RSST/CENTRAL STATION COMPATIBILITY TEST REPORT

ATM-891

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GENERAL

The purpose of the engineering model Resettable Solid State Timer (RSST)/Central Station compatibility testing was to: (1) illustrate that the Central Station/RSST electrical and mechanical interfaces are compatible; (2) ascertain that the RSST performs as specified in a system configuration; and (3) verify that system test methods/procedures are compatible with the flight hardware to be tested later.

The prime functions of the RSST* are to provide: (1) a signal which will terminate ALSEP transmission to earth (unless reset by earth command) at the end of three months; (2) a signal output of 1-second duration and at a frequency of one-per-minute; and (3) a signal output of 1-second duration at a frequency of one-per-18 hours. The second and third signals are utilized to generate "back-up" command functions via counting and decoding networks located in the Command Decoder. Hence, the RSST is a "back-up" for the command link and is not required to perform any function while the command link is operative. To prevent completion of its counting and generation of the transmitter turn off function, a "reset" command is provided to reset the RSST counters and thus start a new count toward the final non-reversible function of turning off the ALSEP transmitters. Thus, the "reset" function is of great importance. An additional function incorporated into the RSST involves the capability of performing short term storage of the accumulated timing information in the event of short-term power interruptions.

A first attempt at running engineering tests on the RSST/C S was unsuccessful due to unreliability of the reset circuitry. The SN001 RSST was returned to the manufacturer where modifications were performed to ensure that command "resets" of its internal counters could be accomplished. The RSST was returned and testing was completed. This testing confirmed satisfactory operation in all respects.

BASIC OSCILLATOR TESTS

The oscillator of the RSST operates at 16,384 Hz. The 16,384 Hz oscillator is counted down by appropriate counter stages to provide the required 1-minute, 18-hour, and 3-month timing signals. The block diagram on the following page illustrates the counter/oscillator arrangement.

* Reference ATM-849 for additional information

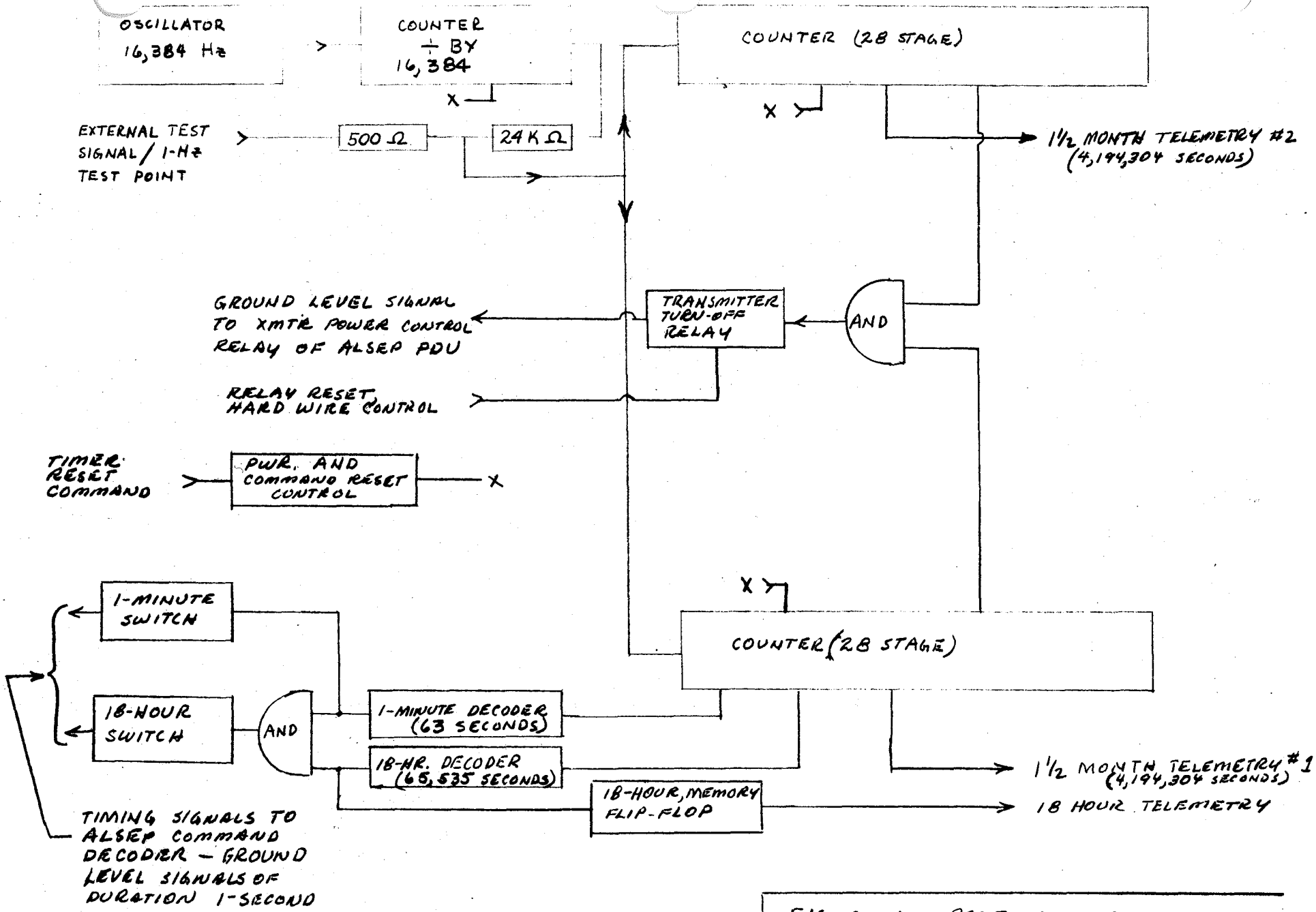


FIGURE 1. RSST FUNCTIONAL BLOCK DIAGRAM

The measurement of the period of the waveform at the 1-Hz test point was performed. Four samples of the 10 period average of this signal were obtained. The period measurements performed indicated that the accuracy is well within the specified tolerances of 5%. The actual error under the test conditions was less than two parts per thousand.

TRANSMITTER TURN-OFF TEST

To perform the Transmitter Turn-off Tests, it was expedient to advance the 28 stage counters with an externally derived test signal applied to the 1-Hz test point. Since the divide by 16,384 counter was verified in the preceeding test, this approach is considered valid. An independent external counter (HP5245 L) was used to totalize the cycles of applied signal between the times of resetting the RSST counters and the actual loss of downlink power. After overcoming some initial problems of triggering the 5245L, repeatable results were obtained. The required number of cycles applied at the 1-Hz test point to advance the RSST to the 3-month transmitter turn-off point was precisely 8,388,608 as required.

TIMER TM TESTS

Three TM monitor points are provided in the RSST. Two of these points monitor the 1-1/2 month timing interval to provide the ground stations a cue to transmit the "reset" command if it is desired to maintain the station in operation for an additional three months. A "low state" of these TM points (O to 33 octal) indicates the parallel 28 stage counters to be in the first 1-1/2 month of counting; a "high state", (230 to 376 octal) indicates that the count has progressed into the second 1-1/2 month count interval. The third TM point monitors the state of the 18 hour flip-flop. This flip-flop is not reset by the reset command and can be in either state at turn-on. The same limits (octal ranges) are used for the 18 hour TM point as are used for the 1-1/2 month TM points. However, it is noted that the low state of the 18 hour TM point actually is zero whereas the "low state" of the 1-1/2 month TM points is approximately 20 octal. This is normal operation. The difference in the "low state" readings of the 18 hr. TM point compared with the 1-1/2 month TM point is caused by diodes utilized to pull-down the 1-1/2 month TM dividers. Table 1 lists typical test point voltages and TM octal values where applicable.

Table 1 TM/Test Point Measurements

Test Point *	State	Voltage (VDC)	Octal Value
TP5 (18 Hour TM)	Low	0.0	000
	High	3.85	304
TP19 (1-1/2 Month TM#1)	Low	0.34	022
	High	3.89	306
TP4 (1-1/2 Month TM#2)	Low	0.29	017
	High	3.95	311
TP28 (3 Month Test Point)	Low	0.0	N/A
	High	10.5	N/A
TP29 (3 Month Test Point)	Low	0.0	N/A
	High	10.5	N/A
TP26 (Oscillator Supply Voltage)	N/A	6.4	N/A
TP23 (Storage Capacitor Voltage)	N/A	10.5	N/A
18 Hr. Output	Low	0.0	N/A
	High	1.5	N/A
1 Minute Output	Low	0.2	N/A
	High	1.5	N/A
Reset Command	Low	0.0	N/A
	High	2.5	N/A
Normal Operating Current (ma.)			20
Operating Current With One Relay Coil Energized			45 ma

*Reference RSST Schematic of Page 8.

COMMAND DECODER INTERFACE TEST

The three signal interfaces between the Command Decoder and the RSST were verified as operating properly and reliably. One of these interface functions is the RSST "reset" command which enables the RSST counters to be reset to zero thus initiating a new timing cycle. The reset must of course be transmitted prior to the three month time-out to be effective since, once the time-out to three months occurs, the latching relay of the RSST will be permanently actuated thus preventing the ALSEP transmitters from operating. The RSST relay can only be reset by applying a ground to a reset wire provided in the external test connector. The remaining two interface functions are the one-minute and eighteen-hour timing outputs which correspond functionally to the one-minute and 12-hour outputs of the Bulova timer used on ALSEP. The signal levels at the interface are, for all practical purposes, identical; the pulse durations are vastly different. The Bulova 12-hour output was on the order of 15 minutes duration whereas both outputs of the RSST are of 1-second duration. A 1-second pulse duration is more than adequate.

TIMER RESET FUNCTIONAL TEST

To ascertain that the "Reset" function was performing properly, the RSST counters were advanced to each of the following counts and a "Reset" command transmitted; the "high" and "low" voltage states of the Reset Test Point (TP20) were measured and found to be acceptable. The high state is the reset state; the low state is the normal operating state.

Accumulated Count	TP20 Voltage (VDC) High	Low
63	10.5	0.08
5,461	10.5	0.08
65,535	10.5	0.08
87,381	10.5	0.08
1,398,101	10.5	0.08
4,194,304	10.5	0.08
8,388,607	10.5	0.08

COUNT STORAGE TEST

Power was interrupted to the timer in the middle of the count to verify that the RSST counters could store their accumulated count for the required 30 seconds. This capability was verified. The transmission of Power Conditioning Unit switchover commands had no effect on the RSST operation.

SYSTEM LEVEL COMPATABILITY TEST

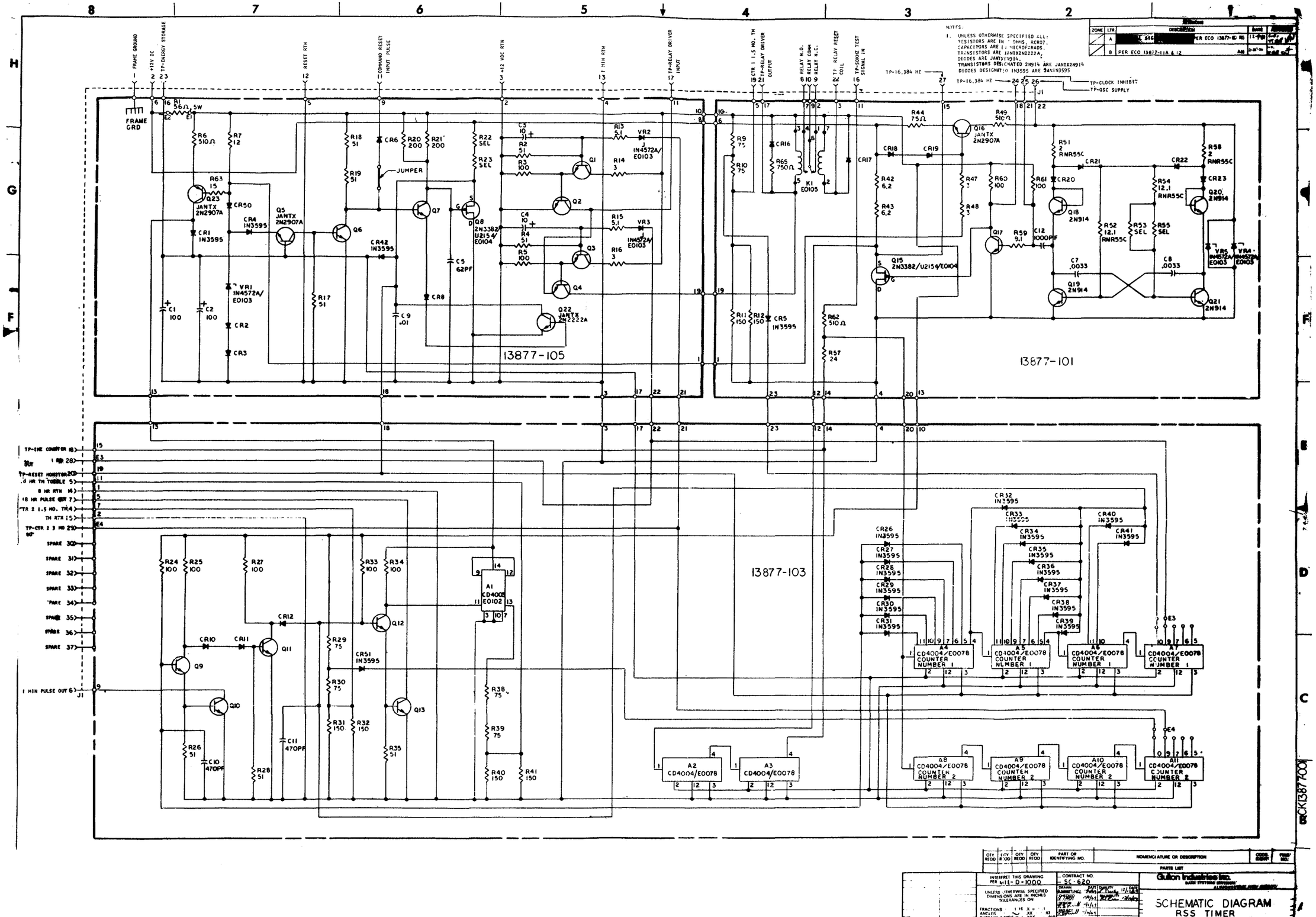
Upon satisfactorily completing the Central Station/RSST compatability test, a system level test was performed using the Prototype Central Station integrated with the Qual ASE, Qual CPLEE, Prototype SIDE and the Prototype PSE. The prime intent of this test was to verify that the ASE receiver was not subjected to interference emanating from system cabling. The ASE receiver is very sensitive to radiation near 30 megahertz; interfering signals close to 30 megahertz would block the ASE receiver thus preventing the detection of the 30 megahertz transmission of the ASE grenade transmitters and result in the loss of time-of-flight information so important to the ASE operation. Hence, the system was configured in the EMI test facility per the Flight 4 EMI Test Procedure (2338180). The ASE operational tests were performed without discrepancy. The minimum signal strength setting which the ASE receiver could recognize was within 1-db of the same measurement performed on the Flight 4 system in the same configuration. Hence, excellent correlation of results was obtained. The results illustrate that the RSST is entirely compatable with the ALSEP system and that the RSST does not generate interference in any system cable which degrades ALSEP operation.

CONCLUSIONS

The first attempt at performing the Engineering Tests of the RSST revealed that the counter reset circuitry performance was marginal. The Engineering Model RSST was returned to the manufacturer where modifications were performed to correct this problem. Retest of the RSST after this modification verified proper operation of the RSST in every respect. The Central Station Verification test (TP 2334344 modified to include special testing of the RSST) confirmed that (1) the outputs of the RSST to the Command Decoder operated properly in advancing the Delayed Command Sequencer of the Decoder, (2) the commandable "reset" function of the

RSST could be performed reliably regardless of whether a preponderance of "ones", a preponderance of "zeroes" or an equal number of "ones" and "zeroes" were accumulated in the counters at the time of "reset", (3) the transmitter turn-off function operated properly in all respects, (4) operating power levels of the RSST were within specification, (5) the basic timing oscillator of the RSST performed well within specification, (6) the external Central Station Test Connector (provided for system tests of the RSST) was compatable with system test requirements, and (7) telemetry functions of the RSST were within specification.

The system level test performed to a modified 2338180 EMI Test Procedure, confirmed that there is no interference between the RSST and the system.


13877-105
13877-101
13877-103
SCHEMATIC DIAGRAM
RSS TIMER
SC-620
Gulton Industries Inc.
DRCK13877000