CLAS-NOTE # 95-015

BENCH TEST RESULTS OF THE PROTOTYPE SIGNAL TRANSLATOR BOARD (STB) FOR REGION 3 DRIFT CHAMBERS OF CLAS

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A prototype STB was tested to determine a range of amplifier efficiency, the effects of charge on the electronic equipment, and the crosstalk.

INTRODUCTION

A Signal Translator Board (STB) populated with sips is an electronic board which amplifies an input signal. To determine whether the prototype board functions correctly, certain parameters must be evaluated. To get the best output signal, the input amplitude range must be found such that the output amplitude is within its minimal and maximal points. After determining this range, the gain of the system can be evaluated. After an appropriate amplitude range is determined, the effects of charge on the board can be observed by varying input pulse widths. Capacitors placed on this board should reduce such charge effects to a minimum. The level of crosstalk between adjacent channels was also determined. Crosstalk of less than 3% is acceptable.

TEST SET UP

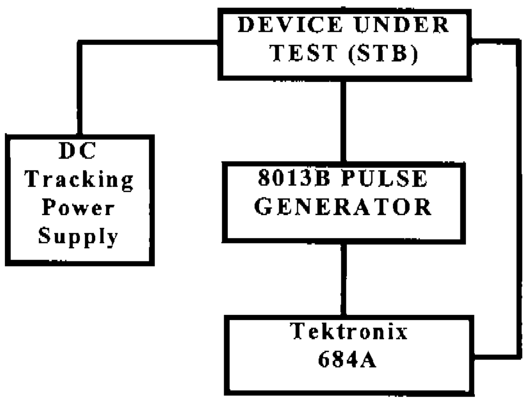

FIG. 1 STB TEST SETUP

The 8013B Pulse Generator was used to establish a constant input pulse. The Pulse Generator can be used to modify the pulse to the desired specifications. The input pulse can then be transmitted through the STB and viewed on the Tectronix 648A Oscilloscope for measurement and observation. The SIPS were powered with a DC Tracking Power Supply (FIG 1).

TEST PROCEDURE

The first test on the STB is to determine whether each channel is operational. After these results have been observed, an input amplitude range must be found which will place the output amplitude within its minimal and saturation points. This is done by evaluating the resulting output amplitudes and pulse forms for varying input amplitudes. After determining this range, gain is evaluated using
:

$$(\text{Output Value} / \text{Input Value}) = \text{Gain}$$

The relationship between input amplitude and gain can be determined by plotting the gain values. From this information, the most efficient pulse amplitude can be determined. The effects of charge on the board can be observed by using the 8013B Pulse Generator to vary input pulse widths. A significant change in the output pulse width would represent an unacceptable levels of influence. Capacitors already placed on the board should reduce these effects to a minimum. Crosstalk can be evaluated by determining the gain between the output amplitude of a pulsed channel of a short trace (C2C6) and a long trace (C2C9) and the amplitudes of crosstalk measured simultaneously in the four most adjacent channels of each.

DATA

Channel #	Input Amp. (mV)	Output Amp. (mV)	Gain
C2C1	10.1	65.6	6.5
C2C2	10.4	65.6	6.3
C2C3	10.5	71.6	6.8
C2C4	10.2	72.8	7.1
C2C5	10.0	73.2	7.3
C2C6	9.9	64.4	6.5
C2C7			
C2C8	10.4	60.0	5.8
C2C9	10.4	38.4	3.7
C2C10	10.4	73.6	7.1
C2C11	10.1	74.8	7.4
C2C12	9.7	93.6	9.6
C2C13	10.2	58.0	5.7
C2C14	10.4	56.4	5.4
C2C15	10.5	43.6	4.2
C2C16	10.3	74.4	7.2

TABLE 1. AMPLITUDE GAIN AT INPUT AMP. 10 mV

Channel #	Input Amp. (mV)	Output Amp. (mV)	Gain
C2C1	20.3	131.2	6.5
C2C2	20.3	128.0	6.3
C2C3	20.4	136.8	6.7
C2C4	20.3	142.0	7.0
C2C5	18.2	166.0	9.1
C2C6	17.6	110.0	6.3
C2C7			
C2C8	17.5	124.0	7.1
C2C9	18.4	82.0	4.5
C2C10	18.0	118.0	6.6
C2C11	17.5	104.0	5.9
C2C12	17.3	136.0	7.9
C2C13	18.1	142.0	7.8
C2C14	18.2	192.0	10.5
C2C15	18.3	98.0	5.4
C2C16	18.1	138.0	7.6

TABLE 2. AMPLITUDE GAIN AT INPUT AMP. 20 mV

Channel #	**Input Amp. (mV)**	**Output Amp. (mV)**	**Gain**
C2C1	31.2	230.0	7.4
C2C2	31.0	240.0	7.7
C2C3	31.0	326.0	10.5
C2C4	31.0	246.0	7.9
C2C5	31.0	226.0	7.3
C2C6	31.0	240.0	7.7
C2C7			
C2C8	31.0	252.0	8.1
C2C9	31.0	140.0	4.5
C2C10	31.0	332.0	10.7
C2C11	31.0	238.0	7.7
C2C12	31.0	238.0	7.7
C2C13	31.0	234.0	7.5
C2C14	31.0	334.0	10.8
C2C15	31.0	164.0	5.3
C2C16	31.0	244.0	7.9

TABLE 3. AMPLITUDE GAIN AT INPUT AMP. 30 mV

Channel #	**Input Amp. (mV)**	**Output Amp. (mV)**	**Gain**
C2C1	41.0	264.0	6.4
C2C2	41.0	272.0	6.6
C2C3	41.0	280.0	6.8
C2C4	41.0	344.0	8.4
C2C5	41.0	254.0	6.2
C2C6	41.0	264.0	6.4
C2C7			
C2C8	41.0	358.0	8.7
C2C9	41.0	190.0	4.6
C2C10	41.0	364.0	8.9
C2C11	41.0	364.0	8.9
C2C12	41.0	288.0	7.0
C2C13	41.0	358.0	8.7
C2C14	41.0	292.0	7.1
C2C15	41.0	172.0	4.2
C2C16	41.0	366.0	8.9

TABLE 4. AMPLITUDE GAIN AT INPUT AMP. 40 mV

CHANNEL#	INPUT PW (ns)	OUTPUT PW (ns)	INPUT PW (ns)	OUTPUT PW (ns)	INPUT PW (ns)	OUTPUT PW (ns)	INPUT PW (ns)	OUTPUT PW (ns)
C2C1	100	101	200	200	300	300	400	400
C2C2	100	101	200	195	300	305	400	397
C2C3	100	104	200	200	300	300	400	405
C2C4	100	103	200	196	300	303	400	402
C2C5	100	104	200	200	300	304	400	407
C2C6	100	104	200	200	300	302	400	409
C2C7	100		200		300		400	
C2C8	100	102	200	202	300	302	400	402
C2C9	100	105	200	200	300	309	400	406
C2C10	100	104	200	200	300	304	400	399
C2C11	100	104	200	203	300	300	400	393
C2C12	100	103	200	210	300	302	400	400
C2C13	100	103	200	200	300	295	400	401
C2C14	100	104	200	200	300	304	400	406
C2C15	100	101	200	202	300	300	400	406
C2C16	100	102	200	200	300	304	400	399

TABLE 5. INPUT PULSE WIDTHS V. OUTPUT PULSE WIDTHS

CHANNEL #	INPUT AMP (mV)	PW 100 ns OUTPUT AMP (mV)	PW 200 ns OUTPUT AMP (mV)	PW 300 ns OUTPUT AMP (mV)	PW 400 ns OUTPUT AMP (mV)
C2C1	100	336	332	330	332
C2C2	100	320	320	322	324
C2C3	100	338	340	342	340
C2C4	100	334	332	336	330
C2C5	100	302	324	332	330
C2C6	100	338	338	336	336
C2C7	100				
C2C8	100	332	336	334	332
C2C9	100	326	322	326	322
C2C10	100	336	334	336	338
C2C11	100	338	336	338	347
C2C12	100	334	336	338	334
C2C13	100	330	331	331	330
C2C14	100	334	334	334	334
C2C15	100	212	212	206	206
C2C16	100	330	336	334	336

TABLE 6. INPUT PULSE WIDTHS V. OUTPUT AMPLITUDES

Channel #	C2C4	C2C5	C2C6	C2C7	C2C8
+ Amp. (mV)	0.595	0.540		0.670	1.78
-- Amp. (mV)	0.530	0.500	163	0.720	1.52
Average (mV)	0.563	0.520		0.695	1.65
Crosstalk	0.345	0.319		0.426	1.01
Channel #	C2C7	C2C8	C2C9	C2C10	C2C11
+ Amp. (mV)	0.328	0.690		0.575	0.470
-- Amp. (mV)	0.355	0.720	200	0.680	0.500
Average (mV)	0.342	0.705		0.628	0.485
Crosstalk	0.171	0.353		0.314	0.243

TABLE 7. CROSSTALK DATA

DATA ANALYSIS

An initial reading of output signals from the board shows that all channels are functional with the exception of channel C2C7. From the data collected at varying amplitudes (TABLES 1-4) a range between 10mV and 60 mV can be identified as the optimum input amplitude range for the STB.

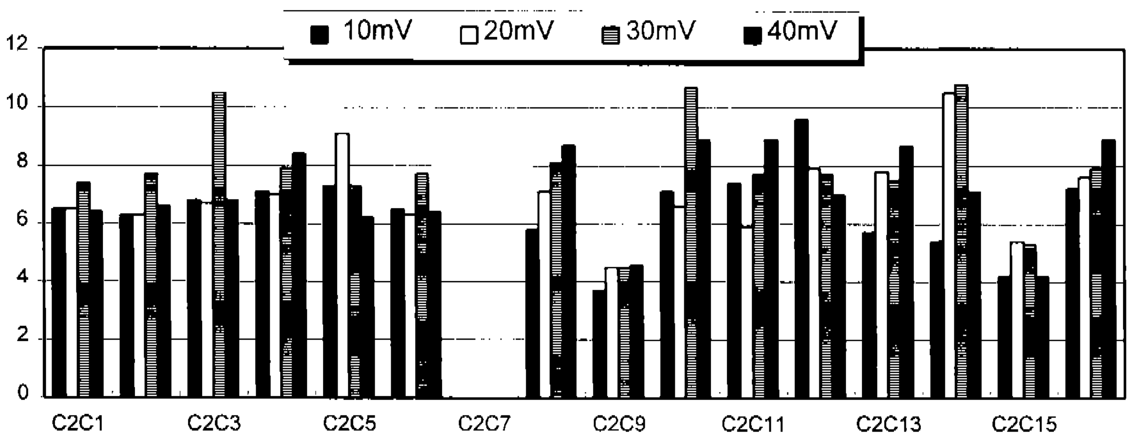

FIG. 2 PLOT OF GAIN AT VARYING AMPLITUDES

When gain is plotted (FIG. 2), the relationship between gain and amplitude can be observed. Channel C2C7 is not functioning correctly and therefore, no output pulse is detected. With the exception of channels C2C9 and C2C15, which both have a comparatively high gain at all amplitudes, the gain values are consistent and linear. The average gain is six.

Analysis of data taken at varying pulse widths (TABLE 5) shows that the difference between the input and output pulse widths is minimal. A comparison of output amplitudes at varied pulse widths (TABLE 6) shows that there is no effect on output amplitude when the pulse width is changed. Note, the input amplitude is well above the maximal point. Therefore, the results reflect the effect of pulse width within the saturation region. The capacitors placed on the board are functioning properly and there is no significant effect of charge on the board.

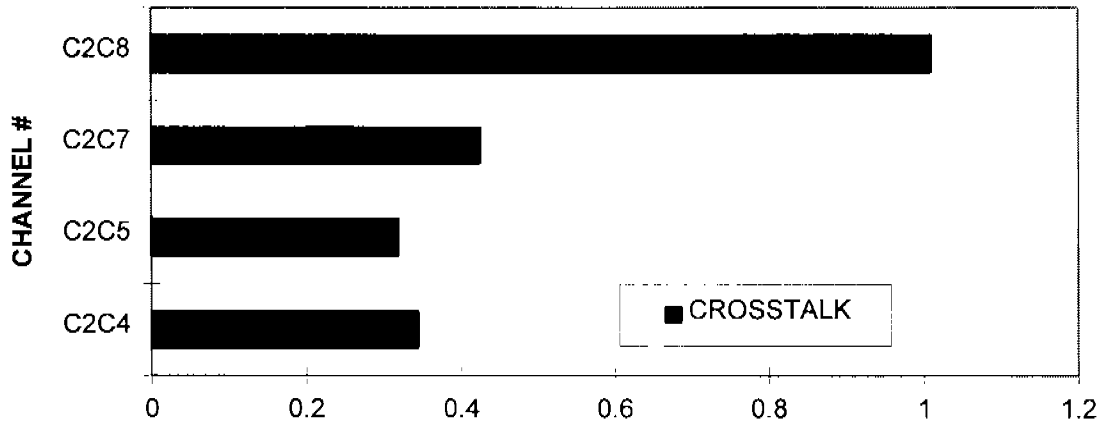

FIG.3 CROSSTALK SHORT TRACE

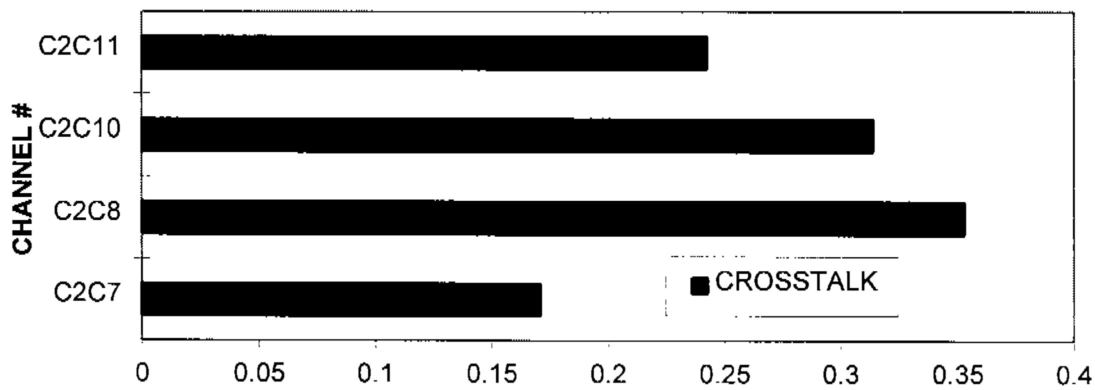

FIG.4 CROSSTALK LONG TRACE

In an STB such as the one tested, a crosstalk of 3% or lower is acceptable. From data acquired in the crosstalk sampling from both a short and long trace (FIG 3-4, TABLE 7), it is observed that there was more influence in channel C2C6, the short trace. In all cases, crosstalk gain never exceeded 1.12%.

CONCLUSION

In conclusion, with the exception of channel C2C7, the board under test functions efficiently. The most effective amplitude range lies between 10mV and 60mV. The average gain is six. The average output rise time was determined to be 8ns---- approximately the same order as the input rise time. Both charge and crosstalk were found to have minimal effects on the board.