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Portable

SCSI bus ANALYZER

Model # D S C - 2 1 6

USER's MANUAL

Revision: 2.52

April 1995

ANCOT Corporation
115 Constitution Drive
Menlo Park, California 94025
(415)322-5322

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TABLE OF CONTENTS

Paragraph		Page
SECTION 1. DESCRIPTION OF EQUIPMENT		
1.1	Introduction	1
1.2	General Description	1
1.3	System Overview	2
1.4	Timing Conditions in Recording	3
1.5	Front Panel	4
	The 24-key keypad	5
1.6	Notational Conventions	5
1.7	User Interface	6
1.8	Timer & Time Stamping	8
1.9	Electrical connection on SCSI bus	8
1.10	SCSI Bus Termination and TERMPWR	8
1.11	Technical Specifications	9
1.12	SCSI standard specifications and references	10
1.12.1	SCSI Standard Specifications	10
1.12.2	Other literature	11
SECTION 2. TRACER/ANALYZER FUNCTIONS AND COMMANDS		
2.1	Trace Memory	13
2.2	Functions and Commands	14
2.2.1	Main Menu	14
2.2.2	Start tracing	15
2.2.3	Pause tracing	15
2.2.4	Stop tracing	16
2.2.5	Mode of tracing	16
2.2.5.1	Save All/Skip data	16
2.2.5.2	Capture phase changes	16
2.2.5.3	Filtering by SCSI ID	17
2.2.5.4	Capture selection only	17
2.2.5.5	Capture 4 edges REQ/ACK	17
2.2.5.6	Capture on external clock	18
2.2.5.7	Capture SCAM Protocol	18
2.2.6	Trigger setup	18
2.2.7	Clear trace	18
2.2.8	Write trace	19
2.2.9	Save/Restore trace	19

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2.2.10 Display trace 19
2.2.11 Setup display format 19
2.2.12 Find event 20
2.2.13 Calculate time differential 20
2.2.14 Utilities 20
2.2.15 SCSI Emulator 21
2.2.16 User Programs 21
2.3 Save/Restore trace functions 23
2.3.1 Save trace to host via serial port 23
2.3.2 Save trace to host via parallel port 24
2.3.3 Save trace to Mirror memory 25
2.3.4 Restore trace from host via serial port 25
2.3.5 Restore trace from host via parallel port 26
2.3.6 Restore trace from Mirror memory 26

SECTION 3.
DISPLAYING THE TRACE MEMORY

3.1 Introduction 27
3.2 Structured display format 29
3.2.1 Structured display with NARROW/WIDE data transfers 30
3.2.2 Structured display with NARROW data transfers 32
3.2.3 Structured display of SCAM protocol 32
3.3 Binary display format 33
3.3.1 Binary display of SCAM protocol 37
3.4 HEX dump format 38
3.5 Compact display format 38
3.6 Command profile format 39
3.7 Changing the display format 41

SECTION 4.
SEARCHING FOR EVENTS IN THE RECORDED TRACE

4.1 Introduction 43
4.1.1 Select a custom control bit pattern 44
4.2 Select the search options 45
4.2.1 Search for WIDE data pattern 45
4.2.2 Set the search direction 46
4.2.3 Set the 'occurrence' counter 46
4.2.4 Set the search address limits 46
4.2.5 Set the search starting address 47
4.2.6 Set the data bits pattern 47
4.4 Repeating the search 48

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SECTION 5.
TRIGGERING

5.1	Introduction	49
5.2	Trigger selections	49
5.3	Trigger examples	52
5.3.1	Post triggering	52
5.3.2	Pre triggering	53
5.3.3	No trigger required	53

SECTION 6.
SCSI INITIATOR EMULATION

6.1	Introduction	55
6.2	Initiator Emulation	55
6.2.1	Change LBA <^A>	57
6.2.2	Macros <^B>, <^L>	57
6.2.3	Data Buffer Management <^D> (see 6.3)	58
6.2.4	Edit CDB <^E>	58
6.2.5	Increment LBA after Write/Read <^F>, <^G>	58
6.2.6	Autofill <^H>	59
6.2.7	Initiator ID <^I>	59
6.2.8	Compare Buffers <^K>	60
6.2.9	Link & Flag Bit <^N>	60
6.2.10	SCSI Reset <^R>	60
6.2.11	Target ID <^T>	61
6.2.12	Logical Unit Number (LUN) <^L>	61
6.2.13	Emulator setup <^X> (see 6.4)	61
6.2.14	Queue Tag <^Y>	61
6.2.15	Repeat Command <^Z>	62
6.3	Data Buffer Management <^D>	63
6.3.1	Select Buffer	63
6.3.2	View and Edit Buffer	63
6.3.3	Fill Buffer	64
6.3.4	Copy Buffer	64
6.3.5	Set Buffer Size	65
6.4	Emulator setup <^X>	66
6.4.1	Alloc / Xfer Lengths	66
6.4.2	Arbitration	67
6.4.3	Identify Message	67
6.4.4	Disconnect / Reconnect	67
6.4.5	Custom Message	68
6.4.6	Data Protocols	68
6.4.7	Mode Sense / Select setup	70
6.4.8	Target Type	70
6.4.9	SCSI Version	71
6.4.10	Timeout selection	71

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SECTION 7.
UTILITIES

7.1	Introduction	73
7.2	Calculate elapsed time in trace	73
7.3	The Utility functions menu	74
7.3.1	Using the screen saver	74
7.3.2	Printing display information	74
7.3.3	Printer timeout	75
7.3.4	Show system configuration	75
7.3.5	Restoring system default parameters	75
7.3.6	REMOTE CONTROL from external host (PC)	76
7.3.7	Setting serial port parameters	77

SECTION 8.
INSTALLATION

8.1	Unpacking	79
8.2	Initial Turn-on	79
8.3	Initial Check-out	80
8.4	Communication, Interfacing, and Setup	80
8.5	EPROM firmware upgrades	81

SECTION 9.
OPTIONS

9.1	Introduction	83
9.2	The applications	83
9.2.1	'Antest', the disk test program	83
9.2.2	C language cross compiler	84
9.2.3	The Trace MIRROR Memory option	84
9.2.4	SCSI connector pods	85

APPENDICES

A	External Connectors and Cables	87
A.1	I/O Interface connectors J1, J3	87
A.2	Auxiliary connectors J2, J4, J7, J8	88
A.3	SCSI connector modules J5, J6	89
A.3.1	S-E 68pin & 50pin conn. module (standard)	90
A.3.2	DIFF 68pin & 50pin conn. module (optional)	91
A.3.3	S-E & DIFF both 68pin conn. module (optional)	92
A.3.4	S-E & DIFF both 50pin conn. module (optional)	93
A.4	Null-Modem cables	94
A.5	Cable adapter DB-9 to DB-25	94
A.6	Cable adapter for trace upload using parallel port	95

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B	Escape Sequences used in screen control	97
B.1	General	97
B.2.1	Escape Sequences - OUT (from DSC-216 to terminal)	97
B.2.2	Escape Sequences - IN (from terminal to DSC-216)	98
C	Trace Upload/Download formats	99
C.1	Header/Trailer Information	99
C.2	Raw data format	100
C.2.1	Natural SCSI events	100
C.2.2	Artificial SCSI events	101
C.3	Readable formats	102
C.4	Trace dump format	103
D	The Keypad & External Keyboard functions	105
D.1	General	105
D.2	The keypad & keyboard table	105
E	The SCAM protocol	107
E.1	General	107
E.2	Using the DSC-216 for SCAM	108
E.2.1	Activating the SCAM display	108
F	Trace MIRROR Memory option	109
G	Save/Restore trace data to/from PC host via parallel port	111
H	Save/Restore trace data to/from PC host via serial port	113
H.1	Setting up PROCOMM options	113
H.2	Saving a trace to host	116
H.3	Restoring a trace from host	117
J	SCSI Facts & Tips	119
J.1	Cabling	119
J.2	Electrical connection and termination on the SCSI bus	119
	Single-Ended	120
	Differential	120
J.3	The TERMPWR	121
J.4	SCSI Initiators & Targets	122
J.5	SCSI device addressing	122
J.6	SCSI data parity	123
J.7	Mixing SE & Diff SCSI devices	123
J.8	SCSI cable length	123
J.9	Extending the SCSI cable	123
INDEX		125

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SECTION 1

DESCRIPTION OF EQUIPMENT

1.1 INTRODUCTION

The DSC-216 is a highly 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 DSC-216 Tracer/Analyzer provides a comprehensive SCSI event tracer and debugger with powerful triggering capability. It provides displays of SCSI Bus activity in a variety of formats for easy interpretation.

1.2 GENERAL DESCRIPTION

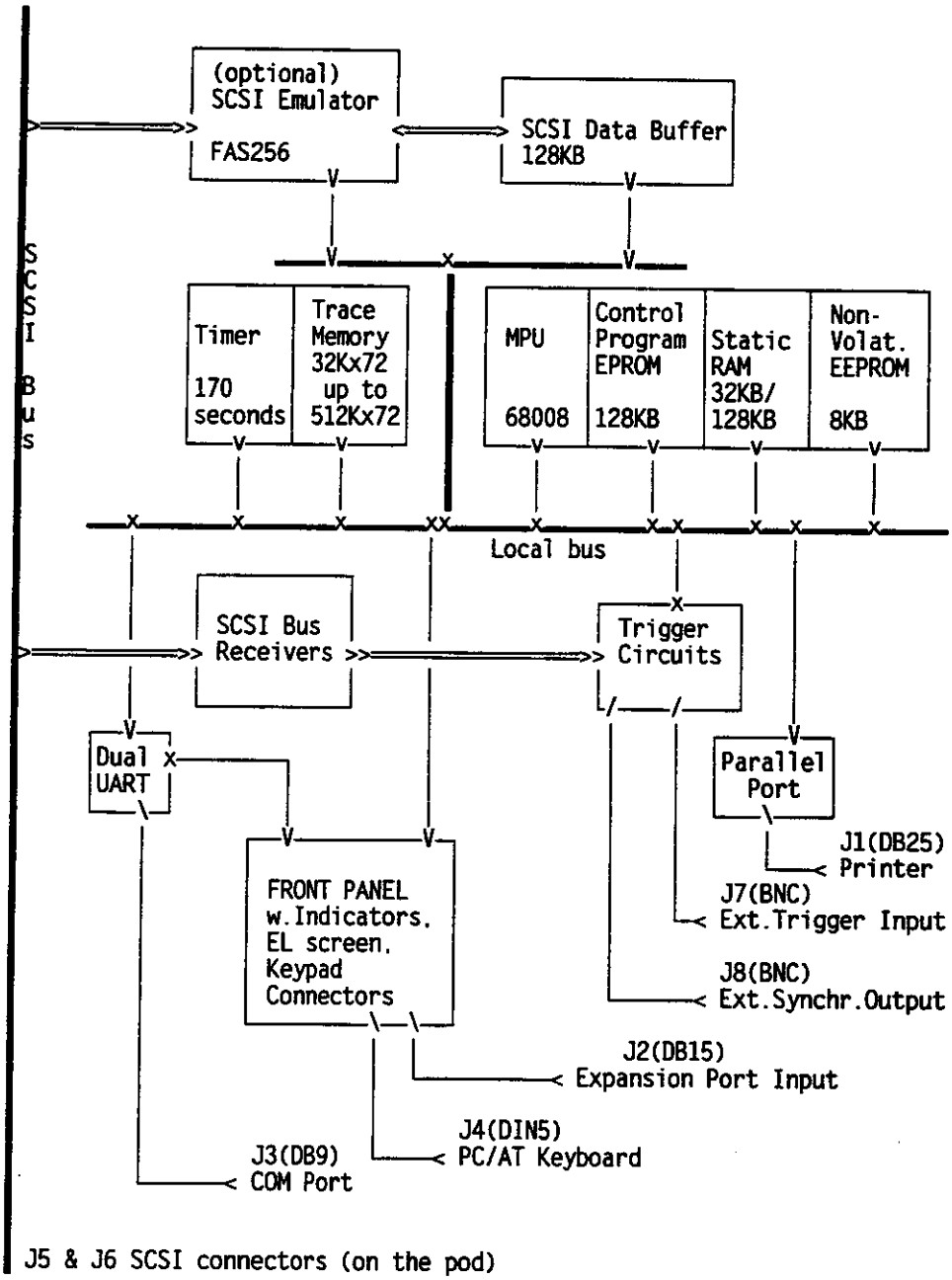
The SCSI Bus Analyzer is used for recording activity on the SCSI Bus to which it is non-intrusively connected. Its circular buffer can hold up to 32K events (standard), 128K or 512K events (optional). The recording method is 'event driven'; only valid data or transitions on certain SCSI signals are recorded. At the time of recording, each event is time-stamped. The recording can later be played back in several forms. It can be displayed on a built-in electroluminescent (EL) flat screen, or sent to a printer to provide a hard copy. Recorded data can be up-loaded to a host computer, and saved on a disk to build a data base for post processing. Optionally, it also can be saved in a non-volatile ("Mirror") memory to be examined later.

The display of recorded SCSI Bus activity can be in two basic forms: a "binary" format similar to a time-domain form of logic analyzers, or a "structured" format which is an interpreted "SCSI-English" form, easily understandable. Other, more specialized display formats are also available. See section 3.

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1.3 SYSTEM OVERVIEW

A simplified block diagram of the DSC-216 SCSI Bus Analyzer is shown below:



The system carries out several major functions:

The Tracer/Analyzer unit is connected to the SCSI Bus by its line receivers. Note that the tracer is a non-intrusive device, which merely senses activity on the SCSI Bus through isolating receivers. The

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load on the tested SCSI Bus is minimal - one 74LS14 input load (or equiv.) per line.

From line receivers, the signals are directed to separate circuits: the trace memory, the trigger circuitry, and to the front panel to be displayed using LED indicators. All parts of the DSC-216 are internally controlled by the local MPU (Motorola's MC68008) running at 8MHz. The control program for the MPU is saved in EPROM with up to 128KB (256KB on Emulator models) capacity.

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

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

1.4 TIMING CONDITIONS IN RECORDING

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

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

- during Information Transfer Phases, a SCSI event can be
  a) qualified by valid edge of REQ or ACK signals:
     During READ operations (Data from Target to Initiator), status of the SCSI Bus signals is recorded in the Trace Memory following the leading edge of REQ signal.
     During WRITE operations (Data from Initiator to Target), status of the SCSI Bus signals is recorded following the leading edge of ACK signal.
  b) recorded during any transition of the REQ or ACK signals, i.e. following all 4 edges of REQ and ACK.
  c) recording of data during data-in or data-out phase can be skipped (after the leading 8 or 32 bytes). Note that all bytes transferred are counted, and the total count will appear in the trace.
  d) any transition on the MSG, C/D, or I/O SCSI Control lines can be recorded.

- status of the SCSI Bus and 3 external signals can be recorded on every negative transition of the bit-0 of the expansion port (J2)

- certain changes on data lines when tracing the SCAM protocol

For more on recording modes read Section 2.2.5.

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1.5 FRONT PANEL

The front panel of the DSC-216 contains a flat panel display screen, a 24-key keypad, two pushbutton switches, and 31 LED indicator lights. Several connectors, a cooling fan, and the main power switch module also share the front panel.

The **DISPLAY SCREEN** is a high-visibility electroluminescent (EL) flat panel, capable of displaying 25 lines of 80 characters each.

The **SYSTEM RESET** switch is used for restarting the system.

The **SCSI RESET** switch is used for generation of the RESET condition on the SCSI bus.

The **LED indicators** are:

POWER
TRACING
TERMINATOR POWER
PRINT mode
SCSI Control Signals: BUSY, SEL, C/D, I/O, MSG, REQ, ACK, RST and ATN
SCSI Data Signals: D0 - D15, and Data-Parity (2)

CONNECTORS located on the front panel of the DSC-216 are:

J1 - Parallel Printer (DB25 female)
J2 - Expansion 3-bit port Input (DB15, female)
J3 - Serial I/O port (DB9 female)
J4 - 5-pin connector for PC/AT keyboard (DIN female)
* J5 - SCSI connector (50-pin, female, alternative-2 - on S/E pod)
* J6 - SCSI connector (68-pin 'P' type, female - on S/E pod)
J7 - External Trigger Input (BNC connector)
J8 - External Synch Output (BNC connector)

*) Note: The J5 and J6 connectors are on a plug-in unit which optionally can be of a different type. The standard screws are: 2-56 with the 50-pin HD connectors and 4-40 with the 68-pin HD connectors. Contact the factory if you require any changes.

EXTERNAL TRIGGER INPUT - The J7 connector (coaxial BNC type), located on the right side of the front panel of the DSC-216 serves for input of an external trigger signal. The DSC-216 will trigger on negative transition if enabled from the trigger menu.

The basic trigger functions, which most users would need, have been implemented in the system. Additional unique trigger functions may be added by using this external trigger.

EXTERNAL SYNCH OUTPUT - The J8 connector (coaxial BNC type), located on the right side of

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the front panel of the DSC-216 serves for providing a trigger signal, which may be used for triggering external instruments like oscilloscopes, logic analyzers, etc. This signal is a low-going pulse which occurs at the same time the trigger event occurs.

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 J2 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. The bit-0 (LSB) can be used as a clocking signal if "external clock" is enabled from the recording mode menu.

See Appendix A for the J2 connector pinout. Note that on this connector there are two pins that carry Vcc (+5V, available up to 100mA), and two pins for GND. The Vcc and GND may be used to power external devices like AD converters, or other adapters.

The integrated **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.

The **24-key KEYPAD** - allows using keys at three levels: the basic function, the 'ALT' and the 'CTRL' modified function. Note that the keypad and the external keyboard can be used interchangeably. You can be using both at the same time: press a key on the keypad, press several keys on the external keyboard, go back to the keypad, etc.

The names of keys on the keypad were selected so that their starting letter corresponds to the letter on the external keyboard as close as possible. For example the **<Run>** key is the same as the **<R>**, the **<Stop>** key is the same as **<S>**, etc. The number-keys on the keypad are the 'ALT' set, and the special less frequently used functions are the 'CTRL' set.

The table in Appendix D lists all keys of the keypad, their corresponding keys on the external keyboard, and their functions.

The **SCSI Connector Adapter (Pod)** - is a field changable pod for Single-Ended or Differential SCSI interface using various connector types. See Appendix A for pinout description.

1.6 NOTATIONAL CONVENTIONS

The primary operator interface with the DSC-216 is through the keypad on the front panel, or through the PC/AT keyboard. 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" key) etc.

Keys that are to be depressed together (the "control combinations") are shown with a "^" (Up-

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Arrow) preceding the other character. For example <^C> or <Ctrl-C> means that you type the "C" key while the Ctrl key is depressed. Combinations may also appear as e.g. <Alt-C>, which means that you 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 "(", and ")". Current selections or defaults are displayed in square brackets "[", and "]".

1.7 USER INTERFACE

The user interface is via **screen** and **keypad** built into the front panel on the DSC-216, via an external keyboard (connected to J4), or via screen and keyboard of a remote control PC/CRT.

The **SYSTEM RESET** switch, on the lower left side of the DSC-216 front panel, if pressed, will reset the system to its initial Power-On state. Remember that selected setup values, stored in EEPROM non-volatile memory, do not change after reset, or if the system is powered OFF. The SYSTEM RESET switch does NOT generate Reset on the SCSI Bus.

SCSI RESET switch, near the SYSTEM RESET switch, if pressed, will generate Reset condition (continuous level) on the SCSI bus; however, it will not affect operation of the DSC-216.

LED indicators on the front panel display instantaneous status of the SCSI data lines and SCSI control lines. These indicators will typically be useful during a major malfunction, when the object system stalls. In these situations the LEDs will help to determine which SCSI Bus phase the system is stopped in, and what condition the active SCSI device is waiting for. For example, an Initiator may be trying to select a non-existing Target device and is not receiving a BUSY signal, or Target may be asserting REQ signal for a data transfer, and is waiting for ACK from the Initiator.

The **TRM.PWR** LED indicates whether TERMINATOR POWER is being supplied on the SCSI Bus, and that it is 4.0 Volt or higher. It is the responsibility of the system integrator to decide which device will supply it. This TRM.PWR LED may be an important indicator, because without the TERMINATING POWER applied, the SCSI Bus may still work, but its reliability may be affected. Also remember, that some SCSI Bus configurations drive their terminators internally and do not need to drive the TRM.PWR line on the SCSI Bus.

The **TRACING** LED indicator lights up when the DSC-216 is in the tracing mode following **<R>** (RUN). It will stay ON until the tracing is stopped either by the **<S>** (Stop) key, the **<P>** (Pause) key, or as a result of a trigger condition.

The **POWER** LED indicates that the DSC-216's power is turned ON.

The operator interface from the keypad, or from the external PC/AT keyboard, is completely menu-driven. The main menu at the root of the DSC-216 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

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the rest of the word is filled in automatically. The function will execute, or if more input is needed, a menu or prompt will appear on the screen. If a wrong key is pressed, the system will either beep, and give the operator a second chance, or in some situations will abort and exit that function. The type of each individual operation will determine which of the two actions will be taken.

Several keys have a characteristic function:

By pressing **<Enter>**, **<Space>**, or **<Yes>** while at the root level, the main menu will be re-displayed.

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

<^C> : There may be several prompts to be answered before a certain function is started. If you change your mind in the middle of this selection process, then by pressing the **<^C>** key you can quit that selection sequence and exit immediately to the root. You can also use the **<^C>** to exit any selection and return directly to the root menu level.

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

<^Print> or <^P> is a toggle switch which will turn "parallel printing" ON or OFF. Printing mode is indicated by a small LED at the <^Print> key. By "parallel printing" we mean sending all data that is being displayed on the screen also to the printer port. Note that only the trace data will be printed (not the menus etc.).

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

OTHER GENERAL RULES:

If a question is asked in a selection dialog expecting a "Y/N" answer, use keys marked **<Yes>** and **<No>** from the keypad. If an external keyboard is used, typing a "Y" is interpreted as YES, and anything else is interpreted as NO.

In edit sessions typically the current selection is displayed. If a different value is required, the operator should type it in. If only **<Enter>** is typed, the current value will stay unchanged. By typing "." (period), **<Esc>**, or **<Q>** the edit session is terminated.
Numeric values, except the timing information (e.g., Time-Stamp), or unless marked, are displayed in Hex format. Similarly, 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 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 AND TIME-STAMPING OF RECORDED SCSI EVENTS

There is a 4-byte, 50 MHz counter in the DSC-216 Analyzer which is used for marking each recorded event in trace memory with a time stamp. The resolution is 20 nanoseconds. The timer will wrap around after 171 seconds.

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 (including possible 3-minute wrap-arounds). This selection is done from the keypad by pressing the **<^TmFmt>** key while in the display mode. Timing information is also available in the STRUCTURED 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 two alternatives for connecting the SCSI bus: the SINGLE-ENDED and DIFFERENTIAL alternatives. They are both supported on the DSC-216 Analyzer, by using inter-changeable pods. Various versions of interface pods and pinouts of all connectors used are listed in Appendix A.
'SCSI FACTS & TIPS' in Appendix J. is a recommended reading for those interested to know more about the S-E and Diff interfaces.

1.10 SCSI Bus TERMINATION AND TERMINATION POWER

The SINGLE-ENDED SCSI interface signals in the DSC-216 are terminated by a built-in active terminator. This terminator is enabled by a sliding switch marked "TERM" positioned to the left from the J5 SE SCSI connector on the SCSI connector adapter.

The DIFFERENTIAL SCSI interface signals are NOT terminated (i.e., there is no internal termination provided). Use the external SCSI-DIFFERENTIAL Terminator. Power (TERMPWR) for this Terminator, if enabled by the "Trm.Pwr" switch (positioned to the left from the J5 SCSI connector), is supplied in both SCSI connectors, the J5 and J6.

The TERMPWR line in the external SCSI-Terminator is interconnected to both connectors; therefore Terminator Power (+4.25 Volt) can be supplied from either end of the SCSI cable, by the external SCSI device, or by the DSC-216.

The TERMPWR is protected by a serial (Schottky) 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.

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!!! 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 FAIL !

The DSC-216 analyzer is shipped from the factory with TERMPWR enabled, and in the case of the SE interface, also with the terminator enabled as a default setting. 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 leave the terminator enabled and whether you need the TERMPWR on, depending on where you are connecting the analyzer - in the middle or at the physical end of the SCSI cable.

'SCSI FACTS & TIPS' in Appendix J. is a recomended reading for those interested to know more about the S-E or Diff interfaces, and SCSI bus termination methods.

1.11 TECHNICAL SPECIFICATIONS

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

- Asynchronous data transfer rates to over 10 MHz

- Synchronous data transfer rates to over 10 MHz

- Single-ended (SE) interface is standard; differential (Diff) interface is optional. SCSI cable adapters/pods are available for SE or Diff, and for 50-pin or 68-pin connectors.

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

- Trace memory is 32K events deep, and 72 bits wide. Optionally it can be expanded to 512K.

- Up to three external signals can be recorded together with SCSI in the trace memory to allow tracing in the tested device.
  External port bit-0 can be used as "clocking" (negative edge is used)

- Recording modes: record all, or skip data, record one or all four edges of REQ and ACK, phase changes, external clock, and filtering by SCSI ID, recording of selections only, or recording of 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.

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- Hard copy of all displays printed via parallel I/O port J1 on an optional printer

- Event time-stamping function up to over 170 seconds before timer counter wrap around, with 20 nanosec resolution

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

- 128K byte (SRAM) system or program memory, and 32K(128K) byte data read/write buffer

- Motorola 68008 local MPU, at 8MHz, with resident firmware in 128K/256K-byte EPROM
- Configuration selectable through menu driven software, stored in non-volatile EEPROM memory

- Serial I/O port (RS-232) with selectable baudrate of up to 38.4K baud with data format and parity

- Powerful triggering capability is menu selectable
  - pre-triggering
  - post-triggering
  - delayed-trigger

  internal triggering by:
  - selected command, status or message
  - 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 pre- or post-triggering through trigger-output BNC connector
  External synch (trigger) input through a BNC connector

- SCSI Bus termination for Single-Ended interface switch selectable (standard), for Differential I/F external (optional)

- Physical dimensions: 11"W x 14.5"D x 5"H. Weight: 13 lbs

- Housed in an elegant transportable high-quality fan-cooled attache case type enclosure, with detachable top cover.
  Built-in EL flat screen & keypad, and switching power supply for 110-220 Volt, 50-60Hz operation
  Storage pouch in cover is for small keyboard, cables, adapters, etc.

1.12 SCSI STANDARD SPECIFICATIONS AND REFERENCES

1.12.1 SCSI STANDARD SPECIFICATIONS

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

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

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

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

Refer to document X3.131-1994.

1.12.2 OTHER LITERATURE

"Basics of SCSI" by ANCOT (1993)
is a quick introduction to SCSI, SCSI terms description, and glossary.

Available from ANCOT Corporation
115 Constitution Drive, Menlo Park, CA 94025
(415) 322-5322
This publication is FREE

"Understanding The Small Computer System Interface" by NCR (1988)
is a quick introduction to basic operations of the SCSI Bus

Available at many bookstores, or can also be purchased directly from:
NCR Corporation
SCSI Technology Group
3718 North Rock Road, Wichita, KS 67226

"The SCSI Encyclopedia" by Jeffrey D. Stai, published by ENDL
Provides a detailed description of basic and advanced operations of SCSI-1 and SCSI-2 interfaces.

Available at many bookstores, or can also be purchased directly from:
ENDL Publications
14426 Black Walnut Court, Saratoga, California 95070
(408)867-6630

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SECTION 2

TRACER / ANALYZER FUNCTIONS AND COMMANDS

2.1 TRACE MEMORY

Trace Memory is a circular buffer 32K, optionally 128K or 512K events deep, with each event 72 bits wide. The 72 bits are used as follows:

2 bytes (16 bits) for SCSI data
2 bits for low and high data parity error flags
6 bits for SCSI control signals (BSY,SEL,RST,MSG,C/D,I/O)
4 bits each (12 bits total) for fast SCSI control signals (REQ,ACK,ATN)
4 bytes (32 bits) for the time stamp
3 bits for expansion port (J2)
1 bit for internal use

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 that 20 nanosec) is taken, latched, and written in the trace memory. Other recording modes are available. See Section 2.2.5.

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

The recording can be started or stopped in three ways. Recording mode can be:

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

Whether recording with or without trigger, the **<Run>** (**<R>**) command has to be used to set the DSC-216 in the TRACING mode. This mode is indicated by the "TRACING" LED on the front panel and a "RUN" 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>** (**<S>**) key, or by a post-trigger condition, if enabled. At that point the current (internal) trace memory physical address is detected, and beginning of valid data is calculated. This is done automatically without

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operator intervention. The earliest event still in the trace is at logical address $00000. The operator does not have access to the physical address however; he/she deals with logical addressing only.

When recording with trigger disabled (internal or external), the trace memory acts as a FIFO buffer. The recording starts with the first SCSI activity following **<Run>**, and continues until stopped by **<Stop>**. If trace memory (physical) capacity is exceeded, it wraps around and starts writing from the physical beginning. Although the trace memory uses internally a linear physical address space, the internal firmware translates physical address to logical before displaying it, to make the trace memory appear circular. When recording is stopped, it reports "STOPPED AT xxFFF(WRAP)". The last recorded event is at trace memory (logical) address 7FFF (1FFFF in 128K, or 7FFFF in 512K versions).

When trigger is used in POST - TRIGGER mode, recording starts as described above, and continues until a trigger condition occurs. When the trigger finally occurs, then depending on trigger delay selection, 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 (delayed trigger)

However, when "Trigger on Trace Memory full" is selected, or External Trigger is used and the last location is filled, recording stops immediately.

When the PRE-TRIGGER mode is used, the tracer has to be enabled by **<Run>**, and the trace memory records all activity on the SCSI Bus. However, whenever a BUS-FREE phase is detected, the internal trace memory address counter is reset, causing the next recording to be written over previously recorded data. This will repeat until the trigger condition occurs; when that happens, the resetting of the trace memory address counter will be disabled, and thus the most recent command will be preserved in the trace memory. All successive recording will continue, until the trace memory fills up. At that point the TRACING mode is reset, even in the middle of a command, and the recording stops.

TRACING will stop immediately, without waiting for a BUS-FREE phase, when the **<Stop>** (<S>) key is pressed.

2.2 FUNCTIONS AND COMMANDS

2.2.1 MAIN MENU

The main menu lists the basic functions of the SCSI Bus tracer. From this level various sub-menus can be accessed. As with all menus, selections can be made as follows :

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- By moving the highlight bar to the desired entry using the arrow keys and then pressing **<Enter>**

- By pressing the selector key, shown either in angle brackets < > or at the start of the line before the entry

- In some cases, letter keys from the PC/AT keyboard act as selector keys.

```
                              DSC-216 MAIN MENU
TRACING                       TRACE MEMORY                 UTILITIES

<Run  > start tracing         <1> - Clear trace            <6> - <^Find> event
<Pause> tracing               <2> - Write trace            <7> - Calc. <^Time> diff
<Stop > tracing               <3> - Save/Restore trace     <8> - <Util>ities
<Mode > of tracing            <4> - <Display> trace        <9> - SCSI Emulator
<Trig >ger setup [Pre ]       <5> - Setup display format   <A> - User Program

>
```

2.2.2 <R> - START TRACING (RUN)

Pressing the **<Run>** key puts the DSC-216 into tracing mode. From that point on, all activity on the SCSI bus will be recorded, subject to the trigger conditions in force. From the external keyboard, the **<R>** key is a selector for this function.

See Section 2.1 for a discussion of tracing itself.
See Section 2.2.5 for a discussion of recording modes.
See Section 2.2.6 and Section 5 for a discussion of triggering.

2.2.3 <P> - PAUSE TRACING

Pressing the **<Pause>** key temporarily halts recording of SCSI bus activity. Pressing **<Run>** will then restart recording. A message "Tracing PAUSE at <addr>" will appear. The 'seam' location will be marked in the trace memory, and can later be found using the 'Find Event' command. From the external keyboard, the **<P>** key is a selector for this function.

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2.2.4 <S> - STOP TRACING

Pressing the **<Stop>** key will halt tracing. From the external keyboard, the **<S>** key is a selector for this function.

2.2.5 <M> - MODE OF TRACING

Press the **<Mode>** key to select the recording mode from the TRACE MODE SETUP menu as shown below. From the external keyboard, the **<M>** key is a selector for this function.

```
TRACE MODE SETUP MENU
---------------------------------
<0> - Save All/Skip Data    [All]
<1> - Capture phase changes   [ ]
<2> - ID Filtering     [0081] [ ]
<3> - Capture Selection Only  [ ]
<4> - Capture 4 Edges REQ/ACK [E]
<5> - Capture on external clk [ ]
<6> - Capture SCAM protocol   [ ]

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

Individual functions are described below.

2.2.5.1 <0> - SAVE ALL / SKIP DATA

This entry allows selection of the 'Skip Data' recording mode. Number in the brackets shows the number of data transfers which will be recorded. When this function is disabled, 'All' will be indicated. If 'Skip Data' is enabled (selected by the left and right-arrow keys) then either 8 or 32 in the brackets indicate that only so many data transfers will be recorded. In either case, the total number of data transfers is counted and recorded in the 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.

2.2.5.2 <1> - 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 'E' character appears in the set of 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.

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2.2.5.3 <2> - FILTERING BY SCSI ID

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 are allowed to 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.

2.2.5.4 <3> - CAPTURE SELECTION ONLY

This function enables or disables skipping of all events except transitions on the SCSI BSY and SEL control lines. This mode is extremely economical of trace events when all that is desired is to see which IDs are being most utilized, or to determine the proportion of idle to active time on the bus.

2.2.5.5 <4> - CAPTURE FOUR EDGES REQ/ACK

This function enables or disables capture of an event on any transition of the REQ or ACK SCSI control lines. When enabled, each transfer of information during the Command, Status, Message or Data phases will cause up to four events to be recorded (on some extremely fast systems, two of the edges may occur so close together as to be telescoped into one recorded event). This recording mode is very valuable in tracing synchronous data transfers, or when checking timing of the REQ and/or ACK signals.

When this function is disabled, the tracer will record only one event for each byte of information transferred. The recording will be qualified by the edge of REQ or ACK that signifies valid data :

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the transition to active REQ for data from the Target, or the transition to active ACK for data to the Target.

2.2.5.6 <5> - CAPTURE ON EXTERNAL CLOCK

This function enables or disables recording of events qualified by an external clock input. When enabled, any low-going transition on expansion connector bit 0 (DB-15 type connector J2, pin 1) will cause recording of a snapshot of the SCSI bus (within 20 nanosec of the transition). This mode is useful to relate the timing of signals internal in tested system to the contents of the SCSI bus.

2.2.5.7 <6> - CAPTURE SCAM PROTOCOL

This mode allows recording of 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.

The reader is referred to Appendix E and the SCSI-3 ANSI specification (document: SCSI-3 Parallel Interface 'SPI', Annex B) for detailed description of the SCAM protocol.

2.2.6 TRIGGER SETUP

Press the <**Trig**> key on the keypad to specify the trigger mode and conditions of the trigger event. From the PC/AT keyboard, the <**T**> key is a selector for this function.
See Section 5 for a complete discussion of the Trigger Setup Menu and triggering.

2.2.7 <1> - CLEAR TRACE

The CLEAR TRACE function is a two-step operation. When selected, a prompt will appear, asking you to confirm that the trace memory should be cleared. If you press <**Yes**> on the keypad, or <**Y**> on the external keyboard, the trace memory will be cleared to all zeros. From the PC/AT keyboard, the <**C**> key is a selector for this function.

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2.2.8 <2> - WRITE TRACE

The WRITE TRACE function allows you to set the contents of trace memory. For each event, you can specify the exact contents of the control-bits word (16 bits), data word (16 bits) and time stamp long word (32 bits). From the external keyboard, the **<W>** key is a selector for this function.

When you select this function, a prompt will appear asking for a starting address. You should type an address in hex in the range 0 - 7FFF (or 0 - 1FFFF if you have the deep trace option). Other values will be rejected. After specifying the starting address, a line will appear showing the current contents of that address's control-bits word. The cursor will be positioned on the first character to allow editing. If you do not wish to change the contents, press the right-arrow key. Otherwise, type the new value and press **<Enter>**. The new contents will be displayed, and the cursor will move to the data word, as the current contents are displayed. Edit the data word just like the control-bits word and the cursor will move to the time stamp long word, which you can also edit.

At any time, press the down-arrow key to move to the next event. Any unedited portion of the event at the cursor will remain as it was, and you will be able to edit the next event. When all is finished, press **<Quit>** to return to the main menu.

2.2.9 <3> - SAVE/RESTORE TRACE

The SAVE/RESTORE TRACE functions allow you to place some or all of the current recorded trace of SCSI Bus activity into a file on an external computer, or into the optional Trace Mirror memory. This functions also allow you to read from a previously stored trace back into the active trace memory for display. See Sections 2.3 for description.

2.2.10 <4> - DISPLAY TRACE

The DISPLAY TRACE function allows you to see the activity 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 **<3>** key is a selector for this function.

2.2.11 <5> - SETUP DISPLAY FORMAT

This function allows you to specify how the recorded activity is displayed. See Section 3 for a complete discussion of the display modes. From the external keyboard, the **<F>** or **<4>** key is a selector for this function.

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2.2.12 <6> - FIND EVENT

This function searches the trace memory for a particular pattern of control or data bits. See Section 5 for a complete discussion of the searching function. Note that searching is accessible from the trace display mode as well, by pressing the <^**Find**> key. From the external keyboard, the <**Ctrl-F**> key combination is a selector for 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. Note that this function is also accessible from the trace display mode, by pressing the <^**FndNxt**> key. From the external keyboard, the <**Ctrl-L**> key combination is a selector for this function.

A **FIND-PREVIOUS** function is also available. Press <^**FndPrv**> to select it. It is similar to FIND-NEXT, but it searches backwards through the trace. From the external keyboard, the <^**K**> is the selector for this function.

The **FIND EVENT** function can use a occurence count, i.e. you can find the n-th occurence of a certain event. The **FIND-NEXT** or **FIND-PREVIOUS** will always find the next first occurence, however.

2.2.13 <7> - CALCULATE TIME DIFFERENTIAL

This function allows you to select two trace events by specifying their addresses, and calculates the elapsed time between the two events. It uses the 20 nanoseconds resolution timestamp. Note that the time in nanoseconds is approximately modulo 170 seconds, due to timer counter wrap-around. In other words, if the two events are actually 175 seconds apart, the difference reported will be approximately 5 seconds. This function is also accessible from the trace display mode by pressing the <^**Time**> key. From the external keyboard, the <**Ctrl-T**> key combination is a selector for this function.

2.2.14 <8> - UTILITIES

This function allows access to utility functions which do not fall into any other category. See Section 7 for a complete discussion of the miscellaneous utility functions. Press the <**Util**> key to access this function. From the external keyboard, the <**U**> key is a selector for this function.

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2.2.15 <9> - SCSI EMULATOR

Press the **<9> or <E>** key to enter the SCSI Emulator menu. See Section 6 for a detailed description of all of the SCSI Initiator Emulator functions.

2.2.16 <A> - USER PROGRAMS

Press **<A>** to start a user program. Such programs include ANTEST (a package, sold as an optional disk testing utility by ANCOT), other user programs provided by ANCOT, or programs developed using the C cross compiler developed by ANCOT. (See section 9.2.2 for more information on the cross compiler.)

Pressing **<A>** results in another option menu.

```
USER PROGRAM MENU
-----------------
<0> - EPROM
<1> - SRAM (load first)
<2> - SRAM (restart)
<3> - EEPROM (load first)
<4> - EEPROM (restart)

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

Using this menu, you can choose:

0 - to start a program resident in EPROM in the expansion socket,
1 - to down-load from host and start a program in SRAM,
2 - to restart (earlier down-loaded) program in SRAM,
3 - to down-load from host and start a program in EEPROM, or
4 - to restart (earlier down-loaded) program in EEPROM.

The EPROM (128KBytes) is a non-volatile storage to hold SCSI target test utility programs. The socket for this EPROM is next to the program (Firmware) EPROM inside of the DSC-216.

The SRAM (96KBytes in all models shipped since beginning of 1994). It can hold program(s), but is cleared after power up.

The EEPROM (up to 6KBytes) can hold smaller programs which are saved until written over.

Programs are down-loaded from the host into the DSC-216 using the serial port, at connector J3. You will need a communications package, such as PROCOMM or PLPLUS, on your host computer capable of transmitting files in ASCII format. Also the file must be written in Motorola S-record format, in order to be executed on the DSC-216. The cross compiler available from ANCOT produces S-record format files. Finally, you will need a null modem cable (supplied by Ancot in accessories kit) to connect your host computer's serial port to the DSC-216 J3 connector. See sec-

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tion 7.3.10 for instructions on setting the serial port (J3) parameters.

To down-load a program from the host, first start your communications program on the host computer, and set the serial port configuration to match the serial port in the DSC-216. Get everything ready so that a single keystroke will start transmitting the file, but do not start transmitting yet.

Next, get the DSC-216 ready to receive the file. Do this by selecting a user program from the USER PROGRAM menu as described above, and choose either SRAM (selection **<1>**) or EEPROM (selection **<3>**) as the target of the loading operation. Message "Load S-Records now" will be displayed on the DSC-216 screen as an indication that the DSC-216 is waiting for the downloading to start, and a counter will appear showing the number of S-records transferred (counting from 0).

Now press the key on the host (**<PgUp>** for PROCOMM) to start the transfer. This order of operations is important because some communications programs start by issuing an initialization string to the modem presumed to be connected. Such strings contain characters which could be interpreted as S-records, and could confuse the software in the DSC-216 receiving the file. By starting the communications program before setting the DSC-216 to receive, the buffer holding any initialization string is flushed out before the file is sent.

If the transfer process seems to hang at the end, you may need to send ASCII character EOT (value 4) from your communications program. You can usually do this by pressing **<^D>** on the host. When the entire file has been transferred, the program will start automatically on the DSC-216. You may need to tell your communications program that the transfer is complete (for example: press **<Esc>** if using PROCOMM).

The down-loading of program process is very similar to down-loading the trace ("restoring trace"). You may read Appendix H. for an example of using the PC and the PROCOMM PLUS program for saving and restoring the trace.

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2.3 SAVE/RESTORE TRACE FUNCTIONS

Choosing the <3> from the system main menu results in the display of the following.

```
SAVE / RESTORE TRACE MENU
-------------------------------------------
<0> - Save trace to host via serial port
<1> - Save trace to host via parallel port
<2> - Save trace to onboard mirror memory
<3> - Restore trace from host via serial port
<4> - Restore trace from host via parallel port
<5> - Restore trace from onboard mirror memory

Serial port setup:  9600  8N1
Your selection (0../Quit) ?
```

You will need a null-modem cable connecting the DSC-216 (serial port - connector J3) to your external host computer to use serial save/restore. If using the parallel port, you will also need an IBM PC or compatible, the special Ancot parallel transfer utility program operating on the PC, and the special Ancot Parallel Cable Adapter to use parallel save/restore. You will need the optional Trace Mirror memory in your DSC-216 to use one of these functions. 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 DSC-216's trace memory. The other save file formats are provided for human-readable archiving. A utility is available in a C-source and IBM PC executable format for converting from Raw Data to human readable format. Contact the factory to obtain this utility.

2.3.1 <0> - SAVE TRACE TO HOST VIA SERIAL PORT

You can transfer and save a trace captured by the DSC-216 to a file on a host computer for later post processing or archival purposes.

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 DSC-216 needs to be connected to the host computer using a null-modem cable. See Appendix A.4 for the pinout. Make sure the connections are made and the host is setup for the same baud rate and data format as the DSC-216, as indicated in the SAVE/RESTORE TRACE menu, line just above the "Your Selection ?" line. In the example on the previous page, serial port setup is shown as "9600 8N1", which indicates:

9600 baudrate, 8 data, No Parity, and 1 Stop bit.

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Select **<0>** from the SAVE/RESTORE TRACE menu and you will be given a choice of file formats to transfer. The following menu will be displayed:

```
FILE FORMAT MENU
-----------------------------
<0> - Raw trace data format
<1> - Structured format
<2> - Binary format
<3> - Hex Dump format
<4> - Compressed format

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

The 'Raw Data' format is the only format which can be downloaded back into the DSC-216 at a later time. This is an encrypted format which ensures that all characters are printable ASCII. See Appendix C for a description of the encryption algorithm.

The other formats are text files which are duplicates of the trace display formats, identical to what appears on the screen of the DSC-216. These formats may be useful for comparisons and post-processing of the trace information, but cannot be reloaded into the DSC-216. Note that this format is not compressed, and files are much larger than the 'Raw Data' format; for this reason, post-processing of 'NON-Raw Data' formats will typically take much longer.

After you select the format, you will be asked for the trace memory range to be saved, then confirm the transfer by pressing **<Yes>** 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 H for an example of using the PC and the PROCOMM PLUS communication package for saving the trace on a PC host.

2.3.2 <1> - SAVE TRACE TO HOST VIA PARALLEL PORT

The parallel port allows faster data transfers, therefore it may be desirable when handling larger files.

You will need a receiver utility at the host computer to use the parallel port. Ancot will provide on request such a utility for the IBM PC/AT or newer (or compatible) computers. The host computer must also have a bi-directional parallel port. See Appendix G for more detail.

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2.3.3 <2> - SAVE TRACE TO MIRROR MEMORY

You may save a trace captured by the DSC-216 in a FLASH ROM based Trace Mirror memory - if you have this option on your unit. The Trace Mirror memory is non-volatile and therefore you can turn off your DSC-216 (for transport), and later restore the same trace back to the trace memory for examination. Proceed as follows:

Select the SAVE TRACE function in the main menu (selection **<3>**), and you will be asked for the address range from trace memory to be saved. You will also be asked for the address in Trace Mirror memory where the trace saving should start. If you type in a Trace Mirror address which is not on a 128 byte boundary, the address you select will be rounded up. If the address range from the trace memory is not a multiple of 128 events, that will also be rounded up. The program will then attempt to write the trace data into the Trace Mirror memory. If it is successful, you will be informed of any change in addresses used within the Trace Mirror memory. If the transfer fails, you will be informed of that also. You should make a note of the addresses within the Trace Mirror which are in use.

Read more on the Trace Mirror memory option in Appendix F.

2.3.4 <3> - RESTORE TRACE FROM HOST VIA SERIAL PORT

A trace saved to a file in 'Raw Data' format can be loaded back into the DSC-216 trace memory for more study. This function is analogous to saving the trace, as described in Section 2.3.2, except that the direction of transfer is different.

Connect the DSC-216 to the host using a null-modem cable. At the host computer end, start the communications program and ready it to send an ASCII file.

Select **<3>** from the SAVE/RESTORE TRACE menu and the following prompt will be displayed:

```
Download (receive) trace in [Raw Data] format.
Start Transfer (Y/N) ?
```

Press **<Yes>** to confirm, then start the transfer from the host end.

> *Some 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 downloads, disconnect the null-modem cable until the next keystroke at the host-end will initiate.*

Note again, that only the 'Raw Data format' file can be reloaded into the DSC-216. Any other file format will result in the "Unrecognized format" message.

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

2.3.5 <4> - RESTORE TRACE FROM HOST VIA PARALLEL PORT

A trace saved to a file in 'Raw Data' format can be loaded back into the DSC-216 trace memory for more study. This function is analogous to saving the trace, as described in Section 2.3.2, except that the direction of transfer is different. See Appendix G.

2.3.6 <5> - RESTORE TRACE FROM MIRROR MEMORY

A trace saved to the Trace Mirror memory can be restored back into the DSC-216 trace memory for more study. This function is analogous to saving the trace, as described in Section 2.3.3, except that the direction of transfer is different. When restoring the trace proceed as follows:

Select the RESTORE TRACE function in the main menu (selection **<3>**), and you will be asked for the address in Trace Mirror memory where the trace segment starts and where it ends (deault is the full segment length). The segment of the trace will be restored to the trace memory starting at location zero (address 0). Any consecutive restore will overlay the previous trace. In other words, only a single restored trace can be examined at a time.

Read more on the Trace Mirror memory option in Appendix F.

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SECTION 3

DISPLAYING THE TRACE MEMORY

3.1 INTRODUCTION

The DSC-216 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. See appendix E for a discussion of the SCSI-3 SCAM protocol and its display on the DSC-216.

When you select the **<Display>** option from the main menu, a message will appear showing which format of display is currently selected, and prompting for a starting address. You may select a different display format at this point; just press the **<No>** on the built-in keypad, or **<N>** from an external keyboard. The Display Format menu will appear, as described in section 3.7.

To start the display, select a starting (and optionally an ending) address in any of the formats which follow. Addresses must be in hexadecimal in the range 0-7FFF (0-1FFFF or 0-7FFFF if you have the optional 128K or 512K deep trace). The address must also be within the recorded range i.e. less than the address at which recording stopped, as reported when you pressed **<Stop>**, or the trigger occurred. If you type an address out of range, it will be rejected and you will be given another opportunity to select an address.

1) Press **<Enter>** with no numeric entry to start displaying at the start of trace memory, with a pause at the end of each page displayed.

2) Type an address and press **<Enter>** to display one page beginning at the address typed.

3) Type two addresses separated by a hyphen (-) and press **<Enter>** to display the entire range of events between and including the two addresses. This is the option you may want to select if you are printing a trace in hard copy through the parallel port, and you need to print more than one screen.

4) Type an address followed by a hyphen (-) and press **<Enter>** to display all events from the address typed to the end of trace.

5) Type a hyphen (-) followed by an address and press **<Enter>** to display all events from the start of trace up to and including the address typed.

6) Type just a hyphen (-) and press **<Enter>** to display the entire recorded trace.

Displaying within a range longer than one screen length would usually be used when also generat-

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ing hard copy on a printer. Use **<Ctrl-^Print>** key on the keypad or **<^P>** on the external keyboard to toggle the printer ON and OFF.

After the initial display, the DSC-216 will pause for more input from you. At that time, you can access the Search functions (see section 5), the Time difference calculator (see section 2.2.13), the Trigger (section 4), the Trace-Mode (section 2.2.5) or Utilities (section 7) menus. You can also continue displaying with the following options.

1) Press **<Next>** from the keypad, **<Space>** or **<PgDn>** key from the keyboard to display the next full page of trace memory in the current format.

2) Press **<Prev>** from the keypad or **<->** from the keyboard to display the previous page of trace memory in the current format. The **<PgUp>** key also accomplishes this action. Note that in the structured format, because of the unpredictability of the number of events making up one page of display, moving backward may not always go exactly one page so the display may scroll to reach the correct place for the start of page. However, in the other formats, page length is determinate, and moving backward goes exactly one page at a time.

3) Press a number from **<1>** to **<9>** to display that many more lines forward in the current display format. This series of lines becomes the entire new page, although the full 25 lines will appear on the screen.

4) Press **<Home>** to display one page starting at the beginning of trace.

5) Press **<End>** to display (about) a page starting about half page before end of trace.

6) **<A>** allows entry of a starting address for the next page to be displayed.

7) Press the **<16-8 bit>** key on the keypad, or the **<W>** key on the external keyboard, to flip between wide (16-bit) and narrow (8-bit) data display. Note that wide data can only occur during a Data-In or Data-Out phase, and only that part of the display is affected. When displaying wide data, the low byte appears first, separated by a hyphen from the high byte. The separator character may be an asterisk (*) if a parity error occurs or a plus-sign (+) if the ATN line is active.

8) Press the **<Alph-Hx>** key on the keypad or the **<H>** key on the external keyboard to flip between ASCII representation and hexadecimal display of data bytes. This will only affect the Structured display. When displaying data in ASCII format, unprintable characters will appear as periods (.).

9) Press the **<Flip>** key on the keypad or the **<F>** key on the external keyboard to toggle between the Structured and Binary display formats. The page displayed will start at the same address as did the one being replaced.

10) Press **<C>** (or **<Alt-C>** on the keypad) to 'flip' to the Compact Display format. The trace display will start at the same address as the page being replaced.

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11) Press <**D**> (or <**Display**> on the keypad) to 'flip' to the Hex Dump display format. The trace display will start at the same address as the page being replaced.

12) Press <**P**> (or <**Pause**> on the keypad) to 'flip' to the Command profile display format. The trace display will start at the same address as the page being replaced.

13) While displaying in Binary format, press <^**BinFmt**> on the keypad or < **L** > on the remote keyboard to toggle between character display and state line display.

14) In the Binary format, press <^**TmFmt**> key on the keypad or <**E**> on the external keyboard to switch between total elapsed time (since start of tracing) and differential time (between successive events). In the Structured format, this key enables/disables the display of timing information.

15) While displaying in Structured format, press <**E**> (or <**Alt-E**> on the keypad) to add the time stamp on the right margin of the screen. In Structured display this always indicates time differential.

3.2 THE STRUCTURED DISPLAY FORMAT

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

The actual data transferred, as well as the ID numbers during Arbitration, Selection and Reselection, are shown in Hex, following a slash. If a **parity error** occurs at any time (except in 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. number of transfers during the Data-In or Data-Out phase is shown in Hex format and in parentheses just after the trace memory address for the last line of the data phase.

NOTE:
There are situations when the tested system hangs during the data phase, and you need to find out how many data bytes were actually transferred. Normally, when the system hangs, you press <**Stop**> or <**S**> to stop the tracing, then <**Esc**> to exit to main menu, and <**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 Bus Free phase is entered. (DSC-216 stores data count in the data byte memory of the Bus Free event. This recording is all done by Hardware be-

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cause 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>**, and 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 similarly are labeled only on the first line.

When enabled, the duration of each phase is displayed on the last line of that phase (if space is available on the line). Press **<^TmFmt>** to toggle between timing display enabled/disabled (press **<E>** on the external keyboard).

Several samples of Structured displays, showing the various recording and display modes, follow.

3.2.1 Structured Display with NARROW or WIDE data transfers

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

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


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```
0004C:                  03 (Length)
0004D:                  01 (SDTR)
0004E:                  32 (Period 200 nsec)
0004F:                  08 (Offset 8 bytes)
00050:       Command    /03 00 00 00 10 00 (Req Sense)
00056: (0008)   Data-In / p  .  .  .  .  .  .  .  .
0005E:       Status     /00 (Good)
0005F:       Message-In /00 (Cmd Cmplt)
00060: Bus Free
00061:    Arbitration   /80 (7)
00064:    Select w/ATN  /81 (0,7)
00067:       Message-Out/C0 (Identify : LUN 0 Disconnect OK)
00068:       Command    /00 00 00 00 00 00 (Test U Rdy)
0006E:       Status     /00 (Good)
0006F:       Message-In /00 (Cmd Cmplt)
00070: Bus Free
00071:    Arbitration   /80 (7)
00074:    Select w/ATN  /81 (0,7)
00077:       Message-Out/C0 (Identify : LUN 0 Disconnect OK)
00078:       Command    /25 00 00 00 00 00 00 00 00 00 (Rd Cap)
00082: (0008)   Data-In /  .  .  .  .  .  .  .  .
0008A:       Status     /00 (Good)
0008B:       Message-In /00 (Cmd Cmplt)
0008C: Bus Free
0008D: ---- End of Trace ----
```

Press **<E>** to enable / disable display of the time stamp on the right margin. The format is the same as in the binary display, and it gives / 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, like with the data phase. To show time for the data phase, the byte count has to be short enough, e.g. by using recording mode 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 the **<16-8bit>** or **<W>** key on the keypad or keyboard respectively 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:          Data-In /DE-E7 D4-D8 FD-FF DE-80 FD-D7 33-AD CF-77 D8-39
001D1: (0200)            BA-6F 76-77 FE-7D B9-1E C3-F7 EF-E6 D7-8A EA-EC
0020F:       Status     /00 (Good)
00213:       Message-In /00 (Cmd Cmplt)
00217: Bus Free
```


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3.2.2 Structured Display with NARROW data transfers

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

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

3.2.3 Structured display of SCAM Protocol :

In the structured display, you will see the SCAM Protocol in simple 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

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

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

Note that in order to analyze the SCAM Protocol, the trace needs to be recorded in the 'Capture SCAM Protocol' mode first. See sections 2.2.5 and 2.2.5.7 for more.

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 20-nanoseconds resolution of the DSC-216.

There are several options in how the information is presented in the Binary format.

First, the control lines can be shown in logic analyzer style, as a rectangular waveform traveling down the page. In this format, 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. Alternatively, you can set the display to be character-based. Active signals show as a mnemonic character, while inactive signals show as periods. The mnemonics are shown in the table below. This option is toggled by pressing the **<Ctrl+^BinFmt>** key on the front panel, or **<L>** from an external keyboard.

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Signal	Character
BSY	B
SEL	S
ATN	A
RST	R
MSG	M
C/D	C
I/O	I
REQ	R
ACK	A

The REQ and ACK signals use the same symbol ('R' or 'A'), but can be distinguished from the RST and ATN signals by their position on the display.

Data can be shown as **wide** or **narrow.** If the wide data format is chosen, then the low byte is shown first, separated from the high byte by a hyphen (-). If a **parity error** occurred, that is shown by an **asterisk (*)** following the offending byte. The asterisk (*) may replace the hyphen (-) separating the two bytes. The bytes are shown in hexadecimal first, followed by their ASCII equivalent in parentheses.

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

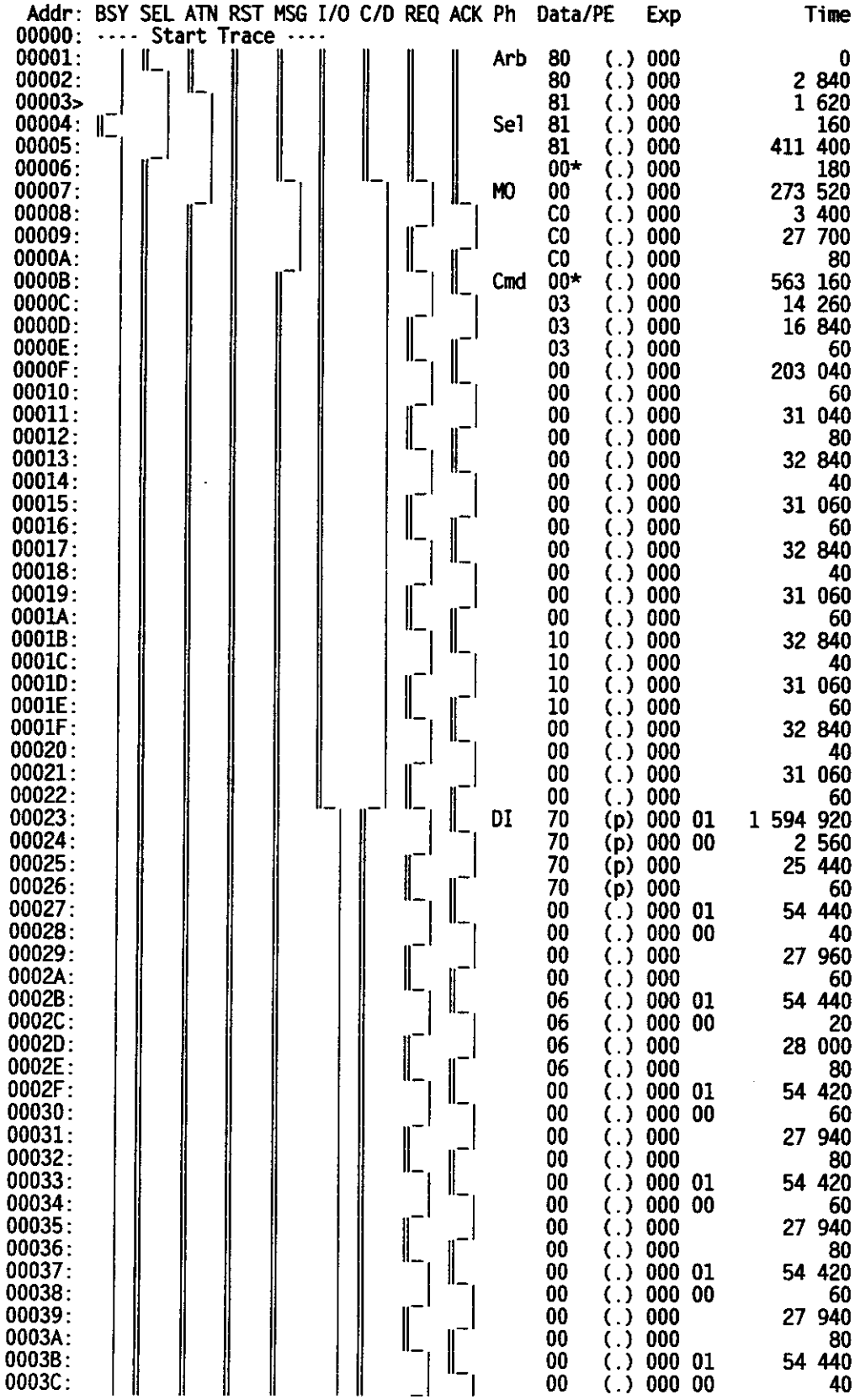
Time stamp information comes in either of two formats also. In the [Total] format, the total **elapsed** time since the start of the recording (modulo about 170 seconds) is shown in the time column. In the [Diff] format, the time **differential** from the preceding event is shown in the time column. All times are expressed as decimal nanoseconds, with a space between each group of three digits. As an example, the "3 123 456 789" represents 3sec 123ms 456us 789ns.

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.

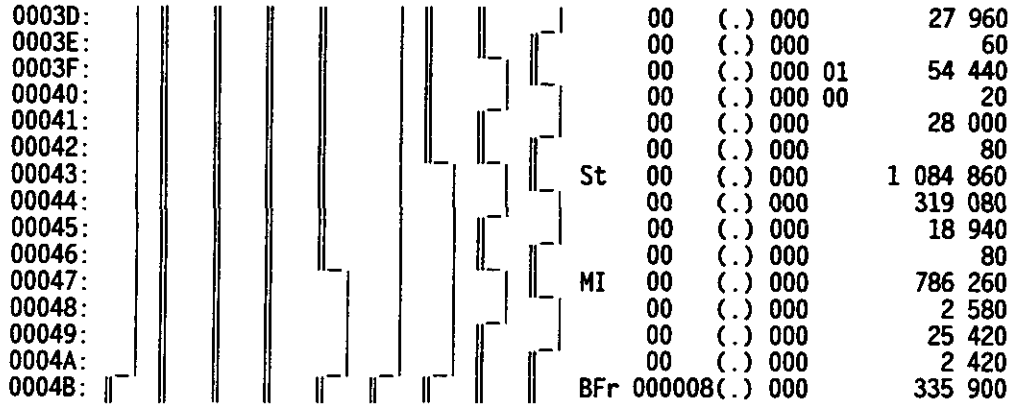
This first display example shows the logic analyzer style of control signals, with 8-bit data and differential time display. This trace also shows 'capture 4 edges REQ/ACK' and 'capture-all-data' mode of recording. Note that the data word at the Bus Free event after the command, holds the data count (0008 bytes) in the data-in phase of this command. Just to the right of the Exp column, during the data phase only, the current **REQ/ACK offset** is shown as a 2-digit hexadecimal number. This number is valid only if the display started at (or before) the start of the data phase. 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, or if Skip-Data is enabled, 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:		DI	70 (p) 000	01	1 594 920
00024:			70 (p) 000	00	2 560
00025:			70 (p) 000		25 440
00026:			70 (p) 000		60
00027:			00 (.) 000	01	54 440
00028:			00 (.) 000	00	40
00029:			00 (.) 000		27 960
0002A:			00 (.) 000		60
0002B:			06 (.) 000	01	54 440
0002C:			06 (.) 000	00	20
0002D:			06 (.) 000		28 000
0002E:			06 (.) 000		80
0002F:			00 (.) 000	01	54 420
00030:			00 (.) 000	00	60
00031:			00 (.) 000		27 940
00032:			00 (.) 000		80
00033:			00 (.) 000	01	54 420
00034:			00 (.) 000	00	60
00035:			00 (.) 000		27 940
00036:			00 (.) 000		80
00037:			00 (.) 000	01	54 420
00038:			00 (.) 000	00	60
00039:			00 (.) 000		27 940
0003A:			00 (.) 000		80
0003B:			00 (.) 000	01	54 440
0003C:			00 (.) 000	00	40

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The following display example shows the character style of control signals with 'Wide' data (16 bits + parity) and total elapsed time display. This trace also shows the single-edge REQ/ACK mode of recording (REQ and ACK not shown) and skip data (after 8 events). Note also the presence of the trigger event, marked with a 'T' next to the 00015 address.

```
 Addr: BSY SEL ATN RST MSG I/O C/D Ph  Data/PE   Exp            Time
00000: ---- Start Trace ----
00001> B   .   .   .   .   .   .   Arb 80-00*(..)000             0
00002: B   S   .   .   .   .   .       80-00*(..)000         2 600
00003> B   S   A   .   .   .   .       81-00*(..)000         4 220
00004: .   S   A   .   .   .   .   Sel 81-00*(..)000         4 360
00005: B   S   A   .   .   .   .       81-00*(..)000       388 240
00006: B   .   A   .   .   .   .       00*00*(..)000       388 440
00007: B   .   .   .   M   .   C   MO  C0-00*(..)000       665 280
00008> B   .   .   .   .   .   C   Cmd 08-00*(..)000     1 270 560
00009> B   .   .   .   .   .   C       00-00*(..)000     1 490 540
0000A> B   .   .   .   .   .   C       00-00*(..)000     1 554 560
0000B> B   .   .   .   .   .   C       00-00*(..)000     1 618 560
0000C> B   .   .   .   .   .   C       01-00*(..)000     1 682 560
0000D> B   .   .   .   .   .   C       00-00*(..)000     1 746 560
0000E> B   .   .   .   M   I   C   MI  04-00*(..)000     3 400 680
0000F: .   .   .   .   .   .   .   BFr 00*00*(..)000     3 673 280
00010: B   .   .   .   .   .   .   Arb 01-00*(..)000     4 735 200
00011: B   S   .   .   .   .   .       01-00*(..)000     4 782 420
00012> .   S   .   .   .   I   .   Rsl 81-00*(..)000     4 819 440
00013: B   S   .   .   .   I   .       81-00*(..)000     4 820 160
00014: B   .   .   .   .   I   .       81*00*(..)000     4 835 840
00015>T B   .   .   .   M   I   C   MI  80-00*(..)000     5 264 660
00016> B   .   .   .   .   I   .   DI  FF-00 (..)000     7 000 000
00017> B   .   .   .   .   I   .       FE-01 (..)000     7 002 800
00018> B   .   .   .   .   I   .       FD-02 (..)000     7 003 080
00019> B   .   .   .   .   I   .       FC-03 (..)000     7 003 380
0001A> B   .   .   .   .   I   .       FB-04 (..)000     7 003 660
0001B> B   .   .   .   .   I   .       FA-05 (..)000     7 003 960
0001C> B   .   .   .   .   I   .       F9-06 (..)000     7 004 240
0001D> B   .   .   .   .   I   .       F8-07 (..)000     7 004 540
0001E> B   .   .   .   .   I   C   St  00-00*(..)000     7 958 880
0001F> B   .   .   .   M   I   C   MI  00-00*(..)000     8 773 220
00020: .   .   .   .   .   .   .   BFr000008*(..)000     9 139 520
00021: ---- End of Trace ----
```

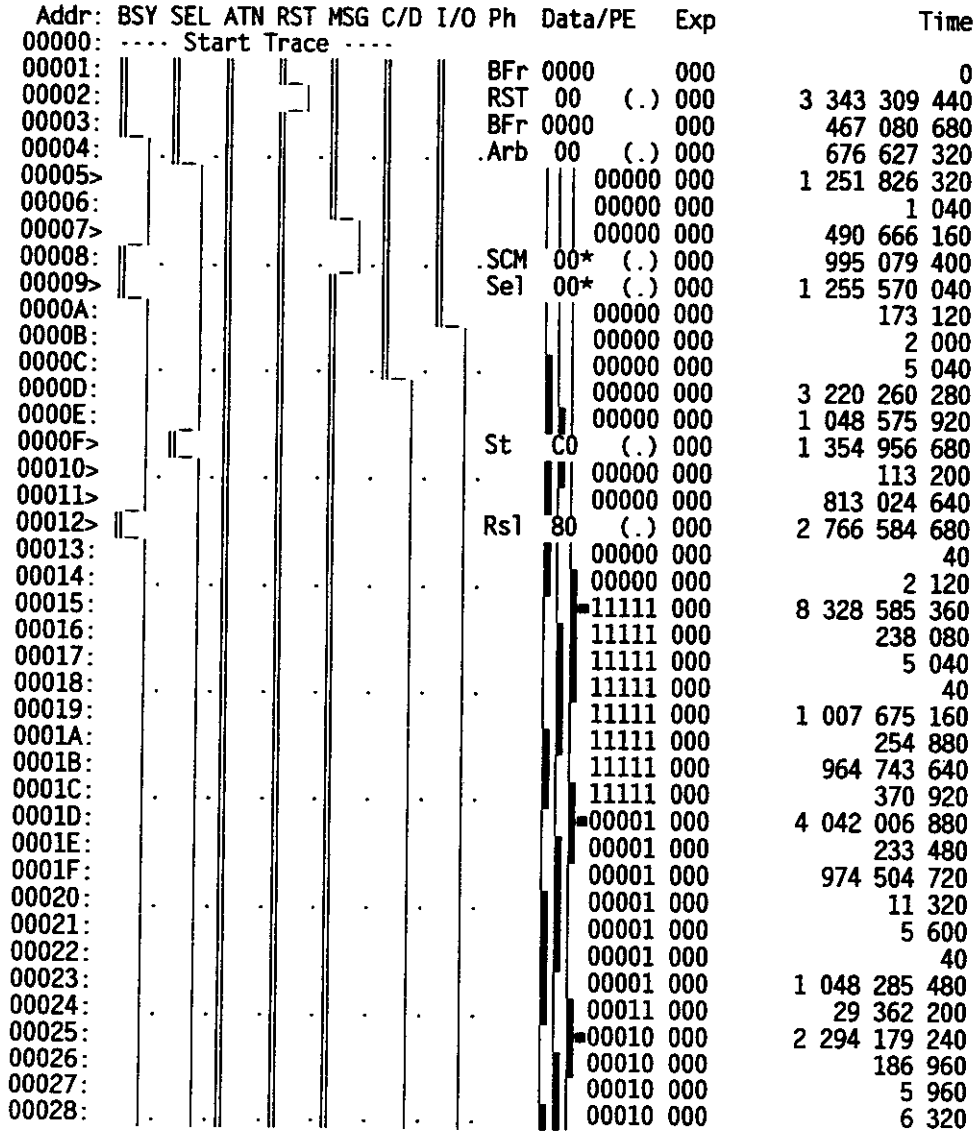

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3.3.1 Binary display of SCAM Protocol :

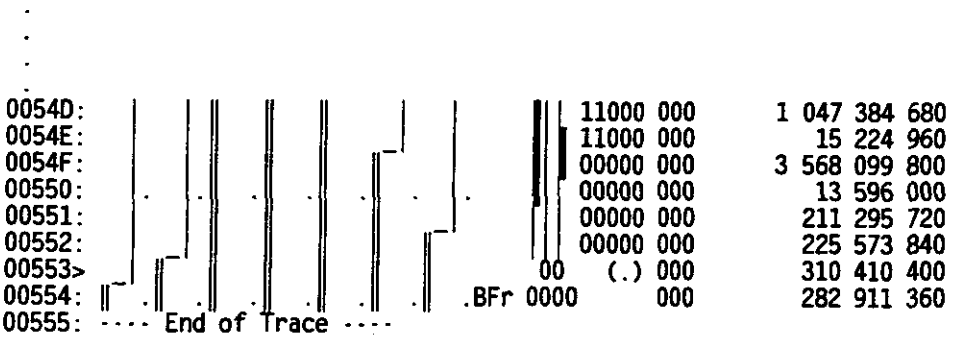
In the binary display format, you will see the SCAM data handshake near the horizontal middle of the screen. The SCAM data and handshake take the place of the normal display of data in Hexadecimal and ASCII. Only the SCAM Selection is interpreted in the Phase column (between the SCSI control lines and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



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Note that in order to analyze the SCAM Protocol, the trace needs to be recorded in the 'Capture SCAM Protocol' mode first. See sections 2.2.5 and 2.2.5.7 for more.

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 : four characters of control bits, a space, another two characters of control bits, a space, four characters of data bits, a space, and eight characters of time stamp bits.

The first sixteen control bits are in the order: [res, ATN0, res, ATN1], [TRG, E2, E1, E0], [PEH, PEL, BSY, SEL], [RST, MSG, C/D, I/O]. The "res" in this text stands for "reserved". The second group of control bits are: [res, ACK0, res, ACK1], [res, REQ0, res, REQ1]. The data bits are MSB (d15) to LSB (d0). The time stamp bits are in their raw form : the number of ticks (each 40 nanoseconds long) since the recording started.

```
00000:  0811 00 0000 75562E28 / 0801 00 0000 7556D1D1 / 0880 00 0080 755AD9BC
00003:  08C0 00 0080 755ADA3E / 48E0 00 0081 755ADA8F / 0860 00 0081 755ADA97
00006:  08E0 00 0081 7571905C / 08A1 00 0000 75719065 / 188A 00 00C0 7571C673
00009:  7882 00 0000 75723CA7 / 7882 0F 0000 757267A8 / 7882 C0 0000 75727428
0000C:  7882 00 0000 757280A8 / 7882 00 0000 75728D28 / 7882 00 0000 757299A8
0000F:  5886 00 0002 7573977C / 588E 00 0000 75743530 / 0801 00 0000 75747CBB
00012:  0880 FE 0080 7578C115 / 08C0 FE 0080 7578C198 / 48E0 00 0081 7578C1E8
e.t.c.
```

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. See section 3.7 for instructions on how to select this display format. Each recorded SCSI connection (from Bus Free to Bus Free) occupies only one

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line of display. You can use this format for pre-viewing 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 O           Disconnect         2 335 000
00D1E: 7<-0                         Good      Cmd Cmplt            946 480
       ...
07FFF: ---- End of Trace ----
```

3.6 THE COMMAND PROFILE FORMAT

This format gives a graphical representation of the proportion of time spent in each phase. See section 3.7 for instructions on how to select this display format. One full command is displayed on each screen, including disconnect(s), reselection(s), 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 (excluding disconnects) command time.

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```
                SCSI COMMAND PROFILE

Trace Address     : 00040 - 0025B
IDs               : I7 -> T0
Command Code      : 08 Read/Rcv
Data Transfered   : 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 Message-Out phase to the first event which is neither Message-Out nor Message-In phase.

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

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

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

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

Disconnect : from start of 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.

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3.7 CHANGING THE DISPLAY FORMAT

The display format can be changed using the TRACE MEMORY DISPLAY FORMAT MENU. Access this menu from the main menu by pressing the **<Alt-4>** key on the keypad, or the **<F>** key (for "format") on the external keyboard. You can also access this menu after pressing **<Display>**, then at the prompt for the display starting address, press **<No>** on the keypad, or **<N>** on the external keyboard.

When in the TRACE MEMORY DISPLAY FORMAT MENU, use the up or down arrow keys to select an item to be changed, then use left or right arrow keys to change it. In a case of multiple choices, the left or right arrow keys will change the value by +1 or -1 respectively.

```
TRACE MEMORY DISPLAY FORMAT: [Structured]
-----------------------------------------
<0> - [24] Lines per page
<1> - Structured Display
<2> - Binary Display
<3> - Hex Dump Display
<4> - Compact Display
<5> - Command Profile

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

<0> - Lines per page - controls the number of lines of display that will be printed between keypresses. The default number of lines is 24 decimal. If you change this value, your selection is saved in EEPROM to become the default next time you turn the DSC-216 on. If you select value = 0, then display will run from the current line to the very end of the trace; this may be useful if you need to print the entire trace out (using the ^P option).

<1> - Structured Display - causes the next page of trace to be presented in Structured format.

<2> - Binary Display - causes the next page of trace to be presented in Binary format.

<3> - Hex Dump Display - causes the next page of trace to be presented in Hex Dump format.

<4> - Compact Display - causes the next page of trace to be presented in a Compact format, showing one SCSI command per line.

<5> - Command Profile - causes the next page of trace to display a timing analysis of a single SCSI command by phase.

See also section 3.1 for other display options.

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SECTION 4

SEARCHING FOR EVENTS IN THE RECORDED TRACE

4.1 INTRODUCTION

The DSC-216 provides a powerful, easy-to-use searching utility. This feature provides you with the ability to 'home in' on the event of interest in your recorded trace, without needing to wade through the uninteresting events either 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 by '>>>>>>'. If the certain event is not found, the current display page will be shown again with "NOT FOUND" message in the lower right corner of the screen.

When you select FIND, from the main menu or from a display, the following menu is displayed:

```
FIND SCSI EVENT MENU
-------------------------------------------------------
Bus Free Phase              Command Phase
Attention Condition         Status Phase
Parity error                Message-In Phase
Arbitration Phase           Message-Out Phase
Selection Phase             Data-In Phase
Reselection Phase           Data-Out Phase
SCSI Reset Condition        Reserved Phase (In)
Trigger Condition           Reserved Phase (Out)
<X> - Trace PAUSE           Data only (ignore phase)
                            <Z> - Custom Control Bit Pattern
                                  xxxx xxxx 00x0 xxxx
Your selection (0../Quit) ?
```

Use the arrow keys and move the bar to the event or phase you want. For a single-key selection, press the selector letter (underlined on the screen) on the external keyboard. Then press **<Enter>**, and the following options menu is displayed:

```
SEARCH OPTIONS MENU
-------------------------
Data Bits Pattern
Wide data pattern [ ]
Forward/Backward   [F]
Occurrence        [ 1]
Addr Range [      ]-[      ]
Start Addr [      ]

        Command Phase
-------------------------
1 : xxxx xxxx   XX
2 : xxxx xxxx   XX
3 : xxxx xxxx   XX
4 : xxxx xxxx   XX
5 : etc
```


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If the phase/event you selected allows a data pattern, the cursor will be placed in the right side, to edit the pattern. Otherwise, tha data pattern will be ignored. The top line, as the 'Command Phase' in the example above, indicates the selected phase to be used.

4.1.1 SELECT A CUSTOM CONTROL BIT PATTERN

Most of the patterns are self-explanatory, but a few need additional comments. Notice as you move the bar through the phase selections that the bit pattern, shown below the "Custom Control Bit Pattern", changes to match the trace event.

<N> - 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.

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

<T> - 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.

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

<D> - 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.

<V> - Reserved Phase (In)
<U> - 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 the (In) or (Out). Data will also be qualified by REQ/ACK for transfers In/Out.

<Z> - 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 <Z> item, the following screen will be displayed:

```
res AT0 res AT1    TRG  E2  E1  E0    PEH PEL BSY SEL    RST MSG C/D I/O
 0   0   0   0      0   0   0   0      0   0   0   0      0   0   0   0
```


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The AT0 is the ATN signal 20nsec before capture of this event. The AT1 is the ATN signal at the time of capture of this event. The E0, E1, and E2 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, then press **<Q>** to return to the big menu. Move within the pattern using **<LeftArrow>** or **<RightArrow>** 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 SEARCH OPTIONS menu will be displayed with cursor waiting in the first data pattern field. The default pattern is all data as 'Don't Care' starting with "1: xxxx xxxx" (binary); you may specify up to 16 bytes. Change the data pattern or simply press **<Enter>** to ignore it. The cursor will move over the "Execute find" message.

Press **<Enter>** again to execute the search.

4.2 SELECT THE SEARCH OPTIONS

The FIND SCSI EVENT 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: simply press **<Enter>** to execute the search. You may have to press **<Enter>** again if the event allows a data pattern.

- To change an option default value: use the arrow keys on the keypad, or the selector letter on the external keyboard, to choose the option you want to modify. Use the **<Enter>** key to toggle or increment your choice. Then press **<Enter>** to execute the search.

4.2.1 SEARCH FOR WIDE DATA PATTERN.

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

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4.2.2 SET THE SEARCH DIRECTION

The currently selected direction of search is shown in square brackets: [F] for forward, [B] for backward. The default is forward.

Press <F> to toggle between F (forward) and B (backward) search direction.

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 n-th event. After you choose <O> the cursor will move into the square 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 square brackets in the 'Addr Range [ ]-[ ]' message.

To change the address range, press <A> and the cursor will move to the first set of brackets showing the default low limit address. Type a new value, then press <**Enter**>. The cursor will move to the other field and you can change the ending point of the search. Press <**Enter**> again to start the search. The analyzer will automatically reorder the start and end points if necessary.

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4.2.5 SET THE SEARCH STARTING ADDRESS

The starting address is initially set to the same value as the address range low limit. It is updated everytime a successful search is executed. If you need to start searching from a different part of the trace memory, press **<S>** and type in the new starting address value. Then press **<Enter>** to start the search.

4.2.6 SET THE DATA BITS PATTERN

When searching for certain phases (like Command, Data-In/Out, etc), usually you may need to define the desired data pattern. You can specify a string up to eight bytes long. Select this option in the OPTIONS menu by pressing **<D>**. The cursor also moves to the data selections automatically if you select an appropriate phase to search for. The data bytes are displayed in both binary and hexadecimal, 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-arrow>** or **<down-arrow>** keys to select the byte to edit. Use the **<left-arrow>** or **<right-arrow>** keys 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 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. The length of the search pattern string will be the number of bytes displayed on the screen. E.g. if you want to search for a string of four bytes, where only the first two bytes are defined, set the first two bytes, then press **<down-arrow>** key two times (to add the third and fourth bytes with "Don't Care" pattern), then press **<Enter>**. The following **<Enter>** will execute the search.

To delete an undesired byte, place the cursor on the byte and press **<Ctrl-Display>** on the keypad, or **<Ctrl-D>** on the external keyboard.

The data pattern can also be edited in hexadecimal. Press **<H>** when in the bit pattern and the cursor will move back to the parentheses at the right. Enter a hexadecimal value. To move back to the binary pattern, press **<H>** again. Pressing **<Enter>** accepts the pattern as displayed. By pressing the **<Esc>** or **<Q>** key, you can cancel your selection (of all data bytes) at any time. After all bits are set, press **<Enter>** to exit from the edit mode, and press **<Enter>** again to execute the search.

EXAMPLE: Searching for a READ command (6 byte CDB) at LBA=35 hex:
Press **<C>** and **<Enter>** - this will position the cursor to the data fields. Type the first byte 00001000, **<down arrow>**, XXX00000, **<down arrow>**, 00000000, **<down arrow>**, 00110101, **<down arrow>**, **<down arrow>**, **<Enter>**, **<Enter>**.

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This will be displayed on the screen as follows:

Data-In Phase	
1 : 0000 1000	08
2 : xxx0 0000	?0
3 : 0000 0000	00
4 : 0011 0101	35
5 : xxxx xxxx	XX
6 : xxxx xxxx	XX

4.4 REPEATING THE SEARCH

After a successful search, you may want to find the next event which matches the same pattern. To do this, press **<^FndNxt>** on the keypad, or **<Ctrl-L>** on the external keyboard. The search will proceed in the same direction as the previous search. You can press **<^FndPrv>** or **<Ctrl-K>** 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.

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SECTION 5

TRIGGERING

5.1 INTRODUCTION

All triggering control stems from the TRIGGER SETUP MENU. Triggering can only take place when the DSC-216 is tracing, as shown by a lit 'Tracing' LED on the bottom left side of the front panel. See section 2.2.2 for starting the trace.

5.2 TRIGGER SELECTIONS

Select the <Trigger> option from the main menu by pressing the **<Trig>** on the keypad or the **<T>** key on the external keyboard, and the following will be displayed:

```
TRIGGER SETUP MENU
------------------------------------------
<0> - Trigger type              [None]
<1> - Post Trigger delay       [BFree]
<2> - Full trace memory            [ ]
<3> - External trigger             [ ]
<4> - Parity error (low byte)      [ ]
<5> - Parity error (high byte)     [ ]
<6> - SCSI Reset                   [ ]
<7> - (Re)Selection Time-out       [ ]
<8> - Selection IDs    [0081]      [ ]
<9> - Reselection IDs  [0081]      [ ]
<A> - Message code       [04]      [ ]
<B> - Command code       [12]      [ ]
<C> - Status code        [02]      [ ]
<D> -    Combine Cmd [OR ] Stat    [ ]
<E> -    Transaction IDs [0081]    [ ]

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

When the TRIGGER SETUP MENU appears, one entry will be highlighted with a bar of inverse video. That is the active selection. Use the **<up-arrow>** or **<down-arrow>** keys to move the highlight bar, or press the selector key, shown in < > next to the item you want to change. With the highlight bar on the item you want to change, press the **<left-arrow>** or **<right-arrow>** keys to cycle through the options for that item. If the item has a numerical value associated with it,

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shown in [ ], and you want to edit that value, first press the **<Enter>** key, then type in the new value in Hex , and press **<Enter>** key again to confirm the new selection.

When a trigger item is enabled, the letter 'E' appears in the square brackets at the right side, next to that item. When an item is disabled, the square brackets are empty. The first two menu items are exceptions to this rule. The legends which may appear in their brackets are described below.

Triggering can be completely disabled. In this case, tracing will be started or stopped only by pressing the **<Stop>** or **<S>** keys. Choose the [None] option for Trigger type.

Tracing can be started by a trigger condition, called **PRE-TRIGGER**. You would use the Pre-trigger if you want to record SCSI bus activity from a certain (trigger) event on. As an example, you may want to trigger on a Check Condition (status=02) and trace your error recovery routine.

Select the [Pre] trigger option for Trigger type in the TRIGGER SETUP MENU. Then start tracing. In this mode, the DSC-216 monitors all activity on the SCSI bus, and records it into the trace memory. However, until the trigger condition occurs, the trace memory address is reset to 0 on each Bus-Free phase, so the events are overwritten by later events. Finally, when the trigger condition occurs, this automatic resetting of the trace memory address is canceled, command which caused the trigger is retained, and all events following are recorded. This method ensures that the trace includes the entire command of the trigger condition. Tracing continues until either the trace memory is completely full or until you stop tracing by pressing **<S>** on the keyboard.

Alternatively, tracing can be stopped by a trigger condition, called **POST TRIGGER**. You would use the Post-trigger if you wanted to record SCSI bus activity preceeding a certain (trigger) event. As an example, you may want to see what is causing a certain error.

Select [Post] trigger option for Trigger type from the TRIGGER SETUP MENU. Also select the desired amount of Trigger delay from the trigger condition to the end of tracing. There are four choices for delay:

1) Select no delay [None], to stop tracing at the instant the trigger condition occurs. If you choose this option, you will not see the remainder of the command, because tracing will already be stopped.

2) Select delay until Bus Free [BFree], to force tracing to continue to the end of the command containing the trigger condition, but not any commands after that.

3) Select [Short] delay to see a small number of events after the trigger event. The number of events is set in the factory for 64 events. This amount of delay may or may not take the trace to the end of the current trigger command and beyond.

4) Select [Long] delay to see a larger number of events after the trigger event. The number of events is set in the factory for 2048 (2K) events. This amount of delay will almost always extend past the end of the current trigger command, and may include several commands which followed.

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The other items in the TRIGGER SETUP MENU are mostly self-explanatory. However, they are listed here to clarify any doubtful points.

<0> - Trigger type : This can be [None], [Pre] or [Post], as described above.

<1> - Trigger delay : This item only affects Post- triggering. It can be [None], [BFree], [Short] or [Long], as described above.

<2> - Full trace memory : When enabled (shown as [E]), the trace memory fills to the point where it would wrap around, then tracing stops. This ensures that all events from the point where tracing started are retained. When disabled, shown as [ ], tracing will continue with later events overwriting the first events in the trace memory (the trace memory acts as a FIFO). At any time thereafter, the most recent 32K (128K or 512K) events will be retained in the trace memory.

<3> - External trigger : When enabled, a low-going signal at the external trigger connector J7 (BNC connector), is a trigger condition.

<4> - 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. This trigger is not guaranteed for synchronous Data (In/Out) phases.

<5> - 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. This trigger is not guaranteed for synchronous Data (In/Out) phases.

<6> - SCSI Reset : When enabled, a transition to the active state of the SCSI RST line is a trigger condition.

<7> - (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.

<8> - 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 square brackets. If match is found, it becomes the trigger condition. Note that this is different from item <E> 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 is duplicated for item <9>. It is not possible to set them for different patterns. This selection will also affect ID filtering, if that recording mode is enabled (see section 2.2.5).

<9> - Reselection IDs : see <8> above.

<A> - Message code : When enabled, the pattern of data bits on the SCSI bus during either Message-In or Message-Out phase is compared to the pattern shown in the first set of

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square brackets. If they match, that is a trigger condition.

<B> - Command code : see <A> above.

<C> - Status code : see <A> above.

<D> - Combine Cmd [AND/OR] Stat : This item is enabled automatically whenever both <B> and <C> are enabled. If the contents of the first set of square brackets is [OR], either the matching Command code or the matching Status code is sufficient to cause triggering. If the contents are [AND], 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.

<E> - Transaction IDs : When enabled, the data pattern in the first set of square brackets MUST be present during Selection or Reselection in order for the matching of Message, Command or Status codes to take effect. Note that this is different from items <8> and <9> above, where the ID is considered independently of the other trigger conditions enabled.

Whenever setting up trigger conditions, exercise care in your selections to avoid undesired synergistic 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 POST 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 we want to find out what the cause is.

Set the trigger conditions as follows :

```
Trigger type                [Post]
Post trigger delay         [BFree]
Status code          [02]     [E]
   Transaction IDs [0084]     [E]
```

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

This setup will start recording when you press <Run>. SCSI events will fill space in the buffer,

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perhaps wrapping the circular buffer, until a command occurs involving Initiator ID 7 and Target ID 2 (as specified by the 0084 in Transaction IDs); this will result in a Check Condition Status (as specified by the 02 in Status Code). It will continue to record until the next Bus Free phase (as specified by the Post trigger delay), and then stop. The final event address will be displayed on the screen as the DSC-216 informs you that the trigger condition has been met. You can then examine the trace to see what commands preceded the Check Condition Status.

5.3.2 PRE TRIGGERING

The problem : Some command is resulting in a condition which causes your SCSI driver to crash. You think it is as a result of linked commands with the flag bit set.

Set the trigger conditions as follows :

```
Trigger type                [Pre ]
Message code        [0B]      [E]
```

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

This setup will start monitoring the bus as soon as you press <Run>, but will ignore all commands until one received with a message of 'Linked-Command-Complete-with-Flag', as specified by the 0B in Message code. That entire command will be recorded, starting at the Bus Free phase preceding it. 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, of course that will also halt tracing. You can then examine the trace to determine what happened after the suspect event.

5.3.3 NO TRIGGER REQUIRED

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

No trigger is required for this problem. Set the Trigger type to [None]. Start tracing by pressing **<Run>**. The DSC-216 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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SECTION 6

SCSI INITIATOR EMULATION

6.1 INTRODUCTION

In many instances it is not enough to passively observe events on the SCSI bus. There are situations when you want to interact with certain devices on the bus, and you need to send SCSI commands. For this, use the SCSI Initiator emulator which gives you control over the action on the bus. The DSC-216/FTE (or /FDE, or /FXE) Analyzer is the model with the SCSI emulator built in.

Using the emulator of the DSC-216/FTE you can act as a SCSI Initiator. You can define the command set matching a certain type of SCSI Target, be it a disk drive, tape drive, printer, etc. You control the protocol for information transfers, deciding whether to use the narrow(8-bit)/wide(16-bit) or fast SCSI modes, or whether to act as an asynchronous/synchronous SCSI device. Via the hierarchical menu structure, you determine how each command proceeds, and control every byte of information transferred.

The current hardware version of the DSC-216 uses the Emulex FAS256 SCSI Protocol Controller chip which allows the fastest possible SCSI emulation. It can do asynchronous data transfers at up to 7 MHz (14 MBytes/sec if using wide SCSI) and up to 10MHz synchronous (20 MBytes/sec), the fastest rate allowed by the SCSI-2 standard today (July 1994). Using the proper adapter pods, the emulator can be used on either single-ended or differential bus interfaces.

6.2 SCSI INITIATOR EMULATION

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

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

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

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

Your Selection ?
```

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

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

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

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

We strongly recommend using external keyboard for operating the SCSI Emulator. If you chose using the keypad however, move the highlight bar (using the arrow keys) over the selected command, then press the **<Enter>** key.

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

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MESSAGES PROGRAMMED BY THE USER:
SCSI Command Descriptor Blocks (CDB) can be preceded by one or more messages. The Ancot DSC-216 allows the use of several of these messages in the same command. Each can be individually enabled or disabled, and its contents set. Enabled messages will be transmitted in the following order:

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

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

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

6.2.1 <^A> - CHANGE LBA

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

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

The DSC-216 Emulator's macro capability lets you define a sequence of commands and other functions which will execute sequentially at the press of a single key. The Emulator is shipped with several default macros installed. You can edit or rewrite them or you can use them as-is. However, each time you restore defaults, the original definitions will be restored as well.

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

The **"^L - List Macros"** command displays all macros currently defined. It is important to realize that a macro is merely a list of keystrokes. This means that for items which merely toggle between states, like the "^G - Incr LBA @ Wt" command, will have an effect dependent on the initial state of

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the toggle. Some items require an **<Enter>** key press to end data input, like the "^A - Chng LBA" command. The **<Enter>** key is not shown as part of the macro, even though it will occur. Instead, the value entered as input is shown in curly brackets {}.

Execute macros by pressing the corresponding number key in the range 1 through 8. Macros can be repeatedly executed if **"^Z - Repeat Command"** is enabled (see Section 6.2.13).

6.2.3 <^D> - DATA BUFFER MANAGEMENT

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

6.2.4 <^E> - EDIT CDB

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

You have complete control over 7 custom CDBs, accessed via SCSI Command letters **<t>** through **<z>** (lower case). The defaults for these CDBs are all zeros, making them 'Test-Unit-Ready' commands. Using the **<^E> - Edit CDB** function, you can make them into any command, including the non-standard ones. You will be asked to specify In, Out, or No buffer if data phase for that particular command requires a buffer. All CDBs are stored in non-volatile memory (EEPROM) and will retain their contents even after a system reset.

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

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

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

These options affect the value of the LBA variable after each SCSI Read or Write command. Note

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that this will affect the CDB only if Autofill is enabled for LBA (see Section 6.2.6). If the incrementation is enabled, then the LBA is incremented as a 32 bit value. The upper bits of the value may be truncated if the CDB does not have room for all of them.

6.2.6 <^H> - AUTOFILL

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

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

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

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

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

6.2.7 <^I> - INITIATOR ID

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

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6.2.8 <^K> - COMPARE BUFFERS

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

6.2.9 <^N> - LINK & FLAG BIT

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

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

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

If this feature is used, the selected command will be sent by the initiator emulator of the DSC-216. The target should go through execution of this command, then respond with 'Intermediate-Condition met' (=14 hex) or 'Intermediate' (=10 hex) status, and 'Linked Command Complete' message-in, then again enter the command phase for the next command. The DSC-216 emulator will send the same CDB second time, this time with the Link bit reset. The target should execute this (second linked) command and should conclude it with status = 00 and message-in = 00. If an error occurs anytime during execution of the first command, 'Check Condition' status should be returned by the target and the command should terminate immediately without starting the second linked command.

6.2.10 <^R> - SCSI RESET

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

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6.2.11 <^T> - TARGET ID

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

6.2.12 <^U> - LOGICAL UNIT (LUN)

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

6.2.13 <^X> - EMULATOR SETUP

This selection allows setting up various operating parameters for the SCSI Emulator. See Section 6.4 for a complete description.

6.2.14 <^Y> - QUEUE TAG

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

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

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

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

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

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

Only one of the first 4 options can be selected at any one time. If item 1 is selected (disabling tagged queued commands), the tag number will not be shown. The [E] shows which option is selected. To avoid confusion, if item <1> Disabled is selected, it is shown by "D" in the parentheses.

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

6.2.15 <^Z> - REPEAT COMMAND

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

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6.3 <^D> - DATA BUFFER MANAGEMENT

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

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

6.3.1 <0> - SELECT BUFFER

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

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

The Custom User Message is a message-out which will be sent following Identify message, just before the Command phase. This would be the Abort, Queue Tag, vendor unique, or similar messages.

The SDTR or WDTR would also be sent in this position, however, these two extended messages are rather complex and therefore are programmed from another menu: from the main menu, select <E> for Emulation, <^X> for Emulation Setup, and <5> for Data Transfer Protocol (SDTR & WDTR) menu.

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

6.3.2 <1> - VIEW AND EDIT BUFFER

This selection allows you to examine each byte of the active buffer. You can modify any or all of the bytes.

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

6.3.3 <2> - FILL BUFFER

This option allows you to select or define a fill pattern which will replicate throughout the buffer. Using the **<left arrow>** or **<right arrow>** keys, select the following patterns:

zeros - every bit in the buffer will be turned off

ones - every bit in the buffer will be turned on

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

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

```
address   Values

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

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

6.3.4 <3> - COPY BUFFER

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

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

6.3.5 <4> - SET BUFFER SIZE

This selection allows you to specify the number of bytes in any of the buffers. Certain maximums must be observed, as shown in the table below:

Buffer	Maximum Size (decimal)	(hex)	Default (hex)
Read	64 KBytes	10000	200
Write	64 KBytes	10000	200
User Msg Out	16 Bytes	10	00
Req Sense Data	64 Bytes	40	20
Inquiry Data	128 Bytes	80	30
Mode Sense Data	255 Bytes	FF	FF
Mode Select Parms	255 Bytes	FF	C

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6.4 <^X> - EMULATOR SETUP

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

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

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

6.4.1 <0> - ALLOCATION/TRANSFER LENGTHS

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

The menu for these selections is as follows:

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

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

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

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

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

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

6.4.2 <1> - ARBITRATION

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

6.4.3 <2> - IDENTIFY MESSAGE

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

6.4.4 <3> - DISCONNECT / RECONNECT

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

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6.4.5 <4> - CUSTOM MESSAGE

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

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

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

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

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

6.4.6 <5> - DATA PROTOCOLS

This selection allows you to control the way that data is transferred during either the Data-In or Data-Out phases. Selecting this option gives access to the following menu:

```
DATA PHASE TRANSFER PROTOCOLS
-----------------------------
<0> - Synchronous Transfers          [E]
<1> -    Offset                     [15]
<2> -    Period(ns)                [100]
<3> -    Resp w/ Msg Reject          [N]
<4> -    Negotiation           [RqS/Inq]
<5> - Wide Transfers                 [E]
<6> -    Transfer Width             [16]
<7> -    Resp w/ Msg Reject          [N]
<8> -    Negotiation           [  Never]
```

SCSI-2 provides for FAST (rates above 5MHz and below 10MHz) and WIDE (2 or 4 bytes) data transfer modes. Note, that only data phases In/Out will use these modes. All other phases (Command, Status, Message phases) always use asynchronous and single-byte transfer mode. Also note, that before FAST and/or WIDE are used, they must be negotiated between each Initiator and Target. A SCSI system can have a mix of devices, each using a different mode. It is also provided for SCSI-1 devices, that do not recognize, and do not support these modes; these devices will reject the SDTR (Synchronous Data Transfer Request) and WDTR (Wide Data Transfer request) extended messages. SDTR and WDTR negotiation(s) usually occur during power-up sequence

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(positioned immediately after Identify message, just before the command phase). The SDTR and WDTR extended messages are attached to Request-sense and/or Inquiry commands. Consult the SCSI-2 specifications for detailed rules defining use of these messages.

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

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

Item **<1>** allows you to select the maximum synchronous offset allowed during data transfers. Offsets up to 15 (hex 0F) are supported.

Item **<2>** allows you to select the synchronous rate. Rates are selectable from 100 ns to 200 ns when using FAST synchronous transfers, and from 200 ns to 875 ns when using normal synchronous transfers. This gives a range of rates from approximately 1.4MHz up to the maximum of 10MHz allowed by SCSI-2.

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

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

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

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

Item **<6>** allows you to select either 8-bit or 16-bit data transfers.

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6.4.7 <6> - MODE SENSE / SELECT SETUP

Selecting this option gives access to the following menu.

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

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

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

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

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

6.4.8 <7> - TARGET TYPE

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

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

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

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6.4.9 <8> - SCSI VERSION

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

6.4.10 <9> - TIMEOUT SELECTION

Timeout options determine how the Emulator will behave if the device being addressed does not respond in a timely manner. If enabled, timeout will abort the current command by issuing a SCSI RESET condition if the command has not completed within approximately 2 seconds.

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

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SECTION 7

UTILITIES

7.1 INTRODUCTION

Several utility functions are provided in the DSC-216. See section 5 for a discussion of the built-in search capability. The other functions are described below.

7.2 CALCULATING ELAPSED TIME IN TRACE

From the main menu, press **<7>** or **<Ctrl-T>** to access this utility. This function can also be accessed from any screen of trace memory display by pressing **<^Time>** or (**<^T>** on the external 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 170 seconds, the timer wrap-around period. Thus if the actual elapsed time was 175 seconds, the utility function will report a time of about 5 seconds.

```
CALCULATE TIME DIFFERENCE
            From address : [    1]
              To address : [000B0]
         Time difference : 1.689 994 440
```

The *'from'* and *'to'* addresses are automatically filled in as default values, and may be typed over. The *'from'* address is always = 1, and the *'to'* address is the currently used trace memory end. The time difference is in nanoseconds. In the example above, it is 1 second, 689 milliseconds, 994 microseconds, and 440 nanoseconds.

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7.3 THE UTILITY FUNCTIONS MENU

From the main menu, press **<Util>** or **<8>** or **<U>**. A second level menu will appear, the UTILITY FUNCTIONS MENU, in the following format:

```
UTILITY FUNCTIONS MENU
--------------------------------------
<0> - Screen saver                  [E]
<1> - Echo trace display to printer [ ]
<2> - Printer timeout               [E]
<3> - Show system configuration
<4> - Restore system defaults
<5> - Remote control via serial port[ ]
<6> - Set serial port parameters

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

Make your selections either by entering the **<Number>** directly (e.g. select 4 for "restore system defaults"), or by moving the highlight bar over a certain line, using the Arrow keys and pressing **<Enter>**.

Individual functions are explained below.

7.3.1 <0> - USING THE SCREEN SAVER

Electroluminescent displays like the one in the DSC-216 are subject to 'screen burn-in' if the contents of the screen do not change for a long period of time; a screen may show a ghost of a previous image. To prevent this effect, the display has a screen saver feature. If a significant time passes with no keyboard or display activity, the screen will blank. To bring it back, press any key.

You can turn off the screen saver feature from the UTILITY FUNCTIONS MENU. Choose item **<0>** to toggle between enabled or disabled screen saver.

7.3.2 <1> - PRINTING DISPLAY INFORMATION

You can print a hard copy of the trace information, just as it appears on the screen. The LED near the bottom of the front panel, by the **<^Print>** key, tells if printing is enabled. When the LED is lit, each line of trace memory displayed to the screen will also be sent to the parallel printer connected to J1. Some displays use the IBM PC Extended Character Set for ASCII graphics. Be sure that your printer has such font selected.

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

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Printing can be enabled or disabled by pressing **<Ctrl-P>** on the keypad or external keyboard anytime, from any menu level, even in the middle of displaying. Another method is selecting item **<1>** in the UTILITY functions menu. The **<Enter>** key toggles between enabled shown as 'E' in the square 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>.

7.3.3 <2> - PRINTER TIMEOUT

When enabled, this option will limit the timeout delay if the printer is not responding. After a few seconds, the character waiting to be sent to the printer will be discarded and printing will be disabled (shown by turning off indicator LED on the front panel).

When disabled, the BIOS will wait indefinitely until the printer is ready (and connected). To recover from a printer "hang", either connect a printer or press **<SystemReset>** (Note: any trace will be lost).

7.3.4 <3> - SHOW SYSTEM CONFIGURATION

Choosing this option will display on the screen all of the system options which are retained through power Off-On cycle (stored in non-volatile memory). Scroll through the screens with **<Next>** or **<Prev>**.

To print the configuration, enable printing before you choose this menu selection. If you are already displaying the information, press **<^Print>**, then **<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.

7.3.5 <4> - RESTORING SYSTEM DEFAULT PARAMETERS

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.

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7.3.6 <5> - REMOTE CONTROL FROM AN EXTERNAL HOST (PC) or USING THE DSC-216 AT A REMOTE LOCATION

There are situations when it is needed to test or troubleshoot a SCSI system at a remote location. It is possible to connect the DSC-216 Analyzer to SCSI bus to be tested, and connect the controlling terminal over a modem, or via a NULL-modem cable.

The operator at the test site (we will call this site-A, and the receiving end site-B) simply connects the DSC-216 to the SCSI bus system as usual. He/she then connects the DSC-216 Serial Port J3 to the modem port. The engineer connects his/her terminal (or host computer) at the other end to the telephone line. If site-A and site-B are close together, a NULL-modem cable can be used instead. See Appendix A for pinout.

Site-A setup: the operator connects the DSC-216 to the SCSI bus under test, and enables the remote control by selecting the UTILITIES menu, and starting selection **<4>**. A message will appear on the screen asking for confirmation. Press **<Yes>** to confirm this, and the message

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

appears on the screen. At this point, the keypad, or a keyboard if connected to J4, is disabled. The DSC-216 can be restarted, to restore control from site-A, by pressing the SYSTEM RESET pushbutton, 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 VT-100 setting). The screen should clear, and the UTILITY menu from the DSC-216 (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 DSC-216; all functions on the DSC-216 should be operational.

When finished with the session, select the Utilities menu from your remote terminal, select item 4 to disable remote control, and confirm the selection by pressing **<Y>**. Control will return to the DSC-216 local screen and keyboard. Remote control can also be disabled by pressing the SYSTEM RESET switch on the DSC-216 front panel, or by cycling power to the DSC-216.

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

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7.3.7 <6> - SETTING SERIAL PORT PARAMETERS

This option allows you to 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, press **<Enter>** 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 again even after power OFF/ON.

The following settings are selectable:

Baud rates : 110, 300, 600, 1200, 2400, 4800, 9600 or 38400 (38.4k)
Number of data bits : 5, 6, 7 or 8
Parity : even, odd or none (No parity)
Stop bits : 1 or 2

When shipped from the factory, the DSC-216 default setting is:

9600 baud
8 data bits
No parity
1 stop bit

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SECTION 8

INSTALLATION

8.1 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 to facilitate return of the equipment for factory service should that become required.

8.2 INITIAL TURN-ON

Connect the line cord to the AC module on the front panel of the DSC-216, and plug it in the three-pin 110-220 Volt (the power supply is auto-ranging) wall outlet. If three-pin outlet is not available, use a two-pin socket with proper ground wire attached and connected to ground.

If you want to use an external keyboard with your DSC-216 rather than the built-in keypad, connect its cord to the J4 KBD connector. Note that this keyboard should be the newer PC/AT type, one which does not require initialization from the host (the DSC-216 does not initialize the keyboard).

Turn the power ON. The power switch is in the upper right corner of the front panel. 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 connector J1 on the front panel of the DSC-216. The printer should be any standard parallel type. For J1 connector pinout see Appendix A.

The unit has all setup values preset to their defaults at the factory, and therefore 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.

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8.3 INITIAL CHECK-OUT

Connect a SCSI cable to an active SCSI bus. Be sure that termination is appropriate. The Trm.Pwr LED at the left side of the front panel should light. If it does not, turn on the Trm.Pwr switch on the SCSI connector pod.

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>**. A message will appear on the screen telling the end address of the recording. If this address is 0 or 1, contact the factory.

Press **<Display>** and **<Enter>**. You will see the recorded trace. Press **<Flip>** to change the display format. You may want to experiment with other recordings modes and triggering at this point.

8.4 COMMUNICATION, INTERFACING, AND SETUP

When using a remote CRT terminal or PC connected via the J3 serial port directly or over a modem, a compatible communication format and protocol have to be used. To aid the user in his/her installation, the serial I/O port is pre-programmed at the factory to a default set of parameters. These are:

J3 port: 9600 baud
8 data bits
No parity
1 stop bit
RTS and CTS enabled

Note that J3 when communicating with a CRT terminal uses the following signals:

pin 2 for RxData
pin 3 for TxData
pin 4 for CTS (to throttle the DSC-216 when sending Data out to remote host/CRT)
pin 5 for RTS (to control input from remote KBD)
pin 7 for Signal GND.

Pin-6 of J3 is HIGH (+5Volt through a 470-ohm resistor), and can be used for "Hot Wiring" the CTS (pin4) of the J3 port for initial startup if READY signal is not available in the terminal. In such a case the baud rate may have to be slowed down, to prevent data overruns.

All the selections described above are stored in the non-volatile EEPROM, and do not need to be selected again, unless different values are required.

If you have problems communicating with the DSC-216 because the serial port is configured

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wrong, you can force the original factory setting. Follow the first 4 steps of the instructions for installing a new firmware EPROM (section 8.5) to open the case. This will give access to a red DIP switch mounted on the main circuit board directly below the front panel's SCSI Reset switch. Note the current state of the switches on the dipswitch. Set the dipswitch position 3 and 8 to the ON (up) position. Connect the terminal cable and apply power. When the main menu appears on the terminal screen, shut off power, disconnect the cables and restore the dipswitch to its previous state. Close the case back up.

8.5 EPROM FIRMWARE UPGRADES

These instructions explain how to install an updated firmware EPROM into your Ancot DSC-216 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 8 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 which is attached directly to the metal pan on the bottom. Find the firmware EPROM to be replaced: it is the big 32-pin .600" chip at the extreme left rear of the main PCB, with an ANCOT label. It has the DSC-216 instrument identification and firmware revision number printed on it. Use a flat blade screwdriver to disengage the EPROM from its socket. If you use care in removing it, the EPROM can be erased and reused.

- Insert the new firmware EPROM into the same socket. The small notch on the ceramic DIP chip goes closest to the outside edge of the main PCB (same as the other chips on that PCB). Be sure that all the legs are aligned with the holes in the socket, before pressing the chip firmly into the socket. Check the legs 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 with the new revision number in the bottom right corner. Then remove the power cable again.

- Reinsert the electronics assembly into the briefcase housing. The handle of the attache

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case should be at the top of the flat display screen. Insert the 8 screws to hold the electronics assembly in the briefcase housing. Tighten the screws firmly (but not too tightly!). Attach the attache lid.

Your DSC-216 is now ready for use with the upgraded firmware.

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SECTION 9

OPTIONS

9.1 INTRODUCTION

ANCOT has developed several optional software applications which may be used with the DSC-216 SCSI Bus Analyzer/Emulator. These applications are available from the factory and are supplied in two formats:

- an EPROM for insertion into the "user ROM socket" of the DSC-216 main circuit board;
- and a file in Motorola S-Record format for downloading from a host computer to the DSC-216 via the serial port.

Each application has its own user manual. The descriptions which follow are not intended to be complete guides, but rather an indication of the capabilities of the applications.

9.2 THE APPLICATIONS

9.2.1 'ANTEST' - THE DISK TEST PROGRAM

ANTEST is ANCOT's Disk Exerciser/Tester Program. It is available on several platforms, including the DSC-216. It is useful for acceptance testing, production testing, or for debugging disk drives. ANTEST is completely menu driven for ease of use. Its reports are sent to the user's screen, a parallel printer, and through the serial port, to a file on a host computer.

ANTEST is capable of numerous tests, to check all aspects of operation of the disk drive under test. These tests include :

Write-Read-Compare
Read (Check for bad data blocks)
Seek time
Data transfer rate
Spin-up time
Start-up time
Throughput rate (I/Os per second)
Comprehensive test
Conformance test

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The user has complete control over the test activity. With a setup menu, select synchronous or asynchronous data transfers, wide (16-bit) or narrow (8-bit) data transfers, Initiator and Target ID numbers, and Logical Unit number.

With other setup menus, the user can control the length of tests, the actual bytes sent to the target, the range of scan of blocks on the disk, etc.

The reports generated by ANTEST are in 40-column format, suitable for printing by ticket printers, for attachment to the drives tested. Pass/Fail is clearly indicated for each test, based on criteria you select.

ANTEST requires the Emulator Board option to be installed on the DSC-216. It uses the emulator to issue the commands to the device under test. If the emulator is not installed, the program will hang.

Ask for #AST-220, which is the ANTEST program package for the DSC-216.

9.2.2 C LANGUAGE CROSS COMPILER

ANCOT offers a compiler which runs on an IBM PC or compatible, and produces native code to execute on the DSC-216. It includes a library of functions for easy use of the capabilities of the DSC-216.

Using this compiler, you can write programs to automate testing and monitoring of the SCSI bus using the DSC-216. ANCOT's disk testing program, ANTEST (mentioned above), was constructed using this compiler.

You can "burn" into EPROM the resulting executable programs, and insert the EPROM into the "user ROM socket" on the DSC-216's main circuit board. You can also (down)load the programs into the system SRAM via the serial port from your host PC. Example programs are provided showing how to use the features in the ANCOT SCSI Library which accompanies the compiler.

Several of the functions in the ANCOT SCSI Library, supplied with the cross compiler, use the Emulation Board option of the DSC-216. If you call one of these functions in your program, and the emulator is not present, the program will hang.

9.2.3 THE TRACE MIRROR MEMORY OPTION

This optional feature allows the DSC-216 to save the captured trace, and preserve it in a non volatile memory; the DSC-216 then can be turned off and possibly transported; later, the trace can be restored back to the DSC-216 for examination. This option is described in Appendix F.

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9.2.4 SCSI CONNECTOR PODS

The J5 and J6 SCSI connectors are mounted on the replaceable module. Several pod types are available: pods for Single-Ended and Differential interfaces, for Narrow (50-pin) and Wide (68-pin) SCSI bus, with 'Centronics' type or high-density type connectors. The Single-Ended interfaces have ('active') terminators built in, enabled by a switch. All pods have TERMPWR enabled by a switch.

Consult Appendix A section A.3 for pinouts, ordering information, and other details.

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APPENDIX A

EXTERNAL CONNECTOR PIN ASSIGNMENT AND CABLES

A.1 I/O INTERFACE CONNECTORS J1, J3

J1 – 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		

J3 – Serial I/O Port RS-232 (DB-9)

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

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A.2 AUXILIARY CONNECTORS J2, J4, J7, J8

J2 – 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.

! WARNING !

NOTE THAT PINS J2/9 AND J2/15 HAVE Vcc (+5V) CONNECTED TO IT. THIS VOLTAGE IS NOT FUSED, HOWEVER THE POWER SUPPLY WILL SHUT OFF AUTOMATICALLY IF OVERLOADED.

J4 – External KEYBOARD PC/AT type Port

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

J7 – 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 of a receiver. This line is interanlly pulled up by a 1k ohm resistor to +5 voly level.

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J8 – External SYNCH OUTPUT (BNC)

center pin – Ext.Synchr signal
shell – Chassis GND

The signal is a standard TTL level, driven by a 20mA driver.

A.3 SCSI CONNECTOR ADAPTER MODULES WITH J5, J6

The J5 and J6 SCSI connectors are mounted on the replaceable module. Several pod types are available:

1. SINGLE—ENDED interface pods:
   1.a: with high-density 68-pin 'P' type connector J5 for WIDE SCSI, and Centronics style 50-pin 'A' type connector J6 for NARROW SCSI. P/N: OP-SA/216.
   This is the standard type, which is shipped installed from the factory.
   1.b: with two 68-pin 'P' type for WIDE SCSI. P/N: OP-SA68/216.

2. DIFFERENTIAL interface pods:
   2.a: with same type connectors as 1.a above. Optional. P/N: OP-DA/216.
   2.b: with same two 68-pin connectors as 1.b above. Optional. P/N: OP-DA68/216.

3. SINGLE-ENDED (J5) & DIFFERENTIAL (J6) interface combination pods:
   3.a: with two high-density 68-pin 'P' type connectors for WIDE SCSI. Optional.
   P/N: OP-UA68/216
   3.b: with two high-density 50-pin connectors for NARROW SCSI. Optional.
   P/N: OP-UA50/216
   3.c: with two 50-pin Centronics type connectors for NARROW SCSI. Optional.
   P/N: OP-UA50C/216

The Single-Ended interfaces have ('active') terminators built in, enabled by a switch.
All pods have TERMPWR enabled by a switch.

Pinouts for all above listed modules follow.

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A.3.1 SCSI SINGLE-ENDED 68-pin & 50-pin CONNECTOR MODULE (standard) P/N: SA-216

J5 – 68 pin HD 'P' type

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	GND	50	GND
17	TRMPWR	51	TRMPWR
18	TRMPWR	52	TRMPWR
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–

J6 – 50-pin (Centronics) 'A' type

1	GND	26	D0–
2	GND	27	D1–
3	GND	28	D2–
4	GND	29	D3–
5	GND	30	D4–
6	GND	31	D5–
7	GND	32	D6–
8	GND	33	D7–
9	GND	34	DPAR–
10	GND	35	GND
11	GND	36	GND
12	open	37	open
13	open	38	TRMPWR
14	open	39	open
15	GND	40	GND
16	GND	41	ATN–
17	GND	42	GND
18	GND	43	BSY–
19	GND	44	ACK–
20	GND	45	RST–
21	GND	46	MSG–
22	GND	47	SEL–
23	GND	48	C/D–
24	GND	49	REQ–
25	GND	50	I/O–

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A.3.2 SCSI DIFFERENTIAL 68—pin & 50-pin CONNECTOR MODULE (optional) P/N: DA-216

J5 – 68-pin HD 'P' type

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	open *	50	GND
17	TRMPWR	51	TRMPWR
18	TRMPWR	52	TRMPWR
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–

J6 – 50-pin (Centronics) 'A' type

1	GND	26	GND
2	D0+	27	D0–
3	D1+	28	D1–
4	D2+	29	D2–
5	D3+	30	D3–
6	D4+	31	D4–
7	D5+	32	D5–
8	D6+	33	D6–
9	D7+	34	D7–
10	DPAR+	35	DPAR–
11	open	36	GND
12	open	37	open
13	TERMPWR	38	TRMPWR
14	open	39	open
15	ATN+	40	ATN–
16	GND	41	GND
17	BSY+	42	BSY–
18	ACK+	43	ACK–
19	RST+	44	RST–
20	MSG+	45	MSG–
21	SEL+	46	SEL–
22	C/D+	47	C/D–
23	REQ+	48	REQ–
24	I/O+	49	I/O–
25	GND	50	GND

*) used for DIFFSENS.

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A.3.3 SCSI S-E and DIFF both 68-pin HIGH DENSITY CONNECTOR MODULE (optional) P/N: UA68-216

J 5 - SINGLE-ENDED 68-pin HD 'P' type

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	GND	50	GND
17	TRMPWR	51	TRMPWR
18	TRMPWR	52	TRMPWR
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–

J6 - DIFFERENTIAL 68-pin HD 'P' type

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	open *	50	GND
17	TRMPWR	51	TRMPWR
18	TRMPWR	52	TRMPWR
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–

*) used for DIFFSENS.

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A.3.4 SCSI S-E and DIFF both 50-pin HIGH DENSITY CONNECTOR MODULE (optional) P/N: UA50-216

Note: This connector module uses both 50-pin High Density connectors (as used on Sun Microsystems computers and others)

J 5 – SINGLE-ENDED 50-pin

1	GND	26	D0–
2	GND	27	D1–
3	GND	28	D2–
4	GND	29	D3–
5	GND	30	D4–
6	GND	31	D5–
7	GND	32	D6–
8	GND	33	D7–
9	GND	34	DPAR–
10	GND	35	GND
11	GND	36	GND
12	open	37	open
13	open	38	TRMPWR
14	open	39	open
15	GND	40	GND
16	GND	41	ATN–
17	GND	42	GND
18	GND	43	BSY–
19	GND	44	ACK–
20	GND	45	RST–
21	GND	46	MSG–
22	GND	47	SEL–
23	GND	48	C/D–
24	GND	49	REQ–
25	GND	50	I/O–

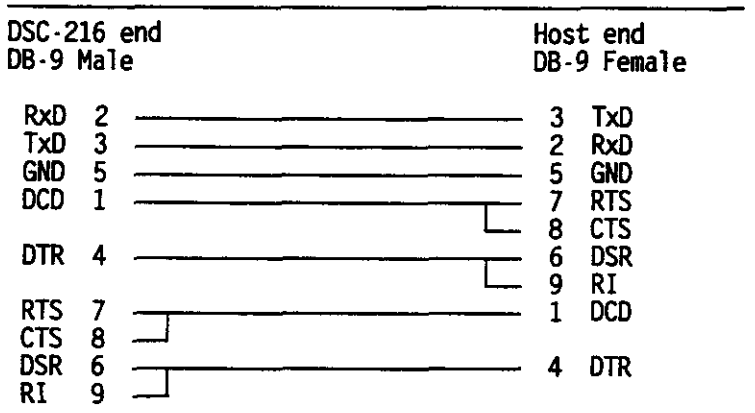
J6 – DIFFERENTIAL 50-pin HD

1	GND	26	GND
2	D0+	27	D0–
3	D1+	28	D1–
4	D2+	29	D2–
5	D3+	30	D3–
6	D4+	31	D4–
7	D5+	32	D5–
8	D6+	33	D6–
9	D7+	34	D7–
10	DPAR+	35	DPAR–
11	open	36	GND
12	open	37	open
13	TRMPWR	38	TRMPWR
14	open	39	open
15	ATN+	40	ATN–
16	GND	41	GND
17	BSY+	42	BSY–
18	ACK+	43	ACK–
19	RST+	44	RST–
20	MSG+	45	MSG–
21	SEL+	46	SEL–
22	C/D+	47	C/D–
23	REQ+	48	REQ–
24	I/O+	49	I/O–
25	GND	50	GND

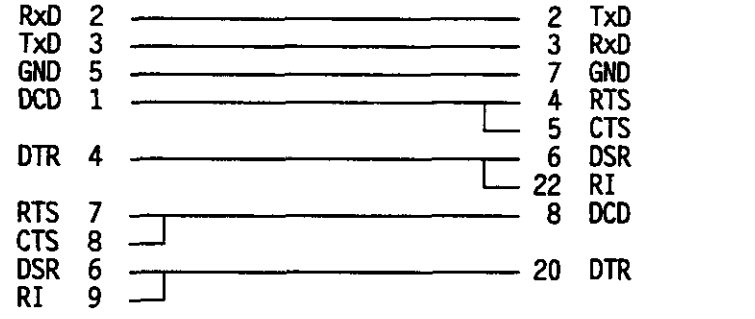
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A.4 NULL-MODEM CABLES

NULL MODEM CABLE WITH DB-9 HOST CONNECTOR

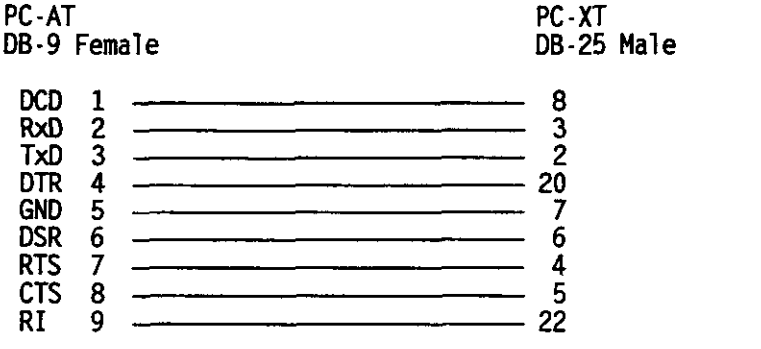


NULL MODEM CABLE WITH DB-25 HOST CONNECTOR



A.5 CABLE ADAPTER DB-9 TO DB-25

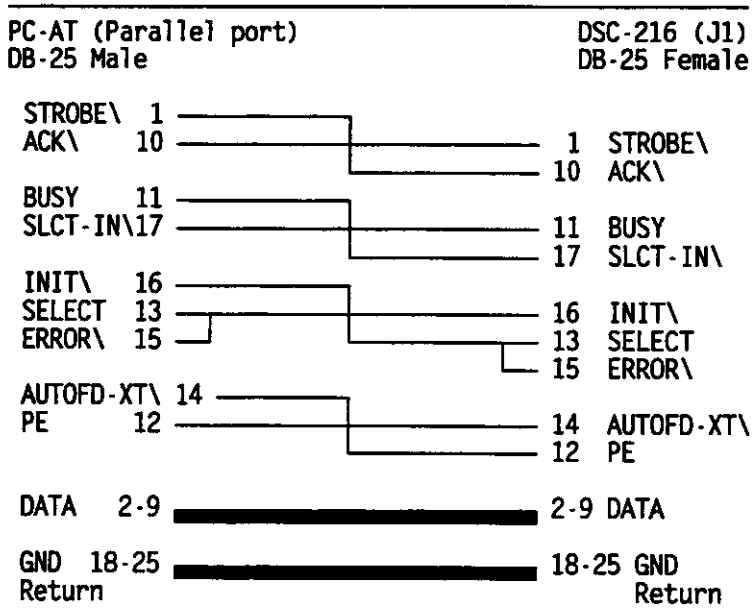
DB-9 TO DB-25 CABLE ADAPTER (PC-AT to PC-XT COM port)



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A.6 CABLE ADAPTER FOR TRACE UPLOAD USING THE PARALLEL PORT

DB-25 TO DB-25 CABLE (PC-AT to DSC-216 Parallel J1)



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CURSOR MOVEMENT SEQUENCES:

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

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

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

B.2.2 ESCAPE SEQUENCES - IN (from Terminal to DSC-216)

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

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APPENDIX 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
0-7	"DSC-216 " (ASCII string)
8-18	Address range. The first value is 5 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 5 hex digits, represents the last trace address transferred.
19	" " (an ASCII space character, 20 Hex)
20	File format code. The following codes are in use: "B" = Binary display format "D" = Diagnostic format (not accessible by customers) "H" = Hex dump format "R" = Raw Data format "S" = Structured display format
21	space
22-25	recording mode. This is a 16 bit, bit-significant code for the recording mode used to obtain this trace. The bits are : bit meaning 0-1 not used 2 Skip data mode enabled (see bit 7) 3 4-edge of Req/Ack enabled 4 Phase changes before Req enabled 5 Record on external clock enabled 6 Filtering by ID enabled 7 When skip data is enabled, 1 = keep 8 events, 0 = keep 32 events 8-9 not used 10 Capture on BSY or SEL transition only 11 Capture SCAM protocol 12-15 not used
26-126	spaces
127	"#"

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event will all be 0's, and the SCSI data word will contain a pattern telling the recording mode used during that tracing session. The recording mode bits are as follows:

Bit	Meaning
D0 - D1, D8 - D9, D12 - D15	Not used.
D2	If cleared, all data transfers are captured. If set, the number of data transfers captured depends on bit D7.
D3	If set, all transitions of SCSI control lines REQ and ACK are captured. If cleared, only the transition which makes the data lines valid is captured. See section 2.2.5.5.
D4	If set, any transition of the SCSI control lines MSG, C/D or I/O is captured. If cleared, transitions on these lines are ignored.
D5	If set, transitions on expansion port pin 1 are captured.
D6	If set, all transitions up to the Selection phase are captured. All later transitions are ignored until the next Bus Free phase, unless the data pattern during selection matches the filtering pattern.
D7	See bit D2. If in Skip data mode, and this bit is set, capture continues until the 8th assertion of ACK in each Data-In or Data-Out phase. If cleared, capture continues until the 32nd assertion of ACK.
D10	If set, only transitions on the SCSI BSY and SEL control lines are captured. All others are ignored.
D11	Capture SCAM Protocol if set.

C.3 READABLE FORMATS

In addition to the Raw Data format, it is possible to upload in either Structured or Binary format. In these formats, the file will contain trace information just as it appears on the screen of the DSC-216 when displaying in these formats. These formats cannot be downloaded back into the DSC-216.

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C.4 TRACE DUMP FORMAT

The Hex Dump format can be used to get the complete contents of the trace memory without having the problem of decrypting the transmitted data. Although the Hex Dump format requires more characters to transmit the same data as in the Raw Data format, it is less than it would be for the Structured or Binary formats. The Hex Dump format cannot be downloaded back into the DSC-216.

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APPENDIX D

THE KEYPAD AND EXTERNAL KEYBOARD FUNCTIONS

D.1 GENERAL

The table below lists the keys on the keypad, their corresponding keys on the external keyboard, and their functions. The table is organized so that it scans over the keypad column by column, starting at the upper left corner and ending with the bottom right corner. Each key is listed in its basic function, followed by its 'Alt' and/or 'Ctrl' function if they apply. All combinations not listed are reserved / undefined.

D.2 THE KEYPAD & KEYBOARD FUNCTIONS TABLE:

24-key keypad	ext.keyboard	Function
Esc	Esc	escape - cancel function
Ctrl-Esc(^Break)	BREAK	Break (Software Reset)
Quit	Q	Quit a function, or exit this menu
Alt-Quit(-)	–	'dash' or 'minus'
Alt	Alt	select Alternate function
Ctrl	Ctrl	select Control function
Run	R	RUN - start tracing
Alt-Run(C)	C	C hex
Stop	S	STOP - stop tracing
Alt-Stop(8)	8	8 hex
Display	D	Display
Alt-Display(4)	4	4 hex
Ctrl-Display	Ctrl-D	delete Data Pattern byte in Search Pattern
No	N	No
Alt-No(0)	0 (zero)	0 hex
Pause	P	Pause tracing
Alt-Pause(D)	D	D hex (Note: same as <Display>)
Flip	F	flip (toggle) between display formats
Alt-Flip(9)	9	9 hex
Ctrl-Flip(^Find)	Ctrl-F	Find certain command/phase/.. in the trace
Next	<space>	display Next page of trace
Alt-Next(5)	5	5 hex
Ctrl-Next(^FNxt)	Ctrl-L	Find next occurence

(continued)

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(continued)

Yes	Y	yes
Alt-Yes(1)	1	1 hex
◄	◄	move cursor left (non-destructive)
Alt-◄(E)	E	E hex
Trig	T	display the trigger selection menu
Alt-Trig(A)	A	A hex
Ctrl-Trig(^Time)	Ctrl-T	calculate time differential between trace events
Prev	–	display Previous page (approximately) of trace (Note: same as <Alt-Quit>)
Alt-Prev(6)	6	6 hex
Ctrl-Prev	Ctrl-K	Find-Previous occurence
X	X	don't care
Alt-X(2)	2	2 hex
Ctrl-X(^Print)	Ctrl-P	toggle printing to external printer
►	►	move cursor right (non-destructive)
Alt-►(F)	F	F hex (Note: same as <Find>)
Mode	M	display the mode-of-recording selection menu
Alt-Mode(B)	B	B hex
Alph-Hx	H	toggle between alpha and hex format in data phase
Alt-AlphHx(7)	7	7 hex
Ctrl-AlphHx(^TmF)	E	toggle differential & elapsed time-stamp format
Util	U	display Utilities menu (Note: same as <Alt-< >)
Alt-Util(3)	3	3 hex
▲	▲	move cursor up
Alt-▲(HM)	Home	Home
Ctrl-▲(PgUp)	Pg-Up	Page Up
▼	▼	move cursor down
Alt-▼(END)	End	End
Ctrl-▼(^PgDn)	Pg-Dn	Page Down
16/8	W	toggle NARROW and WIDE data display
Alt-16/8(BS)	BackSpace	Back Space
Ctrl-16/8(^BinF)	L	toggle binary display formats
Enter	Enter	ENTER selection

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APPENDIX E

THE SCAM PROTOCOL

E.1 GENERAL

The SCAM (SCSI Configured AutoMatically) protocol is a new addition to the SCSI-3 parallel standard which enables assignment of SCSI IDs to individual devices in a automatic way, 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 in two levels (i.e. two versions):

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 with the master. This level protocol 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 level protocol 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.

In the next step, SCAM master assigns the soft IDs to the SCAM capable devices. This is done using a modified Selection phase (with MSG line asserted by the master), and with no data bits being driven on the data bus. The BSY and SEL stay asserted to hold off the legacy devices. All SCAM devices now "wake up" and participate in the protocol. The devices drive certain control lines (C/D and I/O); they execute certain sequences on the D5, D6, and D7 lines, and use the lower five data bits for transfering information about ID which they (the slaves) prefer. The slaves then

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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. Its duration may take a few seconds or less, 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, too – with jumpers on the devices to select a unique ID. SCAM doesn't magically make old devices work, but it doesn't make them any worse either.

E.2 USING THE DSC-216 SCSI BUS ANALYZER FOR SCAM

E.2.1. ACTIVATING THE SCAM DISPLAY

- Go to the Mode menu by pressing <Mode> from either the main menu or from a trace display

- Select item <6> - Capture SCAM Protocol so that an 'E' (for 'enabled') appears in the square brackets. This will also turn ON capture of the Phase Changes (item 2). Both of these must be ON for SCAM tracing.

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

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

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A P P E N D I X F

THE TRACE MIRROR MEMORY OPTION

Ancot now offers a way to capture a trace at a remote location and return to your home office/lab with it. The technology that enables this feature is an optional FLASH ROM-based Trace Mirror memory add-on board for the DSC-216 family of SCSI bus Analyzers.

The Trace Mirror memory is accessible using the SAVE TRACE / RESTORE TRACE functions from the main menu. You have the option of saving an exact copy of the entire installed trace memory (up to 128K events total) or several smaller traces. Memory in the Trace Mirror memory is allocated in blocks of 128 events. If you choose to save a smaller piece of trace memory, the remainder up to the next 128 event boundary will be wasted.

The Trace Mirror memory can be used over and over, simply by rewriting new events to the old addresses within the mirror. This means you must be careful to keep a record of the addresses containing traces you want to preserve, so you don't accidentally overwrite them.

When you select the SAVE TRACE function in the main menu, you will be asked for the address range from trace memory to be saved. You will also be asked for the address in Trace Mirror memory where the trace saving should start. If you type in a Trace Mirror address which is not on a 128 byte boundary, the address you select will be rounded up. If the address range from the trace memory is not a multiple of 128 events, that will also be rounded up. The program will then attempt to write the trace data into the Trace Mirror memory. If it is successful, you will be informed of any change in addresses used within the Trace Mirror memory. If the transfer fails, you will be informed of that also. You should make a note of the addresses within the Trace Mirror which are in use.

The FLASH ROM chips used for the Trace Mirror have a limited lifespan of 10000 write cycles. For most users, this will not be a problem, since the unit will be obsolete before you can do that many write cycles. However, to maximize the lifespan of your unit, you can use different start addresses for your saved short traces, rather than always starting at mirror address 0.

When you use the RESTORE TRACE function in the main menu for restoring from the Trace Mirror memory to normal trace memory, you can specify the exact address range to be restored. The "granularity" of the FLASH write cycles does not apply.

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APPENDIX G

SAVE/RESTORE TRACE DATA TO/FROM PC HOST VIA PARALLEL PORT

PROGRAM NAME:
ANCOTPAR.EXE is the file name of the program executing on the PC host.

REQUIREMENTS:
A bi-directional parallel port conforming to the Enhanced Parallel Port (EPP) standard, configured as LPT1 (using IRQ7) or LPT2 (using IRQ5).
An MS-DOS operating system environment executing on a minimum of a 286 CPU.
A special purpose, vendor supplied, parallel interconnect cable.

OPERATION:
The program operates in two modes: DOWNLOAD, when sending a data file to the DSC-216, and UPLOAD, when receiving data from the DSC-216 and capturing it in a file.

In Download mode, the operator must first configure the DSC-216 to receive the data, and then start the utility ANCOTPAR.EXE on the PC host, with the appropriate filename.
Type:

ancotpar -D trace.001 **<Enter>**

The data transfer then starts and proceeds automatically until the end of the file is reached.

In Upload mode, the program operates as a Terminate-Stay-Resident (TSR) program so that it can be used in conjunction with a terminal emulator program to control the DSC-216 over the serial link. The operator starts the utility with the appropriate command line option and optional Path name and initial filename. The operator can then start the terminal emulator to control the DSC-216 directly. Several upload trace data files can be captured in one session starting with the specified optional filename or a default filename. The operator can then exit and suspend the TSR to free up the memory.

COMMAND LINE OPTIONS:
If the utility is evoked without any options or filename, a simple Help screen, describing the options, will be displayed.

If options are entered they must precede the optional; directory path and/or filename. Available options are as follows:

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- D - program executes in DOWNLOAD mode to transmit the specified file to the DSC-216.

- U - program executes in UPLOAD mode to receive trace data and capture it into one or more files.

- L2 - select LPT2 as the parallel port for data transfer. The program default is LPT1. - L1 can be entered if desired.

- Q - suspend the program currently executing in UPLOAD mode as a TSR, in order to free up the memory.

- T - required when using a Toshiba laptop computer, which utilize a slightly different parallel port format.

FILE NAME GENERATION:
Under MS-DOS, all filenames are composed of a base name of up to 8 characters, followed by an optional 3 character extension. This is generally referred to as the "8 dot 3" format. In Upload mode, the utility reserves the extent name for a 3-digit series number. If the operator should enter an extent name that is non-numeric, it will be replaced with the number "001" or the next available number. For example:

> If the filename is specified as "TEMP.TXT" then the first file will have the name "TEMP.001" and the 2nd file will be "TEMP.002", etc.

If the operator enters a filename with a numeric extent, then the first file generated will use that number, or the next available number. For example:

> If the filename is specified as "TEMP.055" then the first file captured will be "TEMP.005" unless that filename already exists. Otherwise, the first file will be "TEMP.056" or the next available number.

Remember that trace data in "raw format" only can be downloaded (restored) back to the DSC-216.

Also note that downloaded trace is placed in the DSC-216 trace memory always starting from location zero (0). Therefore consecutive uploads automatically overlay the previous traces. In other words, only a single uploaded trace can be examined at a time.

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APPENDIX H

EXAMPLE OF USING THE PC & PROCOMM FOR SAVING/RESTORING THE TRACE VIA SERIAL PORT

There are several communications programs which could be used for the remote control or up/downloading of programs or traces from/to the DSC-216 analyzer. In this Appendix, we will describe using the PROCOMM PLUS program, as an example.

H.1 SETTING UP PROCOMM OPTIONS

First of all, we have to assume that your copy of the PROCOMM PLUS has been installed properly.

Start the program by typing **PCPLUS** followed by the **<Enter>** key and the initial screen will be displayed. Then press any key to enter the terminal emulation mode. There is a good chance that the interface (of PROCOMM) is setup the way you need it, and that PROCOMM displays a good screen.

However, if the setup (of PROCOMM) is wrong, almost any kind of exotic 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 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 pacing (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 until the PROCOMM returns back to the terminal emulation screen.

In the following two sections, we describe how to execute the SAVE TRACE TO HOST (upload) and RESTORE TRACE FROM HOST (download) functions using the PROCOMM program. We are assuming that you correctly connected together the serial ports of the DSC-216 and the PC. Use the serial (NULL MODEM) cable supplied by ANCOT (see pinout in appendix A.4) and connect the J3 'SERIAL' connector (DB-9) on the DSC-216 to the COM port on the PC.

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H.2 SAVE TRACE TO HOST VIA SERIAL PORT

ON THE PC:

- start PROCOMM PLUS (as described in setup) and enter the terminal emulation mode.
- press <**PgDown**> to activate the upload function.
- select <**A**> for ASCII format (all DSC-216 data formats are printable ASCII as transfered on the line) from the intermediate menu
- 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 DSC-216 is ready.

ON THE DSC-216:

Starting from the main menu

- press <**3**> for 'Save/Restore the trace',
- press <**0**> for 'save trace to host via serial port',
- press <**0**> for 'raw trace data format' (you may select any other format, but remember that only the raw data format can be restored back).
- select the starting and ending addresses to define section of the trace to be saved (default would be the full size used)
- at this point, **hold off confirming** the transfer (i.e. do NOT press <Yes> !!) until the PC is ready.

ON THE PC:

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

ON THE DSC-216:

- press the <**Yes**> and you will see the address counter on the DSC-216 counting and the data being listed on the PC. When the transfer is finished, message **"- finished -"** will be displayed on the DSC-216 screen and there will be the EOT character (♦) displayed after the last data line on the PC.

You may need to 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.
You may exit PROCOM PLUS by typing <**Alt-X**> on the PC.
You may return to the main menu on the DSC-216 by typing <**Esc**>.

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H.3 RESTORE TRACE FROM HOST VIA SERIAL PORT

ON THE PC:

- start PROCOMM PLUS and enter the terminal emulation mode
- press **<PgUp>** to activate the upload function
- select **<A>** for ASCII format (all DSC-216 data formats are in ASCII as transfered on the line) from the intermediate menu
- as a response to the prompt, type in the filename where the previously saved trace was stored
- at this point, **hold off pressing <Enter>** until the DSC-216 is ready.

ON THE DSC-216:

From the main menu on the DSC-216
- press **<3>** for 'Save/Restore the trace',
- press **<3>** for 'restore trace from host via serial port',
- press **<Y>** to confirm the start of transfer.

ON THE PC:

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

ON THE DSC-216:

The address counter on the DSC-216 will count as the data is being transfered. When finished, the DSC-216 clears the screen and returns to the main menu.

The trace has now been restored to the DSC-216 trace memory and can be displayed using the **<D>** display function.

You may exit PROCOM PLUS by typing **<Alt-X>** on the PC.

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APPENDIX J

SCSI FACTS & TIPS

Importance of proper cabling and termination in SCSI systems can never be emphasized enough. Bad cabling or termination often results in erratic operation, or sometimes will cause the system not to operate at all. The erratic operation is the worst; the less frequently errors occur, the more difficult it is diagnosing their source. Speed of transmission over the bus is also an important factor determining whether the marginal connection causes errors. Many existing devices on the market today transfer the data at rates under 1 MHz; the SCSI-2 specifies a FAST mode at 10 MHz with tighter timing tolerances. The SCSI-3 FAST/20 mode uses even tighter timing and tolerances. Devices of various speeds can be connected to the same bus, and you may find that only the faster devices cause transmission errors.

J.1 CABLING

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

J.2 ELECTRICAL CONNECTION & TERMINATION ON THE SCSI Bus

There are two alternatives: the Single-Ended and the Differential interfaces. These alternatives are mutually exclusive, and can not be mixed on the same SCSI bus system; all devices and both terminators on the same SCSI bus must use the same kind of interface. All signals should also be terminated at both ends of the cable. The following paragraphs describe the termination alternatives.

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

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physically last ones, as positioned on the SCSI cable, should have the terminators. Exactly two terminators should be used.

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

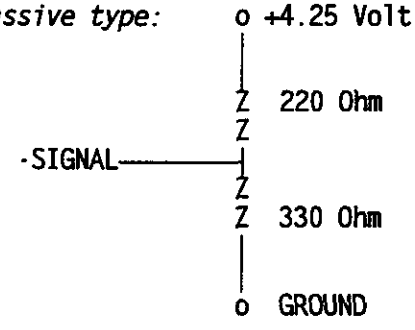
It becomes more complicated if the same SCSI bus is connected to devices in the enclosure (to internal drives) and also to external devices (like an external CD-ROM drive or backup tape drive). In such cases, you have to determine what are the physical ends of the cable, and place terminators in those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

SINGLE-ENDED ALTERNATIVE

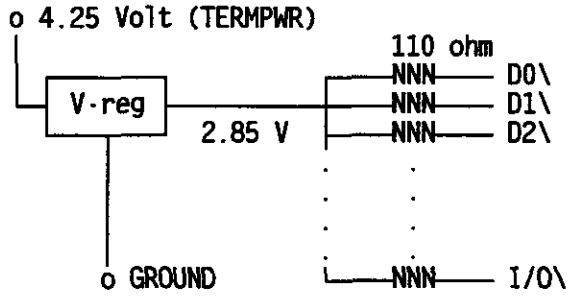
uses transfer over a single "live" line in reference to GROUND. "True" signal is defined as a low level (0 to .8 V), and "False" signal is defined as a high level (2.0 to 5.25 V).

SINGLE-ENDED TERMINATION:

Passive type:



Active type:

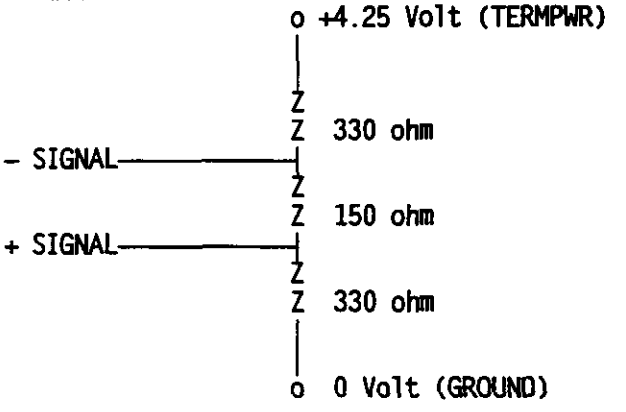


DIFFERENTIAL ALTERNATIVE

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

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Differential termination:



The Differential interface is electrically more robust and therefore there was no need to develop an active type (more expensive) terminator.

NOTE & WARNING:

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

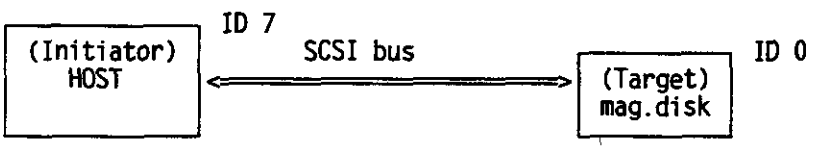
J.3 THE TERMINATOR POWER ('TERMPWR'):

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

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J.4 SCSI INITIATORS & TARGETS

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



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

J.5 SCSI DEVICE ADDRESSING

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

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

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

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J.6 SCSI DATA PARITY

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

J.7 MIXING SE & DIFF SCSI DEVICES

The single-ended and differential interfaces are mutually exclusive. The SCSI bus must use either all single-ended, or all differential components. In situations when you need to connect single-ended and differential devices together on the same SCSI bus, you must use a SE to Diff Converter, for example the ANCOT model SED-608 for the 'Narrow' bus, or model SED-616 for the 2-byte 'Wide' bus. Many of the newer SCSI peripherals use the differential interface.

J.8 SCSI CABLE LENGTH

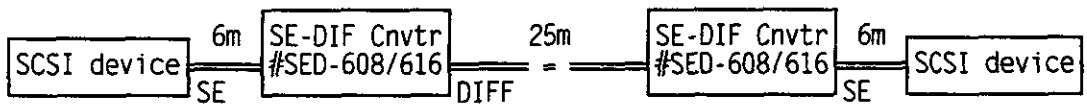
The maximum cable lengths recommended by the SCSI specification are 6 meters for the single-ended bus, and 25 meters for the differential bus. These lengths are recommended for configurations where you need to achieve the maximum specified performance. However, in many situations where longer lengths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

J.9 EXTENDING THE SCSI CABLE

Total length of the cable (for maximum performance at the maximum transfer rates of 5 MHz), as recommended by the SCSI specification, is 6 meters for single-ended or 25 meters for differential configurations. It is possible to extend this length considerably by using single-ended to differential converters. Several schemes are possible, depending on how much distance is needed and which interface is used on the SCSI devices. See the following examples.

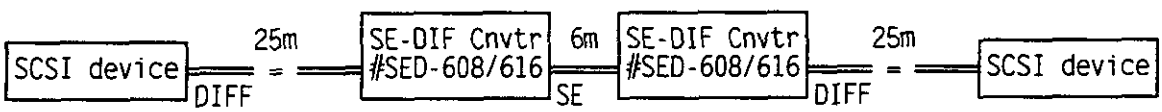
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Example 1:



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

Example 2:



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

Example 3:



Total distance is 31 meters (25 + 6)

The SED-608/616 Converter does not occupy any SCSI ID, and is functionally transparent to the SCSI devices connected. It is possible to use more than two converters in series and thus achieve even longer distance.

The Converters are available from ANCOT for the 'Narrow' bus (SED-608) and for the 'Wide' bus (SED-616). Both models support asynchronous, synchronous, and SCSI-2 Fast modes.

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

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INDEX

ADAPTER MODULES, 89

ALLOCATION/TRANSFER LENGTHS, 66
ANTEST, 83
APPLICATIONS, 83
ARBITRATION, 67
AUTOFILL, 59

BINARY DISPLAY, 33
BUFFER SIZE, 65
Build Macro, 57

C LANGUAGE CROSS COMPILER, 84
CABLE ADAPTER, 87,89
CABLES, 89
CAPTURE FOUR EDGES REQ/ACK, 17
CAPTURE ON EXTERNAL CLOCK, 18
CAPTURE PHASE CHANGES, 16
CAPTURE SCAM PROTOCOL, 18
CAPTURE SELECTION ONLY, 17
CHANGING THE DISPLAY FORMAT, 41
CLEAR TRACE, 18
COMMAND PROFILE FORMAT, 39
COMPACT DISPLAY FORMAT, 38
COMPARE BUFFERS, 60
CONNECTORS, 4, 87
CUSTOM MESSAGE, 68

DATA BUFFER MANAGEMENT, 58
DATA PROTOCOLS, 68
DIFFERENTIAL, 8
DISCONNECT / RECONNECT, 67
DISPLAY, 41
DISPLAY TRACE, 19

EDIT CDB, 58
EMULATOR SETUP, 61, 66
EPROM FIRMWARE UPGRADES, 81
EXPANSION, 5
EXTERNAL KEYBOARD, 105

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EXTERNAL SYNCH, 5
EXTERNAL TRIGGER, 4

FILTERING BY SCSI ID, 17
FIND EVENT, 20
FIND SCSI EVENT, 43
Flag bit, 6, 59
Front panel, 4

HEX DUMP FORMAT, 38

IDENTIFY MESSAGE, 67
INITIAL CHECK-OUT, 80
INITIAL TURN-ON, 79
INITIATOR EMULATION, 55
INITIATOR ID, 59

KEYPAD, 5, 105

LED indicators, 6
Link bit, 59, 60
List Macros, 57
Logical Unit Number (LUN), 61
LUN, 59, 61

Macro, 57
Main menu, 14
MODE OF TRACING, 16
Mode Select, 70
Mode Sense, 70

NOTATION, 5
NULL-MODEM, 94

OPTIONS, 83

PAUSE TRACING, 15
POST TRIGGER, 50, 52
PRE-TRIGGER, 50, 53
Printer timeout, 75
PRINTING, 74
PROCOMM, 113
PROCOMM OPTIONS, 113

QUEUE TAG, 61
Queue Tag message, 57

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Recording, 3
Remote control, 76
REPEAT COMMAND, 62
Restore system defaults, 75
RESTORE TRACE, 111

SAVE ALL, 16
SAVE TRACE, 23
SAVE/RESTORE TRACE, 23, 113
SCAM Protocol, 18, 32, 37, 107
SCREEN, 4
Screen saver, 74
SCSI CONNECTOR PODS, 89
SCSI RESET, 4, 6, 60
SCSI VERSION, 71
SDTR, 57, 63, 68
SEARCHING FOR EVENTS, 43
Serial port, 80
SETUP, 86
SETUP DISPLAY FORMAT, 19
SINGLE-ENDED, 8
SKIP DATA, 16
START TRACING (RUN), 15
STOP TRACING, 16
STRUCTURED DISPLAY, 29
System configuration, 75
SYSTEM RESET, 4, 6

TARGET ID, 61
TARGET TYPE, 70
Time difference, 73
TIME DIFFERENTIAL, 20, 73
TIMEOUT SELECTION, 71
TIME-STAMPING, 8
Trace Memory, 13
TRACE MIRROR MEMORY OPTION, 84, 109
TRACE UPLOAD / DOWNLOAD, 99
TRACING, 6
Trigger delay, 49
TRIGGER SETUP, 18
TRIGGERING, 49
TRM.PWR, 6

UNPACKING, 79
UP/DOWNLOAD TRACE DATA TO PC, 111
User interface, 6
USER PROGRAMS, 21

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UTILITIES, 20
UTILITY FUNCTIONS MENU, 74

WDTR, 57, 63, 68

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