

Coda cx1 Thermal Cycle Test Procedure

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1. Introduction

1.1 Activity Description

This document is intended to specify requirements for ambient pressure thermal testing in a dry nitrogen atmosphere. Tests are to be run on the Coda cx1 sensor unit, 8-marker drive boxes and markers in accordance with the details given in Section 3. The tests subject the flight items to excursions between -10 and 50°C (Qualification: 7 and one-half cycles; Acceptance: 1 and one-half cycles).

2. Requirements

2.1 Context

This procedure is supported by the activities contained in the Short Form Functional Test Procedure (CDL 1-TP07-0100:0208) and the Long Form Functional Test Procedure (CDL 1-TP07-0500:0211).

2.2 List of Hardware Under Test

Coda cx1 sensor unit
Externally powered 8-marker drive box
8 markers

2.3 List of Support Hardware Items

Internally powered 8-marker drive box complete with 1 marker
Mini hub adapted for current and voltage monitoring
Host PC with RS-422 serial card
Power supply for marker drive boxes
Coda interface cable
Serial cable
Environmental chamber
T-type thermocouples and associated Fluke thermometer
Test frame (Required for thermal tests only)
Digital multi-meter
Marker disc

2.4 List of Software Requirements

Coda Motion Analysis Software V6.56
Coda cx1 calibration files
Coda cx1 configuration file
SHARC DSP system file V3.02

2.5 List of Additional Documentation

5 Copies of the Coda cx1 Short Form Functional Test Procedure (CDL 1-TP07-0100:0208)
2 Copies of the Coda cx1 Long Form Functional Test Procedure (CDL 1-TP07-0500:0211)

3. Configuration

3.1 General Constraints

Electrostatic discharge (ESD) protection procedures per MIT 99-01003 shall be observed.

Connector mating/demating procedures per MIT 99-03002 shall be observed. Except that a mate/demate log will not be required.

3.2 Test Configuration

For the environmental tests, conducted inside the confines of the thermal chamber, a test frame is used to facilitate folding of the optical path between the Coda sensor unit and markers so as to achieve an optical path length of 2 meters.

The test frame is manufactured from aluminium structural beams which form the edges of a rectangular box with internal working dimensions of 1000mm x 1000mm x 400mm. At one end of the frame, provision is made for mounting the Coda sensor unit under test together with the markers, drive boxes and the marker disc. At the other end of the frame, a plane mirror is fixed at a distance of 1 meter from the front of the sensor unit. The light from the markers is reflected in the mirror back to the sensor unit and so covers a distance of 2 meters to reach the cameras. Since the inside of the thermal chamber consists of polished stainless steel, baffles, made from 2mm thick lightweight board sprayed matt black, are secured to the sides of the test frame to prevent unwanted marker reflections.

When using the test frame, the test configuration is as specified in CDL 1-TM07-0200:0209 and CDL 1-TM07-0400:0211.

The inside of the Coda sensor unit is instrumented with 2 thermistors arranged as follows:

Thermistor 1 on the internal Coda unit housing
Thermistor 2 on the SHARC board

A further thermistor is used to monitor the air temperature within the test chamber close to the Coda unit.

Thermistor 3 in free space within the test chamber

The resistance versus temperature chart is shown in Appendix 1.

3.3 Test Specification

3.3.1 Thermal Cycling Test

The thermal cycling test is to be run in a dry nitrogen atmosphere within the environmental chamber according to the details given in Figure 1. Nitrogen will also flow through the interior of the Coda housing during the tests. The tests subject the Coda cx1 sensor unit, 8-marker drive boxes and markers to excursions between -10 and 50°C (Qualification: 7 and one-half cycles; Acceptance: 1 and one-half cycles).

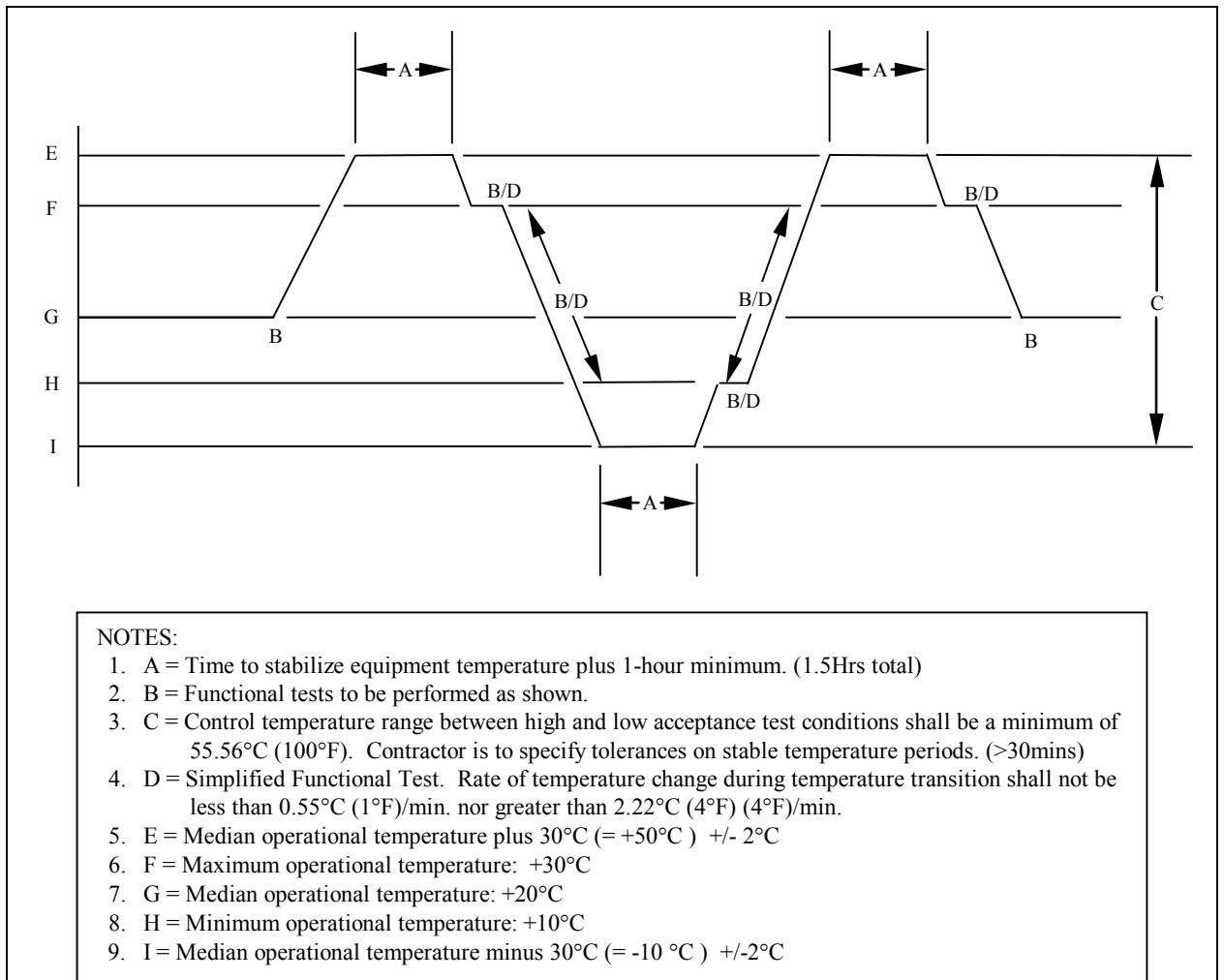


Figure 1. Thermal Cycling Test Procedure

3.3.2 Thermal Soak Test

The thermal soak test is to be run in a dry nitrogen atmosphere within the environmental chamber. The test subjects the Coda cx1 sensor unit, 8-marker drive boxes and markers to a 96 hour thermal duration at 30°C (Position F in Figure 1). The Coda system is kept powered on throughout.

4. Procedures

Administrative information for this test is to be recorded in the space provided in Section 4.1. In addition, the test conductor may annotate the procedures to more accurately document the course of the test whether routine or anomalous. The following pages, plus test data generated by the host PC, will be attached to the test report which is completed every time this test is conducted. The test conductor is assumed to have reasonable familiarity and competence in navigating through software applications which observe standard Windows conventions.

4.1 Identification of Equipment and Personnel

Coda cx1 sensor unit	_____
8 Coda markers	_____
Coda externally powered 8-marker drive box	_____
Test Conductor	_____
Test Date	_____
Test Location	_____
QA Representative	_____
Other individuals	_____

4.2 Long Form Functional Test (Pre-thermal)

Perform the Coda cx1 Long Form Functional Test (CDL 1-TP07-0500:0211), and attach the completed document to this report.

Pass	Fail	Time	Initial

4.3 Thermal Cycling Tests

With the Coda cx1 system mounted on the frame within the environmental chamber, record all thermistor readings in the table provided in Appendix 2. As thermal testing gets under way, record subsequent thermistor readings every 30 minutes.

Perform the thermal cycling test as defined in Figure 1. Run the Short Form Functional Test Procedure (CDL 1-TP07-0100:0208) periodically in-situ where specified (B and B/D) in Figure 1 but do not run the test during temperature transition shown between positions F and H on the diagram. Before acquiring any data, ensure that the internal Coda unit housing temperature (Thermistor 1) has stabilised in line with the chamber air temperature (Thermistor 3) and the fan circulating air within the test chamber is turned off.

Attach the completed documents to this report and record the start and end temperatures within the thermal chamber (Thermistor 3) for each run of the Short Form Test:

Start Temp (°C)	End Temp (°C)	Pass	Fail	Time	Initial

Start Temp (°C)	End Temp (°C)	Pass	Fail	Time	Initial

Start Temp (°C)	End Temp (°C)	Pass	Fail	Time	Initial

Start Temp (°C)	End Temp (°C)	Pass	Fail	Time	Initial

Start Temp (°C)	End Temp (°C)	Pass	Fail	Time	Initial

Start Temp (°C)	End Temp (°C)	Pass	Fail	Time	Initial

4.4 Thermal Soak Test

With the Coda cx1 system mounted on the frame within the environmental chamber, run the Short Form Functional Test Procedure (CDL 1-TP07-0100:0208) and record the start and end temperatures in the table below:

Start Temp (°C)	End Temp (°C)	Pass	Fail	Time	Initial

Perform the thermal soak test as defined in Section 3.3.2 and run the Short Form Test every 24 hours observing the precautions outlined in Section 4.3 of this procedure. Record the start and end temperatures and attach the completed documents to this report.

Start Temp (°C)	End Temp (°C)	Pass	Fail	Time	Initial

Start Temp (°C)	End Temp (°C)	Pass	Fail	Time	Initial

Start Temp (°C)	End Temp (°C)	Pass	Fail	Time	Initial

Start Temp (°C)	End Temp (°C)	Pass	Fail	Time	Initial

4.5 Long Form Functional Test (Post-thermal)

Perform the Coda cx1 Long Form Functional Test (CDL 1-TP07-0500:0211), and attach the completed document to this report.

Pass	Fail	Time	Initial

5. Test Operator Information

5.1 In the Event of Test Failure

Problems are covered in a similar section of the Short Form Test Procedure so are not repeated here.

6. Appendices

Appendix 1: Resistance versus Temperature Chart

Appendix 2: Thermal Cycling Tests Temperature Data Sheet

Appendix 1: Resistance versus Temperature Chart



Resistance Data for YSI Thermistors

Thermistor Mix		"B"
Ohms @ 25°C		2252
Temperature		
°F	°C	
-13.0	-25	29,380
-11.2	-24	27,670
-9.4	-23	26,070
-7.6	-22	24,580
-5.8	-21	23,180
-4.0	-20	21,870
-2.2	-19	20,640
-0.4	-18	19,480
1.4	-17	18,400
3.2	-16	17,390
5.0	-15	16,430
6.8	-14	15,540
8.6	-13	14,700
10.4	-12	13,910
12.2	-11	13,160
14.0	-10	12,460
15.8	-9	11,810
17.6	-8	11,190
19.4	-7	10,600
21.2	-6	10,050
23.0	-5	9534
24.8	-4	9046
26.6	-3	8586
28.4	-2	8151
30.2	-1	7741
32.0	0	7355
33.8	1	6989
35.6	2	6644
37.4	3	6319
39.2	4	6011
41.0	5	5719
42.8	6	5444
44.6	7	5183
46.4	8	4937
48.2	9	4703
50.0	10	4482
51.8	11	4273
53.6	12	4074
55.4	13	3886

57.2	14	3708
59.0	15	3539
60.8	16	3378
62.6	17	3226
64.4	18	3081
66.2	19	2944
68.0	20	2814
69.8	21	2690
71.6	22	2572
73.4	23	2460
75.2	24	2354
77.0	25	2252
78.8	26	2156
80.6	27	2064
82.4	28	1977
84.2	29	1894
86.0	30	1815
87.8	31	1739
89.6	32	1667
91.4	33	1599
93.2	34	1533
95.0	35	1471
96.8	36	1412
98.6	37	1355
100.4	38	1301
102.2	39	1249
104.0	40	1200
105.8	41	1152
107.6	42	1107
109.4	43	1064
111.2	44	1023
113.0	45	983.8
114.8	46	946.2
116.6	47	910.2
118.4	48	875.8
120.2	49	842.8
122.0	50	811.3
123.8	51	781.1
125.6	52	752.2
127.4	53	724.5
129.2	54	697.9
131.0	55	672.5

