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AIM-4F AND AIM-4G TELEMETRY DEVELOPMENT PROGRAM.(U)

MAR 73 J PILCICKI, H BLAKE F09603-71-A-3749

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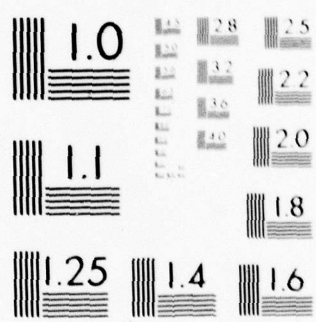

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Publication 0A36-03-2-1220

FINAL REPORT

AIM-4F AND AIM-4G TELEMETRY DEVELOPMENT PROGRAM

March 1973

Prepared for
WARNER ROBINS AIR MATERIEL AREA
ROBINS AIR FORCE BASE, GEORGIA
under Contract F09603-71-A-3749-0006

ARINC RESEARCH CORPORATION

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This final report on the AIM-4F and AIM-4G telemetry development program contains a discussion of the development approach as well as a description of the resulting telemetry hardware. The signal-conditioner circuits, which, unlike standard commutator and transmitter packages, are unique for each telemetry installation, are discussed in detail. Specifications and test results are also presented.

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March 1973

Prepared for

Warner Robins Air Materiel Area
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by

John Pilcicki
Howard Blake

ARINC Research Corporation
a Subsidiary of Aeronautical Radio, Inc.
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ABSTRACT

This final report on the AIM-4F and AIM-4G telemetry development program contains a discussion of the development approach as well as a description of the resulting telemetry hardware. The signal-conditioner circuits, which, unlike standard commutator and transmitter packages, are unique for each telemetry installation, are discussed in detail. Specifications and test results are also presented.

(This report supersedes ARINC Research Publication A36-1-1-1172, published in May 1972 under the same title. That document was prepared at the conclusion of the initial effort under Contract F09603-71-A-3749-0006. The revised version presented herein is a result of contract modification 02, dated 27 June 1972, which provided for revision of the AIM-4F and AIM-4G telemetry specification to correct signal-conditioner deficiencies in the telemetry units and the delivery of modified hardware.)

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CHAPTER ONE

INTRODUCTION

ARINC Research Corporation received a contract (F09603-71-A-3749-0006) on 12 November 1971 to develop telemetry equipment for the AIM-4F and AIM-4G missiles. A complete telemetry installation consists of instrumentation cabling, signal conditioners, commutator, transmitter, RF cabling, antennas, and battery. The deliverable products under the original contract included complete prototype telemetry installations for each of the two missiles, a spare P-band transmitter (with antennas), and a data package suitable for competitive procurement of the packages. Field engineering support was provided for acceptance and flight tests of the telemetry systems.

Three modifications were made to the original contract:

- Modification 01, dated 27 June 1972, extended the completion date of the contract to 12 July 1972. The purpose of this extension was to provide time for the completion of field engineering services.

- Modification 02, dated 27 June 1972, provided for the revision of the AIM-4F and AIM-4G telemetry specification to correct signal-conditioner deficiencies in the last seven channels of each of the telemetry units, and the delivery of modified hardware built according to the revised specification. Deliverable products under modification 02 include (1) modified hardware, (2) documentation suitable for competitive procurement, (3) one month of field support, and (4) this final report.

  The circuit descriptions and specifications presented in this report reflect the changes resulting from contract modification 02.

- Modification 03, dated 16 October 1972, extended the hardware delivery schedule set forth in modification 02. This modification was requested because of problems encountered by the subcontractor in meeting the original schedule.

CHAPTER TWO

TECHNICAL APPROACH

2.1 GENERAL APPROACH

The hardware provided under this contract consists of (1) antenna sets fabricated in the ARINC Research laboratory; (2) instrumentation and RF cable assemblies fabricated at WRAMA by ARINC Research engineers; and (3) telemetry-package assemblies, each consisting of signal conditioners, commutator, transmitter, and battery procured from a subcontractor. Documentation consists of complete detailed drawings and specifications for the antennas and cabling, and specifications and specification-control drawings for subassemblies procured from subcontractors. (See Appendix A for telemetry-unit specification.)

2.2 HARDWARE PROCUREMENT

The specification for the subcontract-procured assembly was developed on the basis of the measurement lists supplied by WRAMA. The specification was submitted to six companies for bids, and four of these responded with proposals. The company selected was Vector, an Aydin Company, in Newtown, Pennsylvania. The Vector plant was visited and various Vector customers were interviewed before the final selection was made.

2.3 HARDWARE FABRICATION

Instrumentation-cable assemblies were developed by (1) studying missile drawings and the missile itself to determine the most accessible terminals for the required test points, (2) fabricating a prototype cable in a disassembled missile and reassembling the missile to verify feasibility, and (3) writing a cable-installation procedure to facilitate future telemetry-cable installations.

In the design of RF cables, subminiature cables and connectors were used to facilitate installation. Power splitters were designed in the form of stripline devices to match the two 50-ohm antennas to the 50-ohm transmitter output. The prototype power splitters were fabricated from copper-clad fiberglass.

Antennas were fabricated by modifying missile stabilizer fins. Material from the fins was machined out to make room for antenna-element installation.

2.4 TESTING

A number of tests of the AIM-4F and AIM-4G telemetry units were performed to assure conformance to all specifications. All subassemblies were first tested individually before final integration tests at WRAMA. Captive-flight tests are planned at Tyndall Air Force Base.

Table 1 is a comprehensive list of the tests performed during the course of this contract.

Table 1. **TELEMETRY-UNIT TESTS**

Test Nomenclature	Location of Test	Description
Breadboard Tests	Vector Co.	Conditioner circuits were tested for transfer-function accuracy over specified temperature ranges. Commutator and transmitter circuits are standard Vector products that did not require breadboard testing. Data from signal-conditioner tests are contained in Vector Company's engineering notebooks.
Transmitter Tests	Vector Co.	Performance test of transmitter apart from system. See Appendix D for results.
Acceptance Tests	Vector Co.	Room-temperature transfer-function test of each channel from signal-conditioner input to commutator output. Data are not recorded.
Qualification Tests	Vector Co.	Test of AIM-4G conditioner, commutator, transmitter, and battery assembly under environmental stresses called for in paragraph 3.3 of the telemetry specifications (see Appendix C).
Antenna Tests	ARINC Research	VSWR and nonquantitative pattern checks of antenna design.
Cable Continuity	WRAMA	Continuity checks of cable installation.
Telemetry Integration Tests	WRAMA	System integration tests to verify 1. Satisfactory telemetry system operation 2. No interference of telemetry equipment with missile operation

Note: Captive-flight tests are also scheduled at Tyndall AFB.

CHAPTER THREE

DESCRIPTION OF TELEMETRY EQUIPMENT

The block diagram of the complete telemetry system applicable to both the AIM-4F and the AIM-4G is presented in Figure 1. Figure 2 is a photograph of the Vector-built assembly containing signal conditioner, commutator, transmitter, and battery. The following sections present descriptions of the component parts of the telemetry system.

3.1 INSTRUMENTATION CABLE

The AIM-4F and AIM-4G missiles do not have readily accessible test points for in-flight instrumentation. For this reason, the missile cable harnesses must be modified for installation of the telemetry unit. Most telemetry test points are located on chassis connectors, and connecting the instrumentation wire to these test points involves soldering a wire to a connector terminal, where one or more wires may already be attached. The wires thus attached are routed along existing wire bundles into the warhead section, where the telemetry-unit-instrumentation connector is located. Test points located in the aft section of the missile in back of the pressure-sealed bulkhead must be passed through a bulkhead connector that maintains a pressure seal.

3.2 SIGNAL CONDITIONERS

The functions of the signal-conditioner circuits are (1) to convert the signals monitored into a 0- to 5-volt scale, (2) to provide an impedance transformation to minimize test-point loading while minimizing driving impedance to the commutator, and (3) to provide the proper frequency-response characteristics to assure adequate data rate while minimizing the effects of ripple and noise.

Because the first 19 measurement channels of the AIM-4F are identical to those of the AIM-4G and the space available for the telemetry package in the two missiles is the same, basic telemetry units containing only the first 19 channels are interchangeable. Signal conditioners are located on three plug-in-type printed circuit cards, with the first 19 channels located on two cards and the last seven channels mounted on the third card. The third signal-conditioner printed circuit card is therefore the only subassembly that distinguishes an AIM-4F unit from an AIM-4G unit. At the instrumentation connector, inputs for the last seven AIM-4F channels are located on

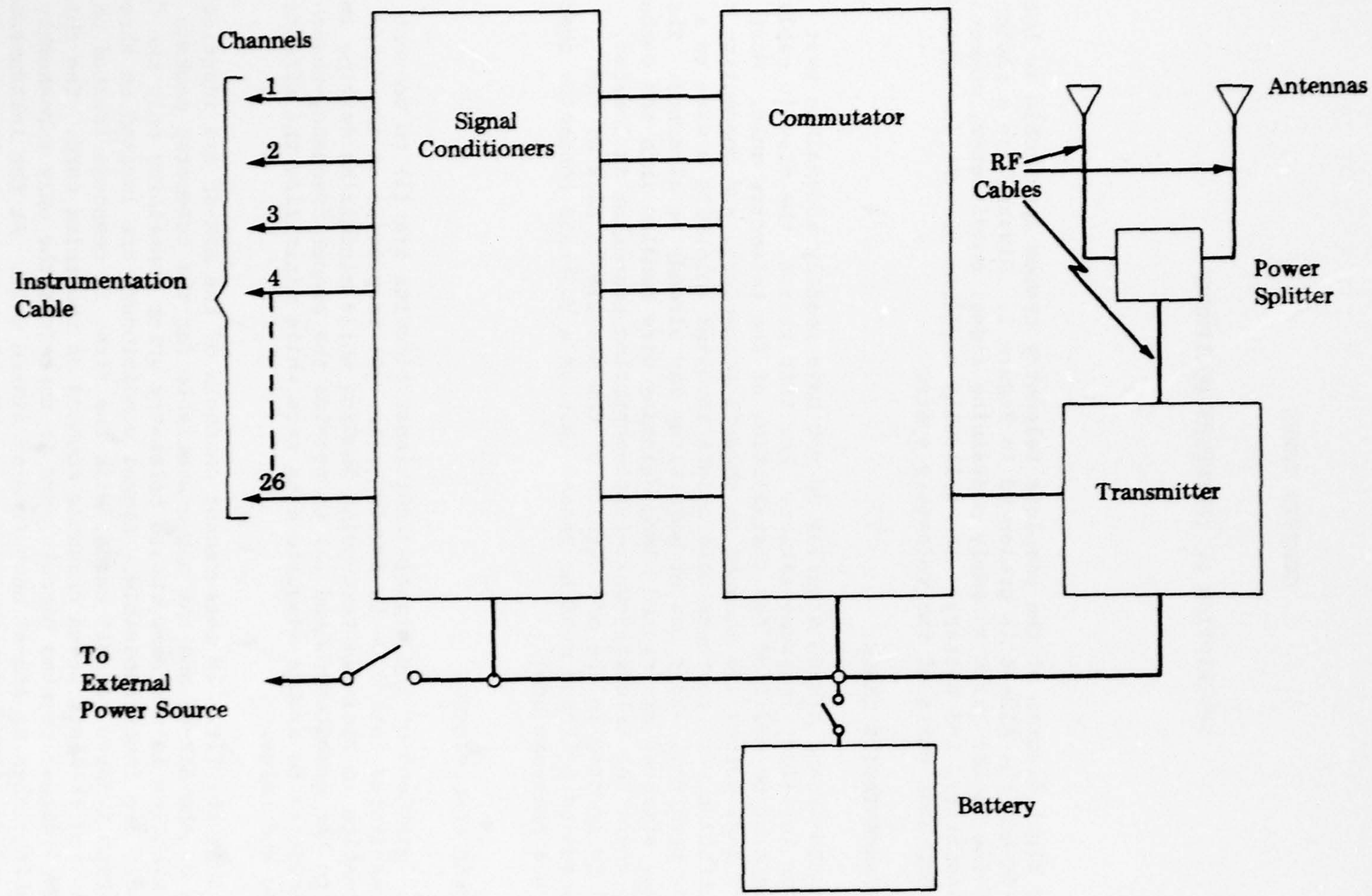


Figure 1. **TELEMETRY-SYSTEM BLOCK DIAGRAM**

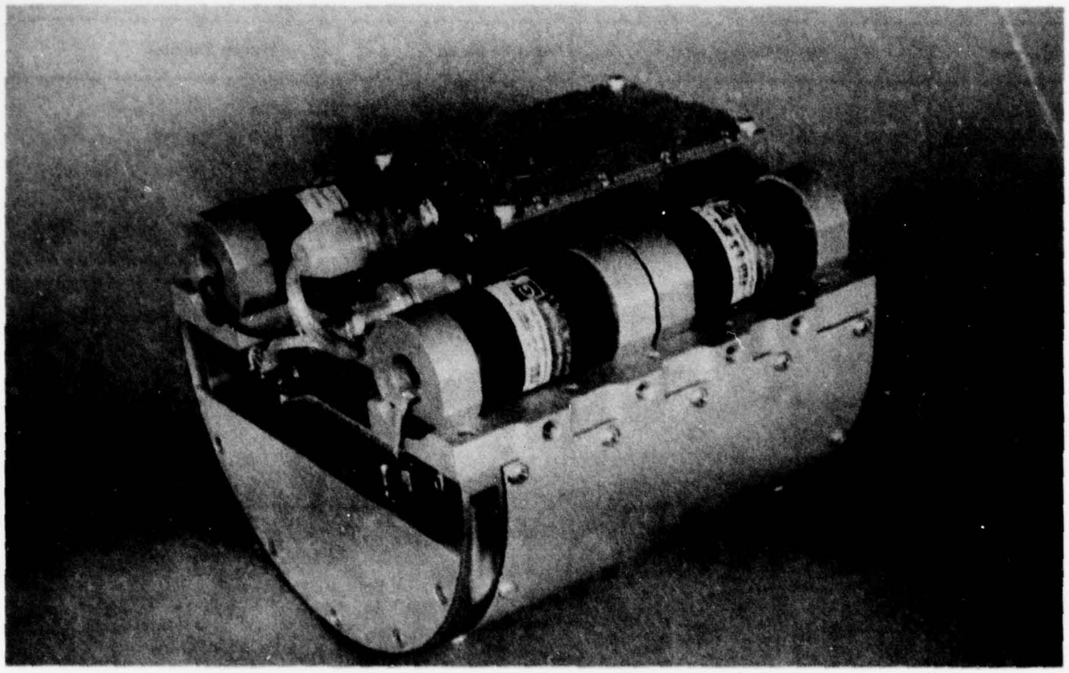


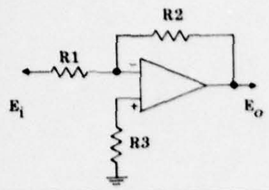
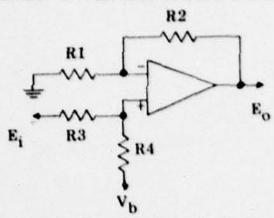
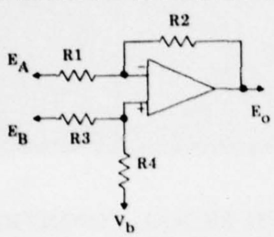
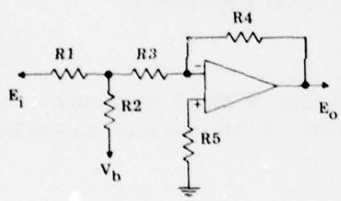
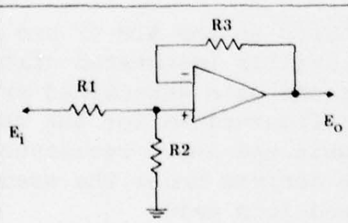
Figure 2. **TELEMETRY ASSEMBLY CONTAINING SIGNAL CONDITIONERS, COMMUTATOR, TRANSMITTER, AND BATTERY**

different pins from those for the last seven AIM-4G channels, making it impossible to damage units by installation in the wrong missile.

3.2.1 Voltage-Amplifier Conditioners

Most of the signal-conditioner circuits in the AIM-4F and AIM-4G telemetry units are voltage amplifiers that utilize integrated-circuit operational amplifiers, with input resistance and gain determined primarily by passive-component values. Simplified configurations for the voltage-amplifier channels, with equations for gain and input resistance, are summarized in Figure 3. The equations were derived under the assumption that open-loop gain is much greater than closed-loop gain.

On some channels, the measurement list (see specifications in Appendix A) requires the provision for selecting one of two transfer functions for particular flights. This requirement was implemented by making gain resistors a combination of two series resistors, one of which can be shorted with a wire.

Channels	Circuit Configuration	Input Resistance	Transfer Function
1, 26G		R1	$E_o = -\frac{R2}{R1} E_i$
2, 11, 12, 24F, 25F, 26F		R3 + R4	$E_o = \left(\frac{R4}{R3 + R4}\right)\left(1 + \frac{R2}{R1}\right)\left(E_i - V_b\right) + \left(1 + \frac{R2}{R1}\right) V_b$ Normally, R1 = R3, R2 = R4, and $E_o = \frac{R2}{R1} E_i + V_b$
3, 4, 5, 6, 7, 8, 9, 10, 14, 15, 16, 19, 22G, 24G, 25G, 20G, 21G		R1 (for E_A) R3 + R4 (for E_B)	$E_o = \left(\frac{R4}{R3 + R4}\right)\left(1 + \frac{R2}{R1}\right)\left(E_B - V_b\right)$ $- \frac{R2}{R1} E_A + \left(1 + \frac{R2}{R1}\right) V_b$ Normally, R1 = R3, R2 = R4, and $E_o = \frac{R2}{R1}\left(E_B - E_A\right) + V_b$
13		$R1 + \frac{R2\,R3}{R2 + R3}$	$E_o = -\frac{R4R1V_b + R4R2E_i}{R3R1 + R3R2 + R1R2}$
17, 18		R1 + R2	$E_o = \frac{R2}{R1 + R2} E_i$

Note: *The first nineteen channels are identical for both the AIM-4F and AIM-4G. Channels 20 through 26 are followed by a G for AIM-4G and an F for AIM-4F.*

Figure 3. **INPUT-RESISTANCE AND TRANSFER-FUNCTION FORMULAS FOR VOLTAGE AMPLIFIER CHANNELS**

3.2.2 Other Signal Conditioners

Various channels in the AIM-4F and AIM-4G telemetry units require functions other than simple voltage amplification and attenuation. Detailed explanations of these channels are presented in the following subsections.

3.2.2.1 Antenna Speed (Channel 23G)

The conditioner circuit for antenna speed converts the information in the form of pulses from a pip coil into an analog indication of the speed of revolution of the antenna gyro. The pip coil receives impulses from a magnet embedded in the antenna gyro and therefore generates one pulse per revolution. Thus the function of the conditioner is to convert a pulse repetition frequency into a voltage.

The schematic diagram of the antenna-speed signal-conditioner circuit is given in Figure 4. The first stage of the circuit is an amplifier (U6) that squares and clips the incoming pulse, making the circuit insensitive to changes in magnitude and shape of the pulse. The triggering threshold of the amplifier is set by R57 and R58; Rf is a resistor that provides regenerative feedback, decreasing the rise and fall times of the output pulse. Clipping is performed by diodes CR5, CR6, CR7, and CR8, and resistors R24 and R26.

The output of the amplifier is applied to the network consisting of capacitor C13, resistor R25, and diodes CR10 and CR11. The time constant of this network is much smaller than the period of the pulse, and thus the leading and trailing edges of the pulse are differentiated. CR10 provides a path to ground for the leading-edge pulse, which is negative; the positive trailing-edge pulse is applied to the second-stage amplifier (U7), which is configured as an integrator (or low-pass filter).

The output of the integrator amplifier is a sawtooth waveform. The average voltage level of this waveform is proportional to the pulse repetition frequency of the incoming pulse. A negative bias voltage is developed by R27 and CR9 and summed into the second-stage amplifier by R28, R29, and R30. This voltage provides a minimum scale reading at some non-zero pulse repetition frequency. The bias voltage is adjustable via potentiometer R30, and thus the minimum scale pulse-repetition frequency or gyro speed can be adjusted.

The third stage of the antenna speed-conditioner circuit (U8) is a two-pole low-pass active filter that smooths the sawtooth waveform into the required dc output.

3.2.2.2 Gate Pusher Pulse Width (Channel 20F)

The function of the channel-20 signal conditioner is to develop an analog voltage that is proportional to the width of the gate-pusher pulse.

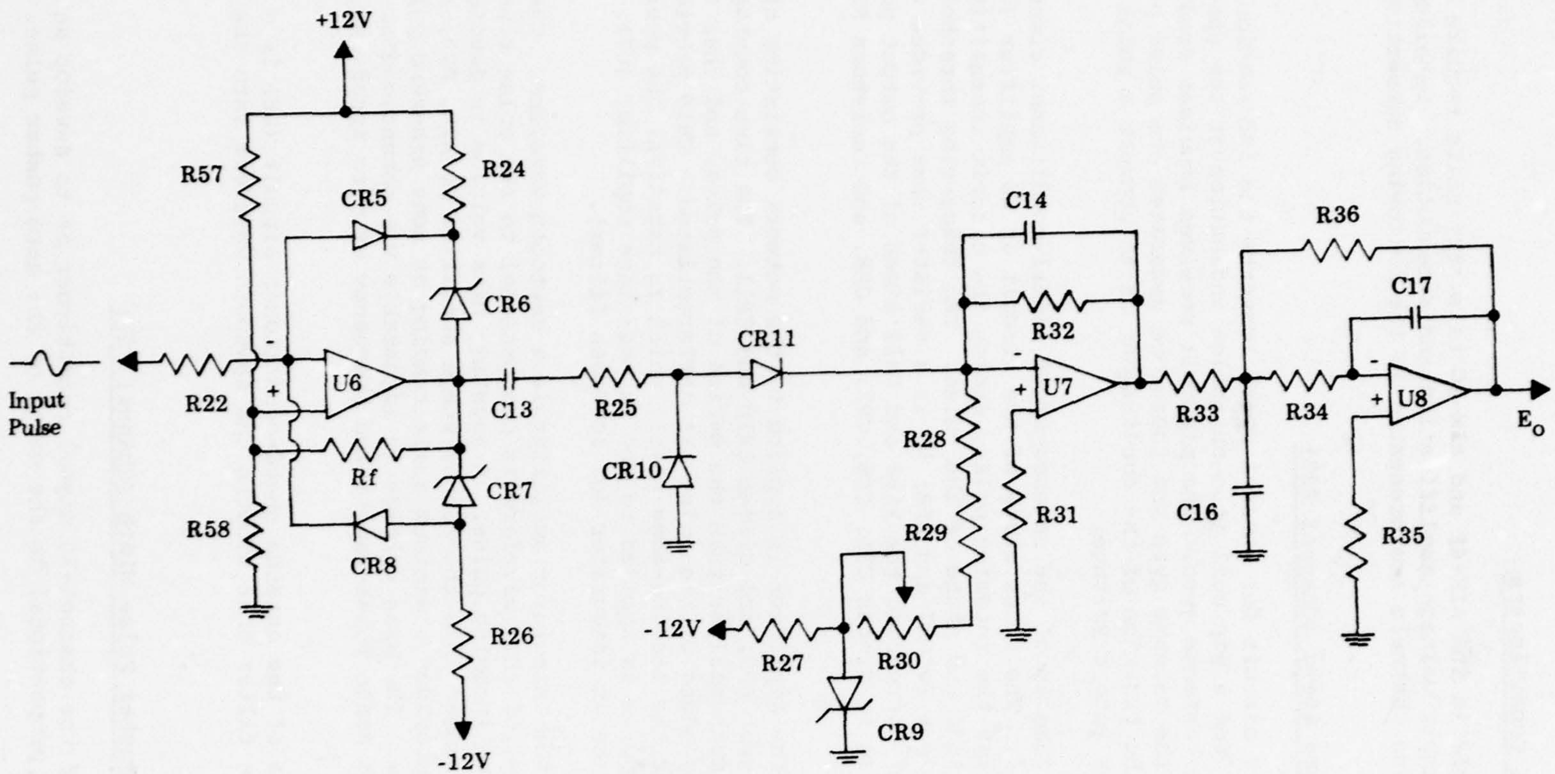


Figure 4. **SIGNAL CONDITIONER CIRCUIT AIM-4G CHANNEL 23 (ANTENNA SPEED)**

Figure 5 is a simplified schematic diagram illustrating the operation of the channel-20 conditioner. The required analog voltage is developed as follows (see waveforms in Figure 6):

1. The gate-pusher pulse is inverted and clamped to a constant amplitude in IC1. The output of IC1 is shown as V_B in Figure 6.

2. Transistor Q1 is turned on for the duration of the gate-pusher pulses. Q1 turns on Q2, which supplies a constant charging current to capacitor C1.

3. The charging of C1 stops at the termination of the gate-pusher pulse, and the peak value is held across the capacitor until the clock turns on Q3, which completely discharges C1. The voltage across C1 is illustrated as V_C in Figure 6.

4. The average value of V_C is the desired analog voltage. Smoothing and scaling are accomplished by applying V_C to an amplifier-filter stage (see Subsection 3.2.2.6).

3.2.2.3 Coincidence Measurements (Channels 21F and 22F)

The function of the coincidence-measuring signal conditioners is to provide a voltage that is proportional to the relative time positions of reference points (leading or trailing edge of two pulses. Figure 7 is a simplified schematic illustrating the operation of the coincidence-measuring channels.

The required analog voltage is developed as follows:

1. The incoming pulse triggers a flip-flop to signify its presence. Inverters and threshold-setting networks are used before the flip-flop to determine the particular amplitude and reference point (leading or trailing edge) to be sensed. The output of one of the flip-flops is shown on a time scale in Figure 8.

2. Gates 1 and 2 are NAND gates that are driven by the flip-flops to perform the logic required in (a) detecting which pulse came first (this determines which gate provides an output pulse) and (b) providing an output pulse whose width is equal to the time to be measured.

3. If gate 1 conducts, a positive current is supplied to C1 through constant-current generator Q2; if gate 2 conducts, a negative current is supplied to C1 through constant-current generator Q3.

4. The net charge across C1 is held until the next clock transition, which completely discharges C1. The clock also resets all flip-flops to their original state. (See Subsection 3.2.2.5 for a discussion of the clock circuit.)

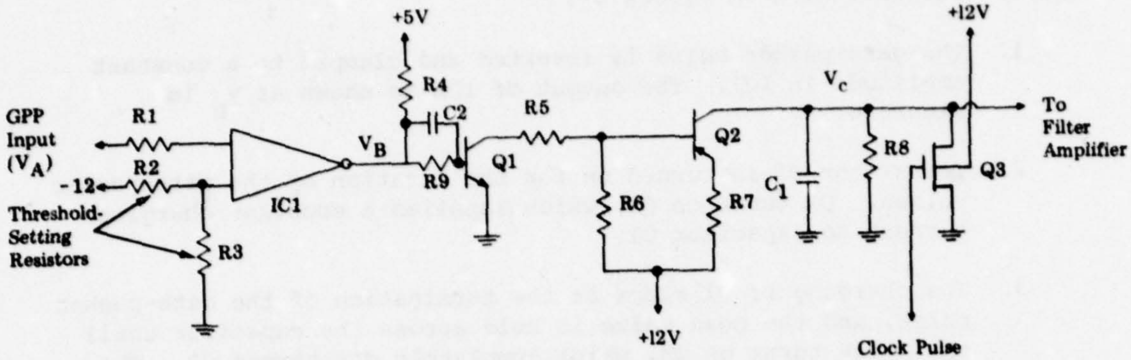


Figure 5. **CHANNEL-20F SIGNAL CONDITIONER**

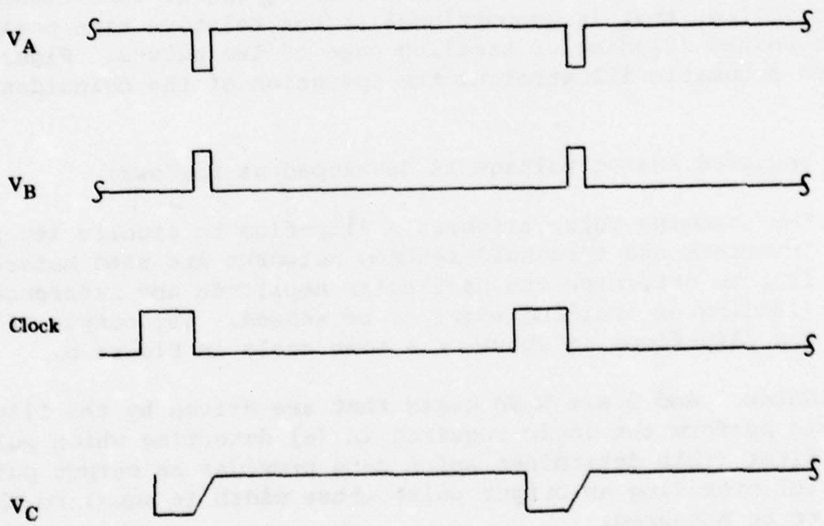


Figure 6. **WAVEFORMS FOR CIRCUIT IN FIGURE 5**
(Not Drawn to Scale)

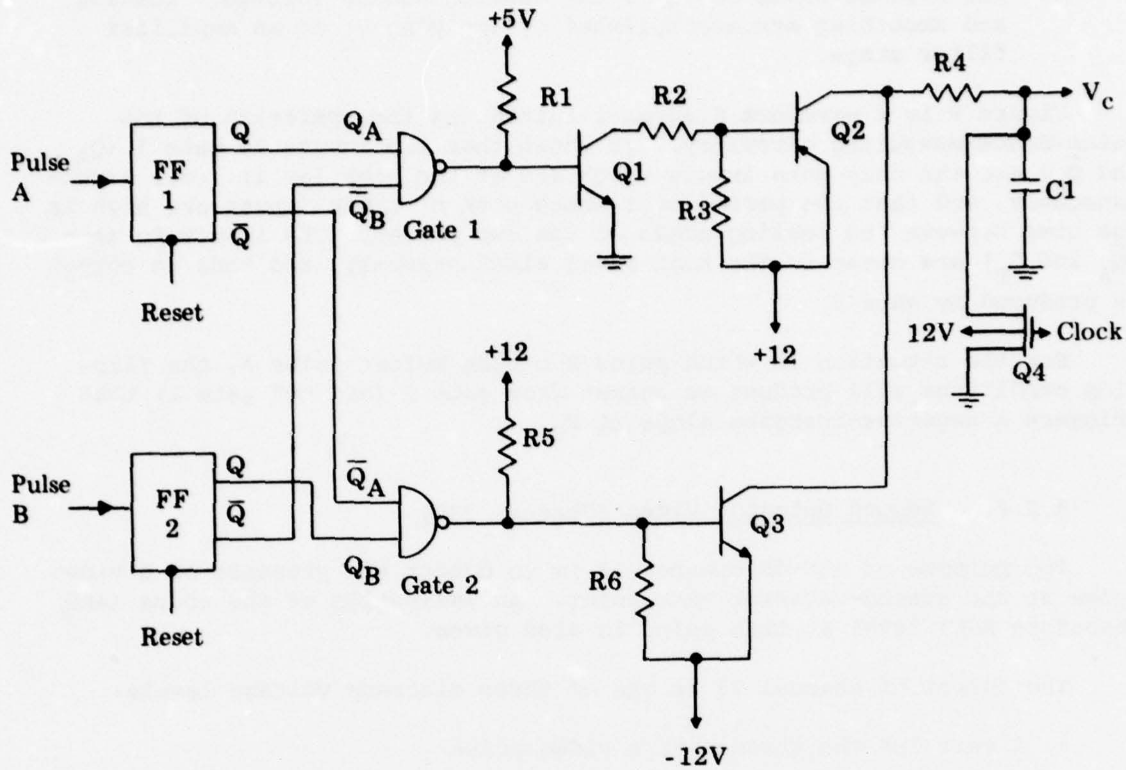


Figure 7. **SCHEMATIC DIAGRAM OF PULSE-COINCIDENCE-MEASURING CIRCUITS**

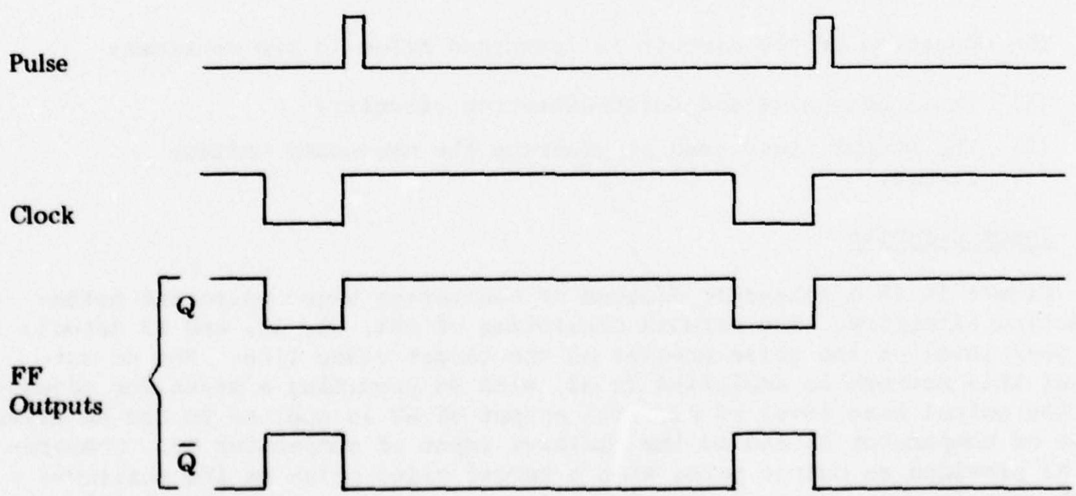


Figure 8. **OUTPUT WAVEFORMS FOR FF1 AND FF2 OF FIGURE 7**

5. The average value of V_C is the desired analog voltage. Scaling and smoothing are accomplished by applying V_C to an amplifier filter stage.

Figure 9 is a waveform diagram illustrating the operation of the coincidence-measuring circuitry. It shows that the inputs to gate 1 (Q_A and $\overline{Q}_B$) are the only gate inputs which are at the high (or 1) level simultaneously, and that the period over which both of these inputs are high is the time between the leading edges of the two pulses. The inputs to gate 2 ($\overline{Q}_A$ and Q_B) are never in the high level simultaneously, and thus no output is produced by gate 2.

For the situation in which pulse B occurs before pulse A, the flip-flop conditions will produce an output from gate 2 (and not gate 1) that triggers a negative-charging slope at V_C.

3.2.2.4 Second Detector Video (Channel 23F)

The purpose of AIM-4F channel 23 is to detect the presence of a video pulse at the second-detector test point. An indication of the noise (and therefore AGC) level at this point is also given.

The output of channel 23 is one of three discrete voltage levels:

- 1 volt for the absence of a video pulse
- 2.5 volts for the presence of a video pulse in low noise (up to 1.5V p-p)
- 4 volts for the presence of a video pulse in high noise (greater than 1.5V p-p)

The operation of the circuit is described below in two sections:

(1) The input pulse and noise-detection circuitry

(2) The output logic used to generate the necessary voltage levels.

Input Circuits

Figure 10 is a schematic diagram of the target video pulse and noise-detection circuitry. The network consisting of CR1, C1, C2, and R3 detects the peak level of the noise present on the target video line. The dc output of this network is amplified in A2, with R5 providing a means for adjusting the output bias level of A2. The output of A2 is applied to the negative input of comparator A1 and to the positive input of comparator A3. Comparator A1 provides an output pulse when a target video pulse on its positive input exceeds the peak noise level by an amount determined by the level present at the negative input. The nominal amount by which the target video pulse must exceed the peak noise is one volt, and R5 provides a means for

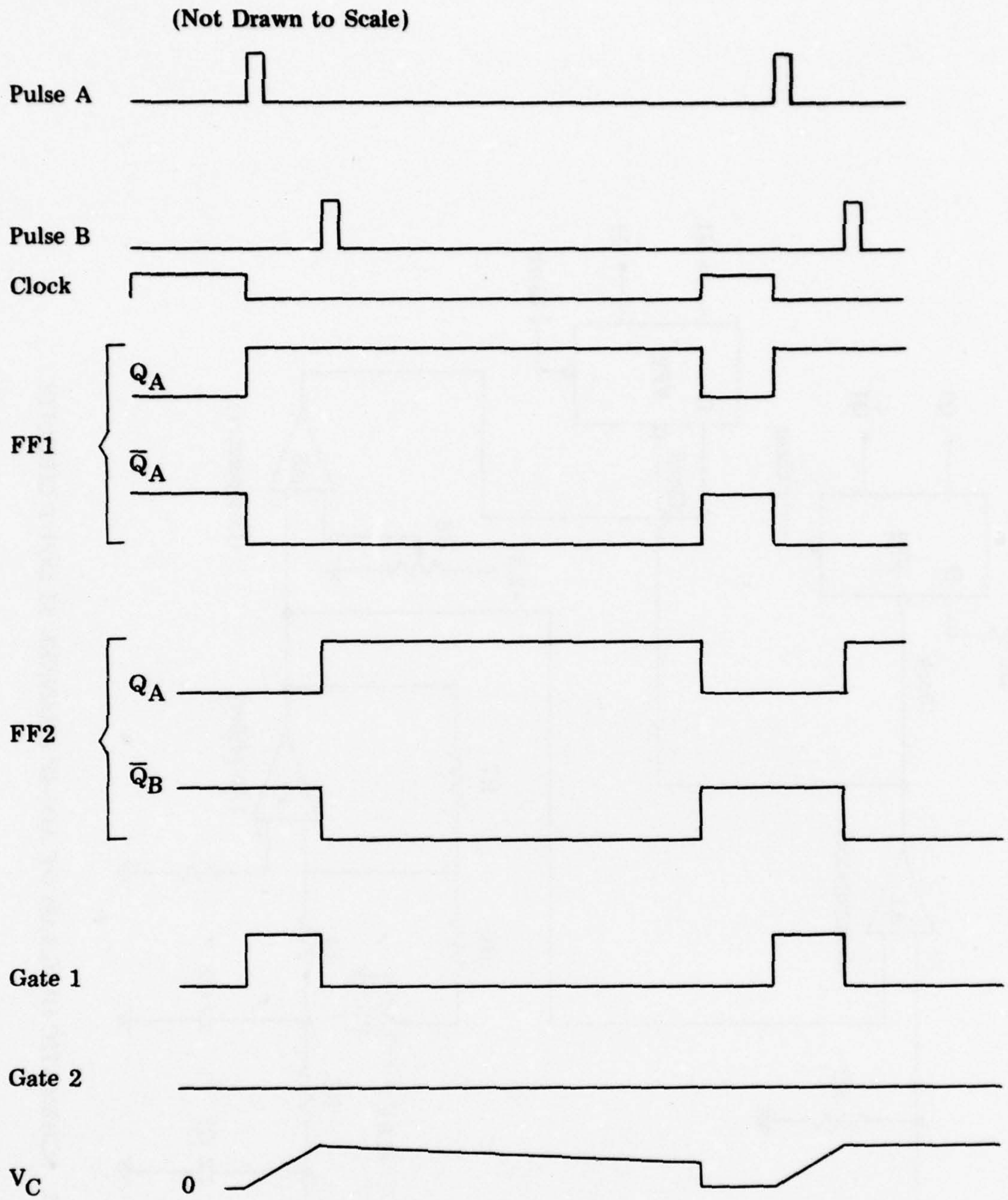


Figure 9. **WAVEFORMS ILLUSTRATING THE OPERATION OF THE CIRCUIT OF FIGURE 7 WHERE PULSE A OCCURS BEFORE PULSE B**

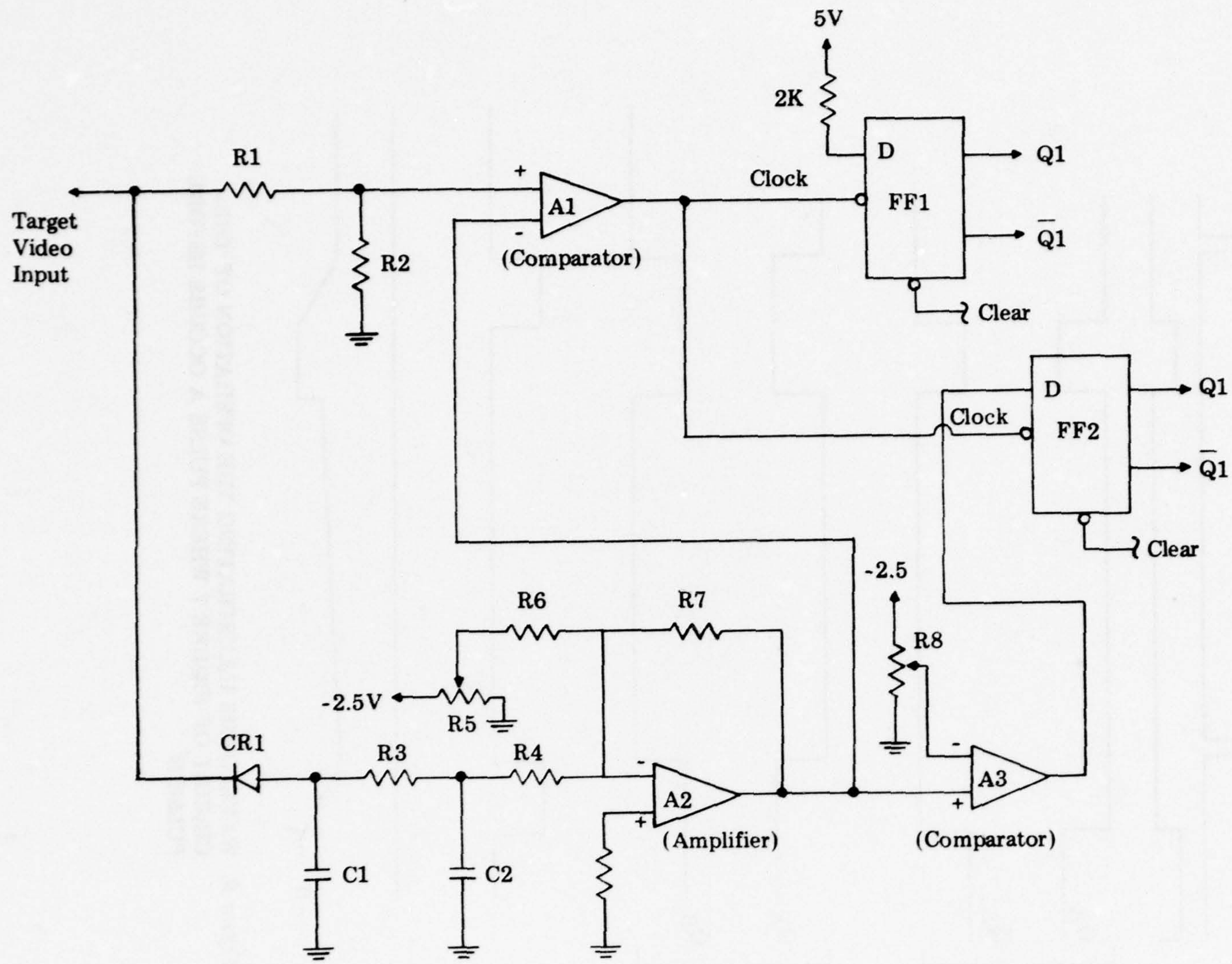


Figure 10. **SCHEMATIC DIAGRAM OF AIM-4F CHANNEL 23 INPUT CIRCUITS**

adjusting this amount from 0.25 to 1.25 volts to adapt this circuit to the particular noise conditions found in the missile. An output pulse from A1 serves as the clock input for flip-flops FF1 and FF2.

Flip-flops FF1 and FF2 are D-type flip-flops that transfer the input logic level at the D input to the output upon the application of the clock pulse. The flip-flop is restored to its original state upon the application of a low (0-volt) level at the "clear" input. The clear input is provided by a system clock, which is described in Subsection 3.2.2.5.

The function of comparator A3 is to switch from its low (0-volt) output state to its high (5-volt) output state when the level of the noise exceeds the 1.5-volt level. This distinguishes low noise level from high noise level, and the exact transition level is adjustable via R8.

On the basis of the comparator functions described above, the flip-flop outputs can be summarized as follows:

Input Condition	FF1		FF2	
	Q1	$\overline{Q1}$	Q2	$\overline{Q2}$
Pulse Absence	Low	High	Low	High
Pulse Present in Low Noise	High	Low	Low	High
Pulse Present in High Noise	High	Low	High	Low

Note that these flip-flop levels are initiated by the detection of a valid pulse by A1 and remain until the clear pulse is applied by the system clock. The system clock is synchronized to the first pulse applied to any of the pulse channels and clears the flip-flops before the next series of pulses is to be measured.

Output Logic Circuitry

The output logic circuitry shown in Figure 11 consists of gates that combine logically the outputs of the flip-flops and produce signals that short-circuit elements of a series resistance network to produce the necessary discrete output-voltage levels. The level shifters shown are required to convert the 0 to 5 volt gate output into the 0 to -12 volt swing necessary to drive the MOSFET switches Q1 and Q2. Amplifier A1 is configured as a 2-pole active low-pass filter that reduces the output ripple resulting from the cyclical nature of the flip-flop action. The discrete states produced

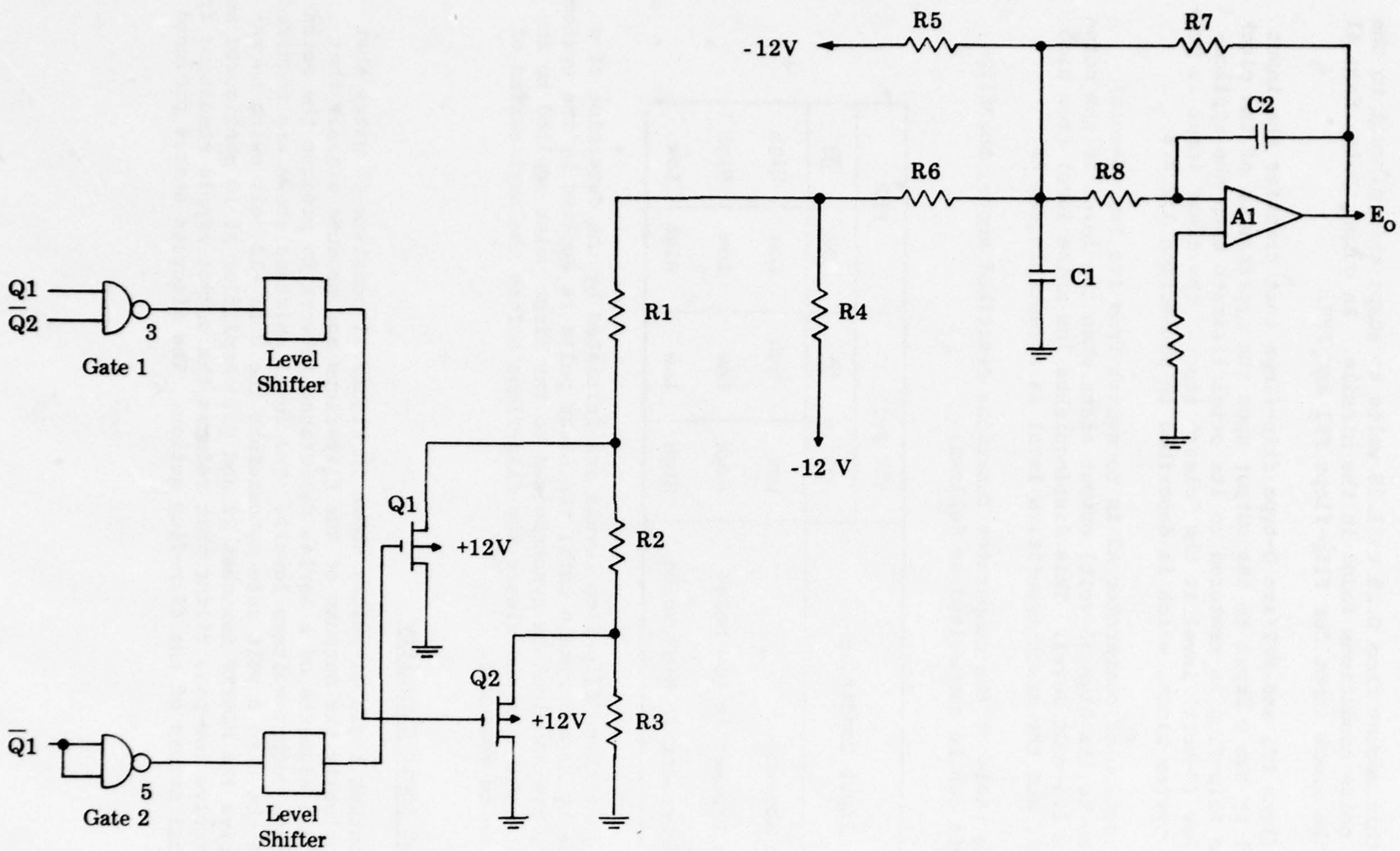


Figure 11. SCHEMATIC DIAGRAM OF CHANNEL 23 GATES AND OUTPUT CIRCUITS

in the output logic circuitry caused by input conditions are summarized as follows:

Input Condition	Gate 1 Output	Gate 2 Output	Q1	Q2	E_o
Pulse Absence	High	Low	ON	OFF	1V
Pulse Present in Low Noise	Low	High	OFF	ON	2.5V
Pulse Present in High Noise	High	High	OFF	OFF	4V

3.2.2.5 Clock for Pulse-Measuring Channels (AIM-4F Channels 20 through 23

To produce the required analog output voltages, the pulse-measuring circuits (channels 20, 21, 22, and 23) in the AIM-4F utilize flip-flops and holding capacitors to maintain the dc output level resulting from a pulse measurement for some period of time shorter than the period of the pulses to be measured. A clock circuit is used to measure the period before resetting the flip-flops and discharging the holding capacitors prior to the next series of pulses to be measured. All pulses to be measured are expected to occur within a few microseconds of each other, and the period of these pulses, which is the missile radar pulse-repetition frequency (prf), is at least 100 times the expected spacing between the different system pulses (the exact radar prf is classified Confidential). The clock is triggered by the first pulse to occur, and it generates a reset pulse after about 80 percent of the pulse period elapses.

An additional feature of the clock circuit is that if the pulse which initiates clock action is not followed by the Missile Range Gate within 5 microseconds, the clock will return to its original state, clearing all flip-flops and discharging all holding capacitors, thus terminating pulse measurements. The purpose of this feature is to reject as invalid inputs all pulses not within a few microseconds of the Missile Range Gate. If an invalid pulse initiates clock action, a short transient will be observed on pulse-measuring circuit outputs, but the dc level will not be affected unless numerous invalid pulses cause repeated output errors.

The clock circuit (Figure 12) consists of an oscillator (U1), a buffer (U2), counters (U3 and U4), and gates (U5, U6, U7, U8, U9, and U10). The oscillator is a free-running square wave generator, and its output frequency is divided by 256 in U3 and U4, which are both configured as 4-bit binary counters. The occurrence of a low logic level at any of the inputs to U9 enables the counter circuits, and the flip-flop clearing signal appears at the output of U8 one-half cycle after the counters are enabled by the output of U9. The counter output from U7 can be disabled after five microseconds by U5 unless the Missile Range Gate input to U5 is triggered to its low logic state by the presence of a Missile Range Gate pulse.

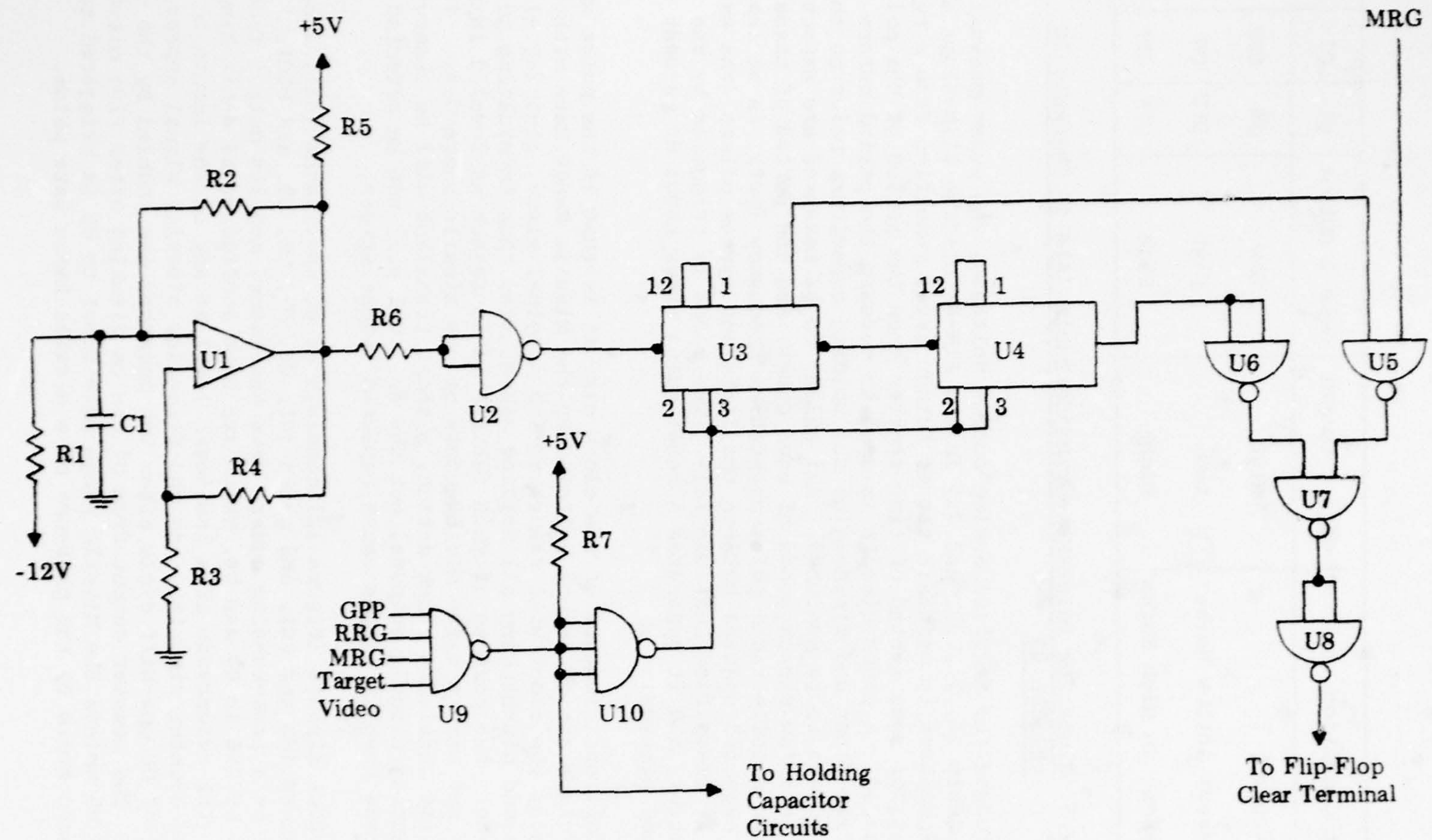


Figure 12. SCHEMATIC DIAGRAM OF CLOCK CIRCUIT FOR AIM-4F PULSE MEASURING CHANNELS

3.2.2.6 Scaling and Smoothing Amplifiers

The scaling and smoothing amplifiers used in the output of AIM-4F channels 20, 21, 22 and 23 and AIM-4G channel 23 are shown in Figure 13. IC1 is a two-pole active filter with a transfer function as follows:

$$\frac{E_o}{E_i} = \frac{1}{1 + b(RCs) + (RCs)^2}$$

where s is the La Place operator and b is the damping ratio.

The IC2 stage is a gain and level-shifting stage with a transfer function as follows:

$$E_{02} = \frac{R3}{R1} E_{01} - \frac{12R3}{R2}$$

The resistors connected to ground on the noninverting inputs of both amplifiers do not affect the transfer functions and are not labeled. These resistors are used to equalize the resistance-to-ground of both the inverting and noninverting inputs, a technique employed to minimize offset errors.

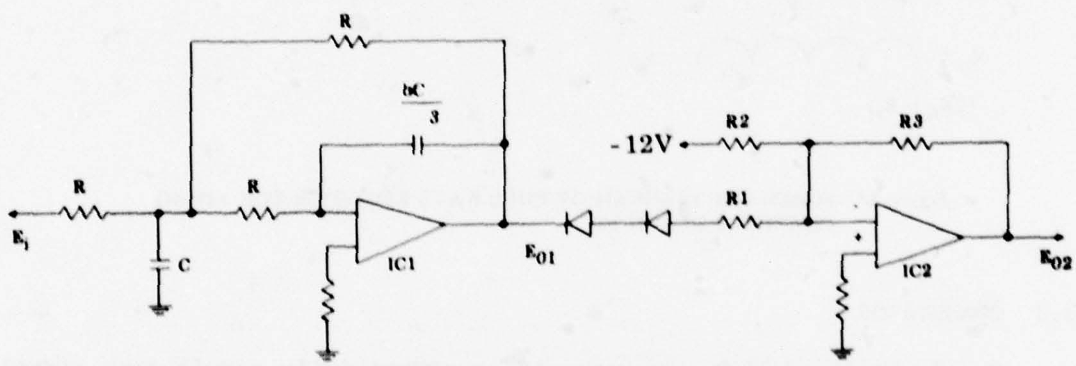


Figure 13. **SCHEMATIC DIAGRAM OF SCALING AND SMOOTHING AMPLIFIERS USED IN AIM-4F PULSE CIRCUITS AND AIM-4G ANTENNA-SPEED CIRCUIT**

3.2.2.7 Full-Wave Rectifier (AIM-4G Channels 22 and 26)

Full-wave rectification is achieved in AIM-4G channels 22 and 26 by using two operational amplifiers configured as shown in Figure 14. The first stage performs half-wave rectification, and the second stage sums the input voltage and the output of the first stage to produce the full-wave rectified output.

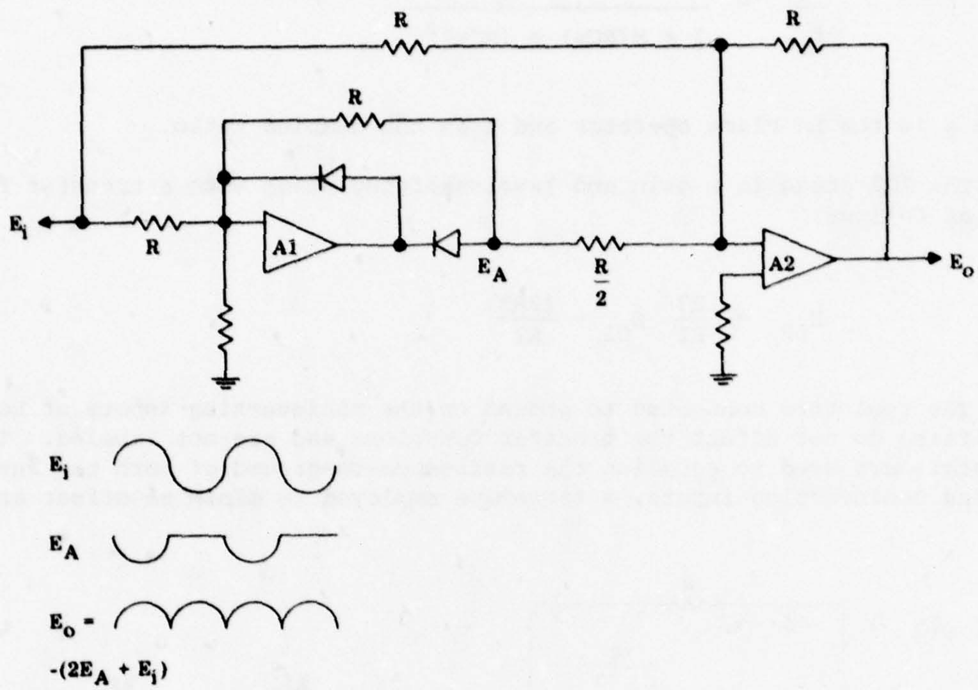


Figure 14. **SCHEMATIC DIAGRAM OF FULL WAVE RECTIFIER FOR AIM-4G CHANNELS 22 AND 26**

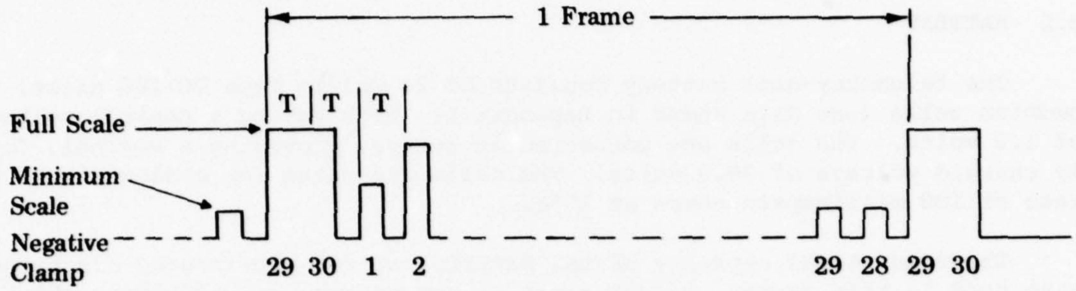
3.3 COMMUTATOR

The function of the commutator is to sequentially sample each signal-conditioner output to produce a single modulation signal. The output waveform of the AIM-4F/G telemetry commutator is shown in Figure 15; the following characteristics of this commutator can be noted:

- Synchronization is provided by a 1½-period maximum pulse located in channels 29 and 30.
- The commutator samples a particular channel for 50 percent of the allotted channel time and then returns to a -1.2 volt pedestal for the remaining 50 percent. This is known as a return-to-zero (RZ) format.

- A commutator frame contains 30 channels. The commutator rate can be adjusted to 5K, 10K, 20K, or 40K channels per second.

Appendix B contains the vendor specification sheet for the commutator.



Channel Rate, Channels per Second	Frames per Second	Data Response, Hz (Based on 5 Samples per Cycle)
40,000	1,333.3	266.6
20,000	666.6	133.3
10,000	333.3	66.6
5,000	166.6	33.3
Minimum Reference Channel — 27 or 28 Maximum Reference Channel — 29 or 30		

Figure 15. **COMMUTATOR OUTPUT FORMAT**

3.4 TRANSMITTERS

The P- and L-band transmitters are both 2-watt solid-state devices in identical housings (see specification sheets, Appendix B). The identical packages make it possible to convert a unit from one frequency band to the other by replacing the transmitter, power splitter, and antenna set. The transmitters both contain FM modulators, making it possible to drive the transmitters directly with the PAM output of the commutator.

The transmitter is mounted directly to the telemetry mounting plate, and high-thermal-conductivity lubricant (such as Dow 340 silicone heat-sink compound) is used to provide a thermal bond. Heat sinking is important because the transmitter self-heating (as much as 30 watts may be dissipated in the L-band unit) may cause the housing temperature to exceed the 85°C maximum if an adequate heat sink is not provided. The Vector Company indicated that if transmitter operation in a room-temperature environment without a heat sink resulted in a housing temperature exceeding 85°C, the output power might drop below the specified value but no catastrophic failure would result. It was emphasized, however, that the transmitter should not be operated when not bolted to a heat-dissipating plate.

3.5 BATTERY

The telemetry-unit battery consists of 24 Gulton Type VO.180 nickel cadmium cells (see data sheet in Appendix B), each having a nominal voltage of 1.2 volts. The cells are connected in series, providing a nominal, fully charged voltage of 28.8 volts. The cells are rated for a slow discharge rate of 180 milliampere hours at 25°C.

The theoretical capacity of the battery, at the accelerated discharge rate used in this system, is not given on the battery specification sheet. Battery discharge tests with an L-band unit (the unit drawing the most current) have resulted in operating times of a minimum of 90 seconds before the battery discharges to a 24-volt level.

The data sheet for the nickel cadmium cells (Appendix B) indicates two important precautions:

1. The battery should not be allowed to discharge to a voltage level that would lead to probable cell reversal. The cell voltage at which cell reversal can take place is 0.9 volt, and the corresponding battery voltage is 0.9 volt/cell × 24 cells, or 21.6 volts. To provide some margin of safety, the lowest voltage to which the battery should be allowed to drop is approximately 24 volts, the minimum for sustaining satisfactory system operation.

2. The battery should be charged at a current not to exceed 15 milliamperes. Battery chargers should thus be constant-current power supplies, which can be designed either by using a transistor as a constant-current source or by using a fixed resistor and a source voltage much higher than the battery voltage.

3.6 POWER SPLITTERS

The power splitter is a device that matches the transmitter output to the two antenna inputs with a minimum of power loss. Power splitters for the prototypes were made by using stripline techniques in the ARINC Research laboratory.

3.7 ANTENNAS

The antennas for the AIM-4F and AIM-4G telemetry system are mounted in two opposite forward stabilizer fins. These are the small dorsal surfaces mounted on the sleeve enclosing the guidance-electronics section. The antennas are fabricated by cutting out a section of the stabilizer and inserting an antenna element made from copper-clad fiberglass. The stabilizer is then built up to its original shape with epoxy and sanded, painted, and tested.

The antenna element is a hybrid J-match design, and VSWR measurements of less than 2:1 are achieved for both the P-band and the L-band designs. A rough antenna pattern was taken in the laboratory, and omnidirectional coverage was verified.

3.8 POWER SWITCHING

Paragraph 3.2 of the specification presented in Appendix A calls for the telemetry unit to transfer from external power to internal power upon the application of a momentary +28 volt signal. This requirement is fulfilled by the circuit shown in Figure 16.

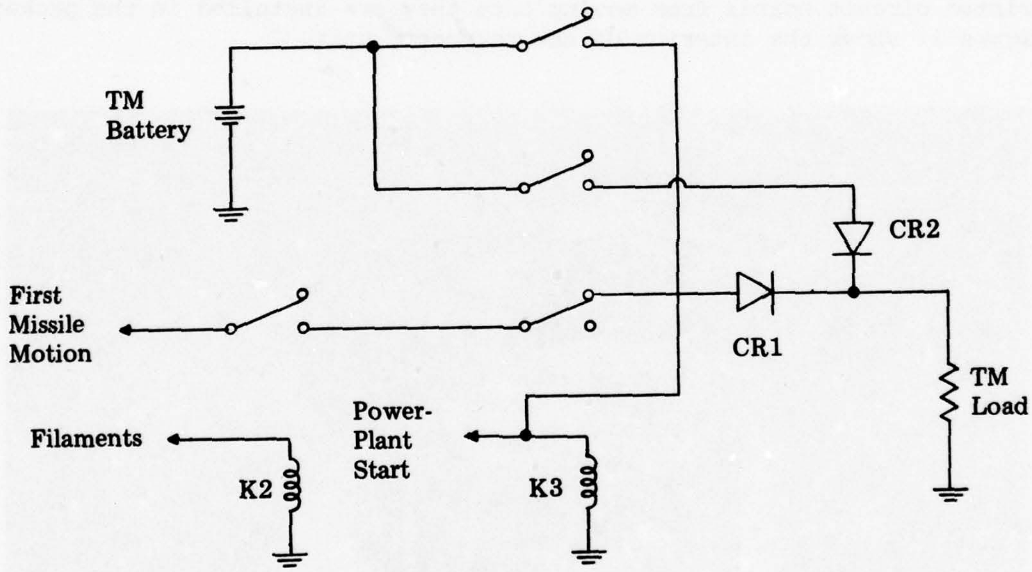


Figure 16. **POWER-SWITCHING CIRCUIT**

External power is first switched to the telemetry unit by the application of filament voltage to the coil of relay K2. External power is provided through the normally open contacts of K2 by "First Missile Motion" voltage, a +28 volt source.

The transfer from external (First Missile Motion) power to internal (battery) power is accomplished by relay K3, which is energized by the application of "Power Plant Start" voltage. K3 is latched in the energized position by the application of battery voltage through normally open contacts to the coil of K3.

3.9 MECHANICAL DESIGN

The main structural member of the telemetry system provided by Vector Company is an aluminum plate or shelf that accepts the mounting bolts passing through the side of the missile. The mounting holes are the same holes used for the warhead assembly. The transmitter and battery are mounted on the lower side of the plate, and the signal conditioner and commutator printed circuit cards are located in a housing above the plate. Power-transfer relays and telemetry power-supply power transistors are mounted directly on the top surface of the plate under the first signal-conditioner printed circuit card. The two commutator cards are hard-wired into the internal telemetry-unit cable, and the three conditioner cards are plugged into the subminiature connectors. Card guides are used to keep all five printed circuit boards from moving once they are installed in the package. Figure 17 shows the interior of the telemetry unit.

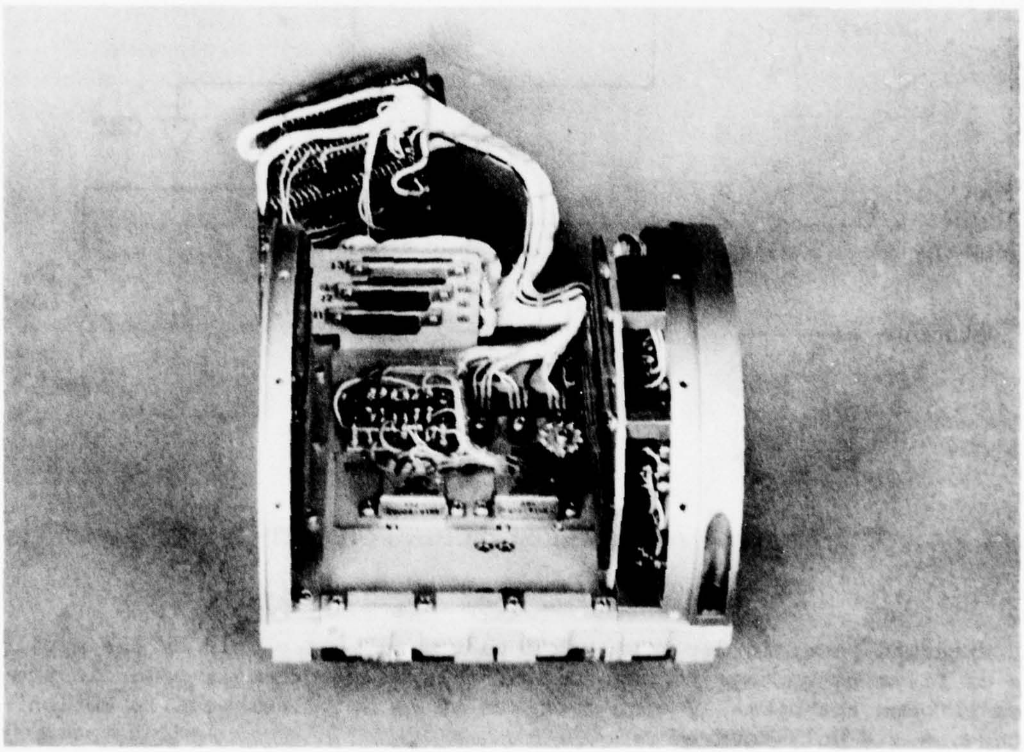


Figure 17. **TELEMETRY-UNIT INTERIOR**

3.10 RFI CONSIDERATIONS

Both the transmitter and the subassembly containing signal conditioners and commutator are enclosed in nickel-plated housings to minimize susceptibility to RFI. In addition, each signal lead passes through a feedthrough capacitor to enter the signal-conditioner/commutator housing. A single-point ground is provided by means of a metallic "mushroom" terminal bolted to the telemetry-unit base plate under the first signal-conditioner card.

CHAPTER FOUR

TEST RESULTS

Formal testing of the signal conditioner, commutator, transmitter, and battery assembly consisted of (1) an acceptance test of the AIM-4F unit to verify performance of each channel at room temperature and (2) a qualification test of the AIM-4G unit to verify performance in the specified environment. The results of these tests are given in the following paragraphs.

4.1 ACCEPTANCE-TEST RESULTS

4.1.1 Initial Acceptance Tests (March 1972)

Acceptance tests on both units involved three-point transfer-function tests, using simulated conditioner inputs and measuring outputs by measuring the commutator output pulse. The outputs were read by means of a Tektronix Type W plug-in unit, which provides a potentiometer-type measurement that permits pulses of 0 to 5 volts to be measured to oscilloscope resolutions of down to 20 millivolts per centimeter.

The results of the acceptance tests on both units indicated that all channels, with the exception of AIM-4F channels 20 through 23, exhibited errors of no more than ±1 percent of full scale (±50 millivolts). AIM-4F channels 20, 21, 22, and 23 were difficult to measure with a high degree of accuracy during acceptance tests. From oscilloscope measurements of relative pulse positions, it was determined that the transfer functions were accurate to approximately ±10 percent.

During the acceptance tests, all power- and signal-switching functions of the units were tested and found to be satisfactory; the commutator output was monitored while the transmitter was radiating through a test antenna in close proximity to the telemetry unit, to verify the absence of RFI effects.

4.1.2 Modified A3 Card Acceptance Tests (February 1973)

Three-point transfer-function tests of channels located on the modified A3 card assemblies were performed at the Vector facility. The data, presented in Appendix E, indicate that all channels conformed to the requirements of the revised specification.

4.2 QUALIFICATION-TEST RESULTS

Qualification tests were performed by the Vector Company on the AIM-4G telemetry package. The tests consisted of operating the unit under the environmental conditions specified in paragraph 3.3 of the specification in Appendix A. No failures were observed during the qualification tests. Appendix C contains the Qualification Test Plan. Data recorded during the tests, as well as the test data taken during transmitter acceptance tests, are presented in Appendix D. On the qualification-test data sheets, it will be noted that the recorded output voltages do not necessarily agree with the expected voltages. The reason for this apparent discrepancy is that during environmental tests, channels were stimulated with any convenient level to verify operation only.

CHAPTER FIVE

CONCLUSIONS

Laboratory tests have indicated that the AIM-4F and AIM-4G telemetry units are effective instrumentation packages. The final judgment cannot be made, however, until completion of integration tests at WRAMA and flight tests at Tyndall Air Force Base.

APPENDIX A

TELEMETRY-UNIT SPECIFICATION

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVED
A	Revised Special Measurement List	9/5/72	[signature]
B	Added Paragraphs 2.3, 3.1.4, 3.2.3 and 3.9 Revised Paragraphs 3.1.3, 3.2.2, 3.4.2, 3.6, 4.2.5, 4.2.6 and Channels 2, 14, 16, 17 and 18 of the Basic Measurement List	9/5/72	[signature]
C	Revised Pages 28, 29, 35 and 36	4-14-73	JP

AIM-4F and AIM-4G

TELEMETRY SPECIFICATION

November 1971

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACT. ± ~ DECIMALS .XX = ± ~ .XXX = ± ~ ANGLES ± ~	ARINC RESEARCH CORPORATION	
MATERIAL / TREATMENT / FINISH	DFTM. [signature] ENG. [signature] CHKD [signature] [signature]	TITLE TELEMETRY SYSTEM SPECIFICATION
NEXT ASSEMBLY: D000412 / USED ON / REF QTY.	SIZE A	DRAWING NO. A000223
SCALE ~		SHEET 1 OF

SYM.	DESCRIPTION	DATE	APPROVED

REVISIONS

CONTENTS

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1. SCOPE

This specification contains the technical requirements and quality assurance provisions for telemetry units to be installed in the AIM-4F and AIM-4G missiles. These missiles have the same warhead space available for telemetry equipment, but the AIM-4F is radar guided while the AIM-4G is infrared guided. The telemetry units shall be interchangeable between the two missiles except for plug-in signal conditioner modules to accommodate the measurements peculiar to the particular missile. The telemetry units shall also be capable of operating with either an L-band or a P-band transmitter with no modification required except the replacement of the transmitter and antennas.

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2. APPLICABLE DOCUMENTS

The following documents shall apply to this specification to the extent specified herein.

2.1 General Telemetry System Requirements

The performance of all telemetry unit subsystems shall conform to the standards set forth in the Inter-Range Instrumentation Group (IRIG) document 106-71, dated January 1971.

2.2 Environmental Test Specification

Pre-production environmental testing applicable will be accomplished according to the methods in MIL-STD-810B.

2.3 Drawings

Kit and installation drawings for the systems specified herein are ARINC Research Corporation drawing numbers:

D000410 for the AIM-4F and D000411 for the AIM-4G

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REVISIONS

3. REQUIREMENTS

3.1 Performance

The telemetry units shall consist of signal conditioners, commutator, modulator and transmitter with characteristics as indicated in succeeding paragraphs.

3.1.1 Transmitter Requirements

3.1.1.1 Frequency

The transmitter shall be capable of operating on any of the VHF frequencies given in Paragraph 5.1.2.1 of IRIG 106-71. The stability of the transmitter carrier frequency including variables such as operating time, supply voltage, temperature, acceleration, vibration and shock, will be ± .01 percent of the assigned carrier frequency. (Reference Paragraph 5.1.2.1.1 of IRIG 106-71).

3.1.1.2 Power

The output RF power shall be 2.0 watts minimum into a 50-ohm load impedance with a voltage standing wave ratio (VSWR) of less than 1.5:1.

3.1.1.3 Bandwidth

The bandwidth spurious emission and interference requirements of the transmitter output shall be in accordance with Paragraph 5.1.2.1.1 of IRIG 106-71.

3.1.2 Transmitter Interchangeability

The transmitter unit shall be capable of being converted from VHF (P-band) to UHF (L-band) operation by replacing the transmitter and antennas with no other modifications.

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3.1.3 Commutator Channel Rate

The commutator shall be capable of operating at channel rates of 5K, 10K, 20K and 40K pps, programmable by a jumper wire on the commutator sub-assembly. Stability of the channel rate shall be ± 2%.

3.1.4 Commutator Ripple and Noise

Ripple and noise on the commutator output pulse train shall be less than 20 millivolts, peak to peak.

3.1.5 Modulation Requirements

Modulation shall be PAM-FM conforming to IRIG requirements (Reference Paragraph 5.4 of IRIG 106-71).

3.1.6 Signal Conditioners

The signal conditioner module shall be a plug-in assembly separate from the commutator and transmitter assemblies. Measurement lists for the AIM-4F and AIM-4G are given in Tables 1 and 2 (at the back of this specification).

3.2 Power Requirements

3.2.1 Internal Power

The telemetry unit shall be equipped with an Internal power source capable of sustaining telemetry unit operation, in any specified environmental condition, for a period of not less than thirty (30) seconds.

3.2.2 External Power

The telemetry unit shall also be capable of operating with +28 ± 4 volt dc external power applied. The system shall tolerate ripple of up to 500 millivolts peak to peak and voltage transients up to ± 50 volts peak and 20 ms duration.

3.2.3 Power Switching

3.2.3.1 Initial Turn-On

Initial system turn-on, for operation with the external power described in paragraph 3.2.2, shall be accomplished by the application of missile filament power for 50 milliseconds. Filament power is 6 to 11 volts, rms and either 1600 Hz or 4900 Hz. The system shall remain energized until the removal of external power before "transfer to internal" or of internal power after "transfer to internal". Current drawn from the 6 to 11 volts rms source shall be less than 250 milliamperes.

3.2.3.2 Transfer to Internal Power

Transfer from external power (paragraph 3.2.2) operation to internal power (paragraph 3.2.1) operation shall be accomplished by the application of +28 ± 4 volts, dc for 50 milliseconds. In the event that initial turn-on is not accomplished by missile filament power as described in paragraph 3.2.3.1, the transfer signal shall be capable of accomplishing initial turn-on for operation on internal power.

3.3 Environmental Requirements

3.3.1 Vibration

The telemetry unit shall be capable of operation during and after exposure to the following vibration levels:

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Double Amplitude Displacement or g Level	Frequency Range
.2"	5 to 10 Hz
1g	10 to 18 Hz
.06"	18 to 40 Hz
5g	40 to 2,000 Hz

3.3.2 High Temperature

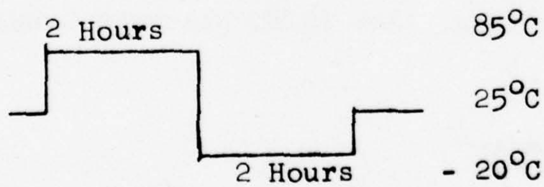
The telemetry unit shall be capable of operation during and after exposure to temperatures up to 85°C.

3.3.3 Low Temperature

The telemetry unit shall be capable of operation during and after exposure to temperatures down to -20°C without the aid of external heaters.

3.3.4 Temperature Shock

The telemetry unit shall be capable of operation during and after exposure to the temperature shock described in the diagram below:



(Transition times are 10 ± 2 minutes)

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3.3.5 Temperature - Altitude

The telemetry unit shall be capable of operation during and after exposure to a combination of pressure equivalent to 50,000 feet and a temperature of -20°C.

3.3.6 Shock

The telemetry unit shall be capable of operation during and after the application of a shock of 50 g's (15 ± 2 ms, ½ sine wave) along its longitudinal axis.

3.4 Interface Requirements

3.4.1 Electrical Interface

Suitable connectors shall be provided to the signal conditioner and transmitter subassemblies to achieve interface with the missile test points and antennas.

3.4.2 Mechanical Interface

The signal conditioner, commutator, transmitter assembly shall be designed for mounting in the warhead section of the AIM-4F and AIM-4G missiles, a cylindrical space 5.500 inches in diameter and 5.375 inches long. (See ARINC Research Drawing Number D000412.)

3.5 Operability

3.5.1 Maintainability

The mean time to replace a malfunctioned component in the telemetry unit shall not exceed 8 hours.

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3.5.2 Useful Life

(a) Operating life of the telemetry unit, excluding its battery power source, shall be no less than ten hours in any specified environmental condition.

(b) Operating life in the laboratory environment shall be 1,000 hours minimum, excluding the battery power source.

3.6 Weight

The completed telemetry unit (less cables and antenna) shall weigh no more than 5 pounds.

3.7 Component Parts

Military standard parts shall be used wherever possible. However, commercial parts can be used when no military part is available for a particular application provided the use of the part does not violate any other requirement in this specification.

3.8 Subsystem Interchangeability

All like components in the AIM-4F and AIM-4G telemetry units shall be physically interchangeable.

3.9 System Radio Frequency Interference (RFI) Requirements

The telemetry system shall be capable of satisfying all requirements specified herein with the transmitter radiating through 2 unity gain antennas positioned a maximum distance of 6 inches from the telemetry system, in any orientation. The noise appearing in the commutator output resulting from the radiated energy shall not exceed 50 millivolts, peak to peak.

4. QUALITY ASSURANCE PROVISIONS

Pre-production tests shall be performed on a sample of one unit to verify that the completed design conforms to the requirements in Section 3. Acceptance tests shall be performed on each production unit to establish reasonable assurance that the units are capable of operating in accordance with the requirements in Section 3.

4.1 Pre-Production Tests

4.1.1 Environmental Tests

4.1.1.1 Vibration

The system shall be subjected to the vibration tests in accordance with Method 514 of MIL-STD-810B, as follows:

Procedure II
Part 2
Curve P (Figure 514-3)

This test calls for the following vabration levels:

Double Amplitude Displacement of g Level	Frequency Range
.2"	5 to 10 Hz
1 g	10 to 18 Hz
.06"	18 to 40 Hz
5 g	40 to 2,000 Hz

4.1.1.2 High Temperature

The unit will be temperature tested in accordance with MIL-STD-810B, Method 501, Procedure I, with the following exceptions:

(a) The system will be stabilized at $85 \pm 2^{\circ}C$ for two hours prior to the application of electrical power.

(b) The unit will be operated at $85 \pm 2^{\circ}C$ for one hour with data on all channel outputs recorded.

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4.1.1.3 Low Temperature

The unit will be temperature tested in accordance with MIL-STD-810B, Method 502, Procedure I, with the following additions:

(a) The temperature in Step 2 shall be -20°C and

(b) The unit will be operated in accordance with Step 4 at -20°C.

4.1.1.4 Temperature Shocks

The unit will be subjected to temperature shock in accordance with MIL-STD-810B, Method 503, Procedure I, except the temperature profile shall be in accordance with Paragraph 3.1.4.4.

4.1.1.5 Temperature-Altitude

The unit will be placed in a test chamber and allowed to stabilize for two hours at a pressure equivalent to 50,000 feet and a temperature of -20°C. At the conclusion of the stabilization period, the unit will be operated for one hour. Data on all channels will be recorded.

4.1.1.6 Shock

The unit will be shock tested in accordance with MIL-STD-810B, Method 516, Procedure I. The shock table will be calibrated to the following specifications:

Force: 50 g

Duration: 15 ± 2 MS

Shape: ½ Sine Wave

4.2 Acceptance Test

4.2.1 Visual Inspection

Completed subassemblies shall be visually inspected to verify that fabrication has been accomplished in conformance to the best commercial practices.

4.2.2 Channel Accuracy

Signal conditioner/commutator assemblies shall be tested for conformance to the input vs. output values indicated in Table 1 and 2.

4.2.3 Transmitter Test

The following parameters shall be checked with the transmitter energized with 28 ± 1 volts and connected to a 50 ± 2 ohm dummy load.

(a) The frequency of the output waveform (unmodified) shall be within ± .01 percent of the assigned frequency. (Record this value).

(b) The frequency of the output waveform (unmodified) shall remain within ± .005 percent of the value established in (a). This stability requirement shall be verified by measuring frequency at the conclusion of (f) and comparing the result for the value measured in (a).

(c) The power output shall be 2.0 watts minimum.

(d) The current drain shall be 900 milliamperes maximum.

(e) The shape of the output waveform shall be a sine wave, free of spikes and noise.

(f) Using a spectrum analyzer, verify the absence of spurious emissions per Paragraph 3.1.1.3.

4.2.4 Final Acceptance Test

Signal conditioner, commutator,transmitter and cable assembly sets shall be tested for conformance to the parameters indicated in Tables 1 and 2. The telemetry unit output shall be measured at the transmitter output with a fifty ± 2 ohm load connected.

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4.2.5 Power Switching Test

Power switching shall be tested for conformance to the requirements in paragraph 3.2.

4.2.6 RFI Test

Monitor the commutator output to verify performance according to the requirements of paragraph 3.9.

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AIM-4F AND AIM-4G BASIC MEASUREMENT LIST

(First 19 Channels are common to both missiles)

Channel No. 1 - AGC

Transfer Function (For E_o = 0 - 5 Volts)	Input E_o = 0V	Input E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = -.5\ E_i$	0V	-10V	75	500K	3

Channel No. 2 - Filament

Transfer Function (For E_o = 0 - 5 Volts	Input E_o = 0V	Input E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = .2\ E_i$	0 V_{rms}	25 V_{rms}	100	1 Meg	3

Comments:

Double-ended measurement. Both ends of center-tapped transformer provided.

Channel No. 3, Pitch Error, and Channel No. 4, Yaw Error

Transfer Function (For E_o = 0 - 5 Volts)	Input E_o = 0V	Input E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = .1\ (E_A - E_B) + 2.5$	E_A=47.5V E_B=72.5V	E_A=72.5V E_B=47.5V	100	5 Meg	3
or	or				
$E_o = .05\ (E_A - E_B) + 2.5$	E_A=35V E_B=85V	E_A=85V E_B=35V			

Comments:

Scales changed by jumpering two resistors per channel.

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AIM-4F AND AIM-4G BASIC MEASUREMENT LIST (continued)

Channel No. 5, Pitch Summing, and Channel No. 6, Yaw Summing

Transfer Function (For E_o = 0 - 5 Volts)	Input E_o = 0V	Input E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = .0208\ (E_A - E_B) + 2.5$	E_A=85V E_B=205V	E_A=205V E_B= 85V	100	5 Meg	3

Channel No. 7, Flipper 1, Channel No. 8, Flipper 2, Channel No. 9, Flipper 3, and Channel No. 10, Flipper 4

Transfer Function (For E_o = 0 - 5 Volts)	Input E_o = 0V	Input E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = .0834\ (E_A - E_B) + 2.5$	E_A=62V E_B=92V	E_A=92V E_B=62V	100	10 Meg	3
or	or				
$E_o = .0417\ (E_A - E_B) + 2.5$	E_A=47V E_B=107V	E_A=107V E_B=47V			

Comments:

Scales changed by jumpering two resistors per channel.

Channel No. 11 - K Unregulated

Transfer Function (For E_o = 0 - 5 Volts)	Input E_o = 0V	Input E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = .05\ (E_1 = 295)$	295V	395V	250	1 Meg	3

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SYM.	DESCRIPTION	DATE	APPROVED

AIM-4F AND AIM-4G BASIC MEASUREMENT LIST (continued)

Channel No. 12 - K Regulated

Transfer Function (For E_o = 0 - 5 Volts)	Input E_o = 0V	E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = .125 (E_i - 220)$	220V	260V	250	1 Meg	3

Channel No.13 - C Regulated

Transfer Function (For E_o = 0 - 5 Volts)	Input E_o = 0V	E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = -.125 (E_i + 120)$	-120V	-160V	250	1 Meg	3

Channel No. 14 - Track Error

Transfer Function (For E_o = 0 - 5 Volts)	Input E_o = 0V	E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = .1668 E_i + 2.5$	-15V Peak	+15V Peak	250	1 Meg	3

Comments:

1. Quiescent level is -50 volts dc.
2. Jumper channel 14 to channel 27 at commutator input to double the sample rate for this channel

Channel No. 15 - Roll Damping

Transfer Function (For E_o = 0 - 5 Volts)	E_o = 0V	E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% Of Full Scale)
$E_o = .25 (E_A - E_B) + 2.5$	E_A=135V E_B=145V	E_A=145V E_B=135V	100	1 Meg	3

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AIM-4F AND AIM-4G BASIC MEASUREMENT LIST (Continued)

Channel No. 16 - HPS/Sequence Detector

Transfer Function (For E_o = 0 - 5 Volts)	Input E_o = 0V	Input E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = E_i$	0V	5V	250	-	3

Comments:

1. Provide 5 volts (5 ma) excitation voltage for the Hydraulic Power Supply (HPS) pressure transducer and the photosensitive device described in 2 (c) below.
2. Superimpose transient, event-marker pulses on this measurement channel as follows:
   (a) Upon application of the +28 ± 4 volt dc "Power Plant Start" voltage, a +4 volt, minimum pulse with a duration of 200 milliseconds, minimum at the 50% amplitude points shall appear at the output of the signal conditioner.
   (b) Upon removal of the 28 ± 4 volt dc "First Motion" voltage a +4 volt, minimum pulse with a duration of 200 milliseconds, minimum at the 50% amplitude points shall appear at the output of the signal conditioner. After removal of the "First Motion Voltage", a resistance of 100 ohms to ground remains at the test point terminal.
   (c) Upon application of a 5 volt, 10 millisecond pulse from the photosensitive device sensing HPS squib activation, generate a +4 volt minimum pulse with a duration of 200 milliseconds minimum at the output of the signal conditioner. The photosensitive device is a part of the cable assembly; the five volt excitation voltage is to be provided by the telemetry unit. The source resistance of the photosensitive cell during the application of the pulse is no more than 100 ohms.
3. The transient voltages described above are expected to occur prior to the appearance of the steady state pressure reading and thus the 4 volt pulses will remain within full scale limits. In the event one of the transients occurs while a pressure reading is present that pulse can exceed the full scale reading.

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AIM-4F AND AIM-4G BASIC MEASUREMENT LIST (Continued)

Channel No. 17, Pitch Head Position, and Channel No. 18, Yaw Head Position

Transfer Function (For E_o = 0 - 5 Volts)	Input E_o = 0V	E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = .1\ E_i$	0V	50V	250	1 Meg	3

Comments:

A 50 $\pm$ .5 Vdc excitation voltage is required for this measurement after launch. The K regulated voltage (channel 12 input) can be used as the source of this voltage provided no more than 7 milliamperes is drawn from this supply. Head position potentiometers provide a resistance to ground of 20K each or 10K for the parallel combination. The excitation voltage shall be applied upon the removal of "First Missile Motion" voltage (28 $\pm$ 4V).

Channel 19 - Rate Gyro Power

Transfer Function (For E_o = 0 - 5 Volts)	E_o = 0V	E_o = 5V	Frequency Response (Hz)	Input Impedance	Accuracy (% of Full Scale)
$E_o = .125\ E_i$	$0V_{rms}$	$40V_{rms}$	250	1 Meg	3

Comments:

Double-ended measurement

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AIM-4F AND AIM-4G BASIC MEASUREMENT LIST (Continued)

NOTES:

1. For "Transfer Function" column, E_o = signal conditioner output voltage; E_1 = signal conditioner input voltage.

2. In "Input" column, V indicates steady dc or slowly varying dc voltage level. See "Frequency Response" column for required data response.

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AIM-4F SPECIAL MEASUREMENT LIST (Revised)

Channel 20 - Gate Pusher Pulse (GPP)

Test Point: J301-B

Source Resistance: 190 Ohms

Nominal Input: -1.5 volt pulse, 1.5 us wide

Pulse Measurement Threshold: -.75 ± .1 volt

Transfer Function:

Input	Output
Pulse Absence	0.5 ± .25 volt
1.2 us pulse	1 volt
1.8 us pulse	5 volts

Frequency Response: 250 Hz

Input Resistance: 10K (Minimum)

Input Capacitance to Ground: 100 pf (Maximum) (See Note 6)

Accuracy: ± 5%

Special Requirements: Linear volts/us scale between 1 V and 5 V outputs.

SYM.	DESCRIPTION	DATE	APPROVED

REVISIONS

AIM-4F SPECIAL MEASUREMENT LIST (Revised)
(Continued)

Channel 21 - Pre-Launch: Missile Range Gate (MRG)/Radar Range Gate (RRG), Relative Pulse Position

Post-Launch: MRG/GPP Relative Pulse Position

Test Points:	GPP	J301-B
	MRG	J501-S
	RRG	J301-C
Source Resistance:	GPP	190 Ohms
	MRG	50 Ohms
	RRG	50 Ohms (See Note 2)
Nominal Input:	GPP	-1.5V, 1.5 us
	MRG	+4.5V, 1 us
	RRG	+28V, .5 us
Pulse Measurement Threshold:	GPP	-.75 ± .1V
	MRG	2.0 ± 0.25V
	RRG	15 ± 1V

Transfer Function:

Pre-Launch: $E_o = 2.5 (T_2 - T_1) + 2.5$ volts (See Note 4)

Post-Launch: $E_o = 2.5 (T_3 - T_1) + 2.5$ volts (See Note 4)

where:

T_1 = MRG leading edge

T_2 = RRG leading edge

T_3 = GPP trailing edge

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AIM-4F SPECIAL MEASUREMENT LIST (Revised)
(Continued)

Channel 21 - (Continued)

Frequency Response: 250 Hz

Input Resistance: 10K minimum (each pulse)

Input Capacitance: GPP - 100 pf (max.) (See Note 6)

MRG - 100 pf (max.) (See Note 6)

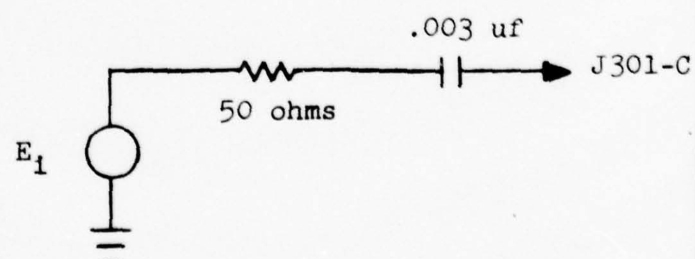
RRG - 400 pf (max.)

Accuracy: ± 5%

Special Notes:

1. RRG and GPP pulse trains do not occur simultaneously

2. RRG is capacitor coupled with .003 uf as shown below:



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AIM-4F SPECIAL MEASUREMENT LIST (Revised)
(Continued)

Channel 22 - MRG/Target Video

Test Points:	MRG	J501-S
	Tgt Video	J501-E
Source Resistance:	MRG	50 Ohms
	Tgt Video	795 Ohms
Nominal Input:	MRG	+4.5V, 1 us
	Tgt Video	+1V, .75 us (Unloaded)
Transfer Function:	$E_o = 2.5\ (T_4 - T_1) + 2.5$ volts (See Note 4)	
	where:	
	T_1 = MRG leading edge and	
	T_4 = Tgt video leading edge	
Pulse Measurement Threshold:	MRG	2.0 ± 0.25V
	Tgt Video	.5 ± .1V
Frequency Response:	250 Hz	
Input Resistance:	10K minimum (each pulse)	
Input Capacitance:	100 pf maximum (each pulse) (see Note 6)	
Accuracy:	± 5%	

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AIM-4F SPECIAL MEASUREMENT LIST (Revised)
(Continued)

Channel 23 - Target Video Presence

Test Point: J501-E

Source Resistance: 795 Ohms

Nominal Input +1V, .75 us

Transfer Function:

E_{in}	E_{out}
Pulse Absence	1.0 Volt
Video in Low Noise	2.5 Volts (See Notes Below)
Video in High Noise	4.0 Volts (See Notes Below)

Frequency Response: 250 Hz

Input Resistance: 10K (minimum)

Input Capacitance: 100 pf (maximum) (See Note 6)

Accuracy: ± 5%

Notes:

1. The video pulse is to be sensed at a threshold level above the noise. The threshold level is to be variable using a potentiometer from 0.25 volts to 1.25 volts. Any signal from the video test point exceeding this threshold, whether target pulse or noise peak, shall be treated as a valid input signal.
2. Low noise is defined as any amplitude value from 0 to 1.0 volts peak to peak with a bandwidth of 5 ± 1 MHz.
3. High noise is defined as any amplitude value from 2 to 8 volts peak to peak with a bandwidth of 5 ± 1 MHz.
4. Transition from low noise to high noise state is to occur at 1.5V ± 0.5V.
5. The video pulse can be as high as 5 volts peak.

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AIM-4F SPECIAL MEASUREMENT LIST (Revised)
(Continued)

Channel 24 - Diode Bias

Test Point:	TP701
Source Resistance:	200 Ohms
Nominal Input:	.5 Volt dc
Transfer Function:	$E_o = 5\ E_i$ Volts
Frequency Response:	250 Hz
Input Resistance:	10K minimum
Accuracy:	±3%

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AIM-4F SPECIAL MEASUREMENT LIST (Revised)

(Continued)

Channel 25 - RF Channel Select

Test Point:	J741-S
Source Resistance:	1 Meg
Nominal Input:	-60 to -85 Volts, dc
Transfer Function:	$E_o = .20 (E_i + 85)$ Volts
Frequency Response:	30 Hz
Input Resistance:	10 Megs (minimum)
Accuracy:	± 3%
Special Requirements:	1 Meg source resistance to be included in transfer function; accuracy requirement applies to internal telemetry unit circuits only. See Note 7.

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REVISIONS

AIM-4F SPECIAL MEASUREMENT LIST (Revised)
(Continued)

<u>Channel 26 - AFC Dither</u>

Test Point:	J741-S
Source Resistance:	1 Meg
Nominal Input:	2.5 V_{rms} (system untuned)
	700 mv rms (system tuned)
Transfer Function:	$E_o = .5\ E_i + 2.5$ Volts
Frequency Response:	250 Hz
Input Resistance:	10 Megs
Accuracy:	± 3%
Special Requirements:	1. Dither frequency is 75 Hz.
	2. Input has -90V maximum dc level
	3. Include voltage division by feedthrough capacitor and loading effect of channel 25 in transfer function. See Note 7.

<u>All Pulse Channels</u>

For each pulse channel, provide sufficient noise suppression and crosstalk suppression to keep noise and crosstalk to a level less than fifty (50) percent of the pulse threshold level measured at the input point of the first pulse sensing circuit (Comparator).

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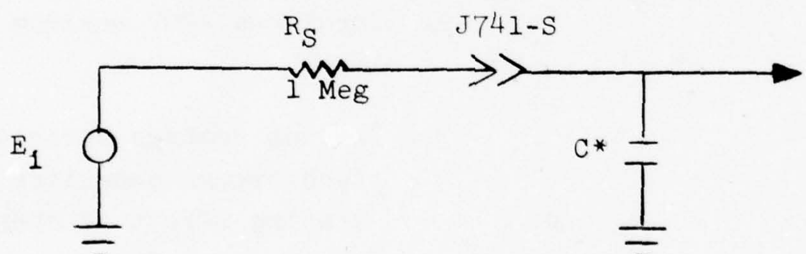
AIM-4F SPECIAL MEASUREMENT LIST (Revised)

Notes:

1. All pulse width values are referenced to fifty-percent pulse amplitude, unless otherwise stated.
2. "Source Resistance" specifies the output resistance of the missile circuitry associated with the test point.
3. "Input Resistance" specifies the minimum allowable input resistance of the signal conditioner circuitry.
4. "$(T_i - T_1)$" is positive if T_1 occurs before T_i, and negative if T_i occurs before T_1. T_i is T_2, T_3, or T_4. Units of time difference are in microseconds.
5. "Nominal Input" is nominal input voltage to the signal conditioner.
6. The total input capacitance on the test point of signal conditioner circuitry of all channels shall not exceed 100 pf.
7. Equivalent circuit of Test Point J741-S:



C* = Feedthrough capacitor in TM unit.

8. E_o is signal conditioner output voltage. E_1 is signal conditioner input voltage, except where otherwise stated.

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AIM-4G SPECIAL MEASUREMENT LIST (Revised)

Channel 20 - Trigger Loop

Test Points: J2610 - E, D

Conditioner to consist of resistor network energized by internal telemetry +28 volts and a differential amplifier. From +28 volts to ground, attach the following series combination: 250K, 50K, 200K, and 100K. Test points indicated above to be connected across the 200K resistor, monitor voltage across the 50K resistor with a differential amplifier. Voltage transfer function of differential amplifier to be 1:1. Frequency response to be 250 Hz. See note 1. Input resistance to be 1 Meg ohm in each leg.

Channel 21 - Roll Damping

Test Point:	P2301 - A, C
Source Resistance:	51K
Transfer Function:	$E_O = .250 (E_B - E_A) + 2.5$ volts
Input/Output Range:	For $E_O = 0V$, $E_A = .5V$, $E_B = -9.5V$
	For $E_O = 5V$, $E_A = -9.5V$, $E_B = .5V$
Frequency Response:	100 Hz
Minimum Input Resistance:	1 Meg
Accuracy:	± 3%

Note: Input voltages E_A and E_B can have -150V transients during turn-on.

AIM-4G SPECIAL MEASUREMENT LIST (Revised)
(Continued)

Channel 22 - Antenna Gyro Power

Test Points: J2102-12, 14

Source Resistance: 100 Ohms

Transfer Function: $E_o = .05\ E_i$ (rms)

Input/Output Range: For E_o = 0V, E_i = 0 $V_{(rms)}$ @ 400 Hz

For E_o = 5V, E_i = 100 $V_{(rms)}$ @ 400 Hz

Frequency Response: 40 Hz

Input Resistance: 1 Meg

Accuracy $\pm$ 3%

Special Note: Double-ended measurement; i.e., E_i is voltage difference between test point J2102-12 and test point J2102-14.

Channel 23 - Antenna Speed

Test Point: J301-c

Source Resistance: 100 Ohms

Transfer Function: Classified CONFIDENTIAL

Input Pulse: 3V, 200 us (Sense at 2 $\pm$ 0.2 volt level)

Frequency Response: 10 Hz

Input Resistance: 50K (minimum)

Accuracy: $\pm$ 3%

Special Note: Value and accuracy of E_o to be independent of variations in input pulse width. and pulse amplitude.

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AIM-4G SPECIAL MEASUREMENT LIST (Revised)

(Continued)

Channel 24 - Pitch Damping

Test Points: P2301-F, D

Source Resistance: 51K

Transfer Function: $E_o = .5\ (E_A - E_B) + 2.5$ volts

Input/Output Limits: For $E_o = 0V$, $E_A = V_o - 2.5V$

$E_B = V_o + 2.5V$

For $E_o = 5V$, $E_A = V_o + 2.5V$

$E_B = V_o - 2.5V$

where:

$V_o \cong -80$ volts

Frequency Response: 100 Hz

Input Resistance: 1 Meg

Accuracy: $\pm 3\%$

Special Note: E_A is voltage at P2301-F

E_B is voltage at P2301-D

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AIM-4G SPECIAL MEASUREMENT LIST (Revised)
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Channel 25 - Yaw Damping

Test Points: P2301-K, H

Source Resistance: 51K

Transfer Function: $E_o = .5\ (E_A - E_B) + 2.5$ volts

Input/Output Limits: For $E_o = 0V$, $E_A = V_o - 2.5V$

$E_B = V_o + 2.5V$

For $E_o = 5V$, $E_A = V_o + 2.5V$

$E_B = V_o - 2.5V$

where:

$V_o \cong -80$ volts

Frequency Response: 100 Hz

Input Resistance: 1 Meg

Accuracy: $\pm 3\%$

Special Note: E_A is voltage at P2301-K

E_B is voltage at P2301-H

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AIM-4G SPECIAL MEASUREMENT LIST (Revised)
(Continued)

Channel 26 - Carrier Signal

Test Point: J401-N

Source Resistance: 3.43K

Transfer Function: $E_o = 2.5\ E_i$ (rms) Volts Sine Wave

Input/Output Limits: For $E_o = 0V$, $E_i = 0\ V_{rms}$

$E_o = 5V$, $E_i = 2\ V_{rms}$

Frequency Response: -250 Hz

Input Resistance: 1 Meg (minimum)

Accuracy: ± 3%

Special Requirements: Test point is capacitor coupled with .001 uf (see Note 2). Telemetry load capacitance for this channel shall be less than 50 pf to minimize its effect on the transfer function.

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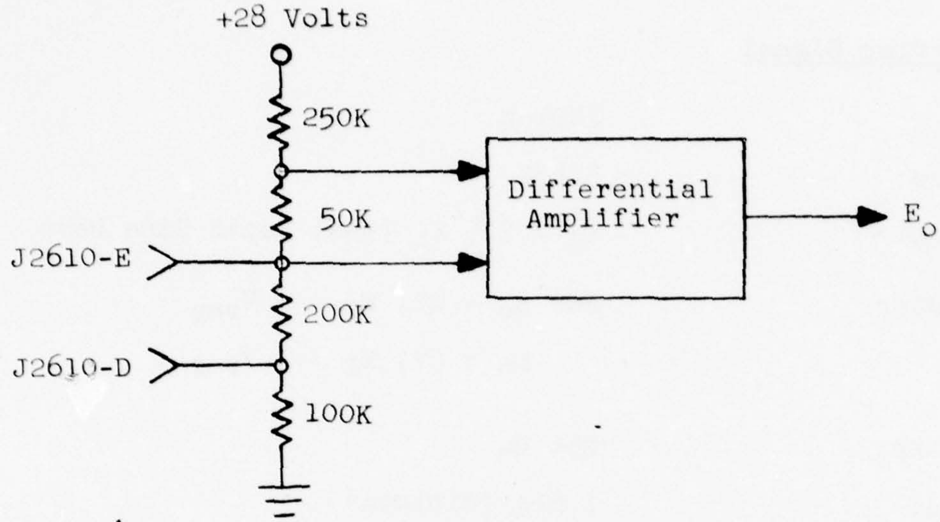
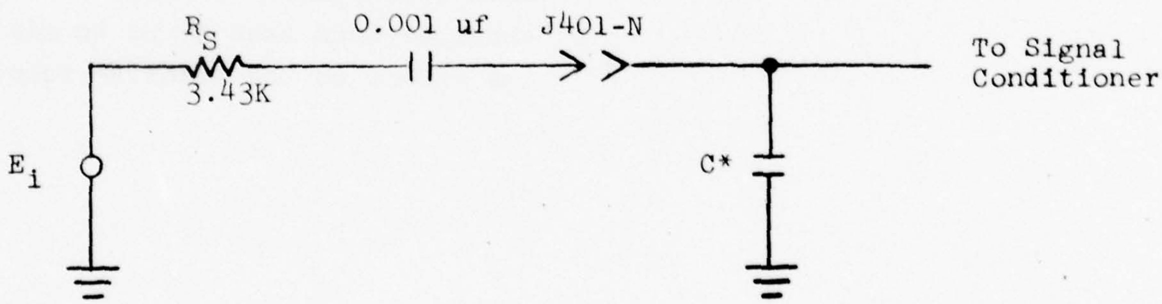
AIM-4G SPECIAL MEASUREMENT LIST (Revised)

Notes:

1. The Channel 20 resistor network is as follows:



2. Equivalent circuit:



C* = Telemetry capacitive load

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AIM-4G SPECIAL MEASUREMENT LIST (Revised)

Notes: (continued)

3. All pulse width values are referenced to fifty-percent pulse amplitude, unless otherwise stated.

4. "Source Resistance" specifies the output resistance of the missile circuitry associated with the test point.

5. "Input Resistance" specifies the minimum allowable input resistance of the signal conditioner circuitry.

6. "Nominal Input" is nominal input voltage to the signal conditioner.

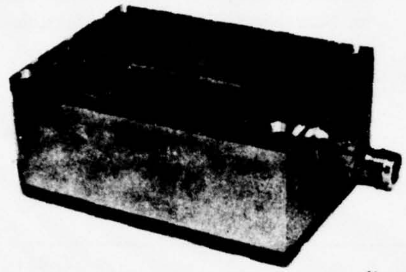
7. E_o is signal conditioner output voltage. E_i is signal conditioner input voltage, except where otherwise stated.

APPENDIX B

COMMERCIAL EQUIPMENT SPECIFICATION SHEETS

VHF FM TRANSMITTER
T-1202 Series

Vector an AYDIN COMPANY



½ actual size

- 2 Watts Minimum Power
- High Efficiency
- Meets IRIG 106-71
- Minimum Size and Weight

The Vector T-1202 Series is an all-transistorized, crystal-stabilized, true FM telemetry transmitter capable of transmitting the intelligence from either analog or digital telemetry multiplex systems. The transmitter is designed for extremely reliable operation under the stringent environmental conditions encountered by manned aircraft, guided missiles, satellites, and space vehicles.

The transmitter is contained in a sealed aluminum case. Special circuits in the transmitter provide protection against damage when operating into a shorted or open load; and protection against damage resulting from reversal of the operating power leads. The T-1202 contains a power line regulator assuring uniform performance over the entire input voltage range and compliance to power line conducted susceptibility and interference requirements. B+ and modulation are isolated from chassis ground.

ELECTRICAL SPECIFICATIONS

POWER OUTPUT: 4 watts nominal at 25°C, 2 watts minimum over environment.

OUTPUT IMPEDANCE: 50 ohms.

FREQUENCY RANGE: 215 to 260 MHz.

OUTPUT FREQUENCY STABILITY: IRIG 106-71 (±0.003%, including drift due to environment available on special order.)

CARRIER DEVIATION: ±125 kHz nominal.

TYPE OF MODULATION: True FM.

INPUT IMPEDANCE: 50 ohms to 100 kilohms, shunted by 25 pF maximum. (20 kilohm min std.)

MODULATION SENSITIVITY: 0.5 volt rms (±10%) for 125 kHz deviation.

FREQUENCY RESPONSE: 100 Hz to 125 kHz ±1.5 dB (dc coupling and response to 1 MHz available).

MODULATION DISTORTION: Less than 2% for 100 kHz deviation at 10 kHz modulating frequency.

LINEARITY: ±1% of best straight line for 125 kHz deviation measured at 10 kHz modulating frequency.

HARMONIC AND SPURIOUS OUTPUTS: In accordance with IRIG-106 71

NOISE: Less than 1 kHz p-p equivalent noise deviation when tested under vibration.

POWER REQUIREMENT: 450 mA maximum over the specified supply voltage and environmental range.

INPUT VOLTAGE: 28 ±4 Vdc.

Vector an AYDIN COMPANY / P.O. Box 328, Newtown, Pa. 18940
Main Offices & Plant: Newtown Industrial Commons, Newtown, Pa.

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE: –20°C to +80°C (wider temperature range available on special order).

HUMIDITY: *90% relative humidity.*

ALTITUDE: Sea level to vacuum. Tested to 250,000 feet.

VIBRATION: 0.4 inch double amplitude, 5 to 50 cps; 20 g from 50 cps to 2000 cps in each of three major axes.

SHOCK: 100 g for 11 milliseconds in any plane.

ACCELERATION: 100 g in any plane.

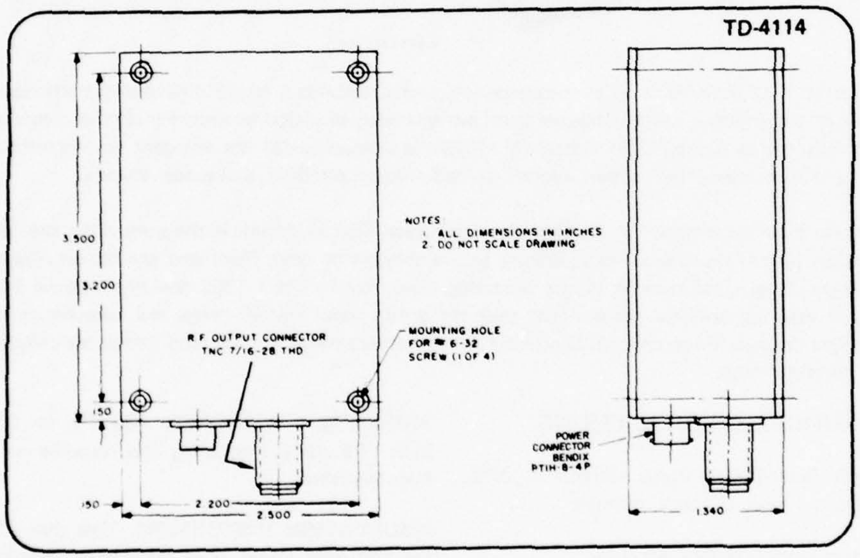
MECHANICAL SPECIFICATIONS

SIZE: See outline drawing

WEIGHT: 15 ounces.

MOUNTING: Clearance holes for four No. 6-32 mounting screws on 2.2 inch by 3.2 inch centers. Available with adaptive mounting plate for interchangeability with prior models.

CONNECTORS: Power connector, Bendix PT1H-8-4P. RF output, TNC 7/16-28THD. Other connectors available.



ORDERING INFORMATION

When ordering specify Vector model number T-1202, part number 27064003, and exact operating frequency in megahertz. For special applications or additional information, contact Vector or the nearest sales representative.

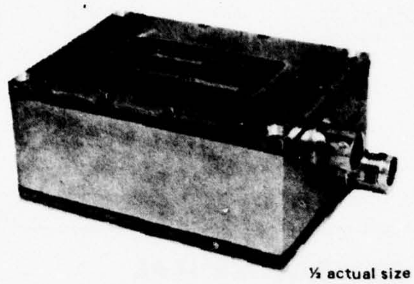
Bulletin No. 27064-3/6-72-3M/Printed in U.S.A.

Vector an AYDIN COMPANY
Phone 215-968-4271/TWX 510-667-2320

REPRESENTATIVE

UHF TELEMETRY TRANSMITTER
T-102S/L Series

Vector an AYDIN COMPANY



½ actual size

- 2 Watts Minimum Power
- L- and S-Band Models
- Minimum Size and Weight
- Meets Latest IRIG Specifications for Stability and EMI
- Wideband Response DC to 1 MHz
- Internal Output Circulator
- Internal Power Line Regulator

The Vector T-102 Series UHF Transmitters are designed for operation in aerospace environments where size, weight and power efficiency are critical.

These transmitters incorporate the most advanced component technologies. Extensive utilization is made of recently developed integrated circuits to enhance overall unit performance. Sophisticated circuit techniques based on many years of experience in RF circuit design are employed providing exceptional performance specifications. The T-102 series transmitters offer superior modulation characteristics: i.e., frequency response from DC to 1 MHz, deviation sensitivity of ± 750 kHz/volt rms and low harmonic distortion. An output circulator internal to the unit allows operation into any load impedance including short and open circuits. The T-102 contains a power line regulator assuring uniform performance over the entire *allowable input voltage range* and compliance to power line conducted susceptibility and interference requirements.

The standard T-102 transmitter specifications meet the requirements of the majorit, of telemetry applications. Numerous modification can be accommodated and additional features incorporated to meet specific customer requirements.

ELECTRICAL SPECIFICATIONS

T-102 performance specifications are in accordance with the latest requirements of the telemetry ranges as well as all applicable IRIG standards.

OUTPUT CHARACTERISTICS

RF POWER OUTPUT: 2 watts minimum into 50 ohm load with VSWR up to 1.5:1.

RF LOAD: Stable operation into any load impedance. Output circulator allows continuous operation into open or short circuit.

OUTPUT FREQUENCY: Crystal controlled center frequency for S-band (between 2200-2300 MHz) and for L-band (between 1435-1540 MHz).

OUTPUT FREQUENCY STABILITY: ± 0.003% of specified, including setting tolerance and drift due to environment.

HARMONIC AND SPURIOUS OUTPUTS: In accordance with IRIG 106-66.

MODULATION CHARACTERISTICS

MODULATION TYPE: FM (PM available).

INPUT IMPEDANCE: 50 ohms to 100 kilohm.

DEVIATION SENSITIVITY: T-102/S, up to ± 750 kHz/volt rms. T-102/L, up to ± 500 kHz/volt rms.

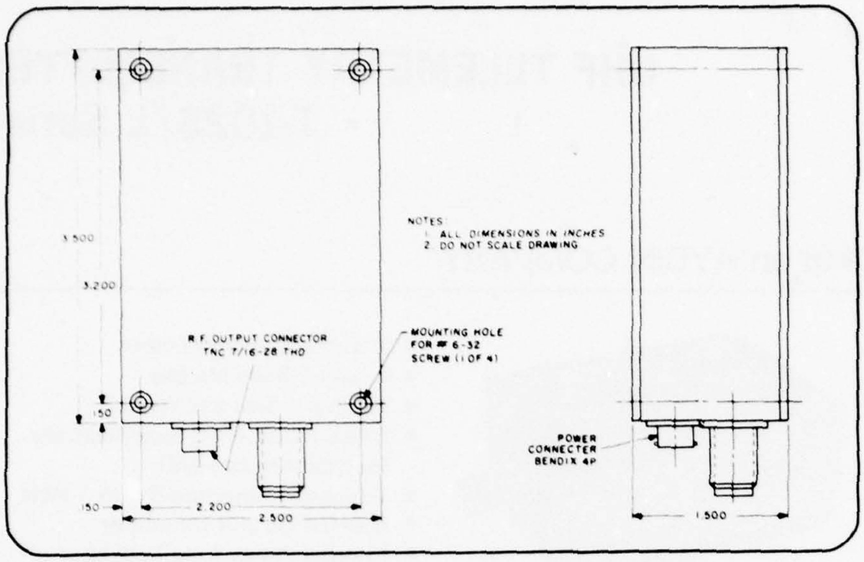
FREQUENCY RESPONSE: DC to 1 MHz ± 1.0 dB.

DEVIATION CAPABILITY: T-102/S, ± 900 kHz maximum. T-102/L, ± 500 kHz maximum.

LINEARITY: 1.0% maximum, best straight line for; T-102/S, ± 750 kHz deviation; T-102/L, ± 500 kHz deviation.

Vector an AYDIN COMPANY / P.O. Box 328, Newtown, Pa. 18940

Main Offices & Plant: Newtown Industrial Commons, Newtown, Pa.



TOTAL HARMONIC DISTORTION: 1.0% maximum for; T-102/S, ± 500 kHz deviation; T-102/L, ± 330 kHz deviation.

POWER SUPPLY CHARACTERISTICS

INPUT VOLTAGE: 28 ± 4 volts, (29 ± 4 volts with optional reverse polarity protection).

INPUT CURRENT: 1.0 amp maximum.

MECHANICAL SPECIFICATIONS

SIZE: 3.5" x 2.5" x 1.5" excluding connectors.

MOUNTING: 6-32 screw on 4 corners, options available.

WEIGHT: 16 oz. maximum.

ENVIRONMENTAL SPECIFICATIONS

All performance specifications will be met under the following conditions:

BASEPLATE TEMPERATURE: −25° to +85°C.

VIBRATION: Sinusoidal at 20g from 20 to 2000 cps in each axis.

SHOCK: 1/2 sine at 50g for 11 milliseconds in each axis.

ACCELERATION: 100g, each axis.

ALTITUDE: Unlimited.

CONNECTORS: Modulation and Supply, Bendix PT02H-8-4P; RF output, TNC female.

QUALITY CONTROL AND PRODUCT ASSURANCE

The Vector T-102 Series transmitter is manufactured under strict Quality Control procedures in accordance with the requirements of MIL-Q-9859A. Additionally, all semiconductors and integrated circuits used in the T-102 are subjected to intensive component preconditioning procedures. Each assembled unit is fully tested to a comprehensive Acceptance Test procedure which includes full performance testing at the thermal extremes.

Vector has participated in numerous "hi-rel" aerospace programs which have required exhaustive component screening, preconditioning and selection procedures. These "hi-rel" procedures or specific customer generated requirements can be invoked in the manufacture of the T-102 series transmitters if necessary.

ORDERING INFORMATION

When ordering specify model number (T-102/S for S-band, T-102/L for L-band) and exact operating frequency in megahertz. For special applications or additional information, contact Vector or the nearest sales representative.

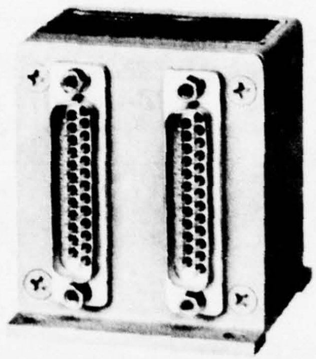
9-69-3M/Printed in USA

Vector an AYDIN COMPANY
Phone 215-968-4271/TWX 510-667-2320

REPRESENTATIVE

AIRBORNE COMMUTATOR
CSV-100 Series

Vector an AYDIN COMPANY



- PAM, PDM, RZ, NRZ
- Expandable Channel Capacity
- Solid State Reliability
- Rates to 100,000 Hz
- Fully Potted, Ruggedized, Flight Qualified

Vector CSV-100 series airborne solid state commutators are versatile, rugged units designed to provide an accurate, stable telemetry pulse train in standard IRIG or special formats. Modular design flexibility permits PAM or PDM outputs, RZ or NRZ. The flexible MOSFET design offers a wide variety of channel quantity and rate combinations with or without internal power ground isolation.

Vector commutators may be ordered in standard or special configurations to meet ordnance, missile, or satellite telemetry applications, and special ordnance design techniques permit shock protection up to 43,000 G's. Small size, light weight, expandable channel capacity, and flight-qualified solid state circuitry make Vector electonic commutators ideal for aerospace telemetry programs.

PAM/PDM SPECIFICATIONS

PAM CHARACTERISTICS

OFFSET: ±5 millivolts maximum (common to all channels).

SCATTER: ±1 millivolt maximum (channel to channel variation).

CROSSTALK: ±0.1% including the case with over-voltage on adjacent channels.

LINEARITY: Less than 0.05% deviation from best straight line.

GAIN: 0.9975 ±0.0025.

OUTPUT FORMAT: Standard–NRZ (100% duty cycle) and RZ (50% duty cycle) formats per telemetry standard IRIG 106-66. In the RZ format a negative pedestal equal to 25% of deviation range for one-half the duration of each channel time slot is provided. The master pulse has an amplitude equal to the full scale signal output and a duration of 1.5 T. (Where T = channel period.) The stability of the pedestal and master pulse levels is ±0.2%.

OUTPUT LIMITING: Provisions are made such that outputs corresponding to channels where overvoltages exist are limited as specified in the table:

Positive Overvoltage	A maximum of 1.0 volt above full scale
Negative Overvoltage	Between zero and negative pedestal level

Vector an AYDIN COMPANY / P.O. Box 328, Newtown, Pa. 18940
Main Offices & Plant: Newtown Industrial Commons, Newtown, Pa.

PDM CHARACTERISTICS

PDM FORMAT: Standard–PDM pulsetrain is in accordance with telemetry standard IRIG 106-66. An internal frame synchronization consisting of a pulse gap equal to two channel periods in duration is provided. Simultaneous PAM and PDM outputs, each brought out on a separate connector pin, can be provided.

PDM PULSE WIDTH: Zero and full scale PDM pulse widths are factory adjusted within the limits of the following table. If required, the zero and full scale pulse width adjustment potentiometers can be made accessible permitting external adjustment within the ranges indicated in the table.

	Channel Rate–PPS	
	112.5	900
Zero Level (microseconds)	720 ±200	90 ±30
Full Scale Level (microseconds)	5600 ±400	700 ±50

OUTPUT RISE AND FALL TIME: Two (2) microseconds maximum, as measured between 5% and 95% points.

PDM LINEARITY: Deviation from best straight line will not exceed ±0.1% of the dynamic range.

PDM PULSE WIDTH STABILITY: ±1% maximum of the dynamic range over the temperature range.

PDM JITTER: Less than ±0.1% of the *dynamic range.*

PDM PULSE AMPLITUDE: Standard PDM output pulse amplitude is +5 ±0.5 Vdc. If required, an externally accessible potentiometer can be provided permitting external pulse amplitude control between +1.0 and +6.0 Vdc.

OUTPUT LIMITING: Provisions are made such that outputs corresponding to channels where overvoltages exist are limited as specified in the table:

	PDM 112.5 Samples/Second	PDM 900 Samples/Second
Positive Overvoltage	A maximum of 960 microseconds added to full scale	A maximum of 120 microseconds added to full scale
Negative Overvoltage	400 microseconds minimum duration	Minimum 50 microseconds duration

ELECTRICAL SPECIFICATIONS

(All specifications are subject to verification at time of order.)

NUMBER OF CHANNELS: 30, 45, 60 and 90 channels per pole are standard. Any number of channels specified by customer can be provided as an option. Programming, if required, is accomplished by jumper connections on an external connector.

NUMBER OF POLES: Standard–One or two poles.

SAMPLING RATE CHARACTERISTICS

CHANNEL RATE: Standard–IRIG rates of 112.5 and 990 pps. Optional–Any channel rate specified by customer up to 100K pps.

FRAME RATE:

$$\text{Frame rate} = \frac{\text{Channel rate}}{\text{Number of channels/frame/pole}}$$

SAMPLING RATE STABILITY: ±2% over the specified temperature range.

Provision for disconnecting the internal clock and advancing with an external clock can be provided.

INPUT CHARACTERISTICS

INPUT SIGNAL VOLTAGE RANGE: Standard–0 to +5Vdc. Optional–Any 5 volt span in the –5Vdc to +5Vdc range.

INPUT IMPEDANCE:

During Sampling Channel On	During Non-Sampling Channel Off	Primary Power Off
5 megohms minimum	10 megohms minimum	10 megohms minimum

BACKCURRENT: ±0.5 microampere maximum *during sampling;* ±0.2 microampere maximum during non-sampling over the temperature range.

OVERVOLTAGE: +15 to -15 Vdc with no effect on accuracy of other channels and no permanent damage.

OUTPUT CHARACTERISTICS

OUTPUT IMPEDANCE: Standard—1000 *ohms maximum* for PAM and PDM outputs. Lower output impedances optional.

SHORT CIRCUIT PROTECTION: No permanent damage will result when the PAM or PDM output is shorted to ground.

POWER REQUIREMENTS

VOLTAGE: +28 ±3Vdc

DRAIN: Fifty (50) milliamperes typical. Exact drain depends on number of channels and options specified.

REVERSE VOLTAGE PROTECTION: No permanent damage will result when the polarity of the input power is reversed.

POWER LINE NOISE: Maximum noise induced across a 1.0 ohm resistor in series with the input power line will be 30 millivolts peak.

GROUND CONNECTIONS: Signal ground and 28 volt power return are common unless otherwise specified. Chassis ground is isolated and brought out on a separate connector pin.

AUXILIARY SYNC PULSE: A pulse from an internal high impedance source is generated each frame and is brought out through a connector pin for synchronizing external bench test and/or auxiliary equipment.

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE: Operating: −25°C to +85°C. Storage: −60°C to +125°C. All units tested to actual operating temperature range specified by customer. Optional operating: −55°C to +110°C.

TEMPERATURE SHOCK: No restrictions.

RELATIVE HUMIDITY: To 95% relative humidity.

ALTITUDE: Unlimited.

SHOCK: 100 G's for 11 ±1 millisecond duration, any axis.

VIBRATION: 10 to 2000 Hz at 25 G's peak, any axis.

ACCELERATION: 100 G's steady state, any axis.

RADIO INTERFERENCE: MIL-I-26600.

STORAGE LIFE: 5 years.

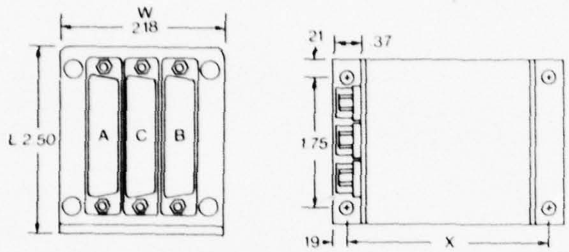
MECHANICAL SPECIFICATIONS

MOUNTING: Per outline drawing.

SIZE: Per outline drawing. Note that the depth varies according to number of channels and output formats specified.

WEIGHT: From 9.0 to 18.0 ounces depending on number of channels and output formats specified.

CONNECTORS: Hermetically sealed, 25-pin, Cannon series DBH connectors with screw-lock provisions are used on units with up to 60 channels total. For units with greater than 60 channels, Cannon, double density, 52-pin series 2DB connectors are used. Units with hermetically sealed, 50-pin series DDH connectors can be provided as an option with a resulting increase of 0.438 inch in dimension L and a 0.374 inch increase in dimension W.



No. Poles	No. Channels	Dim X	Connector Pos.	Connector Type
1	30	1.875	A,B	Cannon DBH25P
	45	2.160	A,B	Cannon DBH25P
	60	2.455	A,B,C	Cannon DBH25P
	90	2.730	A,B	Cannon 2DB52P
2	30	2.160	A,B	Cannon DBH25P
	45	2.445	A,B	Cannon 2DB52P
	60	3.015	A,B,C	Cannon 2DB52P
	90	3.585	•A,B,C,D	Cannon 2DB52P

For PDM add .350" to the X dimension for 1 pole units. Add .700" when both poles have PDM outputs.

Note: Asterisk (•) denotes W and L dimensions are both 2.750 inches for this configuration. The fourth connector, D is not shown.

ORDERING INFORMATION

Any CSV-100 series commutator/multicoder can be ordered using the following ordering format. For example, a 45-channel, 1-pole, 100% duty cycle (no pedestal) PAM commutator with a frame rate of 20 frames per second (channel rate = 900 pulses per second) is specified CSV-100-45-1-900-PAM-NRZ.

Any unit with non-standard number of channels, number of poles, or channel rate can be ordered using the same format with specific numbers filled-in. When other special requirements, such as, isolated signal ground and power return, externally accessible PDM adjustments, special packaging, etc. exist, they should be indicated in narrative form.

SERIES X – X – X – X

SERIES	NUMBER OF CHANNELS/POLE	NUMBER OF POLES	CHANNEL RATE (PPS)	FORMAT
CSV-100	30 45 60 90	1 2	900 112.5	PAM-RZ PAM-NRZ PDM PAM-NRZ & PDM PAM-RZ & PDM

Bulletin 37200 / 7-69-3M / Printed in U.S.A.

REPRESENTATIVE

Vector an AYDIN COMPANY
Phone 215-968-4271/TWX 510-667-2320

Bulletin VO124

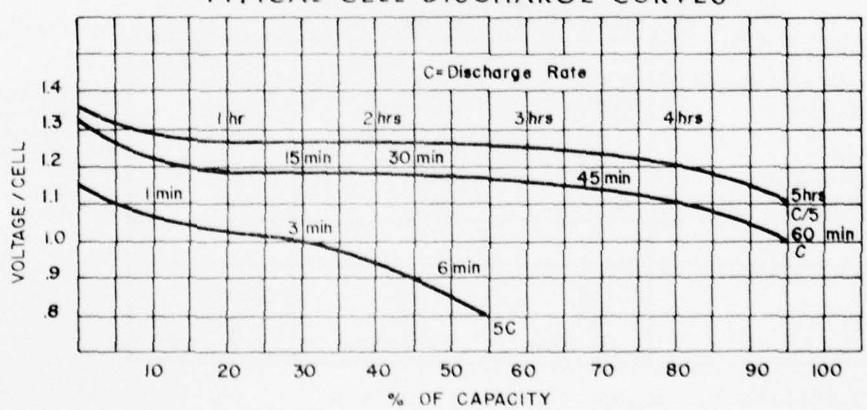
Gulton

SC BUTTON CELL NICKEL CADMIUM BATTERIES

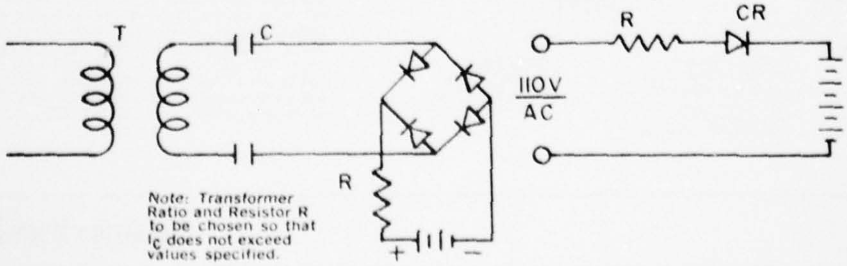
Types VO.180SC, VO.250SC & VO.500SC

The new SC button cells from Gulton are unique...they do not require restriction or expansion constraint. The mechanically stronger cases and covers also eliminate the need for supporting structures when the cells are assembled into batteries. The cells are stacked in heat activated plastic tubing for insulation. This improved construction results in smaller, lighter weight button cell batteries.

TYPICAL CELL DISCHARGE CURVES



TYPICAL CHARGING CIRCUITS



(Continued on reverse side)

TYPICAL SC BUTTON CELL BATTERY SPECIFICATIONS

(Available in any desired voltage on request)

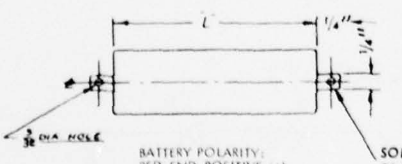
BATTERY TYPE	PART NO.	CATALOG NO.	NOMINAL VOLTAGE	"L" DIMENSION (inches) ±.015	APPROX. WEIGHT (ounces)
VO.180SC 180 MAH Capacity Dia. 1.062±.010	C11452-2	2VO.180SC	2.4	.659	.90
	C11452-3	3VO.180SC	3.6	.951	1.36
	C11452-4	4VO.180SC	4.8	1.243	1.82
	C11452-5	5VO.180SC	6.0	1.535	2.27
	C11452-6	6VO.180SC	7.2	1.827	2.73
	C11452-7	7VO.180SC	8.4	2.119	3.18
	C11452-8	8VO.180SC	9.6	2.411	3.64
	C11452-9	9VO.180SC	10.8	2.703	4.10
	C11452-10	10VO.180SC	12.0	2.995	4.55
VO.250SC 250 MAH Capacity Dia. 1.430±.010	C11459-2	2VO.250SC	2.4	.485	1.34
	C11459-3	3VO.250SC	3.6	.690	2.17
	C11459-4	4VO.250SC	4.8	.895	2.68
	C11459-5	5VO.250SC	6.0	1.100	3.35
	C11459-6	6VO.250SC	7.2	1.305	4.02
	C11459-7	7VO.250SC	8.4	1.510	4.69
	C11459-8	8VO.250SC	9.6	1.715	5.36
	C11459-9	9VO.250SC	10.8	1.920	6.03
	C11459-10	10VO.250SC	12.0	2.125	6.74
VO.500SC 500 MAH Capacity Dia. 1.430±.010	C11620-2	2VO.500SC	2.4	.835	1.83
	C11620-3	3VO.500SC	3.6	1.215	2.76
	C11620-4	4VO.500SC	4.8	1.595	3.68
	C11620-5	5VO.500SC	6.0	1.975	4.60
	C11620-6	6VO.500SC	7.2	2.355	5.52
	C11620-7	7VO.500SC	8.4	2.735	6.45
	C11620-8	8VO.500SC	9.6	3.115	7.37
	C11620-9	9VO.500SC	10.8	3.495	8.29
	C11620-10	10VO.500SC	12.0	3.875	9.22

SC CELL SPECIFICATIONS

ELECTRICAL	VO.180SC	VO.250SC	VO.500SC
Capacity (1 Hour rate):	180 mah	250 mah	500 mah
*ChargingCurrent (I_c):	9-18 ma	12-25 ma	25-40 ma
Trickle Charge Rate:	4-6 ma	5-8 ma	7-12 ma
Cell Voltage During Charge:	1.4V	1.4V	1.4V
Maximum Peak Discharge Current:	3A	5A	7.5A
MECHANICAL			
Diameter:	.982	1.360	1.360
Thickness:	.287	.200	.374
Weight:	.40 ounce	.59 ounce	1.02 ounce

**Cells will withstand I_c for periods in excess of 90 days. If cell is to be maintained at full charge the trickle charge rate can be used indefinitely.*

Full charge requires 20 hrs. at I_c max.



DESIGNATION. Individual button cells are designated by the letters VO followed by a figure indicating the ampere-hour capacity at the discharge rate. Every cell has a nominal voltage of 1.2 volts. Gulton VO series button cell batteries are designated by the cell number and prefixed by the number of cells within the battery. Thus 3VO.500 is a battery that contains three VO cells, model VO.500, and is a 3.6 volt (3 cells x 1.2 volt) battery whose capacity is 500 milliampere hours. These new units are designated as above, but with the addition of the letters "SC", e.g., 3VO.500SC.

Battery Division

Gulton Industries Inc.

Metuchen, New Jersey 08840
Phone: 201-548-2800 • TWX-710-998-0592

Printed in U.S.A. by GULTON INDUSTRIES, INC.

APPENDIX C

QUALIFICATION TEST PROCEDURE

APPLICATION		REVISIONS			
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED

1.0 SCOPE

This procedure details the quality testing for the ARINC FMT-667 Telemetry Equipment.

9				CONT NO.	2892	
8						
7				DWN	[illegible]	3/16/73
6				CKD	[illegible]	
5				ME		
4				EE	E. F White	3/20/7
3				QA		
2				PROJ ENG		
1						
SHT	REV	SHT	REV			

Vector an AYDIN COMPANY
Newtown, Pa. 18940

QUALITY TEST PROCEDURE FOR FMT-667

SIZE	CODE IDENT NO.		
A	13923		61000530
			SHEET 1 OF 41

BRUNING 40-107 12049

FORM E 005

2.0 APPLICABLE DOCUMENTS

2.1 MILITARY

a. MIL-STD-810B

2.2 STANDARDS

a. IRIG 106-71

b. Vector Quality Assurance and Reliability Manual (QARM)

c. Vector Comcheck 845 Manual M-1750.

3.0 TEST EQUIPMENT

3.1 CALIBRATION

All mechanical and electrical inspection and test equipment shall be operating satisfactorily and be within the calibration due date specified on each piece of equipment.

3.2 EQUIPMENT LIST

The equipment listed herein or its equivalent is required to perform this test.

ITEM	NOMENCLATURE	MANUFACTURER	MODEL NO.
A	Fluke Diff. VM	Fluke	883A
B	Electronic Counter	Hewlett/Packard	5245-L
C	AC/DC Digital VM	Dana	5400
D	Audio Oscillator	Hewlett/Packard	200CD
E	Oscilloscope	Tektronix	545, A, B
F	Osc. Plug-in Unit	Tektronix	53/54C, CA
G	PAM/PDM Comcheck	Vector	845
H	Power Supply	E.D.C	VS-11-N
I	Power Supply	Power Design	5015-S
J	Power Supply	Fluke	407
K	Power Supply	Hewlett/Packard	710B
L	Test Transformer	A.D.C.	224-2M
M	Radio Receiver	D.E.I.	TR711
N	50 ohm RF Load	Bird	
O	RF Coupler	Hewlett/Packard	

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 2 OF	

FORM NO. 110 E 005-2

4.0 VISUAL/MECHANICAL

4.1 VISUAL

4.1.1 Examine the system for accuracy, location, and adequacy of the following information:

a. Part Name
b. Manufacturer
c. Model Number
d. Serial Number

4.1.2 The system shall be inspected for the following:

a. Case and/or pins shall be undamaged.
b. Case and connector pins shall be free of potting splashes.
c. Identification (lettering) shall be distinct and completely filled.
d. Exterior surfaces shall not be scratched, cracked, or chipped.
e. Cover mounting plates shall be inspected to verify package seal.
f. Mounting screws shall not be burred, bent, or otherwise damaged.

4.1.3 Product identification shall be in accordance with specifications per contract.

4.2 MECHANICAL

4.2.1 Dimensions

The system shall be measured for conformance to the appropriate outline drawings. After visual/mechanical is completed, fill out Section 1. (Product Examination) as required by the Data Sheet.

5.0 GENERAL REQUIREMENTS

5.1 TEST CONDITIONS

5.1.1 Unless otherwise specified, all tests shall be performed under the following conditions:

a. Temperature: room ambient
b. Humidity: room ambient
c. Pressure: room ambient
d. Power supply voltage: 28 ±0.1 Vdc
e. Warm-up time: 15 minutes

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 3 OF	

FORM NO 110 E 005-2

5.1.2 Test Sequence

a. Production ATP (Pre-Environmental ATP)

b. High Temperature Test

c. Low Temperature Test

d. Temperature Shock Test

e. Post-Environmental ATP (same as a)

f. Pre-Environmental Functional Test

g. Vibration

h. Post-Environmental Functional Test

NOTE: If span between any two tests exceeds eight hours, a pre-environmental functional test must be performed.

i. Shock

j. Post-Environmental Functional Test

k. Temperature (Altitude Test)

l. Post-Environmental Functional Test

m. Post-Environmental ATP - Generate all test data to be shipped with unit

n. Visual

6.0 TEST PROCEDURE

Meets ARINC paragraph 4.2.2.

6.1 PRELIMINARY

6.1.1 For ease in testing, the paragraphs should be performed in the sequence given, but this should not preclude other sequencing in order to effect more efficient usage of personnel or equipment.

6.1.2 Record all the serial numbers of the components as required by the Data Sheets.

6.1.3 Connect the system in the test configuration as shown in Figure 1. Refer to the connector pin assignment list (drawing 80002066) for the individual circuit requirements. Measurements will be made using the Comcheck potentiometric method.

6.1.4 Individual J1 contact numbers are referenced to the same number stud on the test cable terminal board, and all connections for testing are to be made on these studs unless otherwise noted or directed.

6.1.5 Remove transmitter input plug P-1 and insert a lead with a pin termination to suit into J1-B. Connect the other end of this lead to the Comcheck unit and oscilloscope with counter as required.

6.2 WARM-UP

6.2.1 All equipment must be on and have a minimum warm-up of 1/2 hour or as much longer as required to achieve thermal stability of the test voltage sources and equipment used. If particular equipment has a manufacturers recommended stabilization period to meet their stated accuracy, the manufacturers recommendations are to be followed.

6.2.2 Set the following switches on the simulation control unit to the positions listed (Ref. Figure 3).

S-1	SIGNAL POWER	OFF
S-2	SIGNAL POLARITY	NEG.
S-3	Dc REF. POWER	OFF
S-4	Dc REF POLARITY	NEG.
S-5	Dc SIGNAL MODE	S. E.
S-6	Ac REF. MODE	BIAS
S-7	Ac SIGNAL MODE	S. E.

Set all variable voltage level controls on the test voltage sources to 0 volts (Ref. Figure 1).

6.2.3 Turn on the 28 Vdc system supply and adjust it to 28 V ±0.1 Vdc output with the system operating. 28 V is applied to J1-87 and ground to J1-12, 31, 32, 33, 37, 38, and 39.

6.2.4 Turn on the dc battery simulation source and adjust it to 32 V ±0.1 Vdc output. This level is the unloaded output setting at this time.

6.2.5 Turn on the filament simulation oscillator and adjust to 25 V rms output at 1600 Hz with the system operating. Monitor P1-A transmitter plug with a voltmeter, 28 Vdc must be indicated before proceeding with testing.

6.3 INDIVIDUAL CHANNEL TESTS

6.3.1 Channel 1 AGC

6.3.1.1 Procedure

a. Select channel 1 on the Comcheck unit. Apply the DC TEST (+) J1-52 and the (-) to J1-31 GND. Use an E.D.C box for the signal.

b. Display the commutator segment on the Tektronix 545 using the oscilloscope trace enhancement and delay potentiometer functions.

c. Turn S-1 on.

d. Set signal supply to 0 Vdc. The Comcheck should indicate 0 V ±0.15 Vdc .

e. Set signal supply to 5 Vdc. The Comcheck should indicate 2.5 V ±0.15 Vdc.

f. Set signal supply to 10 Vdc. The Comcheck should indicate 5.0 V ±0.15 Vdc.

g. Record the readings of d, e, and f on the Data Sheet.

6.3.2 Channel 2 Track Error

6.3.2.1 Procedure

a. Select channel 2 on the Comcheck unit. Apply AC TEST Hi to J1-53 and Lo to J1-31 GND.

b. Set the oscilloscope as in 6.3.1.1 b.

c. Set simulation switches as follows:

S-1	OFF
S-2	NEG.
S-3	ON
S-4	NEG.
S-5	S.E.
S-6	BIAS
S-7	S.E.

d. Set the bias supply to 50 Vdc.

e. Set the signal oscillator to 0 V. The Comcheck should indicate 0 V ±0.15 Vdc.

6.3.2.1 Procedure (continued)

f. Set the oscillator to 30 V p-p @ 180Hz. The Comcheck should indicate 2.5 V ±0.15 Vdc.

g. Set the oscillator to 60 V p-p. The Comcheck should indicate 5.0 V ±0.15 Vdc.

h. Record the readings of e, f, and g on the Data Sheet.

6.3.3 <u>Channels 3 and 4. Pitch and Yaw Error</u>

6.3.3.1 Procedure

a. Select channel 3 on the Comcheck unit. Apply the DC TEST (+) to J1-54 and (-) to J1-55. Use the Fluke Power Supply or equivalent supply for the signal.

b. Set the oscilloscope as in 6.3.1.1 b.

c. Set the simulation switches as follows:

S-1	ON
S-2	POS
S-3	ON
S-4	POS
S-5	BAL.
S-6	BIAS
S-7	S. E.

d. Set the bias supply to 60 Vdc.

e. Set the signal supply to 25 Vdc. The Comcheck should indicate 0 V ±0.15 Vdc.

f. Turn S-1 off.

g. Turn S-1 on, place S-2 in the NEG position. The Comcheck should indicate 5.0 V to ±0.15 Vdc.

h. Record the readings of e, f, and g on the Data Sheet.

i. Apply the DC TEST (+) to J1-56 and the (-) to J1-57.

j. Select channel 4 on the Comcheck unit.

k. Repeat c, e, f, g, and h as above for channel 4.

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923		
SCALE		SHEET 7 OF	

6.3.4 Channels 5 and 6. Pitch and Yaw Summing

6.3.4.1 Procedure

a. Select channel 5 on the Comcheck unit. Apply the DC TEST (+) to J1-58 and (-) to J1-59.

b. Set the oscilloscope as in 6.3.1.1 b.

c. Set the simulator switches as in 6.3.3.1 c, for channels 3 and 4.

d. Set the bias supply to 145 Vdc.

e. Set the signal supply to 120 Vdc. The Comcheck should indicate 0 V ±0.15 Vdc.

f. Turn S-1 off. The Comcheck should indicate 2.5 V ±0.15 Vdc.

g. Turn S-1 on, place S-2 in the NEG position. The Comcheck should indicate 5.0 V ±0.15 Vdc.

h. Record the readings of e, f, and g on the Data Sheet.

i. Apply the DC TEST (+) to J1-60 and the (-) to J1-61.

j. Select channel 6 on the Comcheck unit.

k. Repeat c, e, f, g, and h as above, for channel.6.

6.3.5 Channels 7, 8, 9, and 10. Flipper 1, 2, 3, and 4.

6.3.5.1 Procedure

a. Select channel 7 on the Comcheck unit. Apply the DC TEST (+) to J1-62 and (-) to J1-63.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Set simulator switches as in 6.3.3.1 c.

d. Set the bias supply to 77 Vdc.

e. Set the signal supply to 30 Vdc. The Comcheck should indicate 0 V ±0.15 Vdc.

f. Turn S-1 off. The Comcheck should indicate 2.5 V ±0.15 Vdc.

g. Turn S-1 on, place S-2 in the NEG position. The Comcheck should indicate 5.0 V ±0.15 Vdc.

h. Record the readings of e, f, and g on the Data Sheet.

i. Apply the DC TEST (+) to J1-64 and the (-) to J1-65.

6.3.5.1 Procedure (continued)

j. Select channel 8 on the Comcheck unit.

k. Repeat c, e, f, g, and h as above, for channel 8.

l. Apply the DC TEST (+) to J1-66 and the (-) to J1-67.

m. Select channel 9 on the Comcheck.

n. Repeat c, e, f, g, and h above for channel 9.

o. Apply the DC TEST (+) to J1-68 and the (-) to J1-69.

p. Select channel 10 on the Comcheck.

q. Repeat c, e, f, g, and h as above, for channel 10.

6.3.6 <u>Channel 11. "K" Unregulated</u>

6.3.6.1 Procedure

a. Select channel 11 on the Comcheck. Apply the DC TEST (+) to J1-70 and the (-) to J1-31 GND.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Set the simulator switches as follows:

S-1	ON
S-2	POS
S-3	OFF
S-4	POS
S-5	S.E.
S-6	BIAS
S-7	S.E.

d. Set the signal supply to 295 Vdc. The Comcheck should indicate 0 V ±0.15 Vdc.

e. Set the signal supply to 345 Vdc. The Comcheck should indicate 2.5 V ±0.15 Vdc.

f. Set the signal supply to 395 Vdc. Read 5.0 V ±0.15 Vdc on the Comcheck.

g. Record the readings of d, e, and f on the Data Sheet.

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AIM-4F AND AIM-4G TELEMETRY DEVELOPMENT PROGRAM.(U)

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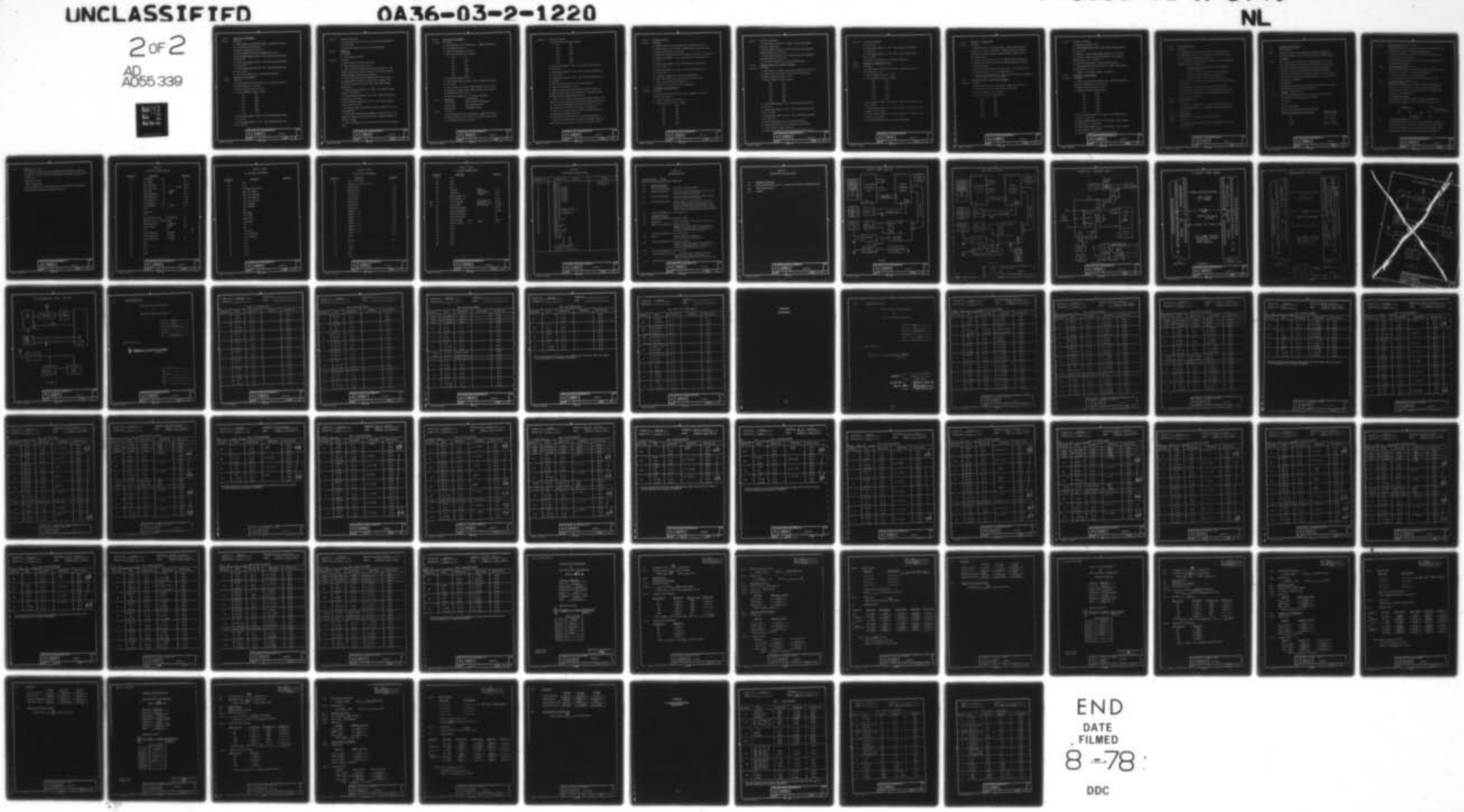

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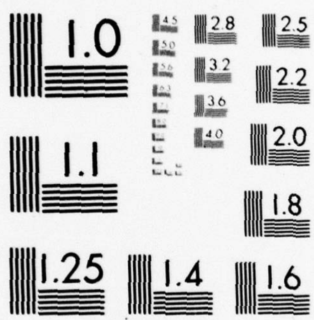
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3

6.3.7 Channel 12. "K" Regulated

6.3.7.1 Procedure

a. Select channel 12 on the Comcheck unit. Apply the DC TEST (+) to J1-74 and the (-) to J1-31 GND.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Set the simulator switches to the pattern of 6.3.6.1 c.

d. Set the signal supply to 220 Vdc. The Comcheck should indicate 0 V ±0.15 Vdc.

e. Set the signal supply to 240 Vdc. The Comcheck should indicate 2.5 V ±0.15 Vdc.

f. Set the signal supply to 260 Vdc. The Comcheck should indicate 5.0 V ±0.15 Vdc.

g. Record the readings of d, e, and f on the Data Sheet.

6.3.8 Channel 13. "C" Regulated

6.3.8.1 Procedure

a. Select channel 13 on the Comcheck unit. Apply the DC TEST (+) to J1-70 and the (-) to J1-31 GND.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Set the simulator switches as follows:

S-1	ON
S-2	NEG
S-3	OFF
S-4	POS
S-5	S. E.
S-6	BIAS
S-7	S. E.

d. Set the signal supply to 120 Vdc. The Comcheck should indicate 0 V ±0.15 Vdc.

e. Set the signal supply to 140 Vdc. The Comcheck should indicate 2.5 V ±0.15 Vdc.

6.3.8.1 Procedure (continued)

f. Set the signal supply to 160 Vdc. The Comcheck should indicate 5.0 V ±0.15 Vdc.

g. Record the readings of d, e, and f on the Data Sheet.

6.3.9 Channel 14

a. Filament

b. Power Transfer Function

6.3.9.1 Procedure

a. Select channel 14 on the Comcheck unit.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Apply a momentary connection between J1-87 and J1-86. The monitor of paragraph 6.2.5 must show the 32 V level of the battery simulation supply, indicating power transfer.

d. Monitor J1-82 and J1-83 with the signal DVM in the ac mode.

e. Set the filament simulation oscillator to 0 V ac output. The dc monitor of c above must remain at its steady state reading observed in c.

f. With the filament oscillator at 0 V output. The Comcheck should indicate 0 V ±0.15 Vdc.

g. Set the filament oscillator to 12.5 V rms. The Comcheck should indicate 2.5 V ±0.15 Vdc.

h. Set the filament oscillator to 25 V rms. The Comcheck should indicate 5.0 V ±0.15 Vdc.

i. Record the transfer verification of c and the readings of f, g, and h on the Data Sheet.

j. Momentarily open the battery simulation 32 V supply (+) lead. The monitor of c shall show the system 28 V level, indicating transfer off the battery supply.

k. Filament oscillator must remain at the 25 V rms of h for continuing tests.

6.3.10 Channel 15. Roll Damping

6.3.10.1 Procedure

a. Select channel 15 on the Comcheck unit. Apply the DC TEST (+) to J1-84 and the (-) to J1-85.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Set the simulator switches as follows:

S-1	ON
S-2	POS.
S-3	ON
S-4	POS.
S-5	BAL.
S-6	BIAS
S-7	S. E.

d. Set the bias supply to 140 Vdc.

e. Set the signal supply to 10 Vdc. The Comcheck should indicate 0 V ±0.15 Vdc.

f. Turn S-1 off. The Comcheck should indicate 2.5 V ±0.15 Vdc.

g. Turn S-1 on, place S-2 in the NEG. position. The Comcheck should indicate 5.0 V ±0.15 Vdc.

h. Record the readings of e, f, and g on the Data Sheet.

6.3.11 Channel 16	HPS PRESSURE
Channel 16(1)	PWR. PLANT START PULSE
Channel 16(2)	FIRST MOTION PULSE
Channel 16(3)	HPS SQUIB EVENTS

6.11.1 Procedure

a. Select channel 16 on the Comcheck unit. Apply the DC TEST (+) to J1-88 and the (-) to J1-31 GND. Use an EDC box for the signal.

b. Set the oscilloscope as in 6.3.3.1 b.

6.3.11.1 Procedure (continued)

c. Set the simulator switches as follows:

S-1	ON
S-2	POS
S-3	OFF
S-4	POS
S-5	S. E.
S-6	BIAS
S-7	S. E.

d. Set the signal supply to 0 Vdc. The Comcheck should indicate 0 V ±0.15 Vdc.

e. Set the signal supply to 2.5 Vdc. The Comcheck should indicate 2.5 V ±0.15 Vdc.

f. Set the signal supply to 5.0 Vdc. The Comcheck should indicate 5.0 ±0.15 Vdc.

g. Record the readings of d, e, and f on the Data Sheet.

h. Set the signal supply to 2.5 Vdc.

i. Apply a momentary connection between J1-87 and J1-86. The monitor of paragraph 6.2.5 must show the 32 V level of the battery simulation supply, indicating power transfer.

j. Apply a (+)28 V p pulse of approximately 100 milliseconds to J1-86. Observe a positive going pip on the oscilloscope display of channel 16.

k. Momentarily interrupt the (+) 28 Vdc lead to J1-87. Observe a positive going pip on the oscilloscope display of channel 16.

l. Apply a (+)5 V p pulse to J1-89. Observe a positive going pip on the oscilloscope display of channel 16.

m. Record the pip verification of j, k, and l on the Data Sheet.

n. Momentarily interrupt the +32 Vdc battery simulation supply and observe that the system returns to +28 Vdc of the system source.

6.3.12 Channels 17 and 18

6.3.12.1 Procedure

a. Select channel 17 on the Comcheck unit. Apply the DC TEST (+) to J1-90 and the (-) to J1-31 GND. Use the Fluke supply for the signal.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Simulator switch positions are to remain as in 6.3.11.1 c for channel 16.

d. Set the signal supply to 0 Vdc. The Comcheck should indicate 0 V ±0.15 Vdc.

e. Set the signal supply to 25 Vdc. The Comcheck should indicate 2.5 V ±0.15 Vdc.

f. Set the signal supply to 50 Vdc. The Comcheck should indicate 5.0 V ±0.15 Vdc.

g. Record the readings of d, e, and f on the Data Sheet.

h. Apply the DC TEST (+) to J1-91 and the (-) to J1-31 GND.

i. Select channel 18 on the Comcheck unit.

j. Repeat c, d, e, f, and g as above, for channel 18.

6.3.13 *Channel 19. Rate Gyro Power*

6.3.13.1 Procedure

a. Select channel 19 on the Comcheck unit. Apply the ac test hi to J1-92 and lo to J1-93.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Set the simulator switches as follows:

S-1	OFF
S-2	POS
S-3	OFF
S-4	POS
S-5	S.E.
S-6	GND.
S-7	BAL

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6.3.13.1 Procedure (continued)

d. Set the signal oscillator to 0 V output. The Comcheck should indicate 0 V ±0.15 Vdc.

e. Set the signal oscillator to 20 V rms at 400 Hz. The Comcheck should indicate 2.5 V ±0.15 Vdc.

f. Set the signal oscillator to 40 V rms at 400 Hz. The Comcheck should indicate 5.0 V ±0.15 Vdc.

g. Record the readings of d, e, and f on the Data Sheet.

6.3.14 Channels 20 and 21. "X" and "Y" Vibration

6.3.14.1 Procedure

a. Select channel 20 on the Comcheck unit. Apply the DC TEST (+) to J1-1 and the (-) to J1-31 GND. Use an EDC box for the signal.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Set the simulator switches as follows:

S-1	ON
S-2	POS
S-3	OFF
S-4	POS
S-5	S.E.
S-6	GND
S-7	BAL

d. Set the signal supply to 0 Vdc. The Comcheck should indicate 0 ±0.15 Vdc.

e. Set the signal supply to 2.5 Vdc. The Comcheck should indicate 2.5 V ±0.15 Vdc.

f. Set the signal supply to 5.0 Vdc. The Comcheck should indicate 5.0 V ±0.15 Vdc.

g. Record the readings of d, e, and f on the Data Sheet.

h. Apply the DC TEST (+) to J1-2 and the (-) to J1-31 GND.

i. Select channel 21 on the Comcheck.

j. Set the signal supply to 0 Vdc. The Comcheck should indicate

6.3.14.1 Procedure (continued)

0 V ±0.15 Vdc.

k. Set the signal supply to 2.5 Vdc. The Comcheck should indicate 2.5 ±0.15 Vdc.

l. Set the signal supply to 5.0 Vdc. The Comcheck should indicate 5.0 ±0.15 Vdc.

m. Record the readings of j, k, and l on the Data Sheet.

6.3.15 Channel 22. Antenna Gyro Power

6.3.15.1 Procedure

a. Select channel 22 on the Comcheck unit. Apply the ac test hi to J1-3 and the lo to J1-4.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Set the simulator switches as follows:

S-1	OFF
S-2	POS
S-3	OFF
S-4	POS
S-5	S.E.
S-6	GND
S-7	BAL

d. Set the signal oscillator to 0 V output. The Comcheck should indicate 0 V ±0.15 Vdc.

e. Set the signal oscillator to 25 V rms at 400 Hz. The Comcheck should indicate 2.5 V ±0.15 Vdc.

f. Set the signal oscillator to 50 V rms at 400 Hz. The Comcheck should indicate 5.0 V ±0.15 Vdc.

g. Record the readings of d, e, and f on the Data Sheet.

6.3.16 Channel 23. Antenna Speed

6.3.16.1 Procedure

a. Select channel 23 on the Comcheck unit. Apply a pulse generator to J1-5 and its return to J1-31 GND. Set this generator to produce a double pulse - positive going first and then negative going - to simulate one cycle of ac.

b. Set the oscilloscope as in 6.3.3.1 b. Monitor the source pulse on one channel of the oscilloscope, the commutator segment on the other. Use alternate display.

c. Set the signal pulse amplitude to +3 V p and - 3 V p to simulate 1 Hz ac 6 V p-p squarewave with a 1.0 millisecond period.

d. For input-output conditions, refer to the classified supplement of ARINC Research Specification A000223.

6.3.17 Channels 24 and 25. Pitch and Yaw Damping

6.3.17.1 Procedure

a. Select channel 24 on the Comcheck unit. Apply the DC TEST (+) to J1-6 and the (-) to J1-7. Use EDC box for the signal.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Set the simulator switches as follows:

S-1	ON
S-2	POS
S-3	OFF
S-4	POS
S-5	BAL
S-6	GND
S-7	BAL

6.3.17.1 Procedure (continued)

d. Set the bias supply to 0 Vdc.

e. Set the signal supply to 5 Vdc. The Comcheck should indicate 0 V ±0.15 Vdc.

f. Open S-1. The Comcheck should indicate 2.5 V ±0.15 Vdc.

g. Close S-1. Place S-2 in the NEG position. The Comcheck should indicate 5.0 V ±0.15 Vdc.

h. Record the readings of e, f, and g on the Data Sheet.

i. Select channel 25 on the Comcheck unit. Apply the DC TEST (+) to J1-8 and the (-) to J1-9

j. Repeat c, e, f, g, and h as above, for channel 25.

6.3.18 <u>Channel 26. Carrier Signal</u>

6.3.18.1 Procedure

a. Select channel 26 on the Comcheck unit. Apply the AC TEST Hi output to J1-10 and the Lo to J1-31 GND.

b. Set the oscilloscope as in 6.3.3.1 b.

c. Set the simulator switches as follows:

S-1	OFF
S-2	POS
S-3	OFF
S-4	POS
S-5	BAL
S-6	GND
S-7	S.E.

d. Set the signal oscillator to 0 V output. The Comcheck should indicate 0 V ±0.15 Vdc.

e. Set the signal oscillator to 1 V rms at 1600 Hz. The Comcheck should indicate 2.5 V ±0.15 Vdc.

f. Set the signal oscillator to 2 V rms at 1600 Hz. The Comcheck should indicate 5.0 V ±0.15 Vdc.

g. Record the readings of d, e, and f on Data Sheet.

6.3.19 A1-K1 and K2 Check

6.3.19.1 Procedure

a. Apply a momentary connection between J1-87 and J1-88. The monitor of paragraph 6.2.5 must show the 32 V level of the battery simulation supply, indicating power transfer.

b. Turn off the 28 V system supply. K1 and K2 are now de-energized. Check for the following conditions:

1. J1-29 to J1-74 reads continuity with approximately 10 kilohms impedance.
2. J1-30 to J1-31 GND reads zero ohms (continuity).
3. J1-34 to J1-90 reads zero ohms (continuity).
4. J1-35 to J1-91 reads zero ohms (continuity).

c. Turn on the 28 V system supply. All the above circuits should read open circuit.

d. Record the verification of b and c above on the Data Sheet.

e. Momentarily interrupt the 32 V battery simulation source. The monitor of 6.2.5 should indicate 28 Vdc indicating system return to the system 28 V power source.

6.3.20 5 V Services Check

6.3.20.1 Procedure

a. Measure the voltage at J1-43, 44, and 45 referenced to J1-31 GND using the digital voltmeter. Record the readings on the Data Sheet.

6.4 RF LINK TEST

6.4.1 Preliminary

6.4.1.1 Connect the system in the configuration of Figure 2.

6.4.1.2 Procedure

a. Perform the tests of paragraph 6.0 as required to satisy ARINC paragraph 4.2.4.

7.0 ENVIRONMENTAL TESTS

7.1 PRELIMINARY

7.1.1 Connect the system in the configuration of Figure 6, using the P-1 test cable of Figure 5 which is to conform to the input signal loading of Table II.

7.1.2 Turn on the 28 V power supply and set the output to 28 V ±0.15 Vdc. Turn on the radio receiver and tune in the transmitter. Sync the Tektronix oscilloscope to the pulse train on the receiver video output connector. Make a trial recording of 2 to 3 minutes duration on CEC recorder, play it back monitoring the output on the oscilloscope. If the playback is normal, proceed with the testing. A summary of the tests is given in Table III.

7.2 PROCEDURE

Apply the following specified environments and methods as documented in attachment I, subcontract U6627 of ARINC.

7.2.1 Vibration (ARINC 4.1.1.1)

The system shall be subjected to the vibration tests in accordance with method 514 of MIL-STD-810B, as follows:

Procedure II

Part 2

Curve P (Figure 514-3)

This test calls for the following vibration levels:

Double Amplitude Displacement or g Level	Frequency Range
0.2"	5 to 10 cps
1 g	10 to 18 cps
0.06"	18 to 40 cps
5 g	40 to 2,000 cps

7.2.2 High Temperature (ARINC 4.1.1.2)

The unit shall be temperature tested in accordance with MIL-STD-810B, method 501, Procedure I, with the following exceptions:

a. The system shall be stabilized at 85 ±2°C for two hours prior to the application of electrical power.

b. The unit shall be operated at 85 ±2°C for one hour with data on all channel outputs recorded.

7.2.3 Low Temperature (ARINC 4.1.1.3)

The unit shall be temperature tested in accordance with MIL-STD-810B, method 502, Procedure I, with the following additions:

a. The temperature in step 2 shall be -20°C and

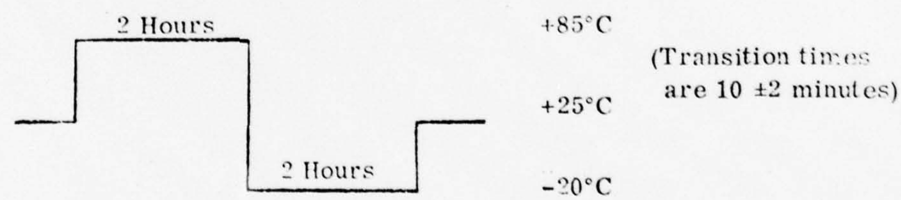
b. The unit shall be operated in accordance with step 4 at -20°C.

7.2.4 Temperature Shocks (ARINC 4.1.1.4)

The unit shall be subjected to temperature shock in accordance with MIL-STD-810B, method 503, Procedure I, except the temperature profile shall be in accordance with paragraph 3.3.4 of attachment 1, subcontract U6627 quoted below:

3.3.4 Temperature Shock

The telemetry unit shall be capable of operation during and after exposure to the temperature shock described in the diagram below:



7.2.5 Temperature Altitude (ARINC 4.1.1.5)

The unit shall be placed in a test chamber and allowed to stabilize for two hours at a pressure equivalent to 50,000 feet and a temperature of -20°C. At the conclusion of the stabilization period, the unit shall be operated for one hour. Data on all channels shall be recorded.

7.2.6 Shock (ARINC 4.1.1.6)

The unit shall be shock tested in accordance with MIL-STD-810B, method 516, Procedure I. The shock table shall be calibrated to the following specifications:

Force: 50 g

Duration: 15 ±2 MS

Shape: 1/2 Sine Wave

7.3 After completion of all environmental tests, perform the test of paragraph 6.3, generating the test data to be shipped with the unit.

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TABLE I

J-1 FUNCTION ASSIGNMENTS

CONTACT	FUNCTION			CHANNEL	
1	X Vibration			20	
2	Y Vibration			21	
3	Ant. Gyro Power		400 Hz	22 (+)	
4	Ant. Gyro Power			22 (-)	
5	Ant. Speed	AIM-4G Only		23	
6	Pitch Damping (+)			24 (+)	
7	Pitch Damping (-)			24 (-)	
8	Yaw Damping (+)			25 (+)	
9	Yaw Damping (-)			25 (-)	
10	Carrier Signal	1600 Hz		26	
11	N.C.				
12	Shield Gnd.				
13	N.C.				
14	Second Detector Video	Pulses etc.		23	
15	(Ch. 24) (0 to +1V) = (0 to 5V)	DC		24	
16	RF Channel Select	AIM-4F Only		25	
17	Dither Voltage			26	
18	N.C.				21 & 22
19	Radar Range Gate	Pulses			
20	Missile Range Gate	Pulses			
21	Gate Pusher Pulse	Pulses		20	
22	N.C.				
23	N.C.				
24	N.C.				
25	N.C.				
26	N.C.				

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TABLE 1 - contd.

J-1 FUNCTION ASSIGNMENTS

CONTACT	FUNCTION	CHANNEL
27	N.C.	
28	N.C.	
29	50 Vdc (115 Vac) output	
30	Sig. Gnd. Monitor	
31	Pwr. Gnd. (Isolated)	
32	Pwr. Gnd. (Isolated)	
33	Pwr. Gnd. (Isolated)	
34	Ch. 17 Monitor	
35	Ch. 18 Monitor	
36	N.C.	
37	DC Ground	
38	DC Ground	
39	DC Ground	
40	Frame Sync.	
41	N.C.	
42	N.C.	
43	5V Spare	
44	5V to Transducer	
45	5V to Photocell	
46	N.C.	
47	N.C.	
48	N.C.	
49	N.C.	
50	N.C.	
51	N.C.	

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TABLE 1 - contd.

J-1 FUNCTION ASSIGNMENTS

CONTACT	FUNCTION	CHANNEL
52	A.G.C. 0 to -10Vdc	1
53	Track Error -30V P to +30V. P	2
54	Pitch Error Hi	3 (+)
55	Pitch Error Lo	3 (-)
56	Yaw Error Hi	4 (+)
57	Yaw Error Lo	4 (-)
58	Pitch Sum Hi	5 (+)
59	Pitch Sum Lo	5 (-)
60	Yaw Sum Hi	6 (+)
61	Yaw Sum Lo	6 (-)
62	Flipper 1 (+)	7 (+)
63	Flipper 1 (-)	7 (-)
64	Flipper 2 (+)	8 (+)
65	Flipper 2 (-)	8 (-)
66	Flipper 3 (+)	9 (+)
67	Flipper 3 (-)	9 (-)
68	Flipper 4 (+)	10 (+)
69	Flipper 4 (-)	10 (-)
70	C Reg.	13
71	N.C.	
72	K Unreg.	11
73	N.C.	
74	K Reg.	12
75	N.C.	
76	N.C.	
77	N.C.	

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TABLE 1 - contd.

J-1 FUNCTION ASSIGNMENT

	CONTACT	FUNCTION			CHANNEL
	78	N.C.			
	79	N.C.			
	80	N.C.			
	81	N.C.			
	82	Filament 1		1600 Hz	14 Hi
	83	Filament 2		Power must be always on	14 Lo
	84	Roll Damping	(+)		15 (+)
	85	Roll Damping	(-)		15 (-)
Xfer	86	Pwr. Plant Start		28V + Pulse will initiate pwr. xfer.	16 Pulse
28V	87	First Motion		28V Pwr Input	16 Pulse
	88	Pressure Transducer			16 DC
	89	H.P.S. Squib Signal			16 Pulse
	90	Pitch Head Position			17
	91	Yaw Head Position			18
	92	Rate Gyro Pwr.	π Ø		19 Hi
	93	Rate Gyro Pwr.	0 Ø	400 Hz	19 Lo
	94	N.C.			
	95	N.C.			
	96	N.C.			
	97	N.C.			
	98	N.C.			
	99	N.C.			
	100	N.C.			

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TABLE II

ENVIRONMENTAL SIMULATION

CHANNEL NO.	SIGNAL ON J-1 AIM-4G	NOTES
1	GND. 52	All numbers are J-1 numbers
2	GND. 53	
3	GND. 55, 54 open	
4	GND. 57, 56 open	
5	GND. 59, 58 open	
6	GND. 61, 60 open	
7	GND. 63, 62 open	
8	GND. 65, 64 open	
9	GND. 67, 66 open	
10	GND. 69, 68 open	
11	GND. 70	
12	GND. 72	
13	GND. 74	
14	GND. 83, limit resistor on 82	
15	GND. 85, 84 open	
16	GND. 88, 86-87-89 open	
17	GND. 90	
18	GND. 91	
19	GND. 92 and 93	
20	GND. 1	
21	GND. 2	
22	GND. 3 and 4	
23	GND. 5	
24	GND. 7, 6 open	
25	GND. 9, 8 open	
26	GND. 10	
	28 V on 87	
	GND. on 12, 31, 32, 33, 30, 37, 38, 39	
	25 V 1600 Hz on 82 and 83 Center tap to GND. or (+)6 Vdc to 82, (-)6 Vdc to 31.	

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 27 OF	

FORM NO. 110 F 005 2

TABLE III

TESTING SEQUENCE

Commutation Rate = 10 k pps
Signals all programmed in low gain configuration.

1.0	<u>IN-HOUSE VECTOR</u>	
1.1	PRE-ENVIRONMENTAL	ATP (same as production ATP)
1.2	HIGH TEMPERATURE	+85°C 2 hour soak, non-operating, 1 hour operating with data on all channels recorded.
1.3	LOW TEMPERATURE	-20°C 2 hour soak, non-operating, 1 hour operating with data on all channels recorded.
1.4	TEMPERATURE SHOCK	Ambient operation, raise to +85°C with rise time of 10 ±2 minutes, 2 hours operating at 85°C, lower to -20°C with falling time of 10 ±2 minutes, 2 hours operating at -20°C, return to ambient with rise time of 10 ±2 minutes, operational check until stabilization.
1.5	POST ENVIRONMENTAL	ATP (same as 1.1)
2.0	<u>OUTSIDE SERVICES</u>	
2.1	PRE-ENVIRONMENTAL FUNCTIONAL TEST	
2.2	VIBRATION	810B, Procedure II, Part 2, Curve P (5g 20 min.)
2.3	POST-ENVIRONMENTAL FUNCTIONAL TEST	<u>NOTE</u>: Retest requirement - if span between any two tests is less than 8 hours, the following pre-environmental functional may be waived.
2.4	PRE-ENVIRONMENTAL FUNCTIONAL TEST	
2.5	SHOCK	810B, Method 516, Procedure I 50g, 15 ±2mS, 1/2 sine wave pulse
2.6	POST-ENVIRONMENTAL FUNCTIONAL TEST	<u>NOTE</u>: Retest requirement - if span between any two tests is less than 8 hours, the following pre-environmental functional may be waived.
2.7	PRE-ENVIRONMENT FUNCTIONAL TEST	
2.8	TEMPERATURE/ALTITUDE	50,000 feet pressure equivalent and -20°C temperature for 2 hours soak non-operaing, 1 hour operation with data on all channels recorded.
2.9	POST-ENVIRONMENTAL FUNCTIONAL TEST	

TABLE III

TESTING SEQUENCE (continued)

3.0	RETURN TO VECTOR
3.1	POST-ENVIRONMENTAL ATP - Generate all test data to be shipped with unit.
3.2	VISUAL/MECHANICAL
3.3	PACKING

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 29 OF	

BENCH TEST SET-UP

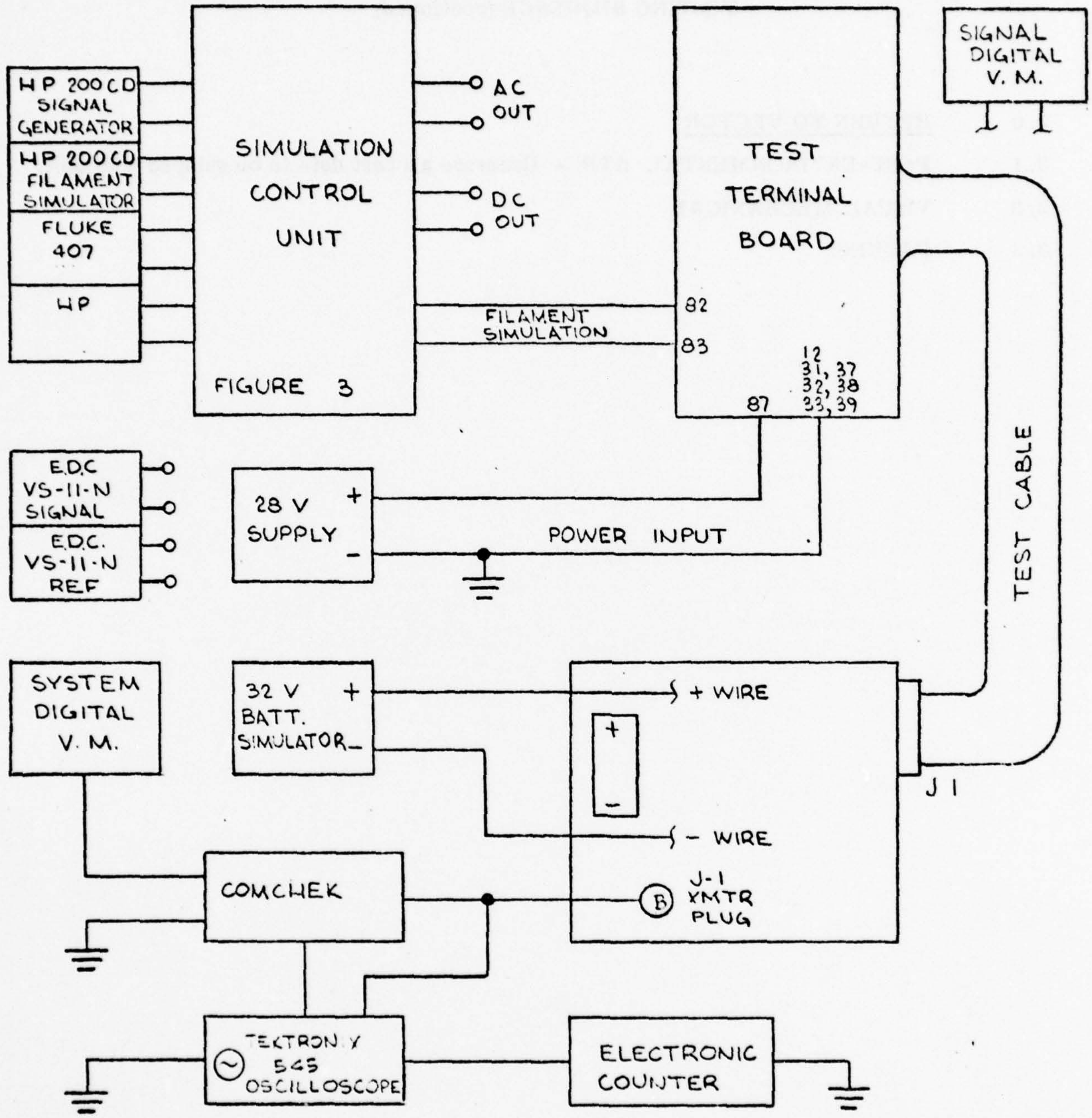

FIGURE 1

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 20 OF	

RF TEST SET-UP

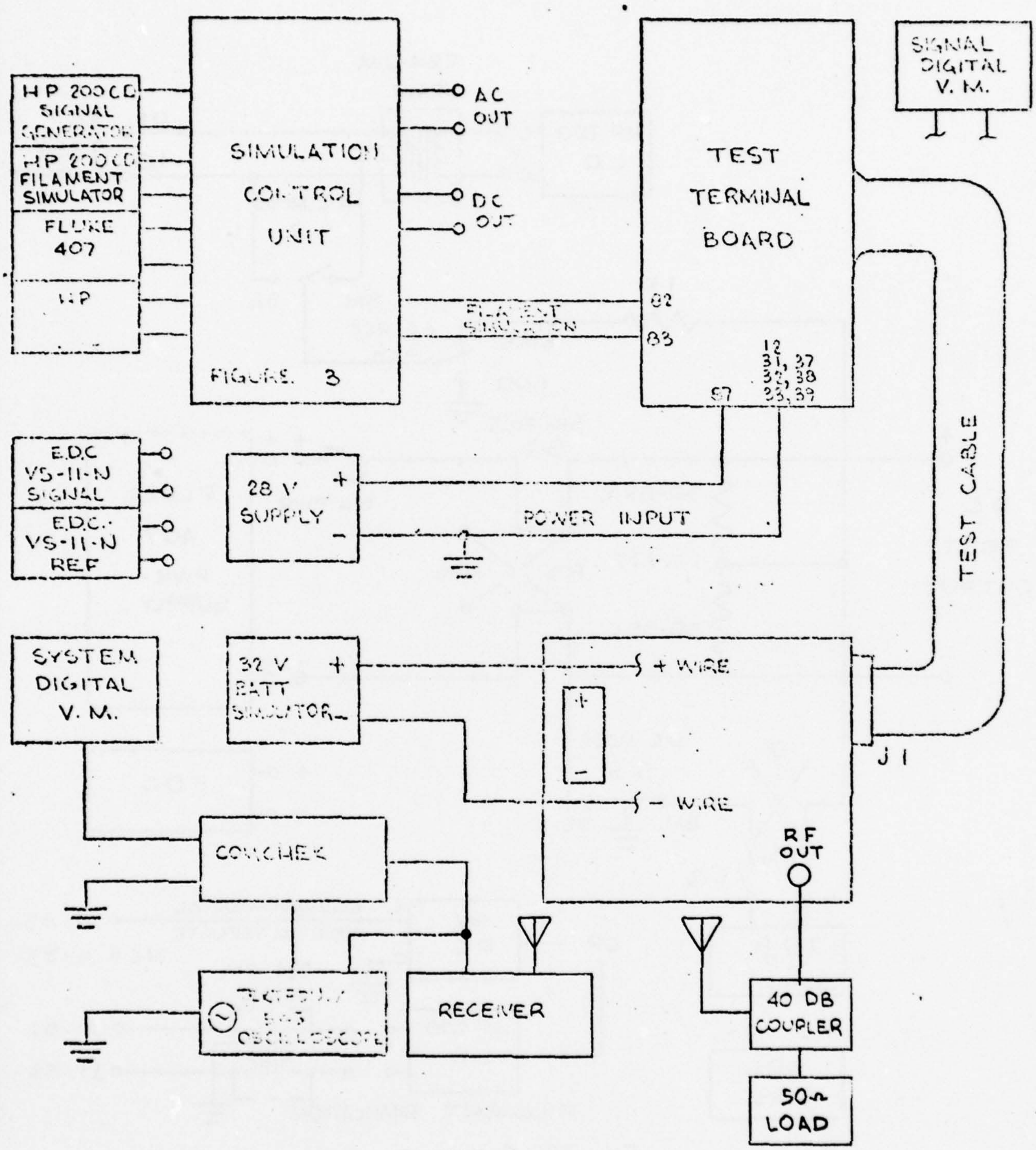

FIGURE 2

Size	Code Ident No.	Drawing No.	Rev
A	13[illegible]	6100050	

Scale | Sheet 81 of

SIMULATION CONTROL UNIT

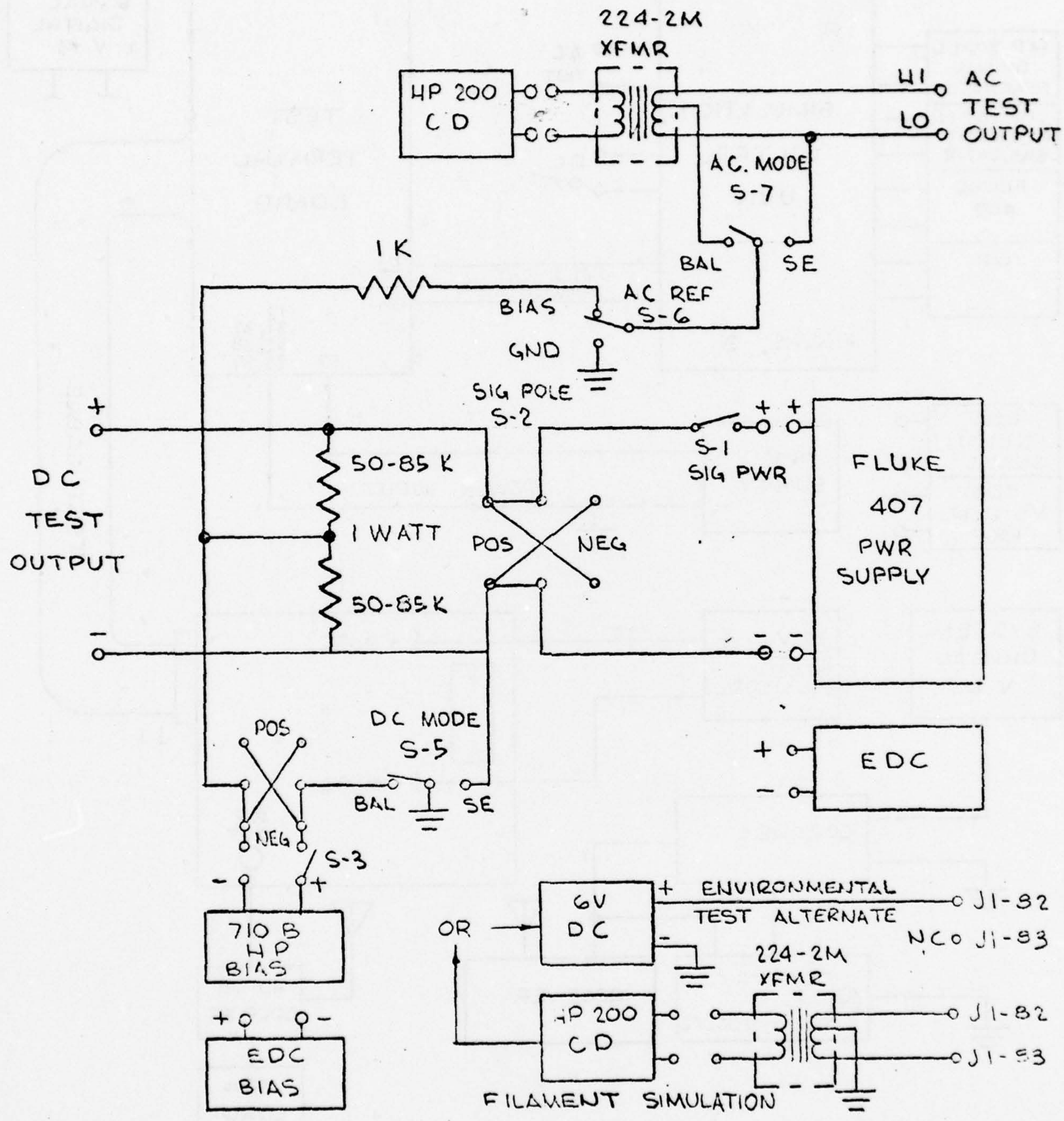

FIGURE 3

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET OF	

FORM NO 110E 005 2

J-1 BENCH TEST CABLE

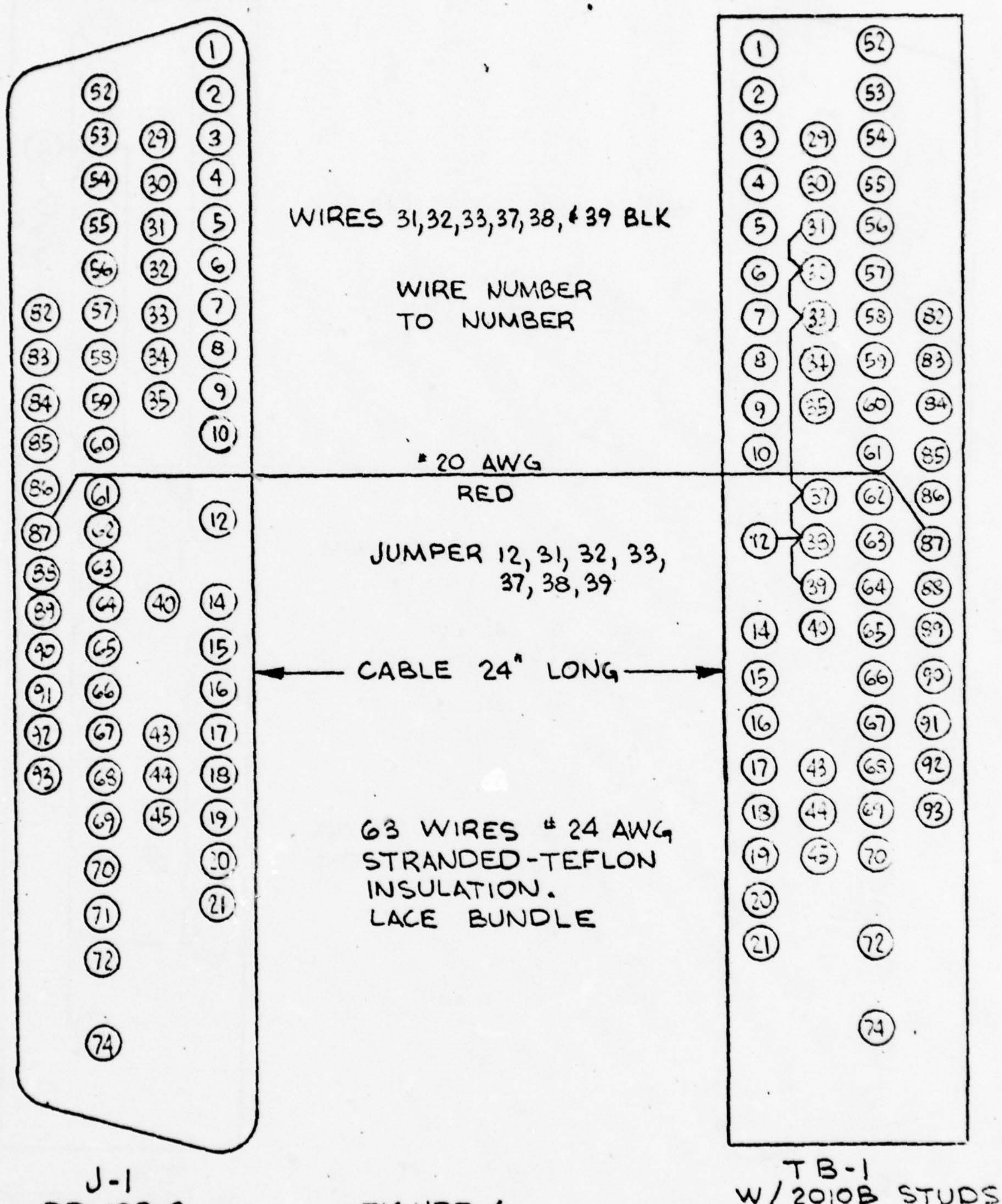

FIGURE 4

SIZE	CODE IDENT NO.	DRAWING NO.		REV
A	13923	61000530		
SCALE			SHEET OF	

FORM NO. 110 E.005-2

J1 ENVIRONMENTAL TEST CABLE

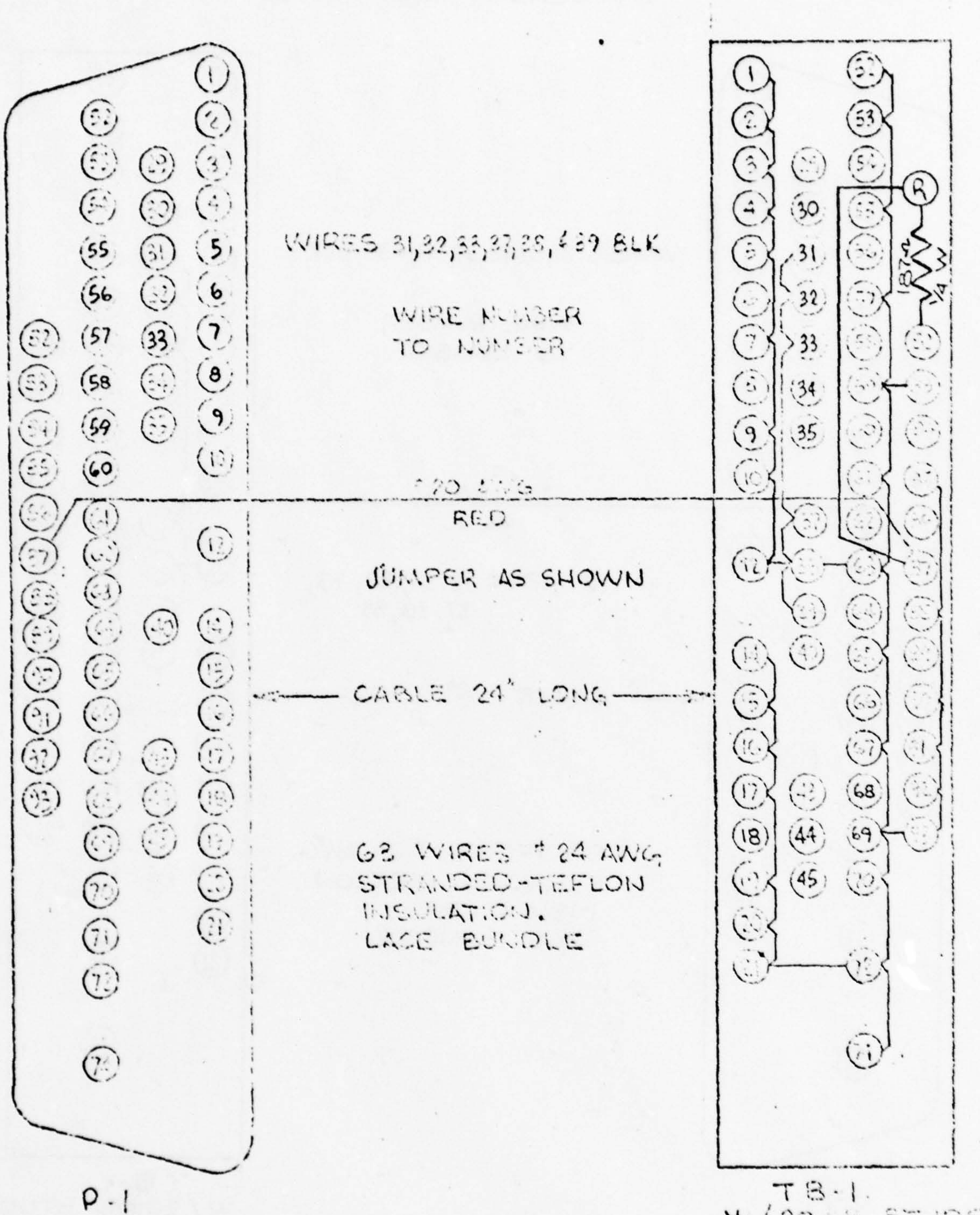

FIGURE 5

SIZE		DRAWING NO.	REV
A		61000530	
SCALE		SHEET 84	

ENVIRONMENTAL TEST SET UP

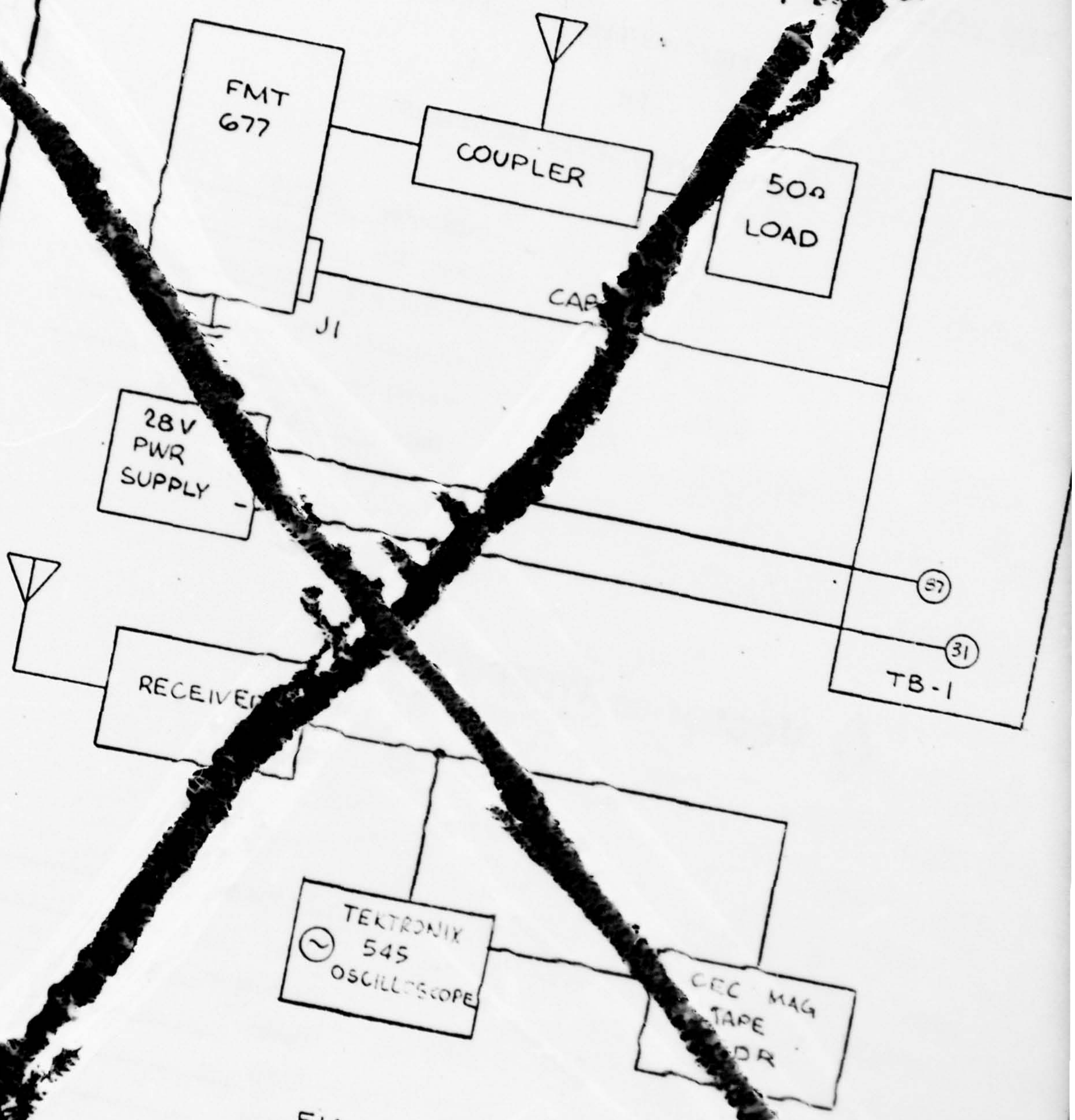

FIGURE 6

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	61000330
SCALE		REV

FORM NO. 110 E 005-2

ENVIRONMENTAL TEST SET-UP

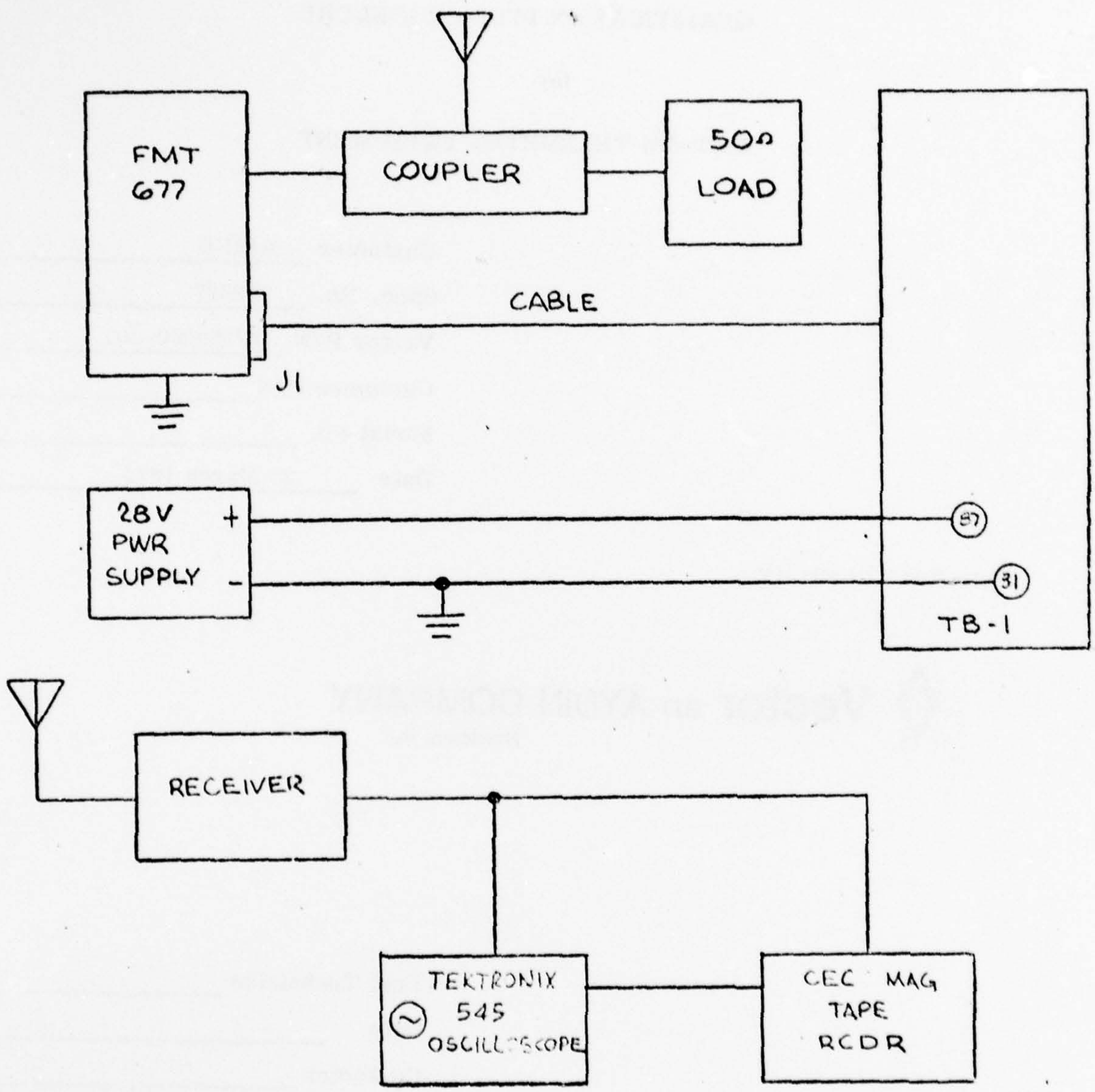

FIGURE 6

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET OF	

8.0 TEST DATA SHEETS

QUALIFICATION TEST PROCEDURE

for

FMT-667 TELEMETRY EQUIPMENT

Customer ARINC

Spec. No. Y6627

Vector P/N 22380000-501

Customer P/N

Serial No.

Date 23 March 1972

MANUFACTURED BY

Vector an AYDIN COMPANY
Newtown, Pa.

Test Technician

Date

Customer

Date

DOD

Date

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 36 OF	

FORM NO. 110 E 005-2

MODEL NO. FMT-667 TESTED BY ____________

SERIAL NO. ____________ DATE ____________

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
1	0 Vdc	0 V		±0.15
	-5 Vdc	2.5 V		±0.15
	-10 Vdc	5.0 V		±0.15
2	0 V	0 V		±0.15
	30 V p-p	2.5 V		±0.15
	60 V p-p	5.0 V		±0.15
3	+25 Vdc	0 V		±0.15
	0 V	2.5 V		±0.15
	-25 Vdc	5.0 V		±0.15
4	+25 Vdc	0 V		±0.15
	0 V	2.5 V		±0.15
	-25 Vdc	5.0 V		±0.15
5	+120 Vdc	0 V		±0.15
	0 V	2.5 V		±0.15
	-120 Vdc	5.0 V		±0.15
6	+120 Vdc	0 V		±0.15
	0 V	2.5 V		±0.15
	-120 Vdc	5.0 V		±0.15
7	+30 Vdc	0 V		±0.15
	0 V	2.5 V		±0.15
	-30 Vdc	5.0 V		±0.15
8	+30 Vdc	0 V		±0.15
	0 V	2.5 V		±0.15
	-30 Vdc	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 37 OF	

MODEL NO. FMT-667 TESTED BY ____________

SERIAL NO. ____________ DATE . ____________

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
9	+30 Vdc	0 V		±0.15
	0 V	2.5 V		±0.15
	-30 Vdc	5.0 V		±0.15
10	+30 Vdc	0 V		±0.15
	0 V	2.5 V		±0.15
	-30 Vdc	5.0 V		±0.15
11	+295 Vdc	0 V		±0.15
	+345 Vdc	2.5 V		±0.15
	+395 Vdc	5.0 V		±0.15
12	+220 Vdc	0 V		±0.15
	+240 Vdc	2.5 V		±0.15
	+260 Vdc	5.0 V		±0.15
13	-120 Vdc	0 V		±0.15
	-140 Vdc	2.5 V		±0.15
	-160 Vdc	5.0 V		±0.15
14	0 V	0 V		±0.15
	12.5 V rms	2.5 V		±0.15
	25 V rms	5.0 V		0.15
14C	Jump 86 to 87	Power Transfer		Verify
15	+10 Vdc	0 V		±0.15
	0 V	2.5 V		±0.15
	-10 Vdc	5.0 V		±0.15
16	0 V	0 V		±0.15
	+2.5 Vdc	2.5 V		±0.15
	+5.0 Vdc	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 38 OF	

FORM NO. 110 E 005 2

MODEL NO. FMT-667 TESTED BY ____

SERIAL NO. ____ DATE ____

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
16(1)	+28 V pulse	+ pulse		Verify
16(2)	28 V interrupt	+ pulse		Verify
16(3)	+5 V pulse	+ pulse		Verify
17	0 V	0 V		±0.15
	+25 Vdc	2.5 V		±0.15
	+50 Vdc	5.0 V		±0.15
18	0 V	0 V		±0.15
	+25 Vdc	2.5 V		±0.15
	+50 Vdc	5.0 V		±0.15
19	0 V	0 V		±0.15
	20 V rms	2.5 V		±0.15
	40 V rms	5.0 V		±0.15
A1-K1	28 V off	Relays closed		Verify
and K2	28 V on	Relays closed		Verify
5 V	N/A	J1-43, 44, 45 = 5 V		Verify
20	0 V	0 V		±0.15
	+2.5 Vdc	2.5 V		±0.15
	+5.0 Vdc	5.0 V		±0.15
21	0 V	0 V		±0.15
	+2.5 Vdc	2.5 V		±0.15
	+5.0 Vdc	5.0 V		±0.15
22	0 V	0 V		±0.15
	25 V rms	2.5 V		±0.15
	50 V rms	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 39 OF	

MODEL NO. FMT-667 TESTED BY ____________

SERIAL NO. ____________ DATE ____________

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
		0 V		±0.15
23	*	2.5 V		±0.15
		5.0 V		±0.15
	+5 Vdc	0 V		±0.15
24	0 V	2.5 V		±0.15
	-5 Vdc	5.0 V		±0.15
	+5 Vdc	0 V		±0.15
25	0 V	2.5 V		±0.15
	-5 Vdc	5.0 V		±0.15
	0 V	0 V		±0.15
26	1 V rms	2.5 V		±0.15
	2 V rms	5.0 V		±0.15

*The data deleted from this block, when combined with certain data from other sources, could be developed into classified information.

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61009530	
SCALE		SHEET 40 OF	

FORM NO. 110-E-005-2

MODEL NO. FMT-667 TESTED BY ______

SERIAL NO. ______ DATE ______

AIM - 4F CH. 20 - 26 DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
20	No pulse	0 V		±0.25
	1.2 μsec p	2.5 V		±0.25
	1.8 μsec p	5.0 V		±0.25
Pre 21 Launch	RRG lags 1 μsec	0 V		±0.25
	Coincidence	2.5 V		±0.25
	RRG leads 1 μs.	5.0 V		±0.25
Post 21 Launch	GPP lage 1 μsec	0 V		±0.25
	Coincidence	2.5 V		±0.25
	GPP leads 1 μs.	5.0 V		±0.25
22	TV lags 1 μsec	0 V		±0.25
	Coincidence	2.5 V		±0.25
	TV leads 1 μ s.	5.0 V		±0.25
23	Level under 0.5V	0.5 V		±0.25
	1 V level	1.0 V		±0.25
	10 V level	4.5 V		±0.25
24	0 V	0 V		±0.15
	+0.5 V	2.5 V		±0.15
	+1.0 V	5.0 V		±0.15
25	+60 Vdc	0 V		±0.15
	+75 Vdc	2.5 V		±0.15
	+90 Vdc	5.0 V		±0.15
26	0 V	0 V		±0.15
	5 V p-p	2.5 V		±0.15
	10 V p-p	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 11 OF	

APPENDIX D

TEST RESULTS

8.0 **TEST DATA SHEETS**

QUALIFICATION TEST PROCEDURE

for

FMT-667 TELEMETRY EQUIPMENT

Customer ARINC

Spec. No. Y6627

Vector P/N 223-0000-501

Customer P/N

Serial No. 102

Date 23 March 1972

MANUFACTURED BY

Vector an AYDIN COMPANY
Newtown, Pa.

Test Technician E. F. White

START Date Mar. 24, 1972

Customer ARINC

COMPLETE Date MARCH 30, 1972

ENGR. [illegible] March 31, 1972

MODEL NO. FMT-667 TESTED BY E.F. White

SERIAL NO. 102 DATE MAR. 24, 1972

Pre-Environmental AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
1	0 Vdc	0 V	+ .023	±0.15
	-5 Vdc	2.5 V	+2.522	±0.15
	-10 Vdc	5.0 V	+5.016	±0.15
2	0 V	0 V	0V	±0.15
	30 V p-p	2.5 V PP	+ 2.500VPP	±0.15
	60 V p-p	5.0 V PP	+5.000VPP	±0.15
3	+25 Vdc	0 V	+ .021	±0.15
	0 V	2.5 V	+ 2.510	±0.15
	-25 Vdc	5.0 V	+ 4.995	±0.15
4	+25 Vdc	0 V	- .002	±0.15
	0 V	2.5 V	+ 2.484	±0.15
	-25 Vdc	5.0 V	+ 4.967	±0.15
5	+120 Vdc	0 V	+ .008	±0.15
	0 V	2.5 V	+ 2.506	±0.15
	-120 Vdc	5.0 V	+ 5.000	±0.15
6	+120 Vdc	0 V	+ .009	±0.15
	0 V	2.5 V	+ 2.505	±0.15
	-120 Vdc	5.0 V	+ 4.996	±0.15
7	+30 Vdc	0 V	- .028	±0.15
	0 V	2.5 V	+ 2.491	±0.15
	-30 Vdc	5.0 V	+ 5.007	±0.15
8	+30 Vdc	0 V	- .018	±0.15
	0 V	2.5 V	+ 2.542	±0.15
	-30 Vdc	5.0 V	+ 5.093	±0.15

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	61000530
SCALE		SHEET OF

MODEL NO. FMT-667

SERIAL NO. 102

TESTED BY E.F. White

DATE Mar. 24, 1972

Pre-Environmental

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
9	+30 Vdc	0 V	-.021	±0.15
	0 V	2.5 V	+2.508	±0.15
	-30 Vdc	5.0 V	+5.045	±0.15
10	+30 Vdc	0 V	-.001	±0.15
	0 V	2.5 V	+2.521	±0.15
	-30 Vdc	5.0 V	+5.039	±0.15
11	+295 Vdc	0 V	+.021	±0.15
	+345 Vdc	2.5 V	+2.526	±0.15
	+395 Vdc	5.0 V	+5.030	±0.15
12	+220 Vdc	0 V	+.005	±0.15
	+240 Vdc	2.5 V	+2.506	±0.15
	+260 Vdc	5.0 V	+5.007	±0.15
13	-120 Vdc	0 V	+.065	±0.15
	-140 Vdc	2.5 V	+2.553	±0.15
	-160 Vdc	5.0 V	+5.038	±0.15
14	0 V	0 V	+.021	±0.15
	12.5 V rms	2.5 V	+2.529	±0.15
	25 V rms	5.0 V	+5.031	0.15
14C	Jump S6 to S7	Power Transfer	E.F.W	Verify
15	+10 Vdc	0 V	+.014	±0.15
	0 V	2.5 V	+2.451	±0.15
	-10 Vdc	5.0 V	+4.995	±0.15
16	0 V	0 V	+.015	±0.15
	+2.5 Vdc	2.5 V	+2.506	±0.15
	+5.0 Vdc	5.0 V	+4.994	±0.15

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	61066530
SCALE		SHEET OF

MODEL NO. FMT-667 TESTED BY E F white

SERIAL NO. 102 DATE Mar, 24, 1972

Pre-Environmental

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
16(1)	+28 V pulse	+ pulse	EFW	Verify
16(2)	28 V interrupt	+ pulse	EFW	Verify
16(3)	+5 V pulse	+ pulse	EFW	Verify
17	0 V	0 V	+.019	±0.15
	+25 Vdc	2.5 V	+2.513	±0.15
	+50 Vdc	5.0 V	+5.005	±0.15
18	0 V	0 V	+.017	±0.15
	+25 Vdc	2.5 V	+2.508	±0.15
	+50 Vdc	5.0 V	+4.997	±0.15
19	0 V	0 V	+ .015	±0.15
	20 V rms	2.5 V	+2.548	±0.15
	40 V rms	5.0 V	+5.081	±0.15
A1-K1	28 V off	Relays closed	EFW	Verify
and K2	28 V on	Relays closed	EFW	Verify
5 V	N/A	J1-43, 44, 45 = 5 V	EFW	Verify
20	0 V	0 V	+.011	±0.15
	+2.5 Vdc	2.5 V	+2.502	±0.15
	+5.0 Vdc	5.0 V	+4.989	±0.15
21	0 V	0 V	+.013	±0.15
	+2.5 Vdc	2.5 V	+2.503	±0.15
	+5.0 Vdc	5.0 V	+4.989	±0.15
22	0 V	0 V	+.024	±0.15
	25 V rms	2.5 V	+2.514	±0.15
	50 V rms	5.0 V	+5.001	±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET OF	

FORM NO. 1104 (8/72)

MODEL NO. FMT-667

SERIAL NO. 102

TESTED BY E.F. White

DATE · Mar. 24, 1977

Pre-Environmental AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
		0 V	+.004	±0.15
23	*	2.5 V	+2.486	±0.15
		5.0 V	+4.963	±0.15
	+5 Vdc	0 V	+.018	±0.15
24	0 V	2.5 V	+2.505	±0.15
	-5 Vdc	5.0 V	+4.990	±0.15
	+5 Vdc	0 V	+.013	±0.15
25	0 V	2.5 V	+2.502	±0.15
	-5 Vdc	5.0 V	+4.986	±0.15
	0 V	0 V	+.018	±0.15
26	1 V rms	2.5 V	+2.507	±0.15
	2 V rms	5.0 V	+4.992	±0.15

*The data deleted from this block, when combined with certain data from other sources, could be developed into classified information.

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	64009530	
SCALE	D-7	SHEET 10 OF	

MODEL NO. FMT-667 TESTED BY E.F. White

SERIAL NO. 102 DATE. MAR. 24, 1972

AIM - 4F/4G DATA SHEET

During -20°C Soak

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
1	0 Vdc	0 V	+.021	±0.15
	-5 Vdc	2.5 V		±0.15 N/A
	-10 Vdc	5.0 V		±0.15
2	0 V	0 V		±0.15
	30 V p-p	2.5 V	+2.519	±0.15
	60 V p-p	5.0 V		±0.15
3	+25 Vdc	0 V		±0.15
	0 V	2.5 V	+2.632	±0.15
	-25 Vdc	5.0 V		±0.15
4	+25 Vdc	0 V		±0.15
	0 V	2.5 V	+2.753	±0.15
	-25 Vdc	5.0 V		±0.15
5	+120 Vdc	0 V		±0.15
	0 V	2.5 V	+2.558	±0.15
	-120 Vdc	5.0 V		±0.15
6	+120 Vdc	0 V		±0.15
	0 V	2.5 V	+2.504	±0.15
	-120 Vdc	5.0 V		±0.15
7	+30 Vdc	0 V		±0.15
	0 V	2.5 V	+2.605	±0.15
	-30 Vdc	5.0 V		±0.15
8	+30 Vdc	0 V		±0.15
	0 V	2.5 V	+2.605	±0.15 N/A
	-30 Vdc	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	61000530

SCALE SHEET OF

MODEL NO. FMT-667 TESTED BY E.F.White

SERIAL NO. 102 DATE .. Mar. 24, 1972

AIM - 4F/4G DATA SHEET

During -20° Soak

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
9	+30 Vdc	0 V		±0.15 N/A
	0 V	2.5 V	+ 2.559	±0.15
	-30 Vdc	5.0 V		±0.15
10	+30 Vdc	0 V		±0.15
	0 V	2.5 V	+ 2.603	±0.15
	-30 Vdc	5.0 V		±0.15
11	+295 Vdc	0 V		±0.15
	+345 Vdc	2.5 V	N.A	±0.15
	+395 Vdc	5.0 V		±0.15
12	+220 Vdc	0 V		±0.15
	+240 Vdc	2.5 V	N.A.	±0.15
	+260 Vdc	5.0 V		±0.15
13	-120 Vdc	0 V		±0.15
	-140 Vdc	2.5 V	N.A.	±0.15
	-160 Vdc	5.0 V		±0.15
14	0 V	0 V	+ .017	±0.15
	12.5 V rms	2.5 V		±0.15
	25 V rms	5.0 V		0.15
14C	Jump 56 to 87	Power Transfer	EFW	Verify
15	+10 Vdc	0 V		±0.15
	0 V	2.5 V	+ 1.945	±0.15
	-10 Vdc	5.0 V		±0.15
16	0 V	0 V	+ .019	±0.15
	+2.5 Vdc	2.5 V		±0.15 N/A
	+5.0 Vdc	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	61000530

MODEL NO. FMT-667 TESTED BY E. F. White

SERIAL NO. 102 DATE Mar. 24, 1972

AIM - 4F/4G DATA SHEET

During -20°c Soak

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)	
16(1)	+28 V pulse	+ pulse	N/A	Verify	
16(2)	28 V interrupt	+ pulse	N/A	Verify	
16(3)	+5 V pulse	+ pulse	N/A	Verify	
17	0 V	0 V	+.018	±0.15	N/A
	+25 Vdc	2.5 V		±0.15	
	+50 Vdc	5.0 V		±0.15	
18	0 V	0 V	+.015	±0.15	
	+25 Vdc	2.5 V		±0.15	
	+50 Vdc	5.0 V		±0.15	
19	0 V	0 V	+.014	±0.15	
	20 V rms	2.5 V		±0.15	N/A
	40 V rms	5.0 V		±0.15	
A1-K1 and K2	28 V off	Relays closed	N/A	Verify	
	28 V on	Relays closed	N/A	Verify	
5 V	N/A	J1-43, 44, 45 = 5 V	EFW	Verify	
20	0 V	0 V	+.017	±0.15	
	+2.5 Vdc	2.5 V		±0.15	N/A
	+5.0 Vdc	5.0 V		±0.15	
21	0 V	0 V	+.017	±0.15	
	+2.5 Vdc	2.5 V		±0.15	
	+5.0 Vdc	5.0 V		±0.15	
22	0 V	0 V	+.023	±0.15	
	25 V rms	2.5 V		±0.15	N/A.
	50 V rms	5.0 V		±0.15	

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE	D-10	SHEET	

MODEL NO. FMT-667

SERIAL NO. 102

TESTED BY E.F. White

DATE : Mar. 24, 1972

AIM - 4F/4G DATA SHEET

During -20°C Soak

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
23	*	0 V 2.5 V 5.0 V	NA	±0.15 ±0.15 ±0.15 N/A
24	+5 Vdc 0 V -5 Vdc	0 V 2.5 V 5.0 V	+ 3.729	±0.15 ±0.15 ±0.15
25	+5 Vdc 0 V -5 Vdc	0 V 2.5 V 5.0 V	+ 3.729	±0.15 ±0.15 ±0.15
26	0 V 1 V rms 2 V rms	0 V 2.5 V 5.0 V	+.017	±0.15 ±0.15 ±0.15 N/A

*The data deleted from this block, when combined with certain data from other sources, could be developed into classified information.

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	[illegible]	

SCALE | SHEET OF

MODEL NO. FMT-667 TESTED BY E. F. White

SERIAL NO. 102 DATE Mar. 25, 1972

+85° Soak

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
1	0 Vdc	0 V	+.018	±0.15
	-5 Vdc	2.5 V		±0.15 N/A
	-10 Vdc	5.0 V		±0.15
2	0 V	0 V		±0.15
	30 V p-p	2.5 V	+2.512	±0.15
	60 V p-p	5.0 V		±0.15
3	+25 Vdc	0 V		±0.15
	0 V	2.5 V	+2.628	±0.15
	-25 Vdc	5.0 V		±0.15
4	+25 Vdc	0 V		±0.15
	0 V	2.5 V	+2.746	±0.15
	-25 Vdc	5.0 V		±0.15
5	+120 Vdc	0 V		±0.15
	0 V	2.5 V	+2.554	±0.15
	-120 Vdc	5.0 V		±0.15
6	+120 Vdc	0 V		±0.15
	0 V	2.5 V	+2.499	±0.15
	-120 Vdc	5.0 V		±0.15
7	+30 Vdc	0 V		±0.15
	0 V	2.5 V	+2.599	±0.15
	-30 Vdc	5.0 V		±0.15
8	+30 Vdc	0 V		±0.15
	0 V	2.5 V	+2.600	±0.15 N/A.
	-30 Vdc	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE	D-12	SHEET 37 OF	

MODEL NO. FMT-667

SERIAL NO. 102

TESTED BY E. F. White

DATE Mar. 25, 1972

+85° Soak

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)	
9	+30 Vdc	0 V	+2.599	±0.15	N/A
	0 V	2.5 V		±0.15	
	-30 Vdc	5.0 V		±0.15	
10	+30 Vdc	0 V	+2.599	±0.15	
	0 V	2.5 V		±0.15	
	-30 Vdc	5.0 V		±0.15	
11	+295 Vdc	0 V	N/A	±0.15	
	+345 Vdc	2.5 V		±0.15	
	+395 Vdc	5.0 V		±0.15	
12	+220 Vdc	0 V	N/A	±0.15	
	+240 Vdc	2.5 V		±0.15	
	+260 Vdc	5.0 V		±0.15	
13	-120 Vdc	0 V	N/A	±0.15	N/A
	-140 Vdc	2.5 V		±0.15	
	-160 Vdc	5.0 V		±0.15	
14	0 V	0 V	+.016	±0.15	N/A
	12.5 V rms	2.5 V		±0.15	
	25 V rms	5.0 V		0.15	
14C	Jump 86 to 87	Power Transfer	E.F.W	Verify	
15	+10 Vdc	0 V	+1.891	±0.15	N/A
	0 V	2.5 V		±0.15	
	-10 Vdc	5.0 V		±0.15	
16	0 V	0 V	+.018	±0.15	N/A
	+2.5 Vdc	2.5 V		±0.15	
	+5.0 Vdc	5.0 V		±0.15	

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 38 OF	

MODEL NO. FMT-667 TESTED BY E. F. White

SERIAL NO. 102 DATE Mar. 25, 1972

+85° Soak

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
16(1)	+28 V pulse	+ pulse	N/A	Verify
16(2)	28 V interrupt	+ pulse	N/A	Verify
16(3)	+5 V pulse	+ pulse	N/A	Verify
17	0 V	0 V	+.015	±0.15
	+25 Vdc	2.5 V	N/A	±0.15
	+50 Vdc	5.0 V		±0.15
18	0 V	0 V	+.015	±0.15
	+25 Vdc	2.5 V		±0.15
	+50 Vdc	5.0 V		±0.15
19	0 V	0 V	+.009	±0.15
	20 V rms	2.5 V	N/A	±0.15
	40 V rms	5.0 V		±0.15
A1-K1	28 V off	Relays closed	N/A	Verify
and K2	28 V on	Relays closed	N/A	Verify
5 V	N/A	J1-43, 44, 45 = 5 V	E.F.W.	Verify
20	0 V	0 V	+.012	±0.15
	+2.5 Vdc	2.5 V	N/A	±0.15
	+5.0 Vdc	5.0 V		±0.15
21	0 V	0 V	+.013	±0.15
	+2.5 Vdc	2.5 V		±0.15
	+5.0 Vdc	5.0 V		±0.15
22	0 V	0 V	+.016	±0.15
	25 V rms	2.5 V	N/A.	±0.15
	50 V rms	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 39 OF	

MODEL NO. FMT-667 TESTED BY E. F. White

SERIAL NO. 102 DATE Mar. 25, 1972

+85° Soak

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
23	*	0 V 2.5 V 5.0 V	N/A	±0.15 ±0.15 ±0.15 N/A
24	+5 Vdc 0 V -5 Vdc	0 V 2.5 V 5.0 V	+ 3.730	±0.15 ±0.15 ±0.15
25	+5 Vdc 0 V -5 Vdc	0 V 2.5 V 5.0 V	+ 3.730	±0.15 ±0.15 ±0.15
26	0 V 1 V rms 2 V rms	0 V 2.5 V 5.0 V	+ .016	±0.15 ±0.15 ±0.15 N/A.

*The data deleted from this block, when combined with certain data from other sources, could be developed into classified information.

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61009530	
SCALE	D-15	SHEET 10 OF	

MODEL NO. FMT-667 TESTED BY E. F. White

SERIAL NO. 102 DATE Mar. 25, 1972

Temp Shock -20°C

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
23	*	0 V 2.5 V 5.0 V	N/A	±0.15 ±0.15 ±0.15 N/A
24	+5 Vdc 0 V -5 Vdc	0 V 2.5 V 5.0 V	+3.729	±0.15 ±0.15 ±0.15
25	+5 Vdc 0 V -5 Vdc	0 V 2.5 V 5.0 V	+3.729	±0.15 ±0.15 ±0.15
26	0 V 1 V rms 2 V rms	0 V 2.5 V 5.0 V	+.018	±0.15 ±0.15 ±0.15 N/A.

*The data deleted from this block, when combined with certain data from other sources, could be developed into classified information.

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61009530	
SCALE		D-16	SHEET 40 OF

MODEL NO. FMT-667

SERIAL NO. 102

TESTED BY E. F. White

DATE Mar 25, 1972

Temp Shock -20°

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
1	0 Vdc	0 V	+.022	±0.15
	-5 Vdc	2.5 V		±0.15 N/A
	-10 Vdc	5.0 V		±0.15
2	0 V	0 V		±0.15
	30 V p-p	2.5 V	+2.523	±0.15
	60 V p-p	5.0 V		±0.15
3.	+25 Vdc	0 V		±0.15
	0 V	2.5 V	+2.639	±0.15
	-25 Vdc	5.0 V		±0.15
4	+25 Vdc	0 V		±0.15
	0 V	2.5 V	+2.758	±0.15
	-25 Vdc	5.0 V		±0.15
5	+120 Vdc	0 V		±0.15
	0 V	2.5 V	+2.562	±0.15
	-120 Vdc	5.0 V		±0.15
6	+120 Vdc	0 V		±0.15
	0 V	2.5 V	+2.507	±0.15
	-120 Vdc	5.0 V		±0.15
7	+30 Vdc	0 V		±0.15
	0 V	2.5 V	+2.608	±0.15
	-30 Vdc	5.0 V		±0.15
8	+30 Vdc	0 V		±0.15
	0 V	2.5 V	+2.607	±0.15 N/A.
	-30 Vdc	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000330	

SCALE SHEET OF

MODEL NO. FMT-667 TESTED BY E. F. White

SERIAL NO. 102 DATE Mar 25, 1972

Temp Shock -20°C

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)	
9	+30 Vdc	0 V		±0.15	N/A
	0 V	2.5 V	+2.601	±0.15	
	-30 Vdc	5.0 V		±0.15	
10	+30 Vdc	0 V		±0.15	
	0 V	2.5 V	+2.603	±0.15	
	-30 Vdc	5.0 V		±0.15	
11	+295 Vdc	0 V		±0.15	
	+345 Vdc	2.5 V	N/A	±0.15	
	+395 Vdc	5.0 V		±0.15	
12	+220 Vdc	0 V		±0.15	
	+240 Vdc	2.5 V	N/A	±0.15	
	+260 Vdc	5.0 V		±0.15	
13	-120 Vdc	0 V		±0.15	
	-140 Vdc	2.5 V	N/A	±0.15	
	-160 Vdc	5.0 V		±0.15	
14	0 V	0 V	+.017	±0.15	
	12.5 V rms	2.5 V		±0.15	N/A
	25 V rms	5.0 V		0.15	
14C	Jump S6 to S7	Power Transfer	E.F.W.	Verify	
15	+10 Vdc	0 V		±0.15	
	0 V	2.5 V	+1.942	±0.15	N/A
	-10 Vdc	5.0 V		±0.15	
16	0 V	0 V	+.019	±0.15	
	+2.5 Vdc	2.5 V		±0.15	N/A
	+5.0 Vdc	5.0 V		±0.15	

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 38 OF	

MODEL NO. FMT-667

SERIAL NO. 102

TESTED BY E. F. White

DATE Mar. 25, 1972

Temp Shock -20°C

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
16(1)	+28 V pulse	+ pulse	N/A	Verify
16(2)	28 V interrupt	+ pulse	N/A	Verify
16(3)	+5 V pulse	+ pulse	N/A	Verify
17	0 V	0 V	+.018	±0.15
	+25 Vdc	2.5 V		±0.15 N/A
	+50 Vdc	5.0 V		±0.15
18	0 V	0 V	+.015	±0.15
	+25 Vdc	2.5 V		±0.15
	+50 Vdc	5.0 V		±0.15
19	0 V	0 V	+.014	±0.15
	20 V rms	2.5 V		±0.15
	40 V rms	5.0 V		±0.15 N/A
A1-K1	28 V off	Relays closed	N/A	Verify
and K2	28 V on	Relays closed	N/A	Verify
5 V	N/A	J1-43, 44, 45 = 5 V	E.F.W.	Verify
20	0 V	0 V	+.017	±0.15
	+2.5 Vdc	2.5 V		±0.15 N/A
	+5.0 Vdc	5.0 V		±0.15
21	0 V	0 V	+.017	±0.15
	+2.5 Vdc	2.5 V		±0.15
	+5.0 Vdc	5.0 V		±0.15
22	0 V	0 V	+.023	±0.15
	25 V rms	2.5 V		±0.15 N/A.
	50 V rms	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 39 OF	

FORM NO. 110F 006-2

MODEL NO. FMT-667 TESTED BY E.F. White

SERIAL NO. 102 DATE Mar. 30, 1972

Temp Shock +85°c

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
1	0 Vdc	0 V	+.046	±0.15
	-5 Vdc	2.5 V		±0.15 N/A
	-10 Vdc	5.0 V		±0.15
2	0 V	0 V		±0.15
	30 V p-p	2.5 V	+2.533	±0.15
	60 V p-p	5.0 V		±0.15
3.	+25 Vdc	0 V		±0.15
	0 V	2.5 V	+2.649	±0.15
	-25 Vdc	5.0 V		±0.15
4	+25 Vdc	0 V		±0.15
	0 V	2.5 V	+2.768	±0.15
	-25 Vdc	5.0 V		±0.15
5	+120 Vdc	0 V		±0.15
	0 V	2.5 V	+2.576	±0.15
	-120 Vdc	5.0 V		±0.15
6	+120 Vdc	0 V		±0.15
	0 V	2.5 V	+2.521	±0.15
	-120 Vdc	5.0 V		±0.15
7	+30 Vdc	0 V		±0.15
	0 V	2.5 V	+2.622	±0.15
	-30 Vdc	5.0 V		±0.15
8	+30 Vdc	0 V		±0.15
	0 V	2.5 V	+2.622	±0.15 N/A
	-30 Vdc	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE	D-20	SHEET 37 OF	

MODEL NO. FMT-667 TESTED BY E. F. White

SERIAL NO. 102 DATE Mar. 30 1972

Temp Shock +85°C AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
9	+30 Vdc	0 V		±0.15
	0 V	2.5 V	+2.621	±0.15 N/A
	-30 Vdc	5.0 V		±0.15
10	+30 Vdc	0 V		±0.15
	0 V	2.5 V	+2.622	±0.15
	-30 Vdc	5.0 V		±0.15
11	+295 Vdc	0 V		±0.15
	+345 Vdc	2.5 V	N/A	±0.15
	+395 Vdc	5.0 V		±0.15
12	+220 Vdc	0 V		±0.15
	+240 Vdc	2.5 V	N/A	±0.15
	+260 Vdc	5.0 V		±0.15
13	-120 Vdc	0 V		±0.15
	-140 Vdc	2.5 V	N/A	±0.15
	-160 Vdc	5.0 V		±0.15
14	0 V	0 V		±0.15
	12.5 V rms	2.5 V	+1.067	±0.15 N/A
	25 V rms	5.0 V		0.15
14C	Jump S6 to S7	Power Transfer	EFW	Verify
15	+10 Vdc	0 V		±0.15
	0 V	2.5 V	+1.914	±0.15 N/A
	-10 Vdc	5.0 V		±0.15
16	0 V	0 V	+.037	±0.15
	+2.5 Vdc	2.5 V		±0.15 N/A.
	+5.0 Vdc	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET 38 OF	

FORM NO. 110 F 005.2

MODEL NO. FMT-667 TESTED BY E. F. White

SERIAL NO. 102 DATE Mar. 30, 1972

Temp Shock +85°C AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
16(1)	+28 V pulse	+ pulse	N/A	Verify
16(2)	28 V interrupt	+ pulse	N/A	Verify
16(3)	+5 V pulse	+ pulse	N/A	Verify
17	0 V	0 V	+.041	±0.15
	+25 Vdc	2.5 V		±0.15 N/A
	+50 Vdc	5.0 V		±0.15
18	0 V	0 V	+.040	±0.15
	+25 Vdc	2.5 V		±0.15
	+50 Vdc	5.0 V		±0.15
19	0 V	0 V	+.035	±0.15
	20 V rms	2.5 V		±0.15
	40 V rms	5.0 V		±0.15 N/A
A1-K1	28 V off	Relays closed	N/A	Verify
and K2	28 V on	Relays closed	N/A	Verify
5 V	N/A	J1-43, 44, 45 = 5 V	E.F.W	Verify
20	0 V	0 V	+.032	±0.15
	+2.5 Vdc	2.5 V		±0.15 N/A
	+5.0 Vdc	5.0 V		±0.15
21	0 V	0 V	+.033	±0.15
	+2.5 Vdc	2.5 V		±0.15
	+5.0 Vdc	5.0 V		±0.15
22	0 V	0 V	+.043	±0.15
	25 V rms	2.5 V		±0.15 N/A.
	50 V rms	5.0 V		±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET OF	

MODEL NO. FMT-667

SERIAL NO. 102

TESTED BY E. F. White

DATE Mar. 30, 1972

Temp Shock +85°C

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
23	*	0 V 2.5 V 5.0 V	N/A	±0.15 ±0.15 ±0.15 N/A
24	+5 Vdc 0 V -5 Vdc	0 V 2.5 V 5.0 V	+ 3.754	±0.15 ±0.15 ±0.15
25	+5 Vdc 0 V -5 Vdc	0 V 2.5 V 5.0 V	+ 3.753	±0.15 ±0.15 ±0.15
26	0 V 1 V rms 2 V rms	0 V 2.5 V 5.0 V	+ .048	±0.15 ±0.15 ±0.15 N/A.

*The data deleted from this block, when combined with certain data from other sources, could be developed into classified information.

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	01009530	
SCALE	D-23	SHEET 10 OF	

MODEL NO. FMT-667 TESTED BY E. F. White

SERIAL NO. 102 DATE Mar. 30, 1972

Post Environmental

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
1	0 Vdc	0 V	+.046	±0.15
	-5 Vdc	2.5 V	+.2.546	±0.15
	-10 Vdc	5.0 V	+5.043	±0.15
2	0 V	0 V	0V	±0.15
	30 V p-p	2.5 V	+2.500VPP	±0.15
	60 V p-p	5.0 V	+5.000VPP	±0.15
3	+25 Vdc	0 V	+.034	±0.15
	0 V	2.5 V	+2.522	±0.15
	-25 Vdc	5.0 V	+5.003	±0.15
4	+25 Vdc	0 V	+.007	±0.15
	0 V	2.5 V	+2.493	±0.15
	-25 Vdc	5.0 V	+4.975	±0.15
5	+120 Vdc	0 V	+.022	±0.15
	0 V	2.5 V	+2.517	±0.15
	-120 Vdc	5.0 V	+5.008	±0.15
6	+120 Vdc	0 V	+.025	±0.15
	0 V	2.5 V	+2.518	±0.15
	-120 Vdc	5.0 V	+5.006	±0.15
7	+30 Vdc	0 V	-.044	±0.15
	0 V	2.5 V	+2.507	±0.15
	-30 Vdc	5.0 V	+5.054	±0.15
8	+30 Vdc	0 V	-.046	±0.15
	0 V	2.5 V	+2.545	±0.15
	-30 Vdc	5.0 V	+5.131	±0.15

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	61000530

SCALE D-24 SHEET OF

MODEL NO. FMT-667 TESTED BY E F White

SERIAL NO. 102 DATE Mar. 30, 1972

Post Environmental AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
9	+30 Vdc	0 V	- .059	±0.15
	0 V	2.5 V	+2.520	±0.15
	-30 Vdc	5.0 V	+5.090	±0.15
10	+30 Vdc	0 V	- .015	±0.15
	0 V	2.5 V	+2.545	±0.15
	-30 Vdc	5.0 V	+5.102	±0.15
11	+295 Vdc	0 V	+.027	±0.15
	+345 Vdc	2.5 V	+2.527	±0.15
	+395 Vdc	5.0 V	+5.023	±0.15
12	+220 Vdc	0 V	+.024	±0.15
	+240 Vdc	2.5 V	+2.523	±0.15
	+260 Vdc	5.0 V	+5.027	±0.15
13	-120 Vdc	0 V	+.084	±0.15
	-140 Vdc	2.5 V	+2.568	±0.15
	-160 Vdc	5.0 V	+5.051	±0.15
14	0 V	0 V	+.030	±0.15
	12.5 V rms	2.5 V	+2.534	±0.15
	25 V rms	5.0 V	+5.040	0.15
14C	Jump S6 to S7	Power Transfer	E.F.W	Verify
15	+10 Vdc	0 V	+.011	±0.15
	0 V	2.5 V	+2.460	±0.15
	-10 Vdc	5.0 V	+4.980	±0.15
16	0 V	0 V	+.009	±0.15
	+2.5 Vdc	2.5 V	+2.503	±0.15
	+5.0 Vdc	5.0 V	+4.985	±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000530	
SCALE		SHEET OF	

MODEL NO. FMT-667

SERIAL NO. 102

TESTED BY E. F. White

DATE Mar. 30, 1972

Post Environmental AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
16(1)	+28 V pulse	+ pulse	E.F.W	Verify
16(2)	28 V interrupt	+ pulse	E.F.W	Verify
16(3)	+5 V pulse	+ pulse	E.F.W	Verify
17	0 V	0 V	+.028	±0.15
	+25 Vdc	2.5 V	+2.521	±0.15
	+50 Vdc	5.0 V	+5.012	±0.15
18	0 V	0 V	+.025	±0.15
	+25 Vdc	2.5 V	+2.516	±0.15
	+50 Vdc	5.0 V	+5.000	±0.15
19	0 V	0 V	+.025	±0.15
	20 V rms	2.5 V	+2.546	±0.15
	40 V rms	5.0 V	+5.063	±0.15
A1-K1	28 V off	Relays closed	E.F.W	Verify
and K2	28 V on	Relays closed	E.F.W	Verify
5 V	N/A	J1-43, 44, 45 = 5 V	E.F.W	Verify
20	0 V	0 V	+.009	±0.15
	+2.5 Vdc	2.5 V	+2.498	±0.15
	+5.0 Vdc	5.0 V	+4.982	±0.15
21	0 V	0 V	+.010	±0.15
	+2.5 Vdc	2.5 V	+2.499	±0.15
	+5.0 Vdc	5.0 V	+4.984	±0.15
22	0 V	0 V	+.034	±0.15
	25 V rms	2.5 V	+2.518	±0.15
	50 V rms	5.0 V	+5.002	±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	61000330	
SCALE		SHEET 29 OF	

FORM NO. 1101 6X 2

MODEL NO. FMT-667

SERIAL NO. 102

TESTED BY E. F. White

DATE Mar. 30, 1972

Post Environmental

AIM - 4F/4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
23	*	0 V	+.004	±0.15
		2.5 V	+2.486	±0.15
		5.0 V	+4.963	±0.15
24	+5 Vdc	0 V	+.029	±0.15
	0 V	2.5 V	+2.514	±0.15
	-5 Vdc	5.0 V	+4.998	±0.15
25	+5 Vdc	0 V	+.021	±0.15
	0 V	2.5 V	+2.507	±0.15
	-5 Vdc	5.0 V	+4.989	±0.15
26	0 V	0 V	+.052	±0.15
	1 V rms	2.5 V	+2.508	±0.15
	2 V rms	5.0 V	+5.005	±0.15

*The data deleted from this block, when combined with certain data from other sources, could be developed into classified information.

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923	01009330	
SCALE		SHEET 40 OF	

ACCEPTANCE TEST RESULTS

of

UHF TELEMETRY TRANSMITTER

1202

MODEL #T-[redacted] ([redacted]) ([redacted])

CUSTOMER ARINC

SPEC. NO. T1202

SALES ORDER 2892

OUTLINE DWG. NO. 82000307

SERIAL NO. 196

FREQUENCY 240.2 MHz

DATE 2/16/72

MANUFACTURED BY

Vector an AYDIN COMPANY
Newtown, Pa.

	Pin Connections
Pin	Function
A or 1	+28V
B or 2	MOD IN
C or 3	GND
D or 4	GND
E or 5	
F or 6	

DATA SHEET
PAGE 1 of 5

REVIEWED AND APPROVED BY

SIZE	CODE IDENT NO.	DRAWING NO.	
A	13923	62003015	B
SCALE		SHEET 13 OF 1?	

Ser # 196
Date 2/16/72
Tested By

3.1 Test Equipt. Calib. ______ (Stamp Acc.)

4.0 Visual/Mechanical ______ (Stamp Acc.)

Weight 12 Oz. (Limit 16 Oz.)

6.0 TEST RESULTS

6.1 Modulation Characteristics

6.1.1 Deviation Sensitivity

6.1.1.3 1 Vrms/ 28.0 kHz Deviation

Limit: 1 Vrms ±10%/ 28.3 kHz Deviation

6.1.2 Modulation Freq. Response

Mod. Freq. Hz	Response dB	Mod. Freq. Hz	Response dB
10	0	100K	-.1
100	0	300K	-.1
1K	0	500K	
10K	0	700K	
50K	0	1M	

LIMIT: ± 1.0 dB FROM D.C Hz TO 300 kHz

6.1.3 MODULATION DISTORTION

Mod. Freq. Hz	Distortion %
100	1.1
1K	1.1
10K	1.2
100K	1.5

LIMIT: 2.0 % per ±100 kHz DEVIATION

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015
SCALE		SHEET 11 OF

Ser # 196
Date 2/16/72
Tested By DJR

6.1.4 Modulation Input Impedance

>20 K ohms Limit: 20 K ohms Min.

6.1.5 Incidental FM

± 0.140 kHz Limit: ± ______ kHz

6.2 Input Characteristics

6.2.1 Reverse Polarity ☑ No Damage

6.2.2 Over Voltage ☑ No Damage

6.2.3 Input Current

	Input Vdc	Input Current (Amps.)
Lo	24	430
Nominal	28	430
High	32	430

Limit: .450 Amps. Max.

6.3 OUTPUT CHARACTERISITCS

6.3.1 Output Power

	Input Vdc	Output Power Watts
Lo	24	3.75
Nominal	28	3.75
High	32	3.75

Limit: 2.0 Watts Min.

6.3.2 Output Frequency

	Input Vdc	Frequency kHz	% From Assigned
Lo	24	201.9	.0008
Nominal	28	240 201.9	.0008
High	32	201.9	.0008

Limit: ± .005 % from Assigned

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015
SCALE		SHEET 13 OF

Ser # 196
Date 2/16/72
Tested By [illegible]

6.3.3 Spurious Output

Freq. MHz	Spur Level (dB)

>70 dB OVER TEMP RANGE

All others >70 dB Below Carrier

Limit:__________ dB Below Carrier (Table 1)

6.3.4 Load VSWR

Open and short circuit load ☐ No Damage N/A

6.4 TEMPERATURE

Temp °C	Input (Vdc)	Input I (Amps)	Output Power	Output Freq.	% From Assign
Lo	Lo 24	390	3.15	206.8	.0028
-20 °C	Nom. 28	390	3.15	206.8	.0028
	32	390	3.15	206.8	.0028
Hi	Lo 24	440	3.75	194.6	.0020
+85 °C	Nom 28	440	3.75	194.6	.0020
	Hi 32	440	3.75	194.6	.0020

Limit: Input I 450 Amps Max.

Output Power 2.0 Watts Min.

Output Freq. ±.005 % from Assigned

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015
SCALE		SHEET OF

FORM 370-5-1 9/67

6.5 VIBRATION

	BEFORE	DURING	AFTER
RF Power (Watts)	3-75	3-75	3-75
RF Freq (kHz)	201.9	201.8	201.8
Input Current (Amps)	.430	430	430
Incidental FM (kHz)	±0.140	<±.5KHZ	±0.140

7.0 PREPARATION FOR DELIVERY

Audit Inspection ________ Stamp acceptance

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015
SCALE		SHEET OF

ACCEPTANCE TEST RESULTS

of

UHF TELEMETRY TRANSMITTER

MODEL #T-102 (S) (L)

CUSTOMER ARINC

SPEC. NO. T1022

SALES ORDER 2892

OUTLINE DWG. NO. 82000307

SERIAL NO. 288

FREQUENCY 1492.5 MHz

DATE 2/16/72

MANUFACTURED BY

Vector an AYDIN COMPANY
Newtown, Pa.

	Pin Connections
Pin	Function
A or 1	+28V
B or 2	MOD IN
C or 3	GND
D or 4	GND
E or 5	
F or 6	

DATA SHEET
PAGE 1 of 5

REVIEWED AND APPROVED BY

SIZE	CODE IDENT NO.	DRAWING NO.	
A	13923	62003015	B
SCALE		SHEET 13 OF 17	

Ser # 288
Date 2/16/72
Tested By [illegible]

3.1 Test Equipt. Calib. ____________ (Stamp Acc.)

4.0 Visual/Mechanical ____________ (Stamp Acc.)

Weight 14 Oz. (Limit 16 Oz.)

6.0 TEST RESULTS

6.1 Modulation Characteristics

6.1.1 Deviation Sensitivity

6.1.1.3 1 Vrms/ 85.0 kHz Deviation

Limit: 1 Vrms ±10%/ 85.0 kHz Deviation

6.1.2 Modulation Freq. Response

Mod. Freq. Hz	Response dB	Mod. Freq. Hz	Response dB
10	0	100K	+.1
100	0	300K	+.1
1K	0	500K	+.1
10K	0	700K	
50K	0	1M	

LIMIT: ± 1.0 dB FROM D.C. Hz TO 500k Hz

6.1.3 MODULATION DISTORTION

Mod. Freq. Hz	Distortion %
100	.75
1K	.70
10K	.50
100K	.80

LIMIT: 1.0 % per ± 300 kHz DEVIATION

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015
SCALE		SHEET 11 OF

Ser # 258
Date 2/16/72
Tested By S [illegible]

6.1.4 Modulation Input Impedance

220 K ohms Limit: 20 K ohms Min.

6.1.5 Incidental FM

± 0.24 kHz Limit: ± 5 kHz

6.2 Input Characteristics

6.2.1 Reverse Polarity ☑ No Damage

6.2.2 Over Voltage ☑ No Damage

6.2.3 Input Current

	Input Vdc	Input Current (Amps.)
Lo	24	850
Nominal	28	850
High	32	850

Limit: 1.0 Amps. Max.

6.3 OUTPUT CHARACTERISITCS

6.3.1 Output Power

	Input Vdc	Output Power Watts
Lo	24	4.9
Nominal	28	4.9
High	32	4.9

Limit: 2.0 Watts Min.

6.3.2 Output Frequency

	Input Vdc	Frequency kHz	% From Assigned
Lo	24	493.7	.0004
Nominal	28	493.7	.0004
High	32	493.7	.0004

Limit: ± .001 % from Assigned

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015
SCALE		SHEET 15 OF

Ser # 288
Date 2/16/72
Tested By SJr

6.3.3 Spurious Output

Freq. MHz	Spur Level (dB)
	>70 db OVER TEMP RANGE

All others >70 dB Below Carrier

Limit: 61.9 dB Below Carrier (Table 1)

6.3.4 Load VSWR

Open and short circuit load ☑ No Damage

6.4 TEMPERATURE

Temp °C	Input (Vdc)	Input I (Amps)	Output Power	Output Freq.	% From Assign
Lo	Lo 24	830	3.7	514.1	.0093
-20 °C	Nom. 28	800	3.9	514.1	.0093
	32	800	3.9	514.1	.0093
Hi	Lo 24	870	3.7	470.1	.0013
+85 °C	Nom 28	840	3.9	470.1	.0013
	Hi 32	840	3.9	470.1	.0013

Limit: Input I 1.0 Amps Max.

Output Power 2.0 Watts Min.

Output Freq. ±.003 % from Assigned

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015
SCALE		SHEET 16 OF

6.5 VIBRATION

	BEFORE	DURING	AFTER
RF Power (Watts)	4.9	4.9	4.9
RF Freq (kHz)	493.7	493.6	493.6
Input Current (Amps)	850	850	850
Incidental FM (kHz)	±0.24	<±1.0 kHz	±0.24

7.0 PREPARATION FOR DELIVERY

Audit Inspection ____(SL)____ Stamp acceptance

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015
SCALE		SHEET 1 OF 1

ACCEPTANCE TEST RESULTS
of
UHF TELEMETRY TRANSMITTER

MODEL #T-~~102~~ 1202 (C) (D)

CUSTOMER ARINC

SPEC. NO. T1202

SALES ORDER 2892

OUTLINE DWG. NO. 82000307

SERIAL NO. 195

FREQUENCY 2319 MHz

DATE 2/16/72

MANUFACTURED BY

Vector an AYDIN COMPANY
Newtown, Pa.

Pin	Pin Connections Function
A or 1	+28V
B or 2	MOD IN
C or 3	GND
D or 4	GND
E or 5	
F or 6	

DATA SHEET
PAGE 1 of 5

REVIEWED AND APPROVED BY

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015

SCALE SHEET 1? OF 1?

Ser # 195
Date 2/16/72
Tested By

3.1 Test Equipt. Calib. __________ (Stamp Acc.)

4.0 Visual/Mechanical __________ (Stamp Acc.)

Weight 12 Oz. (Limit 14 Oz.)

6.0 TEST RESULTS

6.1 Modulation Characteristics

6.1.1 Deviation Sensitivity

6.1.1.3 1 Vrms/ 28.0 kHz Deviation

Limit: 1 Vrms ±10%/ 28.3 kHz Deviation

6.1.2 Modulation Freq. Response

Mod. Freq. Hz	Response dB	Mod. Freq. Hz	Response dB
10	0	100K	-.3
100	0	300K	-.3
1K	0	500K	
10K	0	700K	
50K	-.4	1M	

LIMIT: ± 1.0 dB FROM 0.c Hz TO 300 Hz

6.1.3 MODULATION DISTORTION

Mod. Freq. Hz	Distortion %
100	1.4
1K	1.4
10K	1.4
100K	1.5

LIMIT: 2.0 % per ±100 kHz DEVIATION

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015

SCALE SHEET OF

Ser # 195
Date 2/16/72
Tested By S/JR

6.1.4 Modulation Input Impedance

220 K ohms Limit: 20 K ohms Min.

6.1.5 Incidental FM

± 0.140 kHz Limit: ± ______ kHz

6.2 Input Characteristics

6.2.1 Reverse Polarity ☑ No Damage

6.2.2 Over Voltage ☐ No Damage

6.2.3 Input Current

	Input Vdc	Input Current (Amps.)
Lo	24	410
Nominal	28	410
High	32	410

Limit: 450 Amps. Max.

6.3 OUTPUT CHARACTERISITCS

6.3.1 Output Power

	Input Vdc	Output Power Watts
Lo	24	3.5
Nominal	28	3.5
High	32	3.5

Limit: 2.0 Watts Min.

6.3.2 Output Frequency

	Input Vdc	Frequency kHz	% From Assigned
Lo	24	902.3	.008
Nominal	28	231 902.3	.008
High	32	902.3	.008

Limit: ± .005 % from Assigned

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015
SCALE		SHEET 13 OF

Ser # 195
Date 2/16/72
Tested By S/ST

6.3.3 Spurious Output

Freq. MHz	Spur Level (dB)
	>70 dB OVER TEMP RANGE

All others >70 dB Below Carrier

Limit: 60.4 dB Below Carrier (Table 1)

6.3.4 Load VSWR

Open and short circuit load N/A ☐ No Damage

6.4 TEMPERATURE

Temp °C	Input (Vdc)	Input I (Amps)	Output Power	Output Freq.	% From Assig
Lo	Lo 24	370	2.95	902.6	.0012
-20 °C	Nom. 28	370	2.95	902.6	.0012
	32	370	2.95	902.6	.0012
Hi	Lo 24	410	3.3	892.1	.0032
+85 °C	Nom 28	410	3.3	892.1	.0032
	Hi 32	410	3.3	892.1	.0032

Limit: Input I 450 Amps Max.
Output Power 2.0 Watts Min.
Output Freq. ±.005 % from Assigned

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015
SCALE		SHEET

6.5 VIBRATION

	BEFORE	DURING	AFTER
RF Power (Watts)	3.5	3.5	3.5
RF Freq (kHz)	902.3	902.2	902.2
Input Current (Amps)	410	410	410
Incidental FM (kHz)	±0.140	<±.5kHz	±0.140

7.0 PREPARATION FOR DELIVERY

Audit Inspection ____________ Stamp acceptance

SIZE	CODE IDENT NO.	DRAWING NO.
A	13923	62003015
SCALE		SHEET OF

APPENDIX E

A3 CARD ACCEPTANCE DATA
(February 1973)

MODEL NO. FMT-667 TESTED BY

SERIAL NO. DATE *Feb 1, 2, 1973*

AIM - 4G DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM (Vdc)
20	A & B Open	2.34V	2.290	±0.15V
	B shorted (pin 13)	2.8V	2.695	±0.15
	A & B shorted	3.5V	3.420	±0.15
	A shorted	4.67	4.544	±0.15
21	E_A = 0.5V E_B = -9.5V	0 V	0.008	±0.15
	E_A = E_B = -4.5V	2.5V	2.506	±0.15
	E_A = -9.5V E_B = 0.5V	5.0V	4.998	±0.15
22	0 V	0 V	0.004	±0.15
	50Vrms	2.5V	2.505	±0.15
	100 Vrms	5.0V	5.015	±0.15
23	*	0 V	0.025	±0.15
		2.5V	2.425	±0.15
		5.0V	4.960	±0.15
24	E_A = Vo -2.5V, E_B = Vo +2.5V	0 V	0.111	±0.15
	E_A = E_B = Vo	2.5V	2.536	±0.15
	E_A = Vo + 2.5V, E_B = Vo -2.5V	5.0V	4.943	±0.15
25	E_A =Vo -2.5V, E_B = Vo+2.5V	0 V	0.110	±0.15
	E_A = E_B = Vo	2.5V	2.521	±0.15
	E_A = Vo +2.5V, E_B = Vo -2.5V	5.0V	4.923	±0.15
26	0 V	0 V	+ 0.009	±0.15
	1 Vrms	2.5V	2.471	±0.15
	2 Vrms	5.0V	4.972	±0.15

*The data deleted from this block, when combined with certain data from other sources, could be developed into classified information.

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923		

SCALE SHEET OF

FORM NO 110 E.005-2

MODEL NO. FMT-667 TESTED BY ______________

SERIAL NO. ______________ DATE Feb 1, 2, 1973

AIM - 4F CH. 20 - 26 DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM(Vdc)
	No pulse	1V	0.55	±0.25
20	1.2μ sec p	2V	2.10	±0.25
	1.8μ sec p	5.0V	5.00	±0.25
Pre	RRG leads 1 μsec	0 V	-0.2	±0.25
21	Coincidence	2.5V	2.40	±0.25
Launch	RRG lags 1μsec	5.0V	5.00	±0.25
Post	GPP leads 1 μ sec	0 V	-0.2	±0.25
21	Coincidence	2.5V	2.65	±0.25
Launch	GPP lags 1 μ s.	5.0V	5.10	±0.25
	TV leads 1 μ sec	0 V	- 0.05	±0.25
22	Coincidence	2.5V	2.60	±0.25
	TV lags 1 μ s.	5.0V	5.00	±0.25
	Pulse Absence	1.0V	1.0	±0.25
23	Video in Low Noise	2.5V	2.5	±0.25
	Video in High Noise	4.0V	4.0	±0.25
	0 V	0 V	0.00	±0.25
24	+0.5V	2.5V	2.55	±0.15
	+1.0V	5.0V	5.00	±0.15
	-85 Vdc	0 V	-0.05	±0.15
25	-72.5 Vdc	2.5V	2.50	±0.15
	-60 Vdc	5.0V	4.90	±0.15
	- 0V	2.5Vdc	2.50 (dc)	±0.15
26	5Vp-p	2.5Vp-p	2.70 (p-p)	±0.15
	10Vp-p	5.0Vp-p	5.30 (p-p)	±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923		
SCALE		SHEET OF	

FORM NO. 110 E.005 2

MODEL NO. FMT-667 TESTED BY

SERIAL NO. DATE Feb 1, 2, 1973

AIM - 4F CH. 20 - 26 DATA SHEET

CHANNEL	INPUT	OUT/TM-DC	OUT/READ	TOL/TM(Vdc)
	No pulse	1V	0.55	±0.25
20	1.2μ sec p	2V	2.10	±0.25
	1.8μsec p	5.0V	5.00	±0.25
Pre	RRG leads 1 μsec	0 V	-0.2	±0.25
21	Coincidence	2.5V	2.40	±0.25
Launch	RRG lags 1μsec	5.0V	5.00	±0.25
Post	GPP leads 1 μ sec	0 V	-0.2	±0.25
21	Coincidence	2.5V	2.65	±0.25
Launch	GPP lags 1 μ s.	5.0V	5.10	±0.25
	TV leads 1 μ sec	0 V	- 0.05	±0.25
22	Coincidence	2.5V	2.60	±0.25
	TV lags 1 μ s.	5.0V	5.00	±0.25
	Pulse Absence	1.0V	1.0	±0.25
23	Video in Low Noise	2.5V	2.5	±0.25
	Video in High Noise	4.0V	4.0	±0.25
	0 V	0 V	0.00	±0.25
24	+0.5V	2.5V	2.55	±0.15
	+1.0V	5.0V	5.00	±0.15
	-85 Vdc	0 V	-0.05	±0.15
25	-72.5 Vdc	2.5V	2.50	±0.15
	-60 Vdc	5.0V	4.90	±0.15
	- 0V	2.5Vdc	2.50 (dc)	±0.15
26	5Vp-p	2.5Vp-p	2.70 (p-p)	±0.15
	10Vp-p	5.0Vp-p	5.30 (p-p)	±0.15

SIZE	CODE IDENT NO.	DRAWING NO.	REV
A	13923		
SCALE		SHEET OF	

FORM NO. 110 E.005 2