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+ --------------+
: d i g i t a l !        I N T E R O F F I C E   M E M O R A N D U M
+---------------+
```

TO: Deb Savoie

DATE: 04/12/89
FROM: David Campbell
AND: David Kalin
DEPT: Low End Disk Systems
EXT: 291-7140
LOC/MAIL STOP: NKS1-2/H9
DECmail: LEDS3::Campbell

Subj: Measurements of /REQ & /ACK on:
       AMP 93 Ohm and 75 Ohm SCSI-2 6 meter 50-pin ribbon cable
       Compared against the standard 130 Ohm cable.

Setup: Seven RZ23 100 Mbyte drives were connected to each cable in two
        different configurations. The initiator is a T D Systems Viking
        SCSI controller in a MicroVax and is set to unit #7.

        The seven drives were connected to the cable so that unit #6 was
        the drive closest to the initiator and unit #0 was the drive at
        the end of the cable.

        Terminators were on unit #7 and unit #0

Configuration 1: Evenly spaced connectors along the cable

```
        I------6-------5-------4-------3------2-------1------0
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Configuration 2: Four connectors at each end of the cable

```
        I----6----5----4------------------3----2----1----0
```

GENERAL OBSERVATION:

   The signals at the drives closest to the signal source showed the least
   amount of undershoot.

   All the signals were cleaner when being driven by a drive at either end of
   the cable then when being driven by a drive in the middle of the cable.

   One drive had a glitch on the rising edge of the wave that touched 1.8 V.
   but none of the drives had glitches that went below 1.8 volts.

   The 93 Ohm cable had less glitches then the other cables. This may be
   from the rounding effect that this cable has on the signals.

CONCLUSIONS ON UNDERSHOOT BELOW GROUND

EVENLY SPACED CONNECTORS:

Compared to the standard 130 Ohm cable the 93 Ohm cable has slightly more undershoot.

The 93 Ohm cable also has more effect on the slope of the falling and rising edge of the pulse. The pulse slope is not as steep on the 93 Ohm cable as on the standard cables.

The 93 Ohm cable had a general rounding effect on the signal. The corners and any spikes on the flat portion of the wave were rounded out.

The signal on the 75 Ohm cable closely resembled the signal on the standard cable as far as sharpness of the slope and the presence of the glitch in the upper corner of the pulse.

The 75 Ohm cable had more undershoot and a defined glitch on the rising edge of the wave. The glitch however did not go below two volts on any of the plots.

4 CONNECTORS AT EACH END:

The 93 Ohm cable had slightly more undershoot than the standard cable (approximately the same as above) but displayed a ringing effect along the ground line. The glitch was a little more evident in this configuraration but did not drop to the two volt line.

The 75 Ohm cable had about the same amount of undershoot as the 93 Ohm cable in this configuraration but had some glitches that touched the two volt line.

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CONCLUSIONS ON GLITCHES ON THE RISING EDGE OF THE WAVE

EVENLY SPACED CONNECTORS:

The 93 Ohm cable had less glitches then the standard cable but more of
the glitches came closer to the two volt line.

The 75 Ohm cable had less glitches then the standard cable and more then
the 93 Ohm cable.

The 75 Ohm cable had 2 glitches that dropped below the two volt line.

The glitches were worse on the drives closest to the signal source.

All the cables in this configurations showed more glitches when being
driven by the signal furthest from the initiator.

4 CONNECTORS AT EACH END:

The 93 Ohm cable had less glitches then the standard cable but more of
the glitches came closer to the two volt line.

The 75 Ohm cable had less glitches then the standard cable and more then
the 93 Ohm cable.

The 75 Ohm cable had more glitches that dropped closer to the two volt line
and one glitch that touched the two volt line

This configuration showed more glitches coming closer to the two volt line
then the evenly spaced one.

All the cables in this configurations showed more glitches when being
driven by the signal furthest from the initiator.

CONCLUSIONS ON SPIKES AT ZERO VOLTS

All cable configurations showed some spikes rising from zero volts toward
+ .8 volts. The spike rose higher on the cables that had the four
connectors at each end when the signal is driven from one end of the
cable while probing the signals at the opposite end of the cable.

The 93 Ohm cable had one spike that reached +.8 volts then dropped to
+ .2 volts.

None of the other cables had a spike that reached + .8 volts.

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CH1   500mV   Λ   50ns   2.82 V   VERT

1.805 V

SMALL GLITCH

18 V

SPIKE

CH1gnd.

UNDER SHOOT

STND   DIR (120 Ω)

EVEN   SPCD

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REG

4

CH1   500mV   Λ   50ns   4.32 V   VERT

1.805 V

ROUNDING
EFFECT

STANDARD CABLE
SLOPE

ROUNDING
EFFECT

CH1gnd

UNDER SHOOT

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5
11
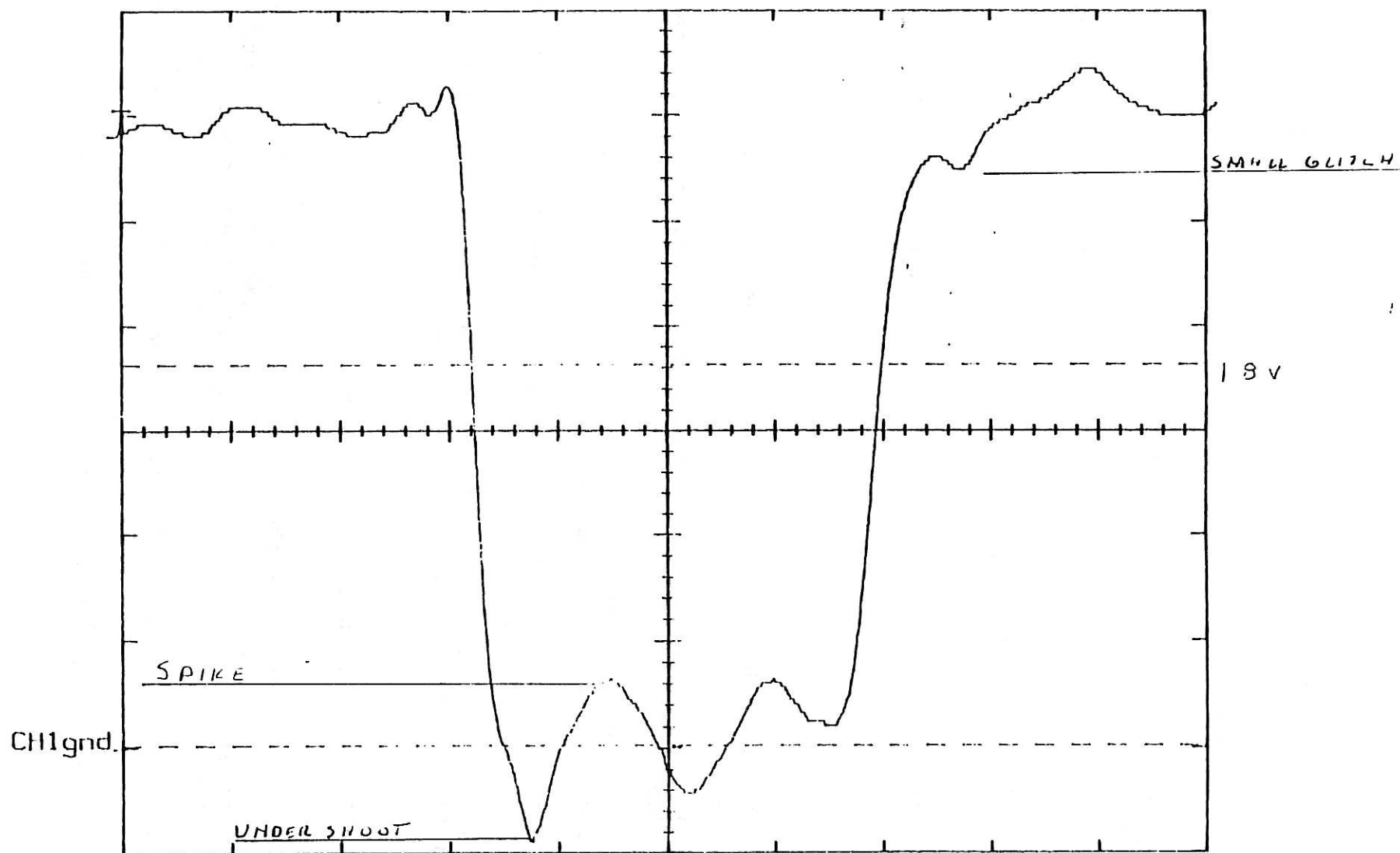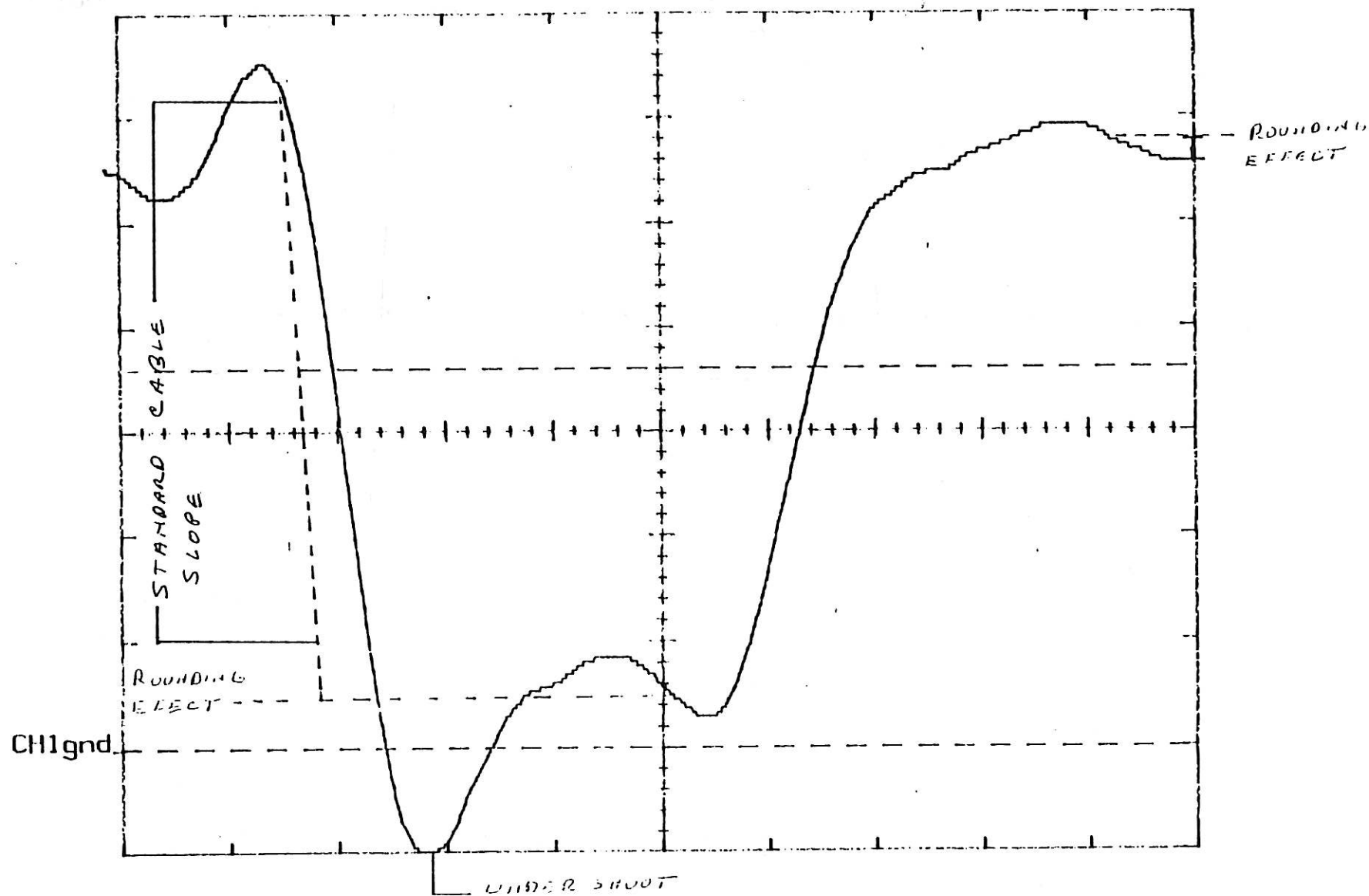
CH1   500mV   A   50ns   2.82 V   VERT

805 V

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+2.0V GLITCH

1.8 V

CH1 gnd

MIDI
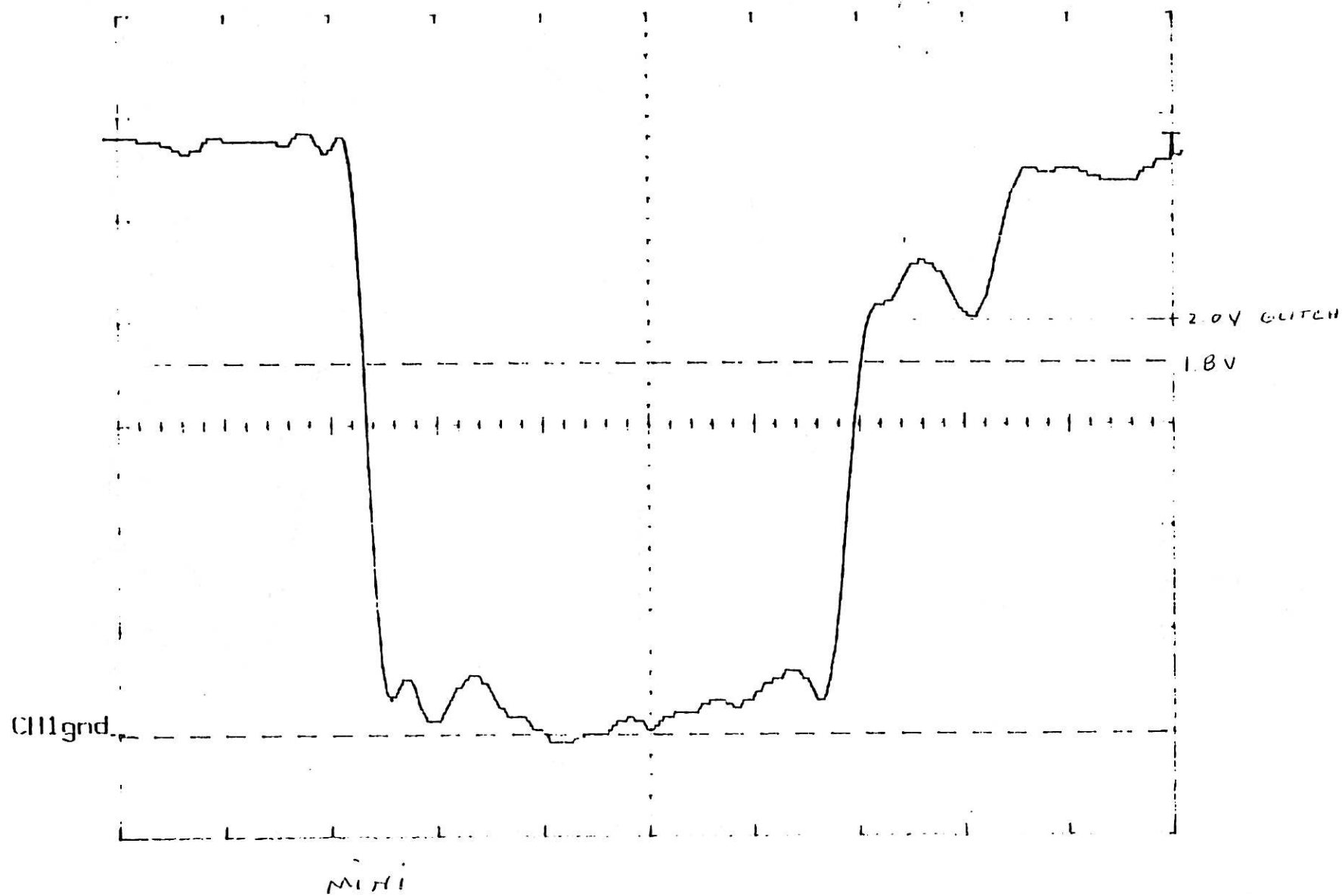
Setup: RZ23 100MB Drives
Initiator: uVAX w/T.D. Systems controller
Terminators @ Unit 0,Initiator

Legend: "" UNDERSHOOT ""

   Numbers = Undershoot below ground in tenths/volt

   '*' = Signal Source

Legend: "" GLITCHES ""

   The top of the wave is at 3.9 volts. The glitches were on
   the rising edge of the wave dropping toward zero volts.

   Numbers = In Volts the amount above ground the Glitch
             pulls the signal down to.

   '#' = No Glitch

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UNDERSHOOT on the Standard 130 Ohm (reference) Cable (evenly spaced)

I	6	5	4	3	2	1	0
REQ 0	*0	0	1	2	2	2	1
REQ 1	1	*0	1	2	2	3	2
REQ 2	4	4	*2	3	5	6	3
REQ 3	4	3	4	*2	3	4	4
REQ 2	3	2	1	1	*0	0	2
REQ 2	2	3	2	1	0	*1	2
REQ 1	1	1	1	1	1	0	*0
ACK *6	1	2	4	4	4	3	3

Amp Cable "A" 93 Ohm (evenly spaced)

I	6	5	4	3	2	1	0
REQ 2	*1	1	0	2	0	3	1
REQ 0	0	*0	1	1	5	2	2
REQ 2	0	0	*0	3	2	3	3
REQ 2	2	3	1	*0	0	0	0
REQ 2	4	2	1	0	*0	0	0
REQ 2	2	3	1	0	0	*0	0
REQ 3	2	3	3	2	1	0	*0
ACK *0	3	6	4	5	6	4	6

Amp Cable "B" 75 Ohm (evenly spaced)

I	6	5	4	3	2	1	0
REQ 0	*0	0	2	3	4	3	3
REQ 5	2	*0	1	2	4	7	4
REQ 3	2	1	*0	2	3	4	4
REQ 4	4	6	4	*0	1	3	2
REQ 3	4	2	1	0	*0	0	C
REQ 4	4	4	3	2	1	*0	0
REQ 2	2	2	2	2	1	0	*0
ACK *0	3	6	5	5	6	5	5

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UNDERSHOOT Standard 130 Ohm (reference) Cable (4 connectors at each end)

	I	6	5	4					3	2	1	0
	0	*0	0	0	-	-	-	-	2	1	2	2
REQ	1	0	*0	0	-	-	-	-	3	3	2	2
REQ	0	0	0	*0	-	-	-	-	2	1	2	1
REQ	3	3	2	2	-	-	-	-	*0	0	0	0
REQ	3	3	3	2	-	-	-	-	0	*0	0	1
REQ	1	3	3	2	-	-	-	-	0	0	*0	0
REQ	4	1	2	3	-	-	-	-	0	0	0	*0
ACK	*0	1	1	3	-	-	-	-	5	6	5	4

Amp Cable "D" 93 Ohm (4 connectors on each end)

	I	6	5	4					3	2	1	0
REQ	1	*1	1	0	-	-	-	-	2	3	3	3
REQ	2	4	*4	4	-	-	-	-	0	0	1	1
REQ	1	0	1	*1	-	-	-	-	2	2	3	3
	5	3	2	3	-	-	-	-	*0	0	0	0
REQ	6	4	4	4	-	-	-	-	1	*0	1	1
REQ	1	0	0	0	-	-	-	-	4	6	*4	6
REQ	4	2	4	5	-	-	-	-	1	1	0	*0
ACK	*3	2	4	3	-	-	-	-	4	7	7	8

Amp Cable "C" 75 Ohm (4 connectors at each end)

	I	6	5	4					3	2	1	0
REQ	0	*0	0	0	-	-	-	-	4	3	6	7
REQ	0	0	*0	0	-	-	-	-	3	5	4	3
REQ	0	0	0	*0	-	-	-	-	4	4	4	3
REQ	2	4	4	4	-	-	-	-	*0	0	0	1
REQ	4	6	5	3	-	-	-	-	0	*0	0	0
	5	3	5	4	-	-	-	-	0	0	*0	0
REQ	5	6	4	3	-	-	-	-	3	2	1	*0
ACK	*1	2	3	3	-	-	-	-	5	6	5	6

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GLITCHES — Standard Cable Evenly Spaced

	I	6	5	4	3	2	1	0
REQ	#	#	#	#	#	#	#	#
REQ	2.4	#	*#	#	#	#	#	3..
REQ	#	#	#	*#	3.5	3.8	3.7	3.7
REQ	#	3.6	#	3.2	*#	2.9	3.3	3.5
REQ	3.6	3.5	#	#	#	*#	#	2.9
REQ	3.4	3.4	3.5	3.4	#	#	*2.9	2.6
REQ	3.4	3.6	3.4	3.4	3.0	2.8	2.8	*2.5
ACK	*2.4	2.9	#	3.2	3.1	#	#	3.6

AMP Cable 93 Ohm Evenly Spaced

	I	6	5	4	3	2	1	0
REQ	#	*#	#	#	#	#	3.8	#
REQ	#	#	*#	#	#	#	3.6	3.7
REQ	#	#	#	*#	#	#	3.8	3.6
REQ	#	#	3.8	#	*#	#	#	2
REQ	3.8	3:6	#	#	#	*#	#	#
REQ	3.6	3.6	#	#	#	2.4	*2.4	2.4
REQ	3.5	3.4	#	2.8	#	#	2.4	*2.4
ACK	*2.4	#	#	#	#	#	#	#

AMP Cable 75 Ohm Evenly Spaced

	I	6	5	4	3	2	1	0
REQ	1.9	*#	#	#	#	#	3.4	3.5
REQ	2.2	2.4	*#	#	#	#	3.4	3.6
REQ	#	#	#	*#	#	#	#	#
REQ	3.2	#	2.6	#	*#	#	#	3.4
REQ	3.1	3.0	2.8	#	#	*2.2	#	2.2
REQ	3.1	3.0	#	#	#	#	*2.0	
REQ	3.3	3.3	#	#	2.2	1.9	2.0	*2.0
ACK	*2.0	2.2	2.0	2.4	2.2	#	3.0	3.3

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GLITCHES — Standard Cable 4 Connectors at Each End

	I	6	5	4				3	2	1	0
	2.8 *	#	2.8	3.0	–	–	–	3.8	3.8	3.8	#
REQ	2.8	2.8 *	3.0	#	–	–	–	3.8	3.8	3.8	3.8
REQ	2.8	2.6	#	* 2.8	–	–	–	3.8	3.8	3.8	3.3
REQ	3.9	#	#	#	–	–	–	* 3.0	2.8	3.0	3.0
REQ	3.8	#	#	#	–	–	–	3.0	* #	#	#
REQ	3.6	3.6	3.6	3.8	–	–	–	3.0	3.1	* 2.8	2.8
REQ	3.6	3.6	3.6	3.0	–	–	–	3.0	#	3.0	* #
ACK	* 2.6	2.8	3.0	3.0	–	–	–	3.4	3.4	3.2	3.4

AMP 93 Ohm Cable 4 Connectors at Each End — Glitches

	I	6	5	4				3	2	1	0
REQ	#	* 2.4	#	#	–	–	–	#	#	#	3.8
REQ	#	3.8	* #	#	–	–	–	#	#	#	#
	2.5	2.3	2.6	* 2.5	–	–	–	3.6	3.6	3.5	3.5
REQ	#	3.5	#	#	–	–	–	* 3.0	2.8	3.0	2.8
REQ	#	#	2.6	2.4	–	–	–	#	* 2.6	2.6	2.5
REQ	#	#	#	#	–	–	–	#	3.8	* #	3.8
REQ	3.4	3.4	3.4	3.4	–	–	–	3.0	2.5	2.8	* 2.6
ACK	* 2.3	2.3	2.7	2.4	–	–	–	#	#	3.2	#

AMP 75 Ohm Cable 4 Connectors at Each End — Glitches

	I	6	5	4				3	2	1	0
REQ	2.4 *	2.4	2.6	#	–	–	–	#	#	3.8	3.6
REQ	2.4	2.4	* 2.4	#	–	–	–	#	#	#	3.8
REQ	2.2	2.4	2.4	* #	–	–	–	#	3.6	3.6	3.4
REQ	#	3.6	#	3.6	–	–	–	* #	2.6	2.6	2.6
REQ	3.2	#	#	3.2	–	–	–	2.2	* #	#	2.4
REQ	3.2	3.2	#	#	–	–	–	#	2.2	* #	#
REQ	3.4	3.3	3.0	3.0	–	–	–	2.0	2.2	2.2	* 2.2
ACK	* 2.1	2.2	2.2	2.2	–	–	–	3.0	3.2	3.0	3.0

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