



**Aerospace
Systems Division**

RSST

Math Models, Block Diagrams
and Predictions

NO.	ATM 881	REV. NO.
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DATE	5/28/70	

ATM 881 releases the Math Models, Block Diagrams and Predictions into the Bendix documentation system for the Resettable Solid State Timer (RSST). The subsystem goals were allocated from the overall system goal of 0.996 for two years, with resets at three month intervals based on criticality to system operation and number of parts. These goals are given in the ALSEP Reliability Status Record, Bendix Form #970-8. Math models and block diagrams have been predicted, based on the negative exponential distribution. The failure rates for each component were assigned using Gulston failure rates for all parts except the RCA CD4000 family of COS/MOS devices. Bendix Reliability arrived at a more realistic failure rate for these devices from test data received from RCA for these devices. The failure rates are listed on reliability worksheets and were adjusted for temperature and stress ratios, and screening reduction factors.

The numerical reliability prediction for the RSST two year lunar phase of operation is 0.989. This was determined as shown in the math model from the summation of failure rates of all components in the system, using the negative exponential distribution. The reliability correction factor for the non-operating standby phase of the mission was calculated to be 0.99999.

Prepared by

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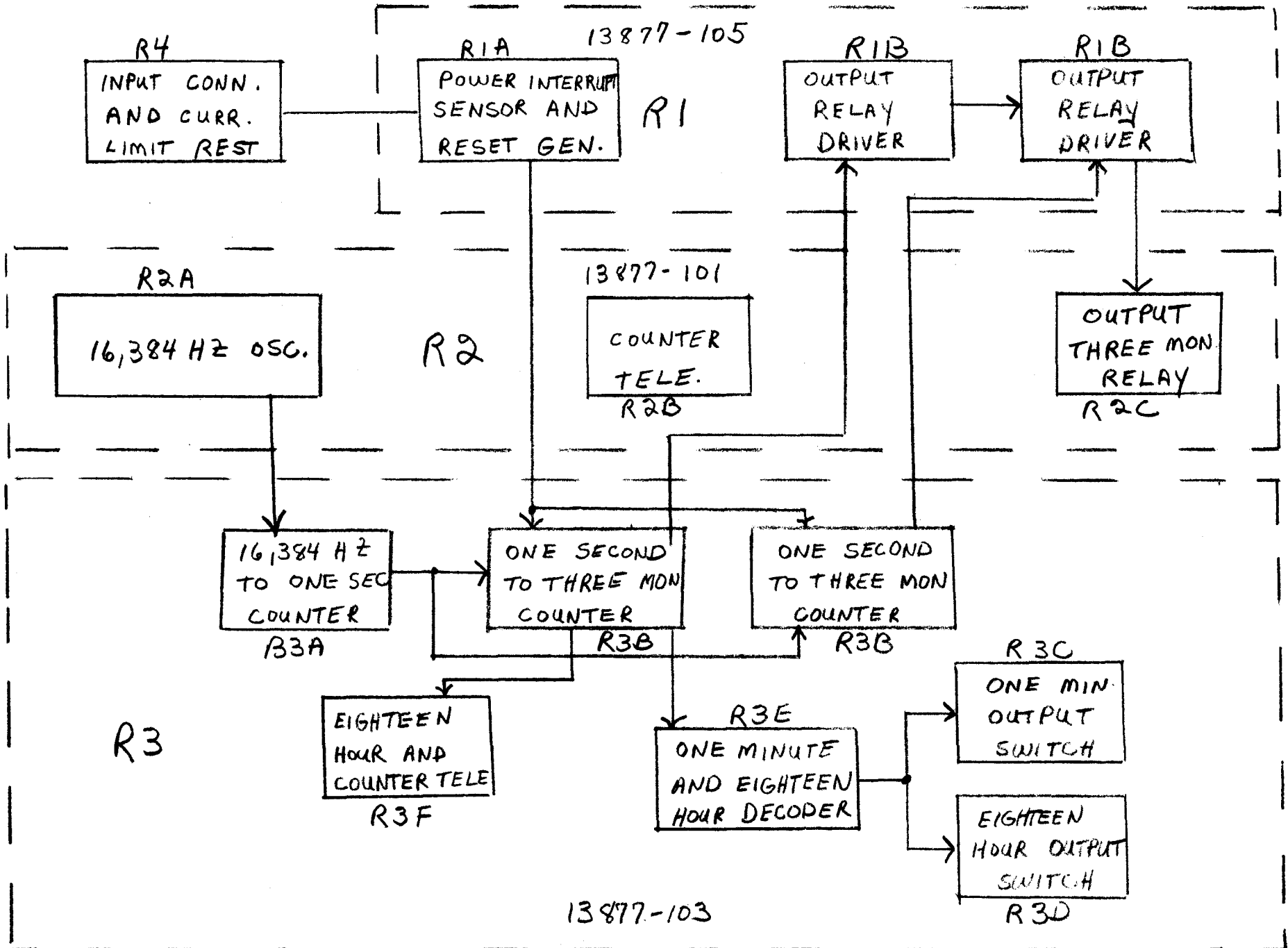
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RELIABILITY BLOCK DIAGRAM
RSST



RELIABILITY MATHEMATICAL MODEL

RSST

Rel. Block Diag Ident Code	Reliability Function	Parametric Values	Reliability Prediction	Constraints Conditions	Nomenclature
		$\lambda \times 10^5$	t Hrs		
R1A	$R = e^{-\lambda t}$	0.001884	17520	0.99967	Reset Cir and Pwr Sensor
R1B		0.000608		0.99989	Output Relay Driver
R1B		0.000608		0.99989	Output Relay Driver
R1		0.003100		0.99946	
R2A		0.002078		0.99964	16,384 Hz OSC
R2B		0.000070		0.99999	Counter Tele
R2C		0.000305		0.99995	Output Three Month Relay
R2		0.002453		0.99957	
R3A		.00960		0.99832	16,384 Hz to One Sec Counter
R3B		.01920		0.99966	One Sec to Three Mon Count.
R3B		.01920		0.99966	One Sec Counter Three Mon Count.
R3C		0.000200		0.99996	One Minute Output SW

RELIABILITY MATHEMATICAL MODEL

RSST

Rel. Block Diag Ident Code	Reliability Function	Parametric Values	Reliability Prediction	Constraints Conditions	Nomenclature
		$\lambda \times 10^5$	t Hrs		
R3D	$R = e^{-\lambda t}$	0.000450	17520	0.99992	Eighteen Hour SW Output
R3E		0.000800		0.99986	One Min. and Eighteen Hr.
R3F		0.00480		0.99917	Eighteen Hr. and Counter Tele
R3		0.05434		0.94714	
R4		0.000407		0.99993	Series Limit Resistor Conn.
System Tot	$R = e^{-\lambda t}$	0.060247	17520	0.8998	

ALSEP RELIABILITY STATUS RECORD

DATE

EQUIPMENT	MNEMONIC CODE	GOAL ALLOCATION	CURRENT PREDICTION		PREVIOUS PREDICTION		CURRENT DEVIATION
			A PRIORI	DATE	A PRIORI	DATE	
RSST	PL13877-101	0.99900	0.99957	1/8/70	0.99957	11/10/69	+0.00057
	PL13877-103	0.99900	0.94714	1/8/70	0.94714	1/8/70	+0.05236
	PL13877-105	0.99900	0.99945	1/8/70	0.99946	11/10/69	+0.00045
	-	0.99900	0.99993	1/8/70	0.99999	11/10/69	+0.00093
Total		0.99600	0.99615	1/8/70	0.99615	1/8/70	+0.05431

NOTE: ALL VALUES IN UNITS OF 0.01 %

RELIABILITY PREDICTION WORKSHEET

UNIT DESIGNATION RSST

SCHEMATIC No. Ck13877-001 REV. A DATE 1/8/70

SUB-UNIT DESIGNATION _____

SCHEMATIC No. _____ REV. _____ DATE _____

REFER- ENCE DESIG- NATION	PART NAME	PART TYPE	MIL-SPEC OR VENDOR	MIL TYPE DESIG- NATION OR VENDOR PART No.	APPLICATION	PART AMB TEMP °C *	PART DERAT- ING *	NUMBER OF TERM- INALS	PART FAILURE RATE %/1000hrs	NUMBER OF PARTS IN SUB- TOTAL	SUB- TOTAL FAILURE RATE %/1000hrs	REF. FAILURE RATE SOURCE	COMMENTS
R1	REST	W.W	MIL-R-39007			80			.000007	1	.000007	A	
J1	CONN	-	Microdot						.0004	1	.0004	A	

SUB-UNIT TOTAL FAILURE RATE .000407

SUB-UNIT MTBF (HOURS)

* INDICATE ESTIMATED OR ACTUAL

A - Gulston

RELIABILITY PREDICTION WORKSHEET

UNIT DESIGNATION RSST

SCHEMATIC No. PL13877-101 REV. A DATE 1/8/70

SUB-UNIT DESIGNATION _____

SCHEMATIC No. _____ REV. _____ DATE _____

REFER- ENCE DESIG- NATION	PART NAME	PART TYPE	MIL-SPEC OR VENDOR	MIL TYPE DESIG- NATION OR VENDOR PART No.	APPLICATION	PART AMB TEMP °C *	PART DERAT- ING *	NUMBER OF TERM- INALS	PART FAILURE RATE %/1000hrs	NUMBER OF PARTS IN SUB- TOTAL	SUB- TOTAL FAILURE RATE %/1000hrs	REF. FAILURE RATE SOURCE	COMMENTS
C7, C8	CAP	MICA	HRDM			80			.00023	2	.000046	A	
C12	CAP	CERM	CKR12						.000005	1	.000005		
CR5	Diode	SI	IN3595						.00005	1	.000050		
CR15-23	Zener	SI	TXIN914						.00005	8	.000400		
VR4, 5	Relay	SI	IN4572A						.0004	2	.000800		
K1	REST	To-5	421-3104						.0002	1	.000200		
R9, 10, 11 12, 4243 44, 4748 49, 53, 55 57, 59, 60 61, 62, 65		Comp	RCR07						.000005	18	.000090		
R51, 58 52, 54	REST	Film	RNR55C						.000008	4	.000032		
Q15	Trans	FET	62154						.00029	1	.000290		
Q16	Trans	SI	TX2N2407A						.00009	1	.000090		
Q17	Trans	SI	TX2N2222A						.00009	1	.000090		
Q18-21	Trans	SI	TX2N914						.00009	4	.000360		

SUB-UNIT TOTAL FAILURE RATE .002453
SUB-UNIT MTBF (HOURS)

* INDICATE ESTIMATED OR ACTUAL

A - Gulton

RELIABILITY PERFORMANCE WORKSHEET

UNIT DESIGNATION RSST

SCHEMATIC No. PL 13877-103 REV. A DATE 1/8/70

SUB-UNIT DESIGNATION _____

SCHEMATIC No. _____ REV. _____ DATE _____

REFER- ENCE DESIG- NATION	PART NAME	PART TYPE	MIL-SPEC OR VENDOR	MIL TYPE DESIG- NATION OR VENDOR PART No.	APPLICATION	PART AMB TEMP °C *	PART DERAT- ING *	NUMBER OF TERM- INALS	PART FAILURE RATE %/1000hrs	NUMBER OF PARTS IN SUB- TOTAL	SUB- TOTAL FAILURE RATE %/1000hrs	REF. FAILURE RATE SOURCE	COMMENTS
A1	FF	COS/MOS	RCA	C04003		80			.0048	1	.00480	A	
A2-11	B. Count	IC	RCA	E0078					.0048	10	.0480		
C10, 11	CAP	CGRM	MIL-C-3901	CKR12					.000005	2	.000010		
CR10-11	Diode	SI	Mil-S-19500	TX1N914					.00005	3	.000150		
CR26-41	Diode	SI	Mil-S-19500	IN3595					.00005	17	.000850		
50													
Q9-13	Trans	SI	Mil-S-19500	TX2N22000					.00009	5	.000450		
R24, 25	REST	Comp	Mil-R-39008	RCR07					.000005	16	.000080		
27, 33, 34													
26, 28, 35													
29, 30, 31													
32, 38, 39													
40, 41													

SUB-UNIT TOTAL FAILURE RATE .002860

SUB-UNIT MTBF (HOURS)

*INDICATE ESTIMATED OR ACTUAL

A-Gulton

