



**Space
Systems Division**

Parts Application Analysis - Array D
Redundant Command Receiver

ATM 983

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DATE 26 Feb. 1971

This Parts Application Analysis was prepared by Motorola's Government Electronics Division as required under the Bendix/Motorola subcontract SC-0721 for the ALSEP program.

The ALSEP Redundant Command Receiver is a solid state receiver with active redundancy that may be used to receive either PM or PM-FM type signals. This receiver includes two identical electrically separate receivers, consisting of an rf converter, an IF and Audio Amp, and a power isolator. In addition, the redundant receiver has an rf power divider referred to as an rf coupler, and a selection circuit referred to as an audio combiner.

The purpose of the Parts Application Analysis is to determine the stress level for each part in each application and to identify any part(s) that is stressed beyond its recommended derating. In this analysis the amount of derating was determined from parts ratings at an operating temperature of 75°C, which represents the maximum temperature anticipated during 2 years of lunar surface operation.

The analysis has shown that 70% of the parts are stressed below 10% of the manufacturers rating at 75°C. Only one part exceeds a 50% stress; Q₄ in the rf converter has a VCE of 55% which presents no particular reliability problem. In conclusion, the analysis has shown that all electrical parts have been conservatively applied in the Redundant Command Receiver.

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27 August 1970

Parts Application Analysis for
ALSEP Redundant Command Receiver
BXA Part Number 2345147

"Preliminary - The Bendix Corporation,
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1.0 INTRODUCTION

The part application analysis was performed on the ALSEP Redundant Command Receiver for Bendix Aerospace Systems. The method of analysis complied with the technique and form requirements of Task 4 and Task 16 of the Reliability Program Plan for the ALSEP Redundant Command Receiver (Motorola Document Number 3875/001, Revision A, dated 30 April 30, 1970).

The analysis was performed on the design configuration as of Nov. 30, 1970.

This report is considered a final parts application analysis submitted to fulfill the requirements of the CDR.

2.0 REQUIREMENTS

The application of all electrical parts has been reviewed. The purpose of the analysis was to determine the degree of derating achieved for each part in each application with respect to its electrical capabilities. Part ratings were obtained from vendor data sheets. The amount of derating was determined from parts ratings at an operating temperature of 75°C, which represents the maximum temperature during the mission profile of 2 years of lunar surface operation.

The following are the recommended derating guidelines used in the analysis:

CAPACITORS

| | |
|---------------------|----------------|
| Ceramic | - 50% Voltage |
| Mica | - 50% Voltage |
| Paper/Plastic | - 50% Voltage |
| Electrolytic, Wet | - 60% Voltage |
| Electrolytic, Solid | - 60% Voltage* |

*Requires series impedance of 3 ohms/volt

RESISTORS

Film - 50% Power
Wirewound - 50% Power
Composition - 50% Power

SEMICONDUCTORS

Diodes, Si - 50% Voltage
- 50% Current
 $T_j = 140^\circ\text{C}$ Maximum

Transistors, Si - 50% Voltage
- 50% Current
 $T_j = 140^\circ\text{C}$ Maximum

TRANSFORMERS AND COILS - 15°C Rise

3.0 SUMMARY OF ANALYSIS AND CONCLUSIONS

Table I presents a summary of the part application analysis. The table shows that a majority of the parts (70%) are stressed below 10% of the manufacturer's rating at the worst case temperature of 75°C .

Q_4 of the RF Converter has a VCE greater than 50% of the rated VCEO.

| <u>RF Converter</u> | <u>Voltage Derating</u> | <u>T_j</u> |
|---------------------|-------------------------|-------------------------|
| Q_4 | 55% | 103°C |

All junction temperatures of all transistors except Q_4 are now 100°C or less, and only Q_4 's voltage derating exceeds 50%. However, since the stress ratio is .55, Q_4 presents no particular reliability problem area (see paragraph 5.0).

In conclusion, the Part Application Analysis has shown that all electrical parts have been conservatively applied in the Redundant Command Receiver at the maximum expected temperature for the assurance of reliable performance during the two-year lunar surface operation.

4.0 ANALYSIS DETAILS

The details of the procedure used in the performance of the Part Application Analysis is contained in the following paragraphs.

The worksheets used in the completion of the PAA are contained in Appendix A. The circuit symbols appearing on these sheets correspond to the circuit symbols assigned to the parts appearing on the module drawings. The following is a list of schematics and revision letters used in the analysis:

| <u>Module</u> | <u>Schematic No.</u> | <u>Revision</u> |
|-----------------------------------|---------------------------------------|-----------------|
| IF and Audio | 63-P11349B | D |
| RF Converter | 63-P11377B | B |
| Power Isolator and Audio Combiner | 63-P113 ⁸⁰ 55 B | B |

Electrical measurements, obtained from breadboard measurements of AC and DC voltages and currents, were used to calculate the part stresses. A derating was obtained by comparing these calculated stresses with the part ratings at a worst case temperature of 75°C. All information is recorded on the worksheets in Appendix A.

Once the electrical stress ratio was calculated, a failure rate based upon this stress ratio and an expected temperature of 45°C was assigned from Motorola R&C's Special Memorandum No. 188, contained in Appendix C, or MIL-HDBK-217A.

The following is a set of assumptions and ground rules used in this analysis:

- a) Electrical measurements were made under normal room ambient conditions and anticipated typical driving signals and loading.
- b) All connectors have been grouped with the modules in which they are assembled.
- c) All select-at-test components were assigned values that would result in the worst case stresses of circuit parts.
- d) Part ratings at 75°C were obtained from MIL specs, vendor sheets, or IRS's.
- e) Temperature rise in transformers and inductors was estimated based upon engineering judgment.
- f) All filters, integrated circuits, solid state amplifiers, and crystal oscillators were entered on the 'MISC. PARTS' sheets. The parameters considered in the analysis were those considered pertinent to the reliability of the application.
- g) Screening factors were used where applicable and appear from SM-188 in the Failure Rate multiplier column of the PAA work-sheets of Appendix A.

The part application analysis summary sheets appear in Appendix B. For each module, failure rates were entered and summed.

The total failure rate for each module is not the failure rate used in the reliability prediction (Motorola Report No. 038). The module failure rate was adjusted by the results of the FMECA (Motorola Report No. 035) and this value was used in the prediction.

5.0 CONCLUSIONS

As mentioned in paragraph 3.0, Q_4 in the RF converter has a junction temperature of 103°C and a voltage stress ratio of .55. Since 55% is not greatly above the recommended 50% and since this situation presents no problem of reliability significance, no further design changes are being considered. Also, 103°C junction temperature is well below the recommended 140°C .

Table 1

Summary of Parts Application Analysis

STRESS DERATINGS OF TRANSISTORS & DIODES (37 total)

| <u>Voltage Derating (%)</u> (Recommended 50% Max.) | <u>Quantity</u> | <u>% of Total</u> | <u>Module</u> | <u>Remarks</u> |
|---|-----------------|-------------------|--|----------------------------|
| ≤10 | 21 | 56 | | |
| >10, ≤20 | 2 | 5.4 | | |
| >20, ≤30 | 4 | 10.8 | | |
| >30, ≤40 | 5 | 13.5 | { Q ₁ -RF Converter Q ₂ -RF Converter Q ₄ -RF Converter | 44% T _J = 97°C |
| >40, ≤50 | 2 | 5.4 | | 43% T _J = 97°C |
| >50, ≤60 | 1 | 2.7 | | 55% T _J = 103°C |
| N/A | 2 | 5.4 | | Zener Diodes |

| <u>Junction Temperature</u> (Recommended 140°C Max.) | <u>Quantity</u> | <u>% of Total</u> | <u>Module</u> | <u>Remarks</u> |
|---|-----------------|-------------------|------------------------------|------------------------|
| ≤100°C | 36 | 97.3 | | |
| >100, ≤140°C | 1 | 2.7 | Q ₄ -RF Converter | T _J = 103°C |

STRESS DERATING OF PARTS OTHER THAN TRANSISTORS AND DIODES (321 total)

| <u>Stress %</u> | <u>Quantity</u> | <u>% of Total</u> | <u>Module</u> | <u>Remarks</u> |
|-----------------|-----------------|-------------------|---|------------------------------|
| ≤10 | 231 | 72 | | |
| >10, ≤20 | 42 | 13.1 | | |
| >20, ≤30 | 9 | 2.8 | | |
| >30, ≤40 | 2 | 0.6 | { C-19-IF and Audio C-7, C8-Power Isolator | Ceramic Max ≤50%; actual 44% |
| >40, ≤50 | 3 | 0.9 | | Elect. Max ≤60%; actual 48% |
| 5°C | 34 | 10.6 | | Inductors and Transformers |

APPENDIX A

PART APPLICATION ANALYSIS
WORKSHEETS

CAPACIT

PROJECT: ALSEP

DATE: 20

ASSEMBLY: REDUNDANT COMMAND

SUBASSEMBLY: Converter

SCHEMATIC NO: P11277B

(Capacitors)

| 1 CIRCUIT SYMBOL NUMBER | 2 TYPE DESIGNATION (MIL OR MFR) AND CONSTRUCTION | 3 MANUFACTURER | 4 CAPACITANCE VALUE and | 5 TOLERANCE % | 6 MANUFACTURER'S RATED VOLTAGE | 7 OPERATING VOLTAGE | | 10 MAXIMUM DUTY CYCLE | 11 BULK AIR TEMPERATURE (C) | 12 CIRCUIT FUNCTION OR APPLICATION | 13 BASIC FAILURE RATE (x/100 HRS) AT 25 C USE BELOW | | 14 SPECIAL ENVIRONMENT (DEFINE) | 15 FAILURE RATE MULTIPLIER | 16 FINAL FAILURE RATE | 18 TOTAL CAPACITOR COUNT PER TYPE | 19 TOTAL FAILURE RATE (x/100 HRS) |
|----------------------------|---|-------------------|----------------------------|------------------|-----------------------------------|------------------------|------------------------------------|--------------------------|--------------------------------|---------------------------------------|--|-----|------------------------------------|-------------------------------|--------------------------|--------------------------------------|--------------------------------------|
| | | | | | | 8 DC PEAK AC | 9 VOLTAGE RATIO OPERATING/RATED | | | | 13A | 13B | | | | | |
| 01 | 21-P11258B | | 33pf | 1 | 500 | 166.5 | .01 | 75 | | | .30 | A | | .1 | | | .000090 |
| 02 | 21-P11258B | | 33pf | 1 | 500 | 166.2 | .01 | 75 | | | .30 | A | | .1 | | | .000090 |
| 03 | ST10251-11 | | 100pf | - | 250 | 175.15 | .01 | 75 | | | 6.00 | B | | - | | | .000500 |
| 04 | 21-P11258B | | 10pf | 1 | 500 | 175.15 | .01 | 75 | | | .30 | A | | .1 | | | .000090 |
| 05 | CKR05 | | 1000 pf | 10 | 200 | 118.1 | .06 | 75 | | | 7.0 | A | | .15 | | | .021050 |
| 06 | CKR05 | | 1000 pf | 10 | 200 | 118.1 | .01 | 75 | | | 7.0 | A | | .15 | | | .021050 |
| 07 | CKR05 | | 1000 pf | 10 | 200 | 97.1 | .01 | 75 | | | 7.0 | A | | .15 | | | .021050 |
| 08 | 21-P11258B | | 5pf | 1 | 500 | 131.2 | .02 | 75 | | | .30 | A | | .1 | | | .000090 |
| 09 | CKR05 | | 1000 pf | 10 | 200 | 121.2 | .03 | 75 | | | 7.0 | A | | .15 | | | .021050 |
| 10 | CKR05 | | 1000 pf | 10 | 200 | 131.1 | .04 | 75 | | | 7.0 | A | | .15 | | | .021050 |
| 11 | CKR05 | | 1000 pf | 10 | 200 | 142.1 | .03 | 75 | | | 7.0 | A | | .15 | | | .021050 |
| 12 | 21-P11258B | | 5pf | 1 | 500 | 118.2 | .02 | 75 | | | .30 | A | | .1 | | | .000090 |
| 13 | CKR05 | | 1000 pf | 10 | 200 | 118.1 | .06 | 75 | | | 7.0 | A | | .15 | | | .021050 |
| 14 | CKR05 | | 1000 pf | 10 | 200 | 118.1 | .06 | 75 | | | 7.0 | A | | .15 | | | .021050 |
| 15 | CKR05 | | 1000 pf | 10 | 200 | 121.1 | .02 | 75 | | | 7.0 | A | | .15 | | | .021050 |
| 16 | CKR05 | | 1000 pf | 10 | 200 | 118.1 | .06 | 75 | | | 7.0 | A | | .15 | | | .021050 |
| 17 | CKR05 | | 1000 pf | 10 | 200 | 142.1 | .01 | 75 | | | 7.0 | A | | .15 | | | .021050 |
| 18 | ST10251-9 | | 100pf | - | 250 | 0.1 | .01 | 75 | | | 6.00 | B | | - | | | .000500 |
| 19 | ECY101R | | 1.5pf | 20 | 500 | 0.1 | .01 | 75 | | | .33 | A | | .18 | | | .000060 |

FOR USE OF RELIABILITY DEPT

| | | | |
|---------------------------------------|------------------------------------|---------------------------|--|
| 20 | | 21 | |
| FAILURE RATE SOURCES (FOR COLUMN #14) | | CALCULATED MTBF _____ HRS | |
| A <u>SM-188</u> | B <u>MIL-HDBK-217 F16, 7.6.13B</u> | | |
| C _____ | D _____ | | |

| | |
|----|--|
| 22 | TOTAL FAILURE RATE <u>.013210</u> @ 1000 HRS |
|----|--|

CAPACITORS

PROJECT: ALSEP

DATE: 20 JULY 1970

ASSEMBLY: Redundant Command

SUBASSEMBLY: AF Controller

SCHEMATIC NO: 1-11377B

(Capacitors)

| 1 CIRCUIT SYMBOL NUMBER | 2 TYPE DESIGNATION (MIL or MFR) CONSTRUCTION | 3 MANUFACTURER | 4 CAPACITANCE VALUE RIG | 5 TOLERANCE % | 6 MANUFACTURER'S RATED VOLTAGE | 7 OPERATING VOLTAGE | 8 VOLTAGE RATIO OPERATING/RATED | 9 MAXIMUM DUTY CYCLE | 10 BULK AIR TEMPERATURE (°C) | 11 CIRCUIT FUNCTION OR APPLICATION | 13 BASIC FAILURE RATE (E-1000 HRS) | | 14 SPECIAL ENVIRONMENT (DEFENSE) | 15 FAILURE RATE MULTIPLIER | 16 FINAL FAILURE RATE | 17 TOTAL CAPACITOR COUNT PER TYPE | 18 TOTAL FAILURE RATE (E-1000 HRS) |
|----------------------------|---|-------------------|----------------------------|------------------|-----------------------------------|------------------------|------------------------------------|-------------------------|---------------------------------|---------------------------------------|---------------------------------------|------------------------|-------------------------------------|-------------------------------|--------------------------|--------------------------------------|---------------------------------------|
| | | | | | | | | | | | 12 DC PEAK AC | 13 30°C (SEE BELOW) | | | | | |
| C20 | ST10251-7 | | .8-10 pf | - | 250 | 01.1 | .01 | 75 | | | .60 | A | - | | | 1.000600 | |
| C21 | 21-P11258P | | 5pf | 1 | 500 | 142.1 | .01 | 75 | | | .30 | A | .1 | | | 1.00090 | |
| C22 | 11205 | | 100 pf | 10 | 200 | 201.1 | .02 | 75 | | | 7.0 | A | .15 | | | 1.001050 | |
| C23 | ECY101R | | 45pf | 20 | 500 | 01.1 | .01 | 75 | | | .33 | A | .18 | | | 1.00060 | |
| C24 | ST10251-9 | | .8-10 pf | - | 250 | 01.1 | .01 | 75 | | | .60 | B | - | | | 1.000600 | |
| C25 | 11205 | | 8.2pf | 10 | 200 | 202.1 | .02 | 75 | | | 7.0 | A | .15 | | | 1.001050 | |
| C26 | 11205 | | 100 pf | 10 | 200 | 751.1 | .01 | 75 | | | 7.0 | A | .15 | | | 1.001050 | |
| C27 | NOT USED | | | | | | | | | | | | | | | | |
| C28 | ECY108R | | 12pf | 3 | 500 | 10.71.1 | .03 | 75 | | | .33 | A | .18 | | | 1.00060 | |
| C29 | NOT USED | | | | | | | | | | | | | | | | |
| C30 | 11205 | | 100 pf | 10 | 200 | 5.30.1 | .04 | 75 | | | 7.0 | A | .15 | | | 1.001050 | |
| C31 | 11205 | | 100 pf | 10 | 200 | 12.21.1 | .06 | 75 | | | 7.0 | A | .15 | | | 1.001050 | |
| C32 | 11205 | | 100 pf | 10 | 200 | 122.1 | .01 | 75 | | | 7.0 | A | .15 | | | 1.001050 | |
| C33 | 11205 | | 100 pf | 10 | 200 | 100.1 | .02 | 75 | | | 7.0 | A | .15 | | | 1.001050 | |
| C34 | 11205 | | 100 pf | 10 | 200 | 201.1 | .03 | 75 | | | 1.0 | A | .15 | | | 1.001050 | |
| C35 | 21-P11265A | | 100pf | 5 | 250 | 1.60.5 | .01 | 75 | | | 2.0 | A | .15 | | | 1.000900 | |
| C36 | 11205 | | 100 pf | 10 | 200 | 201.1 | .01 | 75 | | | 7.0 | A | .15 | | | 1.001050 | |
| C37 | ECY102 | | 170 pf | 10 | 500 | 11.81.5 | .02 | 75 | | | .32 | A | .18 | | | 1.00060 | |
| C38 | 11205 | | 100 pf | 10 | 200 | 731.1 | .01 | 75 | | | 7.0 | A | .15 | | | 1.001050 | |

FOR USE OF RELIABILITY

FAILURE RATE SOURCES (FOR COLUMN #14)

A SM-188 B MIL-IND-217 FIG. 7.6.13B
C _____ D _____

CALCULATED MTBF _____ HRS

TOTAL FAILURE RATE 0.12040 1000 HRS

CAPACITORS

PROJECT: ALSEP

DATE: 20 3 1971

ASSEMBLY: Redundant Command

SUBASSEMBLY: RF CONVERTER

SCHEMATIC NO: 12-011277B

(Capacitors)

| 1 CIRCUIT SYMBOL NUMBER | 2 TYPE DESIGNATION (MIL or MFR) CONSTRUCTION | 3 MANUFACTURER | 4 CAPACITANCE VALUE MFD | 5 TOLERANCE % | 6 MANUFACTURER'S RATED VOLTAGE | | 7 OPERATING VOLTAGE | 8 VOLTAGE RATIO OPERATING/ RATED | 9 MAXIMUM DUTY CYCLE | 10 BULK AIR TEMPERATURE (C) | 12 CIRCUIT FUNCTION OR APPLICATION | 13 BASIC FAILURE RATE (E/1000 HRS) | | 14 SPECIAL ENVIRONMENT (DEFENSE) | 15 FAILURE RATE MULTIPLIER | 16 FINAL FAILURE RATE | 17 TOTAL CAPACITOR COUNT PER TYPE | 18 TOTAL FAILURE RATE (E/1000 HRS) | |
|---------------------------------------|---|-------------------|----------------------------|------------------|-----------------------------------|---------|------------------------|-------------------------------------|-------------------------|--------------------------------|---------------------------------------|---------------------------------------|----|-------------------------------------|-------------------------------|--------------------------|--------------------------------------|---|--|
| | | | | | DC | PEAK AC | | | | | | 13 | 14 | | | | | | |
| C39 | 21-11258B | | 33pf | 1 | 500 | 0.1 | 0.01 | | 75 | | | .30 | A | | .1 | | | .000080 | |
| C40 | 21-11258B | | 33pf | 1 | 500 | 0.1 | 0.01 | | 75 | | | .30 | A | | .1 | | | .000080 | |
| C41 | 21-11258B | | 33pf | 1 | 500 | 0.1 | 0.01 | | 75 | | | .30 | A | | .1 | | | .000080 | |
| C42 | CKROS | | 1000 pf | 10 | 200 | 5.48 | 1.03 | | 75 | | | 7.0 | A | | .15 | | | .001050 | |
| | | | | | | | | | | | | FOR USE OF RELIABILITY DEPT | | | | | | | |
| 20 | | | | | | | | | | | | 21 | | | | | | 22 | |
| FAILURE RATE SOURCES (FOR COLUMN #14) | | | | | | | | | | | | CALCULATED MTBF _____ HRS | | | | | | TOTAL FAILURE RATE <u>0.001290</u> E/1000 HRS | |
| A <u>SM-188</u> B _____ | | | | | | | | | | | | | | | | | | | |
| C _____ D _____ | | | | | | | | | | | | | | | | | | | |

RESISTORS

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: P. Lindquist Component

SUB ASSEMBLY: RF Amplifier

SCHEMATIC NO: 2-01277B

(Resistors)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|-----------------------|--|--------------|-------------------------|---------------|----------------------|---------------------------------|-----------------------------|--------------------|-------------------------|---------------------------------|--|---------------------------------|-------------------------|---------------------------------|-------------------------------|---------------------------------|----|
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MFG OR MFR) AND CONSTRUCTION | MANUFACTURER | RESISTANCE VALUE (OHMS) | TOLERANCE (%) | POWER RATING (WATTS) | MAXIMUM OPERATING POWER (WATTS) | POWER RATIO OPERATING/RATED | MAXIMUM DUTY CYCLE | BULK AIR TEMPERATURE °C | CIRCUIT FUNCTION OR APPLICATION | BASIC FAILURE RATE (1/1000 HRS) AT 100°C (SEE BELOW) | SPECIAL ENVIRONMENTS (DEFINING) | FAILURE RATE MULTIPLIER | FINAL FAILURE RATE (1/1000 HRS) | TOTAL RESISTOR COUNT PER TYPE | TOTAL FAILURE RATE (1/1000 HRS) | |
| R1 | RCR056 | | 56 | 5 | .125 | .021 | .01 | 75 | | | .01 | A | - | | | .000210 | |
| R2 | RCR056 | | 68 | 5 | .125 | .021 | .01 | 75 | | | .01 | A | - | | | .000210 | |
| R3 | RCR056 | | 12K | 5 | .125 | .011 | .09 | 75 | | | .01 | A | - | | | .000210 | |
| R4 | RCR056 | | 12K | 5 | .125 | .023 | .02 | 75 | | | .01 | A | - | | | .000210 | |
| R5 | RCR056 | | 1.2K | 5 | .125 | .007 | .06 | 75 | | | .01 | A | - | | | .000210 | |
| R6 | RCR056 | | 68 | 5 | .125 | .021 | .01 | 75 | | | .01 | A | - | | | .000210 | |
| R7 | RCR056 | | 2.2K | 5 | .125 | .021 | .01 | 75 | | | .01 | A | - | | | .000210 | |
| R8 | RCR056 | | 370 | 5 | .125 | .003 | .02 | 75 | | | .01 | A | - | | | .000210 | |
| R9 | RCR056 | | 6.8K | 5 | .125 | .005 | .04 | 75 | | | .01 | A | - | | | .000210 | |
| R10 | RCR056 | | 10 | 5 | .125 | .001 | .01 | 75 | | | .01 | A | - | | | .000210 | |
| R11 | RCR056 | | 47 | 5 | .125 | .001 | .01 | 75 | | | .01 | A | - | | | .000210 | |
| R12 | RCR056 | | 56K | 5 | .125 | .004 | .03 | 75 | | | .01 | A | - | | | .000210 | |
| R13 | RCR056 | | 100 | 5 | .125 | .007 | .07 | 75 | | | .01 | A | - | | | .000210 | |
| R14 | RCR056 | | 10 | 5 | .125 | .001 | .01 | 75 | | | .01 | A | - | | | .000210 | |
| R15 | RCR056 | | 33K | 5 | .125 | .021 | .01 | 75 | | | .01 | A | - | | | .000210 | |
| R16 | RCR056 | | 18K | 5 | .125 | .003 | .02 | 75 | | | .01 | A | - | | | .000210 | |
| R17 | RCR056 | | 680 | 5 | .125 | .001 | .01 | 75 | | | .01 | A | - | | | .000210 | |
| R18 | RCR056 | | 370 | 5 | .125 | .004 | .19 | 75 | | | .01 | A | - | | | .000210 | |

FOR USE OF RELIABILITY DEPT

FAILURE RATE SOURCES (FOR COLUMN #14)

A SM-188 B _____
C _____ D _____

CALCULATED MTBF _____ HRS

TOTAL FAILURE RATE .00055 1/1000 HRS

RESISTORS

PROJECT: ALSEP

DATE: 20 July 1971

ASSEMBLY: Radio Unit - Command

SUB ASSEMBLY: RF Converter

SCHEMATIC NO: 33-01177 B

(Resistors)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|-----------------------|--|--------------|-------------------------|---------------|----------------------|---------------------------------|-----------------------------|--------------------|-------------------------|---------------------------------|--|------------------------------|-------------------------|---------------------------------|-------------------------------|---------------------------------|----|
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MIL or MFR) AND CONSTRUCTION | MANUFACTURER | RESISTANCE VALUE (OHMS) | TOLERANCE (%) | POWER RATING (WATTS) | MAXIMUM OPERATING POWER (WATTS) | POWER RATIO OPERATING/RATED | MAXIMUM DUTY CYCLE | BULK AIR TEMPERATURE °C | CIRCUIT FUNCTION OR APPLICATION | BASIC FAILURE RATE (S/100 HRS) AT SOURCE (SEE BELOW) | SPECIAL ENVIRONMENTS (DATMS) | FAILURE RATE MULTIPLIER | FINAL FAILURE RATE (E/1000 HRS) | TOTAL RESISTOR COUNT PER TYPE | TOTAL FAILURE RATE (E/1000 HRS) | |
| R19 | RCR056 | | 2.2K | 5 | .125 | .001 | .01 | | 75 | | .01 | A | - | | | .000010 | A |
| R20 | RCR06 | | 2.2 | 5 | .125 | .003 | .02 | | 75 | | .01 | A | - | | | .000010 | |
| R21 | RCR056 | | 12K | 5 | .125 | .004 | .03 | | 75 | | .01 | A | - | | | .000010 | A |
| R22 | RCR056 | | 370 | 5 | .125 | .001 | .01 | | 75 | | .01 | A | - | | | .000010 | |
| R23 | RCR056 | | 20 | 5 | .125 | .001 | .01 | | 75 | | .01 | A | - | | | .000010 | |
| R24 | RCR056 | | 33 | 5 | .125 | .001 | .01 | | 75 | | .01 | A | - | | | .000010 | |
| R25 | RCR056 | | 18K | 5 | .125 | .007 | .06 | | 75 | | .01 | A | - | | | .000010 | A |
| R26 | RCR056 | | 8.2K | 5 | .125 | .002 | .02 | | 75 | | .01 | A | - | | | .000010 | A |
| R27 | NOT USED | | | | | | | | | | | | | | | | |
| R28 | RCR056 | | 10 | 5 | .125 | .001 | .01 | | 75 | | .01 | A | - | | | .000010 | |
| R29 | RCR056 | | 560 | 5 | .125 | .011 | .09 | | 75 | | .01 | A | - | | | .000010 | A |
| R30 | THERMISTOR 06-PI4404A | | 1K | 10 | .250 | .001 | .01 | | 75 | | - | A | - | | | .015000 | |
| R31 | RCR056 | | 56 | 5 | .125 | .001 | .01 | | 75 | | .01 | A | - | | | .000010 | |
| R32 | RCR076 | | 220 | 5 | .250 | .002 | .02 | | 75 | | .01 | A | - | | | .000010 | |
| R33 | RCR056 | | - | 5 | .125 | .010 | .08 | | 75 | | .01 | A | - | | | .000010 | A |
| R40 | RCR056 | | 2.2K | 5 | .125 | .001 | .01 | | 75 | | .01 | A | - | | | .000010 | A |

FOR USE OF RELIABILITY DEPT

| | | |
|---|---------------------------------|--|
| 19 FAILURE RATE SOURCES (FOR COLUMN #14) A <u>SM-188</u> B _____ C _____ D _____ | 20 CALCULATED MTBF _____ HRS | 21 TOTAL FAILURE RATE <u>.015140</u> .000 HRS |
|---|---------------------------------|--|

(INDUCTORS TRANSFORMERS)

PROJECT: ALSEP

DATE: 20 JUL 1970

ASSEMBLY: Radio Unit - Receiver

SUB ASSEMBLY: PT. COMPACTOR

SCHEMATIC NO: 63-P113770

Inductors & Transformers

| 1 | 2 | 3 | CONSTRUCTION | | | | 8 | 9 | 10 | 11 | TEMPERATURE (°C) | | | | | | PRIMARY CURRENT | | SECONDARY | | INPUT READING | | 25 | 26 | 27 |
|-----------------------|--|--------------|--------------------------|--------------------|----------------------|------------------|-----------|--------------------------|----------------|---------------|-------------------|--------------------|-------------------|------------------|---------------------|--------|-----------------|-----------------|--------------|-------------|---------------|----------|-------|---------------------------|---------------------------------|
| | | | 4 | 5 | 6 | 7 | | | | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | | |
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MIL OR MFR) CONSTRUCTION | MANUFACTURER | TYPE OF CASE (SEE BELOW) | WIRE SIZE, PRIMARY | WIRE SIZE, SECONDARY | INSULATION CLASS | VA RATING | INDUCTANCE AT RATED CUR. | SPECIFIED FREQ | MAGNETIC CORE | OPERATING AMBIENT | HOT SPOT (SURFACE) | RISE (AIR METHOD) | EST. ACTUAL RISE | OPERATING TEMP MAX. | ACTUAL | RATED | PRIMARY VOLTAGE | NO. WINDINGS | WINDING NO. | VOLTAGE | WINDINGS | VOLTS | FAILURE RATE (1/1000 HRS) | TOTAL FAILURE RATE (1/1000 HRS) |
| L1 | 24-P14448A | | C | - | - | 125 | .15 | .1 | 20 | 75 | - | - | 5 | 50 | .01 | 1100 | .1 | - | - | - | - | - | - | A | .002060 |
| L2 | 24-P11417B | | C | 32 | - | 105 | - | .05 | 110 | 75 | - | - | 5 | 50 | .01 | 1000 | .1 | - | - | - | - | - | - | A | .002825 |
| L3 | 24-P14448A | | C | - | - | 125 | .15 | 1.0 | 20 | 75 | - | - | 5 | 80 | 4 | 350 | .1 | - | - | - | - | - | - | A | .002060 |
| L4 | 24-P14448A | | C | - | - | 125 | .15 | 1.0 | 20 | 75 | - | - | 5 | 80 | 4 | 350 | .1 | - | - | - | - | - | - | A | .002060 |
| L5 | 24-P11417B | | C | 28 | - | 105 | - | .1 | 220 | 75 | - | - | 5 | 80 | 4 | 150 | .1 | - | - | - | - | - | - | A | .002825 |
| L6 | 24-P14448A | | C | - | - | 125 | .15 | 1.0 | 20 | 75 | - | - | 5 | 50 | 4 | 350 | .1 | - | - | - | - | - | - | A | .002060 |
| L7 | 24-P11417B | | C | 28 | - | 105 | - | .1 | 220 | 75 | - | - | 5 | 50 | 4 | 150 | .1 | - | - | - | - | - | - | A | .002825 |
| L8 | NOT USED | | | | | | | | | | | | | | | | | | | | | | | | |
| L9 | 24-P11417B | | C | 28 | - | 105 | - | .04 | 120 | 75 | - | - | 5 | 50 | .01 | 1000 | .1 | - | - | - | - | - | - | A | .002825 |
| L10 | 24-P11417B | | C | 28 | - | 105 | - | .04 | 120 | 75 | - | - | 5 | 50 | .01 | 1000 | .1 | - | - | - | - | - | - | A | .002825 |
| L11 | 24-P14448A | | C | - | - | 125 | .15 | .15 | 20 | 75 | - | - | 5 | 80 | .01 | 1100 | .1 | - | - | - | - | - | - | A | .002060 |
| L12 | 24-P11417B | | C | 28 | - | 105 | - | .04 | 120 | 75 | - | - | 5 | 80 | .01 | 1000 | .1 | - | - | - | - | - | - | A | .002825 |
| L13 | 24-P14448A | | C | - | - | 125 | .15 | 2.2 | 20 | 75 | - | - | 5 | 80 | .01 | 350 | .1 | - | - | - | - | - | - | A | .002060 |
| L14 | 24-P14448A | | C | - | - | 125 | .15 | .15 | 20 | 75 | - | - | 5 | 80 | .01 | 325 | .1 | - | - | - | - | - | - | A | .002060 |
| L15 | 24-P14448A | | C | - | - | 125 | .15 | 5.6 | 25 | 75 | - | - | 5 | 50 | .01 | 200 | .1 | - | - | - | - | - | - | A | .002060 |
| L16 | 24-P14448A | | C | - | - | 125 | .15 | 1.0 | 20 | 75 | - | - | 5 | 80 | 7 | 350 | .2 | - | - | - | - | - | - | A | .002060 |
| L17 | 24-P14448A | | C | - | - | 125 | .15 | 1.0 | 20 | 75 | - | - | 5 | 80 | 14 | 350 | .2 | - | - | - | - | - | - | A | .002060 |
| L18 | 24-P11417B | | C | 28 | - | 105 | - | .1 | 220 | 75 | - | - | 5 | 80 | 7 | 150 | .1 | - | - | - | - | - | - | A | .002825 |
| L19 | 24-P11417B | | C | 18 | - | 105 | - | .015 | 220 | 75 | - | - | 5 | 80 | .1 | 1620 | .1 | - | - | - | - | - | - | A | .002825 |

28 TYPE OF CASE
 A. HER. SEAL
 B. VAC. IMP.
 C. ENCAP.
 D. OPEN

29 FAILURE RATE SOURCES (FOR COLUMN #26)
 A. SM-188 B. _____
 C. _____ D. _____

30 CALCULATED MTBF _____ HRS

31 TOTAL FAILURE RATE .043200 % 1000 HRS

(INDUCTORS & TRANSFORMERS)

PROJECT: ALSEP

DATE: 20 JULY 1960

ASSEMBLY: Redundant Command Receiver

SUB ASSEMBLY: RF Converter

SCHEMATIC NO: 63-P11377B

Inductors & Transformers)

| 1 CIRCUIT SYMBOL NUMBER | 2 TYPE DESIGNATION (MIL. or MFR) AND CONSTRUCTION | 3 MANUFACTURER | 4 CONSTRUCTION | | | | 8 VA RATING | 9 INDUCTANCE & AT RATED CUR. | 10 RESPECTED FREQ | 11 MISCELLANEOUS | 12 TEMPERATURE (°C) | | | | | | 13 PRIMARY CURRENT | | 14 SECONDARY | | | 15 HIPOT READING | | 25 BASIC FAILURE RATE AT 1000 HRS | 26 SOURCE (SEE BELOW) | 27 TOTAL FAILURE RATE (1000 HRS) | | | | | | | | | |
|----------------------------|--|-------------------|-------------------------------|------------------------|--------------------------|------------------------|----------------|---------------------------------|----------------------|---------------------|------------------------|------------------------|-----------------|------------------------|--------------------------|--------------|-----------------------|-----------------------|--------------------|-------------------|---------------|---------------------|-------------|--------------------------------------|--------------------------|-------------------------------------|--------------------------|--|--|--|--|--|--|---|---------|
| | | | 5 TYPE OF CASE (SEE BELOW) | 6 WIRE SIZE PRIMARY | 7 WIRE SIZE SECONDARY | 10 INSULATION CLASS | | | | | 12 AMBIENT | 13 HOT SPOT SURFACE | 14 (AR RISE) | 15 EXT. ACTUAL RISE | 16 OPERATING TEMP MAX | 17 ACTUAL | 18 RATED | 19 PRIMARY VOLTAGE | 20 NO. WINDINGS | 21 WINDING NO. | 22 VOLTAGE | 23 WINDINGS | 24 VOLTS | | | | 25 REL. DEPT USE ONLY | | | | | | | | |
| L20 | NOT USED | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T1 | NOT USED | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T2 | 24-P11417B | C | 34 | 34 | 105 | - | - | 22 | 75 | - | - | 5 | 80 | .01 | .1 | .1 | .1 | .1 | - | - | | | | | | | | | | | | | | A | .005650 |
| T3 | 24-P11417B | C | 34 | 34 | 105 | - | - | 110 | 75 | - | - | 5 | 80 | .01 | .1 | .1 | .1 | .1 | - | - | | | | | | | | | | | | | | A | .005650 |
| T4 | 24-P11417B | C | 34 | 34 | 105 | - | - | 107 | 75 | - | - | 5 | 80 | .01 | .1 | .1 | .1 | .1 | - | - | | | | | | | | | | | | | | A | .005650 |

28
TYPE OF CASE
A. EMB. SEAL
B. VAC. RESP.
C. ENCAP.
D. OPEN

29
FAILURE RATE SOURCES (FOR COLUMN #28)
A. SM-188 B. _____
C. _____ D. _____

30
CALCULATED MTF _____ HRS

31
TOTAL FAILURE RATE .016950 @ 1000 HRS

(SEMICONDUCTORS)

PROJECT: ALSEP

DATE: 20 July 1960

ASSEMBLY: Redundant Command Receiver

SUB ASSEMBLY: RF Converter

SCHEMATIC NO: 67-113778

| CKT SYM NO. | TYPE DESIGNATION, SEMICONDUCTOR, POLARITY | MANUFACTURER | MAX. TEMP °C | | | AVG PWR DISSIPATION (mw) | | | | | POWER RATIO | | MAXIMUM VOLTAGES | | | | DIODE PIV | | CIRCUIT FUNCTION or APPLICATION | PART SPECIAL ENVIRONMENT (Define) | FOR RELIABILITY USE ONLY | | | | | | | | | | | |
|---|---|--------------|--------------|-----------|-------------|--------------------------|------|-----------|------------|---------|--|-----------------------|------------------|--------------|--------------|--------------|-----------|----------|---------------------------------|-----------------------------------|--------------------------|---|---------------------------|--------------|---------------------------------|-----------|--|--|--|--|--|--|
| | | | AMBIENT TA | ACTUAL TJ | JUNCTION TJ | RATED AT | | | | | ACTUAL RATED 25°C (Amb. or case) | ACTUAL RATED TA or TC | VCBO RATED V | VCB ACTUAL V | VCRO RATED V | VCE ACTUAL V | RATED V | ACTUAL V | | | RATE (3/1000 HRS) | SOURCE (See below) | FAILURE RATE (3/1000 HRS) | COUNTER TYPE | TOTAL FAILURE RATE (3/1000 HRS) | | | | | | | |
| | | | | | | 25°C | | ACTUAL TA | AMBIENT TA | CASE TC | | | | | | | | | | | | | | | | ACTUAL TC | | | | | | |
| | | | | | | AMBIENT | CASE | | | | | | | | | | | | | | | | | | | | | | | | | |
| CR 1 | 48-P16069A | | 75 | 200 | 78 | 500 | - | 300 | - | 20 | .01 | .07 | - | - | - | - | 35 | 10 | | | 2.6 A | .02 | | .000053 | | | | | | | | |
| CR 2 | 48-P16070A | | 75 | 125 | 80 | 200 | - | 100 | - | 10 | .05 | .10 | - | - | - | - | 30 | 1.0 | | | 12.2 A | .02 | | .000244 | | | | | | | | |
| CR 3 | 48-P16070A | | 75 | 125 | 80 | 200 | - | 100 | - | 10 | .05 | .10 | - | - | - | - | 30 | 1.0 | | | 2.2 A | .02 | | .000244 | | | | | | | | |
| CR 4 | JANTXIN3064 | | 75 | 150 | 76 | 250 | - | 175 | - | 1 | .01 | .01 | - | - | - | - | 50 | 0 | | | 3.2 A | .1 | | .000322 | | | | | | | | |
| Q 1 | TRANSISTOR, NPN JANTX2N2857 | | 75 | 175 | 97 | 200 | - | 143 | - | 25 | .13 | .18 | 30 | 7.32 | 15 | 6.2 | - | - | | | 507 A | .1 | | .000507 A | | | | | | | | |
| Q 2 | TRANSISTOR, NPN JANTX2N2857 | | 75 | 175 | 97 | 200 | - | 143 | - | 25 | .13 | .18 | 30 | 5.6 | 15 | 6.4 | - | - | | | 507 A | .1 | | .000507 | | | | | | | | |
| Q 3 | TRANSISTOR, NPN JANTX2N2857 | | 75 | 175 | 97 | 200 | - | 143 | - | 25 | .13 | .18 | 30 | 4.4 | 15 | 5.2 | - | - | | | 507 A | .1 | | .000507 | | | | | | | | |
| Q 4 | TRANSISTOR, NPN JANTX2N2857 | | 75 | 175 | 103 | 200 | - | 143 | - | 32 | .16 | .22 | 30 | 8.5 | 15 | 8.1 | - | - | | | 7.16 A | .1 | | .000716 A | | | | | | | | |
| Q 5 | TRANSISTOR, NPN JANTX2N2857 | | 75 | 175 | 79 | 200 | - | 143 | - | 5 | .03 | .04 | 30 | 4.0 | 15 | 4.7 | - | - | | | 6.6 A | .1 | | .000660 | | | | | | | | |
| FAILURE RATE SOURCE (See Column 23) A <u>SM-183</u> C _____ B _____ D _____ | | | | | | | | | | | NOTE: It is assumed the transient and peak power does not exceed the safe limit. | | | | | | | | | | | TOTAL FAILURE RATE <u>0.03480</u> 3/1000 HRS. | | | | | | | | | | |

(SEMICONDUCTORS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: Redundant Command Receiver

SUB ASSEMBLY: RF Converter

SCHEMATIC NO: 63-P11377B

(Semiconductors)

| CKT SYM NO. | TYPE DESIGNATION, SEMICONDUCTOR, POLARITY | M A N U F A C T U R E R | MAX. TEMP °C | | | AVG PWR DISSIPATION (mw) | | | | | POWER RATIO | | MAXIMUM VOLTAGES | | | | DIODE PIV | | CIRCUIT FUNCTION OR APPLI- CATION | PART SPECIAL ENVIRON- MENT (Define) | FOR RELIABILITY USE ONLY | | | | | | | | | |
|-------------------|--|--|---|---|--|---|------------------------------------|---|---|---|---|---|--|--|--|--|----------------------------|---------------------------------|---|---|--|--|---|---|--|---|---|---|--|---------|
| | | | A M B I E N T T _A | A C T U A L R A T E D T _J | J U N C T I O N A C T U A L T _J | RATED AT | | | | | A C T U A L R A T E D 30°C Ambior case | A C T U A L R A T E D T _A or T _C | V C B O R A T E D V | V C B A C T U A L V | V C E O R A T E D V | V C E A C T U A L V | R A T E D V | A C T U A L V | | | R A T E (%) 1000 HRS | S O U R C E R A T E (%) 1000 HRS | F A I L U R E R A T E (%) 1000 HRS | F A I L U R E R A T E (%) 1000 HRS | T O T A L F A I L U R E R A T E (%) 1000 HRS | | | | | |
| | | | | | | 25°C | | A M B I E N T T _A | A C T U A L R A T E D T _J | A C T U A L R A T E D T _C | | | | | | | | | | | | | | | | A C T U A L R A T E D | A C T U A L R A T E D | A C T U A L R A T E D | | |
| | | | | | | A M B I E N T T _A | C A S E T _C | | | | | | | | | | | | | | | | | | | | | | | |
| 2 6 | TRANSISTOR, NPN JANTX2N12857 | | 75 | 175 | 79 | 200 | - | 143 | - | 5 | .03 | .04 | 30 | 4.5 | 15 | 5.2 | - | - | | | 45C 20-31 (See below) | A | .1 | | | | | | | .000368 |

19 FAILURE RATE SOURCE (See Column 20)
 A SM-18A C _____
 B _____ D _____

20 NOTE: It is assumed the transient and peak power does not exceed the safe limit.

21 TOTAL FAILURE RATE .000368 %/1000 HRS.

BS-321A

(MISC. PARTS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: Redundant Command Receiver

SUB ASSEMBLY: RF CONVERTER

SCHEMATIC NO: 63-P11377A

(Misc. Parts)

| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (CEC, MIL OR MFR) and CONSTRUCTION | MANUFACTURER | AMBIENT TEMPERATURE RANGE | | ELECTRICAL STRESS | | PERCENT DUTY CYCLE | MAJOR CHARACTERISTICS and APPLICATION | FOR RELIABILITY USE ONLY | | | | | |
|---|---|--------------|---------------------------|---------|-------------------|--------|--------------------|---------------------------------------|-----------------------------------|---|-----------------------------------|-------------------------|-----------------------------------|----|
| | | | MAX RATED | MIN ACT | RATED MW | USE MW | | | BASIC FAILURE RATE (1/1000 HOURS) | CORRECTION FACTOR (SEE 10X/D) | PART SPECIAL ENVIRONMENT (DEFINE) | FAILURE RATE MULTIPLIER | TOTAL FAILURE RATE (1/1000 HOURS) | |
| | | | | | | | | | | | | | | DC |
| U2 | NOT USED | | | | | | | | | | | | | |
| U3 | I/c 51-P16072A | | 125 | 75 | 500 | 40 | | COMPLEXITY FACTOR=78 | 7.799 | A | | .05 | .000387 | |
| | | | | | | | | | | | | | | |
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| 15 FAILURE RATE SOURCES (FOR COLUMN 11) A. <u>MOT SM-188</u> B. _____ C. _____ D. <u>MIL Std 217 Chart XXIV</u> | | | | | | | | 16 CALCULATED MTBF _____ HOURS | | 17 TOTAL FAILURE RATE <u>.000387</u> 1/1000 HOURS | | | | |

A

A

ALM-783
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(MISC. PARTS)

PROJECT: ALSEP
 ASSEMBLY: REDUNDANT COMMAND RECEIVER

SUB ASSEMBLY: RF CONVERTER

DATE: 20 July 1979
 SCHEMATIC NO: 43-P-1377B

(Misc. Parts)

| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (CFC, MIL OR MFR) and CONSTRUCTION | MANUFACTURER | AMBIENT TEMPERATURE RANGE °C | | ELECTRICAL STRESS | | PERCENT DUTY CYCLE | MAJOR CHARACTERISTICS and APPLICATION | FOR RELIABILITY USE ONLY | | | | |
|--|---|--------------|------------------------------|----------|-------------------|--------|--------------------|---------------------------------------|-----------------------------------|--|------------------------------------|-------------------------|-----------------------------------|
| | | | MAX RATED | MIN ACT. | RATED MW | USE MW | | | BASIC FAILURE RATE (1/1000 HOURS) | S O U R C E (SEE FIG 1) | PART SPECIAL ENVIRONMENT (AS FREQ) | FAILURE RATE MULTIPLIER | TOTAL FAILURE RATE (1/1000 HOURS) |
| | | | | | | | | | | | | | |
| 1 | Y1 CRYSTAL, QUARTZ 52-11063A | | 85 | 75 | 10 | .5 | | | 0.5 | A | | - | .00050 |
| | | | | | | | | | | | | | |
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| 15 FAILURE RATE SOURCES (FOR COLUMN 11) A. DAT: <u>SA-188</u> B. _____ C. _____ D. SEE FIG 217 Chart XIV | | | | | | | | 16 CALCULATED BY: _____ | | 17 TOTAL FAILURE RATE <u>.00050</u> 1/1000 HOURS | | | |

(MISC. PARTS)

PROJECT: ALSEP

DATE: 20 JULY 1970

ASSEMBLY: Redundant Command Receiver

SUB ASSEMBLY: RF CONVERTER

SCHEMATIC NO: 63-P11377B

(Misc. Parts)

| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (REC, MIL OR MFR) and CONSTRUCTION | MANUFACTURER | AMBIENT TEMPERATURE RANGE °C | | ELECTRICAL STRESS | | PERCENT DUTY CYCLE | MAJOR CHARACTERISTICS and APPLICATION | FOR RELIABILITY USE ONLY | | | | |
|---|---|--------------|------------------------------|------------|-------------------|-------|--------------------|---------------------------------------|-----------------------------------|--|-----------------------------------|-------------------------|-----------------------------------|
| | | | MAX RATED | -SEP- ACT. | RATED V | USE V | | | BASIC FAILURE RATE (1/1000 HOURS) | CORRECTION FACTOR (SEE TABLE) | PART SPECIAL ENVIRONMENT (IF ANY) | FAILURE RATE MULTIPLIER | TOTAL FAILURE RATE (1/1000 HOURS) |
| | | | | | | | | | | | | | |
| FL1 | FILTER, FEEDTHRU 25-14433A | | 125 | 75 | 100 | 12.2 | | 7.4 | A | | .5 | .00370 | |
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| 15 FAILURE RATE SOURCES (FOR COLUMN 11) A. <u>MOT, SM-188</u> B. _____ C. _____ D. <u>SEE SA 217 Chart XXIV</u> | | | | | | | | 16 CALCULATED HOURS _____ HOURS | | 17 TOTAL FAILURE RATE <u>.00370</u> 1/1000 HOURS | | | |

ATM-983
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(CONNECTORS)

PROJECT: ALSEP
 ASSEMBLY: REDUANT COMMAND

SUB ASSEMBLY: RF CONVERTER

DATE: 20 July 1970
 SCHEMATIC NO: 88-P11377B

(Connectors)

| CIRCUIT REF. DESIGNATION | TYPE DESIGNATION (CSC, MIL OR MFR) AND CONSTRUCTION | MANUFACTURER | PINS | | | | | | | | | | AMBIENT TEMP °C | INSERT MATL | GUIDE | NO. OF INSERTIONS DURING LIFE | MISCELLANEOUS REMARKS | BASIC FAILURE RATE (See 24) | SOURCE OF F.R. | F.R. MODIFIER | TOTAL FAILURE RATE (%/1000 Hours) | |
|--------------------------|---|--------------|--------|--------|------------|---------|------|--------------|---------------|--------------------|-----------------------------|-------|-----------------|-------------|-------|---------------------------------------|-----------------------|-----------------------------|----------------|---------------|-----------------------------------|--|
| | | | NUMBER | | CURRENT | | | VOLTAGE | | | | | | | | | | | | | | |
| | | | TOTAL | ACTIVE | RATED Amp. | ACTUAL | | BETWEEN PINS | | ACROSS THE CONTACT | | | | | | | | | | | | |
| | | | | | | MAX. mA | MIN. | RATED | ACTUAL TO GRD | TRANSIENT | STEADY STATE | SURGE | | | | | | | | | | |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | | | |
| J1 | 55-032-0000 | | 1 | 1 | 2 | 1 | - | 400 | .1 | - | - | - | 75 | - | - | - | | 1.0 | A | - | .001 | |
| J2 | 50-050-2214 | | 1 | 1 | 2 | 2 | - | 400 | .1 | - | - | - | 75 | TEFLON | - | - | | 1.0 | A | - | .001 | |
| | | | | | | | | | | | | | | | | | | | | | | |
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| 23 | 24 FAILURE RATE SOURCES (FOR COLUMN 20) | | | | | | | | | | 25 | | | | | 26 | | | | | | |
| REQUIRED LIFE HOURS | A <u>MOT. SM-188</u> B _____ C _____ D _____ | | | | | | | | | | CALCULATED MTBF _____ HOURS | | | | | TOTAL FAILURE RATE _____ %/1000 HOURS | | | | | | |

(BS-321A)

TOTAL MODULE FAILURE RATE
 .112445 %/1000 HRS. A

CAPACITORS

PROJECT: ALSEP

DATE: 20 July 1973

ASSEMBLY: REDUNDANT COMMAND RECEIVER

SUBASSEMBLY: IF AND AUDIO

SCHEMATIC NO: 62-P11349B

(Capacitors)

| 1 CIRCUIT SYMBOL NUMBER | 2 TYPE DESIGNATION (MIL or MFR) AND CONSTRUCTION | 3 MANUFACTURER | 4 CAPACITANCE VALUE | 5 TOLERANCE % | 6 MANUFACTURER'S RATED VOLTAGE | | 7 OPERATING VOLTAGE | 8 VOLTAGE RATIO OPERATING/RATED | 9 MAXIMUM DUTY CYCLE | 10 BULK AIR TEMPERATURE (°C) | 12 CIRCUIT FUNCTION OR APPLICATION | 13 BASIC FAILURE RATE (10 ⁻⁶ /HRS) AT 100°C | | 14 SPECIAL ENVIRONMENT (DEFINE) | 15 FAILURE RATE MULTIPLIER | 16 FINAL FAILURE RATE | 17 TOTAL CAPACITOR COUNT PER TYPE | 18 TOTAL FAILURE RATE (10 ⁻⁶ /HRS) |
|----------------------------|---|-------------------|------------------------|------------------|-----------------------------------|---------|------------------------|------------------------------------|-------------------------|---------------------------------|---------------------------------------|---|-----|------------------------------------|-------------------------------|--------------------------|--------------------------------------|--|
| | | | | | DC | PEAK AC | | | | | | 13A | 13B | | | | | |
| C1 | CSR 13 G | | 15pF | 10 | 50 | 11.3 | 11 | .28 | | 75 | | 1.4 | B | Level P | | | | 201400 |
| C2 | NOT USED | | | | | | | | | | | | | | | | | |
| C3 | NOT USED | | | | | | | | | | | | | | | | | |
| C4 | CKR06 | | .1uF | 10 | 100 | 11.3 | 11 | .12 | | | | 7.3 | A | | .15 | | | 221295 |
| C5 | CKR06 | | .01uF | 20 | 300 | 5.7 | 16 | .03 | | | | 7.0 | A | | .15 | | | 221250 |
| C6 | CKR05 | | .001 | 10 | 200 | 5.7 | 16 | .03 | | | | 7.0 | A | | .15 | | | 221250 |
| C7 | CKR05 | | 33pF | 10 | 200 | 11.3 | 16 | .08 | | | | 7.0 | A | | .15 | | | 221250 |
| C8 | 21-P11257B | | 1.0 | 20 | 50 | 11.3 | 11 | .23 | | | | 7.1 | A | | .15 | | | 221365 |
| C9 | CKR05 | | - | 10 | 200 | 5.7 | 16 | .03 | | | | 7.0 | A | | .15 | | | 221250 |
| C10 | CKR06 | | .0022 | 10 | 200 | 6.3 | 12 | .04 | | | | 7.0 | A | | .15 | | | 221250 |
| C11 | CKR06 | | .0022 | 10 | 200 | 6.3 | 12 | .04 | | | | 7.0 | A | | .15 | | | 221250 |
| C12 | CKR05 | | 120pF | 10 | 200 | 6.3 | 12 | .04 | | | | 7.0 | A | | .15 | | | 221250 |
| C13 | 21-P11258B | | 15pF | 1 | 500 | 6.3 | 16 | .01 | | | | 7.30 | A | | .1 | | | 400080 |
| C14 | CKR06 | | .1 | 10 | 100 | 5.7 | 16 | .10 | | | | 7.0 | A | | .15 | | | 221250 |
| C15 | 21-P11257B | | 1.0 | 20 | 50 | 6.3 | 11 | .13 | | | | 7.4 | A | | .15 | | | 221110 |
| C16 | CKR06 | | - | 10 | 100 | 7.0 | 16 | .13 | .50 | | | 7.0 | A | | .15 | | | 221250 |
| C17 | 21-P11257B | | .170uF | 5 | 100 | 7.0 | 16 | .13 | .50 | | | 7.0 | A | | .15 | | | 221250 |
| C18 | CKR06 | | .1 | 20 | 50 | 7.8 | 11 | .16 | | | | 7.7 | A | | .15 | | | 221185 |
| C19 | 21-P11257B | | .0018 | 5 | 25 | 6.0 | 15 | .44 | .50 | | | 8.9 | A | | .15 | | | 221335 |

FOR USE OF RELIABILITY DEPT

20 FAILURE RATE SOURCES (FOR COLUMN #14)
 A SM-188 B MIL-HDBK-217A
 C _____ D _____

21 CALCULATED MTBF _____ HRS

22 TOTAL FAILURE RATE 018070 1000 HRS

CAPACITORS

PROJECT: ALSEP

DATE: 30 July 1970

ASSEMBLY: R. L. DANT Command Receiver

SUBASSEMBLY: IF AND Audio

SCHEMATIC NO: 2-P11349 B

(Capacitors)

| 1 CIRCUIT SYMBOL NUMBER | 2 TYPE DESIGNATION (MFL OR MFR) AND CONSTRUCTION | 3 MANUFACTURER | 4 CAPACITANCE VALUE | 5 TOLERANCE % | 6 MANUFACTURER'S RATED VOLTAGE | 7 OPERATING VOLTAGE | 8 VOLTAGE RATIO OPERATING/RATED | 9 OPERATING RATED | 10 MAXIMUM DUTY CYCLE | 11 BULK AIR TEMPERATURE (°C) | 12 CIRCUIT FUNCTION OR APPLICATION | 13 BASIC FAILURE RATE (1000 HRS) AT 100°C (SEE BELOW) | 14 SPECIAL ENVIRONMENT (DEFINES) | 15 FAILURE RATE MULTIPLIER | 16 FINAL FAILURE RATE | 18 TOTAL CAPACITOR COUNT PER TYPE | 19 TOTAL FAILURE RATE (1000 HRS) |
|----------------------------|---|-------------------|------------------------|------------------|-----------------------------------|------------------------|------------------------------------|----------------------|--------------------------|---------------------------------|---------------------------------------|--|-------------------------------------|-------------------------------|--------------------------|--------------------------------------|-------------------------------------|
| | | | | | | | | | | | | | | | | | |
| C200 | 21-P11258B | | 22pF | 1 | 100 | 0.16 | .01 | | | 75 | | .30 A | | .1 | | | .000080 |
| C201 | 21-P11258B | | 9.1pF | 1 | 500 | 0.03 | .01 | | | | | .30 A | | .1 | | | .000050 |
| C22 | CKR06 | | 1.0 | 20 | 50 | 5.8 | .12 | | | | | 7.3 A | | .15 | | | .001095 |
| C23 | 21-P11257B | | 1uF | 20 | 50 | 4.1 | .09 | | | | | 7.0 A | | .15 | | | .001050 |
| C24 | 21-P11257B | | 1uF | 20 | 50 | 4.1 | .09 | | | | | 7.0 A | | .15 | | | .001050 |
| C25 | 21-P11257B | | .001 | 5 | 50 | 4.2 | .13 | | | | | 7.5 A | | .15 | | | .001125 |
| C26 | 21-P11257B | | 1.0 | 20 | 50 | 11.3 | .23 | | | | | 9.1 A | | .15 | | | .001365 |
| C27 | 21-P11257B | | 1.0 | 20 | 50 | 4.0 | .16 | | | | | 7.9 A | | .15 | | | .001185 |
| C28 | 21-P11257B | | 1.0 | 20 | 50 | 5.5 | .12 | | | | | 7.3 A | | .15 | | | .001095 |
| C202 | 21-P11258B | | 22pF | 1 | 100 | 1.19 | .01 | | | | | .30 A | | .1 | | | .000080 |
| C203 | 21-P11258B | | 7.5 | 1 | 500 | 1.05 | .01 | | | | | .30 A | | .1 | | | .000080 |
| C31 | CKR06 | | 15uF | 10 | 200 | 6.0 | .05 | | | | | 7.0 A | | .15 | | | .001050 |
| C32 | CKR06 | | 22uF | 10 | 200 | 6.0 | .05 | | | | | 7.0 A | | .15 | | | .001050 |
| C204 | 21-P11258B | | 22pF | 1 | 100 | 1.14 | .01 | | | | | .30 A | | .1 | | | .000080 |
| C205 | 21-P11258B | | 7.5pF | 1 | 500 | 1.05 | .01 | | | | | .30 A | | .1 | | | .000080 |
| C206 | 21-P11258B | | 22pF | 1 | 100 | 1.14 | .01 | | | | | .30 A | | .1 | | | .000080 |
| C33 | 21-P11258B | | 33pF | 1 | 500 | 4.5 | .02 | | | | | .30 A | | .1 | | | .000080 |
| C37 | 21-P11257B | | 1.0 | 20 | 50 | 11.3 | .23 | | | | | 9.1 A | | .15 | | | .001365 |
| C207 | 21-P11258B | | 9.1pF | 1 | 500 | 1.06 | .01 | | | V | | .30 A | | .1 | | | .000080 |

FOR USE OF RELIABILITY DEPT.

| | | |
|---|---------------------------------|--|
| 20 FAILURE RATE SOURCES (FOR COLUMN #14) A <u>SA-152</u> B _____ C _____ D _____ | 21 CALCULATED MTBF _____ HRS | 22 TOTAL FAILURE RATE <u>.012150</u> 1000 HRS |
|---|---------------------------------|--|

CAPACITORS

PROJECT: ALSEP

DATE: 20 July 1973

ASSEMBLY: Redundant Command Receiver

SUBASSEMBLY: IF and Audio

SCHEMATIC NO: 63-P11347B

(Capacitors)

| 1 CIRCUIT SYMBOL NUMBER | 2 TYPE DESIGNATION (MIL or MFR) AND CONSTRUCTION | 3 MANUFACTURER | 4 CAPACITANCE VALUE | 5 TOLERANCE % | 6 MANUFACTURER'S RATED VOLTAGE | 7 OPERATING VOLTAGE | 8 VOLTAGE RATIO OPERATING/RATED | 9 DC PEAK AC | 10 MAXIMUM DUTY CYCLE | 11 BULK AIR TEMPERATURE (°C) | 12 CIRCUIT FUNCTION OR APPLICATION | 13 BASIC FAILURE RATE (1000 HRS) AT 100°C (SEE BELOW) | 14 SPECIAL ENVIRONMENT (DEFENSE) | 15 FAILURE RATE MULTIPLIER | 16 FINAL FAILURE RATE | 17 TOTAL CAPACITOR COUNT PER TYPE | 18 TOTAL FAILURE RATE (1000 HRS) | 19 |
|---|---|-------------------|------------------------|------------------|-----------------------------------|---------------------------------|------------------------------------|-----------------|--------------------------|---------------------------------|---------------------------------------|--|-------------------------------------|-------------------------------|--------------------------|--------------------------------------|-------------------------------------|----|
| | | | | | | | | | | | | | | | | | | |
| C208 | 21-P11257B | | 220pf | 1 | 100 | 0.09 | .01 | | | 75 | | .30 A | | .1 | | | .000080 | A |
| C209 | 21-P11257B | | 47pf | 1 | 500 | 4.0 | .02 | | | | | .30 A | | .1 | | | .000080 | A |
| C211 | CKR05 | | 1000pf | 10 | 200 | 6.0 | .04 | | | | | 7.0 A | | .15 | | | .001050 | |
| C212 | CKR05 | | 1000pf | 10 | 200 | 11.1 | .06 | | | | | 7.0 A | | .15 | | | .001050 | |
| C213 | CKR05 | | 1000pf | 10 | 200 | 2.0 | .01 | | | | | 7.0 A | | .15 | | | .001050 | |
| C244 | 21-P11257B | | 0.1 uF | 20 | 50 | 3.5 | .07 | | | | | 7.0 A | | .15 | | | .001050 | A |
| C245 | CKR05 | | 220pf | 1 | 200 | 1.0 | .02 | | | | | 7.0 A | | .15 | | | .001050 | A |
| C246 | CKR06 | | .1 uF | 10 | 100 | 11.0 | .11 | | | | | 7.1 A | | .15 | | | .001065 | |
| C247 | CKR05 | | 1000pf | 10 | 200 | 4.0 | .02 | | | | | 7.0 A | | .15 | | | .001050 | |
| C248 | CKR05 | | 1000pf | 10 | 200 | 2.0 | .01 | | | | | 7.0 A | | .15 | | | .001050 | |
| C249 | 21-P11257B | | 1 pf | 5 | 50 | 6.0 | .20 | | | | | 8.5 A | | .15 | | | .001275 | |
| C250 | 21-P11257B | | 1.0 | 20 | 50 | 11.3 | .23 | | | | | 9.1 A | | .15 | | | .001365 | |
| C251 | CKR05 | | 330pf | 10 | 200 | 6.0 | .05 | | | | | 7.0 A | | .15 | | | .001050 | A |
| C252 | 21-P11257B | | 430pf | 5 | 25 | 6.0 | .40 | | | | | 12.7 A | | .15 | | | .001905 | |
| C253 | 21-P11257B | | 315pf | 5 | 25 | 6.0 | .40 | | | | | 12.7 A | | .15 | | | .001905 | |
| C254 | 21-P11257B | | 1.0 | 5 | 50 | 6.2 | .13 | | | | | 7.5 A | | .15 | | | .001125 | |
| C255 | NOT USED | | | | | | | | | | | | | | | | | |
| C256 | CKR05 | | 1000pf | 10 | 200 | 9.0 | .05 | | | | | 7.0 A | | .15 | | | .001050 | |
| C257 | CKR05 | | 1000pf | 10 | 200 | 1.0 | .02 | | Y | | | 7.0 A | | .15 | | | .001050 | |
| 20 FAILURE RATE SOURCES (FOR COLUMN #14) A <u>SM-188</u> B _____ C _____ D _____ | | | | | | 21 CALCULATED MTBF _____ HRS | | | | | | 22 TOTAL FAILURE RATE <u>.019300</u> 1000 HRS | | | | | | |

CAPACITORS

PROJECT: ALSEP

DATE: 20 JULY 1970

ASSEMBLY: Redundant Command
K-21180

SUBASSEMBLY: IF AND Audio

SCHEMATIC NO: 63-P11349B

(Capacitors)

| 1 CIRCUIT SYMBOL NUMBER | 2 TYPE DESIGNATION (MIL or MFR) AND CONSTRUCTION | 3 MANUFACTURER | 4 CAPACITANCE VALUE | 5 TOLERANCE % | 6 MANUFACTURER'S RATED VOLTAGE | 7 OPERATING VOLTAGE | 8 VOLTAGE RATIO OPERATING/RATED | 9 MAXIMUM DUTY CYCLE | 10 BULK AIR TEMPERATURE (°C) | 12 CIRCUIT FUNCTION OR APPLICATION | 13 BASIC FAILURE RATE (1/1000 HRS) | | 14 SPECIAL ENVIRONMENT (DEFENSE) | 15 FAILURE RATE MULTIPLIER | 17 FINAL FAILURE RATE | 18 TOTAL CAPACITOR COUNT PER TYPE | 19 TOTAL FAILURE RATE (1/1000 HRS) |
|----------------------------|---|-------------------|------------------------|------------------|-----------------------------------|------------------------|------------------------------------|-------------------------|---------------------------------|---------------------------------------|---------------------------------------|-------------------------|-------------------------------------|-------------------------------|--------------------------|--------------------------------------|---------------------------------------|
| | | | | | | | | | | | 10 DC PEAK VOLTAGE | 11 OPERATING VOLTAGE | | | | | |
| C53 | CKR06 | | .022 | 10 | 100 | 6.21.2 | .07 | | 75 | | 7.0 | A | | .15 | | | .0021050 |
| C54 | 21-P11257B | | 1.0 | 20 | 50 | 11.31 | .23 | | | | 7.1 | A | | .15 | | | .0021365 |
| C60 | CKR05 | | .15 | 10 | 200 | 8.11.0 | .05 | | | | 7.0 | A | | .15 | | | .0021050 |
| C61 | CKR05 | | .15 | 10 | 200 | 5.01.0 | .03 | | | | 7.0 | A | | .15 | | | .0021050 |
| C62 | CKR05 | | .15 | 10 | 200 | 11.01.0 | .06 | | | | 7.0 | A | | .15 | | | .0021050 |
| C63 | 21-P11258B | | 51 pf | 1 | 100 | 0.13.5 | .04 | | | | .30 | A | | .1 | | | .000050 |
| C64 | 21-P11258B | | 56 pf | 1 | 100 | 0.13.5 | .04 | | | | .30 | A | | .1 | | | .000080 |
| C65 | CKR06 | | 0.1 | 10 | 100 | 11.01.0 | .11 | | | | 7.1 | A | | .15 | | | .0021065 |
| C66 | ST10251-11 | | 8-10 pf | - | 200 | 0.13.5 | .02 | | | | .60 | B | | - | | | .000060 |
| C67 | CKR05 | | 56 pf | 10 | 200 | 1.013.5 | .03 | | | | 7.0 | A | | .15 | | | .0021050 |
| C68 | CKR05 | | 56 pf | 10 | 200 | 1.013.5 | .03 | | | | 7.0 | A | | .15 | | | .0021050 |
| C67 | ECY105R | | 5.1 pf | 5 | 500 | 2.01.25 | .01 | | | | .33 | A | | .18 | | | .000060 |
| C70 | ST10251-11 | | 5 pf | - | 200 | 0.13.5 | .02 | | | | .60 | B | | - | | | .000060 |
| C71 | ECY105R | | 5.1 pf | 5 | 500 | 2.01.25 | .01 | | | | .33 | A | | .18 | | | .000060 |
| C72 | CKR05 | | .070 pf | 10 | 200 | 2.01.25 | .02 | | | | 7.0 | A | | .15 | | | .0021050 |
| C73 | CKR05 | | .001 | 10 | 200 | 9.51.0 | .05 | | | | 7.0 | A | | .15 | | | .0021050 |
| C74 | NOT USED | | | | | | | | | | | | | | | | |
| C75 | CKR06 | | .1 pf | 10 | 200 | 6.01.18 | .04 | | | | 7.0 | A | | .15 | | | .0021050 |
| C76 | NOT USED | | | | | | | | | | | | | | | | |

FOR USE OF RELIABILITY DEPT

| | | |
|---|-------------------------------------|--|
| <p>20 FAILURE RATE SOURCES (FOR COLUMN #14)</p> <p>A <u>SM-158</u> D <u>MIL-HDBK-217 E16.7.6.13B</u></p> <p>C _____ D _____</p> | <p>21 CALCULATED MTBF _____ HRS</p> | <p>22 TOTAL FAILURE RATE <u>.013360</u> / 1000 HRS</p> |
|---|-------------------------------------|--|

CAPACITORS

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: Redundant Command Receiver SUBASSEMBLY: IF AND Audio

SCHEMATIC NO: 63-P11349B

(Capacitors)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|--|--|--------------|-------------------|-----------|------------------------------|-------------------|-------------------------------|--------------------|---------------------------|---------------------------------|-------------------------|-------------------------|--------------------------------|--|--------------------|--------------------------------|-------------------------------|----|
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MIL OR MFR) CONSTRUCTION | MANUFACTURER | CAPACITANCE VALUE | TOLERANCE | MANUFACTURER'S RATED VOLTAGE | OPERATING VOLTAGE | VOLTAGE RATIO OPERATING/RATED | MAXIMUM DUTY CYCLE | MILK AIR TEMPERATURE (°C) | CIRCUIT FUNCTION OR APPLICATION | FAILURE RATE (1000 HRS) | FAILURE RATE (1000 HRS) | SPECIAL ENVIRONMENT (DEFINITE) | FAILURE RATE MULTIPLIER | FINAL FAILURE RATE | TOTAL CAPACITOR COUNT PER TYPE | TOTAL FAILURE RATE (1000 HRS) | |
| C77 | 21-P11257B | | 1nF | 20 | 50 | 1.0 | 1.01 | .03 | 75 | | 70 A | | | .15 | | | .001050 | |
| C78 | 21-P11257B | | 1nF | 20 | 50 | 1.0 | 1.01 | .03 | | | 70 A | | | .15 | | | .001050 | |
| C79 | 21-P11257B | | 1nF | 20 | 50 | 6.2 | 2.0 | .13 | | | 7.5 A | | | .15 | | | .001125 | |
| C80 | 21-P11257B | | 1nF | 20 | 50 | 5.0 | | .10 | | | 7.0 A | | | .15 | | | .001050 | |
| C81 | 21-P11257B | | 1nF | 20 | 50 | 6.2 | 2.0 | .17 | | | 8.1 A | | | .15 | | | .001315 | |
| C82 | 21-P11257B | | 1nF | 20 | 50 | 6.2 | 2.0 | .13 | | | 7.5 A | | | .15 | | | .001125 | |
| C83 | 21-P11257B | | 1nF | 20 | 50 | 6.2 | | .13 | | | 7.5 A | | | .15 | | | .001125 | |
| C84 | 21-P11257B | | 1.0 | 20 | 50 | 58 | 1.1 | .12 | V | | 7.3 A | | | .15 | | | .001125 | |
| | | | | | | | | | | | FOR USE OF MANUFACTURER | | | | | | | |
| 20 FAILURE RATE SOURCES (FOR COLUMN #14) | | | | | | | | | | 21 CALCULATED MTBF _____ HRS | | | | 22 TOTAL FAILURE RATE .008865 ± 1000 HRS | | | | |
| A <u>SM-182</u> B _____ | | | | | | | | | | | | | | | | | | |
| C _____ D _____ | | | | | | | | | | | | | | | | | | |

RESISTORS

PROJECT: ALSEP

DATE: 20 JULY 1970

ASSEMBLY: Receiver Command Receiver

SUB ASSEMBLY: IF AND Audio

SCHEMATIC NO: 2-111498

(Resistors)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|-----------------------|--|--------------|-------------------------|---------------|----------------------|---------------------------------|------------------------------|--------------------|-------------------------|---------------------------------|--|-----------------------------|-------------------------|---------------------------------|-------------------------------|---------------------------------|----|
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MIL or MFR) CONSTRUCTION | MANUFACTURER | RESISTANCE VALUE (OHMS) | TOLERANCE (%) | POWER RATING (WATTS) | MAXIMUM OPERATING POWER (WATTS) | POWER RATIO OPERATING/ RATED | MAXIMUM DUTY CYCLE | PULK AIR TEMPERATURE °C | CIRCUIT FUNCTION OR APPLICATION | BASIC FAILURE RATE (R/1000 HRS) AT 25°C SOURCE (SEE BELOW) | SPECIAL ENVIRONMENTS (DAYS) | FAILURE RATE MULTIPLIER | FINAL FAILURE RATE (R/1000 HRS) | TOTAL RESISTOR COUNT PER TYPE | TOTAL FAILURE RATE (R/1000 HRS) | |
| R1 | RCR05G | | 10K | 5 | .125 | .012 | .10 | | 75 | | .01 | A | - | | | .000210 | |
| R2 | RCR05G | | 33K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000210 | |
| R3 | RCR05G | | 3.9K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000210 | |
| R4 | RCR05G | | 470K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000210 | |
| R5 | RCR05G | | 22K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000210 | |
| R6 | RCR05G | | 56K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000210 | |
| R7 | RCR05G | | 56K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000210 | |
| R8 | RCR05G | | 33K | 5 | .125 | .003 | .03 | | | | .01 | A | - | | | .000210 | |
| R9 | RCR05G | | 470K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000210 | |
| R10 | RCR05G | | 8.2K | 5 | .125 | .011 | .09 | | | | .01 | A | - | | | .000210 | |
| R11 | RCR05G | | 10K | 5 | .125 | .005 | .07 | | | | .01 | A | - | | | .000210 | |
| R12 | RCR05G | | 680 | 5 | .125 | .024 | .20 | | | | .01 | A | - | | | .000210 | |
| R13 | RCR05G | | 1.5K | 5 | .125 | .011 | .09 | | | | .01 | A | - | | | .000210 | |
| R14 | RCR05G | | 680 | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000210 | |
| R15 | RCR05G | | 56K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000210 | |
| R16 | RCR05G | | 28K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000210 | |
| R17 | RCR05G | | 1K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000210 | |
| R18 | RNF55C | | 237K | 1 | .1 | .001 | .01 | | | | .265 | A | .0031 | | | .000283 | |

FOR USE OF RELIABILITY DEPT

FAILURE RATE SOURCES (FOR COLUMN #14)

A SM-188 B _____
C _____ D _____

CALCULATED MTBF _____ HRS

TOTAL FAILURE RATE .000253 R/1000 HRS

RESISTORS

PROJECT: ALSEP

DATE: 20 JULY 1970

ASSEMBLY: Subsidiary Command

SUB ASSEMBLY: IF AND Audio

SCHEMATIC NO: 10-211-122

(Resistors)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|--|--|--------------|-------------------------|---------------|----------------------|---------------------------------|-----------------------------|--------------------|-------------------------|---------------------------------|--|-------------------------------|-------------------------------------|---------------------------------|-------------------------------|---------------------------------|----|
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MIL OR MFR) AND CONSTRUCTION | MANUFACTURER | RESISTANCE VALUE (OHMS) | TOLERANCE (%) | POWER RATING (WATTS) | MAXIMUM OPERATING POWER (WATTS) | POWER RATIO OPERATING/RATED | MAXIMUM DUTY CYCLE | BULK AIR TEMPERATURE °C | CIRCUIT FUNCTION OR APPLICATION | BASIC FAILURE RATE (S/1000 HRS) AT 100°C (SEE BELOW) | SPECIAL ENVIRONMENTS (DEFINE) | FAILURE RATE MULTIPLIER | FINAL FAILURE RATE (S/1000 HRS) | TOTAL RESISTOR COUNT PER TYPE | TOTAL FAILURE RATE (S/1000 HRS) | |
| R17 | RCR05G | | 56K | 5 | .125 | .001 | .01 | | 75 | | .01 | A | - | | | .000012 | |
| R20 | RCR05G | | 56K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000012 | |
| R21 | RCR05G | | 47K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000010 | |
| R22 | RCR05G | | 1meg | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000010 | |
| R23 | RCR05G | | 1meg | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000010 | |
| R24 | RCR05G | | 15K | 5 | .125 | .008 | .07 | | | | .01 | A | - | | | .000012 | A |
| R25 | RNP55C | | 5.11K | 1 | .1 | .001 | .01 | | | | 26.5 | A | .0031 | | | .000083 | |
| R26 | RNP55C | | 10K | 1 | .1 | .001 | .01 | | | | 26.5 | A | .0031 | | | .000083 | |
| R27 | RCR05G | | - | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000012 | |
| R28 | RNP55C | | 10K | 1 | .1 | .001 | .01 | | | | 26.5 | A | .0031 | | | .000083 | |
| R27 | RCR05G | | 56K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000010 | |
| R29 | RNP57C | | 200K | 1 | .125 | .001 | .01 | | | | 26.5 | A | .0031 | | | .000083 | |
| R31 | RCR05G | | 220 | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000012 | |
| R32 | RCR05G | | 100 | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000012 | |
| R33 | RCR05G | | 10K | 5 | .125 | .003 | .03 | | | | .01 | A | - | | | .000010 | A |
| R34 | RCR05G | | 820K | 5 | .125 | .001 | .01 | | | | .01 | A | - | | | .000010 | A |
| R35 | RCR05G | | - | 5 | .125 | .006 | .05 | | | | .01 | A | - | | | .000010 | A |
| R36 | RCR05G | | 560 | 5 | .125 | .029 | .24 | | Y | | .01 | A | - | | | .000012 | A |
| 19 FAILURE RATE SOURCES (FOR COLUMN #14) A <u>SM-183</u> B _____ C _____ D _____ | | | | | | | | | | | 20 | | 21 | | | | |
| | | | | | | | | | | | CALCULATED MTBF _____ HRS | | .000472 | | | | |
| | | | | | | | | | | | | | TOTAL FAILURE RATE _____ S/1000 HRS | | | | |

RESISTORS

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: IF AND Audio

SUB ASSEMBLY: IF AND Audio

SCHEMATIC NO: 20-118

(Resistors)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|--|--|--------------|-------------------------|---------------|----------------------|---------------------------------|-----------------------------|--------------------|-------------------------|---------------------------------|--|---------------------------------|--|---------------------------------|-------------------------------|---------------------------------|----|
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MIL OR MFR) CONSTRUCTION | MANUFACTURER | RESISTANCE VALUE (OHMS) | TOLERANCE (%) | POWER RATING (WATTS) | MAXIMUM OPERATING POWER (WATTS) | POWER RATIO OPERATING RATED | MAXIMUM DUTY CYCLE | BULK AIR TEMPERATURE °C | CIRCUIT FUNCTION OR APPLICATION | BASIC FAILURE RATE (R/1000 HRS) 30°C (SEE BELOW) | SPECIAL ENVIRONMENTS (DS-FINES) | FAILURE RATE MULTIPLIER | FINAL FAILURE RATE (R/1000 HRS) | TOTAL RESISTOR COUNT PER TYPE | TOTAL FAILURE RATE (R/1000 HRS) | |
| R37 | RCR05G | | 360 | 5 | .125 | .029 | .24 | | 75 | | .01 A | | - | | | .00010 | A |
| R38 | RCR05G | | 15K | 5 | .125 | .011 | .09 | | | | .01 A | | - | | | .00010 | A |
| R39 | RCR05G | | 56K | 5 | .125 | .001 | .01 | | | | .01 A | | - | | | .00010 | A |
| R40 | RNR55C | | 56.2K | 1 | .1 | .001 | .01 | | | | 26.5 A | | .0031 | | | .00023 | A |
| R41 | RNR55C | | 56.2K | 1 | .1 | .001 | .01 | | | | 26.5 A | | .0031 | | | .00023 | A |
| R42 | RNR55C | | - | 5 | .125 | .001 | .01 | | | | .01 A | | - | | | .00010 | A |
| R43 | RCR05G | | 56K | 5 | .125 | .001 | .01 | | | | .01 A | | - | | | .00010 | A |
| R44 | RNR55C | | 34.8K | 1 | .1 | .001 | .01 | | | | 26.5 A | | .0031 | | | .00023 | A |
| R45 | RNR55C | | 100K | 1 | .1 | .001 | .01 | | | | 26.5 A | | .0031 | | | .00023 | A |
| R46 | RCR05G | | 100 | 5 | .125 | .013 | .11 | | | | .01 A | | - | | | .00010 | A |
| R47 | RNR55C | | 47.5K | 1 | .100 | .001 | .01 | | | | 26.5 A | | .0031 | | | .00023 | A |
| R48 | RNR55C | | 56.2K | 1 | .100 | .001 | .01 | | | | 26.5 A | | .0031 | | | .00023 | A |
| R49 | RNR55C | | 11K | 1 | .1 | .002 | .02 | | | | 26.5 A | | .0031 | | | .00023 | A |
| R50 | RNR55C | | 8.25K | 1 | .1 | .001 | .01 | | | | 26.5 A | | .0031 | | | .00023 | A |
| R51 | RNR55C | | 499 | 1 | .1 | .001 | .01 | | | | 26.5 A | | .0031 | | | .00023 | A |
| R52 | RNR55C | | 200K | 1 | .125 | .001 | .01 | | | | 26.5 A | | .0031 | | | .00023 | A |
| R53 | RCR05G | | 22K | 5 | .125 | .001 | .01 | | | | .01 A | | - | | | .00010 | A |
| R54 | RCR05G | | 3.9K | 5 | .125 | .002 | .02 | | | | .01 A | | - | | | .00010 | A |
| 19 FAILURE RATE SOURCES (FOR COLUMN #14) | | | | | | | | | | | 20 | | 21 | | | | |
| A <u>SM-188</u> B _____ | | | | | | | | | | | CALCULATED MTBF _____ HRS | | TOTAL FAILURE RATE <u>.000910</u> R/1000 HRS | | | | |
| C _____ D _____ | | | | | | | | | | | | | | | | | |

RESISTORS

PROJECT: ALSEP

DATE: 20 July 1972

ASSEMBLY: 6. Instant Comm A/D

SUB ASSEMBLY: IF AND Audio

SCHEMATIC NO: 117-117-13

(Resistors)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---------------------------------------|--|--------------|-------------------------|---------------|----------------------|---------------------------------|-----------------------------|--------------------|-------------------------|---------------------------------|---|--------------------------------|-------------------------------------|---------------------------------|------------------------------|---------------------------------|----|
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MFG OR MFR) CONSTRUCTION | MANUFACTURER | RESISTANCE VALUE (OHMS) | TOLERANCE (%) | POWER RATING (WATTS) | MAXIMUM OPERATING POWER (WATTS) | POWER RATIO OPERATING/RATED | MAXIMUM DUTY CYCLE | SULK AIR TEMPERATURE °C | CIRCUIT FUNCTION OR APPLICATION | BASIC FAILURE RATE (S/1000 HRS) AT 50°C (SEE BELOW) | SPECIAL ENVIRONMENTS (DEFINES) | FAILURE RATE MULTIPLIER | FINAL FAILURE RATE (S/1000 HRS) | TOTAL FAILURE COUNT PER TYPE | TOTAL FAILURE RATE (S/1000 HRS) | |
| R55 | RNR55C | | 2.4K | 1 | .100 | .001 | .01 | | 75 | | 26.5 A | | .0031 | | .000083 | | |
| R56 | RNR57C | | 133K | 1 | .125 | .001 | .01 | | | | 26.5 A | | .0031 | | .000083 | | |
| R57 | RCR05G | | 10 | 5 | .125 | .013 | .11 | | | | .01 A | | - | | .000010 | | |
| R58 | RNR55C | | 21.5K | 1 | .1 | .001 | .01 | | | | 26.5 A | | .0031 | | .000083 | | |
| R59 | RNR55C | | 21.5K | 1 | .1 | .001 | .01 | | | | 26.5 A | | .0031 | | .000083 | | |
| R60 | RNR57C | | 133K | 1 | .125 | .001 | .01 | | | | 26.5 A | | .0031 | | .000083 | | |
| R61 | RCR05G | | 100K | 5 | .125 | .001 | .01 | | | | .01 A | | - | | .000010 | | |
| R62 | RCR05G | | 22K | 5 | .1 | .001 | .01 | | | | .01 A | | - | | .000010 | | |
| R63 | RNR55C | | 10K | 1 | .100 | .001 | .01 | | | | 26.5 A | | .0031 | | .000083 | | |
| R64 | RCR05G | | 22K | 5 | .125 | .001 | .01 | | | | .01 A | | - | | .000010 | | |
| R65 | RCR05G | | 56K | 5 | .125 | .001 | .01 | | | | .01 A | | - | | .000010 | | |
| R66 | RCR05G | | 47K | 5 | .125 | .001 | .01 | | | | .01 A | | - | | .000010 | | |
| R67 | RCR05G | | 56K | 5 | .125 | .001 | .01 | | | | .01 A | | - | | .000010 | | |
| R68 | RCR05G | | 100 | 5 | .125 | .001 | .01 | | | | .01 A | | - | | .000010 | | |
| R69 | RCR05G | | 820K | 5 | .125 | .001 | .01 | | | | .01 A | | - | | .000010 | | |
| R70 | RCR05G | | 82K | 5 | .125 | .001 | .01 | | | | .01 A | | - | | .000010 | | |
| R71 | RCR05G | | 150 | 5 | .125 | .024 | .20 | | | | .01 A | | - | | .000010 | | |
| R72 | RCR05G | | 5.6K | 5 | .125 | .001 | .01 | | Y | | .01 A | | - | | .000010 | | |
| 19 | | | | | | | | | | | 20 | | 21 | | | | |
| FAILURE RATE SOURCES (FOR COLUMN #14) | | | | | | | | | | | CALCULATED MTBF _____ HRS | | TOTAL FAILURE RATE _____ S/1000 HRS | | | | |
| A <u>SM-155</u> B _____ | | | | | | | | | | | | | .000618 | | | | |
| C _____ D _____ | | | | | | | | | | | | | S/1000 HRS | | | | |

RESISTORS

PROJECT: ALSEP

DATE: 23 NOVEMBER 1970

ASSEMBLY: REDUNDANT COMMAND RECEIVER

SUB ASSEMBLY: IF AND AUDIO

SCHEMATIC NO: 63-P11349B

(Resistors)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|--|--|--------------|-------------------------|---------------|----------------------|---------------------------------|-----------------------------|--------------------|-------------------------|---------------------------------|--|-------------------------------|---|---------------------------------|-------------------------------|---------------------------------|----|
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MIL or MFR) AND CONSTRUCTION | MANUFACTURER | RESISTANCE VALUE (OHMS) | TOLERANCE (%) | POWER RATING (WATTS) | MAXIMUM OPERATING POWER (WATTS) | POWER RATIO OPERATING/RAIED | MAXIMUM DUTY CYCLE | BULK AIR TEMPERATURE °C | CIRCUIT FUNCTION OR APPLICATION | BASIC FAILURE RATE (%/1000 HRS) AT °C SOURCE (SEE BELOW) | SPECIAL ENVIRONMENTS (DEFINE) | FAILURE RATE MULTIPLIER | FINAL FAILURE RATE (%/1000 HRS) | TOTAL RESISTOR COUNT PER TYPE | TOTAL FAILURE RATE (%/1000 HRS) | |
| R73 | RCR 05 G | | 5.6K | 5 | .125 | .001 | .01 | | 75 | | .01 | A | | - | | .00010 | A |
| | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |
| 19 FAILURE RATE SOURCES (FOR COLUMN #12) | | | | | | | | | | | 20 | | 21 | | | | |
| A <u>SM-188</u> | | | | | | | | | | | B _____ | | CALCULATED MTBF _____ HRS | | | | |
| C _____ | | | | | | | | | | | D _____ | | TOTAL FAILURE RATE <u>.00010</u> %/1000 HRS | | | | |

(INDUCTORS TRANSFORMERS)

PROJECT: ALSEP

DATE: 30 JULY 1973

ASSEMBLY: REDUNDANT COMMAND RECEIVER

SUB ASSEMBLY: I.F. AND AUDIO

SCHEMATIC NO: C2-P11349B

Inductors & Transformers

| 1 | 2 | 3 | CONSTRUCTION | | | | 8 | 9 | 10 | 11 | TEMPERATURE (°C) | | | | | | PRIMARY CURRENT | | SECONDARY | | | 24 | 25 | 26 | 27 | | | | |
|-----------------------|--|--------------|--------------------------|--------------------|----------------------|------------------|-----------|--------------------------|-----------------|---------------|--------------------------------------|------------|------------------|----------------------|-----|----|-----------------|-------|-----------------|--------------|-------------|---------|----------|-------|---------------|---------------------------------|----------------------|---------------------------------|--|
| | | | 4 | 5 | 6 | 7 | | | | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | | | | 23 | | | |
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MIL or MFR) CONSTRUCTION | MANUFACTURER | TYPE OF CASE (SEE BELOW) | WIRE SIZE, PRIMARY | WIRE SIZE, SECONDARY | INSULATION CLASS | VA RATING | INDUCTANCE AT RATED CUR. | SPECIFIED FREQ. | MISCELLANEOUS | OPERATING AMBIENT HOT SPOT (SURFACE) | (AIR RISE) | EST. ACTUAL RISE | OPERATING TEMP. MAX. | MA | MP | ACTUAL | RATED | PRIMARY VOLTAGE | NO. WINDINGS | WINDING NO. | VOLTAGE | WINDINGS | VOLTS | HIPOT READING | BASIC FAILURE RATE (1/1000 HRS) | AT 125°C (SEE BELOW) | TOTAL FAILURE RATE (1/1000 HRS) | |
| L21 | NOT USED | USED | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| L20 | 24-P11420B | | C | 30 | 125 | | 1.0 | 10.7 | 75 | | 5 | 80 | 2.1 | 100 | .14 | | | | | | | | | | | A | .002060 | A | |
| L21 | | | C | 30 | 125 | | 1.0 | 10.7 | 75 | | 5 | 80 | 1.5 | 100 | .10 | | | | | | | | | | | A | .002060 | A | |
| L22 | | | C | 30 | 125 | | 1.0 | 10.7 | 75 | | 5 | 80 | 1.5 | 100 | .10 | | | | | | | | | | | A | .002060 | A | |
| L23 | ∨ | | C | 30 | 125 | | 1.0 | 10.7 | 75 | | 5 | 80 | .9 | 100 | .06 | | | | | | | | | | | A | .002060 | A | |
| L6 | 24-P12630B | | C | 40 | 125 | | 3.75 | 7.2 | 75 | | 5 | 80 | .1 | 9.6 | .26 | | | | | | | | | | | A | .004120 | | |
| T1 | 24-P11420B | | C | 30 | 36 | 105 | - | 10.7 | 75 | | 5 | 80 | - | 100 | .07 | 1 | 1 | .06 | | | | | | | | A | .005650 | | |
| T2 | | | | | 105 | | - | 10.7 | 75 | | 5 | 80 | - | 100 | .04 | 1 | 1 | .03 | | | | | | | | A | .005650 | | |
| T3 | | | | | 105 | | - | 10.7 | 75 | | 5 | 80 | - | 100 | .70 | 1 | 1 | 3.5 | | | | | | | | A | .005650 | | |
| T4 | | | | | 105 | | - | 10.7 | 75 | | 5 | 80 | - | 100 | .70 | 1 | 1 | 3.5 | | | | | | | | A | .005650 | | |
| T20 | ∨ | | ∨ | ∨ | ∨ | 105 | - | 10.7 | 75 | | 5 | 80 | 1.6 | 100 | .03 | 1 | 1 | .12 | | | | | | | | A | .005650 | A | |
| T6 | ∨ | | ∨ | ∨ | ∨ | 125 | - | 10.7 | 75 | | 5 | 80 | .25 | 100 | .70 | 2 | 1,2 | .70 | | | | | | | | A | .005650 | A | |

26 TYPE OF CASE
 A. HER. SEAL
 B. VAC. IMP.
 C. ENCAP.
 D. OPEN

29 FAILURE RATE SOURCES (FOR COLUMN #26)
 A. SM-188
 B. _____
 C. _____
 D. _____

30 CALCULATED MTBF _____ HRS

31 TOTAL FAILURE RATE .046760 / 1000 HRS

PARTS APPLICATION ANALYSIS

(SEMICONDUCTORS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: REDUNDANT COMMAND RECEIVER

SUB ASSEMBLY: IF AND AUDIO

SCHEMATIC NO: 63-P11349B

| CKT SYM NO. | TYPE DESIGNATION, SEMICONDUCTOR, POLARITY | MANUFACTURER | MAX. TEMP °C | | AVG PWR DISSIPATION (mw) | | | | POWER RATIO | | MAXIMUM VOLTAGES | | | | DIODE PIV | | CIRCUIT FUNCTION OF APPLICATION | PART SPECIAL ENVIRONMENT (Define) | FOR RELIABILITY USE ONLY | | | | | | | |
|--|---|--------------|--------------|-----------|--------------------------|----------|------|------------|-------------|--------------------------------|-----------------------|--------------|--------------|--------------|--------------|---------|---------------------------------|---|--------------------------|-------------------|--|------------|---------------------------|---------------------------------|--------|--------|
| | | | AMBIENT TA | ACTUAL TJ | JUNCTION TEMP °C | RATED AT | | | | ACTUAL RATED 25°C Amb. or case | ACTUAL RATED TA or TC | VCBO RATED V | VCB ACTUAL V | VCR0 RATED V | VCE ACTUAL V | RATED V | | | ACTUAL V | RATE (%/1000 HRS) | SOURCE (See below) | MULTIPLIER | FAILURE RATE (%/1000 HRS) | TOTAL FAILURE RATE (%/1000 HRS) | | |
| | | | | | | AMBIENT | CASE | AMBIENT TA | CASE TC | | | | | | | | | | | | | | | | ACTUAL | ACTUAL |
| | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CR1 | DIODE, TXIN3064 | | 75 | 150 | 76 | 250 | 175 | .80 | .01 | .01 | | | | | | | | | 3.2 | A | .1 | .000320 | | | | |
| CR2 | DIODE, TXIN3064 | | 75 | 150 | 76 | 250 | 175 | .30 | .01 | .01 | | | | | | | | | 3.2 | A | .1 | .000320 | | | | |
| CR3 | DIODE, TXIN3064 | | 75 | 150 | 76 | 250 | 175 | .50 | .01 | .01 | | | | | | | | | 3.2 | A | .1 | .000320 | | | | |
| CR4 | DIODE, 48-P11266B | | 75 | 150 | 100 | 250 | 150 | 50. | .20 | .34 | | | | | | | | | 6.4 | A | .02 | .000128 | | | | |
| CR5 | DIODE, 48-P11266B | | 75 | 150 | 100 | 250 | 150 | 50. | .20 | .34 | | | | | | | | | 6.4 | A | .02 | .000128 | | | | |
| CR6 | DIODE, 48-P11266B | | 75 | 150 | 100 | 250 | 150 | 50. | .20 | .34 | | | | | | | | | 6.4 | A | .02 | .000128 | | | | |
| CR7 | DIODE, 48-P11266B | | 75 | 150 | 100 | 250 | 150 | 50. | .20 | .34 | | | | | | | | | 6.4 | A | .02 | .000128 | | | | |
| VR1 | DIODE, 2F11N755A | | 75 | 175 | 81 | 400 | 246 | 15. | .04 | .06 | | | | | | | | | 3.15 | A | .1 | .0002915 | | | | |
| CR9 | DIODE, TXIN3064 | | 75 | 150 | 76 | 250 | 175 | .5 | .01 | .01 | | | | | | | | | 3.2 | A | .1 | .000320 | | | | |
| 10 FAILURE RATE SOURCE (See Column 23) A 501-198 C _____ B _____ D _____ | | | | | | | | | | | | | | | | | | 11 NOTE: It is assumed the transient and peak power does not exceed the safe limit. | | | 12 TOTAL FAILURE RATE .002227 --- %/1000 HRS. | | | | | |

PARTS APPLICATION ANALYSIS

(SEMICONDUCTORS)

PROJECT: ALSEP

DATE: 20 JULY 1970

ASSEMBLY: REDUNDANT COMMAND RECEIVER

SUB ASSEMBLY: IF AND AUDIO

SCHEMATIC NO: CS-P11349B

| CKT SYM NO. | TYPE DESIGNATION, SEMICONDUCTOR, POLARITY | MANUFACTURER | MAX. TEMP °C | | | AVG PWR DISSIPATION (mw) | | | | POWER RATIO | | MAXIMUM VOLTAGES | | | | DIODE PIV | | CIRCUIT FUNCTION OF APPLICATION | PART SPECIAL ENVIRONMENT (Define) | FOR RELIABILITY USE ONLY | | | | | | |
|--|---|--------------|----------------|----------------|----------------|--------------------------|------|--------|------|----------------------------------|----------------------|--------------------------|--------------------------|--------------------------|--------------------------|-----------|----------|---|-----------------------------------|--|--------------------|-----------------------|---------------------------------|--------|------|----------------|
| | | | T _A | T _J | T _C | RATED AT | | | | ACTUAL RATED 25°C (Amb. or case) | ACTUAL RATED % of 1C | V _{CB0} RATED V | V _{CB} ACTUAL V | V _{CE0} RATED V | V _{CE} ACTUAL V | RATED V | ACTUAL V | | | RATE (%/1000 HRS) | SOURCE (See below) | FAILURE RATE PER TYPE | TOTAL FAILURE RATE (%/1000 HRS) | | | |
| | | | | | | 25°C | | ACTUAL | CASE | | | | | | | | | | | | | | | ACTUAL | CASE | |
| | | | | | | Ambient | Case | | | | | | | | | | | | | | | | | | | T _A |
| Q1A | TRANSISTOR, PNP 2N3049 | | 75 | 175 | 77 | 250 | - | 166 | - | 1.8 | .01 | .02 | 25 | 1.0 | 20 | .3 | | | 10.0 | A | .04 | .000424 | | | | |
| Q1B | | | 75 | 175 | 76 | 250 | - | 166 | - | .8 | .01 | .01 | 25 | 1.0 | 20 | .3 | | | 10.4 | A | .04 | .000416 | | | | |
| Q2 | TRANSISTOR, NPN TX 2N2222A | | 75 | 175 | 79 | 500 | - | 333 | - | 13 | .03 | .04 | 75 | 6. | 50 | 5.8 | | | 7.80 | A | .1 | .000780 | | | | |
| Q3A | TRANSISTOR, PNP 2N3049 | | 75 | 175 | 78 | 250 | - | 166 | - | 4. | .02 | .03 | 25 | 7. | 20 | 7. | | | 5.74 | A | .04 | .000230 | | | | |
| Q3B | | | 75 | 175 | 78 | 250 | - | 166 | - | 4. | .02 | .03 | 25 | 7. | 20 | 7. | | | 7.4 | A | .04 | .000230 | | | | |
| Q4 | TRANSISTOR, NPN TX 2N930 | | 75 | 175 | 77 | 300 | - | 200 | - | 3. | .01 | .02 | 60 | 3. | 45 | 3. | | | 3.80 | A | .1 | .000880 | | | | |
| Q5 | TRANSISTOR, NPN TX 2N2222A | | 75 | 175 | 89 | 500 | - | 333 | - | 45 | .09 | .14 | 75 | 1.5 | 50 | 1.5 | | | 7.9 | A | .1 | .000790 | | | | |
| | | | | | | | | | | | | | | | | | | .003750 | | | | | | | | |
| 18 FAILURE RATE SOURCE (See Column 23) A <u>SM-188</u> C _____ B _____ D _____ | | | | | | | | | | | | | | | | | | 19 NOTE: It is assumed the transient and peak power does not exceed the safe limit. | | 20 TOTAL FAILURE RATE <u>.003750</u> / 1000 HRS. | | | | | | |

BS-321A

ATM-983 Page 37 of 60

(MISC. PARTS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: REUNDANT COMMAND RECEIVER

SUB ASSEMBLY: IF AND AUDIO

SCHEMATIC NO: 63-P11349B

(Misc. Parts)

| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (CNC, MEL OR MFR) and CONSTRUCTION | MANUFACTURER | AMBIENT TEMPERATURE RANGE °C | | ELECTRICAL STRESS POWER | | PERCENT DUTY CYCLE | MAJOR CHARACTERISTICS and APPLICATION | FOR RELIABILITY USE ONLY | | | | |
|---|---|--------------|------------------------------|-------------|-------------------------|----------|-------------------------|---------------------------------------|--|---|----------------------------------|-------------------------|-----------------------------------|
| | | | MAX RATED 4 | TEMP ACT. 5 | RATED 6 MIN | USE 7 MW | | | BASIC FAILURE RATE (S/1000 HOURS) at 75°C (SEE MFR'S DATA) | SOURCE (SEE MFR'S DATA) | PART SPECIAL ENVIRONMENT (DEFIN) | FAILURE RATE MULTIPLIER | TOTAL FAILURE RATE (S/1000 HOURS) |
| | | | | | | | | | | | | | |
| AR1 | 45F 7715312 | | 125 | 75 | 500 | 28 | COMPLEXITY FACTOR = 172 | 15.36 | A | | .1 | .001536 | |
| AR2 | 51-216073A | | 125 | 75 | 500 | 30 | = 81 | 9.72 | A | | .05 | .000486 | |
| AR3 | 45B 7741312 | | 125 | 75 | 500 | 10 | = 92 | 10.40 | A | | .1 | .001040 | |
| AR4 | 45B 7741312 | | 125 | 75 | 500 | 10 | = 92 | 10.40 | A | | .1 | .001040 | |
| AR5 | 45B 7741312 | | 125 | 75 | 500 | 10 | = 92 | 10.40 | A | | .1 | .001040 | |
| AR6 | 45B 7741312 | | 125 | 75 | 500 | 10 | ↓ = 92 | 10.40 | A | | .1 | .001040 | |
| 15 FAILURE RATE SOURCES (FOR COLUMN 11) A. <u>NOTI 5A-188</u> B. _____ C. _____ D. <u>SEE SEE 217 Chart KEY</u> | | | | | | | | 16 CALCULATED MTBF _____ HOURS | | 17 TOTAL FAILURE RATE <u>.006182</u> S/1000 HOURS | | | |

(MISC. PARTS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: REDUNDANT COMMAND RECEIVER

SUB ASSEMBLY: IF AND AUDIO

SCHEMATIC NO: 63-P11349B

(Misc. Parts)

| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (CBC, MEL OR MFR) CONSTRUCTION | MANUFACTURER | AMBIENT TEMPERATURE (°C) | | ELECTRICAL STRESS POWER | | PERCENT DUTY CYCLE | MAJOR CHARACTERISTICS and APPLICATION | FOR RELIABILITY USE ONLY | | | | | | | | | | |
|-----------------------|---|--------------|--------------------------|---------|-------------------------|-----|--------------------|---------------------------------------|--------------------------------------|------------------------|-----------------------------------|-------------------------|-----------------------------------|----|----|----|---------------------------------------|----|--|
| | | | MAX RATED | SER ACT | RATED | USE | | | BASIC FAILURE RATE (1/1000 HOURS) | CORRECTION FACTOR | PART SPECIAL ENVIRONMENT (DEFENS) | FAILURE RATE MULTIPLIER | TOTAL FAILURE RATE (1/1000 HOURS) | | | | | | |
| | | | | | | | | | | | | | | 10 | 11 | 12 | 13 | 14 | |
| U1 | 51-P16071A | | 125 | 75 | 500 | 43 | | COMPLEXITY FACTOR = 78 | 10.14 | A | | .05 | .000507 | | | | | | |
| U2 | 51-P16071A | | 125 | 75 | 500 | 43 | | = 78 | 10.14 | A | | .05 | .000507 | | | | | | |
| U3 | 51-P16071A | | 125 | 75 | 500 | 77 | | = 78 | 11.55 | A | | .05 | .000578 | | | | | | |
| U4 | 51-P16072A | | 125 | 75 | 500 | 66 | | = 78 | 10.92 | A | | .05 | .000546 | | | | | | |
| U5 | 51-P16072A | | 125 | 75 | 500 | 63 | | = 78 | 10.92 | A | | .05 | .000546 | | | | | | |
| | | | | | | | | 15 | FAILURE RATE SOURCES (FOR COLUMN 11) | | 16 | | CALCULATED MTBF _____ HOURS | | 17 | | TOTAL FAILURE RATE _____ 1/1000 HOURS | | |
| | | | | | | | | A. MOT. SM-188 | | B. _____ | | | | | | | | | |
| | | | | | | | | C. _____ | | D. MEL 26 217 CHPT XIV | | | | | | | | | |

DD Form 1288

BS-321A

(MISC. PARTS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: REDUNDANT COMMAND RECEIVER

SUB ASSEMBLY: IF AND AUDIO

SCHEMATIC NO: 63-P11349B

(Misc. Parts)

| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (CNC, MEL OR MEPS) and CONSTRUCTION | MANUFACTURER | AMBIENT TEMPERATURE RANGE °C | | ELECTRICAL STRESS VOLTAGE | | PERCENT DUTY CYCLE | MAJOR CHARACTERISTICS and APPLICATION | FOR RELIABILITY USE ONLY | | | | |
|--|--|--------------|------------------------------|------------|---------------------------|------|--------------------|---------------------------------------|--|--|-------------------------|-----------------------------------|----|
| | | | MAX RATED | TEMP. ACT. | RATED | USE | | | BASIC FAILURE RATE (S/1000 HOURS) at 25°C (SEE MIL-STD-883C) | SPECIAL ENVIRONMENT (DEFENSE) | FAILURE RATE MULTIPLIER | TOTAL FAILURE RATE (S/1000 HOURS) | |
| | | | | | | | | | | | | | 11 |
| FL1 | 25-P14433A | | 125 | 75 | 100 | 11.3 | | 7.3 | A | .5 | .00365 | | |
| FL2 | 25-P14433A | | 125 | 75 | 100 | 12. | | 7.3 | A | .5 | .00365 | | |
| FL3 | 25-P14433A | | 125 | 75 | 100 | 5. | | 7.0 | A | .5 | .00350 | | |
| FL4 | 25-P14433A | | 125 | 75 | 100 | 16.5 | | 7.2 | A | .5 | .00360 | | |
| FL5 | 25-P14433A | | 125 | 75 | 100 | 5.5 | | 7.0 | A | .5 | .00350 | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| 15 FAILURE RATE SOURCES (FOR COLUMN 11) A. <u>MOT. SM-188</u> B. _____ C. _____ D. <u>MIL-STD-217 Chart I/IV</u> | | | | | | | | 16 CALCULATED MTBF _____ HOURS | | 17 TOTAL FAILURE RATE <u>.01790</u> S/1000 HOURS | | | |

(CONNECTORS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: Redundant Command

SUB ASSEMBLY: IF AND AUDIO

SCHEMATIC NO: BS-P11349B

(Connectors)

| CIRCUIT, REF. DESIGNATION | TYPE DESIGNATION (CFC, MIL OR MFR) AND CONSTRUCTION | MANUFACTURER | PINS | | | | | | | | | | AMBIENT TEMP °C | INSERT MATL | GUIDE | NO. OF INSERTIONS DURING LIFE | MISCELLANEOUS REMARKS | FAILURE RATE (See 24) | SOURCE OF F.R. | F.R. MODIFIER | TOTAL FAILURE RATE (S/1000 Hours) | |
|---------------------------|---|--------------|--|--------|---------|--------|---------|--------------|--------|-----------|--------------------|-------|-----------------------------|-------------|-------|-------------------------------|---------------------------------------|-----------------------|----------------|---------------|-----------------------------------|------|
| | | | NUMBER | | CURRENT | | VOLTAGE | | | | | | | | | | | | | | | |
| | | | TOTAL | ACTIVE | RATED | ACTUAL | | BETWEEN PINS | | | ACROSS THE CONTACT | | | | | | | | | | | |
| | | | | | | MAX. | MIN. | RATED | ACTUAL | TRANSIENT | STEADY STATE | SURGE | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7mA | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | |
| J1 | RF, 50-047-0000 | | 1 | 1 | 2A | 14 | - | 400 | 1 | - | - | - | 75 | TEFLON | - | - | | | 1.0 | A | - | .001 |
| | | | | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | | | | |
| 23 | REQUIRED LIFE HOURS | | FAILURE RATE SOURCES (FOR COLUMN 20) | | | | | | | | | | CALCULATED MTBF _____ HOURS | | | | TOTAL FAILURE RATE _____ S/1000 HOURS | | | | | |
| | | | A. <u>MOT. SM-188</u> B. _____ C. _____ D. _____ | | | | | | | | | | | | | | 10010 | | | | | |

(BS-321A)

TOTAL MODULE FAILURE RATE
154011 70/1000 HRS A

CAPACITORS

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: Redundant Command Receiver

SUBASSEMBLY: Audio Combiner / PWR 130

SCHEMATIC NO: 63-P1135CB

(Capacitors)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | |
|--|--|--------------|-------------------|-----------|------------------------------|-------------------|---------|-------|--------------------|---------------------------|---------------------------------|----------------------------------|-------------------------------|--|--------------------|--------------------------------|-----------------------------------|----|--|
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (DEL OR MFR) CONSTRUCTION | MANUFACTURER | CAPACITANCE VALUE | TOLERANCE | MANUFACTURER'S RATED VOLTAGE | OPERATING VOLTAGE | | | MAXIMUM DUTY CYCLE | HULL AIR TEMPERATURE (°C) | CIRCUIT FUNCTION OR APPLICATION | BASE FAILURE RATE (PER 1000 HRS) | SPECIAL ENVIRONMENT (REF/ENV) | FAILURE RATE MULTIPLIER | FINAL FAILURE RATE | TOTAL CAPACITOR COUNT PER TYPE | TOTAL FAILURE RATE (PER 1000 HRS) | | |
| | | | | | | DC | PEAK AC | RATED | | | | | | | | | | | |
| C1 | CSR13G | | 15µf | 10 | 50 | 251.1 | .19 | 1.0 | 75 | | | .780 A | | Level P | | | .000980 | | |
| C2 | CSR13G | | 15µf | 10 | 50 | 251.1 | .19 | 1.0 | 75 | | | .780 A | | Level P | | | .000980 | | |
| C3 | 21-P11257B | | 1µf | 20 | 50 | 5513 | .11 | 1.0 | 75 | | | 7.0 B | | .15 | | | .001050 | | |
| C4 | 21-P11257B | | 1µf | 20 | 50 | 5513 | .11 | 1.0 | 75 | | | 7.0 B | | .15 | | | .001050 | | |
| C5 | 21-P11257B | | 1µf | 20 | 50 | 5513 | .11 | 1.0 | 75 | | | 7.0 B | | .15 | | | .001050 | | |
| C6 | 21-P11257B | | 1µf | 20 | 5 | 5513 | .11 | 1.0 | 75 | | | 7.0 B | | .15 | | | .001050 | | |
| C7 | CLR65BE | | 22µf | 10 | 25 | 122.4 | .48 | 1.0 | 75 | | | 10.5 C | | - | | | .010500 | | |
| C8 | CLR65BE | | 22µf | 10 | 25 | 122.4 | .48 | 1.0 | 75 | | | 10.5 C | | - | | | .010500 | | |
| | | | | | | | | | | | | 20 | | 21 | | 22 | | | |
| FAILURE RATE SOURCES (FOR COLUMN #16) MIL-HDBK-217 - SM-188 CMH-217 FIG. 7.6.12B | | | | | | | | | | | | CALCULATED MTBF _____ HRS | | TOTAL FAILURE RATE: .027160 / 1000 HRS | | | | | |

RESISTORS

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: Instrument Components

SUB ASSEMBLY: Audio COMPILER / PWR ISO

SCHEMATIC NO: 63-P117-6R

(Resistors)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|-----------------------|--|--------------|-------------------------|---------------|----------------------|---------------------------------|------------------------------|--------------------|-------------------------|---------------------------------|---|---------------------------------|-------------------------|----------------------------------|-------------------------------|----------------------------------|----|
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (AIL or MFR) AND CONSTRUCTION | MANUFACTURER | RESISTANCE VALUE (OHMS) | TOLERANCE (%) | POWER RATING (WATTS) | MAXIMUM OPERATING POWER (WATTS) | POWER RATIO OPERATING/ RATED | MAXIMUM DUTY CYCLE | BULK AIR TEMPERATURE °C | CIRCUIT FUNCTION OR APPLICATION | BASIC FAILURE RATES (E/1000 HRS) AT 25°C SOURCE (SEE BELOW) | SPECIAL ENVIRONMENTS (DEFINING) | FAILURE RATE MULTIPLIER | FINAL FAILURE RATES (E/1000 HRS) | TOTAL RESISTOR COUNT PER TYPE | TOTAL FAILURE RATES (E/1000 HRS) | |
| R1 | C2R05G | | 100 | 5 | .125 | .002 | .016 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R2 | C2R05G | | 18K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R3 | C2R05G | | 18K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R4 | RCR05G | | 100 | 5 | .125 | .002 | .016 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R5 | C2R05G | | 1.5K | 5 | .125 | .002 | .016 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R6 | C2R05G | | 71K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R7 | C2R05G | | 12K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R8 | C2R05G | | 18K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R9 | RCR05G | | 18K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R10 | R2R05G | | 1500 | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R11 | R2R05G | | 51K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R12 | C2R05G | | 33K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R13 | C2R05G | | 10K | 10 | .500 | .002 | .004 | 1.0 | 75 | | - | A | - | | | .015000 | |
| R14 | C2R05G | | 33K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R15 | C2R05G | | 33K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R16 | C2R05G | | 33K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R17 | R2R05G | | 1500 | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |
| R18 | RCR05G | | 43K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .00010 | |

FOR USE OF RELIABILITY DEPT

A
A
A
A

FAILURE RATE SOURCES (FOR COLUMN #14)

A SM-188 B _____
C _____ D _____

CALCULATED MTBF _____ HRS

TOTAL FAILURE RATE .015170 E/1000 HRS

RESISTORS

PROJECT: ALSEP

DATE: 20 JULY 1970

ASSEMBLY: 10000000

SUB ASSEMBLY: AUDIO COMP, PWR 150

SCHEMATIC NO: 65-4127-10

17-01-00000000

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|--|--|--------------|-------------------------|---------------|----------------------|---------------------------------|------------------------------|--------------------|-------------------------|---------------------------------|--|-------------------------------|-------------------------|----------------------------------|---|----------------------------------|----|
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MIL or MFR) AND CONSTRUCTION | MANUFACTURER | RESISTANCE VALUE (OHMS) | TOLERANCE (%) | POWER RATING (WATTS) | MAXIMUM OPERATING POWER (WATTS) | POWER RATIO OPERATING/ RATED | MAXIMUM DUTY CYCLE | BULK AIR TEMPERATURE °C | CIRCUIT FUNCTION OR APPLICATION | BASIC FAILURE RATE (\$/1000 HRS) - AT 5% SOURCE (SE & BELOW) | SPECIAL ENVIRONMENTS (DEFINS) | FAILURE RATE MULTIPLIER | FINAL FAILURE RATE (\$/1000 HRS) | TOTAL RESISTOR COUNT PER TYPE | TOTAL FAILURE RATE (\$/1000 HRS) | |
| R19 | RCR05G | | 17K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .000010 | |
| R20 | NOT USED | | | | | | | | | | | | | | | | |
| R21 | RCR05G | | 7.2K | 5 | .125 | .002 | .064 | 1.0 | 75 | | .01 | A | - | | | .000010 | |
| R22 | RCR05G | | 56K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .000010 | |
| R23 | RCR05G | | 150K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .000010 | |
| R24 | RCR05G | | 8.2K | 5 | .125 | .005 | .064 | 1.0 | 75 | | .01 | A | - | | | .000010 | |
| R25 | RCR05G | | 150K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .000010 | |
| R26 | RCR05G | | 22K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .000010 | |
| R27 | RCR05G | | 22K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .000010 | |
| R28 | RCR05G | | 120K | 5 | .125 | .001 | .008 | 1.0 | 75 | | .01 | A | - | | | .000010 | |
| 19 | | | | | | | | | | | 20 | | | | 21 | | |
| FAILURE RATE SOURCES (FOR COLUMN #14) A <u>SM-138</u> B _____ C _____ D _____ | | | | | | | | | | | CALCULATED MTBF _____ HRS | | | | TOTAL FAILURE RATE <u>.000010</u> \$/1000 HRS | | |

FOR USE OF RELIABILITY DEPT

PARTS APPLICATION ANALYSIS

(SEMICONDUCTORS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: Redundant Command Receiver

SUB ASSEMBLY: Airid Container/PWR 150

SCHEMATIC NO: 63-P11356B

(Semiconductors)

| CKT SYM NO. | TYPE DESIGNATION, SEMICONDUCTOR, POLARITY | MANUFACTURER | MAX. TEMP °C | | | AVG PWR DISSIPATION (mw) | | | | POWER RATIO | | MAXIMUM VOLTAGES | | | | DIODE PIV | | CIRCUIT FUNCTION or APPLI- CATION | PART SPECIAL SERVICES REQD (Define) | FOR RELIABILITY USE ONLY | | | | | | | | | |
|-------------------|--|--------------|---------------------------|---|--------------------------|--------------------------|------|---------|------|---|--|--------------------------------|--------------------------------|--------------------------------|--------------------------------|------------|-------------|---|---|------------------------------|-------------|---|-----------|---|-----------|---------------------------|---|---------|------|
| | | | AMBIENT T _A | ACTUAL RATED JUNCTION T _J | ACTUAL T _J | RATED AT | | | | ACTUAL RATED 25°C Ambient case | ACTUAL RATED T _A or T _C | V _{CB0} RATED V | V _{CB} ACTUAL V | V _{CE0} RATED V | V _{CE} ACTUAL V | RATED V | ACTUAL V | | | R _F RATED % | S SOURCE | F FAILURE RATE (%/1000 HRS) | M MODE | F FAILURE RATE (%/1000 HRS) | T TYPE | C COUNT PER TYPE | TOTAL FAILURE RATE (%/1000 HRS) | | |
| | | | | | | AMBIENT | CASE | AMBIENT | CASE | | | | | | | | | | | | | | | | | | | AMBIENT | CASE |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Q1 | TRANSISTOR, NPN JANTX-2N2222A | | 75 | 175 | 96 | 500 | - | 333 | - | 70 | .14 | .21 | 75 | 0.5 | 50 | 1.0 | - | - | | | 8.9 | A | .1 | | | .000890 | | | |
| Q2 | TRANSISTOR, NPN JANTX-2N2222A | | 75 | 175 | 96 | 500 | - | 333 | - | 70 | .14 | .21 | 75 | 0.5 | 50 | 1.0 | - | - | | | 8.9 | A | .1 | | | .000890 | | | |
| Q3 | TRANSISTOR, PNP JANTX-2N2907A | | 75 | 200 | 75 | 400 | - | 286 | - | 12 | .001 | .001 | 60 | 0.1 | 60 | 0.3 | - | - | | | 2.5 | A | .1 | | | .000250 | | | |
| Q4 | TRANSISTOR, PNP JANTX-2N2907A | | 75 | 200 | 91 | 400 | - | 286 | - | 35 | .088 | .122 | 60 | 1.5 | 60 | 3.0 | - | - | | | 11.9 | A | .1 | | | .001140 | | | |
| Q5 | TRANSISTOR, PNP JANTX-2N2907A | | 75 | 200 | 91 | 400 | - | 286 | - | 35 | .088 | .122 | 60 | 1.5 | 60 | 3.0 | - | - | | | 11.9 | A | .1 | | | .001140 | | | |
| Q6 | TRANSISTOR, NPN JANTX-2N2222A | | 75 | 175 | 75 | 500 | - | 333 | - | 1.0 | .002 | .003 | 75 | 3.0 | 50 | 0.3 | - | - | | | 5.66 | A | .1 | | | .000566 | | | |
| Q7 | TRANSISTOR, NPN JANTX-2N2222A | | 75 | 175 | 75 | 500 | - | 333 | - | 1.0 | .002 | .003 | 75 | 3.0 | 50 | 0.3 | - | - | | | 5.66 | A | .1 | | | .000566 | | | |
| Q8 | TRANSISTOR, NPN JANTX-2N2222A | | 75 | 175 | 75 | 500 | - | 333 | - | 1.0 | .002 | .003 | 75 | 3.0 | 50 | 0.3 | - | - | | | 5.66 | A | .1 | | | .000566 | | | |
| Q9 | TRANSISTOR, NPN JANTX-2N2222A | | 75 | 175 | 75 | 500 | - | 333 | - | 1.0 | .002 | .003 | 75 | 1.5 | 50 | 2.0 | - | - | | | 5.97 | A | .1 | | | .000597 | | | |

FAILURE RATE SOURCE (See Column 22)
 A SM-198 C _____
 B _____ D _____

NOTE: It is assumed the transient and peak power does not exceed the safe limit.

TOTAL FAILURE RATE .007305 %/1000 HRS.

PARTS APPLICATION ANALYSIS

(SEMICONDUCTORS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: Point-to-Point

SUB ASSEMBLY: AUDIO CONTROL / PWR 150

SCHEMATIC NO: 63-P1156B

(Semiconductors)

| CKT SYM NO. | TYPE DESIGNATION, SEMICONDUCTOR, POLARITY | M A N U F A C T U R E R | MAX. TEMP °C | | | | AVG PWR DISSIPATION (mw) | | | | POWER RATIO | | MAXIMUM VOLTAGES | | | | DIODE PIV | | CIRCUIT FUNCTION OR APPLI- CATION | PART SPECIAL ENVIRON- MENT (Define) | FOR RELIABILITY USE ONLY | | | | | | | | | |
|--|--|--|---|--|---|--|---|------------------------------------|--|--|---|--|---|---|---|---|-------------------------|----------------------------|---|---|------------------------------------|--|---------------------------------|---------------------------------|--|--|--|--|--|--|
| | | | A M B I E N T T _A | A C T U A L T _A | R A T E D T _J | J U N C T I O N A C T U A L T _J | RATED AT | | | | A C T U A L T _A | A C T U A L RATED T _A OR T _C | V C E O R A T E D | V C B A C T U A L | V C E O R A T E D | V C B A C T U A L | R A T E D | A C T U A L | | | R A T E (%) / 1000 HRS | S O U R C E | F A I L U R E | P E R T Y P E | T O T A L F A I L U R E R A T E (%) / 1000 HRS | | | | | |
| | | | | | | | 25°C | | | | | | | | | | | | | | | | | | | A C T U A L RATED T _A | A C T U A L RATED T _C | A C T U A L RATED T _A | A C T U A L RATED T _C | |
| | | | | | | | A M B I E N T T _A | C A S E T _A | A C T U A L T _A | A C T U A L T _C | | | | | | | | | | | | | | | | | | | | |
| S10 | TRANSISTOR, NPN JANTX 2222A | | 75 | 175 | 75 | 500 | - | 333 | - | 1.0 | .002 | .003 | 75 | 25 | 50 | 2.0 | - | - | | | | | | | 597 | A | .1 | | .000597 | |
| CR1 | JANTX 1N3064 | | 75 | 150 | 75 | 250 | - | 175 | - | .7 | .003 | .004 | - | - | - | - | 75 | 0 | | | | | | | | | | | .000314 | |
| CR2 | JANTX 1N3064 | | 75 | 50 | 75 | 250 | - | 175 | - | .7 | .003 | .004 | - | - | - | - | 75 | 0 | | | | | | | | | | | .000314 | |
| VR1 | JANTX 1N753A | | 75 | 175 | 96 | 400 | - | 320 | - | 3.1 | .008 | .010 | - | - | - | - | V _Z = 6.2 | 6.2 | | | | | | | | | | | .000446 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 FAILURE RATE SOURCE (See Column 22) A <u>SP-152</u> C _____ B _____ D _____ | | | | | | | | | | | 20 NOTE: It is assumed the transient and peak power does not exceed the safe limit. | | | | | | | | | | | 21 TOTAL FAILURE RATE <u>.001671</u> %/1000 HRS. | | | | | | | | |

BS-321A

(INDUCTORS & TRANSFORMERS)

PROJECT: ALSEP

DATE: 20 July 1962

ASSEMBLY: Inductor

SUB ASSEMBLY: Amplifier Power 150

SCHEMATIC NO: 63-PI1565

(Inductors & Transformers)

| 1 | 2 | 3 | CONSTRUCTION | | | | | 8 | 9 | 10 | 11 | TEMPERATURE (°C) | | | | | PRIMARY CURRENT | | SECONDARY | | | HIPOT READING | | REL. DEPT USE ONLY | | | | |
|-----------------------|---|--------------|--------------------------|-------------------|---------------------|------------------|-----------|-------------------------------|----------------------|---------------|-----------------------------|-----------------------|----------------|-----------------------|-------------------------|--------|-----------------|-----------------|--------------|-------------|---------|---------------|-------|--------------------|------------------------|--------------------|---------------------------|---------|
| | | | 4 | 5 | 6 | 7 | | | | | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (MIL. OR MFR) AND CONSTRUCTION | MANUFACTURER | TYPE OF CASE (SEE BELOW) | WIRE GAGE PRIMARY | WIRE GAGE SECONDARY | INSULATION CLASS | VA RATING | INDUCTANCE AT RATED CUR. (MH) | SPECIFIED FREQ (KHZ) | MISCELLANEOUS | OPERATING AMBIENT TEMP (°C) | POT TEMP SURFACE (°C) | OR METHOD (°C) | EST. ACTUAL RISE (°C) | OPERATING TEMP MAX (°C) | ACTUAL | RATED | PRIMARY VOLTAGE | NO. WINDINGS | WINDING NO. | VOLTAGE | WINDINGS | VOLTS | ACROSS | WITH SOURCE (1000 HRS) | ACROSS (SEE BELOW) | TOTAL FAILURES (1000 HRS) | |
| L1 | 24-PI4448A | | C | - | - | 125 | .15 | 2.2 | 7.9 | 75 | - | - | 5 | 80 | 70 | 50 | .04 | - | - | - | - | - | - | - | - | - | A | .002060 |
| L2 | 24-PI4448A | | C | - | - | 125 | .15 | 2.2 | 7.9 | 75 | - | - | 5 | 80 | 70 | 50 | .04 | - | - | - | - | - | - | - | - | - | A | .002060 |

28 TYPE OF CASE
 A. HER. SEAL
 B. VAC. SEEP.
 C. ESCAP.
 D. OPEN

29 FAILURE RATE SOURCES (FOR COLUMN #28)
 A. SM-188 B. _____
 C. _____ D. _____

30 CALCULATED MTF _____ HRS

31 TOTAL FAILURE RATE .004120 / 1000 HRS
 TOTAL MODULE FAILURE RATE
.055516 % / 1000 HRS.

RESISTORS

PROJECT: ALSEP

ASSEMBLY: REDUANT COMMAND RCVR

SUB ASSEMBLY: RF COUPLING

DATE: 20 July 1970

SCHEMATIC NO: 1.4-P-1152

| 1 CIRCUIT SYMBOL NUMBER | 2 TYPE DESIGNATION (MIL or MFR) AND CONSTRUCTION | 3 MANUFACTURER | 4 RESISTANCE VALUE (OHMS) | 5 TOLERANCE (%) | 6 POWER RATING (WATTS) | 7 MAXIMUM OPERATING POWER (WATTS) | 8 POWER RATIO OPERATING/RATED | 9 MAXIMUM DUTY CYCLE | 10 BULB AIR TEMPERATURE °C | 11 CIRCUIT FUNCTION OR APPLICATION | 12 BASIC FAILURE RATE (\$/1000 HRS) AT SOURCE (SEE BELOW) | 13 FOR USE OF RELIABILITY DEPT | 14 SPECIAL ENVIRONMENTS (DEFINIS) | 15 FAILURE RATE MULTIPLIER | 16 FINAL FAILURE RATE (\$/1000 HRS) | 17 TOTAL RESISTOR COUNT PER TYPE | 18 TOTAL FAILURE RATE (\$/1000 HRS) |
|----------------------------|---|-------------------|------------------------------|--------------------|---------------------------|--------------------------------------|----------------------------------|-------------------------|-------------------------------|---------------------------------------|--|-----------------------------------|--------------------------------------|-------------------------------|--|-------------------------------------|--|
| R1 | RCROS | | 51 | 5 | .125 | .001 | .01 | | 75 | | .01 | | | - | | | .0112 A |
| | | | | | | | | | | | | | | | | | |
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19 FAILURE RATE SOURCES (FOR COLUMN #16)

A SM-188 B _____

C _____ D _____

20 CALCULATED MTBF _____ HRS

21 TOTAL FAILURE RATE .00012 \$/1000 HRS

BS-321A

(CONNECTORS)

PROJECT: ALSEP

DATE: 20 July 1990

ASSEMBLY: REDUNDANT COMMAND

SUB ASSEMBLY: RF COUPLING

SCHEMATIC NO: 63-P11356B

(Connectors)

| CIRCUIT, REF. DESIGNATION | TYPE DESIGNATION (CBC, MIL OR MFR) AND CONSTRUCTION | MANUFACTURER | PINS | | | | | | | | | | AMBIENT TEMP °C | INSERT MATL | GUIDE | NO. OF INTERLOCKS DURING LIFE | MISCELLANEOUS REMARKS | CLASSIFICATION | SOURCE OF F.R. | F.R. MODIFIER | TOTAL FAILURE RATE (%/1000 Hours) | |
|---------------------------|---|---------------|--------|--------|-------|---------|------|---------|---------------|-----------|--------------------|-------|-----------------|-------------|-------|-------------------------------|-----------------------|----------------|----------------|---------------|-----------------------------------|-------|
| | | | NUMBER | | | CURRENT | | VOLTAGE | | | | | | | | | | | | | | |
| | | | TOTAL | ACTIVE | RATED | ACTUAL | | RATED | BETWEEN PINS | | ACROSS THE CONTACT | | | | | | | | | | | |
| | | | | | | MAX. MA | MIN. | | ACTUAL TO GRD | TRANSIENT | STEADY STATE | SURGE | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | |
| | RECEPTACLE | DAVID-SPECTRA | 1 | 1 | 2A | 1 | - | 200 | .1 | - | - | - | 75 | TEFLON | - | - | | | 1.0 | A | - | .0015 |
| RF COUPLER A | | | 1 | 1 | 2A | 1 | - | 400 | .1 | - | - | - | 75 | TEFLON | - | - | | | 1.0 | A | - | .001 |
| RF COUPLER B | | | 1 | 1 | 2A | 1 | - | 400 | .1 | - | - | - | 75 | TEFLON | - | - | | | 1.0 | A | - | .001 |

| | | | |
|---------------------|---|-----------------------------|---------------------------------------|
| 23 | 24 | 25 | 26 |
| REQUIRED LIFE HOURS | FAILURE RATE SOURCES (FOR COLUMN 20) A <u>MST. SM-188</u> B _____ C _____ D _____ | CALCULATED MTRF _____ HOURS | TOTAL FAILURE RATE _____ %/1000 HOURS |

(BS-321A)

TOTAL MODULE FAILURE RATE
.003510 %/1000 HRS

(MISC. PARTS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: REDUNDANT COMMAND REVR SUB ASSEMBLY: HOUSING Assy

SCHEMATIC NO: 63-P113.56B

(Misc. Parts)

| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (CFC, MIL OR MFR) and CONSTRUCTION | MANUFACTURER | AMBIENT TEMPERATURE RANGE °C | | ELECTRICAL STRESS | | PERCENT DUTY CYCLE | MAJOR CHARACTERISTICS and APPLICATION | FOR RELIABILITY USE ONLY | | | |
|---|---|--------------|------------------------------|----------|-------------------|-------|--------------------|---------------------------------------|---|--|-------------------------|-----------------------------------|
| | | | MAX RATED | MIN ACT. | RATED V | USE V | | | BASIC FAILURE RATE (1/1000 HOURS) (SEE 45-C-11) | PART SPECIAL ENVIRONMENT (DS FOR) | FAILURE RATE MULTIPLIER | TOTAL FAILURE RATE (1/1000 HOURS) |
| | | | | | | | | | | | | |
| FL1 | 25-P14433A407 | | 125 | 75 | 100 | 10.5 | | | 7.2 | A | .5 | .0036 |
| FL2 | 25-P14433A407 | | ↓ | ↓ | 100 | 5.5 | | | 7.0 | A | .5 | .0035 |
| FL3 | 25-P14433A407 | | ↓ | ↓ | 100 | 10.5 | | | 7.2 | A | .5 | .0036 |
| FL4 | 25-P14433A407 | | ↓ | ↓ | 100 | 0 | | | 7.0 | A | .5 | .0035 |
| FL5 | 25-P14433A407 | | ↓ | ↓ | 100 | 5.5 | | | 7.0 | A | .5 | .0035 |
| FL6 | 25-P14433A407 | | ↓ | ↓ | 100 | 5.0 | | | 7.0 | A | .5 | .0035 |
| FL7 | 25-P14433A407 | | ↓ | ↓ | 100 | 5.0 | | | 7.0 | A | .5 | .0035 |
| FL8 | 25-P14433A407 | | ↓ | ↓ | 100 | 11.5 | | | 7.3 | A | .5 | .00365 |
| FL9 | 25-P14433A407 | | ↓ | ↓ | 100 | 11.5 | | | 7.3 | A | .5 | .00365 |
| 15 FAILURE RATE SOURCES (FOR COLUMN 11) A. <u>MOT. SM-188</u> B. _____ C. _____ D. <u>SEE MIL-STD-217 Chart XIV</u> | | | | | | | | 16 CALCULATED MTF _____ HOURS | | 17 TOTAL FAILURE RATE <u>.03200</u> 1/1000 HOURS | | |

(MISC. PARTS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: REDUANT Command REUR

SUB ASSEMBLY: Housing Assy

SCHEMATIC NO: 62-0113562

(Misc. Parts)

| CIRCUIT SYMBOL NUMBER | TYPE DESIGNATION (CBC, MIL OR MFR) and CONSTRUCTION | MANUFACTURER | AMBIENT TEMPERATURE RANGE °C | | ELECTRICAL STRESS | | PERCENT DUTY CYCLE | MAJOR CHARACTERISTICS and APPLICATION | FOR RELIABILITY USE ONLY | | | | |
|---|---|--------------|------------------------------|------|-------------------|-------|--------------------|---------------------------------------|-----------------------------------|--|------------------------------------|-------------------------|-----------------------------------|
| | | | MAX RATED | ACT. | RATED V | USE V | | | BASIC FAILURE RATE (E/1000 HOURS) | SOURCE (SEE 918) | PART SPECIAL ENVIRONMENT (DE FINE) | FAILURE RATE MULTIPLIER | TOTAL FAILURE RATE (E/1000 HOURS) |
| | | | | | | | | | | | | | |
| FL10 | 25-P14433A407 | | 125 | 75 | 100 | 12.0 | | 7.3 | A | | .5 | .00365 | |
| FL11 | 25-P14433A407 | | 125 | 75 | 100 | 12.0 | | 7.3 | A | | .5 | .00365 | |
| | | | | | | | | | | | | | |
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| 15 FAILURE RATE SOURCES (FOR COLUMN 11) A. <u>MIL-SM-188</u> B. _____ C. _____ D. <u>MIL-RM-217 Chart XIV</u> | | | | | | | | 16 CALCULATED IN _____ HOURS | | 17 TOTAL FAILURE RATE <u>.00730</u> E/1000 HOURS | | | |

TOTAL MODULE FAILURE RATE
.03930 % / 1000 HRS.

BS-321A

ALM-703 Page 21 of 20

(CONNECTORS)

PROJECT: ALSEP

DATE: 20 July 1970

ASSEMBLY: REDUANT COMMAND RECEIVER SUB ASSEMBLY: INTER CONNECTION P...

SCHEMATIC NO: 63-P11356B

(Connectors)

| CIRCUIT, REF. DESIGNATION | TYPE DESIGNATION (CBC, MIL OR MFR) AND CONSTRUCTION | MANUFACTURER | PINS | | | | | | | | | | AMBIENT TEMP °C | INSERT MATL | GUIDE | NO. OF INSERTIONS DURING LIFE | MISCELLANEOUS REMARKS | FAILURE RATE (See 24) | SOURCE OF F.R. (See 24) | F.R. MODIFIER | TOTAL FAILURE RATE (1/1000 Hours) | |
|---------------------------|---|--------------|--|--------|---------|---------|---------|--------------|---------------|-----------|--------------------|-------|-------------------------------|-------------------|-------|--|-----------------------|-----------------------|-------------------------|---------------|-----------------------------------|--|
| | | | NUMBER | | CURRENT | | VOLTAGE | | | | | | | | | | | | | | | |
| | | | TOTAL | ACTIVE | RATED | ACTUAL | | BETWEEN PINS | | | ACROSS THE CONTACT | | | | | | | | | | | |
| | | | | | | MAX. MA | MIN. | RATED | ACTUAL TO GRD | TRANSIENT | STEADY STATE | SURGE | | | | | | | | | | |
| J1 | WST0038M | HUGHES | 38 | 34 | 3A | 35 | - | 490 | 12 | - | - | - | 75 | GLASS FILLED DUAL | YES | - | 1.0 | A | - | .04080 | | |
| W-P1 | 50-024-5000 | | 1 | 1 | 2A | 14 | - | 400 | 1 | - | - | - | 75 | TEFLON | - | - | 1.0 | A | - | .0010 | | |
| W-P2 | 50-024-5000 | | 1 | 1 | 2A | 2 | - | 400 | .1 | - | - | - | 75 | TEFLON | - | - | 1.0 | A | - | .0010 | | |
| W-P1 | 50-024-5000 | | 1 | 1 | 2A | 14 | - | 400 | 1 | - | - | - | 75 | TEFLON | - | - | 1.0 | A | - | .0010 | | |
| W-P2 | 50-024-5000 | | 1 | 1 | 2A | 2 | - | 400 | .1 | - | - | - | 75 | TEFLON | - | - | 1.0 | A | - | .0010 | | |
| | | | 24 FAILURE RATE SOURCES (FOR COLUMN 20) | | | | | | | | | | 25 CALCULATED MTF _____ HOURS | | | 26 TOTAL MODULE FAILURE RATE _____ /1000 HOURS | | | | | | |
| 22 REQUIRED LIFE HOURS | | | A <u>MOT. SM-188</u> B _____ C _____ D _____ | | | | | | | | | | | | | .04480 | | | | | | |

APPENDIX B

PART APPLICATION ANALYSIS
SUMMARY

PARTS APPLICATION ANALYSIS
SUMMARY

OBJECT: ALSEP
 ASSEMBLY: REDUNDANT SUB ASSEMBLY: IF 4 AUDIO
COMMAND RECEIVER

DATE: _____
 SCHEMATIC NO: 63-
P11349B

| DEVICE TYPE | TOTAL NO. USED | TOTAL FAILURE RATE | COMMENTS |
|------------------|----------------|--------------------|----------|
| CAPACITORS | 79 | .071745 | |
| FILTERS | 5 | .01790 | |
| RESISTORS | 73 | .002263 | |
| DIODES | 9 | .002227 | |
| TRANSISTORS | 5 | .003750 | |
| INTEGRATED CKTS. | 11 | .008866 | |
| RELAYS | | | |
| TRANSFORMERS | 6 | .033900 | |
| CONNECTORS | 1 | .0010 | |
| COILS & CHOKES | 5 | .012300 | |

TOTAL ASSEMBLY FAILURE RATE .154011 %/1000 HOURS

MEAN-TIME-TO-FAILURE 649,304 HOURS

MISSION SUCCESS PROBABILITY .9733

PARTS APPLICATION ANALYSIS
SUMMARY

PROJECT: ALSEP DATE: _____
 ASSEMBLY: REDUNDANT SUB ASSEMBLY: RF CONVERTER SCHEMATIC NO: 63-
COMMAND RECEIVER P11377B

| DEVICE TYPE | TOTAL NO. USED | TOTAL FAILURE RATE | COMMENTS |
|--------------------------------|----------------|--------------------|----------|
| CAPACITORS FILTER | 40 1 | .026540 .00370 | |
| RESISTORS | 33 | .015320 | |
| DIODES | 4 | .000860 | |
| TRANSISTORS INTEGRATED CKTS | 6 1 | .002988 .000387 | |
| RELAYS CRYSTAL | 1 | .00050 | |
| TRANSFORMERS | 3 | .016950 | |
| CONNECTORS | 2 | .0020 | |
| COILS & CHOKES | 19 | .043200 | |

TOTAL ASSEMBLY FAILURE RATE .112445 %/1000 HOURS
 MEAN-TIME-TO-FAILURE 889,323 HOURS
 MISSION SUCCESS PROBABILITY .9805

PARTS APPLICATION ANALYSIS
SUMMARY

PROJECT: ALSEP

DATE: _____

ASSEMBLY: REDUNDANT SUB ASSEMBLY: RF COUPLER
COMMAND RECEIVER

SCHEMATIC NO: 63-
P11356B

| DEVICE TYPE | TOTAL NO. USED | TOTAL FAILURE RATE | COMMENTS |
|----------------|----------------|--------------------|----------|
| CAPACITORS | | | |
| RESISTORS | 1 | .000010 | |
| DIODES | | | |
| TRANSISTORS | | | |
| RELAYS | | | |
| TRANSFORMERS | | | |
| CONNECTORS | 3 | .00350 | |
| COILS & CHOKES | | | |
| | | | |

TOTAL ASSEMBLY FAILURE RATE .00351 %/1000 HOURS

MEAN-TIME-TO-FAILURE 28,490,028 HOURS

MISSION SUCCESS PROBABILITY .9994

PARTS APPLICATION ANALYSIS
SUMMARY

PROJECT: ALSEP

DATE: _____

ASSEMBLY: REDUNDANT SUB ASSEMBLY: AUDIO CABINER SCHEMATIC NO: 63-COMMAND RECEIVERPOWER ISOLATORF11356 B

| DEVICE TYPE | TOTAL NO. USED | TOTAL FAILURE RATE | COMMENTS |
|----------------|----------------|--------------------|----------|
| CAPACITORS | 8 | .027160 | |
| RESISTORS | 27 | .015260 | |
| DIODES | 3 | .001074 | |
| TRANSISTORS | 10 | .007902 | |
| RELAYS | | | |
| TRANSFORMERS | | | |
| CONNECTORS | | | |
| COILS & CHOKES | 2 | .004120 | |
| | | | |

TOTAL ASSEMBLY FAILURE RATE .055516 %/1000 HOURSMEAN-TIME-TO-FAILURE 1,801,283 HOURSMISSION SUCCESS PROBABILITY .9903

PARTS APPLICATION ANALYSIS
SUMMARY

PROJECT: ALSEP

DATE: _____

ASSEMBLY: REDUNDANT SUB ASSEMBLY: INTER CONNECTIONS SCHEMATIC NO: 63 -
COMMAND RECEIVER P11356B

| DEVICE TYPE | TOTAL NO. USED | TOTAL FAILURE RATE | COMMENTS |
|------------------|-------------------|-----------------------|----------|
| CAPACITORS | | | |
| RESISTORS | | | |
| DIODES | | | |
| TRANSISTORS | | | |
| RELAYS CABLES | 4 | .0040 | |
| TRANSFORMERS | | | |
| CONNECTORS | 1 | .04080 | |
| COILS & CHOKES | | | |
| | | | |

TOTAL ASSEMBLY FAILURE RATE .04480 %/1000 HOURSMEAN-TIME-TO-FAILURE 2,232,143 HOURSMISSION SUCCESS PROBABILITY .9922

PARTS APPLICATION ANALYSIS
SUMMARY

PROJECT: ALSEP
 ASSEMBLY: REDUNDANT SUB ASSEMBLY: HOUSING
COMMAND RECEIVER

DATE: _____
 SCHEMATIC NO: 63-
P11352B

| DEVICE TYPE | TOTAL NO. USED | TOTAL FAILURE RATE | COMMENTS |
|------------------------------|----------------|--------------------|----------|
| CAPACITORS <i>FILTERS</i> | <i>11</i> | <i>.03930</i> | |
| RESISTORS | | | |
| DIODES | | | |
| TRANSISTORS | | | |
| RELAYS | | | |
| TRANSFORMERS | | | |
| CONNECTORS | | | |
| COILS & CHOKES | | | |
| | | | |

TOTAL ASSEMBLY FAILURE RATE .03930 %/1000 HOURS

MEAN-TIME-TO-FAILURE 2,544,529 HOURS

MISSION SUCCESS PROBABILITY .9931

APPENDIX C

Motorola's Special Memorandum No. 188

APPENDIX C IN ON FILE WITH THE ORIGINAL
MOTOROLA DOCUMENT 3875/040