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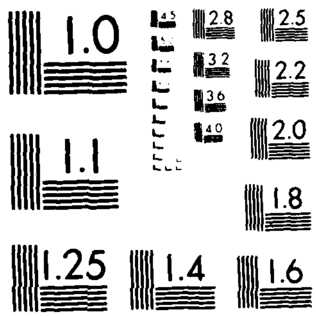
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AFGL-TR-84-0103

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DRIFT SCINTILLATION METER

B. J. Holt

Center for Space Sciences
The University of Texas at Dallas
Box 830688
Richardson, Texas 75083-0688

Final Report
15 June 1979 - 31 March 1984

March 1984

Approved for public release; distribution unlimited

AIR FORCE GEOPHYSICS LABORATORY
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
HANSCOM AFB
MASSACHUSETTS 01731

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This report has been reviewed by the ESD Public Affairs Office (PA) and is releasable to the National Technical Information Service (NTIS).

This technical report has been reviewed and is approved for publication.

William P. Sullivan
WILLIAM P. SULLIVAN
Contract Manager

W J Burke
WILLIAM J. BURKE, Chief
Space Plasmas & Fields Branch
Space Physics Division

FOR THE COMMANDER

Rita C. Sagalyn
RITA C. SAGALYN, Director
Space Physics Division

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This is the Final Report for the subject contract under which The University of Texas at Dallas (UTD) built, tested and delivered an engineering model and three flight versions of the Drift Scintillation Meter (DSM) to the Air Force Geophysics Laboratory for flight on the Air Force DMSP satellites. The report is divided into three sections. Section 1 contains the instrument description and theory of operation. Section 2 contains a description of planned spacecraft-level instrument testing, stimulation requirements and instrument handling and

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safety. Section 3 contains an instrument interconnection diagram and a list of the schematics, drawings, parts lists and wiring lists that describe the as-built configuration of the instrument. This documentation is available to AFGL upon request. Test results, calibration data and procedures are found in the R&D Equipment Information Reports that were submitted to AFGL after each instrument delivery.

Preface

This is the Final Report for the subject contract under which The University of Texas at Dallas (UTD) built, tested and delivered an engineering model and three flight versions of the Drift Scintillation Meter (DSM) to the Air Force Geophysics Laboratory for flight on the Air Force DMSP satellites. The report is divided into three sections. Section 1 contains the instrument description and theory of operation. Section 2 contains a description of planned spacecraft-level instrument testing, stimulation requirements and instrument handling and safety. Section 3 contains an instrument interconnection diagram and a list of the schematics, drawings, parts lists and wiring lists that describe the as-built configuration of the instrument. This documentation is available to AFGL upon request. Test results, calibration data and procedures are found in the R&D Equipment Information Reports that were submitted to AFGL after each instrument delivery.

Contributing Scientists/Engineers

The following scientists and engineers contributed to the research reported in this document:

W. B. Hanson
R. A. Heelis
C. R. Lippincott
D. R. Zuccaro
B. J. Holt
L. L. Harmon
J. C. Brown

Address:

The University of Texas at Dallas
Mail Stop F022
P. O. Box 830688
Richardson, Texas 75083-0688

Telephone:

214-690-2851

or

214-690-2832

Related Contracts

UTD recently completed AFGL contract F19628-82-K-0041, "An Improved Ion Drift Meter."

Publications

The following paper resulted partially from the sponsorship of this contract:

"A Technique for Establishing a Reference Potential on Satellites in Planetary Ionospheres" by D. R. Zuccaro and B. J. Holt, Journal of Geophysical Research, 87, 8327-8329, 1982

Table of Contents

Referenced Illustrations

SECTION 1

INSTRUMENT DESCRIPTION

INSTRUMENT DESCRIPTION

I. GENERAL

The Drift Scintillation Meter (DSM) consists of a Drift Meter sensor, a Scintillation Meter sensor and an electronics box. The sensors are mounted in a common ground plane with the SSIES Ion (RPA) sensor. The potential (V_{BIAS}) on the ground plane and sensor housings is set by the SSIES to a voltage in the range -3 volts to +28 volts to compensate for vehicle potential. In another mode, the DSM sensor potential (SENPOT) circuit senses the potential on a forward-looking reference surface and drives the aperture plane and sensor housings to a potential equal to that of the reference surface. There are no electronics in the sensor packages; the sensor outputs are connected to electrometers in the DSM electronics box via coaxial cables. The DSM electronics box receives regulated voltages and timing signals from the SSIES and outputs analog data on three lines to the SSIES. The three analog outputs are A to D converted by a 9 bit A/D converter and inserted into the SSIES data packet as shown in Figure 1. The three outputs and their sampling frequencies are:

Electrometer/Amplifier - 24 samples/sec.
Drift Meter - 12 samples/sec.
Multiplex - 12 samples/sec.

The scientific objectives associated with the Scintillation Meter are to measure the total ion concentration and the power spectrum of irregularities in total ion concentration in the wavelength range of 1 meter to 10^5 meters. The primary objective of the Drift Meter is to measure two components of the ion drift velocity vector known to be associated with concentration irregularities.

II. PRINCIPLES OF OPERATION

A. Drift Meter - Normal Mode

The Drift Meter employs a gridded collimator and segmented collectors to determine the angle between the normal to the collector and the arriving

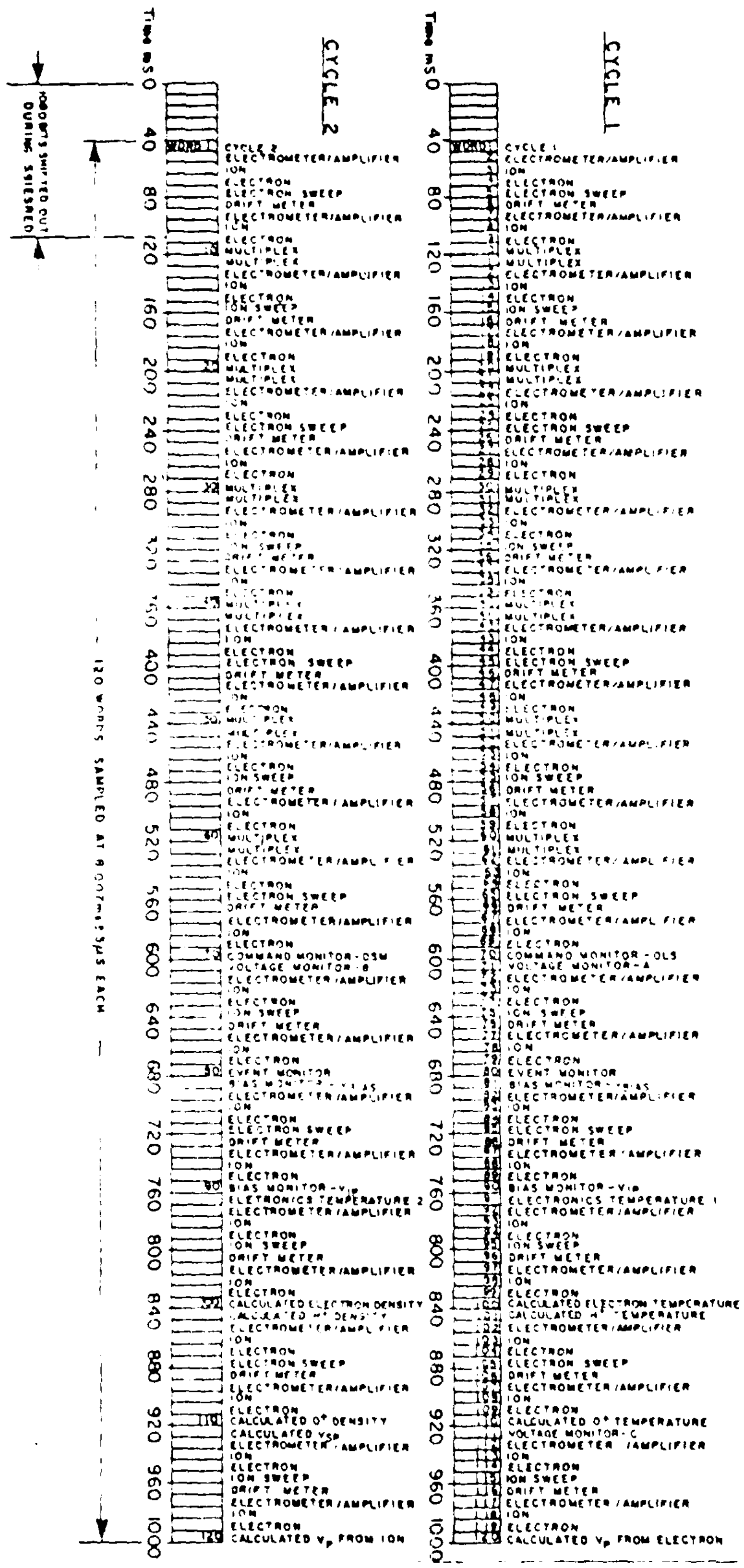


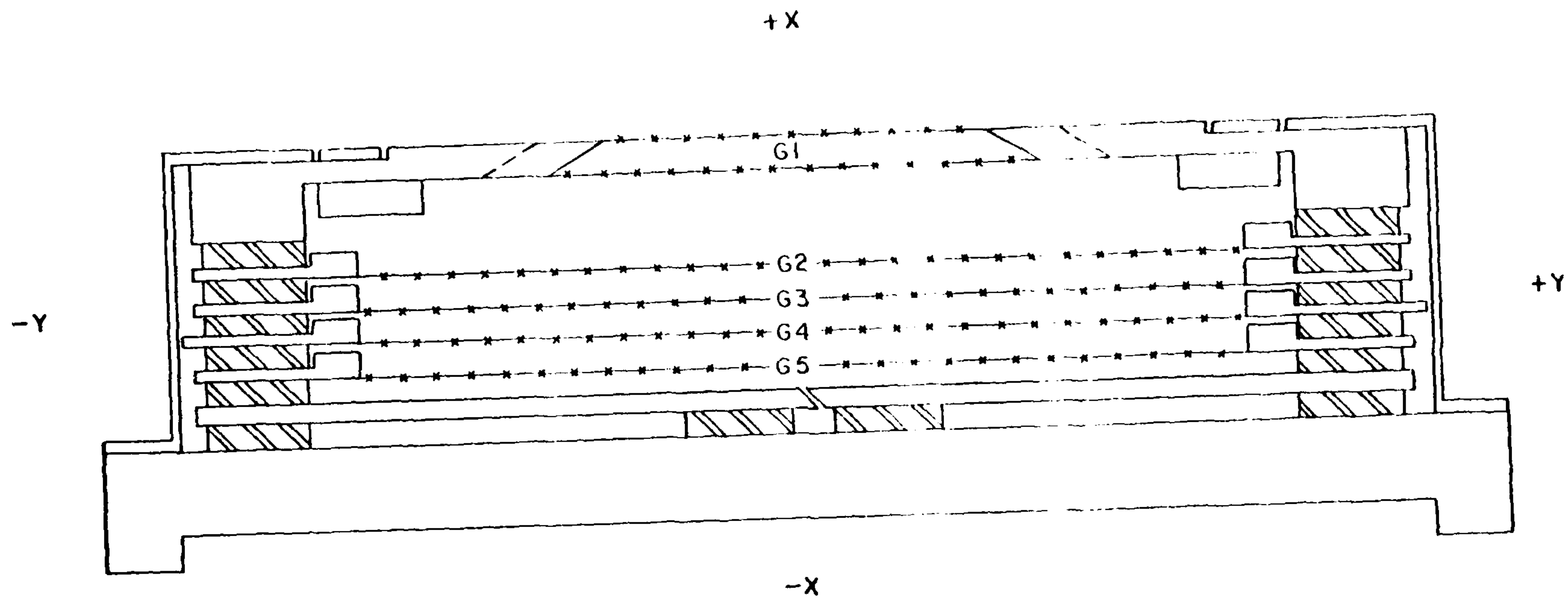
FIGURE 1 SSIES DATA FORMAT

120 WORDS/SEC

particle beam. From this information and a knowledge of the spacecraft attitude and velocity, the ambient drift velocity vector in a plane parallel to the collector surface can be determined. The gridded collimator and collectors are shown in cross-section in Figure 2. The double entrance grid G1, the sensor outer shell, and the ground plane in which the sensors are mounted are connected to V_{BIAS} during all operations. The compensation grid G2 and the repeller grid G3 may have different potentials applied to them depending upon the mode of the instrument. The shield grid G4 is held at V_{BIAS} for electrostatic shielding of the collectors and the suppressor grid G5 is held at -15 volts to ensure that no ambient electrons strike the collector surface and that photo-emission from the collector surface is returned to the collector.

In all velocity measuring modes the drift velocity parallel to the sensor face is determined from two mutually perpendicular velocity components along the Y and Z axes indicated in Figures 2 and 3. Since the exact DSM sensor mounting configuration is still TBD, the axis designation system used in the figure is that of the NASA Dynamics Explorer B satellite wherein the spacecraft is despun with the Y axis pointing toward the center of the earth and the Z axis perpendicular to the orbit plane. In such a configuration we use vertical and horizontal or pitch and yaw to denote the velocity along the Y and Z axes respectively. Figure 3 shows the collector configuration and the square entrance aperture which provides a simple linear geometric relationship between the angle of arrival of the plasma in the X-Y and X-Z planes, the vertical and horizontal ion velocities, and the currents to the collector segments. If α is the horizontal arrival angle, then the horizontal ion velocity is given by

$$V_z = V_x \tan \alpha \qquad 1)$$



-INSULATOR

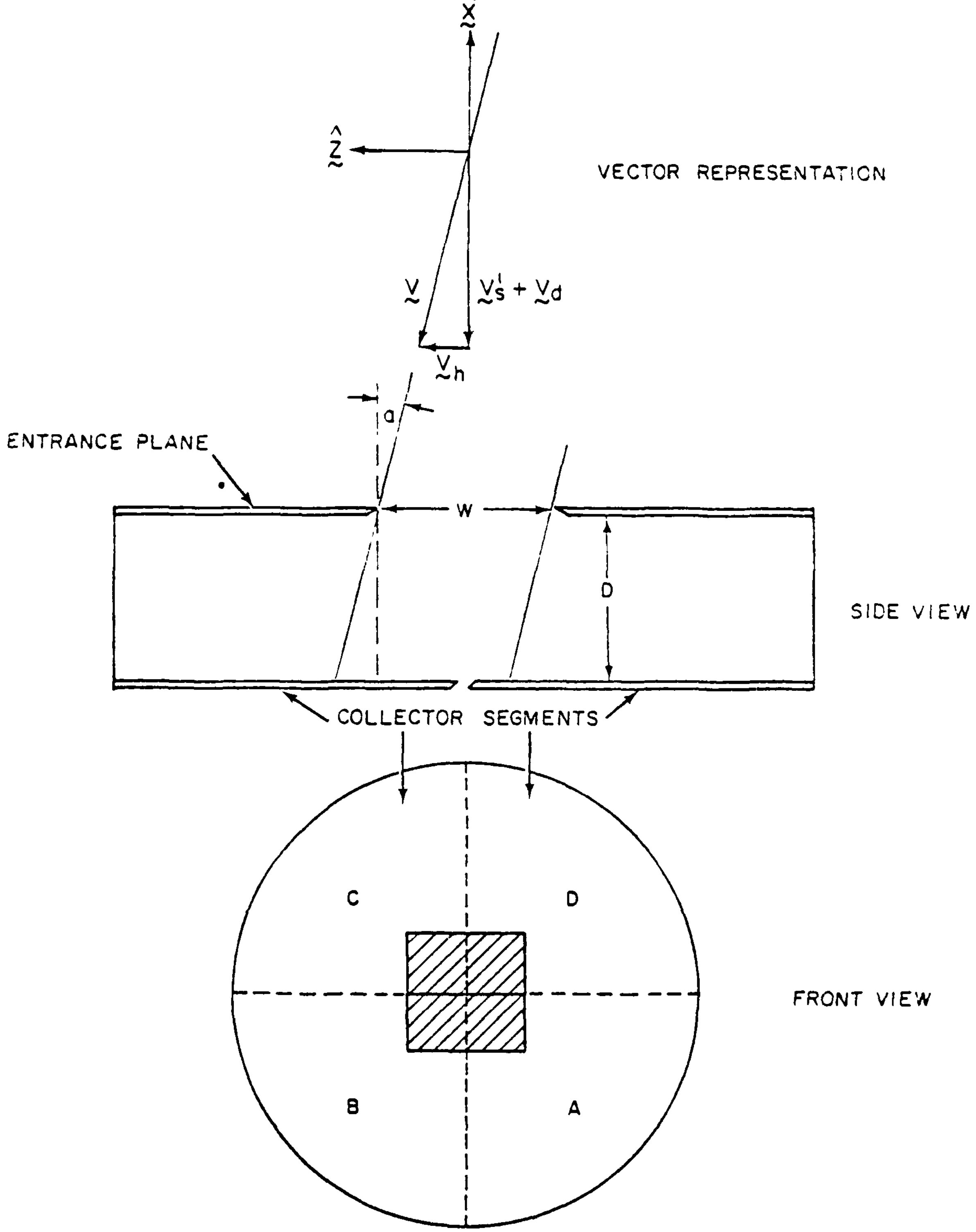
GRID DESIGNATORS

G1 - INPUT
G2 - COMPENSATION
G3 - REPELLER
G4 - SHIELD
G5 - SUPPRESSOR
(ALL 50 LINES / INCH)

NOTE:
COORDINATE SYSTEM USED IS THAT OF THE NASA DYNAMICS EXPLORER SATELLITE.

DRIFT SENSOR CROSS-SECTION

FIGURE 2



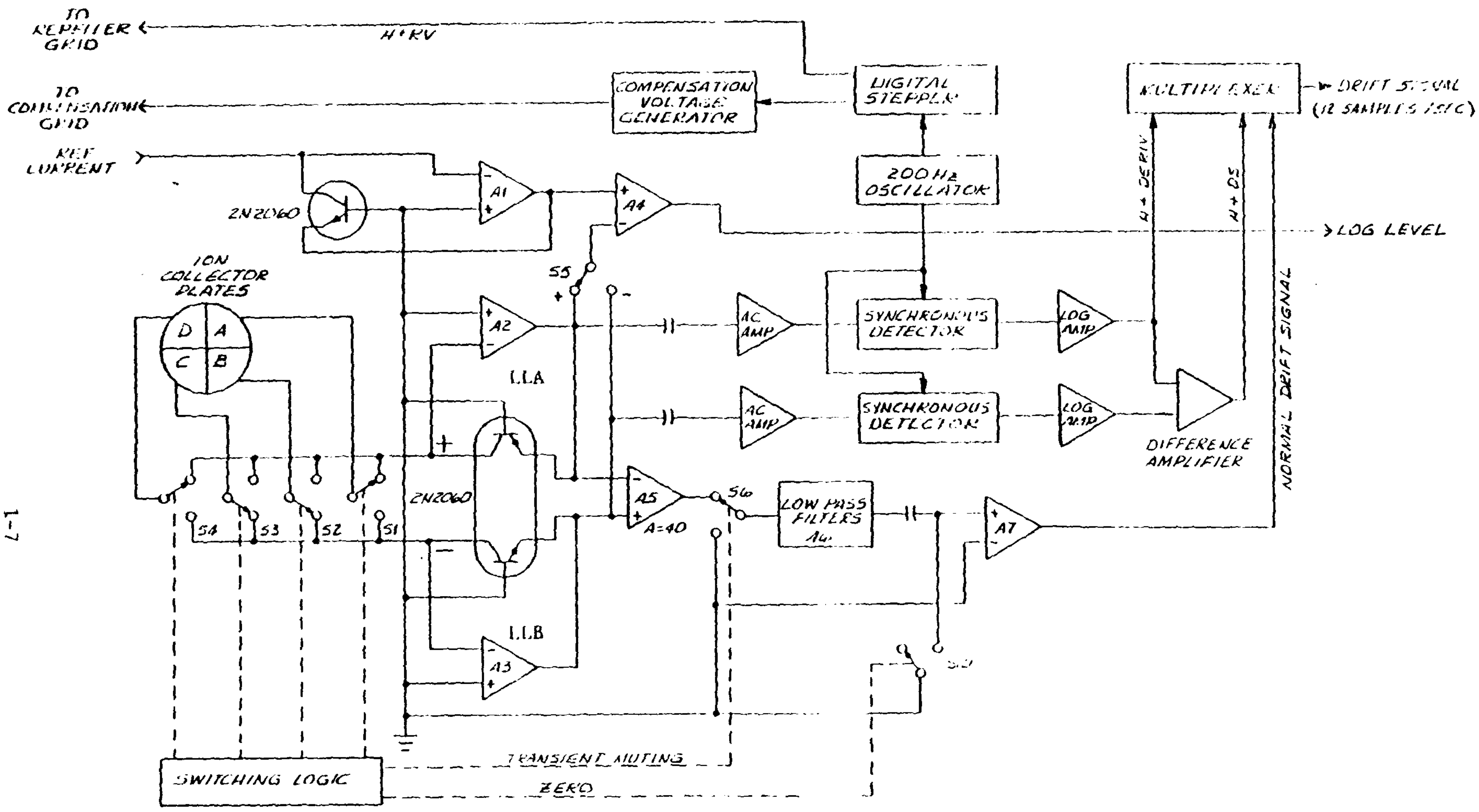
IDM COLLECTOR / APERTURE CONFIGURATION

FIGURE 3

where V_x is the sum of the spacecraft velocity along the X axis of the spacecraft and the particle drift velocity along this axis. The current to the collector is proportional to the collector area illuminated and it can easily be shown that to first order the ratio of the currents on collectors A and D to the currents on collectors B and C is proportional to Tan α.

The current ratio is determined by connecting each collector pair to a logarithmic amplifier (see Figure 4) that provides the input to a linear difference amplifier. The ratio is obtained by a technique called "rezero and offset" which is insensitive to possible imbalances in the log amplifiers. The sequence of operations is synchronized to the SSIES data format. At the beginning of Cycle 1, the log amplifier inputs are configured to measure vertical arrival angles with the zero switch (S10) closed. The input capacitor to A7 charges to a voltage proportional to the vertical ion arrival angle. The output of A7 is always translated by +2.5 volts (nominal) and the nominal +2.5 volt "rezero" level is telemetered on the Multiplex output for housekeeping purposes.

At the first Electrometer/Amplifier conversion pulse (Word #2), the circuit is switched to the offset configuration by opening S10 and reversing the inputs to the log amplifier. The voltage out of the filter (A6) goes to the opposite polarity but with the same amplitude. Since the capacitor has its original charge from the rezero measurement, and the new voltage from the filter is nearly equal but opposite, the voltage into A7 is twice the voltage corresponding to the arrival angle. By measuring the sum of the two current ratios in this manner the result is insensitive to the characteristics of the two log amplifiers.



DRIFT METER FUNCTIONAL DIAGRAM

FIGURE 4

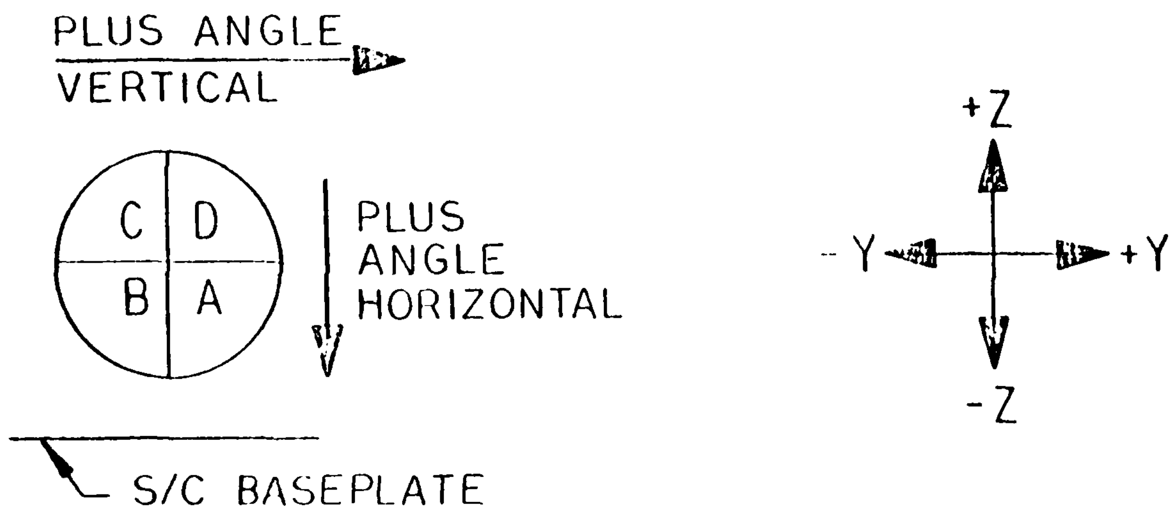
The offset measurement is made at Word #6 (Drift Meter output), allowing ample settling time for transients generated by the collector switching. At the next Electrometer Amplifier conversion pulse (Word #7), the collector pairs are connected to the log amplifiers in the horizontal rezero configuration and the rezero and offset measurement sequence is repeated. The rezero and offset sequence is repeated 12 times per second with alternate vertical and horizontal offset measurements taken.

Figure 5 defines the sense of the horizontal and vertical arrival angles. The collectors are designated as indicated when looking into the sensor face from outside the spacecraft. A plus angle gives a voltage above the nominal 2.5 volts rezero level and a minus angle gives a voltage below 2.5 volts. (The coordinate system and sensor orientation used is again that of Dynamics Explorer and will be specified for DMSP at a later date.)

Since the presence of H^+ as a significant percentage of the ambient ions has been seen to compromise the O^+ arrival angle measurements, a fixed repeller potential may be selected for G3 (0 to 3 volts in 0.5 volt increments) to exclude H^+.

B. Drift Meter - H^+ Mode

The flow velocity of light ions along the earth's magnetic field lines is measured using the same principles involved in the Normal mode. However, we must now accommodate the fact that the light ions will have a much smaller signal than the heavier ions because they have a smaller concentration and a larger thermal velocity. The larger thermal velocity of the light ions means that the constant of proportionality between the tangent of the ion arrival angle and collector current asymmetry will not be the same as that established for heavy ions. This constant can be established, however, if the signal from the light ions can be extracted from the larger heavy ion signal. This is achieved utilizing a modulation technique originally



DRIFT METER

ARRIVAL ANGLE POLARITY DEFINITION

FIGURE 5

employed in the RPA on Atmosphere Explorer for electronically taking the derivative of the characteristic RPA curve.

This technique employs a retarding voltage (H^+RV) applied to the repeller grid G3. The positive DC potential on G3 can be varied stepwise from a selected starting point (0, 1, 2, or 3 volts) for 9 steps at 0.2 volts per step. In addition to the DC potential, a 200 hz. square wave is applied to G3. Since the heavy ions (mass 16 and above) have about 5 ev and above energy with respect to the spacecraft, their ability to reach the collector is not affected by the H^+RV, but the contribution to the total signal from H^+ ions is repeatedly diminished and returned at the square wave frequency. Thus the log amplifier outputs (A2 and A3) will be modulated at 200 hz. and the amplitude of the modulation will be proportional to the collector surface areas illuminated by the H^+ ions. The ratio of these amplitudes is therefore proportional to their arrival angle.

The modulated outputs of the log amplifier are amplified and synchronously detected. The H^+ derivative (H^+DERIV) output provides a signal proportional to the amplitude of the H^+ modulation from which the H^+ concentration can be derived. The H^+ drift signal (H^+DS) output is derived by comparing the modulated log amplifier outputs in a difference amplifier and is proportional to the H^+ arrival angle.

There is a contribution to the modulated signal from heavy ions by virtue of their change in arrival angle caused by the repeller grid. In order to eliminate this undesired signal at least to second order, grid G2 in the collimator is biased at the opposite DC level from the repeller and has the low amplitude modulation applied to it 180° out of phase with the repeller (with the amplitudes scaled appropriately).

The H^+ mode measurement sequence is four seconds long and the data is telemetered 12 times per second on the Drift Meter output in lieu of the Normal mode "offset" data as follows:

Sample #	Cycle A	Cycle B	Cycle C	Cycle D
1	H	H	V	V
2	V	V	H	H
3	H^+DERIV(V)	H^+DS(V)	H^+DERIV(H)	H^+DS(H)
4				
5				
6				
7				
8				
9				
10				
11				
12				

Cycle A is identified by a flag (+5.11 volts) on the Log Level Multiplex output. At the beginning of each cycle, vertical (V) and horizontal (H) offset measurements are made as in the Normal mode. The H^+RV is held at the selected starting point until the end of sample #3. After sample #3 and subsequent samples, the H^+RV is incremented by 0.2 volts and the 200 hz. modulation is applied. The H^+DERIV output is sampled in the vertical configuration during cycle A and in horizontal during cycle C. The H^+DS is sampled in vertical during cycle B and in horizontal during sample D. Either a high or a low modulation level may be selected by command. The low level provides 50 mv. peak to peak during the H^+DERIV measurements and 400 mv. during the H^+DS measurements. The high level provides 100 mv. for H^+DERIV and 800 mv. for H^+DS.

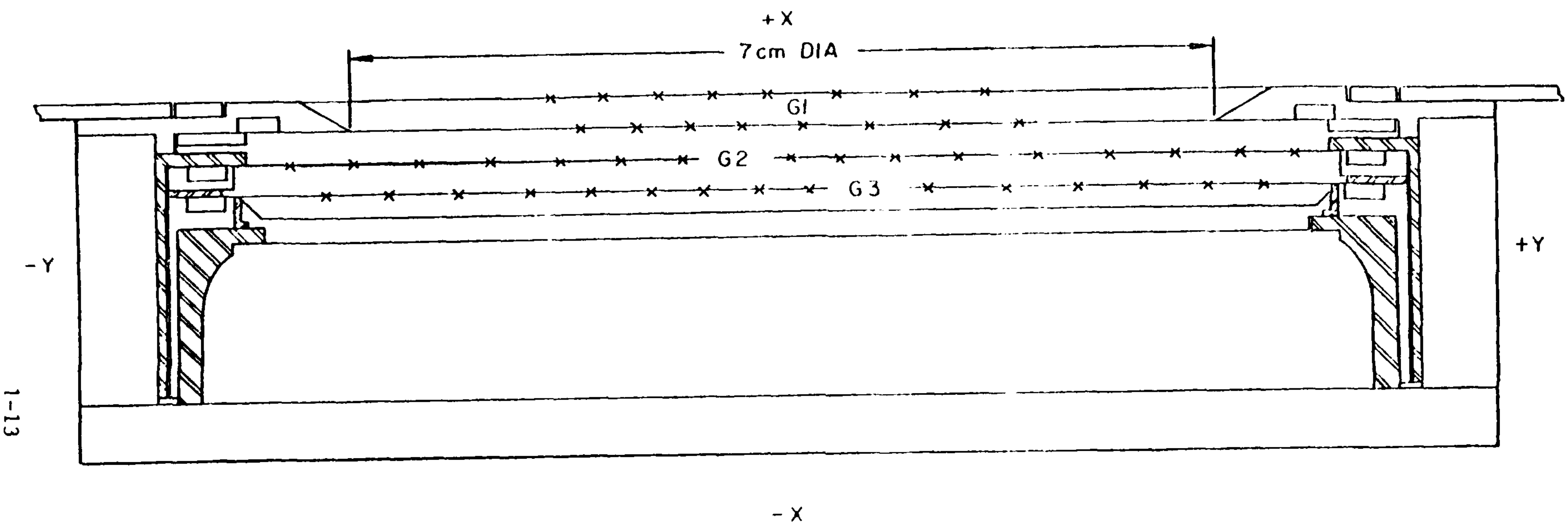
C. Drift Meter - Log Level Output

The Log Level output shown in Figure 4 provides a signal proportional to the ion concentration and is used primarily for Drift Meter housekeeping purposes. The Log Level signal is telemetered via the Multiplex output once per second and monitors the two log amplifiers alternately. The collectors monitored versus Drift Meter mode and data format cycle number are as follows:

NORMAL MODE	CYCLE 1	CYCLE 2		
	B & C (LLA)	A & D (LLB)		
H^+ MODE	CYCLE A	CYCLE B	CYCLE C	CYCLE D
	CYCLE A FLG	B & C (LLB)	A & B (LLA)	C & D (LLB)

D. Scintillation Meter

The Scintillation Meter sensor is illustrated in Figure 6. The double input grid G1 is fixed at the V_{BIAS} potential. G2 serves as an electron suppressor for the collector and also as an electron repeller for ambient electrons. Grid G3 provides electrostatic shielding for the collector. The collector is connected to a linear electrometer that measures the total ion current impinging on the collector (Figure 7). The electrometer has 5 linear sensitivity ranges and the sensitivity is automatically adjusted to maintain maximum sensitivity while staying within the telemetry band. The electrometer sensitivity on the most sensitive range is 6.32×10^{-9} amps/volt and decreases by a factor of $\sqrt{10}$ for each range change to 6.32×10^{-7} amps/volt on the least sensitive range.



▨ - INSULATOR

GRID DESIGNATORS

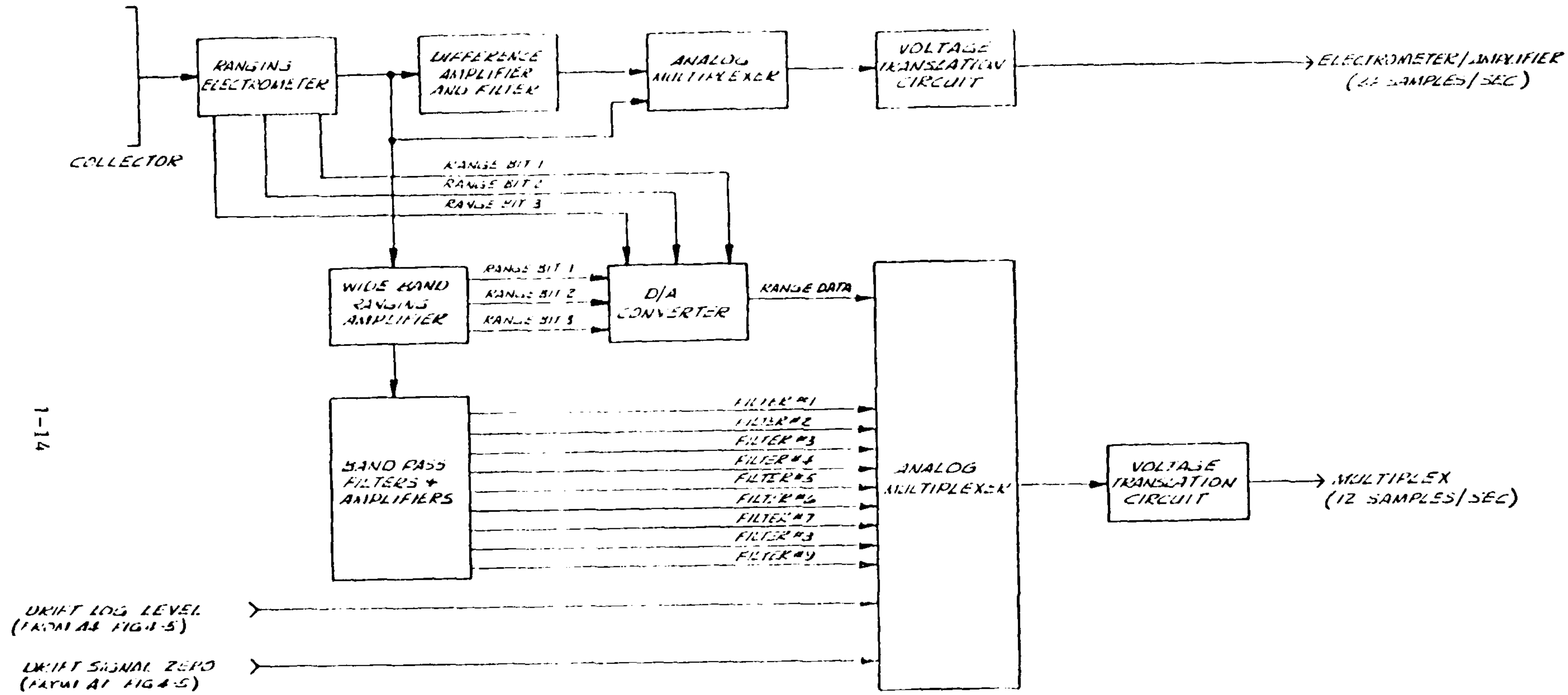
G1 - INPUT (DUAL)
G2 - SUPPRESSOR
G3 - SHIELD
(ALL 50 LINES / INCH)

APERTURE – 38.5 cm^2
TRANSMISSION = 0.663
Aeff = 25.53 cm^2

NOTE:
COORDINATE SYSTEM USED IS THAT OF THE NASA DYNAMICS EXPLORER SATELLITE.

SCINTILLATION METER SENSOR CROSS-SECTION

FIGURE 6



SCINTILLATION METER BLOCK DIAGRAM

FIGURE 7

In order to achieve higher sensitivity to changes in N_i, the electrometer output is stored periodically at one terminal of a x10 difference amplifier and the live electrometer output is connected to the other terminal. The zero output of the difference amplifier is set to the middle of the telemetry band so that either positive or negative changes in N_i can be detected.

An analog multiplexer is used to automatically connect either the electrometer or amplifier to the telemeter (via a 12 hz Bessel filter) depending on the magnitude of the variations in N_i. The analog multiplexer is controlled by comparator circuits that monitor the amplifier output to determine if it is near the upper or lower telemetry band edge. When the amplifier exceeds either the upper or lower comparator limit, the electrometer is connected to the telemeter. At the next T_o Cycle 1 pulse the amplifier is reconnected to the telemeter. (The amplifier is "zeroed" to the nominal +2.7 volt level continuously while the electrometer is connected to the telemeter.) If the amplifier again exceeds either comparator limit within one second, the electrometer is connected continuously to the telemeter until 8 T_o Cycle 1 pulses have elapsed (15 to 16 seconds). At the end of this period, the output is switched back to the amplifier. If over-range occurs again within 1 second, the output is switched back to electrometer for another 15 to 16 second period. If over-range does not occur during the 1 second period, the words remain on the amplifier until one of the following events occurs:

1. An amplifier over-range will switch the output to electrometer. The next T_o CYCLE 1 pulse will initiate a new cycle.
2. After a 16 second period, the output is switched to electrometer for 2 samples.

The above events are flagged when they occur as follows:

EVENT	FLAG	DURATION
Amplifier to electrometer with no electrometer range change	0 volts	Either 1 or 2 samples
Electrometer range change (always causes an amplifier to electrometer switch)	Range Data (See below)	Either 1 or 2 samples
Electrometer to amplifier	+ 5.11 volts	1 sample

Whenever the electrometer changes range, a voltage level indicating the new range setting is output as indicated above (The range setting is also telemetered once per second on the Multiplex output). The nominal output voltage levels versus electrometer range are as follows:

	Range	Voltage Level
1	$6.32x10^{-9}$ A/V	0.28
2	$2x10^{-8}$ A/V	0.24
3	$6.32x10^{-8}$ A/V	0.20
4	$2x10^{-7}$ A/V	0.16
5	$6.32x10^{-7}$ A/V	0.12

(Note: The lower comparator limits are set above 0.28 volts and the upper comparator limits are set below 5 volts. This provides virtually unambiguous flag and range data since the amplifier output is constrained between the comparator limits as is the electrometer except for the bottom of range one and the top of range 5.)

The bandwidth of the ionospheric irregularity measurements is extended by AC coupling the electrometer output to a wide band ranging amplifier (WIBAN) and then to a series of 9 bandpass filters and logarithmic amplifiers

(FIBA1 thru FIBA9). WIBAN has 5 linear sensitivity ranges differing by a factor of $\sqrt{10}$ for each range change. The WIBAN sensitivity range can be automatically determined by the filter channel with the largest output voltage or fixed by ground command. There are two automatic ranging modes available, the free ranging (RNGFR) mode and the restricted ranging (RNGRE) mode. In the RNGFR mode, the WIBAN is allowed to range any time a filter output exceeds the upper comparator limit (nominally 4.5 volts) or the highest filter output goes below the lower comparator limit (nominally 3.[illegible] volts). In the RNGRE mode, ranging is allowed as in the RNGFR mode during a 1/3 second window beginning immediately after all FIBA outputs are sampled and is inhibited at other times.

Each FIBA circuit consists of a logarithmic amplifier preceded by an active bandpass filter. The bandpass characteristics of the filters are as follows:

(The frequencies given are the -6 db points.)

Filter #	Bandpass Frequencies
1	12 - 26 hz
2	26 - 56 hz
3	56 - 120 hz
4	120 - 260 hz
5	260 - 560 hz
6	560 - 1200 hz
7	1.2 - 2.6 khz
8	2.6 - 5.6 khz
9	5.6 - 12 khz

Each log amplifier utilizes an Analog Device AD536 which provides an output proportional to the log of the rms of the input signal. The useful dynamic range of each log amplifier is approximately 60 db with a sensitivity of

1.5 volts per decade (nominal). Each filter output is sampled once per second on the Multiplex output as specified below.

E. Multiplex Output

The Multiplex circuit is shown in Figure 7. The output of the multiplexer is sampled at the rate of 12 samples/second and the multiplexer is switched at the end of each sample period such that each of the 12 inputs is sampled once per second. The 12 inputs are multiplexed and sampled within the SSIES data format as follows:

Multiplex Sample #	Output Data
1	FIBA7
2	FIBA5
3	FIBA3
4	FIBA1
5	FIBA8
6	FIBA6
7	FIBA4
8	FIBA2
9	FIBA9
10	RANGE DATA
11	LOG LEVEL/CYCLE A FLAG
12	DRIFT SIGNAL ZERO/ELECTRONICS TEMP

The Log Level/Cycle A Flag multiplexing is described in II.C. The Drift Signal zero level is read out on odd numbered cycles and the electronics temperature is read on even numbered cycles. The range data output indicates the sensitivity ranges of the electrometer and wide band amplifier. The nominal output voltages versus range combinations are as follows:

ELECTROMETER RANGE

		1	2	3	4	5
	5	3.98	3.88	3.76	3.66	3.56
Wide-band	4	3.16	3.06	2.96	2.84	2.74
Amplifier	3	2.34	2.22	2.14	2.02	1.92
Range	2	1.52	1.42	1.32	1.20	1.10
	1	0.70	0.58	0.50	0.38	0.28

F. Commands

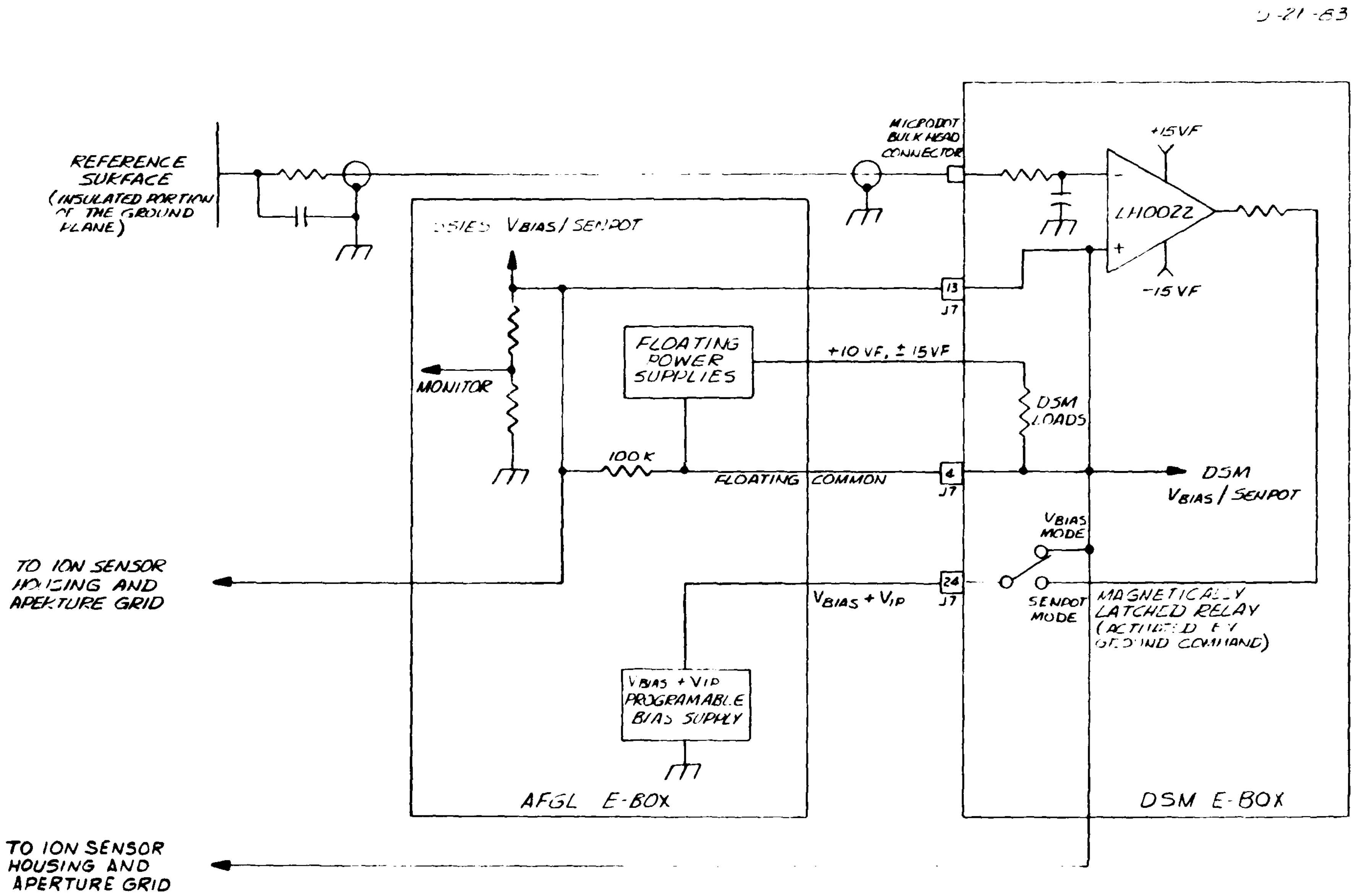
SSIES INTERNAL HEX CODE	FUNCTION	
20	RNGRE	WIBAN RANGE CONTROL
24	RNGFR	
28	RNG01	
29	RNG02	
2A	RNG03	
2B	RNG04	
2C	RNG05	
30	DREP00	DRIFT NORMAL MODE REPELLER VOLTAGE
32	DREP01	
33	DREP15	
34	DREP20	
35	DREP25	
36	DREP30	
38	OWIGLO	DRIFT H^+ MODE H^+RV STARTING POINT/WIGGLE AMPLITUDE
39	OWIGHI	
3A	1WIGLO	
3B	1WIGHI	
3C	2WIGLO	
3D	2WIGHI	
3E	3WIGLO	
3F	3WIGHI	
21	VBIAS	RELAY LATCHING COMMANDS THAT SELECT ONE OF TWO SENSOR BIAS SCHEMES
23	SENPOT	

C. Sensor Potential

Figure 8 illustrates the DSM SENPOT circuit that is included as an auxiliary means of establishing sensor potential. The reference surface is a segment of the ground plane located near the Irregularity Sensor that is insulated from the sensor housings and insulated from the other part of the ground plane. The main part of the ground plane is tied electrically to the ion sensor housings. The reference surface is sized to collect enough ion current to comfortably allow the SENPOT circuit to operate over the available voltage range ($\cong$ - 16 volts to +41 volts) with an ion density of $\sim 100\ cm^{-3}$ and a reference surface insulation resistance of $\gtrsim 10^{11}$ ohms.

The reference surface is connected to the non-inverting input of an LH0022 FET-input operational amplifier that is powered by floating supplies referenced to the sensor potential. The high input impedance and low input bias current of the LH0022 allows the ground plane to float at the potential at which equal ion and electron currents are collected, nominally -1 volt with respect to plasma potential. Since the op-amp must maintain equal voltages at both inputs, it will drive against the spacecraft ground (through the SSIES $V_{BIAS} + V_{IP}$ supply connected to the op-amp output) until the voltage at the non-inverting input is at the ground plane potential. Since the output voltage swing of the op-amp is about ± 13 volts, the $V_{BIAS} + V_{IP}$ supply connected to the output allows control of the sensor potential from about -16 volts to +41 volts with respect to spacecraft potential.

The drive capability of the op-amp is about 10 milliamps. The output current limit of the $V_{BIAS} + V_{IP}$ supply will, of course, also limit the drive capability of the circuit. Since the circuit only has to provide a current equal to the net current collected by the sensors and the leakage currents between the floating ground and spacecraft ground, the required drive capability should be of the order of a few microamps.



DSM SENPOT CIRCUIT

FIGURE 8

SECTION 2

SPACECRAFT-LEVEL INSTRUMENT TESTING, INSTRUMENT HANDLING AND SAFETY

SPACECRAFT-LEVEL INSTRUMENT TESTING,

INSTRUMENT HANDLING AND SAFETY

1.0 General

This section defines the three types of electrical tests planned for the DSM after installation on the spacecraft. Paragraph 5.0 indicates the times during the spacecraft-level test flow that the tests should be performed. The required sensor mechanical alignments versus spacecraft test flow are also indicated.

2.0 Electrical Performance Evaluation Test (EPET)

The EPET provides an automated test procedure for testing instrument response in each major operating mode. Although there are only two distinct DSM modes (Drift meter H^+ or NORMAL), there are other modal parameters that may be selected by command. Each of the 14 DSM commands should be executed at some point during the EPET and the command monitor checked to verify each command. Additionally, several tests (probably one for each SSIES operating mode) will be defined for the EPET wherein the DSM is commanded to a specified mode, 32 consecutive seconds of data are stored and the data are printed out in a specified format. The instrument performance evaluation will be based on visual observation of the printed data. The EPET can be performed either with or without stimulation.

The time required for the EPET will be primarily determined by the speed of the spacecraft ground check-out computer system.

3.0 Stimulation

A battery powered stimulation unit is used to provide test currents to the DSM sensors. The stimulation unit attaches to the protective covers that are installed over the sensor input apertures. The test currents are injected by probes that screw into the front face of the sensor and make contact with the collectors. The stimulation unit requires $\sim$ 6 inches clearance in front of the sensor aperture plane for installation. The planned usage of the stimulation unit is limited to tests performed with attending UTD personnel. Installation or removal of the stimulation unit will require approximately 30 minutes.

4.0 Sensor Grid Test

The sensor grid test is performed by UTD personnel after final instrument installation on the spacecraft and completion of environmental testing. The test consists of attaching test probes to the internal sensor grids and verifying the correct grid potentials.

5.0 DSM Spacecraft-Level Test Requirements

SPACECRAFT ACTIVITY	INSTRUMENT CONFIGURATION	INSTRUMENT TESTS REQUIRED
1. INSTRUMENT INTEGRATION	NO SENSORS	INITIAL POWER TURN ON (IPTO)
	SENSORS INSTALLED	DETAILED ELECTRICAL TEST (DET)
2. SYSTEM ELECTRICAL PERFORMANCE EVALUATION TEST (SEPET)	SENSORS INSTALLED	EPET WITH STIMULATION
3. TEMPERATURE TESTING	NO SENSORS	EPET
4. VACUUM TESTING	NO SENSORS	EPET
5. PRE-VIBRATION/POST-VACUUM	SENSORS INSTALLED	SENSOR ALIGNMENT
6. EMI/RFI TESTING	SENSORS INSTALLED	EPET
7. VIBRATION TESTING	SENSORS INSTALLED	EPET
8. POST-VIBRATION	SENSORS INSTALLED	a. SENSOR ALIGNMENT CHECK b. INSTRUMENT INSPECTION, CALIBRATION AND VACUUM TEST AT UTD (IF REQ'D.) c. REPEAT SENSOR ALIGNMENT (IF REQ'D.)
9. FINAL CLEAN-UP AND TEST	SENSORS INSTALLED	a. EPET WITH STIMULATION b. SENSOR GRID TEST
10. PRE-SHIPMENT TESTS	SENSORS INSTALLED	EPET
11. WTR TESTING	SENSORS INSTALLED	EPET

6.0 Instrument Handling and Safety

6.1 Protective sensor covers should be utilized whenever sensors are installed (except during EMI and vibration testing) to prevent particulate contamination from entering the sensor entrance apertures and to prevent physical damage to the exposed entrance grids. Stimulus probes may be installed with the protective covers in place.

6.2 Most of the exterior of the instrument is painted with Chemglaze Z306 flat black paint and should receive "white-glove" treatment and minimum handling. The Chemglaze paint is attacked (expanded) by almost all common cleaning solvents (alcohol, acetone, freon, Mek, etc.). UTD should be consulted prior to any proposed instrument cleaning operation.

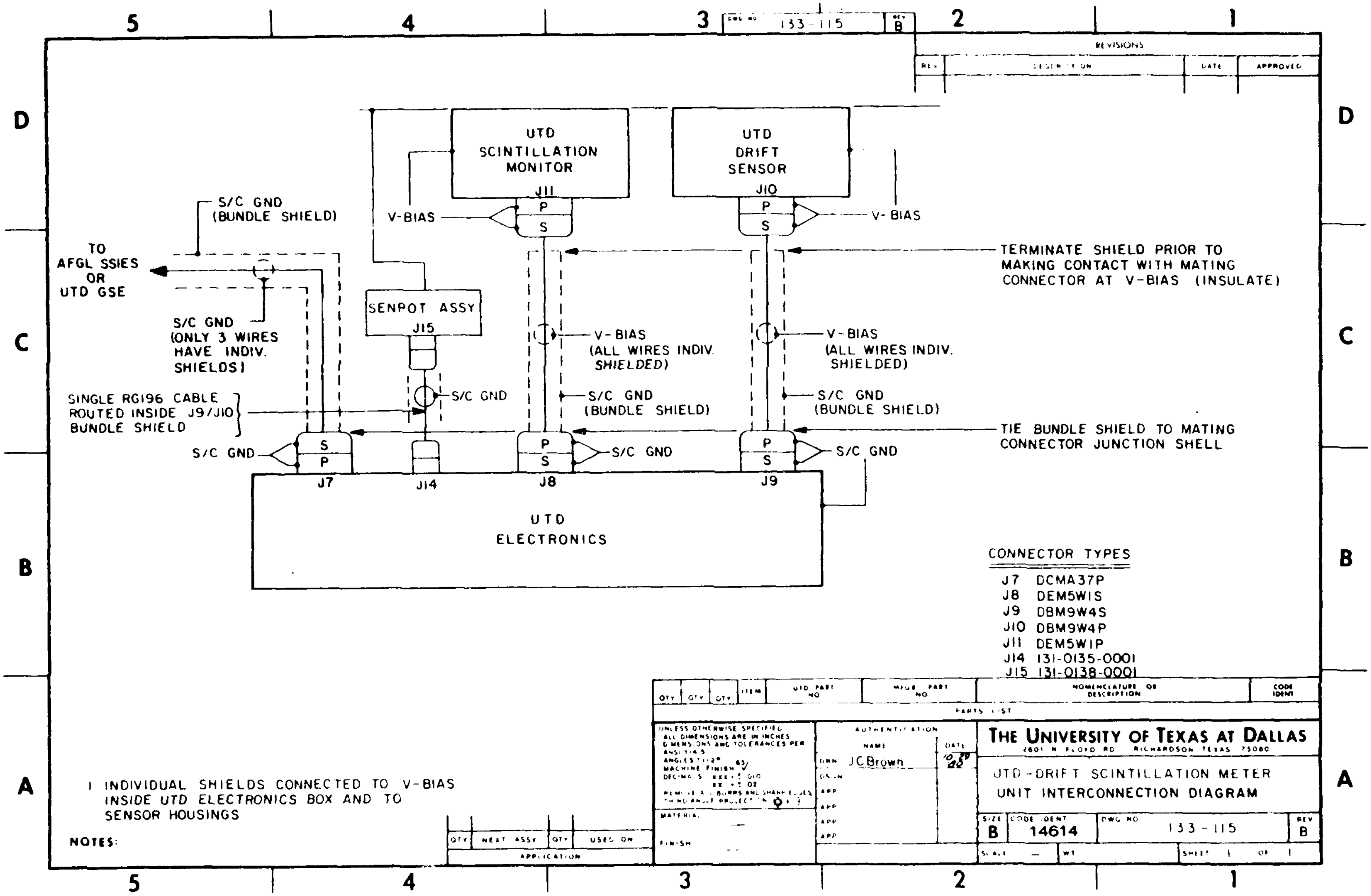
6.3 Always minimize handling of gold plated surfaces and utilize approved gloves when handling is necessary.

7.0 Red Tag Items

The two protective covers over the sensor apertures will be removed at the latest practical time at WTR. Captive hardware (2-56 screws) is used for attaching the protective covers to the sensor face. After removal of the protective covers, gold plated 2-56 screws must be installed in the sensor face to fill the holes.

SECTION 3

DIAGRAMS, SCHEMATICS, DRAWINGS



UTD SCINTILLATION MONITOR
J11
UTD DRIFT SENSOR
J10
SENPOT ASSY
J15
UTD ELECTRONICS
J7
J14
J8
J9
P
S
V-BIAS
S/C GND
S/C GND (BUNDLE SHIELD)
TO AFGL SSIES OR UTD GSE
S/C GND (ONLY 3 WIRES HAVE INDIV. SHIELDS)
SINGLE RG196 CABLE ROUTED INSIDE J9/J10 BUNDLE SHIELD
V-BIAS (ALL WIRES INDIV. SHIELDED)
TERMINATE SHIELD PRIOR TO MAKING CONTACT WITH MATING CONNECTOR AT V-BIAS (INSULATE)
TIE BUNDLE SHIELD TO MATING CONNECTOR JUNCTION SHELL
CONNECTOR TYPES
J7 DCMA37P
J8 DEM5W1S
J9 DBM9W4S
J10 DBM9W4P
J11 DEM5W1P
J14 131-0135-0001
J15 131-0138-0001
REVISIONS
REV
DESCRIPTION
DATE
APPROVED
DWG NO 133-115
REV B
PARTS LIST
THE UNIVERSITY OF TEXAS AT DALLAS
2601 N FLOYD RD RICHARDSON TEXAS 75080
UTD-DRIFT SCINTILLATION METER UNIT INTERCONNECTION DIAGRAM
AUTHENTICATION
NAME
DATE
DRN J C Brown
SIZE B
CODE IDENT 14614
DWG NO 133-115
REV B
SCALE —
SHEET 1 OF 1
APPLICATION
NEXT ASSY
USED ON
MATERIAL
FINISH
1 INDIVIDUAL SHIELDS CONNECTED TO V-BIAS INSIDE UTD ELECTRONICS BOX AND TO SENSOR HOUSINGS
NOTES:

[illegible] DRAWING LIST

- TOP ASSEMBLIES -

133-150	Electronics box assy
PL133-150	" " "
133-300	Scintillation Meter sensor head assy
PL133-300	" " " " "
133-400	Drift sensor head assy
PL133-400	" " " "

- SUBASSEMBLIES -

DSM-1	Electrometer and ranging	
	Board Assy	133-154
	Part list	PL133-154
	Schematic	133-152
	Wire list	133-155
DSM-2	Wide band amplifier	
	Board assy	133-159
	Part list	PL133-159
	Schematic	133-157
	Wire list	133-160
DSM-3	Bandpass amplifier - FIBA 1,4,7	
	Board assy	133-164
	Part list	PL133-164
	Schematic	133-162
DSM-4	Bandpass amplifier FIBA 2,5,8	
	Board assy	133-164
	Part list	PL133-164
	Schematic	133-165
DSM-5	Bandpass amplifier FIBA 3,6,9	
	Board assy	133-164
	Part list	PL133-164
	Schematic	133-166
DSM-6	Duct amplifier and logic	
	Board assy	133-170
	Part list	PL133-170
	Schematic	133-168
	Wire list	133-171
DSM-7	FIBA amplifiers	
	Board assy	133-175
	Part list	PL133-175
	Schematic	133-173

DSM-7A	Filter board assy	
	Board assy	133-179
	Part list	PL133-179
	Schematic	133-177
	Schematic, SENPOT Buffer	133-206
DSM-8	Interface buffer	
	Board assy	133-183
	Part list	PL133-183
	Schematic	133-181
	Wire list	133-184
DSM-11	Analog level shifter	
	Board assy	133-188
	Part list	PL133-188
	Schematic	133-186
	Wire list	133-189
DSM-12	Drift H + detector	
	Board assy	133-193
	Part list	PL133-193
	Schematic	133-191
	Wire list	133-194
DSM-13	Drift amplifier	
	Board assy	133-198
	Part list	PL133-198
	Schematic	133-196
	Wire list	133-199
DSM-14	Drift electrometer	
	Board assy	133-203
	Part list	PL133-203
	Schematic	133-201
	Wire list	133-204