

FAST 360 SCSI SINGLE ENDED

- SINCE THE LAST MEETING MUCH ADDITIONAL DATA HAS BEEN ACQUIRED ON FULLY LOADED SINGLE ENDED CONFIGURATIONS
- THE GENERAL CONCLUSION IS THAT EITHER THE RECEIVER SPECIFICATIONS WILL HAVE TO BE SIGNIFICANTLY TIGHTENED OR THE CONFIGURATIONS WILL HAVE TO BE LIMITED FOR FAST 360 SINGLE ENDED SCSI
- THE FULL 16 DEVICE LOAD CAUSES BOTH THE ASSERTION AND THE NEGATION LEVELS TO EXCEED THE 0.8 AND 2.0 VOLT LEVELS IN THE WORST CASE BUS POSITIONS
- REDUCING THE DEVICE LOAD TO 8 DEVICES RECOVERS ENOUGH OF THE SIGNAL TO BE GENERALLY USEFUL AT 20 MEGATRANSFERS/SEC

FAST 360 SCSI SINGLE ENDED

- **A MAPPING WAS EXECUTED OF THE SINGLE ENDED CONFIGURATIONS POSSIBLE WITHIN THE FOLLOWING PARAMETERS:**
 - 1.5 METERS TOTAL LENGTH
 - 5, 10, 15, 20 MEGATRANSFERS/SEC
 - STUB LENGTHS OF 1.3, 2.9, 4.9"
 - 9 LOADS AT 8" SPACING --
16 LOADS AT 4" SPACING
 - END BUS DRIVING --
MID BUS DRIVING
- **THE FOCUS WAS ON THE WAVEFORMS ON THE BUS**
- **A THREE DIMENSIONAL REPRESENTATION OF THE WAVEFORMS AT DIFFERENT BUS POSITIONS SHOWS THE TRENDS WITH VERY GOOD CLARITY**

BILL HAM, DIGITAL EQUIPMENT FAST 360 SCSI MAY 5, 1994

FAST 360 SCSI ACK WAVEFORMS

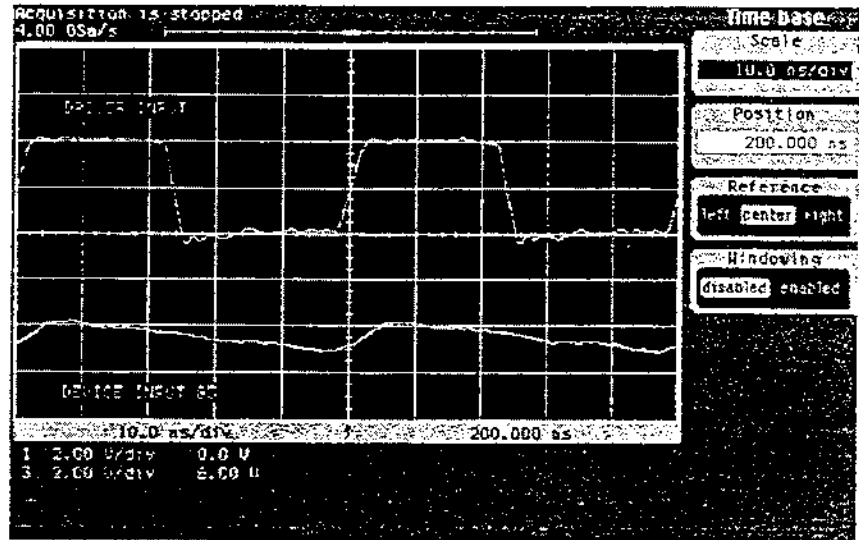
1.5 METERS

T
DRIVER
(POS 1)

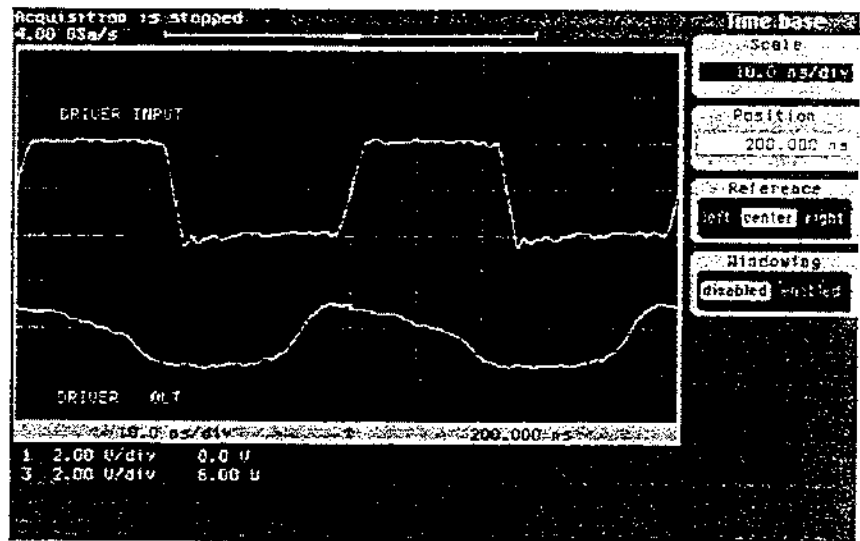
16 LOADS 4.9" STUBS

T

WORST
WAVEFORM
POSITION 4
FROM DRIVER



DRIVER
OUTPUT



BILL HAM, DIGITAL EQUIPMENT FAST 360 SCSI WORKING GROUP MAY 5, 1994

FAST 360 SINGLE ENDED SCSI CONFIGURATION MAP						
TOTAL BUS LENGTH = 1.5 METERS, ACTIVE TERMINATION						
		STUB LENGTH	1.3"	2.9"	4.9"	10.1"
16 DEVICES 4" SPACING						
		SPEED				
		5				
END BUS DRIVING		10				
		15				
		20				
		5				
MID BUS DRIVING		10				
		15				
		20				
9 DEVICES 8" SPACING						
		5				
END BUS DRIVING		10				
		15				
		20				
		5				
MID BUS DRIVING		10				
		15				
		20				
LEGEND:						
WORST WAVEFORM AT ANY POPULATED POSITION ON BUS						
		OK				
		ASSUMED OK				
		MARGINAL				
		RISKY				

BILL HAM
DIGITAL EQUIPMENT

FAST 360 SCSI SSWG
MAY 5, 1994

FAST 360 SCSI SINGLE ENDED

- **SOMETHING HAS TO GIVE WITH A FULLY LOADED 16 DEVICE FAST 360 SCSI 1.5 METER BUS**
- **LIMITING THE NUMBER OF DEVICES PRESERVES THE BEST BACKWARDS COMPATIBILITY BUT THERE ARE OTHER OPTIONS:**
 - **LIMIT DEVICE CAPACITANCE TO AROUND 10 pF EACH (PROJECTED) (THEREBY SACRIFICING BACKWARDS COMPATIBILITY)**
 - **REDUCE THE RECEIVER THRESHOLD WINDOW TO SOMETHING LIKE 1.2 TO 1.6 VOLTS (THEREBY SACRIFICING HYSTERESIS)**
 - **LIMIT THE SPEED TO 15 MEGATRANSFERS AND VERY SHORT STUBS (THEREBY SACRIFICING PERFORMANCE AND FLEXIBILITY)**

BILL HAM, DIGITAL EQUIPMENT FAST 360 SCSI MAY 5, 1994

FAST 360 SCSI SINGLE ENDED

- **EXPERIMENTS WERE DONE WITH "DOUBLE STRENGTH" DRIVERS TO SEE IF INCREASING THE DRIVER STRENGTH COULD BE A MAJOR FACTOR**
- **TWO ADJACENT TRANSCEIVER CHANNELS WERE TIED TOGETHER ON THE SAME BUS LINE AND WERE DRIVEN BY THE SAME LOGIC LINE**
- **THIS APPROXIMATELY DOUBLES THE NEGATION CURRENT AND HALVES THE ASSERTION RESISTANCE**
- **EXPERIMENTAL RESULTS INDICATED ONLY MARGINAL IMPROVEMENTS IN WAVEFORMS**
- **THIS APPROACH SEEMS UNLIKELY TO BE THE WAY TO REGAIN THE NOISE MARGIN LOST BY THE LARGE NUMBER OF LOADS**

BILL HAM, DIGITAL EQUIPMENT FAST 360 SCSI MAY 5, 1994

FAST 360 SCSI SINGLE ENDED

RECOMMENDED CONFIGURATION RULES FOR FAST 360 SCSI (SINGLE ENDED):

- LENGTH LIMITED TO 1.5 METERS**
- 8 DEVICES MAX**
- 4" MAXIMUM STUBS SPACED 8" APART**
- MAX OF 25 pF/PIN**
- CABLE IMPEDANCE ABOVE 80 OHMS
SINGLE ENDED**
- ALL OTHER RULES APPLY:**
 - » ACTIVE NEGATION REQUIRED**
 - » SLEW RATE CONTROL REQUIRED**
 - » NARROW RECEIVER THRESHOLDS**

FAST 540 SCSI ACK WAVEFORMS

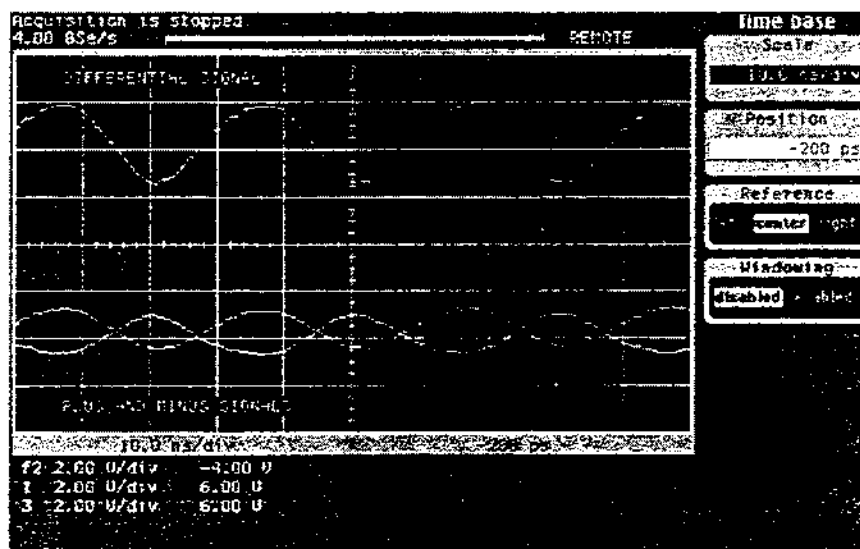
1.5 METERS

T
DRIVER
(POS 1)

16 LOADS 4.9" STUBS

T

DIFFERENTIAL 30 MEGATRANSFERS/SEC



POSITION 15

WAVEFORM IS TYPICAL OF ALL POSITIONS

BILL HAM, DIGITAL EQUIPMENT FAST 360 SCSI WORKING GROUP MAY 5, 1994

FAST 540 SCSI ACK WAVEFORMS

T 21.5 METERS T

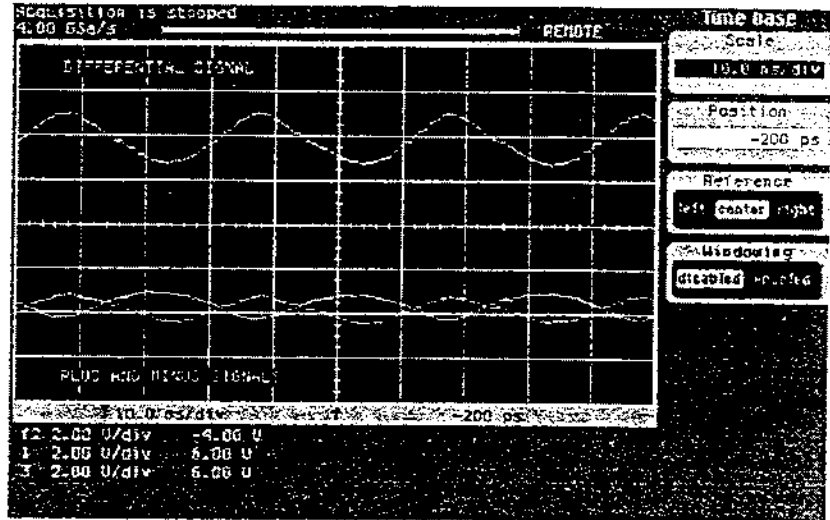
DRIVER
(POS 1)

16 LOADS 4.9" STUBS
CONCENTRATED AT
FAR END ON 4" CENTERS

POSITION 4
(APPROX 1 METER FROM
FAR TERMINATOR)

DIFFERENTIAL
SIGNAL

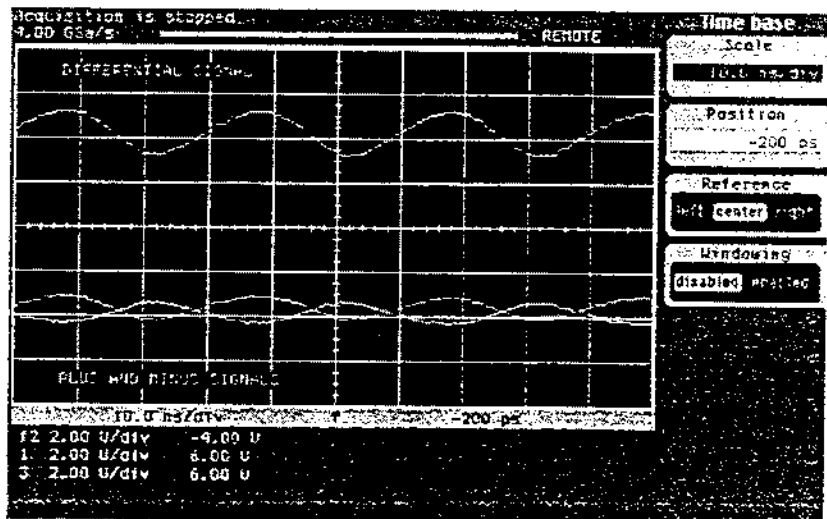
PLUS AND MINUS
SIGNALS



POSITION 16
(AT FAR TERMINATOR)

DIFFERENTIAL
SIGNAL

PLUS AND MINUS
SIGNALS



FAST XXX SINGLE ENDED SCSI

- THIS IS MAINLY A PROGRESS REPORT ON THE PERFORMANCE OF 20 MEGATRANSFER SINGLE ENDED SCSI WITH 8 DEVICES ON A 3 METER BUS
- AT THE LAST WORKING GROUP (MAY 5, 1994) IT WAS DECIDED THAT A 3 METER BUS LENGTH WAS MUCH MORE DESIRABLE THAN THE 1.5 METERS PREVIOUSLY SUGGESTED
- LAST WEEK WE TESTED THE TWO
3.0 ~~1.5~~ METER CONFIGURATIONS DEVELOPED

FAST XXX SINGLE ENDED SCSI

- **IT WAS SHOWN THAT THE 16 DEVICE LOAD ON A 1.5 METER BUS PRODUCED WAVEFORMS THAT WOULD NOT BE DETECTED BY WORST CASE RECEIVERS WITH THE PRESENT SPECIFICATIONS**
- **THE 8 DEVICE DATA SHOWED THAT THE PRESENT RECEIVER SPECIFICATIONS WOULD PROBABLY WORK AT 1.5 METERS**
- **THE NEW DATA SHOWS THAT 8 DEVICES AT 3 METERS NEED SOME SMALL ADJUSTMENT IN THE WORST CASE RECEIVER SPECIFICATIONS (WHICH WOULD ALSO HELP THE 1.5 METER MARGIN)**
- **STUB LENGTH PLAYS ONLY A MINOR ROLE AND THE 2:1 SPACING/LENGTH IS RECOMMENDED**

FAST XXX SINGLE ENDED SCSI

- **RECOMMENDED RECEIVER SPECIFICATIONS:**
 - **ASSERTION EDGE:**
 - **MAY DETECT AT 1.4 VOLTS**
 - **MUST DETECT AT 1.1 VOLTS**
 - **NEGATION EDGE:**
 - **MAY DETECT AT 1.6 VOLTS**
 - **MUST DETECT AT 1.9 VOLTS**
 - **HYSTERESIS:**
 - **200 MV MINIMUM**
 - **NOMINAL CENTER:**
 - **1.5 VOLTS**
- **ALL OTHER SPECIFICATIONS REMAIN UNCHANGED**

FAST XXX SINGLE ENDED SCSI

- **WHAT SHOULD THE REAL NAME FOR "ULTRA SCSI" BE?**
- **THERE SEEMS TO BE BROAD BASED AGREEMENT THAT ULTRA SCSI SHOULD BE DROPPED DUE TO POTENTIAL CONFLICTS WITH EXISTING TRADEMARKS**
- **THERE ALSO SEEMS TO BE AGREEMENT THAT SOME FORM OF "FAST" SCSI IS THE BEST NEW NAME**
- **THE QUESTION IS WHAT NUMBERS SHOULD GO WHERE THE "XXX'S" ARE**

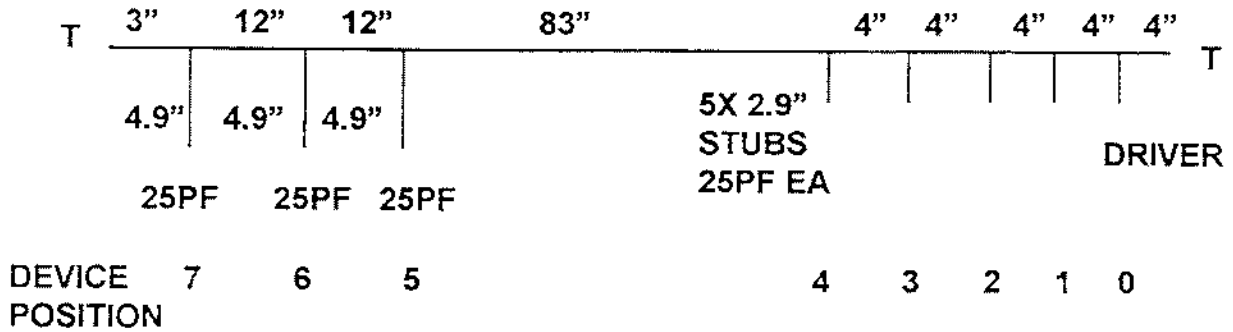
FAST XXX SINGLE ENDED SCSI

POSSIBLE NAMES

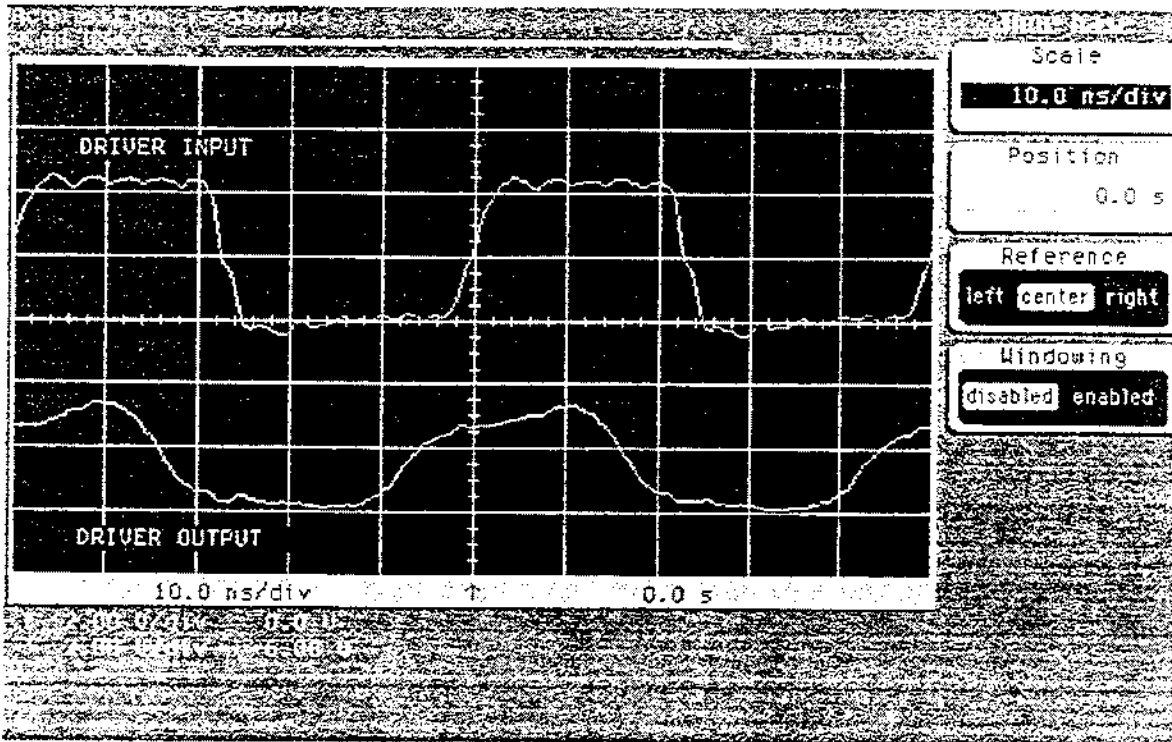
ULTRA	ULTRA-1	ULTRA-2
MEGATRANSFERS/SEC	FAST 20	FAST 40
MEGABYTES/SEC 16 BIT	FAST 40	FAST 80
MEGABYTES/SEC 8BIT	FAST 20	FAST 40
MEGABITS/SEC 16 BIT	FAST 360	FAST 720
MEGABITS/SEC 8 BIT	FAST 180	FAST 360
FAST INTEGER	FAST-2 DOUBLE	FAST-3 QUAD

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH



"DOUBLE STRENGTH" DRIVERS

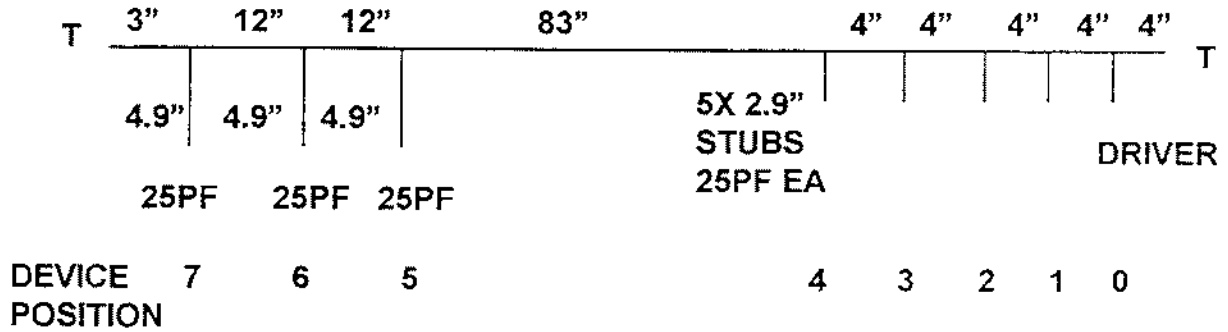


DRIVER (POSITION 0)

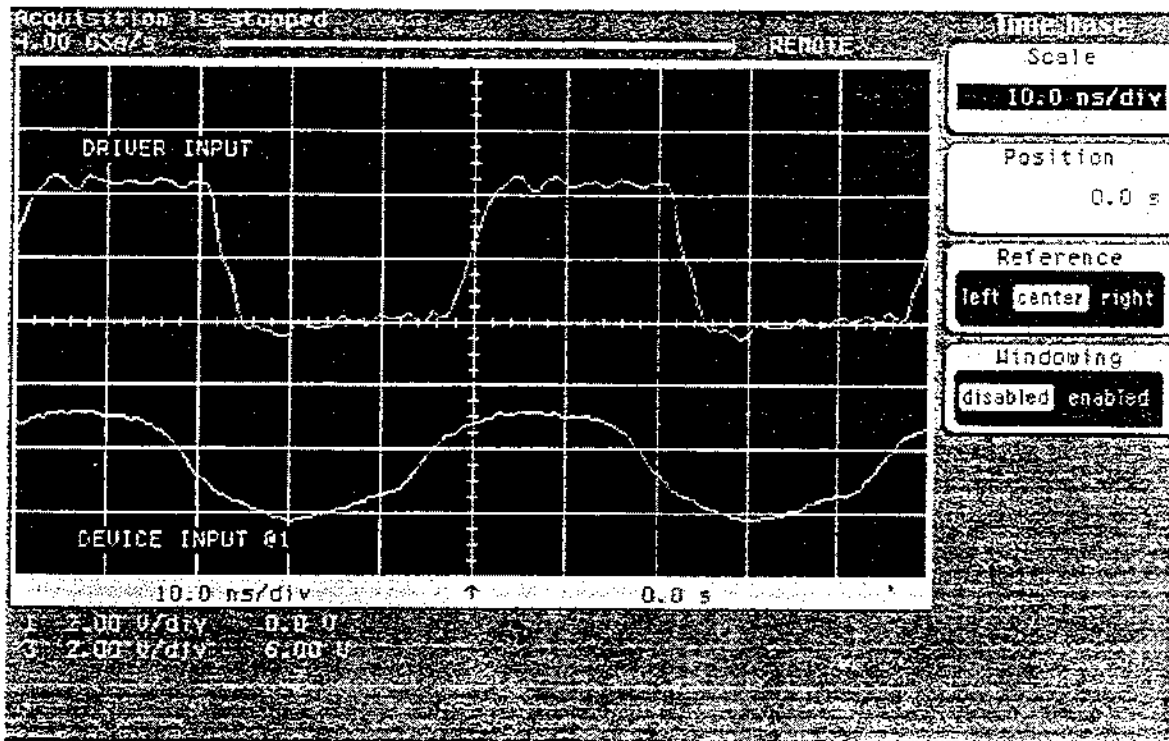
BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH



"DOUBLE STRENGTH" DRIVERS

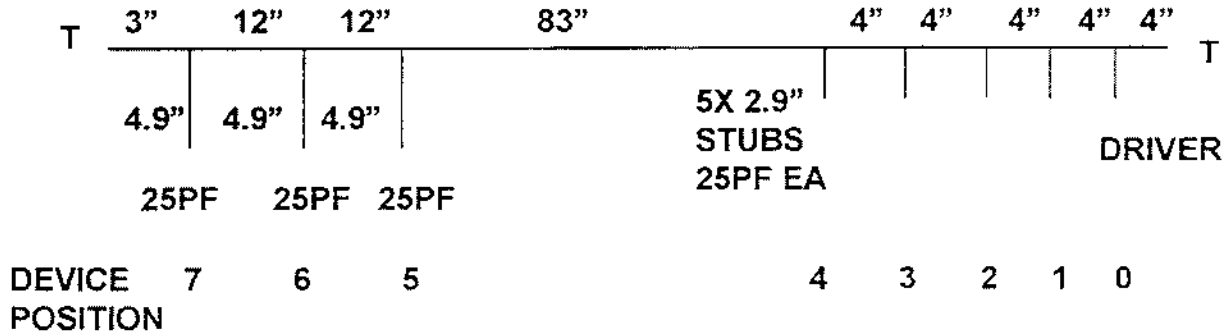


DEVICE POSITION 1

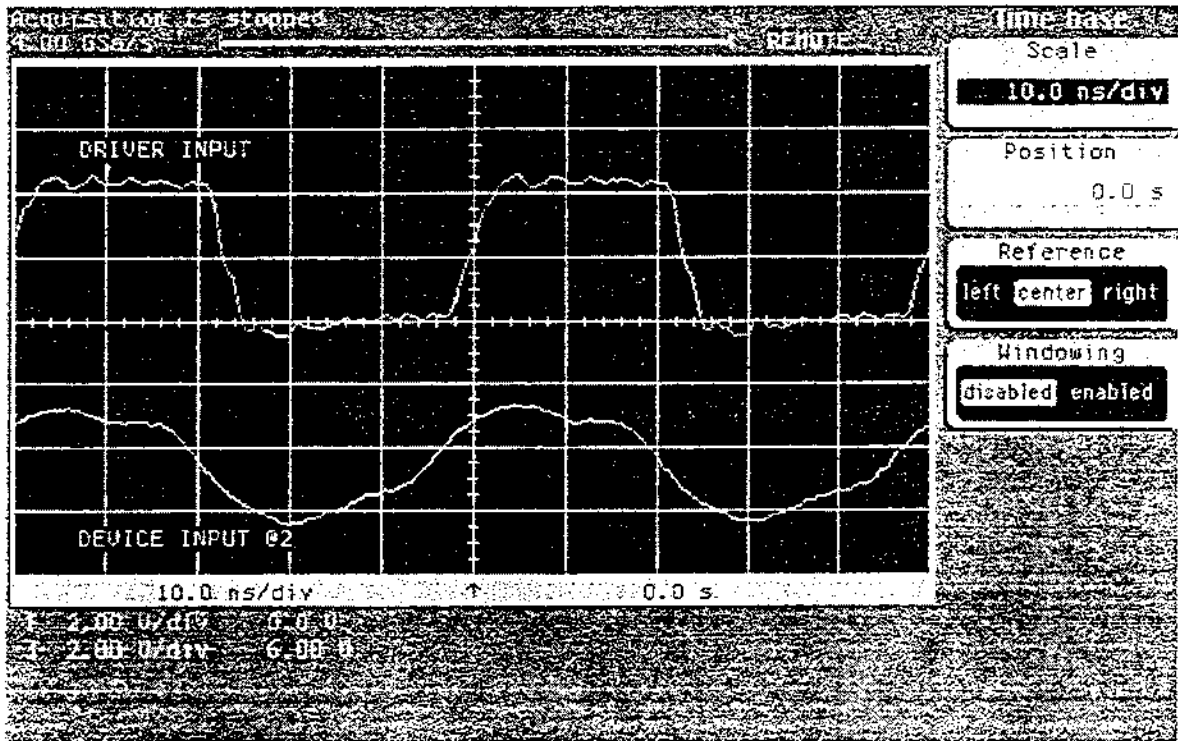
BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH



"DOUBLE STRENGTH" DRIVERS

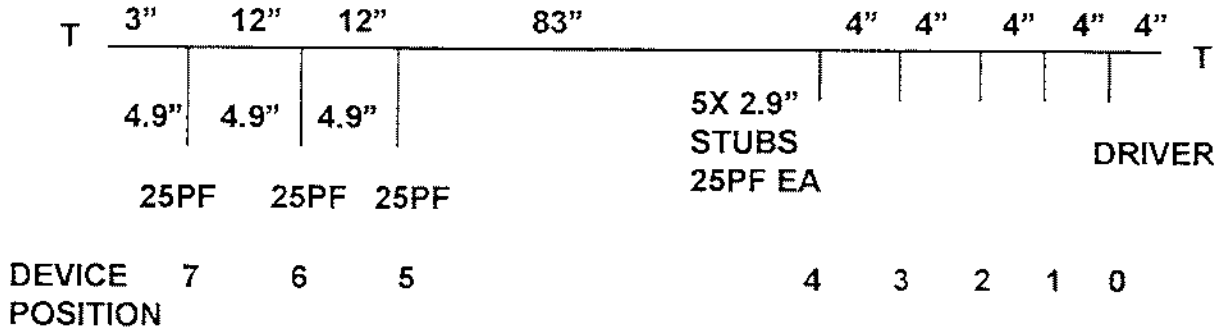


DEVICE POSITION 2

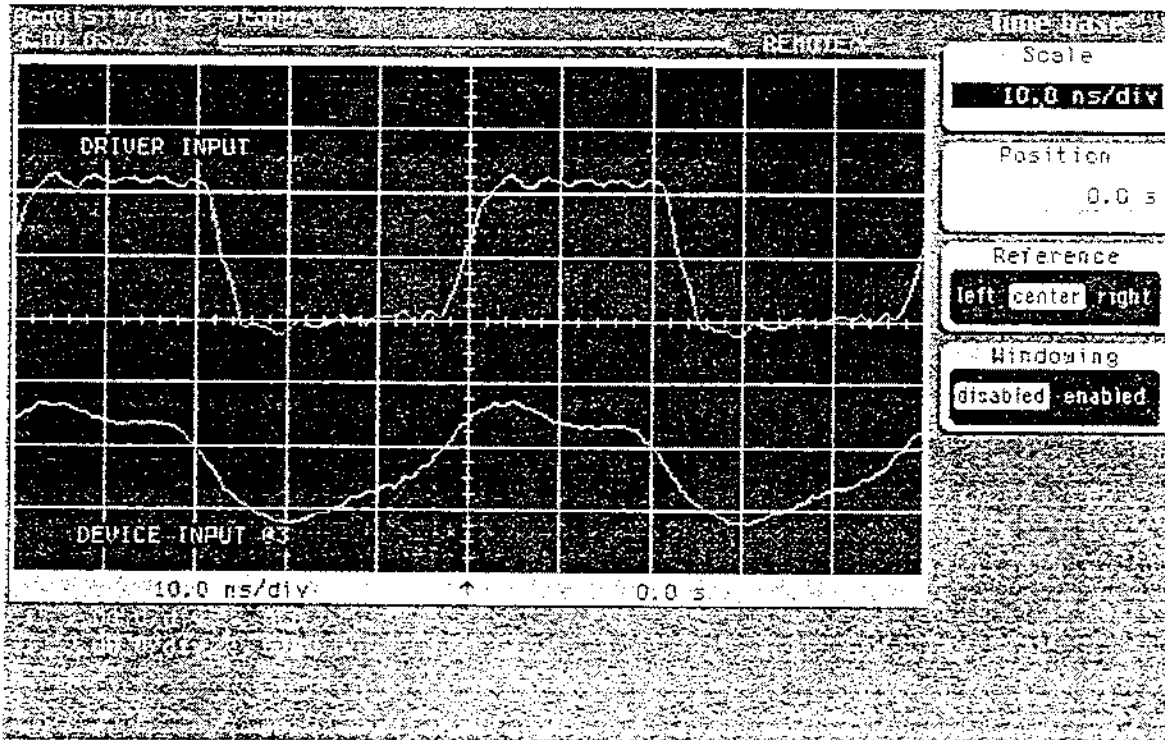
BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH



"DOUBLE STRENGTH" DRIVERS



DEVICE POSITION 3

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

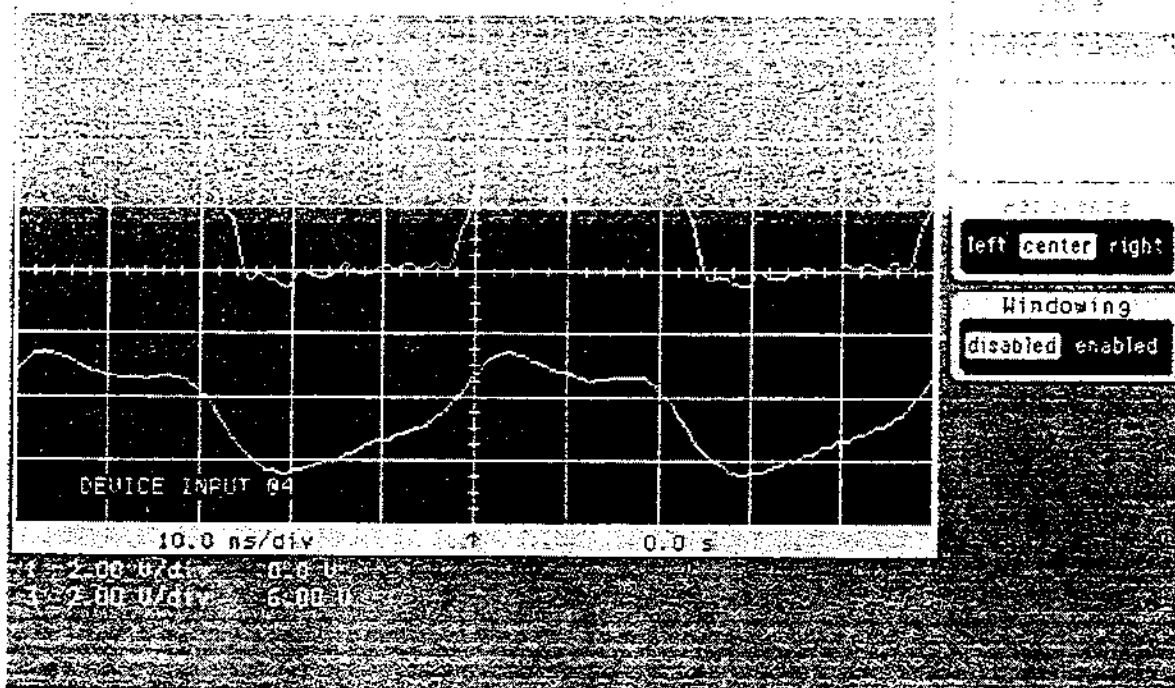
FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

3" 12" 12" 83" 4" 4" 4" 4" 4"

POSITION

"DOUBLE STRENGTH" DRIVERS

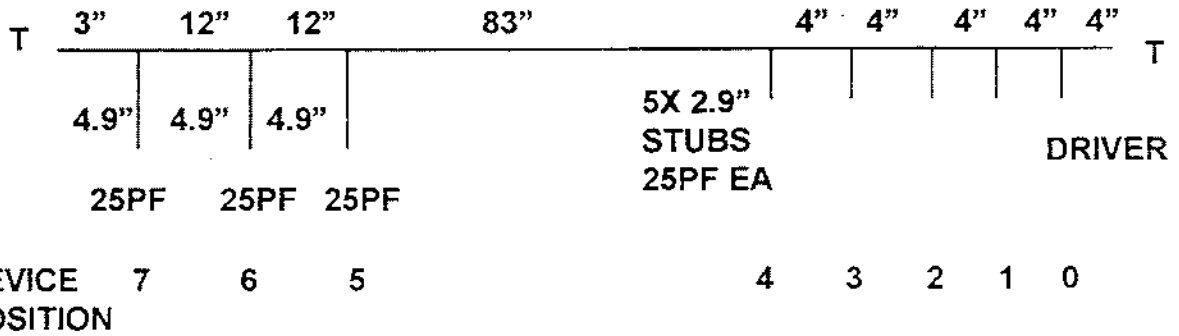


DEVICE POSITION 4

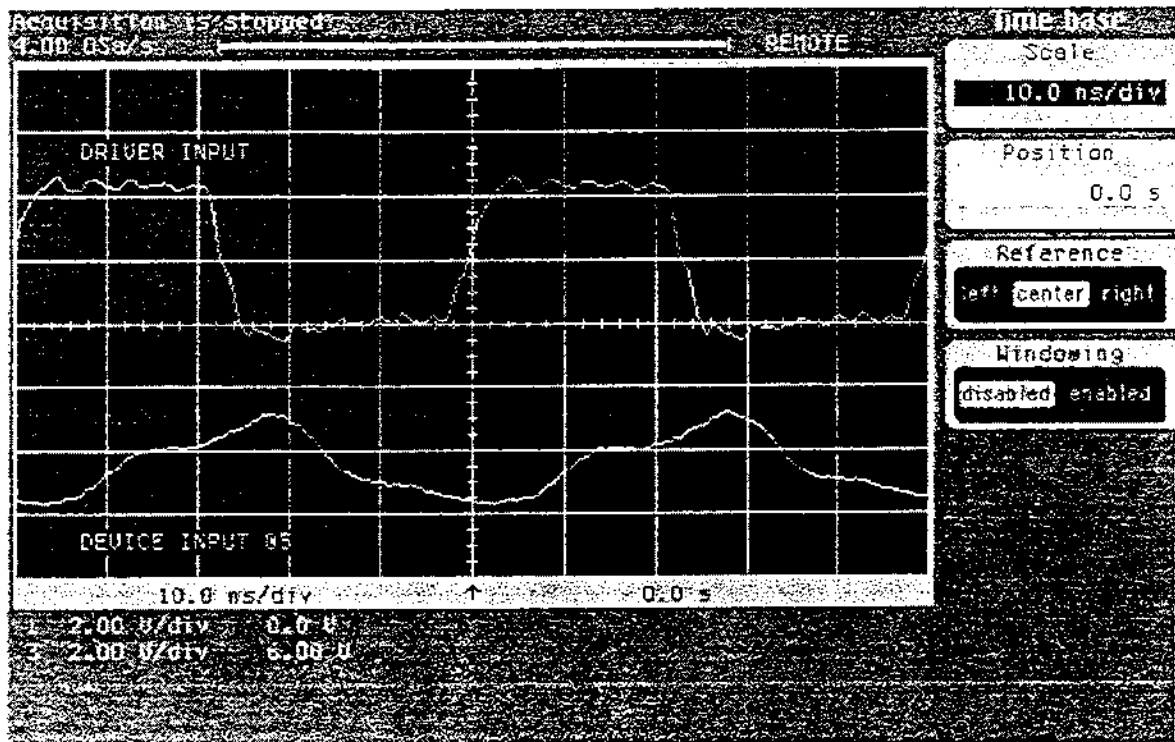
BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH



"DOUBLE STRENGTH" DRIVERS

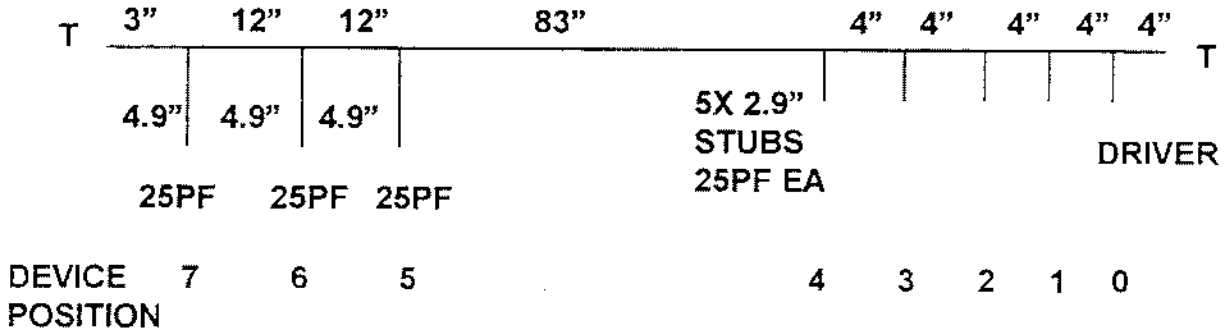


DEVICE POSITION 5

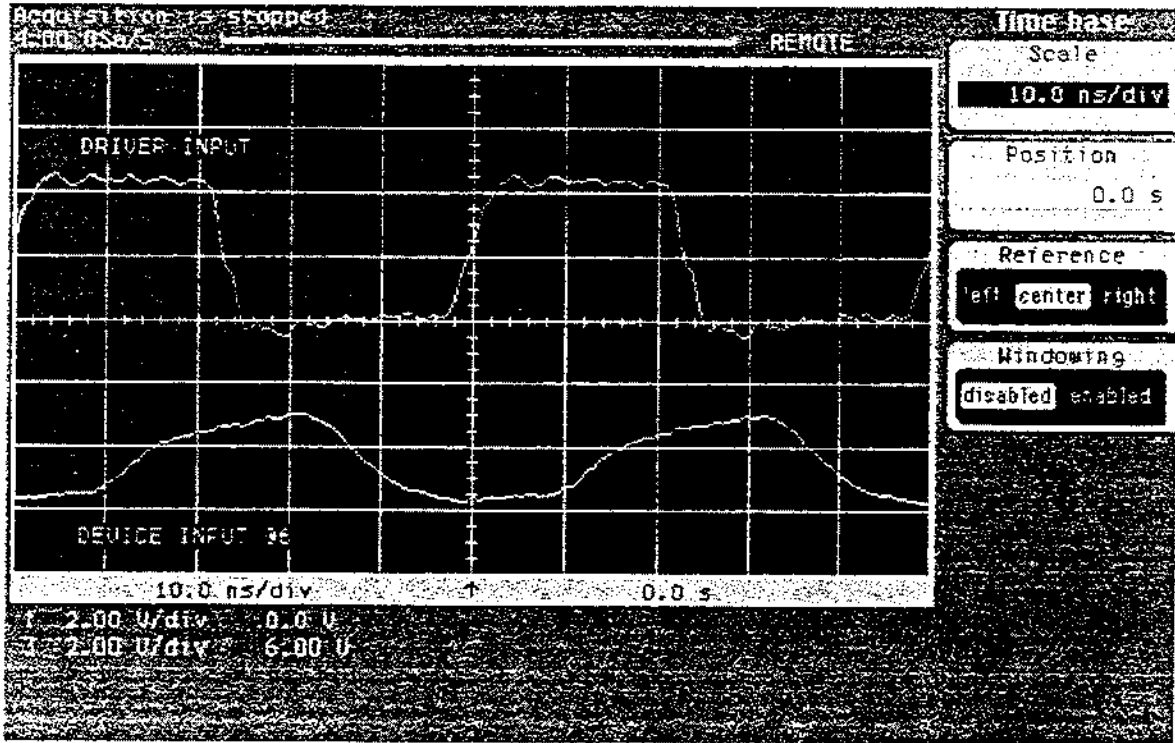
BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH



"DOUBLE STRENGTH" DRIVERS

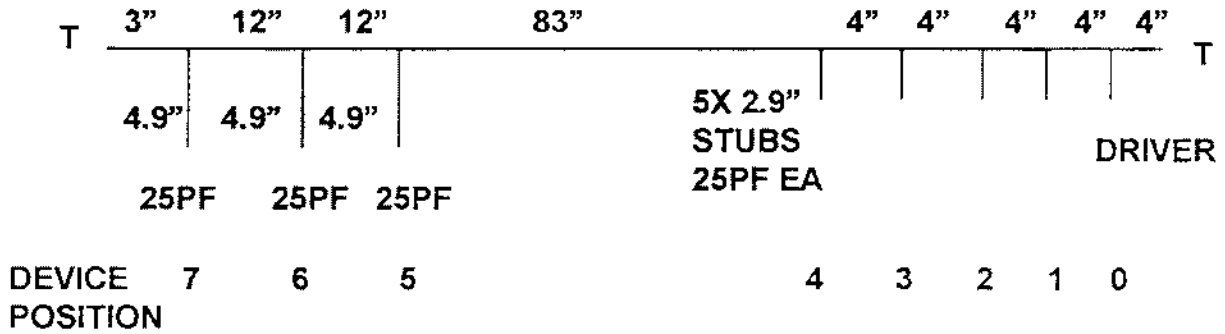


DEVICE POSITION 6

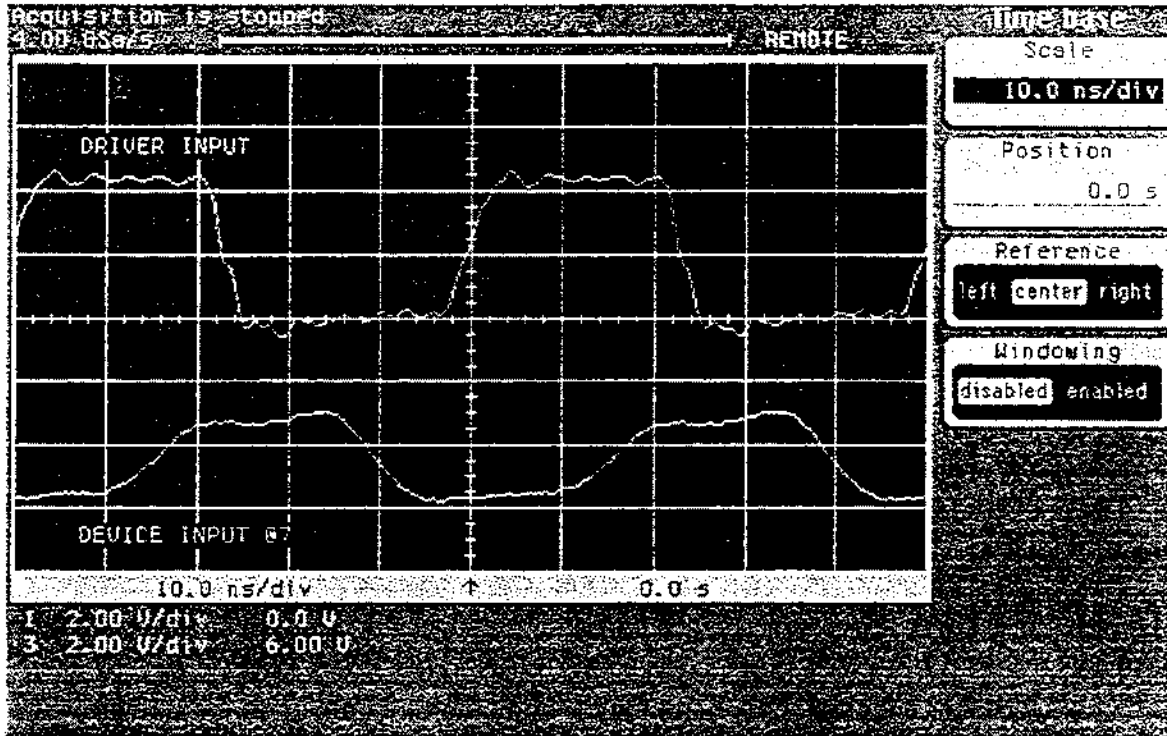
BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

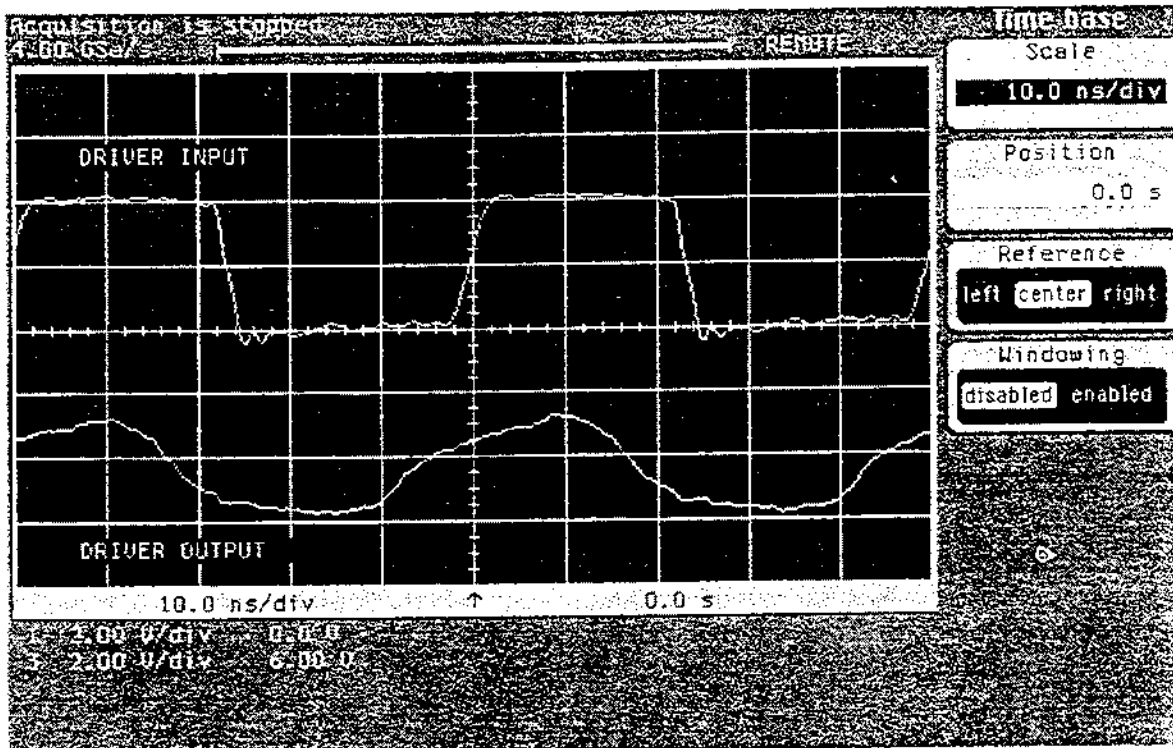


"DOUBLE STRENGTH" DRIVERS

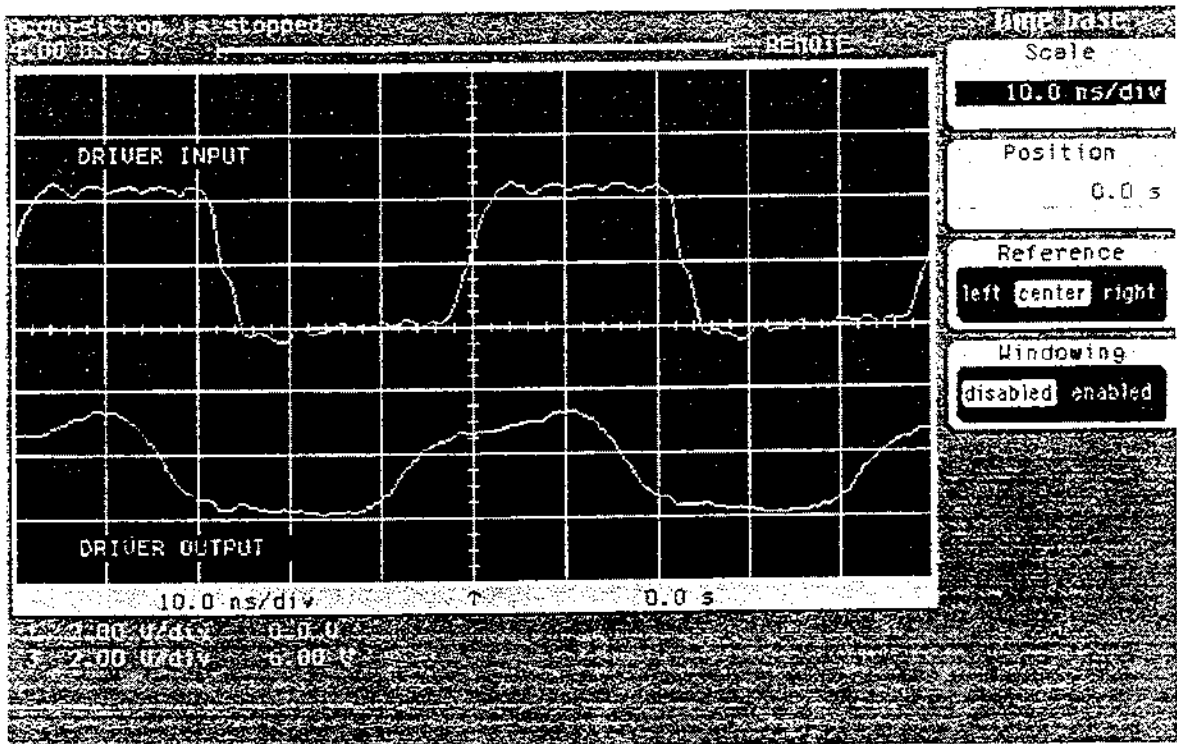


DEVICE POSITION 7

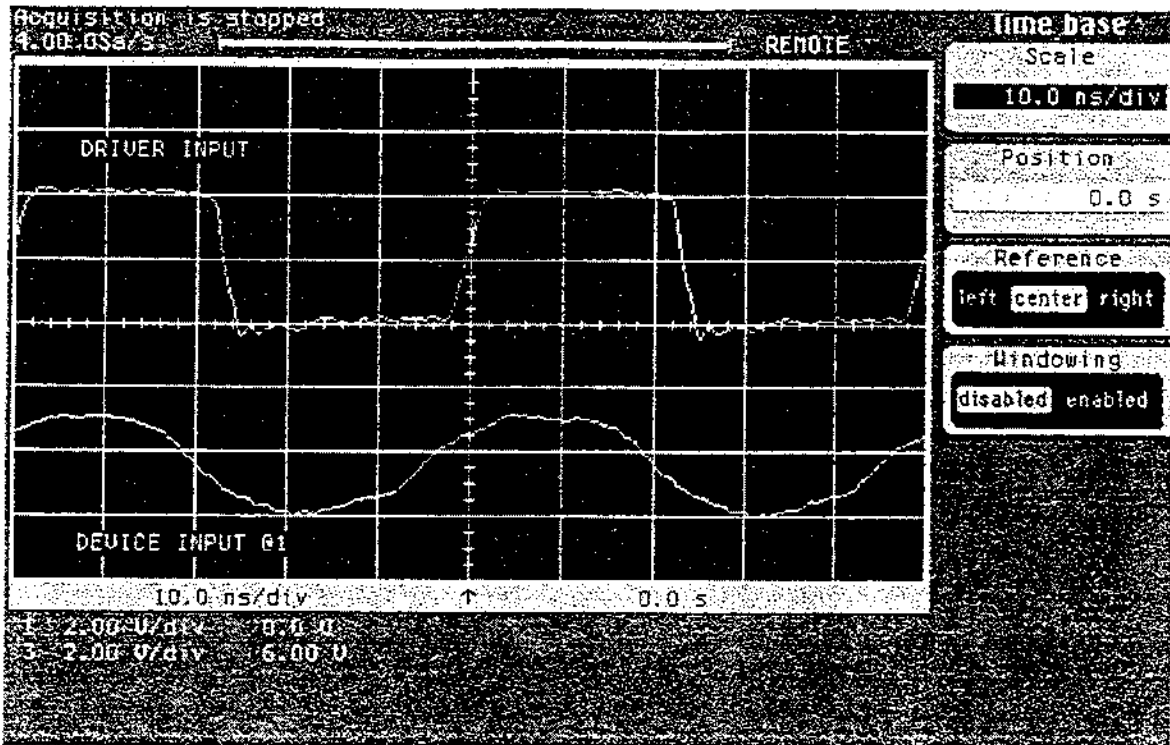
BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994



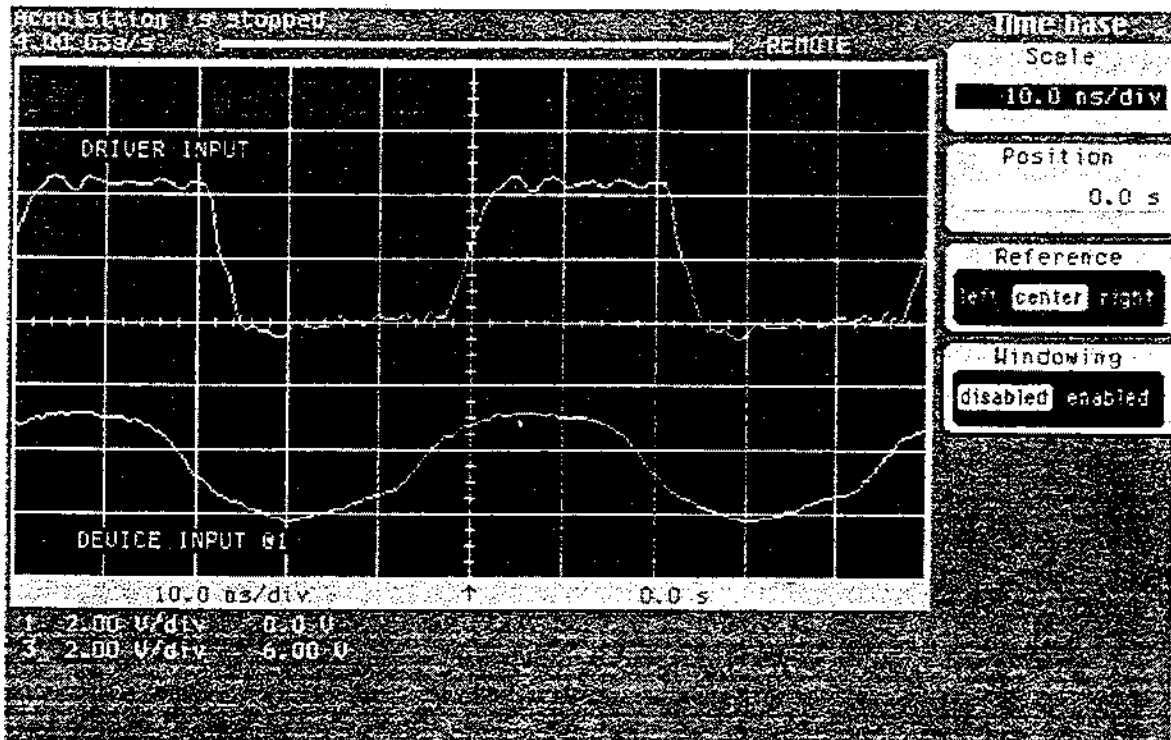
SINGLE DRIVER AT DRIVER (POSITION 0)



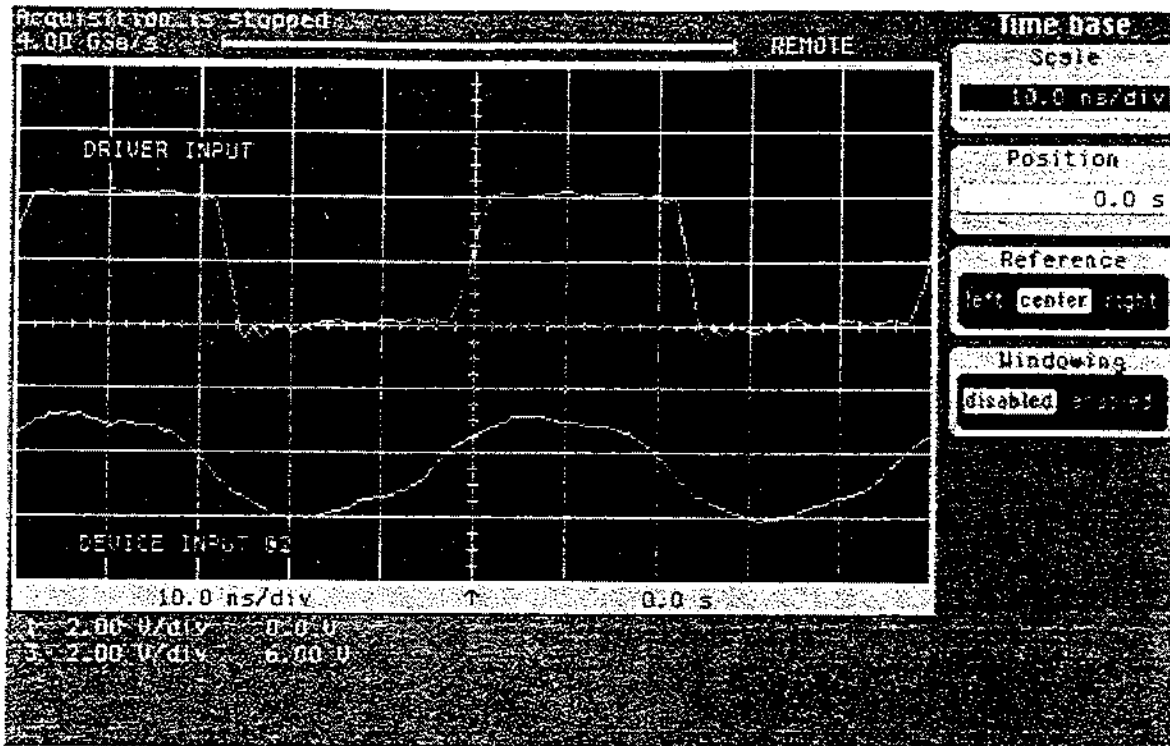
DOUBLE DRIVER AT DRIVER (POSITION 0)



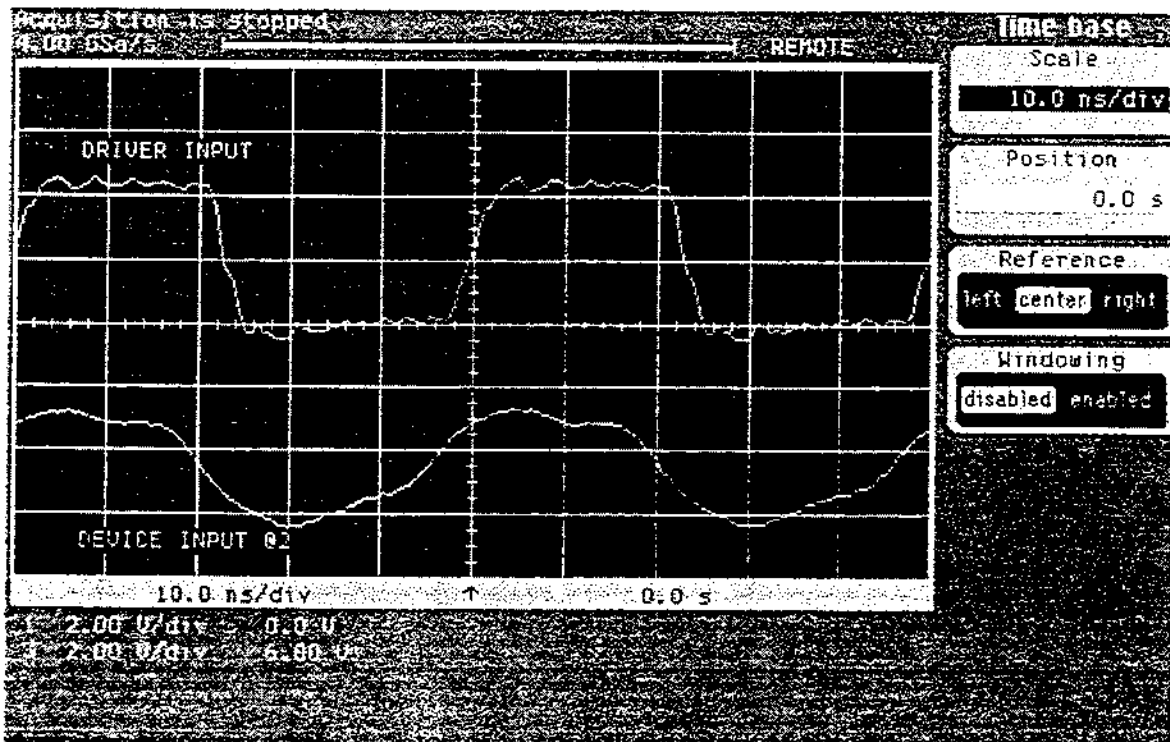
SINGLE DRIVER POSITION 1



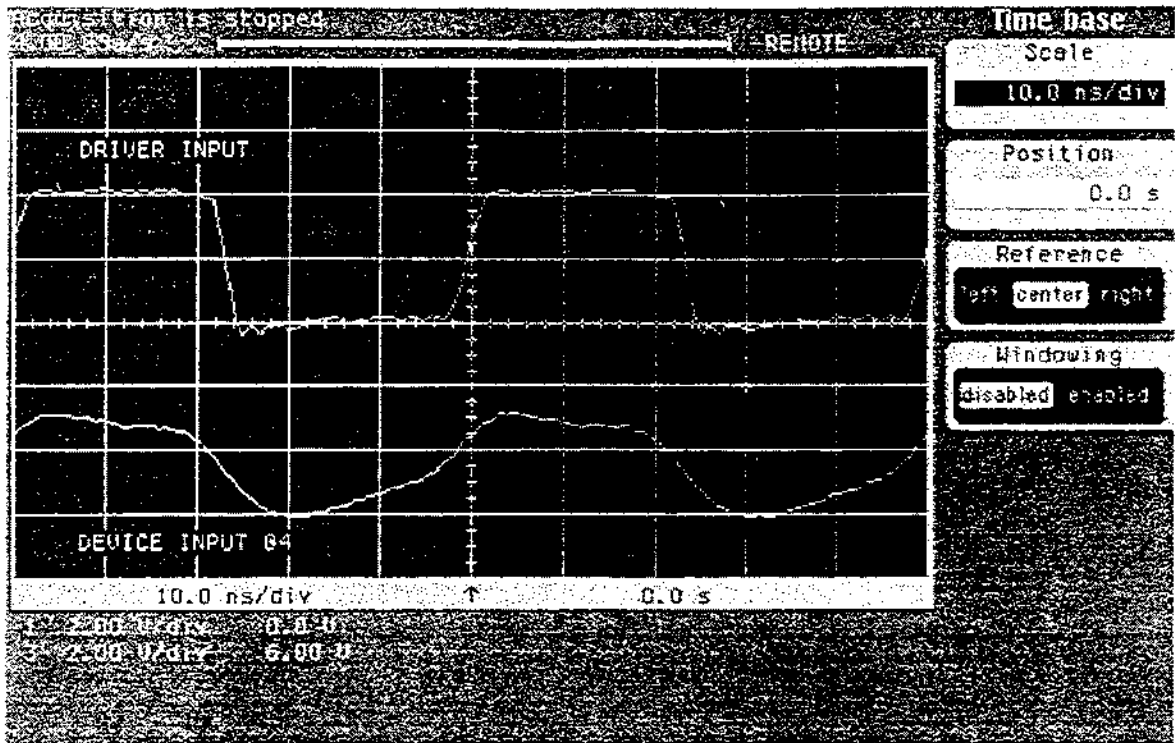
DOUBLE DRIVER POSITION 1



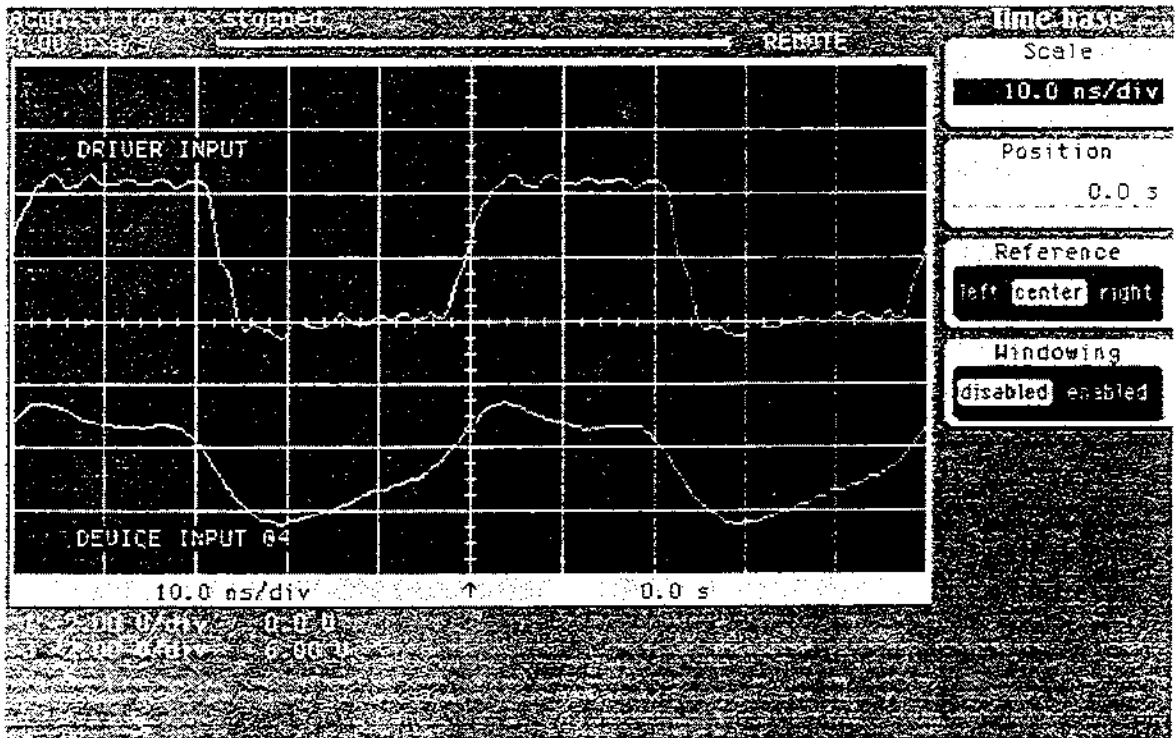
SINGLE DRIVER POSITION 2



DOUBLE DRIVER POSITION 2

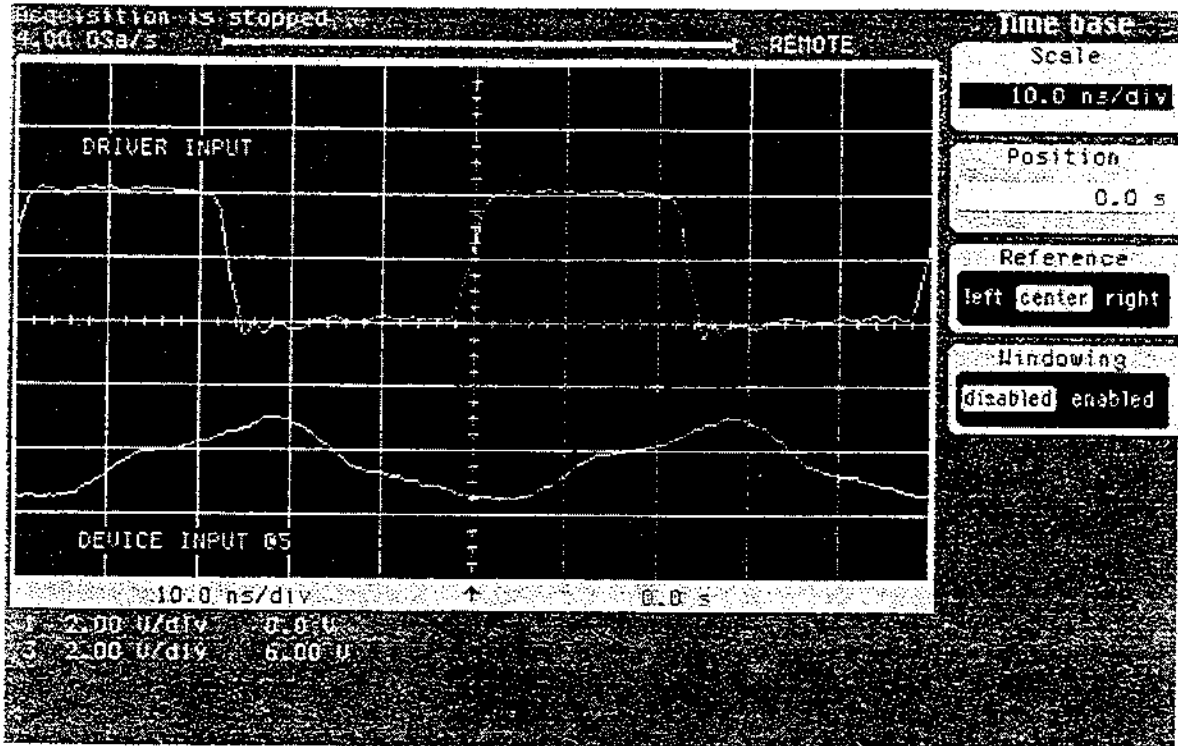


SINGLE DRIVER POSITION 4

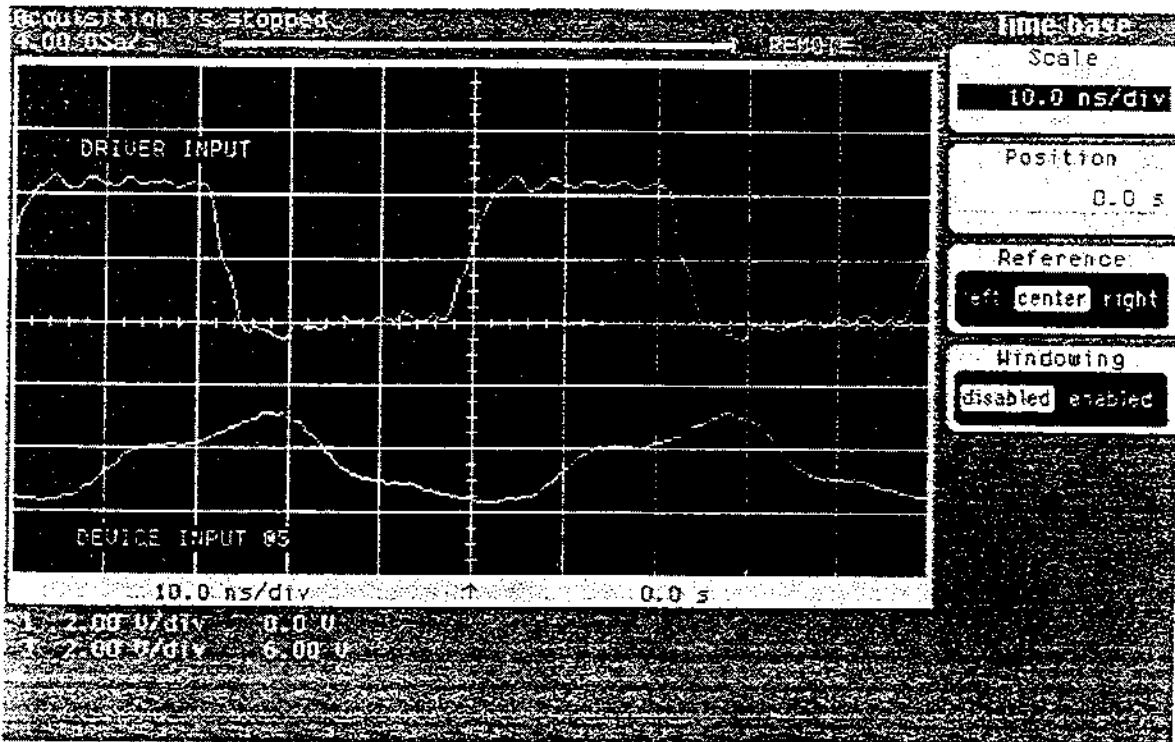


DOUBLE DRIVER POSITION 4

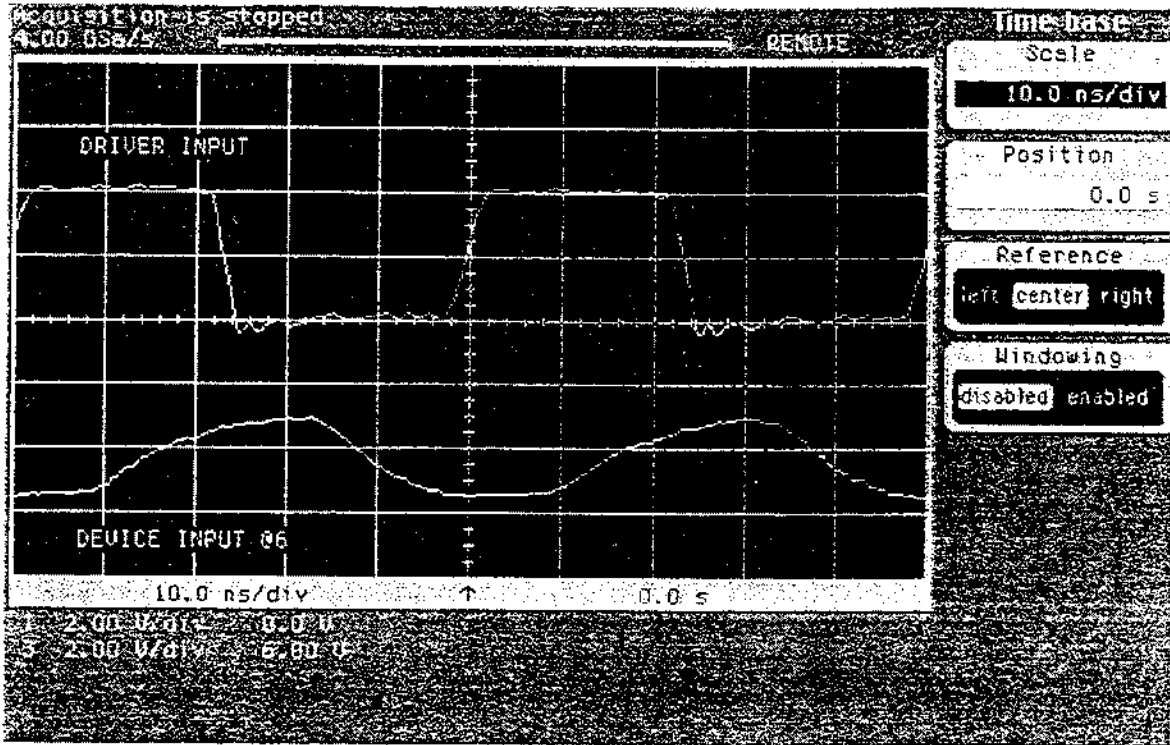
BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994



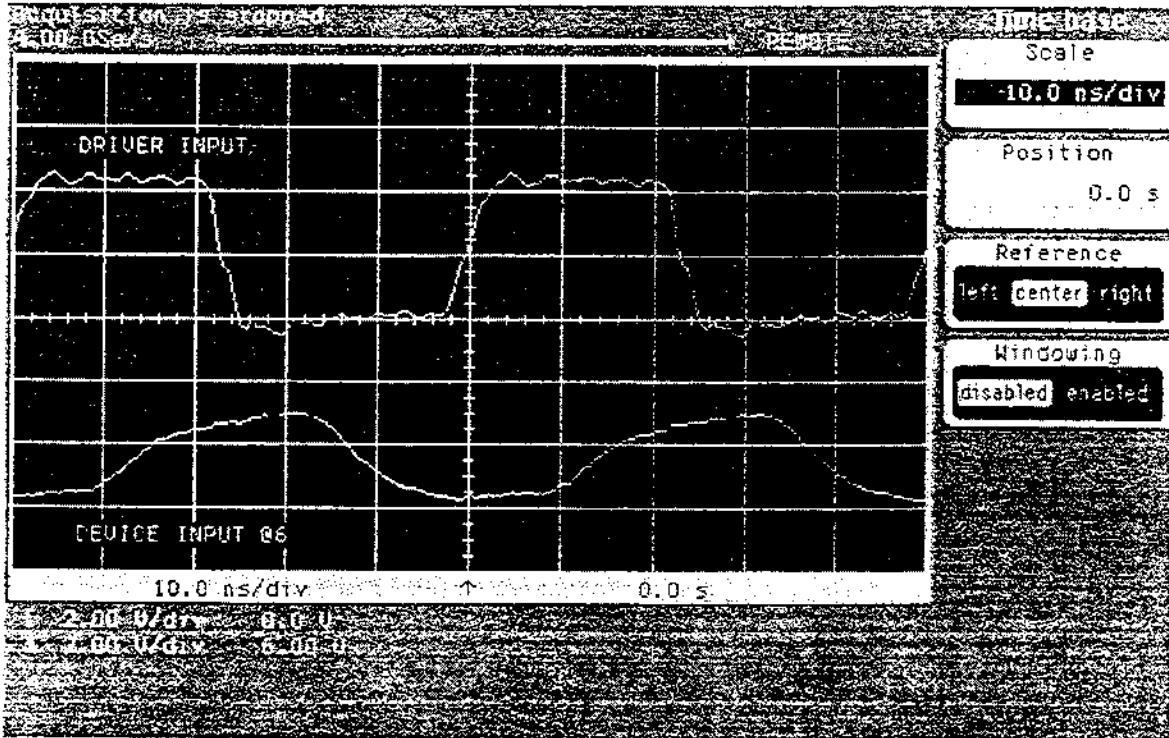
SINGLE DRIVER POSITION 5



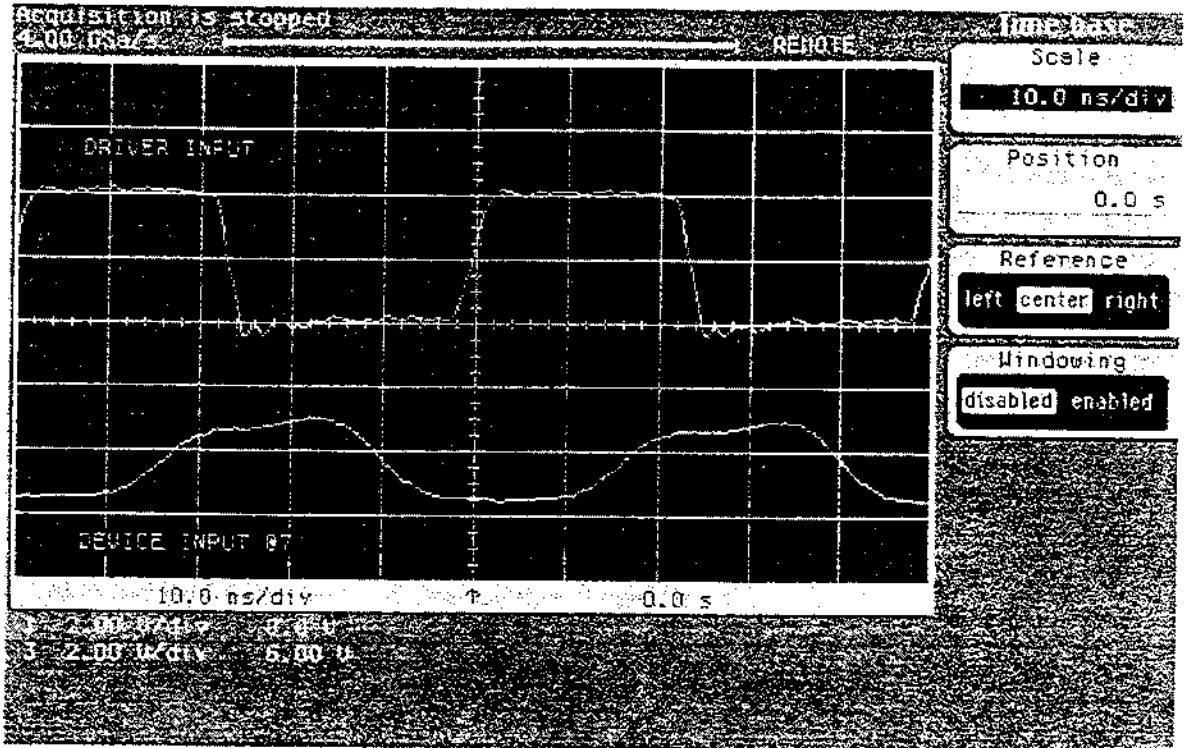
DOUBLE DRIVER POSITION 5



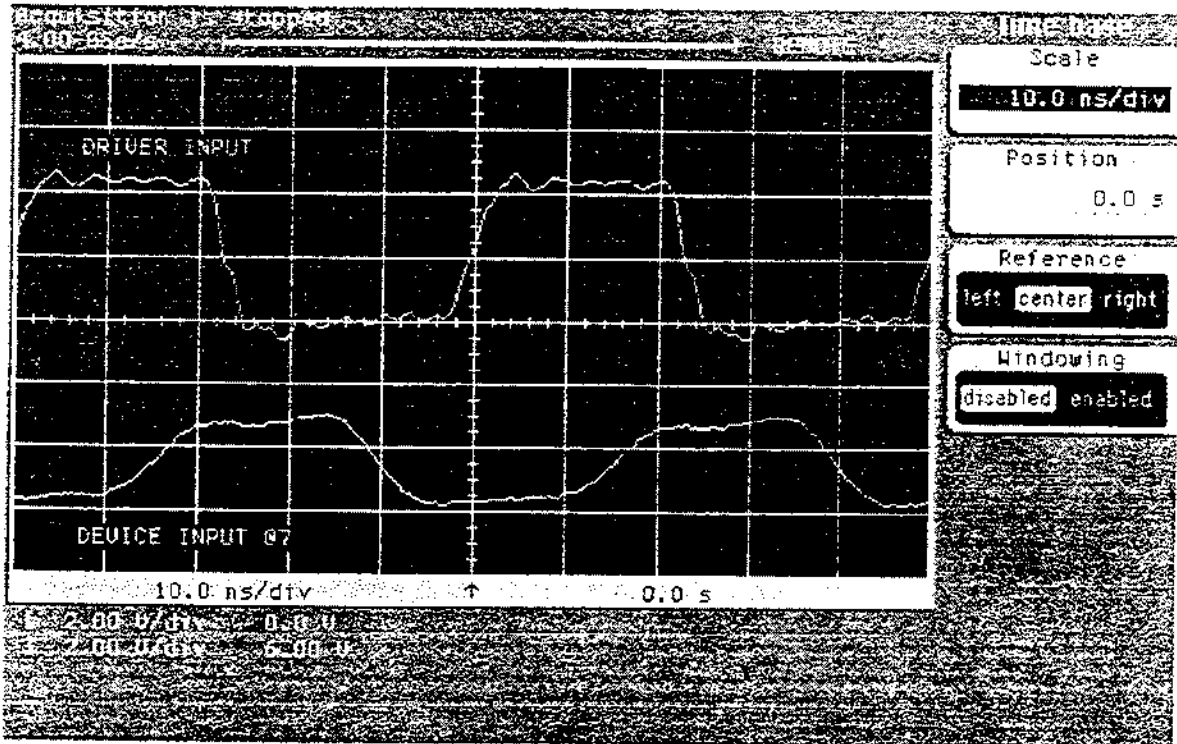
SINGLE DRIVER POSITION 6



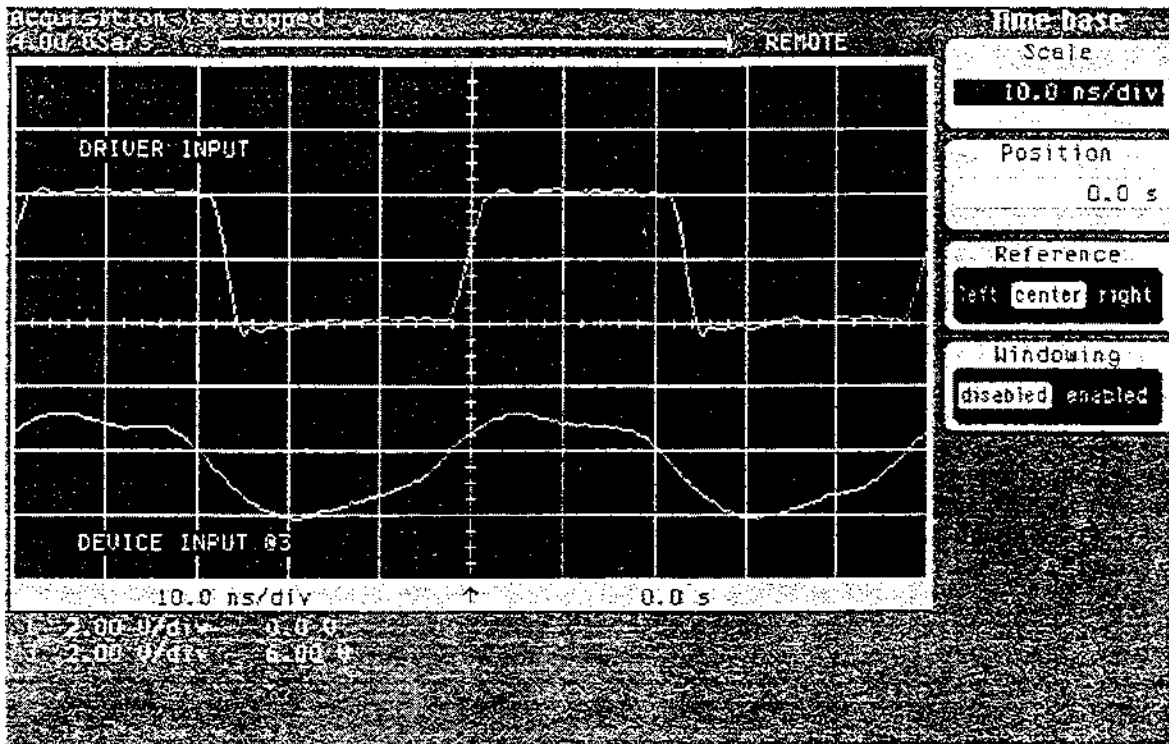
DOUBLE DRIVER POSITION 6



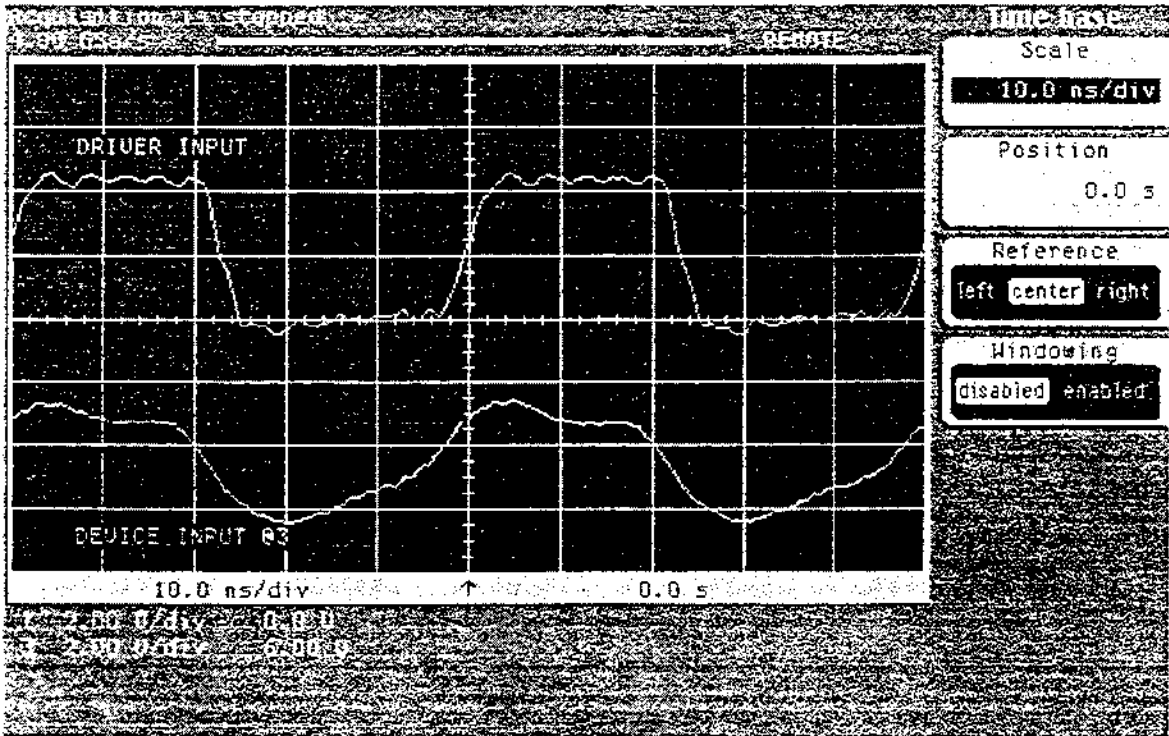
SINGLE DRIVER POSITION 7



DOUBLE DRIVER POSITION 7



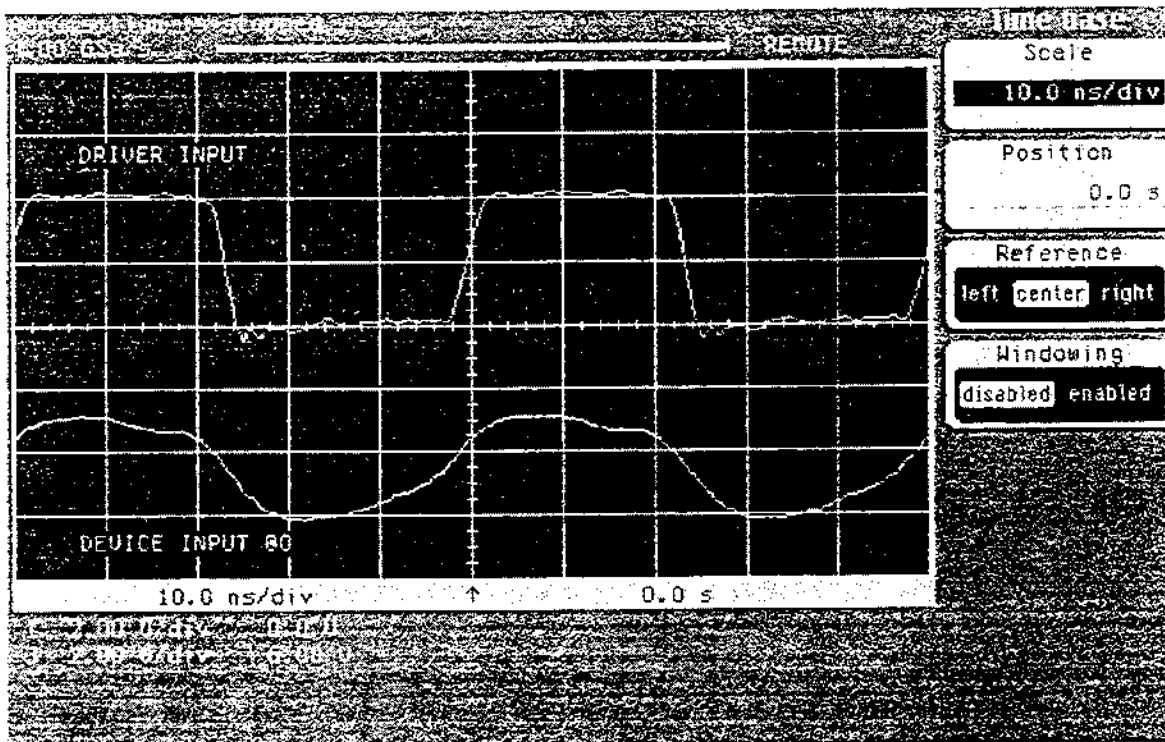
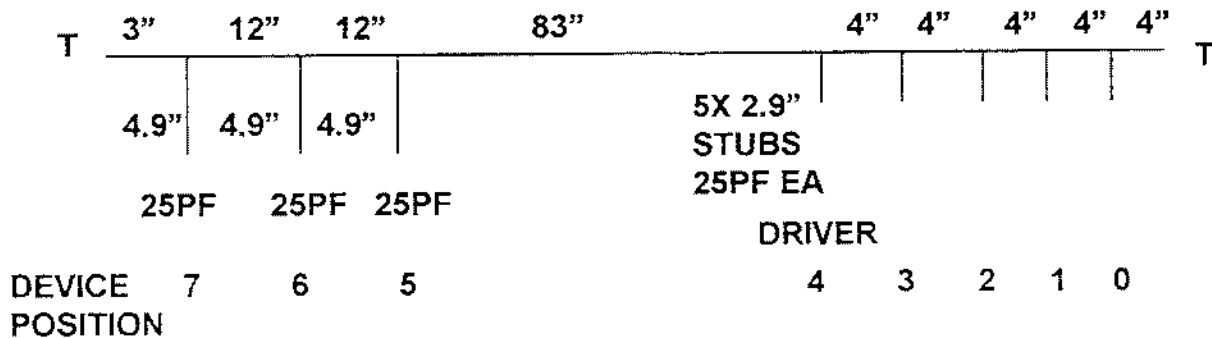
SINGLE DRIVER POSITION 3



DOUBLE DRIVER POSITION 3

FAST 360 SINGLE ENDED SCSI

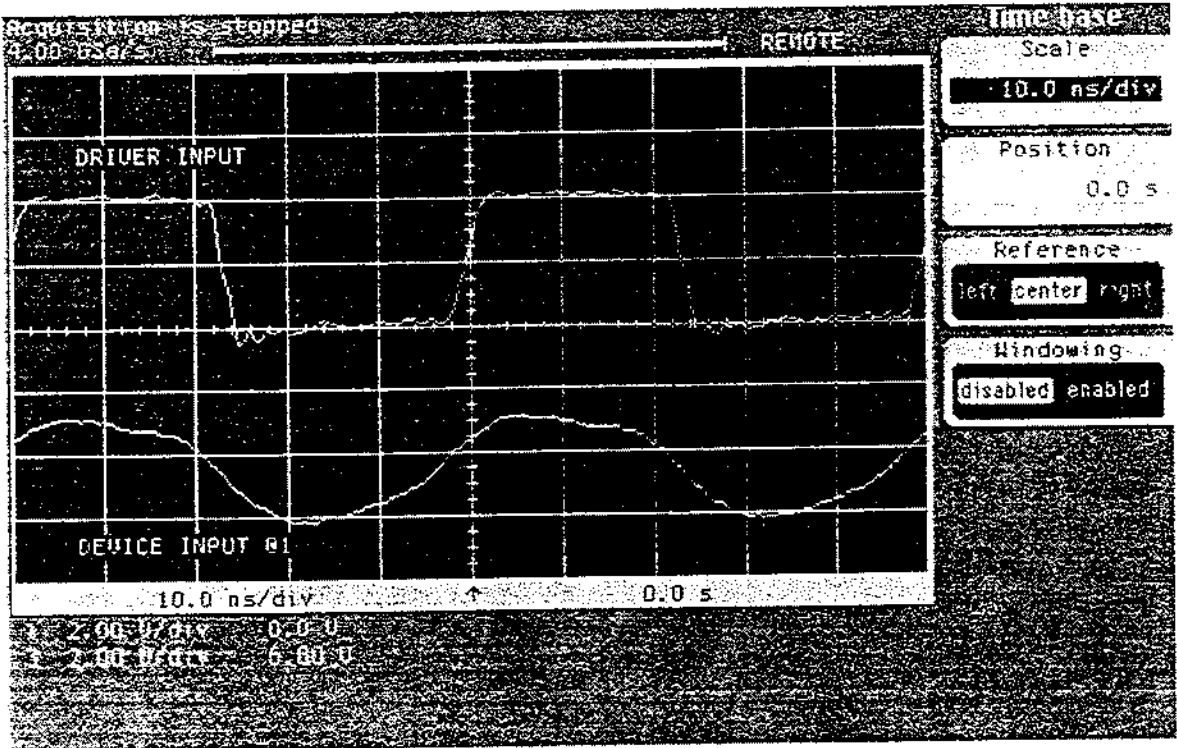
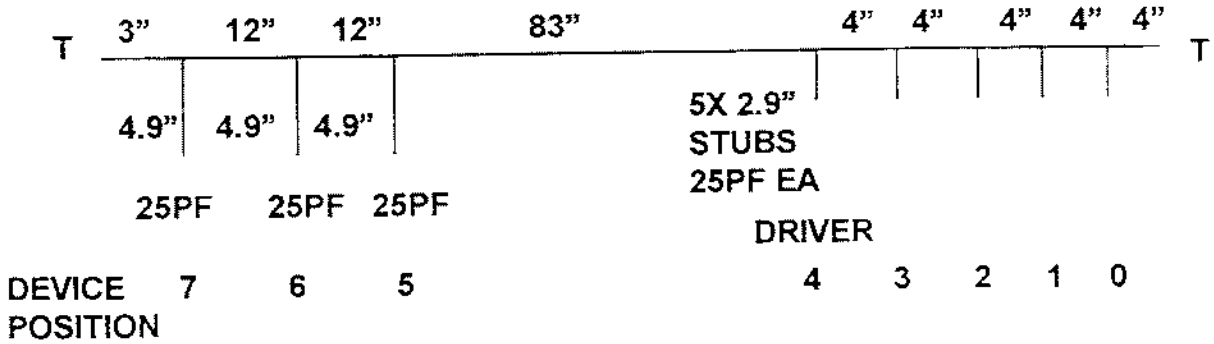
3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 0

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

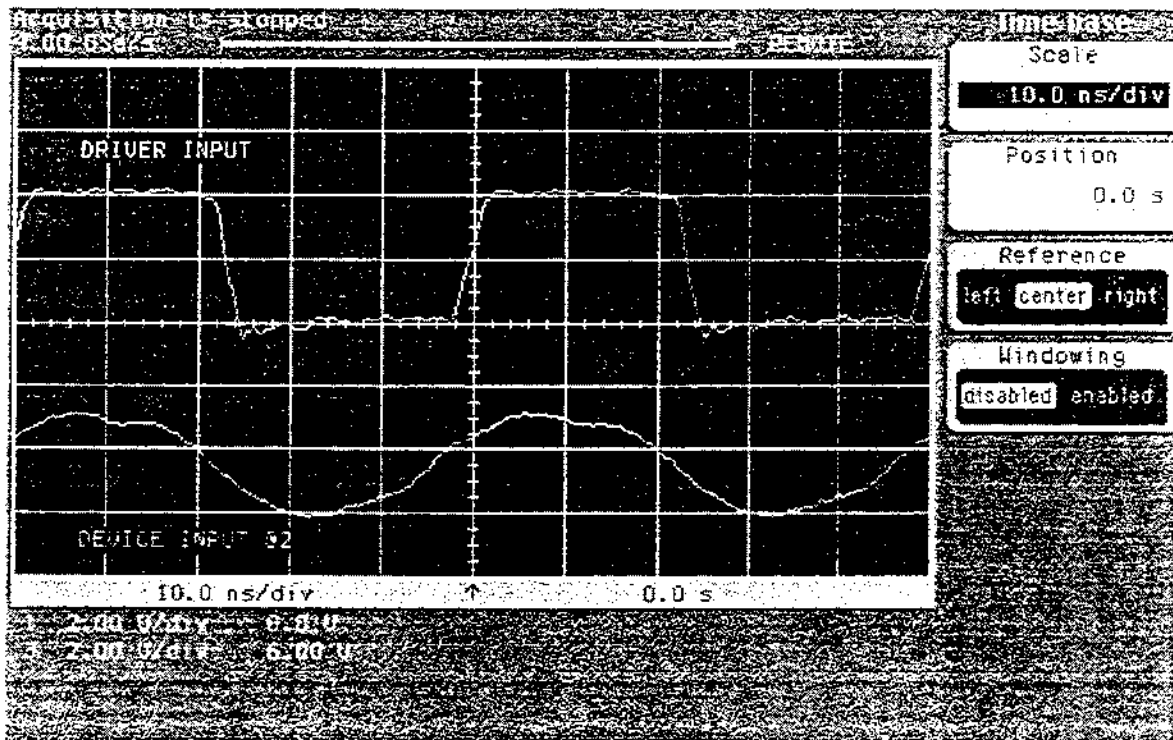
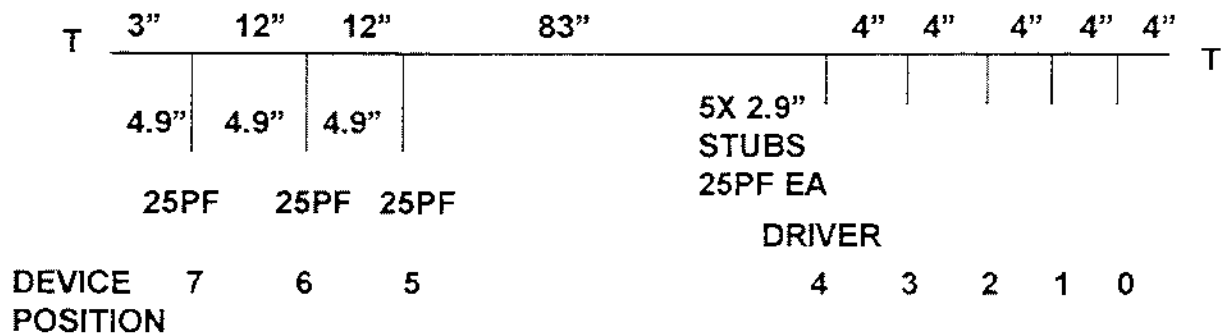


DEVICE POSITION 1

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

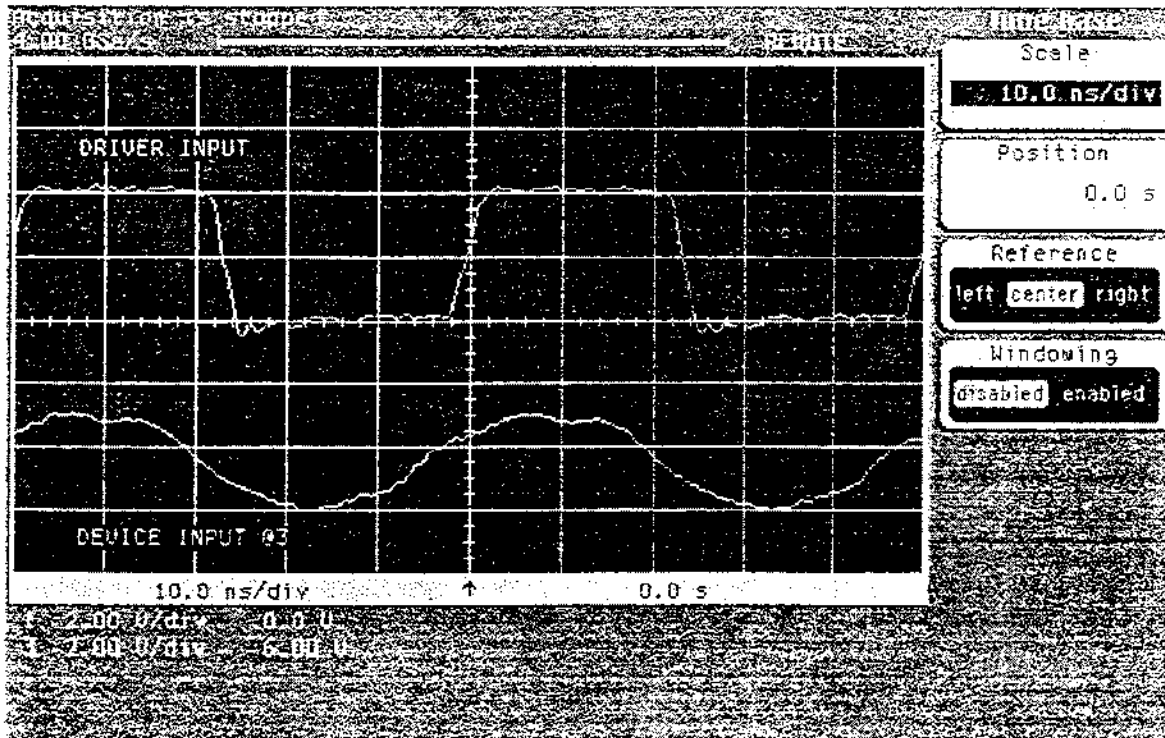
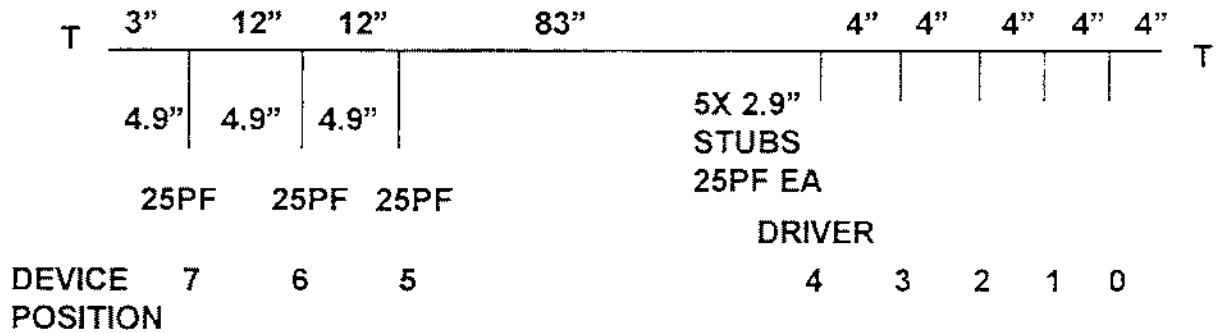


DEVICE POSITION 2

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

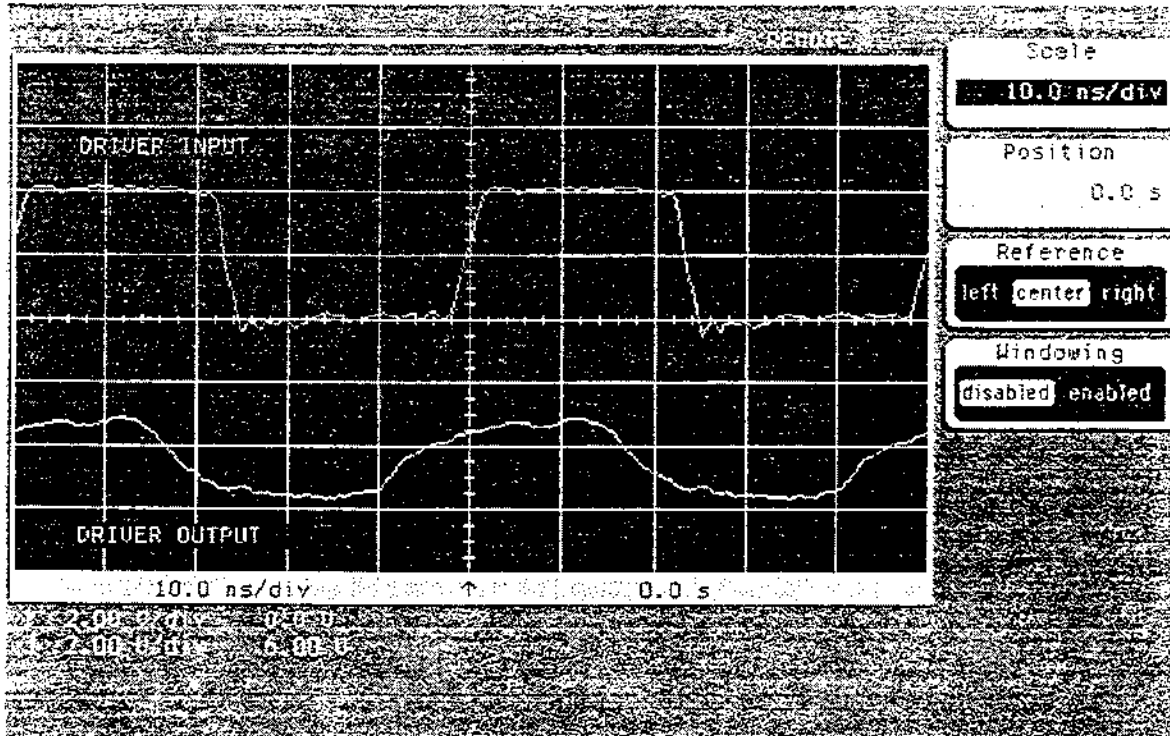
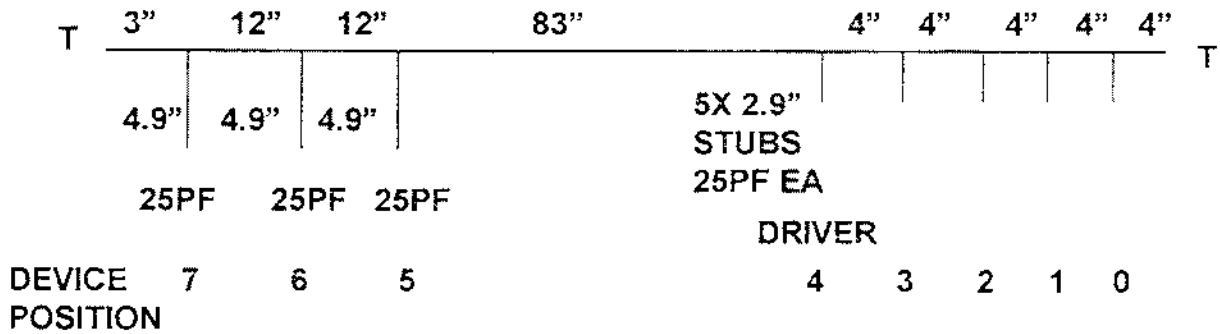


DEVICE POSITION 3

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

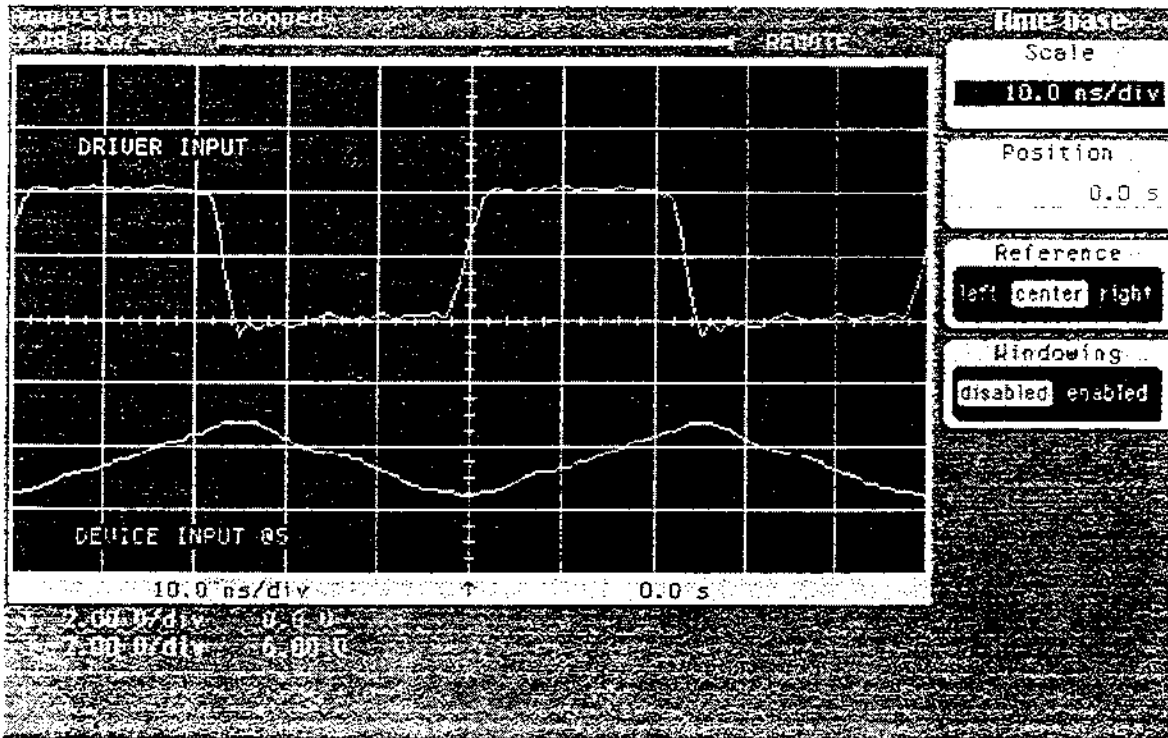
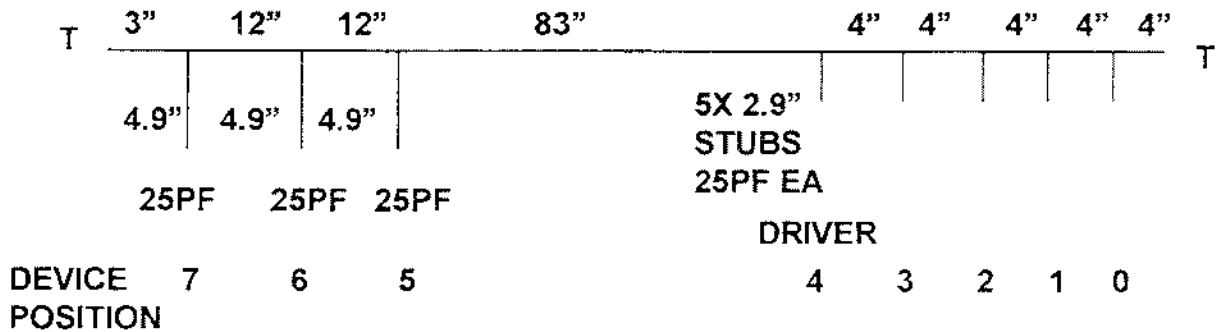
3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 4 (DRIVER)

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

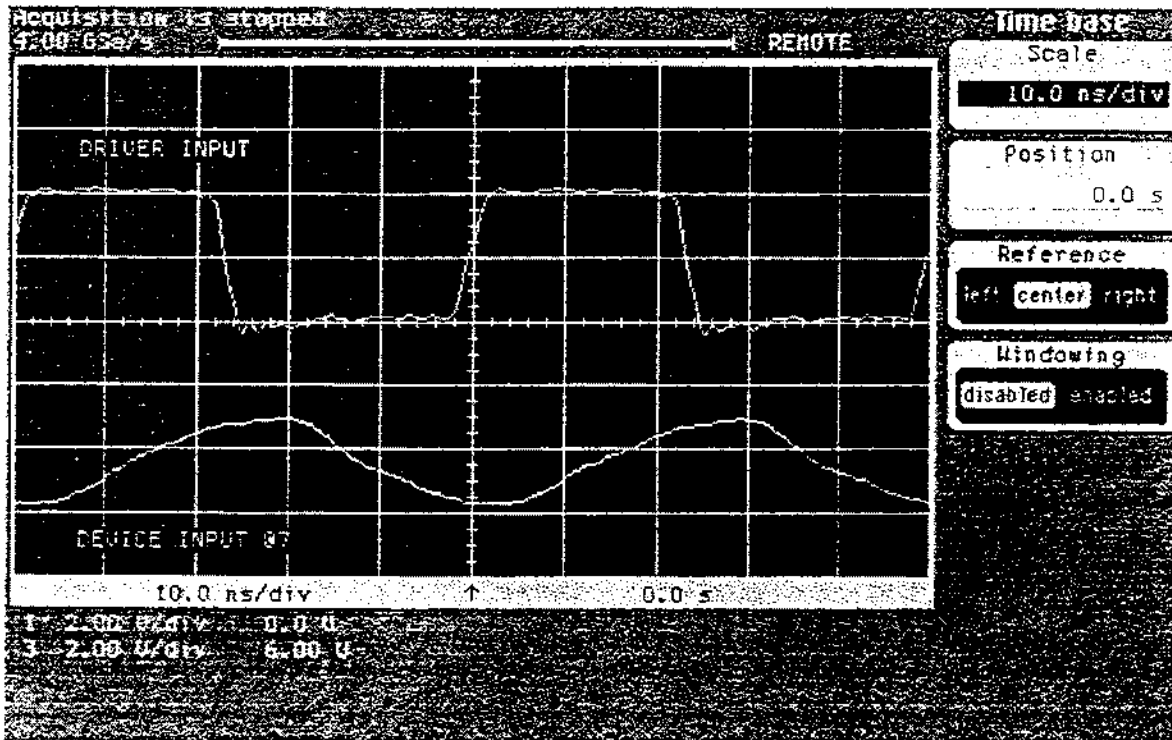
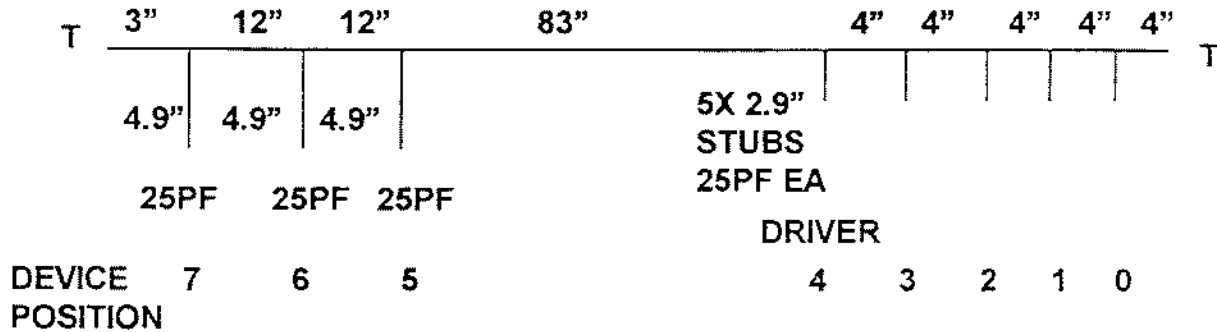


DEVICE POSITION 5

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

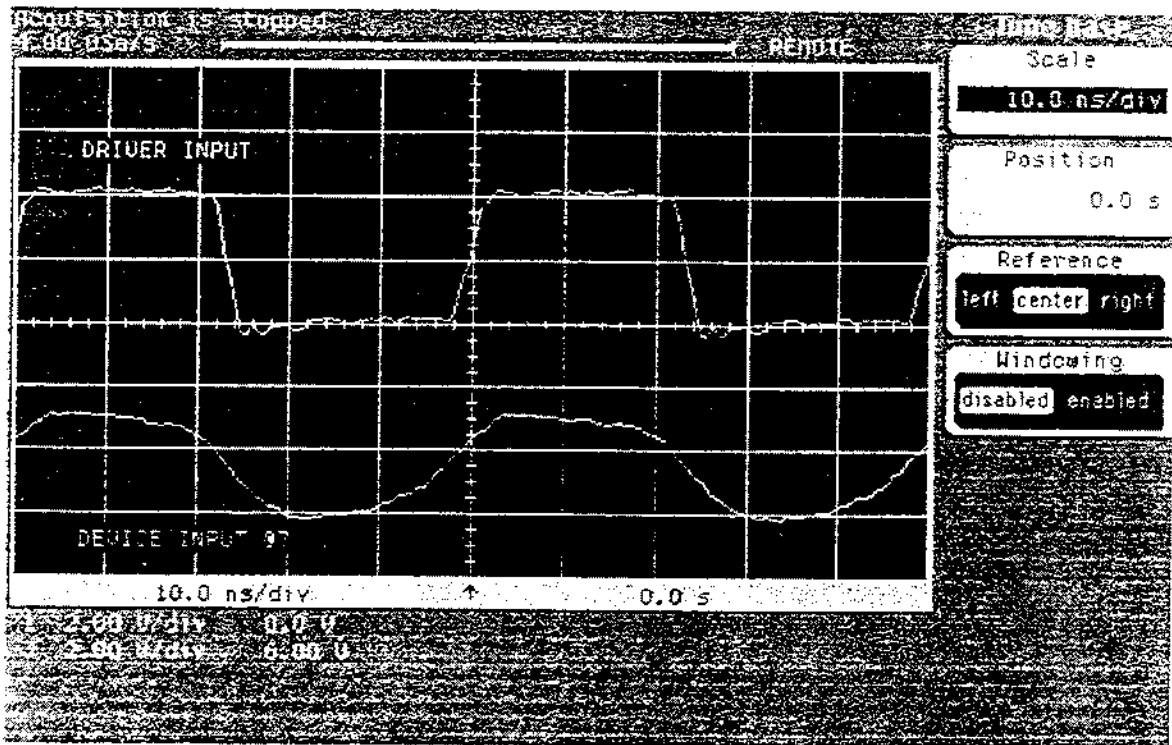
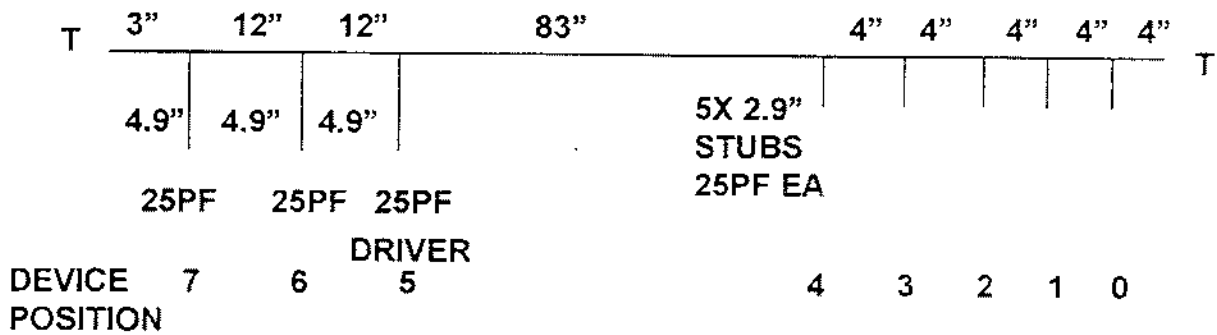


DEVICE POSITION 7

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

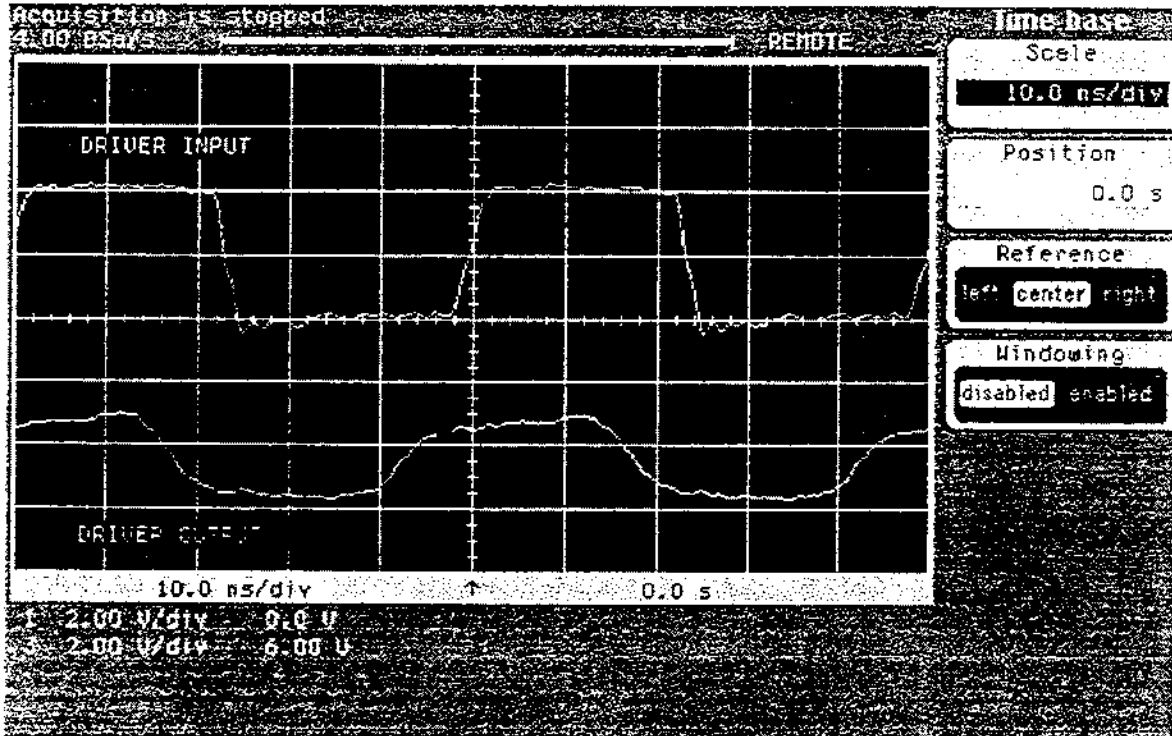
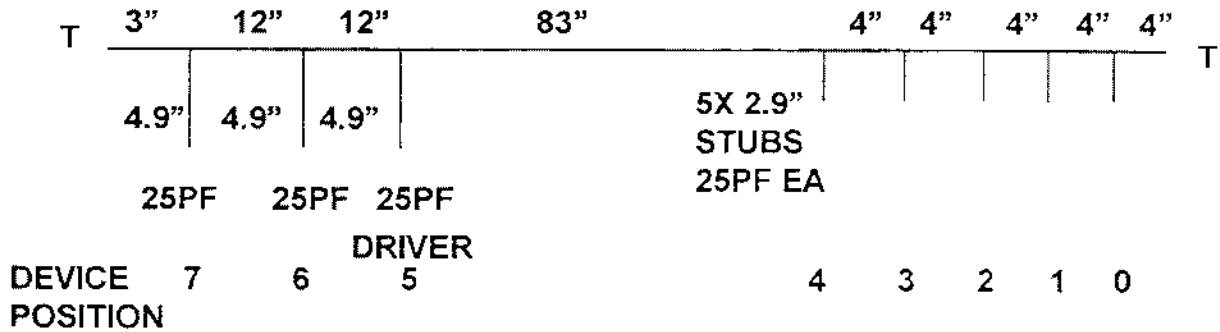


DEVICE POSITION 7

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

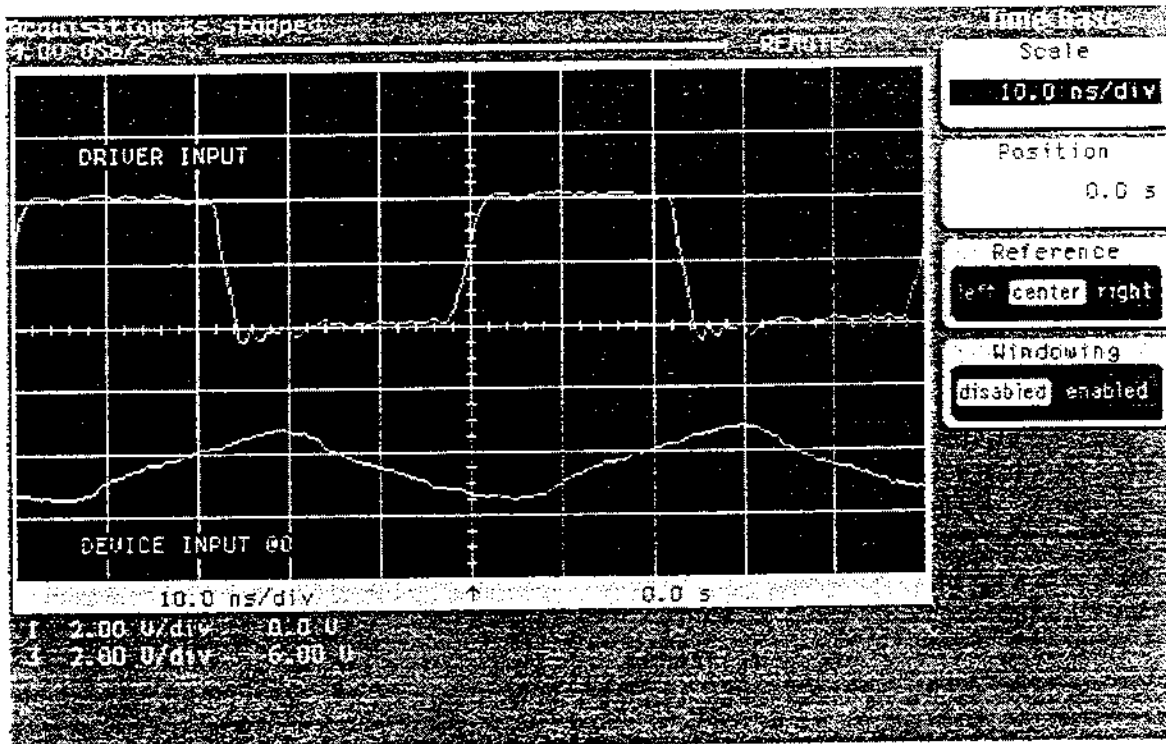
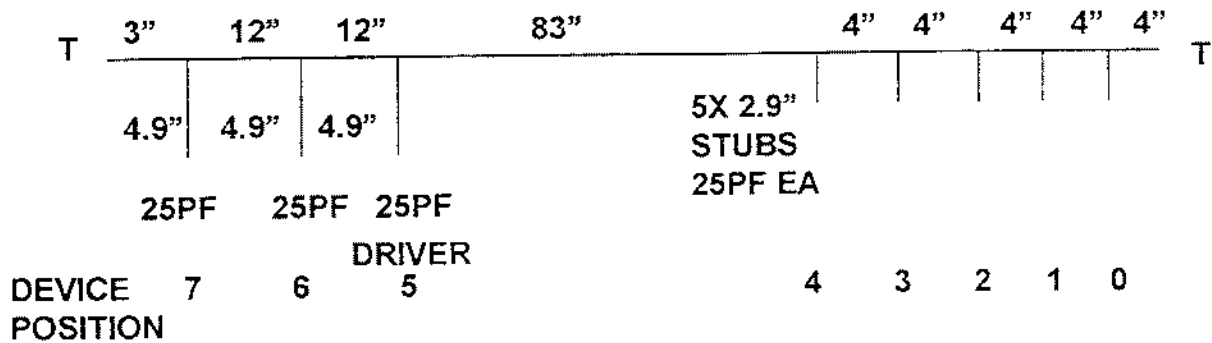


DEVICE POSITION 5 (DRIVER)

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

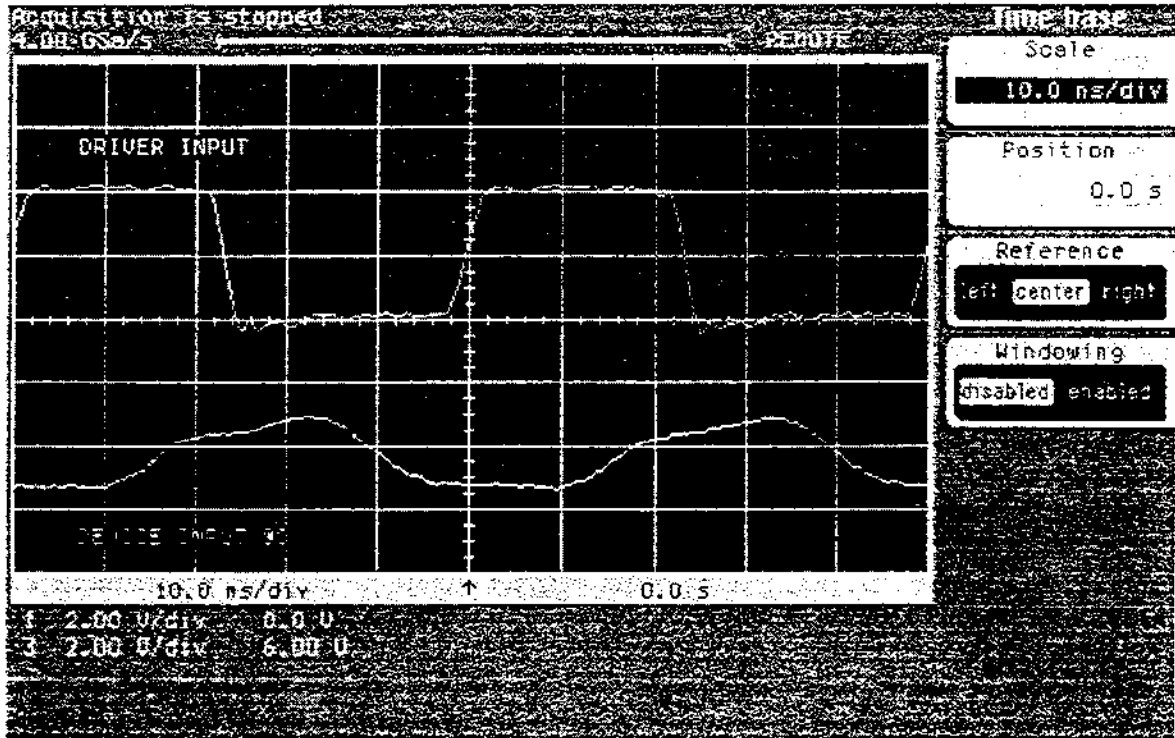
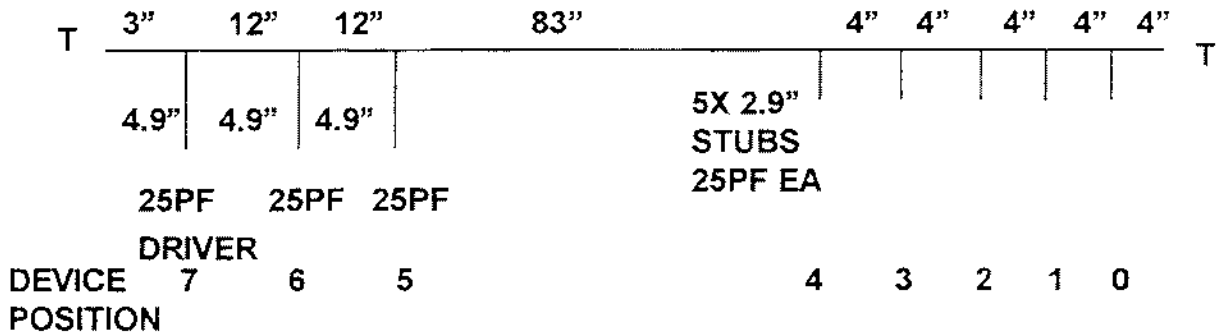


DEVICE POSITION 0

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

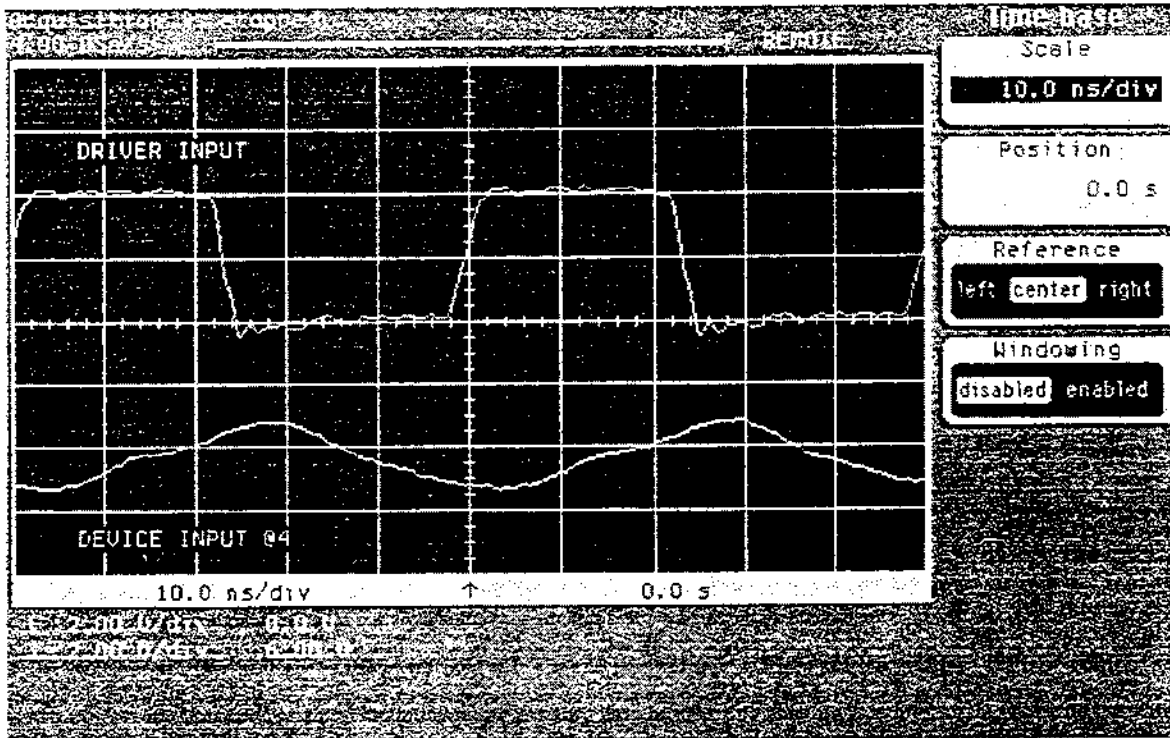
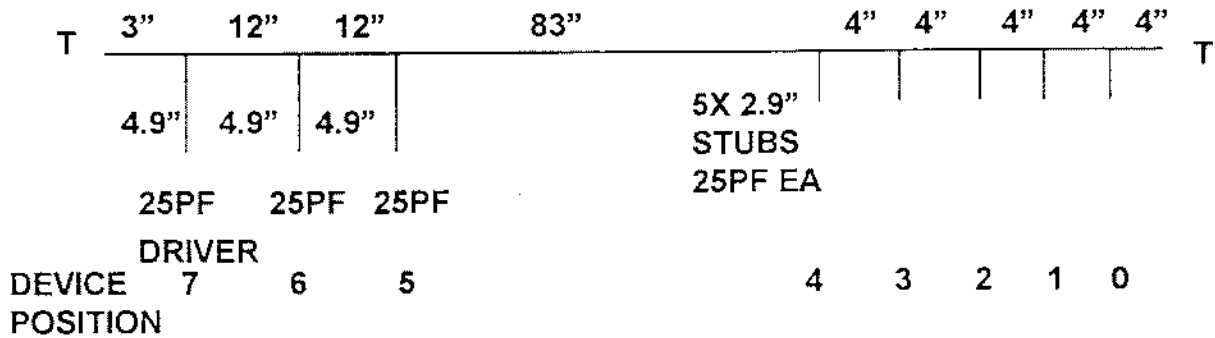
3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 0

FAST 360 SINGLE ENDED SCSI

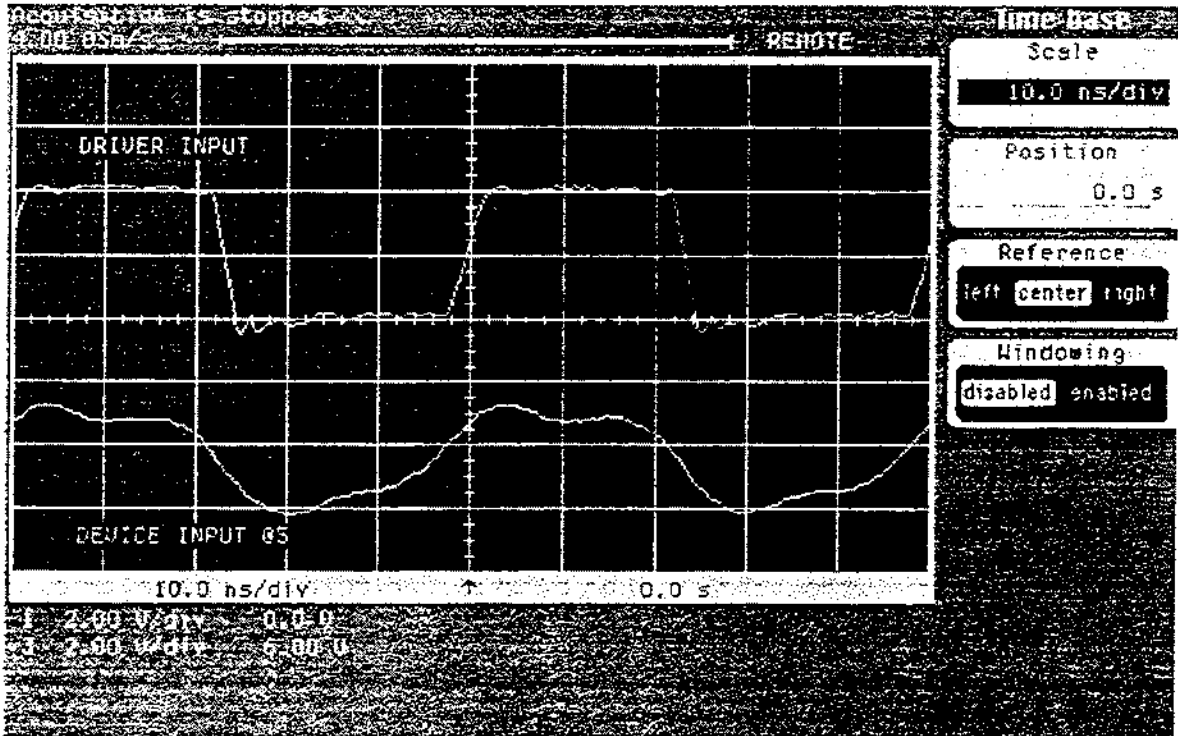
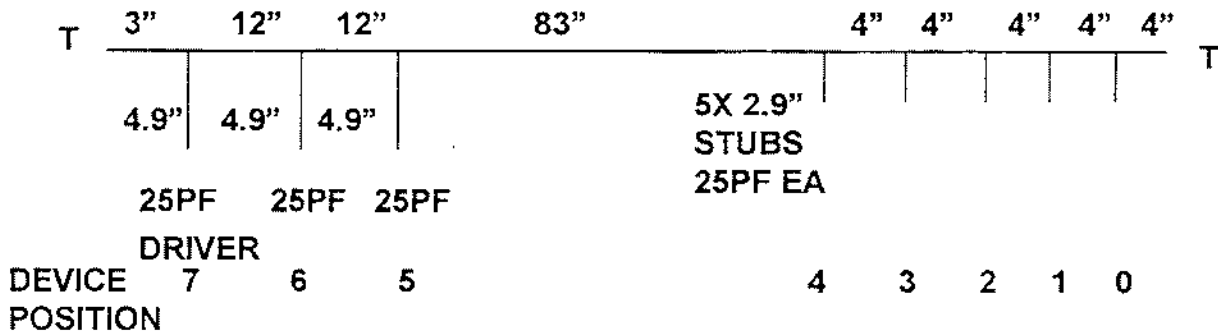
3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 4

FAST 360 SINGLE ENDED SCSI

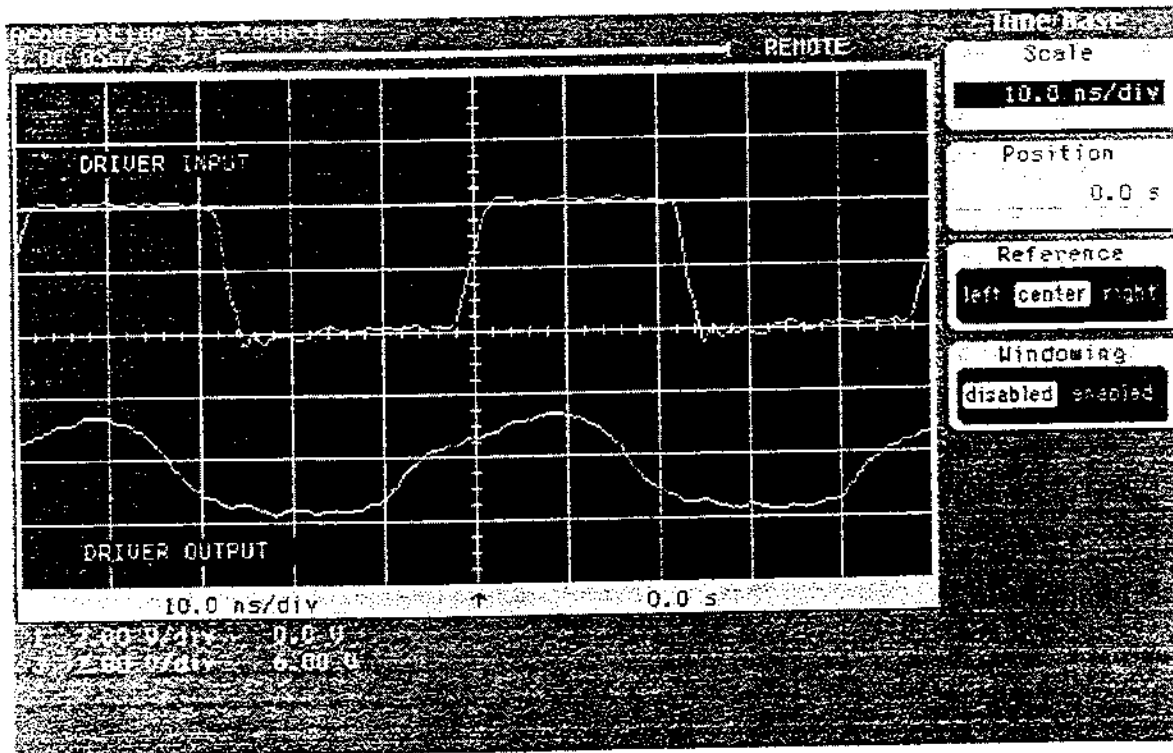
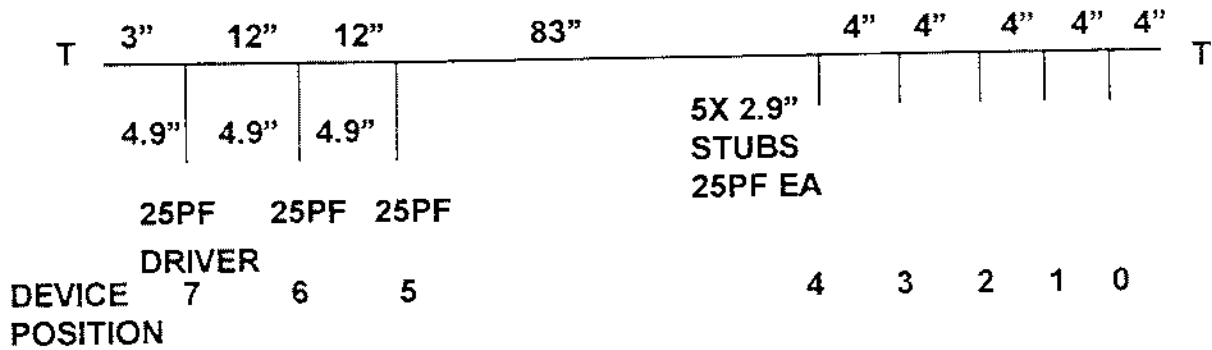
3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 5

FAST 360 SINGLE ENDED SCSI

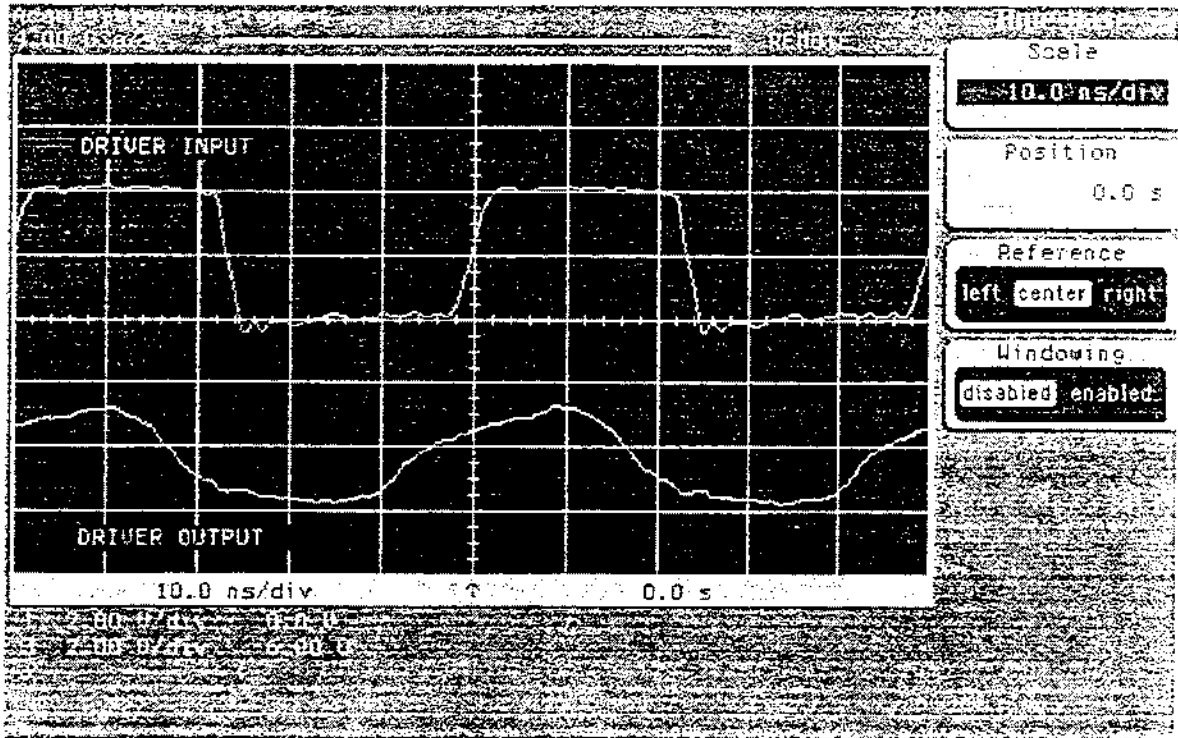
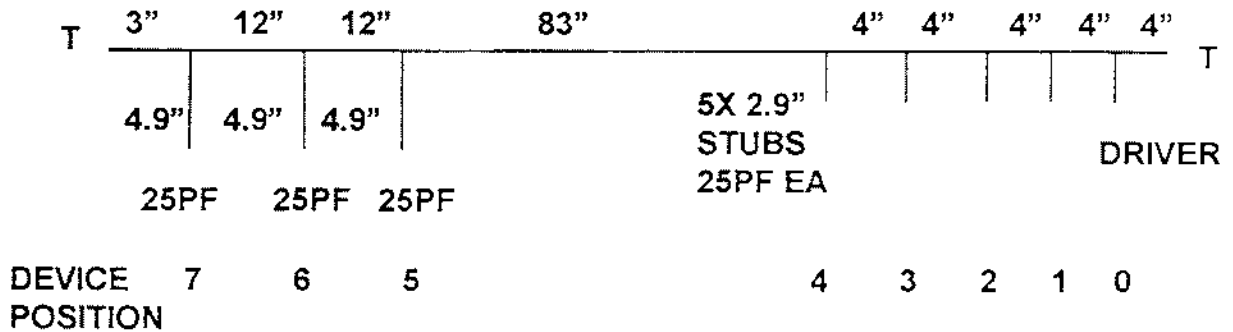
3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 7 (DRIVER)

FAST 360 SINGLE ENDED SCSI

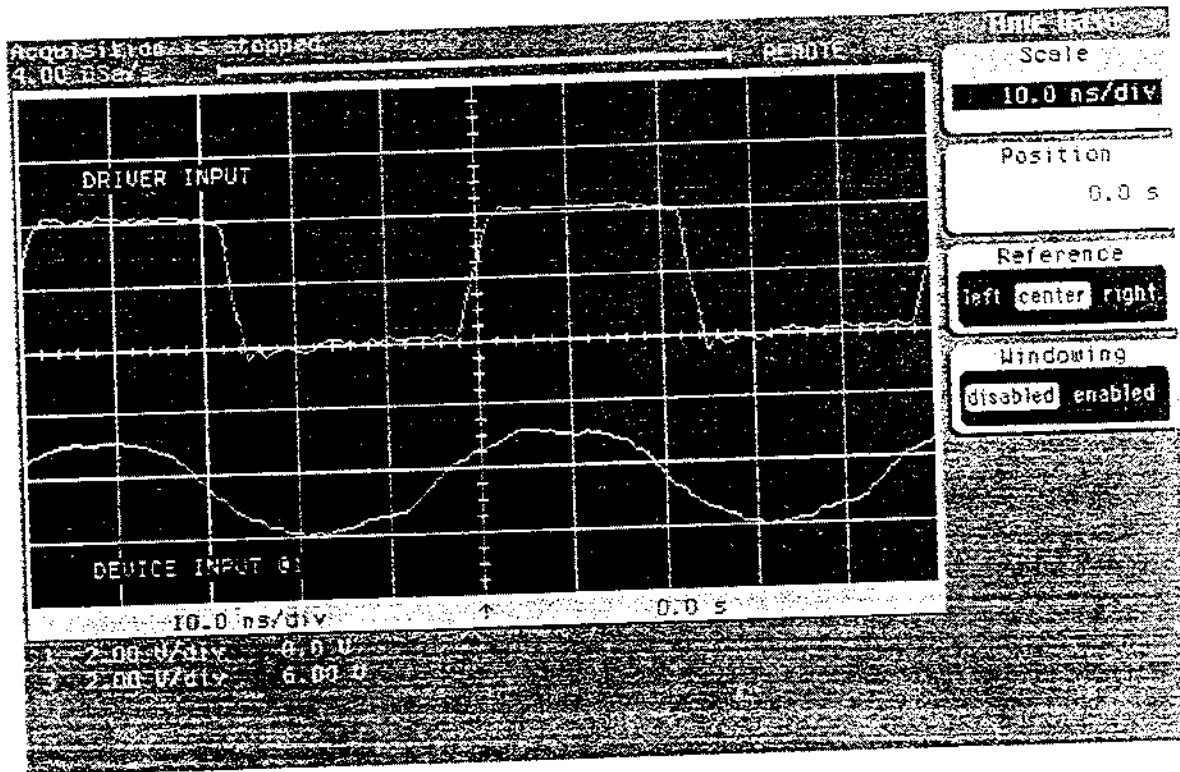
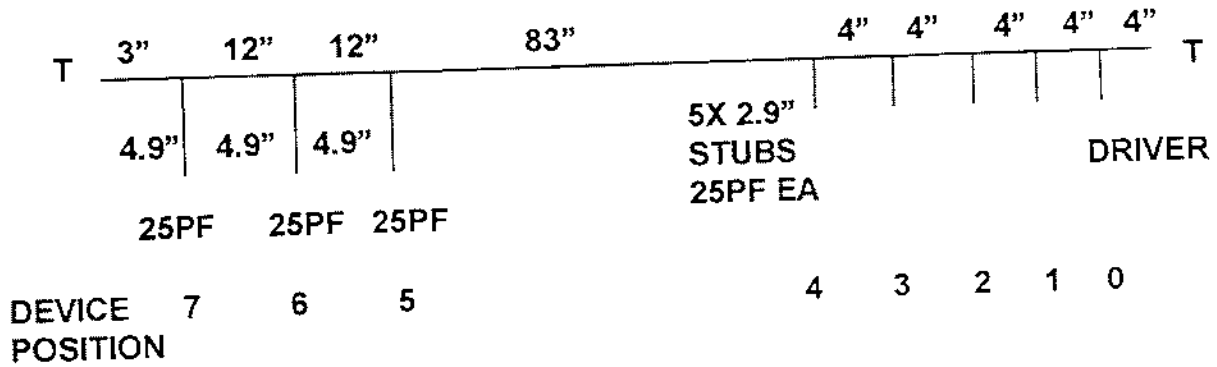
3 METERS (10 FEET) OVERALL LENGTH



DRIVER (POSITION 0)

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

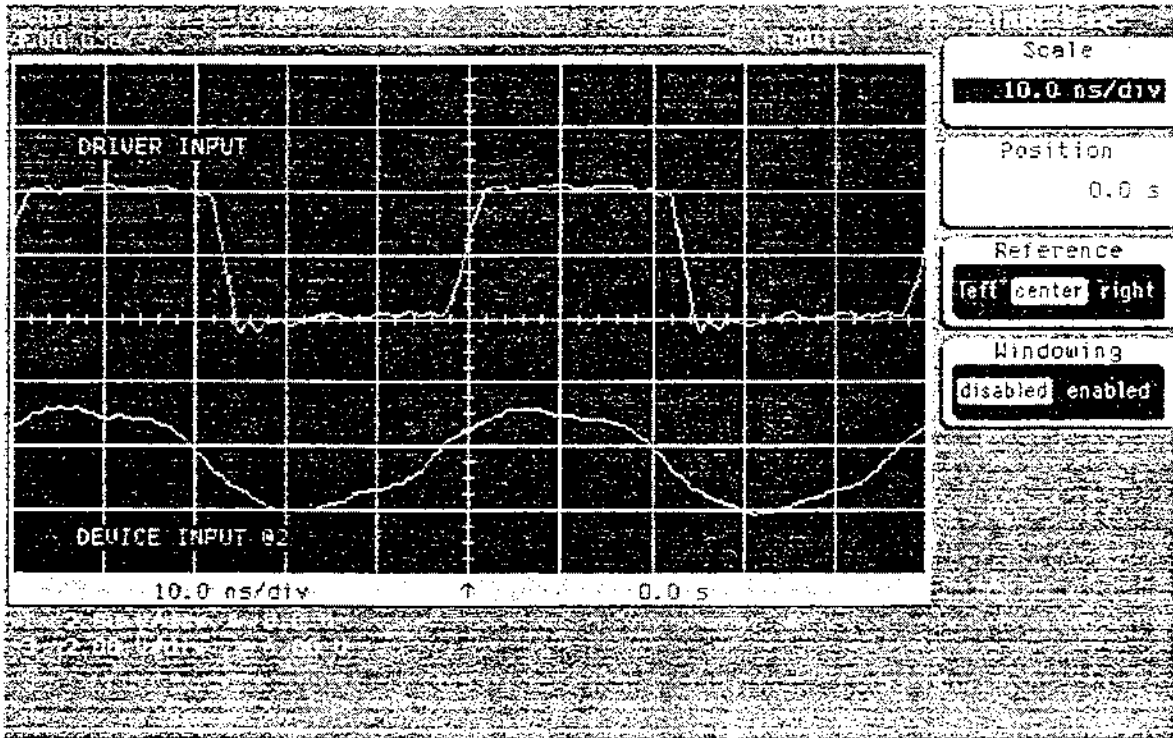
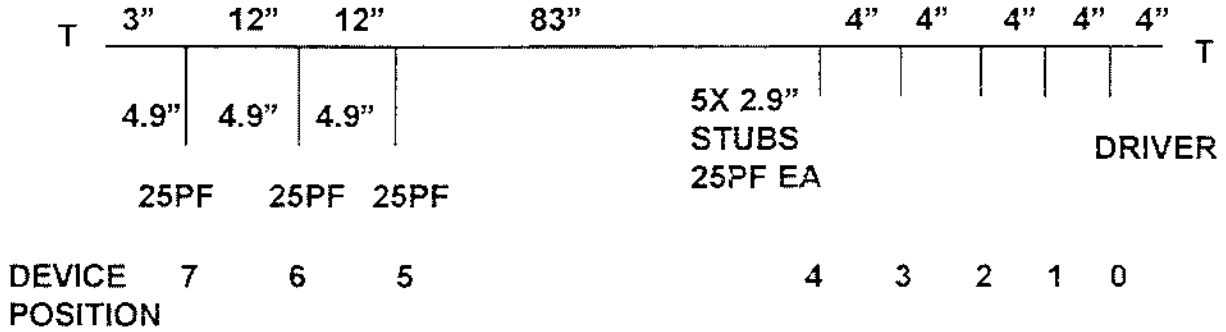


DEVICE POSITION 1

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

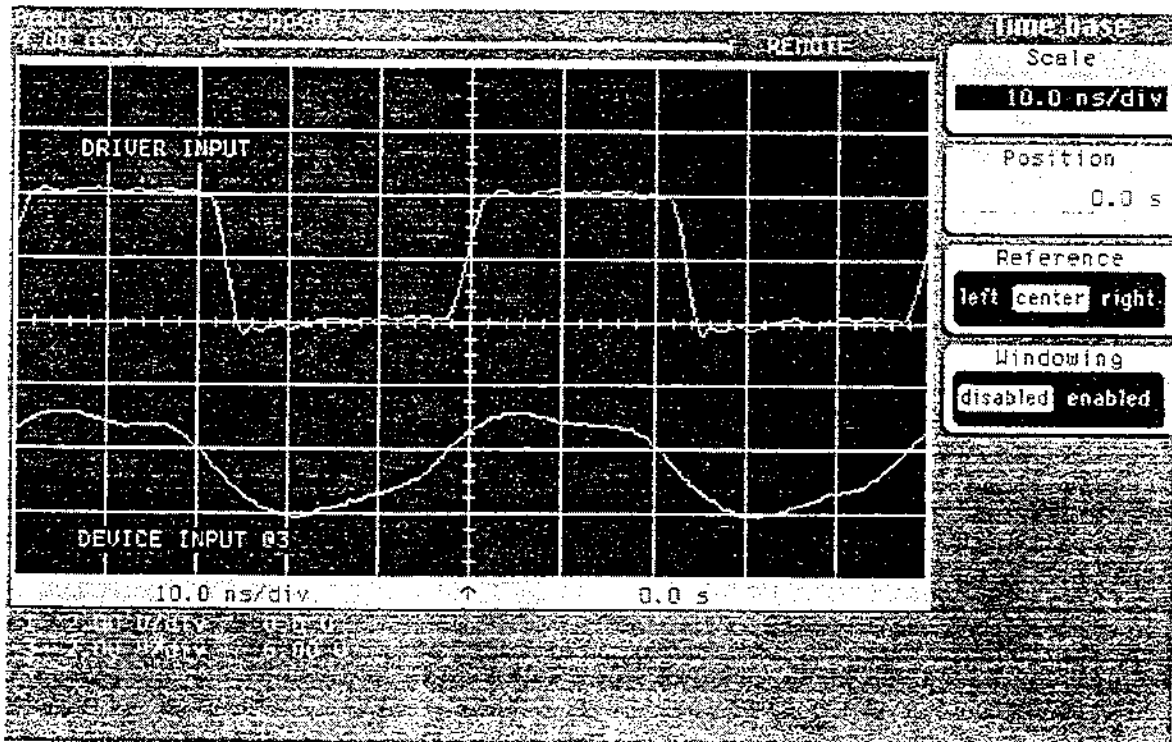
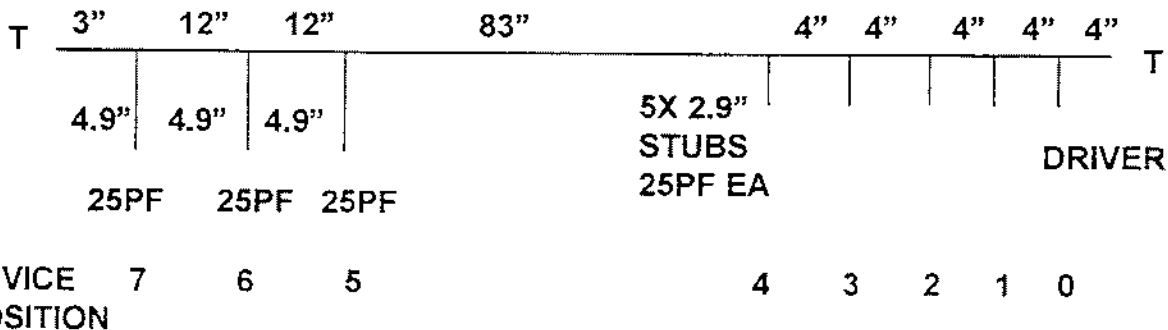
3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 2

FAST 360 SINGLE ENDED SCSI

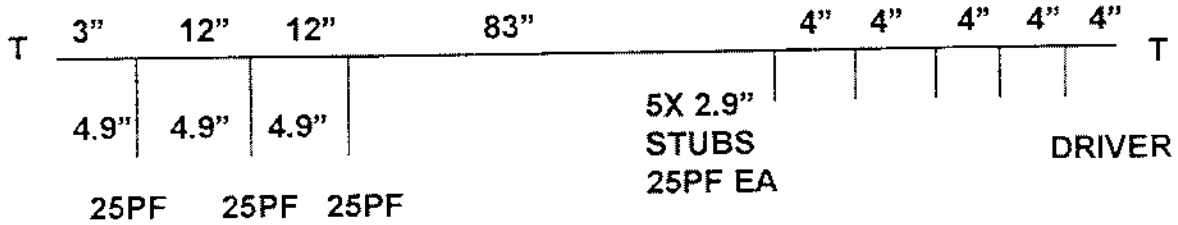
3 METERS (10 FEET) OVERALL LENGTH



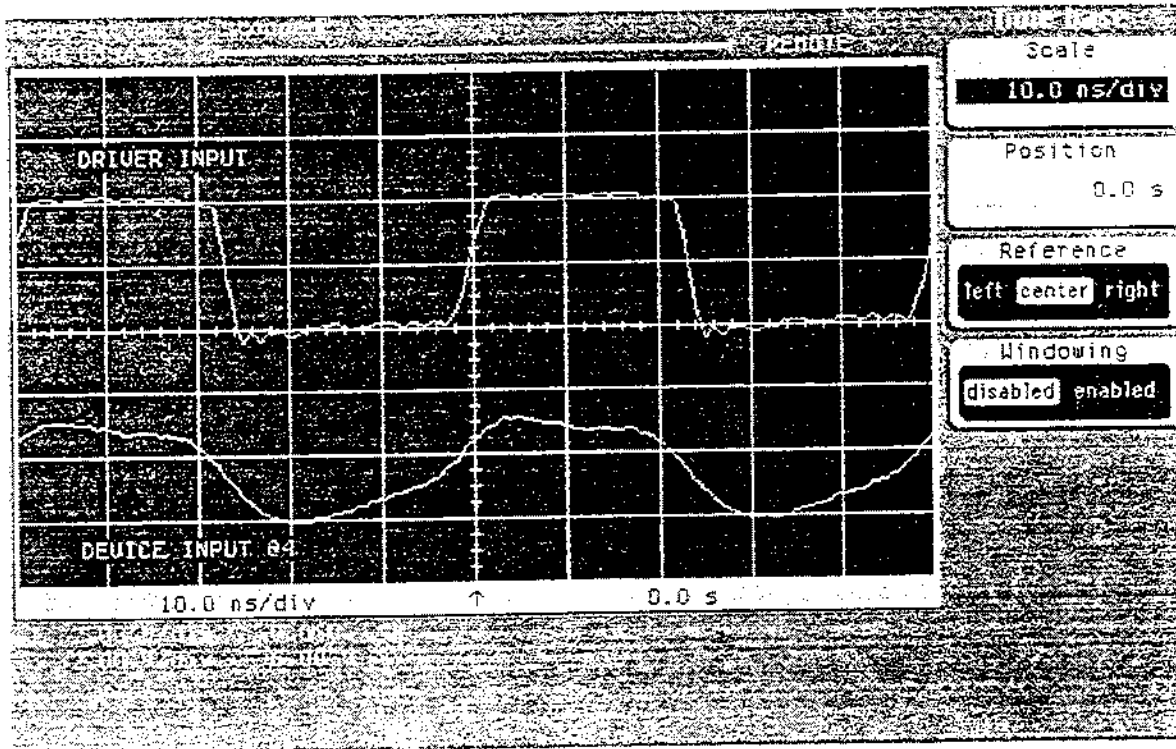
DEVICE POSITION 3

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 7 6 5 4 3 2 1 0

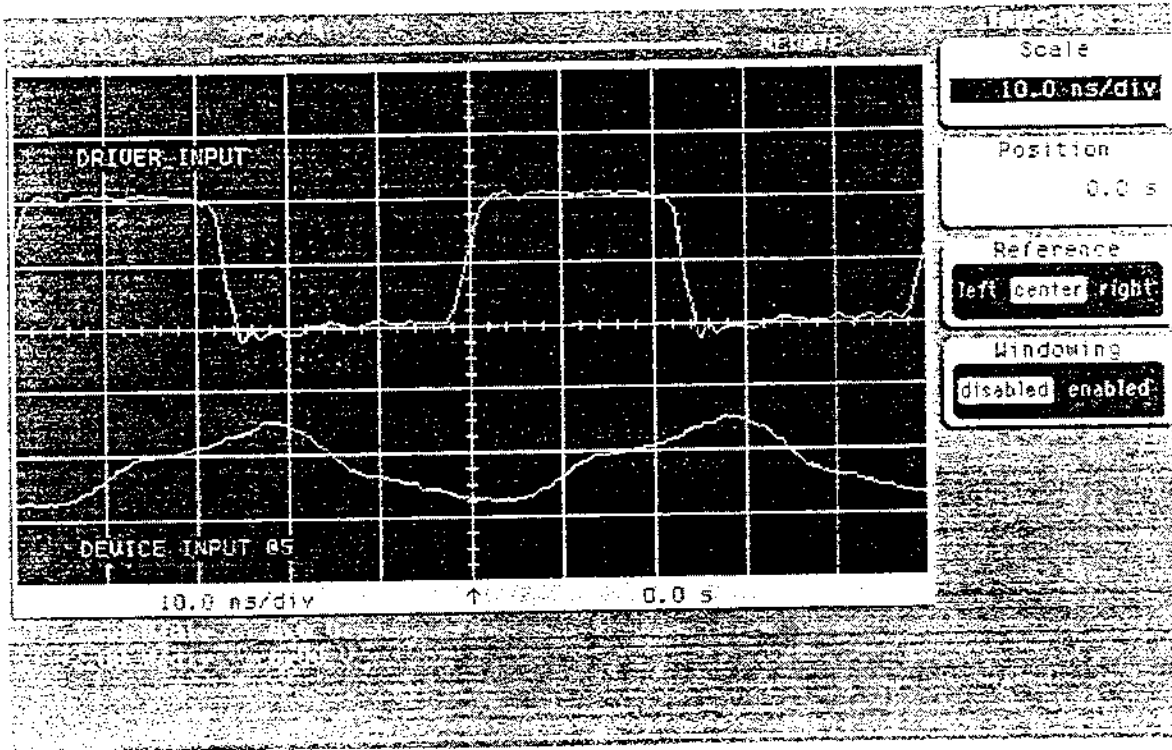
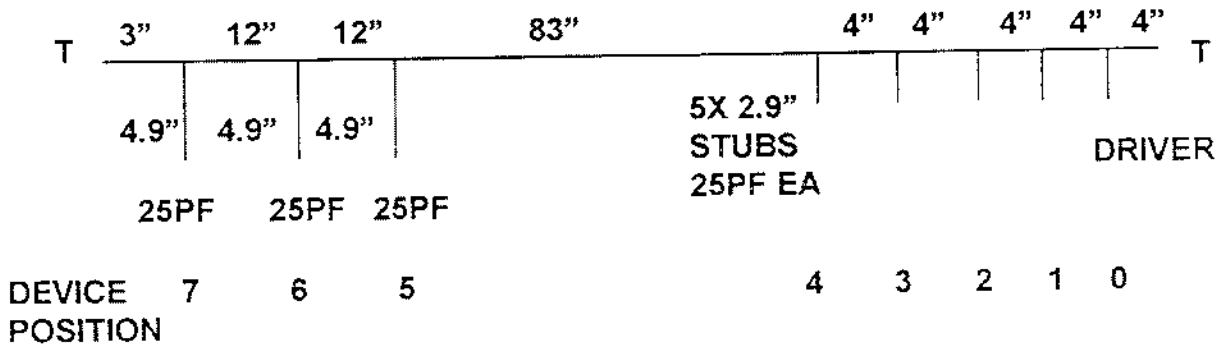


DEVICE POSITION 4

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

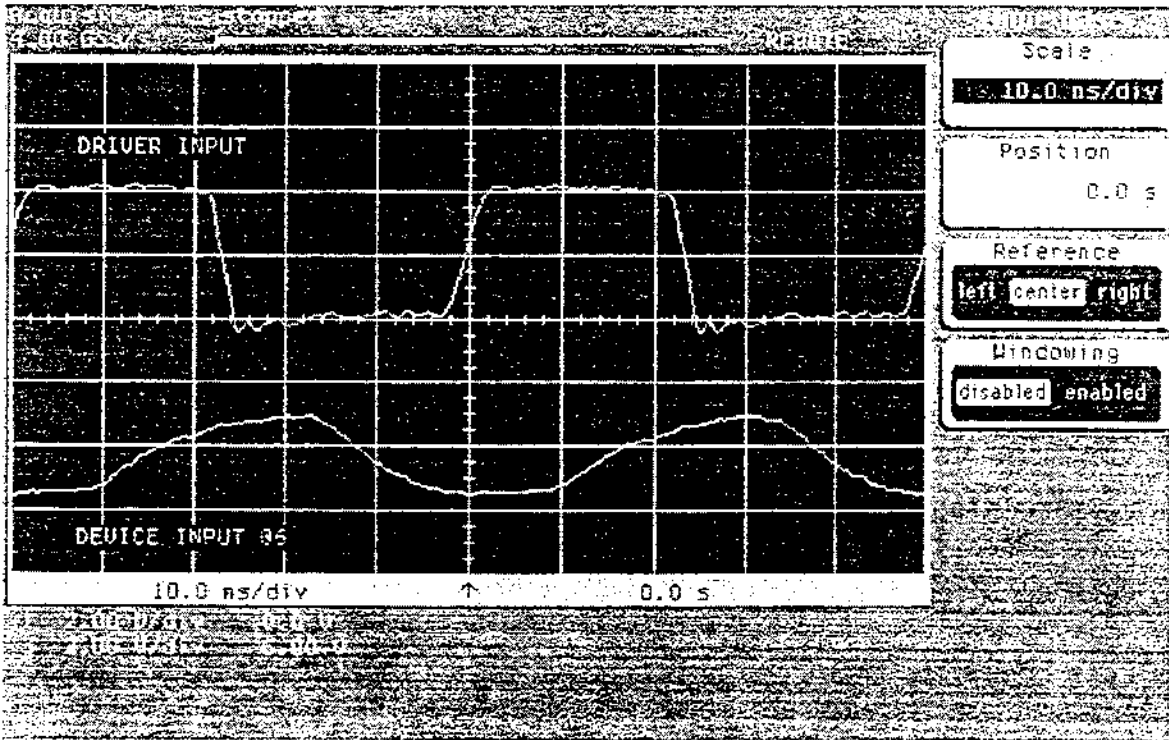
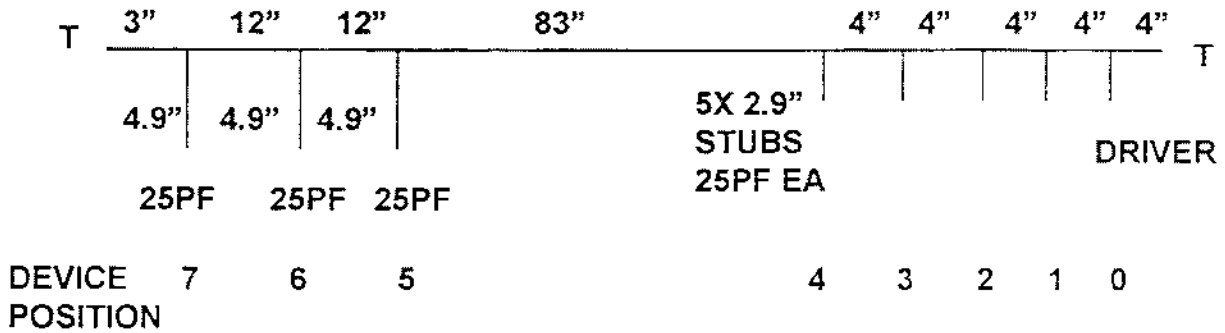
3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 5

FAST 360 SINGLE ENDED SCSI

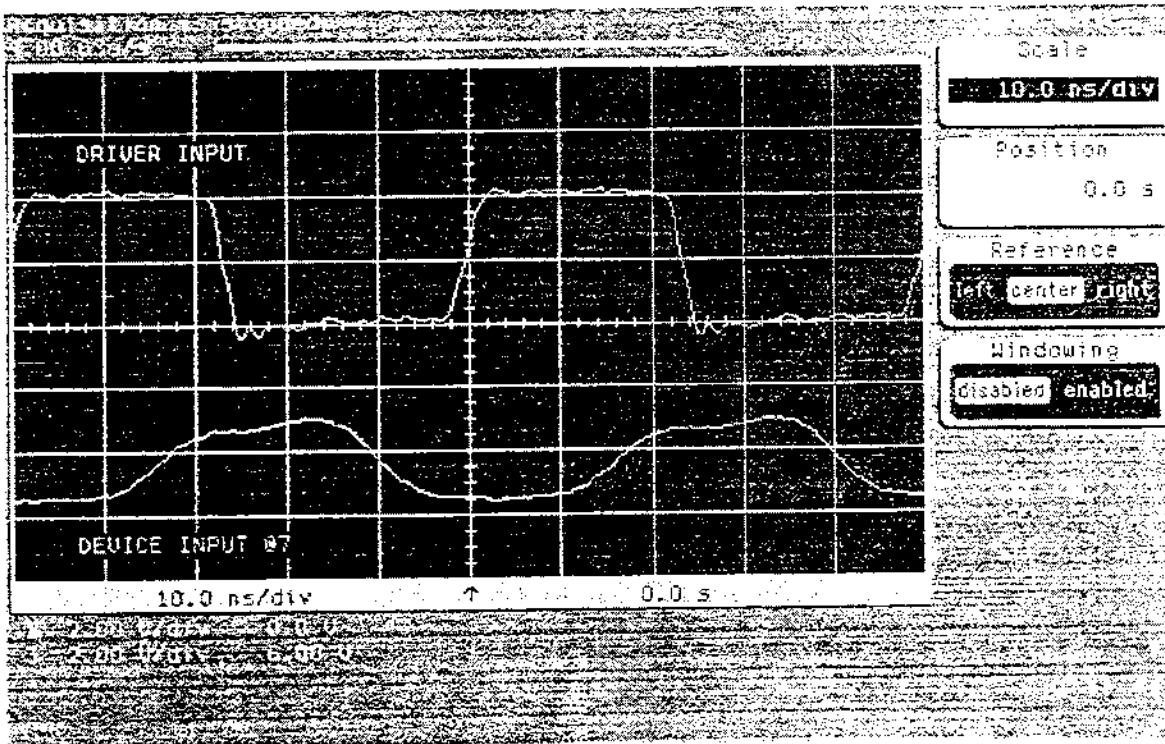
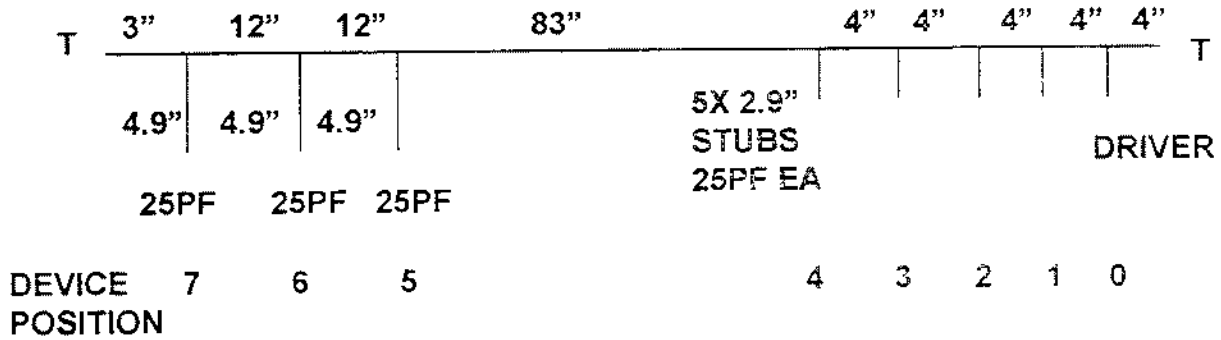
3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 6

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

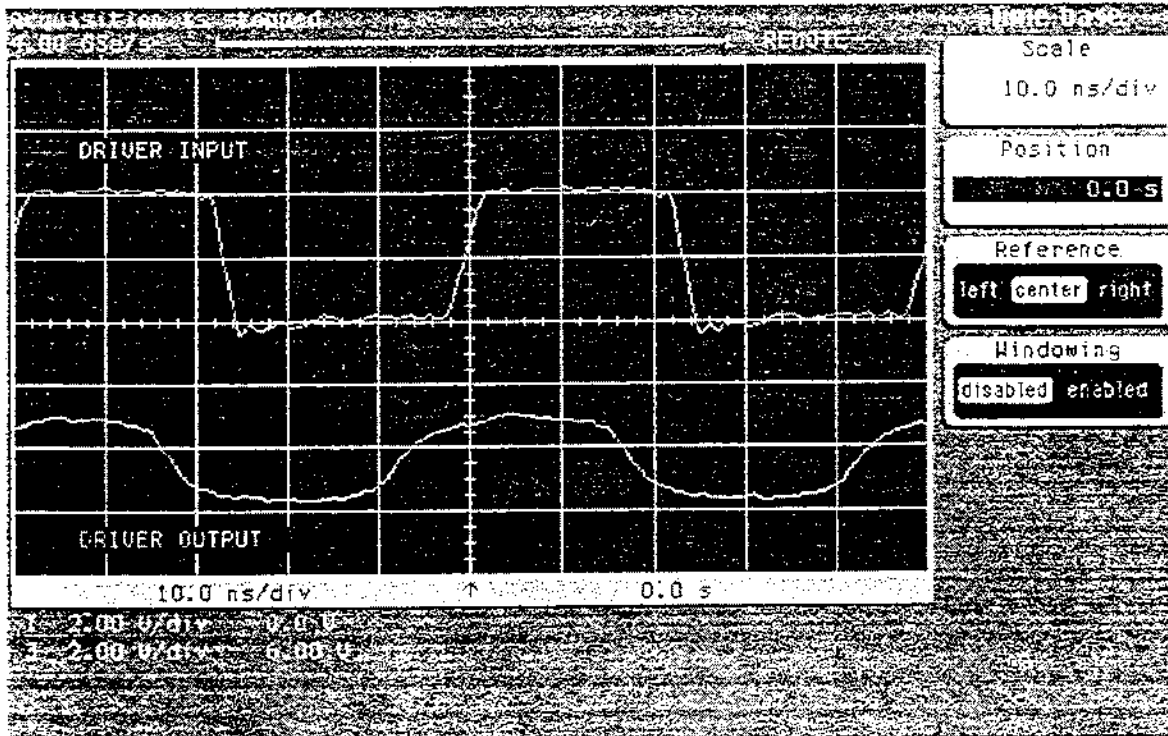
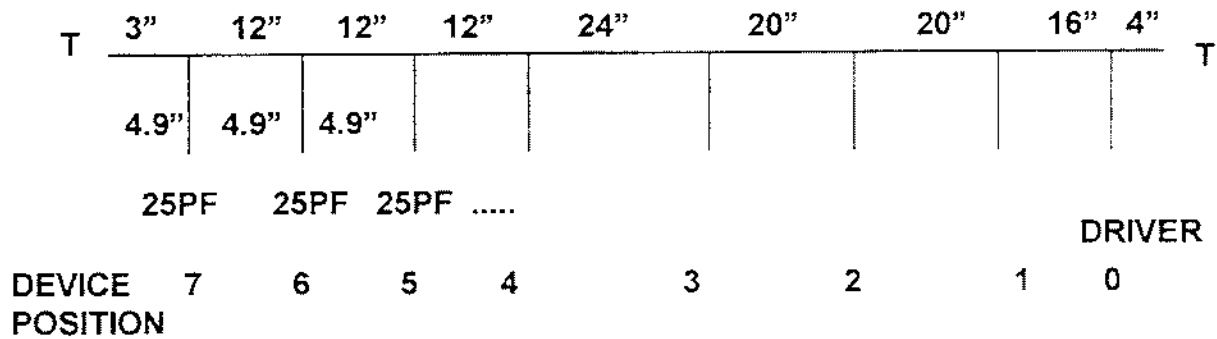


DEVICE POSITION 7

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

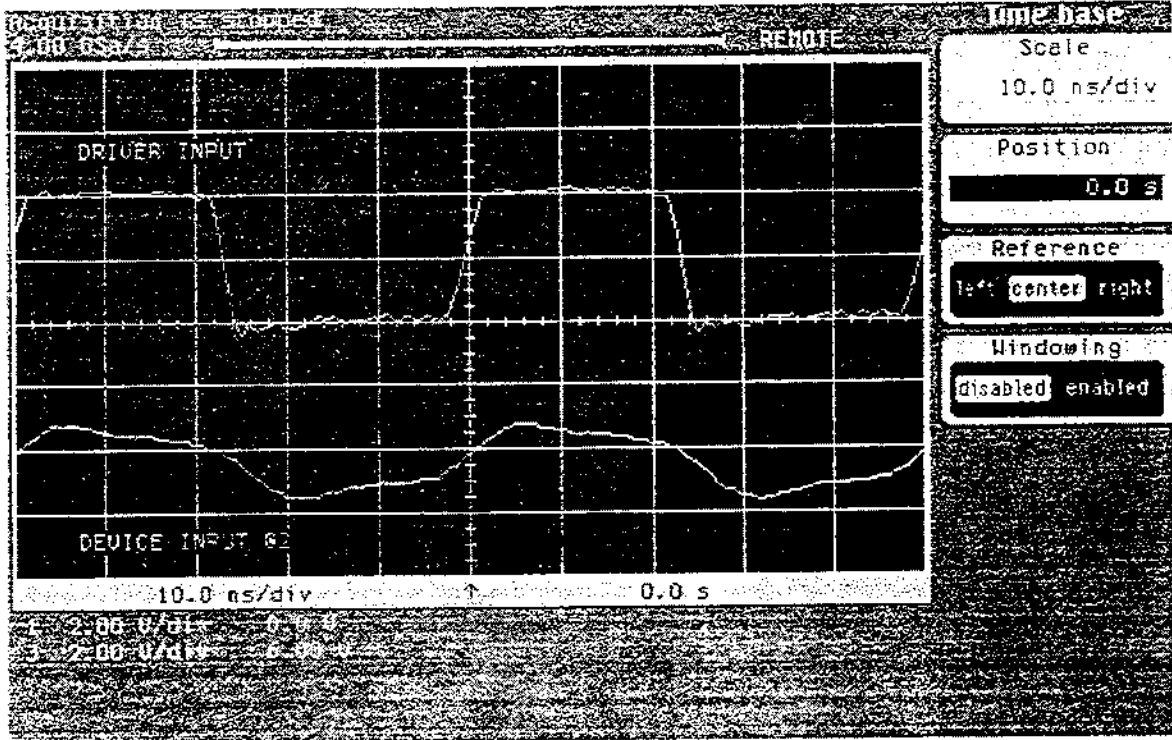
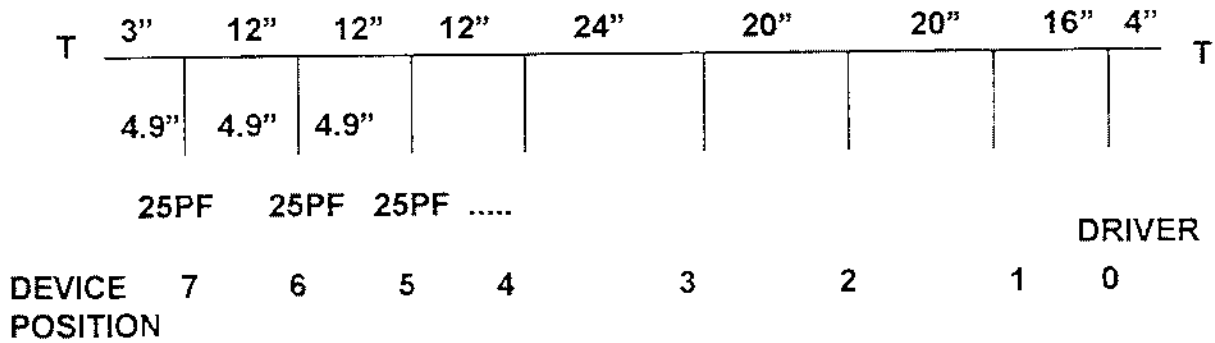


DEVICE POSITION 0 (DRIVER)

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

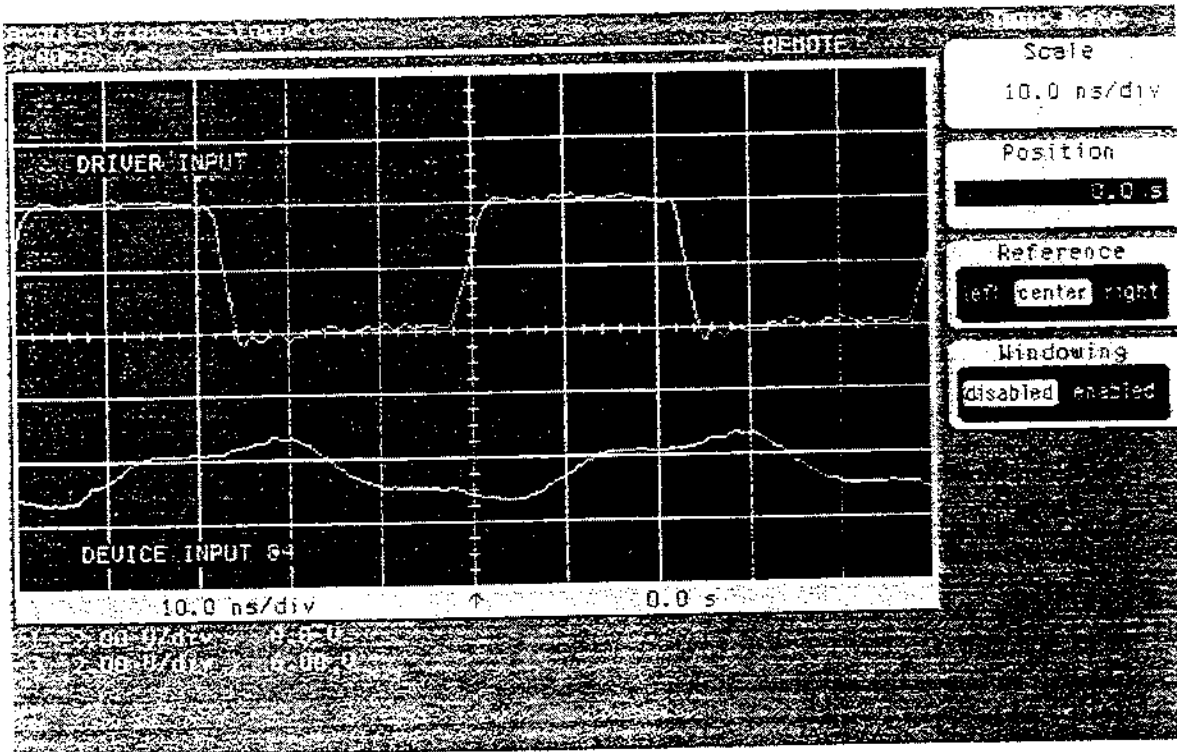
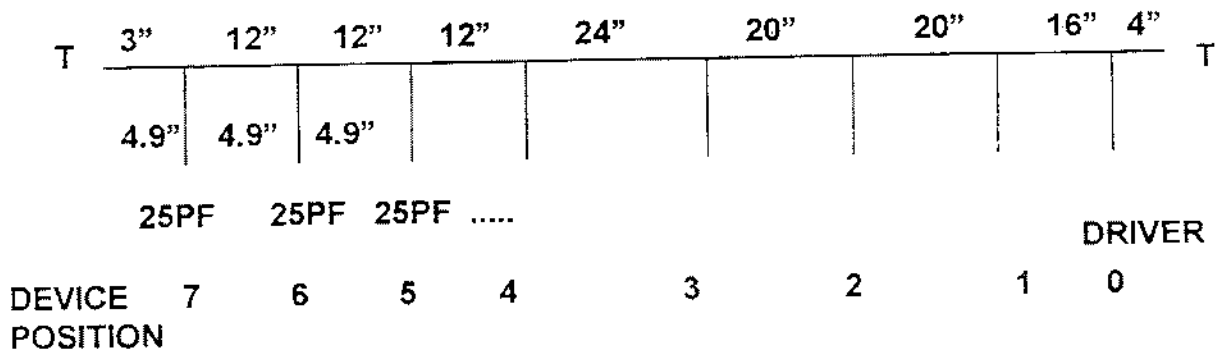


DEVICE POSITION 2

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

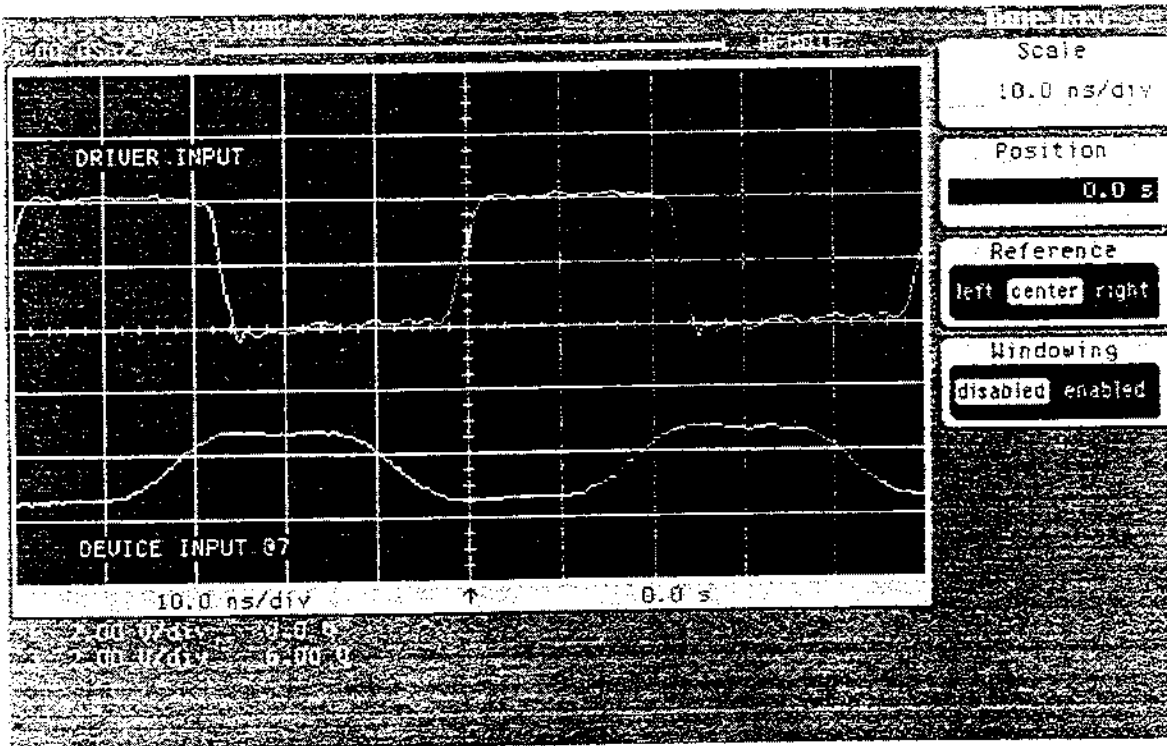
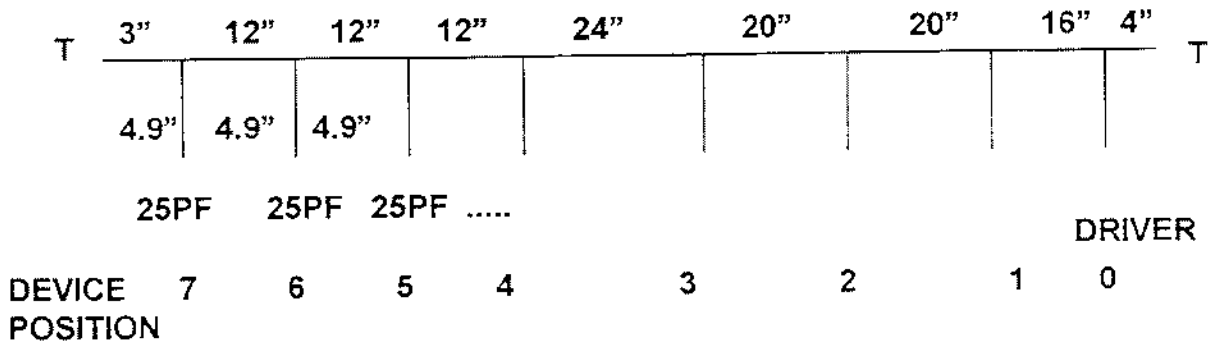


DEVICE POSITION 4

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

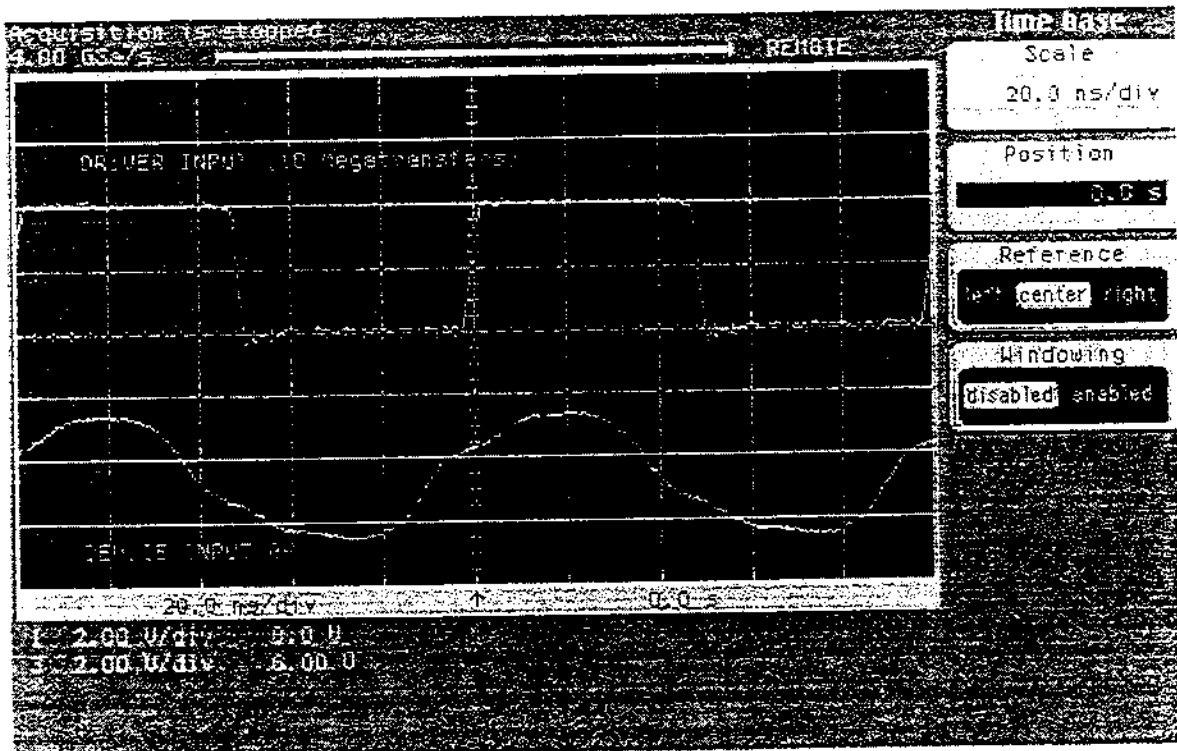
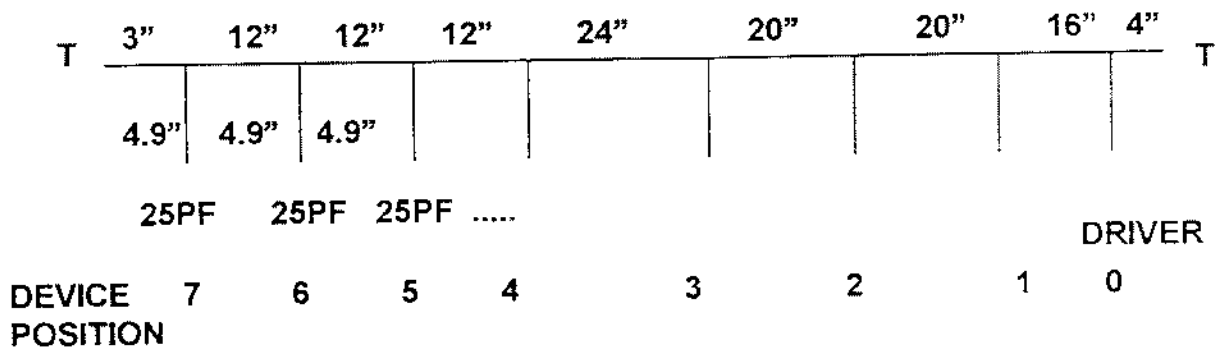
3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 7

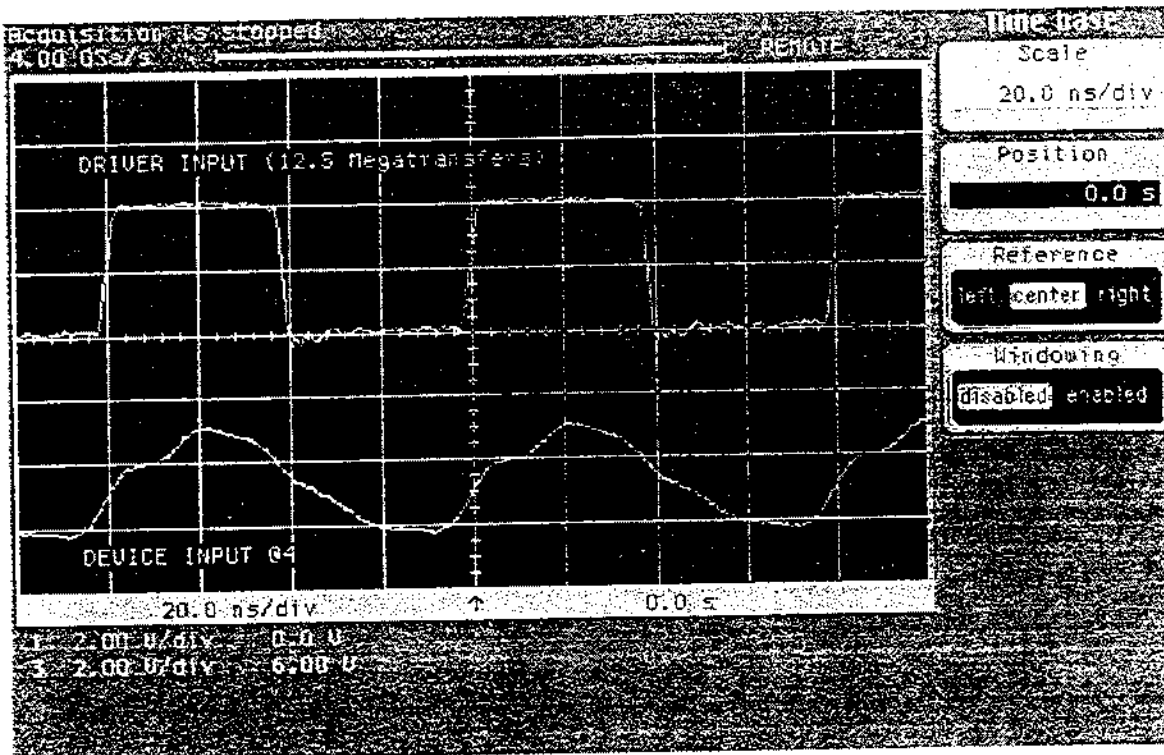
FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

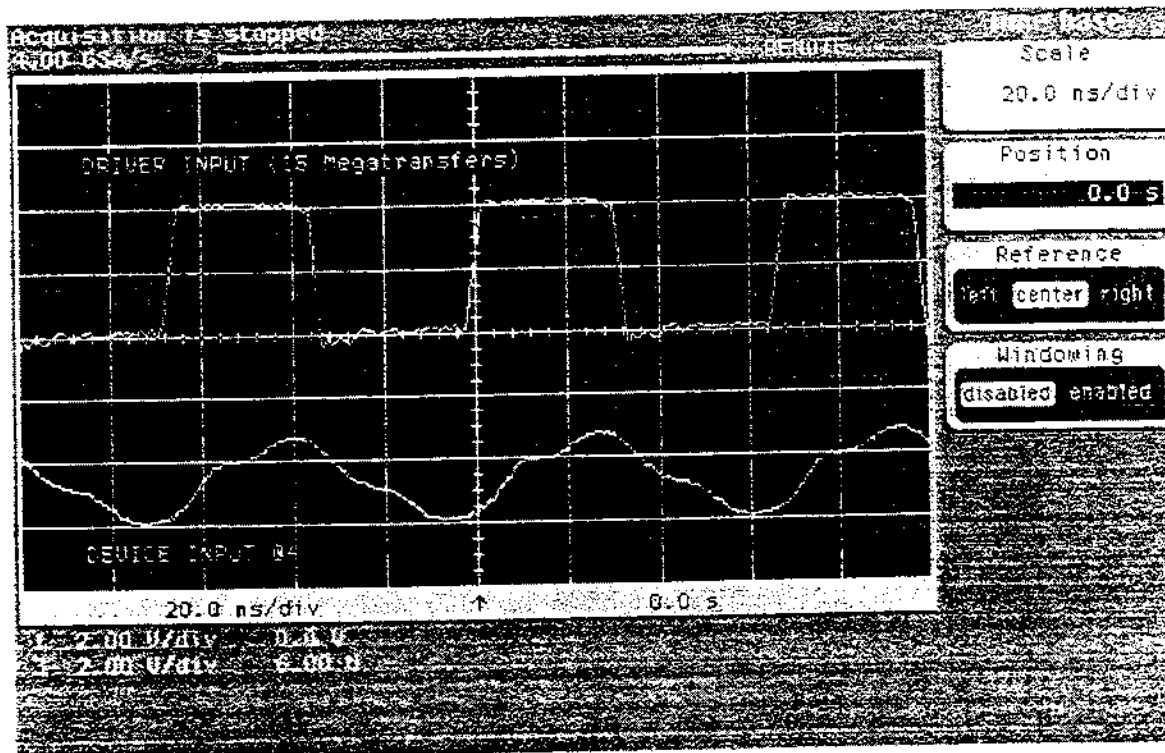


DEVICE POSITION 4 10 MEGATRANSFERS/SEC

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

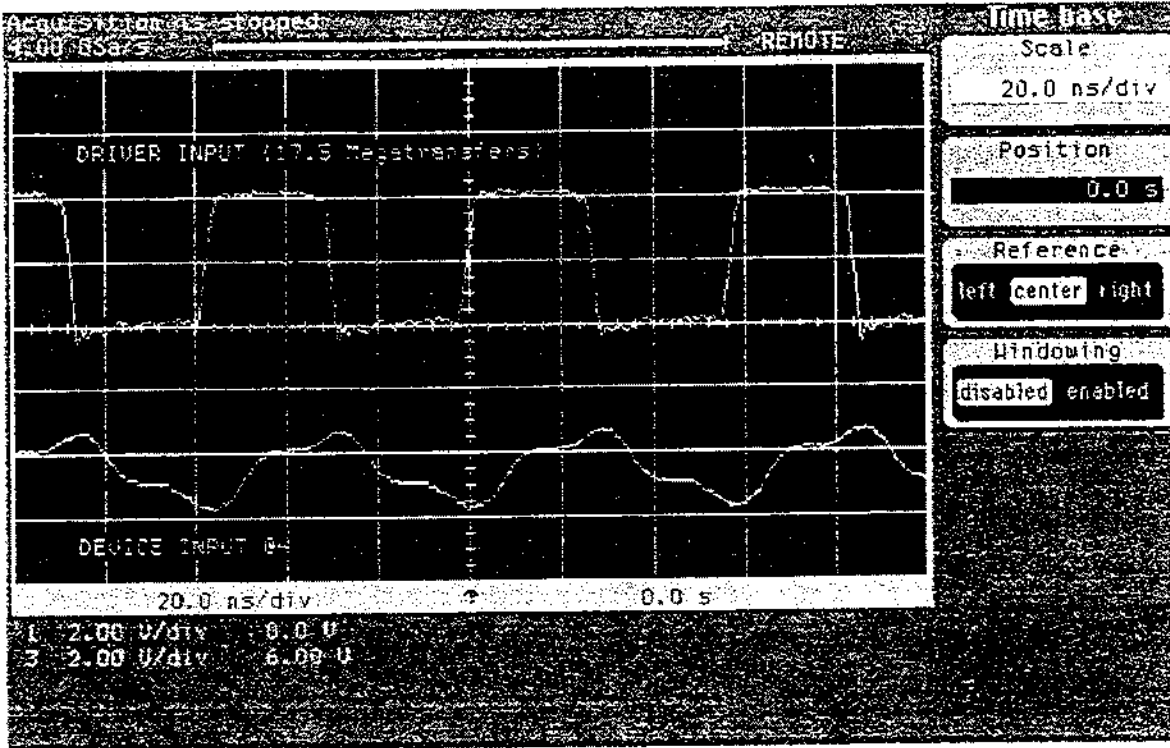


DEVICE POSITION 4 12.5 MEGATRANSFERS/SEC

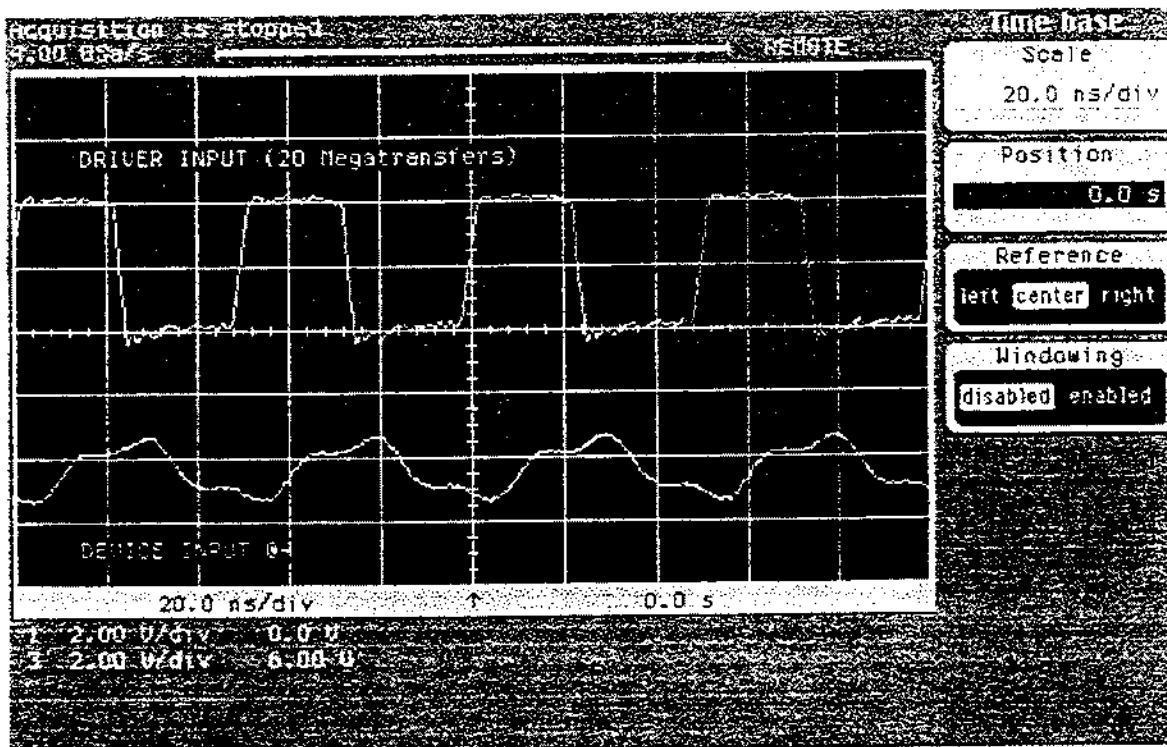


DEVICE POSITION 4 15 MEGATRANSFERS/SEC

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994



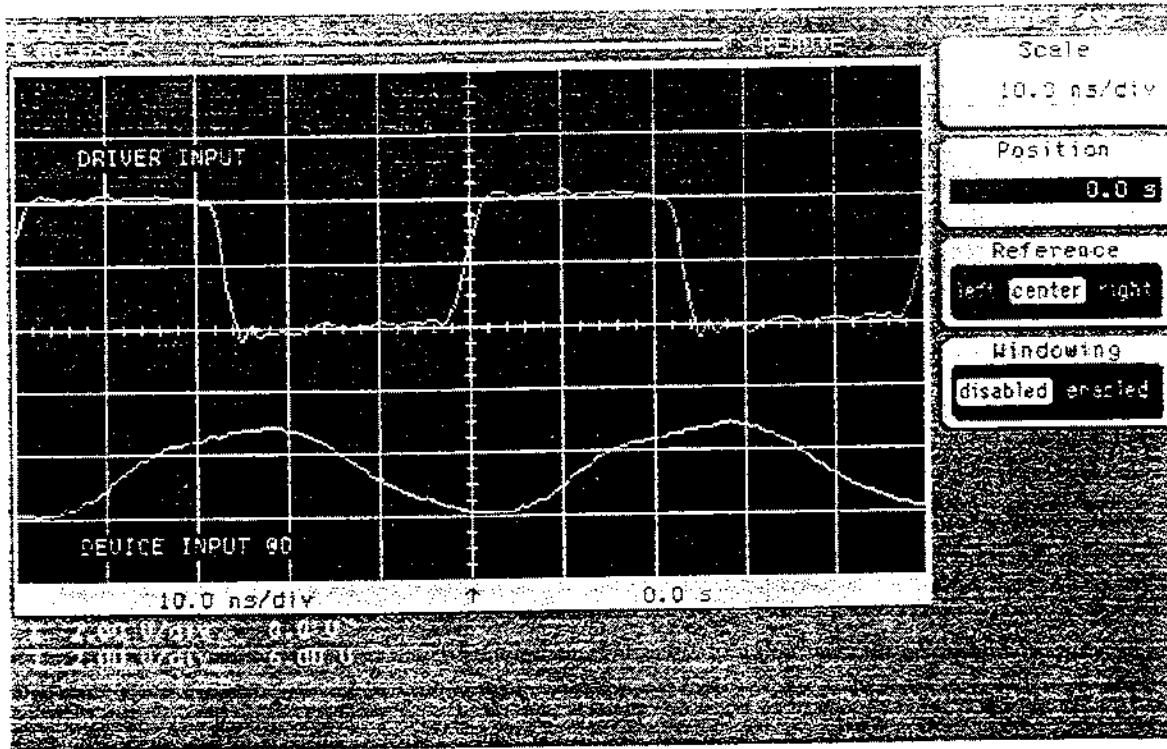
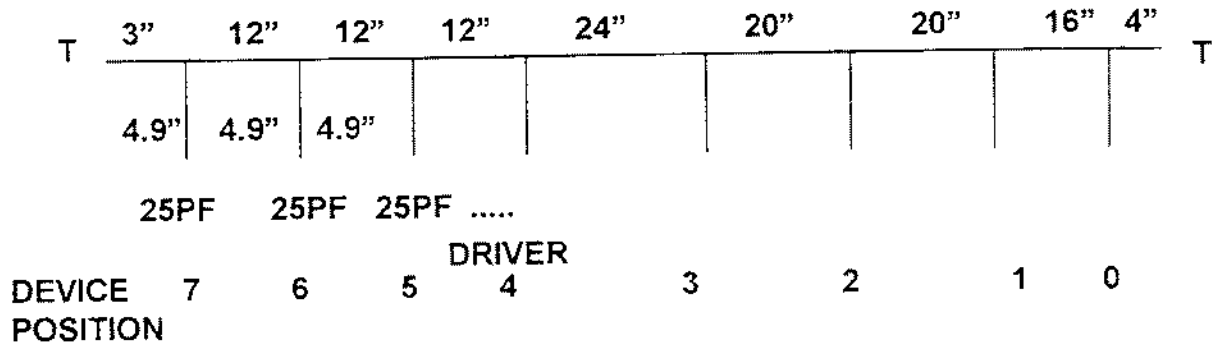
DEVICE POSITION 4 17.5 MEGATRANSFERS/SEC



DEVICE POSITION 4 20 MEGATRANSFERS/SEC

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

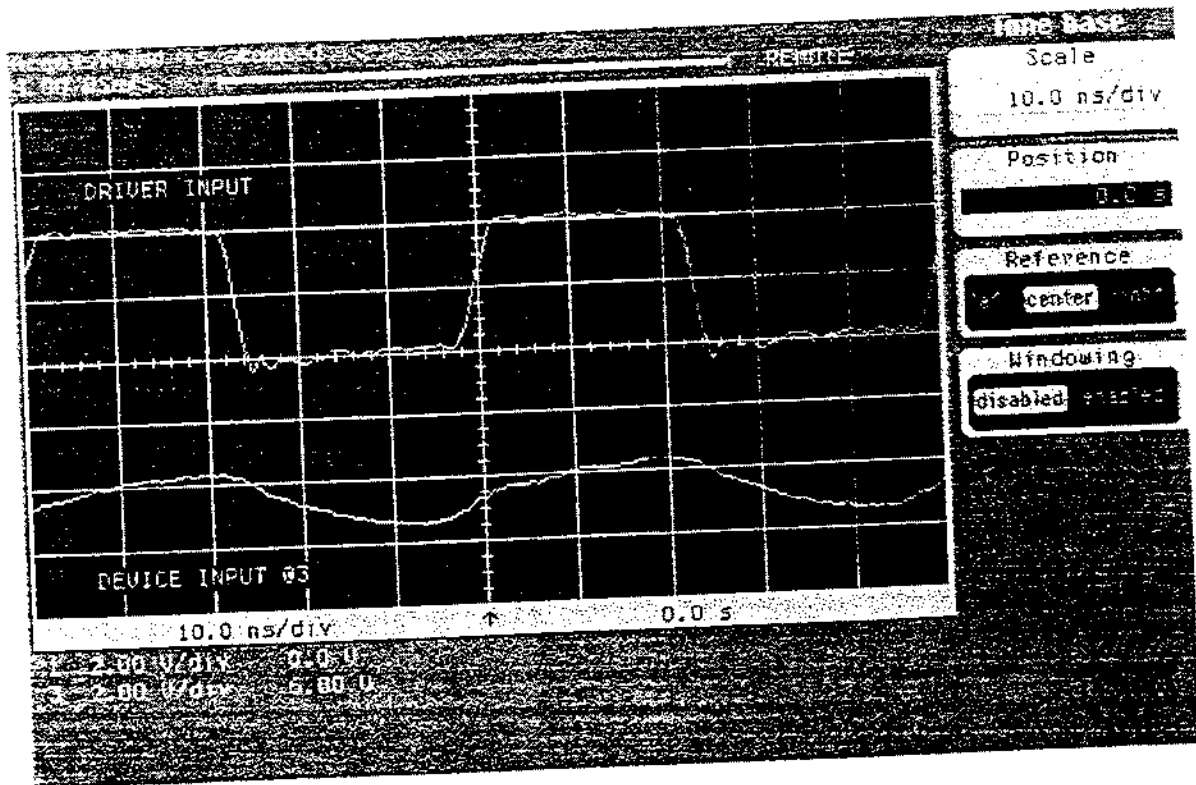
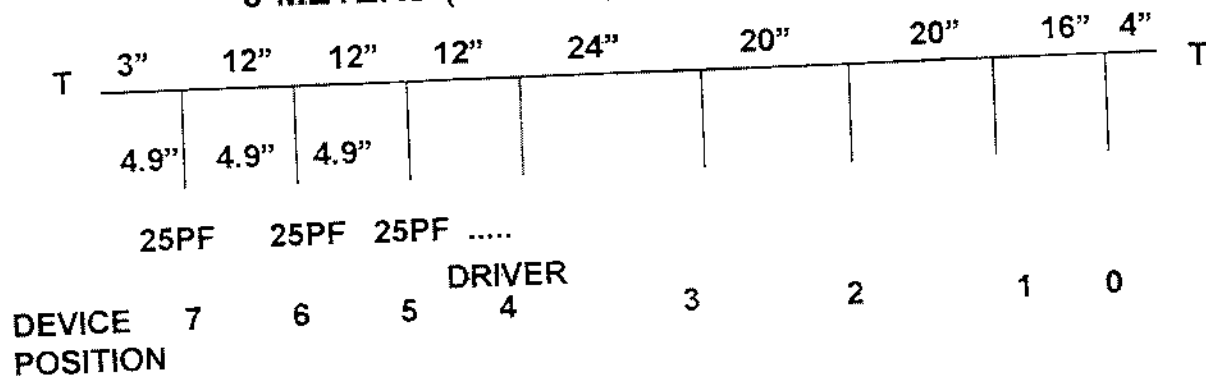


DEVICE POSITION 0

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

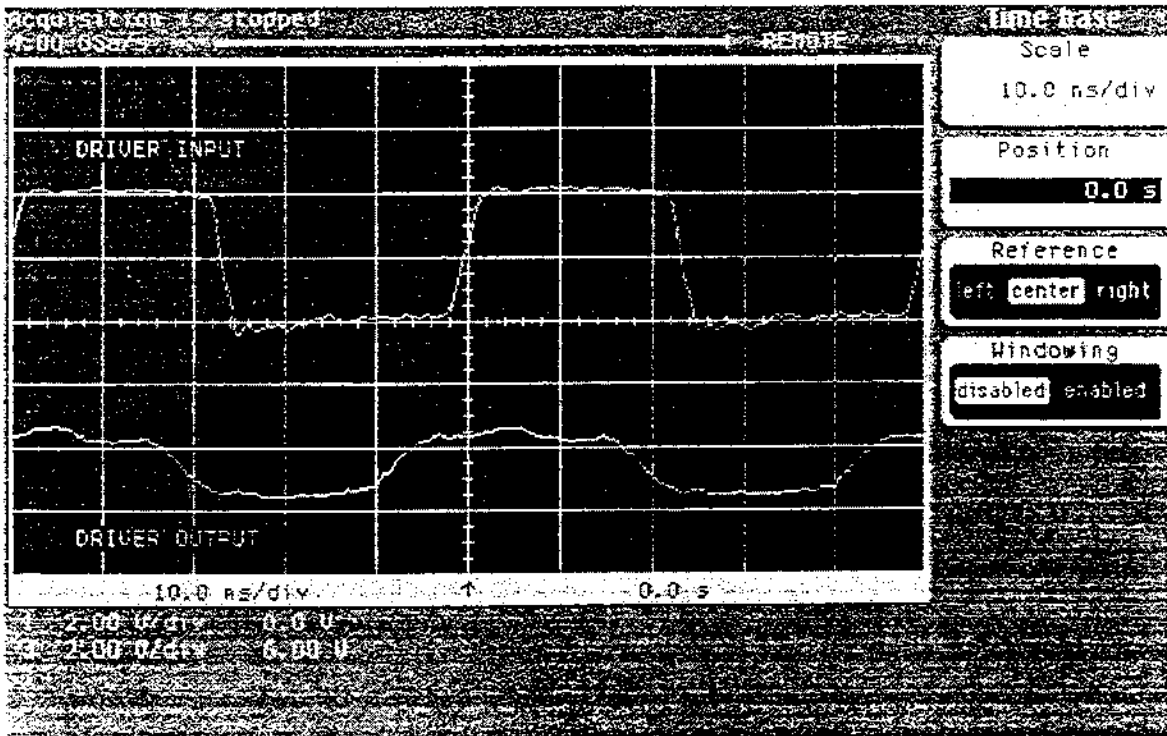
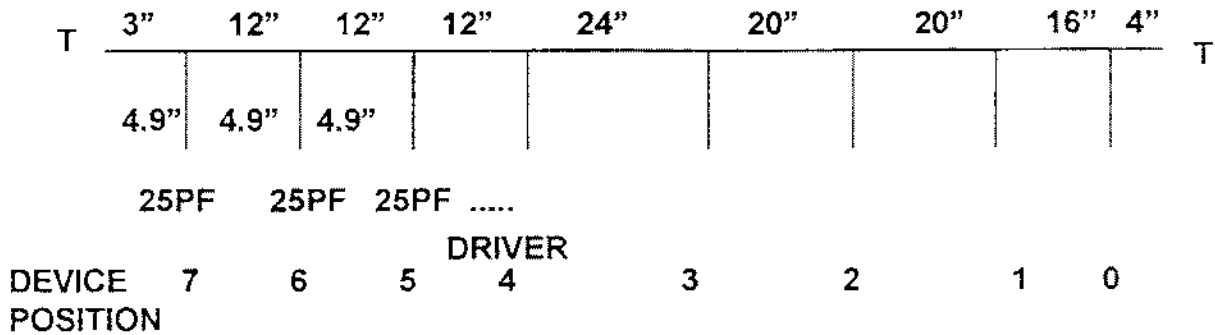


DEVICE POSITION 3

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH

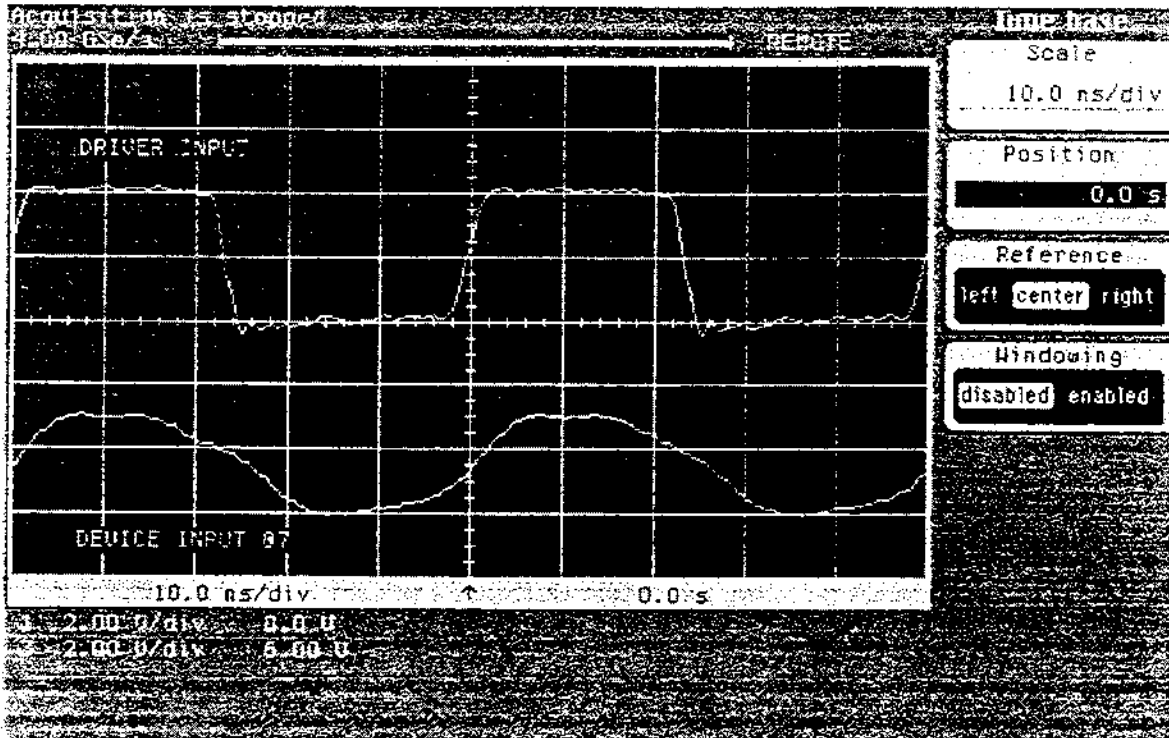
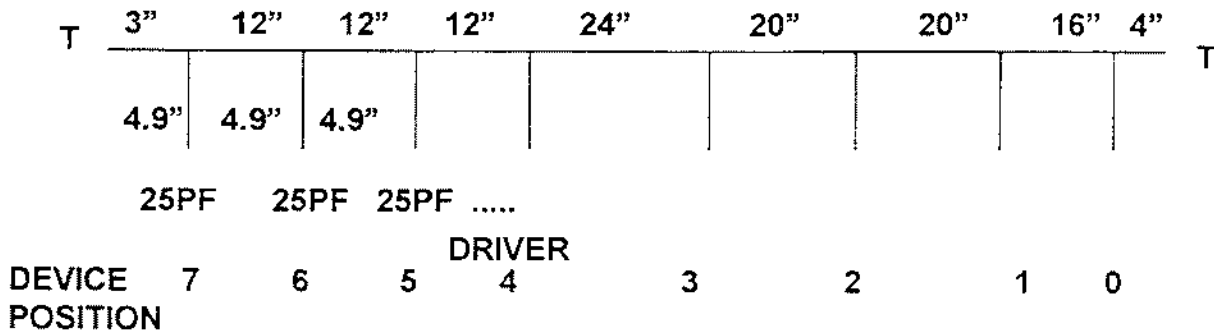


DEVICE POSITION 4 (DRIVER)

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

FAST 360 SINGLE ENDED SCSI

3 METERS (10 FEET) OVERALL LENGTH



DEVICE POSITION 7

BILL HAM DIGITAL EQUIPMENT SCSI WORKING GROUP MAY 18, 1994

400