Bendix
Aerospace Systems Division

ALSEP Array E Parts Application Analysis Signal Conditioning Circuits

NO.	REV. NO.
ATM 998	

DATE 7/10/71

The purpose of ATM 998 is to document the results of the Parts Application Analysis study conducted on the Signal Conditioning Circuits. The Signal Conditioning Circuits are located in Digital Data Processor Module. The circuits condition the T/M temperature sensor signals and T/M voltage monitor signals.

The RTG Hot Temperature and RTG Cold Temperature circuits are triple redundant except for voltage reference and voltage source followers. The other bias resistors and voltage monitor resistors are not redundant. Also included are the T/M Bias Resistors from the Interface Board.

The stress levels shown were determined on the basis of electronic piece parts operating at their nominal value of resistance, capacitance, etc., and nominal application of voltage and current signal levels. The circuit board temperature was 65°C and no semi-conductor junctions exceeded 100°C maximum temperature criterion.

The attached summary sheet provides a list of all parts which are well within both ALSEP and Bendix established derating criteria. All components were derated per ATM-241E. From the analysis, it can be concluded that the Signal Conditioning Circuits are designed in a manner to ensure reliable and long operational life.

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ALSEP Reliability

PARTS APPLICATION ANALYSIS SUMMARY

PROJECT: ALSEP Array E Signal Conditioning Circuit DATE: _____

ASSEMBLY: Data Processo SUB ASSEMBLY: ing Circuit SCHEMATIC NO: 2349466

DEVICE TYPE	TOTAL NO. USED	TOTAL FAILURE RATE	COMMENTS
CAPACITORS	41	.00205	
RESISTORS	72	.01896	
DIODES	3	.00390	
TRANSISTORS			
Integrated Circuit	15	.03470	
TRANSFORMERS			
CONNECTORS			
COILS & CHOKES			
		.05961	

TOTAL ASSEMBLY FAILURE RATE .05961 %/1000 HOURS

MEAN-TIME-TO-FAILURE _____ HOURS

MISSION SUCCESS PROBABILITY _____

PARTS APPLICATION ANALYSIS SUMMARY

PROJECT: ALSEP-E T/M Bias Resistor DATE: _____
ASSEMBLY: Central Station SUB ASSEMBLY: Interface Board SCHEMATIC NO: 2349456

DEVICE TYPE	TOTAL NO. USED	TOTAL FAILURE RATE	COMMENTS
CAPACITORS			
RESISTORS	16	.00302	
DIODES			
TRANSISTORS			
RELAYS			
TRANSFORMERS			
CONNECTORS			
COILS & CHOKES			
		.00302	

TOTAL ASSEMBLY FAILURE RATE _____ %/1000 HOURS

MEAN-TIME-TO-FAILURE _____ HOURS

MISSION SUCCESS PROBABILITY .99698

A. Summary of Signal Conditioning Circuit Discrete Parts Stress Levels

STRESS	QUANTITY
0-12%	120
13-25%	12
26-35%	0
35-50%	0
51-60%	0
>60%	0

B. Summary of Integrated Circuit Loading

IC LOADING	QUANTITY
0-10	7
11-20	8
21-40	0
41-50	0
>50%	0

PARTS APPLICATION ANALYSIS

RESISTORS

(Resistors)

PROJECT: ALSEP (Array E) DATE: _____

ASSEMBLY: Data Processor SUB ASSEMBLY: Signal Conditioning Circuit SCHEMATIC NO: 2349466

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 BULK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (%/1000 HRS) AT 25°C	13 SOURCE (SEE BELOW)	14 SPECIAL ENVIRONMENTS (DEFINE)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (%/1000 HRS)	17 TOTAL RESISTOR COUNT PER TYPE	18 TOTAL FAILURE RATE (%/1000 HRS)
R1	RLR07C512JS	R-39017	5.1K	5%	250	< 1	1%		65°C	TP Current Limit Resistor	.345	A		.001			.000345
R2	RLR07C512JS	R-39017	5.1K	5%	250	< 1	1%		65°C	↓	.345	A					.000345
R3	RNR55E1001FS	R-55182	1K	1%	100	< 1				Cal. Resistor	.205						.000205
R4	RNR55E2000FS		200	1%													
R5	RNR55E1782FS		17.8K														
R6	RNR55E1001FS		1K														
R7 *	RNR55E1000FS RNR55E1820FS		100 182							Voltage Ref. Resistor							
R8 *	RNR55E5361FS ~~RNR55E6491FS~~		5.36K ~~6.49K~~														
R9	RNR55E3161FS		3.16														
R10	RNR55E2000FS		200							Voltage Divider							
R11	RNR55E2262FS		22.6K														
R12	RNR55E1002FS		10K			↓	↓		↓	↓	↓						↓
R13	RNR55E6981FS		698K			6.3	6.3%		75°C	Follower Feedback Resistor	.226						.000226
R14	RNR55E1002FS		10K			2.5	2.5%		70°C	Current Source AR3 Resistor	.214						.000214
R15	RNR55E1002FS																
R16	RNR55E1002FS																
R17	RNR55E1002FS		↓	↓	↓	↓	↓		↓	↓	↓	↓	↓	↓	↓	↓	↓
R18	RNR55E1871FS	↓	1.87K	1%	100	1	1%		65°C	Temp Sensor AR4 Resistor	.205	A		.001			.000205

FOR USE OF RELIABILITY DEPT

19 FAILURE RATE SOURCES (FOR COLUMN #14)
A ATM605A B _____
C _____ D _____

20 CALCULATED MTBF _____ HRS

21 TOTAL FAILURE RATE .00403 %/1000 HRS

FORM 9681
BS-321A

* Selected at test

PARTS APPLICATION ANALYSIS

RESISTORS

(Resistors)

PROJECT: ALSEP (Array E) **DATE:** ____

ASSEMBLY: Data Processor **SUB ASSEMBLY:** Signal Conditioning Circuit **SCHEMATIC NO:** 2349466

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 CASE AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (%/1000 HRS) AT 25°C	13 FAILURE RATE SOURCE (SEE BELOW)	14 SPECIAL ENVIRONMENTS (DEFINE)	15 FAILURE RATE MULTIPLIER	16 TOTAL FAILURE RATE (%/1000 HRS)	17 TOTAL RESISTOR COUNT PER TYPE	18 TOTAL FAILURE RATE (%/1000 HRS)
R19	RNR55E3572FS	R55182	35.7K	1%	100	4	4%		70°C	Temp. Sensor AR4 Resistor	.214	A		.001			.000214
R20	RNR55E1002FS		10K	1%	100	2.5	2.5%		70°C	Current Source AR5 Resister							
R21	RNR55E1002FS		10K	1%	100	2.5	2.5%										
R22	RNR55E1002FS		10K	1%	100	2.5	2.5%										
R23	RNR55E1002FS		10K	1%	100	2.5	2.5%										
R24	RNR55E3321FS		3.32K	1%	100	< 1	< 1%		65°C	Temp. Sensor AR6 Resistor	.205	A		.001			.000205
R25	RNR55E6342FS		63.4K	1%	100	2	2%		70°C	Temp. Sensor AR6 Resistor	.214	A		.001			.000214
R26	RLR07E100JS	R39017	10	5%	250	16	6.4%		70°C	Current Limit Resistor	.370	A		.001			.000370
R27	RNR55E1002FS	R55182	10K	1%	100	2.5	2.5%		70°C	Current Source AR7 Resistor	.214	A		.001			.000214
R28																	
R29																	
R30																	
R31	RNR55E1871FS		1.87K	1%	100	< 1	< 1%		65°C	Temp. Sensor AR8 Resistor	.205	A		.001			.000205
R32	RNR55E3572FS		35.7K	1%	100	< 1	< 1%		65°C		.205	A		.001			.000205
R33	RNR55E1002FS		10K	1%	100	2.5	2.5%		70°C	Current Source AR9 Resistor	.214	A		.001			.000214
R34																	
R35																	
R36																	

FOR USE OF RELIABILITY DEPT

19 FAILURE RATE SOURCES (FOR COLUMN #14)
A ATM 605A B ____
C ____ D ____

20 CALCULATED MTBF ____ HRS

21 TOTAL FAILURE RATE .00398 %/1000 HRS

FORM 0551
BS-321A

PARTS APPLICATION ANALYSIS

RESISTORS

(Resistors)

PROJECT: ALSEP (Array E) **DATE:** ____

ASSEMBLY: Data Processor **SUB ASSEMBLY:** Signal Conditioning Circuit **SCHEMATIC NO:** 2349466

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 BULK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (%/1000 HRS @ 25°C & RATED POWER)	13 FACTOR (SEE BELOW)	14 SPECIAL ENVIRONMENTS (DEFINED)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (%/1000 HRS)	17 TOTAL RESISTOR COUNT PER TYPE	18 TOTAL FAILURES RATE (%/1000 HRS)
R37	RNR55E3321FS	R55182	3.32K	1%	100	< 1	< 1%		65°C	Temp. Sensor AR10 Resistor	.205	A		.001			.000205
R38	RNR55E6342FS		63.4K	1%	100	2	2%		70°C	↓	.214	A		.001			.000214
R39	RNR55E5901FS		5.9K	1%	100	14	14%		90°C	T/M Bias Resistor	.283	A		.001			.000283
R40																	
R41																	
R42																	
R43																	
R44	↓		↓	↓	↓	↓	↓		↓	↓	↓	↓		↓			↓
R45	RNR55E2002FS		20K	1%	100	3	3%		70°C	+12V Measure Resistor	.214	A		.001			.000214
R46	RNR55E1002FS		10K	1%	100	6.4	6.4%		75°C	-12V Measure Resistor	.226	A		.001			.000226
R47	RNR55E4752FS		47.5K	1%	100	< 1	< 1%		65°C	Voltage Divider Resistor	.205	A		.001			.000205
R48	RNR55E8251FS		8.25K	1%	100	< 1	< 1%		↓	AMP AR11 Resistor	.205	A		.001			.000205
R49	RNR55E1002FS		10K	1%	100	2.5	2.5%		70°C	Current Source AR12 Resistor	.214	A		.001			.000214
R50																	
R51																	
R52	↓		↓	↓	↓	↓	↓		↓	↓	↓	↓		↓			↓
R53	RNR55E1871FS		1.87K	1%	100	< 1	< 1%		65°C	Temp. Sensor AR13 Resistor	.205			.001			.000205
R54	RNR55E3572FS		35.7K	1%	100	< 1	< 1%		65°C	Temp. Sensor AR13 Resistor	.205			.001			.000205

FOR USE OF RELIABILITY DEPT

19 FAILURE RATE SOURCES (FOR COLUMN #14)
A ATM 605A B ____
C ____ D ____

20 CALCULATED MTBF ____ HRS

21 TOTAL FAILURE RATE .00423 %/1000 HRS

FORM 0001

BS-321A

PARTS APPLICATION ANALYSIS

RESISTORS

(Resistors)

PROJECT: ALSEP (Array E) DATE: _____

ASSEMBLY: Data Processor SUB ASSEMBLY: Signal Conditioning Circuit SCHEMATIC NO: 2349466

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 BULK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (%/1000 HRS) @ 25°C, SEA LEVEL, 50% RELATIVE HUMIDITY	13 FOR USE OF RELIABILITY DEPT.	14 SPECIAL ENVIRONMENTS (DEFINE)	15 FAILURE RATE MULTIPLIER	16 TOTAL FAILURE RATE (%/1000 HRS)	17 TOTAL NUMBER COUNT PER TYPE	18 TOTAL FAILURE RATE (%/1000 HRS)
R55	RNR55E1002FS	R55182	10K	1%	100	2.5	2.5%		70°C	Current Source AR14 Resistor	.214	A		.001			.000214
R56																	
R57																	
R58																	
R59	RNR55E3321FS		3.32K	1%	100	< 1	< 1%		65°C	Temp. Sensor AR15 Resistor	.205	A		.001			.000205
R60	RNR55E6342FS		63.4K	1%	100	2	2%		70°C		.214	A		.001			.000214
R61	RNR55E3011FS		3.01K	1%	100	3	3%			T/M Bias Resistor	.214	A		.001			.000214
R62																	
R63	RNR55E6042FS		60.4K	1%	100	15	15%		90°C	29V Measure Resistor	.283	A		.001			.000283
R64	RNR55E1002FS		10K	1%	100	2	2%		70°C		.214	A		.001			.000214
R65	RNR55E1002FS		10K	1%	100	1.4	1.4%		65°C	+12V Measure Resistor	.205	A		.001			.000205
R66	RNR55E2002FS		20K	1%	100	13	13%		85°C	-12V Measure Resistor	.267	A		.001			.000267
R67	RNR55E1002FS		10K	1%	100	< 1	< 1%		65°C	Voltage Divider Resistor	.205	A		.001			.000205
R68	RNR55E3011FS		3.01K	1%	100	3	3%		70°C	T/M Bias Resistor	.214	A		.001			.000214
R69									70°C								
R70	RNR55E1002FS		10K	1%	100	2	2%		70°C	5V Measure Resistor							
R71	RNR55E2001FS		2K	1%	100	< 1	< 1%		65°C		.205	A		.001			.000205
RT1	(Thermistor) 2335661	FENWAL	15K @80°F	2%	100	3	3%		70°C	Internal Temp. Measurement	.03	A		.1			.003

19 FAILURE RATE SOURCES (FOR COLUMN #14)
A ATM 605A B _____
C _____ D _____

20 CALCULATED MTBF _____ HRS

21 TOTAL FAILURE RATE .006724 %/1000 HRS

FORM 9551

BS-321A

PARTS APPLICATION ANALYSIS

(SEMICONDUCTORS)

(Semiconductors)

PROJECT: ALSEP (Array E) **DATE:** _____

ASSEMBLY: Data Processor **SUB ASSEMBLY:** Signal Conditioning Circuit **SCHEMATIC NO:** 2349466

CKT SYM NO. (1)	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY (2)	MANUFACTURER (3)	MAX. TEMP °C: AMBIENT ACTUAL T_A (4)	JUNCTION RATED T_J (5)	CASE ACTUAL HOT SPOT T_C (6)	AVG PWR DISSIPATION (mw): RATED AT 25°C AMBIENT (7)	RATED AT 25°C CASE (8)	ACTUAL AMBIENT T_A (9)	ACTUAL CASE T_C (10)	ACTUAL (11)	POWER RATIO: ACTUAL/RATED (Amb. or case) (22)	ACTUAL T_A or T_C / RATED (23)	MAXIMUM VOLTAGES: V_{CBO} RATED V (14)	V_{CB} ACTUAL V (15)	V_{CEO} RATED V (16)	V_{CE} ACTUAL V (17)	DIODE PIV: RATED V (18)	ACTUAL V (19)	CIRCUIT FUNCTION or APPLICATION (20)	PART SPECIAL ENVIRONMENT (Define) (21)	FOR RELIABILITY USE ONLY: RATE (%/1000 HRS) (29)	SOURCE (See below) (30)	FAIL RATE (24)	MULTIPLIER (25)	FINAL FAIL RATE (%/1000 HRS) (26)	TOTAL COUNT PER TYPE (28)	TOTAL FAILURE RATE (%/1000 HRS) (27)
VR1	S1N754A	Dick-erson	60°C	175°C	65°C	400		370		0							6.8V	5V	Max. Voltage Protector		.0013	A					.0013
VR2	S1N754A	Dick-erson	60°C	175°C	65°C	400		370		0							6.8V	4V	Max Voltage Protector			A					.0013
VR3	S1N754A	Dick-erson	60°C	175°C	65°C	400		370		0							6.8V	4V	Max. Voltage Protector			A					.0013

(22) FAILURE RATE SOURCE (See Column 22)
A ATM 605A C _____
B _____ D _____

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

(30) TOTAL FAILURE RATE .0039 %/1000 HRS.

P246A

BS-321A

PARTS APPLICATION ANALYSIS

(MICROCIRCUITS)

PROJECT: ALSEP (Array E) DATE: _____

ASSEMBLY: Data Processor SUB ASSEMBLY: Signal Conditioning Circuit SCHEMATIC NO: 2349466

(Microcircuits)

CKT SYM NO.	TYPE DESIGNATION	MANUFACTURER	TYPE	MAX TEMP °C: ACTUAL AMBIENT	MAX TEMP °C: RATED JUNCTION	MAX TEMP °C: ACTUAL JUNCTION	VOLTAGES: DERATED MAXIMUM	VOLTAGES: ACTUAL	VOLTAGES: DERATED MINIMUM	INPUTS: FAN IN %	INPUTS: % OF MAX I OR V	OUTPUTS: FAN OUT %	OUTPUTS: LOADING %	SPEED: % OF MAX	CLOCK WIDTH: MIN / ACTUAL %	CIRCUIT FUNCTION OR APPLICATION	FOR RELIABILITY USE ONLY: RATE (%/1000 HRS)	SOURCE	FAILURE RATE MULTIPLIER	TOTAL ACTUAL PER TYPE	TOTAL FAILURE RATE (%/1000 HRS)
U1	LM105F	N.S.	Lin.	65°C	150°C	70°C	38V	12V	10V				10%			Voltage Regulator	.0025	A			.0025
AR1	NH0001AF/883	N.S.	Lin.	65°C	150°C	65°C	±16.8	±12	±9				20%			Voltage Follower	.0023	A			.0023
AR2	NH0001AF/883	N.S.	Lin.	65°C	150°C	65°C	±16.8	±12	±9				20%			Current Source					
AR3	NH0001AF/883	N.S.	Lin.	65°C	150°C	65°C	±16.8	±12	±9				10%			Temp. Sensor AMP					
AR4	NH0001AF/883	N.S.	Lin.	65°C	150°C	65°C	±16.8	±12	±9				20%			Current Source					
AR5	NH0001AF/883	N.S.	Lin.	65°C	150°C	65°C	±16.8	±12	±9				10%			Temp. Sensor AMP					
AR6	NH0001AF/883	N.S.	Lin.	65°C	150°C	65°C	±16.8	±12	±9				20%			Current Source					
AR7	NH0001AF/883	N.S.	Lin.	65°C	150°C	65°C	±16.8	±12	±9				10%			Temp. Source AMP					
AR8	NH0001AF/883	N.S.	Lin.	65°C	150°C	65°C	±16.8	±12	±9				20%			Current Source					

23 FAILURE RATE SOURCE (See Column 19)
A ATM 605A C _____
B _____ D _____

24 NOTE DERATED VOLTAGE IS DETERMINED BY
$V_{MAX} = V_{NOM} + .6(V_{RATED\ MAX} - V_{NOM})$
$V_{MIN} = V_{NOM} - .6(V_{NOM} - V_{RATED\ MIN})$

25 TOTAL FAILURE RATE .0209 %/1000 HRS

8xA 679

PARTS APPLICATION ANALYSIS

(MICROCIRCUITS)

PROJECT: ALSEP (Array E) DATE: _____

ASSEMBLY: Data Processor SUB ASSEMBLY: Signal Conditioning Circuit SCHEMATIC NO: 2349466

(Microcircuits)

CKT SYM NO.	TYPE DESIGNATION	MANUFACTURER	TYPE	MAX TEMP °C: AMBIENT ACTUAL	MAX TEMP °C: JUNCTION RATED	MAX TEMP °C: JUNCTION ACTUAL	VOLTAGES: MAXIMUM DERATED	VOLTAGES: ACTUAL	VOLTAGES: MINIMUM DERATED	INPUTS: FAN IN	INPUTS: % OF MAX I OR V	OUTPUTS: FAN OUT	OUTPUTS: LOADING %	SPEED: % OF MAX	CLOCK WIDTH: MIN / ACTUAL %	CIRCUIT FUNCTION OR APPLICATION	FOR RELIABILITY USE ONLY: RATE (%/1000 HRS)	SOURCE (See column 19)	FAILURE RATE MULTIPLIER	TOTAL PER TYPE	TOTAL FAILURE RATE (%/1000 HRS)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
AR9	NH0001AF/883	N.S.	Lin.	65 °C	150°C	65 °C	±16.8	±12	±9				10%			Temp. Sensor AMP	.0023	A			.0023
AR10	NH0001AF/883	N.S.	Lin.	65 °C	150°C	65 °C	±16.8	±12	±9				20%			Voltage Follower					
AR11	NH0001AF/883	N.S.	Lin.	65 °C	150°C	65 °C	±16.8	±12	±9				20%			Current Source					
AR12	NH0001AF/883	N.S.	Lin.	65 °C	150°C	65 °C	±16.8	±12	±9				10%			Temp. Sensor AMP					
AR13	NH0001AF/883	N.S.	Lin.	65 °C	150°C	65 °C	±16.8	±12	±9				20%			Current Source					
AR14	NH0001AF/883	N.S.	Lin.	65 °C	150°C	65 °C	±16.8	±12	±9				10%			Temp. Sensor AMP					

22 FAILURE RATE SOURCE (See Column 19)
A ATM 605A C _____
B _____ D _____

24 NOTE. DERATED VOLTAGE IS DETERMINED BY
$V_{MAX} = V_{NOM} + .6 (V_{RATED\ MAX} - V_{NOM})$
$V_{MIN} = V_{NOM} - .6 (V_{NOM} - V_{RATED\ MIN})$

25 TOTAL FAILURE RATE .0138 %/1000 HRS

8xA 679

PARTS APPLICATION ANALYSIS

CAPACITORS

PROJECT: ALSEP (Array E) **DATE:** _____

ASSEMBLY: Data Processor **SUBASSEMBLY:** Signal Conditioning Circuit **SCHEMATIC NO:** 2349466

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE DESIGNATION (MIL or MFR) AND CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE μμf	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE DC	7 OPERATING VOLTAGE PEAK AC	8 VOLTAGE RATIO: OPERATING/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE (°C)	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (%/1000 HRS) AT 25°C (SEE BELOW)	13 SCREEN (SEE BELOW)	14 SPECIAL ENVIRONMENT (DEFINE)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE	17 TOTAL CAPACITOR COUNT PER TYPE	18 TOTAL FAILURE RATE (%/1000 HRS)
C1	CKR11BX220KR	C-39014	22pf	10%	100V	12		12%		65°C	Op Amp Compensation	.005	A		.01			.00005
C2	CKR06BX224KR	C-39014	22μf	10%	50V	6		12%		65°C	Supply Filter							
C3	CKR06BX224KR	C-39014	.22μf	10%	50	6		12%		65°C	↓							
C4	CKR11BX220KR	C-39014	22pf	10%	100	12		12%		65°C	Op Amp Compensation							
C5	CKR12BX103KR	C-39014	.01μf	10%	100	6		6%		65°C								
C7	CKR11BX470KR	C-39014	47pf	10%	100	12		12%		65°C								
C8	CKR11BX220KR	C-39014	22pf	10%	100	12		12%		65°C								
C9	CKR11BX470KR	C-39014	47pf	10%	100	12		12%		65°C								
C10	CKR11BX220KR	C-39014	22pf	10%	100	12		12%		65°C								
C11	CKR12BX103KR	C-39014	.01μf	10%	100	6		6%		65°C								
C12	CKR11BX470KR	C-39014	47pf	10%	100	12		12%		65°C								
C13	CKR11BX220KR	C-39014	22pf	10%	100	12		12%		65°C								
C14	CKR11BX470KR	C-39014	47pf	10%	100	12		12%		65°C	↓							
C15	CKR06BX224KR	C-39014	.22μf	10%	50	2		4%		65°C	Voltage Regulator Compensation							
C16	CKR11BX470KR	C-39014	47pf	10%	100	12		12%		65°C	↓							
C17	CKR06BX224KR	C-39014	.22μf	10%	50	25		5%		65°C	5V Filter Capacitor							
C18	↓	↓	↓	↓	↓	↓		↓		65°C	↓							
C19	CKR11BX220KR	C-39014	22pf	10%	100	12		12%		65°C	Op Amp Compensation							
C20	CKR12BX103KR	C-39014	.01μf	10%	100	6		6%		65°C	↓							

FOR USE OF RELIABILITY TEST

20 FAILURE RATE SOURCES (FOR COLUMN #14)
A ATM 605A B _____
C _____ D _____

21 CALCULATED MTBF _____ HRS

22 TOTAL FAILURE RATE .00095 % 1000 HRS

BS-321A

PARTS APPLICATION ANALYSIS

CAPACITORS

PROJECT: ALSEP (Array E) **DATE:** _____

ASSEMBLY: Data Processor **SUBASSEMBLY:** Signal Conditioning Circuit **SCHEMATIC NO:** 2349466

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE DESIGNATION (MIL or BITR) AND CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE μμf	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE DC	7 OPERATING VOLTAGE PEAK AC	8 VOLTAGE RATIO, OPERATING/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE (°C)	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (% / 1000 HRS) AT 25°C, 0 STRESS (MIL HDBK)	13	14 SPECIAL ENVIRONMENT (DEFINE)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE	17 TOTAL CAPACITOR COUNT PER TYPE	18 TOTAL FAILURE RATE (% / 1000 HRS)	19 FOR USE OF RELIABILITY PREDICTION
C21	CKR11BX470KR	C-39014	47pf	10%	100	12		12%		65°C	Op Amp Compensation	.005	A			.01		.00005	
C22	CKR11BX220KR		22pf	10%	100	12		12%		65°C									
C23	CKR11BX470KR		47pf	10%	100	12		12%		65°C									
C24	CKR12BX220KR		22pf	10%	100	12		12%		65°C									
C25	CKR12BX103KR		.01μf	10%	100	6		6%		65°C									
C26	CKR11BX470KR		47pf	10%	100	12		12%		65°C									
C27	CKR12BX220KR		22pf	10%	100	12		12%		65°C									
C28	CKR11BX470KR		47pf	10%	100	12		12%		65°C									
C29	↓		↓	↓	↓	↓		↓		↓									
C30	CKR11BX220KR		22pf	10%	100	12		12%		65°C									
C31	CKR06BX224KR		.22μf	10%	50	6		12%		65°C									
C32	CKR06BX224KR		↓	↓	↓	↓		↓		↓									
C33	CKR11BX220KR		22pf	10%	100	12		12%		65°C									
C34	CKR12BX103KR		.01μf	10%	100	6		6%		65°C									
C35	CKR11BX470KR		47pf	10%	100	12		12%		65°C									
C36	CKR11BX220KR		22pf	10%	100	12		12%		65°C									
C37	CKR11BX470KR		47pf	10%	100	12		12%		65°C									
C38	CKR11BX220KR		22pf	10%	100	12		12%		65°C									
C39	CKR12BX103KR	↓	.01μf	10%	100	6		6%		65°C	↓	↓	↓			↓		↓	

20 FAILURE RATE SOURCES (FOR COLUMN #14)
A ATM 605A B _____
C _____ D _____

21 CALCULATED MTBF _____ HRS

22 TOTAL FAILURE RATE .00095 X 1000 HRS

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PARTS APPLICATION ANALYSIS

CAPACITORS

(Capacitors)

PROJECT: ALSEP (Array E) **DATE:**

ASSEMBLY: Data Processor **SUBASSEMBLY:** Signal Conditioning Circuit **SCHEMATIC NO:** 2349466

1 Circuit Symbol Number	2 Type Designation (MIL or MFR) and Construction	3 Manufacturer	4 Capacitance Value mfd	5 Tolerance %	6 Manufacturer's Rated Voltage	7 Operating Voltage DC	8 Operating Voltage Peak AC	9 Voltage Ratio, Operating/Rated	10 Maximum Duty Cycle	11 Bulk Air Temperature (°C)	12 Circuit Function or Application	13 Basic Failure Rate (%/1000 hrs) at __ °C	14 Source (See Below)	For Use of Reliability Dept.	15 Special Environment (Define)	16 Failure Rate Multiplier	17 Final Failure Rate	18 Total Capacitor Count per Type	19 Total Failure Rate (%/1000 hrs)
C40	CKR11BX470KR	C-39014	47pf	10%	100	12		12%		65°C	Op Amp Compensation	.005	A				.01		.00005
C41	CKR11BX220KR	C-39014	22pf	10%	100	12		12%		65°C	↓	↓	↓				↓		↓
C42	CKR11BX470KR	C-39014	47pf	10%	100	12		12%		65°C	↓	↓	↓				↓		↓

20 FAILURE RATE SOURCES (FOR COLUMN #14)
A ATM 605A B ____
C ____ D ____

21 CALCULATED MTBF ____ HRS

22 TOTAL FAILURE RATE .00015 % 1000 HRS

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PARTS APPLICATION ANALYSIS

RESISTORS

(Resistors)

PROJECT: ALSEP (Array E)
ASSEMBLY: Data Processor
SUB ASSEMBLY: T/M Bias Resistors on Interface Board
DATE:
SCHEMATIC NO: 2349456

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 BULK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (%/1000 HRS) AT 25°C, 10 CYCLES (SEE BELOW)	13	14 SPECIAL ENVIRONMENTS (DERIVED)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (%/1000 HRS)	17 TOTAL RESISTOR COUNT PER TYPE	18 TOTAL FAILURE RATE (%/1000 HRS)
R40	RNR55E3011FS	R-55182	3.01K	1%	100	4	4%		70°C	T/M Bias Resistor	.18	A		.001			.00180
R41																	
R42																	
R43																	
R44																	
R45																	
R46	RNR55E5901FS		5.9K			14	14%		90°C		.214			.001			.000214
R47																	
R48	RNR55E3011FS		3.01K			4	4%		70°C		.18			.001			.000180
R49																	
R50																	
R51																	
R52	RNR55E5901FS		5.9K			14	14%		90°C		.214						.000214
R53	RNR55E3011FS		3.01K			4	4%		70°C		.18						.000180
R54																	
R55	RNR55E901FS		5.9K			14	14%		90°C		.214			.001			.000214

FOR USE OF RELIABILITY DEPT

19 FAILURE RATE SOURCES (FOR COLUMN #14)
A ATM 605A B
C D

20 CALCULATED MTBF HRS

21 TOTAL FAILURE RATE: .003054 %/1000 HRS

FORM 0001

BS-321A