VME64x CONNECTOR
TEST REPORT

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1. Background. There was some concerns expressed at the VITA VSO meetings that the proposed 5 row VME64 connector with single beam contacts in rows D and Z, would not perform well under shock and vibration. It was also suggested that the traditional one microsecond discontinuity was inappropriate for today's circuits and that one nanosecond be used as the limit for detecting discontinuities during shock and vibration testing. The Commercial Technology Management Branch at NSWC, Crane volunteered to undertake this testing. Harting Elektronik Inc. of North America provided samples of there har-bus 64 connectors. Harting also provided a copy of their test report No.: T-22/96 entitled: Connectors style har-bus 64, PL 2. Type Test. 1997-02-13. After reviewing the test report and consulting with Harting, Navy users, and industry sources, a test plan was developed that would supplement Harting's testing by adding environmental tests of concern to military users.

2. Tests performed. Paragraphs 2.1 through 2.9 provide a brief description of the tests performed and applicable test conditions. Crane focused on areas of concern to military users that are not required by IEC 603.2 used to specify the standard 96 pin VME connectors. The tests that were performed were shock, thermal and mechanical, and salt fog tests. Vibration tests were done as part of the investigation on determining if the maximum duration of the discontinuity should be changed to one (1) nanosecond from the currently specified one (1) microsecond. Tests of paragraph 2.6, 2.7 and 2.8 were used as pass/fail criteria for the other tests.

2.1 Vibration tests, Sine and Random.

2.1.1 Sine. Tested IAW MIL-STD-1344A, Method 2005.1, test condition III. Vibration frequency 10 to 2000 Hz, test duration of 4 hours in each of 3 mutually perpendicular axis. Acceleration 15 +/- 1.5g.

2.1.2 Random. Tested IAW MIL-STD-1344A, Method 2005.1, test condition V, letter D. Test duration was 1.5 hours in each of 3 mutually perpendicular axis. Minimum acceleration 11.6g's rms.

2.2 Shock test. Tested IAW MIL-STD-1344A, Method 2004.1, test condition A. Half-sine waveform of 11ms duration, 50 g's peak. Three drops, plus and minus directions, in each of 3 mutually perpendicular axis for a total of eighteen drops.

2.3 Thermal shock. Tested IAW MIL-STD-1344A, Method 1003.1. +125 and -55°C and return for 10 cycles with 30 minutes minimum soak time at each temperature.

2.4 Humidity. Tested IAW MIL-STD-1344A, Method 1002.2 Test condition A. Humidity 90-95 %, alternating 25 & 60 deg. C, 0.5 hr ramp up 1.0 hr ramp down 240 hours duration.

2.5 Salt fog. Tested IAW MIL-STD-1344A, Method 1001.1, test condition A. 35 deg. C, 5% solution, 0.5-3.0 ml solution accumulation per hour for 80 sq cm horizontal area, 96 hours exposure.

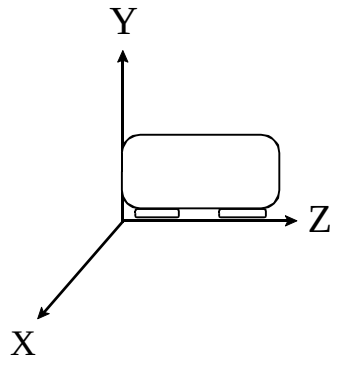
2.6 Dielectric withstanding voltage. Tested IAW MIL-STD-1344A, Method 3001.1

2.7 Low-signal Level Contact Resistance (LLCR). Tested IAW MIL-STD-1344A, Method 3002.1 20 MilliVolts open circuit, 100 MilliAmps short circuit. 30 MilliOhms Maximum for rows D and Z.

2.8 Insulation resistance. Tested IAW MIL-STD-1344A, Method 3003.1 MegOhm meter with 500 Volts DC applied for 2 minutes to mated connector. 100 MegOhm minimum allowed, pin Z1 to Z2 and C1.

3. Test Methodology.

3.1 Sample preparation. Harting Elektronik supplied five mated pairs of their 160 pin connectors part number 0201-160-2101 and 0202-160-2201. The connectors were divided into two groups for testing. Two sets of connectors were selected for Group 1 testing. Group 1 tests are those defined in paragraphs 2.3 through 2.8. Each connector pair was mated and unmated ten (10) times prior to testing to condition the contact surfaces. Two sets were selected for Group 2 tests. Group 2 tests are those defined in paragraphs 2.1 through 2.2 and 2.7. Both pairs of connectors were mounted on test boards and installed in the shock and vibration mounting fixture. The backplane connectors were soldered to the test board rather than use the press fit method. One connector pair had all contacts in rows D and Z wired in series for a total of 64 contacts. The other connector had various individual contacts pinned out. The two- slot backplane with one 6U board was mounted in the fixture. The reference planes used for shock and vibration testing are as illustrated. Sample preparation and test methodology were as defined in MIL-STD-1344A.



3.2 Test sequence. Two mated pairs of connectors were selected and labeled as sample

1 and 2 and subjected to the test sequence of paragraph 4.1. Two additional mated pairs were subjected to the group 2 test sequence of paragraph 4.2.

4. Test Results. Test data for group 1 and 2 LLCR tests are contained in appendix A.

4.1 Group 1 environmental test results.

4.1.1 Initial Low Level Contact Resistance (LLCR). 20 contacts were selected for monitoring, 10 each in rows D and Z. Limits are 60 mΩ maximum for rows D and Z. The minimum was 1.21 mΩ, the maximum was 9.82 mΩ with the average being 5.03 mΩ and the nominal being 5.04 mΩ.

4.1.2 Post thermal shock. No evidence of damage visible using 8x microscope. LLCR readings were 1.84 mΩ minimum, 11.02 mΩ maximum with the average being 5.65 mΩ and the nominal being 6.20 mΩ

4.1.3 Post humidity. No evidence of damage or corrosion visible using 8x microscope. LLCR readings were 2.02 mΩ minimum, 9.92 mΩ maximum with the average being 5.40 mΩ and the nominal being 5.37 mΩ.

4.1.4 Post salt fog. No evidence of corrosion visible using 8x microscope. LLCR readings were 2.03 mΩ minimum, 11.80 mΩ maximum with the average being 5.49 mΩ and the nominal being 5.02 mΩ.

4.2 Group 2 mechanical test results.

4.2.1 Initial Low Level Contact Resistance (LLCR). For connector #1 all contacts in rows D and Z were connecter in series. This gave 139.5 mΩ total resistance for the 64 pins. For connector #2 various pairs of pins were connected in series with Z31/Z32 having 9.64 mΩ. These pins on connectors 1 and 2 were monitored continuously during the shock and vibration testing for discontinuity.

4.2.2 Post vibration. LLCR readings were 157.3 mΩ for connector #1 and 15.1 mΩ for connector #2. No evidence of damage or fretting visible using 8x microscope.

4.2.3 Post shock. LLCR readings were 138.1 mΩ for connector #1 and 15.3 mΩ for connector #2. No evidence of damage visible using 8x microscope.

4.2.3 Shock and vibration discontinuity monitoring results. No “opens or discontinuities” were detected. Two types of monitoring for opens was used during shock and vibration testing. A counter with a trigger sensitivity of 500 pico seconds was used to detect an increase in contact resistance. The threshold was

set to trigger on an order-of-magnitude change in resistance. For connector #2 that was about 100 mΩ. The other method, used for connector #1, was to continuously monitor a voltage drop across the contacts using an oscilloscope.

5.0 Observations. Figure 1 shows the resistance change that occurred when a 50 g shock was applied, the scale is 1 millivolt per milli-ohm. No changes greater than one (1) milli-ohm per nanosecond were observed. The mechanical oscillations induced in the contacts of row D and Z have a period of 180 nanoseconds. To determine if the duration of the discontinuity is effected by the amplitude of the shock pulse, this test was repeated with a 15 g shock. There was no appreciable change in the period while the amplitude decreased significantly.

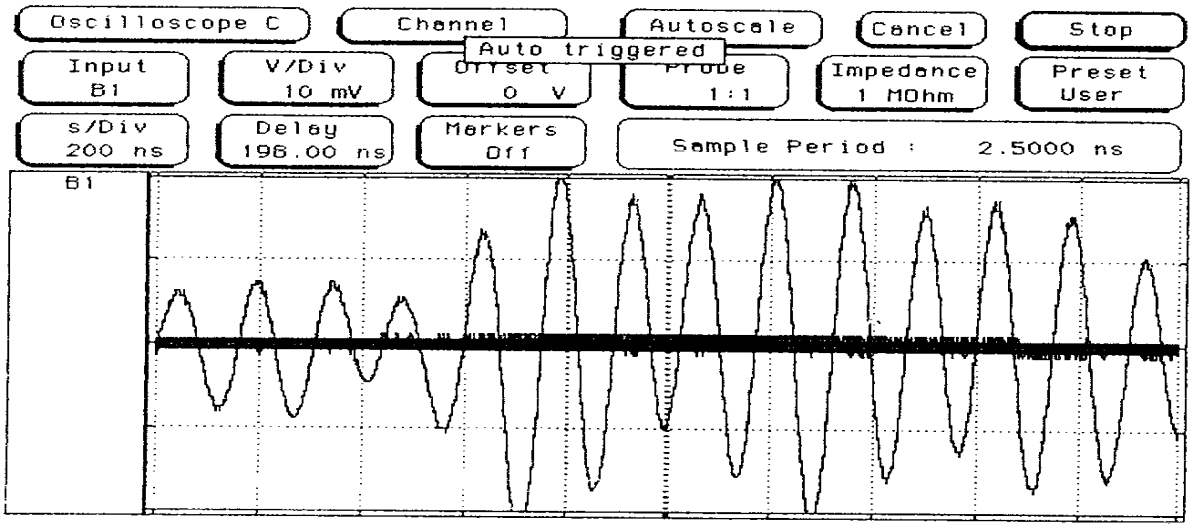


Figure 1. Screen capture of +X axis, 50 g, 12 ms shock test results.

6.0 Conclusions. These connectors passed all tests. Discontinuities do not appear to be a problem at these vibration levels. Observation of the rate of change in resistance during vibration indicates that a contact of this mass, size and spring constant can not possibly generate discontinuities in the sub nanosecond range. It appears likely from this test that discontinuities of less than one microsecond are possible. It is therefore recommended that ten (10) nanoseconds is a realistic limit for discontinuity during shock and vibration. This is well within the range of modern test equipment while maintaining the traditional factor of 10 times the accuracy requirement.

Appendix A

Connector, VME64x			Harting Elektronik Inc					
MIL-STD-1344A			0201 160 2101 and 0202 160 2101					
Pin	Initial, low level contact resistance 6/17/97		Post thermal shock, low level contact resistance 6/19/97		Post humidity, low level contact resistance 7/3/97		Post salt fog, low level contact resistance 7/18/97	
	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2
Z1	4.72	3.88	5.02	4.49	6.94	3.54	2.03	3.25
Z2	3.13	4.76	4.56	4.53	5.48	5.10	3.63	4.01
Z3	6.18	5.70	8.05	5.09	7.86	3.98	4.84	3.90
Z7	2.51	3.42	1.84	4.15	3.14	2.02	5.84	2.35
Z11	7.33	7.41	7.88	8.99	6.00	8.34	4.58	9.92
Z15	9.82	7.92	11.02	5.80	9.10	5.60	4.31	5.07
Z19	1.90	7.27	8.80	9.80	9.90	9.05	9.54	7.44
Z23	3.72	4.48	2.98	2.40	2.95	3.17	6.86	3.22
Z27	1.21	2.33	8.98	8.14	5.49	6.68	4.24	7.92
Z31	2.92	5.15	6.52	5.42	5.30	5.37	5.42	2.17
Z32	7.12	4.08	7.42	7.60	5.31	8.12	7.04	5.02
D1	2.54	5.03	2.48	3.64	3.33	4.51	5.67	5.24
D5	5.02	4.46	4.08	3.04	5.56	2.13	3.74	4.40
D9	5.12	5.86	9.82	3.67	9.40	3.43	9.06	4.20
D13	6.59	7.10	7.11	4.04	6.86	3.72	8.11	2.07
D17	7.65	4.15	3.94	8.52	3.26	9.92	4.04	11.80
D21	4.69	4.50	4.16	5.74	4.63	3.09	5.27	4.87
D25	4.05	9.06	3.30	5.20	2.56	4.97	3.20	5.46
D29	5.04	4.04	2.30	2.54	4.20	3.16	4.27	3.78
D32	4.01	5.17	7.02	6.20	6.69	6.00	8.19	7.11

Group 1. Low Level Contact Resistance data sheet.

Connector, VME64x			Harting Elektronik Inc			
MIL-STD-1344A			0201 160 2101 and 0202 160 2101			
Pins	Initial, low level contact resistance		Post vibration, low level contact resistance		Post shock, low level contact resistance	
	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2
Z1-Z32, D1- D32	139.5	NA	157.3	NA	138.1	NA
Z31-Z32	NA	9.64	NA	15.1	NA	15.3

Group 2. Low Level Contact Resistance data sheet.

NOTE: All readings are in Milliohms unless otherwise specified.