X3T9.2/87-38

Preliminary Results of SCSI–2 Cable Testing

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1.0 SCOPE

The intent of the following tests was to compare a new generation of high density SCSI–2 cables, connectors, and terminators against their predecessors from the SCSI–1 era. The goal was to determine whether the new family of SCSI–2 accessories will satisfy some of the reliability criteria of the SCSI specification and of Sun systems. The first step taken was to test configurations with full length cables (6 meters = 20 ft), and with one to two drives attached to the SCSI bus. The next step will be testing the maximum configurations with full length cables and eight devices attached to the bus (ID = 0 .. 7). This preliminary report deals with the first step configurations.

2.0 STRATEGY

High density shielded cables 100 ohms and 70 ohms were used and interconnected to an overall length of 6 meters. Then they were measured and compared to a single piece low density nonshielded flat cable of a similar length. The total length the SCSI bus exceeded the maximum length of 20 ft defined by the SCSI specification in order to create the worst case one drive situation. The termination power was supplied from the initiator over the whole cable length to support the worst case notion.

The measurements consisted of both the synchronous and the asynchronous transfers, and were conducted in two different ways. One part was examining the signal waveforms of *REQ–*

and *ACK–* for reads and then writes. The other part of the task was running long term reliability tests by checking the integrity of data. This was done by write–read–verify scheme mostly through overnight tests guaranteeing that the number of bits transferred across the bus was higher than $> 10^{11}$ for each case.

3.0 EQUIPMENT USED

1) Tektronix 2465 Oscilloscope 300 MHz
2) Tektronix C–5C Oscilloscope Camera
3) Gould K450B Logic Analyzer with printer
4) Ancot DSC–202 SCSI–bus Analyzer with printer
5) Different Sun Systems

4.0 GLOSSARY OF TERMS AND SIGNALS

SCSI device A host computer adapter or a peripheral controller or an intelligent peripheral that can be attached to the SCSI bus.

SCSI ID The bit–significant representation of the SCSI address referring to one of the signal lines.

initiator A SCSI device (usually a host system) that requests an operation to be performed by another SCSI device

target A SCSI device that performs an operation requested by an initiator.

Terminating power 4.25 volts dc to 5.25 volts dc

Input characteristics signal true 0.0 volts dc to 0.8 volts dc
signal false 2.0 volts dc to 5.25 volts dc

REQ– Request is a target signal indicating a request for *REQ/ACK* data transfer handshake.

ACK– Acknowledge is an initiator signal to indicate an acknowledgment for a *REQ/ACK* data transfer handshake.

5.0 TESTING RESULTS

CABLE	Read–Write–Verify > 10^{11} bits		Termination Power $\frac{V_I \ / \ V_T \ [V]}{\text{Voltage Drop } [V]}$
	asynch.	synch.	
High Density 100 ohm	no errors	no errors	$\frac{4.49 \ / \ 4.26}{0.230}$
High Density 70 ohm	no errors	no errors	$\frac{4.50 \ / \ 4.28}{0.220}$
Low Density 100 ohm	no errors	no errors	$\frac{4.52 \ / \ 4.37}{0.150}$

Table 1

Table 1 shows that all cables passed the reliability test of transferring and verifying more than 10^{11} bits of data across the SCSI bus. The termination power was supplied from the initiator and measured at both the initiator and the target terminator to make sure that it is within the specification range. The *REQ– / ACK–* waveforms for all the test cases are displayed in Figures 3 – 14.

6.0 SUMMARY

The purpose of these measurements was to find out how reliably the shielded SCSI–2 cables can replace the existing low density nonshielded SCSI–1 ones. In the first approach, full length cables of both types were tested in configurations with one or two targets on the bus in asynchronous and synchronous transfer modes.

Table 1 shows that no errors were observed during the long term tests while transferring and verifying large amounts of data (> 10^{11} bits). Figures 3 – 14 satisfy the input characteristics as defined by the SCSI specification. All SCSI devices were single–ended and the terminating power lied within the defined voltage range.

In the next round of measurements, a full blown configuration with maximum length cables

and eight devices on the SCSI bus will be utilized to finish this investigation.

7.0 ACKNOWLEDGMENTS

I wish to acknowledge James Allen, Dexter Anderson, Roger Butler–Fielden, Rich Clewett, Alex Pappas, Curt Ridgeway, Paul Rikkonen, Pat Thurber, and Hao Tran for their continuous support during the measurements and valuable informations in the preparation of this document.

List of Vendors that Provided Test Samples

AMP Incorporated, Intercom Division, Harrisburg, PA

Robert Whiteman, Product Manager , (717) 780-7481
Charles Brill, Computer Standards, (717) 561-6198, FAX (717) 561-6179

- Furukawa 70 ohm shielded cable with AMP connectors
- High density terminators

Amphenol Corporation, Interconnect Products Division, Endicott, NY

Bill Sopchak, Product Manager, (607) 786-4307, FAX (607) 786-4311
Richard Somers, V.P., QuadRep Inc, (408) 432-3300

- C&M 100 ohm shielded cable with AMP and Honda connectors
- Passive and active terminators

Astro Wire and Cable, Worchester MA

Peter Blackford, Chief Engineer, (800) 447-1128, (617) 754-3281

- 100 ohm +-10 ohm shielded cable

Icontec Incorporated, Milpitas, CA – Manufacturing and assembly company

Allen Haigh, V.P., (408) 945-7766, FAX (408) 945-4360

- Cables designed and built by Icontec, 110 ohm +-10% differential impedance

Fujitsu Component of America, Inc. Santa Clara, CA

Joel Urban, Marketing Manager, (408) 562-1722, FAX (408) 727-0355
Bob Thornton, Product Engineer, (408) 562-1735

- Connectors, terminators and Furukawa 70 and 100 ohm shielded cables

Madison Cable, Worchester, MA

John Osborne, Product Manager, (508) 752-7320

- 105 ohm +-7 ohm and 120 ohm +-10 ohm shielded cable

Methode Electronics, Chicago, IL

John Cannon, Product Manager, (312) 867-9600 / X371, FAX (312) 867-9130
Bob Masterson, Applications Eng. Mgr, (303) 695-1333
Roger Fontenot, Sales Engineer, (408) 262-3812

* In-line and end of line terminators

Quintec Interconnect, San Jose, CA – Cable assembly company

Greg Sulger, Sales Engineer, (408) 272-8000

* Providing Astro or Madison shielded cable

Cables that have been used for the testing were supplied by AMP Inc, Amphenol, Icontec, and Quintec. The cables were build to Sun's assembly specifications:

8 x 530-1434-01 0.45 meter Shielded SCSI-2 Male-Male connectors
5 x 530-1508-01 1.20 meter Shielded SCSI-2 Male-Male connectors
2 x 530-1435-02 2.00 meter Shielded SCSI-2 Male to 50-pin Sub-D Male

The cable vendors used were Astro, C&M, Furukawa, and Madison Cable, connector vendors were AMP, Honda and Fujitsu. Terminators have been supplied by AMP, Amphenol, Fujitsu and Methode.

Asynchronous SCSI Cable Test Configurations

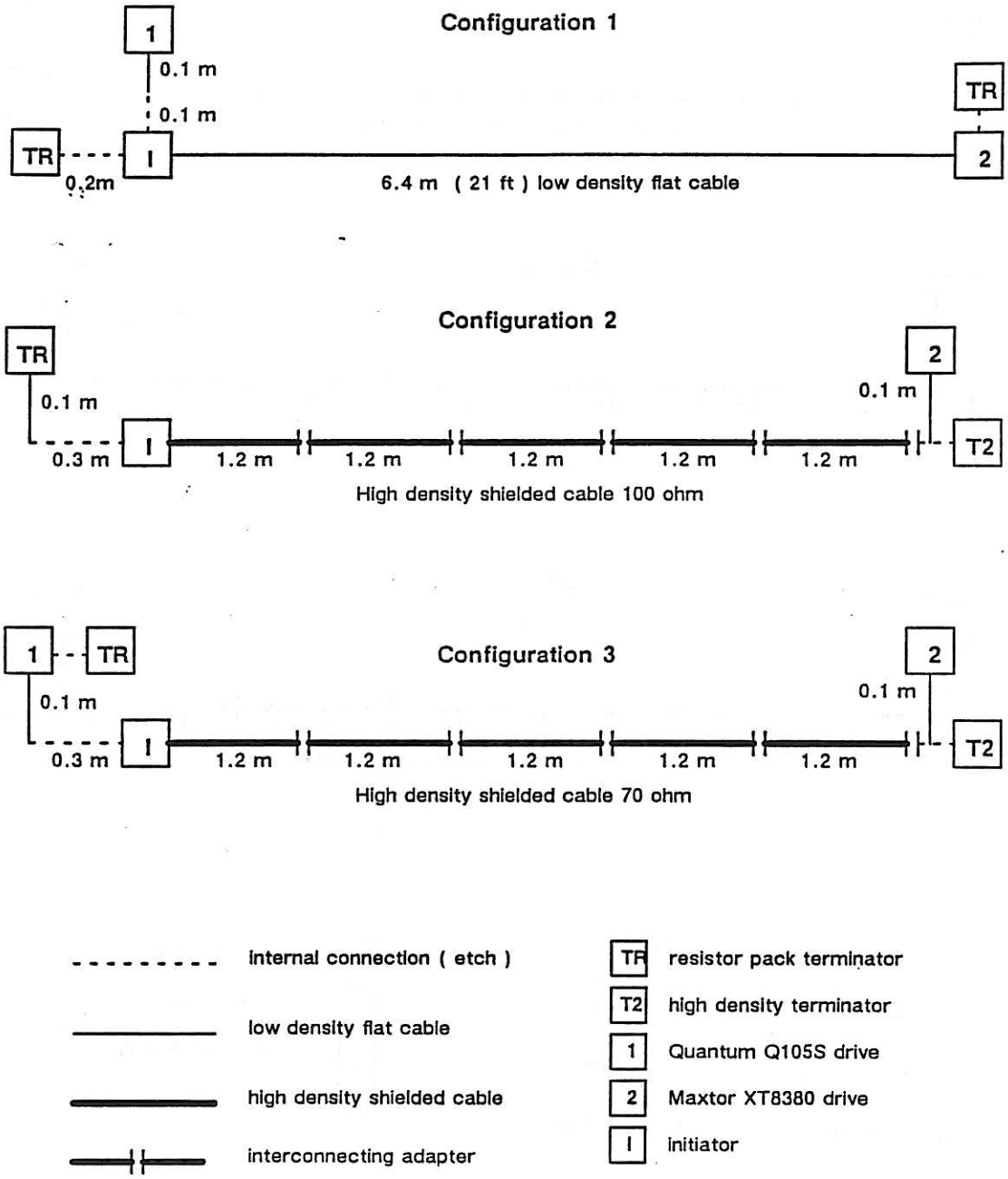

Figure 1

Synchronous SCSI Cable Test Configurations

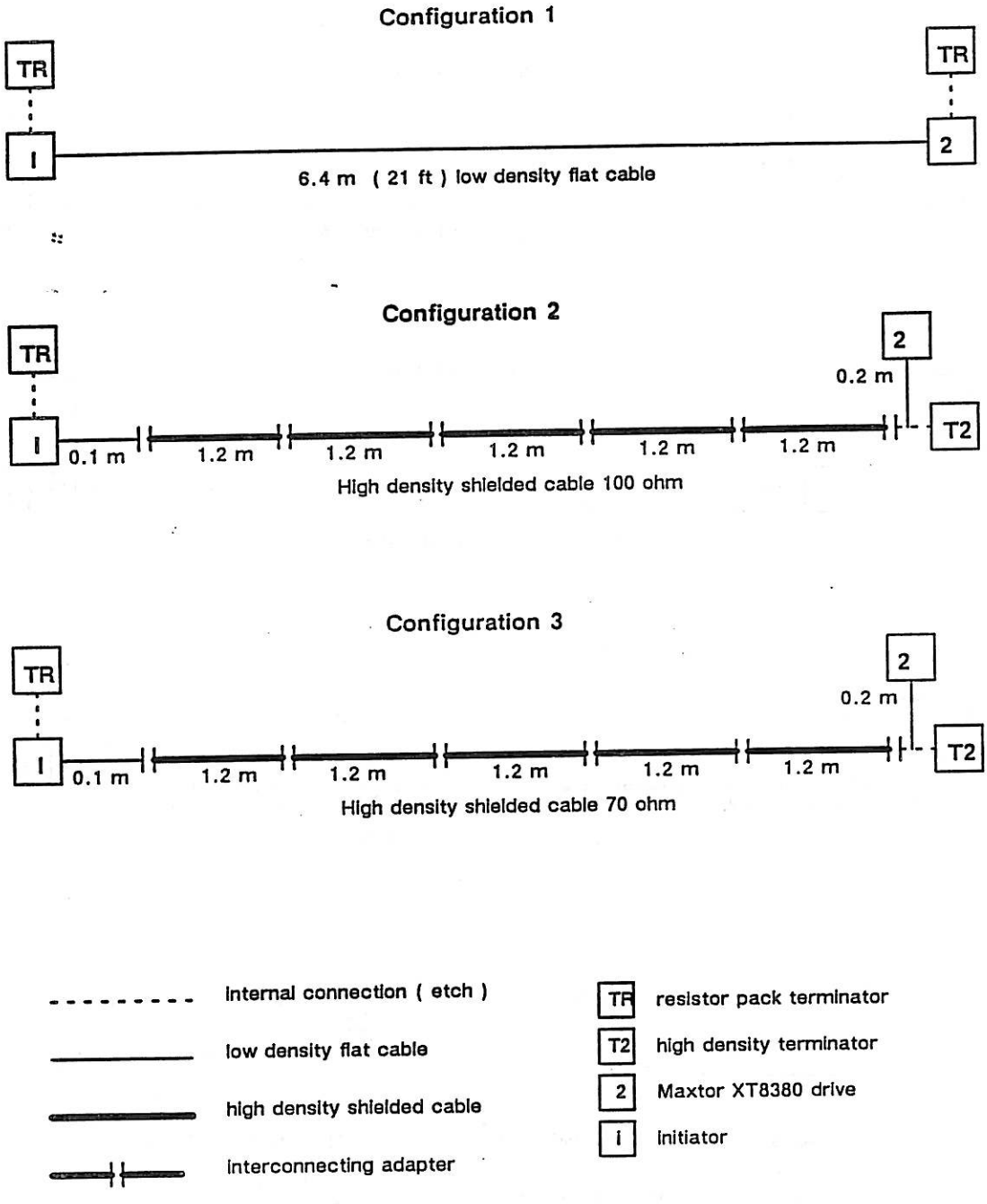

Figure 2

Asynchronous Transfers SCSI-2 High Density 100 ohm Cable (20 ft)

READ - file system I/O read (10 MB sequential file)

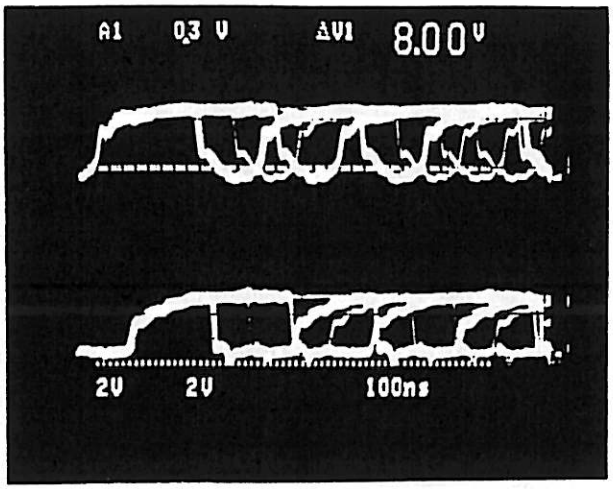

Figure 3

WRITE - file system I/O read (10 MB sequential file)

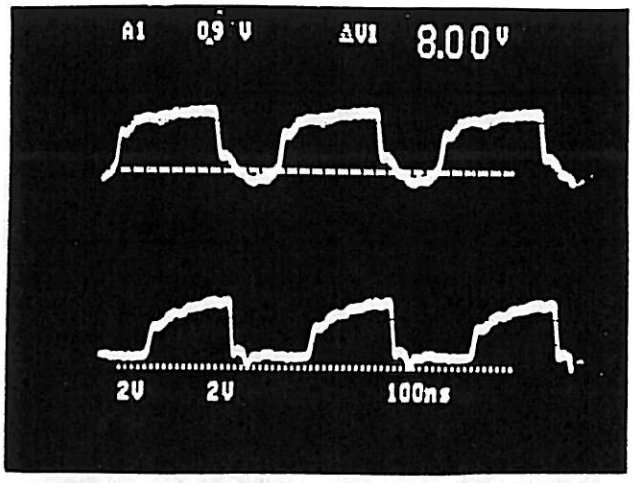

Figure 4

Asynchronous Transfers SCSI-2 High Density 70 ohm Cable (20 ft)

READ - file system I/O read (10 MB sequential file)

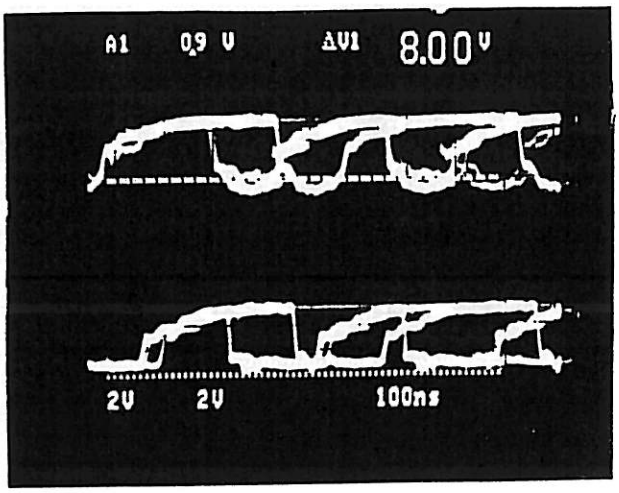

Figure 5

WRITE - file system I/O read (10 MB sequential file)

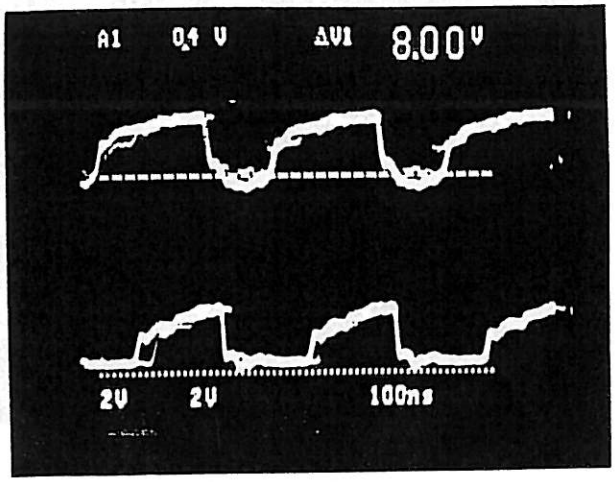

Figure 6

Asynchronous Transfers Low Density SCSI-1 Cable (21 ft = 6.4 m)

READ – file system I/O read (10 MB sequential file)

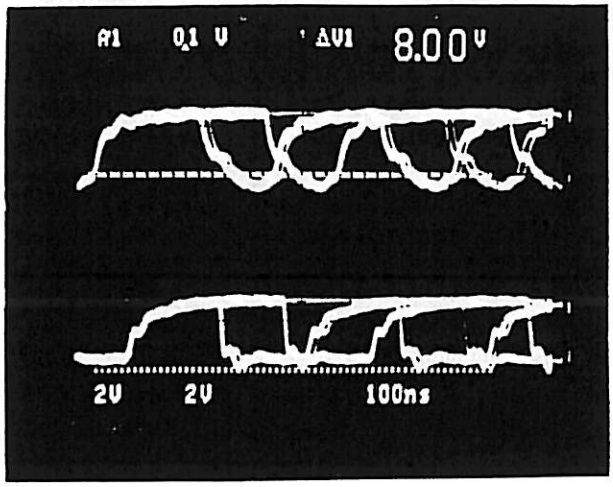

Figure 7

WRITE – file system I/O read (10 MB sequential file)

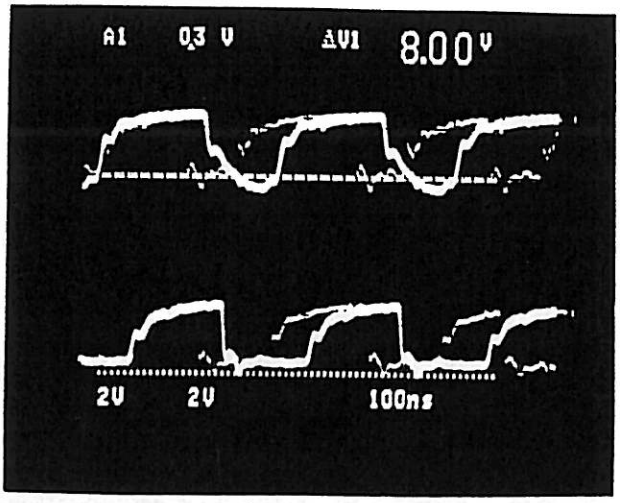

Figure 8

Synchronous Transfers SCSI-2 High Density 100 ohm Cable (20 ft)

READ – file system I/O read (10 MB sequential file)

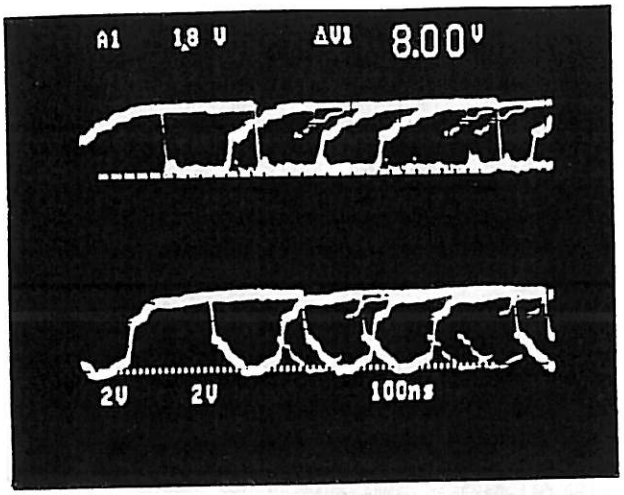

Figure 9

WRITE – file system I/O read (10 MB sequential file)

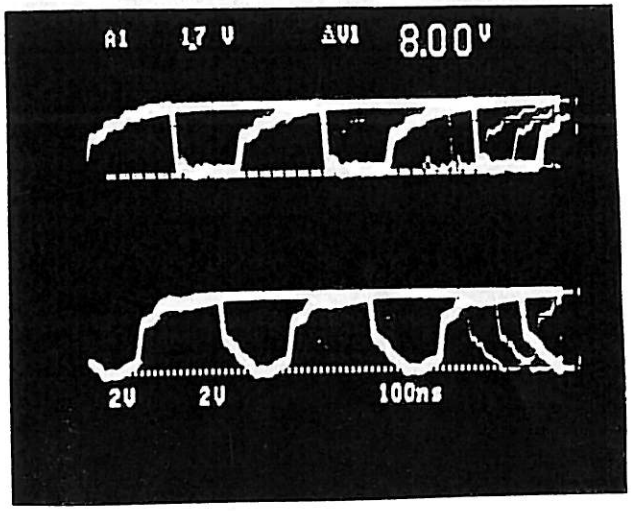

Figure 10

Synchronous Transfers SCSI-2 High Density 70 ohm Cable (20 ft)

READ – file system I/O read (10 MB sequential file)

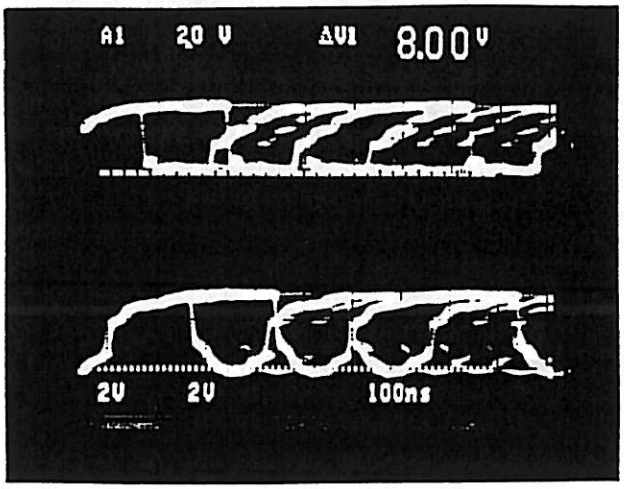

Figure 11

WRITE – file system I/O read (10 MB sequential file)

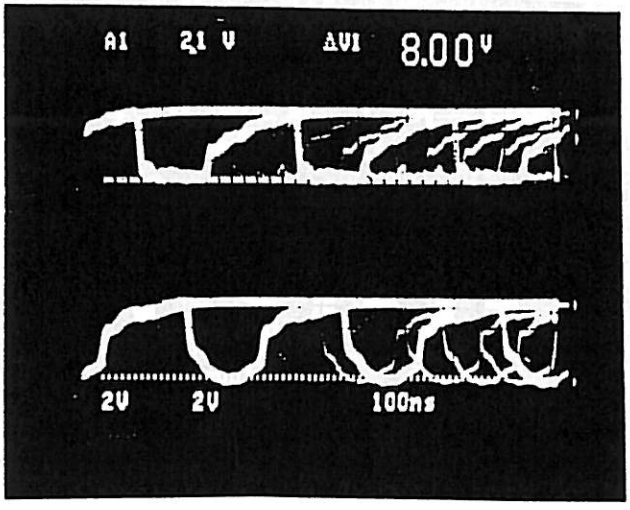

Figure 12

Synchronous Transfers Low Density SCSI-1 Cable (21 ft = 6.4 m)

READ - file system I/O read (10 MB sequential file)

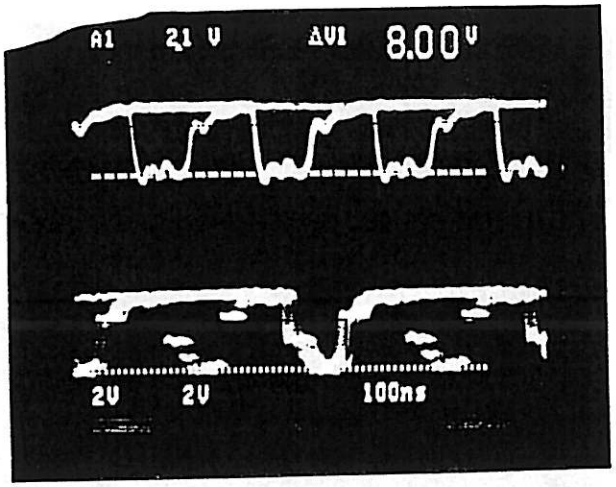

Figure 13

WRITE - file system I/O read (10 MB sequential file)

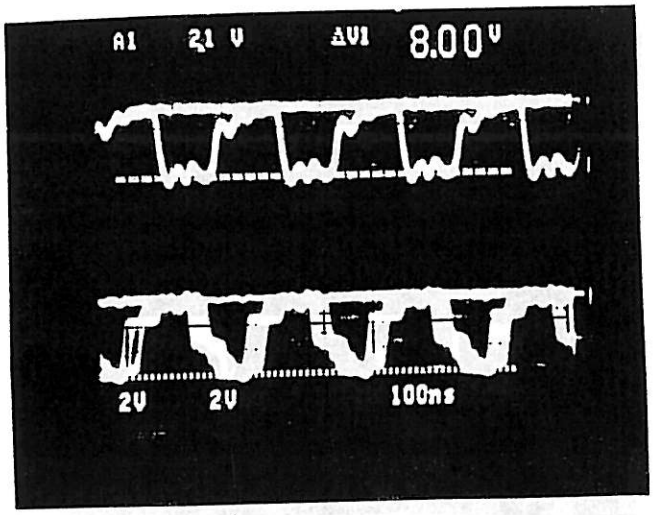

Figure 14