2080. You may have to replace these from time to time as new pages become available from Ancot-s web site. Do not delete the file Aancot.hlp@. This is the main helpfile for the briefcase version.

1.7.4 MENUS

The user interface is through: the **screen** and **keyboard** built into the front panel of the Ultra-2080; an external keyboard connected to Serial-1; a mouse; or screen and keyboard of a remote control PC/CRT.

The operator interface from the keyboard, or from the external PC/AT keyboard, is completely menu-driven. The main menu at the root of the Ultra-2080 firmware system serves for selection of functions related to tracing, trigger selection, and display of recorded data. See Ultra-2080/LITE User-s Manual for menus used in the **remote control mode**.

The main functions are actuated by a single key stroke (**<Alt>** letter). A menu or prompt will appear on the screen. If an incorrect key is pressed, the system will either beep, and give the operator a second chance, or in some situations abort and exit that function. The type of each individual operation will determine which of the actions will be taken.

Several keys have characteristic functions:

<Esc> will exit from a menu, and step one level back. By repeating **<Esc>** you will eventually return to the main menu at the root. The **<Esc>** key from the keyboard has a similar effect.

There may be several prompts to choose from before you reach your selected function. If you change your mind in the middle of this selection process, you can quit that selection sequence by pressing **<Esc>**, or by selecting **<Cancel>**, and exit immediately to the previous menu.

<Pause> causes the system to pause. Press **<Run>** to continue.

<Home> selects the A<OK>@ button
<End> selects the A<Cancel>@ button

1.7.5 OTHER GENERAL RULES:

In edit sessions typically the current selection is displayed. If a different value is required, type it in. If only **<Enter>** is typed, the current value will stay unchanged.

Numeric values, except the timing information (e.g., Time Stamp), are displayed in Hex format. All numeric answers are expected to be in Hex unless marked otherwise.

Currently selected values are displayed in "[ ]" brackets. If such a value appears at the cursor for input, typing **<Enter>** selects that value.

From menus displaying a highlighted entry, the arrow keys and the tab keys move the highlight from one entry to the next. Most menu selections also have a "selector" key, which will move the highlight directly to that entry.

1.8 TIMER

There is a 6-byte 50 MHZ counter in the Ultra-2080 Analyzer used for marking each recorded event in trace memory with a time stamp. The resolution is 20 nanoseconds. The timer will wrap around after approximately 213 days. The REQ/ACK signals are sampled each 1/5 cycle (4 ns) to give finer granularity resolution.

The time stamp is displayed together with the recorded data in the BINARY display format. It can be selected to show as time differential (time increment from the previous event), or as time elapsed from the beginning of the tracing. Make this selection on the keyboard by pressing **<E>** while in the display mode. Timing information is also available in the STRUCTURED format display. When enabled, the duration of each phase will be displayed on the last line of that phase, if space permits.

1.9 ELECTRICAL CONNECTION ON THE SCSI BUS

There are three alternatives for connecting the SCSI bus: the SINGLE-ENDED and LVD (Low Voltage Differential), and DIFFERENTIAL HVD (High Voltage Differential) connectors. Pinouts of all connectors used are listed in Appendix A.

'SCSI FACTS & TIPS' in Appendix F is recommended reading for those interested in knowing more about the various aspects of SCSI usage.

1.10 SCSI BUS TERMINATION AND TERMINATION POWER

No internal termination is provided. Use an external SCSI differential HVD or LVD, or single-ended terminator. Power (TERMPWR) for this Terminator is supplied in all SCSI connectors.

TERMPWR is protected by a Schottky serial diode for protection against back flow, and by a 1.0 Amp fuse for protection against electrical short. The fuse acts as a circuit breaker with automatic reset. In case of a short on TERMPWR, the breaker disconnects the circuit; when the short is removed, the breaker restores TERMPWR within 20 seconds.

!!! WARNING !!!

NOTE THAT IF TERMPWR IS SUPPLIED BY MULTIPLE SOURCES TO THE SCSI BUS, AND IF ACCIDENTALLY THE 'TERMPWR' PIN OF THE SCSI BUS CABLE GETS GROUNDED, THEN THE 'TERMPWR' LEAD OF THE SCSI BUS CABLE WILL HAVE TO WITHSTAND THE SUM OF THE CURRENTS FROM ALL THE SOURCES 1 AMP EACH (EACH FUSED AT 1 AMP) BEFORE THE FUSES BEGIN TO BREAK !

As a rule, there should be exactly two terminators on a SCSI bus, one on each physical end. Therefore, before connecting the analyzer to a system to be tested, see whether you should add the terminator. This depends on where you are connecting the analyzer: in the middle or at the physical end of the SCSI cable.

'SCSI FACTS & TIPS' in Appendix F is recommended reading for those interested in knowing more about SCSI bus termination methods.

1.11 TECHNICAL SPECIFICATIONS

- Compatible with SCSI specifications as defined by the ANSI X3T9.2 committee for SCSI-1 and SCSI-2, and the current draft SCSI-3 SPI/SIP, including Fast/40

- Asynchronous data transfer rates to over 6 MBps

- Synchronous data transfer rates to over 40M transfers per sec

- Three interfaces are standard: Single-ended (S-E), differential HVD (High Voltage Differential), and LVD (Low Voltage Differential). All SCSI connectors are the 68-pin female type for wide interface. Use a 68-to-50 pin adapter for the narrow interface.

- Non-intrusive tracer. Only signal changes are stored, therefore recording time is not limited.

- Trace memory is 128K events deep and 48 bits wide. Optionally it can be expanded to 512K.

- Up to three external signals can be recorded together with SCSI in trace memory to allow tracing in the tested device. External port pin 1 can be used as "clocking" (both edges are used).

- Recording modes: record all; skip data; record one, two, or all four edges of REQ and ACK; phase changes; capture expansion port changes; filtering by SCSI ID; recording selections only; and recording SCSI-3 SCAM protocol

- Display of recorded trace data in several formats: in structured (Pascal-like) expanded or compact form, binary, hexadecimal, or Command Profile format.

- Hard copy of all displays printed via parallel I/O port on an optional printer

- Event time-stamping function for more than 200 days before timer counter wrap around, with 20 ns resolution (4 ns for REQ & ACK).

- Non-volatile EEPROM memory for storage of current setup and mode parameters

- 1 Mbyte system or program memory, and 8MByte data read/write SCSI buffer

- Motorola 68340 local MPU with resident firmware in 64K byte EPROM and 1MB of flash memory.

- Configuration selectable through menu driven software, stored in non-volatile EEPROM memory

- One 10/100 Mbit Ethernet port

- One serial RS-232 I/O port with a selectable baud rate up to 115K with data format and parity options

- One serial I/O port for a PC compatible serial mouse

- Powerful triggering capability, menu selectable: delayed-trigger (trigger position in trace)
  Internal triggering by:
  selected command, status or message pattern/code
  combination of command and status and ID, or message and ID
  (re)select, (re)select timeout
  data parity error
  Trace Memory is full (post-trigger)
  External triggering through trigger-input BNC connector
  External synch (trigger) output through a BNC connector

- Physical dimensions: 16.5"W x 12.5"D x 4.5"H. Weight: 12 lbs

- Housed in a transportable high-quality fan-cooled attaché case type enclosure, with detachable top cover. Built-in LCD flat screen, keyboard, and switching power supply for 110-220V 50-60Hz operation. A storage pouch for a small keyboard, cables, adapters, etc.

1.12 SCSI SPECIFICATIONS AND REFERENCES

1.12.1 SCSI STANDARD SPECIFICATIONS

Mechanical, electrical and functional definitions of the SCSI-1 are described in:

SCSI-1 Specification Number: ANSI X3.131-1986
Title: Information Systems - Small Computer Systems Interface (SCSI)

Can be purchased from:
American National Standards Institute, Inc. (ANSI)
1430 Broadway, New York, N.Y. 10018
Phone: (212)642-4900 Fax: (212)302-1286

SCSI-2 and SCSI-3 Specifications are available from:
GLOBAL ENGINEERING DOCUMENTS
3130 South Harbor Blvd, Suite 330, Santa Ana, California 92704
(800)854-7179 or (303)792-2181 Fax: (303)792-2192

For the SCSI2, refer to document X3.131-1994.

1.12.2 OTHER LITERATURE

Basics of SCSI - Fourth Edition by Ancot
a quick introduction to SCSI, SCSI terms description, and glossary.

Available from Ancot Corporation
115 Constitution Drive, Menlo Park, CA 94025
Phone: (650) 322-5322 Fax: (650) 322-0455
Internet http://www.ancot.com
This publication is FREE

The Book of SCSI by Peter M. Ridge
contains chapters on anatomy of SCSI, connecting SCSI HW, installing SCSI in a PC, troubleshooting, cables, ASPI programming, CAM, etc.

Available at many bookstores, or purchased directly from:
NO STARCH PRESS
1903 Jameston Lane, Daly City, CA 94013-3466
(415)334-7200

1.12.3 INTERNET RESOURCES

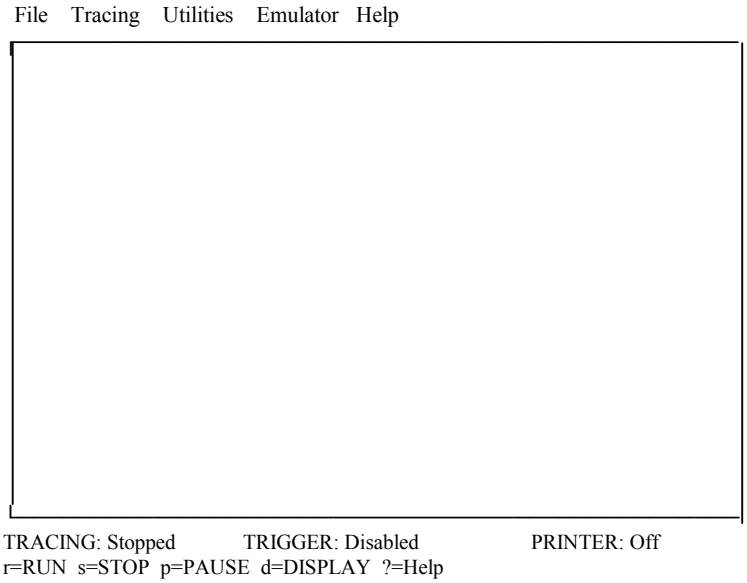
http://www.ancot.com
http://www.sta.com
http://www.symbios.com/T10

S E C T I O N 2

FUNCTIONS AND COMMANDS

2.1 INTRODUCTION

Section 2 describes the commands you need most often for taking full advantage of the features of the Ultra-2080 SCSI Bus Analyzer. The text information is closely related to the menu screens embedded in the system, and follows the same structure. The main menu, and most of the subordinate menus following, show across the top line the four principal pull-down menus. These four are the route to all commands and functions. Subsection 2.2 below describes the trace memory in the Analyzer; the four succeeding subsections cover the use of the four main pull-down menus: FILE, TRACING, UTILITIES, EMULATOR, and HELP. Each of these five subsections describe the features and functions of the successive sub-menus they contain.



The main menu lists the pull-down menus of the Analyzer. To open one of the pull-down menus from the keyboard, use <Alt-letter> where Aletter@ is highlighted on the pull-down menu. Another way is to click on a pull-down menu with a mouse. As with all menus, selections can be made as follows :

- Move the highlight bar to the desired entry using the arrows and press **<Enter>**.
- Press the selector key, shown by typing the highlighted character in the item text.
- Use the mouse and left-click on the selection.
- In some cases, use letter keys on the PC/AT keyboard as selector keys.

2.2 TRACE MEMORY

Trace Memory is a circular buffer 128K events deep, optionally 256K or 512K events deep, with each event 48 bits wide. The content of trace memory is explained in more detail in Appendix C.

Trace Memory is used in a very efficient way: only valid data, and transitions on certain SCSI bus signals cause recording. The qualifier for Data, Command, Status, and Message recording is REQ or ACK strobe. In standard recording mode, when REQ for DATA-IN is asserted, or ACK is asserted for Data Out, a snapshot of the SCSI bus (within less than 4 ns) is taken, latched, and written in the trace memory. Other recording modes are available. See Section 2.4.6.

There are several SCSI control signals that cause recording whenever a transition on these is detected. They are: RST, ATN, SEL, and BSY. Again, as with the data, a snapshot of the SCSI bus is taken at the time of the transition (within 20 ns) and the event is subsequently recorded in the trace memory.

The recording can be started or stopped in one of two ways:

a. - without trigger: operator starts recording by pressing **<Run>** or by typing **<R>**, and stops it by pressing **<Stop>** or by typing **<S>**.
b. - with trigger, either immediate or delayed.

Whether recording with or without trigger, **<Run>** has to be used to set the Ultra-2080 in the TRACING mode. This mode is indicated by the "TRACING" LED on the front panel and a message on the screen. When activity on the SCSI bus starts, the trace memory starts filling. When the memory is full, it will wrap around and continue writing from the physical beginning. The recording will continue until stopped by the **<Stop>** key, or by a post-trigger condition, if enabled. At that point the current (internal) trace memory physical address is detected, and beginning of valid data is calculated. This is done automatically without operator intervention. The earliest event still in the trace is at logical address 00000h. The operator does not have access to the physical address however, but deals with logical addressing only.

When recording with trigger disabled (internal or external), the trace memory acts as a FIFO buffer. The recording starts with the first SCSI activity following **<Run>**, and continues until stopped by **<Stop>**. If trace memory (physical) capacity is exceeded, it wraps around and starts writing from the physical beginning. Although the trace memory uses internally a linear physical address space, the internal firmware translates physical address to logical before displaying it, to make the trace memory appear circular. When recording is stopped, it reports "STOPPED AT xxFFF(WRAP)". The last recorded event is at trace memory (logical) address 1FFFF (7FFFF in 512K versions).

When triggering is used, recording starts as described above, and continues until a trigger condition occurs. When the trigger finally occurs, then depending on trigger position, the recording either:

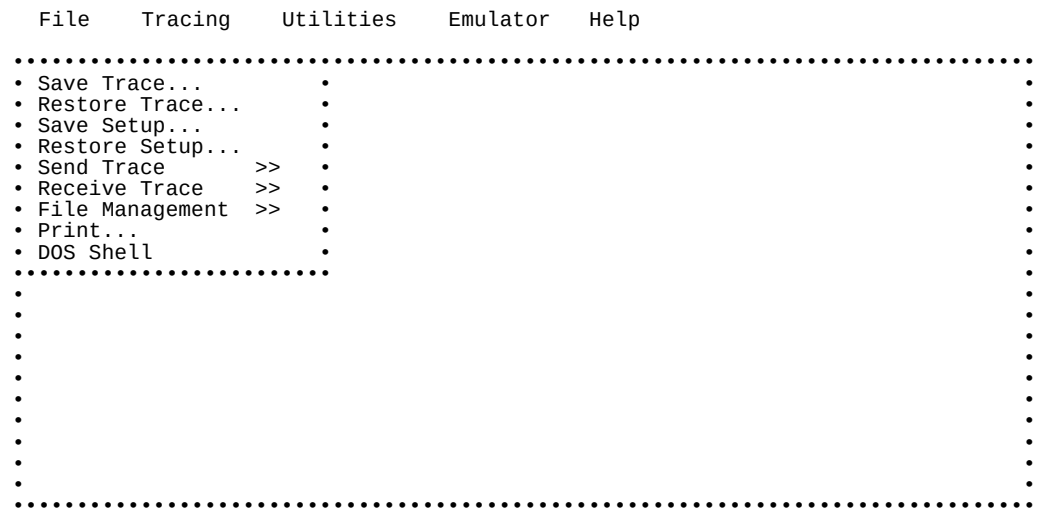
- stops immediately
- continues to the end of the current command when BUS-FREE Phase is detected
- or records a certain number of additional events before stopping (post trigger delay).

When External Trigger is used and the last location is filled, recording stops immediately.

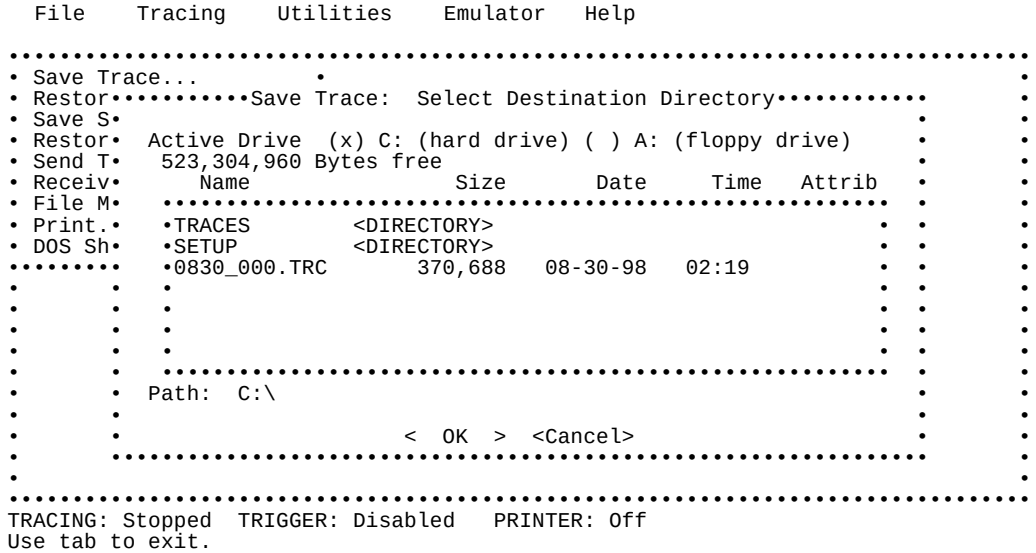
TRACING will stop immediately, without delay, when **<Stop>** is pressed.

2.3 FILE

Select File from the main menu to bring up the screen below.



Many of the functions in the File Menu use a Afile selection menu@ which has different headings depending on context. Example shown below is file selection menu for the ASave Trace@ menu item.



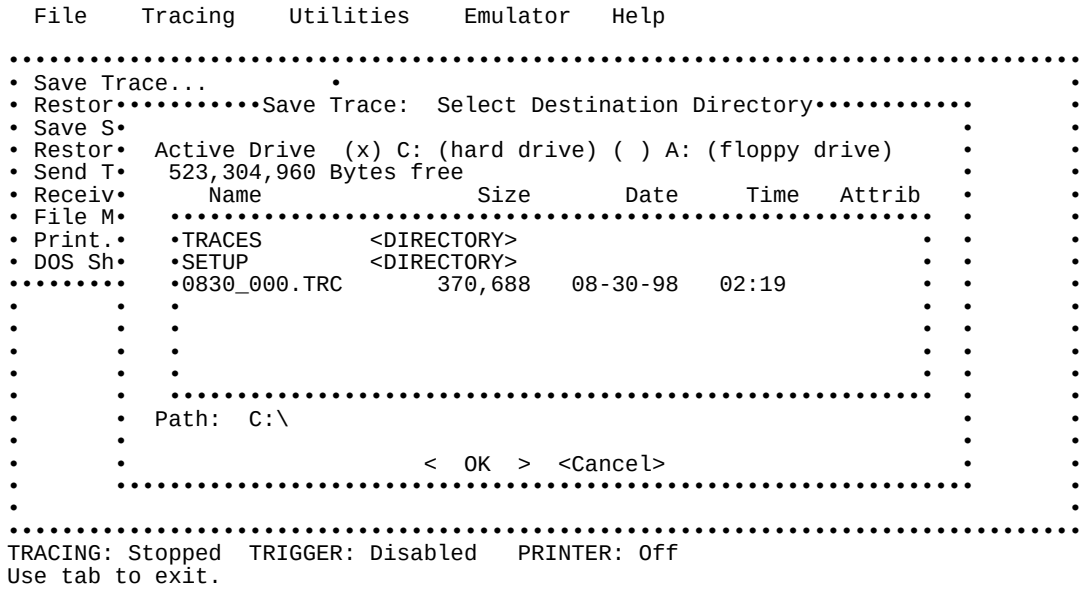
The file selection menu allows you to select the drive and has a window for browsing the file system. If you select a directory, that directory is displayed. If you select a file, the path and file name are shown directly below the browsing window and the cursor moves to < OK > button. You can move around in the browsing window with the mouse or with the arrow keys. You can exit the browsing window by using TAB.

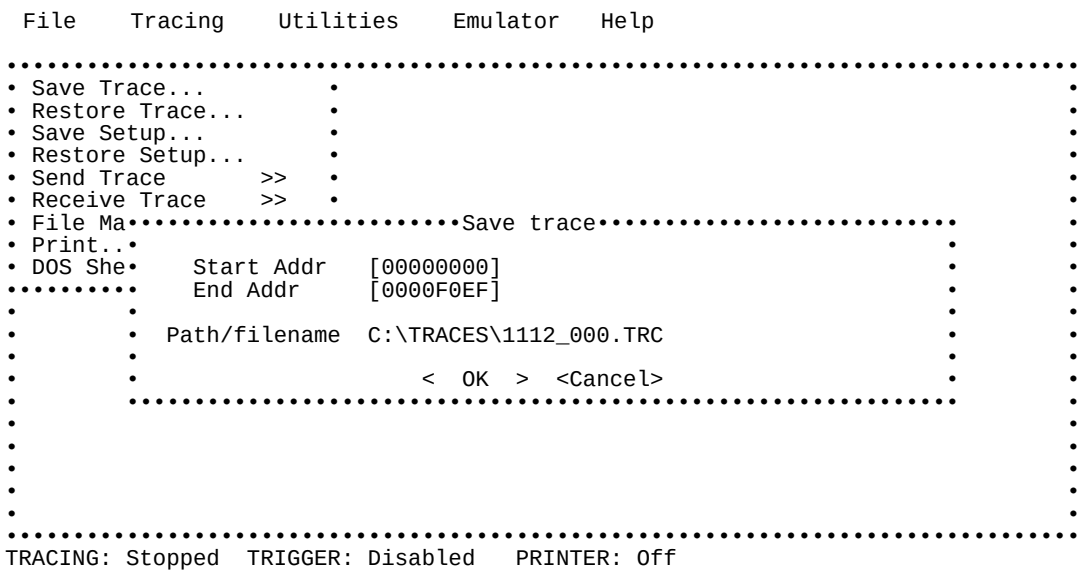
2.3.1 SAVE TRACE

With this selection you can save the trace on the internal hard disk.

With the file selection menu shown below you can select the directory where you want the trace to be saved.

With the second menu shown below you can select the trace memory address range and destination file name. The suggested default file name comprises the month and day and an incrementing number, e.g., "0805_002.TRC" Aug. 5, trace no. 2. If a different path or name is desired, select the "Path/filename" field and type the desired selection e.g.., A\traces\mytrace.001@. If you have the optional floppy disk, you may also save the trace to the floppy by using "a:\filename" or select the floppy disk in the first menu.





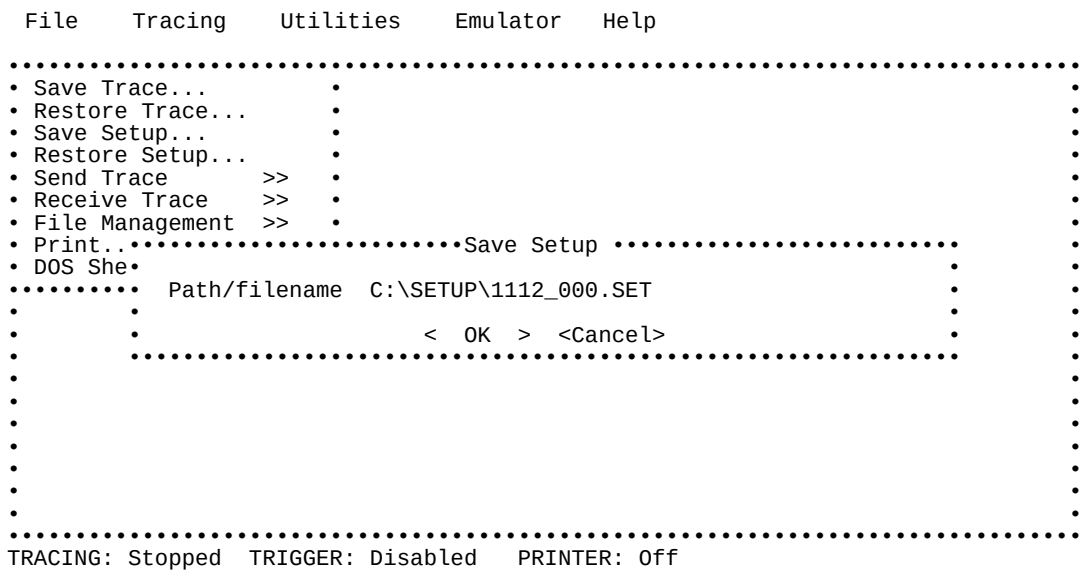
2.3.2 RESTORE TRACE

With the file selection menu, select the trace(file) to be restored.

2.3.3 SAVE SETUP

With this selection you can save the current setup of the Ultra-2080. The setup includes triggering and trace mode information. First, select the destination directory from the file selection menu. The next menu shows the default name.

The suggested default file name is comprised of the month and day and an incrementing number, e.g.., "0805_002.SET" Aug. 5, setup no. 2. If a different path or name is desired, select the "Path/filename" field and type the desired selection, e.g.., \setup\mysetup.001. If you have the optional floppy disk, you may also save the setup to the floppy by using "a:\filename" or by selecting floppy disk in the file selection menu.



2.3.4 RESTORE SETUP

With the file selection menu, select the setup(file) to be restored.

2.3.5 SEND TRACE

You can transfer and save a trace captured by the Ultra-2080 to a file on a host computer for later processing or archival purposes. Two processes are available using a communication program to transfer ASCII files; and using XMODEM. You may also transfer trace to the optional floppy disk.
You will need a cable connecting the Ultra-2080 serial port to your external host computer to use serial send or receive. Selecting the method and direction of trace transfer results in other prompts and menus to lead you through the process.

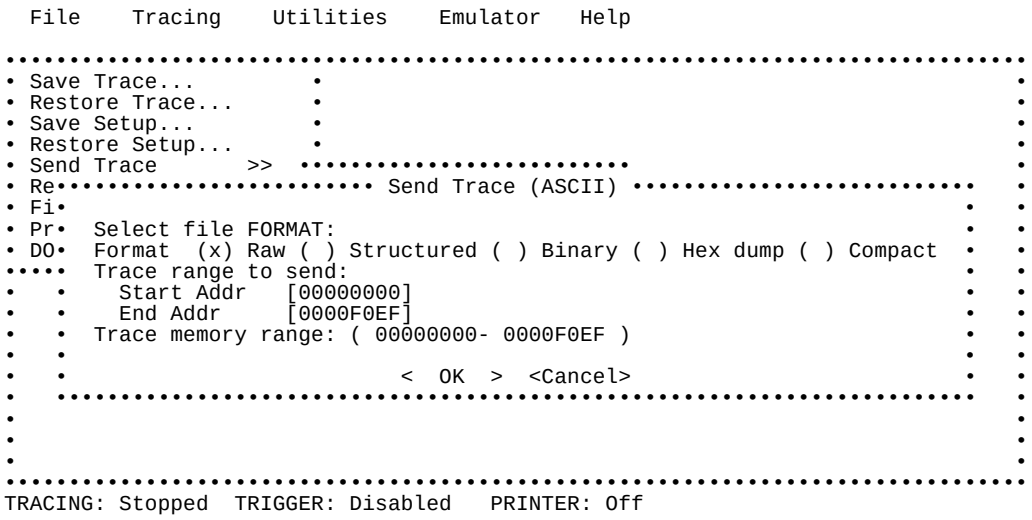
Only the Raw Data format can be restored from a host computer file back into the Ultra-2080's trace memory. The other save file formats are provided for human-readable archiving. A utility will be available in a C-source and IBM PC executable format for converting from raw data to human readable format. Contact the factory for more information.

SERIAL PORT

P At the host computer end, you will need a communications program capable of transferring ASCII files and storing them using the host computer file system. Most UNIX systems provide these programs as system utilities. Apple Macintosh systems and MS-DOS systems will require an add-on program. BITCOM or PROCOMM are perhaps the most popular of these programs for the PC.

The Ultra-2080 must be connected to the host computer using a **straight through cable**. See Appendix A for the pinout. Make sure the connections are made and the host is setup for the same baud and data format as for the Ultra-2080.

Select ASerial Port (ASCII)@ or ASerial Port (Xmodem)@ from the menu and you will be given a choice of file formats to transfer. Selecting ASerial Port (ASCII)@ will display the following menu. The XMODEM transfer uses only the raw trace data format.



The 'Raw Data' format is the only one that can be downloaded into the Ultra-2080 later. See Appendix C for a description of the content. The other formats are text files which are duplicates of the trace display formats, identical to that which appears on the screen of the Ultra-2080. These formats may be useful for comparisons and post-processing of the trace information, but cannot be reloaded into the Ultra-2080. Note that they are not compressed, and files are much larger than the 'Raw Data' format. For this reason, post-processing of 'NON-Raw Data' formats will typically take much longer.

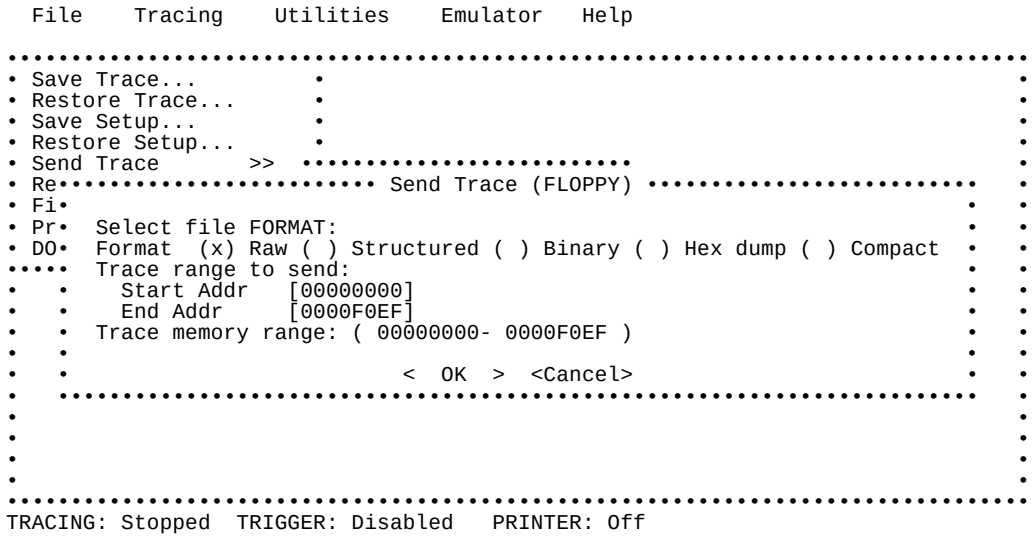
After selecting the format, select the trace memory range to be saved, then confirm the transfer by selecting **<OK>** to start communications. Most communications programs can be set to echo received characters to the screen, so you can follow the transfer as it is progressing.

The transfer is completed when the EOT character (04 Hex) is sent to the host. When the EOT is finally received, disable reception at the host end. This will automatically close and save the file with most communications packages.

See Appendix E for an example of using the PC and the PROCOMM PLUS communication package for saving the trace on a PC host.

FLOPPY DISK

P Select AFloppy Disk@ from the SEND FILE menu. Refer to the Serial Port menu.



The ›Raw Data‹ format is the only one that can be later downloaded into the Ultra-2080.
See Appendix C for a description of the content.

The other formats are text files which are duplicates of the trace display formats, identical to that which appears on the screen of the Ultra-2080. These formats may be useful for comparisons and post-processing of the trace information, but cannot be reloaded into the Ultra-2080. Note that they are not compressed, and the files are much larger than the ›Raw Data‹ format.

After selecting the format, select the trace memory address range to be saved and the filename to use. Once the file is written on the diskette, you may view the file on a PC if you have not selected the raw data format.

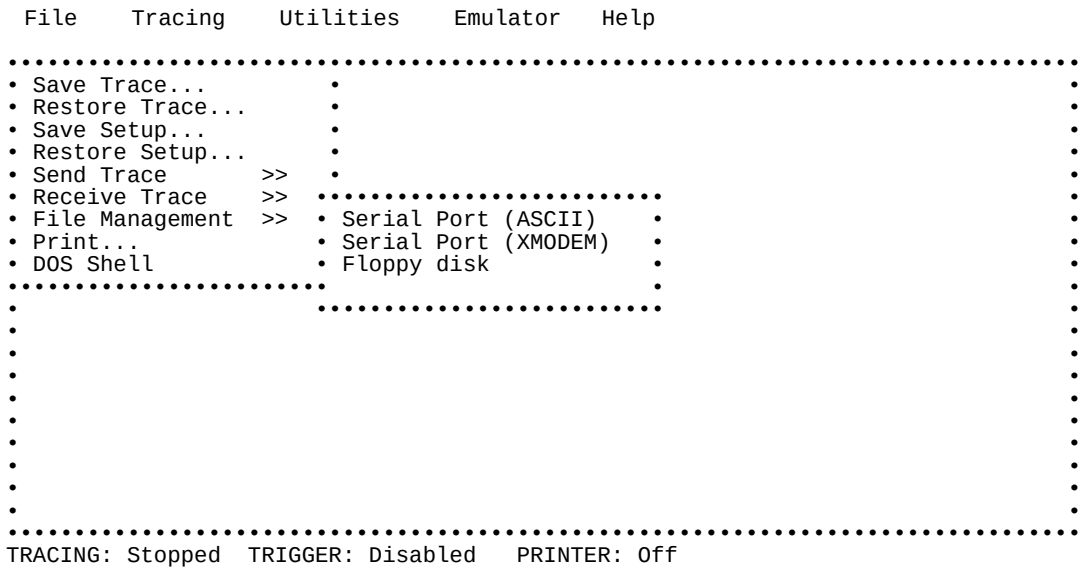
2.3.6 RECEIVE TRACE

P SERIAL PORT

A trace saved to a file in 'Raw Data' format or XMODEM format can be loaded back into the Ultra-2080 trace memory for more study. This function is analogous to saving the trace, as described in Section 2.3.1, except that the direction of transfer is different.

Connect the Ultra-2080 to the host using a straight through cable. At the host computer end, start the communications program and ready it to send either an ASCII or an XMODEM file.

Select ASerial Port (ASCII)@ or ASerial Port (XMODEM)@ from the RECEIVE FILE menu; the following prompt will be displayed:



Select **<OK>** to confirm, then start the transfer from the host end.

Care has been taken to ignore any modem initialization characters your communications package may send out before the actual file, but it is impossible to allow for every possibility. If you repeatedly get the message "Unrecognized format" when attempting to download, disconnect the straight through cable until the next keystroke at the host-end will initiate.

Note again that only the Raw Data format file or the XMODEM format can be reloaded into the Ultra-2080. Any other file format will result in the "Unrecognized format" message.

See Appendix E for an example of using the PC and the PROCOMM PLUS communication package for restoring the trace from a PC host.

P FLOPPY DISK

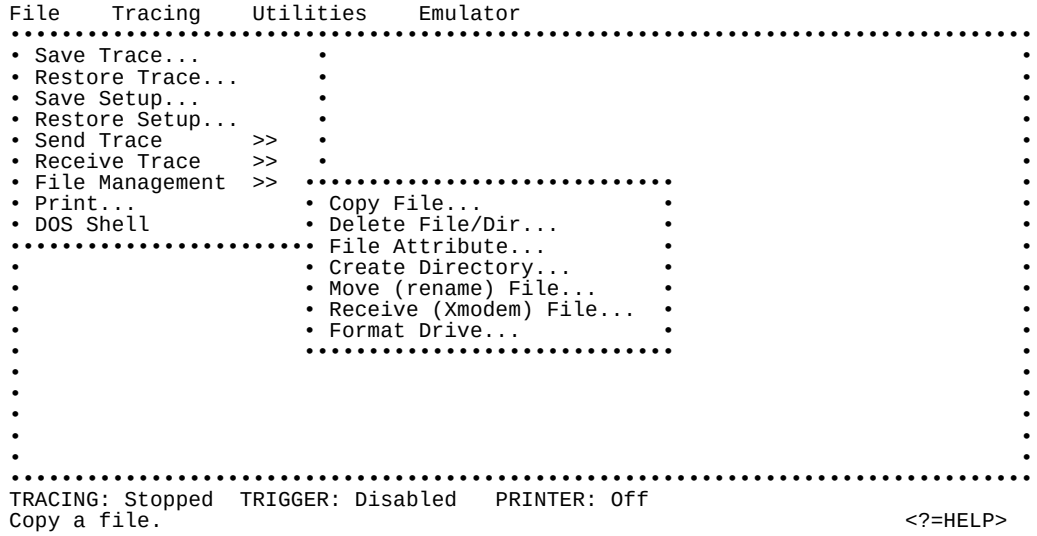
A trace saved to the floppy in ›Raw Data= format can be loaded back into the Ultra-2080 trace memory for more study. This function is analogous to saving the trace, as described in Section 2.3.1 except that the direction of transfer is different.

Place the floppy diskette in the floppy disk drive and select AFloppy Disk@ from the RECEIVE FILE menu; a file selection menu will be displayed.

The left half shows the files and the right half shows the directories and drives. The up and down arrows move the cursor up and down in the window and the **<TAB> <Shift TAB>** keys move the cursor between the two windows. Once the proper file has been selected, enter **<Return>;** the file will be read from the floppy diskette to trace memory. If the format of the file is not ›Raw Data=, the file will not be loaded.

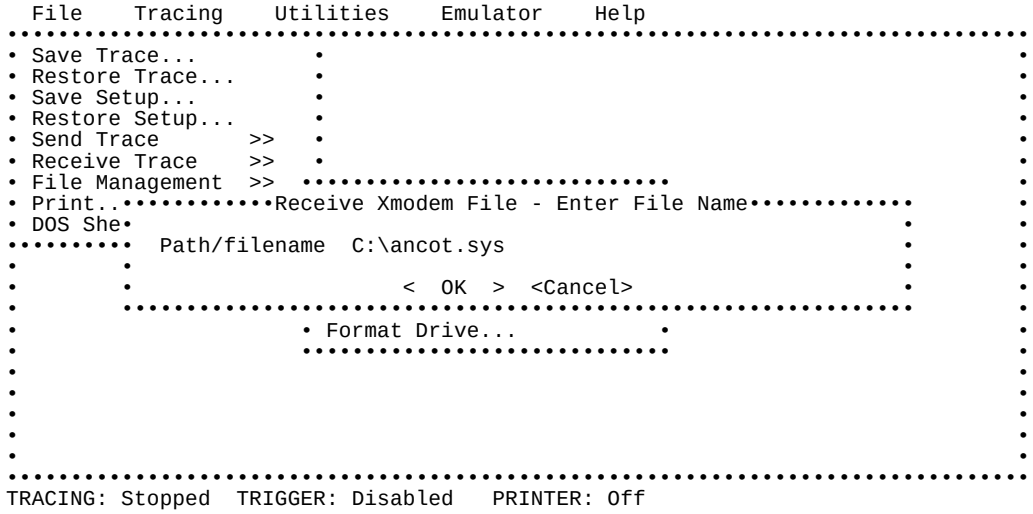
2.3.7 FILE MANAGEMENT

Under this heading you can save traces and setup parameters to the hard disk in the Ultra -2080. There are also commands for manipulating files and directories on the disk. When you select AFile Management@ from the File menu, the screen below will appear:



Selecting one of the items will display the file selection menu with the appropriate heading.

Selecting AReceive (Xmodem) File@ will bring up the following menu:



This will allow you to download any file (using the ›1K Xmodem= protocol) directly to the hard disk on the Ultra2080.

This is most commonly used to download the file Aancot.sys@ to the root directory of the C drive (C:\). This is a self extracting file which installs additional files needed by the Ultra2080.

2.3.8 PRINT

The APrint@ setting will turn parallel printing ON or OFF. The printing mode is indicated by a message on the main menu. "Print: On" means that data being displayed on the screen is sent also to the printer port. Note that only the trace data will be printed, not the menus.

You can print a hard copy of the trace information, just as it appears on the screen. A message on the main menu near the bottom of the screen tells if printing is enabled. When printing is active, each line of trace memory displayed on the screen will also be sent to the parallel printer connector. Some displays use the IBM PC Extended Character Set for ASCII graphics. Be sure that your printer has this font selected.

All trace display formats can be printed except the 'Command Profile'.

Printing can be enabled or disabled by pressing **<Ctrl-P>** on the keyboard anytime, from any trace display menu. The **<Enter>** key toggles between enabled shown as 'X' in brackets, and disabled shown by empty brackets.

When using a PC for remote control, use the **<Alt-P>** instead: the **<Ctrl-P>** is used by the PC locally. However, when using the PROCOMM package on the PC, the printing function cannot be used at all, because PROCOMM 'swallows' the **<Alt-P>**.

2.3.9 DOS SHELL

With the DOS shell you can enter commands at the AC:\>@ prompt to control the file system. The list below shows the commands available. This Ahelp@ message is displayed when you first enter the DOS shell. It may be repeated by typing A?@ or Ahelp@.

```
Command Description         Parameters
------- -----------         ----------
?,HELP  Help
X,Q     Exit shell
```

```
CD      Change Directory    PATH or CD to display CWD
COPY    Copy file/dir       FROMPATH TOPATH
DEL     Delete file/dir     PATH
DIFF    Compare files       PATH PATH
DIR     Directory listing   PATH
FORMAT  Format Disk         A: or C:
MKDIR   Make Directory      PATH
MOVE    Move file/dir       OLDNAME NEWNAME
ATTRIB  Change attributes   PATH RDONLY|HIDDEN|SYSTEM|ARCHIVE|NORMAL
WT      Write Trace         START END PATH
WS      Write Setup         PATH
RT      Read Trace          PATH
RS      Read Setup          PATH

C:\SETUP\>
```

P CD Change Directory

"cd" by itself will display the current directory path. "cd" with a path will change to the selected directory.

EXAMPLE:

```
cd traces -    This will change to the "traces" directory.
cd \ -         This will change to the root directory.
```

P COPY Copy file/dir

Acopy@ will copy one file to a new file. If the new file already exists, the copy will not take place and a warning will be printed.

EXAMPLE:

```
copy trace1 trace2 - This will copy "trace1" to "trace2"
```

P DEL Delete file/dir

Delete a file or directory. A directory must be empty in order to delete it. The Adel@ command will not delete files with the RDONLY attribute set.

EXAMPLE:

```
del trace1 - delete the file Atrace1"
```

P DIFF Compare files

Compare two files to see if they are the same. This will not show differences, but will simply compare them.

EXAMPLE:
```
diff trace1 trace2 - compare file Atrace1" with file Atrace2"
TRACE1) (TRACE2) Files are the same
```

P DIR Directory listing

This will display a list of files in the current directory. The display includes the time and date of creation and the size of the file.

P FORMAT Format Disk

This will format either the hard disk or a floppy disk. An additional prompt will ask you to confirm your intent to format the disk.
```
   WARNING: Format will erase the contents of the disk.
```

Examples:
```
   format c:   format the hard disk
   format a:   format a floppy disk
```

P MKDIR Make Directory

Create a sub directory in the current directory.

EXAMPLE:
```
mkdir mytrace - creates the directory Amytrace@
```

P MOVE Move file/dir

This renames a file or directory.

EXAMPLE:
```
move trace1.trc mytrace.trc - moves (renames) Atrace1.trc@ to Amytrace.trc@
```

P ATTRIB Change attributes

This you can examine or change a file-s attributes. If no attributes are given, the file-s current attributes are displayed. The attributes are RDONLY, HIDDEN, SYSTEM, ARCHIVE, NORMAL. The DIRENT attribute is reserved for directories and cannot be changed. At the present time, only the presence or absence of the RDONLY attribute is used.

EXAMPLES:

```
attrib mytrace - list the attributes of the file Amytrace@
Attributes: ARCHIVE

attrib mytrace rdonly - make the file Amytrace@ read only

attrib mytrace - list the attributes of the file Amytrace@
Attributes: ARDONLY|ARCHIVE

attrib mytrace normal - remove all file attributes

attrib mytrace - list the attributes of the file Amytrace@
Attributes: NORMAL FILE (No bits set)
```

P WT Write Trace

Write a trace or part of a trace to the disk. You must supply the start and end addresses of the trace or you may use the default dash A-@ for either or both addresses. If the end address of the trace is past the end of the current trace, the end of trace address will be used.

EXAMPLES:

```
wt 0 1ffff trace1 -   saves the entire trace to disk in file Atrace1".
wt - - trace1 -     saves the entire trace to disk (using default
             addresses) in file Atrace1"
wt 1000 2000 trace1 - saves trace from address 1000 to 2000 to disk in file
            Atrace1".
```

P WS Write Setup

This saves all the current setup parameters to the current directory on the disk. The parameters include mode, trigger, utilities and emulator variables. For example, you could setup certain trigger conditions and save them with the ws command (ws mytrig). You could then read the settings back at a later time using the **rs** command (**rs mytrig**).

EXAMPLE:

```
ws setup1 - saves current setup to disk in the file Asetup1".
```

P RT Read Trace

Read a trace from the disk to trace memory. After reading the trace from disk to trace memory, the trace may then be viewed in the normal manner.

EXAMPLE:

```
rt trace1 - read Atrace1" from the disk to trace memory.
```

P RS Read Setup

Read a setup file from the disk and change setup parameters.

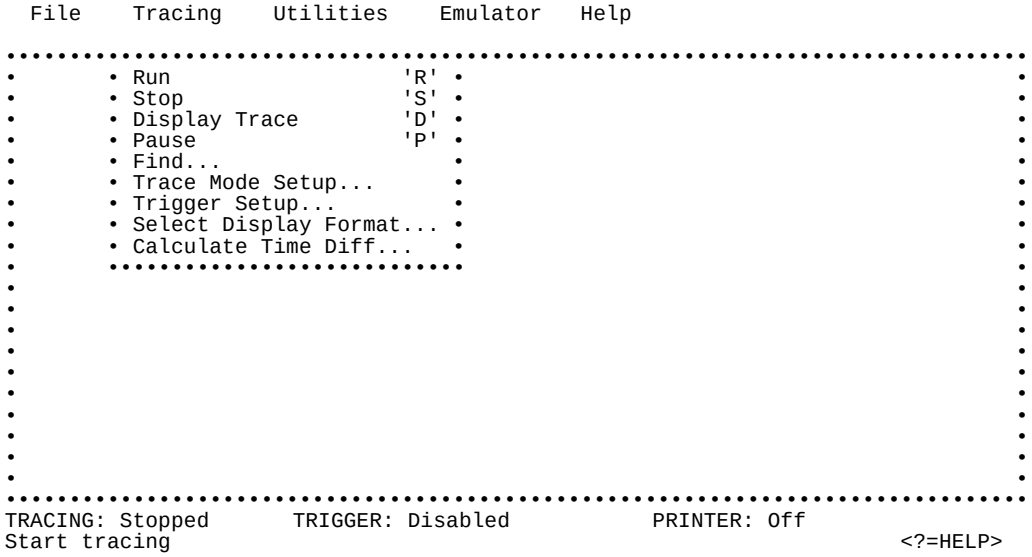
EXAMPLE:
`rs setup1 - read Asetup1" from the disk and update all parameters.`

P X, Q, Exit

Exit from the DOS shell.

2.4 TRACING

Select Tracing from the main menu to bring up the functions for tracing and for processing the traces created. The following screen appears, with the functions listed in the pull-down menu.



Note that you can call up help from anywhere in the menu structure by entering A?@, or by clicking on the symbols at the lower right corner of the screen above. See Subsection 2.6.

2.4.1 RUN

To put the Ultra-2080 into tracing mode:
press **<Run>** or **<R>** on the built-in keyboard
or press **<F1>** or **<R>** on the external keyboard
or click on ARun@ with mouse.

From that point on, all activity on the SCSI bus will be recorded, subject to the trigger conditions in force.

See Section 2.2 for a discussion of tracing itself.
See Section 2.4.6 for a discussion of trace mode options.
See Section 5 for information on triggering.

2.4.2 STOP

Press **<Stop>** or **<F2>** to halt tracing. On the keyboard, **<S>** selects this function. With a mouse, click on AStop@.

2.4.3 DISPLAY TRACE

This function shows you the activity which was recorded while tracing. See Section 3 for a complete discussion of the display modes and how to interpret the various parts of the display. From the external keyboard, the **<D>** or **<F3>** key is a selector for this function. With a mouse, click on ADisplay Trace@.

This function may be selected while the trace is running. In this case it will automatically perform the AStop@ function.

2.4.4 PAUSE

Press **<Pause>** to halt temporarily the recording of SCSI bus activity. Press **<Run>** to restart recording. A message "Paused@ will appear. The 'seam' location will be marked in the trace memory, and can later be found using the 'Find Event' command. On the keyboard, **<P>** or **<F4>** will select this function. With a mouse, click on APause@.

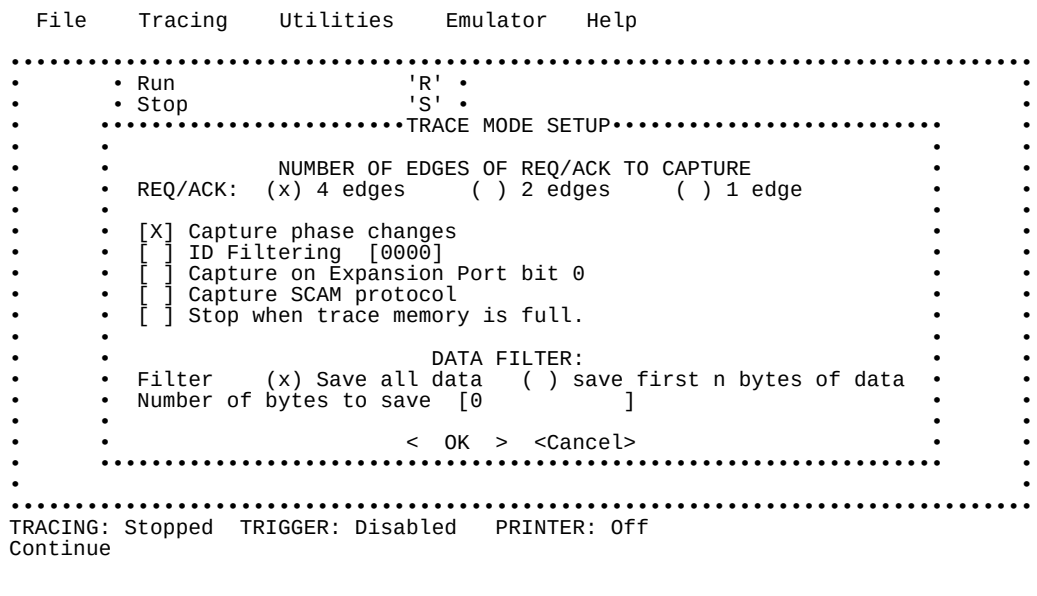
2.4.5 FIND

This function searches trace memory for a particular pattern of control or data bits. Press **<Srch>** or **<F6>** on the keyboard, or AFind@ from the ATracing@ menu on the display and activate the AFind Trace Event@ menu.

See Section 4 for a complete discussion of the searching function.

2.4.6 TRACE MODE SETUP

Under this heading a new menu screen appears, with several selections applicable to the tracing process, as listed below.



P NUMBER OF EDGES OF REQ/ACK TO CAPTURE

With this function you can specify the number of edges of REQ and ACK to capture for transferring a byte of data.

1 Edge - The Ultra-2080 will record only one event for each byte of data. The recording will be made on the valid edge of REQ or ACK. These are determined by the I/O signal. For data from the target to the initiator, REQ and I/O are asserted. For data from the initiator to the target, ACK is asserted and I/O is de-asserted.

2 Edges - The Ultra-2080 will record two events for each byte of data. The recording will be made on the leading edges of both REQ and ACK.

4 Edges - The Ultra-2080 will record four events for each byte of data. The recording will be made on each edge, leading and trailing, of both REQ and ACK.

P CAPTURE PHASE CHANGES

This entry enables or disables the recording of transitions on the SCSI control lines : MSG, C/D and I/O. When enabled, an 'X' character appears in the brackets, and any transition on the information transfer phase-determining lines is recorded as a SCSI event. When disabled, transitions on these lines do not cause an event to be recorded.

P ID FILTERING

This entry enables or disables the Filter mode of recording. When enabled, the tracing circuits will record all transactions up to and including the selection phase. However, unless the pattern of ID bits during the selection phase matches the user-defined pattern, all other activity until the next Bus Free state will not be recorded. Note that it is the exact pattern of bits during Selection phase that determines whether later events are recorded. Therefore you can choose to observe only events between a particular pair of devices.

The following example is provided to clarify this subject. Assume the bus being monitored has Initiators as ID 6 and ID 7 and Targets as ID 0, ID 1 and ID 2. You might think that you could capture all traffic to Target ID 1 from both Initiators. However, if you try this by setting only bit number 1 in the pattern, that pattern will never be matched, since both the Initiator's and Target's ID numbers are set during Selection phase. You might also try setting bits 1, 6 and 7. That will not work either, since only two bits may be set during selection phase. You can, however, capture all transactions between a pair of ID numbers, for example ID 0 and ID 6. You could even capture only transactions between ID 0 and ID 2 (although this situation would be questionable, since both of those ID numbers belong to Targets).

When this function is enabled, you can set the bit pattern to match. Note that 16 bits are provided in the pattern. This is to allow matching of SCSI WIDE Selection IDs. The default pattern is for ID 7 (commonly used by Initiators) and ID 0 (commonly used by Targets), and shows as the pattern [0081] in the menu.

P CAPTURE SELECTION ONLY

If 0000 is selected, this enables skipping of all events except transitions on the SCSI BSY and SEL control lines. This mode is an extremely economical use of trace events when you want is to see which IDs are being most utilized, or to determine the proportion of idle to active time on the bus.

P CAPTURE ON EXPANSION PORT BIT 0

This function enables or disables recording of events when Exp(0) changes. When enabled, any transition, up or down, on expansion connector bit 0 (DB-15 type connector, pin-1) will cause recording of a snapshot of the SCSI bus, within 20 ns of the transition.

This mode is useful for relating the timing of signals internal in tested system to the contents of the SCSI bus.

P **CAPTURE SCAM PROTOCOL**

With this mode you can record events during the auto-configuration process of the SCSI-3 SCAM Protocol. In this mode, whenever both BSY and SEL signals are active, transitions on D5, D6, or D7 (the SCAM Handshake lines) cause an event to be recorded. Since transitions on the certain data lines cause recording (which in normal trace mode would be ignored), more of the trace memory is used than in the normal trace mode.

Note: Use of this option requires that the ACapture Phase Changes@ option be enabled.

Refer to Appendix D and the SCSI-3 ANSI specification (document: SCSI-3 Parallel Interface 'SPI', Annex B) for detailed descriptions of the SCAM protocol.

P **STOP WHEN TRACE MEMORY IS FULL**

With this mode selected, tracing will automatically stop when trace memory fills up, and will not overwrite the beginning of the trace. This mode automatically sets the appropriate trigger options.

P DATA FILTER

With this entry you can select the 'Skip Data' recording mode. The number in the brackets shows how many data transfers will be recorded. If ASave first n bytes of data@ is enabled, using the left and right arrows, the number of bytes showing in the brackets will be recorded. This number ranges from 1 to 255. In either case, the total number of data transfers is counted and recorded in trace memory, and will appear in the structured display. Skipping data does not inhibit the transfer of data across the SCSI bus. Only recording is affected.

2.4.7 TRIGGER OPTIONS

See Section 5 for information on triggering.

2.4.8 SET DISPLAY FORMAT

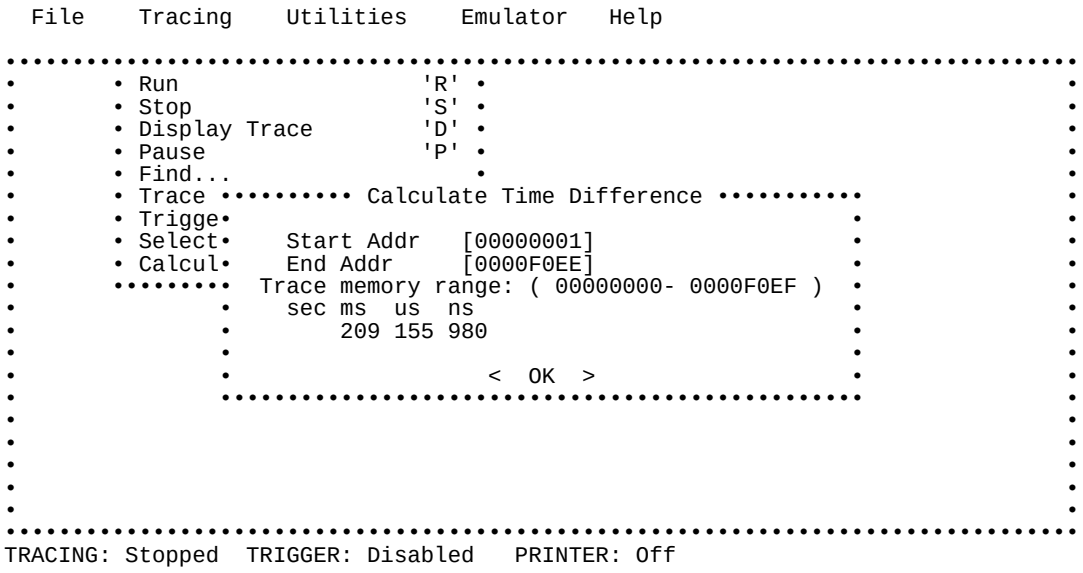
With this function you can specify how the recorded activity is displayed. See Section 3 for a complete discussion of the display modes.

2.4.9 TIME CALCULATION

With this function you can select two trace events by specifying their addresses, and calculate the elapsed time between the two events. It uses the 20 nanoseconds resolution time stamp. This function is also accessible from the trace display mode by pressing **<Ctrl-T>.**

From the main menu, select ATracing@, then ATime Calculation@ to access this utility. You can also reach this function from any screen of trace memory display by pressing <^**T**> on the keyboard.

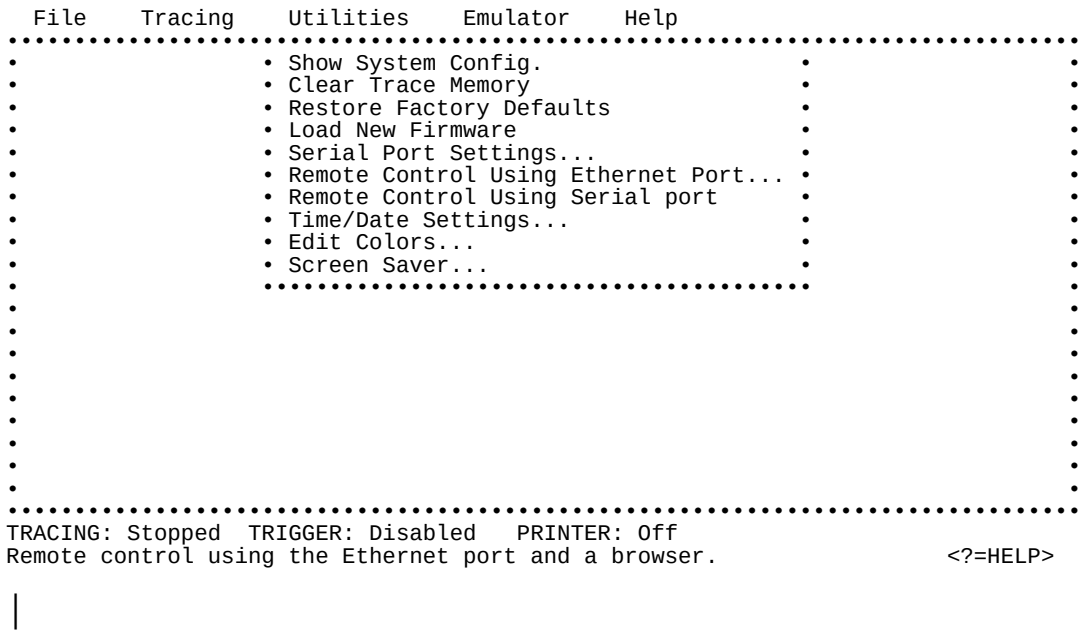
You will be asked to provide two trace memory addresses. These may be entered in either order. The utility then examines the time stamp for each event, and reports the time elapsed from the earlier event to the later event. Note that elapsed time is modulo about 6 months, the timer wrap-around period.



The Astart@ and Aend@ addresses are automatically filled in as default values, and may be typed over. The Astart@ address is always = 1, and the Aend@ address is the currently used trace memory end. The time difference is in nanoseconds. In the example above, it is 209 milliseconds, 155 microseconds, and 980 nanoseconds.

2.5 UTILITIES

With this function you can select utilities not falling into any other category. From the main menu, click on Utilities to bring up the screen below.



Make your selections either by entering the highlighted letter directly, or by moving the highlight bar over the chosen line, using the arrow keys, and pressing **<Enter>**. Individual functions are explained below.

2.5.1 SHOW SYSTEM CONFIGURATION

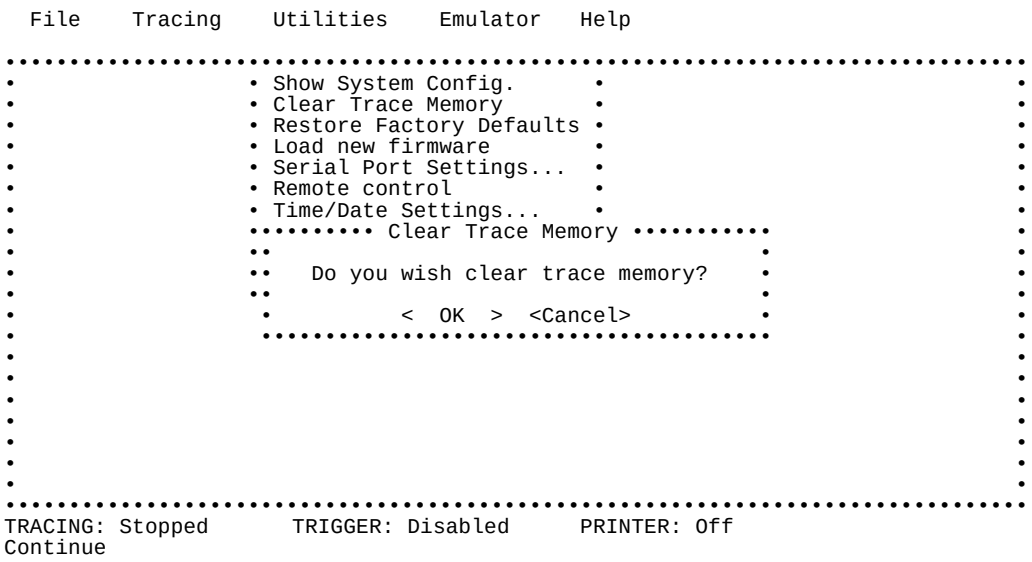
Choosing this option will display on the screen all of the system options retained through the power Off-On cycle, stored in non-volatile memory. Scroll through the screens with **<PgUp>** or **<PgDn>**.

To print the configuration, enable printing before you choose this menu selection. If you are already displaying the information, press **<Next>** or **<Prev>**. If any of the options are printed, they will all be printed (about 3 pages).

You can also see the default values for the system configuration. Press **<Flip>** to toggle between defaults and current values.

2.5.2 CLEAR TRACE MEMORY

Choosing this option will clear all of the trace memory.



Note that the trace memory is always cleared when you select RUN to start recording. Therfore it is not necessary to use this function before new recording.

2.5.3 RESTORE FACTORY DEFAULTS

With this selection, all of the variables stored in EEPROM will be restored to their default values. Similarly, the variables in SRAM are restored to the power-on state.

2.5.4 LOAD NEW FIRMWARE

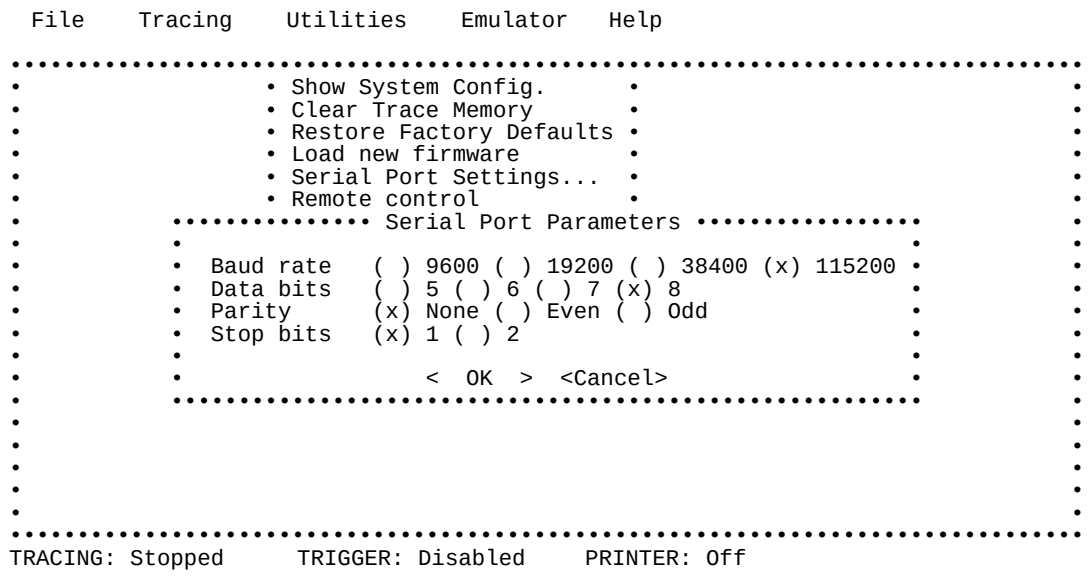
With this function you can download a new firmware version into the Ultra-2080 flash memory. You will be asked to confirm your choice. Read Section 7.6 for a more detailed description.

2.5.5 SERIAL PORT SETTINGS

With this option you can specify the exact RS-232 protocol to be used for transfers, including baud rate, number of data bits, stop bits, and parity.

A list of the current settings will appear on the screen. Use the up or down arrow keys to move the highlight to the item you wish to change. Use the left or right arrow keys to scroll through the available options for that item. When all items are correct, select **<OK>** to record them and exit. The settings are also stored in non-volatile EEPROM memory and will be used as a default next time you do any communications, even after power OFF/ON.

The following settings are selectable:



When shipped from the factory, the Ultra-2080 default setting is:

9600 baud
8 data bits
no parity
1 stop bit

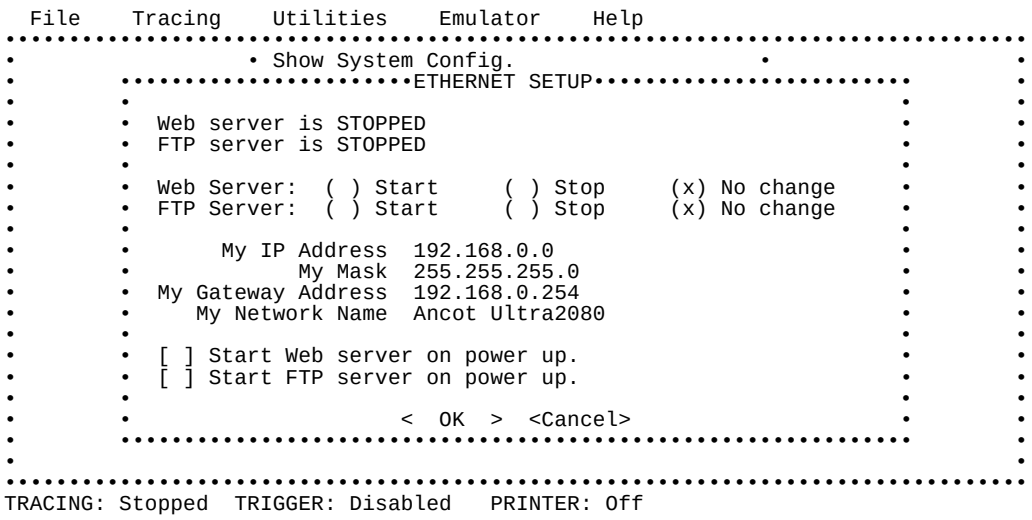
NOTE: While some communications programs can use 115.2 Kbaud, some computers may not be able to use this rate. This may result in lost characters or cause the computer to "hang". If this happens, use a lower baud rate.

2.5.6 REMOTE CONTROL USING ETHERNET PORT

The Ultra2080 has a built in web server and FTP server. The web server allows you to control the Ultra2080 with a web browser and the FTP server allows you to upload and download files between a host and the Ultra2080.

When using the web server, remember that more than one person may be connected to the unit at any one time. This feature can be an advantage if used properly. For example, it allows a group of engineers to study the same trace and discuss the same situation. It also allows viewing a trace in more than one format, if, for example you use two browser windows and open the same trace but display it in different formats (e.g. one in structured, the other in binary format). This flexibility is an advantage however, care must be taken that users do not interfere. It is best if only one user controls the unit while the other users limit themselves to viewing.
Use functions in your browser to save copies of the trace to be used for later viewing or editing. Use the editing features in your browser if only a part of the trace is to be saved.

Select the ARemote Control Using Ethernet Port@ from the Utilities menu, and the following sub-menu will be displayed:



This menu allows you to setup the Ethernet port and the servers in your Ultra2080. It also shows the current status of the web server and the FTP server (either STOPPED or RUNNING). You may start or stop one or both servers by checking the appropriate boxes. You must also set a valid IP address (My IP Address, Mask, and Gateway) for this particular Ultra2080. Consult your system administrator in order to obtain a valid IP address. In addition, you may configure the Ultra2080 to automatically start up one or both of the servers after power on. The default is NOT to start the servers.

When the Ultra2080 web server responds to a request, a packet is sent to the originating (destination) IP address. If both the Ultra2080 and the destination address are on the same network, the packet is sent to the destination IP address. If they are not on the same network, the packet is sent to the IP address of a gateway. The gateway will forward the packet. The mask is

used to determine if the destination IP address is on the same network. A value of 255 means to match the corresponding value exactly, and a value of 0 means to ignore the value. For a value of 255.255.255.0, this means that the first three numbers must match exactly. For this mask, this gives a range of 256 IP addresses.

IP Address The IP address of the Ultra2080 on your local network. See your system administrator to obtain a valid IP address.
Mask The mask for your IP address. A value of 255 is an exact match. A value of 0 is ignored.
Gateway Address The IP address to send the packet to if the destination is not on your local network. The gateway will forward the packet.
Network Name This is a local name which you can assign to the Ultra2080. If you hard code a network name, set this tring to match.

The factory default IP address is 192.168.0.0. This is an Ancot assigned private address which should only be used in private settings, in LAN within an enterprise, where it would be unique. This address may run into conflict situations in settings where more enterprises are involved.

After entering the IP address and checking the desired selection boxes, press **<OK>** (for Quit) to apply the settings and exit. Pressing **<Cancel>** will not change anything and will return you to the main menu. Physical connection of the Ultra2080 to your network by is by cable connected to the RJ45 connector on the front panel. The Ethernet hardware will automatically detect the proper speed of your network (either 10 or 100 Mbit Ethernet).

If you exit this menu with the Web Server in RUNNING mode, and if the Ultra2080 is connected to the LAN, then you can access it remotely using (almost) any of the popular browsers. Use your IP address as the web page name - example: Ahttp//www.192.168.0.0".

When System Defaults are restored, both servers will be stopped (now and after power up), and Ancot factory default IP address will be set.

2.5.7 REMOTE CONTROL USING SERIAL PORT

There are situations when a SCSI system at a remote location needs testing or troubleshooting. It is possible to connect the Ultra-2080 Analyzer to the SCSI bus to be tested, and connect the controlling terminal over a modem, or via a straight through cable.

The operator at Site A, the test site, connects the Ultra-2080 to the SCSI bus system as usual. the test site (we will call this site-A, and the receiving end site-B) simply connects. The Ultra-2080 Serial-1 Port is then connected to the modem port; the terminal, or host computer, is connected to the other end of the telephone line, Site B. If Site-A and Site-B are close together, a straight through cable can be used instead. See Appendix A for the pinout.

Site-A setup: connect the Ultra-2080 to the SCSI bus under test, and enable the remote control by selecting the UTILITIES menu, and ARemote Control@. A message will appear on the screen asking for confirmation. Press **<Y>** to confirm this, and the message

```
THIS UNIT IS UNDER REMOTE CONTROL - DO NOT DISTURB
```

appears on the screen. At this point the keyboard, if connected to J4, is disabled. The Ultra-2080 can be restarted, to restore control from site-A, by pressing the SYSTEM RESET push button, or by turning the power OFF and ON.

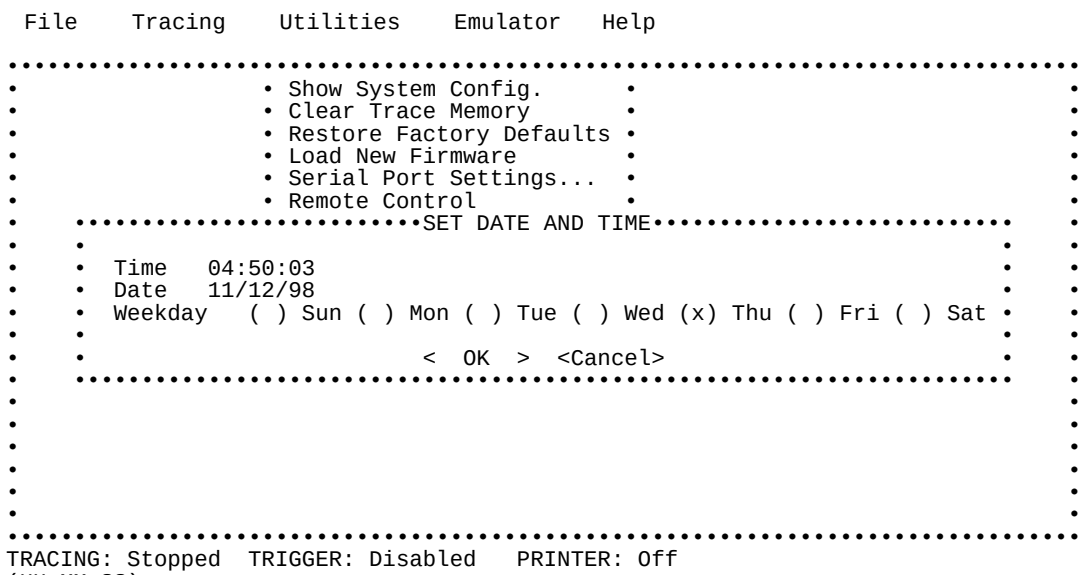
Site-B operation: log onto the remote terminal or host computer, and start the communications utility program (BITCOM, PROCOMM or similar, using the VT-100 setting). The screen should clear, and the UTILITY menu from the Ultra-2080 (from site-A by modem) should display on your screen. At this point, the keyboard on your remote terminal should act as if connected directly to the Ultra-2080; all functions on the Ultra-2080 should be operational.

When finished with the session, select the Utilities menu from your remote terminal, select item 6 to disable remote control, and confirm the selection by pressing **<Y>**. Control will return to the Ultra-2080 local screen and keyboard. Remote control can also be disabled by pressing the SYSTEM RESET switch on the Ultra-2080 front panel, or by cycling power to the Ultra-2080.

The terminal used for remote control should support the ANSI escape sequences for clearing, moving the cursor, and for inverse video. See Appendix B for definitions of the sequences used.

2.5.8 TIME/DATE SETTINGS

With this function you can change the date and time on the Ultra-2080. These entries are used by the disk software to assign a creation date and time for any saved traces or setups. The display shown below is used to change the date and time:

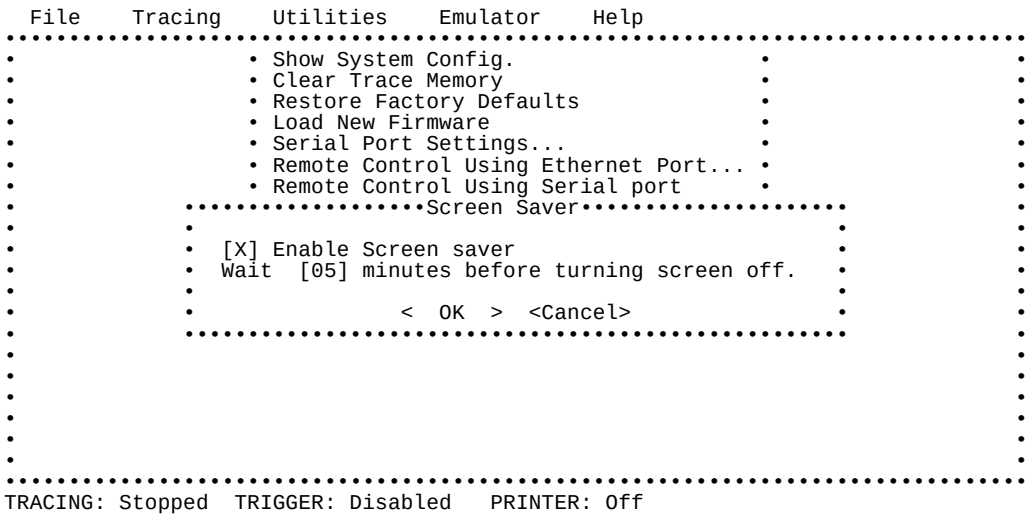


Select either ATime@ or ADate@ to edit the field. Select AWeekday@ to set the proper day of the week.

2.5.9 THE SCREEN SAVER

LCD displays like the one in the Ultra-2080 can have their life extended by using a screen saver. If a significant time passes with no keyboard or display activity, the screen will blank. To bring it back, press any key except Ctrl, Alt, and Shift.

You can turn off the screen saver feature from the Utility menu. Choose AEnable Screen Saver@ to toggle between enabled or disabled.



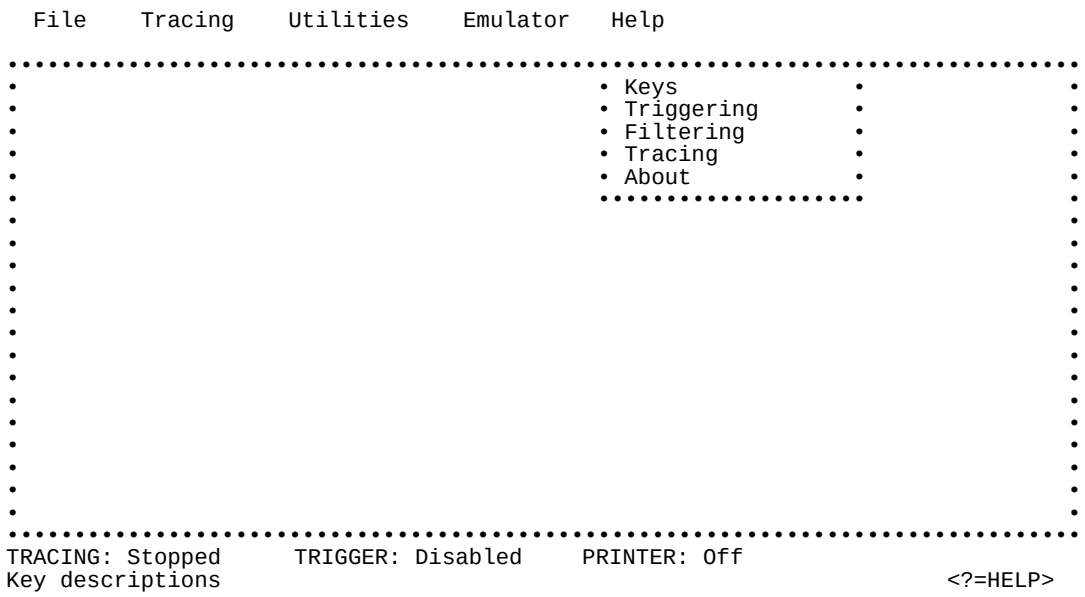
The default timeout before the screen saver takes effect is 5 minutes. To change this value, enter a number from 1 to 99 (minutes) in the brackets.

2.6 SCSI INITIATOR EMULATOR

Choosing this function will allow you to enter the SCSI Initiator Emulator menu. See Section 6 for a detailed description of all the SCSI Initiator Emulator functions. Note that the Emulator function is optional and the AEmulator@ label will be displayed only in systems with the SCSI Emulator hardware installed.

2.7 HELP

From the main menu, click on Help to bring up the screen below.



Only the ›About= selection is implement with the first release. More to be added later

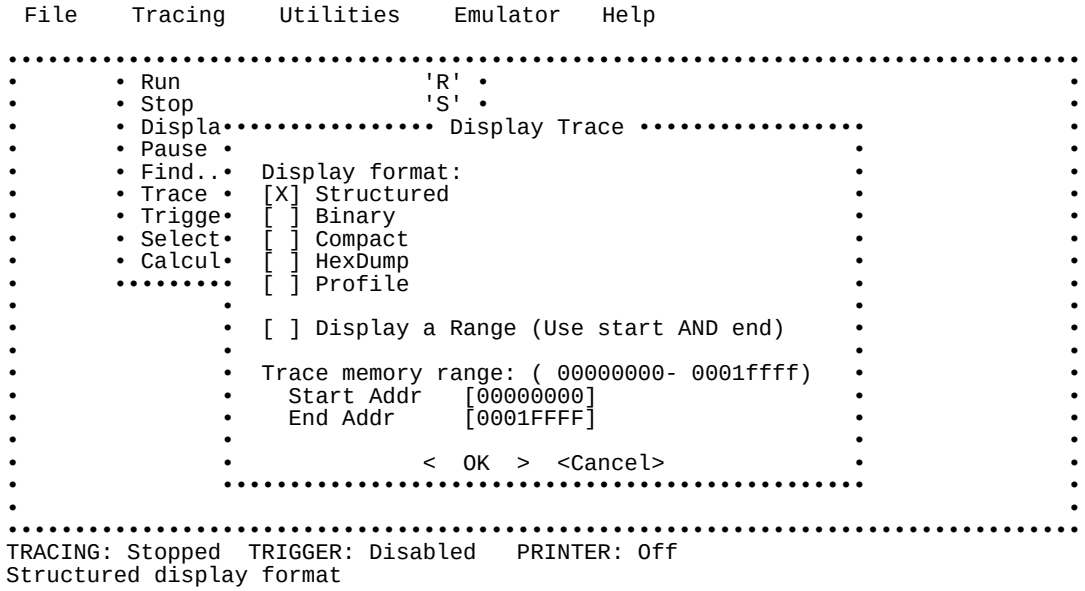
S E C T I O N 3

DISPLAYING THE TRACE MEMORY

3.1 INTRODUCTION

The Ultra-2080 has several display formats for the data captured by tracing. Each format has its own characteristics and special capabilities to let you view the events recorded.

When you select **Tracing** from the main menu, then **Display Trace**, or **›D-**, or **<Disp>**, or **<F3>**, the following menu will be displayed:



This screen will allow you to select the display format and a starting address. If you select ADisplay a Range ...@, the trace will display continuously from the start address to the end. Displaying within a range longer than one screen length would usually be selected when also generating hard copy on a printer. Use **<^P>** on the keyboard to toggle the printer **ON** and **OFF**. When displaying a range longer than one screenful, press any key on the keyboard to pause the display. A prompt at the bottom of the screen will tell you how to stop displaying (AQ@ or A<Esc>@), or continue displaying (any key). After all selections have been made, select <OK> with the arrow keys or with the mouse, or press <Ctrl-Home> followed by <Enter>.
The following table describes the keys you can use while displaying a trace.

The following keys are active in the trace display mode: (letters are case insensitive)

Moving around in a trace:

Key	Meaning
<down arrow>	Scroll down one line
<up arrow>	Scroll up one line
<PgDn>,<Space>,+	Scroll down one screen
<PgUp>,-	Scroll up one screen
<Home>	Display one screen starting at the beginning of the trace
<End>	Display one screen ending with the end of the trace
A	Display one screen starting at a given address

Changing to another trace format:

Key	Meaning
F,F5,<Flip>	Flip between structured and binary display or flip from any other display format to structured format
B	Display trace in binary format.
C	Display trace in compact format.
D	Display trace in hex dump format.
P	Display trace in command profile format.
S	Display trace in structured format.
^d	Display trace in diagnostic format.

Changing the appearance of a trace:

Key	Meaning
W	Flip between wide (16-bit) and narrow (8-bit) data display. When displaying wide data, the low byte appears first, separated by a hyphen from the high byte. The separator character may be an asterick (*) if a parity error occurs or a plus-sign (+) if the ATN line is active.
H	Structured display only. Flip between ASCII or hexadecimal display of the data bytes. Unprintable characters appear as periods.
E	Binary format - flip the time display between total elapsed time since the start of tracing or differential time between successive events. Structured format - Turns on and off the displaying of differential time on the right edge of the screen if there is sufficient room.
<right arrow>, <left arrow>	Flip between displaying coarse and fine time for time displays which exceed approximately 83 seconds. Times exceeding 83 seconds are indicated with a "<" or ">" to the left of a time.

Misc.:

Key	Meaning
Q,ESC	Quit and return to previous menu
R,F1,<Run>	Start recording a new trace and return to the main menu.
^t	Compute the time difference between two trace events.

^f,F6,<Find>	Open the find menu to search the trace for selected events.
^k,Shft<find next>	Find the previous occurence of an event.
^l,<find next>	Find the next occurence of an event.
^p	Toggle the printer ON and OFF.

3.2 THE STRUCTURED DISPLAY FORMAT

This format is the easiest to read and interpret. Each line of display starts with the trace memory address of the first event of the line. Each SCSI phase is labeled with its name. In addition, the first byte of the Command Descriptor Block (CDB) is interpreted, as are each Message byte and Status byte. Phases are indented as with program structure. The Reset condition and Bus Free phases are aligned with the left edge of the display after the address. Arbitration, Selection and Reselection phases are indented one tab stop, 3 spaces. Command, Status, Message-In and Message-Out phases are indented a further tab stop, 6 spaces. Data-In, Data-Out and the two Reserved phases are indented another tab stop, 9 spaces.

The actual data transferred, as well as the ID numbers during Arbitration, Selection and Reselection, are shown in Hex, following a slash. If a **parity error** occurs at any time, except in the arbitration phase, an **asterisk** will follow directly after the offending byte. If no parity error occurred, but the SCSI **ATN line** is active, that is shown as a **plus-sign** following the byte. **Data count**, i.e., the number of transfers during the Data-In or Data-Out phase, is shown in Hex format and in parentheses just after the trace memory address for the last line of the data phase.

NOTE:

There are situations when the tested system hangs during the data phase, and you need to find out how many data bytes were actually transferred. Normally, when the system hangs, you press **<Stop>** or **<S>** to stop the tracing, then **<Disp>** or **<D>** to display the trace. You will not see the data count (in parentheses) at the end of the last (hung) data phase on the structured display. This is because the data count is recorded in the trace memory when the Bus Free phase is entered. The Ultra-2080 stores data count in the data byte memory of the Bus Free event. This recording is all done by hardware because of the recording speed requirement. If you need to see the data count, press the SCSI RESET pushbutton to reset the Target before you press **<Stop>**; this will result in Bus Free phase, and subsequent recording of the data count in the trace memory.

To avoid clutter, multi-byte messages have the phase label only on the first byte. Multi-line data phases are also labeled only on the first line.

When enabled, the duration of each phase is displayed on the last line of that phase, if space is available on the line. Press **<E>** to toggle between timing display enabled or disabled.

Several samples of Structured displays are shown below, with the various recording and display modes.

3.2.1 Structured Display with NARROW or WIDE data transfers

The example display on the next page shows the data in ASCII format. The recording captured all data. This recording was made with ACapture 1 edge of REQ/ACK enabled@. Note that in line 4 the IDs of the SCSI devices involved are shown both as the bits set on the SCSI bus, and as the decimal equivalent ID numbers of the two devices. Also note that during the first Message-Out phase, the Initiator held ATN active, as shown by the (+) following each message byte. This trace shows a typical boot sequence for a host adapter card at ID 7 finding out about the Target device at ID 0.

```
00000: ---- Start Trace ----
00001:    Arbitration      /80 (7)
00004:    Select w/ATN     /81 (0,7)
00007:       Message-Out   /C0+(Identify : LUN 0 Disconnect OK)
00008:       Message-Out   /01+(Ext Msg)
00009:        03+(Length)
0000A:                      01+(SDTR)
0000B:                      28+(Period 160 nsec)
0000C:                      08 (Offset 8 bytes)
0000D:       Message-In    /01(Ext Msg)
0000E:                      03 (Length)
0000F:                      01 (SDTR)
00010:                      32 (Period 200 nsec)
00011:                      08 (Offset 8 bytes)
00012:       Command       /12 00 00 00 30 00 (Inquiry)
00018:          Data-In    / .  .  .  .  .  .  .  .  A N C O T
00028:                      D S C  -  3 0 2  /  J
00038: (0024)               3 . 4 0
0003C:       Status        /00 (Good)
0003D:       Message-In    /00 (Cmd Cmplt)
0003E: Bus Free
0003F:    Arbitration      /80 (7)
00042:    Select w/ATN     /81 (0,7)
00045:       Message-Out   /C0+(Identify : LUN 0 Disconnect OK)
00046:       Message-Out   /01+(Ext Msg)
00047:                      03+(Length)
00048:                      01+(SDTR)
00049:                      28+(Period 160 nsec)
0004A:                      08 (Offset 8 bytes)
0004B:       Message-In    /01 (Ext Msg)
0004C:                      03 (Length)
0004D:                      01 (SDTR)
0004E:                      32 (Period 200 nsec)
0004F:                      08 (Offset 8 bytes)
00050:       Command       /03 00 00 00 10 00 (Req Sense)
00056: (0008)   Data-In    / p  .  .  .  .  .  .  .
0005E:       Status        /00 (Good)
0005F:       Message-In    /00 (Cmd Cmplt)
00060: Bus Free
00061:    Arbitration      /80 (7)
00064:    Select w/ATN     /81 (0,7)
00067:       Message-Out   /C0 (Identify : LUN 0 Disconnect OK)
```

```
00068:       Command       /00 00 00 00 00 00 (Test U Rdy)
0006E:       Status        /00 (Good)
0006F:       Message-In    /00 (Cmd Cmplt)
00070: Bus Free
00071:    Arbitration      /80 (7)
00074:    Select w/ATN     /81 (0,7)
00077:       Message-Out   /C0 (Identify : LUN 0 Disconnect OK)
00078:       Command       /25 00 00 00 00 00 00 00 00 00 (Rd Cap)
00082: (0008)   Data-In    / .  .  .  .  .  .  .  .
0008A:       Status        /00 (Good)
0008B:       Message-In    /00 (Cmd Cmplt)
0008C: Bus Free
0008D: ---- End of Trace ----
```

Press **<E>** to enable or disable display of the time stamp on the right margin. The format is the same as in the binary display, and it specifies time for that certain phase. The time stamp will not be displayed if there is no room on the right side of the screen, as with the data phase. To show time for the data phase, the byte count has to be short enough, e.g., by using the recording mode the with "skip data after 8 bytes" option.

```
00060: Bus Free                                              354 934 680
00061:    Arbitration      /80 (7)                               3 560
00064:    Select w/ATN     /81 (0,7)                           833 600
00067:       Message-Out   /C0 (Identify : LUN 0 Disconnect OK)  589 920
00068:       Command       /00 00 00 00 00 00 (Test U Rdy)     2 061 040
0006E:       Status        /00 (Good)                          1 061 720
0006F:       Message-In    /00 (Cmd Cmplt)                       663 920
00070: Bus Free                                                3 415 120
```

When viewing WIDE data transfers, press **<W>** on the keyboard to toggle this display option. The WIDE data in the data-in/out phase will be shown as two bytes (the low byte first) separated by a hyphen. If the recording was made on a NARROW system, the upper byte (not driven) will be marked by an asterisk, indicating parity error.

```
00187: Bus Free
00188:    Arbitration      /01 (0)
0018A:    Reselection      /81 (0,7)
0018D:       Message-In    /80 (Identify : LUN 0)
00191:D         Data-In    /DE-E7 D4-D8 FD-FF DE-80 FD-D7 33-AD CF-77 D8-39
001D1: (0200) BA-6F 76-77 FE-7D B9-1E C3-F7 EF-E6 D7-8A EA-EC
0020F:       Status        /00 (Good)
00213:       Message-In    /00 (Cmd Cmplt)
00217: Bus Free
```

3.2.2 Structured Display with NARROW data transfers

The following display is shown with data in Hex. Recording was done in Skip-Data (32 transfers) mode, with '*capture 4 edges REQ/ACK*' mode turned ON. Note the byte count (in parentheses, in Hex format) on the last line of the data phase for each transfer.

```
00000: ---- Start Trace ----
00001:    Arbitration      /80 (7)
00004:       Select w/ATN  /81 (0,7)
00008:       Message-Out   /C0 (Identify : LUN 0 Disconnect OK)
0000C:       Command       /08 00 00 00 01 00 (Read/Rcv)
00023:       Message-In    /04 (Disconnect)
00027: Bus Free
00028:    Arbitration      /01 (0)
0002A:    Reselection      /81 (0,7)
0002D:       Message-In    /80 (Identify : LUN 0)
00031:          Data-In    /00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00071: (0200)               00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
000AF:       Status        /00 (Good)
000B3:       Message-In    /00 (Cmd Cmplt)
000B7: Bus Free
000B8:    Arbitration      /80 (7)
000BB:    Select w/ATN     /81 (0,7)
000BF:       Message-Out   /C0 (Identify : LUN 0 Disconnect OK)
000C3:       Command       /08 00 00 22 01 00 (Read/Rcv)
000DA:          Data-In    /FF FF FF F7 FF FF 7F 15 FE FF FF FF FF FF F7 6F
0011A: (0200)               FF FF FF FF FF FF FF FF BB FF FF FF FF FF FF 9F
00158:       Status        /00 (Good)
0015C:       Message-In    /00 (Cmd Cmplt)
00160: Bus Free
00161:    Arbitration      /80 (7)
00164:    Select w/ATN     /81 (0,7)
00169:       Message-Out   /C0 (Identify : LUN 0 Disconnect OK)
0016C:    Command          /08 00 00 5C 22 00 (Read/Rcv)
00183:       Message-In    /04 (Disconnect)
00187: Bus Free
00188:    Arbitration      /01 (0)
0018A:    Reselection      /81 (0,7)
0018D:       Message-In    /80 (Identify : LUN 0)
00191:          Data-In    /DE E7 D4 D8 FD FF DE 80 FD D7 33 AD CF 77 D8 39
001D1: (4400)               BA 6F 76 77 FE 7D B9 1E C3 F7 EF E6 D7 8A EA EC
0020F:       Status        /00 (Good)
00213:    Message-In       /00 (Cmd Cmplt)
00217: Bus Free
00218: ---- End of Trace ----
```

3.2.3 Structured Display of SCAM Protocol

In the structured display, you will see the SCAM Protocol in plain English. A sample is shown below. During the Isolation phase, it is assumed that the identification string, after the 'type' code bytes, is printable ASCII, and is displayed that way. For the 'type' code, and for any non-printable character, the value is displayed in Hexadecimal between angle brackets **<xx>**.

Function codes are displayed both in Hexadecimal and in English. The Isolation phase is labeled as either 'Terminated' or 'Complete'. Command codes are given in English. In all cases, if an illegal handshake occurs, it is labeled as such. One example is at the end of the SCAM process, when the Master releases C/D.

```
00000: ---- Start Trace ----
00001: RESET Start
00002: RESET End
00002: Bus Free
00004:    Arbitration   /(no ID)
00005:    SCAM Selection
0000B:    SCAM Function : 1F Synch Pattern
00011:       SCAM Function : 00 Assign ID
00017:          Name : <12><00> ANCOT   SCAM Test 00001 (Complete)
000F8:             Assign ID 00
000FE:       SCAM Function : Invalid handshake
00102: Bus Free
00103: ---- End of Trace ----
```

Note that in order to analyze the SCAM Protocol, the trace needs to be recorded in the 'Capture SCAM Protocol' mode first.

3.3 THE BINARY DISPLAY FORMAT

If the Structured display format is compared to a computer program written in a high-level language, the Binary display format is like the same program written in assembly language. In the Binary format, each event captured gets one line of display. In this display format, you can see the exact state of each SCSI control line at the time of the event's capture, plus the state of the SCSI data lines and the Ancot expansion lines. Furthermore, the timing of the activity is shown, accurate to the 4ns resolution of the Ultra-2080. There are several options in how the information is presented in the Binary format.

The control lines are shown in logic analyzer style, as a rectangular waveform traveling down the page. An active signal is shown as a thin line on the right side of the area dedicated to that control line. Inactive signals show as thick lines on the left side of their respective areas.

Data can be shown as **wide** or **narrow.** If the wide data format is chosen, the low byte is shown first, separated from the high byte by a hyphen (-). If a **parity error** occurred, that is shown by

an **asterisk (*)** following the offending byte. The asterisk (*) may replace the hyphen (-) separating the two bytes. The bytes are shown in hexadecimal first, followed by their ASCII equivalent in parentheses.

Each line of display also shows the state of the three signals received through the expansion connector J2 (DB-15) marked as '**Exp**' in the examples below. E2 is the most significant bit, shown on the left of the triad. It is followed by E1 and then E0.

Time stamp information comes in either of two formats also. In the elapsed format, the total **elapsed** time since the start of the recording (modulo about 200 days) is shown in the time column. In the differential format, the time **differential** between the two events is shown in the time column. All times are expressed as decimal nanoseconds, with a space between each group of three digits. As an example, the "3 123 456 789" represents 3sec 123ms 456μs 789ns.

If a less-than symbol ("<") appears to the left of the time stamp, the time exceeded approximately 83 seconds. To see the larger numbers of the time stamp, press the left or right arrow keys. The following illustration shows a time stamp with a large time.

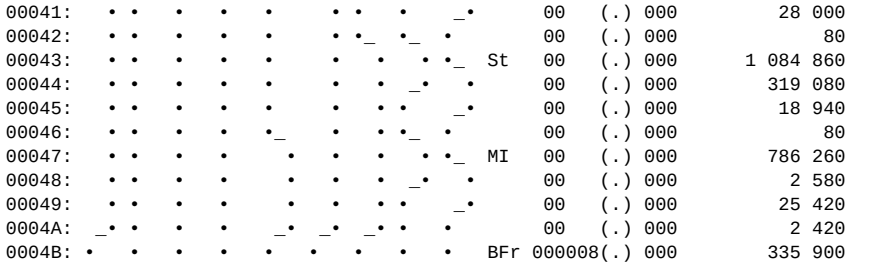
```
<51  371  901  220   or  >  0h  01m  51s
  s   ms   μs   ns
```

The total time shown by this time stamp is 0 hours, 1 minute, 51 seconds, 371 milliseconds, 901 microseconds, and 220 nanoseconds.

Each line of display shows whether the **data** byte on that line is **valid.** If it is valid, then the address on the left is followed by a right angle **bracket (>).** If not, the address is followed by a colon (:). The various display options are shown in the following sample displays.

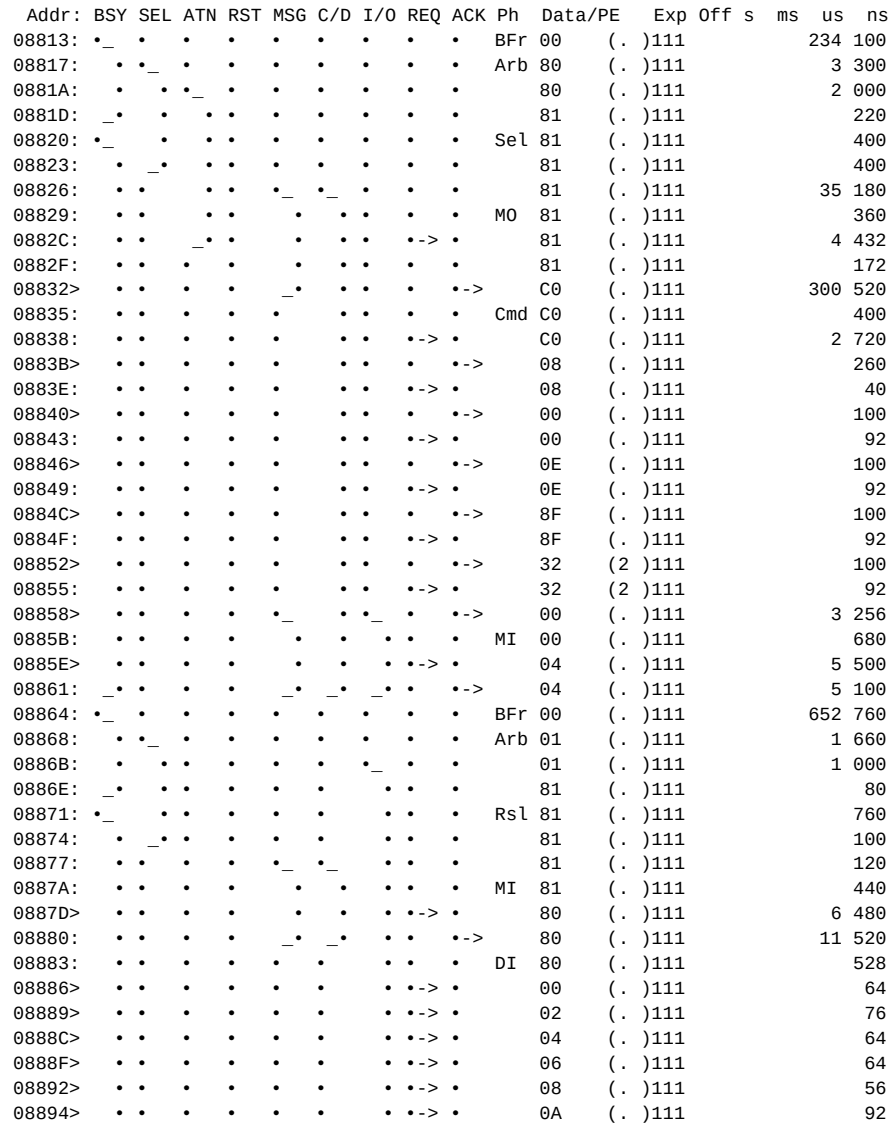
The display example on the next two pages shows the logic analyzer style of control signals, with 8-bit data and differential time display. This trace also shows the 'capture 4 edges REQ/ACK' and 'capture-all-data' modes of recording. Note that the data word, at the Bus Free event after the command, holds the data count (0008 bytes) in the data-in phase of this command. Just to the right of the Exp column, during the data phase only, the current **REQ/ACK offset** is shown as a 2-digit hexadecimal number. This number is valid only in 4-edge mode. The number is generated from the recording of the REQ and ACK signals in the data phase; if the recording mode does not include 4-edge capture, the offset is not shown.

```
Addr: BSY SEL ATN RST MSG I/O C/D REQ ACK Ph  Data/PE   Exp           Time
00000: ---- Start Trace ----
00001:   • •_  •   •   •   •   •   •   •   Arb  80   (.) 000             0
00002:   •   • •_  •   •   •   •   •   •         80   (.) 000         2 840
00003>  _•   •   • •   •   •   •   •   •         81   (.) 000         1 620
00004: •_    •   • •   •   •   •   •   •   Sel  81   (.) 000           160
00005:   •  _•   • •   •   •   •   •   •         81   (.) 000       411 400
00006:   • •     • •   •_  •   •_  •_  •         00*  (.) 000           180
00007:   • •    _• •     • •     •   • •_  MO   00   (.) 000       273 520
00008:   • •   •   •     • •     •  _•   •       C0   (.) 000         3 400
00009:   • •   •   •     • •     • •    _•       C0   (.) 000        27 700
0000A:   • •   •   •    _• •     • •_  •         C0   (.) 000            80
0000B:   • •   •   •   •   •     •   • •_  Cmd  00*  (.) 000       563 160
0000C:   • •   •   •   •   •     •  _•   •       03   (.) 000        14 260
0000D:   • •   •   •   •   •     • •    _•       03   (.) 000        16 840
0000E:   • •   •   •   •   •     • •_  •         03   (.) 000            60
0000F:   • •   •   •   •   •     •   • •_       00   (.) 000       203 040
00010:   • •   •   •   •   •     •  _•   •       00   (.) 000            60
00011:   • •   •   •   •   •     • •    _•       00   (.) 000        31 040
00012:   • •   •   •   •   •     • •_  •         00   (.) 000            80
00013:   • •   •   •   •   •     •   • •_       00   (.) 000        32 840
00014:   • •   •   •   •   •     •  _•   •       00   (.) 000            40
00015:   • •   •   •   •   •     • •    _•       00   (.) 000        31 060
00016:   • •   •   •   •   •     • •_  •         00   (.) 000            60
00017:   • •   •   •   •   •     •   • •_       00   (.) 000        32 840
00018:   • •   •   •   •   •     •  _•   •       00   (.) 000            40
00019:   • •   •   •   •   •     • •    _•       00   (.) 000        31 060
0001A:   • •   •   •   •   •     • •_  •         00   (.) 000            60
0001B:   • •   •   •   •   •     •   • •_       10   (.) 000        32 840
0001C:   • •   •   •   •   •     •  _•   •       10   (.) 000            40
0001D:   • •   •   •   •   •     • •    _•       10   (.) 000        31 060
0001E:   • •   •   •   •   •     • •_  •         10   (.) 000            60
0001F:   • •   •   •   •   •     •   • •_       00   (.) 000        32 840
00020:   • •   •   •   •   •     •  _•   •       00   (.) 000            40
00021:   • •   •   •   •   •     • •    _•       00   (.) 000        31 060
00022:   • •   •   •   •   •_   _• •_  •         00   (.) 000            60
00023:   • •   •   •   •   •     • •     • •_  DI   70   (p) 000 01   1 594 920
00024:   • •   •   •   •   •     • •    _•   •       70   (p) 000 00       2 560
00025:   • •   •   •   •   •     • •    •    _•       70   (p) 000         25 440
00026:   • •   •   •   •   •     • •    •_  •         70   (p) 000             60
00027:   • •   •   •   •   •     • •     • •_       00   (.) 000 01       54 440
00028:   • •   •   •   •   •     • •    _•   •       00   (.) 000 00           40
00029:   • •   •   •   •   •     • •    •    _•       00   (.) 000         27 960
0002A:   • •   •   •   •   •     • •    •_  •         00   (.) 000             60
0002B:   • •   •   •   •   •     • •     • •_       06   (.) 000 01       54 440
0002C:   • •   •   •   •   •     • •    _•   •       06   (.) 000 00           20
0002D:   • •   •   •   •   •     • •    •    _•       06   (.) 000         28 000
0002E:   • •   •   •   •   •     • •    •_  •         06   (.) 000             80
0002F:   • •   •   •   •   •     • •     • •_       00   (.) 000 01       54 420
00030:   • •   •   •   •   •     • •    _•   •       00   (.) 000 00           60
00031:   • •   •   •   •   •     • •    •    _•       00   (.) 000         27 940
00032:   • •   •   •   •   •     • •    •_  •         00   (.) 000             80
00033:   • •   •   •   •   •     • •     • •_       00   (.) 000 01       54 420
00034:   • •   •   •   •   •     • •    _•   •       00   (.) 000 00           60
00035:   • •   •   •   •   •     • •    •    _•       00   (.) 000         27 940
00036:   • •   •   •   •   •     • •    •_  •         00   (.) 000             80
00037:   • •   •   •   •   •     • •     • •_       00   (.) 000 01       54 420
00038:   • •   •   •   •   •     • •    _•   •       00   (.) 000 00           60
00039:   • •   •   •   •   •     • •    •    _•       00   (.) 000         27 940
0003A:   • •   •   •   •   •     • •    •_  •         00   (.) 000             80
0003B:   • •   •   •   •   •     • •     • •_       00   (.) 000 01       54 440
0003C:   • •   •   •   •   •     • •    _•   •       00   (.) 000 00           40
0003D:   • •   •   •   •   •     • •    •    _•       00   (.) 000         27 960
0003E:   • •   •   •   •   •     • •    •_  •         00   (.) 000             60
0003F:   • •   •   •   •   •     • •     • •_       00   (.) 000 01       54 440
00040:   • •   •   •   •   •     • •    _•   •       00   (.) 000 00           20
```



```
00041:   • •   •   •   •     • •   •    _•      00   (.) 000         28 000
00042:   • •   •   •   •     • •_  •_  •         00   (.) 000            80
00043:   • •   •   •   •     •   •   • •_  St   00   (.) 000     1 084 860
00044:   • •   •   •   •     •   •  _•   •      00   (.) 000       319 080
00045:   • •   •   •   •     •   • •    _•      00   (.) 000        18 940
00046:   • •   •   •   •_    •   • •_  •        00   (.) 000           80
00047:   • •   •   •     •   •   •   • •_  MI   00   (.) 000       786 260
00048:   • •   •   •     •   •   •  _•   •      00   (.) 000         2 580
00049:   • •   •   •     •   •   • •    _•      00   (.) 000        25 420
0004A:  _• •   •   •    _•  _•  _• •   •        00   (.) 000         2 420
0004B: •   •   •   •   •   •   •   •   •   BFr 000008(.) 000       335 900
```

The following display example shows the same style of display recorded in 2-edge mode.



```
 Addr: BSY SEL ATN RST MSG C/D I/O REQ ACK Ph  Data/PE   Exp Off s  ms  us  ns
08813: •_  •   •   •   •   •   •   •   •   BFr 00    (. )111           234 100
08817:   • •_  •   •   •   •   •   •   •   Arb 80    (. )111             3 300
0881A:   •   • •_  •   •   •   •   •   •       80    (. )111             2 000
0881D:  _•   •   • •   •   •   •   •   •       81    (. )111               220
08820: •_    •   • •   •   •   •   •   •   Sel 81    (. )111               400
08823:   •  _•   • •   •   •   •   •   •       81    (. )111               400
08826:   • •     • •   •_  •_  •   •   •       81    (. )111            35 180
08829:   • •     • •     •   • •   •   •   MO  81    (. )111               360
0882C:   • •    _• •     •   • •   •-> •       81    (. )111             4 432
0882F:   • •   •   •     •   • •   •   •       81    (. )111               172
08832>   • •   •   •    _•   • •   •   •->     C0    (. )111           300 520
08835:   • •   •   •   •     • •   •   •   Cmd C0    (. )111               400
08838:   • •   •   •   •     • •   •-> •       C0    (. )111             2 720
0883B>   • •   •   •   •     • •   •   •->     08    (. )111               260
0883E:   • •   •   •   •     • •   •-> •       08    (. )111                40
08840>   • •   •   •   •     • •   •   •->     00    (. )111               100
08843:   • •   •   •   •     • •   •-> •       00    (. )111                92
08846>   • •   •   •   •     • •   •   •->     0E    (. )111               100
08849:   • •   •   •   •     • •   •-> •       0E    (. )111                92
0884C>   • •   •   •   •     • •   •   •->     8F    (. )111               100
0884F:   • •   •   •   •     • •   •-> •       8F    (. )111                92
08852>   • •   •   •   •     • •   •   •->     32    (2 )111               100
08855:   • •   •   •   •     • •   •-> •       32    (2 )111                92
08858>   • •   •   •   •_    • •_  •   •->     00    (. )111             3 256
0885B:   • •   •   •     •   •   • •   •   MI  00    (. )111               680
0885E>   • •   •   •     •   •   • •-> •       04    (. )111             5 500
08861:  _• •   •   •    _•  _•  _• •   •->     04    (. )111             5 100
08864: •_  •   •   •   •   •   •   •   •   BFr 00    (. )111           652 760
08868:   • •_  •   •   •   •   •   •   •   Arb 01    (. )111             1 660
0886B:   •   • •   •   •   •   •_  •   •       01    (. )111             1 000
0886E:  _•   • •   •   •   •   •     • •   •       81    (. )111                80
08871: •_    • •   •   •   •   •     • •   •   Rsl 81    (. )111               760
08874:   •  _• •   •   •   •   •     • •   •       81    (. )111               100
08877:   • •   •   •   •_  •_    • •   •       81    (. )111               120
0887A:   • •   •   •     •   •   • •   •   MI  81    (. )111               440
0887D>   • •   •   •     •   •   • •-> •       80    (. )111             6 480
08880:   • •   •   •    _•  _•   • •   •->     80    (. )111            11 520
08883:   • •   •   •   •   •     • •   •   DI  80    (. )111               528
08886>   • •   •   •   •   •     • •-> •       00    (. )111                64
08889>   • •   •   •   •   •     • •-> •       02    (. )111                76
0888C>   • •   •   •   •   •     • •-> •       04    (. )111                64
0888F>   • •   •   •   •   •     • •-> •       06    (. )111                64
08892>   • •   •   •   •   •     • •-> •       08    (. )111                56
08894>   • •   •   •   •   •     • •-> •       0A    (. )111                92
```

```
08897>   • •   •   •   •   •     • •-> •       0C    (. )111               64
0889A>   • •   •   •   •   •     • •-> •       0E    (. )111               64
0889D>   • •   •   •   •   •     • •-> •       10    (. )111               56
0889F>   • •   •   •   •   •     • •-> •       12    (. )111               88
088A2>   • •   •   •   •   •     • •-> •       14    (. )111               60
088A5>   • •   •   •   •   •     • •-> •       16    (. )111               76
088A8>   • •   •   •   •   •     • •-> •       18    (. )111               64
088AB>   • •   •   •   •   •     • •-> •       1A    (. )111               64
088AE>   • •   •   •   •   •     • •-> •       1C    (. )111               56
088B0>   • •   •   •   •   •     • •-> •       1E    (. )111            5 740
088B3:   • •   •   •   •   •     • •   •->     1E    (. )111               48
088B6:   • •   •   •   •   •     • •   •->     1E    (. )111               24
088B7>   • •   •   •   •   •     • •-> •       20    (  )111               20
088B8:   • •   •   •   •   •     • •   •->     20    (  )111               28
088BA>   • •   •   •   •   •     • •-> •       22    (" )111               20
088BB:   • •   •   •   •   •     • •   •->     22    (" )111               24
088BC>   • •   •   •   •   •     • •-> •       24    ($ )111               20
088BD:   • •   •   •   •   •     • •   •->     24    ($ )111               28
088BF>   • •   •   •   •   •     • •-> •       26    (& )111               20
088C0:   • •   •   •   •   •     • •   •->     26    (& )111               24
088C1>   • •   •   •   •   •     • •-> •       28    (( )111               20
088C2:   • •   •   •   •   •     • •   •->     28    (( )111               28
088C4>   • •   •   •   •   •     • •-> •       2A    (* )111               20
088C5:   • •   •   •   •   •     • •   •->     2A    (* )111               28
 Addr: BSY SEL ATN RST MSG C/D I/O REQ ACK Ph  Data/PE   Exp Off s  ms  us  ns
```

The following display example shows the same style of display except with 'Wide' data (16 bits + parity) and total elapsed time display. This trace also shows the single-edge REQ/ACK mode of recording and skip data after 8 events.

```
Addr: BSY SEL ATN RST MSG C/D I/O REQ ACK Ph  Data/PE   Exp Off s  ms  us  ns
00000: ---- START OF TRACE ----
00003: •_  •   •   •   •   •   •   •   •   BFr 00-00 (..)111           431 200
00006:   • •_  •   •   •   •   •   •   •   Arb 00-00 (..)111           434 700
00009:   •   • •_  •   •   •   •   •   •       80-00 (..)111           436 720
0000C:  _•   •   • •   •   •   •   •   •       81-00 (..)111           436 920
0000F: •_    •   • •   •   •   •   •   •   Sel 81-00 (..)111           437 300
00012:   •  _•   • •   •   •   •   •   •       81-00 (..)111           437 720
00015:   • •     • •   •_  •_  •   •   •       00-00 (..)111           440 460
00018:   • •    _• •     •   • •   •   •   MO  00-00 (..)111           445 620
0001B:   • •   •   •     •   • •   •   •       C0-00 (..)111           445 820
0001E>   • •   •   •    _•   • •   •   •->     C0-00*(..)111           746 260
00021:   • •   •   •   •     • •   •   •   Cmd 00-00 (..)111           749 100
00024>   • •   •   •   •     • •   •   •->     0A-00*(..)111           749 400
00027>   • •   •   •   •     • •   •   •->     00-00*(..)111           749 600
0002A>   • •   •   •   •     • •   •   •->     0F-00*(..)111           749 800
0002D>   • •   •   •   •     • •   •   •->     CD-00*(..)111           750 000
00030>   • •   •   •   •     • •   •   •->     32-00*(2.)111           750 200
00033>   • •   •   •   •_    • •_  •   •->     00-00*(..)111           753 580
00036:   • •   •   •     •     •   • •   •   MI  00-00 (..)111           754 300
00039>  _• •   •   •    _•  _•  _•  •-> •       04-00*(..)111           763 740
0003C: •_  •   •   •   •   •   •   •   •   BFr 00-AB (..)111         1 417 500
00040:   • •_  •   •   •   •   •   •   •   Arb 00-00 (..)111         1 419 320
00043:   •   • •   •   •   •   •_  •   •       01-00 (..)111         1 420 320
00046:  _•   • •   •   •   •     • •   •       81-00 (..)111         1 420 400
00049: •_    • •   •   •   •     • •   •   Rsl 81-00 (..)111         1 421 220
0004C:   •  _• •   •   •   •     • •   •       81-00 (..)111         1 421 300
0004F:   • •   •   •   •_  •_    • •   •       01-00 (..)111         1 421 400
00052:   • •   •   •     •   •   • •   •   MI  00-00 (..)111         1 421 840
00055>   • •   •   •    _•  _•  _•  •-> •       80-00*(..)111         1 438 400
00058:   • •   •   •   •   •   •   •   •   DO  00-00 (..)111         1 444 460
0005B>   • •   •   •   •   •   •   •   •->     00-01 (..)111         1 444 520
0005E>   • •   •   •   •   •   •   •   •->     02-03 (..)111         1 444 580
00061>   • •   •   •   •   •   •   •   •->     04-05 (..)111         1 444 640
00064>   • •   •   •   •   •   •   •   •->     06-07 (..)111         1 444 700
00067>   • •   •   •   •   •   •   •   •->     08-09 (..)111         1 444 760
0006A>   • •   •   •   •   •   •   •   •->     0A-0B (..)111         1 444 820
```

```
0006D>   • •   •   •   •   •   •   •   •->     0C-0D (..)111         1 444 880
00070>   • •   •   •   •   •   •   •   •->     0E-0F (..)111         1 444 940
00073>   • •   •   •   •   •   •   •   •->     10-11 (..)111         1 444 980
00075>   • •   •   •   •   •   •   •   •->     12-13 (..)111         1 445 060
00078>   • •   •   •   •   •   •   •   •->     14-15 (..)111         1 445 120
0007B>   • •   •   •   •   •   •   •   •->     16-17 (..)111         1 445 180
0007E>   • •   •   •   •   •   •   •   •->     18-19 (..)111         1 445 240
00081>   • •   •   •   •   •   •   •   •->     1A-1B (..)111         1 445 300
00084>   • •   •   •   •   •   •   •   •->     1C-1D (..)111         1 445 360
00087>   • •   •   •   •   •   •   •   •->     1E-1F (..)111         1 445 420
0008A>   • •   •   •   •   •   •   •   •->     20-21 ( !)111         1 445 480
 Addr: BSY SEL ATN RST MSG C/D I/O REQ ACK Ph  Data/PE   Exp Off s  ms  us  ns
```

3.3.1 Binary display of the SCAM Protocol

In the binary display format, you will see the SCAM data handshake near the horizontal middle of the screen. The SCAM data and handshake take the place of the normal display of data in Hexadecimal and ASCII. Only the SCAM Selection is interpreted in the Phase column (between the SCSI control lines and the data). It is shown as SCM.

The handshake is shown as thick (active) or thin (inactive) lines for D7, D6 and D5 (left to right). The data is shown in binary from D4 to D0 (left to right). The event with valid data is shown with a square bullet between the handshake and the data. An example is shown below.

Note the short duration event at address 18. It seems that this is a spurious capture, since no change is evident from the preceding event. This is the "wired-or glitch" which must be filtered out by the software or hardware executing the protocol.

```
 Addr: BSY SEL ATN RST MSG C/D I/O Ph  Data/PE   Exp              Time
00000: ---- Start Trace ----
00001: •   •   •   •_  •   •   •   BFr 0000      000                0
00002: •   •   •    _• •   •   •   RST  00   (.) 000      3 343 309 440
00003: •_  •   •   •   •   •   •   BFr 0000      000        467 080 680
00004:   •.•_ .•  .•  .•  .•  .•  .Arb  00   (.) 000        676 627 320
00005>   •   • •   •   •   •   •       ••• 00000 000      1 251 826 320
00006:   •   • •   •   •_  •   •       ••• 00000 000              1 040
00007>  _•   • •   •     • •   •       ••• 00000 000        490 666 160
00008: •  .  •.•  .•  . _•.•  .•  .SCM  00*  (.) 000        995 079 400
00009> •_    • •   •   •   •   •   Sel  00*  (.) 000      1 255 570 040
0000A:   •   • •   •   •   •   •_      ••• 00000 000            173 120
0000B:   •   • •   •   •   •     •     ••• 00000 000              2 000
0000C:   •.  •.•  .•  .•  .•_ .  •.     ••• 00000 000              5 040
0000D:   •   • •   •   •     •   •     ••• 00000 000      3 220 260 280
0000E:   •  _• •   •   •     •   •     ••• 00000 000      1 048 575 920
0000F:   • •_  •   •   •     •   • St   C0   (.) 000      1 354 956 680
00010>   •.  •.•  .•  .•  .  •.  •.     ••• 00000 000            113 200
00011>  _•   • •   •   •     •   •     ••• 00000 000        813 024 640
00012> •_    • •   •   •     •   • Rsl  80   (.) 000      2 766 584 680
00013:   •   • •   •   •     •   •     ••• 00000 000               40
00014:   •.  •.•  .•  .•  .  •.  •.     ••• 00000 000              2 120
00015:   •   • •   •   •     •   •     •••#11111 000      8 328 585 360
00016:   •   • •   •   •     •   •     ••• 11111 000            238 080
00017:   •   • •   •   •     •   •     ••• 11111 000              5 040
00018:   •.  •.•  .•  .•  .  •.  •.     ••• 11111 000                 40
00019:   •   • •   •   •     •   •     ••• 11111 000      1 007 675 160
0001A:   •   • •   •   •     •   •     ••• 11111 000            254 880
0001B:   •   • •   •   •     •   •     ••• 11111 000        964 743 640
0001C:   •.  •.•  .•  .•  .  •.  •.     ••• 11111 000            370 920
0001D:   •   • •   •   •     •   •     •••#00001 000      4 042 006 880
0001E:   •   • •   •   •     •   •     ••• 00001 000            233 480
0001F:   •   • •   •   •     •   •     ••• 00001 000        974 504 720
00020:   •.  •.•  .•  .•  .  •.  •.     ••• 00001 000             11 320
00021:   •   • •   •   •     •   •     ••• 00001 000              5 600
00022:   •   • •   •   •     •   •     ••• 00001 000                 40
00023:   •   • •   •   •     •   •     ••• 00001 000      1 048 285 480
00024:   •.  •.•  .•  .•  .  •.  •.     ••• 00011 000         29 362 200
00025:   •   • •   •   •     •   •     •••#00010 000      2 294 179 240
00026:   •   • •   •   •     •   •     ••• 00010 000            186 960
00027:   •   • •   •   •     •   •     ••• 00010 000              5 960
00028:   •.  •.•  .•  .•  .  •.  •.     ••• 00010 000              6 320
 .
 .
 .
0054D:   •   • •   •   •     •   •     ••• 11000 000      1 047 384 680
0054E:   •   • •   •   •    _•   •     ••• 11000 000         15 224 960
0054F:   •   • •   •   •   •     •     ••• 00000 000      3 568 099 800
00550:   •.  •.•  .•  .•  .•  .  •.     ••• 00000 000         13 596 000
00551:   •   • •   •   •   •    _•     ••• 00000 000        211 295 720
00552:   •  _• •   •   •   •   •       ••• 00000 000        225 573 840
00553>  _• •   •   •   •   •   •        00   (.) 000        310 410 400
00554: •  .•  .•  .•  .•  .•  .•  .BFr 0000      000        282 911 360
00555: ---- End of Trace ----
```

Note that in order to analyze the SCAM Protocol, the trace needs to be recorded in the 'Capture SCAM Protocol' mode first.

3.4 THE HEX DUMP FORMAT

The Hex display format is very compact but also hard to read. It is intended only for the most intractable problems. Each line of output shows the starting address plus the contents of trace memory for that address and for the following two addresses, each separated by slash.

The format of each event is: 8 characters of control bits, a space, and 4 characters of REQ/ACK.

```
00000:  F1000021 0000 / 80901CA4 0000 / 80000006 0000
00003:  07A00040 0000 / 80901D0D 0000 / 80000006 0000
00006:  07B00040 0000 / 80901D49 0000 / 80000006 0000
00009:  17700040 0000 / 80901D50 0000 / 80000006 0000
0000C:  17100041 0000 / 80901D65 0000 / 80000006 0000
0000F:  17300041 0000 / 80901D6B 0000 / 80000006 0000
00012:  17E00000 0000 / 80901DEA 0000 / 80000006 0000
00015:  17E60000 0000 / 80901E48 1F00 / 80000006 1F00
00018:  07A600C0 1F00 / 80901E4D 1F00 / 80000006 1F00
0001B:  47A600C0 1F07 / 80905768 0000 / 80000006 0000
0001E:  07E20000 0000 / 809057C6 1F00 / 80000006 1F00
00021:  47A2000A 1F03 / 809057D5 0700 / 80000006 1F00
00024:  47A20000 1F1F / 809057DB 0700 / 80000006 1F00
00027:  47A20000 1F03 / 809057E2 0F00 / 80000006 1F00
0002A:  47A20010 1F07 / 809057E9 1F00 / 80000006 1F00
0002D:  47A20001 1F1F / 809057EF 0300 / 80000006 1F00
00030:  47A20000 1F01 / 80905896 0000 / 80000006 0000
00033:  07E70000 0000 / 809058B7 0000 / 80000006 0000
00036:  27A70004 0300 / 809059DA 0000 / 80000006 0000
00039:  07C00000 0000 / 07C0AB00 0000 / 8090DA82 0000
Addr    Ctrl     R A    Ctrl     R A    Ctrl     R A
```

3.5 THE COMPACT DISPLAY FORMAT

The compact display format is a condensed version, which can be used for viewing the captured SCSI activity with up to 24 commands per screen. Each recorded SCSI connection (from Bus Free to Bus Free) occupies only one line of display. You can use this format for previewing a certain area of trace memory, then switch to the Structured Display format or the Binary Display format to see it in more detail.

The information presented includes :

- Trace Memory Address of Start of Connection
- SCSI ID of Initiator and Target and direction of connection (i.e., Selection vs. Reselection)
- Command (CDB) transmitted
- Number of bytes of data transferred and the direction, In or Out
- SCSI Status transmitted
- Final Message of connection
- Elapsed time of connection

Note that not all connections have all these types of information. Those which do not apply are left blank.

```
00000: ---- Start Trace ----
00001:  7->0 Req Sense 000012   I            Good        Cmd Cmplt         5 297 400
0002F:  7->0 Test U Rdy                      Good        Cmd Cmplt         1 406 200
00041:  7->0 Read/Rcv                       Disconnect    819 720
00052:  7<-0                    000200 I     Good        Cmd Cmplt         2 464 400
              ...
00B0C:  7->0 Write/Send         000200 0     Disconnect  2 335 000
00D1E:  7<-0                    Good         Cmd Cmplt     946 480
                 ...
07FFF:    ---- End of Trace ----
```

3.6 THE COMMAND PROFILE FORMAT

This format gives a graphical representation of the proportion of time spent in each phase. One full command is displayed on each screen, including disconnects, reselections, all information transfer phases, etc. The heading of the display shows the trace memory address range occupied by the command, the SCSI IDs of the Initiator and Target, and the opcode and interpretation of the command transmitted. This format assumes that each command is contiguous in the trace. If commands are interleaved, the resulting display is unpredictable.

The Command Total time is shown at the bottom of the screen. If one or more disconnects were involved in this command, then the Command Total will be shown as two values: first the time with disconnect included, followed by the time with disconnect excluded. The disconnect itself is shown on the line above the Command Total, both in raw time in nanoseconds, and as a percentage of total command time, including disconnects.

Each bar displayed also shows timing information, both in raw time in nanoseconds, and as a percentage of the total command time, excluding disconnects.

```
     SCSI COMMAND PROFILE

Trace Address        :  00040 - 0025B
IDs                  :  I7 -> T0
Command Code         :  08 Read/Rcv
Data Transferred     :  512 Bytes

Arb/Sel:              71 600 ns            3.7%
ID Msg:               93 920 ns            4.9%
Command:             300 560 ns           15.9%
Data:                735 600 ns           38.9%
Status:              286 360 ns                        15.1%
End Msg:             398 480 ns           21.1%
                      ••••••••••••
Cmd Total:               1 886 520 ns
```

The following definitions of phases are used in calculating the timing:

Arb/Sel: from the assertion of BSY to the first event in Message-Out (for the Identify message).

ID Msg: from the start of the Message-Out phase to the first event which is neither Message-Out nor Message-In phase.

Command: from the first event in the Command phase to the first event not in Command phase.

Data: from the first event of either Data-In or Data-Out phase to the first event after the last event in the same phase, after subtracting any disconnect time.

Status: from the first event in Status phase to the first event not in Status phase.

End Msg: from the first event in the last Message-In phase of this command to the release of BSY (Bus Free).

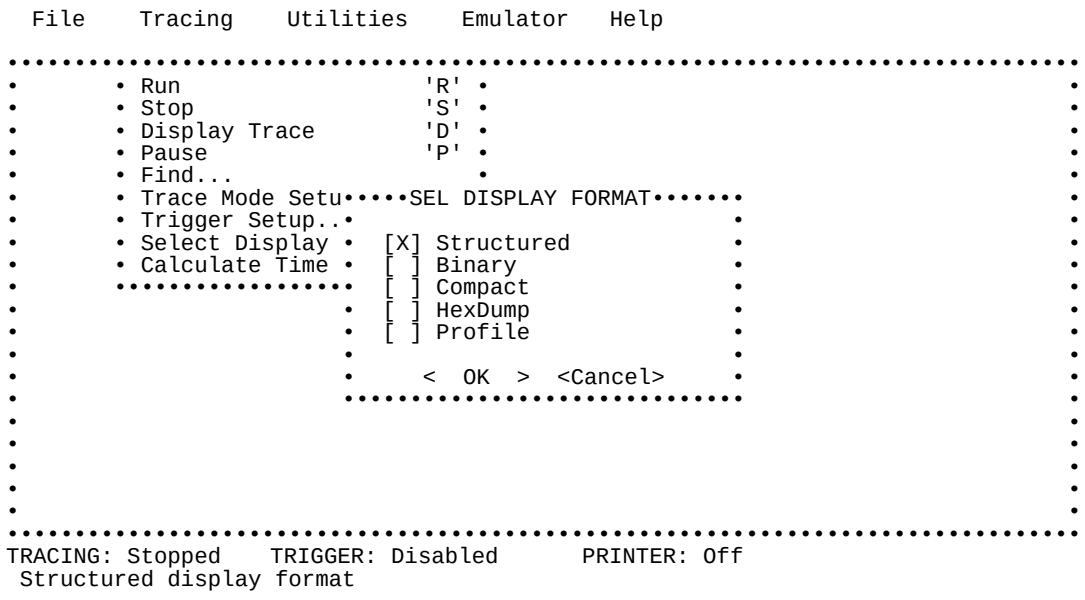
Disconnect: from start of the Message-In phase for any disconnect message to the end of Message-In phase for the Identify message after reconnect. All such periods within this command are added together.

Command Total:
from the assertion of BSY just before the Selection phase to the release of BSY after the Status phase. The time not including disconnect time is also shown for commands which involved a disconnect.

3.7 CHANGING THE DISPLAY FORMAT

The display format can be changed by selecting ATRACING@ from the main menu, then A>Set Display Format@. You can also change the format after pressing **<Display>**, as described in section 3.1.

When in the ASet Display Format@ menu, use the up or down arrow keys to select an item to be changed, then **<Enter>** to change it.



Structured - causes the next page of trace to be presented in Structured format.

Binary - causes the next page of trace to be presented in Binary format.

Compact - causes the next page of trace to be presented in a Compact format, showing one SCSI command per line.

HexDump - causes the next page of trace to be presented in Hex Dump format.

Profile - causes the next page of trace to display a timing analysis of a single SCSI command by phase.

S E C T I O N 4

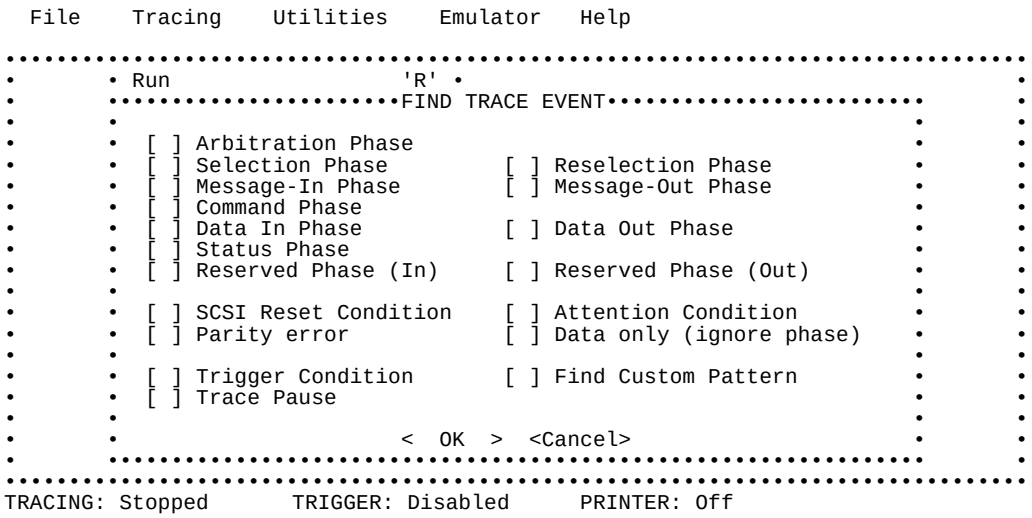
SEARCHING FOR EVENTS IN THE RECORDED TRACE

4.1 INTRODUCTION

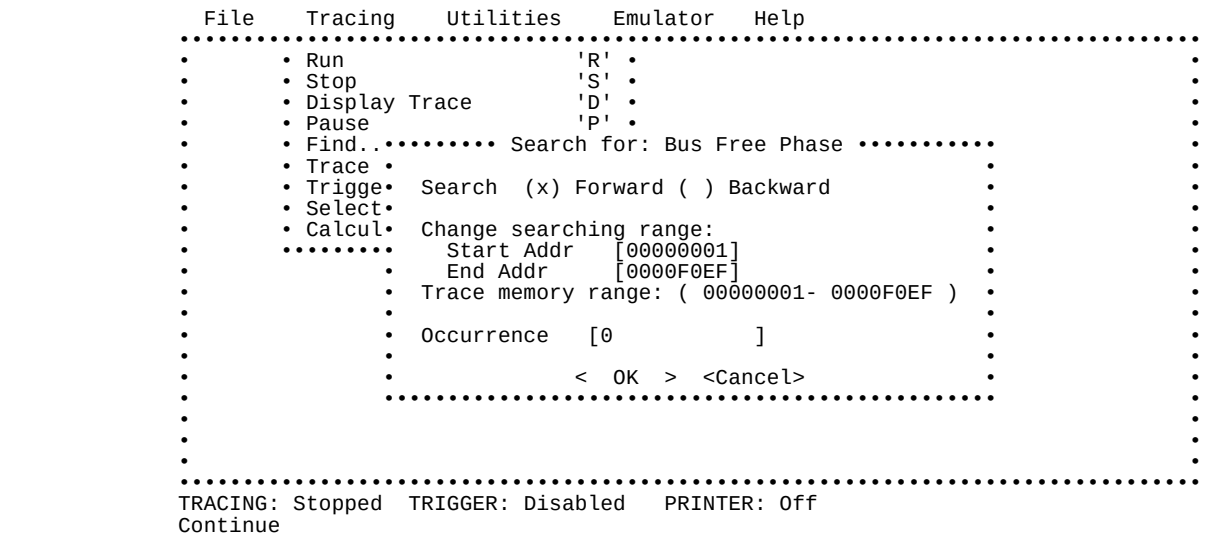
The Ultra-2080 provides a powerful, easy-to-use searching utility. This feature provides you with the ability to 'home in' on the event of interest in your recorded trace, without needing to wade through the uninteresting events before or after. You can specify the exact combination of phase and data pattern you are interested in. If the event exists in the trace, the corresponding part of trace memory will be displayed, and the found event line will be marked.

If the event is not found, the current display page will be shown again with a "NOT FOUND" box in the center of the screen.

When you select **<Srch>** or **<F6>** on the keyboard, or AFind@ from the ATracing@ menu on the display, the following menu is displayed:



Use the arrow keys to select the event or phase you want. For a single-key selection, press on the keyboard the selector letter highlighted on the screen. Press **<Enter>** to enable the selection, then select **<OK>** (<Home>) and press **<Enter>**; the following option menu is displayed:



Using the arrow keys or the mouse, you may change any of the default values for search direction, searching range, occurrence, or patterns. The heading for the menu shows which search item is selected.

4.1.1 SELECT A CUSTOM CONTROL BIT PATTERN

Most of the patterns are self-explanatory, but a few need additional comments.

> **Attention condition**. This event is matched when BSY and ATN are both active, and RST is inactive. This commonly occurs during Selection, and during extended messages, as well as when the Initiator needs to send a message to the Target.

Parity error. This event is matched when BSY is active, data are valid (qualified by REQ/ACK for data In/Out, and during Selection and Reselection), and parity is EVEN (the parity error bit is set) for the low byte of SCSI data. If wide data pattern is enabled, the parity error bit for the high byte of SCSI data is also examined.

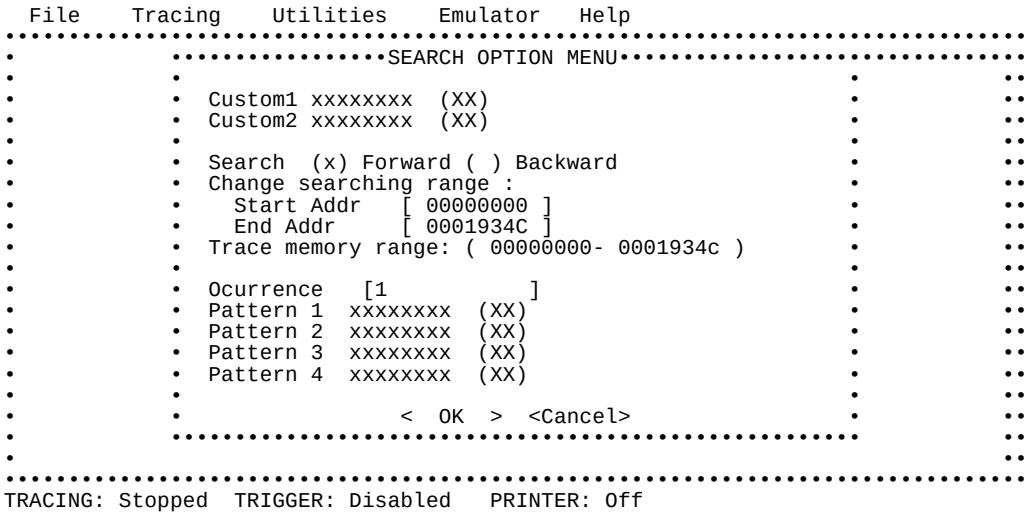
> **Trigger condition.** There is at most one matching event in any recorded trace. The direction flag is ignored in searching for this event. The search automatically proceeds in the correct direction.

Trace PAUSE. Each time recording is paused, an artificial event (PAUSE marker) is written into the trace memory.

Data only (ignore phase). This pattern ignores the state of the control lines MSG, C/D and I/O. However, BSY will be active, SEL and RST will be inactive, and the data transfer will be qualified by REQ/ACK for transfers In/Out. The data pattern specified can even span more than one phase.

Reserved Phase (In)
Reserved Phase (Out). The ANSI SCSI specification leaves undefined (reserved for future standardization) two of the eight possible configurations of information transfer phases. These patterns are matched when MSG is active and C/D is inactive, and the state of I/O matches In or Out. Data will also be qualified by REQ/ACK for transfers In or Out.

Custom Control Bit Pattern. Use this selection if none of the patterns matches the event phase you want to find. When you press **<Enter>** with the bar on the ACustom Control Bit Patt@ item, the following screen will be displayed:



Notice that the menu help line (at the bottom of the menu) shows the meaning of the individual bits. The "Custom 1" and "Custom" 2 help lines are shown below.

Custom 1 help line: res res res ATN TRG EX2 EX1 EX0
Custom 2 help line: PEH PEL BSY SEL RST MSG C/D I/0

The X0, X1, and X2 are the signals on pins 1, 2, and 3 of the Expansion connector J2, at the time of capture of this event.

You can edit individual bits of the search phase pattern using the 0, 1 and X keys. Move within the pattern using the left or right arrow keys.

After you select the phase pattern, you will also be given the option of selecting a qualifying data pattern for that same event. The default pattern is all data as 'Don't Care', starting with "1: xxxx xxxx" (binary). Change the data pattern by entering A1@, A0@, or AX@, or use the arrow keys to move to the next field.

Press **<OK>** to execute the search.

4.2 SELECT THE SEARCH OPTIONS

The FIND MENU gives a list of phases and conditions to search for. It also lists several options to control the search. The options are explained in detail in the paragraphs below.

- To accept the option default values, select **<OK>** to execute the search.

- To change an option default value, use the selector letter on the keyboard to choose the option you want to modify. Use the **<Enter>** key to toggle your choice. Then select **<OK>** to execute the search.

4.2.1 SEARCH FOR WIDE DATA PATTERN

This selection will affect searches only if the Data Bits Pattern is also specified. The default value is a 'blank', indicating that the wide data pattern is not chosen. When not enabled, only the low byte of SCSI data will be considered in the search. If the wide data pattern is enabled, both the low byte (bits 0-7) and the high byte (bits 8-15) of the captured trace will be examined for the data pattern. When using wide data, bytes are assumed to arrive low byte first. The search is smart enough that a pattern which spans two or more transfers will be found, no matter whether the first byte of the pattern is in the low or high byte of SCSI data.

4.2.2 SET THE SEARCH DIRECTION

The currently selected direction of search is shown by AX@ in brackets. The default is forward. Use the left and right arrows to choose.

4.2.3 SET THE OCCURRENCE COUNTER

If occurrence is set to 0 or 1, the search will find the next event matching the pattern. The default is 1. If set to any higher number n, the search will display only the nth event. After you choose Aoccurrence@ the cursor will move into the brackets; type your selection and press **<Enter>**. The maximum value is 99.

The occurrence counting is used by the FIND function when it is executed for the first time. Any subsequent FIND-NEXT or FIND-PREVIOUS function will search for the very first occurrence of the event, ignoring the occurrence counter setting.

4.2.4 SET THE SEARCH ADDRESS LIMITS

It might take a very long time to search for a certain item if searching over the entire trace memory, especially if the trace memory is 512K events long. You may need to limit the search range.

The default limits are set to the beginning and the end of trace most recently recorded, and are shown in brackets in the AStart Addr [ ]@ and AEnd Addr [ ]@ message.

To change the address range, select AStart addr@ or AEnd addr@. The cursor will move to the first set of brackets showing the default limit address. Type a value, then press **<Enter>**. The Analyzer will automatically reorder the start and end points if necessary.

4.2.5 SET THE SEARCH STARTING ADDRESS

The starting address is initially set to the same value as the address range low limit. It is updated every time a successful search is executed. If you need to start searching from a different part of the trace memory, select AStart addr@ and type in the new starting address value. Then select **<OK>** to start the search.

4.2.6 SET THE DATA BITS PATTERN

When searching for certain phases, such as Command, Data In/Out, etc., usually you may need to define the desired data pattern. You can specify a string up to four bytes long. Select APattern 1" or APattern 2@ etc., and enter the desired bit or byte pattern. The data bytes are displayed in both binary and hexadecimal, and the default values are all 'X' ("don't cares"). This pattern is used along with Data, Command, and several other search options.

Use the up or down arrows to select the pattern to edit. Use the left or right arrows to edit within one byte. The display shows each bit of the pattern as 0,1 or X ("Don't care"). Change the bit under the cursor by typing a 0,1 or X, which replaces any value already there. To select the next byte and to edit it, press the **<down-arrow>** key. If no byte is already displayed, a "don't care" byte will be created there.

4.3 REPEATING THE SEARCH

After a successful search, you may want to find the next event which matches the same pattern. To do this, press **<Ctrl-L>**, or **<F7>**, or **<Find Next>** on the keyboard. The search will proceed in the same direction as the previous search. Press **<Ctrl-K>**, **<Shft-F7>**, or **<Shft-Find Next>** to search in the opposite direction.

The FIND-NEXT or FIND-PREVIOUS functions will always search for the first next or first previous occurrence; these functions do not use the occurrence counter.

Note that searching is accessible from the trace display mode as well, by pressing **<Srch>** or **<F6>**. From the keyboard, the **<Ctrl-F>** key combination selects this function.

The **FIND-NEXT** function repeats a previous search for the next matching event. If no previous search was made, it searches for the next Bus Free event.

The **FIND EVENT** function can use a occurrence count, i.e., you can find the nth occurrence of a certain event. The **FIND-NEXT** or **FIND-PREVIOUS** will always find the very next occurrence, however.

S E C T I O N 5

TRIGGERING

5.1 INTRODUCTION

All triggering control stems from selecting Tracing on the main menu, then Trigger Setup on the pull-down menu. Triggering can take place only when the Ultra-2080 is tracing, as shown by a lit 'Tracing' LED on the bottom left side of the front panel. See Section 2.2 for starting the trace.

5.2 TRIGGER OPTIONS

Select ATracing@ from the main menu, then ATrigger Setup@. The following menu will be displayed:

```
  File    Tracing    Utilities    Emulator   Help

••••••••••••••••••••••••••••••••••TRIGGER SETUP•••••••••••••••••••••••••••••••••
•       • Run   •                                                •               •
•       • Stop  •  [ ] Trigger Master Enable                     •               •
•       • Displa•  [ ] Stop when trace memory is full.           •               •
•       • Pause •  [ ] External trigger input                    •               •
•       • Find..•  [ ] Parity error (low byte)                   •               •
•       • Trace •  [ ] Parity error (high byte)                  •               •
•       • Trigge•  [ ] SCSI rEset                                •               •
•       • Select•  [ ] (Re)Selection Time-out                    •               •
•       • Calcul•  [ ] Selection      IDs   [0081]               •               •
•       •••••••••  [ ] Reselection    IDs   [0081]               •               •
•                  [ ] Message In     Code1  [04]                •               •
•                  [ ] Message Out    Code2  [07]                •               •
•                  [ ] Command        Code3  [12]                •               •
•                  [ ] Status         Code4  [02]                •               •
•                  [ ] Command and Status                        •               •
•                  [ ] IDs and (MSG or Cmd or Stat)              •               •
•                  Post trigger  ( ) Until Bus Free (x) delay    •               •
•                  Delay  •-------------------+ [100%]           •               •
•                                                                •               •
•                           <  OK  >  <Cancel>                   •               •
••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••
TRACING: Stopped  TRIGGER: Disabled   PRINTER: Off
```

When the TRIGGER SETUP MENU appears, use the up or down arrow, <Tab>, or <Shift-Tab> to move the highlight bar, or press the highlighted letter next to the item you want to change, then press **<Enter>.** If the item has a numerical value associated with it, shown in brackets, and you want to edit that value, first press the **<Enter>** key to select the item, then use the arrow or tab keys to move to the numeric field. Next type in the new value in Hex, and press **<Enter>** again to confirm the new selection.

When a trigger item is enabled, the letter 'X' appears in the brackets at the left side, next to that item. When an item is disabled, the brackets are empty.

Triggering can be completely disabled by unselecting the ATrigger Master Enable@ option. In this case, tracing will be started or stopped only by pressing the **<Stop>** or **<S>** keys.

Once the trigger has been selected and enabled with ATrigger Master Enable@ use the arrow keys to move to **<OK>** and press **<Enter>**. From the main menu, press **<Run>** to start tracing. The Ultra-2080 will then start recording all SCSI bus activity until the trigger condition has been met. Once the trigger condition has been met, the Ultra-2080 will continue recording until either the condition selected by item *›Post trigger delay '*, or *'until Bus Free'* has been met. If *›until Bus Free'* is selected, tracing will stop at the next Bus Free, placing the trigger point near the end of the trace. If *›Post trigger delay=* is selected, tracing will continue until the selected percentage of trace memory is filled. If 0% is selected, tracing will stop after 10 more events and the trigger will be at the end of the trace. If 100% is selected, tracing will continue until all but the 10 events before the trigger have been recorded. This will place the trigger event at the start of the trace.

When selecting *'Post trigger delay=* you can place the trigger point anywhere in trace memory. In this manner, the desired amount of early-trigger or late-trigger delay can be selected.

Other items in the TRIGGER SETUP MENU are mostly self-explanatory. They are listed below.

Trigger Master Enable: When enabled, the selected trigger options are enabled. When disabled, no triggering will occur.

Stop When Trace Memory is Full: When enabled, tracing will automatically stop when trace memory fills up. The post trigger delay is automatically set to 100%.

External trigger input: When enabled, a transition, low or high, at the external trigger connector (BNC) is a trigger condition.

Parity error, low byte: When enabled, a byte on the SCSI low data lines (D0-7, DPL) with even parity is a trigger condition. Any SCSI information transfer phase, selection or reselection phase is a candidate for this trigger.

Parity error, high byte: When enabled, a byte on the SCSI high data lines (D8-15, DPH) with even parity is a trigger condition if it occurs during a Data-In, Data-Out, or Reserved information transfer phase. Other phases are not candidates for this trigger.

SCSI Reset: When enabled, a transition to the active state of the SCSI RST line is a trigger condition.

(Re)Selection Time-out: When enabled, a failed selection or reselection attempt is a trigger condition. Failed selection is defined as no response, by making BSY active, for a period of more than 250 milliseconds after the calling device drops BSY with SEL active.

Selection IDs: When enabled, the pattern of data bits on the SCSI bus during selection is matched against the pattern shown in the first set of brackets. If match is found, it becomes the trigger condition. Note that this is different from **Combine IDs & [MSG/CMD/STAT]** below, where the ID pattern is considered only in conjunction with the Message, Command or Status code. Note that the pattern selected for this item should be duplicated for **Reselection IDs** below. It is, however, possible to set these for different patterns. This selection will also affect ID filtering, if that recording mode is enabled.

Reselection IDs: see **Selection IDs** above.

Message In/Message Out: When enabled, the pattern of data bits on the SCSI bus during the selected message phase is compared to the pattern shown in the first set of brackets. If it matches, it becomes a trigger condition.

Command Code: See **Message In** above.

Status Code: see **Message In** above.

Combine Cmd & Status: Both the matching Command code **AND** the matching Status code must be present in the same command to cause triggering. Note that a disconnect is considered a change of command. Thus a setup requiring a Read Command code [08] and Good Status code [00] will not be detected on a command for which the target disconnects. However, Command [08] and Status [02] normally will be detected, because most such commands will not have any disconnect.

Combine IDs & [MSG/CMD/STAT]: When enabled, the data pattern in Selection or Reselection IDs MUST be present during Selection or Reselection in order for the matching of Message, Command or Status codes to take effect, whichever occurs first. Note that this is different from Selection or Reselection IDs above, where the ID is considered independently of the other trigger conditions enabled.

Post Trigger Delay: This item specifies the amount of trace memory to use for recording following the trigger. It is specified as a percent of trace memory.

Bus Free: Stops tracing at the first Bus Free following the trigger event.

NOTE: ›**Post Trigger Delay**‹ and ›**Bus Free**‹ are mutually exclusive; one or the other is always selected. These two selections control when recording stops following a trigger.

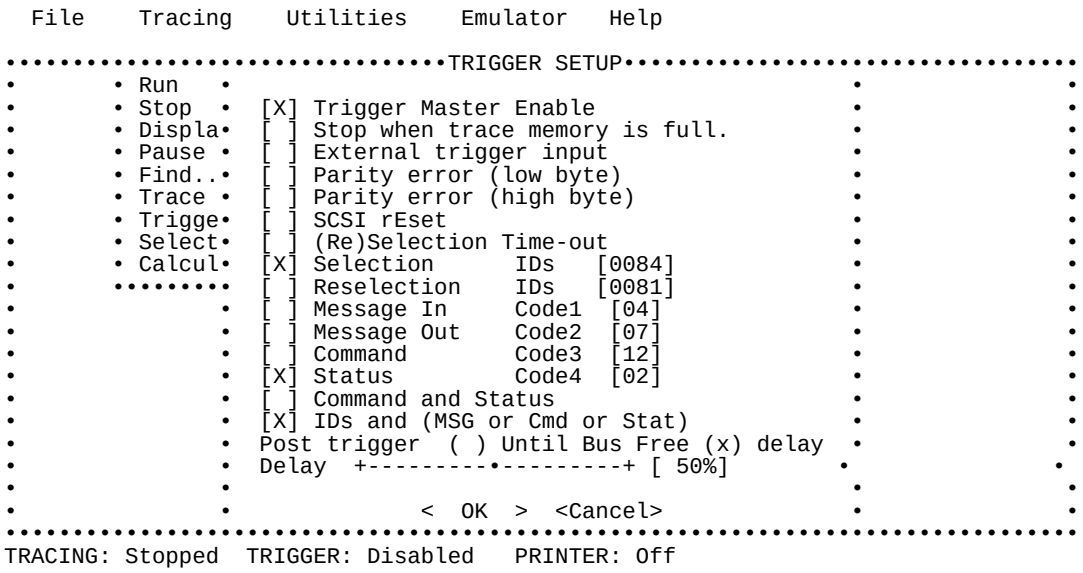
Whenever setting up trigger conditions, exercise care in your selections to avoid undesired effects between the conditions enabled. Consider carefully the event you are trying to key on, to enable properly the conditions which will trigger on that event.

5.3 TRIGGER EXAMPLES

5.3.1 LATE TRIGGERING

The problem : Target ID 2 on the bus is sending Check Condition Status even after a Request Sense command during the power-up sequence. This prevents the boot procedure from completing, and you want to find out what the cause is.

Set the trigger conditions as follows :



All other conditions are disabled; this is shown by empty brackets at the left edge of the Trigger Menu.

This setup will start recording when you press <Run>. SCSI events will fill space in the buffer, perhaps wrapping the circular buffer, until a command occurs involving Initiator ID=7 and Target ID=2, as specified by the 0084 in Selection IDs; this will result in a Check Condition Status, as specified by the 02 in Status Code. Recording will continue until the next Bus Free phase, and then stops. The final event address will be displayed on the screen as the Ultra-2080 informs you that the trigger condition has been met. You can then examine the trace to see what commands preceded the Check Condition Status (02).

5.3.2 EARLY TRIGGERING

The problem : A command results in a condition which causes your SCSI driver to crash. You think it is because of linked commands with the flag bit set.

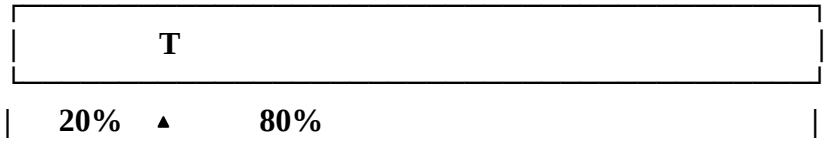
Set the trigger conditions as follows :

```
  File    Tracing    Utilities    Emulator   Help

•••••••••••••••••••••••••••••••••TRIGGER SETUP•••••••••••••••••••••••••••••••••
•       • Run   •                                                •               •
•       • Stop  •  [X] Trigger Master Enable                     •               •
•       • Displa•  [ ] Stop when trace memory is full.           •               •
•       • Pause •  [ ] External trigger input                    •               •
•       • Find..•  [ ] Parity error (low byte)                   •               •
•       • Trace •  [ ] Parity error (high byte)                  •               •
•       • Trigge•  [ ] SCSI rEset                                •               •
•       • Select•  [ ] (Re)Selection Time-out                    •               •
•       • Calcul•  [ ] Selection      IDs   [0081]               •               •
•       •••••••••  [ ] Reselection    IDs   [0081]               •               •
•                •  [X] Message In     Code1  [0B]              •               •
•                •  [ ] Message Out    Code2  [07]              •               •
•                •  [ ] Command        Code3  [12]              •               •
•                •  [X] Status         Code4  [02]              •               •
•                •  [ ] Command and Status                      •               •
•                •  [ ] IDs and (MSG or Cmd or Stat)            •               •
•                •  Post trigger  ( ) Until Bus Free (x) delay  •               •
•                •  Delay  +---•---------------+ [ 80%]        •               •
•                •                                              •               •
•                •              <  OK  >  <Cancel>              •               •
•••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••
TRACING: Stopped  TRIGGER: Disabled   PRINTER: Off
```

All other trigger conditions are disabled as shown by empty brackets at the left edge of the Trigger Menu.

This setup will start recording events as soon as you press <Run>, and will continue recording all commands until one received with a message of 'Linked-Command-Complete-with-Flag', as specified by the 0B hex in the Message code. At that point, having previously selected a post trigger delay of 80%, you will be able to examine commands before the 0B hex message code. Your trace looks like this:



Events will be recorded until the trace memory is completely full, and then will stop to prevent overwriting the trigger event. If you press **<Stop>** before the memory fills up, that will also halt tracing. You can then examine the trace to determine what happened after the suspect event.

5.3.3 NO TRIGGER REQUIRED

The problem: occasionally the bus will hang. You want to find out the IDs involved in the transaction hanging the bus, the command causing the hang, etc.

No trigger is required for this problem. Set the '*Trigger Master Enable to [ ]'*. Start tracing by pressing **<Run>**. The Ultra-2080 will record all activity on the bus, wrapping the circular buffer each time it fills completely. When the bus hangs, press **<Stop>** to halt tracing. The message will tell you the ending address in the trace memory. This is always the maximum trace memory address if the memory wrapped. You can then examine the events just before that address to find the cause of the hanging bus.

S E C T I O N 6

SCSI INITIATOR EMULATION

6.1 INTRODUCTION

In many instances it is not enough to observe events passively on the SCSI bus. There are situations when you want to interact with certain devices on the bus, and you need to send SCSI commands. For this, use the SCSI Initiator emulator which gives you control over the action on the bus. The Ultra-2080/BxE Analyzer models come with the SCSI emulator built in.

Using the emulator of the Ultra-2080/BxE you can act as a SCSI Initiator. You can define the command set matching a certain type of SCSI Target, be it a disk drive, tape drive, printer, etc. You control the protocol for information transfers, deciding whether to use the narrow 8-bit, wide 16-bit, or fast SCSI modes, or whether to act as an asynchronous/synchronous SCSI device. Using the hierarchical menu structure, you determine how each command proceeds, and control every byte of information transferred.

The current hardware version of the Ultra-2080 uses the Symbios 53C895 SCSI Protocol Controller chip, which can emulate up to FAST/40 SCSI. It can do asynchronous data transfers at up to 7 MHZ (14 MBps if using WIDE SCSI) and up to 40MHz synchronous (80 MBps with WIDE). Connecting to the proper SCSI connector pair on the front panel, the emulator can be used on either Single-Ended, High Voltage Differential (HVD) or Low Voltage Differential (LVD) bus interfaces. When attaching the Ultra-2080 to the bus to be tested, the hardware in the Analyzer senses which interface exists, and automatically enables the proper transceivers.

6.2 SCSI INITIATOR EMULATION

To enter the SCSI INITIATOR EMULATION MENU from the MAIN MENU, select option **"<9> - Emulate"** or **<E>.** You can issue SCSI commands one at a time or a string of commands (macros) directly from this menu. You can select your commands from the upper part of the menu; you can also access several auxiliary functions of the Emulator from the lower part. The menu is as follows:

```
                          SCSI INITIATOR MENU
_____________________________________________________________________

SCSI COMMANDS:
A - (00) Test U Rdy     F - (12) Inquiry       K - (28) Read (10)
B - (03) Req Sense      G - (16) Reserve Unit  L - (2A) Write (10)
C - (04) Format Unit    H - (17) Release Unit  M - (3B) Write Buffer
D - (08) Read (6)       I - (1D) Send Diagn    N - (3C) Read Buffer
E - (0A) Write (6)      J - (25) Read Capacity

a - (01) Rezero         d - (1B) Start         h - (1E) Prvnt Med Rem
b - (0B) Seek (6)       e - (1B) Stop          I - (1E) Allow Med Rem
c - (2B) Seek (10)      f - (1A) Mode Sense    t-z [t]  Vendor Specific
                        g - (15) Mode Select   1-8      Exec Macro

AUXILIARY FUNCTIONS:
^X - Setup              ^E - Edit CDB          ^I - Initiator ID    [7]
^B - Build Macro  [ ]   ^H - Autofill  [AXLU]  ^T - Target ID       [0]
^L - List Macros        ^N - Link Bit    [LF]  ^U - Logical Unit LUN[0]
^D - Data Buf Mgmt      ^Y - Queue Tag[ ][  ]  ^A - LBA      [00000001]
^K - Compare Buffers    ^Z - Repeat cmd   [ ]  ^F - Incr LBA @ Wt   [ ]
^R - SCSI Reset                                ^G - Incr LBA @ Rd   [ ]

Your Selection ?
```

The SCSI COMMANDS section is self explanatory. Remember that the format of commands and consequently their execution may be affected by some of the auxiliary commands. Functions such as **<^H>, <^N>, <^F>, <^G>** will affect the contents of the CDB sent for a command .

Execute individual SCSI commands either by typing their symbol (e.g. type **<A>** for Test-Unit-Ready,..) or move cursor over the **<A>** field and press **<Enter>**. The A through N and a through I are preprogrammed SCSI commands, saved in internal EEPROM. The t, u, v, w, x, y, and z are seven vendor specific commands; they are preset in the EEPROM to zeros as a default. Use **<^E>** editing function to change them. The 1 through 8 are eight macro's.

To access the individual **Vendor Specific** commands place the cursor on this selection and press **<Enter>**. The letter in brackets shows the current Vendor Specific command. Use the left or right arrow to cycle through the list until the desired letter is shown in the brackets, then press **<Enter>** to execute that command.

Functions **<R>, <P>, <S>**, and **<Q>** are the same as in the MAIN MENU level, and they are not listed in this SCSI INITIATOR MENU. These are the RUN, PAUSE, or STOP used for starting, pausing, or stopping the trace, and QUIT for exiting from this menu. These functions are described in Sections 2.2.2, 2.2.3, and 2.2.4 respectively.

In the following paragraphs, individual auxiliary functions are explained in more detail. Functions are listed in alphabetical order. Functions such as **"^X - Setup"** and **"^D - Data Buffer Management"** are rather complex; they are described in Sections 6.4 and 6.3 respectively.

MESSAGES PROGRAMMED BY THE USER

SCSI Command Descriptor Blocks (CDB) can be preceded by one or more messages. The Ultra-2080 can be used to include several of these messages in the same command. Each can be individually enabled or disabled, and its contents set. Enabled messages will be transmitted in the following order:

Identify message
Queue Tag message (2 bytes)
Custom User message (1 - 16 bytes)
WDTR (4 bytes)
SDTR (5 bytes)

Any of these might be rejected by the target, or have a response message-in phase. If so, the remainder of the list will be sent following the response. From the Initiator Emulator's perspective, the Custom User message is entirely rejected if any one byte is rejected.

Read Sections 6.2.14 and 6.4.5 for more detailed descriptions of how to program custom messages.

6.2.1 <^A> - CHANGE LBA

This function lets you define the Logical Block Address to be used on the next command with such a field (e.g., a Read command). If the LBA bit of the Autofill variable is set, the LBA you define will be used for the next command. See Section 6.2.6.

6.2.2 <^B>, <^L> - MACROS

With the Emulator's macro capability you can define a sequence of commands and other functions that will execute sequentially at the press of a single key. The Emulator is shipped with several default macros installed. You can edit or rewrite them or use them unchanged. However, each time you restore defaults, the original definitions will be restored as well.

The **"^B - Build Macro"** command enables you to construct a macro. The macro buffer is 64 characters long, so the macro can be quite complex. As you press each key, that character will become part of the macro, and will also be executed. When you complete your definition, press **<^B>** again. You can then save or discard the macro you have built. If you define an empty macro, it can be saved. You can erase any previously defined macros. Macros may not be nested, i.e., you cannot make one macro part of another.

The **"^L - List Macros"** command displays all macros currently defined. It is important to realize that a macro is merely a list of keystrokes. This means that for items which merely toggle between states, like the "^G - Incr LBA @ Wt" command, will have an effect dependent on the initial state of the toggle. Some items require an **<Enter>** key press to end data input, like the "^A - Chng LBA" command. The **<Enter>** key is not shown as part of the macro, even though it will occur. Instead, the value entered as input is shown in braces {}. Execute macros by pressing the corresponding number key in the range 1 through 8. Macros can be repeatedly executed if the **"^Z - Repeat Command"** is enabled. See Section 6.2.13.

6.2.3 <^D> - DATA BUFFER MANAGEMENT

This item gives access to the Data Buffer Management, which will display its own menu. See Section 6.3 for a complete discussion of the buffer management functions.

6.2.4 <^E> - EDIT CDB

With this function you can set or clear any bit of any defined CDB (Command Descriptor Blocks), including the Vendor Unique CDBs. The current contents of the CDB selected are displayed, and you can change any or all of the bytes. The modified CDB is retained until you restore defaults. See Section 7.3.5.

You have complete control over seven custom CDBs, accessed via SCSI Command letters **<t>** through **<z>** (lower case). The defaults for these CDBs are all zeros, making them 'Test-Unit-Ready' commands. Using the **<^E> - Edit CDB** function, you can make them into any command, including the non-standard ones. You will be asked to specify In, Out, or No buffer, if the data phase for that particular command requires a buffer. All CDBs are stored in non-volatile memory (EEPROM) and will retain their contents even after a system reset.

Edit the CDBs as follows: Press the **<^E>** key to enter the 'Edit CDB' mode, and enter the letter representing the SCSI command CDB to be edited. Current CDB will be displayed in Hex format. Move the cursor, using the left or right arrow, and change individual bytes. When finished, press **<Q>** to save the new edited values and return to the Initiator Emulation menu.

Remember that while executing individual SCSI commands, certain fields will be filled in 'on the fly' if the ^H - Autofill function is enabled. Read more on this in Section 6.2.6 below.

6.2.5 <^F>, <^G> - INCREMENT LBA AFTER WRITE/READ

These options affect the value of the LBA variable after each SCSI Read or Write command. Note that this will affect the CDB only if Autofill is enabled for LBA. See Section 6.2.6. If the incrementation is enabled, then the LBA is incremented as a 32-bit value. The upper bits of the value may be truncated if the CDB does not have room for all of them.

6.2.6 <^H> - AUTOFILL

Of particular interest is the **"^H - Autofill"** selection. Autofill, if fully enabled, will insert the current values for LBA, Allocation/Transfer Length, Link (and flag) bit and Target LUN into the CDB. Each of these items can be individually enabled or disabled, using the following values.

Selection Code	Affected field
A	LBA
X	Alloc/transfer length
L	Link and Flag bits
U	LUN

Open the Autofill field by pressing **<Enter>**. Then using the selection codes, toggle individual selections ON and OFF; you can turn a particular bit ON to enable automatic fill of that field in any affected CDB. Turning it OFF leaves that field with the value it held on the previous use of the affected command. The selection code will toggle selections ON and OFF. The corresponding selection code will be displayed in upper case for ON state, and in lower case for OFF state. As an example, type **<U>** to enable and disable automatic filling of LUN in subsequent execution of commands. This autofill will be effective until the **<U>** is turned OFF by typing **<U>** again. Similarly, it works with the L, X, or A selections respectively.

For example, to have the Emulator fill in the Link bit and the LBA, but to leave the LUN and transfer length alone: open the Autofill field by pressing **<Enter>** then toggle the **<L>** and **<A>** codes; this selection will be displayed as 'A x L u'. The Emulator will then look at the current settings for the LBA to enter it into the CDB. It will also check how you want the Link and Flag bits set in the last byte of the CDB, and fill them in.

Note that the Autofill for LUN does not affect the LUN field of the Identify message. That field will always hold the current value of the LUN variable.

6.2.7 <^I> - INITIATOR ID

Determines the SCSI ID number to be used by the Initiator Emulator. The ID number currently selected is entered in hex (0 through F). The corresponding bit will be asserted on the data bus during Arbitration to identify the Initiator.

6.2.8 <^K> - COMPARE BUFFERS

Selecting this option causes a byte-by-byte comparison of the current contents of the SCSI Read Data Buffer and the SCSI Write Data Buffer. Both of these buffers should have their lengths defined beforehand. See Section 6.3.5 for details. If their lengths are different, then the shorter one will be used for the comparison. The number of mismatches is reported (e.g. 'K0003') if any are detected. If the buffers compare correctly, only 'K-' is displayed on the screen, and no other report is issued.

6.2.9 <^N> - LINK & FLAG BIT

With this selection you can emulate linked commands. Using **<Enter>** you can change this variable to 3 possible states, as shown by the codes below:

Code	Function
blank	Link and Flag bits both cleared
L	Link bit set, Flag bit cleared
FL	Link and Flag bits both set

The Link & Flag bits feature is intended to test target handling of linked commands. The Link bit is used to continue the I/O process across multiple commands. The Flag bit is typically used to cause an interrupt in the initiator between linked commands.

If this feature is used, the selected command will be sent by the initiator emulator of the Ultra-2080. The target should go through execution of this command, then respond with 'Intermediate-Condition met' (=14 hex) or 'Intermediate' (=10 hex) status, and 'Linked Command Complete' message-in, then again enter the command phase for the next command. The Ultra-2080 emulator will send the same CDB second time, this time with the Link bit reset. The target should execute this second linked command and should conclude it with status = 00 and message-in = 00. If an error occurs anytime during execution of the first command, 'Check

Condition' status should be returned by the target and the command should terminate immediately without starting the second linked command.

6.2.10 <^R> - SCSI RESET

Selecting this option asserts the SCSI RST line, causing a Reset condition on the bus. The line is held asserted approximately 26 microseconds, then released. (The SCSI specification requires a minimum of 25 microseconds, with no maximum.)

6.2.11 <^T> - TARGET ID

Determines the SCSI ID number of the Target to be selected by the Initiator Emulator. The Target ID number currently selected is shown in hex, 0 through F. The corresponding bit for the currently selected Target ID will be asserted on the data bus during Selection.

6.2.12 <^U> - LOGICAL UNIT (LUN

Determines the Logical Unit Number (LUN) in the Target to be selected by the Initiator Emulator. Enter the new LUN selection in the range 0 through 7.

6.2.13 <^X> - EMULATOR SETUP

With this selection you can set up various operating parameters for the SCSI Emulator. See Section 6.4 for a complete description.

6.2.14 <^Y> - QUEUE TAG

This selection is shown in the Emulation menu as **<^Y> - Queue Tag[ ][ ]**. When disabled, the two brackets will be empty. When enabled, the first set of brackets holds a letter telling which type of tag will be used. Possible letters are :

<S> simple tag
<H> head-of-queue tag
<O> ordered tag

The second set of brackets holds the actual tag number that will be used.

Select this option by pressing the **<^Y>** key, and a sub-menu will be displayed as shown below. This menu will enable the function and set the exact message content to be used.

```
QUEUE TAG MESSAGE MENU
──────────────────────────
<1> - Disabled         (D)
<2> - Simple Queue     ( )
<3> - Head of Queue    ( )
<4> - Ordered Queue    ( )
──────────────────────────
<5> - Tag number       [00]
──────────────────────────
<Q> - Quit, Save Changes
<Esc> Quit, Discard Changes

Your selection (0../Q) ?
```

Only one of the first four options can be selected at any one time. If item 1 is selected, disabling tagged queued commands, the tag number will not be shown. The [E] shows which option is selected. To avoid confusion, if item <1> Disabled is selected, it is shown by "D" in the parentheses.

To select a different type of queue tag message, either type the number of the selection or move the highlight bar to that line and press **<Space>** or **<Enter>**.

6.2.15 <^Z> - REPEAT COMMAND

When enabled by **<Enter>**, this item causes the next command selected to be executed repeatedly until stopped by a press on any key. The halting keypress also disables repeating for subsequent commands until explicitly enabled again. Macros can also be repeated, just like individual commands.

6.3 <^D> - DATA BUFFER MANAGEMENT

With this selection you can manipulate the data buffers used for SCSI commands. You can fill the outgoing data with a variety of patterns, or view and edit each individual byte. You can also view the contents of the incoming buffers from the previous SCSI command.

```
DATA BUFFER MANAGEMENT MENU
_____________________________________________
<0> - Select Buffer...       [Data-Out]
<1> - View and Edit Buffer
<2> - Fill Buffer...
<3> - Copy Buffer...
<4> - Set Buffer Size           [$0200]
```

6.3.1 <0> - SELECT BUFFER

Always select the proper buffer before viewing, editing, or filling it. Toggle the buffer selection using the arrow keys. The following buffers can be selected:

- (SCSI) Data In
- (SCSI) Data Out
- (Custom) User Message
- Mode Select (Data
- Mode Sense (Data)
- Request Sense (Data)
- Inquiry Data

The Custom User Message is a message-out which will be sent following Identify message, just before the Command phase. This would be the Abort, Queue Tag, vendor unique, or similar messages. The SDTR or WDTR would also be sent in this position; however, these two extended messages are rather complex and therefore are programmed from another menu. From the main menu, select **<E>** for Emulation, **<^X>** for Emulation Setup, and **<5>** for Data Transfer Protocol (SDTR & WDTR) menu.

When copying a buffer to buffer, the source buffer is designated on the **<0>**-Select Buffer line. You will be prompted to select the destination buffer when you type **<3>** for Copy Buffer.

6.3.2 <1> - VIEW AND EDIT BUFFER

With this selection you can examine each byte of the active buffer, and modify any of them.

Editing is very simple. Use the cursor control keys to move to the byte you want to change. Then type the new value for the byte. As long as you type keys which are valid hexadecimal digits, the cursor will move along in the buffer and the new data will replace the old. You can also use the cursor control keys to skip over or move back within the buffer. If you type only a single digit for a byte, followed by **<Enter>** or some key which is not a valid hex digit, the digit you typed will be used as the value for the entire byte; it will appear as the low-order 4 bits. To end the editing session, press **<Quit>**. Keys which have no meaning in the context of the editor will be ignored.

6.3.3 <2> - FILL BUFFER

With this option you can select or define a fill pattern which will replicate throughout the buffer. Using the left arrow or right arrow, select the following patterns:

zeros - every bit in the buffer will be turned off
ones - every bit in the buffer will be turned on

random - a pseudo-random pattern of byte value will be used to fill the buffer. The seed byte is generated by internal clock interrupt.

incr. - you will be asked for a pattern of up to 15 bytes. Type the desired pattern in Hex, separating bytes with spaces. The pattern will be used to fill the buffer. Each copy of the pattern will be incremented from the previous copy. For example, if you chose the pattern $A0 F2, the buffer will be filled with the following pattern:

address Values

```
 0:      a0  f2  a0  f3  a0  f4  a0  f5  a0  f6  a0  f7  a0  f8  a0  f9
10:      a0  fa  a0  fb  a0  fc  a0  fd  a0  fe  a0  ff  a1  00  a1  01
```

const - you will be asked for a pattern like that for an incrementing fill. The pattern will be used unchanged to fill the entire buffer.

6.3.4 <3> - COPY BUFFER

With this selection you can copy from the active buffer to any other buffer for outgoing data. If the buffers are the same size, the entire length will be copied. If the buffers are different sizes, only the length of the shorter one will be copied. The remainder of the longer buffer will be unchanged. You can copy any source buffer into (almost) any destination buffer; the exception for destination are the input buffers.

Before copying, always select the proper source buffer. Toggle the selection using the arrow keys in selection **<0>**. When you type **<3>** for Copy Buffer, you will be prompted to select the destination buffer. Select the destination using the arrow keys, then press **<Enter>** to execute the copy.

6.3.5 <4> - SET BUFFER SIZE

With this selection you can specify the number of bytes in any of the buffers. Certain maximums must be observed, as shown in the table below:

Buffer	Maximum Size (decimal)		Default (hex)
Read	8	Mbytes	800000 200
Write	8	Mbytes	800000 200
User Msg Out	16	Bytes	10 00
Req Sense Data	64	Bytes	40 20
Inquiry Data	128	Bytes	80 30
Mode Sense Data	255	Bytes	FF FF
Mode Select Parms	255	Bytes	FF C

6.4 <^X> - EMULATOR SETUP

Selecting option <^**X**> gives access to the various operating parameters of the SCSI emulator. Parameters can be changed through selections from this menu:

```
      EMULATOR SETUP MENU
_____________________________________
<0> - Alloc/Xfer Lengths...
<1> - Arbitration              [E]
<2> - Identify Message         [E]
<3> - Disconnect/Reconnect...  [E]
<4> - Custom Message...        [ ]
<5> - Data Xfer Protocols (W/SDTR)
<6> - Mode Sense/Select setup...
<7> - Target type...     [0(Disk)]
<8> - SCSI Version             [2]
<9> - Command Timeout          [E]
```

You can make your selections either by moving the highlight bar and pressing <**Enter**>, or directly by pressing the selector key on the left side on this menu. The left and right arrow keys change the current value in brackets.

6.4.1 <0> - ALLOCATION/TRANSFER LENGTHS

This selection enables you to control the amount of data to be transmitted or received and saved during various data phases. All numeric entries are in hex (0 - F). See Section 6.3.5 for maximum allowable values.

The menu for these selections is as follows:

```
      ALLOCATION / TRANSFER LENGTHS
_____________________________________________
<0> - Xfer Len - Rand Acc       [00000001] blocks
<1> - Xfer Len - Seq Acc/Proc/Comm[000200] bytes
<2> - Target Block Size            [0200] bytes
<3> - Alloc Length for Request Sense [020] bytes
<4> - Alloc Length for Inquiry      [030] bytes
```

<0> - Initiator Transfer Length for a random access device type: a value which will be filled in the TxLgh field of Read/Write type commands if 'Autofill' is enabled.

<1> - Initiator Transfer Length for a Seq.Access, , Processor, or Communications device type: a value which will be filled in the TxLgh field of Read/Write type commands if 'Autofill' is enabled.

<2> - Target Block Size: defines the data block size expected in the Target. The data buffer used by the Read/Write type commands will be sub-divided based on this value.

<3> - Allocation Length for Request Sense: a length of buffer allocated for Sense data received from the Target in a Request Sense command. The maximum value is 20 hex. This value will be filled in the Allocation Length field of a Request sense command if 'Autofill' is enabled.

<4> - Allocation Length for Inquiry: a length of buffer allocated for Inquiry data received from the Target in a Inquiry command. The maximum value is 40 hex. This value will be filled in the Allocation Length field of an Inquiry command if 'Autofill' is enabled.

6.4.2 <1> - ARBITRATION

For SCSI-2, Arbitration is mandatory. However, in SCSI-1, it was optional and some very early systems did not arbitrate. You can disable Arbitration in order to emulate those early SCSI-1 systems. Note that by disabling Arbitration, the Disconnect / Reconnect option will also be disabled.

6.4.3 <2> - IDENTIFY MESSAGE

This selection determines whether Selection with Attention will be used to signal a desire by the Initiator to send a Message Out to the Target before the CDB. This message phase is normally used for an Identify Message, for Queue Tag messages and for Protocol Negotiations. When Arbitration is disabled, Identify Message is also disabled.

6.4.4 <3> - DISCONNECT / RECONNECT

This selection determines whether the Target can disconnect during the command. When emulating a SCSI Initiator, the Identify message will have the "disconnect permission" bit (bit 6) cleared as a default. When Arbitration or Identify Message is disabled, the Disconnect is also disabled.

6.4.5 <4> - CUSTOM MESSAGE

With this selection you can specify an extension to the initial Message-Out phase of a command, and the bytes to be sent in that extended phase. Selecting this option opens to the following menu:

```
   CUSTOM MESSAGE MENU
_____________________________
<0> - Edit msg-out buffer
<1> - Use [   never]

Your selection (0../Q) ?
```

Press **<Enter>** with bar over the **<0> - Edit buffer** or press **<0>** to open another window, showing the current contents of the buffer. Only those bytes up to the current length are shown. The cursor will be on the first byte of the buffer. To add bytes to the buffer, simply press the down arrow key and the cursor will move to a new byte, up to a total of 16 bytes. When you enter a value for the byte, the meaning will be shown to the right. To change an existing byte, move the cursor to that byte and type the new value. Press **<Q>** to stop editing and save the new buffer.

Selecting **<1> - Use** will toggle between the options "never", "always" and "next cmd".

6.4.6 <5> - DATA PROTOCOLS

With this selection you can control the way data is transferred during either the Data-In or Data-Out phases. This option opens the following menu:

```
DATA PHASE TRANSFER PROTOCOLS
_____________________________________________
<0> - Synchronous Transfers          [E]
<1> -    Offset                     [32]
<2> -    Period(ns)                 [25]
<3> -    Resp w/ Msg Reject          [N]
<4> -    Negotiation           [RqS/Inq]
<5> - Wide Transfers                 [E]
<6> -    Transfer Width             [16]
<7> -    Resp w/ Msg Reject          [N]
<8> -    Negotiation           [  Never]
```

SCSI-3 provides for FAST/20 (Ultra), FAST/40 (Ultra2), and FAST/80 (Ultra3) (rates to 20MHz, 40MHz, and 80MHz respectively) and WIDE (2 bytes) data transfer modes. Note, that only Data Phases In/Out will use these higher speed modes. All other phases (Command, Status, Message phases) always use asynchronous and single-byte transfer mode. Also note that before the FAST/xx and/or WIDE are used, they must be negotiated between each Initiator and Target. A SCSI system can have a mix of devices, each using a different mode. It is also provided for SCSI-1 devices that neither recognize nor support these modes; these devices will reject the SDTR (Synchronous Data Transfer Request) and WDTR (Wide Data Transfer request) extended messages. SDTR and WDTR negotiations usually occur during the power-up sequence, and are positioned immediately after Identify message, just before the command phase. The SDTR and WDTR extended messages are attached to Request-sense and/or Inquiry commands. Consult the SCSI specifications for detailed rules defining use of these messages.

When making selections from the menu, use arrow keys to toggle between values within allowed limits.

Items **<0>** and **<5>** are used for enabling the use of SDTR and WDTR extended messages to negotiate synchronous and wide data transfer modes. If enabled, format of the SDTR and WDTR will be defined by parameters, as currently selected. Also note that enabling synchronous or wide transfers still requires negotiation. See items <4> and <8>.

Item **<1>** Select the maximum synchronous offset allowed during data transfers. Offsets up to 32 (hex 20) are supported.

Item **<2>** Select the synchronous rate. Rates are selectable from 25 ns to 450 ns. This gives a range of rates from approximately 1.4 MHZ up to the maximum of 40 MHZ.

Items **<3>** and **<7>** Select how the Emulator responds to WDTR/SDTR negotiations when a particular transfer type is disabled. If "Respond w/ Msg Reject" is enabled, the emulator will reject WDTR and/or SDTR extended messages. If disabled, it will respond with an extended message which shows an inability to transfer data with the protocol requested. For example, if Wide Data Transfers are disabled, and the Emulator receives a WDTR extended message, it will respond with a WDTR extended message showing '0' for the width byte. Similarly, the SDTR message response will have a 0 offset byte.

Items **<4>** and **<8>** asks you to decide when WDTR / SDTR negotiation should be done:

a) never,
b) next command,
c) on each Request Sense or Inquiry command.
d) on every command

The SCSI-2 specification recommends negotiating with each Request Sense or Inquiry command. If the "next command" is selected, this function will revert to "never" after that command.

Item **<6>** Select either 8-bit or 16-bit data transfers.

6.4.7 <6> - MODE SENSE / SELECT SETUP

This option opens the following menu.

```
        MODE SENSE / MODE SELECT MENU
_____________________________________________
<0> - Mode Sense Alloc Length (In)   [$24]
<1> - Mode Select Param List Length [$0C]
<2> - Edit Mode Select Parameter List
<3> - Copy Mode Sense Data to Mode Select Parms
```

Item **<0>** specifies the buffer size in bytes allocated by the Initiator for Mode Sense data received from the Target.

Item **<1>** specifies the number of bytes which the Initiator will send, if the Target allows it, as parameters of the Mode Select Command.

Item **<2>** view and change the data sent as parameters. This acts the same as the Data Buffer Management menu.

Item **<3>** copy Mode Sense Data, as received from the Target, to the Mode Select Parameter List buffer before sending it back to the Target. This would be useful when you are experimenting (editing) with certain parameters, but want to preserve the rest as it is.

6.4.8 <7> - TARGET TYPE

With this selection you can specify the type of target addressed by following commands. Several commands vary in the contents of the CDB and the meaning of the bits in the CDB depending on the target type. Currently the supported target types include :

Type 0 - Random Access Devices: Disk drives. Many of these commands will act the same way for Optical drives, CD-ROM drives and similar devices)
Type 1 - Sequential Access Devices (Tape drives)
Type 3 - Processor Devices

If interest warrants, other device types will be added in the future. Commands which apply to all devices can, of course, be sent to any device type. Also, using the vendor specific commands, you can define commands for other device types.

6.4.9 <8> - SCSI VERSION

With this selection you can specify whether to use SCSI-1 or SCSI-2 protocols. Only a few commands are affected by the SCSI version. If you are not sure which version is supported by the device being addressed, we recommend that you select the SCSI-2 version.

6.4.10 <9> - TIMEOUT SELECTION

Timeout options determine how the Emulator will behave if the device being addressed does not respond in a timely manner. If enabled, timeout will abort the current command by issuing a SCSI RESET condition if the command has not completed within approximately two seconds.

It is important to disable timeout if you are going to issue a command that is not expected to complete within the timeout period, such as a tape rewind command, or a disk format command.

S E C T I O N 7

INSTALLATION

7.1 UNPACKING

Inspect the shipping carton for signs of damage before opening. If there is any evidence of damage, notify the carrier and Ancot immediately.

Remove the instrument and all accessories from the shipping carton, and compare the contents with the parts list accompanying the package, or listed on the packing slip. If any equipment is missing, contact the Ancot local representative, or Ancot directly as soon as possible.

You may want to save the shipping carton for return of the equipment for factory service, if that is required.

7.2 INITIAL TURN-ON

Connect the line cord to the AC module on the front panel of the Ultra-2080, and plug it into the three-pin 110-220 Volt wall outlet (the power supply is auto-ranging). If a three-pin outlet is not available, use a two-pin socket with a proper ground wire attached and connected to ground.

If you want to use an external keyboard with your Ultra-2080, connect its cord to the KBD connector. If you want to use a mouse, connect its cord to the mouse port on the front panel.

Turn the power ON. During the Power-UP sequence, all memories in the system are diagnosed automatically. You will be notified at this time if any errors are detected by the Power-UP diagnostic. If no errors are detected, the main menu will be displayed on the screen.

If a printer is to be used, connect it by a standard PC/AT printer cable to the DB-25 parallel port connector on the front panel of the Ultra-2080. The printer should be any standard parallel type. For the parallel DB-25 connector pinout see Appendix A.

The unit has all setup values preset to their defaults at the factory; all basic functions should be operational. However, setup values may be changed using the various selections in the individual menus, or directly from the main menu.

7.3 INITIAL CHECKOUT

Connect a SCSI cable to an active SCSI bus. Be sure that termination is appropriate. The TERMPWR LED located by the used SCSI connector should be on.

Press **<Run>**. Allow enough time for some activity to occur on the SCSI bus. You will see the SCSI Control and Data LEDs flash on and off with the activity. Press **<Stop>**.

Press **<Disp>** and **<Enter>**. If only AStart of Trace@ and AEnd of Trace@ are showing, contact the factory. You will see the recorded trace. Press **<Flip>** or AF@ to change the display format. You may want to experiment with other recording modes and with triggering at this point.

7.4 COMMUNICATION, INTERFACING, AND SETUP

When using a remote CRT terminal or PC connected via the Serial-1 port directly or over a modem, a compatible communication format and protocol must be used. To help the user to install, the Serial-1 I/O port is programmed at the factory to a default set of parameters. These are:

Serial-1 port:	9600 baud
	8 data bits
	no parity
	1 stop bit
	RTS and CTS is not used

Note that Serial-1 when communicating with a CRT terminal uses the X-On/X-Off protocol; only signal pins 2 and 3 are used.

Selections described above are stored in the non-volatile EEPROM, and do not need to be selected again, unless different values are required. Set different parameters using *ASerial Port Settings@* from the Utilities menu. This is described in Section 7.1.6.

If you have problems communicating with the Ultra-2080 because the serial port is configured wrong, you press the SCSI RESET push button and hold it down while resetting the unit with the SYSTEM RESET push button. You may do the same by turning the power off and on again,

while holding the SCSI RESET. This sequence will reset the Serial-1 port to its default (9600 baud) setting.

You may need to use this procedure only with the Ultra-2080/Lite, because you can access this analyzer only from the external terminal / PC. When using the Ultra-2080 portable model however, you can always restore defaults from the built-in screen and keypad, using the utilities *'restore defaults'* function. The internal screen and keyboard are independent from the Serial-1 port setting.

7.5 EPROM UPGRADES

Flash memory holds the executable programs that control all operation of the Ultra-2080 analyzer. The flash memory also holds the boot routine used for power up during normal operation. The EPROM holds the primary (very basic) boot code that is used only when there is no valid code in the flash memory. After a valid executable program (including boot) is loaded to the flash memory, the flash takes over.

We expect that the user will never need to replace the EPROM with the primary boot code. However, in this chapter we describe the procedure for replacing the EPROM just in case.

The following instructions explain how to install an updated primary boot code EPROM into your Ancot Ultra-2080 SCSI Bus Analyzer. If you decide that you want the factory to install your upgrade for you, contact Ancot directly.

- Remove the briefcase cover to reveal the instrument front plate.

- Make sure that all cables are disconnected from the front plate, including the power cable.

- Remove the 4 black Phillips screws (2 on each edge) holding the front plate to the briefcase housing.

- Carefully lift the front plate and the attached circuit boards and metal pan from the briefcase housing. Place the assembly on a flat surface.

- Locate the main circuit board. It is the largest PCB, attached directly to the metal pan on the bottom. Find the firmware EPROM to be replaced: it is the big 32-pin (.600") chip on the bottom of the main PCB, with an Ancot label. It has the Ultra-2080 instrument identification and firmware revision number printed on it. Use a flat blade screwdriver to disengage the EPROM from its socket.

- Insert the new version EPROM into the same socket. The small notch on the ceramic DIP chip should be on the same side with the marker on the PCB (orientation is the same as the other chips on that PCB). Be sure that all the pins are aligned with the holes in the socket, before pressing the chip firmly into the socket. Check the pins again to be sure none of them were damaged during insertion.

- To verify correct installation, apply power and the unit should display the main menu.

- Reinsert the electronics assembly into the briefcase housing. The handle of the briefcase should be at the top side of the display screen. Insert the eight screws to hold the electronics assembly in the briefcase housing. Tighten the screws firmly, but not overly so. Attach the briefcase lid.

Your Ultra-2080 is now ready for use with the upgraded EPROM.

7.6 FIRMWARE UPGRADES (Flash Memory)

Flash memory holds the executable programs that control all operation of the Ultra-2080 Analyzer and the hard disk contains other files used by the system (Help files, Web pages, etc.). In order to upgrade the Ultra-2080 operation, new firmware must be downloaded to the Flash memory through the Serial-1 port on the front panel. You must use a straight through cable and a communications program running on a PC. Ancot recommends using the PROCOMM set at a speed of 115.2 Kbaud. Downloading new firmware at the 115.2 Kbaud rate will take about 90 seconds.

The download program can be entered by selecting ALoad New Firmware@ from the Utilities menu. Another method of entering the download program is to press the SYSTEM RESET button on the Ultra-2080 front panel and then press the **<Esc>** key or the **Aq@** key when the following message appears:

To download new firmware press ESC or Aq@ now!!

This message will last for about 2 seconds.

Once the download program has been entered, select the fastest baud rate your communications program can use, with the right or left arrow. At this point, start the download from the PC using the communications program with the baud rate set to match the one selected on the Ultra-2080. Then press **<Enter>.** Next press **<Y>** to put the Ultra-2080 in the download mode. The message *"Waiting for S-Records"* will appear. This message will also appear on the screen of

the download program. If it does not appear, check the baud rate and the cables. The file to download is supplied as "u2080.chk" by Ancot. The progress of the download will be displayed on the screen. At the completion of downloading, the system will re-boot with the new firmware.

At this point, you must download the file Aancot.sys@ to the root directory of the Ultra2080 hard disk (AC:\@). The file Aancot.sys@ is a self extracting file which will install the necessary files during the next reboot.

The file Aancot.sys@ can be downloaded through the serial port using 1K Xmodem download protocol or through the Ethernet port using FTP. In either case, all settings were changed to the factory defaults after downloading the program (Au2080.chk@). You will have to change the serial port or the Ethernet settings to the desired values.

If you choose to download Aancot.sys@ using the serial port do the following:

1. Set the serial port to the proper settings (Utilities/Serial Port Settings) 115kBaud is recommended.

2. Start the download on the Ultra2080. (File/File Management/Receive (Xmodem) File). The default destination of AC:\ancot.sys@ is correct.

3. On your computer, start the 1K Xmodem download of the file Aancot.sys@.

4. When the transfer is complete, re-boot the Ultra2080 by pressing System Reset. During the boot process, the Ultra2080 detects the presence of the file Aancot.sys@ and asks the you if the new files are to be installed. Click < OK > or press return and the new files will be installed and the file Aancot.sys@ will be renamed to Aancotsys.bak@.

7.7 FLOPPY DISK DRIVE INSTALLATION

Install the optional floppy disk drive by connecting one end of the supplied cable to the drive, and the other end to the PARALLEL PRINTER connector on the front panel of the Ultra-2080.

The floppy diskettes are DOS compatible and may be used on any PC.

A P P E N D I X A

EXTERNAL CONNECTOR PIN ASSIGNMENT AND CABLES

A.1 I/O INTERFACE CONNECTORS

Parallel PRINTER Port (DB–25)

1	STB–	14	AFD–
2	PD0	15	ERR–
3	PD1	16	INIT–
4	PD2	17	SLIN–
5	PD3	18	GND
6	PD4	19	GND
7	PD5	20	GND
8	PD6	21	GND
9	PD7	22	GND
10	ACK–	23	GND
11	BUSY	24	GND
12	PE	25	GND
13	SLCT		

Serial-1 or Serial-2 I/O Ports RS–232 (DB–9)

1	DCD
2	RXD
3	TXD
4	DTR
5	Signal GND
6	DSR
7	RTS
8	CTS
9	RI

A.2 AUXILIARY CONNECTORS

Expansion Port (DB—15)

1	bit 0	9	+5 Volt *
2	bit 1	10	Signal GND
3	bit 2	11	Reserved
4	Reserved	12	Reserved
5	Reserved	13	Reserved
6	Reserved	14	Signal GND
7	Reserved	15	+5 Volt *
8	Reserved		

*) Up to 100 mA is available from this Vcc source.

External KEYBOARD PC/AT type Port marked "KBD"

1	CLK	4	Signal GND
2	DATA	5	+5 Volt
3	N.C.		

External TRIGGER INPUT (BNC)

center pin — Ext.Trigger signal
shell — Chassis GND

The signal should be TTL level. It is received in the input side of the LS14-type receiver. This line is internally pulled up by a 1k ohm resistor to the +5 volt level.

External SYNCH OUTPUT (BNC)

center pin — Ext.Synchr signal
shell — Chassis GND

A.3 SINGLE-ENDED/LVD CONNECTORS

68-pin HD 'P' type for S-E (Single-Ended)				68-pin HD ›P= type for the LVD (Low Voltage Differential)			
1	GND	35	D12—	1	D12+	35	D12-
2	GND	36	D13—	2	D13+	36	D13-
3	GND	37	D14•	3	D14+	37	D14
4	GND	38	D15•	4	D15+	38	D15-
5	GND	39	DPAR1•	5	DPAR1+	39	DPAR1-
6	GND	40	D0•	6	D0+	40	DO-
7	GND	41	D1•	7	D1+	41	D1-
8	GND	42	D2•	8	D2+	42	D2-
9	GND	43	D3•	9	D3+	43	D3-
10	GND	44	D4•	10	D4+	44	D4-
11	GND	45	D5•	11	D5+	45	D5-
12	GND	46	D6•	12	D6+	46	D6-
13	GND	47	D7•	13	D7+	47	D7-
14	GND	48	DPAR•	14	DPAR+	48	DPAR-
15	GND	49	GND	15	GND	49	GND
16	DIFFSENS	50	GND	16	DIFFSENS	50	GND
17	TERMPWR	51	TERMPWR	17	TERMPWR	51	TERMPWR
18	TERMPWR	52	TERMPWR	18	TERMPWR	52	TERMPWR
19	open	53	open	19	open	53	open
20	GND	54	GND	20	GND	54	GND
21	GND	55	ATN•	21	ATN+	55	ATN-
22	GND	56	GND	22	GND	56	GND
23	GND	57	BSY•	23	BSY+	57	BSY-
24	GND	58	ACK•	24	ACK+	58	ACK-
25	GND	59	RST•	25	RST+	59	RST-
26	GND	60	MSG•	26	MSG+	60	MSG-
27	GND	61	SEL•	27	SEL+	61	SEL-
28	GND	62	C/D•	28	C/D+	62	C/D-
29	GND	63	REQ•	29	REQ+	63	REQ-
30	GND	64	I/O•	30	I/O+	64	I/O-
31	GND	65	D8•	31	D8+	65	D8-
32	GND	66	D9•	32	D9+	66	D9-
33	GND	67	D10•	33	D10+	67	D10-
34	GND	68	D11•	34	D11+	68	D11-

A.4 DIFFERENTIAL HVD CONNECTORS

68-pin HD 'P' type for the HVD
(High Voltage Differential)

1	D12+	35	D12–
2	D13+	36	D13–
3	D14+	37	D14–
4	D15+	38	D15–
5	DPAR1+	39	DPAR1-
6	GND	40	GND
7	D0+	41	D0–
8	D1+	42	D1–
9	D2+	43	D2–
10	D3+	44	D3–
11	D4+	45	D4–
12	D5+	46	D5–
13	D6+	47	D6–
14	D7+	48	D7–
15	DPAR+	49	DPAR–
16	DIFFSENS	50	GND
17	TERMPWR	51	TERMPWR
18	TERMPWR	52	TERMPWR
19	open	53	open
20	ATN+	54	ATN–
21	GND	55	GND
22	BSY+	56	BSY–
23	ACK+	57	ACK–
24	RST+	58	RST–
25	MSG+	59	MSG–
26	SEL+	60	SEL–
27	C/D+	61	C/D–
28	REQ+	62	REQ–
29	I/O+	63	I/O–
30	GND	64	GND
31	D8+	65	D8–
32	D9+	66	D9–
33	D10+	67	D10–
34	D11+	68	D11–

A P P E N D I X B

ESCAPE SEQUENCES FOR SCREEN CONTROL

B.1 GENERAL

Any terminal or computer emulating a terminal connected as a remote display device for the Ancot Ultra-2080 SCSI Bus Analyzer will need to recognize and act on the following Escape sequences. Each sequence begins with an introducer sequence, followed by one or more parameters, followed by a terminating character.

The introducer sequence is either a single Esc character (1B hex) or the Esc character followed by a single '[' character (5B hex).

Parameters are decimal numbers transmitted as the ASCII characters '0' (30 hex) through '9' (39 hex). Parameters are separated from each other by a semicolon (3B hex). In cases where the parameter value is negative, the semicolon is replaced by a colon (3A hex). There are no negative parameters in any of the sequences currently used.

The terminating character is always a printable ASCII character, usually either an upper or lower case letter. Terminating characters differ depending on the purpose to be accomplished by the escape sequence.

B.2 ESCAPE SEQUENCES - OUT (from Ultra-2080 to Terminal)

CHARACTER ATTRIBUTE SEQUENCES:

<Esc>[0m	Sets attribute to normal video (bright character on dark background)
<Esc>[7m	Sets attribute to inverse video (dark character on bright background)

SCREEN CLEARING SEQUENCES:

<Esc>[0J	Clears from cursor to end of screen
<Esc>[2J	Clears entire screen
<Esc>[0K	Clears from cursor to end of line
<Esc>[2K	Clears entire line
<Esc>[L	Insert line

CURSOR MOVEMENT SEQUENCES:

Sequence sent to the terminal to move the apparent location of the cursor displayed:

<Esc>[<row>;<column>H Move cursor to row <row> and column <column>.

For all movement commands, the screen is assumed to have 25 rows, numbered from 1 to 25, and 80 columns, numbered from 1 to 80. If a parameter is missing or outside the range, 1 is used.

B.3 ESCAPE SEQUENCES - IN (from Terminal to Ultra-2080)

<Esc>A	Move cursor up
<Esc>B	Move cursor down
<Esc>C	Move cursor right
<Esc>D	Move cursor left

A P P E N D I X C

TRACE UPLOAD / DOWNLOAD FORMATS

C.1 HEADER / TRAILER INFORMATION

Each file transmitted has a 128-byte header, consisting of the following fields:

Byte	Field
0-9	"Ultra-2080 " (ASCII string)
10-26	Address range. The first value is 8 hex digits, with leading 0's, representing the first trace address transferred. A hyphen only (no spaces) separates the first value from the second. The second value, also 8 hex digits, represents the last trace address transferred.
27	" " (an ASCII space character, 20 Hex)
28	File format code. The following codes are in use: "B" = Binary display format "D" = Diagnostic format (not accessible by customers) "H" = Hex dump format "R" = Raw Data format "S" = Structured display format "X" = Xmodem
29	space
30-33	recording mode. This is a 32-bit, bit-significant code for the recording mode used to obtain this trace. The bits are : bit — meaning 0-1 — edge mode: 01=1 edge, 10=2 edges, 11=4 edges 2-4 — not used 5 — Phase changes before REQ enabled 6 — Record on external clock enabled 7 — Capture SCAM protocol 8-31 — not used
34-126	spaces
127	"#"

After the file is transferred, a trailer character ASCII EOT (hex 04) is transmitted. This signals the end of transfer. If required by your communications package, halt the transfer and save the file on disk.

C.2 RAW DATA FORMAT

The Raw Data format is the only one that can be loaded back into the Ultra-2080 for further viewing or more analysis. The determining factor is the presence of the header record that is transmitted during upload. If this record is missing, in the wrong format, or otherwise corrupted, downloading will be aborted. Also, if a SCSI event record cannot be interpreted, downloading will be aborted.

The Raw Data file format is ASCII coded hexadecimal. Each SCSI event (8 bytes) is followed by a line feed/carriage return combination.

C.2.1 NATURAL SCSI EVENTS

Natural events are those captured as a result of a transition on a SCSI control line. The exact recording mode is as set in the Mode Menu. See also Section C.2.2 below.

The Ultra-2080 SCSI Bus Analyzer uses a special high resolution recording method for the REQ & ACK signals. These signals show as REQ# and ACK# here. The 0 bit (REQ0) is the state at the time of capture; the 1 bit (REQ1) = 4 ns before capture, the 2 bit (REQ2) = 8 ns, the 3 bit (REQ3) = 12 ns, and the 4 bit (REQ4) = 16 ns.

Normal trace events are those captured as a result of a transition on a SCSI control line or as a result of a time stamp being inserted by the trace hardware. The exact recording mode is as set in the Trace Options menu. Artifical trace events are placed in trace memory by the recording hardware or by software. A trace event consists of six bytes. The first four bytes are always meaningful and the last two bytes are only meaningful when recording in 4-edge mode. The high bit of each trace event is a Flag bit. If this bit is zero, the trace event is a natural trace event. If this bit is a one, the trace event is a time stamp or an artifical trace event.

The time stamp has a resolution of 20 nsec. The time stamp is the total accumulation of time since the start of tracing

The tables below describe both natural and artifical trace events. Standard SCSI signal definitions apply to signals ATN, BSY, SEL, RST, MSG, C/D, and I/O. Other abbreviations used below are:

Flag	Flag bit. 1 = Artifical trace event, 0 = Natural trace event
ACK, REQ	ACK or REQ starts in this trace event
Trig	Trigger condition has occurred before this event

Exp2, Exp1, Exp0	Expansion port bits 0 - 2
PEH, PEL	Set if low and/or high data byte has a parity error
REQ16 - REQ0	4 nsec resolution for REQ
ACK16 - ACK0	4 nsec resolution for ACK
T0 - T23	Low time stamp (20 nsec resolution)
T24 - T47	High time stamp
Offset counter	REQ/ACK offset
Data Count	Total bytes of data transfered during the proceeding Data Phase

P Normal Trace Event Bit Definitions (One and Two Edge Mode)

The second four bytes of the trace event are invalid. All normal trace events have the Flag bit set to 0.

Case 1. Valid edge of REQ or ACK or any non Data Phase
REQ and Data In Phase, or ACK and Data Out Phase, or non-Data Phase

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Flag	ACK	REQ	ATN	Trig	Exp2	Ex1	Exp0	PEH	PEL	BSY	SEL	RST	MSG	C/D	I/O
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Case 2. Invalid edge of REQ or ACK during the Data Phase
no REQ and Data In Phase, or no ACK and Data Out Phase

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Flag	ACK	REQ	ATN	Trig	Exp2	Ex1	Exp0	PEH	PEL	BSY	SEL	RST	MSG	C/D	I/O
REQ/ACK Offset Counter								1	0	1	0	1	1	0	0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Case 3. BSY goes away from previous trace event (not artificial event) to this trace event.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Flag	ACK	REQ	ATN	Trig	Exp2	Ex1	Exp0	PEH	PEL	BSY	SEL	RST	MSG	C/D	I/O
Data Count Mid								Data Count Low							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Case 4. BSY goes away plus one event

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Flag	ACK	REQ	ATN	Trig	Exp2	Ex1	Exp0	PEH	PEL	BSY	SEL	RST	MSG	C/D	I/O
1	0	1	0	1	0	1	1	Data Count High							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

P Normal Trace Event Bit Definitions (Four Edge Mode)

If recording in four edge mode, the first four bytes are the same as one and two edge mode. For each transition of REQ or ACK, the next two bytes of trace memory contain a finer resolution for timing and the last two bytes are invalid. Each bit in the register represents four ns.

.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
0	0	0	REQ 16	REQ 12	REQ 8	REQ 4	REQ 0	0	0	0	ACK 16	ACK 12	ACK 8	ACK 4	ACK 0
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

P Time Stamp Trace Event Bit Definition

For the Time stamp trace event, the Flag Bit is set to 1.
If there is one time event, it will be the low time stamp. If there are two time stamps in a row, the first is the low time stamp and the second is the high time stamp.

Case 1. Low time stamp (0x80).

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
1	0	0	0	0	0	0	0	T23	T22	T21	T20	T19	T18	T17	T16
T15	T14	T13	T12	T11	T10	T9	T8	T7	T6	T5	T4	T3	T2	T1	T0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Case 2. High time stamp (0x80).

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
1	0	0	0	0	0	0	0	T47	T46	T45	T44	T43	T42	T41	T40
T39	T38	T37	T36	T35	T34	T33	T32	T31	T30	T29	T28	T27	T26	T25	T24
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

C.2.2 ARTIFICIAL SCSI EVENTS

In addition to the events captured as a result of transitions on the SCSI control lines, there are three types of artificial events written to the trace during recording. Each time the tracer is started by pressing **<Run>**, a **'start trace'** event is written, which has the pattern F1 hex in the high bytes of trace memory. Similarly, a **'pause in tracing'** is marked by the pattern F3 hex, and the **'end of tracing'** has the pattern F2 hex. For these events, the time-stamp and REQ/ACK bytes of the SCSI event will all be 0's, and the SCSI data word will contain a pattern telling the recording mode used during that tracing session. See the following tables.

P **Artificial Trace Event Bit Definition (Non-time stamp)**

For the Time stamp trace event, the Flag Bit is set to 1. If there is one time event, it will be the low time stamp. If there are two time stamps in a row, the first is the low time stamp and the second is the high time stamp. The fourth byte of the trace event contains the trace mode.

Case 1. Start of Trace (0xF1)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
1	1	1	1	0	0	0	1	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	SCAM	EXT INP	ALL PHASES	-	-	-	EDGE MODE 1	EDGE MODE 0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Case 2. End of Trace (0xF2)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
1	1	1	1	0	0	1	0	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	SCAM	EXT INP	ALL PHASES	-	-	-	EDGE MODE 1	EDGE MODE 0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Case 3. Pause Trace (0xF3)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
1	1	1	1	0	0	1	1	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	SCAM	EXT INP	ALL PHASES	-	-	-	EDGE MODE 1	EDGE MODE 0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

TRACE MODE BITS

Bit	Name	Meaning
7	SCAM	SCAM Enables capturing SCAM-significant SCSI transitions
6	EXT INP	External Input Enables capturing an event on the rising edge of the external input signal.
5	ALL PHASES	All Phases When this bit is a one, the trace acquisition logic generates events on changes on the following signals: BSY, SEL, ATN, RST, REQ/ACK, MSG, CD, I/O. When this bit is a zero, the trace acquisition logic generates events on changes on the following signals: BSY, SEL, ATN, RST, REQ/ACK.
4		Unused
3		Unused
2		
1	EDGE MODE 1	These two bits define the recording mode as either one edge, two edge, or four edge mode. (See below)
0	EDGE MODE 0	

EDGE MODE BITS

Bit 1	Bit 0	Meaning
0	0	Invalid
0	1	**ONE EDGE REQ/ACK** The trace acquisition logic generates an event on the rising edge of REQ (if I/O is asserted) **or** the rising edge of ACK (if I/O is disserted)
1	0	**TWO EDGE REQ/ACK** The trace acquisition logic generates an event on each rising edge of REQ and ACK
1	1	**FOUR EDGE REQ/ACK** The trace acquisition logic generates an event on each rising and falling edge of REQ or ACK

The time stamp counts ticks since recording started; each tick is 20 ns.

C.3 READABLE FORMATS

In addition to the Raw Data format, it is possible to upload in either Structured, Diagnostic, or Hex Dump format. In these formats, the file will contain trace information just as it appears on the screen of the Ultra-2080 when displaying in these formats. These formats cannot be downloaded back into the Ultra-2080.

A P P E N D I X D

THE SCAM PROTOCOL

D.1 GENERAL

The ASCSI Configured AutoMatically@ (SCAM) protocol is a new addition to the SCSI-3 parallel standard, which enables assignment of SCSI IDs to individual devices automatically and totally under software control. The SCAM protocol has been designed to tolerate and to allow coexistence of legacy devices with hardwired IDs (jumpers) and the new SCAM-capable devices on the same SCSI cable.

We refer the reader to the SCSI-3 specification (document: SCSI-3 Parallel Interface 'SPI', Annex B) for detailed description of the protocol. In this document, we will only outline the concepts of SCAM.

The SCAM protocol is defined on two levels:

1. Level-1 SCAM master devices use hard IDs. Only a single level-1 SCAM master is allowed on the bus. The SCAM slave devices must power up before or at the same time as the master. This protocol level can be implemented using most of the currently available SCSI controller chips.

2. Level-2 SCAM master devices may use hard or soft IDs. There may be multiple level-2 SCAM masters on the bus. The SCAM masters and slaves may power up independently. This protocol level may require a new generation of SCSI controller chips.

The SCAM ID assignment sequence executes as the first thing after power up, or after SCSI reset. The sequence is as follows:

First, the SCAM master (the host adapter) scans the bus for hardwired IDs (the legacy devices), and builds a table of IDs already assigned. The SCAM devices are designed to ignore these short-duration selections.

Second, the SCAM master assigns the soft IDs to the SCAM capable devices. This is

done using a modified Selection phase, with the MSG line asserted by the master, and with no data bits being driven on the data bus. The BSY and SEL stay asserted to hold off the legacy devices. All SCAM devices now "wake up" and participate in the protocol. The devices drive certain control lines (C/D and I/O); they execute certain sequences on the D5, D6, and D7 lines, and use the lower five data bits for transferring information about ID which they (the slaves) prefer. The slaves then receive ID confirmation from the SCAM master via these low order bits. The SCAM protocol will assign IDs 0 through 7 on a Narrow bus, and IDs 0 through F hex on a Wide bus. The soft IDs come from the pool of IDs available following the hard ID scan.

The SCAM protocol executes during the boot process. This may take a few seconds, depending on how many devices are on the bus.

SPECIAL SITUATIONS:

What if there is no SCAM host adapter? Does that imply that all SCAM devices will respond slowly to Selection? "No". Each SCAM device is shipped with a preferred ID number. For example, external disk drives will ask for ID 6.

Can there be more than one SCAM host adapter on the bus? "Yes, but" there is a SCAM function code which initiates a "dominant master contention" protocol. The first host adapter to win an Isolation becomes the master for that SCAM protocol sequence. All others become slaves.

What if you have a non-SCAM master and several devices with the same preferred ID? In that case, the bus will have the same problems as SCSI-2 today, when multiple devices want the same ID. This is solved the same way, with jumpers on the devices to select a unique ID. SCAM doesn't magically make old devices work, but it also doesn't make them any worse.

D.2 USING THE Ultra-2080 FOR SCAM

D.2.1 ACTIVATING THE SCAM DISPLAY

- Go to the Mode menu by selecting ATracing/Mode@ from the main menu.

- Select **A**Capture SCAM Protocol@ and press <Enter>. This will also turn ON capture of the Phase Changes (item 2). Both of these must be ON for SCAM tracing.

- Start tracing by pressing **<RUN>** from any of the normal places. The SCAM Protocol will be captured automatically when it occurs.

See Section 3 for a display of a SCAM trace in structured and binary display format.

A P P E N D I X E

USING THE PC & PROCOMM or Win95 HYPERTERMINAL

There are several communications programs which could be used for the remote control or up/downloading of programs or traces from/to the Ultra-2000 analyzer. In this Appendix, we will describe using the PROCOMM program and the Windows95 HyperTeminal, as examples.

E.1 REMOTE CONTROL - USING THE PROCOMM

E.1.1 SETTING UP PROCOMM OPTIONS

First, we assume that your copy of PROCOMM has been installed properly. Start the program by typing **PCPLUS** followed by **<Enter>**, and the initial screen will be displayed. Then press any key to enter the terminal emulation mode. There is a good chance that the PROCOMM interface is set up the way you need it, and that PROCOMM displays a good screen.

If you need to change the baud rate of PROCOMM to match that of the Ultra-2080, enter **<Alt-P>** and choose the correct settings.

However, if the setup of PROCOMM is wrong, almost any kind of erratic behavior can be expected. To correct it, type **<Alt-S>** and you will enter the PROCOMM SETUP so that you can select correct options. The following menu will be displayed:

```
   MODEM OPTIONS
▸  TERMINAL OPTIONS
▸  DISPLAY/SOUND OPTIONS
▸  GENERAL OPTIONS
   HOST MODE OPTIONS
▸  FILE/PATH OPTIONS
   COLOR OPTIONS
▸  PROTOCOL OPTIONS
   EDITOR OPTIONS
   SAVE SETUP OPTIONS
```

You need to edit only the few selections marked by '▸' above.

A. TERMINAL OPTIONS:

```
A - Terminal emulation        VT-100
B - Duplex                    FULL
C - Soft flow ctrl (XON/XOFF) ON
D - Hard flow ctrl (RTS/CTS)  OFF
E - Line wrap                 ON  (Don't Care)
F - Screen scroll             ON  (Don't Care)
G - CR translation            CR
H - BS translation            NON-DESTRUCTIVE
I - Break length (millisecs)  350 (Don't Care)
J - Enquiry (ENQ)             OFF (Don't Care)
K - EGA/VGA true underline    OFF (Don't Care)
L - Terminal width            80  (Don't Care)
M - ANSI 7 or 8 bit commands  8 BIT
```

B. DISPLAY/SOUND OPTIONS

In this options menu, all selections are "Don't Care", except the 'F'.
Set it as follows:

```
F - Status line               OFF
```

C. GENERAL OPTIONS

In this options menu, all selections are "Don't Care", except the 'B'.
Set it as follows:

```
B - CD high at exit           IGNORE
```

D. FILE/PATH OPTIONS

We recommend that you check the selected download path. The default path for the downloaded file is:

```
C:\PCPLUS\DOWNLOAD
```

You should change it to whichever directory you prefer to use.

E. PROTOCOL OPTIONS

When selected, the following sub-menu will be displayed first:

```
  GENERAL OPTIONS
▸ ASCII PROTOCOL OPTIONS
  KERMIT PROTOCOL OPTIONS
  ZMODEM PROTOCOL OPTIONS
  EXTERNAL PROTOCOL OPTIONS
```

Select ASCII PROTOCOL OPTIONS and the following detailed selection sub-menu will be displayed. All selections here are "Don't Care", except the ones listed below.
Set them as follows:

```
D - Character pacing (millisec)  0
E - Line spacing (1/10)          0
G - Strip 8th bit                NO
I - CR translation (upload)      NONE
J - LF translation (upload)      NONE
K - CR translation (download)    NONE
L - LF translation (download)    NONE
```

When finished with all these selections, press **<Esc>** three times and save changes when prompted, or when PROCOMM returns to the terminal emulation screen.

The next two sections describe how to execute the SAVE TRACE TO HOST (upload) and RESTORE TRACE FROM HOST (download) functions using the PROCOMM program. It is assumed that you correctly connected together the serial ports of the Ultra-2080 and the PC. Use the serial straight through cable supplied by Ancot (see the pinout in Appendix A) and connect the SERIAL-1 DB-9 connector on the Ultra-2080 to the COM port on the PC.

E.1.2 SAVE TRACE TO HOST

E.1.2.1 ASCII TRANSFER

ON THE PC:

- start PROCOMM as described in setup, and enter the terminal emulation mode.
- press **<PgDown>** to activate the upload function.
- select **<A>** for ASCII format from the intermediate menu (all Ultra-2080 data formats are printable ASCII as transferred on the line).
- as a response to the prompt, type the filename where you want to save the trace.
- at this point, hold off pressing the **<Enter>** until the Ultra-2080 is ready.

ON THE Ultra-2080:

Starting from the main menu

- select file
- select ASend Trace@
- select ASerial Port (ASCII)@. You can select any other format, but remember that only the raw data format can be restored.
- select the starting and ending addresses to the define section of the trace to be saved. (the default would be the full size used)
- select <OK>
- at this point, **hold off confirming** the transfer (i.e., do NOT press **<Y>** !!) until the PC is ready.

ON THE PC:

- press **<Enter>** to start the upload function.

ON THE Ultra-2080:

- press **<Y>** to see the address counter on the Ultra-2080 counting and the data being listed on the PC. When the transfer is finished, message **"- finished -"** will be displayed on the Ultra-2080 screen, and the EOT character (♦) will be displayed after the last data line on the PC.

Press **<Esc>** on the PC to stop the transfer and save the file.
The trace is now saved on the PC in the designated file.
Exit PROCOMM by typing **<Alt-X>** on the PC.
Return to the main menu on the Ultra-2080 by typing **<Esc>**.

E.1.2.2 XMODEM TRANSFER

ON THE PC:

- start PROCOMM PLUS, as described in setup, and enter the terminal emulation mode.
- press **<PgDown>** to activate the upload function.
- select **<X>** for XMODEM
- as a response to the prompt, type the filename where you want to save the trace.
- at this point, PROCOMM will display a progress box and wait for the transfer to begin.

ON THE Ultra-2080:

Starting from the main menu

- select AFile@
- select ASend Trace@
- select ASerial Port (XMODEM)@
- select the starting and ending addresses of the section of the trace to be saved (the default is the full trace)
- select <OK>
- at this point, the XMODEM transfer should start.

You will see the address counter on the Ultra-2080 counting, and the progress box in PROCOMM will be counting. When the transfer is finished, you can exit PROCOMM by typing **<Alt-X>** on the PC. You can return to the main menu on the Ultra-2080 by typing **<Esc>.**

E.1.3 RESTORE TRACE FROM HOST

E.1.3.1 ASCII TRANSFER

ON THE PC:

- start PROCOMM and enter the terminal emulation mode
- press **<PgUp>** to activate the download function
- select **<A>** for ASCII format from the intermediate menu (all Ultra-2080 data formats are in ASCII as transferred on the line)
- in response to the prompt, type in the filename where the previously saved trace was stored
- at this point, **hold off pressing <Enter>** until the Ultra-2080 is ready.

ON THE Ultra-2080:

From the main menu on the Ultra-2080:

- select AFile@
- select AReceive Trace@
- select ASCII transfer
- press **<OK>** to confirm the start of transfer.

ON THE PC:

- press **<Enter>** on the PC to start the restore operation.

ON THE Ultra-2080:

The address counter on the Ultra-2080 will count as the data is being transferred. When finished, the Ultra-2080 clears the screen and returns to the main menu.

The trace has now been restored to the Ultra-2080 trace memory and can be displayed using **<D>**.

Exit PROCOM by typing **<Alt-X>** on the PC.

E.1.3.2 XMODEM TRANSFER

ON THE Ultra-2080:

From the main menu

- select AFile@
- select AReceive File@
- select Xmodem transfer
- at this point, the Ultra-2080 is waiting for the transfer to begin.

ON THE PC:

- start PROCOMM (as described in setup) and enter the terminal emulation mode
- press **<PgUp>** to activate the download function
- select **<X>** for XMODEM
- responding to the prompt, type the filename where the previously saved trace was stored
- at this point the transfer should start and PROCOMM will display a progress box.

You will see the address counter on the Ultra-2080 counting, and the progress box in PROCOMM will be counting. When the transfer is finished, exit PROCOMM by typing **<Alt-X>** on the PC. Return to the main menu on the Ultra-2080 by typing **<Esc>**.

E.2 REMOTE CONTROL - USING THE Win95 HYPERTERMINAL

The following is a step by step procedure for successfully setting up your unit to run remotely with HyperTerminal.

Step 1: Turn the power to the Ultra2080 on and attach the Ancot serial cable to the serial port on the Ultra2080.

Step 2: While your PC is off, insert the other end of the Ancot serial cable into an available COM port on your PC.

Step 3: Turn on your PC and select the Hypertrm icon (under Start / Programs / Accessories / /HyperTerminal). HyperTerminal will walk you through a set-up sequence for a new connection.

Step 4: In the dialog box titled "Connection Description" (if you don't see it pull it up by selecting File/New Connection). Enter a name that you will remember (e.g.U2080), and select an icon.
Click on the "OK" button.

Step 5: HyperTerminal will route you to a dialog box with the heading "phone Number". In the 'Connect Using" field select the COM port to which you attached the serial cable (under File/Properties/Phone Number/Connect using:).
Click on the "OK" button.

Step 6: You should now be looking at a dialog box titled COM Properties (under File/Properties/Phone Number (tab)/Configure (button)). Make the following selections:

Bits per second: 9600 (can be set as high as 115.2k)
Data bits: 8
Parity bits: None
Stop bits: 1
Flow Control: Xon/Xoff

Step 7: Next, click on the File menu and select Properties. Click the Settings tab and set emulation to VT100.
Click on the "O.K." button.

Step 8: On the Ultra2080, selectUtilities/Serial Port Settings ..
Make sure that the selections you chose in Step-6 are the same on the Ultra2080.

Step 9: On the Ultra2080, select Utilities/Remote Control

Step 10: You should now be connected to your Ultra2080.
Press the <Esc> key to display the Main Menu.

Note (1): With the Ultra2080 Lite press System Reset to return to the Main Menu.
Note (2): Make sure that the baud rates match both on the Ultra2080 and on HyperTerm. You should be using the highest baud rate which your computer can support.

A P P E N D I X F

SCSI FACTS & TIPS

F.1 GENERAL

The importance of proper cabling and termination in SCSI systems can never be emphasized enough. Poor cabling or termination often results in erratic operation, or may cause the system not to operate at all. Erratic operation is the worst; the less often errors occur, the more difficult it is to diagnose their source. Speed of transmission over the bus is also an important factor in determining whether the marginal connection causes errors; this is becoming more and more a factor with the ever increasing speeds of the new SCSI devices.

F.2 CABLING

We recommend using good quality cables. Always use cable with twisted pairs, whether the flat or the round type. As a rule, do not use the non-twisted type for external connections. Its sensitivity to electrical noise and crosstalk often results in low signal quality and low electrical margin, causing troubles not worth the small financial savings. To ensure good quality, buy cables from a reputable vendor.

F.3 ELECTRICAL CONNECTION & TERMINATION ON THE SCSI BUS

There are three alternatives: the SE (Single-Ended), the HVD (High Voltage Differential), and the LVD (Low Voltage Differential) interfaces. These alternatives are mutually exclusive, and can not be mixed on the same SCSI bus system; all devices and both terminators on the same SCSI bus must use the same kind of interface. All signals should be terminated at both ends of the cable. The only exception is for the SE and LVD interface coexistence. The SE and LVD, when connected to the same physical cable, default automatically to SE operation if at least one SE device is detected (by sensing the DIFFSENSE line).

The LVD interface is highly recommended for all SCSI busses with Ultra and higher transfer rates, however, the SE and HVD can and will be used in the future too.

The SCSI cable is used as a transmission line, and its termination is very important. According to the SCSI specifications, as well as to good engineering practice, the SCSI cable should be terminated on both physical ends. If more devices are connected to the same cable, then only the last ones, as positioned on the SCSI cable, should have the terminators. Exactly two terminators should be used.

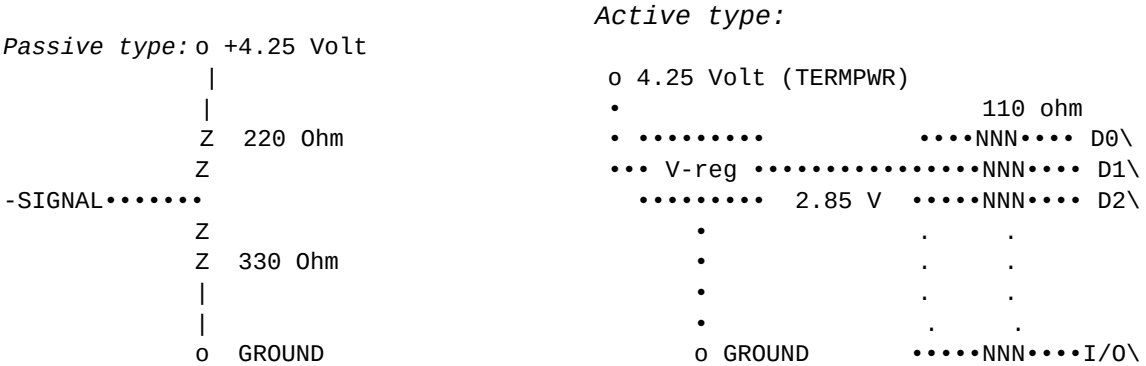
Termination is straightforward when using a SCSI adapter in the host computer connected to a single disk drive. In such case, terminators have to be installed in both the SCSI Host Bus Adapter (HBA) and the disk. This is often the case when peripherals are built into the system, such as an internal disk drive.

It becomes more complicated if the same SCSI bus is connected to internal devices and also to external devices, such as an external CD-ROM drive or a backup tape drive. In such cases, you have to determine what are the physical ends of the cable, and place terminators in those devices. Terminators in all other devices should be disabled. In systems with the internal cable brought out to the back panel, where you would only occasionally be attaching external peripherals, it may be practical to use one terminator permanently installed in the SCSI adapter inside the chassis, and to use a removable external 'plug-in' terminator in the external SCSI connector on the back panel of the host chassis. This external terminator can then be removed when attaching an additional external SCSI peripheral (e.g., tape for back-up), and inserted in the second daisy chained SCSI connector on the external peripheral.

F.3.1 SINGLE-ENDED ALTERNATIVE

This alternative uses transfer over a single "live" line in reference to GROUND. "True" signal is defined as a low level (0 to .8 V), and "False" signal is defined as a high level (2.0 to 5.25 V).

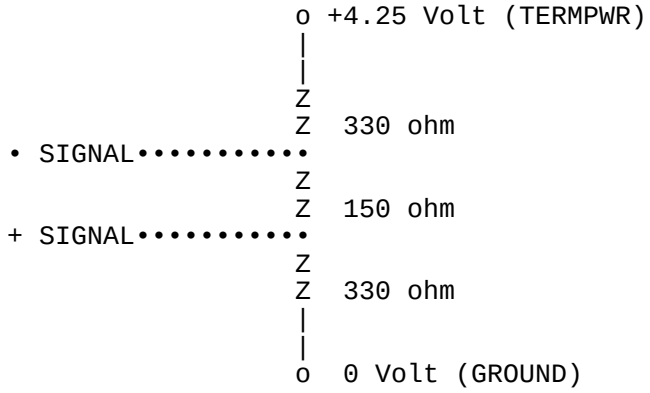
SINGLE-ENDED TERMINATION:



F.3.2 HIGH VOLTAGE DIFFERENTIAL (HVD) ALTERNATIVE

This alternative uses transfers over two electrically symmetrical lines denoted +SIGNAL and -SIGNAL. The "True" signal is defined as +SIGNAL more positive than -SIGNAL, and the "False" signal is defined as +SIGNAL more negative than -SIGNAL.

DIFFERENTIAL TERMINATION:

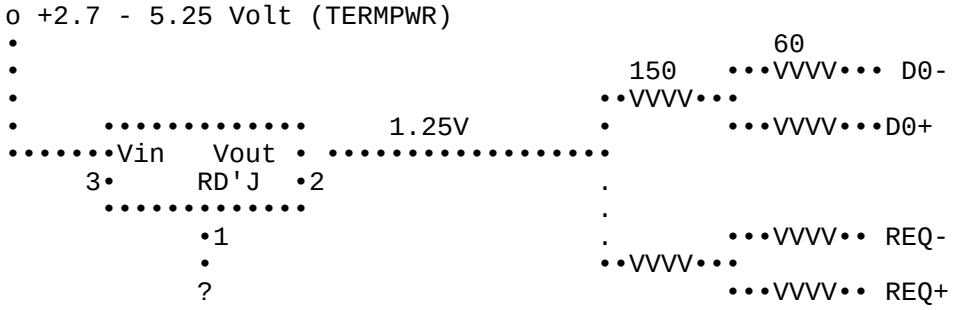


Note: The HVD interface is electrically more robust than the SE, therefore there was no need to develop a more expensive active type terminator.

F.3.3 LOW VOLTAGE DIFFERENTIAL (LVD) ALTERNATIVE

This alternative uses transfers over two electrically symmetrical lines denoted +SIGNAL and -SIGNAL. "True" signal is defined as +SIGNAL more positive than -SIGNAL, the "False" signal is defined as +SIGNAL more negative than -SIGNAL.

LVD TERMINATION (active type):



NOTE & WARNING

It is important to remember that the terminator must match the interface type: single-ended interfaces must use single-ended terminators; differential interfaces must use differential terminators.

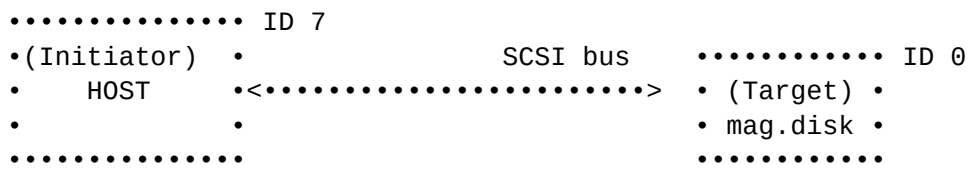
In case of single-ended terminators, there are two types available: 'passive' and 'active'. The 'active' type S-E terminator is electrically better since it provides higher noise immunity. It is permissible to mix the two S-E terminator types: you can use the 'passive' type on one end of the SCSI cable, and the 'active' type on the other end of the same cable.

F.4 THE TERMINATOR POWER (TERMPWR)

The terminators are sometimes implemented as SIP resistors (the passive type) which are inserted in a socket near the SCSI connector on the device itself, or on the SCSI adapter. Sometimes the terminators are in the form of external "through-connector" type plug-ins. The SCSI devices often provide the power (TERMPWR) for their own terminators internally; however, do not rely on that. The TERMPWR (pin 26 on the 50-pin SCSI cable) is specified to be at least 4.0 volts (SCSI-1 spec), or 4.25 volts (the newer SCSI-2 spec). Experiments show that the higher the TERMPWR (up to 5.25 volts maximum), the better the noise immunity. Also, it is not sufficient to measure TERMPWR level at the source. Sometimes a device does not provide its own TERMPWR, and uses it from the SCSI cable. There may be no problems if the cable is short. However, if the cable is long, then you have to consider the voltage drop across the full length of the cable. You may discover that the TERMPWR at the terminator, where it is finally used, is lower than the specified limit.

F.5 SCSI INITIATORS & TARGETS

There are two kinds of devices on the SCSI bus: the SCSI Initiators start the communication, and the Targets respond. The Initiators are devices that request commands to be carried out. Targets are devices that carry out commands. SCSI host adapters are Initiators, but at times, the host adapter may need to act as a Target for some commands. SCSI peripheral devices are Targets, but for some commands e.g., a COPY command, the peripheral may need to act as an Initiator temporarily. The single-byte SCSI bus (SCSI-1 or SCSI-2 Narrow) supports up to eight devices, in any mix of Initiators and Targets, with the limitation that at least one Initiator and at least one Target are present. The SCSI-2 Wide bus supports up to 16 devices.



A SCSI system may be as simple as a single computer with SCSI host adapter connected by cable to a single SCSI Target device, such as a disk drive.

F.6 SCSI DEVICE ADDRESSING

Each device on a SCSI cable must use its own ID# address. The SCSI ID# (initiator or target address) of each SCSI device connected must be selected by setting the proper jumpers or switches on the SCSI device itself. Each ID# must be unique; duplicate addresses may hang the whole SCSI bus, or may result in unpredictable behavior. This latter case may be difficult to identify.

You may not need to be concerned about SCSI IDs on working systems. However, as a rule, always verify SCSI ID# selections when adding a new device to an existing SCSI system. Most SCSI peripherals are shipped from the factory with the SCSI ID# set to 0.

The newer SCSI devices (starting in 1994) have their SCSI IDs assigned automatically without the need for mechanical jumpers. This method is defined in the SCSI-3 SCAM protocol standard document. A brief description of SCAM is in Appendix D.

F.7 SCSI DATA PARITY

The data path on the SCSI bus consists of 8 data lines and 1 parity line (on the 'Narrow' bus). SCSI-1 specified parity as an option, however in SCSI-2 it became mandatory. You can expect that practically all systems in operation today support parity. The only catch may be that on some devices of the SCSI-1 variety, parity could be disconnected and has to be enabled by a jumper. On some systems parity error, if detected, will be reported, but the system remains operational; on other systems, parity errors will cripple its operation.

F.8 MIXING S-E & HVD SCSI DEVICES

The S-E and HVD interfaces are mutually exclusive. The SCSI bus must use either all SE, or all HVD components. In situations when you need to connect SE and HVD devices together on the same SCSI bus, you must use a S-E to HVD Converter, such as the Ancot model SED-608 for the Narrow bus, or model SED-616 for the 2-byte Wide bus.

F.9 MIXING S-E & LVD SCSI DEVICES

The S-E and LVD interfaces have compatible connector pin assignments. The odd numbered connector pins carry the negative lines for both the S-E and LVD; even numbered pins carry the positive lines for the LVD, and grounds for the S-E interface. The compatibility between the two is limited; many new SCSI devices use LVD but will switch automatically to S-E if they detect a device on the same cable that uses S-E interface (by sensing the DIFFSENSE line). This capability is called *Multi-Mode* .

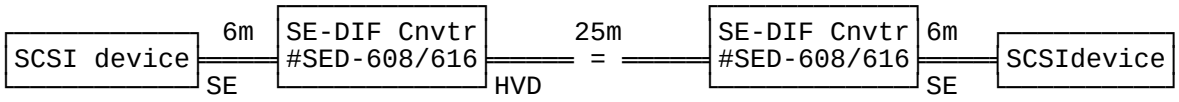
F.10 SCSI CABLE LENGTH

The maximum cable lengths recommended by the SCSI specification are 6 meters for the single-ended bus, and 25 meters for the HVD bus. These lengths are recommended for configurations where you need to achieve the maximum specified performance. However, in many situations where longer lengths are required, maximum performance is not the issue. Remember that you can extend the cable length significantly, especially in low noise environments, or if slower transfer rates are used and all design standards are respected.

F.11 EXTENDING THE SCSI CABLE

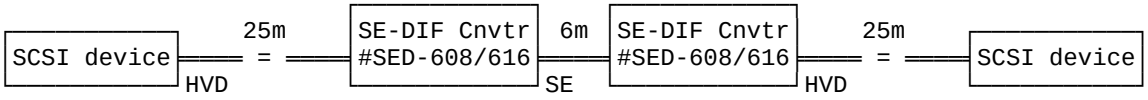
The total length of the cable, for maximum performance at the maximum transfer rates of 5 MHZ as recommended by the SCSI specification, is 6 meters for S-E or 25 meters for HVD configurations. The total allowable cable length is shorter and shorter as the transfer rates increase. Fortunately, it is possible to extend SCSI cable length considerably by using SE to HVD converters. Several schemes are possible, depending on how much distance is needed and which interface is used on the SCSI devices. Some examples:

Example 1:



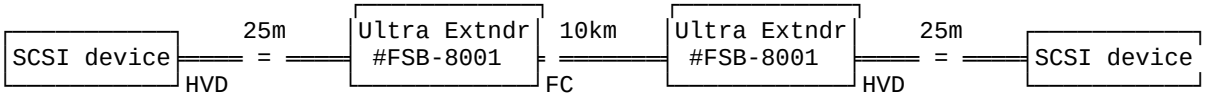
Total distance is 37 meters (6 + 25 + 6)

Example 2:



Total distance is 56 meters (25 + 6 + 25)

Example 3:



Total distance is 10 kilometers

Example 4:



Total distance is 31 meters (25 + 6)

The FSB-8001/8002 Ultra SCSI Bus Extenders use standard Fibre Channel optical fiber cable, either multimode for distances up to 1.25 miles (about 2 km), or single mode for distances up to 6 miles (about 10 km).

The Converters do not occupy any SCSI ID, and their functionally is transparent to the SCSI devices connected. It is possible to use more than two converters in series and thus achieve even longer distance.

The Converters are available from Ancot for the Narrow bus (SED-608) and for the Wide bus (SED-616). Both models support asynchronous, synchronous, and SCSI-2 Fast modes. The FSB8001/8002 SCSI bus extenders using Fibre Channel optical cable are available with SE or HVD interfaces.

WARNING ! It is very important that you use good quality cables in these 'maximum distance systems'. The deficiencies in the cable (crosstalk, capacitance, skew, etc.) will accumulate over the long length, and may exceed maximum allowable value.

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