Validation Test Report

ENCODER 9P BASE ASSY
ENCODER 9P BASE INNER HSG

June 22, 2012.

Tested & Reported By	Reviewed By	Approved By	Test Date	From May 22, 2012 To June 22, 2012
			Classification	Unrestricted

● TE CONNECTIVITY RELIABILITY TEST REPORT

Test Name : Validation for ENCODER 9P BASE ASSY / ENCODER 9P BASE INNER HSG

1. Introduction

1-1 Purpose

Testing was performed on the ENCODER 9P BASE ASSY / ENCODER 9P BASE INNER HSG to determine if it conformance to the requirements of Product Specification 108-61148.

1-2 Scope

This report covers the electrical, mechanical, environmental performance of the ENCODER 9P BASE ASSY / ENCODER 9P BASE INNER HSG .
The testing was performed between May 22 , 2012 and June 22, 2012.

1-3 Test Samples

The test samples were randomly selected from normal current production lots, and the follwing part numbers were used for test:

Description	Part Number
ENCODER 9P BASE ASSY	2108418-1
ENCODER 9P BASE INNER HSG	2108422-1

1-4 Conclusion

The ENCODER 9P BASE ASSY / ENCODER 9P BASE INNER HSG meets the electrical, mechanical, and environmental performance requirements of Product Specification 108-61148.

1-5 Attechment

1) Test Sequence
2) Requirements and Test Procedure
3) Test Result
4) Photograph of Test

1) Test Sequence

Test Examination	Test Group										
	1	2	3	4	5	6	7	8	9	10	
	Test Sequence (a)										
Examination of Product	1,4	1,3	1	1	1,7	1,7	1	1,5	1	1,5	
Termination Resistance (Low Level)					3,6	2,4,6		2,4	2,5	2,4	
Insulation Resistance	2								3,6		
Dielectric Withstanding Voltage	3								7		
Temperature Rising		2									
Post Contact Insertion Force			2								
Post Contact Retention Force				2							
Connector Mating Force					2						
Connector Un-mating Force					4						
Durability (Repeated Mating /Un-mating)					5						
Vibration						5					
Physical Shock						3					
Degrees of Protection							2				
Thermal Shock								3			
Humidity-Temperature Cycling									4		
Temperature Life (Heat Aging)										3	
Number of samples (set)	5	5	5	5	5	5	5	5	5	5	

Fig. 2

(a) Numbers indicate sequence in which the tests are performed.

2) Requirements and Test Procedure

No.	Test Description	Requirement	Procedure
3.6.1	Examination of Product	Meets requirements of Product drawing and the specification.	Visual Inspection No physical damage
		Electrical Requirements	
3.6.2	Termination Resistance (Low Level)	10 mΩ Max. (Initial) 500 mΩ Max.(Ground Initial)	Subject mated contacts assembled in housing to closed circuit current of 10mA Max. at open circuit voltage of 20mV Max. as shown Fig.3. AMP Spec.109-5311-1
3.6.3	Insulation Resistance	500 MΩ Min.	Impressed voltage 500V DC for 1 minute between adjacent circuits of mated connector. AMP Spec. 109-5302-4
3.6.4	Dielectric Withstanding Voltage	No creeping discharge nor flashover shall be occurred. Current leakage: 5mA Max.	Apply 500V AC for 1 minute between adjacent contacts of mated connector. AMP Spec. 109-5301
3.6.5	Temperature Rising	30℃ Max. under loaded rating current.	Measure temperature rising by energized current as shown Fig.4 AMP Spec. 109-5310-2
		Mechanical Requirements	
3.6.6	Post Contact Insertion Force	4.9 N (0.5kgf) Max. per contact	Measure the force required to insert contact into housing. Operation Speed : 25mm/min.
3.6.7	Post Contact Retention Force	7.84 N (0.8kgf) Min. per contact	Apply an axial pull-off load to crimped wire. Operation Speed : 25mm/min.
3.6.8	Connector Mating Force	Initial : 29.4 N (3.0 kgf) Max.	Measure the force required to mate connectors. Operation Speed :25 mm/min. AMP Spec. 109-5206
3.6.9	Connector Un-mating Force	Initial : 3.92 N(0.4 kgf) Min.	Measure the force required to un-mate connectors. Operation Speed : 25 mm/min. AMP Spec. 109-5206
3.6.10	Durability (Repeated Mating /Un-mating)	⊿R=20 mΩ Max. (Final) ⊿R=500 mΩ Max.(GRND Final)	No. of Cycles : 100 cycles. Screws are to be removed. AMP Spec. 109-5213
3.6.11	Vibration	No electrical discontinuity greater than 1μsec Max. shall occur. ⊿R=20 mΩ Max. (Final) ⊿R=500 mΩ Max. (GRND Final)	Subject mated connectors to 10-500-10Hz traversed in 15 minute at 1.5 mm amplitude 3 hours each of 3 mutually perpendicular planes. 4.3V or less voltage continues for 1 μsec or more in gauge by applying 100mA, 5V open voltage. AMP Spec. 109-5202 Condition A

3.6.12	Physical Shock	No electrical discontinuity greater than 1μsec Max. shall occur. △R=20 mΩ Max. (Final) △R=500 mΩ Max. (GRND Final)	Accelerated Velocity :490 m/s2 (50 G) Waveform : Half sine curve Duration : 11 m sec. Velocity Change : 3.4 m/s Number of Drops : 3 drops each to normal and reversed directions of X, Y and Z axes, totally 18 drops. 4.3V or less voltage continues for
			1 μsec or more in gauge by applying 100mA, 5V open voltage. AMP Spec. 109-5208 Condition A
3.6.13	Degrees of Protection	IP67 (Dust-tight and protected temporary immersion in water)	IEC 60529
		Environmental Requirements	
3.6.14	Thermal Shock	△R= 20 mΩ Max. (Final) △R= 500 mΩ Max. (GRND Final)	Mated connector -40℃/30 min.,105℃/30min. Shift time 5min MAX Making this a cycle, repeat 100 cycles. AMP spec.109-5103 Condition H
3.6.15	Humidity-Temperature Cycling	Insulation resistance 500MΩ Min. (final) △R=20 mΩ Max. (Final) △R=500 mΩ Max. (GRND Final)	Mated connector, 25~65℃, 90~95 % R. H. 10 cycles Cold shock -10℃ performed AMP Spec. 109-5106
3.6.16	Temperature Life (Heat Aging)	△R=20 mΩ Max. (Final) △R=500 mΩ Max. (GRND Final)	Mated connector 105°C, Duration :250hours AMP Spec. 109-5104-3 Condition C

Fig. 1 (End)

Note 1: Shall meet visual requirements, show no physical damage and meet requirement of additional tests as specified in the test sequence shown in Figure 2.

3) Test Result

- Test Group 1

NO.	Test Items	Test Condition	Acceptance criteria	Test Result					Judgment
				Sample1	Sample2	Sample3	Sample4	Sample5	
1	Examination of Product	Initial	No physical damage.	OK	OK	OK	OK	OK	OK
		Final		OK	OK	OK	OK	OK	OK
2	Insulation resistance (unit : mΩ)	Initial	500 MΩ Min.	4.44GΩ	4.04GΩ	4.96GΩ	4.32GΩ	4.07GΩ	OK
3	Dielectric withstanding Voltage	Initial	No creeping discharge nor flashover shall be occurred. Current leakage : 0.5 mA Max.	17μA	19μA	13μA	18μA	18μA	OK

- Test Group 2

NO.	Test Items	Test Condition	Acceptance criteria	Test Result					Judgment
				Sample1	Sample2	Sample3	Sample4	Sample5	
1	Examination of Product	Initial	No physical damage.	OK	OK	OK	OK	OK	OK
		Final		OK	OK	OK	OK	OK	OK
2	Temperature Rising	Initial	30 ℃ Max. under loaded rating current.	3.40℃	3.99℃	4.67℃	4.63℃	4.08℃	OK

3) Test Result

- Test Group 3

NO.	Test Items	Test Condition	Acceptance criteria	Test Result					Judgment
				Sample1	Sample2	Sample3	Sample4	Sample5	
1	Examination of Product	Initial	No physical damage.	OK	OK	OK	OK	OK	OK
2	Post Contact Insertion Force	Initial	4.9N (0.5kgf) Max. per contact.	Refer to Attachment.					OK

- Test Group 4

NO.	Test Items	Test Condition	Acceptance criteria	Test Result					Judgment
				Sample1	Sample2	Sample3	Sample4	Sample5	
1	Examination of Product	Initial	No physical damage.	OK	OK	OK	OK	OK	OK
2	Post Contact Retention Force	Initial	7.84N (0.8kgf) Min. per contact.	Refer to Attachment.					OK

3) Test Result
- Attachment

Unit : kgf

Contact Insertion Force		1	2	3	4	5	6	7	8	9	Max.	Min.	Avg.
Initial	S1	0.39	0.35	0.42	0.43	0.36	0.33	0.32	0.28	0.40	0.43	0.28	0.36
	S2	0.41	0.37	0.42	0.39	0.43	0.31	0.40	0.38	0.42	0.43	0.31	0.39
	S3	0.43	0.38	0.41	0.38	0.40	0.34	0.35	0.33	0.39	0.43	0.33	0.38
	S4	0.42	0.33	0.38	0.39	0.35	0.39	0.32	0.39	0.37	0.42	0.32	0.37
	S5	0.38	0.37	0.39	0.41	0.34	0.37	0.34	0.40	0.39	0.41	0.34	0.38

Unit : kgf

Contact Retention Force		1	2	3	4	5	6	7	8	9	Max.	Min.	Avg.
Initial	S1	1.10	1.40	1.78	1.62	1.35	0.99	1.20	1.20	1.51	1.78	0.99	1.35
	S2	1.19	0.92	1.40	1.71	1.33	1.39	1.16	1.22	1.34	1.71	0.92	1.30
	S3	1.69	1.21	1.10	1.53	1.08	1.06	1.31	1.25	1.70	1.70	1.06	1.33
	S4	1.29	1.26	1.28	1.33	1.41	1.40	1.52	1.19	1.30	1.52	1.19	1.33
	S5	1.55	1.34	1.07	1.52	1.16	1.07	1.46	1.41	1.39	1.55	1.07	1.33

3) Test Result
- Test Group 5

NO.	Test Items	Test Condition	Acceptance criteria	Test Result					Judgment
				Sample1	Sample2	Sample3	Sample4	Sample5	
1	Examination of Product	Initial	No physical damage.	OK	OK	OK	OK	OK	OK
		Final		OK	OK	OK	OK	OK	OK
2	Connector Mating Force	Initial	29.4N(3.0kgf) Max.	1.23kgf	1.64kgf	1.62kgf	1.41kgf	1.84kgf	OK
3	Connector Unmating Force	Initial	3.92N (0.4kgf) Min.	1.29kgf	1.12kgf	1.43kgf	1.21kgf	1.32kgf	OK
4	Termination resistance (unit : mΩ)	Initial	Contact : 10 mΩ Max. Ground : 500mΩ Max.	Refer to attachment.					OK
		After Durability	Contact : 20 mΩ Max. Ground : 500mΩ Max.						OK

3) Test Result
- Attachment

Unit : mΩ

Termination resistance		Signal								Max.	Min.	Avg.
		1	2	3	4	5	6	7	8			
Initial	S1	8.71	8.64	8.81	4.51	5.26	5.33	6.63	4.92	8.81	4.51	6.60
	S2	4.03	3.98	3.81	3.07	5.67	6.89	8.65	4.97	8.65	3.07	5.13
	S3	5.05	5.01	9.01	4.72	5.96	5.36	4.85	5.72	9.01	4.72	5.71
	S4	4.60	4.47	4.61	5.62	8.70	7.86	8.55	4.41	8.70	4.41	6.10
	S5	5.17	3.41	8.64	4.55	4.78	5.20	7.97	5.80	8.64	3.41	5.69
After Durability	S1	10.03	11.01	9.00	4.69	5.84	4.90	6.13	4.92	11.01	4.69	7.07
	S2	4.90	5.73	4.65	6.72	14.60	10.50	14.50	6.50	14.60	4.65	8.51
	S3	7.64	7.30	9.10	7.20	7.25	6.70	5.92	8.89	9.10	5.92	7.50
	S4	4.10	4.36	5.81	4.45	10.70	11.02	7.63	5.13	11.02	4.10	6.65
	S5	7.74	3.98	13.15	4.58	9.54	10.50	9.10	8.20	13.15	3.98	8.35

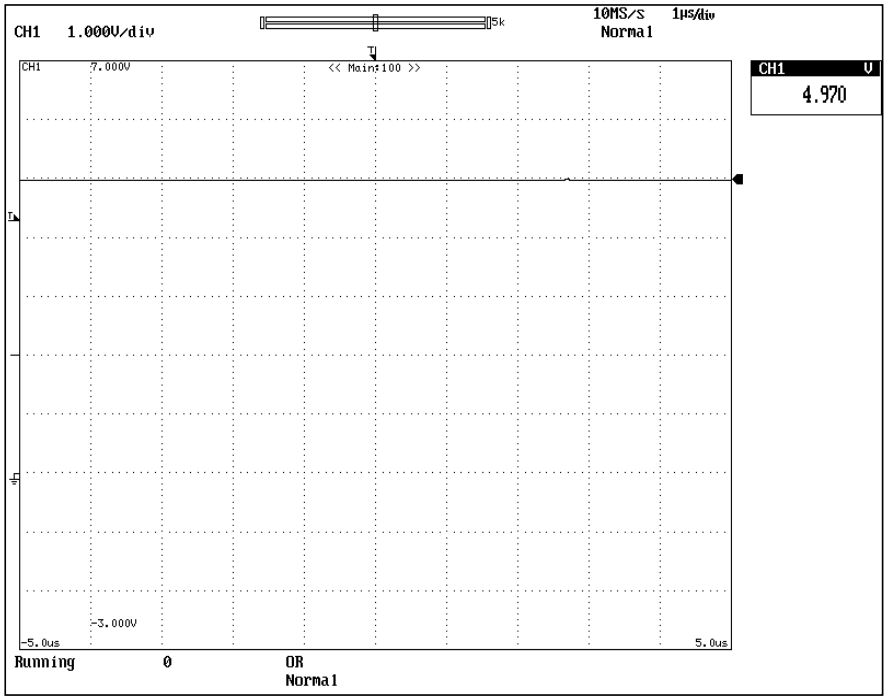
Unit : mΩ

Termination resistance	Ground					Max.	Min.	Avg.
	S1	S2	S3	S4	S5			
Initial	70.01	71.20	45.10	33.90	23.19	71.20	23.19	48.68
After Durability	25.70	11.07	18.13	39.70	23.10	39.70	11.07	23.54

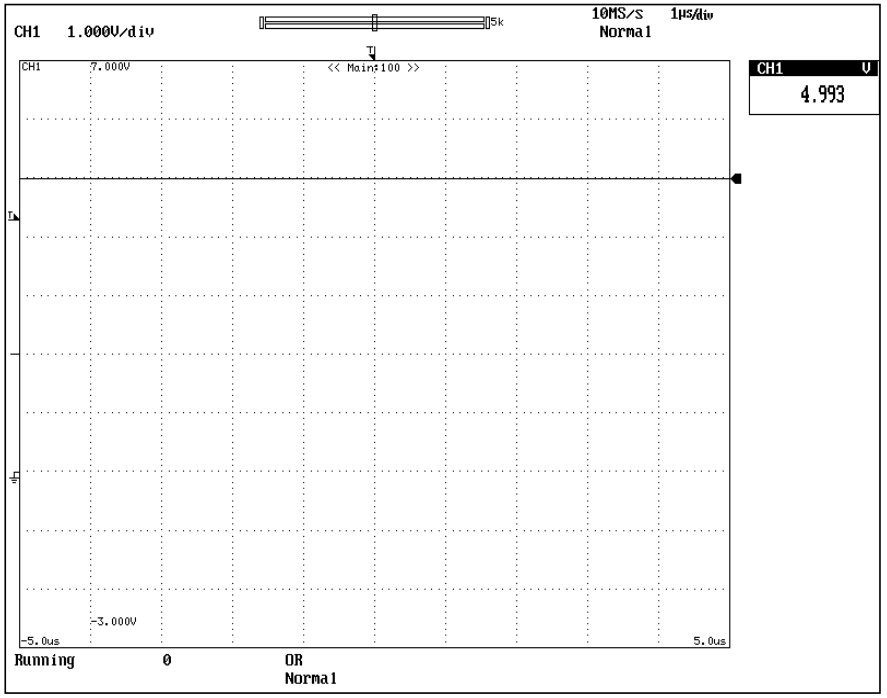
3) Test Result
- Test Group 6

NO.	Test Items	Test Condition	Acceptance criteria	Test Result					Judgment
				Sample1	Sample2	Sample3	Sample4	Sample5	
1	Examination of Product	Initial	No physical damage.	OK	OK	OK	OK	OK	OK
		Final		OK	OK	OK	OK	OK	OK
2	Termination resistance (unit : mΩ)	Initial	Contact : 10 mΩ Max. Ground : 500mΩ Max.	Refer to attachment.					OK
		After Physical Shock	Contact : 20 mΩ Max. Ground : 500mΩ Max.						OK
		After Vibration							OK
3	Physical Shock	-	No electrical discontinuity greater than 1μsec Max. shall occur.	OK	OK	OK	OK	OK	OK
4	Vibration	-	No electrical discontinuity greater than 1μsec Max. shall occur.	OK	OK	OK	OK	OK	OK

- *Physical Shock*



- *Vibration*



※ No electrical discontinuity greater than 1µ sec occurred.

3) Test Result
- Attachment

Unit : mΩ

Termination resistance		Signal								Max.	Min.	Avg.
		1	2	3	4	5	6	7	8			
Initial	S1	6.22	6.60	4.56	7.81	5.69	7.10	4.57	5.95	7.81	4.56	6.06
	S2	6.12	7.76	5.41	6.90	5.81	6.90	7.69	7.64	7.76	5.41	6.78
	S3	4.13	5.83	5.28	4.64	6.82	5.05	5.79	7.31	7.31	4.13	5.61
	S4	5.35	3.92	4.55	4.83	6.20	5.65	6.45	6.07	6.45	3.92	5.38
	S5	4.97	5.37	6.14	6.77	6.21	4.44	5.33	6.35	6.77	4.44	5.70
After Physical Shock	S1	7.31	8.20	4.71	9.56	8.43	8.21	7.25	7.22	9.56	4.71	7.61
	S2	7.71	9.33	5.86	8.40	7.31	6.85	6.82	7.73	9.33	5.86	7.50
	S3	4.42	7.00	6.34	6.19	8.00	7.75	7.58	7.95	8.00	4.42	6.90
	S4	5.62	3.52	5.80	8.04	7.82	7.51	7.19	6.85	8.04	3.52	6.54
	S5	7.28	5.84	6.96	7.90	8.46	4.77	6.11	7.97	8.46	4.77	6.91
After Vibration	S1	8.40	9.80	4.86	11.30	11.16	9.31	9.93	8.48	11.30	4.86	9.16
	S2	9.30	10.90	6.31	9.90	8.80	6.80	5.94	7.82	10.90	5.94	8.22
	S3	4.70	8.17	7.40	7.74	9.17	10.44	9.36	8.58	10.44	4.70	8.20
	S4	5.89	3.11	7.04	11.24	9.43	9.36	7.92	7.63	11.24	3.11	7.70
	S5	9.58	6.30	7.78	9.03	10.70	5.10	6.88	9.59	10.70	5.10	8.12

Unit : mΩ

Termination resistance	Ground					Max.	Min.	Avg.
	S1	S2	S3	S4	S5			
Initial	42.50	43.10	35.70	27.11	36.80	43.10	27.11	37.04
After Physical Shock	52.55	51.30	44.00	30.16	60.55	60.55	30.16	47.71
After Vibration	62.60	59.50	52.30	33.21	84.30	84.30	33.21	58.38

3) Test Result
- Test Group 7

NO.	Test Items	Test Condition	Acceptance criteria	Test Result					Judgment
				Sample1	Sample2	Sample3	Sample4	Sample5	
1	Examination of Product	Initial	No physical damage.	OK	OK	OK	OK	OK	OK
2	Degree of Protection	After Dust	No ingress of dust.	OK	OK	OK	OK	OK	OK
		After Water	No ingress of water.	OK	OK	OK	OK	OK	OK

<After Dust>

<After Water>

3) Test Result
- Test Group 8

NO.	Test Items	Test Condition	Acceptance criteria	Test Result					Judgment
				Sample1	Sample2	Sample3	Sample4	Sample5	
1	Examination of Product	Initial	No physical damage.	OK	OK	OK	OK	OK	OK
		Final		OK	OK	OK	OK	OK	OK
2	Termination resistance (unit : mΩ)	Initial	Contact : 10 mΩ Max. Ground : 500mΩ Max.	Refer to attachment.					OK
		After Thermal Shock	Contact : 20 mΩ Max. Ground : 500mΩ Max.						OK

3) Test Result
- Attachment

Unit : mΩ

Termination resistance		Signal								Max.	Min.	Avg.
		1	2	3	4	5	6	7	8			
Initial	S1	7.17	5.12	5.59	4.19	5.39	4.74	5.74	6.72	7.17	4.19	5.58
	S2	7.01	7.57	4.59	8.24	4.51	7.23	5.25	5.82	8.24	4.51	6.28
	S3	5.99	3.61	3.39	4.49	7.23	6.55	9.21	9.33	9.33	3.39	6.23
	S4	5.70	9.44	4.96	5.72	6.18	7.65	7.37	7.22	9.44	4.96	6.78
	S5	6.21	8.87	5.04	5.03	6.56	8.26	8.62	4.80	8.87	4.80	6.67
After Thermal Shock	S1	5.84	5.59	5.67	6.60	6.16	6.27	9.68	9.91	9.91	5.59	6.97
	S2	5.71	8.23	7.29	5.56	5.30	9.48	6.32	8.67	9.48	5.30	7.07
	S3	6.04	4.71	3.94	6.23	7.23	8.97	9.10	7.15	9.10	3.94	6.67
	S4	6.29	9.85	5.46	6.57	12.95	10.26	8.82	11.44	12.95	5.46	8.96
	S5	4.99	8.03	5.83	5.76	6.91	7.57	10.51	4.81	10.51	4.81	6.80

Unit : mΩ

Termination resistance	Ground					Max.	Min.	Avg.
	S1	S2	S3	S4	S5			
Initial	28.90	70.20	71.60	89.00	55.30	89.00	28.90	63.00
After Thermal Shock	30.84	72.30	68.20	54.20	56.80	72.30	30.84	56.47

3) Test Result
- Test Group 9

NO.	Test Items	Test Condition	Acceptance criteria	Test Result					Judgment
				Sample1	Sample2	Sample3	Sample4	Sample5	
1	Examination of Product	Initial	No physical damage.	OK	OK	OK	OK	OK	OK
2	Termination resistance (unit : mΩ)	Initial	Contact : 10 mΩ Max. Ground : 500mΩ Max.	Refer to attachment.					OK
		After Humidity	Contact : 20 mΩ Max. Ground : 500mΩ Max.						OK
3	Dielectric withstanding Voltage	After Humidity	No creeping discharge nor flashover shall be occurred. Current leakage : 0.5 mA Max.	17μA	18μA	17μA	18μA	18μA	OK
4	Insulation resistance (unit : mΩ)	Initial	500 MΩ Min	6.42GΩ	4.86GΩ	5.33GΩ	5.63GΩ	6.26GΩ	OK
		After Humidity		3.55GΩ	3.97GΩ	4.07GΩ	3.91GΩ	4.10GΩ	OK

3) Test Result
- Attachment

Unit : mΩ

Termination resistance		Signal								Max.	Min.	Avg.
		1	2	3	4	5	6	7	8			
Initial	S1	7.68	6.85	4.81	4.07	4.82	5.54	9.86	6.61	9.86	4.07	6.28
	S2	5.21	7.65	4.51	4.94	7.60	6.83	5.80	7.89	7.89	4.51	6.30
	S3	6.97	7.81	7.95	8.17	6.62	5.93	4.67	5.99	8.17	4.67	6.76
	S4	6.98	5.42	5.85	5.44	6.54	7.20	7.23	7.10	7.23	5.42	6.47
	S5	5.22	7.11	5.44	8.05	7.32	5.50	5.97	6.68	8.05	5.22	6.41
After Humidity	S1	7.50	9.38	9.48	7.81	6.94	11.34	6.38	9.12	11.34	6.38	8.49
	S2	7.75	9.66	6.54	11.01	9.76	11.86	9.56	9.76	11.86	6.54	9.49
	S3	8.24	11.36	9.37	10.82	9.70	11.15	8.38	12.12	12.12	8.24	10.14
	S4	11.20	5.84	9.22	8.58	7.10	11.39	7.38	10.41	11.39	5.84	8.89
	S5	7.64	8.21	8.16	8.37	9.24	10.05	8.05	7.61	10.05	7.61	8.42

Unit : mΩ

Termination resistance	Ground					Max.	Min.	Avg.
	S1	S2	S3	S4	S5			
Initial	39.60	48.20	21.90	27.03	40.50	48.20	21.90	35.45
After Humidity	45.60	49.10	58.30	36.90	46.00	58.30	36.90	47.18

3) Test Result
- Test Group 10

NO.	Test Items	Test Condition	Acceptance criteria	Test Result					Judgment
				Sample1	Sample2	Sample3	Sample4	Sample5	
1	Examination of Product	Initial	No physical damage.	OK	OK	OK	OK	OK	OK
		Final		OK	OK	OK	OK	OK	OK
2	Termination resistance (unit : mΩ)	Initial	Contact : 10 mΩ Max. Ground : 500mΩ Max.	Refer to attachment.					OK
		After Temperature Life	Contact : 20 mΩ Max. Ground : 500mΩ Max.						OK

3) Test Result
- Attachment

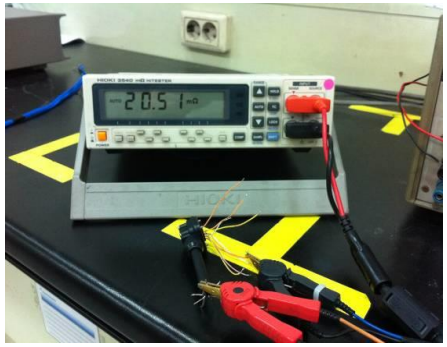
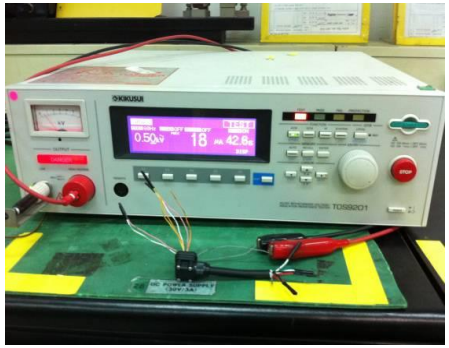
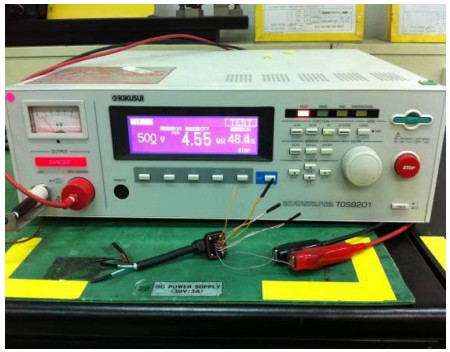
Unit : mΩ

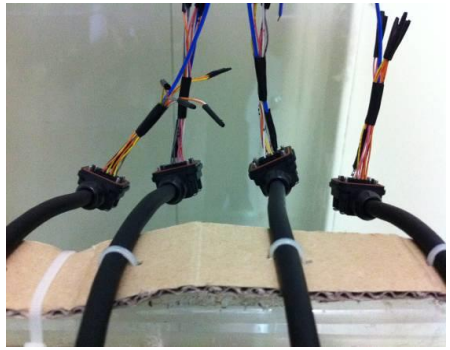
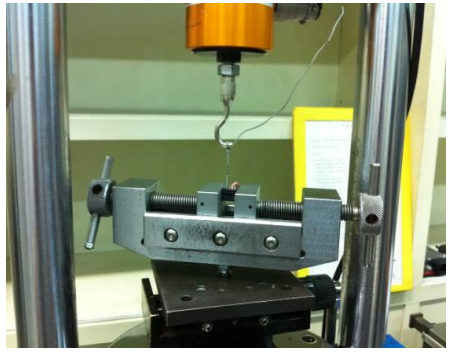
Termination resistance		Signal								Max.	Min.	Avg.
		1	2	3	4	5	6	7	8			
Initial	S1	8.98	4.48	6.55	4.17	5.75	6.34	8.27	7.50	8.98	4.17	6.51
	S2	5.46	6.69	6.27	6.69	9.35	4.53	7.01	7.05	9.35	4.53	6.63
	S3	5.33	8.13	6.56	6.51	9.83	5.64	5.57	8.73	9.83	5.33	7.04
	S4	5.42	8.87	8.06	4.55	7.34	6.39	6.35	9.67	9.67	4.55	7.08
	S5	6.40	5.59	4.97	3.89	4.62	4.45	7.78	4.47	7.78	3.89	5.27
After Temperature Life	S1	11.37	9.82	8.79	7.95	8.82	8.64	13.59	8.79	13.59	7.95	9.72
	S2	7.64	8.19	7.27	8.40	5.72	7.30	11.90	8.78	11.90	5.72	8.15
	S3	7.62	7.54	8.84	8.71	10.15	7.57	7.97	11.39	11.39	7.54	8.72
	S4	9.82	12.70	9.84	8.55	7.74	8.38	10.10	8.82	12.70	7.74	9.49
	S5	7.13	9.25	10.49	4.20	7.25	9.09	10.44	7.72	10.49	4.20	8.20

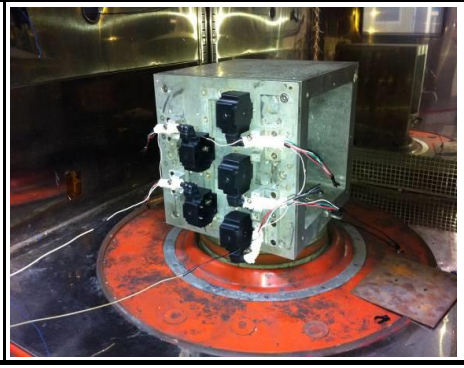
Unit : mΩ

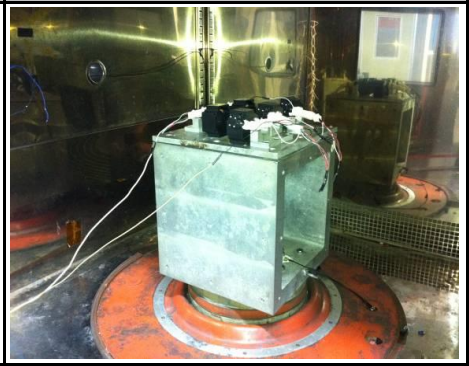
Termination resistance	Ground					Max.	Min.	Avg.
	S1	S2	S3	S4	S5			
Initial	47.80	65.70	82.20	52.50	46.60	82.20	46.60	58.96
After Temperature Life	43.80	82.00	83.80	62.80	89.00	89.00	43.80	72.28

4) Photograph of Test

NO.	Test Items	Photograph	Remark
1	Termination Resistance		–
2	Dielectric Withstanding Voltage		–
3	Insulation Resistance		–

NO.	Test Items	Photograph	Remark
4	Temperature Rising		–
5	Post Contact insertion Force		–
6	Post Contact Retention Force		–

NO.	Test Items	Photograph	Remark
7	Connector Mating Force		-
8	Connector Unmating Force		-
9	Vibration		-

NO.	Test Items	Photograph	Remark
10	Physical Shock		-
11	Degrees of Protection		-
12	Thermal Shock		-

NO.	Test Items	Photograph	Remark
13	Humidity		-
14	Temperature Life		-
15	-	-	-

NO.	Test Items	Photograph	Remark
16	-	-	-
17	-	-	-
18	-	-	-