Nasa CR 65432

A Report

GPO PRICE $ ______

CFSTI PRICE(S) $ ______

Hard copy (HC) 2.50

Microfiche (MF) .75

ff 653 July 65

QUALIFICATION TEST PROCEDURE
FOR
MULTICODER, MICROMINIATURE HIGH LEVEL

PREPARED FOR

NASA MANNED SPACECRAFT CENTER
GENERAL RESEARCH PROCUREMENT BRANCH
HOUSTON, TEXAS

CONTRACT NUMBER [redacted]
NAS9-4396

[redacted]

N66 32627 (ACCESSION NUMBER)	(THRU)
84 (PAGES)	1 (CODE)
CR-65432 (NASA CR OR TMX OR AD NUMBER)	09 (CATEGORY)

FACILITY FORM 602

[redacted]

Space Craft, Inc.
8620 South Memorial Parkway
Huntsville, Alabama

QUALIFICATION TEST PROCEDURE

FOR

MULTICODER, MICROMINIATURE HIGH LEVEL

PREPARED FOR

NASA MANNED SPACECRAFT CENTER

GENERAL RESEARCH PROCUREMENT BRANCH

HOUSTON, TEXAS

CONTRACT NUMBER

NAS9-4396

TABLE OF CONTENTS

1.0 SCOPE

The Qualification Test Procedure consists of the following sections:

(a) Pre-Environmental Acceptance Test

(b) Environmental Testing

(c) Post Environmental Acceptance Test

(d) Data Sheets

The detail procedures for each section will delineate the manner, method, and sequence of tests to be performed. The Data Sheets to record the results are found in Section 5.0 of this procedure.

The purpose of the Qualification Test Procedure is to demonstrate that the Multicoder complies in every respect with Specification MSC-MUL-10. The Qualification Test Unit (Prototype) shall be identical with the production unit.

The Qualification Test shall be conducted in the following order:

(a) Acceptance Test

(b) Environmental Test

(c) Acceptance Test (Ambient temperature only)

1.1 Environmental Testing Agencies

(1) Space Craft, Inc.
8620 South Memorial Parkway
Huntsville, Alabama

(2) Wyle Laboratories
Highway 20 West
Huntsville, Alabama

1.2 Method of Testing

The Acceptance Test Procedure and Radio Frequency Interference Tests will be performed by SCI personnel at the Space Craft, Inc. facility. The remaining environmental tests will be conducted at Wyle Laboratories Test Facility. Wyle Laboratories personnel will operate the environmental test equipment and SCI personnel will monitor the electrical operation of the system under test. Wyle Labs will furnish test reports which will form a portion of the data sheets used in this procedure. SCI will furnish data sheets documenting those tests performed by SCI personnel.

1.3 Applicable Documents

The following publications and documents are a part of the specification. In each case, the most recent issue in effect applies. Each document shall be available for reference during the Qualification Testing.

1.3.1 MIL-STD-125, 130 - Marking

1.3.2 MIL-I-6181B - Interference Control Requirements

1.3.3 MIL-I-26600/MSC-EMI-10A - Radio Frequency Interference

1.3.4 MIL-E-5272A - Environmental Testing, Aeronautic and Associated Equipment

1.3.5 NPC-200-3 - Inspection System Provisions for Suppliers of Space Materials, Parts Components, and Services

1.3.6 NPC-200-4 - Quality Requirements for Hand Soldering of Electrical Connections.

1.3.7 MSFC-STD-154 - Printed Circuit Design and Construction

1.3.8 MIL-STD-810 Environmental Testing, Aeronautic and Associated Equipment

SECTION II

PRE-ENVIRONMENTAL ACCEPTANCE TEST

2.0 PRE-ENVIRONMENTAL ACCEPTANCE TEST

2.1 General

The Pre-Environmental Acceptance Test describes in detail the method of testing the Multicoder to fulfill the requirements of Specification MSC-MUL-10. Also included with each method is a list of test equipment and a diagram showing equipment connection. Included in the Acceptance Test is a system checkout under temperature extremes.

2.2 Test Equipment Inventory

2.2.1 Calibration Requirements

All equipment used for inspection and test purposes shall be within the calibration period. If substitution of test equipment is necessary, the alternate equipment shall be equivalent to the required equipment.

2.2.2 Required Equipment

The following test equipment or its equivalent is necessary for the performance of the Acceptance Test. (See Figure A)

2.3 Nonfunctional Inspection

2.3.1 Product Marking

The assembly shall be marked for identification in accordance with MIL-STD-125, 130. In addition, the nameplate of the unit shall include the number and applicable issue of Specification MSC-MUL-10.

TEST EQUIPMENT
FIGURE A

Description	Mfgr.	Model	Range	Cal. Period	Cal. Location	Calibration Accuracy
Power Supply	Trygon	HR40-500	0-40v 500 ma	90 days	SCI	± 3 %
Counter	Hewlett-Packard	523 DR	10 cps to 1.2 mc	90 days	SCI	± 1 count ± 1 time Base Accuracy
Differential Voltmeter	John Fluke	825A	0-500 v	90 days	SCI	± 0.02% from .1 to 500v, 0.02 % +25 mv below .1v
Oscillator	Hewlett-Packard	204B	5 cps-550 kc	90 days	SCI	± 3 %
D. C. Milliammeter	Sensitive Research	S	0-1000 ma	90 days	SCI	.5% full scale
Power Amplifier	McIntosh	40	-	90 days	SCI	-
Square Wave Generator	Hewlett-Packard	211A	1 cps to 1mc	6 months	SCI	-
Oscilloscope	Tektronix	535A	DC to 15 mc	90 days	SCI	3 %

TEST EQUIPMENT (cont'd)

Description	Mfgr.	Model	Range	Cal. Period	Cal. Location	Calibration Accuracy
Multicoder Test Set	SCI	101	PAM or DC 0-5v	N/A	N/A	0.1 % - PAM
Multicoder Input Test Box	SCI	N/A	N/A	N/A	N/A	N/A

2.3.2 Workmanship

The assembly shall be free from burrs, scratches, chips, or any foreign material that may adversely affect the performance and endurance of any part or component.

2.3.3 Volume

The maximum volume of the Multicoder shall be 10 cubic inches, exclusive of connectors.

2.3.4 Weight

The weight of the Multicoder shall not exceed 12 ounces.

2.4 Functional Inspection

2.4.1 General

All functional tests will be performed under the following conditions:

(a) Temperature - Each functional test shall be performed at $+25^{\circ}C$, $-35^{\circ}C$ and $+71^{\circ}C$. The Multicoder shall be placed in the environmental oven and allowed to stabilize for one hour prior to testing at temperature extremes.

(b) Supply Voltage - All tests, except where specifically stated, will be conducted with the supply voltage set to $28.0 \pm .1$ volts D. C. The Multicoders ability to withstand input voltage variation is demonstrated in Section 2.4.2.

2.4.2 Supply Voltage

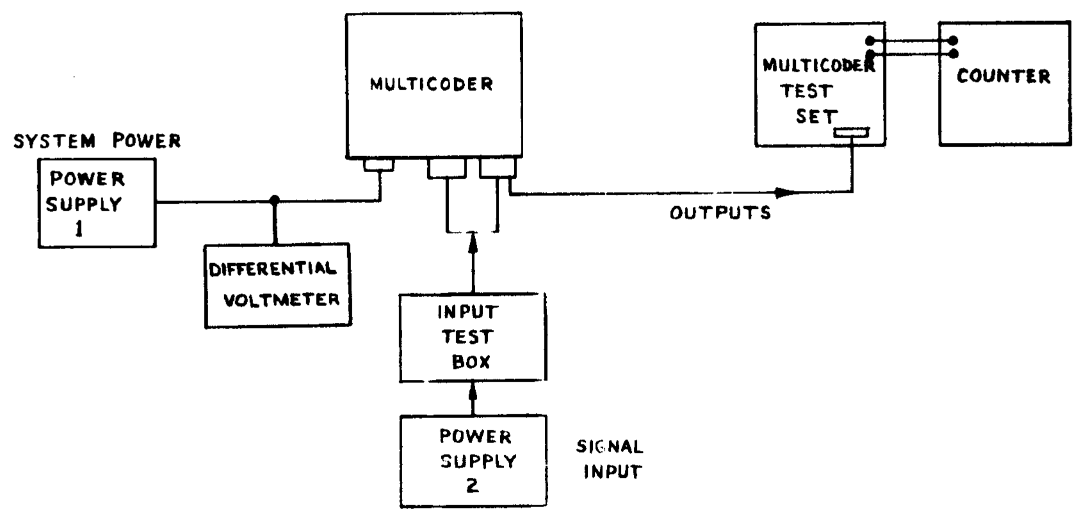
The test shall demonstrate that the variation in input supply voltage shall not result in any system malfunction.

2.4.2.1 Test Equipment

1. Power Supply (2), Trygon Model HR40-500
2. Counter, Hewlett-Packard 523 DR
3. Multicoder Test Set, SCI Model 101
4. Multicoder Input Test Box
5. Differential Voltmeter, John Fluke, Model 825A

2.4.2.2 Test Procedure

1. Arrange equipment as shown in Figure 1.
2. Adjust Power Supply # 1 to 28.0 $\pm$0.1 VDC.
3. Adjust Power Supply # 2 to 2.5 $\pm$0.01 VDC and apply to Channel 1 input.
4. With the Multicoder Test Set, select Channel One.
5. Read and record the output PAM voltage by reading the lamp display on the test set.
6. With the counter, read and record the PDM pulse width.
7. Adjust Power Supply # 1 to 24.0 $\pm$0.1 VDC.
8. Read and record the PAM and PDM outputs.
9. Adjust Power Supply # 1 to 32.0 $\pm$0.1 VDC.
10. Repeat 2.4.2.2.8
11. Adjust Power Supply # 1 to 37.0 $\pm$0.1 VDC, and allow the unit to operate with this voltage input for 10 minutes.
12. Repeat 2.4.2.2.8.
13. Adjust Power Supply # 1 to 22.0 $\pm$0.1 VDC.
14. Repeat 2.4.2.2.8.



REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL

SUPPLY VOLTAGE & POWER REVERSAL

FIGURE 1

DRAWN	N. KEY
DATE	10-20-65
CHECKED	
DATE	
APPROVED	
DATE	
PROJ. ENG.	
DATE	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH

NEXT ASSY. USED ON
APPLICATION

SCALE NONE UNIT WT.

Space Craft Inc. Huntsville, Ala.

DWG. SIZE B SCI- 21254

SHEET 1 OF 1

2.4.2.3 Test Results - The multicoder shall operate normally with a supply voltage of 28 ± 4 volts D. C. The multicoder shall be operative with a supply voltage of 22 volts with input versus output errors less than 10%. With a supply voltage of 37 vdc applied for 10 minutes the multicoder shall not be damaged and shall have input versus output errors of less than 10%.

2.4.3 Supply Current - The test shall demonstrate that the multicoder draws less than 40 milliamperes with a supply voltage of 28 VDC.

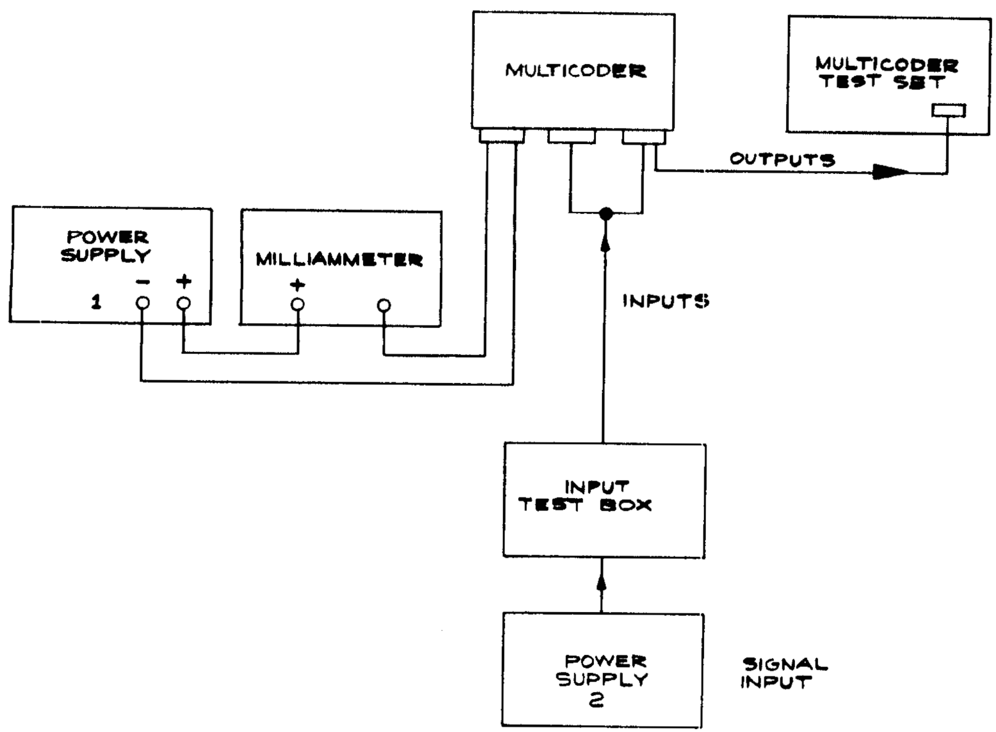
2.4.3.1 Test Equipment

1. Power Supply (2), Trygon Model HR40-500
2. D. C. Milliammeter, Sensitive Research Model S.
3. Multicoder Test Set, SCI Model 101
4. Multicoder Input Test Box.

2.4.3.2 Test Method

1. Arrange equipment as shown in Figure 2.
2. Adjust Power Supply # 1 to 28.0 ± 0.1 VDC.
3. Strap all Multicoder signal inputs together.
4. Adjust Power Supply # 2 to 2.5 ± 0.01 VDC.
5. Read and record the supply current.

2.4.3.3 Test Results - With 28 VDC supply voltage, the maximum supply current shall be 40 milliamperes.



NOTES:

1. ALL SIGNAL INPUTS ARE TIED TO THE SAME POTENTIAL.

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL

DRAWN	Tommy Ashmore
DATE	10-20-65
CHECKED	
DATE	
APPROVED	
DATE	
PROJECT ENGINEER	
DATE	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH

NEXT ASSY USED ON
APPLICATION

SUPPLY CURRENT, FIGURE 2

SCALE UNIT WT

Space Craft Inc.
Huntsville, Ala.

DWG SIZE B
SCI- 21252
SHEET 1 OF 1

2.4.4 Power Reversal - The test shall demonstrate that reversal of the polarity of the input power supply voltage shall not damage the multicoder.

2.4.4.1 Test Equipment

1. That specified in 2.4.2.1.

2.4.4.2 Test Method

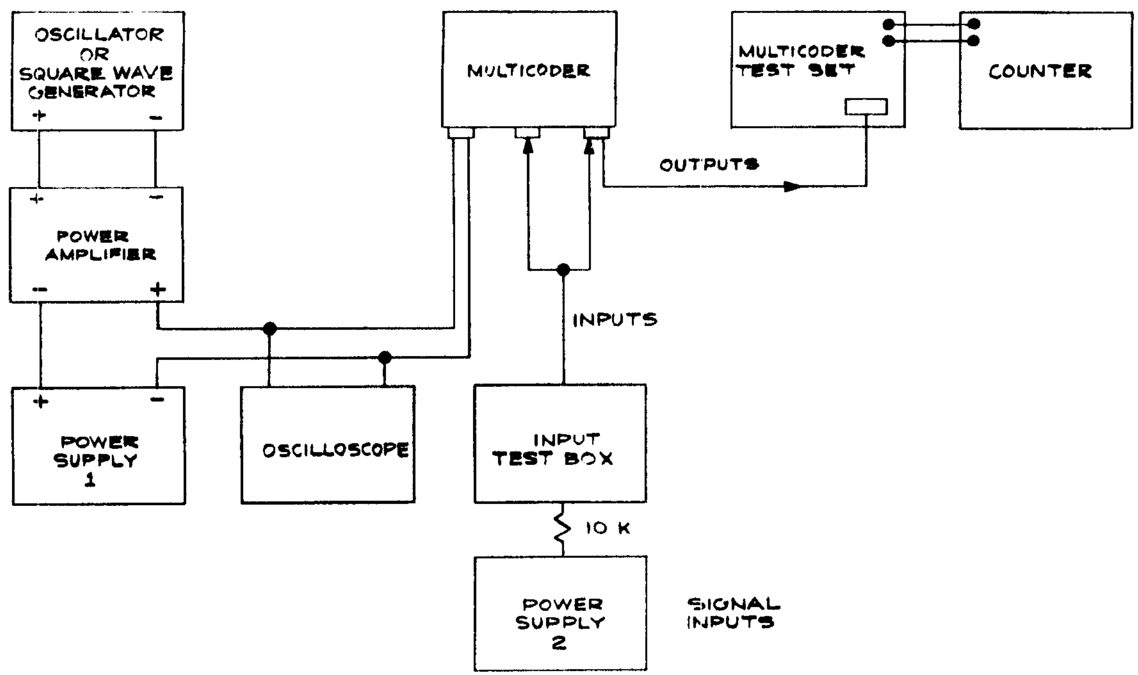
1. Repeat 2.4.2.2.1 through 2.4.2.2.6.
2. Reverse the polarity of the supply voltage.
3. Return the supply voltage to the proper polarity.
4. Read and record the PAM and PDM output.

2.4.4.3 Test Results - Reversal of the polarity of the input power supply voltage shall not damage the multicoder.

2.4.5 Ripple - The test shall demonstrate that ripple applied to the input supply voltage shall not cause the multicoder to malfunction.

2.4.5.1 Test Equipment

1. Power Supply (2), Trygon Model HR40-500.
2. Power Amplifier, McIntosh 40
3. Oscillator, Hewlett Packard 204B.
4. Oscilloscope, Tektronix 535A.
5. Multicoder Test Set, SCI Model 101.
6. Square Wave Generator, Hewlett Packard, Model 211A.
7. Counter, Hewlett Packard 523 DR.
8. Multicoder Input Test Box.



REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL

NEXT ASSY.	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES; TOLERANCES ON FRACTIONS DECIMALS ANGLES
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH

DRAWN	Tommy Ashmore
DATE	10-20-65
CHECKED	
DATE	
APPROVED	
DATE	
PROJECT ENGINEER	
DATE	

RIPPLE TEST,
FIGURE 3

SCALE UNIT WT

Space Craft Inc.
Huntsville, Ala.

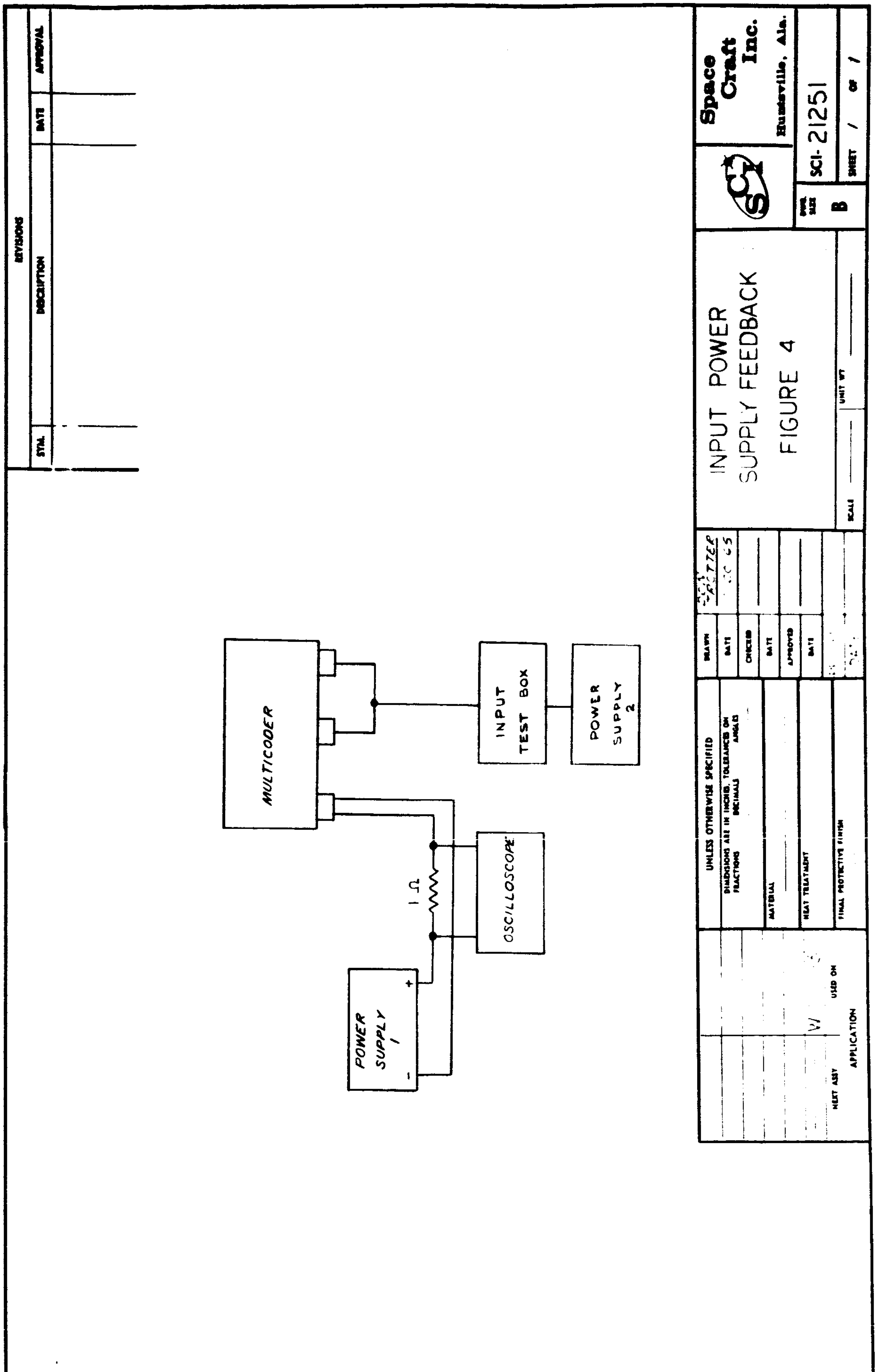
DWG SIZE B SCI-21262
SHEET 1 OF 1

2.4.5.2 Test Method

1. Arrange the equipment as shown in Figure 3.
2. Adjust Power Supply # 1 to 28.0 $\pm$0.01 VDC.
3. Connect Power Supply # 2 to the input of channel one through a 10K resistor. Adjust the voltage until the digital display representing the PAM output of channel one reads 1110000110.
4. Read and record the PAM and PDM output of channel one.
5. Adjust the gain of the power amplifier and square wave generator to give a $4.0^{+0.0}_{-0.2}$ vpp, 10 cps square wave, open circuit, and apply to power line.
6. Sweep the square wave generator from 10 - 2000 cps. Monitor the PAM and PDM outputs to insure that ripple has negligible effects on the Multicoder operation.
7. Disconnect the square wave generator and replace with the oscillator.
8. Adjust the gain of the oscillator and power amplifier to give a 3 vpp, 10 cps sine wave, open circuit, and apply to power line.
9. Sweep the oscillator from 10-100,000 cps. Monitor the PAM and PDM outputs to insure that ripple has negligible effect on the multicoder operation.

2.4.5.3 Test Results - The multicoder output shall not vary more than $\pm$1% of full scale output during subjection to the previously noted ripple conditions.

2.4.6 Input Power Supply Feedback - The test shall demonstrate that feedback by the multicoder to the input power supply shall not exceed 30 millivolts p-p as measured across a one ohm source.


REVISIONS
SYM.
DESCRIPTION
DATE
APPROVAL
MULTICODER
INPUT TEST BOX
POWER SUPPLY 2
OSCILLOSCOPE
1 Ω
POWER SUPPLY 1
+
-
NEXT ASSY
USED ON
APPLICATION
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES. TOLERANCES ON
FRACTIONS
DECIMALS
ANGLES
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH
DRAWN
DATE
CHECKED
DATE
APPROVED
DATE
INPUT POWER
SUPPLY FEEDBACK
FIGURE 4
SCALE
UNIT WT
Space Craft Inc.
Huntsville, Ala.
DWG SIZE
B
SCI-21251
SHEET 1 OF 1

2.4.6.1 Test Equipment

1. Power Supply (2), Trygon HR40-500
2. Oscilloscope, Tektronix 535A
3. Multicoder Input Test Box

2.4.6.2 Test Method

1. Arrange equipment as shown in Figure 4.
2. Adjust Power Supply # 1 to 28.0 $\pm$0.1 VDC.
3. Adjust Power Supply # 2 to read 2.5 $\pm$0.1 VDC and apply to all inputs.
4. With the scope, monitor the feedback across the one ohm resistor.

2.4.6.3 Test Results - Feedback by the multicoder to the input power supply shall not exceed 30 millivolts peak-to-peak as measured across a one ohm source.

2.4.7 Transient Susceptibility - The test shall demonstrate that transient pulses applied to the input supply voltage shall not cause damage to the multicoder.

2.4.7.1 Test Equipment

1. Power Supply (2), Trygon Model HR40-500
2. Counter, Hewlett Packard 523-DR
3. Oscillator, Hewlett Packard Model 204B
4. Multicoder Test Set, SCI Model 101
5. Transient Pulse Generator
6. Oscilloscope, Tektronix 535A
7. Multicoder Input Test Box

2.4.7.2 Test Method

1. Arrange equipment as shown in Figure 5.
2. Set Power Supply # 1 to 28.0 $\pm$0.1 VDC.
3. Connect Power Supply # 2 to all inputs through a 10K resistor. Adjust the voltage so that the output lights on the Multicoder Test Set read 1110000110.
4. Read and record the PAM and PDM outputs of channel one.
5. Apply a transient pulse with the following characteristics to the input supply voltage.

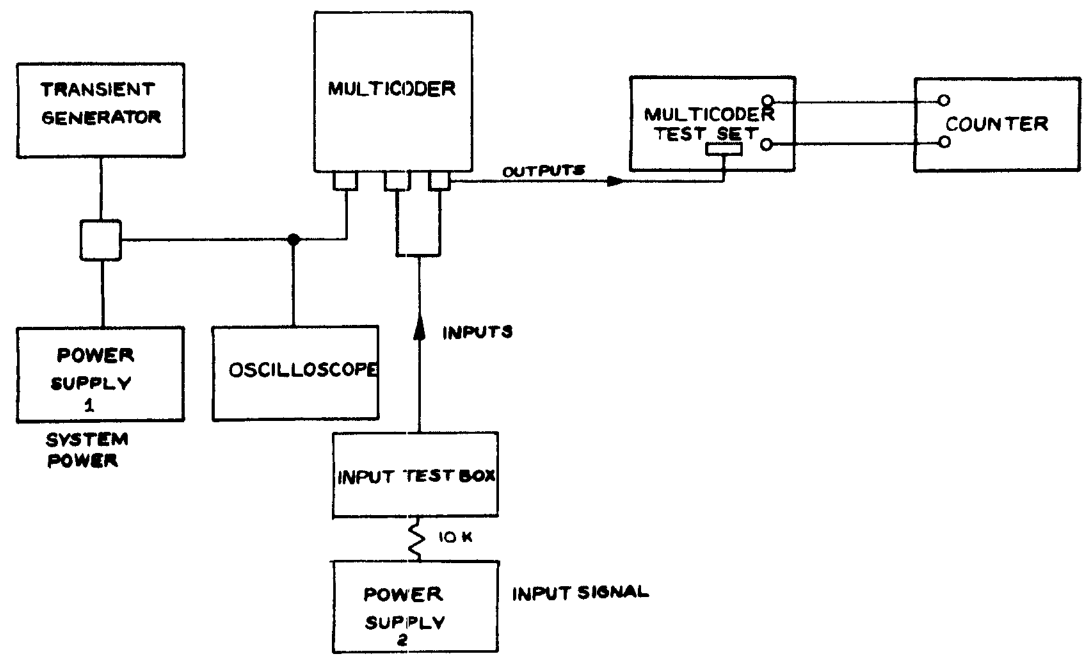
Amplitude	15 volts
Rise Time	8 msec or less
Duration	20 milliseconds

6. Repeat 2.4.7.2.4
7. Apply a transient pulse with the following characteristics to the input supply voltage.

Amplitude	-30 volts
Rise Time	8 msec or less
Duration	20 milliseconds

2.4.7.3 Test Results - The application of transient pulses to the supply voltage input shall not damage the multicoder. The multicoder shall operate normally within 5 seconds after passage of transient.

2.4.8 Reverse Current - The test shall demonstrate that the current fed back to the original source on any channel input is less than 1.0 microampere during sample time and less than 0.1 microampere during non-sample time.



REVISIONS

SYM.	DESCRIPTION	DATE	APPROVAL

W.O. 1193
NEXT ASSY. USED ON
APPLICATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES, TOLERANCES ON: FRACTIONS DECIMALS ANGLES
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH

DRAWN
DATE 0-20-63
CHECKED
DATE
APPROVED
DATE
PROJ ENG
DATE

TRANSIENT
SUSCEPTIBILITY TEST
FIGURE 5

SCALE NONE
UNIT WT

Space Craft Inc.
Huntsville, Ala.

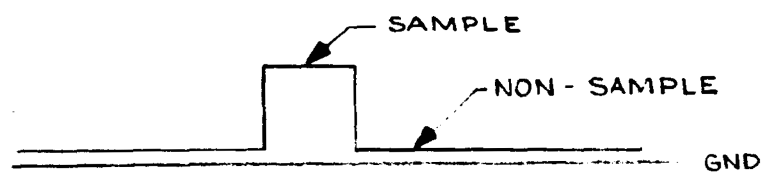
DWG. SIZE B
SCI- 21253
SHEET 1 OF 1

2.4.8.1 Test Equipment

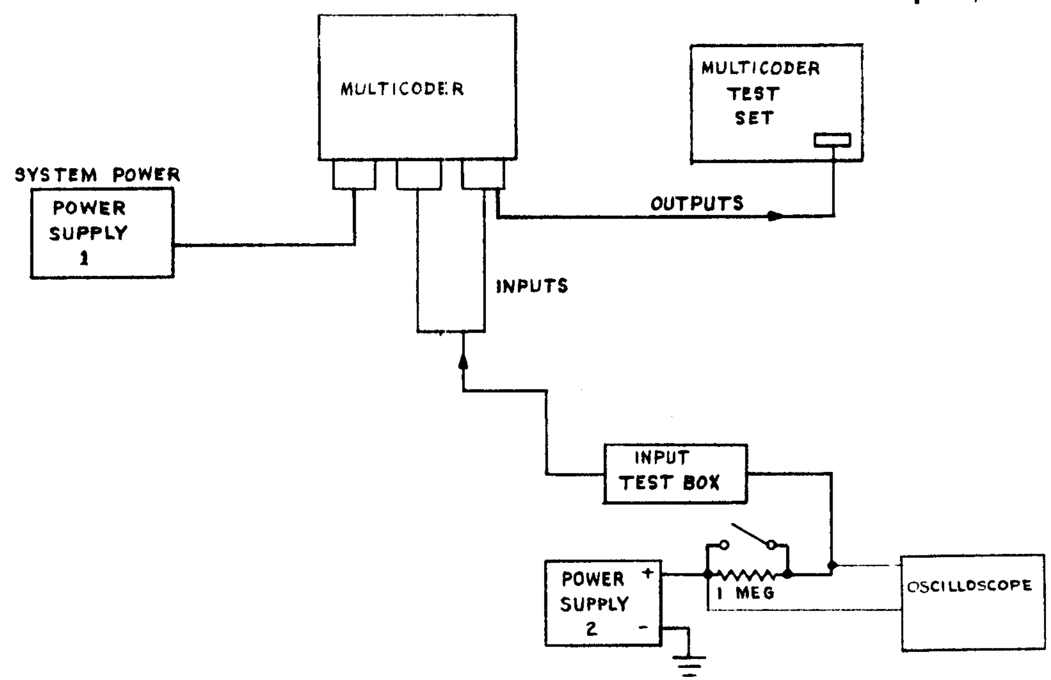
1. Power Supply (3), Trygon Model HR40-500.
2. Multicoder Test Set, SCI Model 101.
3. Multicoder Input Test Box
4. Oscilloscope, Tektronix 535A

2.4.8.2 Test Method

1. Arrange equipment as shown in Figure 6.
2. Set Power Supply # 1 to 28.0 $\pm$0.1 VDC.
3. Strap inputs 1-4 and 6-88 together. Adjust Power Supply # 2 to 5.0 $\pm$0.1 VDC and apply to these inputs.
4. Adjust Power Supply # 3 to 5.0 $\pm$0.1 VDC and apply to Channel 5 through the one megohm resistance.
5. With the scope, read and record the voltage across the one megohm resistance during both sample and non-sample time. The wave-form will appear as follows-adjusting if necessary the strapped channel supply.



6. Remove the one megohm resistor from Channel 5 and place on the input of Channel 11. Strap channel 5 to the remaining inputs.
7. Read and record the voltages across the one megohm resistor.
8. Repeat the above procedure for Channels 21, 31, 41, 51, 61, 71, 81 and 83.



REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH

NEXT ASSY. | USED ON
APPLICATION

DRAWN	N. KEY
DATE	10-21-65
CHECKED	
DATE	
APPROVED	
DATE	
PROJ. ENG	
DATE	

REVERSE CURRENT
FIGURE 6

SCALE NONE | UNIT WT.

Space Craft Inc.
Huntsville, Ala.

DWG. SIZE B | SCI- 21266
SHEET 1 OF 1

2.4.8.3 Test Results - Current fed back to the signal source shall not exceed 1.0 microampere during channel sample time and 0.1 microampere during channel off time. From the readings taken, the reverse current can be calculated.

$I_R = \frac{V_R}{R} \times 1.1$ where R = 1 megohm, and the constant 1.1 is used because of the shunting effect of the scope impedance (10 meg).

2.4.9 Input Impedance - The test shall demonstrate that the multicoder input impedance exceeds 1.5 megohm during channel on time and 50 megohms during channel off time.

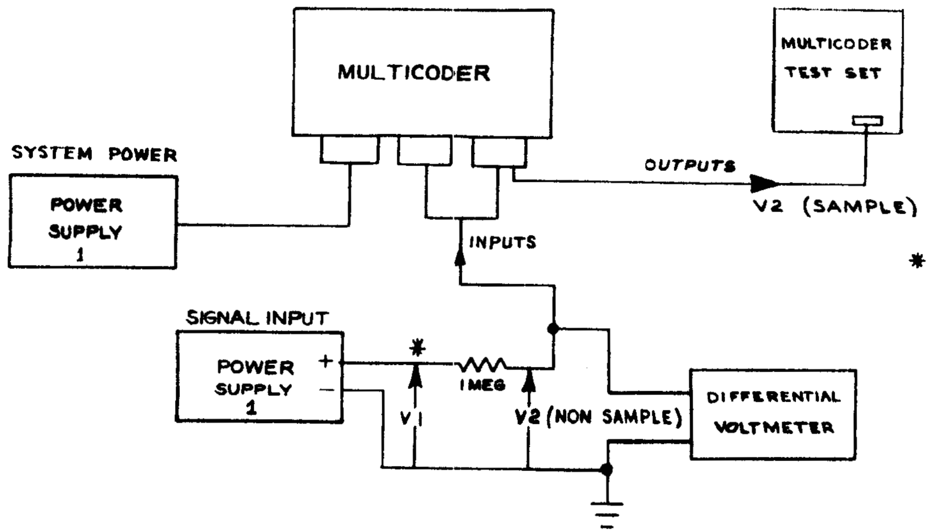
2.4.9.1 Test Equipment

1. Power Supply (2), Trygon Model HR40-500.
2. Differential Voltmeter, John Fluke 825A.
3. Multicoder Test Set, SCI Model 101.
4. Multicoder Input Test Box.

2.4.9.2 Test Method

1. Arrange equipment as shown in Figure 7.
2. Adjust Power Supply # 1 to 28.0 $\pm$0.1 VDC.
3. Adjust Power Supply # 2 to 5.0 $\pm$0.01 VDC at Channel 5 input.
4. Read and record V_1 and V_2. For non sample measurement, V_2 is measured at the input to the unit using a Fluke. Sample time measurement is accomplished using the Multicoder Test Set and is therefore measured at the system output.

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL



* NOTES:
FOR MEASURING V1 AND V2 USE A DIFFERENTIAL VOLT METER FOR NON-SAMPLE MEASUREMENT & THE MULTICODER TEST SET FOR SAMPLE TIME MEASUREMENT.

W.O.-1193	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES	DRAWN	[illegible]	INPUT IMPEDANCE FIGURE 7	Space Craft Inc. Huntsville, Ala.
NEXT ASSY. / USED ON	MATERIAL	DATE	10-20-65		DWG. SIZE B
APPLICATION	HEAT TREATMENT	CHECKED			SCI-21261
	FINAL PROTECTIVE FINISH	APPROVED		SCALE NONE	UNIT WT.
		PROJ. ENG.			SHEET 1 OF 1
		DATE			

5. Remove Power Supply # 2 and short the input to ground.

6. Read and record V_1 and V_2 for both sample and non-sample channel time.

7. Repeat the above procedure for channels 11, 21, 31, 41, 51, 61, 71, 81, and 83.

2.4.9.3 Test Results - The input impedance of the multicoder shall be 1.5 megohms minimum during channel on time and 50 megohms minimum during channel off time. From the preceeding readings, the input impedance can be calculated from the following formula:

$$R_{input} = \frac{R_1 \Delta V_2}{\Delta V_1 - \Delta V_2}$$

Since R_1 is a constant, 1 megohm, the minimum ratio of the voltages to meet the input impedance requirements are as follows:

Sample Time $\frac{\Delta V_2}{\Delta V_1} \geq .48$

Non Sample Time $\frac{\Delta V_2}{\Delta V_1} \geq .98$

2.4.10 Signal Overvoltage - The test shall demonstrate that an input signal of -30 to +30 volts shall not damage the multicoder.

2.4.10.1 Test Equipment

1. Power Supply (2), Trygon Model HR 40-500.
2. Multicoder Test Set, SCI Model 101.
3. Multicoder Input Test Box.
4. Counter, Hewlett Packard 523 DR.

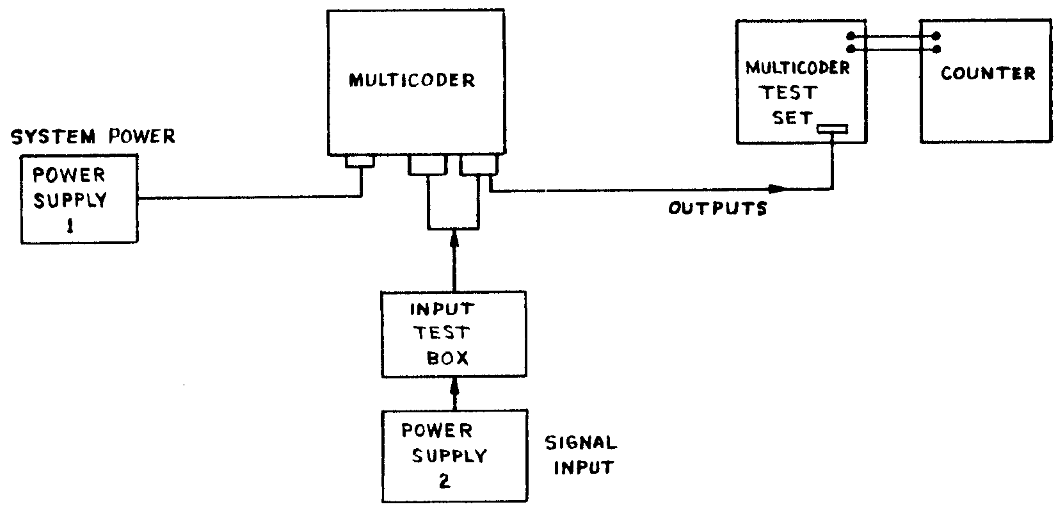
2.4.10.2 Test Method

1. Arrange equipment as shown in Figure 8.
2. Adjust Power Supply # 1 to read 28.0 ± 0.1 VDC
3. Adjust Power Supply # 2 to read 2.5 ±0.01 VDC at the input to channel one. Ground the remaining inputs.
4. Read and record the output PAM and PDM signals of channel one.
5. Increase Power Supply # 2 to read 30.0 ±0.1 VDC and leave at this potential for 10 seconds.
6. Return Power Supply # 2 to 2.5 ±0.01 VDC.
7. Repeat 2.4.10.2.4.
8. Reverse the leads on Power Supply # 2 and adjust the voltage so that -30 ±0.1 VDC is applied to the multicoder signal input. Apply this signal for 10 seconds.
9. Repeat 2.4.10.2.6 and 2.4.10.2.7.

2.4.10.3 Test Results - An input signal of -30 to +30 volts shall not damage the multicoder.

2.4.11 PAM and PDM Linearity - The test shall demonstrate that the output PAM and PDM is linear over the full input voltage range.

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL



	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES	DRAWN	N. KEY	SIGNAL OVERVOLTAGE PAM & PDM LINEARITY FIGURE 8	Space Craft Inc. Huntsville, Ala.
		DATE	10-20-65		
	MATERIAL	CHECKED			DWG. SIZE B
		DATE			SCI- 21255
	HEAT TREATMENT	APPROVED			
		DATE			
NEXT ASSY. / USED ON		PROJ. ENG.			
APPLICATION	FINAL PROTECTIVE FINISH	DATE		SCALE NONE / UNIT WT.	SHEET 1 OF 1

2.4.11.1 Test Equipment

1. Power Supply (2), Trygon Model HR 40-500.
2. Multicoder Input Test Box.
3. Multicoder Test Set, SCI Model 101.
4. Counter, Hewlett Packard 523 DR.

2.4.11.2 Test Method

1. Arrange equipment as shown in Figure 8.
2. Adjust Power Supply # 1 to read 28.0 $\pm$0.1 VDC.
3. Ground the input to channel five.
4. Read and record the output PAM voltage by recording the digital display on the test set.
5. Read and record the PDM pulse width.
6. Adjust power supply # 2 to read successively, 1.0, 2.0, 3.0, 4.0, and 5.0 $\pm$ 0.001 VDC. At each input signal level, read and record the PAM and PDM signal outputs for the noted channel. Plot error against theoretical values.

2.4.11.3 Test Results - The following linearity specifications shall apply.

PAM-The output PAM versus input voltage shall be linear within 0.25% of full scale of a straight line drawn through the pulse amplitude end points measured with 0 and 5 vdc inputs.

PDM-The output pulse width shall be within 0.25% of full scale of a straight line drawn through the pulse width end points measured with 0 and 5 vdc inputs.

2.4.12 Crosstalk - The test shall demonstrate that crosstalk does not effect the multicoder.

2.4.12.1 Test Equipment

1. As specified in 2.4.11.1.

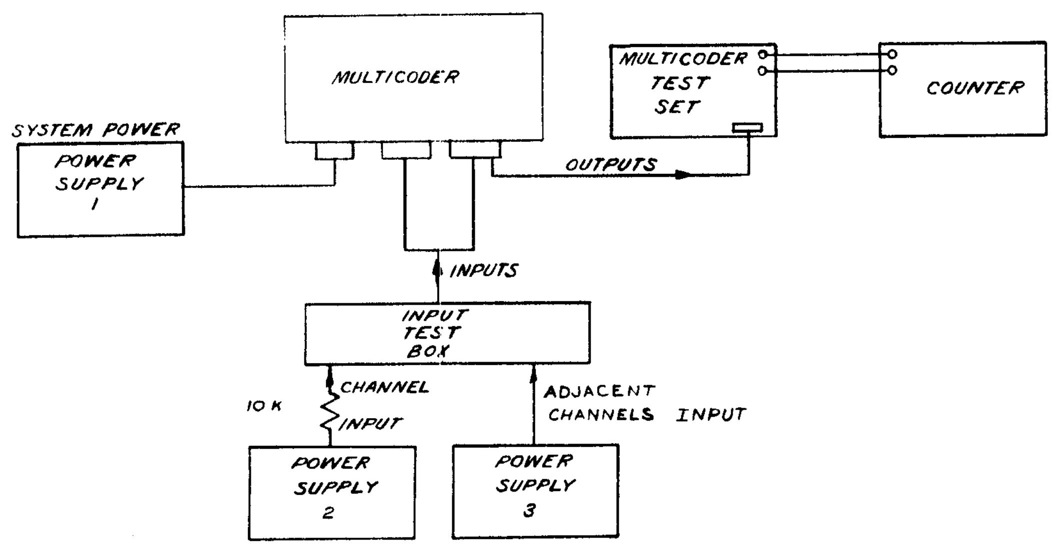
2.4.12.2 Test Method

1. Arrange equipment as shown in Figure 9.
2. Adjust Power Supply # 1 to read 28.0 $\pm$0.1 VDC.
3. Connect Power Supply # 2 to Channel 5 input through a 10K resistor.
4. Adjust the voltage of Power Supply # 2 until the digital display on the test set reads 1110000110.
5. Strap Channels 4 and 6 together and connect to Power Supply # 3.
6. Vary Power Supply # 3 from -30 to + 30 VDC.
7. Read and record the output PAM and PDM signals to insure that crosstalk has no effect on the signal of Channel 5.
8. Repeat the preceeding procedure for Channels 11, 21, 31, 41, 51, 61, 71, 81, and 83. In every case, apply the signal through a 10K source impedance, and vary the voltage on the adjacent channels from -30 to +30 VDC.

2.4.12.3 Test Results

The effect on any one channel by any combination of normal or overvoltage input signals to all other channels shall be a change in output value of 0.1% of full scale.

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL



NEXT ASSY. ——	USED ON WO 1193	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES	DRAWN DON TROTTER	CROSSTALK	Space Craft Inc. Huntsville, Ala.
APPLICATION		MATERIAL	DATE 10-20-65	FIGURE 9	DWG. SIZE B
		HEAT TREATMENT	CHECKED		SCI-21256
		FINAL PROTECTIVE FINISH	DATE	SCALE	SHEET 1 OF 1
			APPROVED	UNIT WT.	
			DATE		
			PROJ ENG		
			DATE		

2.4.13 Source Impedance Effects - The test shall demonstrate that any source impedance on the input connection will not affect the operation of the remaining channels.

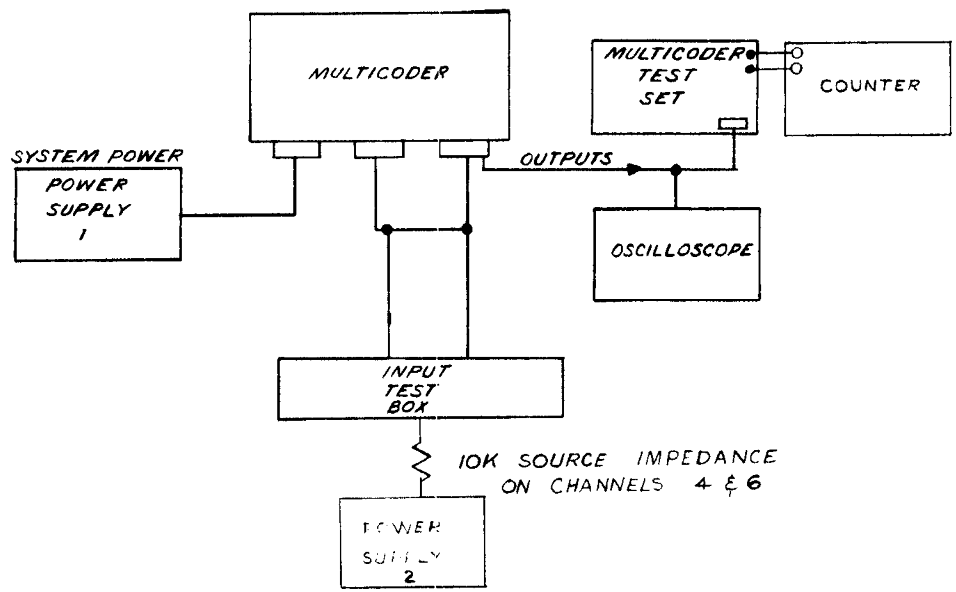
2.4.13.1 Test Equipment

1. Power Supply (2), Trygon Model HR40-500.
2. Multicoder Test Set, SCI Model 101.
3. Multicoder Input Test Box.
4. Oscilloscope, Tektronix Model 535A.
5. Counter, Hewlett Packard, Model 523 DR.

2.4.13.2 Test Method

1. Arrange equipment as shown in Figure 10.
2. Adjust Power Supply # 1 to read 28.0 $\pm$0.1 VDC.
3. Strap inputs 1-88 together.
4. Connect Power Supply # 2 to the above inputs and adjust until the digital representation of the PAM output voltage on channel six reads 1110000110.
5. Read and record the PAM and PDM output of channels 4 and 6. (These channels will have a 10K source impedance).
6. Ground the input to channel 5.
7. Repeat 2.4.13.2.5.
8. Open circuit the input to channel 5.
9. Read and record the PAM and PDM outputs of both channels 5 and 6.

2.4.13.3 Test Results - Any source impedance from zero to infinity on the input connection for any number of channels shall not affect the operation of the remain-



REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL

SOURCE IMPEDANCE EFFECTS

FIGURE 10

DRAWN	DON TROTTER
DATE	10-20-65
CHECKED	
DATE	
APPROVED	
DATE	
PROJ. ENG.	
DATE	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH

NEXT ASSY.	USED ON
	WO 1193
APPLICATION	

SCI Space Craft Inc. Huntsville, Ala.

DWG. SIZE B — SCI-21259

SCALE — UNIT WT. — SHEET 1 OF 1

ing channels. The PAM pulse amplitude of any channel with an open input shall be between 1.5 and 6.25 volts. The PDM pulse duration for any channel with an open input shall be between 165 and 825 microseconds.

2.4.14 Output Format - PAM and PDM - The test shall demonstrate that the Multicoder output is compatible with the required specifications for the following tests.

PAM:
a) Frame Rate
b) Duty Cycle
c) Pulse Spacing
d) Pulse Spikes
e) Rise and Decay Time
f) Output Noise

PDM:
a) Amplitude
b) Rise Time
c) Decay Time

2.4.14.1 Test Equipment

1. Power Supply (2), Trygon Model HR 40-500.
2. Oscilloscope, Tektronix 535A.
3. Counter, Hewlett Packard Model 523-DR.
4. Multicoder Test Set, SCI Model 101.
5. Multicoder Input Test Box.

2.4.14.2 Test Method

1. Arrange equipment as shown in Figure 11.
2. Adjust Power Supply # 1 to read 28.0 $\pm$0.1 VDC.
3. Strap inputs 1-88 together.
4. Connect Power Supply # 2 to the inputs and adjust until all lights on the digital display are lit.

5. With the counter, read and record the following:

PAM

a) Frame Rate (Monitor C_I)

b) Duty Cycle

c) Pulse Spacing

6. With the oscilloscope, read and record the following.

PAM

a) Rise and Decay Time

b) Pulse Spikes

c) Output Noise

PDM

a) Amplitude

b) Rise and Decay Time

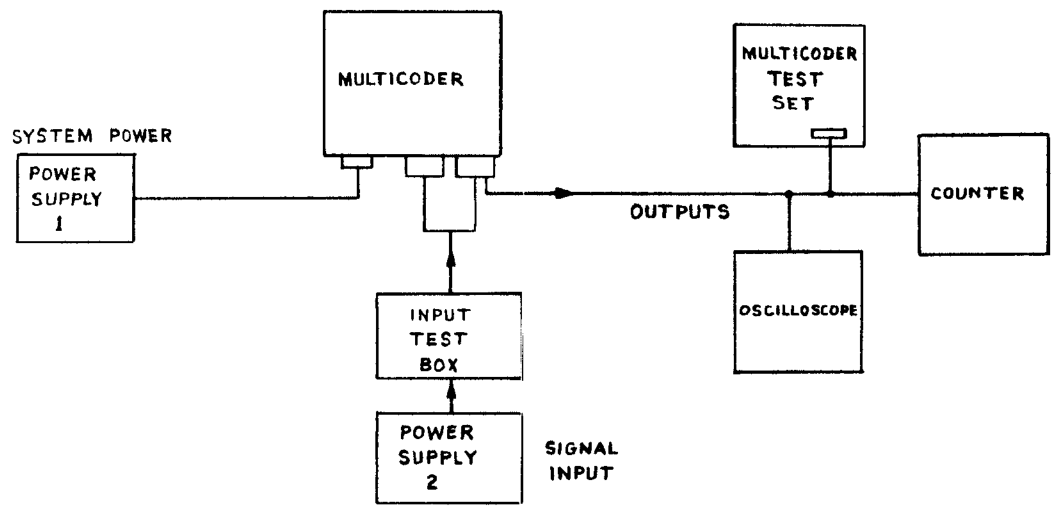
2.4.14.3 Test Results - The output format shall have the following characteristics.

PAM

a) Frame Rate - 100 ± 3 milliseconds

b) Duty Cycle - 50 $\pm 1\%$

c) Pulse Spacing - The time from leading edge to leading edge of the PAM data pulses shall be 1111 ± 50 microseconds maximum



REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL

NEXT ASSY.	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH

DRAWN	N. KEY
DATE	10-20-65
CHECKED	
DATE	
APPROVED	
DATE	
PROJ. ENG.	
DATE	

PAM & PDM OUTPUT
FORMAT
FIGURE 11

SCALE NONE UNIT WT.

Space Craft Inc.
Huntsville, Ala.

DWG. SIZE B SCI-21257
SHEET 1 OF 1

d) Rise and Decay Time - 30 microseconds maximum

e) Pulse Spikes - Any spikes shall occur during the first and last 5% of the pulse and shall not exceed 3% of full scale amplitude.

f) Output Noise - 10 millivolts peak to peak.

PDM

a) Amplitude - 4.6 $\pm$ 0.5 volts

b) Rise and Decay Time - 5 microseconds maximum

2.4.15 PAM Channel Scatter and Pulse Width Scatter and Jitter

The test shall demonstrate that the variation between output channels, with a common input, is within the prescribed limits.

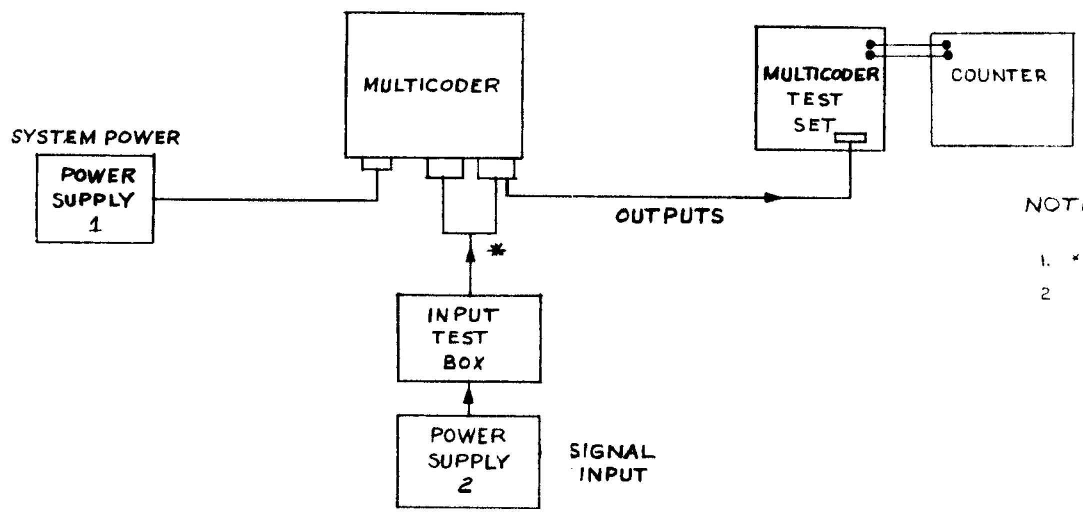
2.4.15.1 Test Equipment

1. Power Supply (2), Trygon Model HR 40-500.
2. Multicoder Test Set, SCI Model 101.
3. Multicoder Input Test Box.
4. Counter, Hewlett Packard Model 523-DR.

2.4.15.2 Test Method

1. Arrange equipment as shown in Figure 12.
2. Adjust Power Supply # 1 to read 28.0 $\pm$0.1 VDC.

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL



NOTE:

1. * ALL INPUTS STRAPPED TOGETHER
2. EACH INPUT HAS 10K SOURCE IMPEDANCE

W.O. 1193	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES	DRAWN L.E.F	PAM & PDM CHANNEL SCATTER FIGURE 12	Space Craft Inc. Huntsville, Ala.	
NEXT ASSY. USED ON	MATERIAL	DATE 10-20-65		DWG. SIZE B	SCI-21258
APPLICATION	HEAT TREATMENT	CHECKED	SCALE NONE	UNIT WT.	SHEET 1 OF 1
	FINAL PROTECTIVE FINISH	DATE / APPROVED / DATE / PROJ ENG / DATE			

3. Connect a 10K, 1% resistor to each of the 88 inputs.

4. Strap all inputs together and adjust Power Supply # 2 until the output PAM digital display of Channel 5 reads 1110000110.

5. Read and record the PAM and PDM outputs on Channels 5, 11, 21, 31, 41, 51, 61, 71, 81 and 83.

2.4.15.3 Test Results - With the same input signal applied to all input channels, the maximum offset between the amplitude of any one PAM channel pulse and any other PAM channel pulse shall be 10 millivolts. The difference between the pulse width of any one PDM channel and any other PDM channel shall be a maximum of 1.4 microseconds with the same signal applied to all channel inputs.

2.4.16 Synchronization Pulse - The test shall demonstrate that these pulses have the correct amplitude, duration, and time of occurance.

2.4.16.1 Test Equipment

1. Power Supply Trygon Model HR 40-500.
2. Counter, Hewlett Packard 523 DR.
3. Oscilloscope, Tektronix 535A.

2.4.16.2 Test Method

1. Arrange equipment as shown in Figure 13.
2. Adjust power supply # 1 to read 28.0 ±0.1 VDC.
3. With the counter, read and record the pulse width and repetition rate.
4. With a calibrated scope, read and record the pulse amplitude, rise and decay times, and noise.

2.4.16.3 Test Results - The PAM master pulse shall have an amplitude of 5 volts ±2% and shall occur during Channel 89 on and off times and Channel 90 on time. The noise and rise and decay specifications of the PAM data pulses shall apply to the PAM master pulse.

2.4.17 Clock Output - The test shall demonstrate that the clock frequency corresponds to the logic signal drive for the multicoder signal input gates.

2.4.17.1 Test Equipment

1. Power Supply, Trygon Model HR 40-500
2. Counter, Hewlett Packard Model 523-DR.

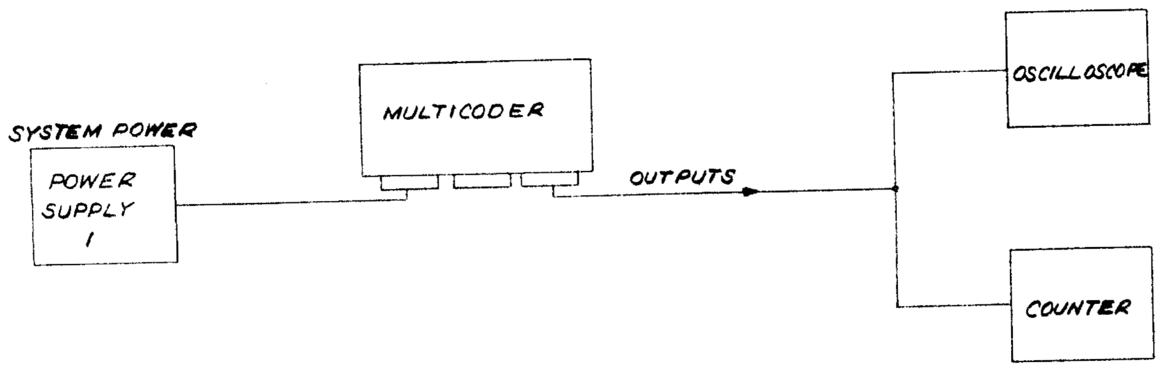
2.4.17.2 Test Method

1. Arrange equipment as shown in Figure 13.
2. Adjust power supply # 1 to read 28.0 ± 0.1 VDC.
3. Read and record the clock frequency.

2.4.17.3 Test Results - The clock frequency shall be 1111 ±50 microseconds.

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVAL



		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES	DRAWN	A. Smith	SYNCHRONIZATION PULSE, CLOCK OUTPUT, FIGURE 13
			DATE	20-SEPT-65	
		MATERIAL	CHECKED		
			DATE		
		HEAT TREATMENT	APPROVED		
	Wo 1193		DATE		
NEXT ASSY.	USED ON	FINAL PROTECTIVE FINISH	PROJ ENG		SCALE NONE
APPLICATION			DATE		UNIT WT.

Space Craft Inc.
Huntsville, Ala.

DWG SIZE B | SCI-21269
SHEET 1 OF 1

2.4.18 Zero and Full Scale PAM Amplitude and PDM Pulse Width

The test shall demonstrate that the PAM and PDM outputs are correct for input voltages ranging from -30 to +30 volts.

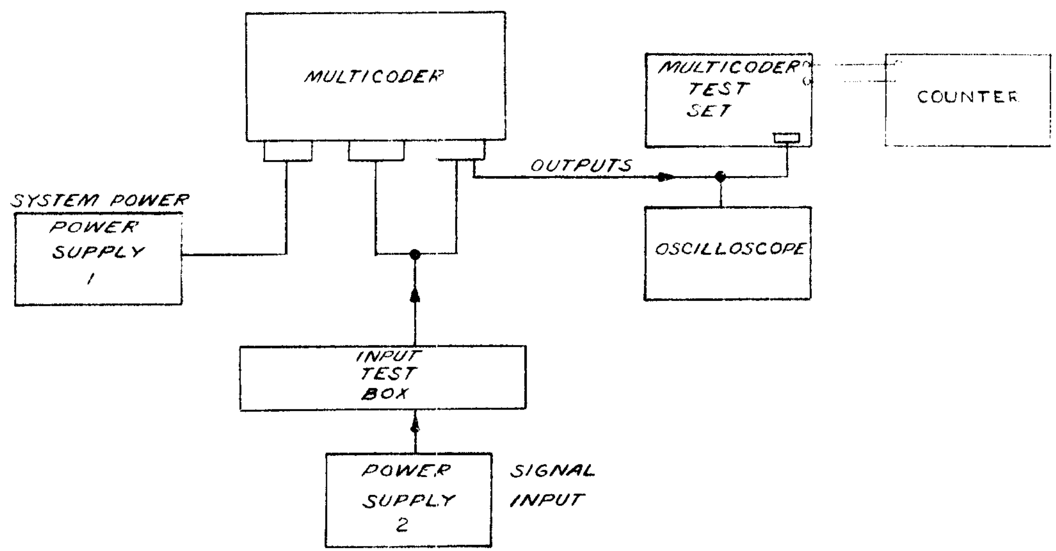
2.4.18.1 Test Equipment

1. Power Supply (2), Trygon Model HR 40-500.
2. Multicoder Test Set, SCI Model 101.
3. Multicoder Input Test Box.
4. Counter, Hewlett Pakard Model 523 DR.

2.4.18.2 Test Method

1. Arrange the equipment as shown in Figure 14.
2. Adjust Power Supply # 1 to read 28.0 ± 0.1 VDC.
3. Ground inputs 1-4 and 6-88.
4. Connect Power Supply # 2 to the input of Channel 5 and adjust until the voltage reads 5.0 ±0.01 VDC.
5. Read and record the PAM and PDM outputs of Channel 5.
6. Increase Power Supply # 2 to +30.0 ±0.1 volts.
7. Repeat 2.4.18.2.5.
8. Reverse the leads on Power Supply # 2 and apply -30.0 ±0.1 volts to the input.
9. Repeat 2.4.18.2.5.
10. Remove Power Supply # 2 and ground the input to Channel 5.
11. Repeat 2.4.18.2.5.

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL



APPLICATION: NEXT ASSY. ——— / USED ON WO 1193	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS — DECIMALS — ANGLES — MATERIAL — HEAT TREATMENT — FINAL PROTECTIVE FINISH —	DRAWN: DON TROTTER DATE: 10-20-65 CHECKED — DATE — APPROVED — DATE — PROJ ENG DATE	ZERO & FULL SCALE PAM & PDM OUTPUTS FIGURE 14 SCALE — UNIT WT. —

SCI Space Craft Inc. Huntsville, Ala.

DWG. SIZE B | SCI-21260 | SHEET 1 OF 1

2.4.18.3 Test Results - The following limits on the PAM and PDM shall apply.

Input (Volts)	PAM (Volts)	PDM (Microseconds)
5	5 $\pm$0.1	660 $\pm$ 10
30	$\leq$ 6.25	$\leq$ 825
-30	$\geq$ .50	$\geq$ 50
0	1 $\pm$0.1	110 $\pm$ 10

2.4.19 Off Time Voltage - The test shall measure the level of the PAM output between pulses.

2.4.19.1 Test Equipment

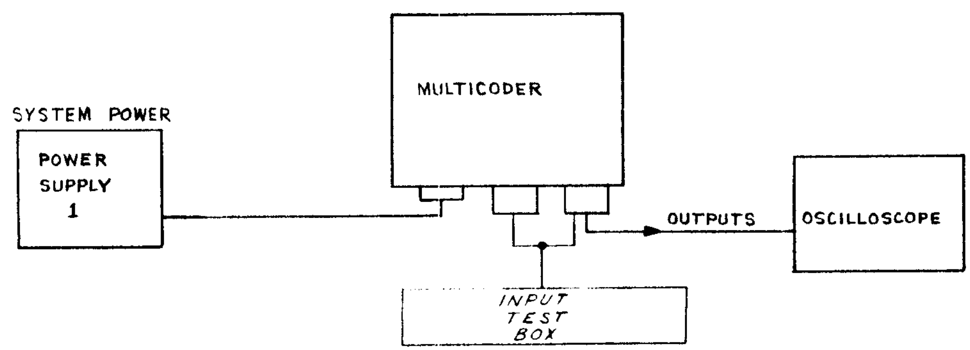
1. Power Supply, Trygon Model HR 40-500.
2. Oscilloscope, Tektronix 535A.
3. Multicoder Input Test Box.

2.4.19.2 Test Method

1. Arrange equipment as shown in Figure 15.
2. Adjust power supply # 1 to read 28.0 $\pm$ 0.1 VDC.
3. With the scope, read and record the output signal level between channels.

2.4.19.3 Test Results - The level of the PAM output between pulses shall be $\pm$ 50 millivolts maximum.

2.4.20 DPDM Output - The test shall measure the DPDM output characteristics.



REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL

UNLESS OTHERWISE SPECIFIED	
DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES	
MATERIAL	
HEAT TREATMENT	
FINAL PROTECTIVE FINISH	
NEXT ASSY.	USED ON
APPLICATION	

DRAWN	N. KEY
DATE	10-20-65
CHECKED	
DATE	
APPROVED	
DATE	
PROJ. ENG	
DATE	

OFF TIME VOLTAGE

FIGURE 15

SCALE NONE UNIT WT.

Space Craft Inc. Huntsville, Ala.

DWG. SIZE B SCI-21262

SHEET 1 OF 1

2.4.20.1 Test Equipment

1. Power Supply (2), Trygon, Model HR 40-500.
2. Oscilloscope Tektronix 535A.
3. Current Probe.
4. Multicoder Input Test Box.

2.4.20.2 Test Method

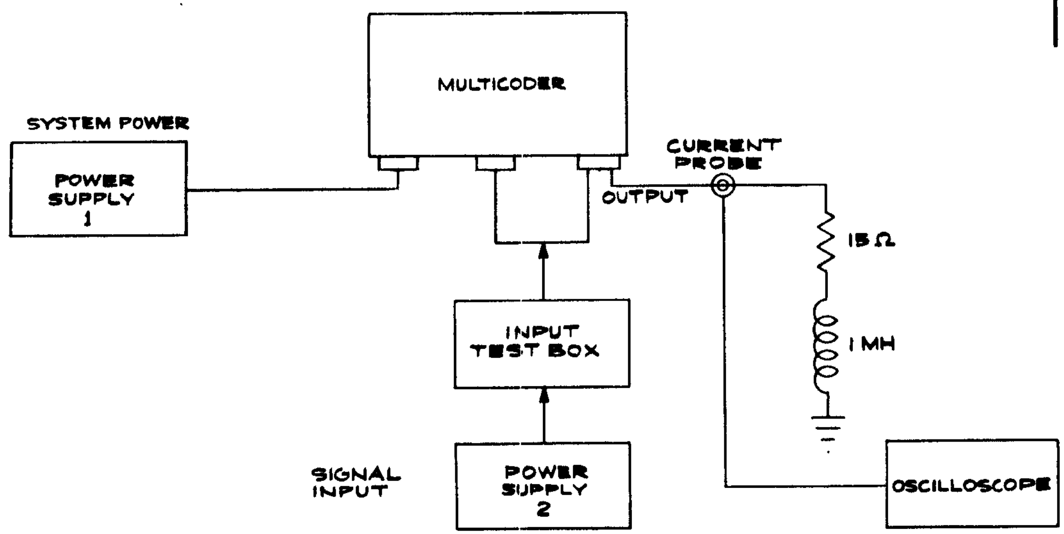
1. Arrange equipment as shown in Figure 16.
2. Strap inputs 1-88 together.
3. Adjust Power Supply # 1 to read 28.0 $\pm$0.1 volts.
4. Adjust Power Supply # 2 to read 2.5 $\pm$ 0.1 VDC and apply to the signal inputs.
5. With the current probe and scope, read and record the following DPDM characteristics.

   (a) Magnitude of Current Pulses
   (b) Pulse Width at 10% amplitude
   (c) Overshoot.
   (d) Rise Time

2.4.20.3 Test Results - The following limits shall apply to the DPDM output when loaded with 15 ohms in series with a 1 mh inductor.

(a)	Magnitude	16 $\pm$ 4 milliamperes
(b)	Pulse Width	15 $\pm$ 5 microseconds
(c)	Overshoot	30% of pulse amplitude, decaying to zero within 50 microseconds
(d)	Rise Time	8 microseconds maximum

2.4.21 Temperature Tests - The test shall demonstrate that the multicoder shall operate as specified over temperature extremes.



REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH

NEXT ASSY. | USED ON
APPLICATION

DRAWN	Tommy Ashmore
DATE	10-21-65
CHECKED	
DATE	
APPROVED	
DATE	
PROJECT ENGINEER	
DATE	

DPDM OUTPUT
CURRENT WAVEFORM
PULSE WIDTH & RISE TIME
FIGURE 16

SCALE | UNIT WT.

Space Craft Inc.
Huntsville, Ala.

DWG. SIZE B | SCI- 21268
SHEET 1 OF 1

2.4.21.1 Test Equipment

1. As specified in Sections 2.4.2 through 2.4.20.

2.4.21.2 Test Method

1. Place the multicoder in the environmental oven.
2. Reduce the temperature to $-35^{\circ}C$ and allow the unit to soak for 1 hour.
3. Repeat all tests outlined in Sections 2.3.2 through 2.3.20.
4. Increase the chamber temperature to $+71^{\circ}C$ and allow for the unit to stabilize for 1 hour.
5. Repeat all tests.

2.4.21.3 Test Results

The unit shall operate without malfunction when subjected to temperature extremes of $-35^{\circ}C$ and $+71^{\circ}C$.

SECTION III

ENVIRONMENTAL TESTING

3.0 ENVIRONMENTAL TESTING

3.1 General

The environmental testing of the multicoder shall demonstrate that the unit can operate without malfunction when submitted to launch, deep space, and re-entry environmental conditions.

With the exception of the fungus test, all environmental tests specified in MSC-MUL-10 will be performed. They are as follows:

a) Thermal Shock
b) Altitude
c) Acceleration
d) Shock
e) Acoustic Noise
f) Vibration
   1. Random Motion
   2. Sinusoidal Motion
g) Humidity
h) RFI
i) 0_2 Atmosphere
j) Salt Fog
k) Sand and Dust

3.2 Functional Test

The following test will be used during each of the environmental tests to demonstrate that the multicoder is operating properly.

3.2.1 Test Equipment

1. Power Supply (2), Trygon Model HR 40-500.
2. Multicoder Test Set, SCI Model 101.
3. Oscilloscope, Tektronix 535A.
4. Counter, Hewlett Packard, Model 523-DR.
5. Multicoder Input Test Box.

3.2.2 Test Method

1. Arrange equipment as shown in Figure 17.
2. Adjust Power Supply # 1 to 28.0 volts.
3. Strap inputs 1-88 together and adjust Power Supply # 2 to read 2.5 $\pm$ 0.01 volts, D.C.
4. Read and record the output PAM, PDM, and DPDM signals of Channel 5.
5. Submit the multicoder to the environmental tests outlined in Section 3.1.
6. During each test, read and record the PAM, PDM, and DPDM signals of Channel 5.

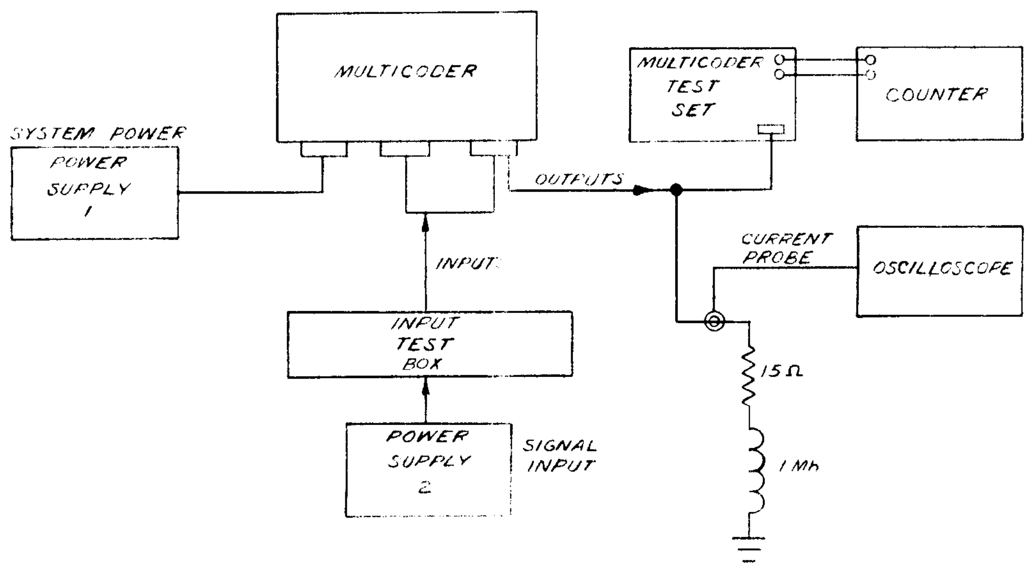
3.2.3 Test Results

The multicoder shall operate without malfunction when submitted to the environmental conditions.

3.3 Environmental Performance

Unless otherwise stated, the multicoder shall operate as specified herein during its subjection to the following environmental conditions. This operation shall include energizing and de-energizing of the multicoder. The functional test will be run during each environmental condition.

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL



UNLESS OTHERWISE SPECIFIED	DRAWN	DON TROTTER	**FUNCTIONAL TEST**
DIMENSIONS ARE IN INCHES; TOLERANCES ON: FRACTIONS DECIMALS ANGLES	DATE	10-20-65	FIGURE 17
MATERIAL	CHECKED		
HEAT TREATMENT	DATE		
FINAL PROTECTIVE FINISH	APPROVED		
	DATE		

NEXT ASSY. | USED ON: WC 1135 | APPLICATION

Space Craft Inc. Huntsville, Ala.

DWG. SIZE B | SCI- 21267 | SCALE | UNIT WT. | SHEET 1 OF

3.3.1 Thermal Shock

The multicoder shall operate as specified herein during a 10 minute exposure to an ambient temperature of $+230^{o}$ F after the temperature of the multicoder case has been allowed to stabilize at $+122^{o}$F.

3.3.2 Altitude

The multicoder shall operate as specified herein with no structural deformation or arcing during an ascent from normal atmospheric pressure to 200,000 feet equivalent pressure in 2.5 minutes and during operation at any ambient pressure between normal atmospheric pressure and a pressure of 1×10^{-6} millimeters of mercury.

3.3.3 Acceleration

The multicoder shall operate as specified herein during its subjection to 40 g's of acceleration for three minutes in each direction of the three mutually perpendicular axes.

3.3.4 Shock

The multicoder shall operate as specified herein during the application of three 50 g shock impulses with a duration of 11 milliseconds in each direction of the three mutually perpendicular axes.

3.3.5 Acoustic Noise

The multicoder shall operate as specified herein during its subjection to random noise at a level of 165 db referenced to 0.0002 dynes/cm^2 with the following characteristics:

Octave Band	Sound Pressure Level
4.7 - 9.4 cps	155 db
9.4 - 18.8 cps	163 db
18.8 - 37.5 cps	164 db
37.5 - 75 cps	161 db
75 - 150 cps	158 db
150 - 300 cps	155 db
300 - 600 cps	150 db
600 - 1200 cps	145 db
1200 - 2400 cps	139 db
2400 - 4800 cps	133 db
4800 - 9600 cps	129 db

3.3.6 Vibration

The multicoder shall operate as specified herein during its subjection to the following vibration along any axes.

3.3.6.1 Random Motion

The multicoder shall be subjected to random vibration with three sigma cut off and with the following characteristics:

15 g RMS for 15 seconds

Frequency	Vibration
10 cps	0.0573 g^2/cps
10 - 75 cps	Linear increase to 0.1607g^2/cps
75 - 220 cps	Constant 0.1607 g^2/cps
220-2020 cps	Linear decrease to 0.0573 g^2/cps

12 g RMS for 180 seconds

Frequency	Vibration
10 cps	0.0367 g^2/cps
10-75 cps	Linear increase to 0.1028 g^2/cps
75-220 cps	Constant 0.1028 g^2/cps
220-2020 cps	Linear decrease to 0.0367 g^2/cps

Random vibration shall be applied along each of three mutually perpendicular axis for a minimum duration as specified with sufficient time allowed to monitor performance.

3.3.6.2 Sinusoidal Motion

The multicoder shall be subjected to sinusoidal vibration swept logarithmically from 5 cps to 2 kc to 5 cps in 10 minutes for each of the three mutually perpendicular axis. Equipment shall be operative and monitored during the test. Levels of vibration shall be as follows:

Frequency	Vibration
5-10 cps	Constant 0.20 inch double amplitude (in D.A.)
10-18 cps	Constant 1 g
18-56 cps	Constant 0.06 inch D.A.
56-2000 cps	Constant 10 g

3.3.7 0_2 Atmosphere

The multicoder shall operate as specified herein during subjection 100% O_2 atmosphere at 7 psia for a period of not less than one hour with no corrosion or arcing.

3.3.8 Salt Fog

The multicoder operation shall be unaffected during subjection to salt fog as specified in MIL-STD-810 (USAF) Method 509.

3.3.9 Humidity

The multicoder shall operate as specified herein when subjected to 100% humidity including condensation over a temperature range of 80° F to 160° F with temperature cycling as specified in MIL-STD-810 (USAF) Method 507.

3.3.10 Sand and Dust

The multicoder shall operate as specified herein in an environment of sand and dust as encountered in desert and ocean beach areas (equivalent to 140-mesh silica flour with a particle velocity up to 500 feet per second) as described in MIL-STD-810 (USAF) Method 510.

3.3.11 RFI

The multicoder shall be designed and tested in accordance with MIL-I-26600/MSC-EMI-10A. In particular, the manufacturer shall comply with paragraphs 3.4., 4.1.2 and 4.1.3 of MIL-I-26600. The detailed procedure is outlined in the RFI Test Plan submitted to MSC.

SECTION IV

POST ENVIRONMENTAL ACCEPTANCE TEST

4.0 POST ENVIRONMENTAL ACCEPTANCE TEST

4.1 General

The Post-Environmental Acceptance Test is identical to the pre-environmental acceptance test with the exception of the temperature tests, which will be omitted. The procedure and necessary test equipment are as those outlined in Section 2.0.

SECTION 5.0

DATA SHEETS

5.1 Supply Voltage

Input

28V	PAM	____________
	PDM	____________
24V	PAM	____________
	PDM	____________
32V	PAM	____________
	PDM	____________
37V	PAM	____________
	PDM	____________
22V	PAM	____________
	PDM	____________

5.2 Supply Current

____________ Milliamperes

5.3 Power Reversal

A. Before Power Reversal

PAM ____________

PDM ____________

B. After Power Reversal

PAM ____________

PDM ____________

5.4 Ripple

A. Normal Operation

PAM ____________

PDM ____________

B. Square Wave Superimposed

PAM ____________

PDM ____________

C. Sine Wave Superimposed

PAM ____________

PDM ____________

5.5 Input Power Supply Feedback

____________ Millivolts

5.6 Transient Susceptibility

A. Before Applying Transient

PAM ____________

PDM ____________

B. After Application of Positive Transient

PAM ____________

PDM ____________

C. After Application of Negative Transient

PAM ____________

PDM ____________

5.7 Reverse Current

A. Non-Sample

Channel	V_R	Reverse Current
5		
11		
21		
31		
41		
51		
61		
71		
81		
83		

B. Sample

Channel	V_R	Reverse Current
5		
11		
21		
31		
41		
51		
61		
71		
81		
83		

5.8 Input Impedance

A. Non Sample

Channel	V_{21}	V_{22}	V_{11}	V_{12}
5	____	____	____	____
11	____	____	____	____
21	____	____	____	____
31	____	____	____	____
41	____	____	____	____
51	____	____	____	____
61	____	____	____	____
71	____	____	____	____
81	____	____	____	____
83	____	____	____	____

Channel	ΔV_2	ΔV_1	Ratio
5	____	____	____
11	____	____	____
21	____	____	____
31	____	____	____
41	____	____	____
51	____	____	____
61	____	____	____
71	____	____	____
81	____	____	____
83	____	____	____

5.8 (Cont'd)

Input Impedance

B. Sample

Channel	V_{21}	V_{22}	V_{11}	V_{12}
5	______	______	______	______
11	______	______	______	______
21	______	______	______	______
31	______	______	______	______
41	______	______	______	______
51	______	______	______	______
61	______	______	______	______
71	______	______	______	______
81	______	______	______	______
83	______	______	______	______

Channel	ΔV_2	ΔV_1	Ratio
1	______	______	______
11	______	______	______
21	______	______	______
31	______	______	______
41	______	______	______
51	______	______	______
61	______	______	______
71	______	______	______
81	______	______	______
83	______	______	______

5.9 Signal Overvoltage

A. Before Applying Overvoltage

PAM ______________

PDM ______________

B. After Application of + 30 V Signal

PAM ______________

PDM ______________

C. After Application of - 30 V Signal

PAM ______________

PDM ______________

5.10 PAM and PDM Linearity

Input Voltage	PAM	PDM
Zero	_____	_____
One	_____	_____
Two	_____	_____
Three	_____	_____
Four	_____	_____
Five	_____	_____

5.11 Crosstalk

Channel	Without Crosstalk		With Crosstalk	
	PAM	PDM	PAM	PDM
5	_____	_____	_____	_____
11	_____	_____	_____	_____

5.11 (Cont'd)

Crosstalk

Channel	Without Crosstalk PAM	Without Crosstalk PDM	With Crosstalk PAM	With Crosstalk PDM
21	______	______	______	______
31	______	______	______	______
41	______	______	______	______
51	______	______	______	______
61	______	______	______	______
71	______	______	______	______
81	______	______	______	______
83	______	______	______	______

5.12 Source Impedance Effects

Source Impedance Effects		Channel 4	Channel 6
Normal	PAM	______	______
	PDM	______	______
Zero	PAM	______	______
	PDM	______	______
Open	PAM	______	______
	PDM	______	______
Open Channel	PAM	______	______
	PDM	______	______

5.13 Output Format - PAM and PDM

A. PAM

1. Frame Rate ________________
2. Duty Cycle ________________
3. Pulse Spacing ________________
4. Pulse Spikes ________________
5. Rise Time ________________
6. Decay Time ________________
7. Output Noise ________________

B. PDM

1. Amplitude ________________
2. Rise Time ________________
3. Decay Time ________________

5.14 PAM Channel Scatter and Pulse Width Scatter and Jitter

Channel	PAM	PDM
5	______	______
11	______	______
21	______	______
31	______	______
41	______	______
51	______	______
61	______	______
71	______	______
81	______	______
83	______	______

5.15 Synchronization Pulse

A. Pulse Width ______________

B. Repetition Rate ______________

5.16 Clock Output

Frequency ______________

5.17 Zero and Full Scale PAM Amplitude and PDM Pulse Width

Input Voltage	PAM (Volts)	PDM (Microseconds)
5	________	________
30	________	________
-30	________	________
0	________	________

5.18 Off Time Voltage

________ Volts

5.19 DPDM Output

A) Magnitude ________

B) Pulse Width ________

C) Overshoot ________

D) Rise Time ________

5.20 Thermal Shock

Prior to Test	During Test
PAM ________	PAM ________
PDM ________	PDM ________
DPDM ________	DPDM ________

5.21 Altitude

Prior to Test	During Test
PAM ________	PAM ________
PDM ________	PDM ________
DPDM ________	DPDM ________

5.22 Acceleration

Prior to Test	During Test
PAM ________	PAM ________
PDM ________	PDM ________
DPDM ________	DPDM ________

5.23 Shock

Prior to Test	During Test
PAM ________	PAM ________
PDM ________	PDM ________
DPDM ________	DPDM ________

5.24 Acoustic Noise

Prior to Test	During Test
PAM ________	PAM ________
PDM ________	PDM ________
DPDM ________	DPDM ________

5.25 Vibration

A. Random Motion

Prior to Test	During Test
PAM ________	PAM ________
PDM ________	PDM ________
DPDM ________	DPDM ________

B. Sinusoidal Motion

Prior to Test	During Test
PAM ________	PAM ________
PDM ________	PDM ________
DPDM ________	DPDM ________

5.26 Humidity

Prior to Test	During Test
PAM ________	PAM ________
PDM ________	PDM ________
DPDM ________	DPDM ________

5.27 <u>0^2 Atmosphere</u>

Prior to Test	During Test
PAM ________	PAM ________
PDM ________	PDM ________
DPDM ________	DPDM ________

5.28 <u>Salt Fog</u>

<u>Prior to Test</u>	<u>During Test</u>
PAM ________	PAM ________
PDM ________	PDM ________
DPDM ________	DPDM ________

5.29 <u>Sand and Dust</u>

Prior to Test	During Test
PAM ________	PAM ________
PDM ________	PDM ________
DPDM ________	DPDM ________

APPENDIX A

MULTICODER TEST SET

MULTICODER TEST SET

The Multicoder Test Set provides a method of sampling the output PAM and PDM signals provided by the Multicoder. The outputs provided are a 10 bit digital display of the PAM amplitude, and terminals for monitoring the pulse width of any PDM channel. The test set is self contained with an internal 115 VAC to 28 VDC power supply. The logic necessary to select any of the 90 channels consists of ÷9 and ÷10 counters which are synchronized to the Multicoder timing using the clock and sync outputs of the Multicoder. The outputs of the ÷ 9 and ÷ 10 counters connect to two rotary switches, thus providing a method of channel selection. These counts, when decoded, uniquely define any of the 90 channel times.

The PAM portion of the test set contains a highly accurate 10 bit Analog-to-Digital Converter. The ADC is essentially the same as that used in the Saturn Model 301 PCM system with only minor changes being incorporated. The ADC accepts single ended high level inputs in the range of 0-5 volts. The accuracy is +0.05%, therefore the PAM amplitude can be measured accurately to within 4 millivolts. The 10-bit output of the ADC connects to lamp drivers thus providing a visual digital readout of the PAM amplitude.

The test set also contains circuitry for sampling any of the PDM channels. Two terminals are provided for monitoring the PAM signal.