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SCSI BUS ANALYZER

Model # U l t r a - 2 1 6 0

USER-S MANUAL

Revision 1.0

July 1999

Ancot Corporation
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Menlo Park, California 94025
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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 Ultra2160 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 Ultra2160 Analyzer provides a comprehensive SCSI event tracer, a debugger with powerful triggering capability, and an optional SCSI initiator emulator (not available yet). It provides displays of SCSI bus activity in a variety of formats for easy interpretation.

The Analyzer comes in the following configurations:

The Ultra2160/Bxx is the briefcase model, and the Ultra2160/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 16 Mevents standard, and optional 8M, 4M, or 2M events.

The model numbers used for the Ultra2160 are as follows:

Ultra2160/mse where:

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

s = Memory Size
- Q - standard 16M trace events
- J - optional 8M trace events
- C - optional 4M trace events
- V - standard 2M trace events

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

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

Examples:

Ultra2160/BQ - Standard briefcase model with 16M trace events.
Ultra2160/BC - Briefcase model with optional 4M trace events.
Ultra2160/BQE - Briefcase model with optional 16M trace events and emulator

1.2 GENERAL DESCRIPTION

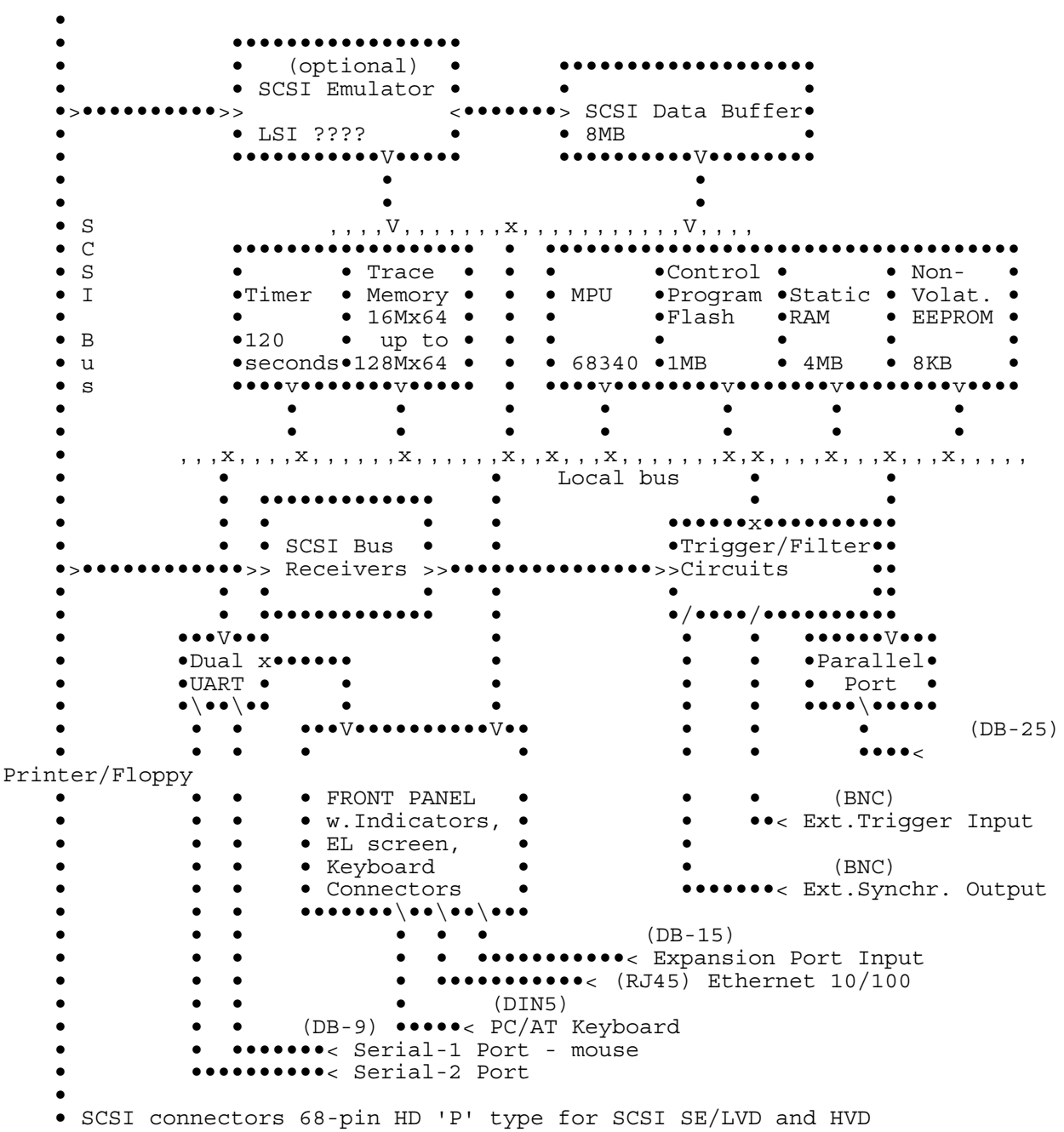
The SCSI Bus Analyzer is used for recording activity on the SCSI Bus to which it is connected non-intrusively. Its circular buffer can hold up to 16M events (standard for Ultra2160/BQx), 8M, 4M, or 2M events (optional). The recording method is event driven; only valid data or transitions on certain SCSI 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. It can also be viewed with a web browser. 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.

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1.3 SYSTEM OVERVIEW

A simplified block diagram of the Ultra2160 SCSI Bus Analyzer is shown below:



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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 Ultra2160 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, connected by the serial port or 10/100 Ethernet, and 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.

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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.

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1.5 FRONT PANEL



The front panel of the Ultra2160 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.

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Figure1.

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 Ultra2160 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.

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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 Ultra2160. 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 Ultra2160 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.

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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 Ultra2160 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 Ultra2160 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 or using the mouse, is completely menu-driven. The main menu at the root of the Ultra2160 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.

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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 Ultra2160 using a straight serial cable. You also may use a modem connection. We recommend that you follow directions described in Appendix B. Once a serial connection has been established, you are able to control the Ultra2160 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 Ultra2160 and starting the web server, you may control the Ultra2160 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 Ultra2160. For instance if you assigned the IP address 192.168.1.1 to the Ultra2160, type Ahttp://192.168.1.1" in the location or address field and your browser will access the main page of the Ultra2160.

If you need to access files on the Ultra2160, 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 Ultra2160. 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 Ultra2160; an external keyboard connected to Serial-1; a mouse; or screen and keyboard of a remote control PC/CRT.

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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 Ultra2160 firmware system serves for selection of functions related to tracing, trigger selection, and display of recorded data. See Ultra2160/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.

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1.8 TIMER

There is a 6-byte 50 MHZ counter in the Ultra2160 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.

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 !

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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.

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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 NCITS T10 Comittee draft SCSI-3 SPI/SIP, including Fast/80

- Asynchronous data transfer rates to over 6 MBps

- Synchronous data transfer rates to over 80M transfers per sec (160 MBytes)

- 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 up to 16M events deep and 64 bits wide.

- 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, or all four edges of REQ and ACK (for Double Transition (DT) Data Phases, Data is latched on both edges of REQ or 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

- 4 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.

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- 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 attache 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

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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

The Programmer-s Guide to SCSI by Brian Sawert (1998)
is a very thorough description of the SCSI. Starting with fundamentals, explaining ASPI, SCRIPTS, programming the Target mode, running SCSI under Windows or UNIX, etc
Published by Addison-Wesley, available in many bookstores.

The SCSI bus & IDE Interface - Second Edition by Friedhelm Schmidt (1997)
in addition of describing the SCSI in good detail, this book also compares SCSI with IDE, and also has a brief chapter on ATAPI.
Published by Addison-Wesley, available in many bookstores.

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1.12.3 INTERNET RESOURCES

http://www.ancot.com	- Ancot-s web site
http://www.sta.com	- SCSI Trade Association web site
http://www.T10.org	- NCITS (SCSI) web site

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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 Ultra2160 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, 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

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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 2M, 4M, 8M, or 16M events deep, with each event 64 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 Ultra2160 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

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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. The last recorded event is at trace memory (logical) address FFFFFF for the 16M version.

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).

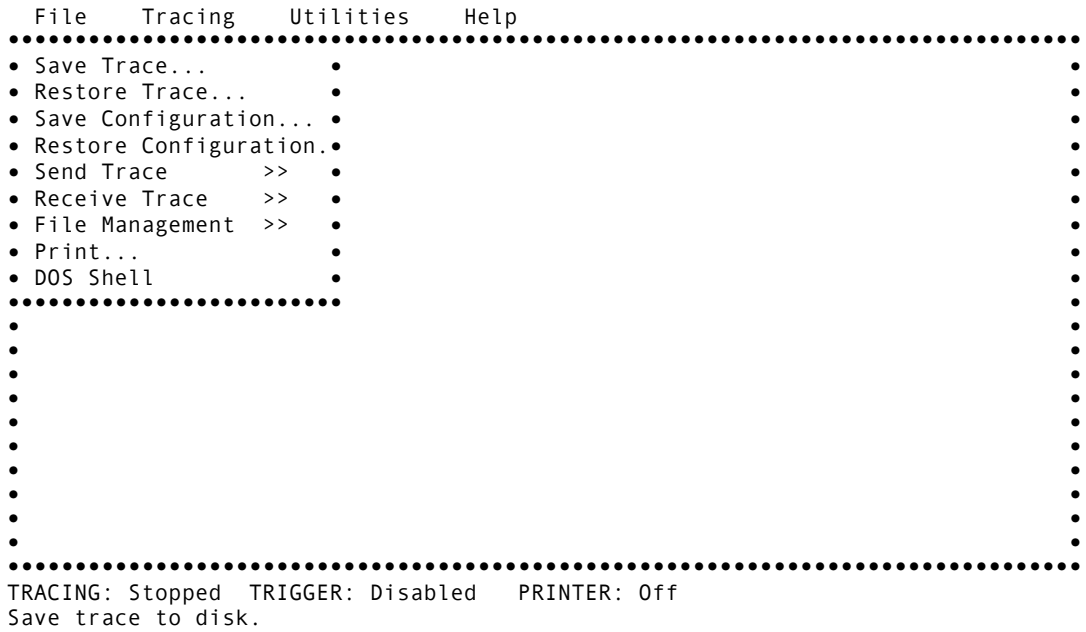
When External Trigger is used and the last location is filled, recording stops immediately.

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

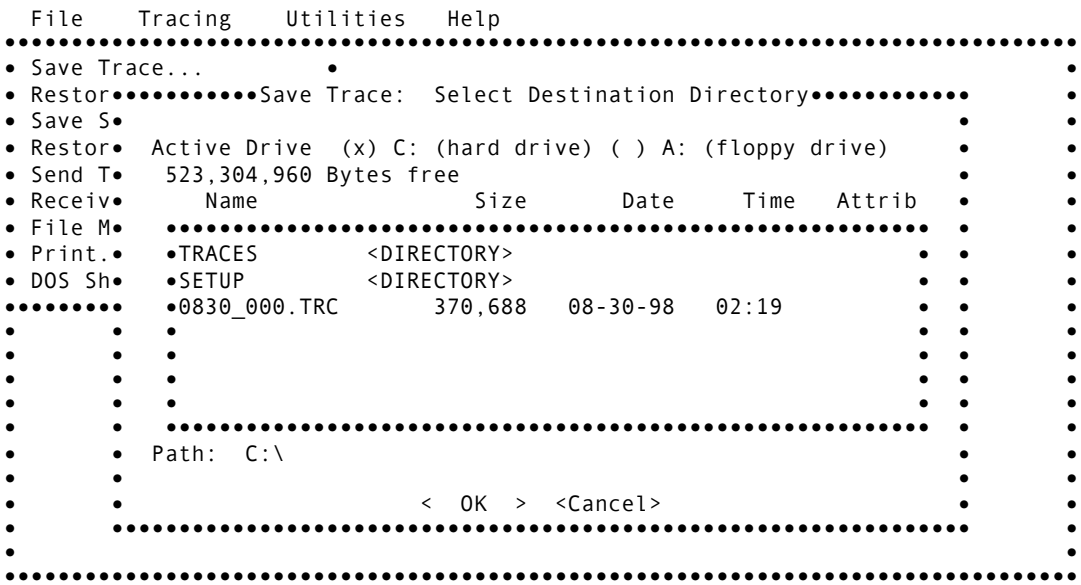
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2.3 FILE

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.



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```
TRACING: Stopped  TRIGGER: Disabled   PRINTER: Off
Use tab to exit.
```

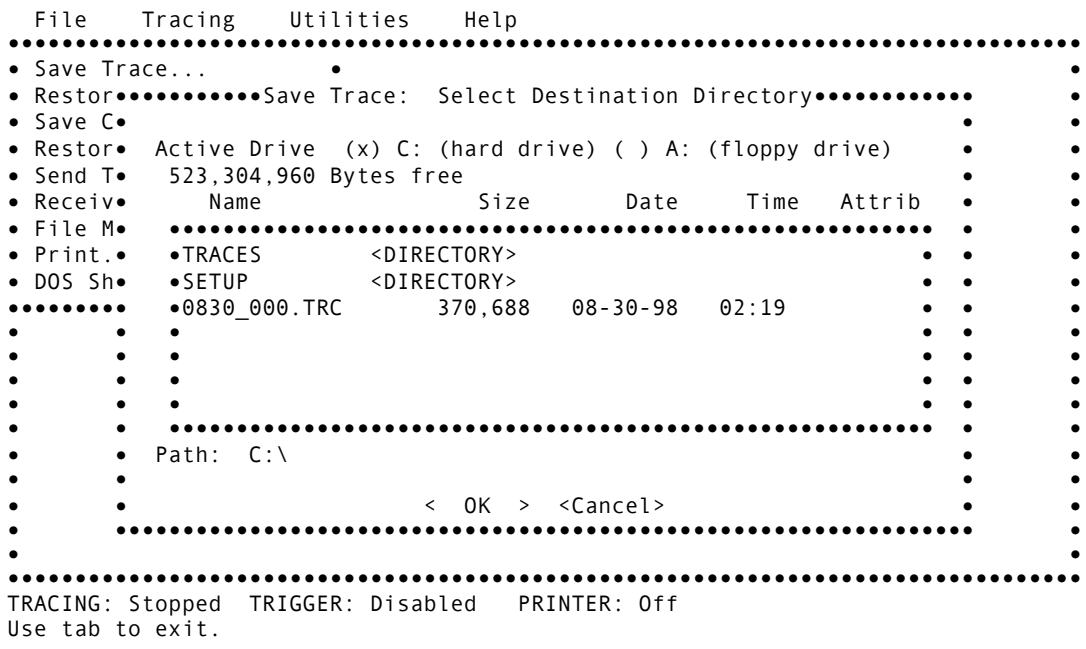
The file selection menu allows you to select the drive and has a window for browsing the file system. If you select a directory, that directory is displayed. If you select a file, the path and file name are shown directly below the browsing window and the cursor moves to < OK > button. You can move around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

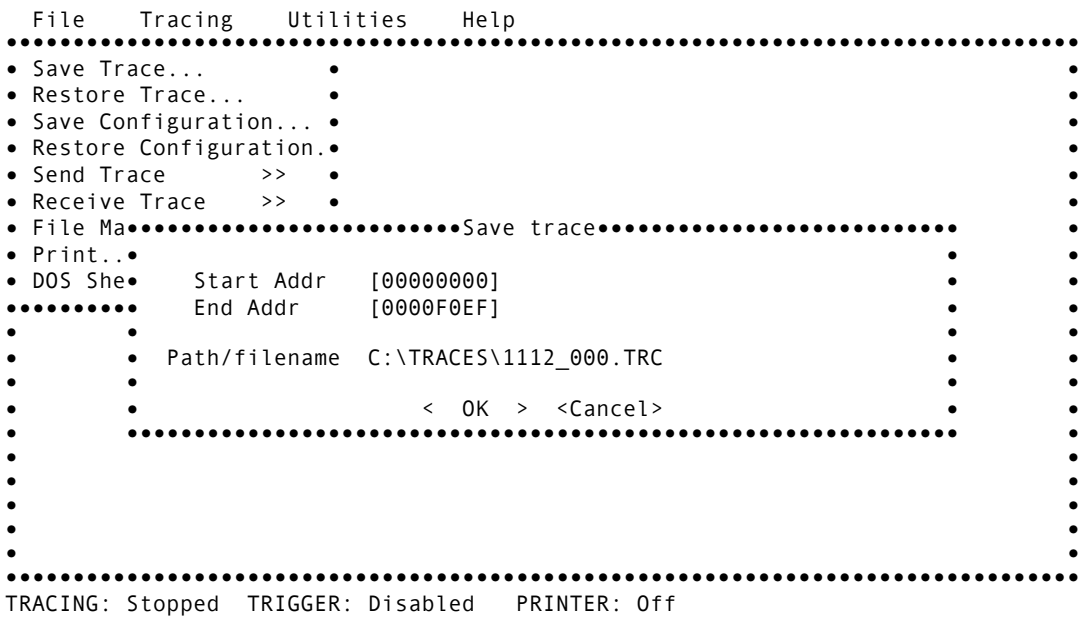
With the file selection menu shown below you can select the directory where you want the trace to be saved.

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.



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2.3.2 RESTORE TRACE

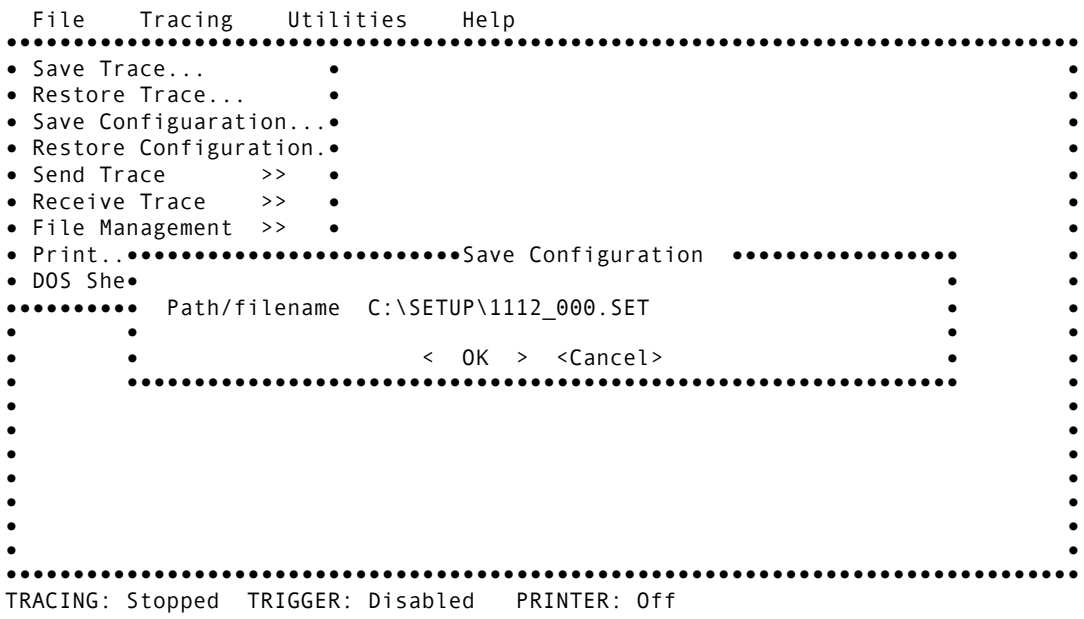
With the file selection menu, select the trace(file) to be restored.

2.3.3 SAVE CONFIGURATION

With this selection you can save the current configuration of the Ultra2160. This 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.

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2.3.4 RESTORE CONFIGURATION

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

2.3.5 SEND TRACE

You can transfer and save a trace captured by the Ultra2160 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 Ultra2160 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 Ultra2160'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.

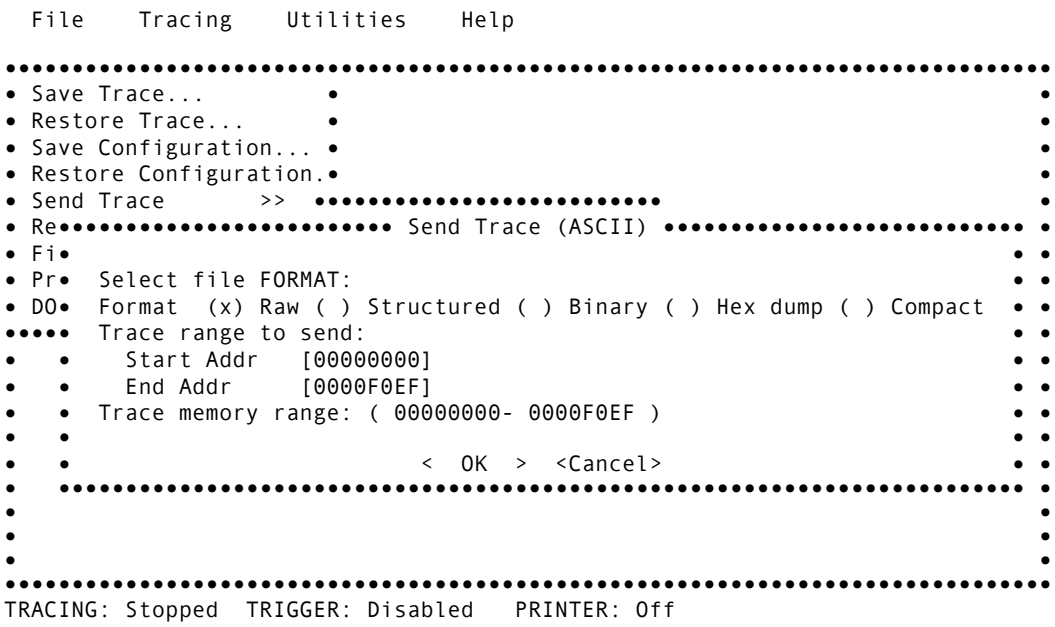
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SERIAL PORT

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 Ultra2160 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 Ultra2160.

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 Ultra2160 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 Ultra2160. These formats may be useful for comparisons and post-processing of the trace information, but cannot be reloaded into the Ultra2160. 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.

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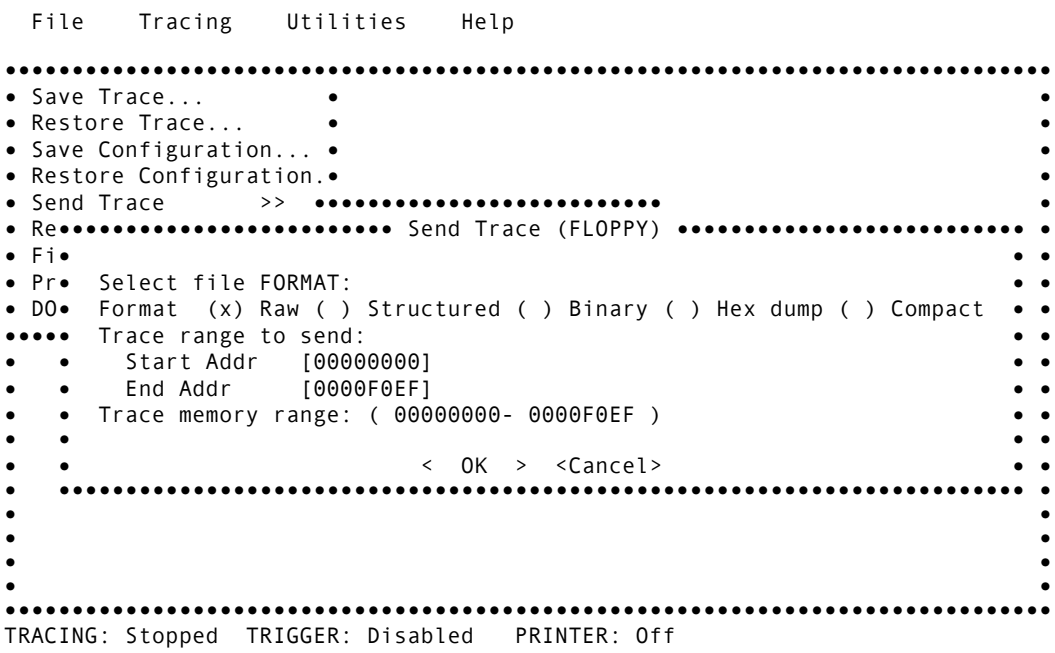
After selecting the format, select the trace memory range to be saved, then confirm the transfer by selecting **<OK>** to start communications. Most communications programs can be set to echo received characters to the screen, so you can follow the transfer as it is progressing.

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 B 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-2160. 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 Ultra2160. These formats may be useful for comparisons and post-processing of the trace information, but cannot be reloaded into the

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Ultra2160. 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.

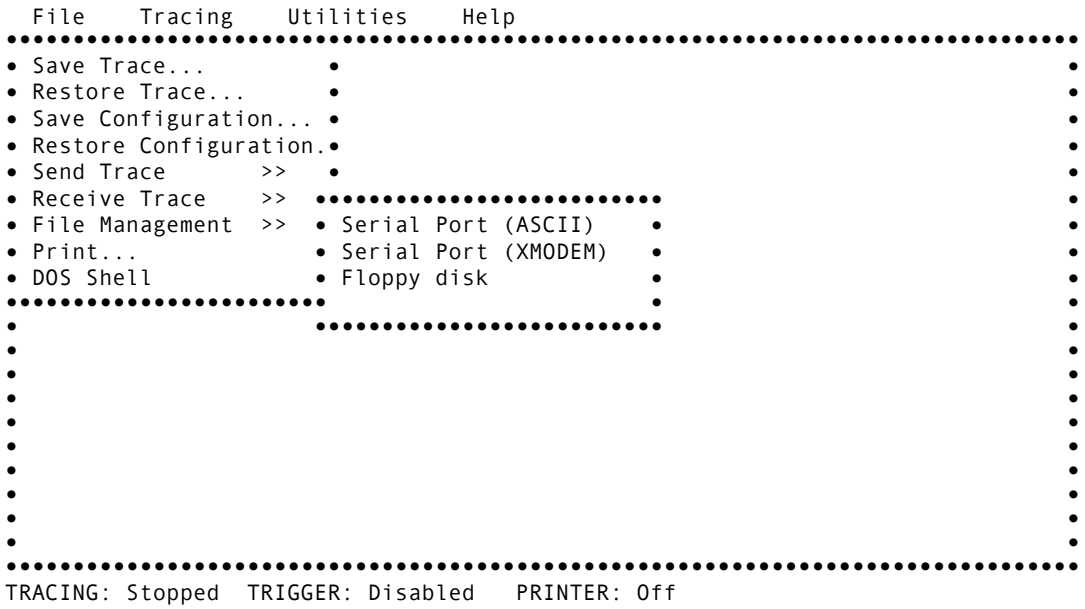
2.3.6 RECEIVE TRACE

P SERIAL PORT

A trace saved to a file in 'Raw Data' format or XMODEM format can be loaded back into the Ultra2160 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 Ultra2160 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.

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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 Ultra2160. Any other file format will result in the "Unrecognized format" message.

See Appendix B 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 Ultra2160 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.

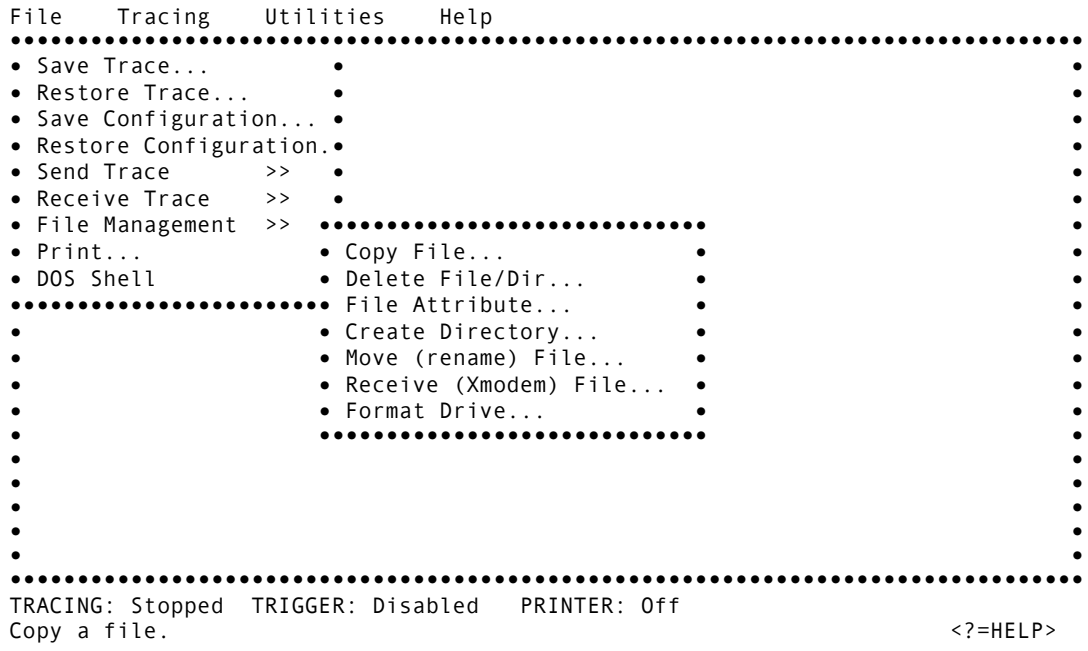
Place the floppy diskette in the floppy disk drive and select AFloppy Disk@ from the RECEIVE FILE menu; a file selection menu will be displayed.

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

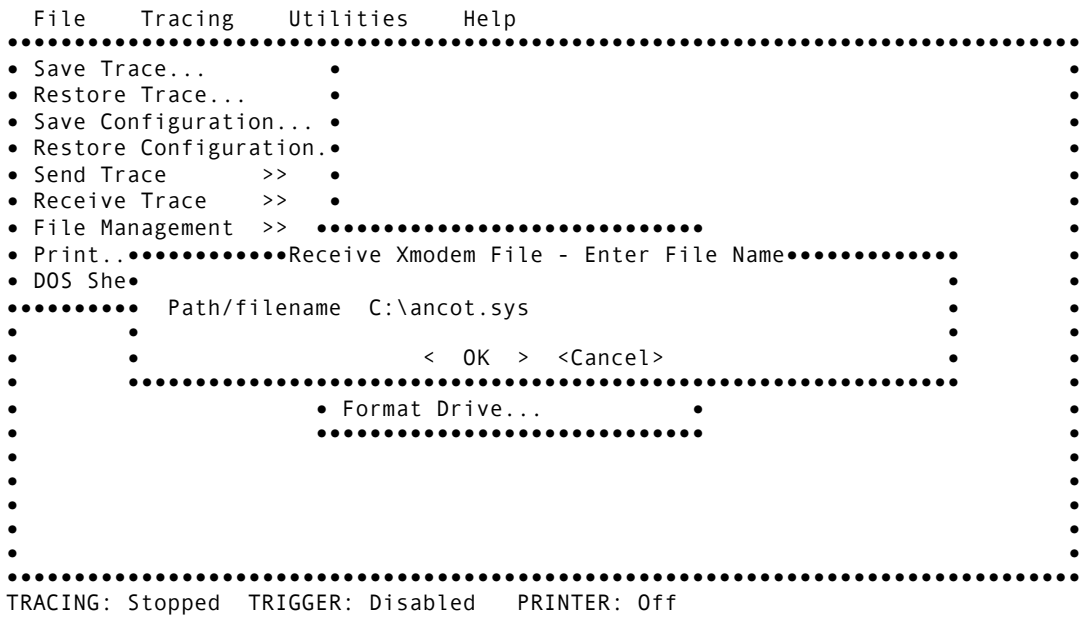
Under this heading you can save traces and configuration (setup) parameters to the hard disk in the Ultra -2160. There are also commands for manipulating files and directories on the disk. When you select AFile Management@ from the File menu, the screen below will appear:

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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:



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This will allow you to download any file (using the ›1K Xmodem= protocol) directly to the hard disk on the Ultra2160.

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 Ultra2160.

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@.

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```
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 Configuration PATH
RT      Read Trace          PATH
RS      Read Configuration  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:

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```
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

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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 Configuration

This saves all the current configuration parameters to the current directory on the disk. The parameters include mode, trigger, and utilities 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 configuration1 - saves current configuration to disk in the file
Asetup1".
```


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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 Configuration

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

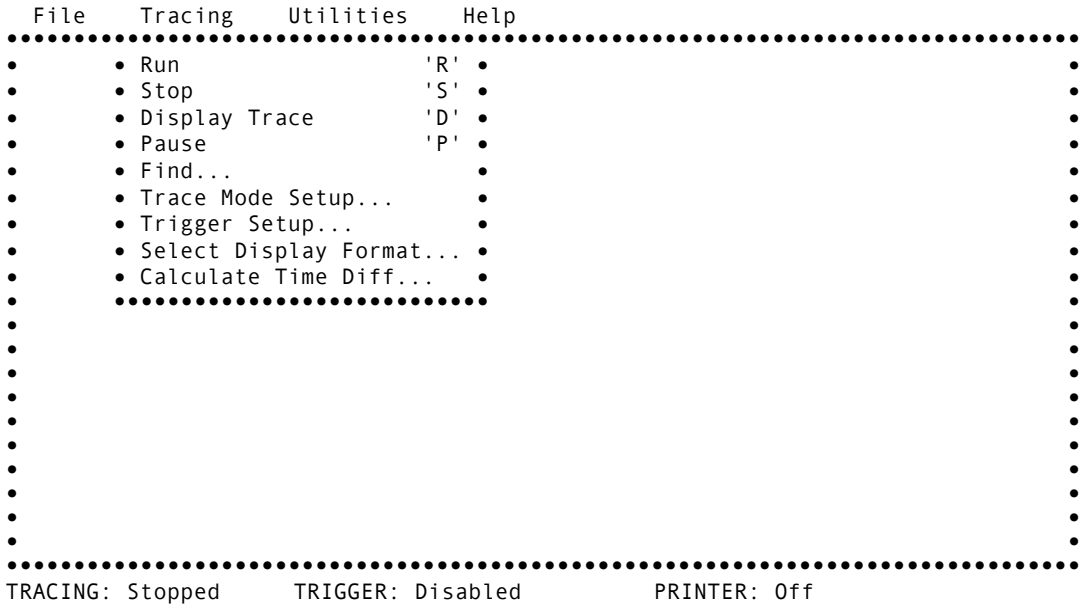
EXAMPLE:
`rs configuration1 - read Asetup1" from the disk and update all parameters.`

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.



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```
Start tracing                                                    <?=HELP>
```

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 Ultra2160 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@.

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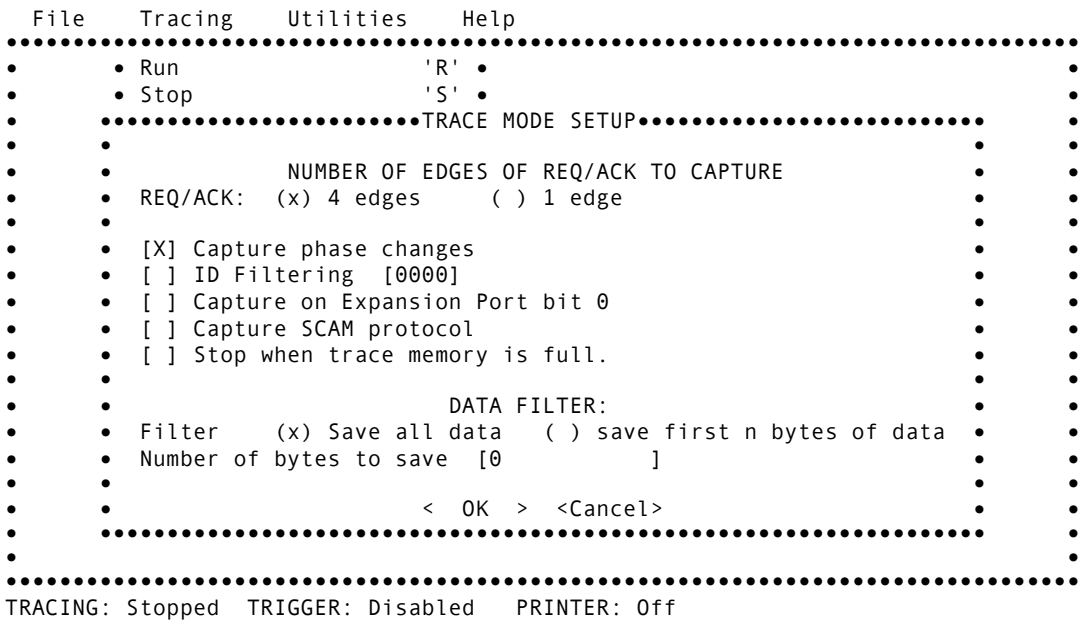
2.4.5 FIND

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 Ultra2160 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.

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4 Edges - The Ultra2160 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

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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.

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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.

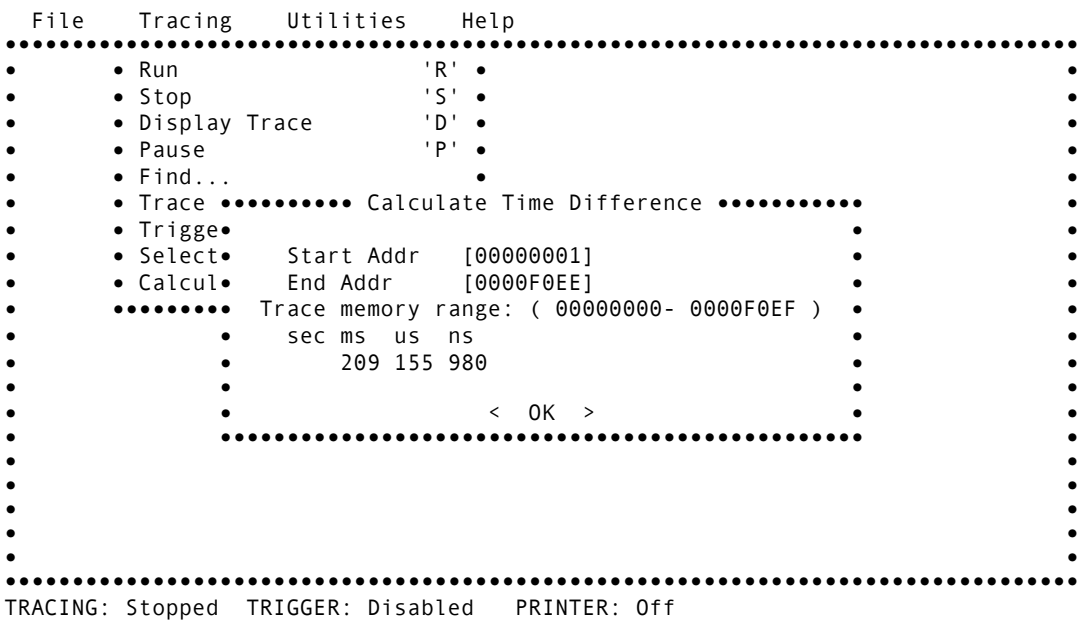
2.4.9 TIME CALCULATION

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.

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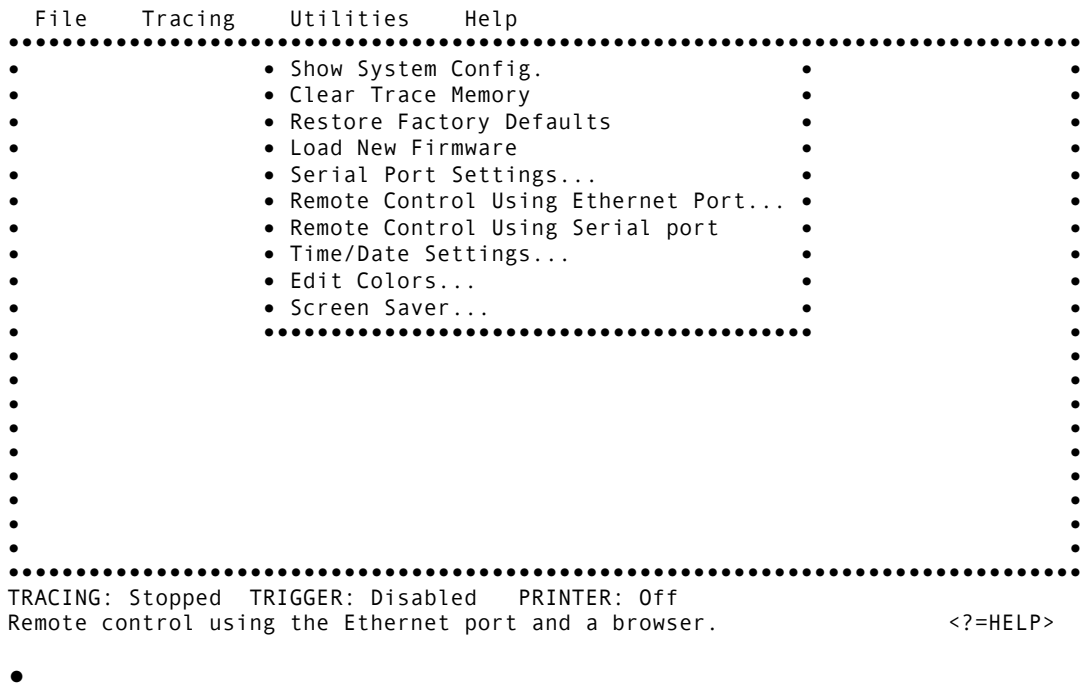


The Astart@ and Aend@ addresses are automatically filled in as default values, and may be typed over. The Astart@ address is always = 1, and the Aend@ address is the currently used trace memory end. The time difference is in nanoseconds. In the example above, it is 209 milliseconds, 155 microseconds,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

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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>**.

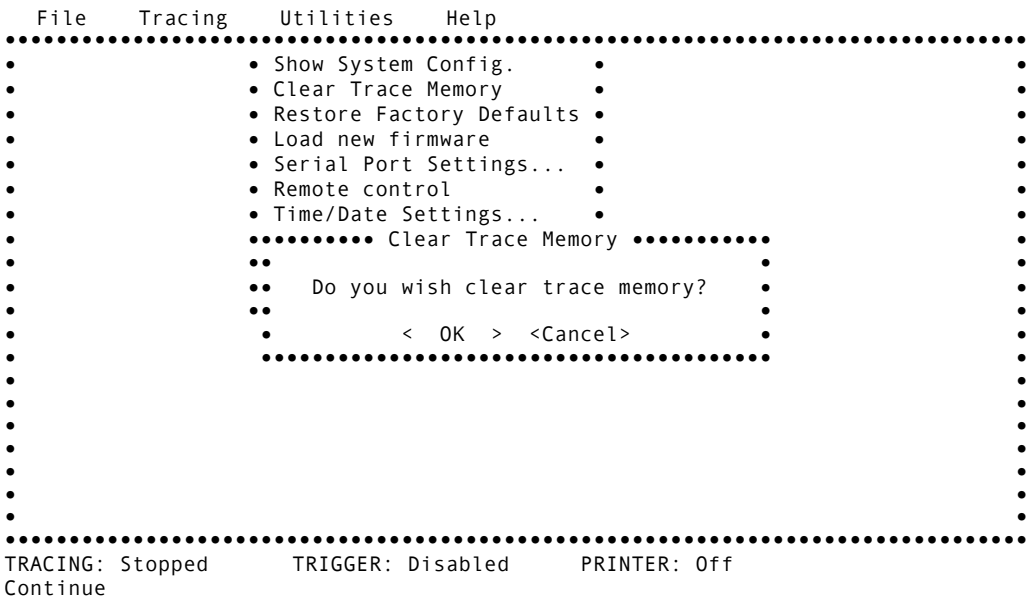
To print the configuration, enable printing before you choose this menu selection. If you are already displaying the information, press **<Next>** or **<Prev>**. If any of the options are printed, they will all be printed (about 3 pages).

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

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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 Ultra2160 flash memory. You will be asked to confirm your choice. Read Section 7.6 for a more detailed description.

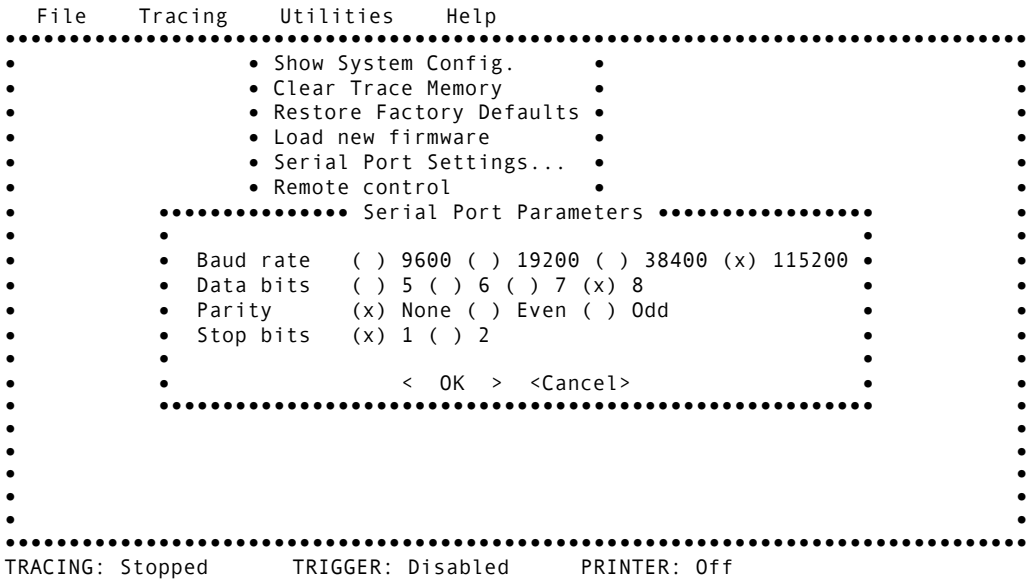
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2.5.5 SERIAL PORT SETTINGS

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 Ultra2160 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.

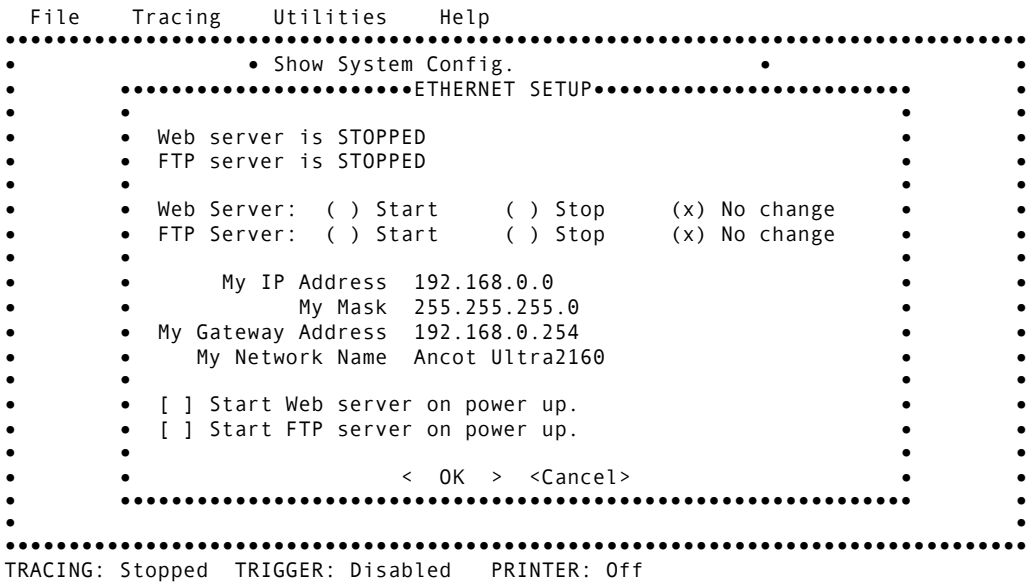
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2.5.6 REMOTE CONTROL USING ETHERNET PORT

The Ultra2160 has a built in web server and FTP server. The web server allows you to control the Ultra2160 with a web browser and the FTP server allows you to upload and download files between a host and the Ultra2160.

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 Ultra2160. 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 Ultra2160. Consult your system administrator in order to obtain a valid IP address. In addition, you may configure

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the Ultra2160 to automatically start up one or both of the servers after power on. The default is NOT to start the servers.

When the Ultra2160 web server responds to a request, a packet is sent to the originating (destination) IP address. If both the Ultra2160 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 Ultra2160 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 Ultra2160. 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 Ultra2160 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 Ultra2160 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.

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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 Ultra2160 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 Ultra2160 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-2160 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 Ultra2160 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 Ultra2160 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 Ultra2160 (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 Ultra2160; all functions on the Ultra2160 should be operational.

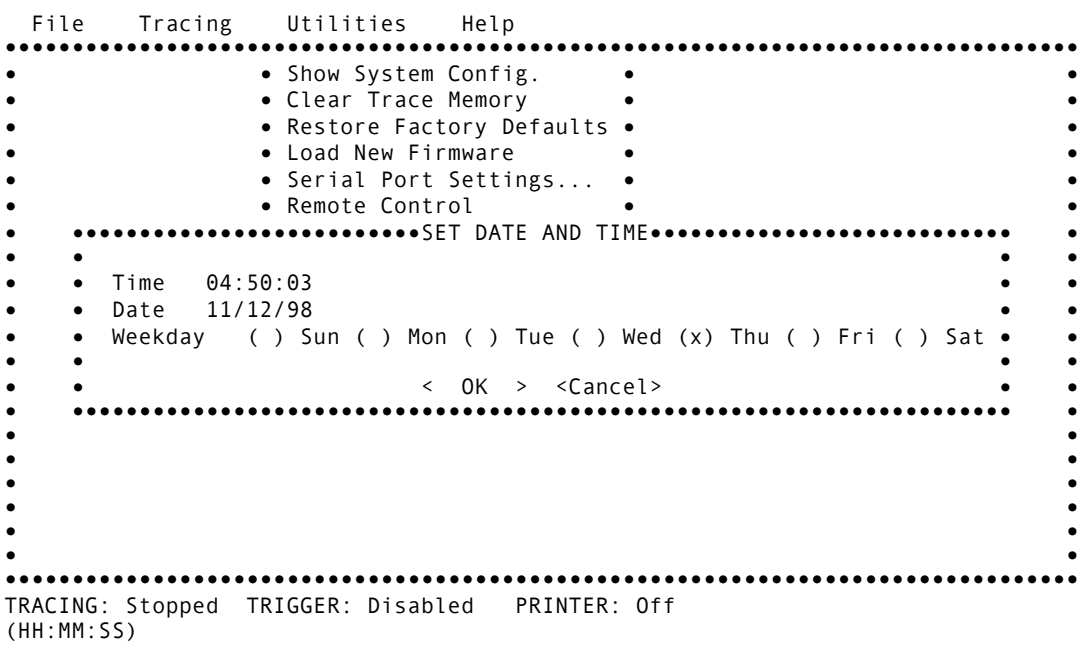
When finished with the session, select the Utilities menu from your remote terminal, select item 6 to disable remote control, and confirm the selection by pressing **<Y>**. Control will return to the Ultra2160 local screen and keyboard. Remote control can also be disabled by pressing the SYSTEM RESET switch on the Ultra2160 front panel, or by cycling power to the Ultra2160.

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

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2.5.8 TIME/DATE SETTINGS

With this function you can change the date and time on the Ultra2160. 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:



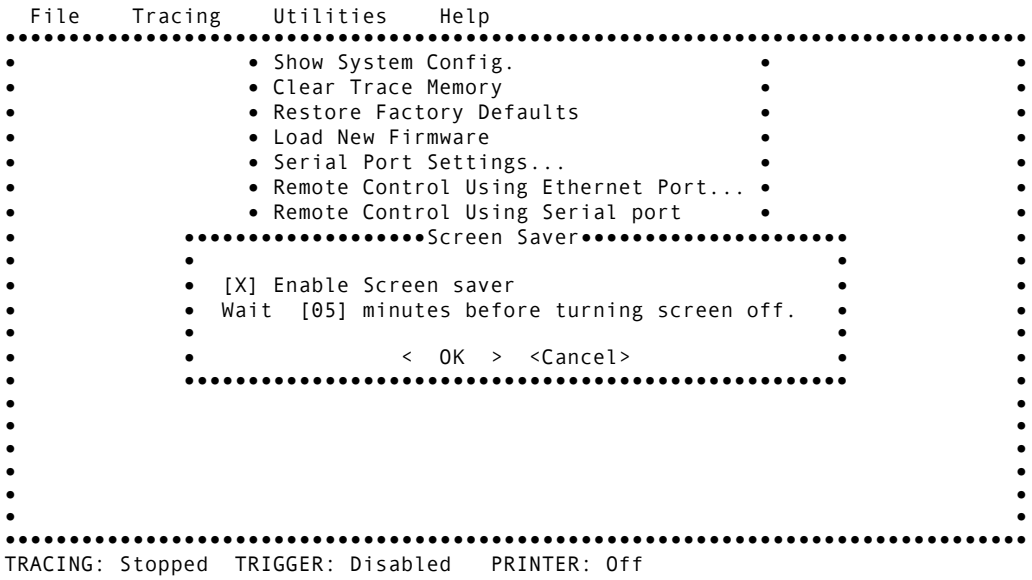
Select either ATime@ or ADate@ to edit the field. Select AWeekday@ to set the proper day of the week.

2.5.9 THE SCREEN SAVER

LCD displays like the one in the Ultra2160 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.

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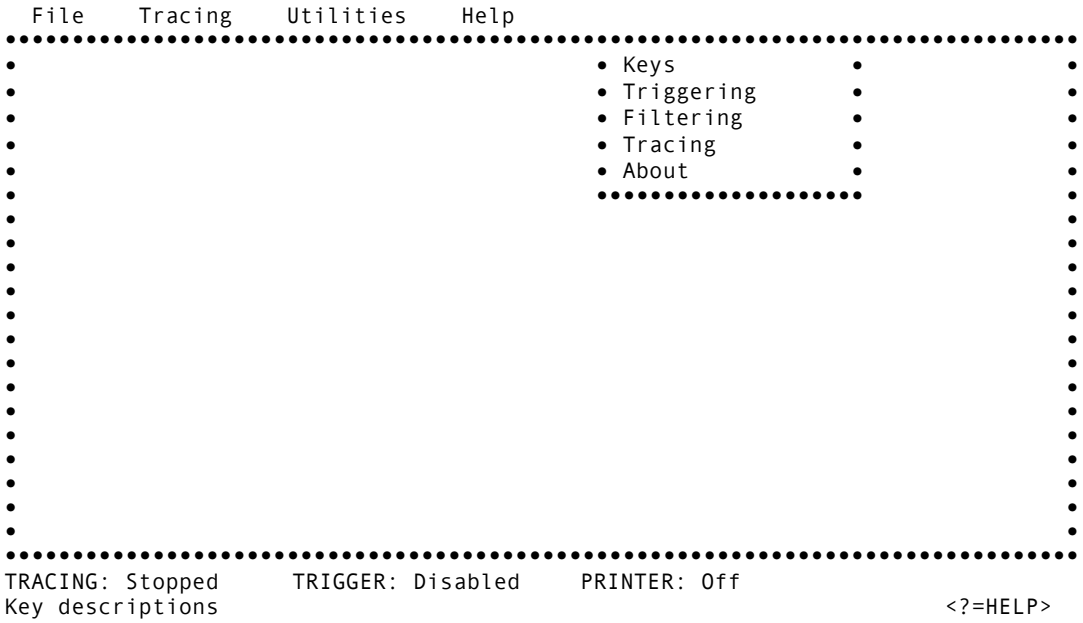


The default timeout before the screen saver takes effect is 5 minutes. To change this value, enter a number from 1 to 99 (minutes) in the brackets.

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2.6 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.

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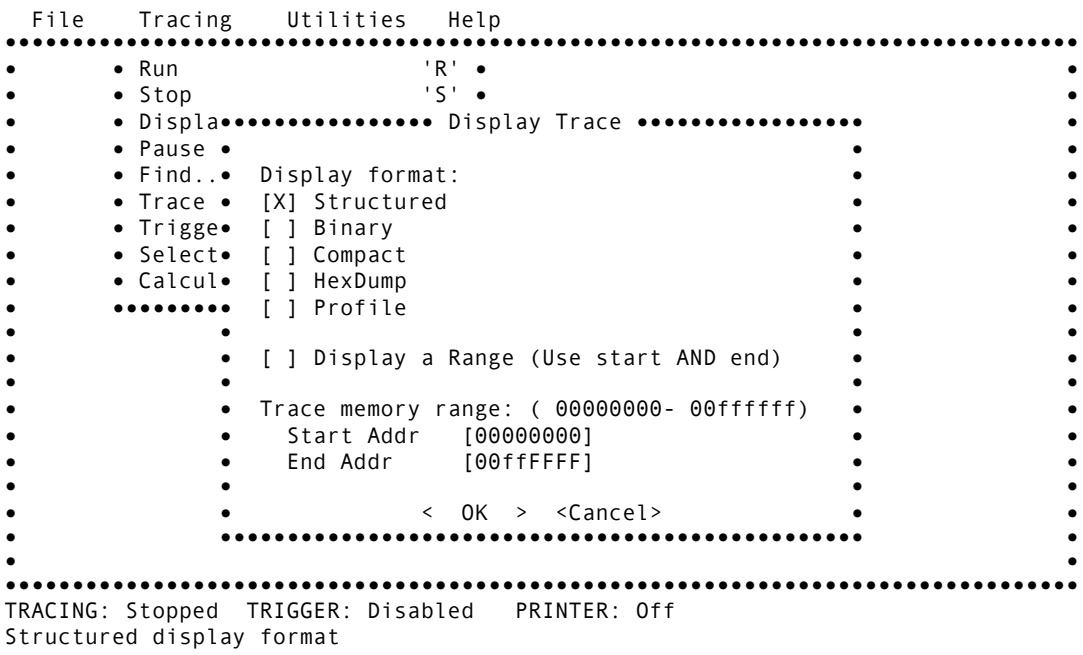
S E C T I O N 3

DISPLAYING THE TRACE MEMORY

3.1 INTRODUCTION

The Ultra2160 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

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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>,        Flip between displaying coarse and fine time for time
<left arrow>          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.
```


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```
^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.
```


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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. ST-Data-In (Single-Transition), ST-Data-Out and the DT-Data-In (Double-Transition), DT-data-Out 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.

Remember that **transfers** represent the number of REQ-s (or ACK-s). For Single Transition, Narrow (8 bit) transfers, this is the number of bytes sent. For Single Transition Wide (16 bit) transfers, this is one half the number of bytes sent. For Double Transition transfers (160MBytes), this is one forth the number of bytes sent.

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 Ultra2160 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.

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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:      ST-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)
```


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```
0004F:                    08 (Offset 8 bytes)
00050:       Command       /03 00 00 00 10 00 (Req Sense)
00056: (0008)ST-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)ST-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)
```


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```
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:       ST-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:       ST-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:       ST-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 with DT transfers

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The following example includes the DT-Data-In and DT-Data-Out double transition phases:

```
0000557:Bus Free
000055B:   Arbitration   /80 (7)
000055F:   Select w/ATN  /82 (1,7)
0000569:      Message-Out/C0+(Identify : LUN  0 Disconnect OK)
0000570:      Message-Out/01+(Ext Msg)
0000576:                  06+(Length)
000057C:                  04+(Parallel Protocol Req)
0000583:                  09+(Period: 12.5 nsec)
000058A:                  00+(Reserved)
0000591:                  7F+(Offset: 127 xfers)
0000598:                  01+(Width : 2 bytes)
00005A0:                  02 (Options: DT DATA Phases with CRC)
00005A7:      Message-In /01 (Ext Msg)
00005AD:                  06 (Length)
00005B3:                  04 (Parallel Protocol Req)
00005BA:                  09 (Period: 12.5 nsec)
00005C0:                  00 (Reserved)
00005C6:                  1F (Offset: 31 xfers)
00005CD:                  01 (Width : 2 bytes)
00005D3:                  02 (Options: DT DATA Phases with CRC)
00005DD:      Command    /3B 0A 00 00 00 00 00 80 00 (Wt Buf)
000061D:      Message-In /04 (Disconnect)
0000624:Bus Free
0000628:   Arbitration   /02 (1)
000062C:   Reselection   /82 (1,7)
0000634:      Message-In /80 (Identify : LUN  0 )
0000653:      DT-Data_Out/00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
000065B:                  10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
0000663:                  00 00 FF FF 00 00 FF FF 00 00 FF FF 00 00 FF FF
0000668:                  55 55 AA AA 55 55 AA AA 55 55 AA AA 55 55 AA AA
000066F:                  FF FF 00 01 FF FF 00 02 FF FF 00 04 FF FF 00 08
0000677:                  FF FF 00 10 FF FF 00 20 FF FF 00 40 FF FF 00 80
000067C:                  FF FF 01 00 FF FF 02 00 FF FF 04 00 FF FF 08 00
0000682:                  FF FF 10 00 FF FF 20 00 FF FF 40 00 FF FF 80 00
000068A:(000021)     CRC /E3 84 B4 2E
000068E:      Status     /00 (Good)
0000696:      Message-In /00 (Cmd Cmplt)
000069C:Bus Free
```

3.2.4 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
```


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```
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 Ultra2160. 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.

ST-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. DT-Data is always shown as Wide. The Bytes are shown without a space or hyphen. In the APE@ column, the AP/CRCA@ bit is shown.

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

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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 456Fs 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.

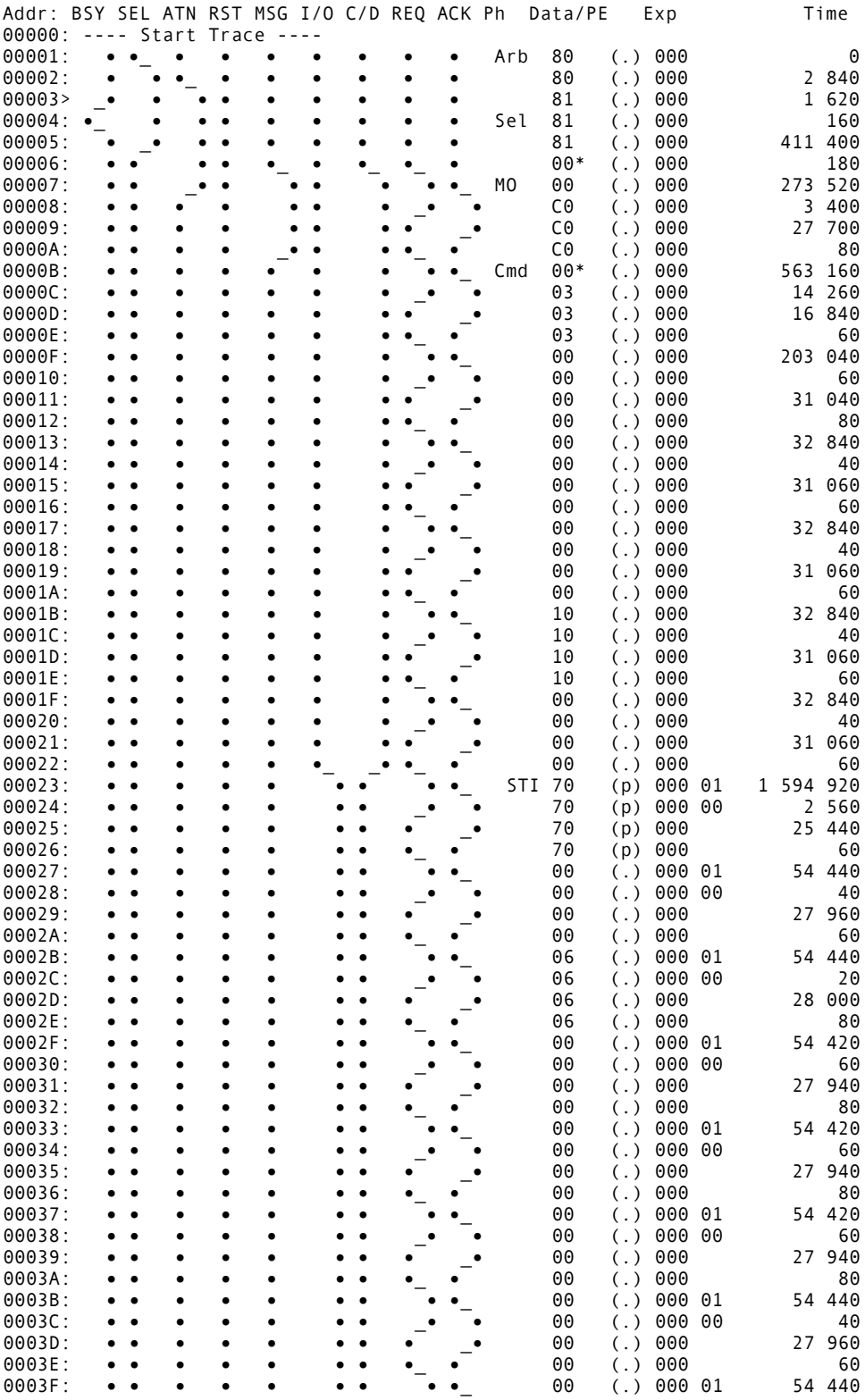
```
<51  371  901  220   or  >  0h  01m  51s
  s   ms   Fs   ns
```

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.

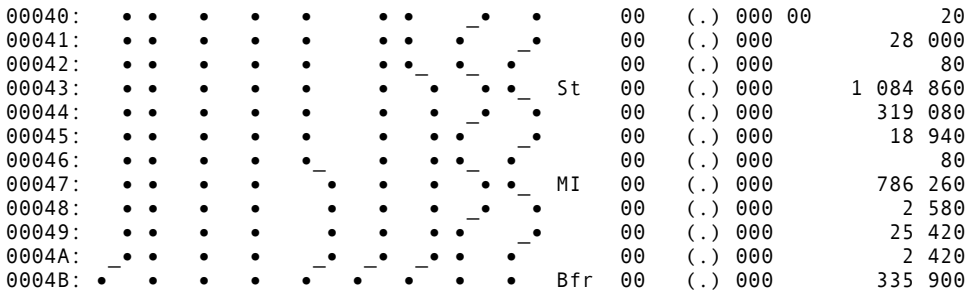
The display example on the next two pages shows the logic analyzer style of control signals, with 8-bit data and differential time display. This trace also shows the 'capture 4 edges REQ/ACK' and 'capture-all-data' modes of recording. Just to the right of the Exp column, during the data phase only, the 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.

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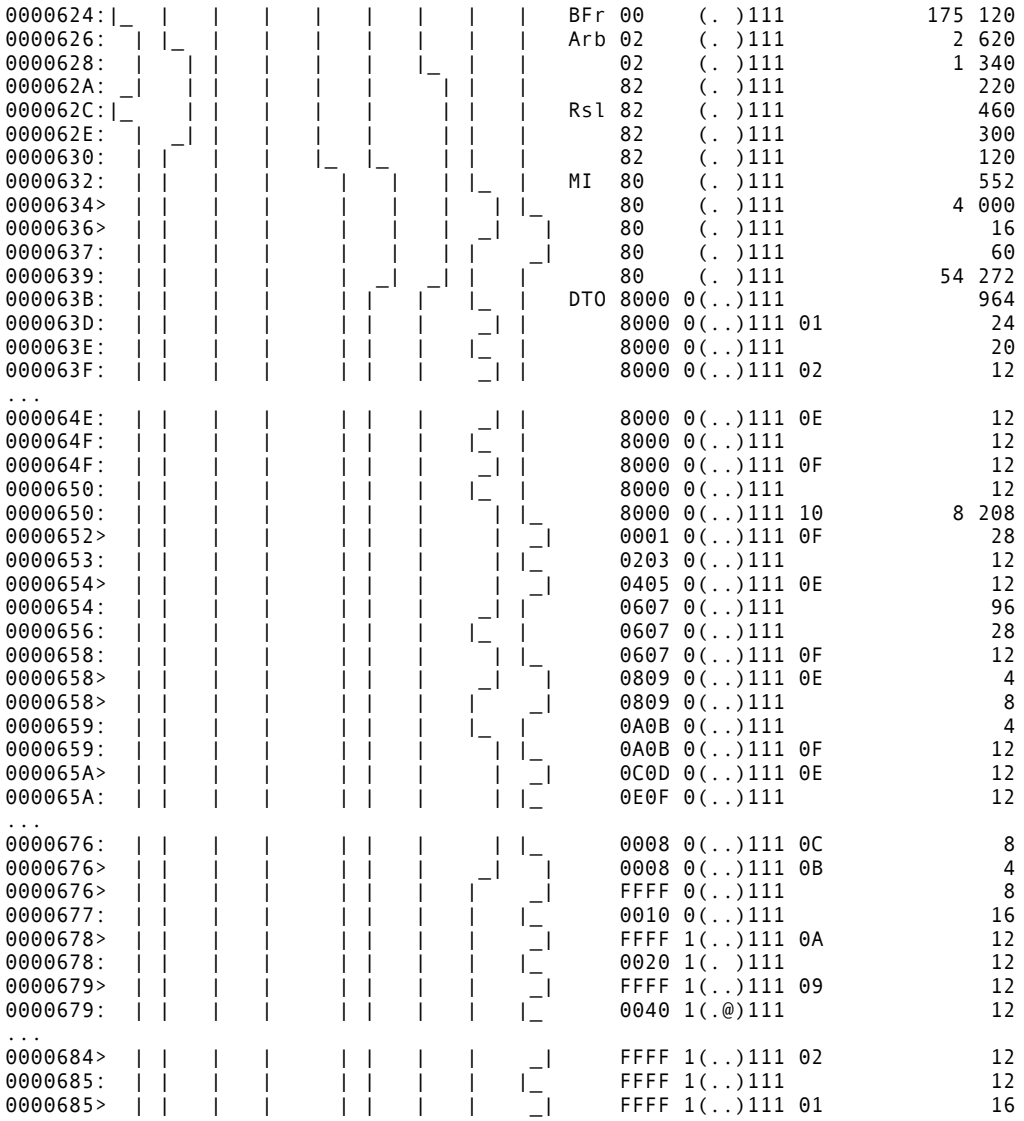


```
Addr: BSY SEL ATN RST MSG I/O C/D REQ ACK Ph  Data/PE   Exp            Time
00000: ---- Start Trace ----
00001:   • •_  •   •   •   •   •   •   •   Arb  80   (.) 000             0
00002:   •   • •_  •   •   •   •   •   •        80   (.) 000         2 840
00003>  _•   •   • •   •   •   •   •   •        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:   • •   •   •   •   •       • •     • •_  STI 70   (p) 000 01   1 594 920
00024:   • •   •   •   •   •     • •    _•   •    70   (p) 000 00       2 560
00025:   • •   •   •   •   •     • •    •    _•   70   (p)              25 440
00026:   • •   •   •   •   •     • •    •_   •    70   (p)                 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
```

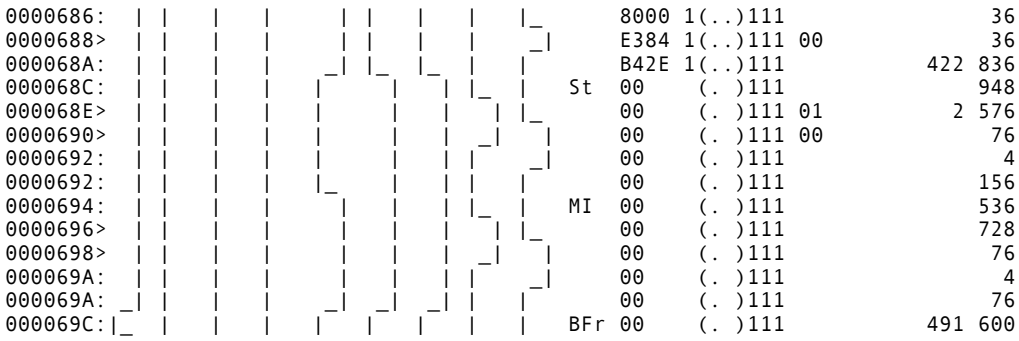

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The following example shows the start and the end of a DT transfer:



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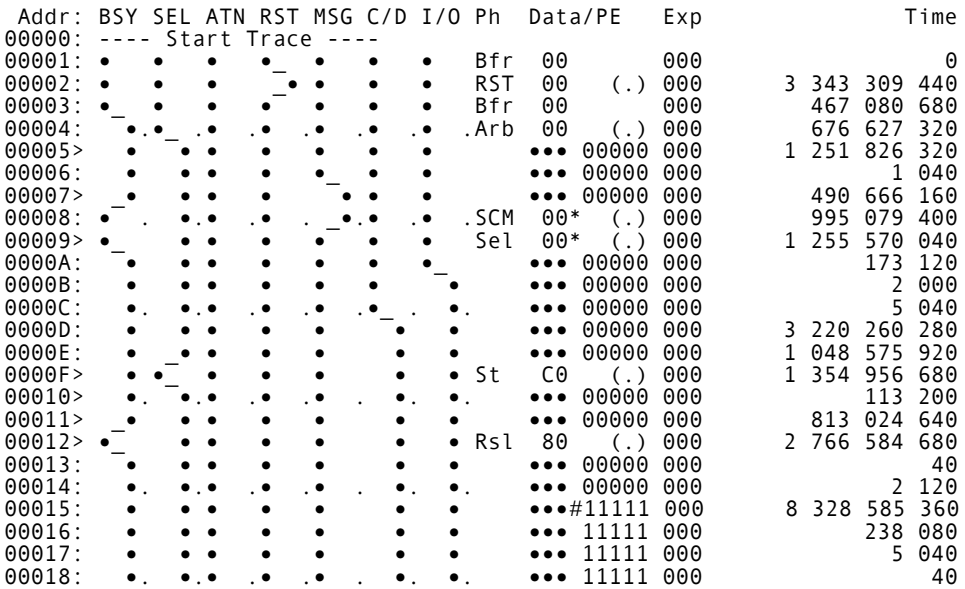
```
0000686:  | |   |   |     | |   |   |   |_      8000 1(..)111              36
0000688>  | |   |   |     | |   |   |    _|     E384 1(..)111 00           36
000068A:  | |   |   |    _| |_  |_  |   |       B42E 1(..)111          422 836
000068C:  | |   |   |   |     |   | |_  |   St  00    (. )111              948
000068E>  | |   |   |   |     |   |   | |_      00    (. )111 01         2 576
0000690>  | |   |   |   |     |   |  _|   |     00    (. )111 00           76
0000692:  | |   |   |   |     |   | |     _|    00    (. )111               4
0000692:  | |   |   |   |_    |   | |   |       00    (. )111             156
0000694:  | |   |   |     |   |   | |_  |   MI  00    (. )111             536
0000696>  | |   |   |     |   |   |   | |_      00    (. )111             728
0000698>  | |   |   |     |   |   |  _|   |     00    (. )111              76
000069A:  | |   |   |     |   |   | |     _|    00    (. )111               4
000069A: _| |   |   |    _|  _|  _| |   |       00    (. )111              76
000069C:|_  |   |   |   |   |   |   |   |   BFr 00    (. )111          491 600
```

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  00       000                0
00002: •   •   •    _• •   •   •   RST  00   (.) 000        3 343 309 440
00003: •_  •   •   •   •   •   •   Bfr  00       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
```


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```
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  00       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: 2 longwords of 8 characters each.

```
0000002: 07C00000 00000000 / ACE00000 1D08ECE4 / 07E00000 00000000
0000005: 81F30000 1D08EED9 / 07F00000 00000000 / 860B0000 1D08F4E6
0000008: 07F40000 00000000 / 806A0000 1D08F552 / 07D40000 00000000
000000B: AB8D0000 1DC7E0E1 / 07D00000 00000000 / 86150000 1DC7E6F8
000000E: 07F00000 00000000 / 80640000 1DC7E75E / 07F10000 00000000
0000011: 80F50000 1DC7E855 / 07A100C0 00200000 / 85FA0000 1DC7EE51
0000014: 07800000 00200000 / AEA30000 53559CF6 / 07C80000 00000000
0000017: 8A460000 5355A73E / 07C00000 00000000 / B5510000 69153C91
000001A: 07200080 00000000 / 807B0000 69153D0E / 07300080 00000000
000001D: 803D0000 69153D4D / 17300081 00200000 / 80030000 69153D52
0000020: 17100081 00200000 / B6B00000 69D8B404 / 17000000 00200000
0000023: 80150000 69D8B41B / 07800000 00200000 / B1CA0000 69D905E7
0000026: 07200080 00000000 / 807B0000 69D90664 / 07300080 00000000
0000029: 803C0000 69D906A2 / 17300082 00200000 / 80030000 69D906A7
000002C: 17100082 00200000 / AEF00000 69DC1599 / 17300082 00200000
```


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```
000002F: 80070000 69DC15A2 / 17200082 00200000 / 87A40000 69DC1D48
0000032: 17260000 00200000 / 801A0000 69DC1D64 / 37261101 87A00000
0000035: 81460000 69DC1EAC / 07261101 9FA00000 / 80040000 69DC1EB2
0000038: 472600C0 1F21FFFF / 07261100 B8BF00C0 / 80010000 69DC1EB6
000003B: 07261100 C0BC00C0 / 80070000 69DC1EBF / 07221100 80A000C0
000003E: 801A0000 69DC1EDB / 27221101 87A000C0 / 80970000 69DC1F74
0000041: 47220012 3E2FFFFF / 80040000 69DC1F7A / 07221100 C0B80012
0000044: 80060000 69DC1F82 / 27221101 87A00012 / 80050000 69DC1F89
0000047: 47220000 3F270012 / 80040000 69DC1F8F / 07221100 C0BE0000
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

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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.

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

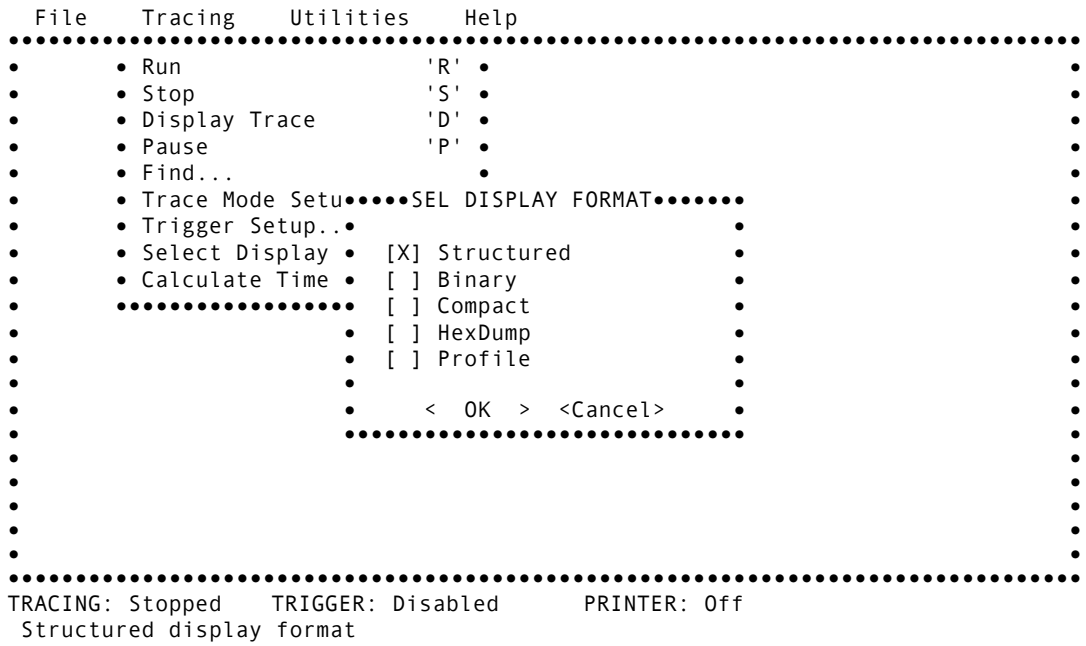
Disconnect: from start of the Message-In phase for any disconnect message to the end of Message-In phase for the Identify message after reconnect. All such periods within this command are added together.

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.

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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.

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S E C T I O N 4

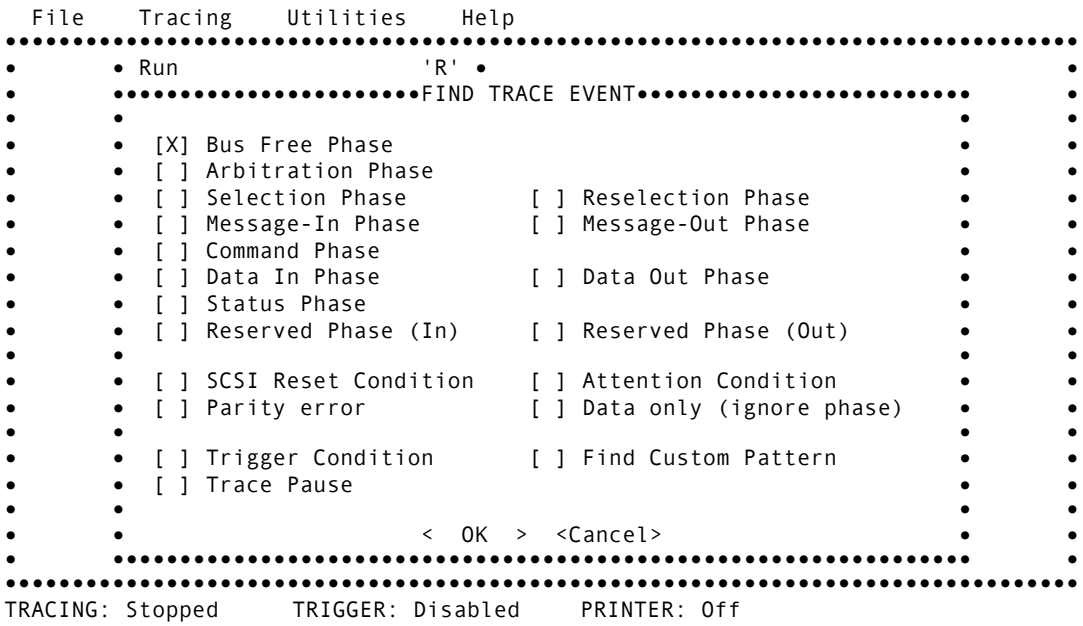
SEARCHING FOR EVENTS IN THE RECORDED TRACE

4.1 INTRODUCTION

The Ultra2160 provides a powerful, easy-to-use searching utility. Searching is assisted by a AWarpSearch@ (TM) hardware search engine. 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.

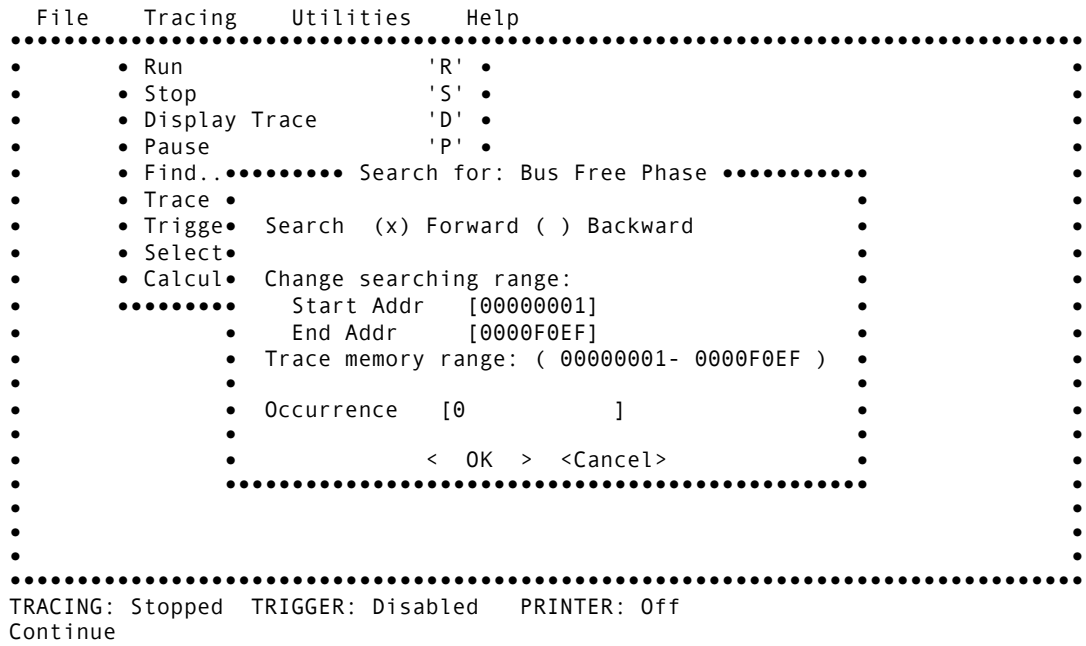
If the event is not found, the current display page will be shown again with a "NOT FOUND" box in the center of the screen.

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



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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

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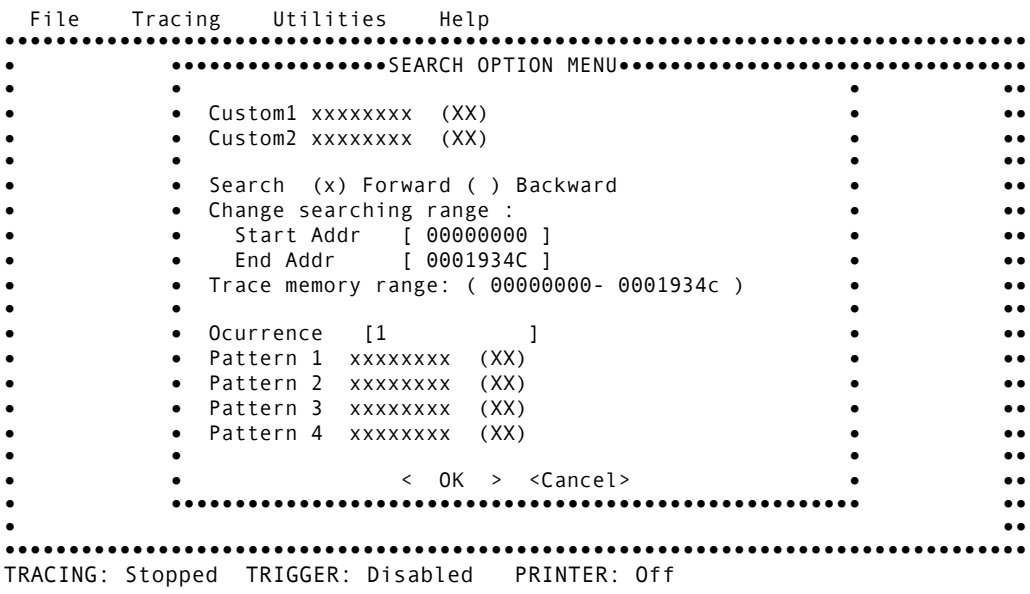
parity error bit is set) for the low byte of SCSI data. If wide data pattern is enabled, the parity error bit for the high byte of SCSI data is also examined.
Trigger condition. There is at most one matching event in any recorded trace. The direction flag is ignored in searching for this event. The search 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:



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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

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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

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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.

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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.

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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 Ultra2160 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    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
```


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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 Ultra2160 will then start recording all SCSI bus activity until the trigger condition has been met. Once the trigger condition has been met, the Ultra2160 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.

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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.

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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 :

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```
  File    Tracing    Utilities    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•  [X] Selection      IDs   [0084]               •               •
•       •••••••••  [ ] Reselection    IDs   [0081]               •               •
•                •  [ ] Message In     Code1  [04]               •               •
•                •  [ ] Message Out    Code2  [07]               •               •
•                •  [ ] Command        Code3  [12]               •               •
•                •  [X] Status         Code4  [02]               •               •
•                •  [ ] Command and Status                       •               •
•                •  [X] IDs and (MSG or Cmd or Stat)             •               •
•                •  Post trigger  ( ) Until Bus Free (x) delay   •               •
•                •  Delay  +---------•---------+ [ 50%]         •               •
•                •                                              •               •
•                •             <  OK  >  <Cancel>               •               •
••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••
TRACING: Stopped  TRIGGER: Disabled   PRINTER: Off
```

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 Ultra2160 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 :

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```
  File    Tracing    Utilities    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:

```
---------------------------------
|       T                       |
---------------------------------
|    20%   >       80%          |
```

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.

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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 Ultra2160 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.

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S E C T I O N 6

SCSI INITIATOR EMULATION

6.1 INTRODUCTION

TBA

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SECTION 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 Ultra2160, 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 Ultra2160, 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 Ultra2160. The printer should be any standard parallel type. For the parallel DB-25 connector pinout see Appendix A.

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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 Ultra2160 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,

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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 Ultra2160/Lite, because you can access this analyzer only from the external terminal / PC. When using the Ultra2160 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 Ultra2160 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 Ultra2160 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 Ultra2160 instrument identification and firmware revision number printed on it. Use a flat blade screwdriver to disengage the EPROM from its socket.

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- 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 Ultra2160 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 Ultra2160 Analyzer and the hard disk contains other files used by the system (Help files, Web pages, etc.). In order to upgrade the Ultra2160 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 Ultra2160 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-2160. Then press **<Enter>.** Next press **<Y>** to put the Ultra-2160 in the download mode. The

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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 "u2160.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 Ultra2160 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 (Au2160.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 Ultra2160. (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 Ultra2160 by pressing System Reset. During the boot process, the Ultra2160 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 Ultra2160.

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

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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

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```
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
```


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A.3 SINGLE-ENDED/LVD CONNECTORS

68-pin HD 'P' type for S-E (Single-Ended)

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

68-pin HD ›P: type for the LVD (Low Voltage Differential)

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

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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•

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A P P E N D I X B

USING THE PC & PROCOMM or Microsoft Win95/98 HYPERTERMINAL

There are several communications programs which could be used for the remote control or up/downloading of programs or traces from/to the Ultra2160 analyzer. In this Appendix, we will describe using the PROCOMM program and the Windows95 HyperTeminal, as examples.

B.1 REMOTE CONTROL - USING THE PROCOMM

B.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 Ultra2160, 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.

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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.



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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 Ultra2160 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 Ultra2160 to the COM port on the PC.

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B.1.2 SAVE TRACE TO HOST

B.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 Ultra2160 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 Ultra2160 is ready.

ON THE Ultra2160:

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 Ultra2160:

- press **<Y>** to see the address counter on the Ultra2160 counting and the data being listed on the PC. When the transfer is finished, message **"- finished -"** will be displayed on the Ultra2160 screen, and the EOT character (**ì**) 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 Ultra2160 by typing **<Esc>**.

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B.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 Ultra2160:

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 Ultra2160 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 Ultra2160 by typing **<Esc>.**

B.1.3 RESTORE TRACE FROM HOST

B.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 Ultra2160 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 Ultra2160 is ready.



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ON THE Ultra2160:

From the main menu on the Ultra2160:

- 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 Ultra2160:

The address counter on the Ultra2160 will count as the data is being transferred. When finished, the Ultra2160 clears the screen and returns to the main menu.

The trace has now been restored to the Ultra2160 trace memory and can be displayed using **<D>**.

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

B.1.3.2 XMODEM TRANSFER

ON THE Ultra2160:

From the main menu

- select AFile@
- select AReceive File@
- select Xmodem transfer
- at this point, the Ultra2160 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 Ultra2160 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 Ultra2160 by typing **<Esc>**.



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B.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 Ultra2160 on and attach the Ancot serial cable to the serial port on the Ultra2160.

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.U2160), 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 Ultra2160, selectUtilities/Serial Port Settings ..
Make sure that the selections you chose in Step-6 are the same on the Ultra2160.

Step 9: On the Ultra2160, select Utilities/Remote Control



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Step 10: You should now be connected to your Ultra2160.
Press the <Esc> key to display the Main Menu.

Note (1): With the Ultra2160 Lite press System Reset to return to the Main Menu.
Note (2): Make sure that the baud rates match both on the Ultra2160 and on HyperTerm. You should be using the highest baud rate which your computer can support.

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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-2160 " (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 AK@ = Trace Memory Image written to disk "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

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The Raw Data format is the only one that can be loaded back into the Ultra2160 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. For an exact description of the raw data format, please contact Ancot.

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 Ultra2160 when displaying in these formats. These formats cannot be downloaded back into the Ultra2160.

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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



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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 Ultra2160 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.



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

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