NASA/ NASA/TP-2019-220346

Pioneer F/G: Spacecraft/Scientific Instrument Specification

Charlie F. Hall
Pioneer Project Manager
Ames Research Center, Moffett Field, CA

December 1969

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NASA/ **NASA/TP-2019-220346**

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Charlie F. Hall
Pioneer Project Manager
Ames Research Center, Moffett Field, CA

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, CA 94035-1000

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PIONEER PROGRAM

National Aeronautics and Space Administration
Ames Research Center
Moffett Field, California
94035

PIONEER F/G PROJECT
SPECIFICATION PC-220
SPACECRAFT/SCIENTIFIC INSTRUMENT

APPROVAL:

NASA/ARC
Pioneer Project Manager, Charles F. Hall, Charles F. Hall (Signature) 12/23/69 (Date)

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PIONEER F/G PROJECT

SPECIFICATION PC-220

SPACECRAFT/SCIENTIFIC INSTRUMENT

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SPACECRAFT/SCIENTIFIC INSTRUMENT INTERFACE

PC-220.00

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California 94035

PIONEER F/G PROJECT

SPECIFICATION PC-220.00

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

October 20, 1969

1. SCOPE

This specification defines for the Pioneer F and G spacecraft and the scientific instruments:

(a) The characteristics of the spacecraft pertinent to the scientific instruments and the requirements of the spacecraft on the scientific instruments (Specification PC-220.01).
(b) The characteristics of the scientific instruments pertinent to the spacecraft and the requirements of the scientific instruments on the spacecraft (Specification PC-220.02 through PC-220.12).

Adherence to this specification is essential to achieve compatibility between the respective subsystems.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATIONS (1)

PC-210, Pioneer F/G Spacecraft and Related Requirements

PC-211, Pioneer F/G Ground Support Equipment Requirements

PC-213, Pioneer F/G Scientific Instruments and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATIONS (1)

PC-220.01, Spacecraft

PC-220.02, JPL Helium Vector Magnetometer

PC-220.03, ARC Plasma Analyzer

Revision

PC-220.04, U/Chicago Charged Particle Instrument (1)

PC-220.05, U/Iowa Geiger Tube Telescope

PC-220.06, GSFC Cosmic Ray Telescope

PC-220.07, UCSD Trapped Radiation Detector

PC-220.08, USC Ultraviolet Photometer

PC-220.09, U/Arizona Imaging Photopolarimeter

PC-220.10, CIT Jovian Infrared Radiometer

PC-220.11, GE Asteroid/Meteoroid Detector

PC-220.12, LaRC Meteoroid Detector

3. REQUIREMENTS

3.1 MECHANICAL

The mechanical characteristics of the spacecraft and the scientific instruments shall conform to the applicable characteristics and with the applicable requirements specified in sections 3.1 of Specifications PC-220.01 through PC-220.12.

3.2 ELECTRICAL

The electrical characteristics of the spacecraft and the scientific instruments shall conform to the applicable characteristics and with the applicable requirements specified in section 3.2 of Specification PC-220.01 and sections 3.3 of PC-220.02 through PC-220.12.

3.3 DATA HANDLING AND SIGNALS

The data handling and signal characteristics of the spacecraft and the scientific instruments shall conform to the applicable characteristics and with the applicable requirements specified in section 3.3 of Specification PC-220.01 and sections 3.4 of PC-220.02 through PC-220.12. (1)

3.4 THERMAL

The thermal characteristics of the spacecraft and the scientific instruments shall conform to the applicable characteristics and with the applicable requirements specified in section 3.4 of Specification PC-220.01 and sections 3.2 of PC-220.02 through PC-220.12. (1)

3.5 ELECTROMAGNETIC INTERFERENCE, NOISE AND GROUNDS

3.5.1 Electromagnetic Interference. The spacecraft and scientific instruments shall not provide conducted or radiated interference which will cause adverse effects on other instruments or spacecraft subsystems during any operating mode of the spacecraft. All spacecraft equipment shall be designed and fabricated in conformance with paragraph 4.2 of MIL-STD-461 as an initial baseline design guide. Scientific instruments shall be designed and fabricated in accordance with section 3.4.1 of PC-213.03. (1)

3.5.1.1 Critical Frequencies. A summary of known critical frequencies and related energy levels is given in Figure 3.5.1.1.

3.5.2 Noise and Grounds. The noise and grounding characteristics of the spacecraft and the scientific instruments shall conform to the applicable characteristics and requirements specified in section 3.5 of Specification PC-220.01. (1)

4. PRODUCT ASSURANCE PROVISIONS

Not applicable.

5. HANDLING, SHIPPING, AND STORAGE

Not applicable.

6. NOTES

6.1 DEFINITIONS

6.1.1 Scientific Instrument. The scientific instruments may include any or all of the following constituent elements:

(a) Sensors or transducers and their associated mounting, positioning, focusing, protecting, or enhancing mechanisms or devices.
(b) Electronic signal conditioning, conversion, and processing circuitry.
(c) Electronic logic and data processing, conditioning, and storage circuitry.
(d) Power conversion, conditioning, and distribution circuitry employed to convert spacecraft primary power to instrument power requirements.
(e) Housing, including thermal insulation and conduction paths to spacecraft, light and other radiation covers and baffles as required.
(f) Radio frequency isolation and filtering to minimize interference and susceptibility.
(g) Thermal insulation, coatings, and venting as necessary to maintain suitable thermal conditions in external or appendage-mounted units.
(h) Provisions for mounting the instrument to the spacecraft, exclusive of threaded fasteners which will normally be furnished by the Spacecraft Integration Contractor.
(i) Appendages required by the instrument exclusive of the spacecraft booms or appendages.
(j) Ballast weight as required to equalize the mass properties of various units which may be interchanged.

6.2 ABBREVIATIONS (12)

ARC	Ames Research Center
AWG	American Wire Gage
CA	Converter Assembly of Spacecraft
CDU	Command Distribution Unit of Spacecraft
CIT	California Institute of Technology
CTRF	Central Transformer-Rectifier-Filter
DSU	Data Storage Unit of Spacecraft
DTU	Digital Telemetry Unit of Spacecraft
ETG	Electrically Heated Thermoelectric Generator(s)
GE	General Electric Co.
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
IA	Inverter Assemblies
IPP	Imaging Photopolarimeter Instrument
JPL	Jet Propulsion Laboratory
LaRC	Langley Research Center
MRO	Memory Readout
NASA	National Aeronautics and Space Administration
PCU	Power Control Unit of Spacecraft
PPO	Pioneer Project Office
rf	Radio Frequency
RTG	Radioisotope Thermoelectric Generator(s)
SA	Shunt Assembly of Spacecraft
SBRC	Santa Barbara Research Center
SLA	Sun Look Angle
SR	Shunt Radiator
TBS	To be supplied
TRW	TRW Systems Group of Thompson, Ramo, Wooldridge, Inc.
TS	True state
TWT	Travelling Wave Tube
USC	University of Southern California
UCSD	University of California at San Diego

ITEM	CONVERTER FREQUENCY		MISCELLANEOUS GENERATED FREQUENCIES		SENSITIVE FREQUENCIES	
	FREQUENCY	POWER	FREQUENCY	POWER	FREQUENCY	SENSITIVITY
SPACECRAFT						
JPL HELIUM VECTOR MAGNETOMETER	25KHZ					
ARC PLASMA ANALYZER	5KHZ 7.5KHZ	4.19W 350MW	14KHZ TO 16.7KHZ(ADJ.) 15KHZ TO 19KHZ (ADJ.) 1.6MHZ	1.4W OR LESS 420MW OR LESS 50MW OR LESS		
U/CHICAGO CHARGED PARTICLE INSTRUMENT	4 TO 6 KHZ					
U/IOWA GEIGER TUBE TELESCOPE	20KHZ					
GSFC COSMIC RAY TELESCOPE	20KHZ	2.2W				
UCSD TRAPPED RADIATION DETECTOR					1MHZ TO 100MHZ	
USC ULTRAVIOLET PHOTOMETER	20KHZ 50KHZ					
U/ARIZONA IMAGING PHOTOPOLARIMETER						
CIT INFRARED RADIOMETER						
GE ASTEROID/METEOROID DETECTOR	18KHZ TO 20KHZ	2W	250KHZ 2MHZ 4MHZ	1MW 7MW 7MW	20HZ TO 22KHZ	
LaRC METEOROID DETECTOR						

TITLE

CRITICAL FREQUENCIES

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC NO. PC-220.0[illegible]

FIG. 3.5.1.1

REV. NO. 1 | DATE 12-22-69 | SHEET 1 OF 1

SPACECRAFT/SCIENTIFIC-INSTRUMENT

PC-220.01

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California 94035

PIONEER F/G PROJECT

SPECIFICATION PC-220.01

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

SPACECRAFT

October 20, 1969

1. SCOPE

Specification PC-220.01 defines the characteristics of the Pioneer F and G spacecraft pertinent to the scientific instruments and the requirements of the spacecraft on the scientific instruments.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATIONS (1)

PC-210, Pioneer F/G Spacecraft and Related Requirements

PC-211, Pioneer F/G Ground Support Equipment Requirements

PC-213, Pioneer F/G Scientific Instruments and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATIONS

PC-220.00, Pioneer F/G Spacecraft/Scientific Instrument Interface

PC-223, Pioneer F/G Spacecraft/RTG Interface (1)

PC-224, Pioneer F/G GOE/DSN Interface

2.3 MILITARY SPECIFICATIONS

MIL-A-8625C, Anodic Coating for Aluminum and Aluminum Alloys

MIL-B-5087B, Bonding - Electrical and Lighting Protection for Aerospace Systems

MIL-C-5541A, Chemical films for Aluminum and Aluminum Alloys

MIL-C-14550, Copper Plating (Electro-deposited)

MIL-G-45204B, Gold Plating (Electro-deposited)

MIL-STD-461, Electromagnetic Interference Characteristics Requirements for Equipment

MIL-STD-462, Electromagnetic Interference Characteristics, Measurement of

MIL-M-3171C, Magnesium Alloys, Process for Corrosion Protecting of

2.4 OTHER SPECIFICATIONS

FED STD QQ-S-365A, Silver Plating, Electrodeposited - General Requirement for

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Size.

3.1.1.1 Platform-Mounted Instruments. The dimensions of the instruments shall be compatible with the overall area and balance requirements of the equipment platform.

3.1.1.2 Boom-Mounted Instruments. The dimensions of the instruments shall be compatible with the space available below the antenna in the boom-stowed spacecraft configuration.

3.1.2 Mass Properties.

3.1.2.1 Weight. The total weight of the scientific instruments, including the cabling between boxes, connectors, containers, and boom-mounted equipment, will not exceed the spacecraft capabilities specified in PC-210.03, section 3.2.2.3. The boom-mounted equipment shall not exceed two pounds for the sensor and connectors. (13)

3.1.3 Mounting.

3.1.3.1 Platform Mounted Instruments. Platform mounted instruments shall be secured to the equipment platform with 6-32 UNC screws. Mounting hole centerlines will be located a minimum of 5/8 inch from the edge of the equipment platform. One of three mounting methods shall be used for securing instruments to the equipment platform. (5)

(a) 3/8" x 3/8" x 1/8" tabs without gussets.
(b) 3/8" x 3/8" x 1/8" tabs with gussets (if this method is used, tab width shall be increased by 2 times the gusset thickness).
(c) Through-holes within the instrument housing.

The attachment hole size in the instrument mounting tab, or through-hole within the instrument, shall be 0.177 inch in diameter and spot faced 3/8 inch diameter for No. 6 flat washer. The spot face edge radius shall be 0.008 $\pm$.008 inch. Mounting hole spacing shall be held to within

±.0035 inch (true position tolerance of ±.010 inch). Each scientific instrument shall employ a minimum of four mounting positions. Each position shall be limited to 100 lbs. in tension and 100 lbs. in shear.

3.1.3.2 Externally-Mounted Instruments. The instrument sensor on the boom shall be designed to mate with the attach fitting shown in figure 3.1.3.2, sheet 1 of 2. The GE astercid meteoroid detectors shall be designed for attachment to the mounting plate shown in figure 3.1.3.2, sheet 2 of 2. (4)

3.1.4 Equipment Orientation. The orientation of the instruments on the mounting platform is shown in Figure 3.1.4.

3.1.5 Viewing. The equipment compartment will be constructed of aluminum honeycomb with aluminum face sheets and covered by an aluminized Mylar or aluminized Kapton thermal blanket. Openings in the compartment required by instruments within the compartment will be mainly in the sidewalls but may be accommodated in the top or bottom of the compartment. Dimensions of the compartment and the thermal blanket are shown in Figure 3.1.5. Within these limits, openings required by the instruments may have any shape which does not compromise the spacecraft structural integrity or thermal requirements. (1)

3.1.6 Miscellaneous

3.1.6.1 Joint between Spacecraft Thermal Blanket and Instruments. The joint between the thermal blanket and the projection through the spacecraft wall of a viewing instrument will be closed with a thermal shield provided by the spacecraft contractor. The instrument aperture shall extend at least 1/4 inch beyond the spacecraft thermal blanket. (5)

3.1.6.2 Boom Impact Load. The impact load at the end of the boom during boom deployment will not exceed 4-1/2 g's.

3.1.6.3 Exterior Surfaces of Instruments. Surfaces of instrument sensors that project through openings in the compartment shall be included within the compartment thermal blanket if the projection through the spacecraft wall and thermal blanket is no greater than 1/4 inch net. Such projecting surfaces that cannot be included shall have a low emittance finish. (1)

3.2 ELECTRICAL POWER

3.2.1 Hardware. The Electrical Power Subsystem consists of the following spacecraft system assemblies: (12)
(a) 2 Inverter Assemblies (IA)
(b) 1 Power Control Unit (PCU)
(c) 1 Shunt Radiator (SR)
(d) 1 Battery
(e) Central Transformer-Rectifier-Filter (CTRF)

The Electrical Power Subsystem functionally includes the Radioisotope Thermoelectric Generator (RTG) system.

3.2.2 Power Sources.

3.2.2.1. Ground Power Console. Ground power will be used as required throughout the prelaunch activities.

3.2.2.2 Electrically Heated Thermoelectric Generator (ETG). A complete ETG System (four ETG's) will be available and will be used to power the spacecraft for most of the spacecraft system tests. The ETG simulates the RTG electrical, mechanical and thermal characteristics, but not its radiation output. (11)

3.2.2.3 Radioisotope Thermoelectric Generator (RTG). During flight and also for some system tests the electrical power source will be the RTG system (four RTG's). The RTG's are modified SNAP-19 design. (11)

3.2.3 Control.

3.2.3.1 Voltage. The 4.2-volt dc outputs from the power source are chopped and stepped up to 30.5 V rms, 2.5 kHz ac, squarewave, by the four inverters of the two IA. The four inverter outputs are paralleled on the ac bus. Most of the ac power is rectified and filtered to supply the main dc bus. The main dc bus is voltage regulated by dumping excess power in the SR, through a dissipative shunt in the PCU. The regulated dc voltage is reflected back through the ac bus, and through the fixed-ratio inverters, to control the operating voltage of each power source. Part of the ac power is stepped down, rectified, and filtered in the CTRF to supply dc power to various spacecraft loads. Each TWT has its own converter, supplied from the main dc bus. All 28 V dc spacecraft loads and all scientific instrument loads are also supplied from the main dc bus. (11)

3.2.3.2 __Battery__. The spacecraft battery (silver-cadmium) supplies power as required whenever the load momentarily exceeds the RTG system capability. The battery is automatically recharged whenever power is available.

3.2.3.3 Overload Protection. If the total load exceeds the capability of the electrical power subsystem, then loads will be dropped in an automatic sequence. The first group of loads turned off will include all the scientific instruments.

3.2.4 Output Characteristics.

3.2.4.1 Distribution. Each scientific instrument will receive electrical power through an individual, fused, branch circuit. The branch circuit will normally remain energized. The power allotted to the instrument is measured at the spacecraft/instrument interface connector. (11)

3.2.4.2 Voltage. Measured in PCU (ahead of fuse). (5)

3.2.4.2.1 Steady State. Regulated to 28 V dc. (5)

(a) Short term error: ± one-percent

(b) Long term drift (superimposed): ± one-percent

NOTE: Voltage at the terminals of each scientific instrument will be lower by the voltage drop through the fuse and wire of its branch circuit. Typically, this is 0.1 to 0.2 volt.

3.2.4.2.2 Noise. Except for the transient voltage excursions specified in Section 3.2.4.2.3, the peak-to-peak amplitude of any voltage excursion, periodic or aperiodic, shall not exceed 560 millivolts at any frequency between 30Hz and 10.0kHz decreasing at a 20dB/decade rate to 280 millivolts at 20.0kHz and remaining at 280 millivolts through 100MHz. (15)

3.2.4.2.3 Transient Voltage Excursions. (15)

(a) Performance - No degradation of performance shall result when voltage transients having the characteristics shown in Figure 3.2.4.2.3, sheet 1, are seen on the nominal 28 Vdc bus.

Revision

(b) Damage - No instrument damage, long term degradation, or modes where proper performance is not automatically resumed when the transient is removed, shall occur when voltage transient having the characteristics shown in Figure 3.2.4.2.3, sheet 2, are seen on the nominal 28 Vdc bus. (15)

3.2.4.3 Source Impedance. The source impedance is shown in Figure 3.2.4.3.

3.2.5 Required Load Characteristics.

3.2.5.1 Switch. Each scientific instrument shall provide for maintaining its own electrical load ON or OFF in accordance with a state signal which is supplied by the spacecraft and controlled by ground command. The state signal is described in section 3.3.3.6. The idling power drawn by an instrument during the OFF state shall not exceed 5 milliwatts. As a design goal, the instrument's power control circuitry shall be configured so that no single part failure within the instrument will prevent turn-off whenever the state signal is commanded to the OFF state. (5)

3.2.5.2 Maximum Load.

3.2.5.2.1 Average.

(a) Dependable Power: 22 watts total for scientific instruments.

(b) Nondependable Power: (To be assigned on an "if available" basis.) Scientific instrument load in excess of 22 watts.

3.2.5.2.2 Peak. The peak scientific instrument load shall not exceed 35 watts.

3.2.5.2.3 Duty Cycle. Peak loads shall not exceed 50 watt-minutes on a duty cycle no greater than 2 percent for scientific instruments (sum of all instruments at any point in time). (1)

3.2.5.3 Inrush Current. The duration of instantaneous load current of each instrument is a function of fuse size and instrument load characteristics. Upon application of the 28 V dc primary power to the instrument's primary power circuit, and upon application of the power control state signal to the instrument's secondary converter control circuit, the instrument's load current surge shall not exceed the following limit envelope: (5)

(a) Above 500 mA for total elapsed time of 10 microseconds.

(b) Up to 500 mA for up to 50 milliseconds, total elapsed time.

(c) Up to 200 mA for up to 200 milliseconds, total elapsed time.

(d) Up to 120 percent of nominal steady state (average) load current for the balance of the first second.

(e) Nominal load current thereafter.

3.2.5.3.1 Fuse Sizes. The fuse size shall be as follows: (9)

Fuse Size	Reference Designator	Experiment
3/4A	0850	JPL Helium Vector Magnetometer
3/4A	0851	ARC Plasma Analyzer
1/2A	0852	U/Chicago Charged Particle Instrument
3/8A	0853	U/Iowa Geiger Tube Telescope
3/8A	0854	GSFC Cosmic Ray Telescope
3/8A	0855	UCSD Trapped Radiation Detector
3/8A	0856	USC Ultraviolet Photometer
3/4A	0857	U/Arizona Imaging Photopolarimeter
3/8A	0858	CIT Infrared Radiometer
1/2A	0859	GE Asteroid-Meteoroid Detector
1/4A	0860	LaRC Meteoroid Detector.

3.2.5.4 Load Noise. When operating from a power source impedance of 1.0 ohms, no single instrument shall feed back into the power input circuit any electrical noise either periodic or aperiodic in excess of 280 millivolts peak-to-peak at any frequency between 30Hz and 10.0kHz decreasing at a 20dB/decade rate to 140 millivolts peak-to-peak at 20.0kHz and remaining at 140 millivolts peak-to-peak or less from 20.0kHz through 100MHz. (15)

3.2.5.5 Ground. The power supply circuit shall be dc isolated from chassis ground within each instrument. (See section 3.5.3 for general grounding concept.) (13)

3.2.5.6 Capacitance. The net effective capacitance from power input to instrument case shall not exceed 0.5 microfarad. The net effective capacitance from power return to instrument case shall not exceed 0.5 microfarad. In each case the leakage resistance shall be greater than 140,000 ohms. Any capacitance that may be added between power input and power return shall not exceed 300 microfarads. (1)

3.2.6 Connectors and Cabling.

3.2.6.1 Connector Types. The connector installed on an instrument that connects the instrument to the spacecraft harness shall be a male (straight or coaxial insert) pin connector selected from the Cannon, Golden D, Mark I, nonmagnetic with a NMC-A-106 suffix, series of connectors. The use of two identical connectors on any one box is prohibited. (4)

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3.2.6.2 Interface Connector Location. The centerline of the interface connector shall be located 1.5 inches above the base of the instrument and parallel thereto. The shorter dimension of the connector shall be towards the base. (1)

3.2.6.3 Interface Connector Pins. The mating surfaces shall be equivalent electrically to bare metal. Pins for the power and signal lines shall be adjacent to their corresponding return lines to facilitate the twisting of the wires in the spacecraft harness. The pin assignments shall be in accordance with section 3.4.1 of Specifications PC-220.02 (1) through PC-220.12.

3.2.6.4 Test Connector Location. The location for the test connector shall be the top surface of the instrument, unless otherwise directed by the ARC/PPO.

3.2.6.5 Connector Encapsulation. If encapsulated, the encapsulation shall be done with mated connectors to insure proper pin alignment. ARC/PPO shall be notified of the use of any encapsulated interface connectors.

3.2.6.6 Connector Identification. Each connector shall be identified (13) by a number in accordance with section 3.2.4.2 of Specifications PC-220.02 through PC-220.12.

Reference Designator	Instrument
0850	JPL Helium Vector Magnetometer
0851	ARC Plasma Analyzer
0852	U/Chicago Charged Particle Instrument
0853	U/Iowa Geiger Tube Telescope
0854	GSFC Cosmic Ray Telescope
0855	UCSD Trapped Radiation Detector
0856	USC Ultraviolet Photometer
0857	U/Arizona Imaging Photo - Polarimeter
0858	CIT Infrared Radiometer
0859	GE Asteroid/Meteoroid Detector
0860	LaRC Meteoroid Detecter

Experiments consisting of more than one unit will be identified by assigning a basic reference designator for the main unit and an alphabetic subunit identifier for each additional unit required.

Example:

Magnetometer	0850
Sensor	0850A

3.2.6.7 Wiring. The type of wire between any two units of one instrument shall be shielded, twisted pairs or coaxial cables (if required for signal leads). Between the spacecraft and the instrument, or between any two units of one instrument, the maximum wire size will be 20 AWG and the minimum size will be 28 AWG. (1)

3.3 DATA HANDLING AND SIGNALS

3.3.1 Functional Description. The spacecraft will accept from the scientific instruments information in digital, analog, or state form, convert the analog and state information to digital form, and arrange all information in an appropriate format for the time multiplexed transmission to earth or storage on board the spacecraft. The spacecraft will also supply the instruments with various timing and spacecraft operational status signals as well as functional commands.

3.3.1.1 Telemetry Word. A telemetry word in the main science formats (Formats A, B, and D) will consist of 3 binary bits. A telemetry word in the engineering formats (Formats C-1, C-2, C-3, and C-4) and the subcommutated science formats (Formats E-1 and E-2) will consist of 6 binary bits. Spacecraft generated words will be transmitted with the most significant bit first.

3.3.1.2 Data Bit Rates. The data subsystem will be capable of processing scientific and engineering data at the following rates:

(a) 2048 bits per second
(b) 1024 bits per second
(c) 512 bits per second
(d) 256 bits per second
(e) 128 bits per second
(f) 64 bits per second
(g) 32 bits per second
(h) 16 bits per second.

Bit rate changes will occur within one DTU bit period following the receiption of a bit rate command by the data subsystem. (4)

3.3.1.3 Frame. The data subsystem will assemble the information from the instruments into frames composed of a series of 192 bits.

3.3.1.4 Format and Word Assignments. The words in a frame are assigned in several formats. The formats are organized for specific purposes and are selected by ground command (4) for particular spacecraft operational modes. Format changes will occur within one DTU bit period following the reception of a format command by the data subsystem. (4)

3.3.1.4.1 Format A. Format A is the first format for scientific information and will be used primarily during interplanetary cruising. Scientific information for this format shall be in digital form only. Word assignments for Format A are shown in Figure 3.3.1.4.1.

3.3.1.4.2 Format B. Format B is the second format for scientific information and will be used primarily during Jupiter encounter. Scientific information for this format shall be in digital form only. Word assignments for Format B are shown in Figure 3.3.1.4.2.

3.3.1.4.3 Formats C-1, C-2, C-3, and C-4. Formats C-1, C-2, C-3, and C-4 contain spacecraft engineering information. Each of the engineering formats may be telemetered as the main frame. However, usually it will be subcommutated in two words in each of the science formats, Format A and B. When one of the engineering formats is commanded to be telemetered as the main frame, engineering words 1 through 4 and 17 through 20 are replaced with the identification, frame sync, and subcom words of the main frame. However, words 1 through 4 and 17 through 20 will be telemetered in the engineering subcom word of the main frame. Instrument power on/off indicators will be telemetered in Format C-1. Word assignments for Formats C-1, C-2, C-3, and C-4 are shown in Figure 3.3.1.4.3. (15)

3.3.1.4.4 Formats D-1 through D-3. Formats D-1 through D-3 are special purpose scientific formats. In each format all 192 bits will be allocated to a single scientific instrument (except for Format D-2), with the selected instrument supplying digital data on a single input channel. The selected Format D will be telemetered only at the main frame rate in combination with Format A or Format B on an alternating basis. The Format D scientific instrument assignments are as follows:

(a) Format D-1: U/Arizona imaging photopolarimeter. When the data subsystem is operating in Format D-1, the DSU will store data in groups of not greater than 6144 bits when signaled by the IPP instrument. The rate (4) at which the instrument transfers data to the DSU shall be no greater than 16,384 bits per second in bursts of 6 or 10 bits during a total read-in time of 0.5 seconds maximum each spacecraft revolution. Upon completion of storing, the data will be read out in groups of 192 bits into each D-1 format until completion of readout or until the next store signal is received from the IPP instrument. (13)

(b) Format D-2: CIT Infrared Radiometer (bits 1 through 24) and U/Arizona Imaging Photopolarimeter (bits 25 through 192). The data subsystem when operating in Format D-2, will telemeter the first 24 bits in each D-2 format from the Infrared Radiometer followed by 168 bits from the Imaging Photopolarimeter. The DSU will operate the same as in Format D-1 above for the IPP instrument. The data will be read out of the DSU in groups of 168 bits into each D-2 format until completion of readout or until the next store signal is received from the IPP instrument

(c) Format D-3: ARC Plasma Analyzer.

3.3.1.4.5 Formats E-1 and E-2. Formats E-1 and E-2 are for the subcommutation of scientific information in two words of each Format A and B or one word of each Format C-1, C-2, C-3, and C-4 when telemetered as the main frame. The two formats will be telemetered sequentially at all times and only in the subcommutated science word of the main frame. Word assignments for Formats E-1 and E-2 are shown in Figure 3.3.1.4.5. (4)

3.3.1.5 Operational Modes of Data Subsystem. The data subsystem will be capable of operating in three basic modes as follows:

(a) Real Time Mode. Data are transmitted directly without intermediate storage at a bit rate selected by ground command.

(b) Telemetry Storage Mode. Data are stored and transmitted simultaneously and continuously until either the DSU is full or the data subsystem is commanded to the real time mode. The DSU can be partially filled and data stored at a later time beginning at the memory location of the last previously stored data. When the telemetry storage mode is terminated by ground command, or when the DSU is filled, the data subsystem will automatically switch to the real time mode in the format and bit rate used during the telemetry storage mode.

(c) Memory Readout Mode. Data are read out from the DSU and transmitted at a bit rate selected by ground command. When memory readout is completed, the data subsystem will automatically switch to the real time mode and the format used before memory readout, and remain in the bit rate used during memory readout.

3.3.1.6 On-Board Storage Capacity. A storage capacity of 49,152 bits (256 frames) will be provided by the DSU of the data subsystem. The DSU stores only data processed by the DTU of the data subsystem. However, the DSU will function as a buffer storage for up to 6144 bits of data from the Imaging Photopolarimeter when the data subsystem is operating in Formats D-1 or D-2.

3.3.2 Signals from Scientific Instruments.

3.3.2.1 Characteristics. The characteristics of digital, analog, timing, and operational status signals from the scientific instruments to the data subsystem shall be as defined in Figure 3.3.2.1. (4)

3.3.2.2 Circuit Diagrams. The DTU/DSU interface circuits for signals from the scientific instruments to the DTU and DSU will be as shown in Figure 3.3.2.2, sheets 1 through 3. (10)

3.3.2.3 Analog Signal and Coding Accuracy. An analog signal received by the data subsystem from a scientific instrument will be converted into a 6-bit digital word in the digital telemetry unit. For an impedance of the analog signal source less than 5,000 ohms, the overall error in converting the signal will be ±1 bit. For a larger source impedance the error will be increased.

3.3.2.4 Signal Fault Voltages. The exposure limit of the spacecraft to fault voltages on the signal lines will be as given in Figure 3.3.2.4. The fault voltage exposure limit of the spacecraft is defined as the maximum voltage level on the signal lines to which the spacecraft may be exposed with no degradation of operation after removal of the fault.

3.3.3 Signals to Scientific Instruments.

3.3.3.1 Timing Signals. The data subsystem will supply the following timing signals to the scientific instruments as required. (10)

(a) Main Frame Rate Pulse. A pulse generated at the end of each main frame.
(b) Science Subframe Rate Pulse. A pulse generated at the end of each 64th main frame.
(c) Word Rate Pulse. A pulse generated during the last bit period of each word.
(d) Bit Shift Pulse. A pulse generated at the operating bit rate of the DTU that shifts digital bits from the scientific instruments to the data subsystem.
(e) 32.768 kHz Clock. A square wave pulse train with a 32.768 kHz repetition rate.
(f) 2048 Hz Clock. A pulse train with a 2048 Hz repetition rate. (1)
(g) Word Gate. A voltage level provided for the time period that the spacecraft data subsystem will accept digital data from an output line of a scientific instrument. The digital word gate is continuous throughout consecutive word assignments in the main frame. The length of the word gate is also dependent upon the operating bit rate of the data subsystem. The word gate will be capable of driving a second scientific instrument which will use the word gate as a timing signal only. There will be no readout of data from the second instrument. (1)
(h) End of Memory. A signal generated whenever the DSU reaches the last memory location. (4)

3.3.3.2 DTU Operational Status. The data subsystem will supply state signals to the scientific instruments indicating the following operational conditions of the DTU as required:

(a) Bit Rates. The status of the eight bit rates will be presented in a coded form using three lines as follows:

(1) 2048 bps - 111
(2) 1024 bps - 110
(3) 512 bps - 101
(4) 256 bps - 100
(5) 128 bps - 011
(6) 64 bps - 010
(7) 32 bps - 001
(8) 16 bps - 000

(b) Formats. A, B, D, D-3 on individual lines. (1)
When the DTU is operating in any Format D, the Format A or B state line will alternate between the true and false states in frame synchronism with the actual Format A/D or B/D transmission. Conversely, the Format D state line will remain in the true state for the entire duration that the DTU is operating in any Format A/D or B/D. The Format D-3 state line will remain in the true state for the entire duration that the DTU is operating in either Format A/D-3 or B/D-3.

(c) Modes. TS, MRO on individual lines.

3.3.3.3 Roll Index Pulse. The spacecraft will provide to the instruments, as required, a roll index pulse when a fixed reference line on the spacecraft perpendicular to the spin axis ascends through a plane parallel to the ecliptic plane. It will be possible to select by ground command either the roll pulse or the filtered roll pulse as the roll index pulse. The roll index pulse will comply with the requirements of section 3.3.3.6. (1)

3.3.3.3.1 Roll Pulse. It will be possible to select by ground command either the Sun or Canopus as a stimulus source for the roll pulse. (1)

Revision

3.3.3.3.2 Sun for Source Stimulus. When the stimulus source is the Sun, the angle between the fixed reference line and the plane parallel to the ecliptic plane at the initiation of the roll pulse for Sun angles between 2° and 10° will: (1)

(a) Vary no more than ±1 1/4° on a short-term basis (jitter).
(b) Vary no more than ±5° on a long-term basis. (days)

For look angles greater than 10° the angle will:

(c) Vary no more than ±3/4° on a short-term basis (jitter).
(d) Vary no more than ±3° on a long-term basis. (days)

3.3.3.3.3 Canopus for Source Stimulus. When the stimulus source is Canopus, the angle between the fixed reference line and the plane parallel to the ecliptic plane at the initiation of the roll pulse will:

(a) Vary no more than ±1/2° on a short-term basis (jitter).
(b) Vary no more than ±3° on a long-term basis.
(c) Be fixed and known a priori to within ±1/2° or can be calculated to within ±1/2° after determining the spacecraft position and attitude.

Requirement (b) will be met by providing the capability for adjusting the time between the roll pulse and the signal from the roll sensor by ground command and telemetering the value of the time.

3.3.3.3.4 Filtered Roll Pulse. The filtered roll pulse will be derived from the roll pulse and for steady rpm will meet the following requirement: (13)

(a) When operating in the spin averaging mode, the time between any set of adjacent filtered roll pulses will be the same as that between any other set in the same spin averaging period (64 revolutions) to within 150 μsec.

The circuitry that performs the filtering of the roll pulse will be redundant.

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3.3.3.3.5 Roll Attitude. The spacecraft telemetry data will provide information which will permit correlating the attitude of the roll index reference line to an accuracy of $\pm 1/2^{\circ}$ with a given telemetry word by ground calculation. (1)

3.3.3.4 Spin Period Sector Generator. The requirements of the spin period sector generator are as follows: (13)

(a) Divide each spacecraft revolution into 512 sectors (to within 150 μs) using the roll index pulse (section 3.3.3.3) as a reference.
(b) Operate over spacecraft spin rate range from 2 rpm to 7 rpm.
(c) Provide the following output pulses each revolution of the spacecraft to the scientific instruments and spacecraft subsystems as required based upon receipt of one roll pulse per revolution:

(1) One pulse each 1/8 revolution
Accuracy = $\frac{\text{Spin Period}}{8}$ to within 150 μs.

(2) One pulse each 1/64 revolution
Accuracy = $\frac{\text{Spin Period}}{64}$ to within 150 μs.

(3) One pulse each 1/152 revolution
Accuracy = $\frac{\text{Spin Period}}{512}$ to within 150 μs.

(d) The spin period sector generator will be a redundant system.

3.3.3.5 Commands. Fifty function commands have been allocated for scientific instrument use. The command assignments and nomenclature are shown in Figure 3.3.3.5. The interface circuit for low-level function commands will be as shown in Figure 3.3.3.7, sheet 6 of 7. The On/OFF command interface circuit will be as shown in Figure 3.3.3.7, sheet 7 of 7. (13)

Revision

3.3.3.6 Characteristics. The characteristics of signals from the spacecraft to the scientific instruments will be as defined in Figure 3.3.2.1. A definition of terms for the pulse signals and their characteristics is given in Figure 3.3.3.6.

3.3.3.7 Circuit Diagrams. Interface circuits for signals from the DTU and DSU to the scientific instruments will be as shown in Figure 3.3.3.7, sheets 1 through 7. (10)

3.3.3.8 Signal Timing Diagram. The time relationship of the timing signals supplied by the data subsystem to the instruments is shown in Figure 3.3.3.8.

3.3.3.9 Signal Fault Voltage to Instruments. The exposure limit of the instruments to fault voltages on the signal lines shall be as given in Figure 3.3.2.4. The fault voltage exposure limit is defined as the maximum voltage level on the signal lines to which the instruments may be exposed with no degradation of operation after removal of the fault.

3.3.3.10 Spacecraft/Instrument Thermistors. The interface circuit for spacecraft-supplied instrument thermistors will be as shown in Figure 3.3.3.10. These thermistors are powered and conditioned by the spacecraft, and will therefore, read out instrument temperatures at all times, (i.e., instrument power ON or OFF). (11)

3.4 THERMAL

3.4.1 Operating Temperatures.

3.4.1.1 Instruments within Spacecraft Compartment. Temperatures in the vicinity of scientific instruments that are mounted within the equipment compartment or to the exterior surfaces of the compartment will be maintained between 0°F and 90°F when the instrument is powered. When averaged over any 10-minute period of normal operation, the instrument thermal energy balance shall be such that: (13)

(a) The dissipated energy through external viewing ports shall not exceed the internally generated energy plus 1 watt.

(b) The sum of the absorbed energy through external viewing ports and the internally generated energy shall not exceed 0.20 watts per square inch of instrument mounting surface.

(c) The sum of the dissipated energy through the external viewing ports for all scientific instruments shall not exceed 18 watts when the platform temperature in the vicinity of the scientific instruments is 20°F or lower. (1)

3.4.1.2 Instruments Exterior to Spacecraft Compartment. Instruments not mounted within the equipment compartment or to the exterior surfaces (within the insulation blanket) of the compartment shall provide their own temperature control. (1)

3.4.2 Environment External to Spacecraft Compartment.

Instruments that are mounted external to the spacecraft compartment or have sensors that penetrate or are exterior to the compartment may be exposed to the following environments:

(a) Prelaunch. Within the environment inside the fairing achieved by the on-stand air conditioning as specified in PC-213.00. The RTG's will be in the stowed configuration. (1)

(b) Powered Flight.

(1) Within the environment inside the fairing resulting from heating from the fairing as specified in PC-213.00 and from heating from the RTG's as specified in PC-213.00. (1)

(2) Within the environment encountered after fairing jettison for the powered flight profile specified in PC-213.00 including the effects of aerodynamic heating, eclipse, or radiation from the Sun and Earth normal to any area on the non-spinning spacecraft. (1)

(3) Within the environment resulting from the burning of the third-stage motor, as specified in PC-213.00. (1)

3.4.3 Surface Coating of Magnetometer Boom. The boom for the magnetometer sensor, including the sensor/boom interface flange, will be coated or wrapped in accordance with the thermal specifications in PC-220.02. (1)

3.5 ELECTROMAGNETIC INTERFERENCE, NOISE AND GROUNDS

3.5.1 Electromagnetic Interference. Spacecraft equipment and scientific instruments shall comply with the electromagnetic interference requirements specified in section 3.5.1 of Specification PC-220.00.

3.5.2 Noise. Restrictions on noise introduced into the spacecraft power system are given in section 3.2.5.4. Restrictions on noise introduced into the spacecraft and instrument signal lines are given in Figure 3.3.2.1.

3.5.3 Grounds.

3.5.3.1 Power Grounds.

3.5.3.1.1 Primary. The primary dc power leads to the scientific instruments shall be twisted pairs with the return connected to the spacecraft ground at one point only. The single ground point for primary dc power is located inside the Power Control Unit. (5)

3.5.3.1.2 Secondary. The secondary power developed within the scientific instrument shall be connected to the chassis ground but dc isolated from the primary power. Secondary dc power distributed from the instrument to an external load (sensor) shall be dc isolated from the load chassis and shall imply a single-point secondary dc power ground within the instrument package. (13)

3.5.3.2 Signal Returns. Signal returns shall be connected to chassis ground within the instrument. For instruments with special noise immunity requirements, other return lines to the spacecraft will be provided. The instrument power ON/OFF command return shall be referenced to the instrument primary power return. (5)

3.5.3.2.1 RF, Command, and Digital Pulse Signals. All signals between the spacecraft and the scientific instruments shall be limited to a maximum of 200 microamps each. Shielded cable shall be used for all rf, command, digital, and pulsed interface signals. Coaxial cables shall be used only when signal levels and circuit sensitivities/impedance demand it. (1)

Revision

3.5.3.2.2 Analog Signals. These signals shall also be of a magnitude less than 200 microamperes. The following scientific instrument analog signals shall be run on single shielded wires: (12)

(a) Ab
(b) Ac
(c) Ad
(d) Af
(e) Cb
(f) Cc
(g) Cd
(h) Cp
(i) Ee

3.5.3.3 Shield Ground. A shield either grounded at one end or both ends of the cable run shall employ a shield ground directly to the spacecraft structure. The shield ground wire shall be as short as possible (generally less than 1.0 inch) using a halo-ring or similar terminating device bonded to the spacecraft structure via the scientific instrument chassis. (1)

3.5.3.3.1 Shield Termination. (1)

(a) Shields which are intended to reduce magnetic field coupling shall be grounded at both ends of the cable run.

(b) Shields which are intended to reduce electric field coupling may be grounded at one end of the cable run, provided the shield length is shorter than one fifth of the wavelength of the highest frequency of interest. The shield termination should be at the grounded end of the circuit unless otherwise specified.

(c) A shield length longer than one fifth of the wavelength of the highest frequency of interest shall be grounded at both ends and at all intermediate interfaces.

(d) Coaxial cable shields shall be grounded at both ends and at all intermediate interfaces.

3.5.3.3.2 Shields on Cables. Interconnecting cables for rf (15 kHz and above) or high impedance circuits (1,000 ohms) and higher) shall have the shields chassis grounded at both the source and load ends.

3.5.3.4 Bonding. The mounting base plate of the scientific instrument shall be in total contact with the spacecraft mounting surface. The electrical bond between any interface connector shell via the scientific instrument chassis to the spacecraft platform shall not exceed a dc resistance of 10.0 milliohms. (4)

Revision

3.6 MISCELLANEOUS

3.6.1 Spin

3.6.1.1 Spin Rate. The nominal spacecraft spin rate will be between 4 and 4.9 revolutions per minute controllable to ±0.05 rpm.

3.6.1.2 Spin Direction. The spin direction of the spacecraft as viewed from the spacecraft high-gain antenna toward the mounting platform will be in the counterclockwise direction.

3.6.2 Spacecraft Axes Notation. The spacecraft axes notation is as presented in Figure 3.6.2. (4)

4. PRODUCT ASSURANCE PROVISIONS

4.1 QUALITY ASSURANCE

Not applicable.

4.2 RELIABILITY PROVISIONS

Not applicable.

4.3 TESTS

The scientific instruments, during and subsequent to integration in the spacecraft, will be exposed to the tests specified in applicable portions of section 4.3 of NASA/ARC Specification PC-210.03 and section 4.6.4 of PC-213.03. (1)

5. HANDLING, SHIPPING, AND STORAGE

Not applicable.

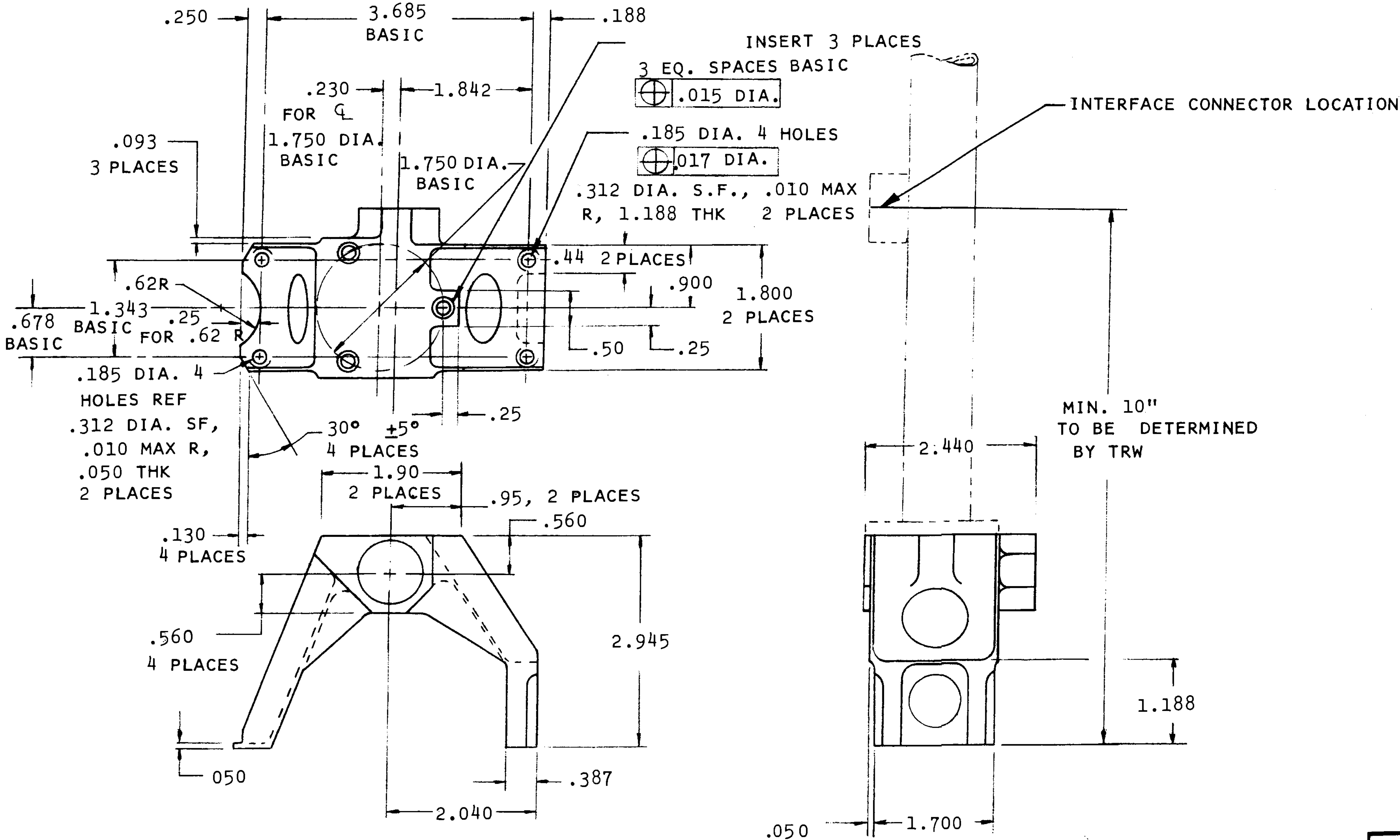
6. NOTES

6.1 DEFINITIONS

See section 6.1 of Specification PC-220.00

6.2 ABBREVIATIONS

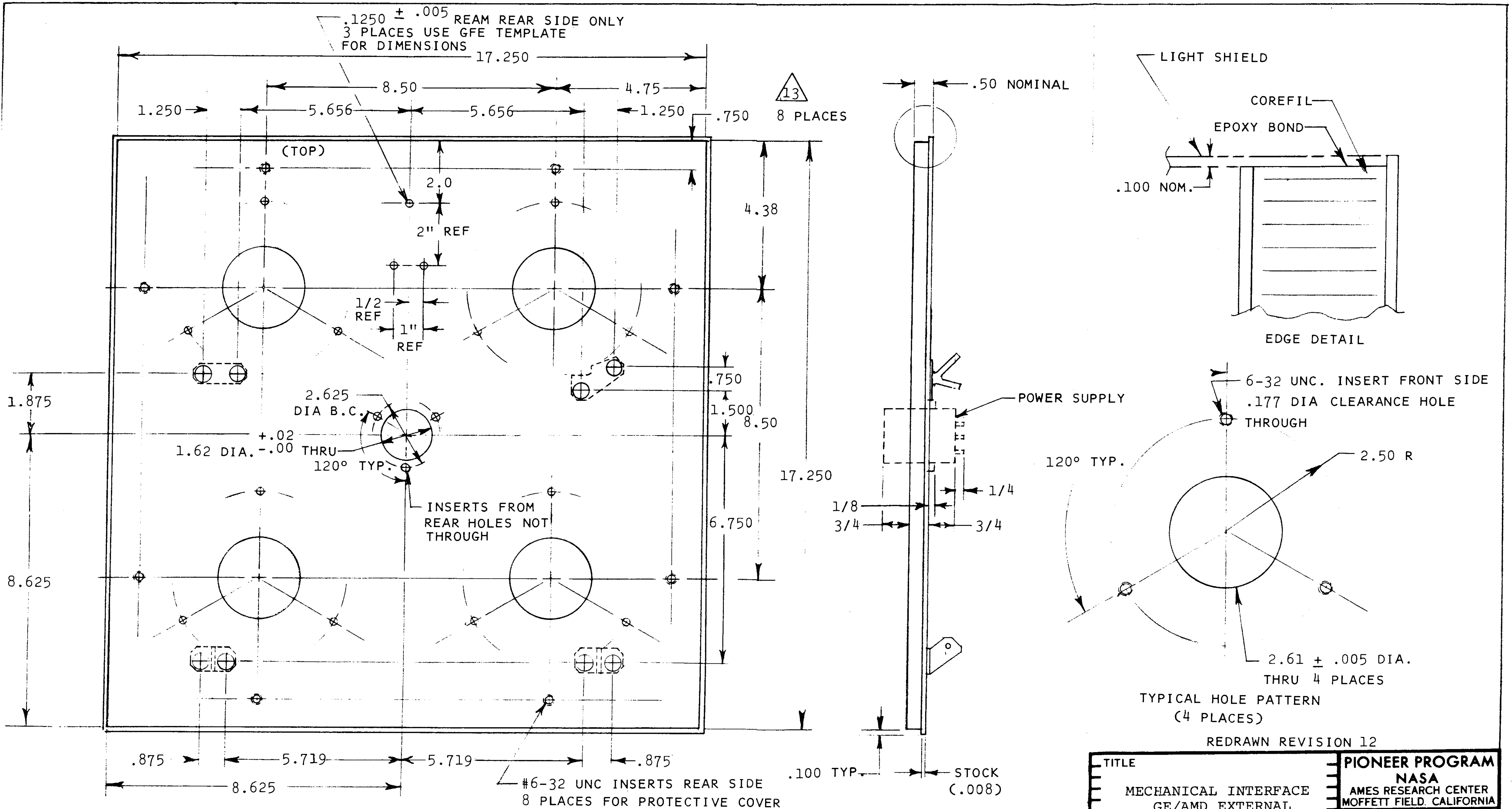
See section 6.2 of Specification PC-220.00.



REPRODUCED FROM TRW DWG #122441

REDRAWN REVISION 14

TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
MECHANICAL INTERFACE ATTACH FITTING JPL MAGNETOMETER	DOC. NO. PC-220.01
	FIG. 3.1.3.2
REV. NO. 14 — DATE 10-31-70	SHEET 1 OF 2



TITLE

MECHANICAL INTERFACE
GE/AMD EXTERNAL
MOUNTING PLATE

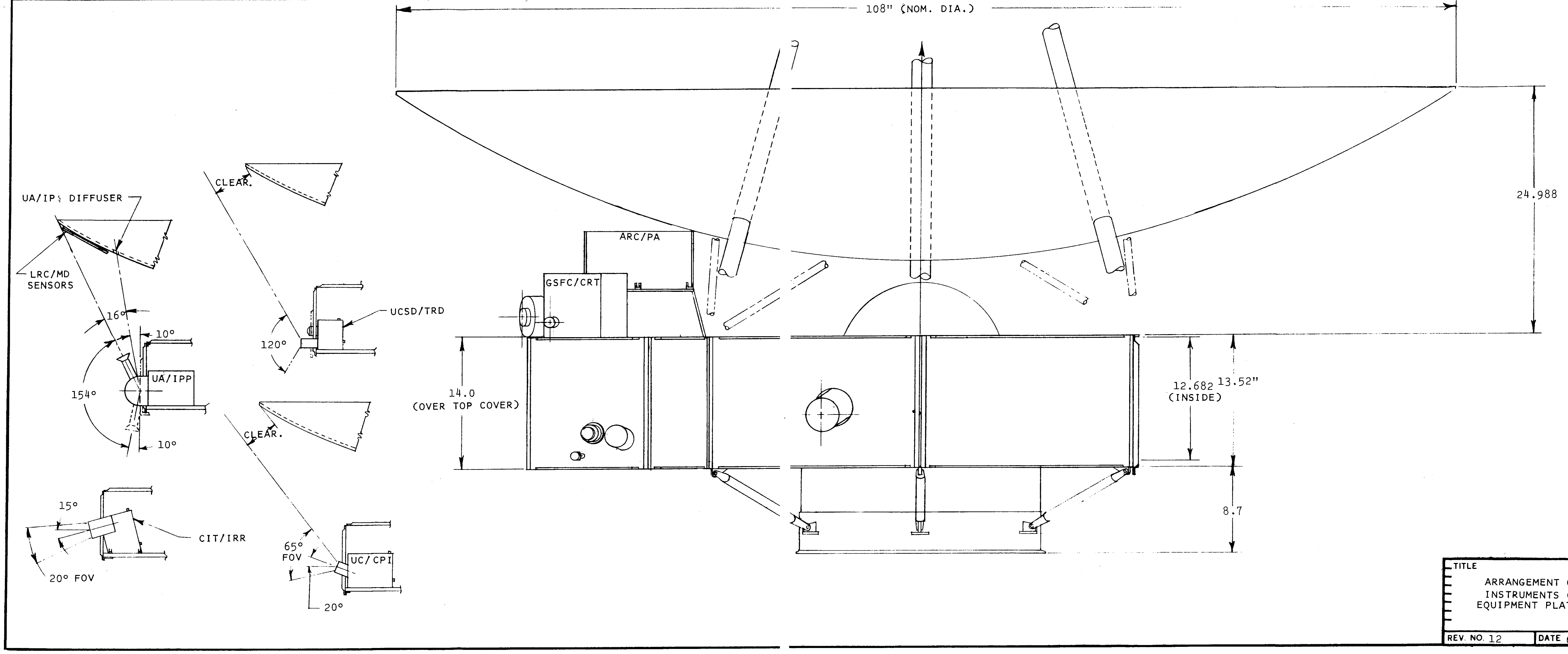
PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.01

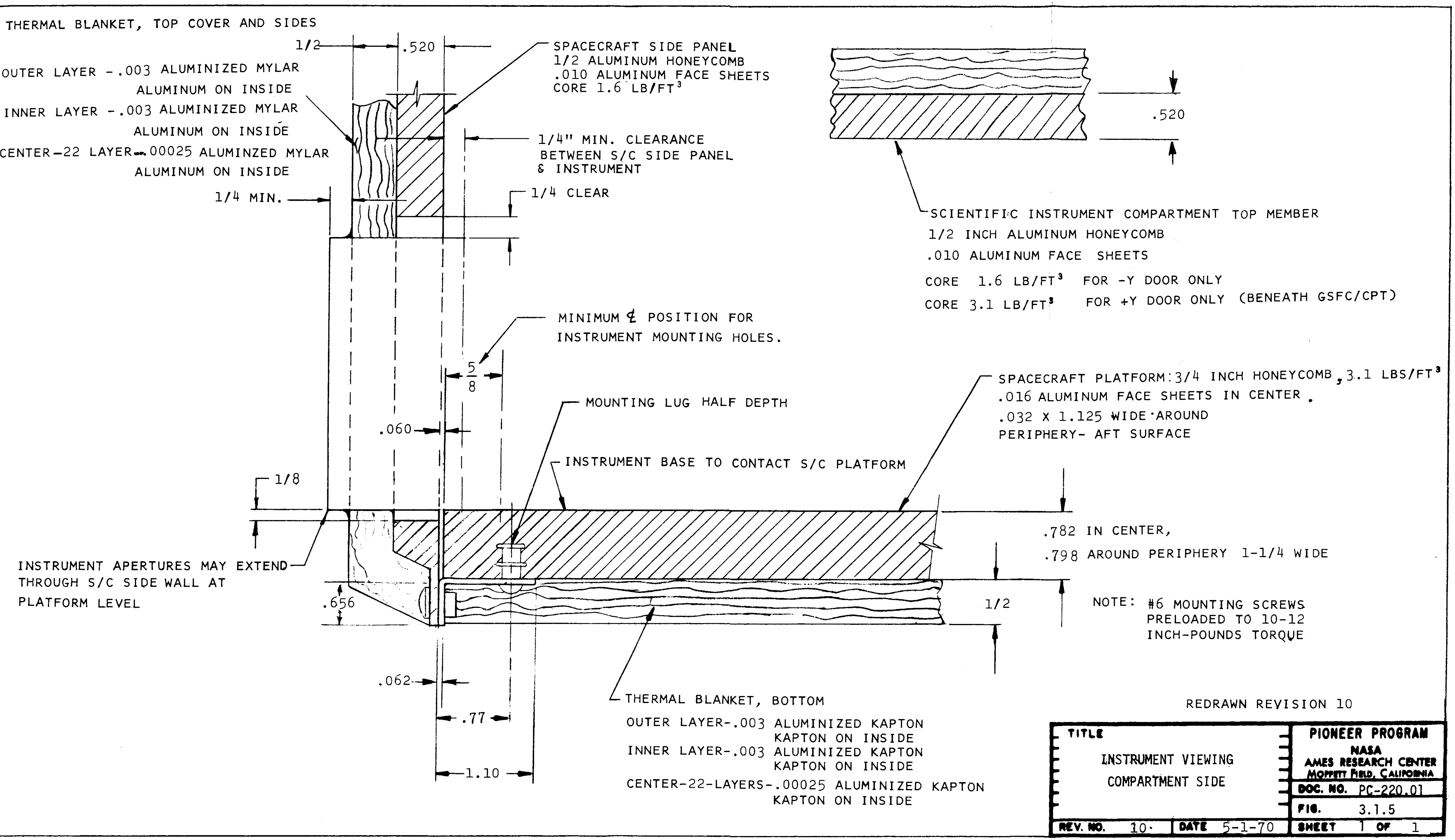
FIG. 3.1.3.2

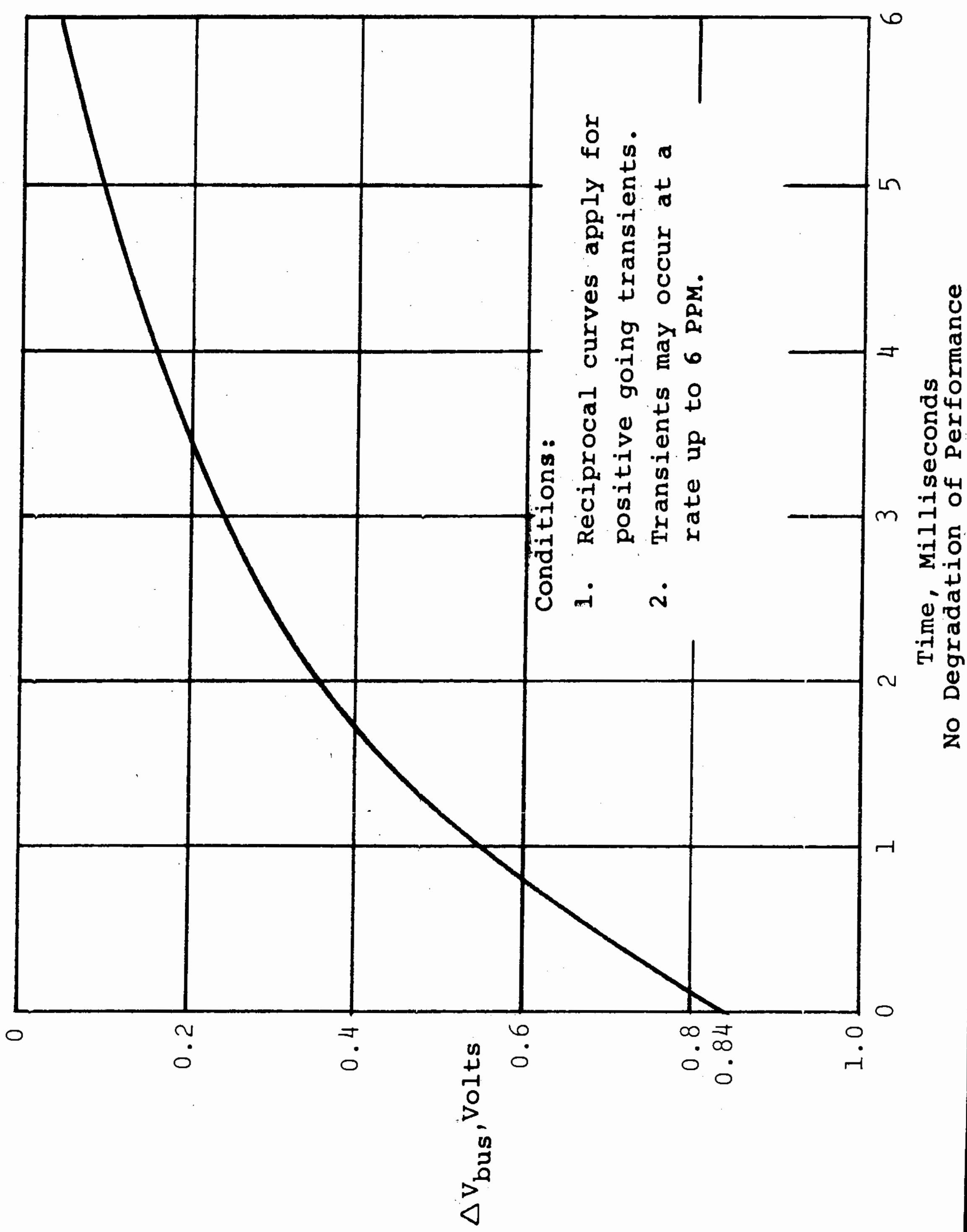
REV. NO. 13 | DATE 8-31-70 | SHEET 2 OF 2

TITLE ARRANGEMENT OF INSTRUMENTS ON EQUIPMENT PLATFORM	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC NO PC-220.01
	FIG 3.1.4
REV NO 15 / DATE 1-30-71	SHEET 1 OF 2

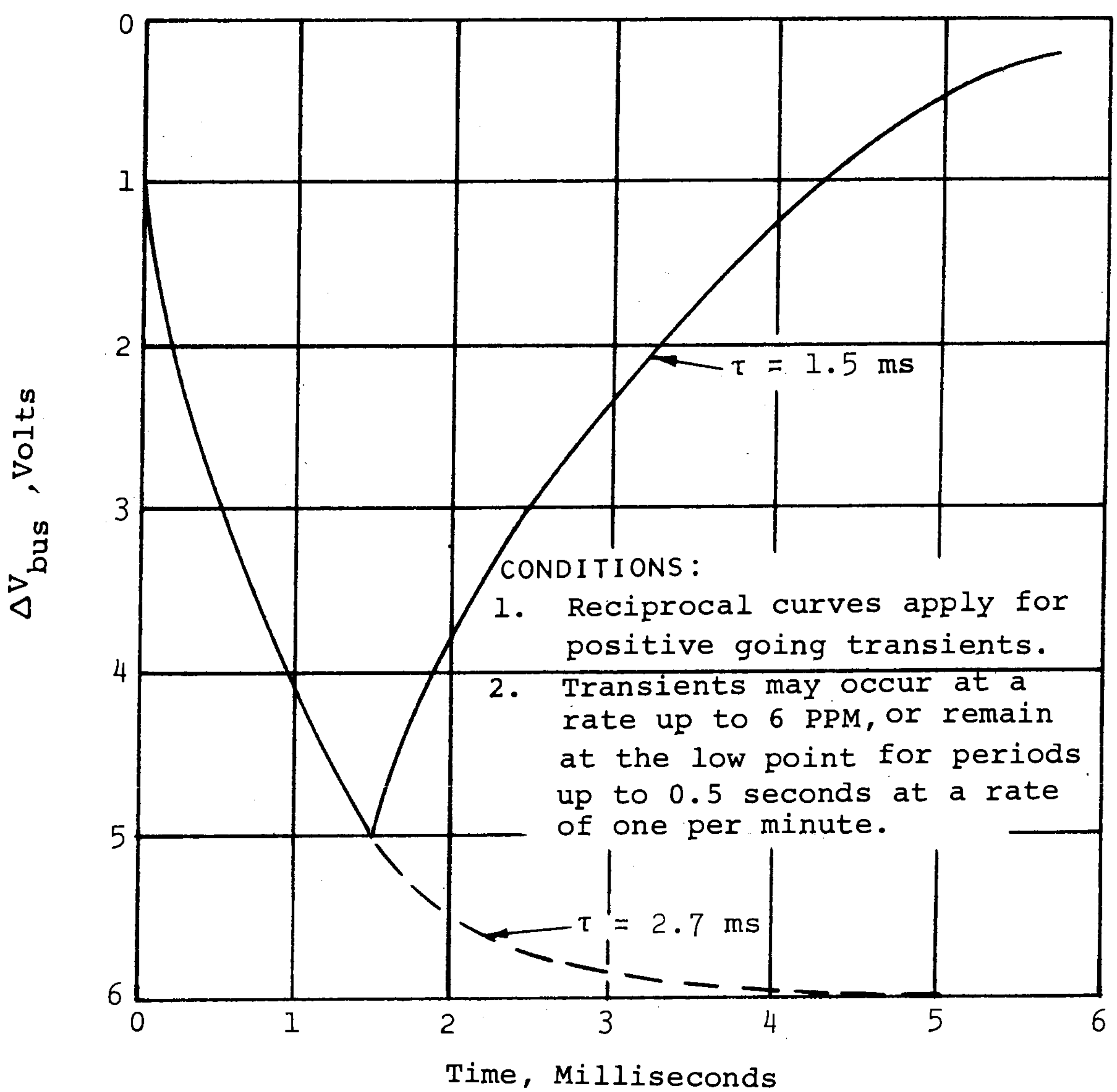


TITLE ARRANGEMENT OF INSTRUMENTS ON EQUIPMENT PLATFORM	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.01
	FIG. 3.1.4
REV. NO. 12 DATE 6-26-70	SHEET 2 OF 2


THERMAL BLANKET, TOP COVER AND SIDES
OUTER LAYER - .003 ALUMINIZED MYLAR ALUMINUM ON INSIDE
INNER LAYER - .003 ALUMINIZED MYLAR ALUMINUM ON INSIDE
CENTER-22 LAYER-.00025 ALUMINZED MYLAR ALUMINUM ON INSIDE
1/4 MIN.
1/2
.520
SPACECRAFT SIDE PANEL
1/2 ALUMINUM HONEYCOMB
.010 ALUMINUM FACE SHEETS
CORE 1.6 LB/FT³
1/4" MIN. CLEARANCE BETWEEN S/C SIDE PANEL & INSTRUMENT
1/4 CLEAR
.520
SCIENTIFIC INSTRUMENT COMPARTMENT TOP MEMBER
1/2 INCH ALUMINUM HONEYCOMB
.010 ALUMINUM FACE SHEETS
CORE 1.6 LB/FT³ FOR -Y DOOR ONLY
CORE 3.1 LB/FT³ FOR +Y DOOR ONLY (BENEATH GSFC/CPT)
MINIMUM ℄ POSITION FOR INSTRUMENT MOUNTING HOLES.
5/8
.060
MOUNTING LUG HALF DEPTH
SPACECRAFT PLATFORM: 3/4 INCH HONEYCOMB, 3.1 LBS/FT³
.016 ALUMINUM FACE SHEETS IN CENTER.
.032 X 1.125 WIDE AROUND PERIPHERY- AFT SURFACE
INSTRUMENT BASE TO CONTACT S/C PLATFORM
1/8
.782 IN CENTER,
.798 AROUND PERIPHERY 1-1/4 WIDE
INSTRUMENT APERTURES MAY EXTEND THROUGH S/C SIDE WALL AT PLATFORM LEVEL
.656
1/2
NOTE: #6 MOUNTING SCREWS PRELOADED TO 10-12 INCH-POUNDS TORQUE
.062
.77
1.10
THERMAL BLANKET, BOTTOM
OUTER LAYER-.003 ALUMINIZED KAPTON KAPTON ON INSIDE
INNER LAYER-.003 ALUMINIZED KAPTON KAPTON ON INSIDE
CENTER-22-LAYERS-.00025 ALUMINIZED KAPTON KAPTON ON INSIDE
REDRAWN REVISION 10
TITLE
INSTRUMENT VIEWING COMPARTMENT SIDE
PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA
DOC. NO. PC-220.01
FIG. 3.1.5
REV. NO. 10
DATE 5-1-70
SHEET 1 OF 1

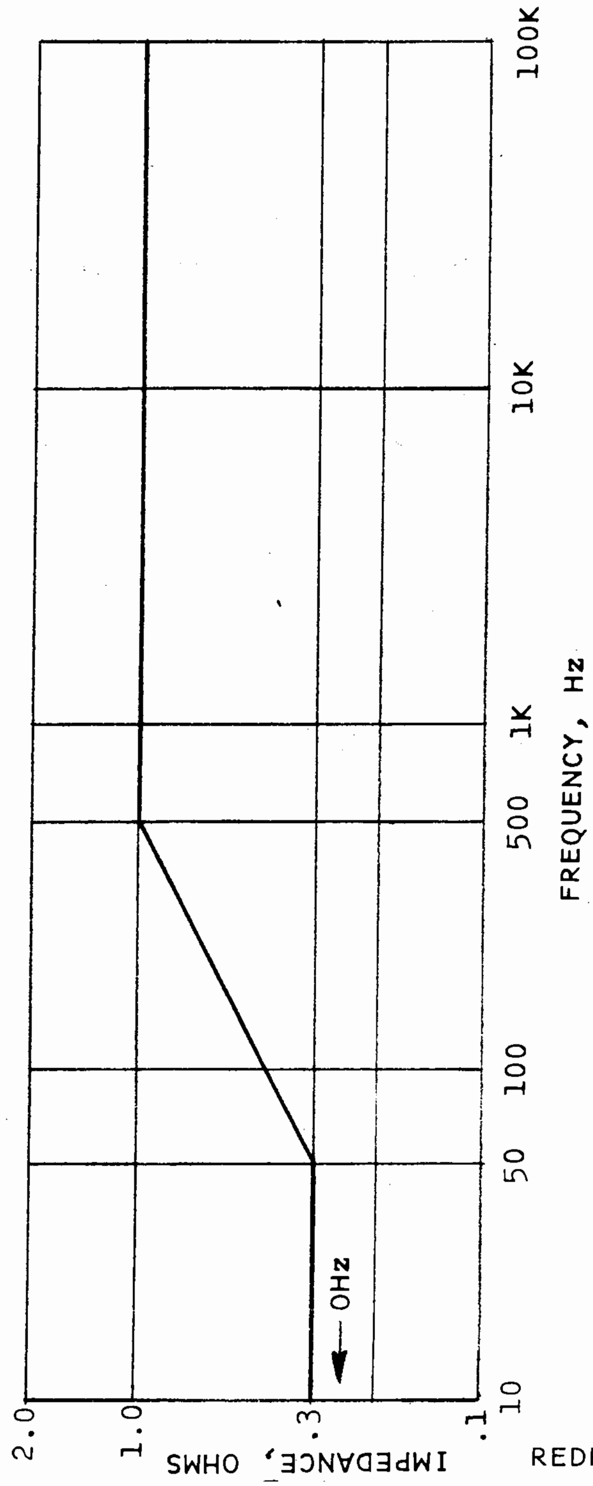


REPRODUCED FROM	TITLE Bus Voltage Transient Characteristics	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.01
		FIG. 3.2.4.2.3
	REV. NO. 15 — DATE 1-30-71	SHEET 1 OF 2



No Damage or Long Term Degradation

REPRODUCED FROM	TITLE Bus Voltage Transient Characteristics (Excluding TWT)	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.01
		FIG. 3.2.4.2.3
	REV. NO. 15 DATE 1-30-71	SHEET 2 OF 2



REDRAWN REVISION 12

REPRODUCED FROM

TITLE

POWER BUS SOURCE
DYNAMIC IMPEDANCE

REV. NO. 12

DATE 6-26-70

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.01

FIG. 3.2.4.3

SHEET 1 OF 1

1 MODE ID	2 BIT RATE ID	3–8 FRAME SYNC					
9	10	11 Ec	12	13 Fa	14	15 Ea	16
17 Ea	18	19	20	21 Ca	22	23	24
25	26	27 Ca	28	29	30	31 Da	32
33–34 FORMAT ID		34–36 SUBCOM ID		37–38 ENGINEERING SUBCOM		39–40 SCIENCE SUBCOM	
41	42	43 Eb	44	45	46	47 Aa	48
49	50	51	52 Aa	53	54	55	56 Ga
57 Ga	58	59	60	61 Ba	62	63	64

A – JPL Helium Vector Magnetometer
B – ARC Plasma Analyzer
C – U/Chicago Charged Particle Instr.
D – U/Iowa Geiger Tube Telescope
E – GSFC Cosmic Ray Telescope
F – UCSD Trapped Radiation Detector
G – USC Ultraviolet Photometer
H – U/Arizona Imaging Photopolarimeter
I – CIT Infrared Radiometer
J – GE Asteroid/Meteoroid Det.
K – LaRC Meteoroid Detector

<u>Phantom Word Gates</u>

Da to Instrument G
Ea to Instrument B

6

Lower case letters denote separate data lines.

REPRODUCED FROM	TITLE WORD ASSIGNMENTS FOR FORMAT A	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.01
		FIG. 3.3.1.4.1
	REV. NO. 6 DATE 4-3-70	SHEET 1 OF 1

Word	Assignment
1	MODE ID
2	BIT RATE ID
3–8	FRAME SYNC
9, 10, 11, 12, 13	Fa
14, 15, 16	Ea
17	Ea
18, 19, 20, 21, 22, 23, 24	Ca
25, 26, 27, 28	Ca
29, 30, 31, 32	Da
33–34	FORMAT ID
34–36	SUBCOM ID
37–38	ENGINEERING SUBCOM
39–40	SCIENCE SUBCOM
41, 42, 43, 44	Fa
45, 46, 47, 48	Aa
49, 50, 51, 52, 53, 54	Aa
55, 56	Ga
57	Ga
58, 59, 60, 61, 62, 63, 64	Ba

A – JPL Helium Vector Magnetometer
B – ARC Plasma Analyzer
C – U/Chicago Charged Particle Instr.
D – U/Iowa Geiger Tube Telescope
E – GSFC Cosmic Ray Telescope
F – UCSD Trapped Radiation Detector
G – USC Ultraviolet Photometer
H – U/Arizona Imaging Photopolarimeter
I – CIT Infrared Radiometer
J – GE Asteroid/Meteoroid Det.
K – LaRC Meteoroid Detector

Phantom Word Gates

Da to Instrument G
Ea to Instrument B

6

Lower case letters denote separate data lines.

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	WORD ASSIGNMENTS FOR FORMAT B	DOC. NO. PC-220.01
		FIG. 3.3.1.4.2
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Word	Bit	Measurement	Type
C-101		DTU A/D Calibration Voltage (Low) 168 mVdc	A
C-102		DTU A/D Calibration Voltage (Med) 1.512 Vdc	A
C-103		DTU A/D Calibration Voltage (High) 2.424 Vdc	A
C-104	1	Extended SCID-MSB (2^{12})	B
	2	Extended SCID (2^{11})	B
	3	Extended SCID (2^{10})	B
	4	Extended SCID (2^{9})	B
	5	Extended SCID (2^{8})	B
	6	Extended SCID-LSB (2^{7})	B
C-105		RTG 2 Current 0-11A	A
C-106		Battery Voltage 0-15 Vdc	A
C-107		DC Bus Voltage 26-30 Vdc	A
C-108	1	JPL/HVM Power On/Off (On=1)	B
	2	ARC/PA Power On/Off (On=1)	B
	3	UC/CPI Power On/Off (On=1)	B
	4	UI/GTT Power On/Off (On=1)	B
	5	GSFC/CRT Power On/Off (On=1)	B
	6		B
C-109		Battery Charge Current 0-0.3A	A
C-110		RTG 1 Voltage 0-6 Vdc	A
C-111		Receiver A AGC Conscan +4 dB AM to -4 dB AM	A
C-112	1	Roll Attitude Timer-MSB (2^{11})	B
	2	Roll Attitude Timer (2^{10})	B
	3	Roll Attitude Timer (2^{9})	B
	4	Roll Attitude Timer (2^{8})	B
	5	Roll Attitude Timer (2^{7})	B
	6	Roll Attitude Timer (2^{6})	B
C-113		RTG 4 Voltage 0-6 Vdc	A
C-114		RTG 3 Current 0-11A	A
C-115		Battery Temperature -20°F to +120°F	A
C-116	1	Roll Attitude Timer (2^{5})	B
	2	Roll Attitude Timer (2^{4})	B
	3	Roll Attitude Timer (2^{3})	B
	4	Roll Attitude Timer (2^{2})	B
	5	Roll Attitude Timer (2^{1})	B
	6	Roll Attitude Timer-LSB (2^{0})	B
C-117		TRF +5 Volt Output CDU Bus A 0-6 Vdc	A
C-118		TRF +5 Volt Output CDU Bus B 0-6 Vdc	A
C-119		DC Bus Voltage 0-30 Vdc	A
C-120	1	JPL/HVM Boom Released (Released=0)	B
	2	RTG 1/2 Deployed (Deployed=0)	B
	3	RTG 3/4 Deployed (Deployed=0)	B
	4	S/C Separation Status (Separation=0)	B
	5	Decoder A Addressed (Addressed=1)	B
	6	Decoder B Addressed (Addressed=1)	B

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WORD ASSIGNMENTS FOR

FORMAT C-1

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FIG. 3.3.1.4.3

REV. NO. 15 DATE 1-30-71

SHEET 1 OF 11

Word	Bit	Measurement	Type
C-121		Receiver B AGC Conscan +4 dB AM to -4 dB AM	A
C-122		Shunt Bus Current 0-3A	A
C-123		RTG 4 Current 0-11A	A
C-124	1	UCSD/TRD Power On/Off (On=1)	B
	2	USC/UV Power On/Off (On=1)	B
	3	UA/IPP Power On/Off (On=1)	B
	4	CIT/IR Power On/Off (On=1)	B
	5	GE/AMD Power On/Off (On=1)	B
	6	LaRC/MD Power On/Off (On=1)	B
C-125		RTG 2 Voltage 0-6 Vdc	A
C-126		Battery Discharge Current 0-10A	A
C-127		RTG 1 Current 0-11A	A
C-128	1	Battery Charge Status (Auto=0, Float=1)	B
	2	Battery Discharge Status (Enable=0)	B
	3		B
	4		B
	5	Ordnance Relay Status Prime (Arm=1)	B
	6	Ordnance Relay Status Redundant (Arm=1)	B
C-129		DC Bus Current 0-6A	A
C-130			A
C-131		RTG 3 Voltage 0-6 Vdc	A
C-132	1	Coded/Uncoded Data (Coded=1)	B
	2	RTG 1/2 & Mag Boom Ordnance Status (Safe = 0) 16	B
	3	RTG 3/4 Ordnance Status (Safe=0)	B
	4	RTG 1/2 Redundant Ordnance Status (Safe=0)	B
	5	RTG 3/4 Redundant Ordnance Status (Safe=0)	B
	6	CDU Sequencer Status (Enabled=1)	B

Word	Bit	Measurement	Type
C-201		RTG 1 Fin Root Temperature 160°F to 360°F	A
C-202		RTG 2 Fin Root Temperature 160°F to 360°F	A
C-203		RTG 3 Fin Root Temperature 160°F to 360°F	A
C-204		RTG 4 Fin Root Temperature 160°F to 360°F	A
C-205		TWT A Temperature 40°F to 125°F	A
C-206		Driver A Temperature 20°F to 110°F	A
C-207		TWT A Converter Temperature 40°F to 125°F	A
C-208		TWT A Cathode Current 24 to 30 mA	A
C-209		Shunt Bus Current 0-3A	A
C-210		Propellant Supply Pressure 0-600 PSIA	A
C-211		TWT A Helix Current 0 to 10 mA	A
C-212		Receiver A Loop Stress -100 kHz to +100 kHz	A
C-213		Receiver B Signal Strength -149 dBm to -63 dBm	A
C-214		TWT B RF Output Power 26 to 40.4 dBm	A
C-215		TWT B Cathode Current 24 to 30 mA	A
C-216		TWT B Helix Current 0 to 10 mA	A
C-217		RTG 4 Hot Junction Temperature 880°F to 1200°F	A
C-218		RTG 3 Hot Junction Temperature 880°F to 1200°F	A
C-219		RTG 2 Hot Junction Temperature 880°F to 1200°F	A
C-220		RTG 1 Hot Junction Temperature 880°F to 1200°F	A
C-221		TWT B Converter Temperature 40°F to 125°F	A
C-222		Receiver A VCO Temperature 20°F to 110°F	A
C-223		Driver B Temperature 20°F to 110°F	A
C-224		TWT A Reference Voltage 0-28 Vdc	A
C-225			A
C-226			A
C-227		Receiver B VCO Temperature 20°F to 110°F	A
C-228		TWT B Temperature 40°F to 125°F	A
C-229		Receiver B Loop Stress -100 kHz to +100 kHz	A
C-230		TWT B Reference Voltage 0-28 Vdc	A
C-231		TWT A RF Output Power 26 to 40.4 dBm	A
C-232		Receiver A Signal Strength -149 dBm to -63 dBm	A

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FIG. 3.3.1.4.3

SHEET 3 OF 11

Word	Bit	Measurement	Type
C-301		S/C Platform Temperature 1 0°F to 140°F	A
C-302		S/C Platform Temperature 2 0°F to 140°F	A
C-303		SRA Temperature -10°F to +95°F	A
C-304		S/C Platform Temperature 3 0°F to 140°F	A
C-305	1	Stored Command Time Register-MSB (2^6)	D
	2	Stored Command Time Register (2^5)	D
	3	Stored Command Time Register (2^4)	D
	4	Stored Command Time Register (2^3)	D
	5	Stored Command Time Register (2^2)	D
	6	Stored Command Time Register (2^1)	D
C-306	1	Stored Command Time Register-LSB (2^0)	D
	2	Stored Command Register-MSB (2^7)	D
	3	Stored Command Register (2^6)	D
	4	Stored Command Register (2^5)	D
	5	Stored Command Register (2^4)	D
	6	Stored Command Register (2^3)	D
C-307	1	Stored Command Register (2^2)	D
	2	Stored Command Register (2^1)	D
	3	Stored Command Register-LSB (2^0)	D
	4	Stored Command Identification-Bit 1	D
	5	Stored Command Identification-Bit 2	D
	6	Stored Command Identification-Bit 3	D
C-308	1	Receiver A Signal Present (Signal Present=1)	B
	2	Receiver B Signal Present (Signal Present=1)	B
	3	Receiver A Oscillator Enabled/Disabled (Enabled=1)	B
	4	Receiver B Oscillator Enabled/Disabled (Enabled=1)	B
	5	Spin Thruster B Pulse Count	B
	6	Spin Thruster A Pulse Count	B
C-309		Velocity Thruster Cluster 1 Temperature 40°F to 200°F	A
C-310		Spin Thruster Cluster Temperature 40°F to 200°F	A
C-311		VPT 1 Thruster Temperature 400°F to 1800°F	A
C-312		VPT 2 Thruster Temperature 400°F to 1800°F	A
C-313	1	Conscan-Thruster Phase Output Status (0°=0, 180°=1)	D
	2	Conscan Threshold Mode Status (Hi=1, Med=0)	D
	3	Conscan A Sin Θ - LSB	D
	4	Conscan A Sin Θ	D
	5	Conscan A Sin Θ	D
	6	Conscan A Sin Θ	D
C-314	1	Conscan A Sin Θ	D
	2	Conscan A Sin Θ	D
	3	Conscan A Sin Θ - MSB	D
	4	Conscan A Sin Θ - Sign/Code Bit	D
	5	Conscan A Cos Θ - LSB	D
	6	Conscan A Cos Θ	D

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	WORD ASSIGNMENTS FOR FORMAT C-3	DOC. NO. PC-220.01
		FIG. 3.3.1.4.3
	REV. NO. 16 DATE 4-30-71	SHEET 4 OF 11

Word	Bit	Measurement	Type
C-315	1	Conscan A Cos Θ	D
	2	Conscan A Cos Θ	D
	3	Conscan A Cos Θ	D
	4	Conscan A Cos Θ	D
	5	Conscan A Cos Θ - MSB	D
	6	Conscan A Cos Θ - Sign/Code Bit	D
C-316	1	Conscan Power On/Off (On=1)	B
	2	Conscan Threshold (Above=1)	B
	3		B
	4	Receiver Switch Status (A/B=Hi/Med=1),(A/B=Med/Hi=0)	B
	5	Transmitter Switch Status (A/B=Med/Hi=1),(A/B=Hi/Med=0)	B
	6	Antenna Feed Switch Status (Norm=0, Offset=1)	
C-317		SSA Temperature -30°F to +194°F	A
C-318		S/C Platform Temperature 4 0°F to 140°F	A
C-319		S/C Platform Temperature 5 -20°F to +110°F	A
C-320		S/C Platform Temperature 6 -20°F to +110°F	A
C-321	1	Velocity Thruster 2 (1B) Pulse Count - MSB (2^5)	D
	2	Velocity Thruster 2 (1B) Pulse Count (2^4)	D
	3	Velocity Thruster 2 (1B) Pulse Count (2^3)	D
	4	Velocity Thruster 2 (1B) Pulse Count (2^2)	D
	5	Velocity Thruster 2 (1B) Pulse Count (2^1)	D
	6	Velocity Thruster 2 (1B) Pulse Count - LSB (2^0)	D
C-322	1	Velocity Thruster 4 (2A) Pulse Count - MSB (2^5)	D
	2	Velocity Thruster 4 (2A) Pulse Count (2^4)	D
	3	Velocity Thruster 4 (2A) Pulse Count (2^3)	D
	4	Velocity Thruster 4 (2A) Pulse Count (2^2)	D
	5	Velocity Thruster 4 (2A) Pulse Count (2^1)	D
	6	Velocity Thruster 4 (2A) Pulse Count - LSB (2^0)	D
C-323	1		D
	2		D
	3		D
	4		D
	5		D
	6		D
C-324	1	Command Memory Status (Processing=0, Standby=1)	B
	2		B
	3		B
	4		B
	5		B
	6	Command Execute (Toggle=1 or 0)	B
C-325		VPT 4 Thruster Temperature 400°F to 1800°F	A
C-326		Velocity Thruster Cluster 2 Temperature 40°F to 200°F	A
C-327		Propellant Supply Temperature 40°F to 160°F	A
C-328		VPT 3 Thruster Temperature 400°F to 1800°F	A

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WORD ASSIGNMENTS FOR

FORMAT C-3

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FIG. 3.3.1.4.3

REV. NO. 16 DATE 4-30-71

Word	Bit	Measurement	Type
C-329	1	Velocity Thruster 1 (1A) Pulse Count - MSB (2^5)	D
	2	Velocity Thruster 1 (1A) Pulse Count (2^4)	D
	3	Velocity Thruster 1 (1A) Pulse Count (2^3)	D
	4	Velocity Thruster 1 (1A) Pulse Count (2^2)	D
	5	Velocity Thruster 1 (1A) Pulse Count (2^1)	D
	6	Velocity Thruster 1 (1A) Pulse Count - LSB (2^0)	D
C-330	1	Velocity Thruster 3 (2B) Pulse Count - MSB (2^5)	D
	2	Velocity Thruster 3 (2B) Pulse Count (2^4)	D
	3	Velocity Thruster 3 (2B) Pulse Count (2^3)	D
	4	Velocity Thruster 3 (2B) Pulse Count (2^2)	D
	5	Velocity Thruster 3 (2B) Pulse Count (2^1)	D
	6	Velocity Thruster 3 (2B) Pulse Count - LSB (2^0)	D
C-331	1		D
	2		D
	3		D
	4		D
	5		D
	6		D
C-332	1	Sequencer Power On/Off (On=1)	B
	2	Overload Protection On/Off (On=0)	B
	3	Receiver Reverse Inhibit (Inhibit=1)	B
	4	Command Processor Memory A Select/B Select (A=1)	B
	5	Command Memory DTU Identification (DTU=1)	B
	6	CDU +5V Bus Status A/B (Bus A=1)	B

Word	Bit	Measurement	Type
C-401	1		B
	2		B
	3		B
	4		B
	5		B
	6		B
C-402			A
C-403	1	Precession Pair: VPT 1&4/VPT 2&3 (VPT 1&4 = 1)	D
	2	Pulse Length - Bit 1	D
	3	Pulse Length - Bit 2	D
	4	Pulse Length - Bit 3	D
	5	Delta V Pair: VPT 1&3/VPT 2&4 (VPT 1&3 = 1)	D
	6	Spin Control Direction Up/Down (Up=0)	D
C-404	1	Star Time Gate - LSB (2^0)	D
	2	Star Time Gate (2^1)	D
	3	Star Time Gate (2^2)	D
	4	Star Time Gate (2^3)	D
	5	Star Time Gate - MSB (2^4)	D
	6	Delta V/SCT Mode Enabled/Disabled (Enabled=1)	D
C-405	1	Spin Period - MSB (2^{17})	D
	2	Spin Period (2^{16})	D
	3	Spin Period (2^{15})	D
	4	Spin Period (2^{14})	D
	5	Spin Period (2^{13})	D
	6	Spin Period (2^{12})	D
C-406	1	Spin Period (2^{11})	D
	2	Spin Period (2^{10})	D
	3	Spin Period (2^9)	D
	4	Spin Period (2^8)	D
	5	Spin Period (2^7)	D
	6	Spin Period (2^6)	D
C-407	1	Spin Period (2^5)	D
	2	Spin Period (2^4)	D
	3	Spin Period (2^3)	D
	4	Spin Period (2^2)	D
	5	Spin Period (2^1)	D
	6	Spin Period - LSB (2^0)	D
C-408	1	Roll Pulse/Roll-Index Pulse Phase Error - MSB (2^4)	D
	2	Roll Pulse/Roll-Index Pulse Phase Error (2^3)	D
	3	Roll Pulse/Roll-Index Pulse Phase Error (2^2)	D
	4	Roll Pulse/Roll-Index Pulse Phase Error (2^1)	D
	5	Roll Pulse/Roll-Index Pulse Phase Error - LSB (2^0)	D
	6	Phase Error Sign - (Roll Pulse before Index Pulse = 1)	D

Word	Bit	Measurement	Type
C-409	1	VPT 1 Firing Status (Firing =1)	B
	2	VPT 2 Firing Status (Firing =1)	B
	3	VPT 4 Firing Status (Firing =1)	B
	4	VPT 3 Firing Status (Firing =1)	B
	5	SCT 1 Firing Status (Firing =1)	B
	6	SCT 2 Firing Status (Firing =1)	B
C-410	1	Despin On/Off (On=1)	D
	2	Conscan Enabled/Disabled (Enabled=1)	D
	3	Clock Select A - Bit 1	D
	4	Clock Select B - Bit 2	D
	5	Star Angle Gate 45°/360° (45° =1)	D
	6	Star Level >180% Canopus Yes/No (Yes=1)	D
C-411	1	No. 1 Precession Magnitude - LSB (2^0)	D
	2	No. 1 Precession Magnitude (2^1)	D
	3	No. 1 Precession Magnitude (2^2)	D
	4	No. 1 Precession Magnitude (2^3)	D
	5	No. 1 Precession Magnitude (2^4)	D
	6	No. 1 Precession Magnitude (2^5)	D
C-412	1	No. 1 Precession Magnitude (2^6)	D
	2	No. 1 Precession Magnitude (2^7)	D
	3	No. 1 Precession Magnitude (2^8)	D
	4	No. 1 Precession Magnitude (2^9)	D
	5	No. 1 Precession Magnitude - MSB (2^{10})	D
	6	Delta V Magnitude - LSB (2^0)	D
C-413	1	Delta V Magnitude (2^1)	D
	2	Delta V Magnitude (2^2)	D
	3	Delta V Magnitude (2^3)	D
	4	Delta V Magnitude (2^4)	D
	5	Delta V Magnitude (2^5)	D
	6	Delta V Magnitude (2^6)	D
C-414	1	Delta V Magnitude (2^7)	D
	2	Delta V Magnitude (2^8)	D
	3	Delta V Magnitude (2^9)	D
	4	Delta V Magnitude (2^{10})	D
	5	Delta V Magnitude (2^{11})	D
	6	Delta V Magnitude - MSB (2^{12})	D
C-415	1	No. 2 Precession Magnitude - LSB (2^0)	D
	2	No. 2 Precession Magnitude (2^1)	D
	3	No. 2 Precession Magnitude (2^2)	D
	4	No. 2 Precession Magnitude (2^3)	D
	5	No. 2 Precession Magnitude (2^4)	D
	6	No. 2 Precession Magnitude (2^5)	D

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Word	Bit	Measurement	Type
C-416	1	No. 2 Precession Magnitude (2^6)	D
	2	No. 2 Precession Magnitude (2^7)	D
	3	No. 2 Precession Magnitude (2^8)	D
	4	No. 2 Precession Magnitude (2^9)	D
	5	No. 2 Precession Magnitude - MSB (2^{10})	D
	6	Star Coincidence Yes/No (Yes=1)	D
C-417	1	SPSG Roll Reference 0°/180° (0°=0)	B
	2	SPSG Mode - Bit 1	B
	3	SPSG Mode - Bit 2	B
	4		B
	5		B
	6		B
C-418			A
C-419	1	Star Delay - LSB (2^0)	D
	2	Star Delay (2^1)	D
	3	Star Delay (2^2)	D
	4	Star Delay (2^3)	D
	5	Star Delay (2^4)	D
	6	Star Delay (2^5)	D
C-420	1	Star Delay (2^6)	D
	2	Star Delay (2^7)	D
	3	Star Delay (2^8)	D
	4	Star Delay (2^9)	D
	5	Star Delay (2^{10})	D
	6	Star Delay - MSB (2^{11})	D
C-421	1	Star Count - LSB (2^0)	D
	2	Star Count (2^1)	D
	3	Star Count - MSB (2^2)	D
	4	CEA Power Status - Bit 1 (DSLA On = 1)	D
	5	CEA Power Status - Bit 2 (DSLB On = 1)	D
	6	CEA Power Status - Bit 3 (PSE On = 1)	D
C-422	1	Spacing Bit	D
	2	Spacing Bit	D
	3	Spacing Bit	D
	4	Spacing Bit	D
	5	Spacing Bit	D
	6	No. 2 Precession Redundant Magnitude - LSB (2^0)	D
C-423	1	No. 2 Precession Redundant Magnitude (2^1)	D
	2	No. 2 Precession Redundant Magnitude (2^2)	D
	3	No. 2 Precession Redundant Magnitude (2^3)	D
	4	No. 2 Precession Redundant Magnitude (2^4)	D
	5	No. 2 Precession Redundant Magnitude (2^5)	D
	6	No. 2 Precession Redundant Magnitude (2^6)	D

Word	Bit	Measurement	Type
C-424	1	No. 2 Precession Redundant Magnitude - MSB (2^7)	D
	2	No. 2 Precession Angle - LSB (2^0)	D
	3	No. 2 Precession Angle (2^1)	D
	4	No. 2 Precession Angle (2^2)	D
	5	No. 2 Precession Angle (2^3)	D
	6	No. 2 Precession Angle (2^4)	D
C-425	1	No. 2 Precession Angle (2^5)	D
	2	No. 2 Precession Angle (2^6)	D
	3	No. 2 Precession Angle (2^7)	D
	4	No. 2 Precession Angle (2^8)	D
	5	Delta V Redundant Magnitude - LSB (2^0)	D
	6	Delta V Redundant Magnitude (2^1)	D
C-426	1	Delta V Redundant Magnitude (2^2)	D
	2	Delta V Redundant Magnitude (2^3)	D
	3	Delta V Redundant Magnitude (2^4)	D
	4	Delta V Redundant Magnitude (2^5)	D
	5	Delta V Redundant Magnitude (2^6)	D
	6	Delta V Redundant Magnitude - MSB (2^7)	D
C-427	1	Time Delay - LSB (2^0)	D
	2	Time Delay (2^1)	D
	3	Time Delay (2^2)	D
	4	Time Delay (2^3)	D
	5	Time Delay (2^4)	D
	6	Time Delay (2^5)	D
C-428	1	Time Delay - MSB (2^6)	D
	2	No. 1 Precession Redundant Magnitude - LSB (2^0)	D
	3	No. 1 Precession Redundant Magnitude (2^1)	D
	4	No. 1 Precession Redundant Magnitude (2^2)	D
	5	No. 1 Precession Redundant Magnitude (2^3)	D
	6	No. 1 Precession Redundant Magnitude (2^4)	D
C-429	1	No. 1 Precession Redundant Magnitude (2^5)	D
	2	No. 1 Precession Redundant Magnitude (2^6)	D
	3	No. 1 Precession Redundant Magnitude - MSB (2^7)	D
	4	No. 1 Precession Angle - LSB (2^0)	D
	5	No. 1 Precession Angle (2^1)	D
	6	No. 1 Precession Angle (2^2)	D
C-430	1	No. 1 Precession Angle (2^3)	D
	2	No. 1 Precession Angle (2^4)	D
	3	No. 1 Precession Angle (2^5)	D
	4	No. 1 Precession Angle (2^6)	D
	5	No. 1 Precession Angle (2^7)	D
	6	No. 1 Precession Angle - MSB (2^8)	D

Word	Bit	Measurement	Type
C-431	1	ACS Sequence Status - Bit 1	D
	2	ACS Sequence Status - Bit 2	D
	3	ACS Sequence Status - Bit 3	D
	4	Star Time Gate Enabled/Disabled (Enabled = 1)	D
	5	Reference Select - Bit 1	D
	6	Reference Select - Bit 2	D
C-432	1	Star Location - Octant 1 Absent/Present (Absent = 0)	D
	2	Star Location - Octant 8 Absent/Present (Present = 1)	D
	3	ACS Registers Inhibit Status (Normal = 0)	D
	4	Precession Register 1 Arm/Disarm (Arm = 1)	D
	5	Delta V Register Arm/Disarm (Arm = 1)	D
	6	Precession Register 2 Arm/Disarm (Arm = 1)	D

1 Bb Analog	2 Bc Analog	3 Ab Analog	4 Ac Analog	5 Ad Analog	6 Ae Digital	7 Ka Digital	8 Ch Ck Ci Cl Cj Cm Bilevel
9 Gd Analog	10 Co Analog	11 Cb Analog	12 Cc Analog	13 Cd Analog	14 Ce Digital	15 Ce Digital	16 Ce Digital
17 Ib Analog	18 Ja Analog	19 Jb Analog	20 Analog	21 Analog	22 Jc Digital	23 Jc Digital	24 Dc Je Ej Gb Jd Gc Bilevel
25 Ed Analog	26 Ee Analog	27 Ef Analog	28 Eg Analog	29 Eh Analog	30 Ei Digital	31 Ic Digital	32 Ic Digital

A - JPL Helium Vector Magnetometer
B - ARC Plasma Analyzer
C - U/Chicago Charged Particle Instr.
D - U/Iowa Geiger Tube Telescope
E - GSFC Cosmic Ray Telescope
F - UCSD Trapped Radiation Detector
G - USC Ultraviolet Photometer
H - U/Arizona Imaging Photopolarimeter
I - CIT Infrared Radiometer
J - GE Asteroid/Meteoroid Det.
K - LaRC Meteoroid Detector

Lower case letters denote separate data lines.

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	WORD ASSIGNMENTS FOR FORMAT E-1	DOC. NO. PC-220.01
		FIG. 3.3.1.4.5
	REV. NO. 9 / DATE 4-24-70	SHEET 1 OF 4

Word	Measurement	
1	ARC/PA Detectors Temperature	
2	ARC/PA Electronics Temperature	
3	JPL/HVM Spectrum Analyzer/X-Axis Output	
4	JPL/HVM Spectrum Analyzer/Y-Axis Output	
5	JPL/HVM Spectrum Analyzer/Z-Axis Output	
6	Digital - JPL/HVM Status	
7	Digital - LaRC/MD Event Count	
8	Bilevel	
	Bit 1 - UC/CPI Detector D1 Status	9
	Bit 2 - UC/CPI Detector D2 Status	9
	Bit 3 - UC/CPI Detector D7 Status	9
	Bit 4 - UC/CPI Priority Mode Status	
	Bit 5 - UC/CPI Calibrate Status	9
	Bit 6 - UC/CPI Calibrate Status	
9	USC/UV Electronics Temperature	
10	UC/CPI Electronics Temperature	
11	UC/CPI Egg Current Range 1	
12	UC/CPI Egg Current Range 2	
13	UC/CPI Egg Current Range 3	
14	Digital - UC/CPI Fission Detector	9
15	Digital - UC/CPI Fission Detector	9
16	Digital - UC/CPI Fission Detector	9
17	CIT/IR Low Range Temperature	
18	GE/AMD Preamp Temperature	
19	GE/AMD Secondary Voltage	
20		
21		
22	Digital - GE/AMD Event Data	
23	Digital - GE/AMD Event Data	
24	Bilevel	
	Bit 1 - UI/GTT Logic Status	9
	Bit 2 - GSFC/CRT Status	
	Bit 3 - GE/AMD Star Exclusion Status	
	Bit 4 - GE/AMD Data Readout Status	9
	Bit 5 - USC/UV Channel Status	
	Bit 6 - USC/UV Roll Status	
25	GSFC/CRT Electronics Temperature	
26	GSFC/CRT Analog Data D1	
27	GSFC/CRT Analog Data D2	
28	GSFC/CRT Detector Temperature	
29	GSFC/CRT Secondary Voltage	
30	Digital - GSFC/CRT Identification Data	
31	Digital - CIT/IR Command Register - Part 1	
32	Digital - CIT/IR Command Register - Part 2	

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TITLE

WORD ASSIGNMENTS FOR

FORMAT E-1

REV. NO. 9 | DATE 4-24-70

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA
DOC. NO. PC-220.01
FIG. 3.3.1.4.5

1 Id Analog	2 Af Analog	3 Ab Analog	4 Ac Analog	5 Ad Analog	6 Cf Digital	7 Kb Digital	8 Jf Jg Bilevel
9 Fb Analog	10 Fc Analog	11 Fd Analog	12 Cp Analog	13 Cq Analog	14 Cg Digital	15 Cg Digital	16 Cg Digital
17 Hb Analog	18 Analog	19 Analog	20 Db Analog	21 Dd Analog	22 Jc Digital	23 Jc Digital	24 Cn Fe Gb Ff Gc Bilevel
25 Analog	26 Analog	27 Analog	28 Analog	29 Analog	30 Digital	31 Digital	32 Digital

A - JPL Helium Vector Magnetometer
B - ARC Plasma Analyzer
C - U/Chicago Charged Particle Instr.
D - U/Iowa Geiger Tube Telescope
E - GSFC Cosmic Ray Telescope
F - UCSD Trapped Radiation Detector
G - USC Ultraviolet Photometer
H - U/Arizona Imaging Photopolarimeter

I - CIT Infrared Radiometer
J - GE Asteroid/Meteoroid Det.
K - LaRC Meteoroid Detector

Phantom Word Gates
Cf to instrument A

Lower case letters denote separate data lines.

REPRODUCED FROM

TITLE

WORD ASSIGNMENTS FOR FORMAT E-2

REV. NO. 12 | DATE 6-26-70

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.01
FIG. 3.3.1.4.5
SHEET 3 OF 4

Word	Measurement	
1	CIT/IR High Range Temperature	
2	JPL/HVM Commutated Housekeeping Data	
3	JPL/HVM Spectrum Analyzer/X-Axis Output	
4	JPL/HVM Spectrum Analyzer/Y-Axis Output	
5	JPL/HVM Spectrum Analyzer/Z-Axis Output	
6	Digital - UC/CPI L1 PHA	
7	Digital - LaRC/MD Event Count	
8	Bilevel	
	Bit 1 - GE/AMD Threshold Level Status	
	Bit 2 - GE/AMD Bandwidth Status	
	Bit 3 -	
	Bit 4 -	
	Bit 5 -	
	Bit 6 -	
9	UCSD/TRD Pulse Temperature	16
10	UCSD/TRD High Voltage Regulator Current	16
11	UCSD/TRD Detector C Temperature	16
12	UC/CPI D7 Count Rate	
13	UC/CPI Egg Temperature	
14	Digital - UC/CPI L1, L2 Coincidence Count Rate	
15	Digital - UC/CPI D1, D2, S, D3, D7 Count Rate	
16	Digital - UC/CPI D2, D4, D5, D6, D7 Count Rate	
17	UA/IPP - Standby Verification	
18		
19		
20	UI/GTT 7.75 V dc Monitor	
21	UI/GTT Electronics Temperature	
22	Digital - GE/AMD Event Data	
23	Digital - GE/AMD Event Data	
24	Bilevel	
	Bit 1 -	
	Bit 2 - UCSD/TRD (Grounded)	16
	Bit 3 - UCSD/TRD High Voltage Status	
	Bit 4 - UC/CPI GSE Stimulus Status	
	Bit 5 - USC/UV Channel Status	
	Bit 6 - USC/UV Roll Status	
25		
26		
27		
28		
29		
30	Digital -	
31	Digital -	
32	Digital -	

NOMENCLATURE	SIGNAL DESCRIPTION	ORIGIN	LOADED CHARACTERISTICS & TOLERANCES					IMPEDANCE, OHMS			Comments	Noise, Volts (P-P)	
			AMPLITUDE (+) VOLTS On (True)	(+) VOLTS Off (False)	Duration µS (50% - 50%)	Rise Time µS (10% - 90%)	Fall Time µS (90% - 10%)	SPACECRAFT On (True)	SPACECRAFT Off (False)	INSTRUMENT		From Spacecraft	From Instrument
Main-Frame Rate Pulse	A pulse at the end of each frame.	DTU	4.5 ±1	0.25 ±0.25	60 ±25	1 to 5	1 to 10	300 max	4 k max	50 k min 50 pf max	Use at least half of 50 k ohm to isolate 50 pf.		
Science Subframe Rate Pulse	A pulse every 64 frames except when operating in a Format D; then every 128 frames.	"	"	"	"	"	"	"	"	"	"		
Word Rate Pulse	A pulse generated during the last bit period of each word.	"	"	"	"	"	"	"	"	"	"		
Bit Shift Pulse	Pulses continuously generated at the operating bit rate.	"	"	"	"	1 to 7.5	1 to 15	"	"	"	"		
Roll Index Pulse	A single pulse per spacecraft revolution.	"	"	"	"	"	"	"	"	"	"		
Sector Generator Pulse	512 pulses per spacecraft revolution.	"	"	"	"	1 to 5	1 to 10	"	"	"	"		
	64 and 8 pulses per spacecraft revolution.	"	"	"	50% ±10% Duty Cycle	"	"	"	"	"	"		
32.768 kHz Clock (High Clock)	A square wave with a 32.768 kHz repetition pulse.	"	"	"	"	"	"	"	"	"	"		
2048 Hz Clock (Low Clock)	A pulse train with a 2048 Hz repetition rate.	"	"	"	"	"	"	"	"	"	"		
Bit Rate ID Signal	Continuous states indicating operating bit rate. 3 wire connection (one wire per bit with 000 = lowest bit rate and 111 = highest bit rate).	"	"	"	Duration of Condition	1 to 30	1 to 50	"	"	500 K min 50 pf max	Use at least half of 500 K ohm to isolate 50 pf.		
Mode ID Signal	Continuous states indicating operating mode.	"	"	"	"	"	"	"	"	"	"		
Format ID Signal	States indicating operating format. (Formats A, B, D, and D-3).	"	"	"	"	"	"	"	"	"	"		
Word Gate	Gate to each instrument to indicate time of reading out digital data to DTU. Separate line for main-frame and sub-frame digital words.	"	"	"	"	"	1 to 50*	5 k	123 k max	50 k min 50 pf max	Use at least half of 50 k ohm to isolate 50 pf.		
Digital Data	A pulse shall indicate one and no pulse shall indicate zero.	Sci. Inst.	"	"	One DTU Bit Period	-	-	Current to DTU shall be 5 µA max	Current from DTU will be 100 NA max	5 k max	Duration is bit rate dependent.		
Instrument Operational Status	Bi-level states indicating operational conditions of instruments. Separate line required for each signal.	"	"	"	Duration of Condition	-	-	"	"	"	- - - - - - -		
Analog Data	Normalized analog voltage. Separate line required for each word.	"	Normalized 0 to 3.0	-	-	-	-	Current to DTU shall be 200 NA max	"	5 k max for ±1 bit A/D conv. accuracy	3.0 V max from instrument		

*The maximum fall time of the word gate signal will be less than 50 µs when loaded with a parallel combination of word gate output and instrument input resistance of 35 k ohms, and circuit capacitance of 600 pf maximum.

TITLE	PIONEER PROGRAM
SPACECRAFT AND INSTRUMENT SIGNALS	NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.01
	FIG. 3.3.2.1
REV. NO. 15 DATE 1-30-71	SHEET 1 OF 2

			LOADED CHARACTERISTICS AND TOLERANCES					IMPEDANCE, OHMS				NOISE, VOLTS (P-P)	
NOMENCLATURE	SIGNAL DESCRIPTION	ORIGIN	AMPLITUDE (+) VOLTS On (True)	Off (False)	Duration μs (50% - 50%)	Rise Time μs (10% - 90%)	Fall Time μs (90% - 10%)	SPACECRAFT On (True)	Off (False)	INSTRUMENT	COMMENTS	From Spacecraft	From Instrument
End of Memory	A pulse when DSU reaches last memory location.	DSU	4.5 ±1	0.25 ±0.25	Duration of Condition	1 to 5	1 to 10	300 max	4 k max	50 k min 50 pf max	Use at least half of 50 k ohm to isolate 50 pf.		
IPP Data Store Gate	Gate to DSU to indicate data is to be stored in buffer.	UA/IPP	"	"	Duration of Store Period	1 to 3	1 to 3	Current to DSU shall be 200 μA max	Current to DSU shall be 35 μA max	- 9	Gate will be at a continuous high level during data store.		
IPP Bit Shift Clock	16.384 kHz clock pulses to DSU for shifting digital data into DSU buffer.	UA/IPP	"	"	50% ±10% Duty Cycle	"	"	"	"	- 9	Pulses occur in bursts of 6 or 10 bits		
IPP Digital Data	NRZ data with low state to indicate a zero and high state to indicate a one.	UA/IPP	"	"	One Clock Period	"	"	"	"	- 9	Data bits stored in bursts of 6 or 10 bits		
Function Commands	Pulse upon receipt of a ground command. Separate line for each command.	CDU	0.25 ±0.25	$4^{+1.4}_{-1.5}$	50 ±20 Millisec.	100 max	10 max	Current to CDU shall be 200 μA max	Current from CDU will be 100 μA max	500 pf max	Pulse of decreasing voltage to instrument upon receipt of function command. 5.0 V max from instrument to CDU during non-cmd.		
On-Off Commands	Step signal upon receipt of a ground command. Single line connection.	CDU	$4^{+1.4}_{-1.5}$	0.25 ±0.25	Duration of Condition	"	"	Current from CDU will be 100 μA max	Current to CDU shall be 200 μA max	- 9	Step signal is of increasing voltage to instru. upon receipt of on-command. 5.0 V max from instru. to CDU during off-state.		

TITLE

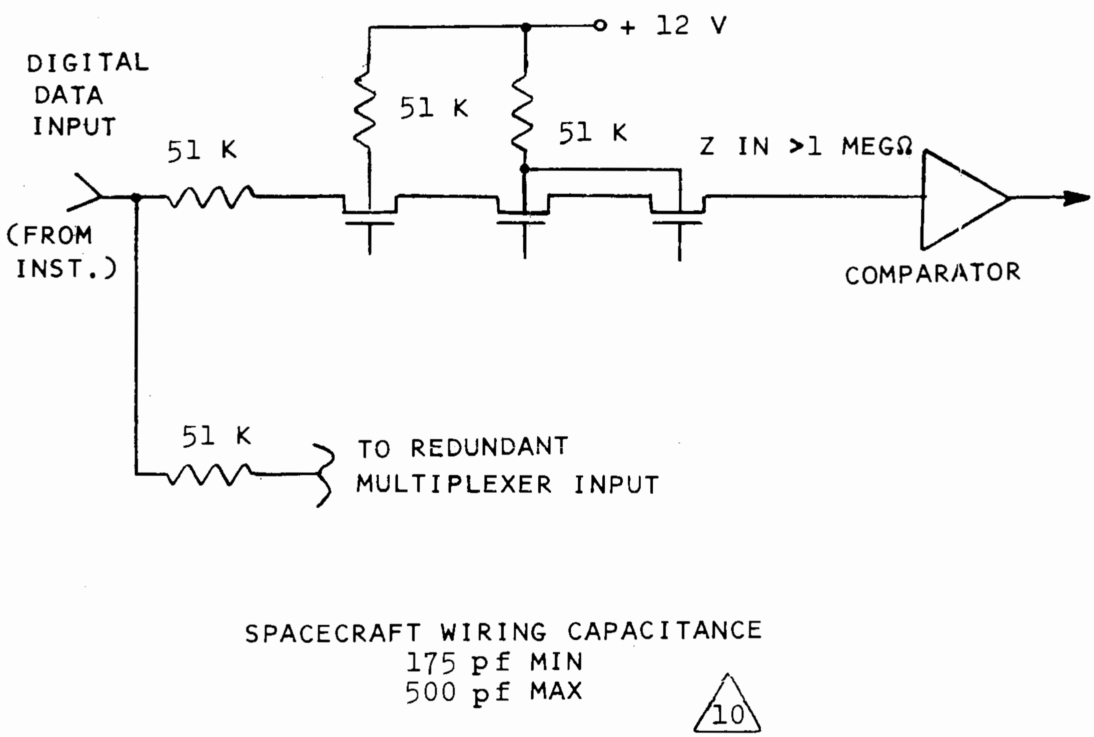
SPACECRAFT
AND
INSTRUMENT SIGNALS

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

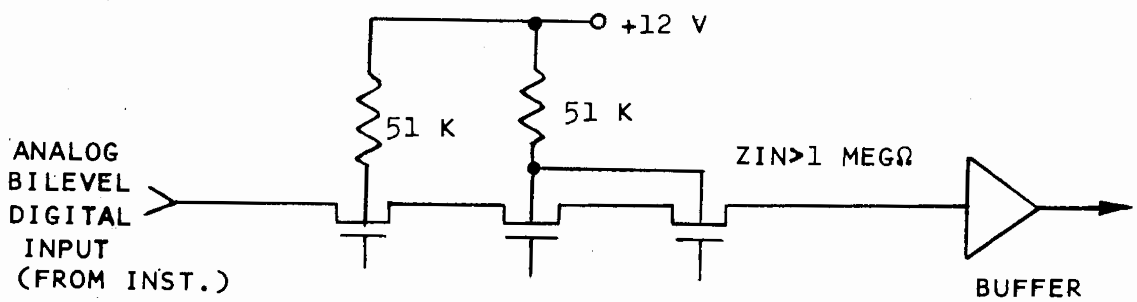
DOC. NO. PC-220.01

FIG. 3.3.2.1

REV. NO. 9 DATE 4-24-70 SHEET 2 OF 2



REPRODUCED FROM	TITLE CIRCUIT FOR MAIN FRAME DIGITAL DATA	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.01
		FIG. 3.3.2.2
	REV. NO. 10 / DATE 5-1-70	SHEET 1 OF 3

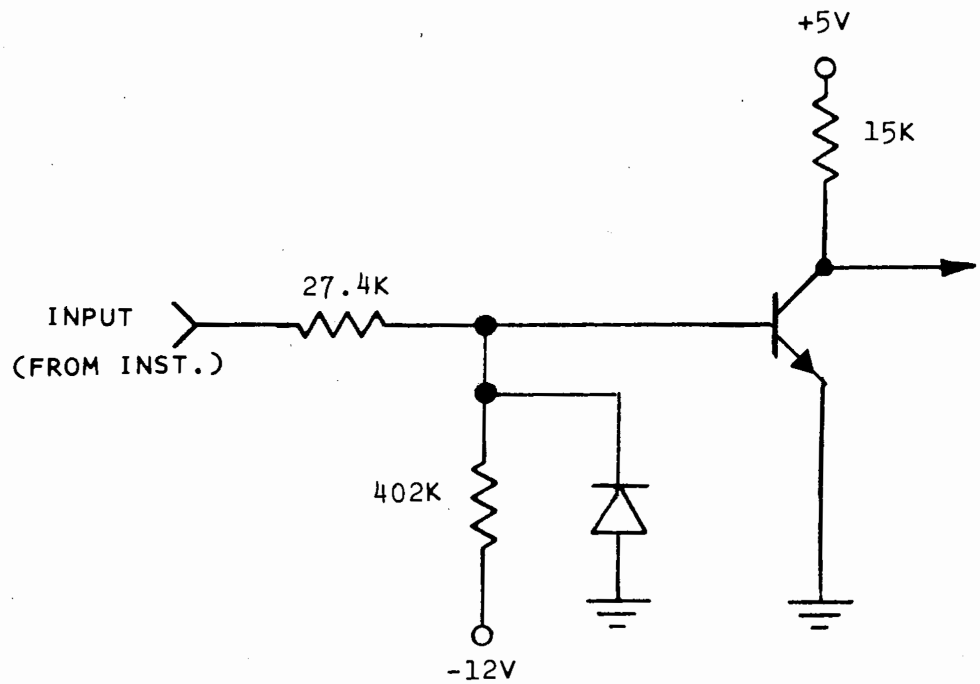


SPACECRAFT WIRING CAPACITANCE

175 pf MIN (SHIELDED WIRES) 15

500 pf MAX

REPRODUCED FROM	TITLE CIRCUIT FOR SUBFRAME ANALOG BI-LEVEL, AND DIGITAL DATA	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.01
		FIG. 3.3.2.2
	REV. NO. 15 / DATE 1-30-71	SHEET 2 OF 3



SPACECRAFT WIRING CAPACITANCE
175 pf MIN
500 pf MAX

REPRODUCED FROM	TITLE DSU CIRCUIT FOR UA/IPP BIT SHIFT CLOCK, DATA STORE GATE, AND DIGITAL DATA	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.01
		FIG. 3.3.2.2
	REV. NO. 10 / DATE 5-1-70	SHEET 3 OF 3

SIGNAL NOMENCLATURE	EXPOSURE LIMIT, VOLTS (P-P)											
	SPACECRAFT	JPL HELIUM VECTOR MAGNETO-METER	ARC PLASMA ANALYZER	U/CHICAGO CHARGED PARTICLE INSTRUMENT	U/IOWA GEIGER TUBE TELESCOPE	GSFC COSMIC RAY TELESCOPE	UCSD TRAPPED RADIATION DETECTOR	USC ULTRA-VIOLET PHOTOMETER	U/ARIZONA IMAGING PHOTO-POLARIMETER	CIT INFRARED RADIOMETER	GE ASTEROID-METEOROID DETECTOR	LaRC METEOROID DETECTOR
MAIN FRAME RATE PULSE	+8 0	N/A	N/A	±10	N/A	N/A	+10 -2	N/A	N/A	N/A	N/A	N/A
SCIENCE SUBFRAME RATE PULSE	+8 0	N/A	N/A	±10	N/A	N/A	N/A	N/A	N/A	±10	N/A	N/A
WORD RATE PULSE	+8 0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BIT SHIFT PULSE	+8 0	±50	±10	±10	+25 -3	+20 -4	+10 -2	±9	N/A	±10	+40 -10	+25 -15
ROLL INDEX PULSE	+8 0	N/A	±10	±10	N/A	+20 -4	N/A	±9	±10	±10	+40 -10	N/A
SECTOR GENERATOR PULSE	+8 0	N/A	±10	±10	N/A	+20 -4	N/A	N/A	±10	±10	+40 -10	N/A
32.768 kHz CLOCK	+8 0	±50	N/A	N/A	N/A	+20 -4	+10 -2	N/A	±10	±10	N/A	N/A
2.048 kHz CLOCK	+8 0	N/A	N/A	N/A	N/A	N/A	+10 -2	N/A	N/A	±10	N/A	N/A
DTU OPERATIONAL STATUS (BILEVEL)	+8 0	N/A	±10	N/A	N/A	+20 -4	±10	N/A	N/A	N/A	N/A	N/A
WORD GATE	±10	±50	±10	±10	+25 -3	+20 -4	+10 -2	±9	N/A	+ 7 -10	+40 -10	+25 -15
DIGITAL DATA	±10	+5 -0	±10	±10	±3	+7.5 -0.5	+5.5 -0.5	±9	±10	+3 -0.5	+6 -1	+10 -10
INSTRUMENT OPERATIONAL STATUS (BILEVEL)	±10	N/A	N/A	±10	+7.75 -0.5	+7.5 -0.5	N/A	±9	N/A	N/A	+6 -1	N/A
ANALOG DATA	±10	CURRENT I≤10ma	±10	±0.5	16 +36 -0.5	+6 -3	±10	N/A	±10	+3 -1	+6 -1	N/A
FUNCTION COMMAND PULSE	+5.5 -0.5	+5.5 -0.1	±10	+5 0	16 +25 -3	+20 -4	+5.5 -0.5	±9	+6.8 0	±10	+40 -10	N/A
POWER ON-OFF COMMAND PULSE	+5.5 -0.5	+15 0	±10	+10 0	+40 -5	± 50	+5.5 -0.5	±9	±10	±10	+40 -10	+25 -8

REDRAWN REVISION 14

TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
EXPOSURE LIMITS FOR FAULT VOLTAGES	DOC. NO. PC-220.01
	FIG. 3.3.2.4
REV. NO. 16 DATE 4-30-71	SHEET 1 OF 2

	EXPOSURE LIMIT, VOLTS (P-P)	
SIGNAL NOMENCLATURE	SPACECRAFT	U/ARIZONA IMAGING PHOTOPOLARI-METER
END OF MEMORY PULSE	$^{+8}_{0}$	± 50
DATA STORE GATE	$\pm$ 15	± 10
BIT SHIFT CLOCK	$\pm$ 15	± 10

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REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	EXPOSURE LIMITS FOR FAULT VOLTAGES	DOC. NO. PC-220.01
		FIG. 3.3.2.4
	REV. NO. 14 / DATE 10-31-70	SHEET 2 OF 2

	SCIENTIFIC INSTRUMENT	COMMAND NUMBER	COMMAND NAME
A	JPL HELIUM VECTOR MAGNETOMETER		1. MANUAL RANGE 2. RANGE DECREMENT 3. RANGE INCREMENT 4. DATA INTERCHANGE
B	ARC PLASMA ANALYZER		1. TARGET SUPPRESSION 2. DETECTOR A HIGH VOLTAGE STEP 3. DETECTOR B HIGH VOLTAGE STEP 4. IN-FLIGHT CALIBRATION (IFC) 5. FSM SPACECRAFT REV/H.V. STEP 6. DETECTOR B H.V. LIMIT 7. DETECTOR A H.V. AND C.C.M. BIAS 8. DETECTOR B H.V. 9. INTEGRATION PERIOD 10. DATA SOURCE MODE/C.C.M. H.V. BANK SEL. 11. LEFT C.C.M. BIAS SUPPLY STEP 12. RIGHT C.C.M. BIAS SUPPLY STEP
C	U/CHICAGO CHARGED PARTICLE INSTRUMENT		1. PRIORITY MODE CONTROL 2. DISABLE DETECTOR D2 3. DISABLE DETECTOR D1 4. DISABLE DETECTOR D7 5. CALIBRATION 6. LOGIC RESET
D	U/IOWA GEIGER TUBE TELESCOPE		1. REDUNDANT LOGIC SELECT
E	GSFC COSMIC RAY TELESCOPE		1. MODE SELECT 2. CALIBRATE
F	UCSD TRAPPED RADIATION DETECTOR		1. HIGH VOLTAGE MODE SELECT 2. LOW VOLTAGE MODE SELECT
G	USC ULTRAVIOLET PHOTOMETER		1. DEPLOY COVER
H	U/ARIZONA IMAGING PHOTOPOLARIMETER		1. MODE 2 (ZODIACAL LIGHT) 2. MODE 3 (JUPITER PHOTOPOLARIMETRY) 3. MODE 4 (JUPITER IMAGING) 4. STARTING LOOK ANGLE RESET 5. LOOK ANGLE STEP REVERSE 6. LOOK ANGLE STEP INHIBIT 7. START DATA AT THRESHOLD 8. LOW SAMPLE RATE 9. GAIN INCREMENT 10. GAIN DECREMENT 11. SPOKE ADVANCE FINE 12. SPOKE ADVANCE COARSE 13. START LOOK ANGLE INCREMENT

	SCIENTIFIC INSTRUMENT	COMMAND NUMBER	COMMAND NAME
I	CIT INFRARED RADIOMETER		1. SPOKE ADVANCE
J	GE ASTEROID/METEOROID DETECTOR		1. THRESHOLD LEVEL-NORMAL 2. THRESHOLD LEVEL HIGH 3. WIDE BANDWIDTH 4. MEDIUM BANDWIDTH 5. NARROW BANDWIDTH 6. DATA READOUT DISABLE/ENABLE 7. STAR EXCLUSION DISABLE/ENABLE
K	LaRC METEOROID DETECTOR	NONE	NONE

NOTES:

1. EACH INSTRUMENT IS ASSIGNED ONE POWER ON AND ONE OFF COMMAND.
2. ONE COMMAND IS ASSIGNED TO TURN OFF ALL INSTRUMENTS AT THE SAME TIME.
3. THE USC/UV DEPLOY COVER COMMAND IS AN ON/OFF STEP COMMAND

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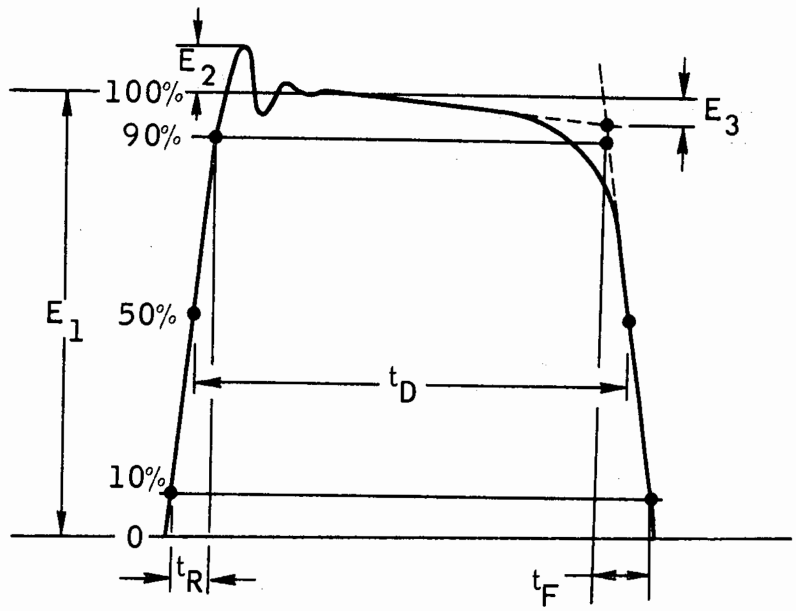
TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
SCIENTIFIC INSTRUMENT COMMAND ASSIGNMENT AND NOMENCLATURE	DOC. NO. PC-220.01 FIG. 3.3.3.5
REV. NO. 15 DATE 1-30-71	SHEET 1 OF 1



t_R = RISE TIME

t_D = PULSE DURATION

t_F = FALL TIME

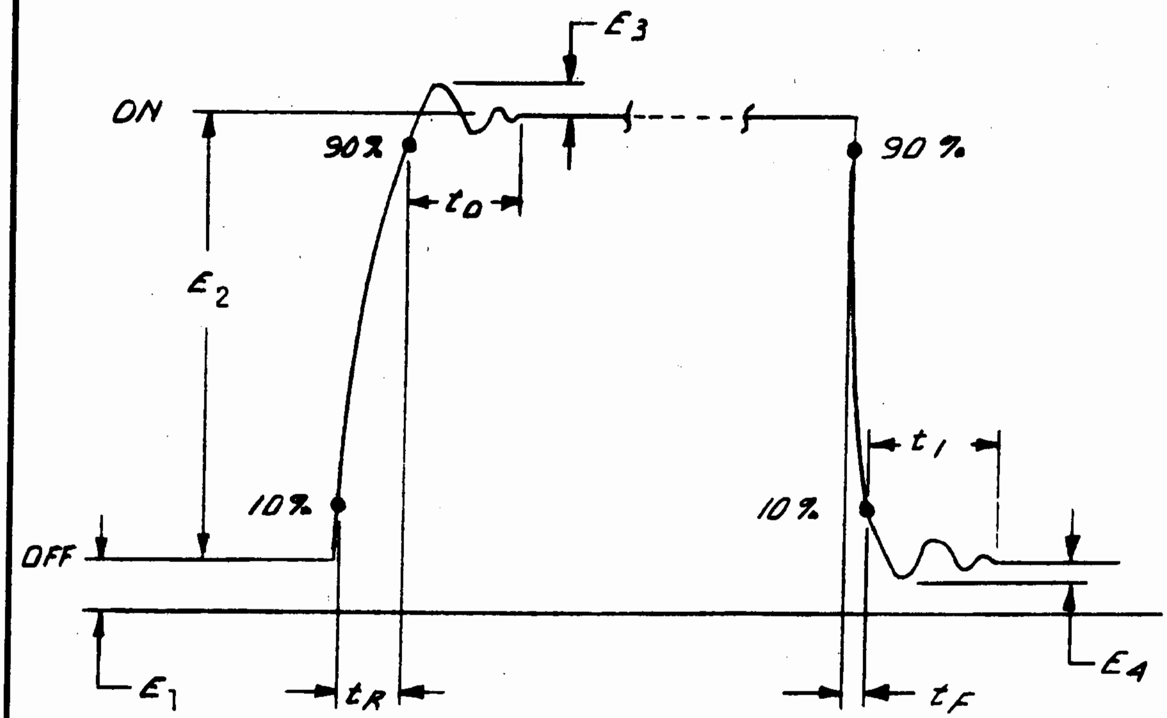
E_1 = PULSE AMPLITUDE

E_2 = MAXIMUM OVERSHOOT = 0.5 V

E_3 = MAXIMUM DROOP = 0.5 V

Note: Maximum Undershoot = 0.0 V

REPRODUCED FROM	TITLE DEFINITION OF TERMS AND CHACTERISTICS OF PULSE SIGNALS FROM THE DTU	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	REV. NO. 4 / DATE 3-6-70	DOC. NO. PC-220.01 FIG. 3.3.3.6 SHEET 1 OF 3



t_R = RISE TIME = 100 μsec MAXIMUM

t_F == FALL TIME = 10 μsec MAXIMUM

t_0 = t_1 = 250 μsec MAXIMUM (9)

E_1 = OFF (FALSE) VOLTAGE LEVEL = +0.25 ±0.25 VOLTS

E_2 = ON (TRUE) VOLTAGE LEVEL = $+4\,^{+1.4}_{-1.5}$ VOLTS

E_3 = MAXIMUM OVERSHOOT = 0.5 VOLTS (9)

E_4 = MAXIMUM UNDERSHOOT = 0.5 VOLTS (9)

REPRODUCED FROM

TITLE

CHARACTERISTICS
OF ON/OFF STEP
COMMAND SIGNAL

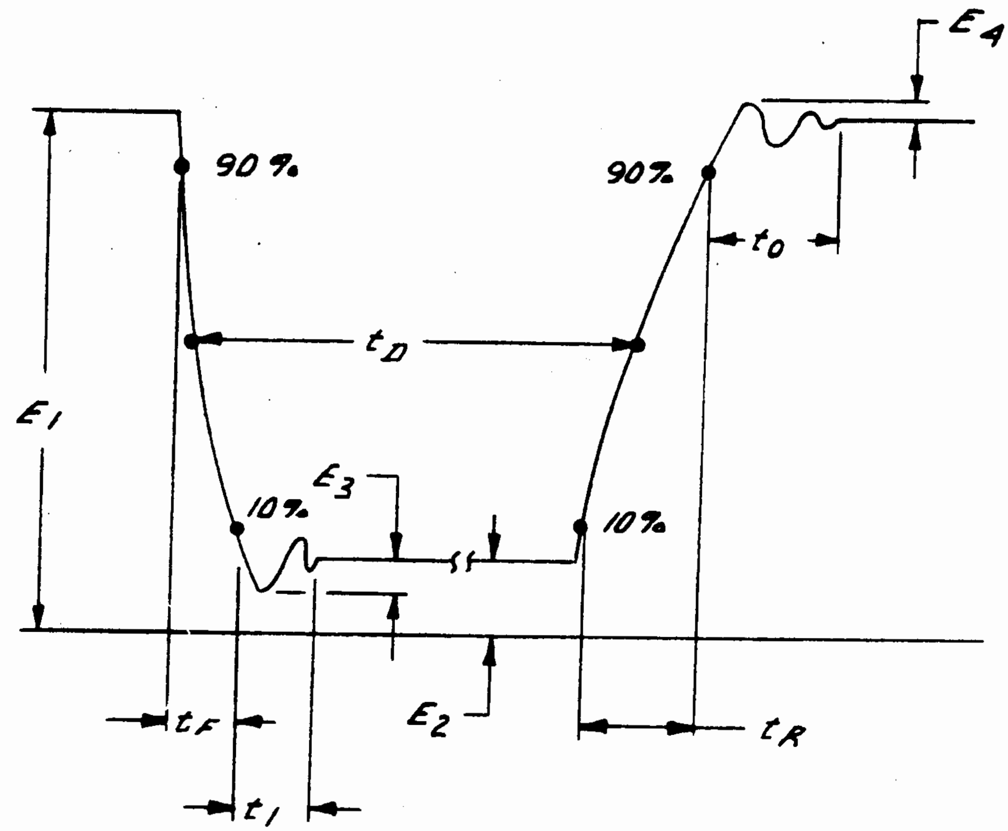
REV. NO. 9 DATE 4-24-70

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD. CALIFORNIA

DOC. NO. PC-220.01

FIG. 3.3.3.6

SHEET 2 OF 3



t_R = RISE TIME = 100 μsec MAXIMUM

t_F = FALL TIME = 10 μsec MAXIMUM

t_D = PULSE DURATION = 50 MS ±20 MS @ 1/2 AMPLITUDE

E_1 = OFF (FALSE) VOLTAGE LEVEL = $+4\ {}^{+1.4}_{-1.5}$ VOLTS

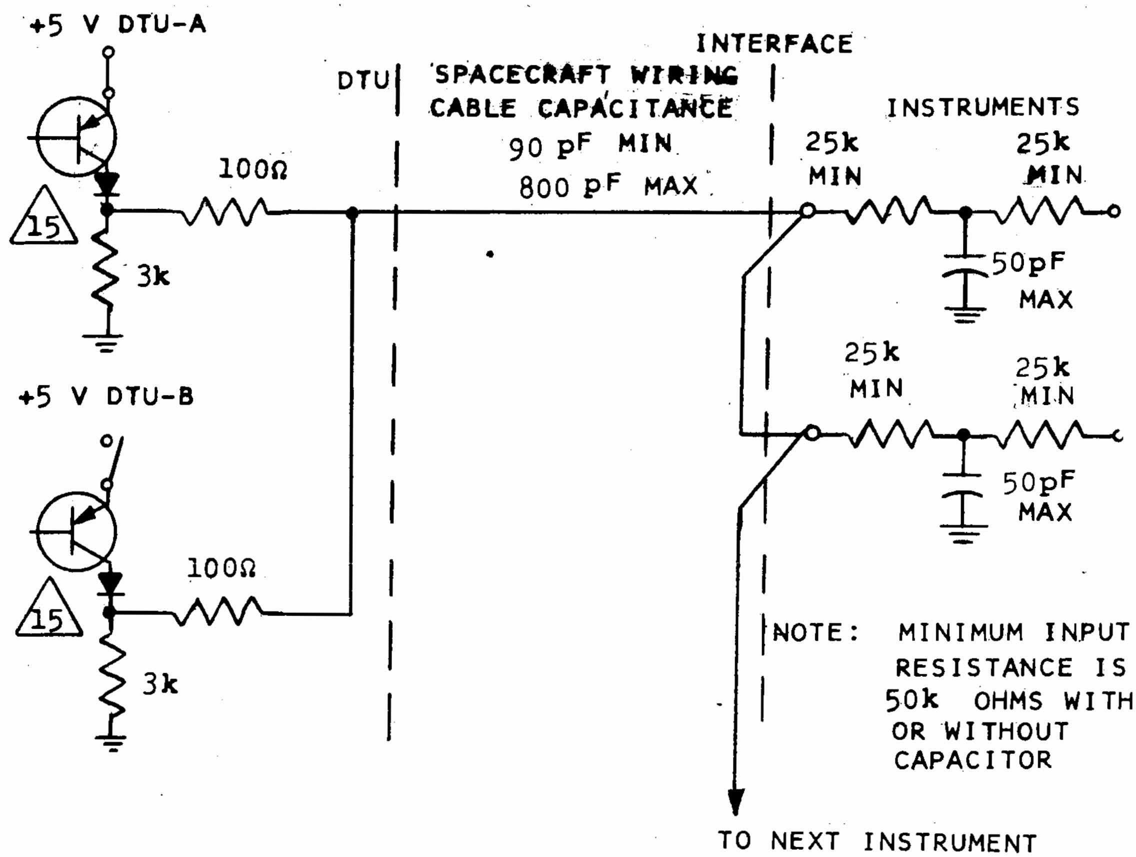
E_2 = ON (TRUE) VOLTAGE LEVEL = +0.25 ±0.25 VOLTS

E_3 = MAXIMUM UNDERSHOOT = 0.5 VOLTS (9)

E_4 = MAXIMUM OVERSHOOT = 0.5 VOLTS (9)

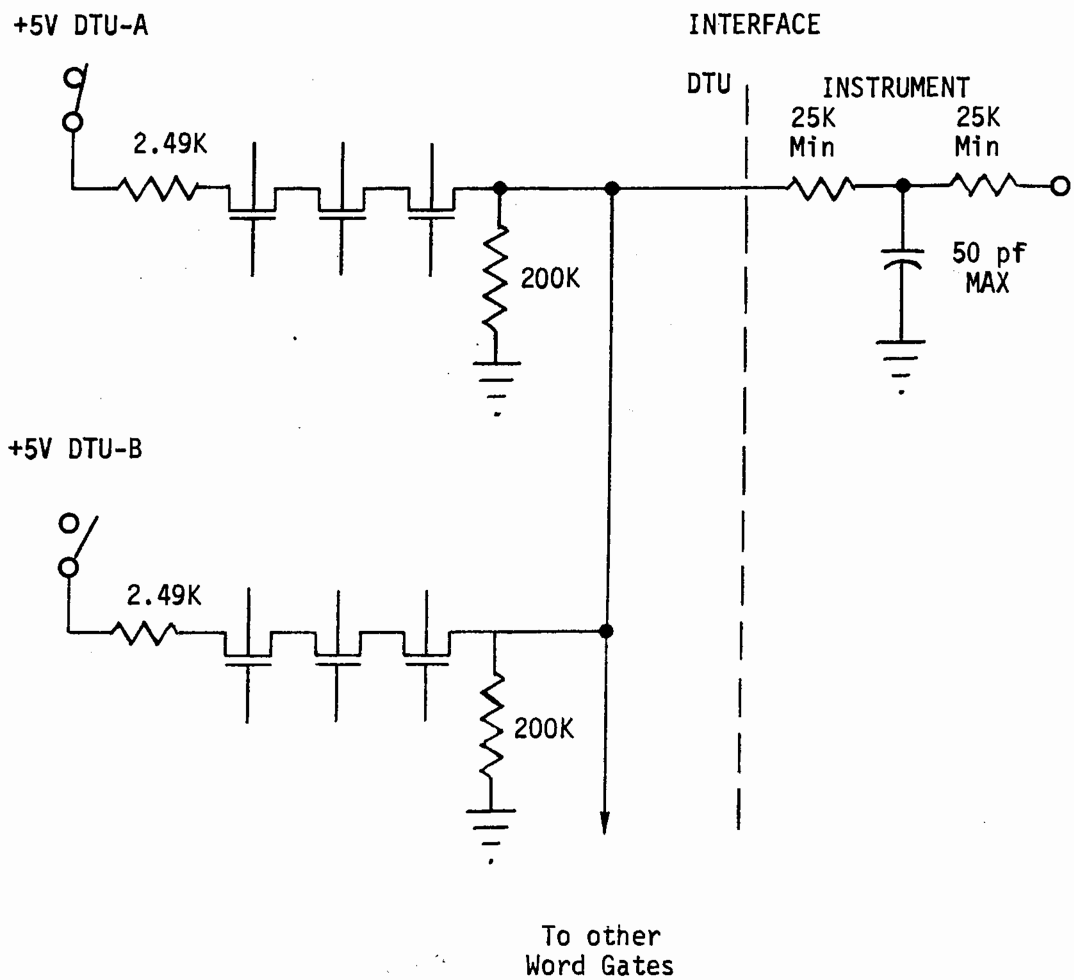
t_0 = t_1 = 250 μsec MAXIMUM (9)

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CHARACTERISTICS OF FUNCTION COMMAND PULSE SIGNAL	DOC. NO. PC-220.01
		FIG. 3.3.3.6
	REV. NO. 9 / DATE 4-24-70	SHEET 3 OF 3



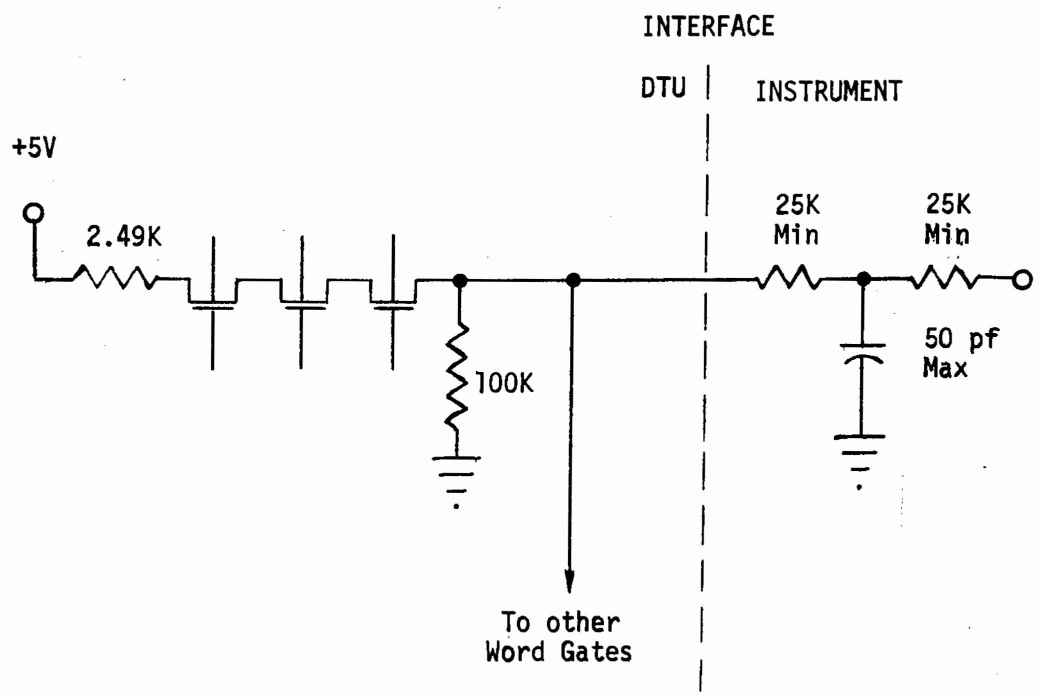
The cable capacitance of the bit shift pulse and the roll index pulse is 1200 pf max. each.

REPRODUCED FROM	TITLE: CIRCUIT FOR TYPICAL TIMING PULSE SIGNAL, ROLL INDEX PULSE, AND SPIN PERIOD SECTOR PULSE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.01
		FIG. 3.3.3.7
	REV. NO. 15 — DATE 1-30-71	SHEET 1 OF 7



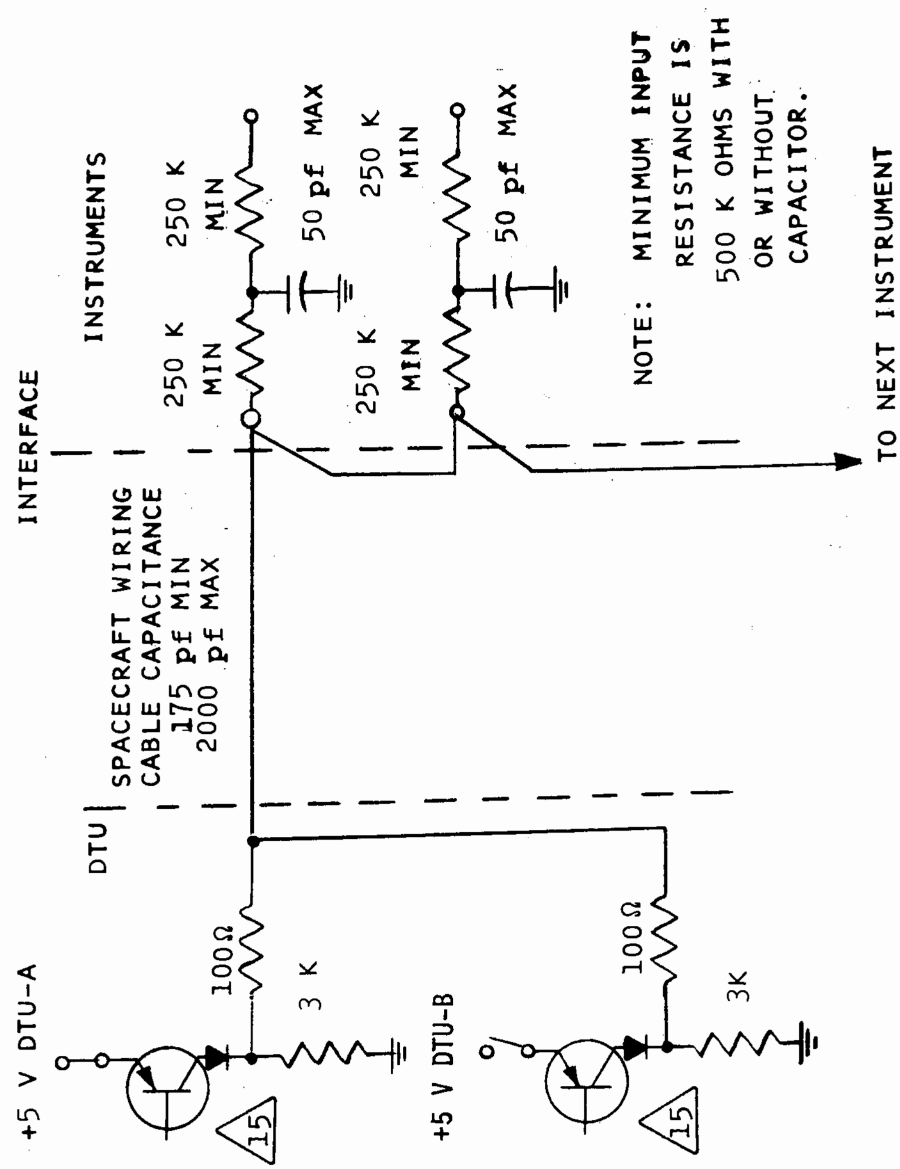
NOTES:
(1) Minimum input resistance is 50K ohms with or without capacitor.
(2) Spacecraft wiring will be 200 pf min and and 600 pf max.
(3) The parallel combination of 200K ohms and instr load shall not be less than 17K

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CIRCUIT FOR MAIN FRAME DIGITAL WORD GATE	DOC. NO. PC-220.01
		FIG. 3.3.3.7
	REV. NO. 10 / DATE 5-1-70	SHEET 2 OF 7

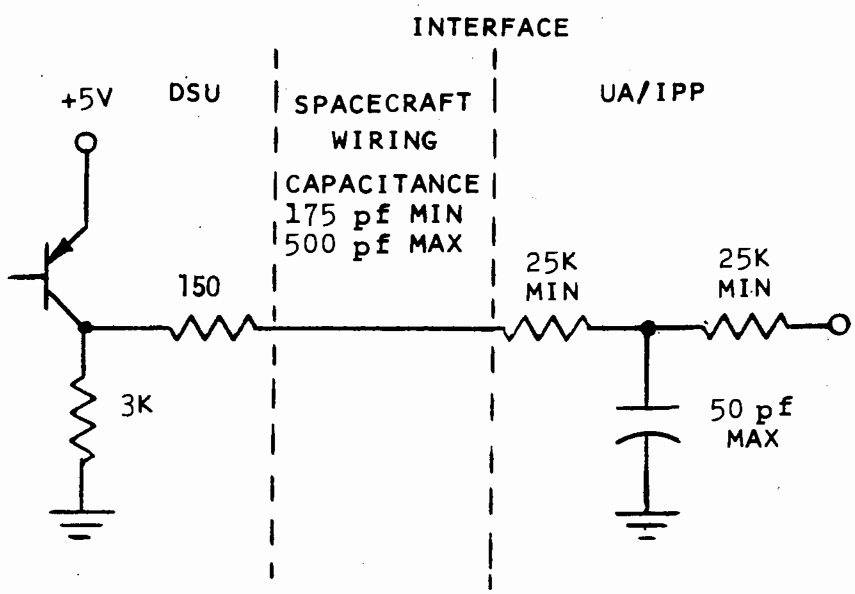


NOTES:
(1) Minimum input resistance is 50K ohms with or without capacitor.
(2) Spacecraft wiring will be 200 pf min and 600 pf max.
(3) The parallel combination of 100K ohms and instr load shall not be less than 17K.

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CIRCUIT FOR SUBFRAME DIGITAL WORD GATE	DOC. NO. PC-220.01
		FIG. 3.3.3.7
	REV. NO. 10 / DATE 5-1-70	SHEET 3 OF 7

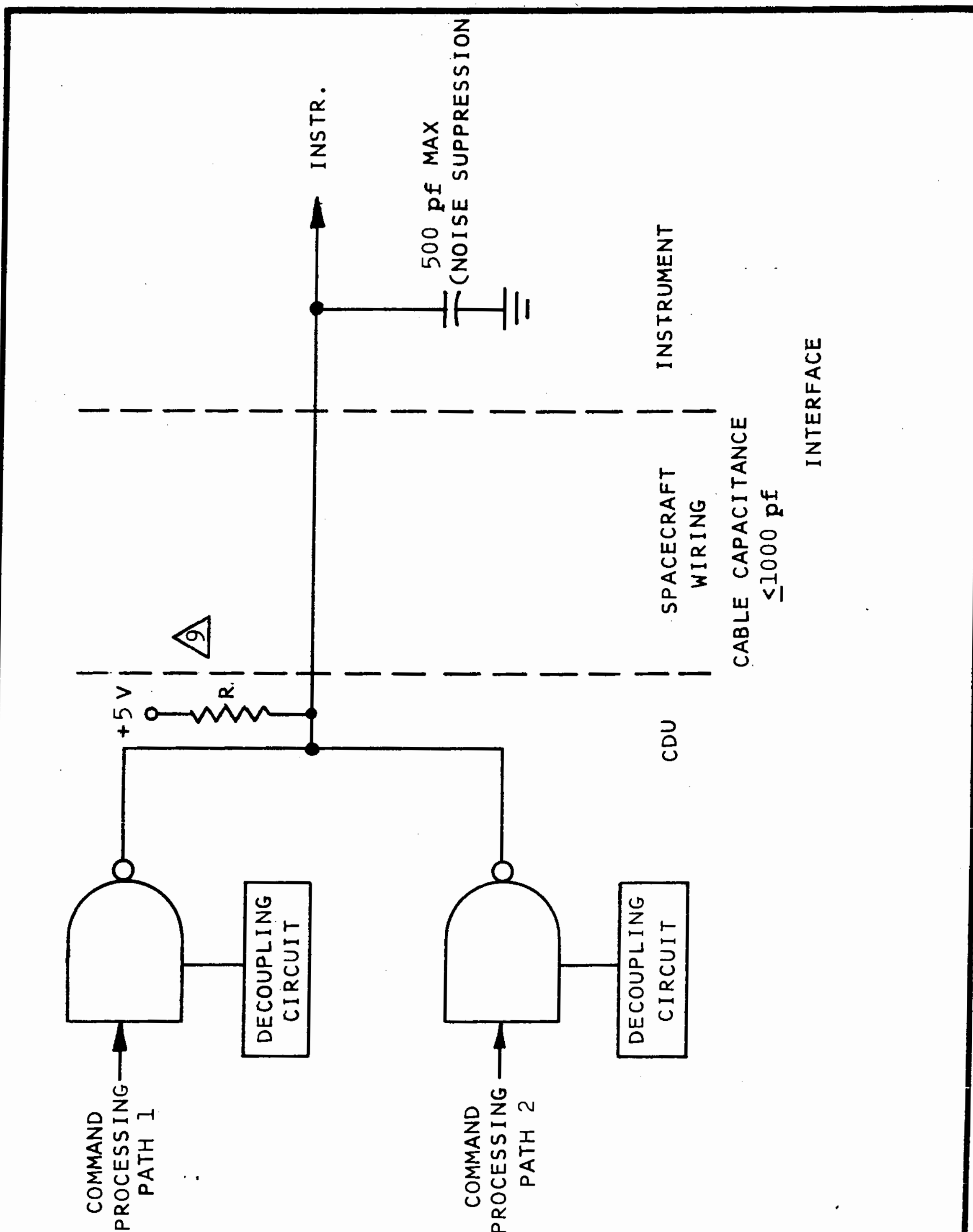


REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CIRCUIT FOR TYPICAL DTU OPERATIONAL STATUS SIGNAL	DOC. NO. PC-220.01
		FIG. 3.3.3.7
	REV. NO. 15 / DATE 1-30-71	SHEET 4 OF 7

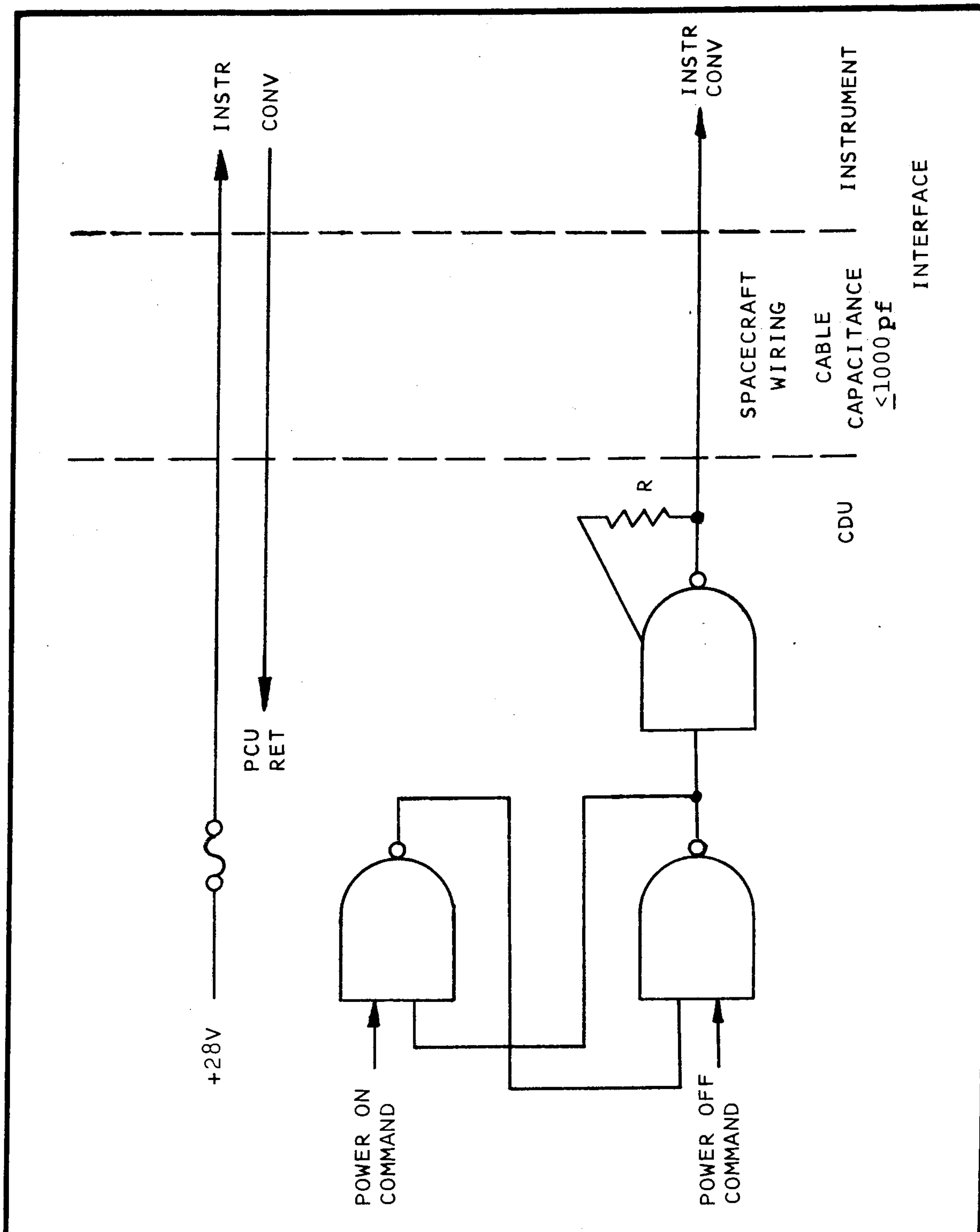


NOTE: MINIMUM INPUT RESISTANCE IS 50K OHMS WITH OR WITHOUT CAPACITOR

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DSU CIRCUIT FOR UA/IPP END OF MEMORY SIGNAL	DOC. NO. PC-220.01
		FIG. 3.3.3.7
	REV. NO. 10 DATE 5-1-70	SHEET 5 OF 7



REPRODUCED FROM	TITLE CIRCUIT FOR TYPICAL LOW LEVEL FUNCTION COMMAND PULSE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. 220.01
		FIG. 3.3.3.7
	REV. NO. 10 — DATE 5-1-70	SHEET 6 OF 7



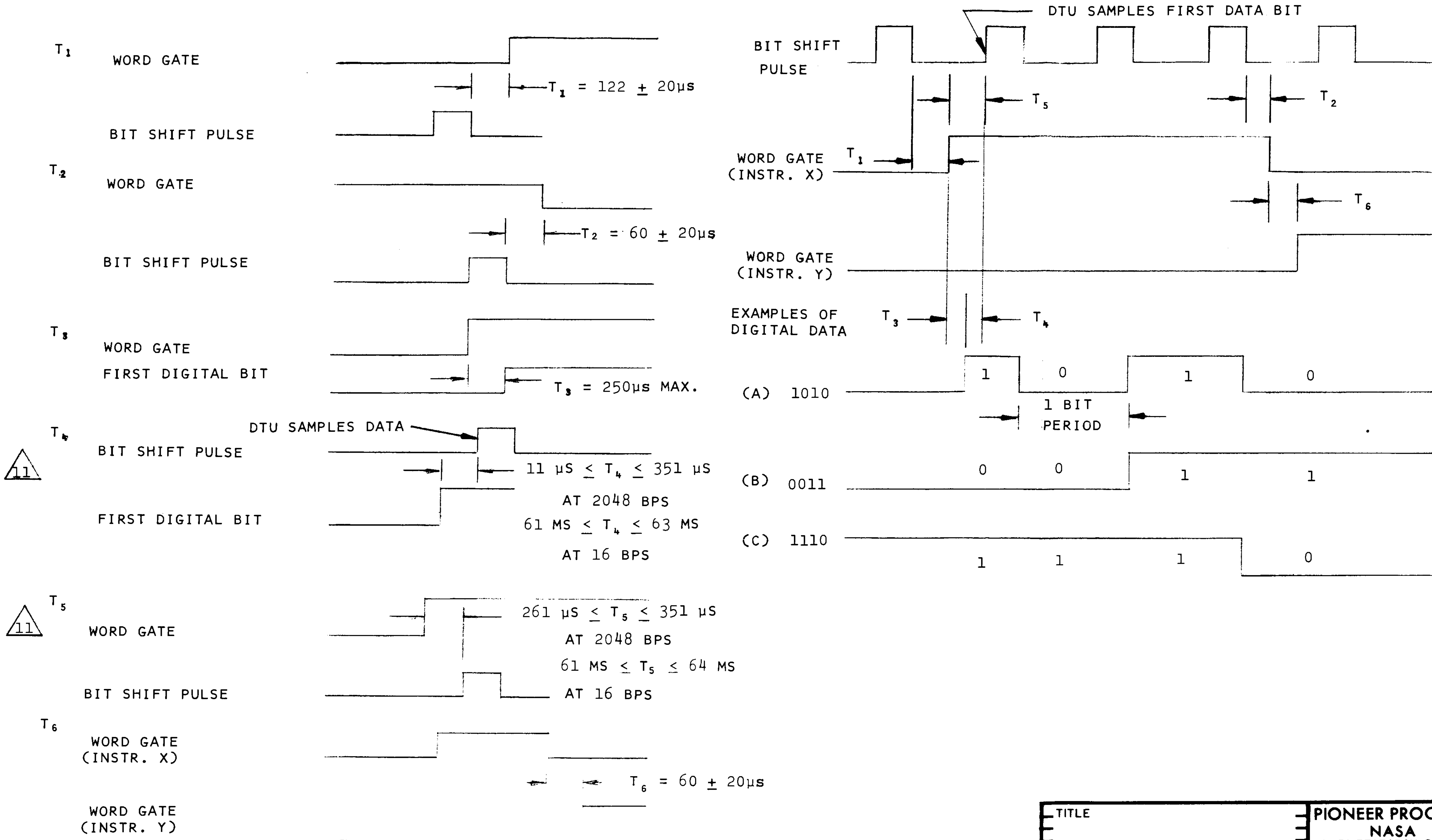
REPRODUCED FROM

TITLE

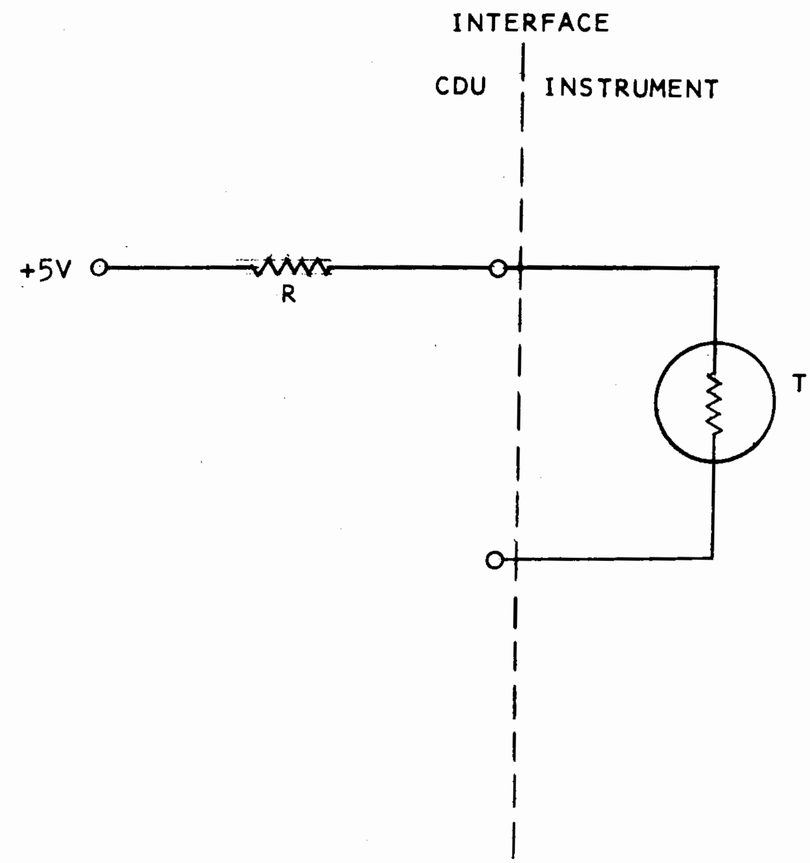
CIRCUIT FOR
INSTRUMENT POWER
ON/OFF COMMAND

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO.	220.01
FIG.	3.3.3.7
REV. NO. 10	DATE 5-1-70
SHEET 7	OF 7



TITLE: TIMING SIGNAL RELATIONSHIPS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.01
	FIG. 3.3.3.8
REV. NO. 11 — DATE 5-22-70	SHEET 1 OF 1

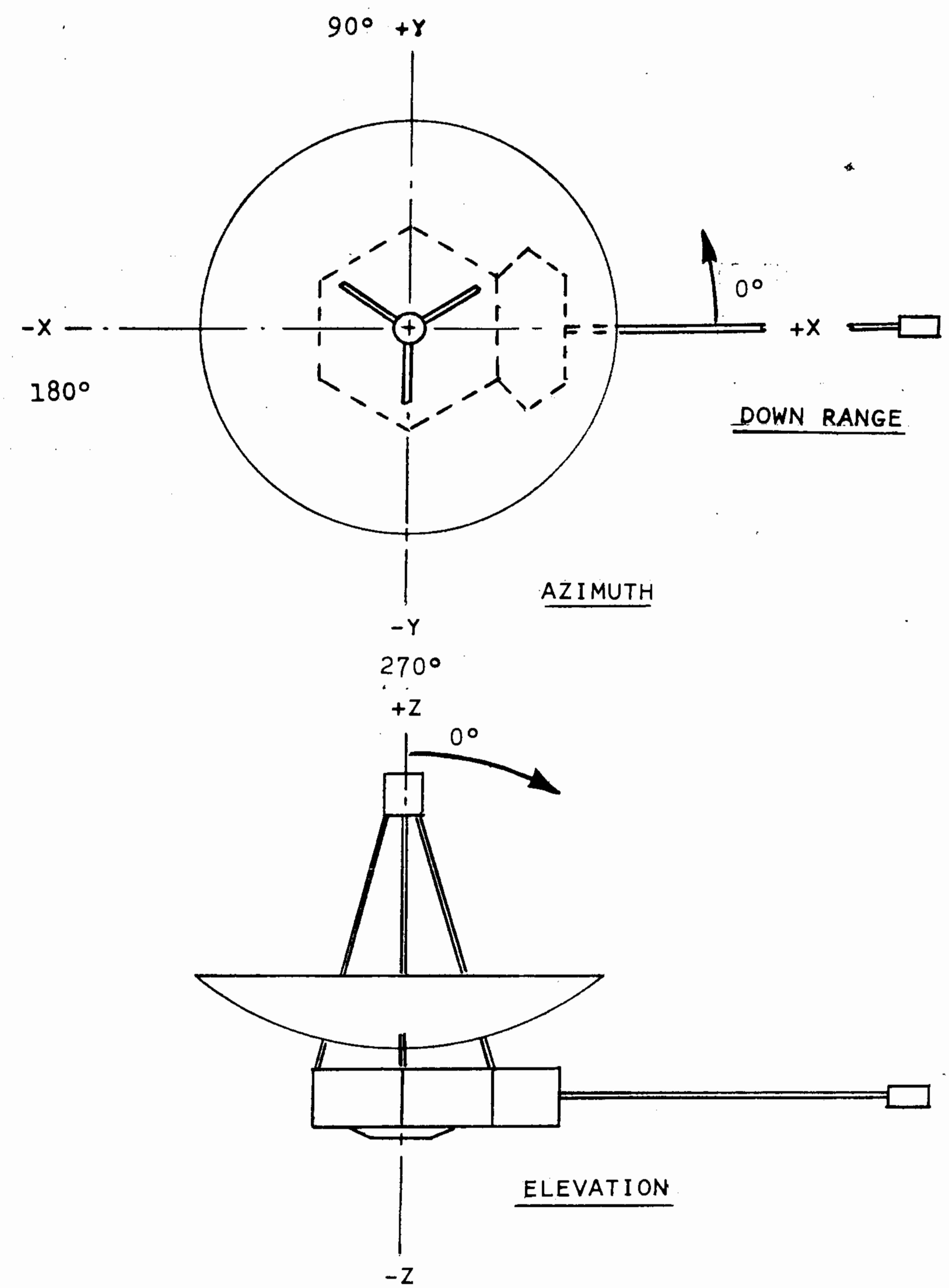


NOTES:

R = 8.87 kΩ
T = THERMISTOR (PT4-49-2) R_T = 1kΩ @ 107 °F
TEMPERATURE RANGE: 0°F TO 120°F

16

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INTERFACE CIRCUIT FOR S/C SUPPLIED THERMISTORS	DOC. NO. PC-220.01
		FIG. 3.3.3.10
	REV. NO. 16 / DATE 4-30-71	SHEET 1 OF 1



REPRODUCED FROM

TITLE

SPACECRAFT AXES NOTATION

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.01

FIG. 3.6.2

REV. NO. 4 | DATE 3-6-70 | SHEET 1 OF 1

JPL/HELIUM VECTOR MAGNETOMETER

PC-220.02

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California

PIONEER PROGRAM

SPECIFICATION PC-220.02

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

JPL/HELIUM VECTOR MAGNETOMETER

October 20, 1969

1. SCOPE

Specification PC-220.02 defines the characteristics and requirements of the JPL/Helium Vector Magnetometer instrument pertinent to the Pioneer spacecraft.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATION

PC-213.00, Scientific Instrument and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATION

PC-220.00, Spacecraft/Scientific-Instrument Interface Specification

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Configuration. The dimensions, configuration and connector locations for the instrument will be as specified in Figure 3.1.1.

3.1.2 Mass Properties.

3.1.2.1 Weight (Present) (15)

Electronics		4.3 lb
Remote Sensor (Includes pigtail, RHU, cap, and thermal insulation)		1.3 lb
	Total	5.6 lb

Revision

3.1.2.2 Center of Gravity. The center of gravity notation of the instrument will be as indicated in Figure 3.1.1. The c.g. locations will be as follows: (12)

Elect.	a = 2.3 $\pm$.25	b = 1.7 $\pm$ .25	c = 3.8 $\pm$ .25
Sensor	a = 1.8 $\pm$.25	b = 0.9 $\pm$ .25	c = 3.5 $\pm$ .25

3.1.2.3 Moments of Inertia. The moments of inertia of the instrument about the center of gravity of the units will be as follows: (1)

Moments of Inertia (in-lb-sec^2)

Elect.	I_a = TBS	I_b = TBS	I_c = TBS
Sensor	I_a = TBS	I_b = TBS	I_c = TBS

3.1.3 Mounting. The instrument mounting faces and methods will be as indicated in Figure 3.1.1, sheets 1 and 2.

3.1.4 Sensor Orientation. The JPL/HVM sensor shall be aligned with the aid of the GFE alignment fixture, which defines the directions of the sensor axes as shown in Figure 3.1.4. Each of the axes' directions so defined shall be known to $\pm$ 15 minutes with respect to spacecraft coordinates. In flight, the orientation in inertial space of each sensor axis shall be known to $\pm$ 1/2° with respect to spacecraft coordinates except during a two hour period following each orientation maneuver. (16)

3.1.5 Viewing. None

3.1.6 Miscellaneous

3.1.6.1 Attach Fitting. The attach fitting to mate the magnetometer sensor to the boom shall incorporate an RHU (Radioactive Heater Unit), per PC-220.01, Figure 3.1.3.2, sheet 1 of 2. (15)

3.2 ELECTRICAL

3.2.1 Power Load (Present) (11)

Standby	TBS
Steady State (Interplanetary)	3.08W
Steady State (Encounter)	4.10W

3.2.2 Duty Cycle. The power requirements for this instrument are on a continuous basis during normal operating mode.

3.2.3 Converter Frequency. The converter frequency will be as indicated in Figure 3.5.1.1 of PC-220.00

Revision

3.2.4 Connectors

3.2.4.1 Connector Pin Assignments. Pins on the connectors for this instrument will be wired in accordance with Figure 3.2.4.1.

3.2.4.2 Connector Identification. Each connector attached to the instrument will be identified with a number in accordance with Figure 3.2.4.2.

3.2.5 Instrument Interface Circuits. Figure 3.2.5, shows the instrument input/output circuits which interface with the spacecraft/instrument interface timing, power, command and data lines.

3.2.6 Instrument/GSE Interface Circuits. Figure 3.2.6, shows the GSE input/output circuits which interface with the instrument thru the instrument stimulus/test connector.

3.2.7 Block Diagram. Figure 3.2.7 is a typical block diagram of the JPL Helium Vector Magnetometer.

3.2.8 JPL/HVM Sensor to Electronics Boom Cable. The JPL/HVM sensor to electronics boom cable shall be configured in accordance with the wiring diagram presented in Figure 3.2.8. (4)

3.2.8.1 Sensor Coil Drive. Deleted. (4)

3.2.8.2 Detector & Ignition. Deleted. (4)

3.2.8.3 Cable Connectors. Deleted. (4)

3.2.8.4 Cable Power Loss. Power losses in the 108 MHz coaxial boom cable shall be no greater than 2.5 dB for boom cable length. (13)

3.2.8.5 Impedance. The impedance of the 108 mHz coaxial boom cable shall be 52 $^{+4}_{-3}$ ohms over the temperature range of plus 75°F to minus 150°F with a design goal of 52 ±3 ohms. (13)

Revision

3.2.9 JPL/HVM Sensor/Spacecraft Isolation. With the JPL/HVM instrument integrated (in flight configuration) with the spacecraft, the sensor chassis shall be electrically isolated from spacecraft chassis. The isolation shall be 1 megohm or greater. Also, the two sensor "pigtail" connectors and corresponding mate on the boom cable (at sensor end) shall be electrically isolated from spacecraft chassis. Each mated pair of connectors shall be isolated from spacecraft chassis by 1 megohm or greater. (14)

3.3 DATA HANDLING AND INSTRUMENT CONTROL (1)

3.3.1 Signals from the Instrument. The scientific instrument will provide the following signals.

Main Frame (Formats A & B)	1 Line
Science Subcom	
Digital	1 Line
Analog	4 Lines

3.3.2 Signals to the Instrument. The scientific instrument will be provided with the following signals.

3.3.2.1 Power. 2 Lines

3.3.2.2 Commands.

Power ON/OFF	1 Line
Functional	4 Lines

3.3.2.3 Timing and Control (4)

(a)	Word gate - main frame	1 Line
(b)	Word gate - science subcom	1 Line
(c)	Word gate - science subcom E-2, Word 6 (phantom) Cf	1 Line
(d)	Bit shift pulse	1 Line
(e)	Clock - 32.768 kHz	1 Line

Revision

3.3.3 Telemetry Word Assignments. Telemetry word assignments are specified in PC-220.01, sections 3.3.1.4.1 thru 3.3.1.4.5.

3.3.4 Instrument Words. Arrangements of instrument words within the telemetry word assignments for this instrument are as shown in PC-260.01.

3.4 THERMAL (1)

3.4.1 Operating Limits. This instrument will be capable of operating over the following temperature range: (15)

Platform-mounted unit:	-31°F to +122°F
Boom-mounted unit:	-76°F to +95°F

3.4.2 Thermal Load

3.4.2.1 Platform-Mounted Unit. The platform-mounted unit of this instrument shall not be exposed to the thermal environment exterior to the spacecraft while in space flight. The average thermal load supplied to the spacecraft by electrical power dissipation within the platform-mounted unit will be as follows: (4)

Interplanetary	2.53W
Encounter	3.85W

3.4.2.2 Non-Platform-Mounted Unit. The sensor will dissipate electrical power in the form of thermal energy in the amounts indicated below:

Interplanetary	0.55W
Encounter	0.85W

3.4.3 Surface Thermal Properties.

3.4.3.1 Mounting Surfaces. The mounting surfaces of the instrument will be treated in accordance with PC-213.03, section 3.2.6.8.1.

3.4.3.2 Nonmounting Surfaces . The non-mounting surfaces of the instrument viewing the inside of the spacecraft will be treated in accordance with PC-213.03, section 3.2.6.8.6.

3.4.3.3 Surface Coating - Mag. Boom and Attach Fitting. The magnetometer boom and attach fitting shall be designed and wrapped with suitable material such that the net heat gain to the sensor unit through the attach fitting and boom cables shall be no less than 450 milliwatts at a sensor/ attach fitting junction temperature of -40°F. The net heat gain to the sensor unit through the attach fitting and boom cables shall be no greater than 1.8 watts at a sensor/ attach fitting junction temperature of +120°F. (13)

3.4.3.4 Exposed Magnetometer Boom Cable. Deleted. (4)

3.4.3.5 Mounting Surface Area. The thermal conducting area of the instrument units contiguous with the spacecraft mounting surfaces will be as follows: (9)

(a) Platform-mounted unit: 16.3 square inches
(b) Nonplatform-mounted unit: not applicable

3.5 COMPATIBILITY

3.5.1 Electromagnetic-Special Requirements & Characteristics. This instrument is sensitive to the frequencies indicated in Figure 3.5.1.1, Pioneer Specification PC-220.00.

3.5.2 Radioactive Sources.

3.5.2.1 Internal Sources (On-Board). TBS

3.5.2.2 External Sources (Test). None.

3.6 MISCELLANEOUS REQUIREMENTS & CHARACTERISTICS

3.6.1 Spin Rate. The preferred spin rate of the spacecraft for operation of this instrument is greater than 3.75 rpm. The instrument will operate satisfactorily for spacecraft spin rates between 2 and 7 rpm.

4. PERFORMANCE ASSURANCE PROVISIONS

Not applicable.

5. PREPARATION FOR DELIVERY, HANDLING, SHIPPING & STORAGE (1)

5.1 HANDLING

5.1.1 General. The scientific instruments shall at all times be handled in a manner which will minimize the possibility of damage to the instrument. Grasping of the instrument by other than the base section shall not be permitted.

5.1.2 Protective Covers. This instrument employs a protective cover with the sensor. This cover shall remain in position during all systems tests except physical properties measurements, vibration, thermal vacuum, and other tests as directed by the NASA/ARC Experiment Test Engineer. The experiment test connector shall be covered with MISTIK type 7000 fiberglass or equivalent approved nonconductive tape just prior to launch. During test operations and storage, all exposed connectors shall be protected with dust covers.

5.2 SHIPPING

Except when mounted on the spacecraft, this scientific instrument shall be transported only in its custom carrying case. Movement of the instrument to and from TRW will be the responsibility of NASA/ARC.

5.3 STORAGE

Whenever the instrument is not mounted on the spacecraft platform, or not in use for bench tests, it shall be stored in the protective carrying case furnished by the experimenter and placed in the bonded stores area of TRW. The carrying case will contain suitable chemical desiccant, the condition of which will be monitored periodically during protracted storage periods, by the cognizant NASA test engineer.

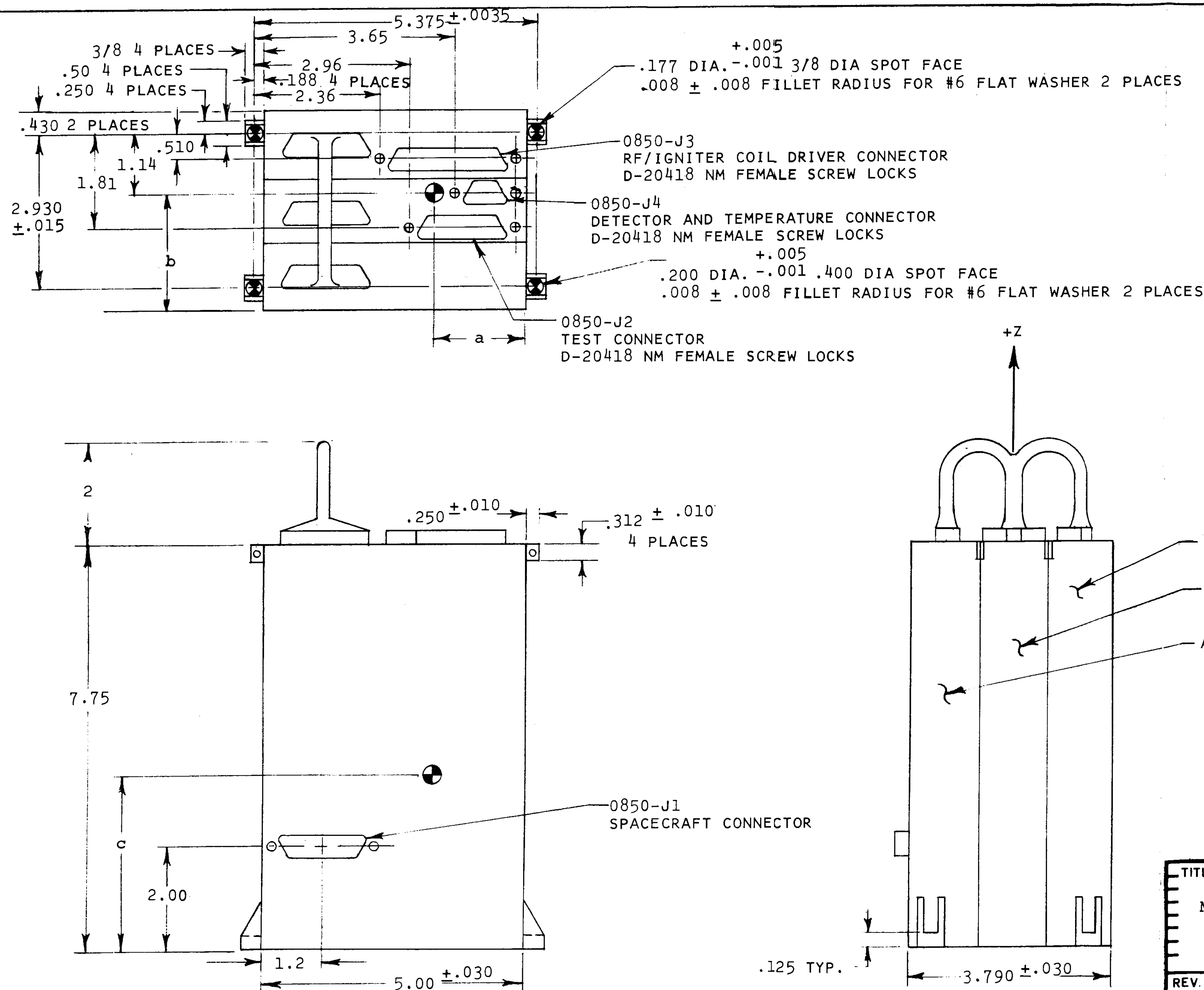
6. NOTES

6.1 DEFINITIONS

See Section 6.1 of Specification PC-220,00.

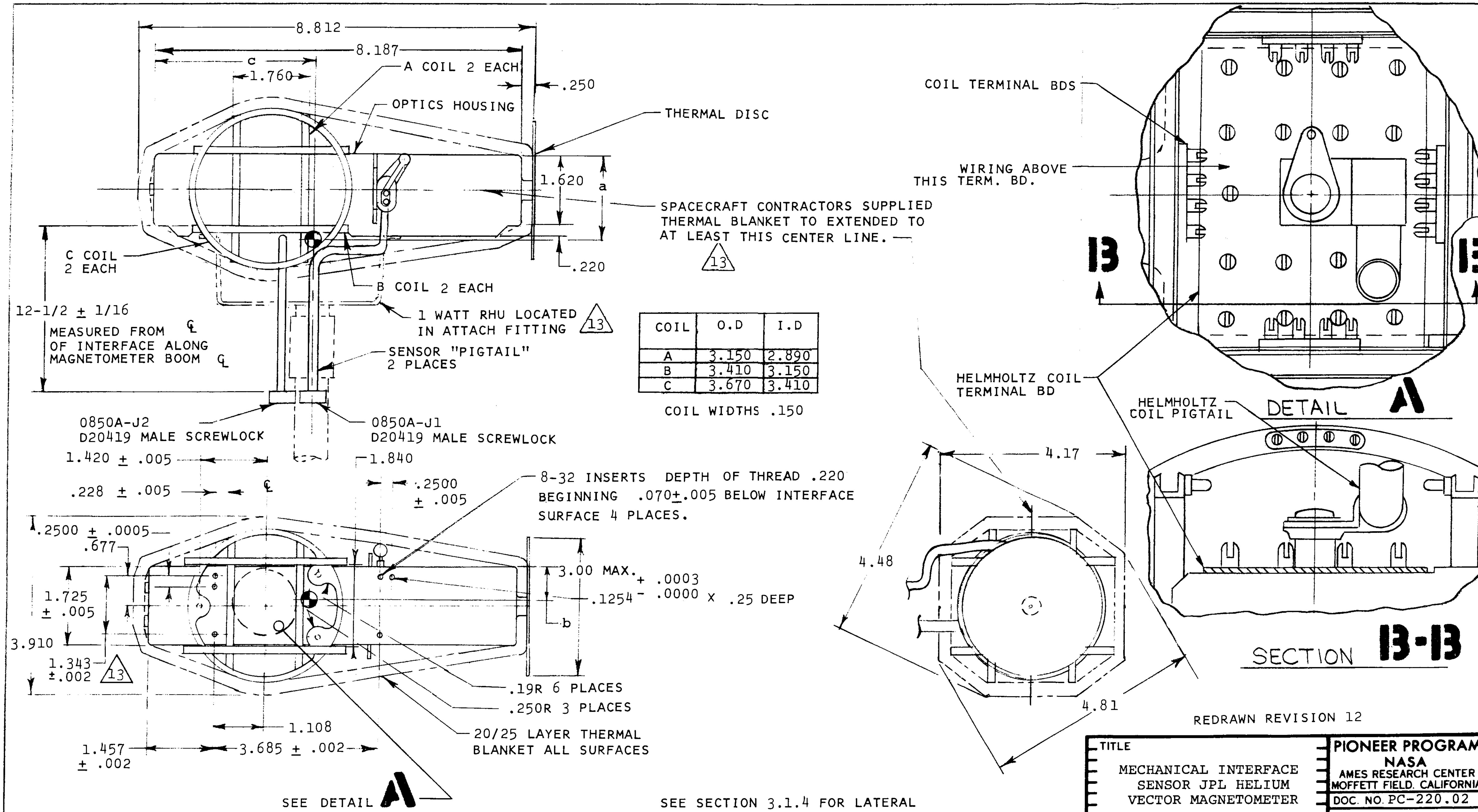
6.2 ABBREVIATIONS

See Section 6.2 of Specification PC-220.00.



REDRAWN REVISION 12

TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
MECHANICAL INTERFACE ELECTRONICS	DOC. NO. PC-220.02
	FIG. 3.1.1
REV. NO. 12 — DATE 6-26-70	SHEET 1 OF 2



COIL	O.D	I.D
A	3.150	2.890
B	3.410	3.150
C	3.670	3.410

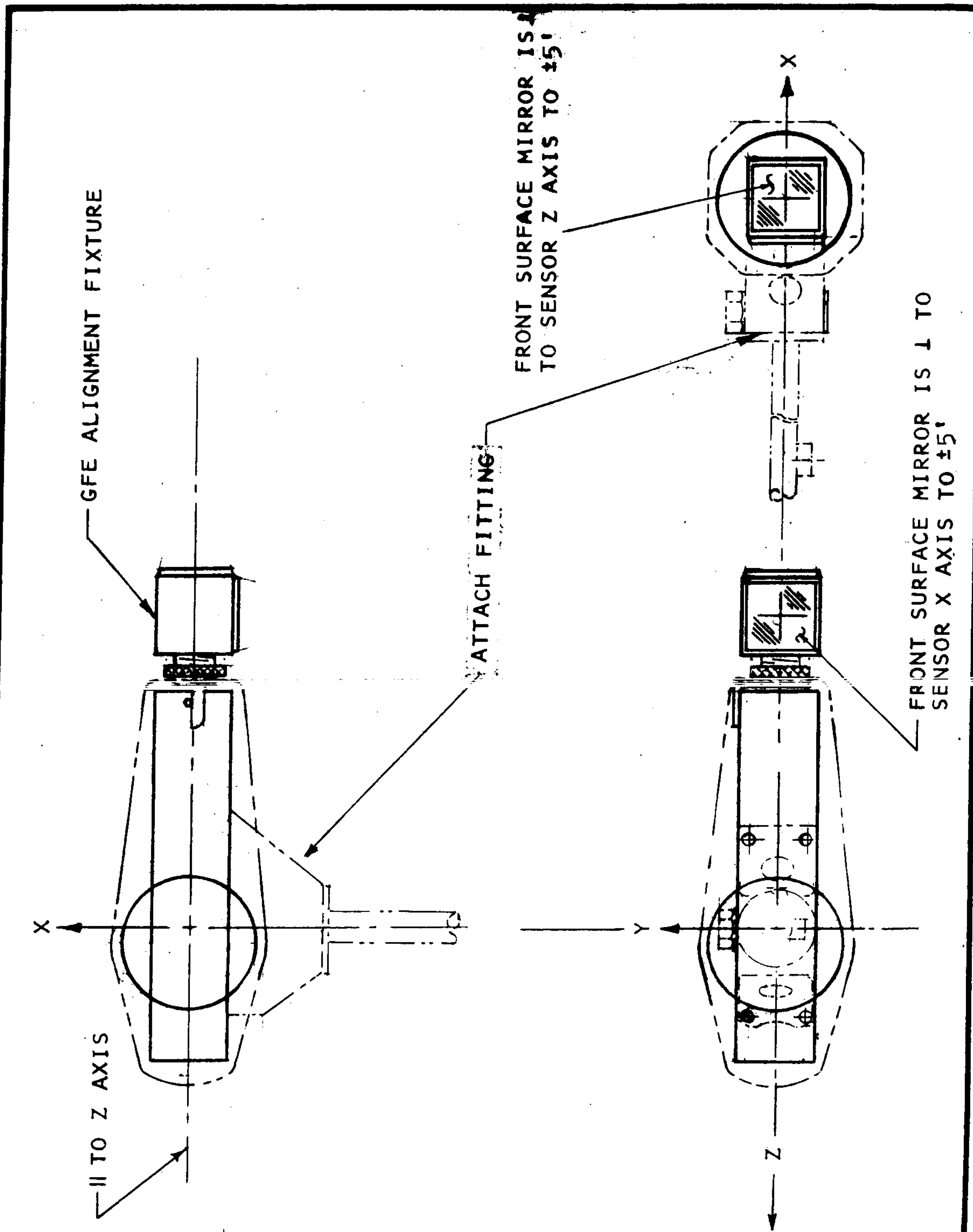
COIL WIDTHS .150

SEE SECTION 3.1.4 FOR LATERAL AXES ORIENTATION REQUIREMENTS

TITLE
MECHANICAL INTERFACE SENSOR JPL HELIUM VECTOR MAGNETOMETER

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.02
FIG. 3.1.1
REV. NO. 13 | DATE 8-31-70 | SHEET 2 OF 2



REPRODUCED FROM	TITLE SENSOR ORIENTATION JPL HELIUM VECTOR MAGNETOMETER	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.02
		FIG. 3.1.4
	REV. NO. 16 / DATE 4-30-71	SHEET 1 OF 1

PIN NO.	FUNCTION
1	+28 VDC POWER
2	POWER RETURN
3	CMND - POWER ON/OFF
4	ANALOG (HOUSEKEEPING) S.S.C. (E2) WORD 2
5	ANALOG (SPECTRUM ANALYZER) S.S.C. (E1/E2) WORD 3
6	ANALOG (SPECTRUM ANALYZER) S.S.C. (E1/E2) WORD 4
7	ANALOG (SPECTRUM ANALYZER) S.S.C. (E1/E2) WORD 5
8	CHASSIS GROUND
9	SPARE
10	WORD GATE - MAIN FRAME (Aa)
11	WORD GATE - SCIENCE SUBCOM (Ae)
12	BIT SHIFT PULSE
13	WORD GATE (PHANTOM) - SCIENCE SUBCOM (Cf)
14	CHASSIS GROUND
15	CLOCK - 32.768 kHz
16	DIGITAL DATA - MAIN FRAME
17	DIGITAL DATA - SCIENCE SUBCOM
18	CMND - MANUAL RANGE
19	CMND - RANGE DECREMENT
20	CMND - RANGE INCREMENT
21	CMND - DATA INTERCHANGE
22	SPARE
23	SPARE
24	SPARE
25	SPARE

REPRODUCED FROM

TITLE

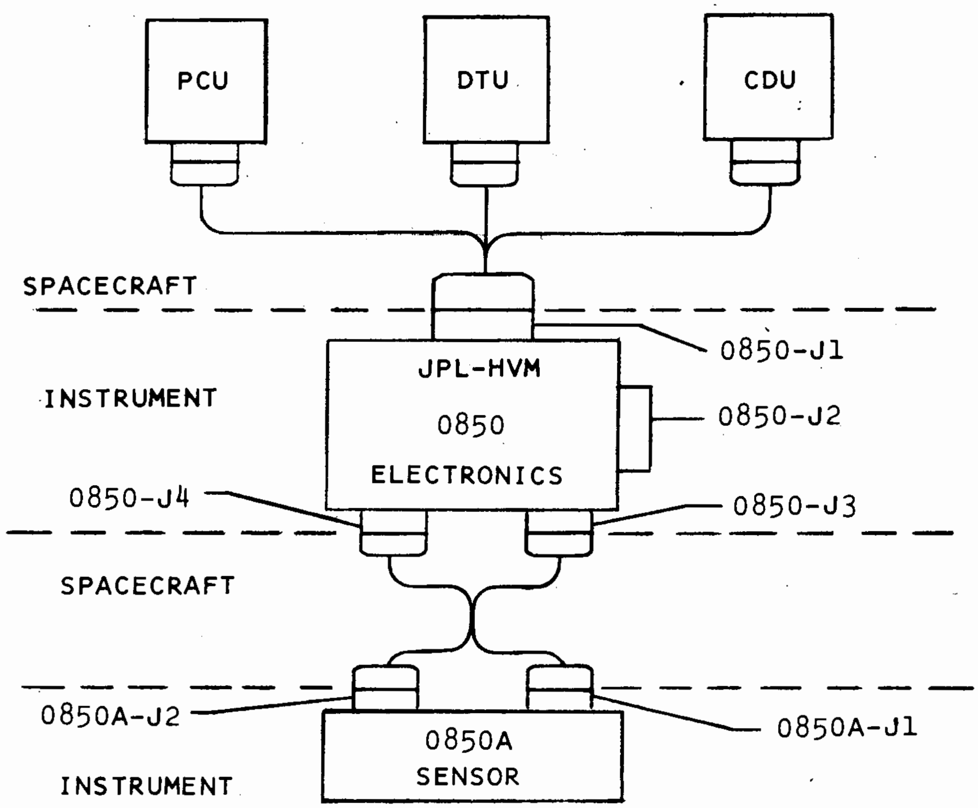
PIN ASSIGNMENTS
CONNECTOR 0850-J1
INTERFACE

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.02

FIG. 3.2.4.1

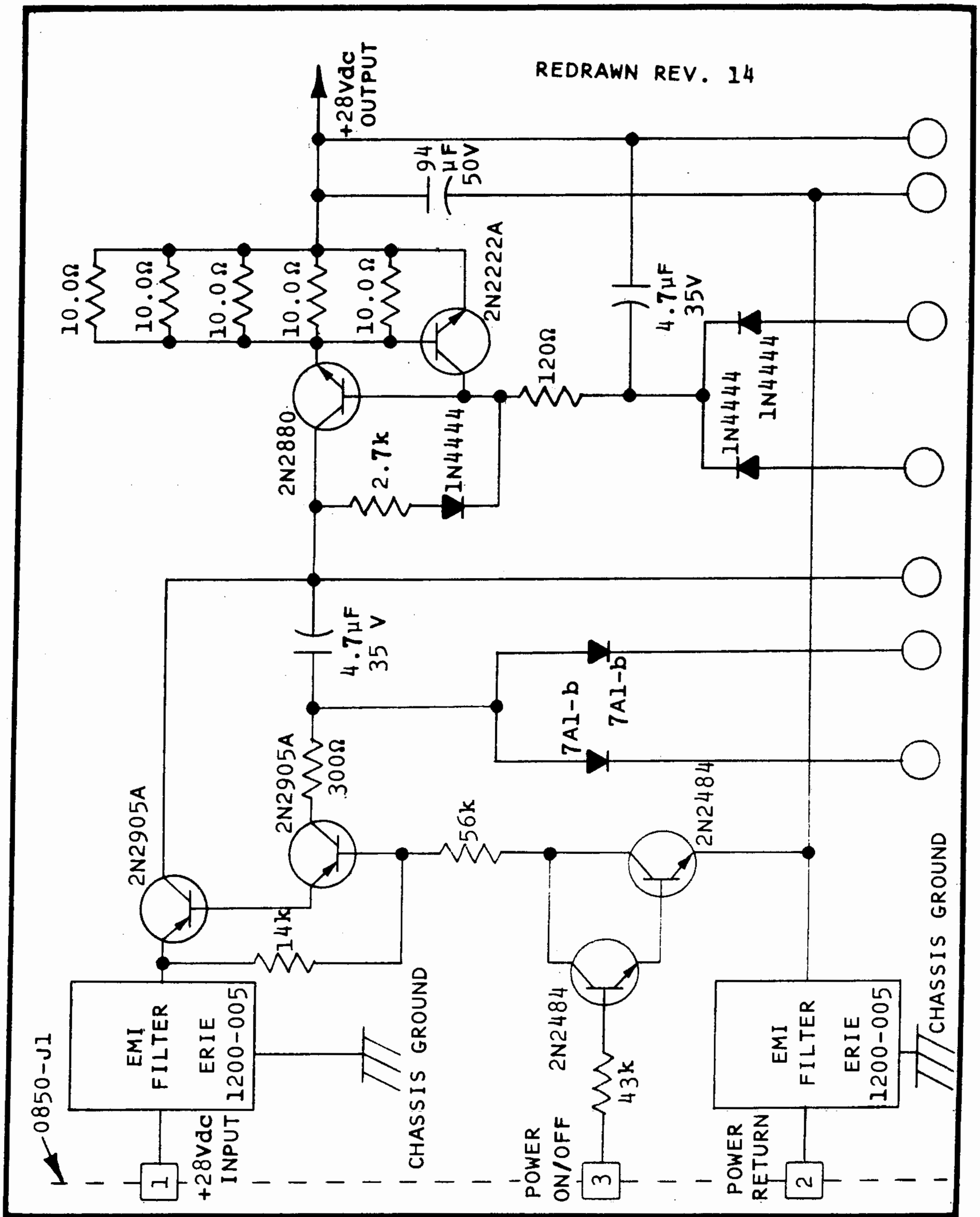
REV. NO. 3 | DATE 2-27-70 | SHEET 1 OF 1



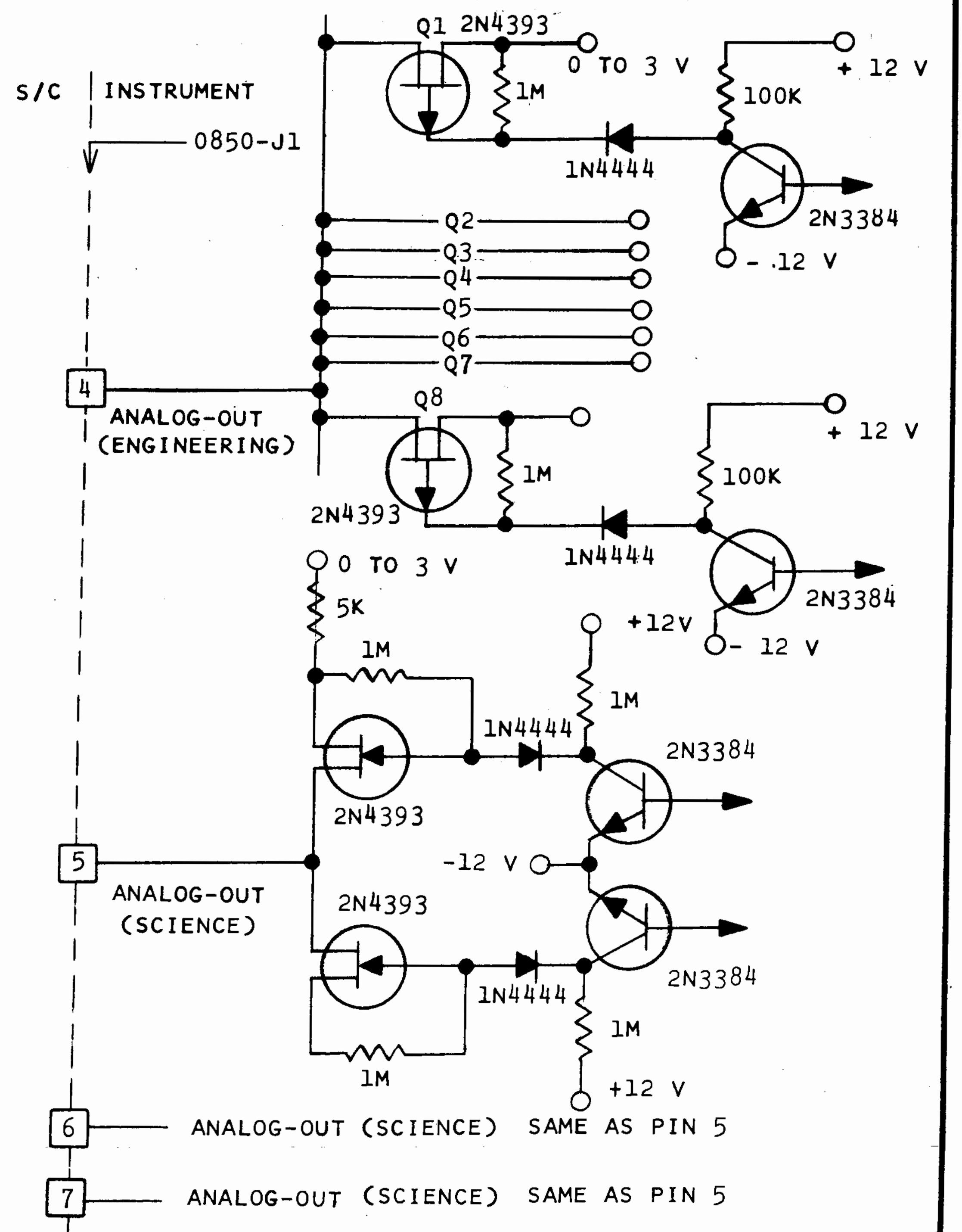
CONNECTOR	FUNCTION	TYPE
0850-J1	SPACECRAFT/INST.	DBM-25P
0850-J2	TEST	DBM-25S
0850-J3	INST./SENSOR	DCM-27W2S
0850-J4	INST./SENSOR	DEM-9S
0850A-J1	SENSOR/INST.	DBM-17W2P
0850A-J2	SENSOR/INST.	DAM-15P

NOTE: ALL CONNECTORS ARE CANNON GOLDEN D MARK I UNLESS OTHERWISE SPECIFIED.

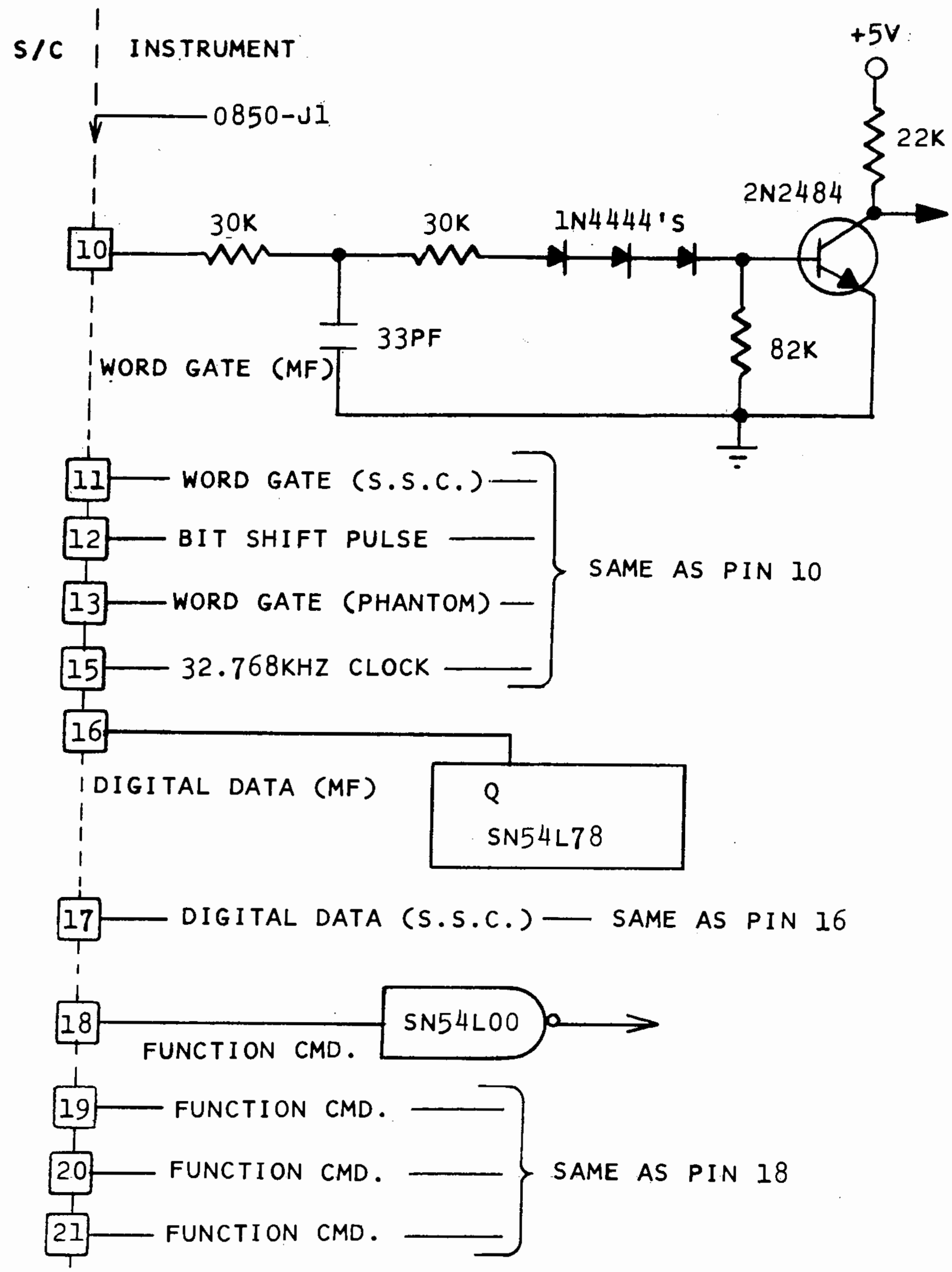
REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CONNECTOR I.D. JPL-HVM	DOC. NO. PC-220.02
		FIG. 3.2.4.2
	REV. NO. 4 / DATE 3-6-70	SHEET 1 OF 1



REPRODUCED FROM	TITLE	PIONEER PROGRAM
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.02
		FIG. 3.2.5
	REV. NO. 14 / DATE 10-31-70	SHEET 1 OF 3



REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	DOC. NO. PC220.02
		FIG. 3.2.5
	REV. NO. 12 — DATE 6-26-70	SHEET 2 OF 3



REPRODUCED FROM

TITLE

INSTRUMENT/SPACECRAFT
INTERFACE CIRCUITS

REV. NO. 12 DATE 6-26-70

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.02

FIG. 3.2.5

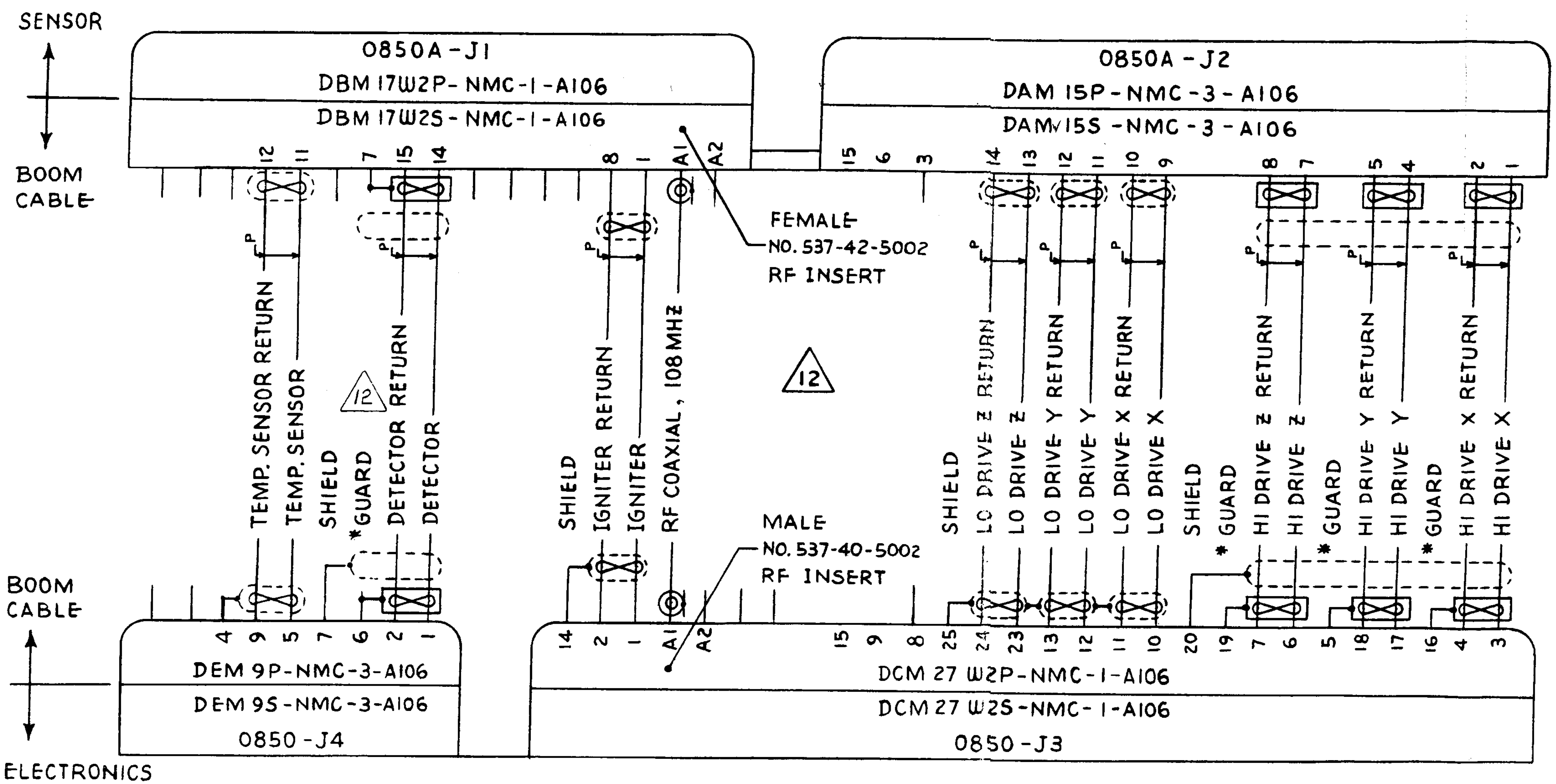
SHEET 3 OF 3

To Be Supplied

REPRODUCED FROM	TITLE INSTRUMENT/GSE INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.02
		FIG. 3.2.6
	REV. NO. / DATE	SHEET 1 OF 1

To Be Supplied

REPRODUCED FROM	TITLE BLOCK DIAGRAM JPL HELIUM VECTOR MAGNETOMETER	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.02
		FIG. 3.2.7
	REV. NO. / DATE	SHEET 1 OF 1



NOMENCLATURE

single wire, shielded.

twisted pair, shielded.

RF coaxial, double shielded.

twisted pair, Guarded *

NOTE: * GUARDS have applied voltages; therefore, they shall be electrically isolated from shields and other guards.

All wires, with the exception of the rf coaxial lines and the igniter pair, shall be 28 gauge. The igniter pair shall be 26 gauge.

TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
WIRING DIAGRAM JPL/HVM BOOM CABLE	DOC. NO. PC-220.02
	FIG. 3.2.8
REV. NO. 12 · DATE 6-26-70	SHEET 1 OF 1

ARC PLASMA

PC-220.03

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California

PIONEER PROGRAM

SPECIFICATION PC-220.03

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

ARC PLASMA

October 20, 1969

1. SCOPE

Specification PC-220.03 defines the characteristics and requirements of the ARC Plasma instrument pertinent to the Pioneer spacecraft.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATION

PC-213.00, Scientific Instruments and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATION

PC-220.00, Spacecraft/Scientific-Instrument Interface Specification

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Configuration. The dimensions, configuration and connection locations for the instrument will be as specified in Figure 3.1.1.

3.1.2 Mass Properties.

3.1.2.1 Weight (Present). 11.7 lbs (15)

Revision

3.1.2.2 Center of Gravity. The center of gravity notation of the instrument will be as indicated in Figure 3.1.1. The c.g. locations will be as follows: (5)

$a = 5.0 \pm 0.5 \quad b = 5.8 \pm 0.5 \quad c = 3.0 \pm .25$

3.1.2.3 Moments of Inertia. The moments of inertia of the instrument about the center of gravity of the units will be as follows:

Moments of Inertia (in-lb-sec^2)

I_a = TBS I_b = TBS I_c = TBS

3.1.3 Mounting. The instrument mounting faces and methods will be as indicated in Figure 3.1.1.

3.1.4 Sensor Orientation. The ARC/PA viewing apertures shall view in the direction of the spacecraft plus Z axis. The instrument shall be positioned on the spacecraft with the aid of a GFE alignment fixture which defines the normal to the viewing aperture face plate and the direction of the aperture centerline as shown in Figure 3.1.4. The normal to the viewing aperture face plate so defined shall be parallel to the spacecraft Z axis to $\pm$ 0.1°. The aperture centerline so defined shall be parallel to the spacecraft "X" axis to $\pm$ 0.1° and the angle between this line and the roll index fixed reference line shall be known to $\pm$ 0.1°. (16)

3.1.5 Viewing. The instrument requires two unobstructed 20° x 140° fan shaped solid view angles as shown in Figure 3.1.5. (11)

3.2 ELECTRICAL

3.2.1 Power Load (Present) (13)

Standby	TBS
Steady State (Normal)	4.5W
Steady State (Low Power)	4.0W
Steady State (High Power)	5.0W

Revision

3.2.2 Duty Cycle. The power requirements for the instrument are on a continuous basis during any one operating mode. The operating mode is a function of a commanded modes; (13)

(a) MFM-1, MFM-2, MFM-3, MFM-4, FSM-1, FSM-2, FSM-3
(b) CCM BIAS Voltage - 8 steps per bank
(c) Count rate of CCM's

The power will be steady state between 4.0 and 5.0 watts depending on the mode commanded and the CCM ion count activity.

3.2.3 Converter Frequency. The converter frequency will be as indicated in Figure 3.5.1.1 of PC-220.00.

3.2.4 Connectors.

3.2.4.1 Connector Pin Assignments. Pins on the connectors for this instrument will be wired in accordance with Figure 3.2.4.1.

3.2.4.2 Connector Identification. Each connector attached to the instrument will be identified with a number in accordance with Figure 3.2.4.2.

3.2.5 Instrument Interface Circuits. Figure 3.2.5, shows the instrument input/output circuits which interface with the spacecraft/instrument interface timing, command and data lines.

3.2.6 Instrument/GSE Interface Circuits. Figure 3.2.6 shows the GSE input/output circuits which interface with the instrument thru the instrument stimulus/test connector.

3.2.7 Block Diagram. Figure 3.2.7 is a typical block diagram for the Plasma Instrument.

3.3 DATA HANDLING AND INSTRUMENT CONTROL

3.3.1 Signals from the Instrument. The scientific instrument will provide the following signals: (9)

Main Frame - Formats A, B & D3	1 Line
Science Subcom - Analog Electrical Temperature	2 Lines
- Analog Detector Temperature	1 Line

3.3.2 Signals to the Instrument. The scientific instrument will be provided with the following signals.

3.3.2.1 Power. (9)

+28 vdc	1 Line
+28 vdc Return	1 Line

3.3.2.2 Commands.

Power ON/OFF	1 Line
Functional	12 Lines

Revision

3.3.2.3 Timing and Control (13)

(a)	Bit shift pulse	1 Line
(b)	Roll index pulse	1 Line
(c)	Sector generator (512 Sectors)	1 Line
(d)	Word gate - main Frame	1 Line
(e)	Word gate - (phantom) main frame (Ea)	1 Line
(f)	Format D3 status	1 Line
(g)	Bit rate status	3 Lines

3.3.3 Telemetry Word Assignments. Telemetry word assignments are specified in PC-220.01, sections 3.3.1.4.1 thru 3.3.1.4.5.

3.3.4 Instrument Words. Arrangements of instrument words within the telemetry word assignments for this instrument are as shown in PC-260.02.

3.4 THERMAL (1)

3.4.1 Operating Limits. This instrument will be capable of operating over the following temperature range: (15)

Platform-mounted unit: -20°F to +110°F

3.4.2 Thermal Load, Platform-Mounted Unit. The platform-mounted unit of this instrument shall be exposed to the thermal environment exterior to the spacecraft while in space flight. The average thermal load supplied to the spacecraft by electrical power dissipation within the platform-mounted unit will be TBS watts.

3.4.3 Surface Thermal Properties.

3.4.3.1 Mounting Surfaces. The mounting surfaces of the instrument will be treated in accordance with PC-213.03, section 3.2.6.8.1.

Revision

3.4.3.2 Nonmounting Surfaces The non-mounting surfaces of the instrument viewing the inside of the spacecraft will be treated in accordance with PC-213.03, section 3.2.6.8.6.

3.4.4 Mounting Surface Area. The thermal conducting area of the instrument units contiguous with the spacecraft mounting surfaces will be as follows: (9)

Platform-mounted unit: 32 square inches maximum

3.5 COMPATIBILITY

3.5.1 Electromagnetic-Special Requirements & Characteristics. This instrument is sensitive to the frequencies indicated in Figure 3.5.1.1, Pioneer Specification PC-220.00.

3.5.2 Radioactive Sources. None.

3.6 MISCELLANEOUS REQUIREMENTS & CHARACTERISTICS

3.6.1 Spin Rate. The preferred spin rate of the spacecraft for operation of this instrument is 4.5 rpm. The instrument will operate satisfactorily for spacecraft spin rates between 2 and 7 rpm. (1)

4. PERFORMANCE ASSURANCE PROVISIONS

Not applicable.

5. PREPARATION FOR DELIVERY, HANDLING, SHIPPING & STORAGE (1)

5.1 HANDLING

5.1.1 General. The scientific instruments shall at all times be handled in a manner which will minimize the possibility of damage to the instrument. Grasping of the instrument by other than the base section shall not be permitted.

Revision

5.1.2 Protective Covers. This instrument employs a protective cover with the sensor. This cover shall remain in position during all systems tests except physical properties measurements and thermal vacuum. The cover shall be removed during vibration and other tests directed by the NASA/ARC Experiment Test Engineer, however, it is required that the optic apertures be covered with MYSTIK type 7000 fiberglass or equipment approved nonconductive tape during these tests. The experiment test connector shall be covered with MYSTIK type 7000 fiberglass or equivalent approved nonconductive tape just prior to launch. During test operations and storage, all exposed connectors shall be protected with dust covers. (9)

5.1.3 Shorting Plug. To be supplied.

5.2 SHIPPING

Except when mounted on the spacecraft, this scientific instrument shall be transported only in its custom carrying case. Movement of the instrument to and from TRW will be the responsibility of NASA/ARC.

5.3 STORAGE

Whenever the instrument is not mounted on the spacecraft platform, or not in use for bench tests, it shall be stored in the protective carrying case furnished by the experimenter and placed in the bonded stores area of TRW. The carrying case will contain suitable chemical desiccant, the condition of which will be monitored periodically during protracted storage periods, by the cognizant NASA test engineer.

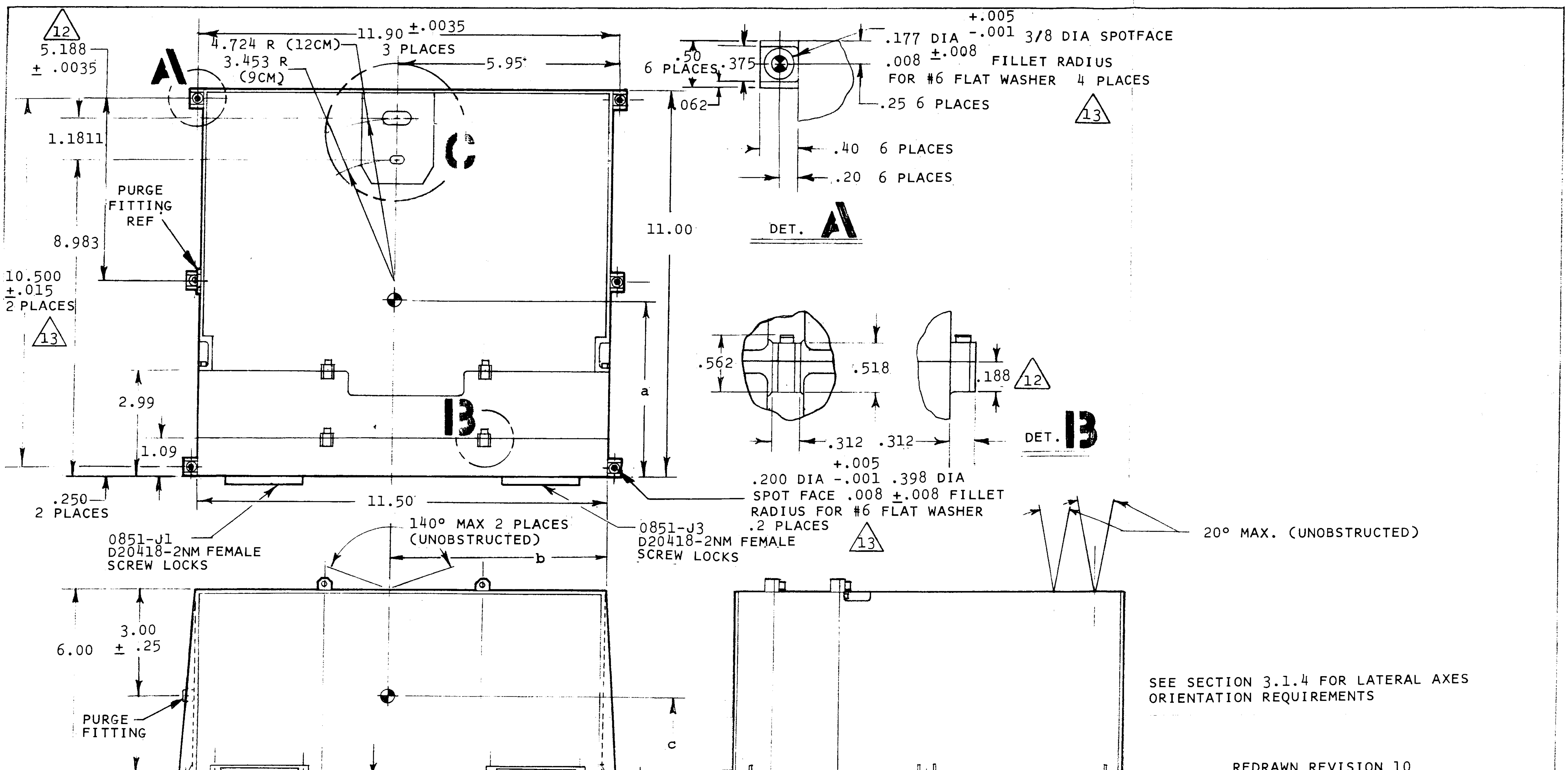
6. NOTES

6.1 DEFINITIONS

See Section 6.1 of Specification PC-220.00.

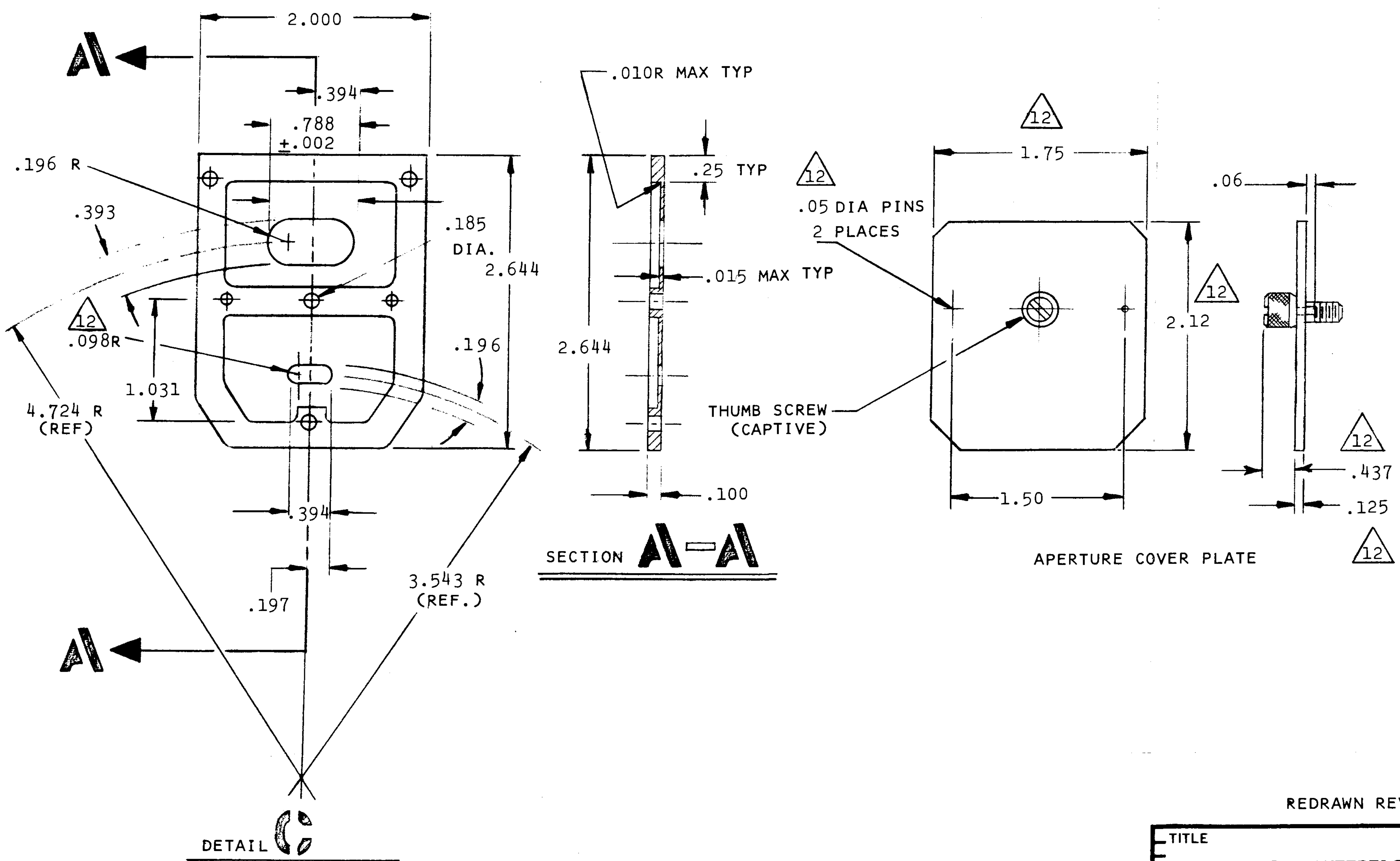
6.2 ABBREVIATIONS

See Section 6.2 of Specification PC-220.00.



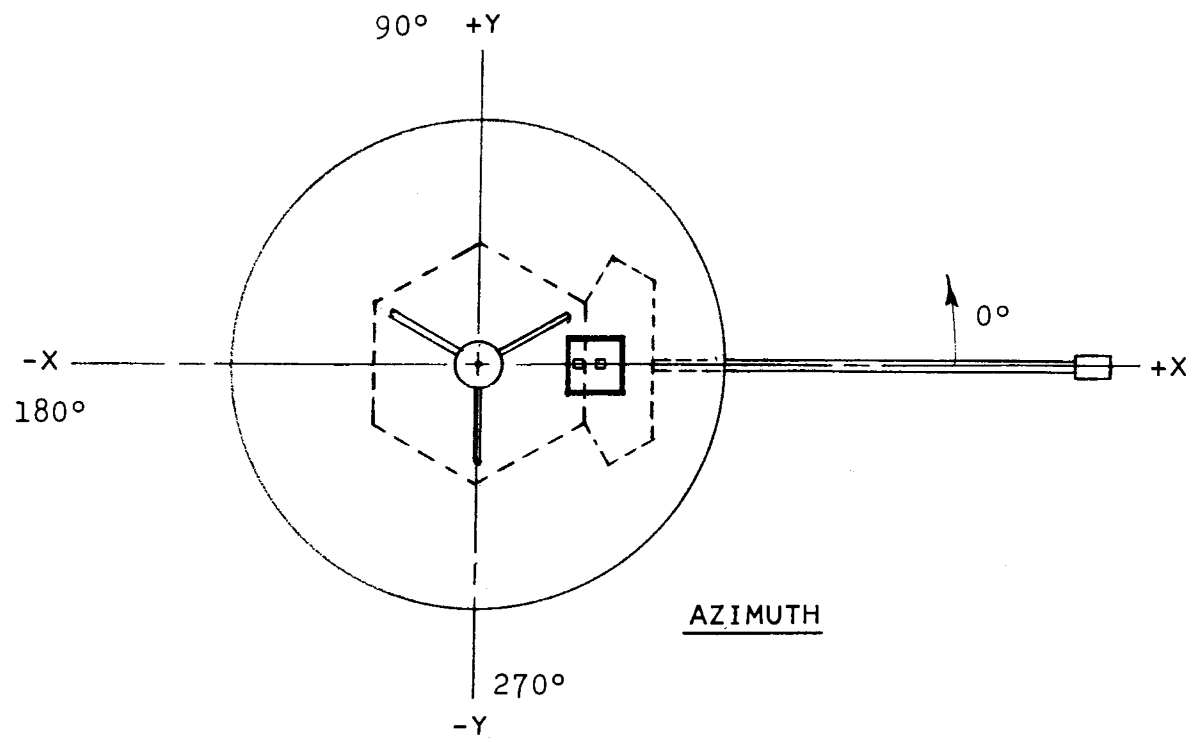
REDRAWN REVISION 10

TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
MECHANICAL INTERFACE ARC PLASMA ANALYZER	DOC. NO. PC-220.03
	FIG. 3.1.1
REV. NO. 13 / DATE	SHEET 1 OF 2

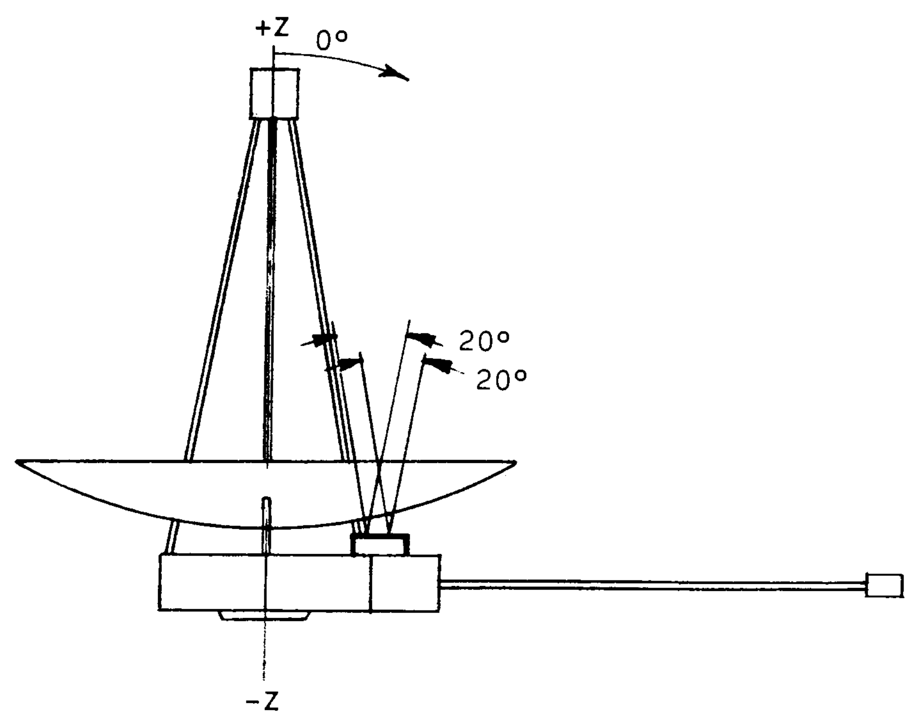


REDRAWN REVISION 10

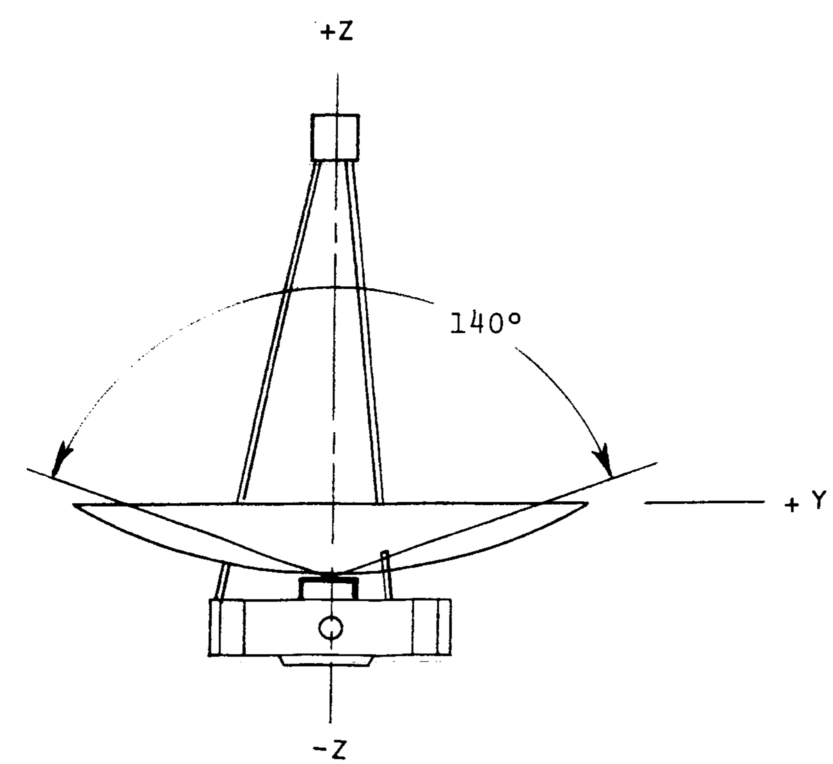
TITLE MECHANICAL INTERFACE ARC PLASMA ANALYZER	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.03
	FIG. 3.1.1
REV. NO. 12 DATE 6-26-70	SHEET 2 OF 2



AZIMUTH



ELEVATION

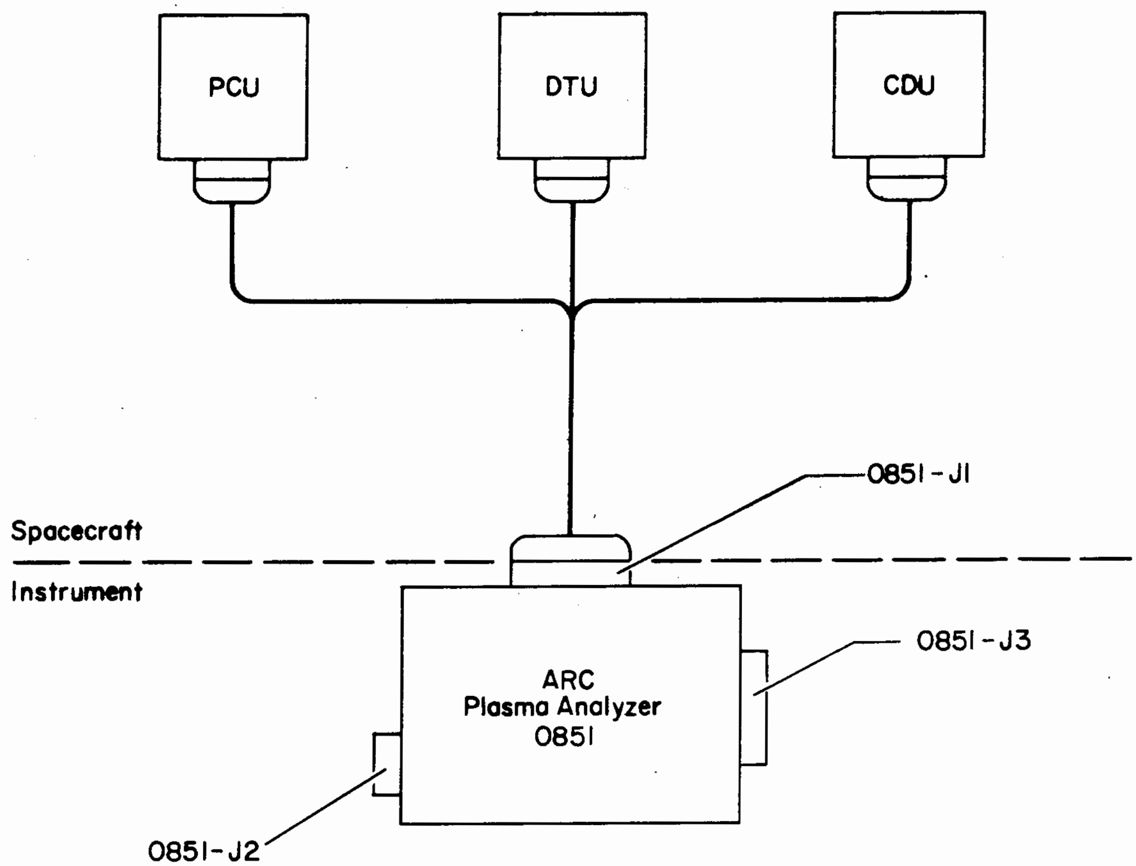


TITLE VIEWING ARC PLASMA ANALYZER		**PIONEER PROGRAM** **NASA** AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.03
		FIG. 3.1.5
REV. NO. 12	DATE 6-26-70	SHEET 1 OF 1

12

PIN NO.	FUNCTION
1	+28 VDC POWER
2	ANALOG (ELECT. TEMP) - S.S.C. (E1) WORD 2
3	RETURN FOR 2
4	CMND 1 - TARGET SUPPRESSION
5	CMND 2 - DETECTOR A H.V. STEP
6	CMND 3 - DETECTOR B H.V. STEP
7	CMND 4 - IN FLIGHT CALIBRATION (IFC)
8	CMND 5 - FSM SPACECRAFT REV/H.V. STEP
9	CMND 6 - DETECTOR B H.V. LIMIT - ON/OFF
10	STATUS - BIT RATE (L.S.B.)
11	STATUS - BIT RATE (M.S.B.)
12	CMND - POWER ON/OFF
13	SPARE
14	ROLL INDEX PULSE
15	SECTOR GENERATOR (512 SECTORS)
16	SPARE
17	DIGITAL DATA OUT - MAIN FRAME
18	WORD GATE - (PHANTOM) MAIN FRAME (Ea) 10
19	SPARE
20	POWER RETURN
21	ANALOG (DETECT. TEMP) S.S.C. (E1) WORD 1
22	SPARE
23	CMND 7 - DETECTOR A H.V. & C.C.M. BIAS - ON/OFF
24	CMND 8 - DETECTOR B H.V. ON/OFF
25	CMND 9 - INTEGRATION PERIOD
26	CMND 10 - DATA SOURCE MODE/C.C.M. H.V. BANK SELECT
27	CMND 11 - LEFT C.C.M. BIAS SUPPLY STEP
28	CMND 12 - RIGHT C.C.M. BIAS SUPPLY STEP
29	STATUS - BIT RATE (BIT 2)
30	SPARE
31	SPARE
32	WORD GATE - MAIN FRAME (Ba)
33	SPARE
34	STATUS - FORMAT D3
35	BIT SHIFT PULSE
36	SPARE
37	SPARE

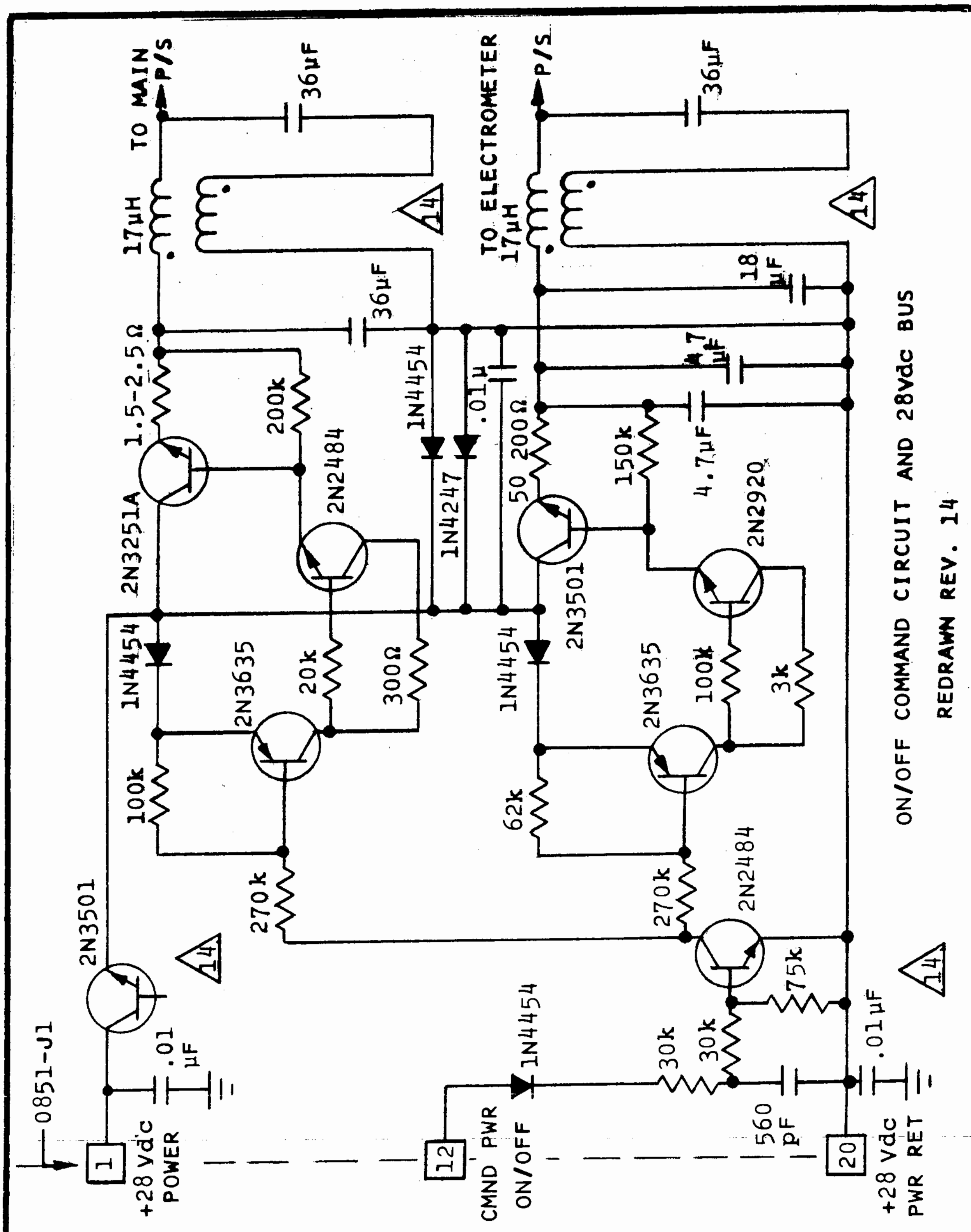
REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CONNECTOR 0851-J1 PIN ASSIGNMENTS	DOC. NO. PC-220.03
		FIG. 3.2.4.1
	REV. NO. 10 — DATE 5-1-70	SHEET 1 OF 1



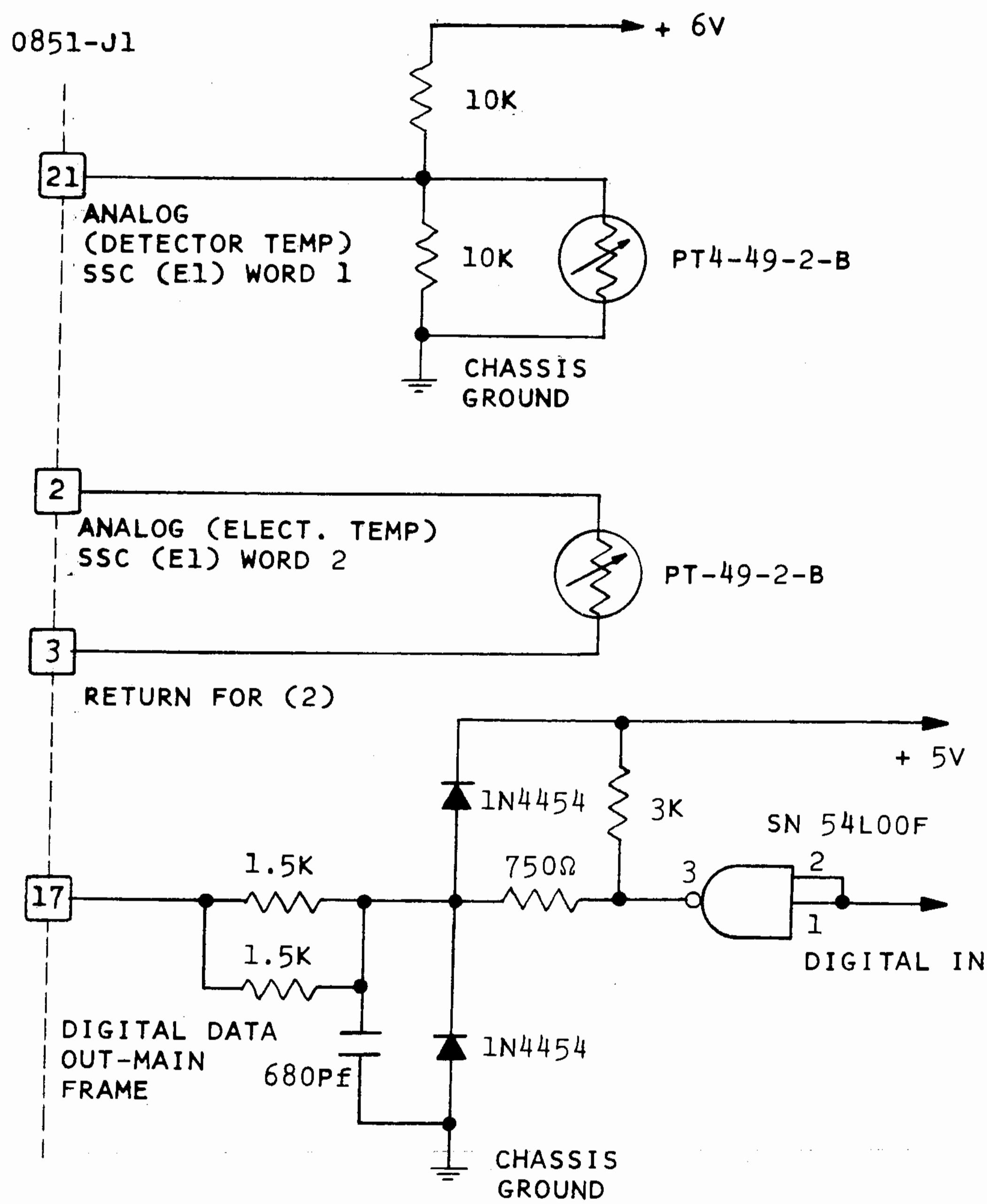
CONNECTOR	FUNCTION	TYPE
0851-J1	INTERFACE	DCM-37P-NMC-A106
0851-J2	CCM SHORTING PLUG	DALE GS16-2DG
0851-J3	TEST	DCM-37S-NMC-A106

NOTE: ALL CONNECTORS ARE CANNON GOLDEN D MARK I UNLESS OTHERWISE SPECIFIED.

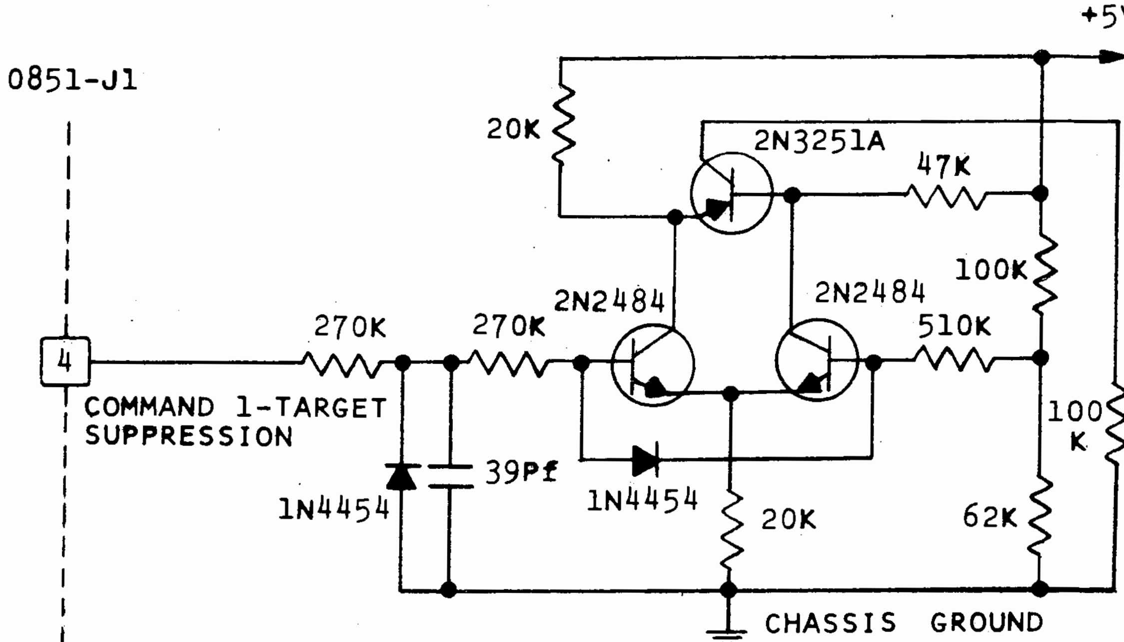
REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CONNECTOR I.D. ARC PLASMA ANALYZER	DOC. NO. PC-220.03
		FIG. 3.2.4.2
	REV. NO. 4 / DATE 3-6-70	SHEET 1 OF 1



REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INTERFACE CIRCUITS ARC PLASMA INSTRUMENT	DOC. NO. PC-220.03
		FIG. 3.2.5
	REV. NO. 14 / DATE 10-31-70	SHEET 1 OF 4



REPRODUCED FROM	TITLE: INTERFACE CIRCUITS ARC PLASMA INSTRUMENT	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.03
		FIG. 3.2.5
	REV. NO. 12 / DATE 6-26-70	SHEET 2 OF 4



5 COMMAND 2 - DETECTOR A H.V. STEP (SAME AS PIN 4)

6 COMMAND 3 - DETECTOR B H.V. STEP (SAME AS PIN 4)

7 COMMAND 4 - IN FLIGHT CALIBRATION (SAME AS PIN 4)

8 COMMAND 5 - FSM SPACECRAFT REV / H.V. STEP (SAME AS PIN 4)

9 COMMAND 6 - DET. B H.V. LIMIT ON/OFF (SAME AS PIN 4)

10 STATUS-BIT RATE (L.S.B.) SAME AS PIN 4

11 STATUS-BIT RATE (M.S.B.) SAME AS PIN 4

23 COMMAND 7 - DET A H.V. & CCM BIAS ON/OFF (SAME AS PIN 4)

24 COMMAND 8 - DET B H.V. ON/OFF (SAME AS PIN 4)

25 COMMAND 9 - INTEGRATION PERIOD (SAME AS PIN 4)

26 COMMAND 10 - DATA SOURCE MODE/CCM H.V. SELECT (SAME AS PIN 4)

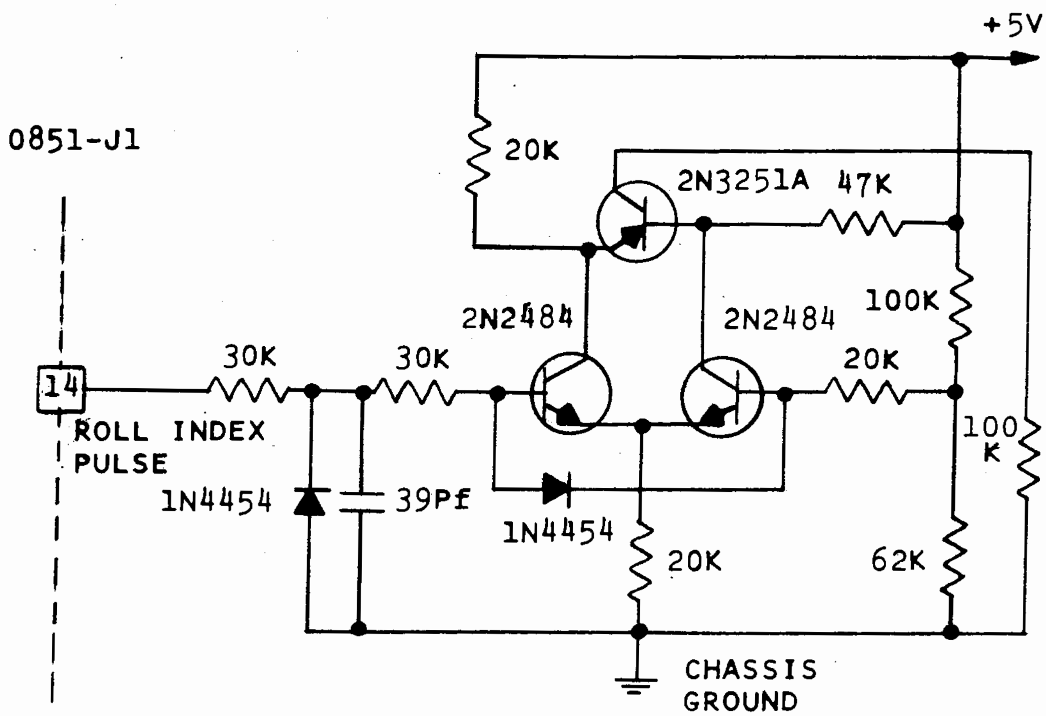
27 COMMAND 11 - LEFT CCM BIAS SUPPLY STEP (SAME AS PIN 4)

28 COMMAND 12 - RIGHT CCM BIAS SUPPLY STEP (SAME AS PIN 4)

29 STATUS-BIT RATE (BIT 2) SAME AS PIN 4

34 STATUS-FORMAT D3 (SAME AS PIN 4)

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INTERFACE CIRCUITS ARC PLASMA INSTRUMENT	DOC. NO. PC-220.03
		FIG. 3.2.5
	REV. NO. 12 / DATE 6-26-70	SHEET 3 OF 4



15 SECTOR GENERATOR (SAME AS PIN 14)

18 WORD GATE - (PHANTOM) MAIN FRAME (Ea) - SAME AS PIN 14

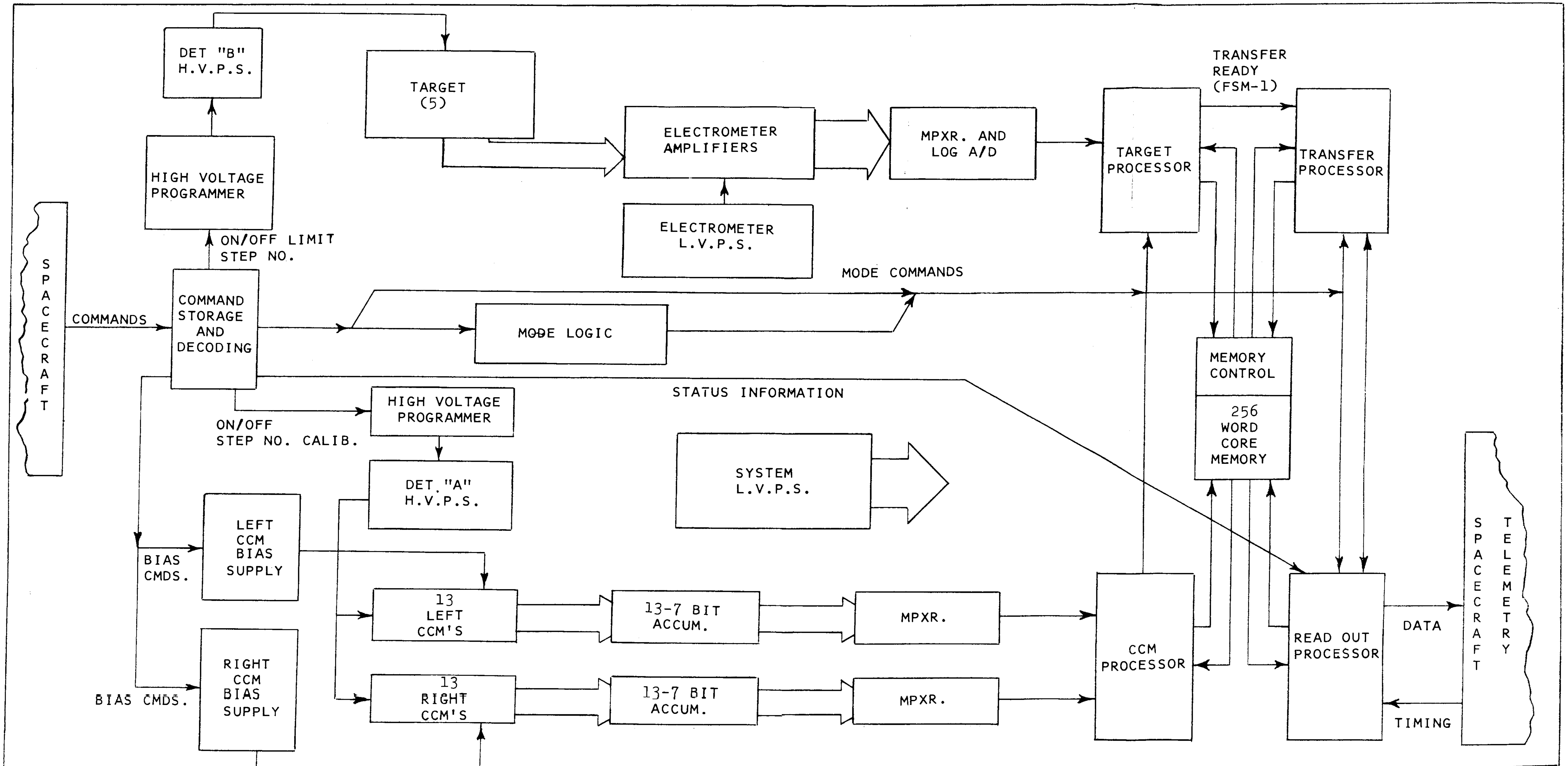
32 WORD GATE - MAIN FRAME (Ba) - SAME AS PIN 14

35 BIT SHIFT PULSE (SAME AS PIN 14)

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INTERFACE CIRCUITS ARC PLASMA INSTRUMENT	DOC. NO. PC-220.03
		FIG. 3.2.5
	REV. NO. 12 — DATE 6-26-70	SHEET 4 OF 4

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/GSE INTERFACE CIRCUITS	DOC. NO. PC-220.03
		FIG. 3.2.6
	REV. NO. / DATE	SHEET 1 OF 1



TITLE
BLOCK DIAGRAM
ARC
PLASMA ANALYZER

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.03
FIG. 3.2.7
REV. NO. 11 DATE 5-22-70 SHEET 1 OF 1

CHICAGO/CHARGED PARTICLE INSTRUMENT

PC-220.04

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California

PIONEER PROGRAM

SPECIFICATION PC-220.04

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

CHICAGO/CHARGED PARTICLE INSTRUMENT
October 20, 1969

1. SCOPE

Specification PC-220.04 defines the characteristics and requirements of the Chicago/Charged Particle instrument pertinent to the Pioneer spacecraft.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATIONS

PC-213.00, Scientific Instruments and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATION

PC-220.00, Spacecraft/Scientific-Instrument Interface Specification

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Configuration. The dimensions, configuration and connector locations for the instrument will be as specified in Figure 3.1.1.

3.1.2 Mass Properties.

3.1.2.1 Weight (Present). 7.3 lb (15)

Revision

3.1.2.2 **Center of Gravity.** **The center of gravity notation of the instrument will be as indicated in Figure 3.1.1. The c.g. locations will be as follows:** (12)

$a = 5.0 \pm 1.0 \quad b = 3.8 \pm 1.0 \quad c = 2.25 \pm 1.0$

3.1.2.3 **Moments of Inertia.** **The moments of inertia of the instrument about the center of gravity of the units will be as follows:**

Moments of Inertia (in-lb-sec^2)

I_a = TBS $\qquad I_b$ = TBS $\qquad I_c$ = TBS

3.1.3 **Mounting.** **The instrument mounting faces and methods will be as indicated in Figure 3.1.1.**

3.1.4 Sensor Orientation. The instrument shall be positioned on the spacecraft such that the viewing requirements of section 3.1.5 are satisfied. A GFE alignment fixture will be provided which will define the direction of the centerline of the main telescope to $\pm 2^\circ$. The azimuthal angle between the roll index pulse fixed reference line and the centerline of the main telescope as defined by the alignment fixture shall be known to $\pm$ 30 minutes. (16)

3.1.5 Viewing. The sensor viewing requirement are as follows: (12)

a. Main telescope: Unobstructed 65° solid cone angle field of view in the forward looking direction.

b. Low energy telescope: Unobstructed 70° solid cone angle field of view in the forward looking direction.

3.2 ELECTRICAL (1)

3.2 1 Power Load (Present) (11)

Standby	TBS
Average	2.39W
Peak	2.39W

Revision

3.2.2 Duty Cycle. The power requirements for this instrument are on a continuous basis during normal operating mode.

3.2.3 Converter Frequency. The converter frequency will be as indicated in Figure 3.5.1.1 of PC-220.00.

3.2.4 Connectors.

3.2.4.1 Connector Pin Assignments. Pins on the connectors for this instrument will be wired in accordance with Figure 3.2.4.1, sheets 1 and 2. (5)

3.2.4.2 Connector Identification. Each connector attached to the instrument will be identified with a number in accordance with Figure 3.2.4.2.

3.2.5 Instrument Interface Circuits. Figure 3.2.5, shows the instrument input/output circuits which interface with the spacecraft/instrument interface timing, power, command and data lines.

3.2.6 Instrument/GSE Interface Circuits. Figure 3.2.6 shows the GSE input/output circuits which interface with the instrument thru the instrument stimulus/test connector.

3.2.7 Block Diagram. Figure 3.2.7 is a typical block diagram for the Charged Particle Composition Instrument.

3.3 DATA HANDLING AND INSTRUMENT CONTROL (1)

3.3.1 Signals from the Instrument. The scientific instrument will provide the following signals. (5)

Main Frame-Formats A and B	1 Line
Scientific Subcom	
Digital	3 Lines
Analog	5 Lines
~~Bilevel~~	~~7 Lines~~
Spacecraft Temperature Sensor	2 Lines
Signal Return	1 Line

3.3.2 Signals to the Instrument. The scientific instrument will be provided with the following signals.

3.3.2.1 Power. 2 Lines

3.3.2.2 Commands.

Power ON/OFF	1 Line
Functional	6 Lines

3.3.2.3 Timing and Control. (5)

(a)	Roll index pulse	1 Line
(b)	Sector generator (8 sectors)	1 Line
(c)	Word gate - main frame	1 Line
(d)	Word gate - science subcom	3 Lines
(e)	Rate pulse - main frame	1 Line
(f)	Rate pulse - science subcom	1 Line
(g)	Bit shift pulse	1 Line

3.3.3 Telemetry Word Assignments. Telemetry word assignments are specified in PC-220.01, sections 3.3.1.4.1 thru 3.3.1.4.5.

3.3.4 Instrument Words. Arrangements of instrument words within the telemetry word assignments for this instrument are as shown in PC-260.03.

3.4 THERMAL (1)

3.4.1 Operating Limits. This instrument will be capable of operating over the following temperature range:

Platform-mounted unit: -20°F to + 104°F

3.4.2 Thermal Load, Platform-Mounted Unit. The platform-mounted unit of this instrument shall be exposed to the thermal environment exterior to the spacecraft while in space flight. The average thermal load supplied to the spacecraft by electrical power dissipation within the platform-mounted unit will be TBS watts.

3.4.3 Surface Thermal Properties.

3.4.3.1 Mounting Surfaces. The mounting surfaces of the instrument will be treated in accordance with PC-213.03, section 3.2.6.8.1.

3.4.3.2 Nonmounting surfaces. The nonmounting surfaces of the instrument viewing the inside of the spacecraft will be treated in accordance with PC-213.03, section 3.2.6.8.6.

3.4.4 Mounting Surface Area. The thermal conducting area of the instrument units contiguous with the spacecraft mounting surfaces will be as follows:

Platform-mounted unit: 60 square inches.

3.5 COMPATIBILITY (1)

3.5.1 Electromagnetic-Special Requirements & Characteristics. This instrument is sensitive to the frequencies indicated in Figure 3.5.1.1, Pioneer Specification PC-220.00.

3.5.2 Radioactive Sources.

3.5.2.1 Internal Sources (On-Board.) None.

3.5.2.2 External Sources (Test). Cobalt 60 - TBS millicuries

3.6 Miscellaneous Requirements & Characterisitics.

3.6.1 Spin Rate. The preferred spin rate of the spacecraft for operation of this instrument is 4 to 4.9 rpm. instrument will operate satisfactorily for spacecraft spin rates between 2 and 7 rpm. (1)

4. PERFORMANCE ASSURANCE PROVISION.

Not appliable.

5. PREPARATION FOR DELIVERY, HANDLING, SHIPPING & STORAGE (1)

5.1 HANDLING

5.1.1 General. The scientific instruments shall at all times be handled in a manner which will minimize the possiblity of damage to the instrument. Grasping of the instrument by other than the base section shall not be permitted.

5.1.2 Protective Covers. This instrument employs a protective cover with the sensor. This cover shall remain in position during all systems tests except physical properties measurements, vibration, thermal tests except physical properties measurements, vibration, thermal vacuum, and other tests as directed by the NASA/ARC Experiment Test Engineer. The experiment test connector shall be covered with MISTIK type 7000 fibergalss or equivalent, approved nonconductive tape just prior to launch. During test operations and storage, all exposed connectors shall be protected with dust covers.

5.2 SHIPPING

Except when mounted on the spacecraft, this scientific instrument shall be transported only in its custom carrying case. Movement of the instrument to and from TRW will be the responsibility of NASA/ARC.

5.3 STORAGE

Whenever the instrument is not mounted on the space-craft platform, or not in use for bench tests, it shall be stored in the protective carrying case furnished by the experimenter and placed in the bonded stores area of TRW. The carrying case will contain suitable chemical desiccant, the condition of which will be monitored periodically during protracted storage periods, by the cognizant NASA test engineer.

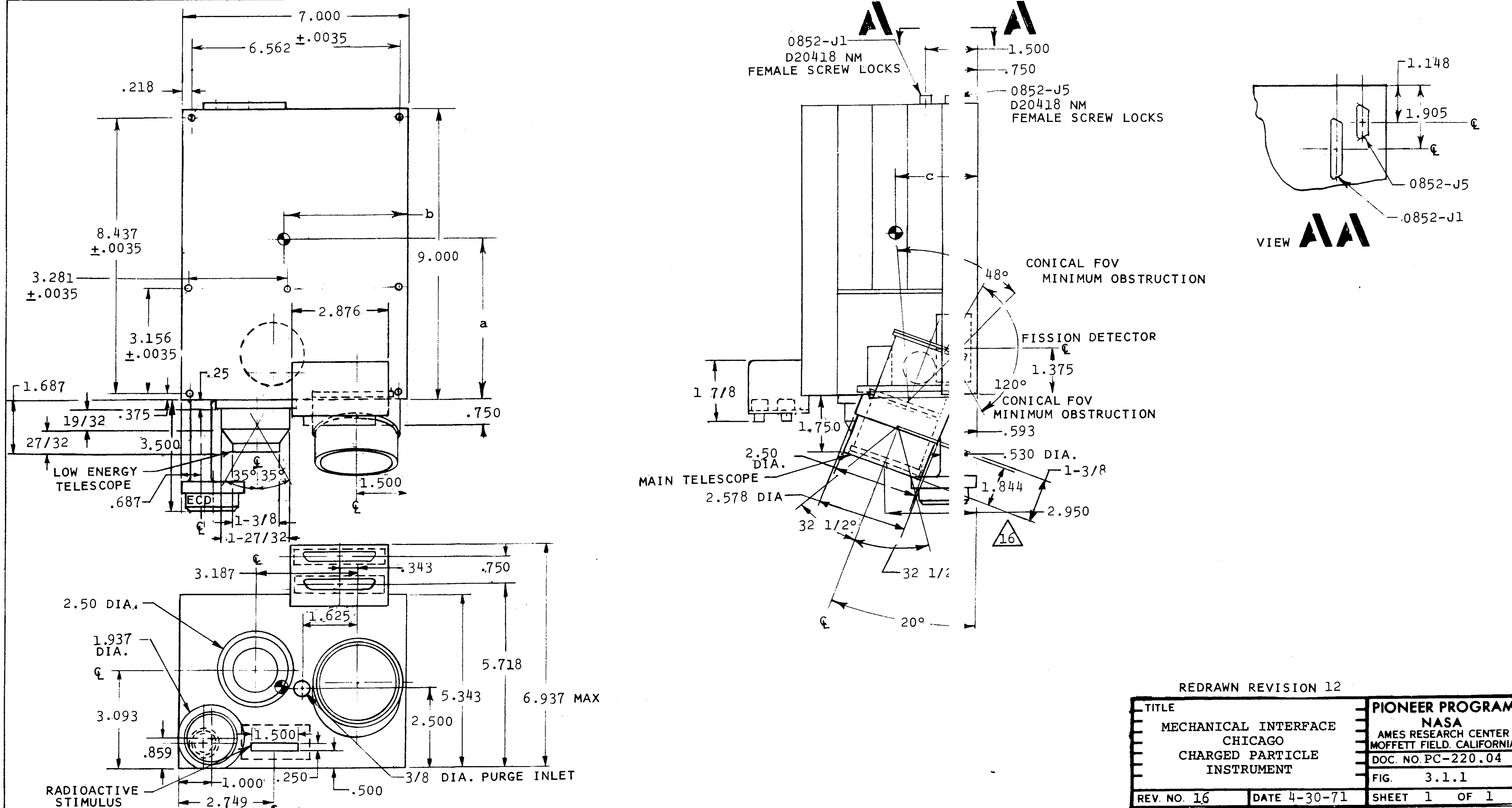
6. NOTES

6.1 DEFINITIONS

See Section 6.1 of Specification PC-220.00.

6.2 ABBREVIATIONS

See Section 6.2 of Specification PC-220.00.



REDRAWN REVISION 12

TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
MECHANICAL INTERFACE CHICAGO CHARGED PARTICLE INSTRUMENT	DOC. NO. PC-220.04
	FIG. 3.1.1
REV. NO. 16 — DATE 4-30-71	SHEET 1 OF 1

PIN NO.	FUNCTION	
1	SIGNAL RETURN	11
2	CHASSIS GROUND	11
3	CHASSIS GROUND	11
4	CHASSIS GROUND	11
5	SECTOR GENERATOR (8 SECTORS)	
6	WORD GATE - MAIN FRAME(Ca)	
7	WORD GATE - S.S.C. (E2) WORD 6 (Cf)	
8	DIGITAL DATA OUT - MAIN FRAME	
9	DIGITAL DATA OUT - S.S.C. (E2) WORD 6	
10	ANALOG (EGG CURRENT RANGE 1) S.S.C. (E1) WORD 11	
11	ANALOG (EGG CURRENT RANGE 2) S.S.C. (E1) WORD 12	
12	ANALOG (EGG CURRENT RANGE 3) S.S.C. (E1) WORD 13	
13	BILEVEL (DET. D1 STATUS) S.S.C. (E1) WORD 8, BIT 1	
14	BILEVEL (DET. D2 STATUS) S.S.C. (E1) WORD 8, BIT 2	
15	BILEVEL (DET. D7 STATUS) S.S.C. (E1) WORD 8, BIT 3	
16	BILEVEL (PRIORITY STATUS) S.S.C. (E1) 8-4	
17	CMND DISABLE DETECTOR D1	
18	CMND DISABLE DETECTOR D7	
19	CMND DISABLE DETECTOR D2	
20	BIT SHIFT PULSE	
21	RATE PULSE - MAIN FRAME	
22	RATE PULSE - SCIENCE SUBCOM	
23	ROLL INDEX PULSE	
24	WORD GATE - S.S.C. (E1) WORDS 14, 15 & 16 (Ce)	
25	WORD GATE - S.S.C. (E2) WORDS 14, 15 & 16 (Cg)	
26	DIGITAL DATA OUT - S.S.C. (E1) WORDS 14, 15 & 16	
27	DIGITAL DATA OUT - S.S.C. (E2) WORDS 14, 15 & 16	
28	ANALOG (EGG TEMPERATURE) S.S.C. (E2) WORD 13	
29	ANALOG (D7 COUNT RATE) S.S.C. (E2) WORD 12	
30	ANALOG (ELECT. TEMPERATURE) - S.S.C. (E1) WORD 10	
31	RETURN FOR 30	
32	BILEVEL (CALIB. STATUS) S.S.C. (E1) WORD 8, BIT 5	
33	BILEVEL (CALIB. STATUS) S.S.C. (E1) WORD 8, BIT 6	
34	BILEVEL (GSE STATUS) S.S.C. (E2) WORD 24, BIT 4	
35	CMND - PRIORITY MODE CONTROL	
36	CMND - CALIBRATE	
37	CMND - LOGIC RESET	

NOTE: PINS 30 AND 31 ARE GFE THERMISTOR OUTPUTS TO BE POWERED AND CONDITIONED BY SPACECRAFT.

PIN NO. 1 SHALL BE TIED TO GROUND ON THE SPACECRAFT SIDE OF THE INTERFACE CONNECTOR. 11

REPRODUCED FROM

TITLE

PIN ASSIGNMENTS
CONNECTOR 0852-J1

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.04

FIG. 3.2.4.1

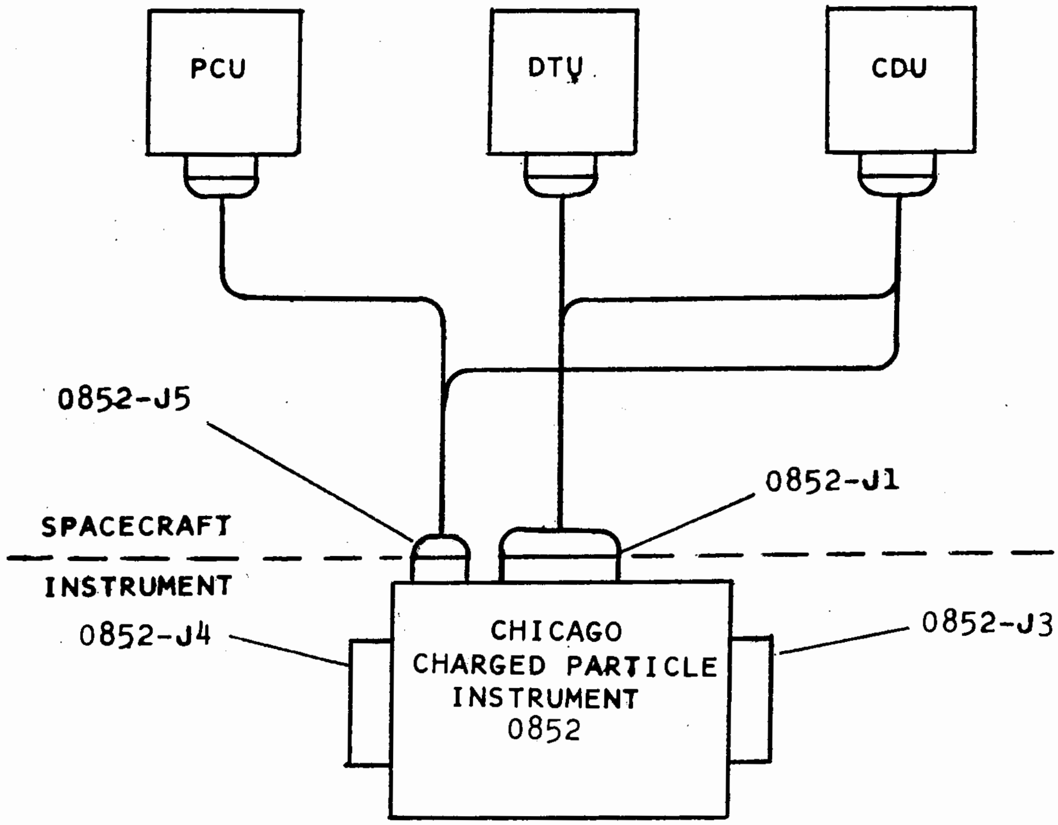
REV. NO. 11 | DATE 5-22-70 | SHEET 1 OF 2

PIN NO.	FUNCTION	
1	+28 VDC POWER	
2	POWER RETURN	
3	CMND - POWER ON/OFF	
4	CHASSIS GROUND	11
5	CHASSIS GROUND	11
6	+28 VDC POWER	
7	POWER RETURN	
8	CHASSIS GROUND	11
9	CHASSIS GROUND	11

NOTE:

1. Pins 1 and 6 of harness connector 0852-P5 shall be wired in parallel.
2. Pins 2 and 7 of harness connector 0852-P5 shall be wired in parallel.
3. Redundant lines to PCU are not required.

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	PIN ASSIGNMENTS CONNECTOR 0852-J5	DOC. NO. PC-220.04
		FIG. 3.2.4.1
	REV. NO. 11 / DATE 5-22-70	SHEET 2 OF 2

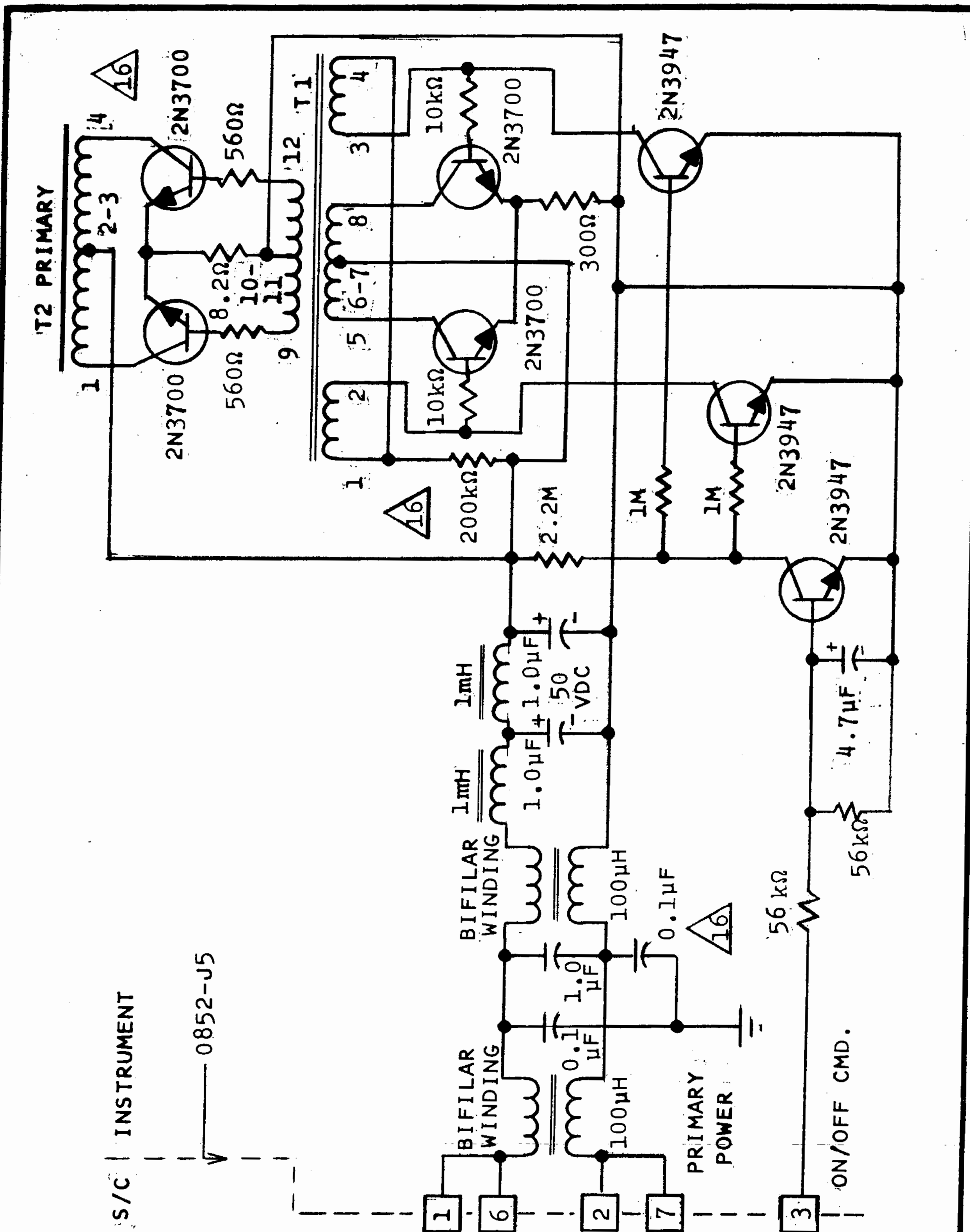


CONNECTOR	FUNCTION	TYPE
0852-J1	INTERFACE	DCM-37 P-NMC A106
0852-J2	NOT USED	----
0852-J3	TEST	DCM-8W8S
0852-J4	TEST	DCM-13W6S
0852-J5	POWER	DEM-9P-NMC-A106

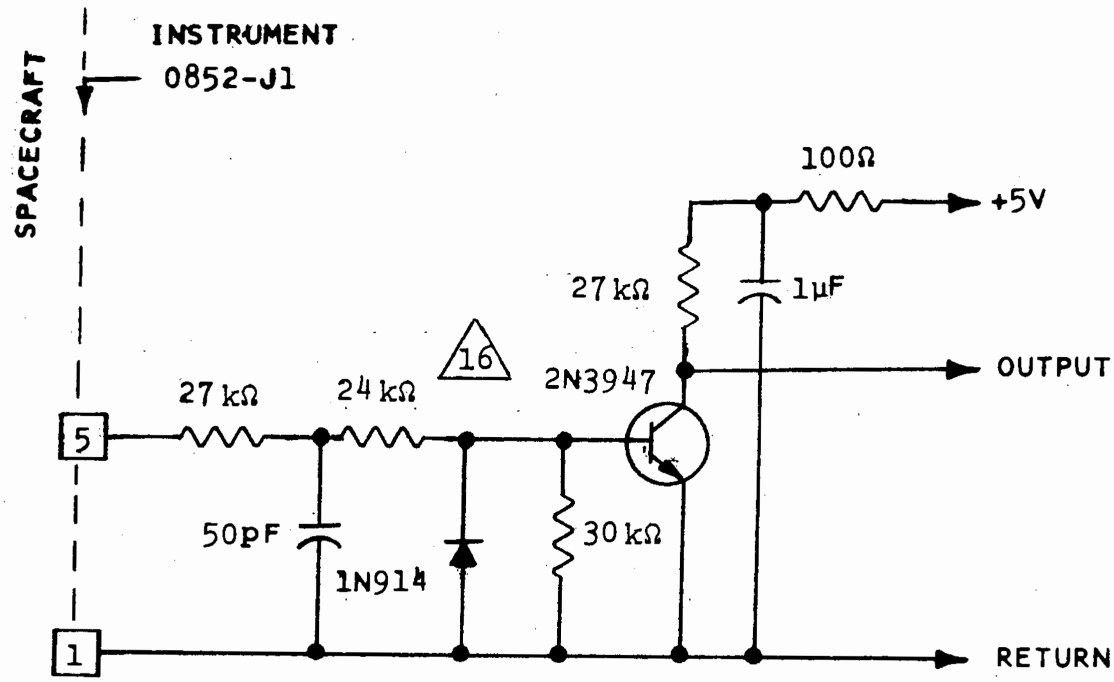
9

NOTE: ALL CONNECTORS ARE CANNON GOLDEN "D" MARK I UNLESS OTHERWISE SPECIFIED.

REPRODUCED FROM	TITLE	PIONEER PROGRAM
	CONNECTOR I.D. CHICAGO CHARGED PARTICLE INSTRUMENT	NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.04
		FIG. 3.2.4.2
	REV. NO. 9 DATE 4-24-70	SHEET 1 OF 1



REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	**PIONEER PROGRAM** **NASA** AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.04
		FIG. 3.2.5
	REV. NO. 16 DATE 4-30-71	SHEET 1 OF 6



SECTOR GENERATOR (8 SECTORS)

6 WORD GATE -MAIN FRAME (Ca) - SAME AS PIN 5

7 WORD GATE - S.S.C. (E2) WORD 6 (Cf) - SAME AS PIN 5

20 BIT SHIFT PULSE ———— SAME AS PIN 5

21 RATE PULSE - MAIN FRAME ——— SAME AS PIN 5

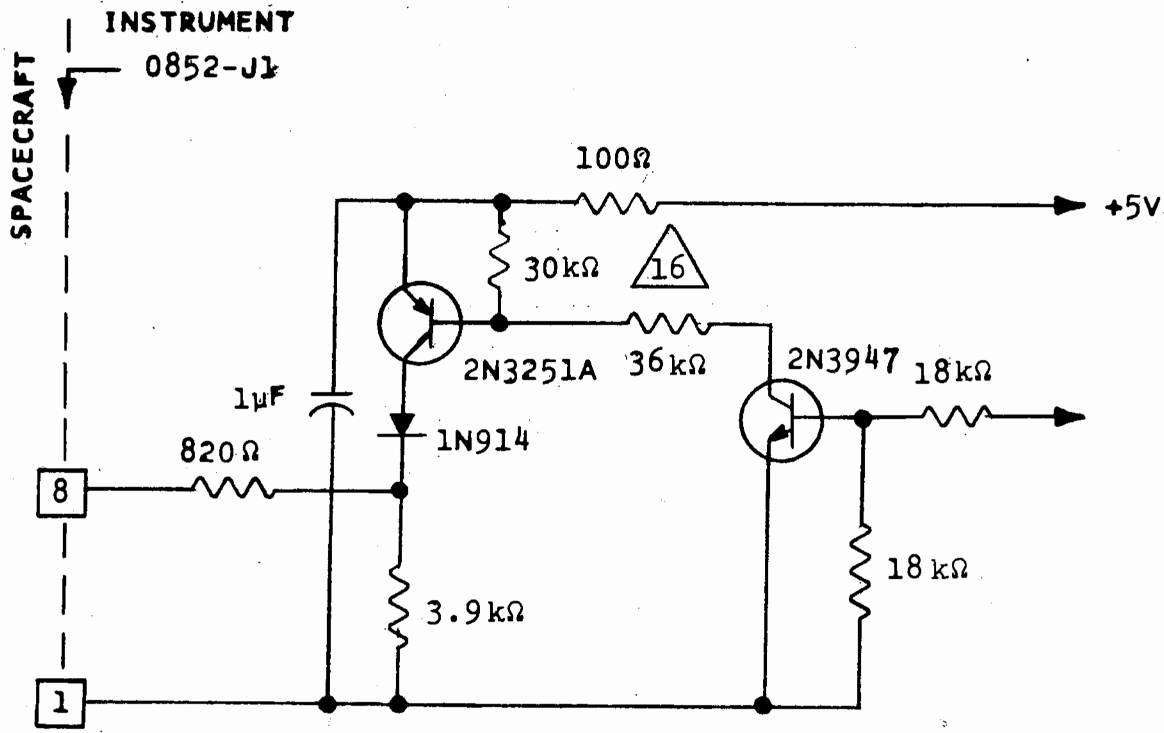
22 RATE PULSE - SCIENCE SUBCOM - SAME AS PIN 5

23 ROLL INDEX PULSE - SAME AS PIN 5

24 WORD GATE - S.S.C. (E1) WORDS 14, 15 AND 16 (Ce) - SAME AS PIN 5

25 WORD GATE - S.S.C. (E2) WORDS 14, 15, AND 16 (Cg) - SAME AS PIN 5

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	DOC. NO. PC-220.04
		FIG. 3.2.5
	REV. NO. 16 / DATE 4-30-71	SHEET 2 OF 6



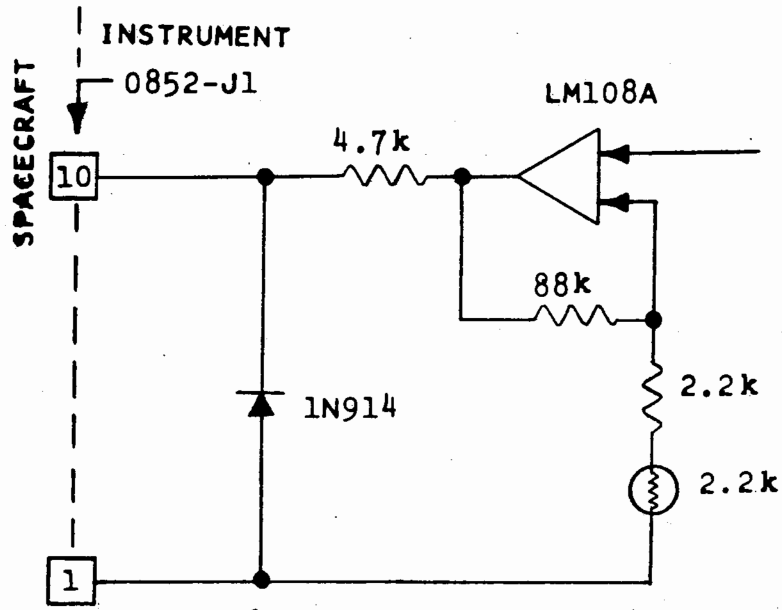
DIGITAL DATA OUT - MAIN FRAME

9 DIGITAL DATA OUT - S.S.C. (E2) WORD 6 - SAME AS PIN 8

26 DIGITAL DATA OUT - S.S.C. (E1) WORDS 14, 15, AND 16 - SAME AS PIN 8

27 DIGITAL DATA OUT - S.S.C. (E2) WORDS 14, 15, AND 16 - SAME AS PIN 8

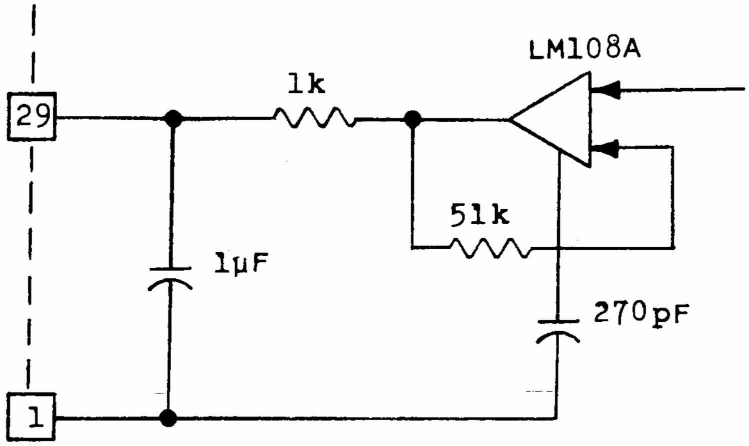
REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.04
		FIG. 3.2.5
	REV. NO. 16 DATE 4-30-71	SHEET 3 OF 6



ANALOG (EGG CURRENT RANGE 1) S.S.C. (E1) WORD 11

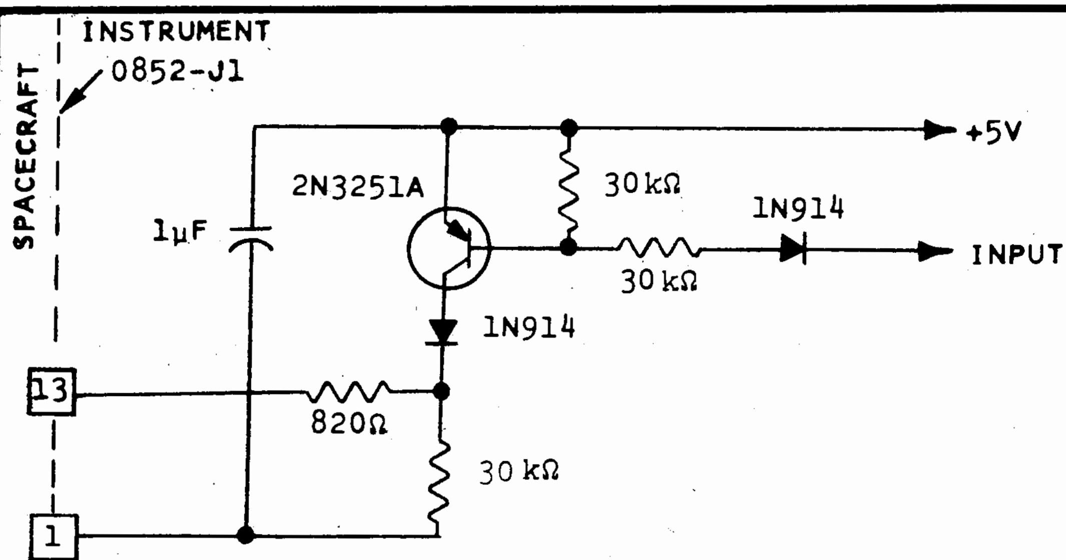
11 ANALOG (EGG CURRENT RANGE 2) S.S.C. (E1) WORD 12 - SAME AS PIN 10

12 ANALOG (EGG CURRENT RANGE 3) S.S.C. (E1) WORD 13 - SAME AS PIN 10



ANALOG (D7 COUNT RATE) S.S.C. (E2) WORD 12

REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO: PC-220.04
		FIG. 3.2.5
	REV. NO. 14 | DATE 10-31-70	SHEET 4 OF 6



BILEVEL (DET. D1 STATUS) S.S.C. (E1) WORD 8, BIT 1

14 BILEVEL (DET. D2 STATUS) S.S.C. (E1) WORD 8, BIT 2 - SAME AS PIN 13

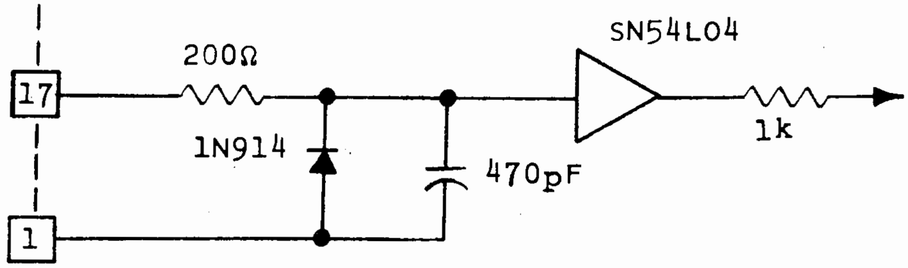
15 BILEVEL (DET. D7 STATUS) S.S.C. (E1) WORD 8, BIT 3 - SAME AS PIN 13

16 BILEVEL (PRIORITY STATUS) S.S.C. (E1) WORD 8, BIT 4 - SAME AS PIN 13

32 BILEVEL (CALIBRATION STATUS) S.S.C. (E1) WORD 8, BIT 5 - SAME AS PIN 13

33 BILEVEL (CALIBRATION STATUS) S.S.C. (E1) WORD 8, BIT 6 - SAME AS PIN 13

34 BILEVEL (GSE STIMULUS STATUS) S.S.C. (E2) WORD 24, BIT 4 - SAME AS PIN 13

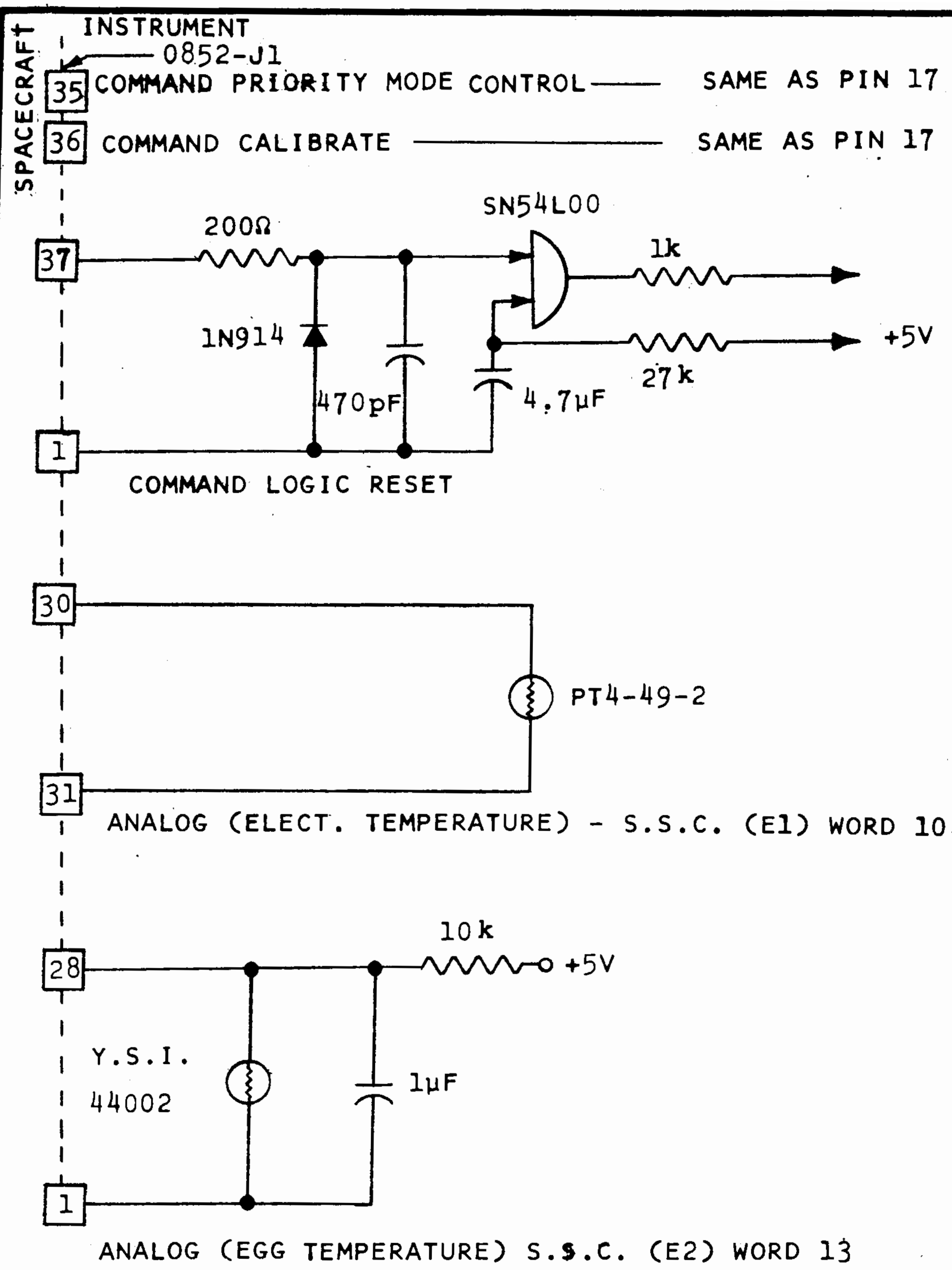


COMMAND DISABLE DETECTOR D1

18 COMMAND DISABLE DETECTOR D7 - SAME AS PIN 17

19 COMMAND DISABLE DETECTOR D2 - SAME AS PIN 17 16

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	DOC. NO. PC-220.04
		FIG. 3.2.5
	REV. NO. 16 — DATE 4-30-71	SHEET 5 OF 6



REPRODUCED FROM

TITLE
INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.04
FIG. 3.2.5
REV. NO. 14
DATE 10-31-70
SHEET 6 OF 6

To Be Supplied

REPRODUCED FROM	TITLE INSTRUMENT/GSE INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.04
		FIG. 3.2.6
	REV. NO. / DATE	SHEET 1 OF 1

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD. CALIFORNIA
	BLOCK DIAGRAM CHICAGO CHARGED PARTICLE INSTRUMENT	DOC. NO. PC-220.04
		FIG. 3.2.7
	REV. NO. / DATE	SHEET 1 OF 1

U/IOWA GEIGER TUBE TELESCOPE

PC-220.05

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California

PIONEER PROGRAM

SPECIFICATION PC-220.05

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

U/IOWA GEIGER TUBE TELESCOPE

October 20, 1969

1. SCOPE

Specification PC-220.05 defines the characteristics and requirements of the Geiger Tube Telescope instrument pertinent to the Pioneer spacecraft.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATIONS

PC-213.00, Scientific Instruments and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATION

PC-220.00, Spacecraft/Scientific-Instrument Interface Specification

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Configuration. The dimensions, configuration and connector locations for the instrument will be as specified in Figure 3.1.1.

Revision

3.1.2 Mass Properties.

3.1.2.1 Weight (Present) (13)

Electronics	2.6 lb
Shielding	1.0 lb
	3.6 lb

3.1.2.2 Center of Gravity. The center of gravity notation of the instrument will be as indicated in Figure 3.1.1. The c.g. locations will be as follows: (14)

a = .93 b = 3.48 c = 2.24

3.1.2.3 Moments of Inertia. The moments of inertia of the instrument about the center of gravity of the units will be as follows:

Moments of Inertia (in-lb-sec^2)

I_a = TBS I_b = TBS I_c = TBS

3.1.3 Mounting. The instrument mounting faces and methods will be as indicated in Figure 3.1.1.

3.1.4 Sensor Orientation. The instrument shall be positioned on the spacecraft such that the viewing requirements of section 3.1.5 are satisfied. A GFE alignment fixture will be provided which will define the direction of the centerline of the main telescope to $\pm$ 2°. The azimuthal angle between the roll index pulse fixed reference line and the main telescope centerline as defined by the alignment fixture shall be known to $\pm$ 30 minutes. (16)

3.1.5 Viewing. The Geiger Tube Telescope (GTT) 30° x 60° FOV and low energy detector 45° conical FOV may be intruded by the magnetometer boom and sensor. (10)

3.2 ELECTRICAL

3.2.1 Power Load (Present)

Standby	TBS
Average	0.8W
Peak	0.8W

3.2.2 Duty Cycle. The power requirements for this instrument are on a continuous basis during normal operating mode.

3.2.3 Converter Frequency. The converter frequency will be as indicated in Figure 3.5.1.1 of PC-220.00.

3.2.4 Connectors.

3.2.4.1 Connector Pin Assignments. Pins on the connectors for this instrument will be wired in accordance with Figure 3.2.4.1.

3.2.4.2 Connector Identification. Each connector attached to the instrument will be identified with a number in accordance with Figure 3.2.4.2.

3.2.5 Instrument Interface Circuits. Figure 3.2.5, shows the instrument input/output circuits which interface with the spacecraft/instrument interface timing, power, command, and data lines.

3.2.6 Instrument/GSE Interface Circuits. Figure 3.2.6 shows the GSE input/output circuits which interface with the instrument thru the instrument stimulus/test connector.

3.2.7 Block Diagram. Figure 3.2.7 is a typical block diagram of the Geiger Tube Telescope Instrument.

3.3 DATA HANDLING AND INSTRUMENT CONTROL (1)

3.3.1 Signals from the Instrument. The scientific instrument will provide the following signals: (4)

Main Frame (Formats A & B)	1 Line
Science Subcom:	
Analog	1 Line
Bilevel	1 Line
Spacecraft Temperature Sensor	2 Lines

3.3.2 Signals to the instrument. The scientific instrument will be provided with the following signals:

3.3.2.1 Power. 2 Lines

3.3.2.2 Commands.

Power ON/OFF	1 Line
Functional	1 Line

3.3.2.3 Timing and Control.

Bit shift pulse	1 Line
Word gate (main frame)	1 Line

3.3.3 Telemetry Word Assignments. Telemetry word assignments are specified in PC-220.01, sections 3.3.1.4.1 thru 3.3.1.4.5.

3.3.4 Instrument Words. Arrangements of instrument words within the telemetry word assignments for this instrument are as shown in Figure 3.3.4.

3.4 THERMAL (1)

3.4.1 Operating Limits. This instrument will be capable of operating over the following temperature range: (15)

Platform-mounted unit: -20°F to +120°F

3.4.2 Thermal Load, Platform-Mounted Unit. The platform-mounted unit of this instrument shall be exposed to the thermal environment exterior to the spacecraft while in space flight. The average thermal load supplied to the spacecraft by electrical power dissipation within the platform-mounted unit will be TBS watts.

Revision

3.4.3 Surface Thermal Properties.

3.4.3.1 Mounting Surfaces. The mounting surfaces of the instrument will be treated in accordance with PC-213.03, section 3.2.6.8.1.

3.4.3.2 Nonmounting Surfaces. The non-mounting surfaces of the instrument viewing the inside of the spacecraft will be treated in accordance with PC-213.03, section 3.2.6.8.6.

3.4.4 Mounting Surface Area. The thermal conducting area of the instrument units contiguous with the spacecraft mounting surfaces will be as follows:

(a) Platform-Mounted Unit: 25 square inches

3.5 COMPATIBILITY (1)

3.5.1 Electromagnetic - Special Requirements & Characteristics. This instrument is sensitive to the frequencies indicated in Figure 3.5.1.1, Pioneer Specification PC-220.00.

3.5.2 Radioactive Sources.

3.5.2.1 Internal Sources (On-Board). None.

3.5.2.2 External Sources (Test). Cobalt 60 - 100 microcurie. (13)

3.6 MISCELLANEOUS REQUIREMENTS & CHARACTERISTICS

3.6.1 Spin Rate. The preferred spin rate of the spacecraft for operation of this instrument is 4 rpm. The instrument will operate satisfactorily for spacecraft spin rates between 2 and 5 rpm.

4. PERFORMANCE ASSURANCE PROVISIONS

Not applicable.

5. PREPARATION FOR DELIVERY, HANDLING, SHIPPING & STORAGE (1)

5.1 HANDLING

5.1.1 General. The scientific instruments shall at all times be handled in a manner which will minimize the possibility of damage to the instrument. Grasping of the instrument by other than the base section shall not be permitted.

5.1.2 Protective Covers. This instrument employs a protective cover with the sensor. These covers shall remain in position during all systems tests except physical properties measurements, vibration, thermal vacuum, and other tests as directed by the NASA/ARC Experiment Test Engineer. The experiment test connector shall be covered with MISTIK type 7000 fiberglass or equivalent approved noneonductive tape just prior to launch. During test operations and storage, all exposed connectors shall be protected with dust covers. (13)

5.2 SHIPPING

Except when mounted on the spacecraft, this scientific instrument shall be transported only in its custom carrying case. Movement of the instrument to and from TRW will be the responsibility of NASA/ARC.

5.3 STORAGE

Whenever the instrument is not mounted on the spacecraft platform, or not in use for bench tests, it shall be stored in the protective carrying case furnished by the experimenter and placed in the bonded stores area of TRW. The carrying case will contain suitable chemical desiccant, the condition of which will be monitored periodically during protracted storage periods, by the cognizant NASA test engineer.

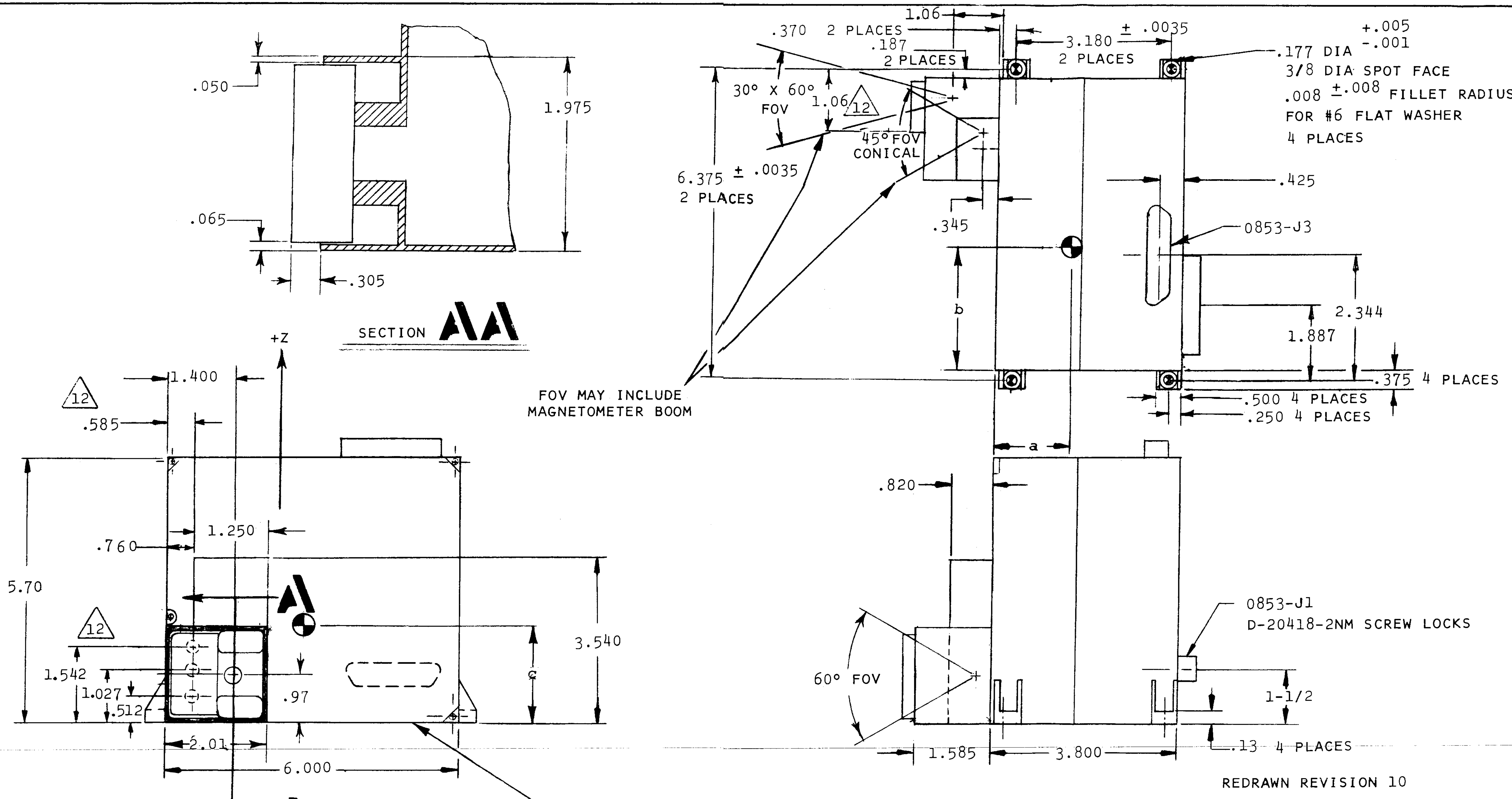
6. NOTES

6.1 DEFINITIONS

See section 6.1 of Specification PC-220.00.

6.2 ABBREVIATIONS

See section 6.2 of Specification PC-220.00.



SEE SECTION 3.1.4 FOR LATERAL AXES ORIENTATION REQUIREMENTS

REDRAWN REVISION 10

TITLE MECHANICAL INTERFACE IOWA GEIGER TUBE TELESCOPE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.05
	FIG. 3.1.1
REV. NO. 12 / DATE 6-26-70	SHEET 1 OF 1

PIN NO.	FUNCTION
1	+28 VDC POWER
2	POWER RETURN
3	CMND - POWER ON/OFF
4	SPARE
5	CMND - REDUNDANT LOGIC SELECT
6	SPARE
7	BILEVEL (LOGIC "A"/LOGIC "B") SCI. SUBCOM (E1), WORD 24, BIT 1
8	ANALOG (7.75 VDC MONITOR) SCIENCE SUBCOM (E2), WORD 20
9	ANALOG (ELECT. TEMP) SCIENCE SUBCOM (E2), WORD 21
10	RETURN FOR 9
11	SPARE
12	BIT SHIFT PULSE
13	WORD GATE - MAIN FRAME (Da)
14	SPARE
15	DIGITAL DATA OUT - MAIN FRAME

5

REPRODUCED FROM

TITLE

PIN ASSIGNMENTS
CONNECTOR 0853-J1
(INTERFACE)

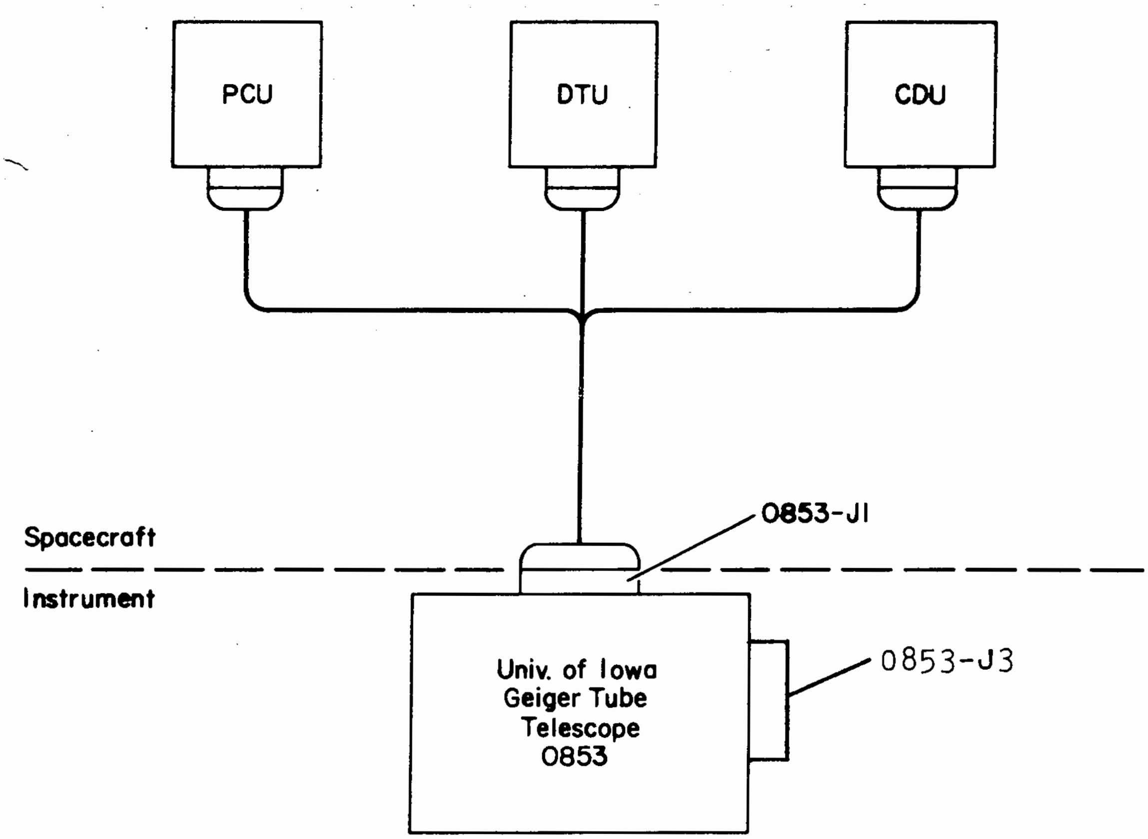
PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.05

FIG. 3.2.4.1

REV. NO. 5 | DATE 3-20-70

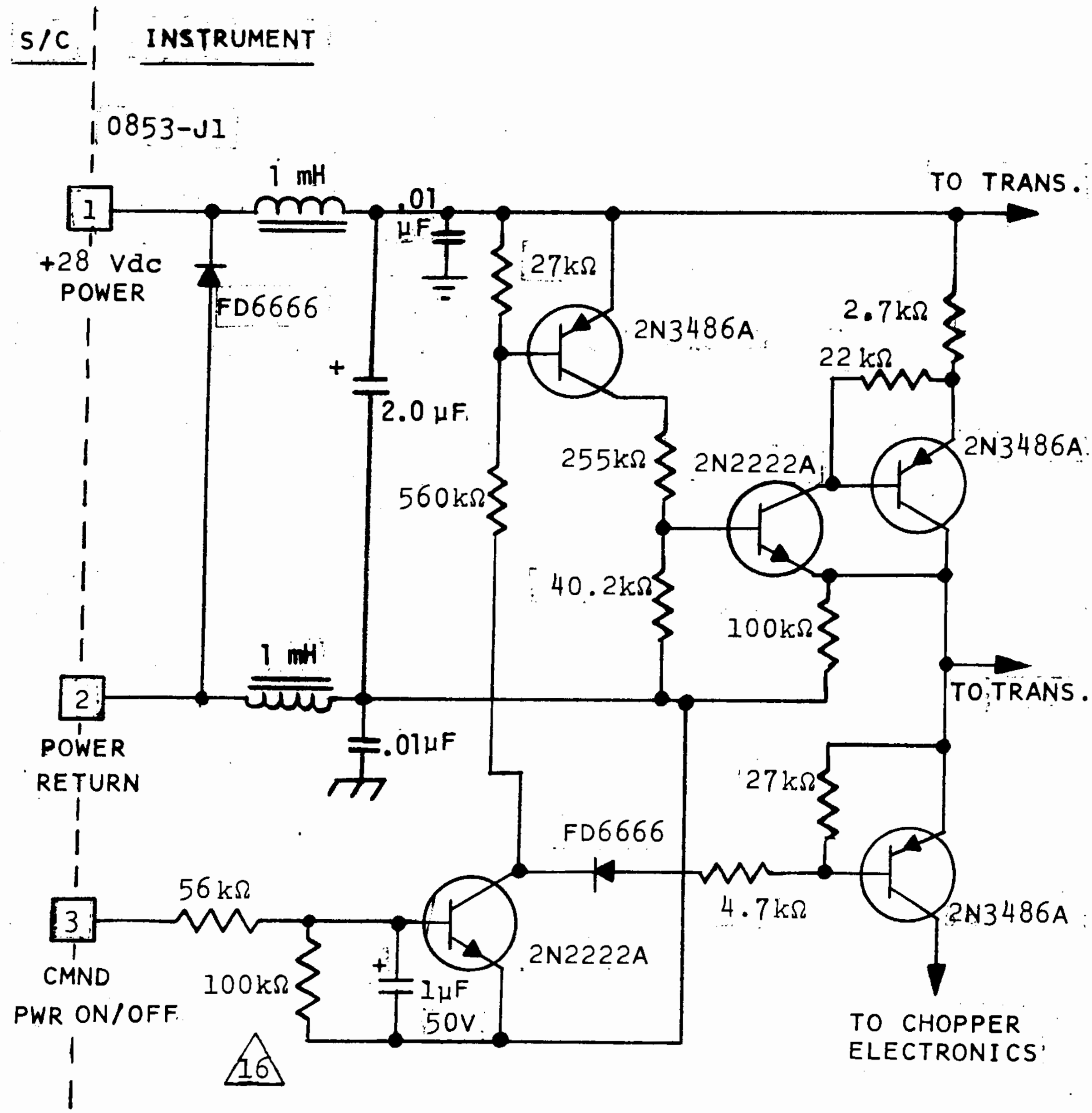
SHEET 1 OF 1



CONNECTOR	FUNCTION	TYPE
0853-J1	INTERFACE	DAM-15P
0853-J2	NOT USED	---
0853-J3	TEST	DAM-15S

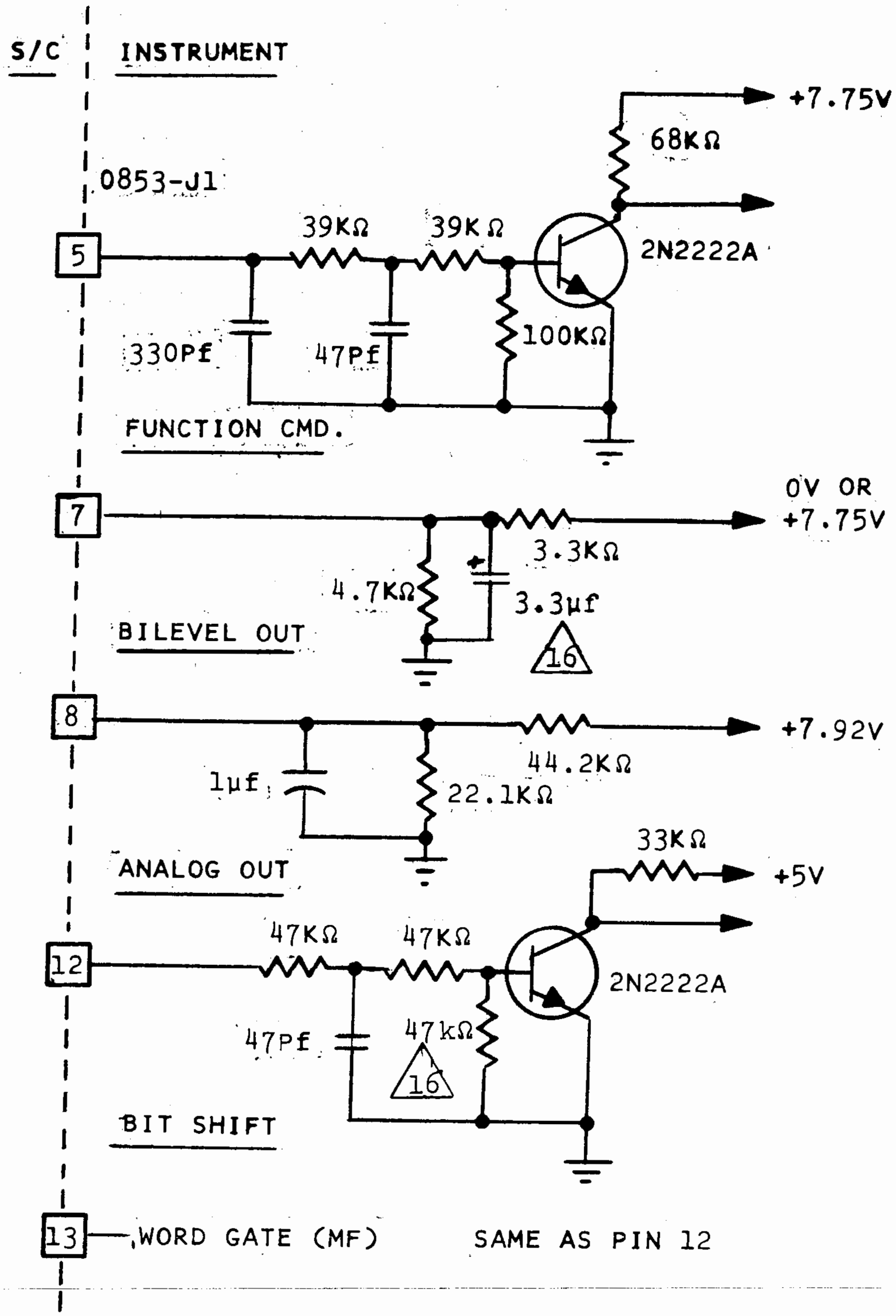
NOTE: ALL CONNECTORS ARE CANNON GOLDEN D MARK I
UNLESS OTHERWISE SPECIFIED.

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CONNECTOR I. D. UNIVERSITY OF IOWA GEIGER TUBE TELESCOPE	DOC. NO. PC-220.05 FIG. 3.2.4.2
	REV. NO. 4 — DATE 3-6-70	SHEET 1 OF 1

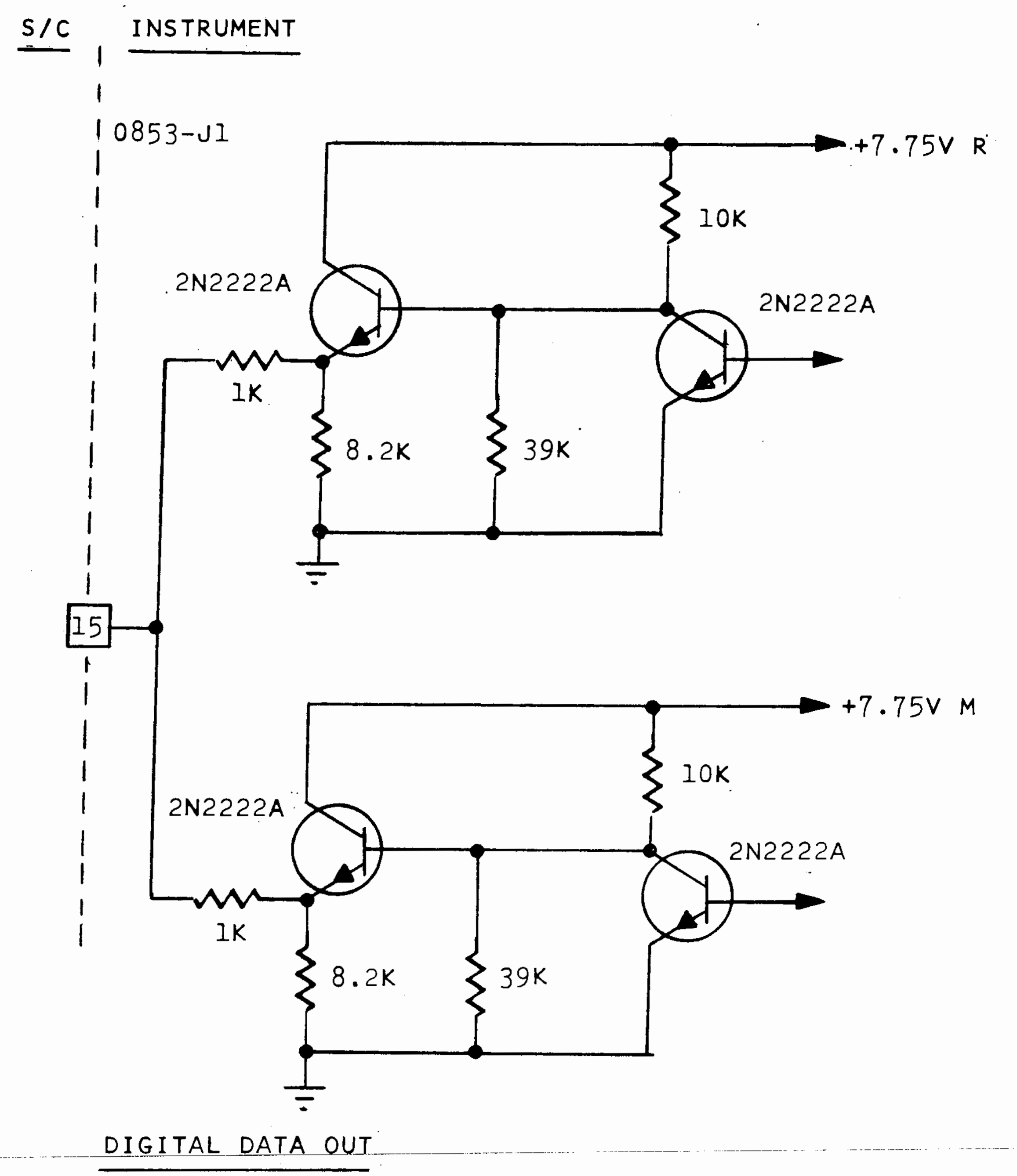


PRIMARY POWER

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	DOC. NO. PC-220.05
		FIG. 3.2.5
	REV. NO. 16 — DATE 4-30-71	SHEET 1 OF 3



REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	DOC. NO. PC-220.05
		FIG. 3.2.5
	REV. NO. 16 — DATE 4-30-71	SHEET 2 OF 3



REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	DOC. NO. PC-220.05
		FIG. 3.2.5
	REV. NO. 12	DATE 6-26-70	SHEET 3 OF 3

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/GSE INTERFACE CIRCUITS	DOC. NO. PC-220.05
		FIG. 3.2.6
	REV. NO. / DATE	SHEET 1 OF 1

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	BLOCK DIAGRAM U/IOWA GEIGER TUBE TELESCOPE	DOC. NO. PC-220.05
		FIG. 3.2.7
	REV. NO. / DATE	SHEET 1 OF 1

GSFC/COSMIC RAY TELESCOPE

PC-220.06

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California

PIONEER PROGRAM

SPECIFICATION PC-220.06

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

GSFC/COSMIC RAY TELESCOPE
October 20, 1969

1. SCOPE

Specification PC-220.06 defines the characteristics and requirements of the GSFC/Cosmic Ray Telescope pertinent to the Pioneer spacecraft.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATIONS

PC-213.00, Scientific Instruments and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATION

PC-220.00, Spacecraft/Scientific-Instrument Interface Specification

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Configuration. The dimensions, configuration and connector locations for the instrument will be as specified in Figure 3.1.1.

3.1.2 Mass Properties.

3.1.2.1 Weight (Present) (15)

Electronics		4.4 lb
Shielding		2.6 lb
	Total	7.0 lb

Revision

3.1.2.2 Center of Gravity. The center of gravity notation will be as indicated in Figure 3.1.1. The c.g. locations will be as follows: (5)

$a = 3.3 \qquad b = 1.5 \qquad c = 1.7$

3.1.2.3 Moments of Inertia. The moments of inertia of the instrument about the center of gravity of the units will be as follows:

Moments of Inertia (in-lb-sec^2)

I_a = TBS $\qquad$ I_b = TBS $\qquad$ I_c = TBS

3.1.3 Mounting. The instrument mounting faces and methods will be as indicated in Figure 3.1.1.

3.1.4 Sensor Orientation. The instrument shall be positioned on the spacecraft such that the viewing requirements of Section 3.1.5 are satisfied. A GFE alignment fixture which defines the direction of the LET II Telescope centerline to $\pm$ 15 minutes will be affixed to the front of the telescope. The centerline of the LET II Telescope so defined shall make an angle of 18° $\pm$2° in azimuth with respect to the spacecraft +X axis. The azimuthal angle between this centerline and the roll index pulse fixed reference line shall be known to $\pm$ 30 minutes. (16)

3.1.5 Viewing. The viewing requirements for each of the three telescopes are as follows: (4)

(a) HET: 40° solid view cone, both ends. Front view cone shall be clear of RTG and its support structure. Rear view cone shall be clear of high-gain antenna reflector. No openings are required in the thermal blanket.

(b) LET I: 50° solid view cone. Opening required in thermal blanket for telescope. No obstructions permitted in view cone.

(c) LET II: 30° solid view cone. Opening required in thermal blanket for telescope. No obstructions permitted in view cone.

3.2 ELECTRICAL

3.2.1 Power Load (Present) (11)

Standby	TBS
Steady State (Normal)	2.8W
Steady State (Low Power)	2.4W

Revision

3.2.2 Duty Cycle. The power requirements for this instrument are on a continuous basis during normal operating mode.

3.2.3 Converter Frequency. The converter frequency will be as indicated in Figure 3.5.1.1 of PC-220.00.

3.2.4 Connectors.

3.2.4.1 Connector Pin Assignments. Pins on the connectors for this instrument will be wired in accordance with Figure 3.2.4.1.

3.2.4.2 Connector Identification. Each connector attached to the instrument will be identified with a number in accordance with Figure 3.2.4.2.

3.2.5 Instrument Interface Circuits. Figure 3.2.5 shows the instrument input/output circuits which interface with the spacecraft/instrument interface timing, command and data lines.

3.2.6 Instrument/GSE Interface Circuits. Figure 3.2.6 shows the GSE input/output circuits which interface with the instrument thru the instrument stimulus/test connector.

3.2.7 Block Diagram. Figure 3.2.7 is a typical block diagram of the GSFC Cosmic Ray Telescope.

3.3 DATA HANDLING AND INSTRUMENT CONTROL (1)

3.3.1 Signals from the Instrument. The scientific instrument will provide the following signals:

Main frame (formats A & B)	1 Line
Science subcom	
Digital	1 Line
Analog	4 Lines
Bilevel	1 Line
Spacecraft Temperature Sensor	2 Lines

			Revision
3.3.2	Signals to the Instrument. The scientific instrument will be provided with the following signals.		
3.3.2.1	Power.	2 Lines	(8)
3.3.2.2	Commands.		
	a. Power ON/OFF	1 Line	(8)
	b. Functional	2 Lines	
3.3.2.3	Timing and Control.		(12)
	(a) Word gate-main frame (Formats A & B)	3 Lines	
	(b) Word gate science subcom	1 Line	
	(c) Roll index pulse	1 Line	
	(d) Sector generator (8 sectors)	1 Line	
	(e) Bit shift pulse	1 Line	
	(f) Bit rate I.D.	3 Lines	
	(g) Format A status	1 Line	
	(h) Format B status	1 Line	
	(i) Clock - 32.768 kHz	1 Line	

3.3.3 Telemetry Word Assignments. Telemetry word assignments are specified in PC-220.01, sections 3.3.1.4.1 thru 3.3.1.4.5.

3.3.4 Instrument Words. Arrangements of instrument words within the telemetry word assignments for this instrument are as shown in PC-260.05.

3.4 THERMAL (1)

3.4.1 Operating Limits. This instrument will be capable of operating over the following temperature range:

Platform-mounted unit: -20° to 104°F

3.4.2 Thermal Load Platform-Mounted Unit. The platform-mounted unit of this instrument shall be exposed to the thermal environment exterior to the spacecraft while in spaceflight. The average thermal load supplied to the spacecraft by electrical power dissipation within the platform-mounted unit will be TBS watts.

3.4.3 Surface Thermal Properties.

3.4.3.1 Mounting Surfaces. The mounting surfaces of the instrument will be treated in accordance with PC-213.03, section 3.2.6.8.1.

3.4.3.2 Nonmounting surfaces. The nonmounting surfaces of the instrument viewing the inside of the spacecraft will be treated in accordance with PC-213.03, section 3.2.6.8.6.

3.4.4 Mounting Surface Area. The thermal conducting area of the instrument units contiguous with the spacecraft mounting surfaces will be as follows:

Platform-mounted unit: 40 square inches.

3.5 COMPATIBILITY (1)

3.5.1 Electromagnetic-Special Requirements & Characteristics. This instrument is sensitive to the frequencies indicated in Figure 3.5.1.1, Pioneer Specification PC-220.00.

3.5.2 Radioactive Sources

3.5.2.1 Internal Sources (ON-Board). None.

3.5.2.2 External Sources (Test). To be supplied.

3.6 MISCELLANEOUS REQUIREMENTS & CHARACTERISTICS

3.6.1 Spin Rate. The preferred spin rate of the spacecraft for operation of this instrument is 4.9 rpm. The instrument will operate satisfactorily for spacecraft spin rates between 2 and 7 rpm. (1)

4. PERFORMANCE ASSURANCE PROVISIONS

Not Applicable.

Revision

5. PREPARATION FOR DELIVERY, HANDLING, SHIPPING & STORAGE (1)

5.1 HANDLING

5.1.1 General. The scientific instruments shall at all times be handled in a manner which will minimize the possibility of damage to the instrument. Grasping of the instrument by other than the base section shall not be permitted.

5.1.2 Protective Covers. This instrument employs a protective cover with the sensor. This cover shall remain in position during all systems tests except physical properties measurements, vibration, thermal vacuum, and other tests as directed by the NASA/ARC Experiment Test Engineer. The experiment test connector shall be covered with MISTIK type 7000 fiberglas or equivalent approved nonconductive tape just prior to launch. During test operations and storage, all exposed connectors shall be protected with dust covers.

5.2 SHIPPING

Except when mounted on the spacecraft, this scientific instrument shall be transported only in its custom carrying case. Movement of the instrument to and from TRW will be the responsibility of NASA/ARC.

5.3 STORAGE

Whenever the instrument is not mounted on the spacecraft platform or not in use for bench tests, it shall be stored in the protective carrying case furnished by the experimenter and placed in the bonded stores area of TRW. The carrying case will contain suitable chemical desiccant, the condition of which will be monitored periodically during protracted storage periods, by the cognizant NASA test engineer.

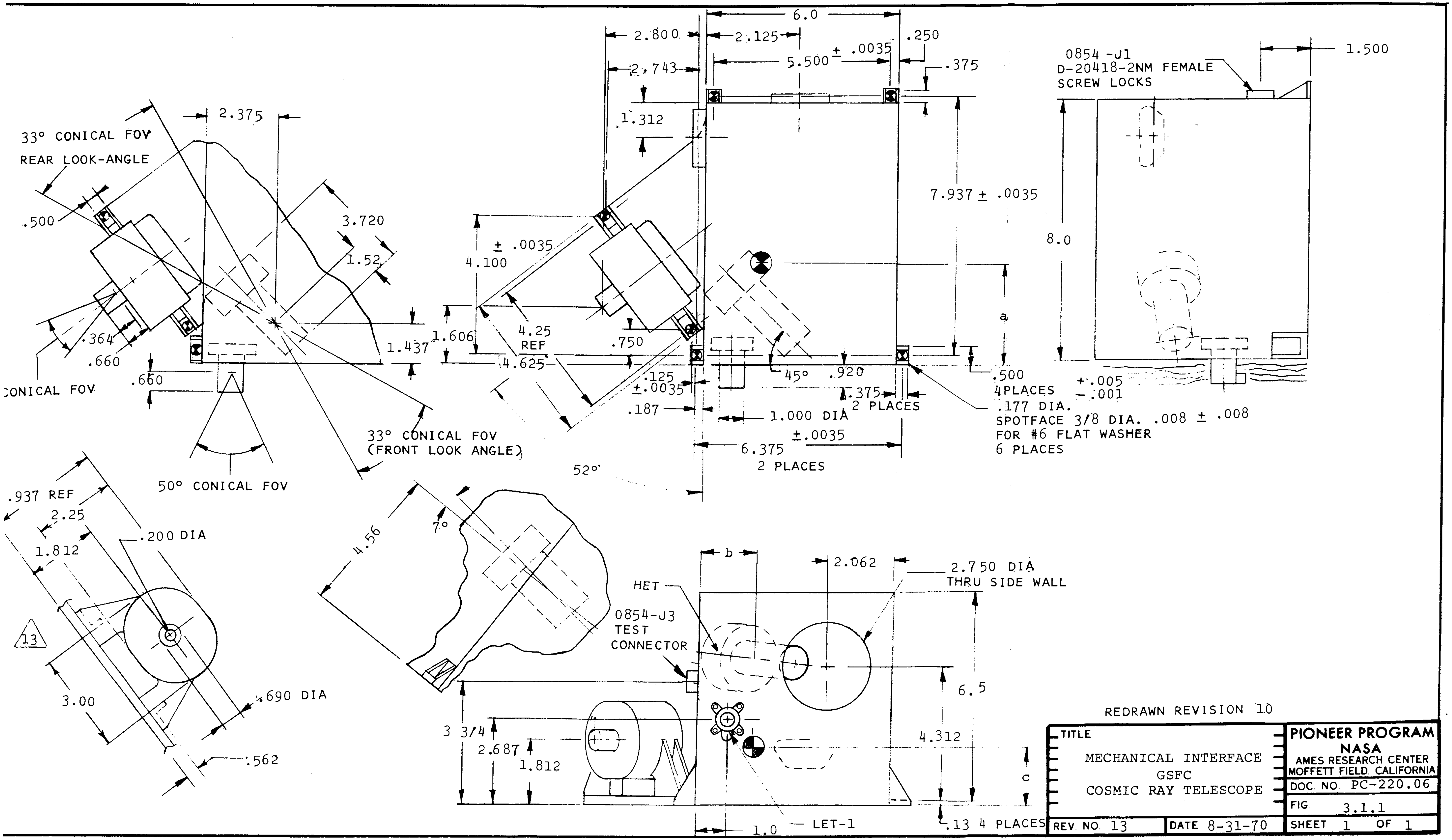
6. NOTES

6.1 DEFINITIONS

See Section 6.1 of Specification PC-220.00.

6.2 ABBREVIATIONS

See Section 6.2 of Specification PC-220.00.



REDRAWN REVISION 10

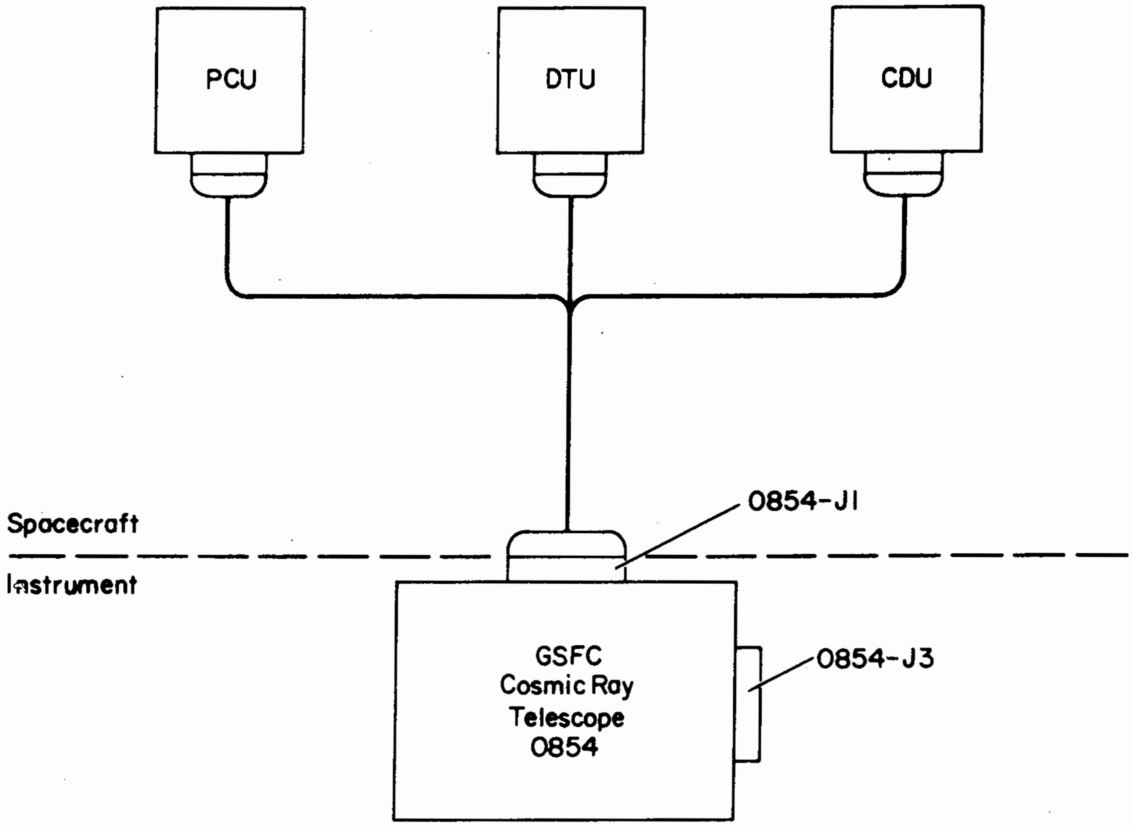
TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
MECHANICAL INTERFACE GSFC COSMIC RAY TELESCOPE	DOC. NO. PC-220.06
	FIG. 3.1.1
REV. NO. 13 DATE 8-31-70	SHEET 1 OF 1

PIN NO.	FUNCTION	
1	+28 VDC POWER	
2	POWER RETURN	
3	CMND - POWER ON/OFF	
4	SIGNAL RETURN	
5	32.768 kHz CLOCK	
6	SPARE	
7	CMND - CALIBRATE/NORMAL	13
8	CMND - MODE SELECT STEP	13
9	SPARE	
10	WORD GATE - MAIN FRAME (Ea)	
11	WORD GATE - MAIN FRAME (Eb)	
12	WORD GATE - MAIN FRAME (Ec)	
13	WORD GATE - SCIENCE SUBCOM (Ei)	
14	BIT SHIFT PULSE	
15	ROLL INDEX PULSE	
16	SECTOR GENERATOR (8 SECTORS)	
17	SPARE	
18	DIGITAL DATA OUT - MAIN FRAME	
19	DIGITAL DATA OUT - SCIENCE SUBCOM	
20	+28 VDC POWER	
21	POWER RETURN	
22	SPARE	
23	SPARE	
24	ANALOG (ELECT. TEMP.) SCIENCE SUBCOM (E1) WORD 25	
25	RETURN FOR 26	
26	ANALOG (DETECTOR TEMP) SCIENCE SUBCOM (E1) WORD 28	
27	ANALOG (D1 DATA) SCIENCE SUBCOM (E1) WORD 26	
28	ANALOG (D2 DATA) SCIENCE SUBCOM (E1) WORD 27	
29	ANALOG (SECONDARY VOLTAGE) SCIENCE SUBCOM (E1) WORD 29	
30	BILEVEL (CRT STATUS) SCIENCE SUBCOM (E1) WORD 24, BIT 2	
31	SPARE	
32	STATUS - BIT RATE I.D. LINE 1	
33	STATUS - BIT RATE I.D. LINE 2	
34	STATUS - BIT RATE I.D. LINE 3	
35	STATUS - FORMAT A	
36	STATUS - FORMAT B	
37	SPARE	

NOTES:

1. Pins 1 and 20 of harness connector 0854-P1 shall be wired in parallel.
2. Pins 2 and 21 of harness connector 0854-P2 shall be wired in parallel.
3. Redundant lines to PCU are not required.
4. Pin No. 4 shall be tied to ground on the spacecraft side of the interface connector.

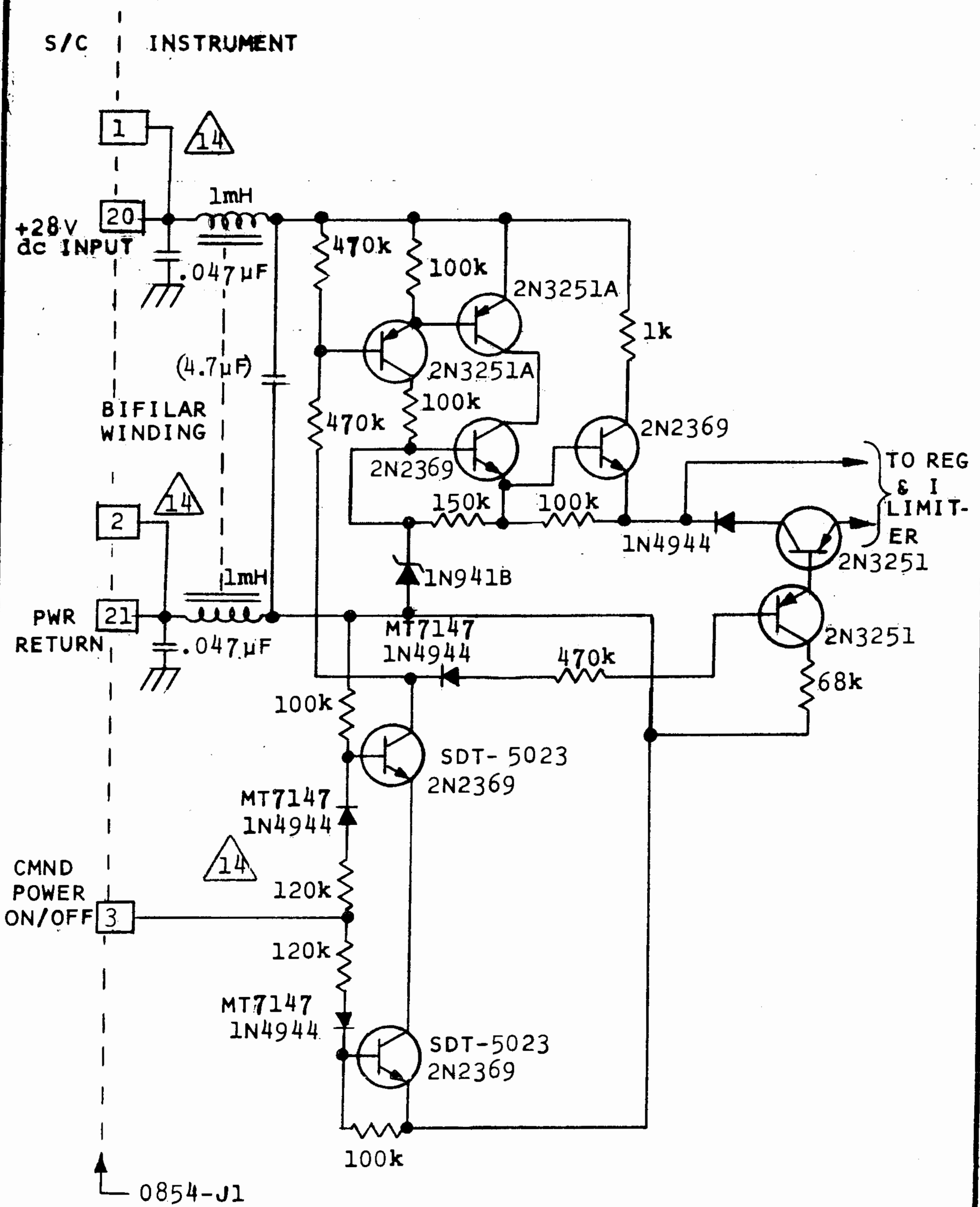
REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	PIN ASSIGNMENTS CONNECTOR 0854-J1	DOC. NO. PC-220.06
		FIG. 3.2.4.1
	REV. NO. 13 / DATE 8-31-70	SHEET 1 OF 1



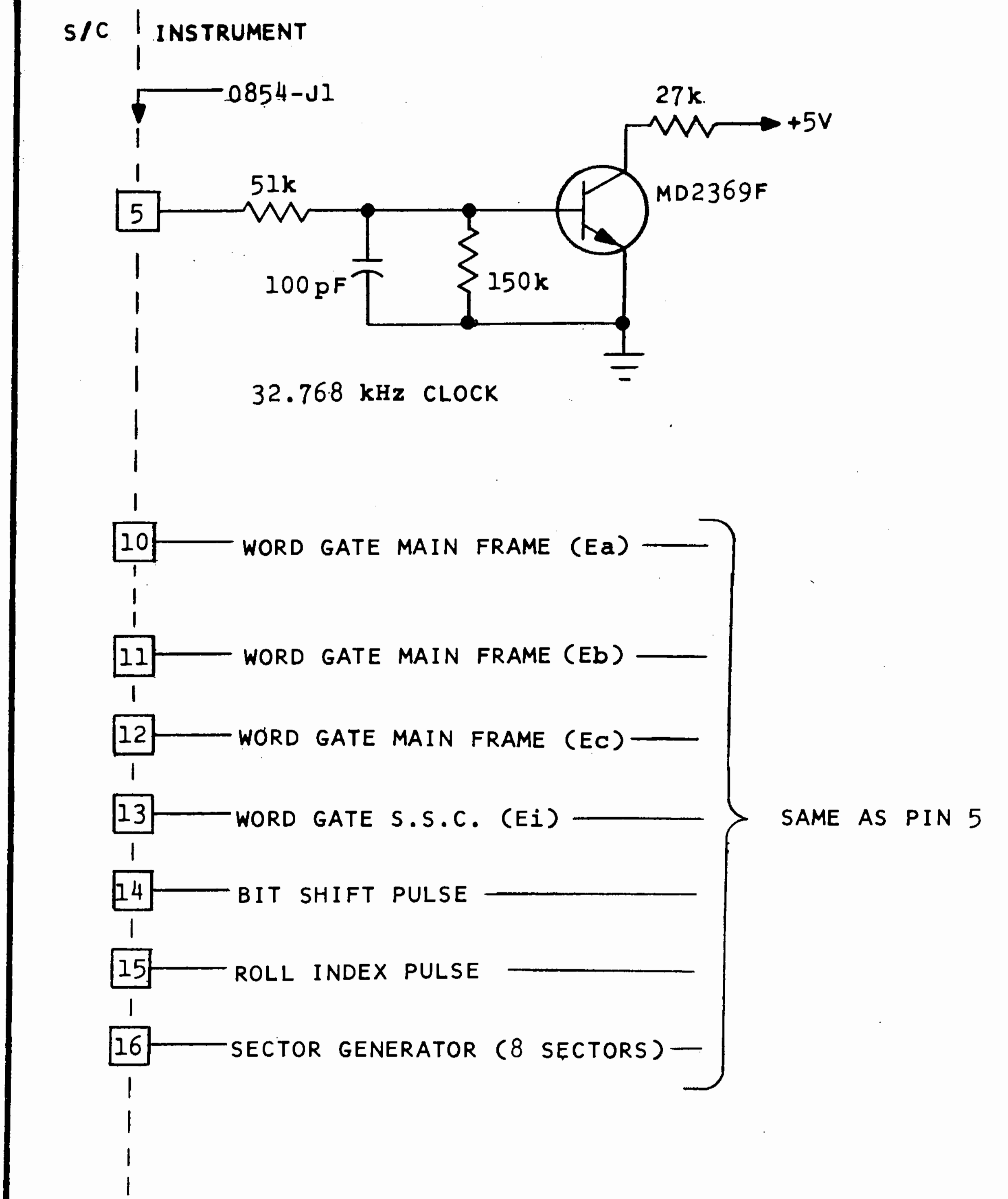
CONNECTOR	FUNCTION	TYPE
0854-J1	INTERFACE	DCM-37P
0854-J2	NOT USED	---
0854-J3	TEST	DAM-15S

NOTE: ALL CONNECTORS ARE CANNON GOLDEN D MARK I UNLESS OTHERWISE SPECIFIED.

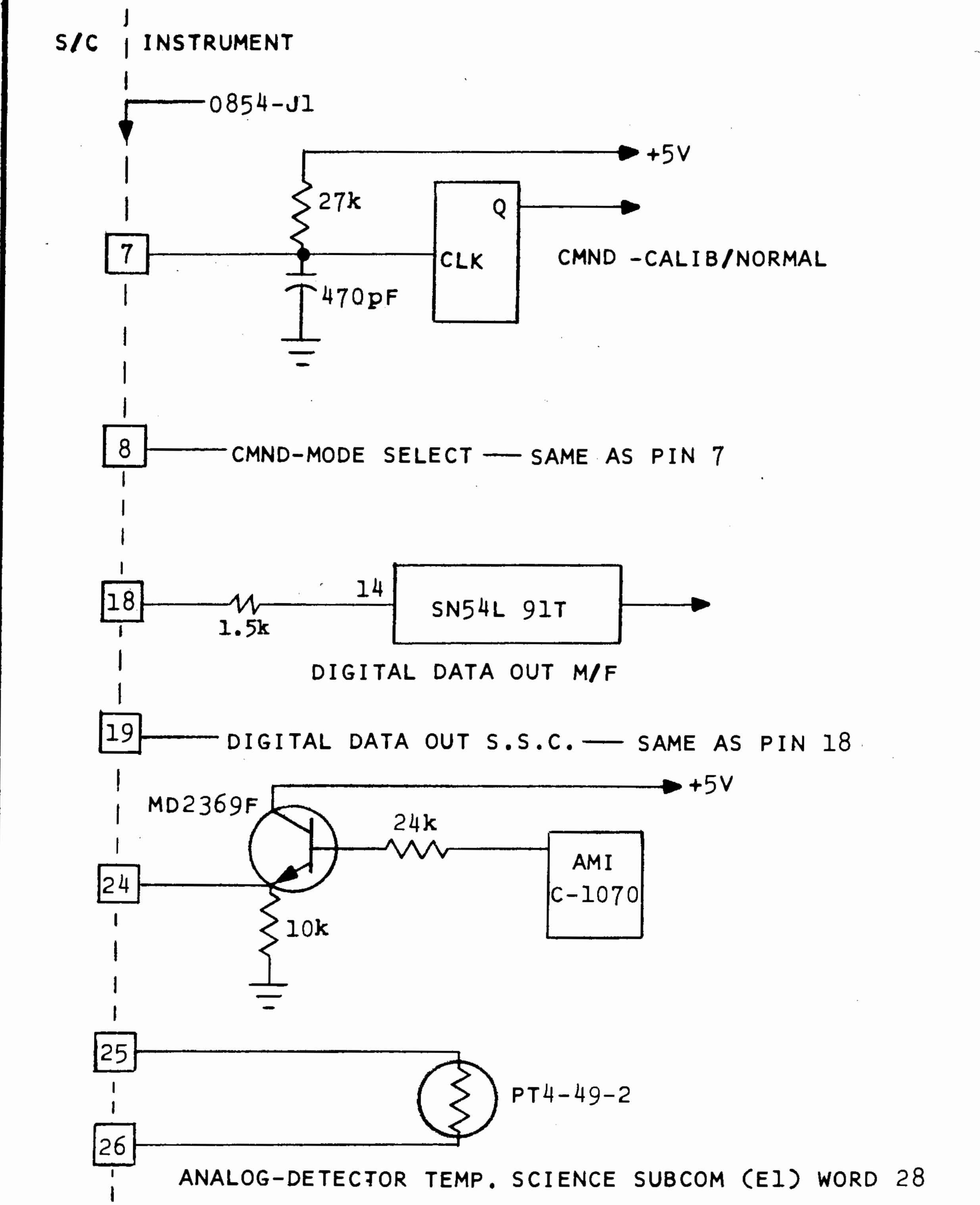
REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CONNECTOR I.D. GSFC COSMIC RAY TELESCOPE	DOC. NO. PC-220.06
		FIG. 3.2.4.2
	REV. NO. 4 DATE 3-6-70	SHEET 1 OF 1



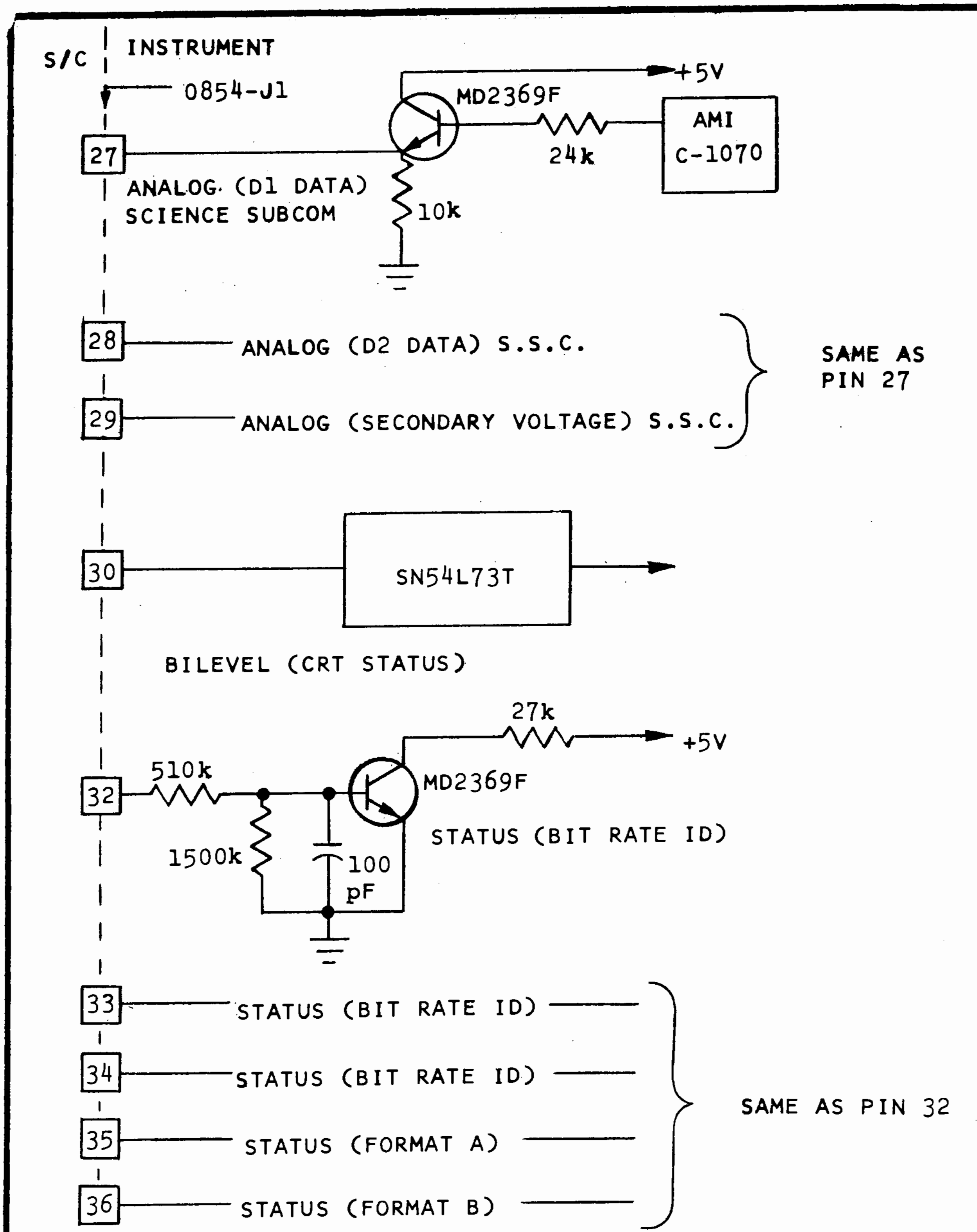
REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.06
		FIG. 3.2.5
	REV. NO. 14 — DATE 10-31-70	SHEET 1 OF 4



REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.06
		FIG. 3.2.5
	REV. NO. 14 DATE 10-31-70	SHEET 2 OF 4



REPRODUCED FROM	TITLE	PIONEER PROGRAM
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.06
		FIG. 3.2.5
	REV. NO. 14 — DATE 10-31-70	SHEET 3 OF 4



REPRODUCED FROM

TITLE

INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.06

FIG. 3.2.5

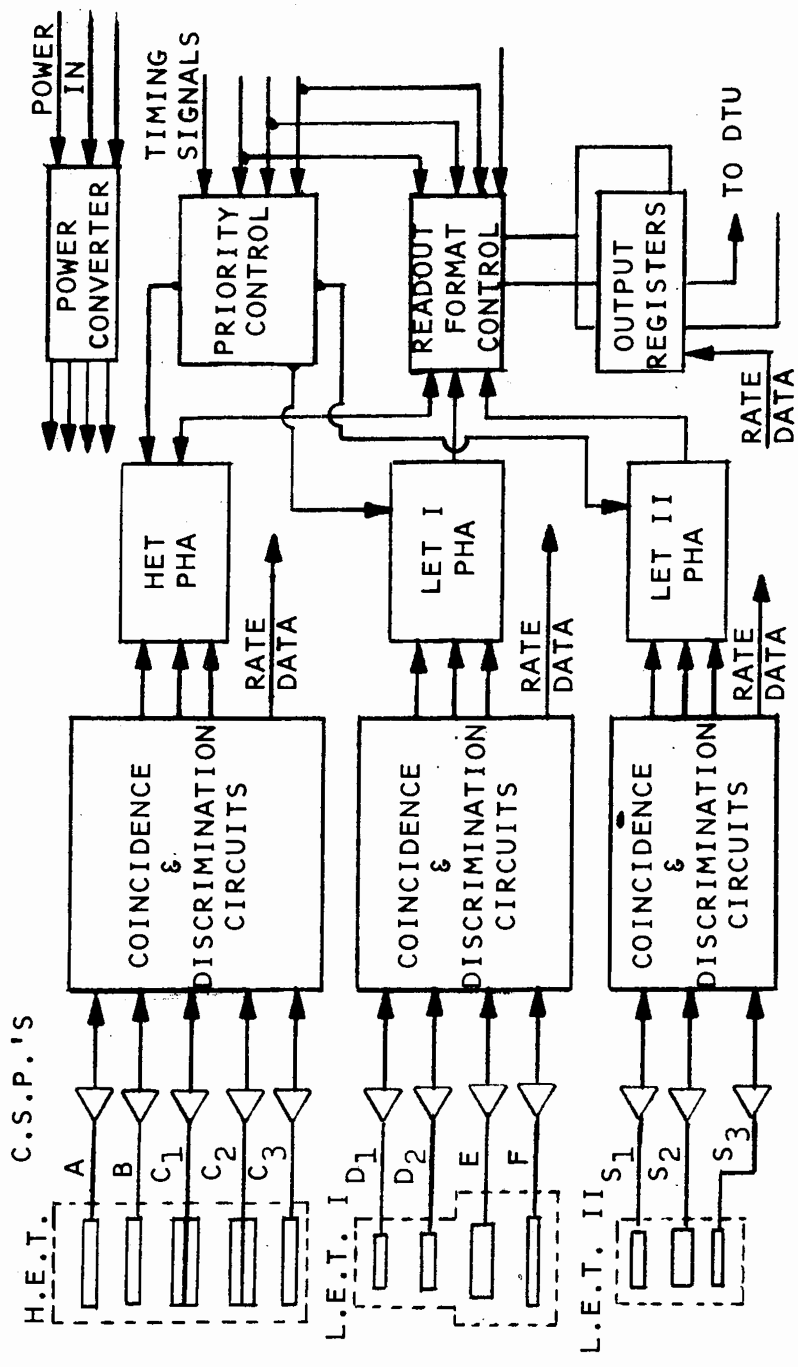
REV. NO. 14

DATE 10-31-70

SHEET 4 OF 4

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/GSE INTERFACE CIRCUITS	DOC. NO. PC-220.06
		FIG. 3.2.6
	REV. NO. / DATE	SHEET 1 OF 1



REPRODUCED FROM	TITLE BLOCK DIAGRAM GSFC COSMIC RAY TELESCOPE		PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
			DOC. NO. PC-220.06
			FIG. 3.2.7
	REV. NO. 4	DATE 3-6-70	SHEET 1 OF 1

UCSD/TRAPPED RADIATION DETECTOR

PC-220.07

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California

PIONEER PROGRAM

SPECIFICATION PC-220.07

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

UCSD/TRAPPED RADIATION DETECTOR

October 20, 1969

1. SCOPE

Specification PC-220.07 defines the characteristics and requirements of the USCD/Trapped Radiation Detector pertinent to the Pioneer spacecraft.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATIONS

PC-213.00, Scientific Instruments and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATION

PC-220.00, Spacecraft/Scientific-Instrument Interface Specification

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Configuration. The dimensions, configuration and connector locations for the instrument will be as specified in Figure 3.1.1.

3.1.2 Mass Properties.

3.1.2.1 Weight (Present). 3.9 lb (15)

Revision

3.1.2.2 Center of Gravity. The center of gravity notation will be as indicated in Figure 3.1.1. The c.g. locations will be as follows: (5)

a = 2.0 b = 2.8 c = 2.5

3.1.2.3 Moments of Inertia. The moments of inertia of the instrument about the center of gravity of the units will be as follows:

Moments of Inertia (in-lb-sec^2)

I_a = TBS I_b = TBS I_c = TBS

3.1.3 Mounting. The instrument mounting faces and methods will be as indicated in Figure 3.1.1.

3.1.4 Sensor Orientation. The UCSD/TRD instrument shall be positioned on the spacecraft such that the viewing requirements of Section 3.1.5 are satisfied. A GFE alignment fixture, which defines the centerline of detector "C" to $\pm 2°$, will be affixed to the front surface of the telescope. The centerline of detector "C" telescope, so defined, shall be parallel to the spacecraft X axis to $\pm$ 30 minutes. The azimuthal angle between this centerline and the roll index pulse fixed reference line shall be known to $\pm$ 30 minutes. (16)

3.1.5 Viewing. (1)

Det. C	60° Half	Minimum Obstruction
Det. E	30° Half	Unobstructed
Det. S	30° Half	Unobstructed
Det. M	No View	

3.2 ELECTRICAL

3.2.1 Power Load (Present) (11)

Standby	TBS
Steady State (Normal)	2.1W
Steady State (Low Power)	2.0W

3.2.2 Duty Cycle. The power requirements for this instrument are on a continuous basis during normal operating mode.

3.2.3 Converter Frequency. The converter frequency will be as indicated in Figure 3.5.1.1. of PC-220.00.

3.2.4 Connectors.

3.2.4.1 Connector Pin Assignments. Pins on the connectors for this instrument will be wired in accordance with Figure 3.2.4.1.

3.2.4.2 Connector Identification. Each connector attached to the instrument will be identified with a number in accordance with Figure 3.2.4.2.

3.2.5 Instrument Interface Circuits. Figure 3.2.5, shows the instrument input/output circuits which interface with the spacecraft/instrument interface timing, command and data lines.

3.2.6 Instrument/GSE Interface Circuits. Figure 3.2.6, shows the GSE input/output circuits which interface with the instrument thru the instrument stimulus/test connector.

3.2.7 Block Diagram. Figure 3.2.7 is a typical block diagram of the Trapped Radiation Instrument.

Revision

3.3 DATA HANDLING AND INSTRUMENT CONTROL

3.3.1 Signals from the Instrument. The scientific instrument will provide the following signals:

Main frame - format A (1 Block)	1 Line
Main frame - format B (2 Blocks)	
Science Subcom	
Analog	3 Lines
Bilevel	2 Lines

(11)

3.3.2 Signals to the Instrument. The scientific instrument will be provided with the following signals:

3.3.2.1 Power. 2 Lines

3.3.2.2 Commands. (8)

Power ON/OFF	1 Line
Functional	2 Lines

3.3.2.3 Timing and Control.

(a)	Word gate - main frame (Formats A & B)	1 Line
(b)	Clock - 32.768 kHz	1 Line
(c)	Clock - 2048 Hz	1 Line
(d)	Bit Shift pulse	1 Line
(e)	Format A status	1 Line
(f)	Format D status	1 Line
(g)	Bit rate I.D.	3 Lines
(h)	Main frame rate pulse	1 Line

3.3.3 Telemetry Word Assignments. Telemetry word assignments are specified in PC-220.01, sections 3.3.1.4.1 thru 3.3.1.4.5.

3.3.4 Instrument Words. Arrangements of instrument words within the telemetry word assignments for this instrument are as shown in PC-260.06.

(1)

3.4 THERMAL

3.4.1 Operating Limits. This instrument will be capable of operating over the following temperature range:

Platform-mounted unit: -20°F to +104°F

3.4.2 Thermal Load, Platform-Mounted Unit. The platform-mounted unit of this instrument shall be exposed to the thermal environment exterior to the spacecraft while in space flight. The average thermal load supplied to the spacecraft by electrical power dissipation within the platform-mounted unit will be watts.

3.4.3 Surface Thermal Properties.

3.4.3.1 Mounting Surfaces. The mounting surfaces of the instrument will be treated in accordance with PC-213.03, section 3.2.6.8.1.

3.4.3.2 Nonmounting Surfaces. The nonmounting surfaces of the instrument viewing the inside of the spacecraft will be treated in accordance with PC-213.03, section 3.2.6.8.6.

3.4.4 Mounting Surface Area. The thermal conducting area of the instrument units contiguous with the spacecraft mounting surfaces will be as follows:

Platform-mounted unit: 30 square inches

3.5 COMPATIBILITY (1)

3.5.1 Electromagnetic-Special Requirements & Characteristics. This instrument is sensitive to the frequencies indicated in Figure 3.5.1.1, Pioneer Specification PC-220.00.

3.5.2 Radioactive Sources.

3.5.2.1 Internal Sources (On-Board). To be supplied.

3.5.2.2 External Sources (Test). To be supplied.

3.6 MISCELLANEOUS REQUIREMENTS & CHARACTERISTICS

3.6.1 Spin Rate. The preferred spin rate of the spacecraft for operation of this instrument is 4.9 rpm. The instrument will operate satisfactorily for spacecraft spin rates between 2 and 7 rpm. (1)

4. PERFORMANCE ASSURANCE PROVISIONS

Not Applicable.

5. PREPARATION FOR DELIVERY, HANDLING, SHIPPING & STORAGE (1)

5.1 HANDLING

5.1.1 General. The scientific instruments shall at all times be handled in a manner which will minimize the possibility of damage to the instrument. Grasping of the instrument by other than the base section shall not be permitted.

5.1.2 Protective Covers. This instrument employs a protective cover with the sensor. This cover shall remain in position during all systems tests except physical properties measurements, vibration, thermal vacuum, and other tests as directed by the NASA/ARC Experiment Test Engineer. The experiment test connector shall be covered with MISTIK type 7000 fiberglass or equivalent approved nonconductive tape just prior to launch. During test operations and storage, all exposed connectors shall be protected with dust covers.

5.2 SHIPPING

Except when mounted on the spacecraft, this scientific instrument shall be transported only in its custom carrying case. Movement of the instrument to and from TRW will be the responsibility of NASA/ARC.

5.3 STORAGE

Whenever the instrument is not mounted on the spacecraft platform, or not in use for bench tests, it shall be stored in the protective carrying case furnished by the experimenter and placed in the bonded stores area of TRW. The carrying case will contain suitable chemical desiccant, the condition of which will be monitored periodically during protracted storage periods, by the cognizant NASA test engineer.

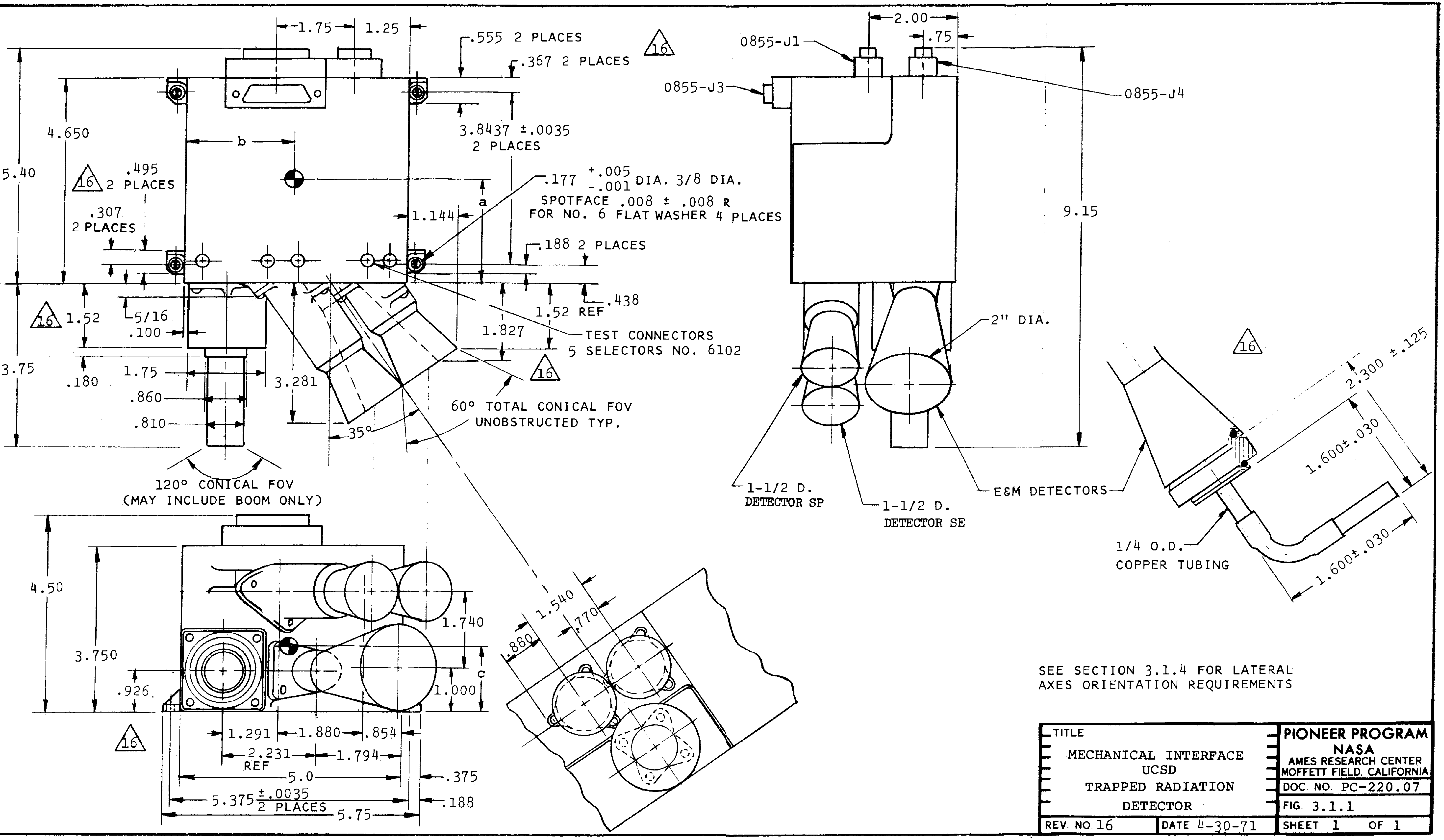
6. NOTES

6.1 DEFINITIONS

See Section 6.1 of Specification PC-220.00.

6.2 ABBREVIATIONS

See Section 6.2 of Specification PC-220.00.



SEE SECTION 3.1.4 FOR LATERAL AXES ORIENTATION REQUIREMENTS

TITLE: MECHANICAL INTERFACE UCSD TRAPPED RADIATION DETECTOR	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.07
	FIG. 3.1.1
REV. NO. 16 DATE 4-30-71	SHEET 1 OF 1

PIN NO.	FUNCTION	
1	SPARE	
2	COMMAND - HIGH VOLTAGE MODE ON	
3	COMMAND - HIGH VOLTAGE MODE OFF	
4	SPARE	
5	32.768 kHz CLOCK	
6	2048 Hz CLOCK	
7	BIT SHIFT PULSE	
8	MAIN FRAME WORD GATE (Fa)	
9	MAIN FRAME RATE PULSE	
10	DIGITAL DATA OUT - MAIN FRAME	
11	BILEVEL (GROUNDED) S.S.C. (E2) WORD 24, BIT 2	(16)
12	BILEVEL (H.V. STATUS) S.S.C. (E2) WORD 24, BIT 3	
13	SPARE	
14	SPARE	
15	STATUS - BIT RATE I.D. (1)	
16	STATUS - BIT RATE I.D. (2)	
17	STATUS - BIT RATE I.D. (3)	
18	STATUS - FORMAT A	
19	STATUS - FORMAT D	
20	SPARE	
21	ANALOG (PULSE TEMP) S.S.C. (E2) WORD 9	(16)
22	ANALOG (DET. C TEMP) S.S.C. (E2) WORD 11	(16)
23	ANALOG (H.V. REG. CURRENT) S.S.C. (E2) WORD 10	(16)
24	SPARE	
25	SPARE	

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	PIN ASSIGNMENTS CONNECTOR 0855-J1	DOC. NO. PC-220.07
		FIG. 3.2.4.1
	REV. NO. 16 / DATE 4-30-71	SHEET 1 OF 2

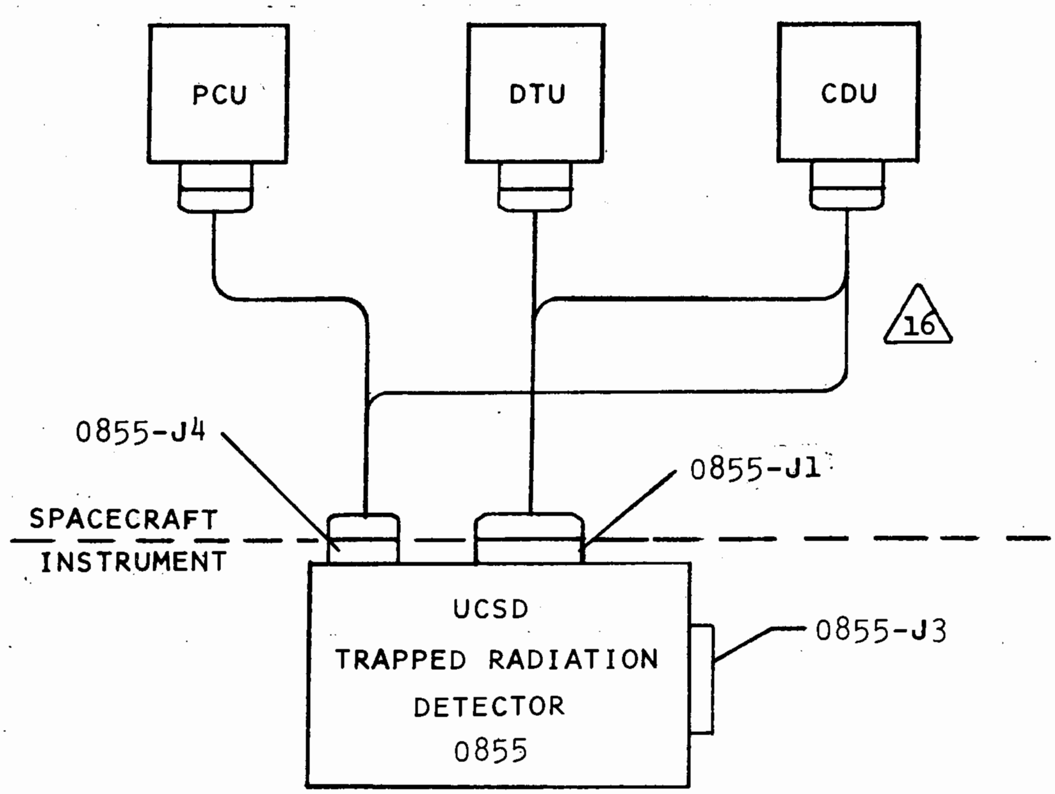
PIN NO.	FUNCTION
1	+28 VDC POWER
2	POWER RETURN
3	COMMAND - POWER ON/OFF
4	SPARE
5	SPARE
6	+28 VDC POWER
7	POWER RETURN
8	SPARE
9	SPARE

11

NOTES:

1. Pins 1 and 6 of harness connector 0855-P4 shall be wired in parallel.
2. Pins 2 and 7 of harness connector 0855-P4 shall be wired in parallel.
3. Redundant lines to PCU are not required.

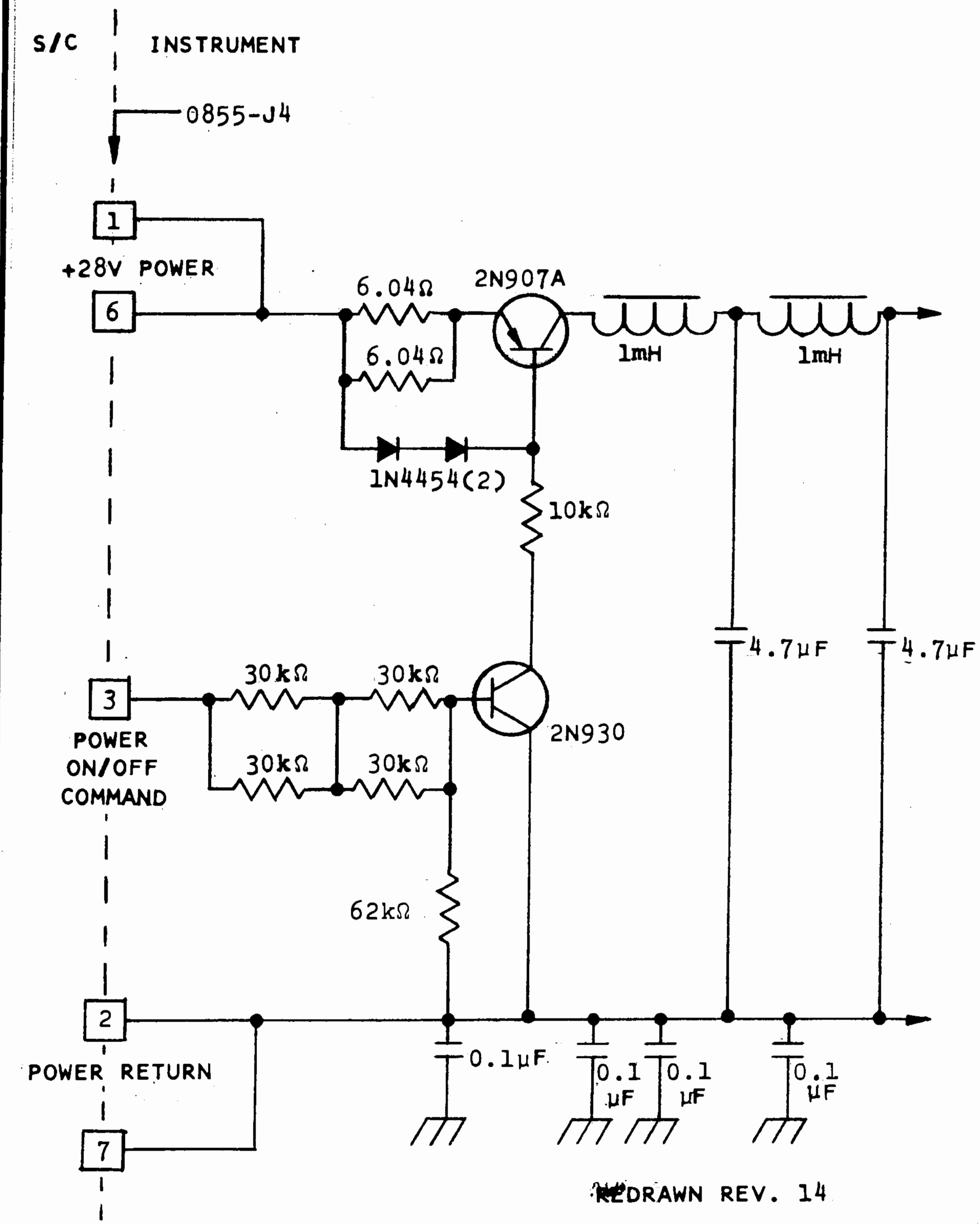
REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD. CALIFORNIA
	PIN ASSIGNMENTS CONNECTOR 0855-J4	DOC. NO. PC-220.07
		FIG. 3.2.4.1
	REV. NO. 11 DATE 5-22-70	SHEET 2 OF 2



CONNECTOR	FUNCTION	TYPE
0855-J1	INTERFACE	DBM-25P
0855-J2	NOT USED	---
0855-J3	TEST	DBM-25S
0855-J4	POWER	DEM-9P

NOTE: ALL CONNECTORS ARE CANNON GOLDEN D MARK I UNLESS OTHERWISE SPECIFIED.

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CONNECTOR I.D. UCSD TRAPPED RADIATION DETECTOR	DOC. NO. PC-220.07 FIG. 3.2.4.2
	REV. NO. 16 DATE 4-30-71	SHEET 1 OF 1



REDRAWN REV. 14

REPRODUCED FROM

TITLE

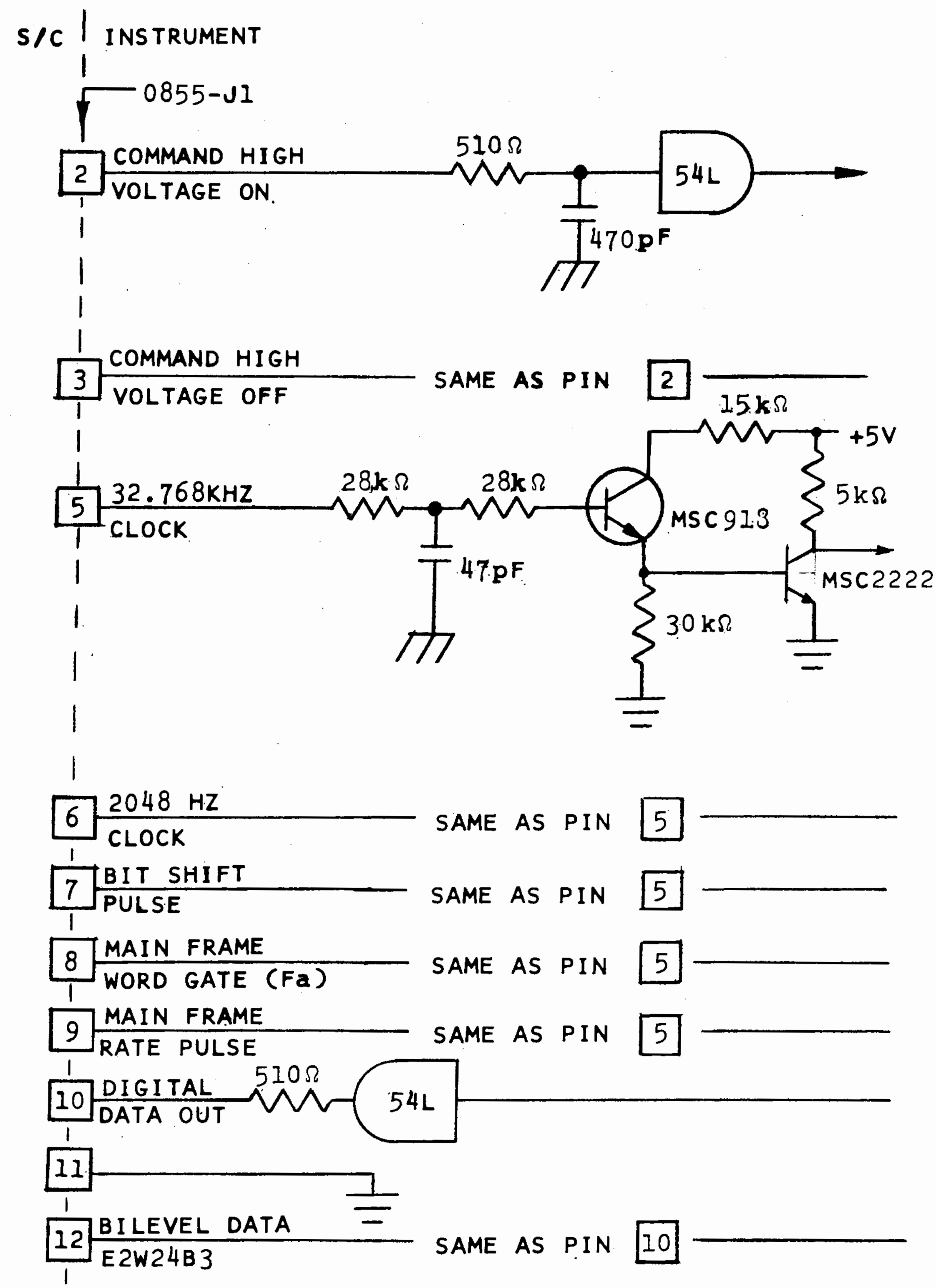
INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

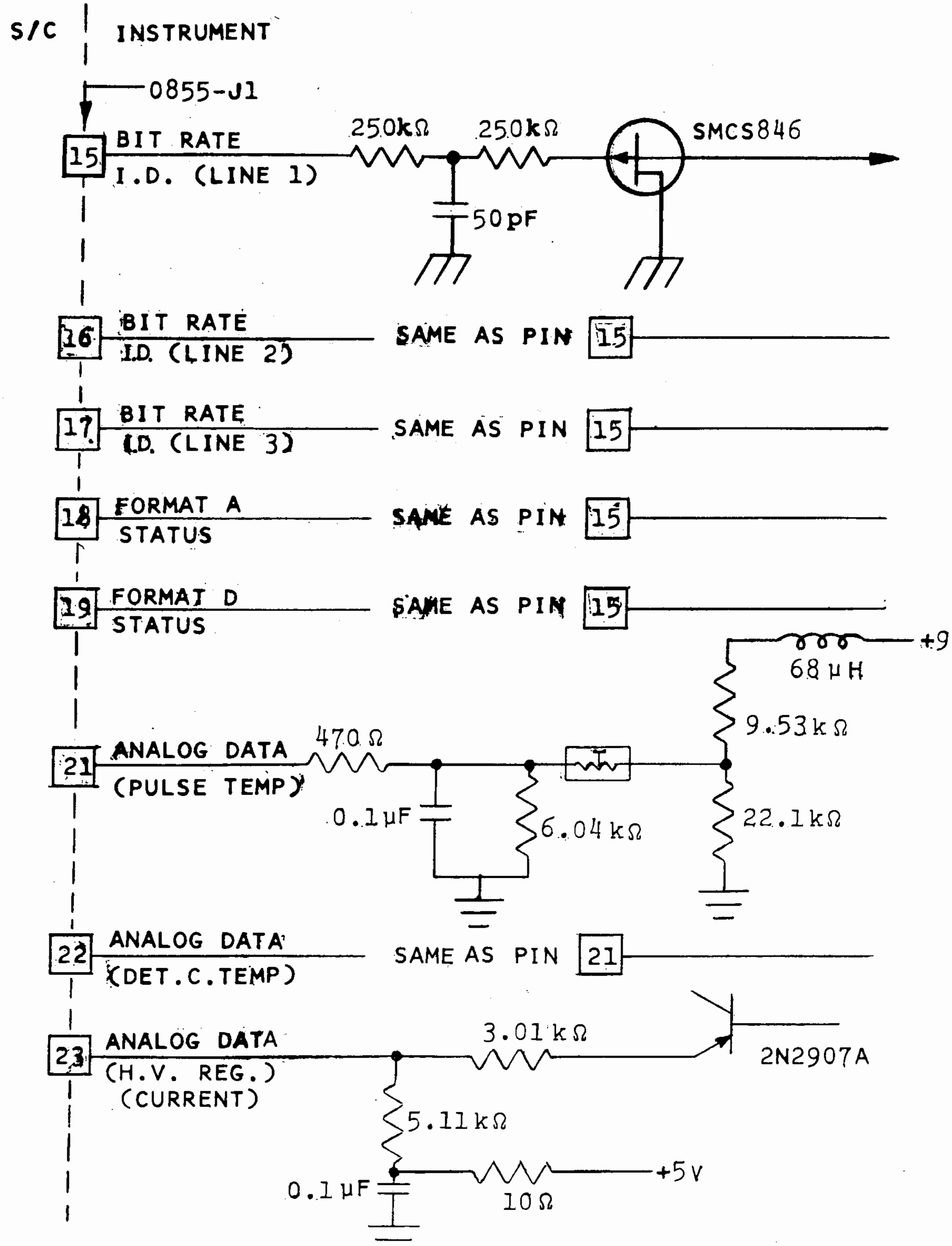
DOC. NO. PC-220.07

FIG. 3.2.5

REV. NO. 16 | DATE 4-30-71 | SHEET 1 OF 3



REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.07
		FIG. 3.2.5
	REV. NO. 16 / DATE 4-30-71	SHEET 2 OF 3



REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.07
		FIG. 3.2.5
	REV. NO. 16 / DATE 4-30-71	SHEET 3 OF 3

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/GSE INTERFACE CIRCUITS	DOC. NO. PC-220.07
		FIG. 3.2.6
	REV. NO. / DATE	SHEET 1 OF 1

USC/UV PHOTOMETER

PC-220.08

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California

PIONEER PROJECT

SPECIFICATION PC-220.08

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

USC/UV PHOTOMETER

October 20, 1969

1. SCOPE

Specification PC-220.08 defines the characteristics and requirements of the USC/UV Photometer pertinent to the Pioneer spacecraft.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATIONS

PC-213.00, Scientific Instruments and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATION

PC-220.00, Spacecraft/Scientific-Instrument Interface Specification

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Configuration. The dimensions, configuration and connector locations for the instrument will be as specified in Figure 3.1.1.

3.1.2 Mass Properties.

3.1.2.1 Weight (Present). 1.5 lb (11)

Revision

3.1.2.2 Center of Gravity. The center of gravity notation will be as indicated in Figure 3.1.1. The c.g. locations will be as follows: (5)

$a = 2.5 \pm 0.5$ $b = 1.7 \pm 0.5$ $c = 1.0 \pm 0.5$

3.1.2.3 Moments of Inertia. The moments of inertia of the instrument about the center of gravity of the units will be as follows:

Moments of Inertia ($in\text{-}lb\text{-}sec^2$)

I_a = TBS I_b = TBS I_c = TBS

3.1.3 Mounting. The instrument mounting faces and methods will be as indicated in Figure 3.1.1

3.1.4 Sensor Orientation. The UV photometer shall be oriented such that the line of intersection of the spacecraft x-y plane and the plane perpendicular to the x-y plane and containing the instrument telescope axis passes through the spacecraft spin axis at encounter to $\pm$ 6 minutes. The spacecraft spin axis shall be assumed to be on the -x axis 7.8 $\pm$ 0.1 inches from the y axis. See Figure 3.1.4. The azimuthal angle between the roll index pulse fixed reference line and the projection on the spacecraft X-Y plane of the telescope centerline as defined by the alignment fixture shall be known to $\pm$ 6 minutes. The GFE alignment fixture will locate the centerline of the instrument telescope axis to $\pm$6'. A scribe line will be provided on the instrument as shown in Figure 3.1.4. The line described by a point on the scribe and point "B" in Figure 3.1.4 shall be coplanar to $\pm$6 minutes with the normal to the alignment fixture. (16)

3.1.5 Viewing. An unobstructed FOV of 28° 4' by 2.5° is required. This solid angle shall be free from reflected and scattered light. See Figure 3.1.1 for further details. (4)

3.2 ELECTRICAL

3.2.1 Power Load (Present) (11)

Standby	300 μw
Average	1.0 w
Peak	7.0 w

3.2.2 Duty Cycle. The 7w peak power occurs one time only, with a period of 0.010 second time of occurance- approximately L = 24 hours.

3.2.3 Converter Frequency. The converter frequency will be as indicated in Figure 3.5.1.1 of PC-220.00

Revision

3.2.4 Connectors.

3.2.4.1 Connector Pin Assignments. Pins on the connectors for this instrument will be wired in accordance with Figure 3.2.4.1.

3.2.4.2 Connector Identification. Each connector attached to the instrument will be identified with a number in accordance with Figure 3.2.4.2.

3.2.5 Instrument Interface Circuits. Figure 3.2.5, shows the instrument input/output circuits which interface with the spacecraft/instrument interface timing, command and data lines.

3.2.6 Instrument/GSE Interface Circuits. Figure 3.2.6, shows the GSE input/output circuits which interface with the instrument thru the instrument stimulus/test connector.

3.2.7 Block Diagram. Figure 3.2.7 is a typical block diagram for the UV instrument.

3.3 DATA HANDLING AND INSTRUMENT CONTROL (1)

3.3.1 Signals from the Instrument. The scientific instrument will provide the following signals.

Main frame - formats A & B	1 Line
Science subcom	
Spacecraft Temperature Sensor	2 Lines
Bilevel	2 Lines

3.3.2 Signals to the Instrument. The scientific instrument will be provided with the following signals.

3.3.2.1 Power. 2 Lines

3.3.2.2 Commands. (15)

ON/OFF (Power)	1 Line
ON/OFF (Deploy Cover)	1 Line

3.3.2.3 Timing and Control (6)

(a) Word gate - main frame (Formats A & B)	1 Line
(b) Word gate - phantom (main fr.) Da	1 Line
(c) Bit shift pulse	1 Line
(d) Roll index pulse	1 Line

3.3.3 Telemetry Word Assignments. Telemetry word assignments are specified in PC-220.01, sections 3.3.1.4.1 thru 3.3.1.4.5.

3.3.4 Instrument Words. Arrangements of instrument words within the telemetry word assignments for this instrument are as shown in PC-260.07.

3.4 THERMAL (1)

3.4.1 Operating Limits. This instrument will be capable of operating over the following temperature range: (15)

Platform-mounted unit: -20°F to +120°F

3.4.2 Thermal Load, Platform-Mounted Unit. The platform-mounted unit of this instrument shall be exposed to the thermal environment exterior to the spacecraft while in space flight. The average thermal load supplied to the spacecraft by electrical power dissipation within the platform-mounted unit will be 0.9 watts.

3.4.3 Surface Thermal Properties.

3.4.3.1 Mounting Surfaces. The mounting surfaces of the instrument will be treated in accordance with PC-213.03, section 3.2.6.8.1.

3.4.3.2 Non-Mounting Surfaces. The nonmounting surfaces of the instrument viewing the inside of the spacecraft will be treated in accordance with PC-213.03, section 3.2.6.8.6.

3.4.4 Mounting Surface Area. The thermal conducting area of the instrument units contiguous with the spacecraft mounting surfaces will be as follows:

Platform-mounted unit: 25 square inches, max.

3.5 COMPATIBILITY

3.5.1 Electromagnetic-Special Requirements & Characteristics. This instrument is sensitive to the frequencies indicated in Figure 3.5.1.1, Pioneer Specification PC-220.00.

Revision

3.5.2 Radioactive Sources.

3.5.2.1 Internal Sources (On-Board). None.

3.5.2.2 External Sources (Test). Beta Source.

3.6 MISCELLANEOUS REQUIREMENTS & CHARACTERISTICS (1)

3.6.1 Spin Rate. The preferred spin rate of the spacecraft for operation of this instrument is 5.0 rpm. The instrument will operate satisfactorily for spacecraft spin rates between 1.0 and 5.0 rpm.

4. PERFORMANCE ASSURANCE PROVISIONS

Not Applicable.

5. PREPARATION FOR DELIVERY, HANDLING, SHIPPING & STORAGE (1)

5.1 HANDLING

5.1.1 General. The scientific instruments shall at all times be handled in a manner which will minimize the possibility of damage to the instrument. Grasping of the instrument by other than the base section shall not be permitted.

5.1.2 Protective Covers (13)

5.1.2.1 Experiment Test Connector. The experiment test connector shall be covered with MISTIK type 7000 fiberglass or equilvalent approved nonconductive tape just prior to launch. During test operations and storage, all exposed connectors shall be protected with dust covers.

5.1.2.2 Sensor Cover. This instrument employs a protective cover with the sensor. This cover shall remain in position during all systems tests except those tests requiring piston actuation of the cover as required in the test procedures. The cover is a flight item in that it remains on the instrument during launch. (13)

Revision

5.1.2.2.1 Cover Actuators. There are two piston actuators and the activation of either piston actuator will expel the protective cover. They are fired from spacecraft 28-volt power by an actuator signal generator circuit located in the instrument. Upon firing, the actuator pistons extend and force the cover out of spring clips and away from the instrument. (13)

5.1.2.2.2 Characteristics (13)

(a) Size and weight. The cover is less than 2.5 inches in diameter. Its weight is 6 grams.
(b) Material. The cover is made of aluminum and is gold plated.
(c) Redundant actuator. The cover is expelled from the experiment field-of-view limiter by 2 Atlas IMT 1110, piston actuators, upon command. Normally, in the event of a failure, one piston is more than sufficient to remove the cover.
(d) Electrical.

(1) Bridgewire Resistance and Tolerance: 25 ±5 ohms
(2) Maximum No-Fire Current: 10 ma for 10 seconds at 175°F
(3) All-Fire Current: 100 ma for 10 ms at -65°F
(4) Dielectric Strength Specifications: 500 Vdc from any terminal to the case

(e) Chemical Composition. Ignition drop - 2 mg KDNBF (Potassium Dinitrobenzofuroxan) and lacquer binder. Base charge - 6 mg; 50% KDNBF, 50% diatomaceous earth.
(f) Other Information

(1) Type of hardware involved in gaining access and physical removal of expended actuators.

Only ordinary mechanic's tools are expected to be required.

(2) Interstate Commerce Commission Classification of Explosive Components:

Item is classified "Unclassified, nonhazardous."

(3) Shorting Plug. There is a safety (shorting) plug that, when installed, will prevent accidental firing of the actuators (see circuit diagram, Figure 3.2.5).

5.2 SHIPPING

Except when mounted on the spacecraft, this scientific instrument shall be transported only in its custom carrying case. Movement of the instrument to and from TRW will be the responsibility of NASA/ARC.

5.3 STORAGE

Whenever the instrument is not mounted on the spacecraft platform, or not in use for bench tests, it shall be stored in the protective carrying case furnished by the experimenter and placed in the bonded stores area of TRW. The carrying case will contain suitable chemical desiccant, the condition of which will be monitored periodically during protracted storage periods, by the cognizant NASA test engineer.

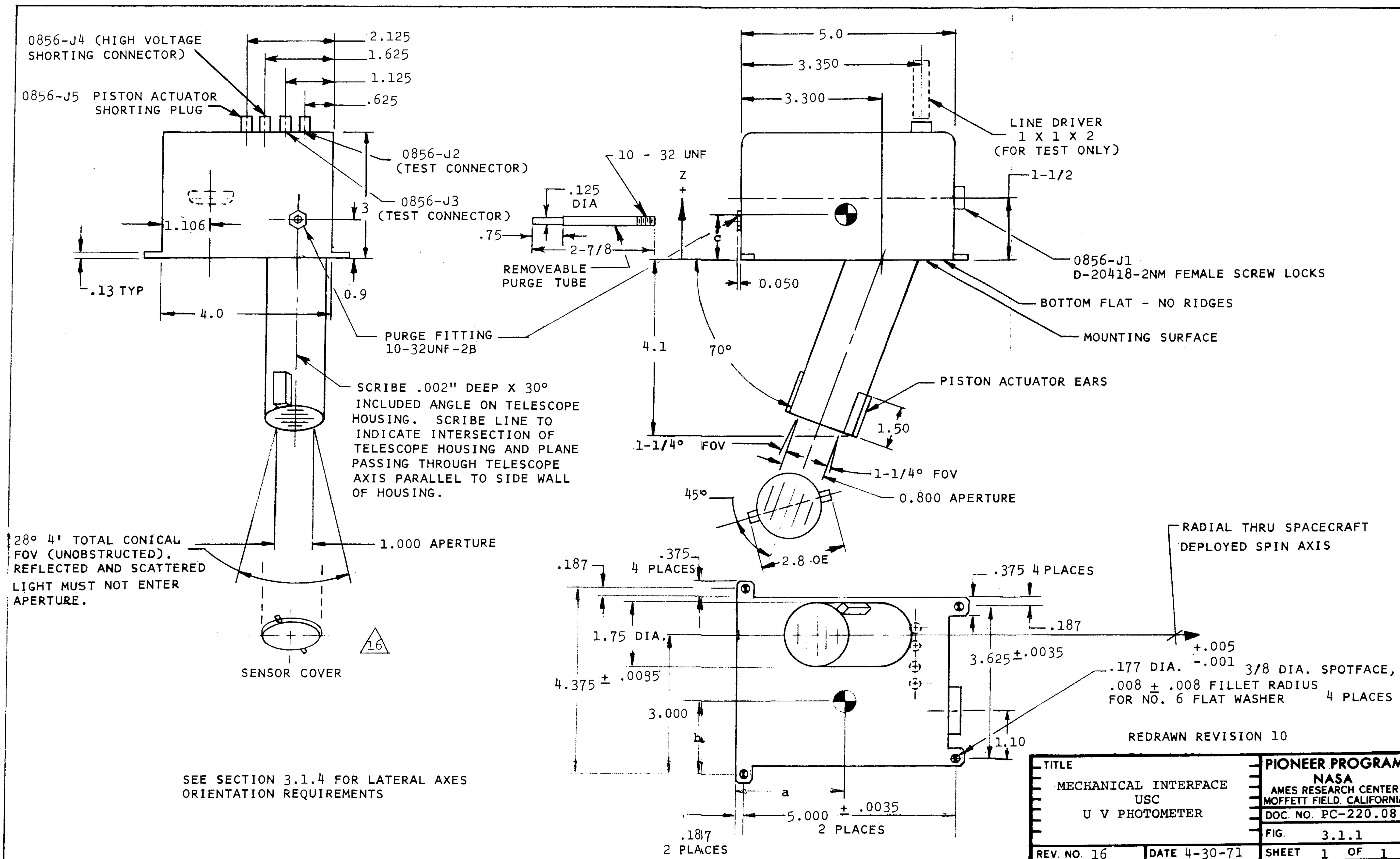
6. NOTES

6.1 DEFINITIONS

See Section 6.1 of Specification PC-220.00

6.2 ABBREVIATIONS

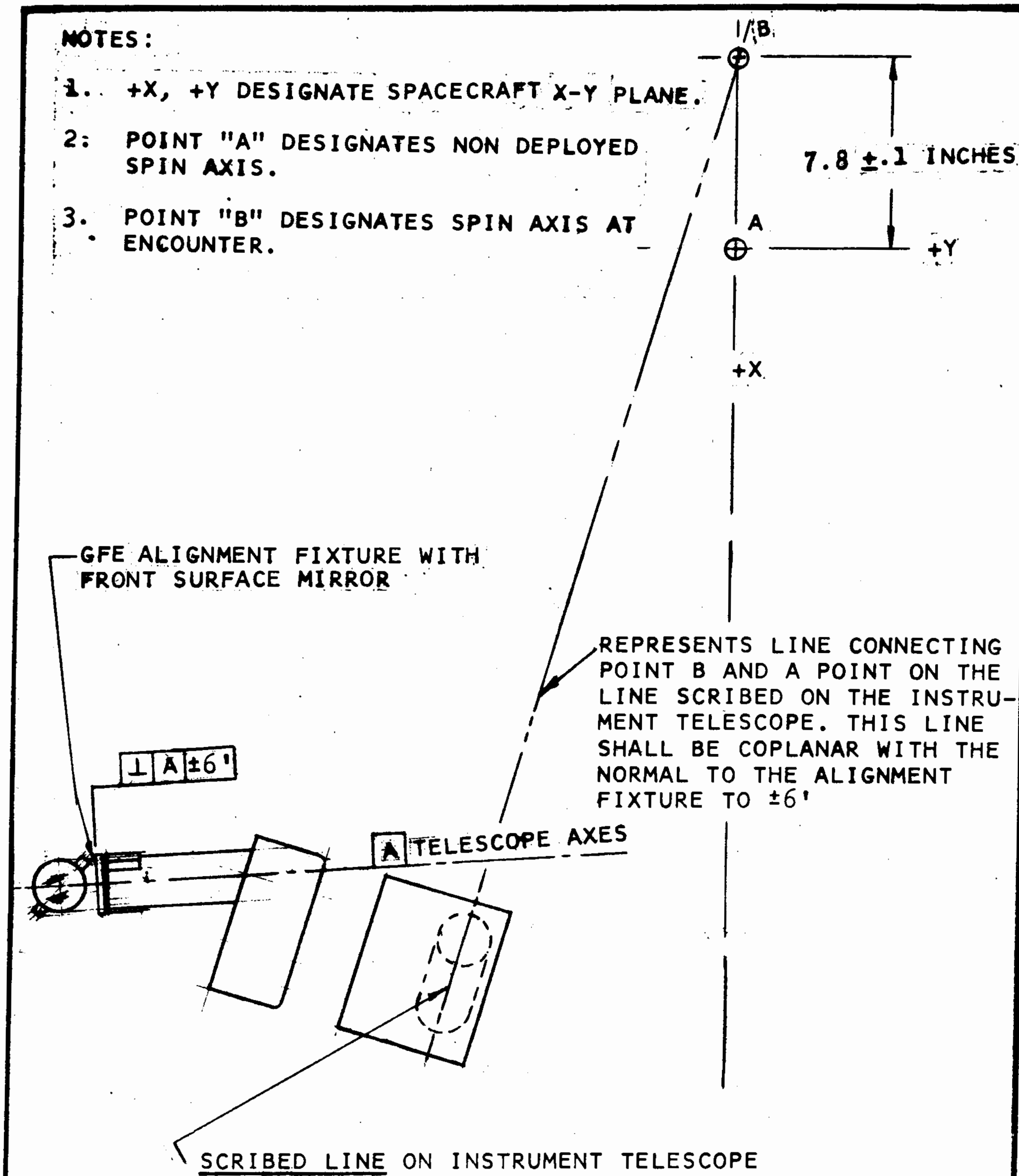
See Section 6.2 of Specification PC-220.00



TITLE: MECHANICAL INTERFACE USC U V PHOTOMETER	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.08
	FIG. 3.1.1
REV. NO. 16 / DATE 4-30-71	SHEET 1 OF 1

NOTES:

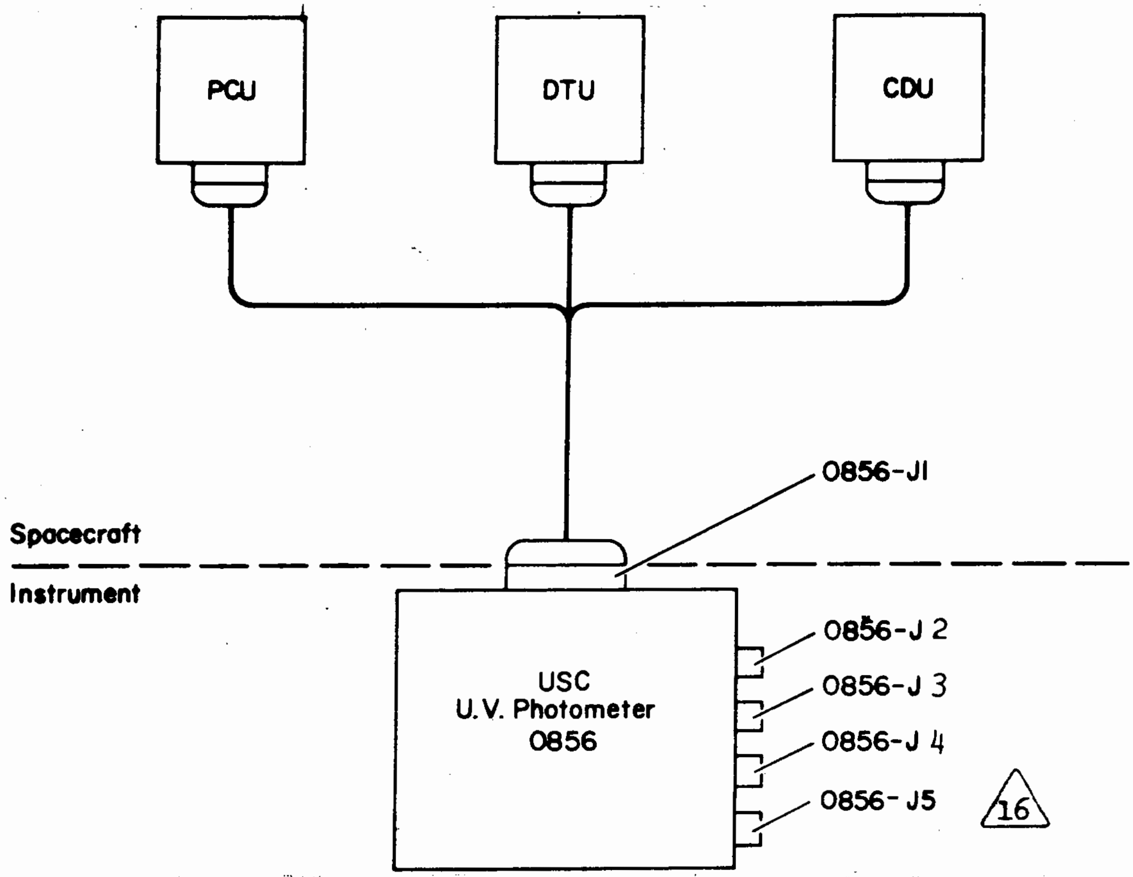
1. +X, +Y DESIGNATE SPACECRAFT X-Y PLANE.
2. POINT "A" DESIGNATES NON DEPLOYED SPIN AXIS.
3. POINT "B" DESIGNATES SPIN AXIS AT ENCOUNTER.



REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	SENSOR ORIENTATION FOR USC ULTRAVIOLET PHOTOMETER	DOC. NO. PC 220.08
		FIG. 3.1.4
	REV. NO. 16 / DATE 4-30-71	SHEET 1 OF 1

PIN NO.	FUNCTION
1	+28 VDC POWER
2	POWER RETURN
3	CMND - POWER ON/OFF
4	CMND - PISTON ACTUATOR
5	ANALOG (ELECT. TEMP.) - SCIENCE SUBCOM (E1) WORD 9
6	RETURN FOR 5
7	BILEVEL (CHANNEL STATUS) SCIENCE SUBCOM (E1) WORD 24, BIT 5
8	BILEVEL (ROLL STATUS) SCIENCE SUBCOM (E1) WORD 24, BIT 6
9	SPARE
10	BIT SHIFT PULSE
11	WORD GATE - MAIN FRAME (Ga)
12	WORD GATE (PHANTOM) MAIN FRAME (Da)
13	ROLL INDEX PULSE
14	CHASSIS GROUND 11
15	DIGITAL DATA OUT - MAIN FRAME

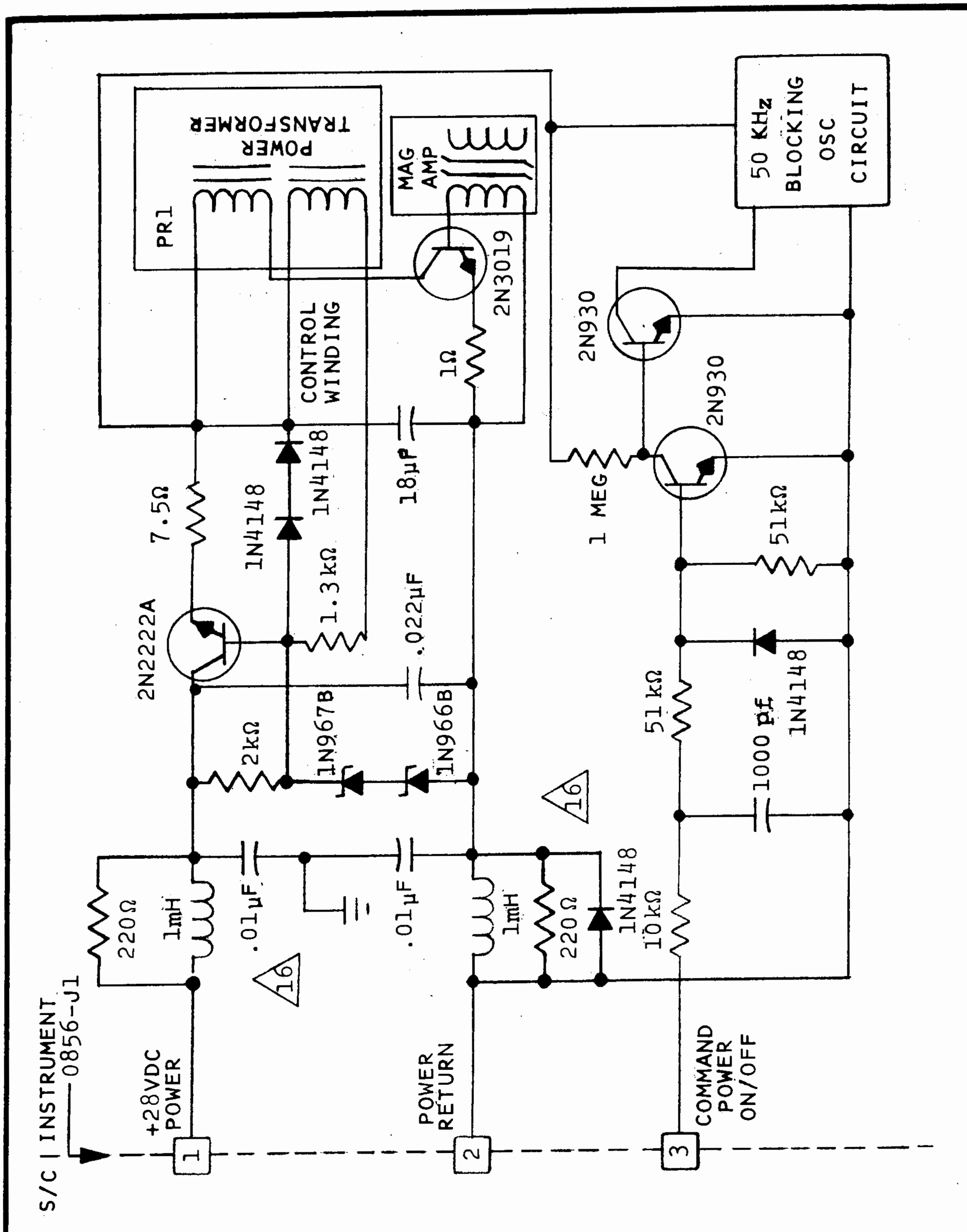
REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	PIN ASSIGMENTS CONNECTOR 0856-J1	DOC. NO. PC-220.08
		FIG. 3.2.4.1
	REV. NO. 11 DATE 5-22-70	SHEET 1 OF 1



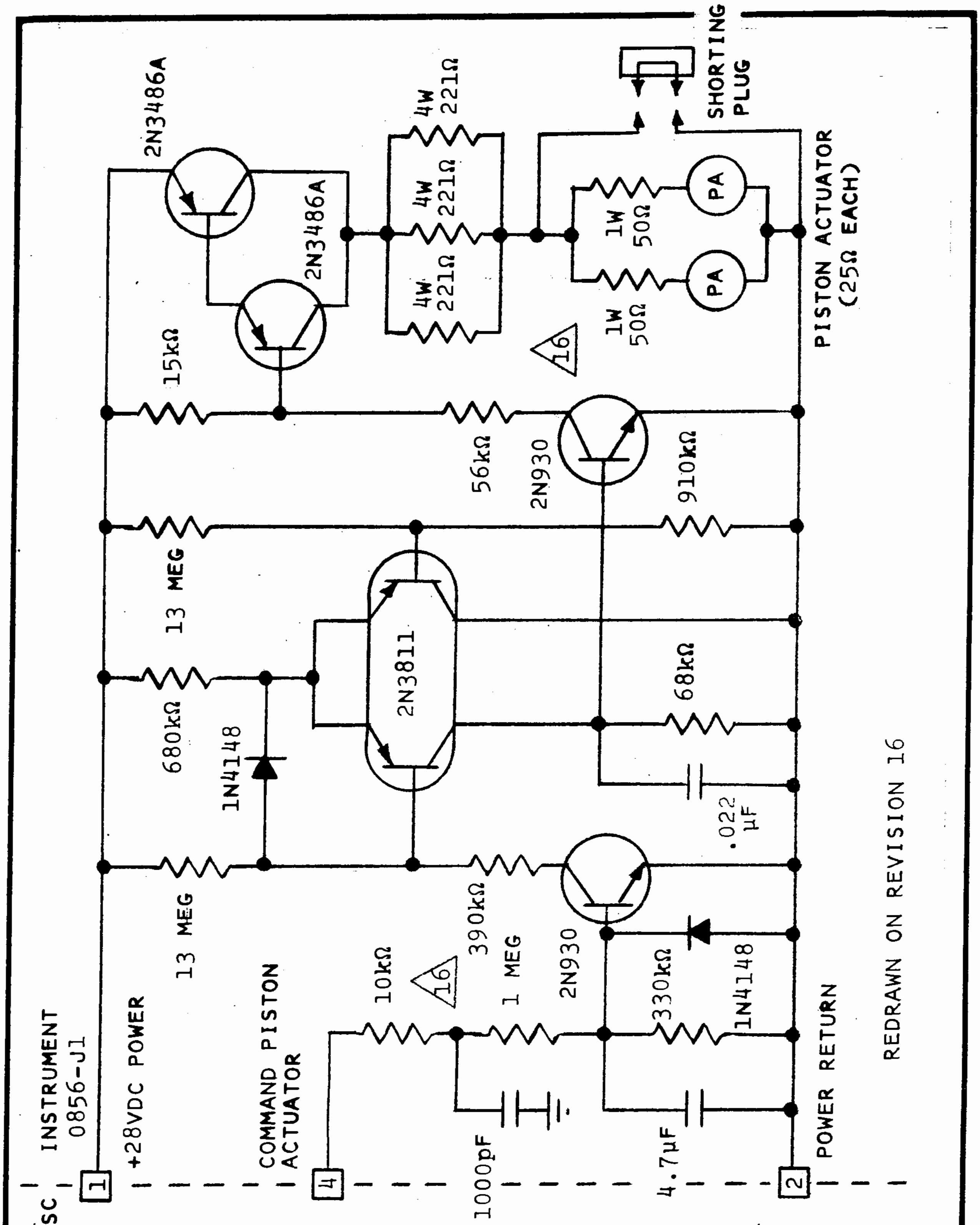
CONNECTOR	FUNCTION	TYPE
0856-J1	INTERFACE	DAM-15P
0856-J2	TEST A	MICRODOT 031-0052 (S-93)
0856-J3	TEST B	MICRODOT 031-0052 (S-93)
16 0856-J4	HIGH VOLTAGE	MICRODOT 031-0052 (S-93)
0856-J5	PISTON ACTUATOR	MICRODOT 031-0052 (S-93)

NOTE: ALL CONNECTORS ARE CANNON GOLDEN D MARK I UNLESS OTHERWISE SPECIFIED.

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CONNECTOR I.D. USC UV PHOTOMETER	DOC. NO. PC-220.08
		FIG. 3.2.4.2
	REV. NO. 16 / DATE 4-30-71	SHEET 1 OF 1



REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	DOC. NO. PC-220.08
		FIG. 3.2.5
	REV. NO. 16 — DATE 4-30-71	SHEET 1 OF 4



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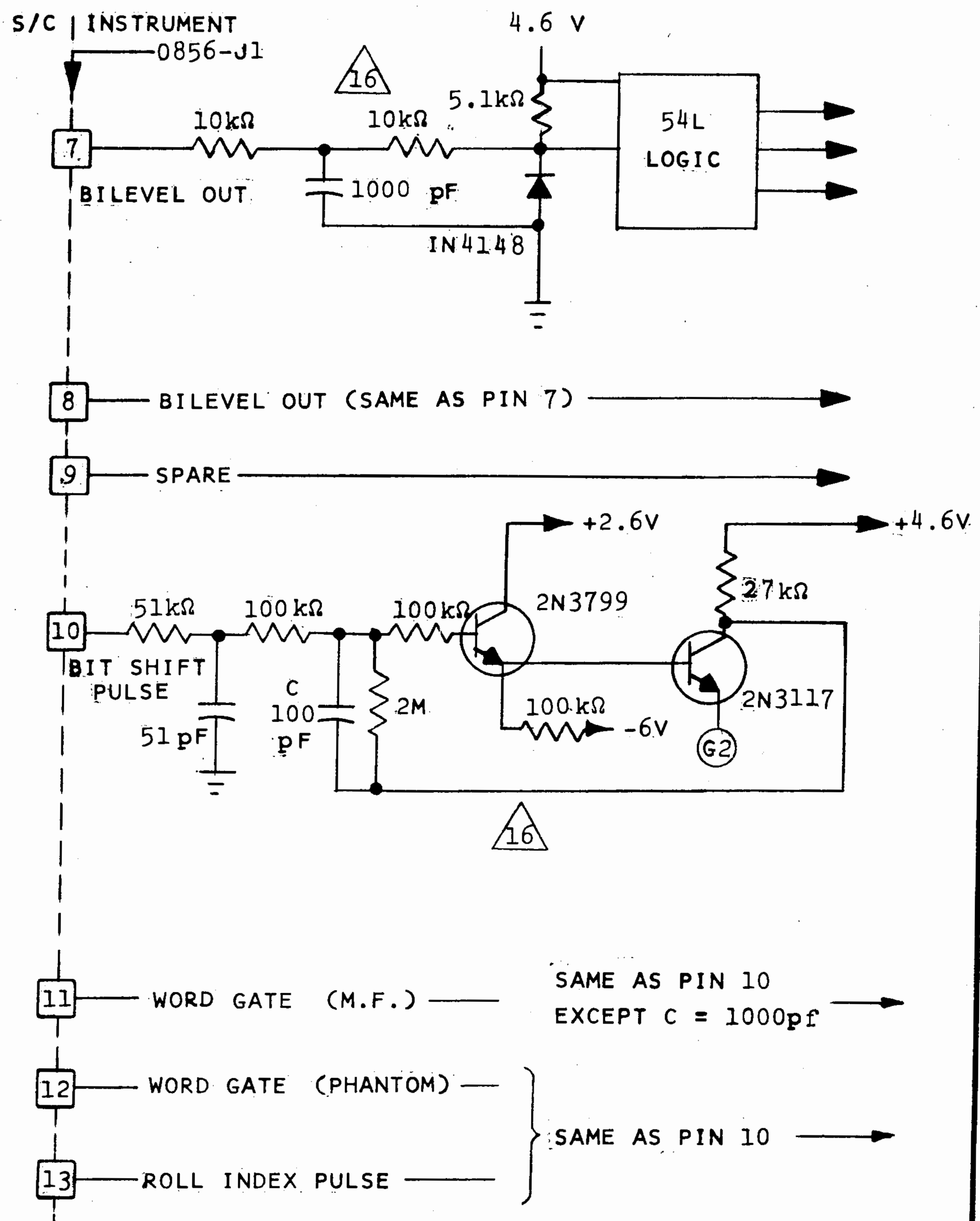
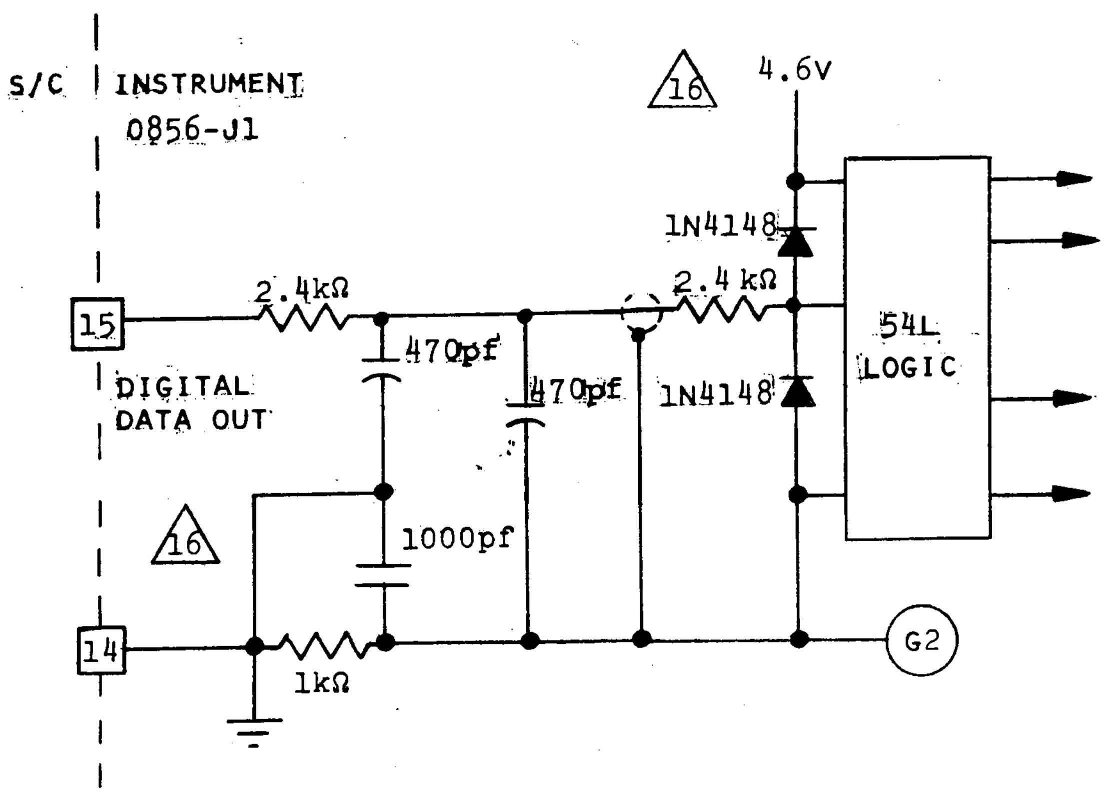
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	DOC. NO. PC-220.08
		FIG. 3.2.5
	REV. NO. 16 DATE 4-30-71	SHEET 2 OF 4



REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.08
		FIG. 3.2.5
	REV. NO. 16 DATE 4-30-71	SHEET 3 OF 4



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TITLE
INSTRUMENT/SPACECRAFT
INTERFACE CIRCUITS

REV. NO. 16 | DATE 4-30-71

PIONEER PROGRAM
NASA
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MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.08

FIG. 3.2.5

SHEET 4 OF 4

To Be Supplied

REPRODUCED FROM	TITLE INSTRUMENT/GSE INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.08
		FIG. 3.2.6
	REV. NO. | DATE	SHEET 1 OF 1

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	BLOCK DIAGRAM USC UV PHOTOMETER	DOC. NO. PC-220.08
		FIG. 3.2.7
	REV. NO. DATE	SHEET 1 OF 1

ARIZONA/IMAGING PHOTOPOLARIMETER

PC-220.09

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California

PIONEER PROGRAM

SPECIFICATION PC-220.09

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

ARIZONA/IMAGING PHOTOPOLARIMETER

October 20, 1969

1. SCOPE

Specification PC-220.09 defines the characteristics and requirements of the Arizona/IPP Instrument pertinent to the Pioneer spacecraft.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATIONS

PC-213.00, Scientific Instruments and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATION

PC-220.00, Spacecraft/Scientific-Instrument Interface Specification

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Configuration. The dimensions, configuration and connector locations for the instrument will be as specified in Figure 3.1.1.

3.1.2 Mass Properties.

3.1.2.1 Weight (Present) (15)

Electronics		9.3 lb
Stationary	8.1	
Moveable	1.2	
Diffuser		0.2 lb
Total		9.5 lb

Revision

3.1.2.2 Center of Gravity. The center of gravity notation will be as indicated in Figure 3.1.1. The c.g. locations will be as follows: (5)

a = 2.8 b = 4.0 c = 2.3

The change in c.g. of the IPP due to maximum travel of the telescope will be less than 0.05 inches on any axis.

3.1.2.3 Moments of Inertia. The moments of inertia of the instrument about the center of gravity of the units will be as follows:

Moments of Inertia (in-lb-sec^2)

I_a = TBS I_b = TBS I_c = TBS

3.1.3 Mounting. The instrument mounting faces and methods will be as indicated in Figure 3.1.1.

3.1.4 Sensor Orientation. The instrument shall be oriented on the equipment platform such that the viewing requirements of section 3.1.5 and Figure 3.1.4 are satisfied. (16)
The azimuthal angle between the roll index pulse fixed reference line and the optical axis of the telescope (with telescope in the SLA-4 position) shall be known to ± 15 minutes. The center of the diffuser as shown in Figure 3.1.4 shall be within ± 1/8" of the centerline of the telescope when the telescope is in the SLA-7 position. The centerline of the telescope is defined as parallel to the optical axis and passing through a reference dot on the aperture cover.

3.1.5 Viewing. The IPP telescope requires an unobstructed $2^\circ \times 2^\circ$ field of view for all telescope look angles between 29° and 170°. The telescope look angle is defined as the angle between the telescope line of sight and the spacecraft spin axis. In addition, the IPP telescope requires a 60° full cone free of scattered light. (12)

Revision

3.1.6 Telescope Stepping. The IPP telescope is capable of being incrementally stepped thru an angular range of 160° in a plane which contains the IPP telescope axis of revolution and which is perpendicular to the spacecraft equipment compartment. The incremental step size is 0.5 milliradians and the maximum step rate is 3 steps per second. (4)

3.1.7 Solar Light Diffuser. The solar light diffuser will be secured within a holder assembly and the holder assembly shall be integrated into the spacecraft high gain antenna reflector as indicated in Figure 3.1.4. (4)

3.2 ELECTRICAL

3.2.1 Power Load (Present) (11)

Standby	TBS
Average	3.5 W
Peak	4.1 W

3.2.2 Duty Cycle. The peak power for this instrument will occur during the imaging mode of operation for approximately 2.75 sec. once per every four spin periods.

Revision

3.2.3 Converter Frequency. The converter frequency will be as indicated in figure 3.5.1.1. of PC-220.00.

3.2.4 Connectors.

3.2.4.1 Connector Pin Assignments. Pins on the connectors for this instrument will be wired in accordance with figure 3.2.4.1.

3.2.4.2 Connector Identification. Each connector attached to the instrument will be identified with a number in accordance with Figure 3.2.4.2.

3.2.5 Instrument Interface Circuits. Figure 3.2.5, shows the instrument input/output circuits which interface with the spacecraft/instrument interface timing, command and data lines.

3.2.6 Instrument/GSE Interface Circuits. Figure 3.2.6, shows the GSE input/output circuits which interface with the instrument thru the instrument stimulus/test connector.

3.2.7 Block Diagram. Figure 3.2.7 is a typical block diagram for the IPP Instrument.

3.3 DATA HANDLING AND INSTRUMENT CONTROL (1)

3.3.1 Signals from the Instrument. The scientific instrument will provide the following signals. (9)

(a)	Main frame - Format D_1 & D_2	1 Line	
(b)	Data store gate	1 Line	
(c)	Bit shift pulse (16.384 kHz Bursts)	1 Line	
(d)	Science subcom (Analog)	1 Line	(12)

Figure 3.3.1 indicates the required timing relationship for the data store gate, the bit shift clock, and the digital data.

Revision

3.3.1.1 Data Store Gate. The data store gate signal will be accepted by the spacecraft buffer only when the spacecraft is operating in Formats D-1 and D-2. The gate will be in the high state when data are to be transferred to the spacecraft buffer. The width of the gate will be variable and will be determined by the instrument. The time jitter between the leading edge of the data store gate and the trailing edge of an instrument bit shift clock pulse shall be between 0 microseconds and 2 microseconds. The characteristics of the data store gate will be as defined in Figure 3.3.2.1 of PC-220.01. (3)

3.3.1.2 Bit Shift Clock. The bit shift clock will be a square wave with a 50% ±10% duty cycle period and a maximum repetition rate of 16,384 pulses per second. The trailing edge of a bit shift clock pulse will be used to mark the trailing edge of a data bit. There will be at least 60 ±5 microseconds between the leading edge of a data store gate and the trailing edge of the first bit shift clock pulse. The characteristics of the bit shift clock will be as defined in Figure 3.3.2.1 of PC-220.01. (3)

3.3.1.3 Digital Data. The scientific instrument digital data to be stored in the spacecraft buffer will be supplied in an NRZ format. A bit period will be the time period between two successive trailing edges of the instrument bit shift clock train. The trailing edge of the instrument bit shift clock will mark the trailing edge of an NRZ data bit. A low state will equal a logical "zero" and a high state a logical "one." The time jitter between the leading edge of the instrument digital data and the trailing edge of an instrument bit shift clock pulse will be between 0 microseconds and 2 microseconds. The characteristics of the instrument digital data will be as defined in Figure 3.3.2.1 of PC-220.01 (3)

3.3.2 Signals to the Instrument. The scientific instrument will be provided with the following signals.

3.3.2.1 Power. 2 Lines

3.3.2.2 Commands.

Power ON/OFF	1 Line
Functional	13 Lines

Revision

3.3.2.3 Timing and Control. (4)

(a) Roll index pulse	1 Line
(b) End of memory signal	1 Line
(c) Clock 32.768 kHz	1 Line
(d) Sector generator (512 sectors)	1 Line

The required timing relationship for the E.O.M. signal and the data store gate is presented in Figure 3.3.1.

3.3.3 Telemetry Word Assignments. Telemetry word assignments are specified in PC-220.01, sections 3.3.1.4.1 thru 3.3.1.4.5.

3.3.4 Instrument Words. Arrangements of instrument words within the telemetry word assignments for this instrument are as shown in PC-260.08.

3.4 THERMAL (1)

3.4.1 Operating Limits. This instrument will be capable of operating over the following temperature range: (15)

Platform-mounted unit: -20°F to +110°F

3.4.2 Thermal Load, Platform-Mounted Unit. The platform-mounted unit of this instrument shall be exposed to the thermal environment exterior to the spacecraft while in space flight. The average thermal load supplied to the spacecraft by electrical power dissipation within the platform-mounted unit will be TBS watts.

3.4.3 Surface Thermal Properties.

3.4.3.1 Mounting Surfaces. The mounting surfaces of the instrument will be treated in accordance with PC-213.03, section 3.2.6.8.1.

3.4.3.2 Nonmounting Surfaces. The nonmounting surfaces of the instrument viewing the inside of the spacecraft will be treated in accordance with PC-213.03, section 3.2.6.8.6.

Revision

3.4.4 Mounting Surface Area. The thermal conducting area of the instrument units contiguous with the spacecraft mounting surfaces will be as follows:

Platform-mounted unit: 98 square inches.

3.5 COMPATIBILITY (1)

3.5.1 Electromagnetic Special Requirements & Characteristics. This instrument is sensitive to the frequencies indicated in Figure 3.5.1.1, Pioneer Specification PC-220.00.

3.5.2 Radioactive Sources.

3.5.2.1 Internal Sources (On-Board). C^{14} Activated Phosphor.

3.5.2.2 External Sources (Test). C^{14} Activated Phosphor.

3.6 MISCELLANEOUS REQUIREMENTS & CHARACTERISTICS

3.6.1 Spin Rate. The preferred spin rate of the spacecraft for operation of this instrument is less than 5 rpm. The instrument will operate satisfactorily for spacecraft spin rates between 3 and 6 rpm. (1)

4. PERFORMANCE ASSURANCE PROVISIONS

Not applicable.

5. PREPARATION FOR DELIVERY, HANDLING, SHIPPING & STORAGE (1)

5.1 HANDLING

5.1.1 General. The scientific instruments shall at all times be handled in a manner which will minimize the possibility of damage to the instrument. Grasping of the instrument by other than the base section shall not be permitted.

5.1.2 Protective Covers. This instrument employs a protective cover with the sensor. This cover shall remain in position during all systems tests except physical properties measurements, vibration, thermal vacuum, and other tests as directed by the NASA/ARC Experiment Test Engineer. The experiment test connector shall be covered with MISTIK type 7000 fiberglass or equivalent approved non-conductive tape just prior to launch. During test operations and storage, all exposed connectors shall be protected with dust covers.

5.2 SHIPPING

Except when mounted on the spacecraft, this scientific instrument shall be transported only in its custom carrying case. Movement of the instrument to and from TRW will be the responsibility of NASA/ARC.

5.3 STORAGE

Whenever the instrument is not mounted on the spacecraft platform, or not in use for bench tests, it shall be stored in the protective carrying case furnished by the experimenter and placed in the bonded stores area of TRW. The carrying case will contain suitable chemical desiccant, the condition of which will be monitored periodically during protracted storage periods by the cognizant NASA test engineer.

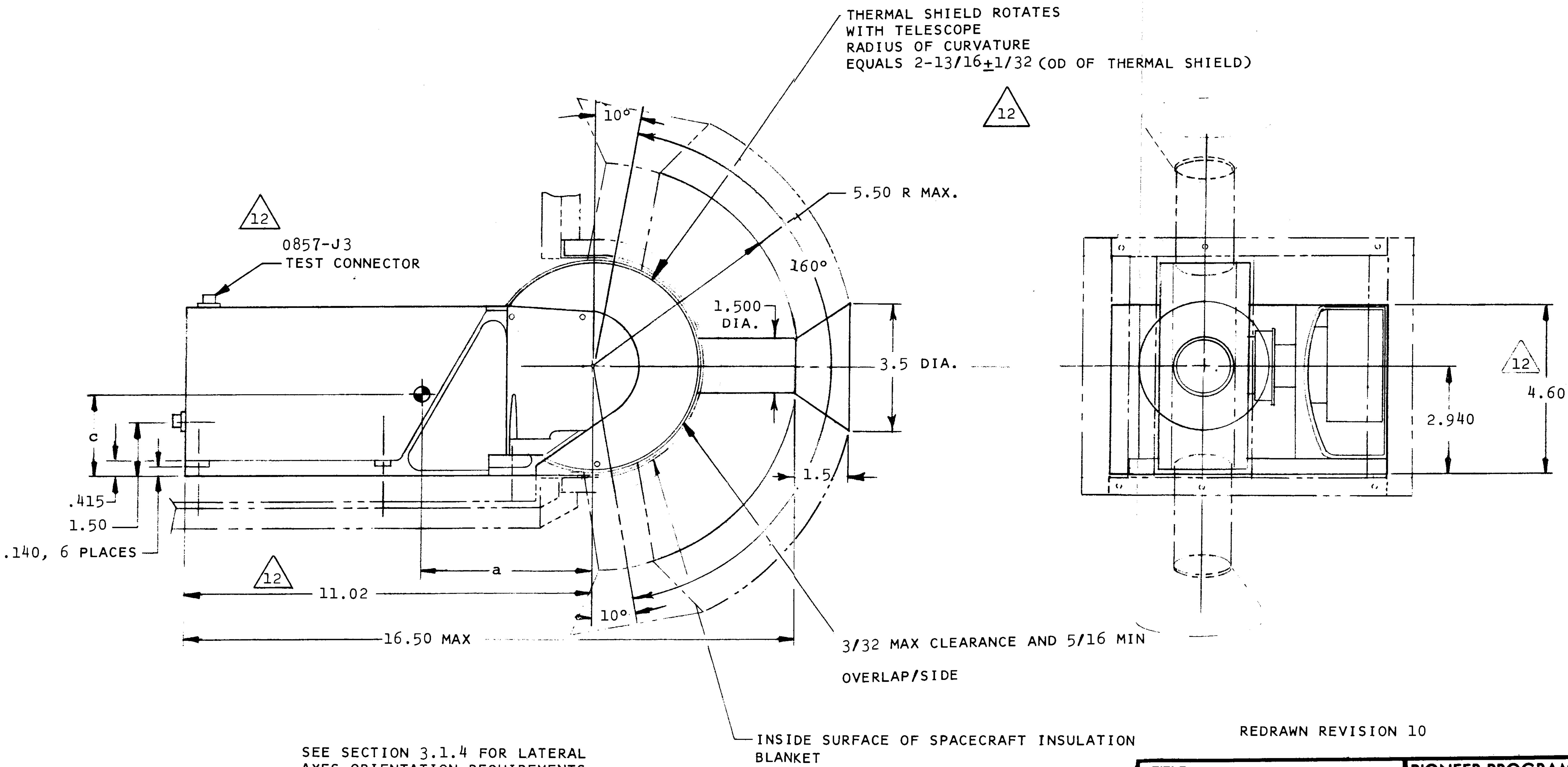
6. NOTES

6.1 DEFINITIONS

See Section 6.1 of Specification PC-220.00.

6.2 ABBREVIATIONS

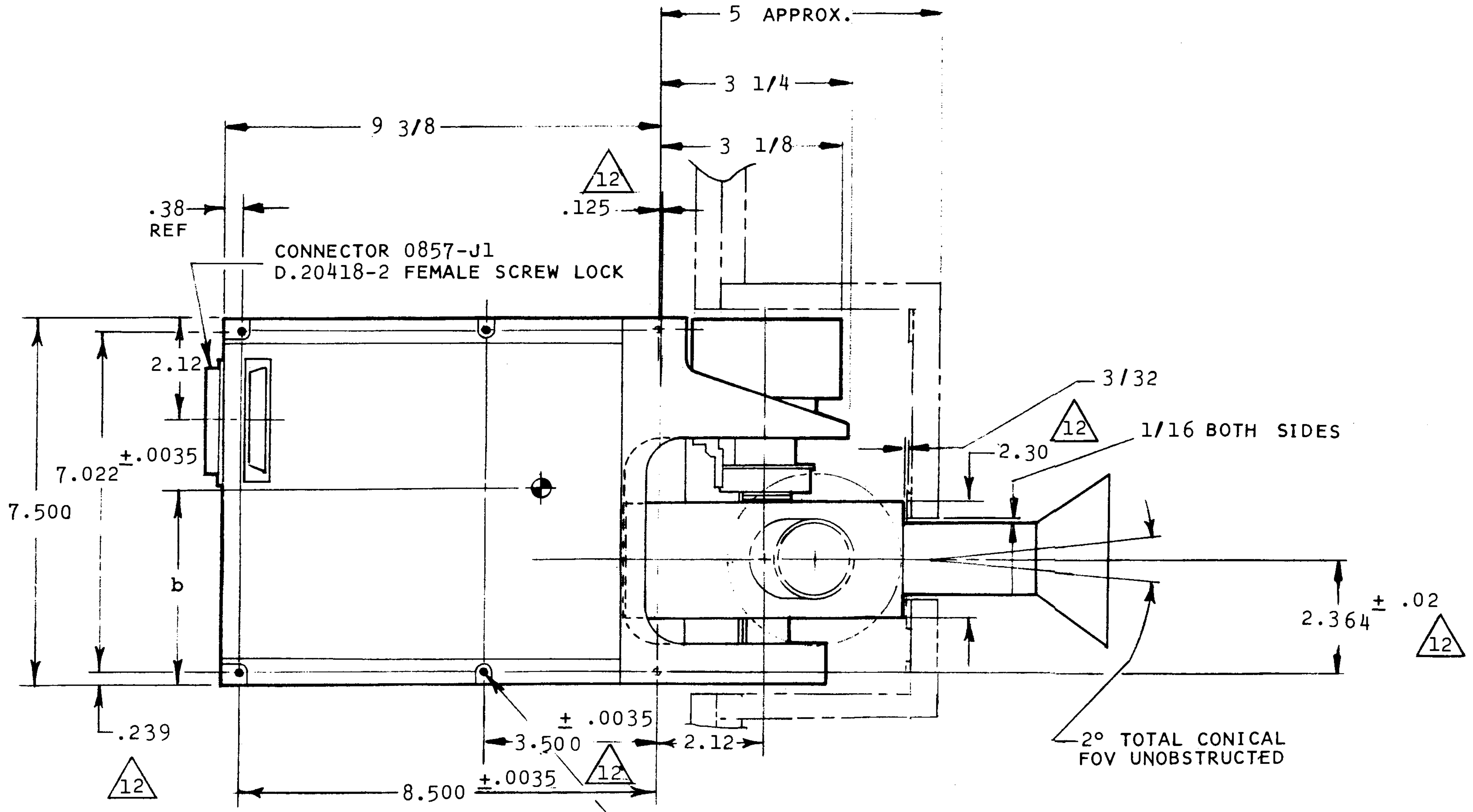
See Section 6.2 of Specification PC-220.00.



REDRAWN REVISION 10

SEE SECTION 3.1.4 FOR LATERAL
AXES ORIENTATION REQUIREMENTS

TITLE MECHANICAL INTERFACE ARIZONA IMAGE PHOTOPOLARIMETER	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.09
	FIG. 3.1.1
REV. NO. 12 DATE 6-26-70	SHEET 1 OF 2

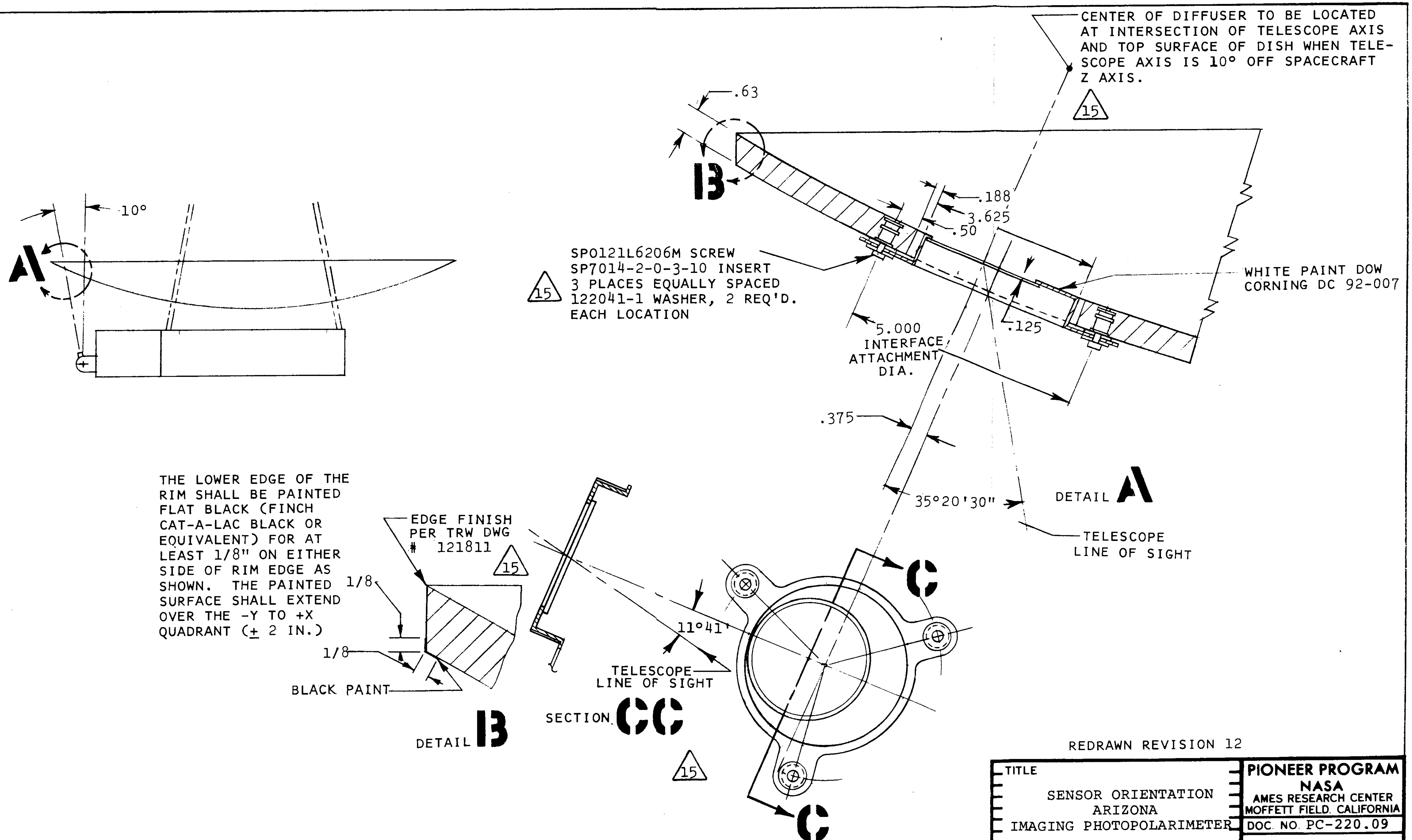


.177 DIA $^{+.005}_{-.001}$ 3/8 DIA SPOT FACE
.008 ±.008 FILLET RADUIS FOR #6 FLAT WASHER 6 PLACES

SEE SECTION 3.1.4 FOR LATERAL
AXES ORENTATION REQUIREMENTS

REDRAWN REVISION 10

TITLE MECHANICAL INTERFACE ARIZONA IMAGING PHOTOPOLARIMETER	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.09
	FIG. 3.1.1
REV. NO. 12 / DATE 6-26-70	SHEET 2 OF 2



REDRAWN REVISION 12

TITLE SENSOR ORIENTATION ARIZONA IMAGING PHOTOPOLARIMETER	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.09
	FIG. 3.1.4
REV. NO. 15 DATE 1-30-71	SHEET 1 OF 1

PIN NO.	FUNCTION
1	+28 VDC POWER
2	POWER RETURN
3	CMND POWER ON/OFF
4	SPARE
5	CMND MODE 2 (ZODIACAL LIGHT)
6	CMND MODE 3 (PHOTOPOLARIMETRY)
7	CMND MODE 4 (IMAGING)
8	CMND STARTING LOOK ANGLE RESET
9	CMND LOOK ANGLE STEP REVERSE
10	CMND LOOK ANGLE STEP INHIBIT
11	CMND START DATA AT THRESHOLD
12	CMND LOW SAMPLE RATE
13	CMND PMT GAIN INCREMENT
14	CMND PMT GAIN DECREMENT
15	CMND SPOKE ADVANCE - FINE (1/64TH ROLL)
16	CMND SPOKE ADVANCE - COARSE (1/8TH ROLL)
17	CMND START LOOK ANGLE INCREMENT
18	SPARE
19	DIGITAL DATA OUT (FORMAT D1 & D2)
20	DATA STORE GATE
21	BIT SHIFT CLOCK (16.384 kHz)
22	STANDBY VERIFICATION (S.S.C. E2, WORD 17) 12
23	SPARE
24	SPARE
25	SPARE
26	ROLL INDEX PULSE
27	END OF MEMORY
28	32.768 kHz CLOCK
29	SECTOR GENERATOR (512 SECTORS)
30	SPARE
31	SPARE
32	SPARE
33	SPARE
34	CHASSIS GROUND 12
35	CHASSIS GROUND
36	SIGNAL RETURN (GSE USE ONLY)
37	SIGNAL RETURN (GSE USE ONLY)

REPRODUCED FROM

TITLE

PIN ASSIGNMENTS
CONNECTOR 0857-J1

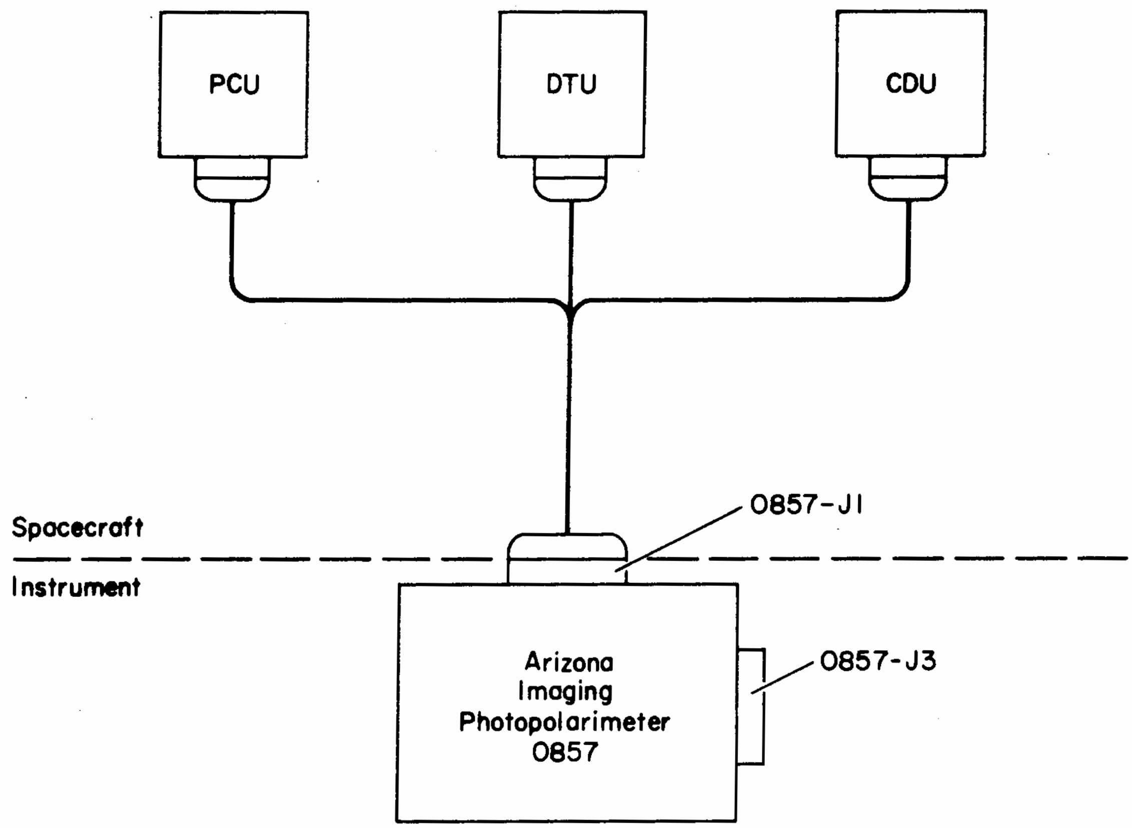
PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.09

FIG. 3.2.4.1

REV. NO. 12 DATE 6-26-70

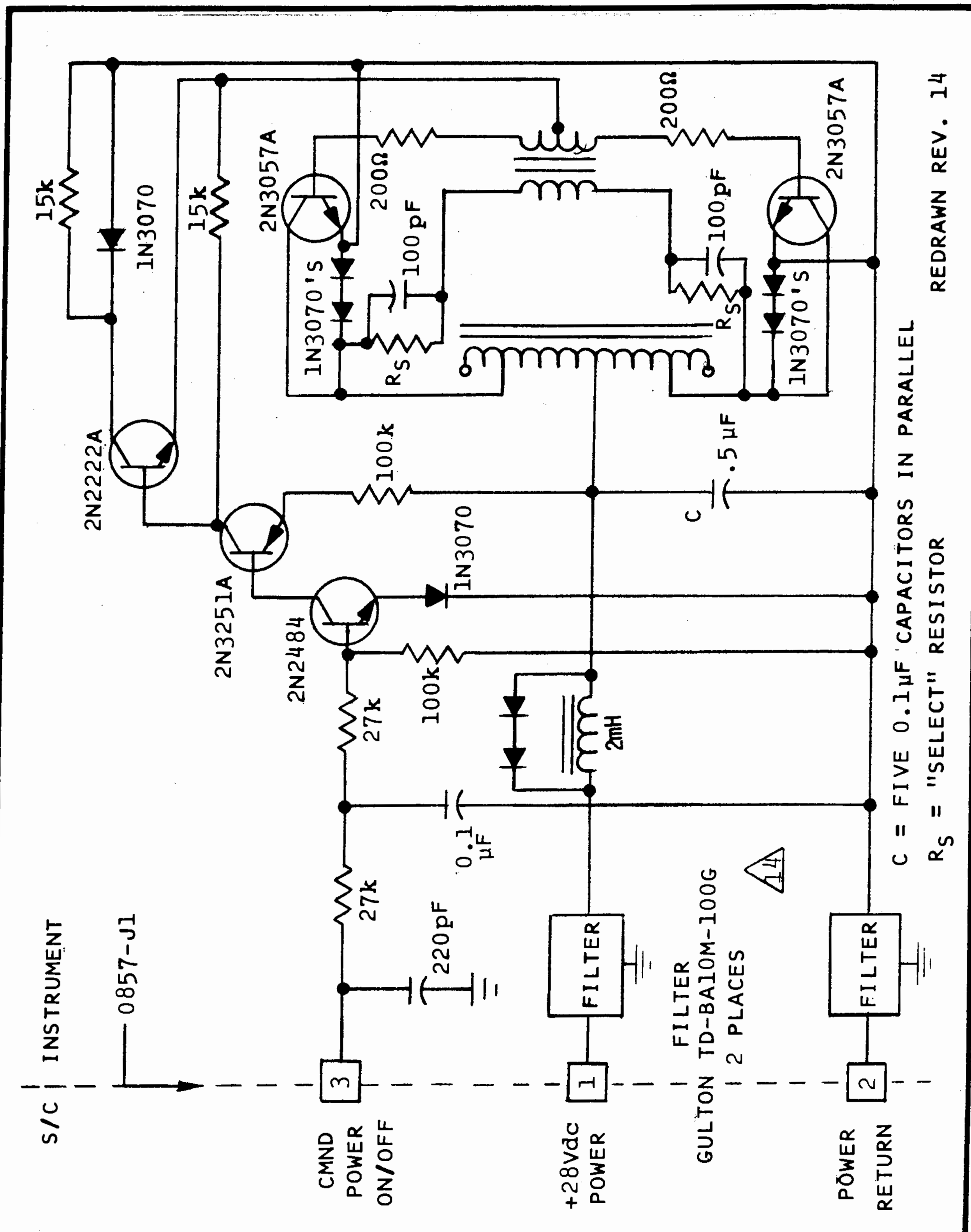
SHEET 1 OF 1



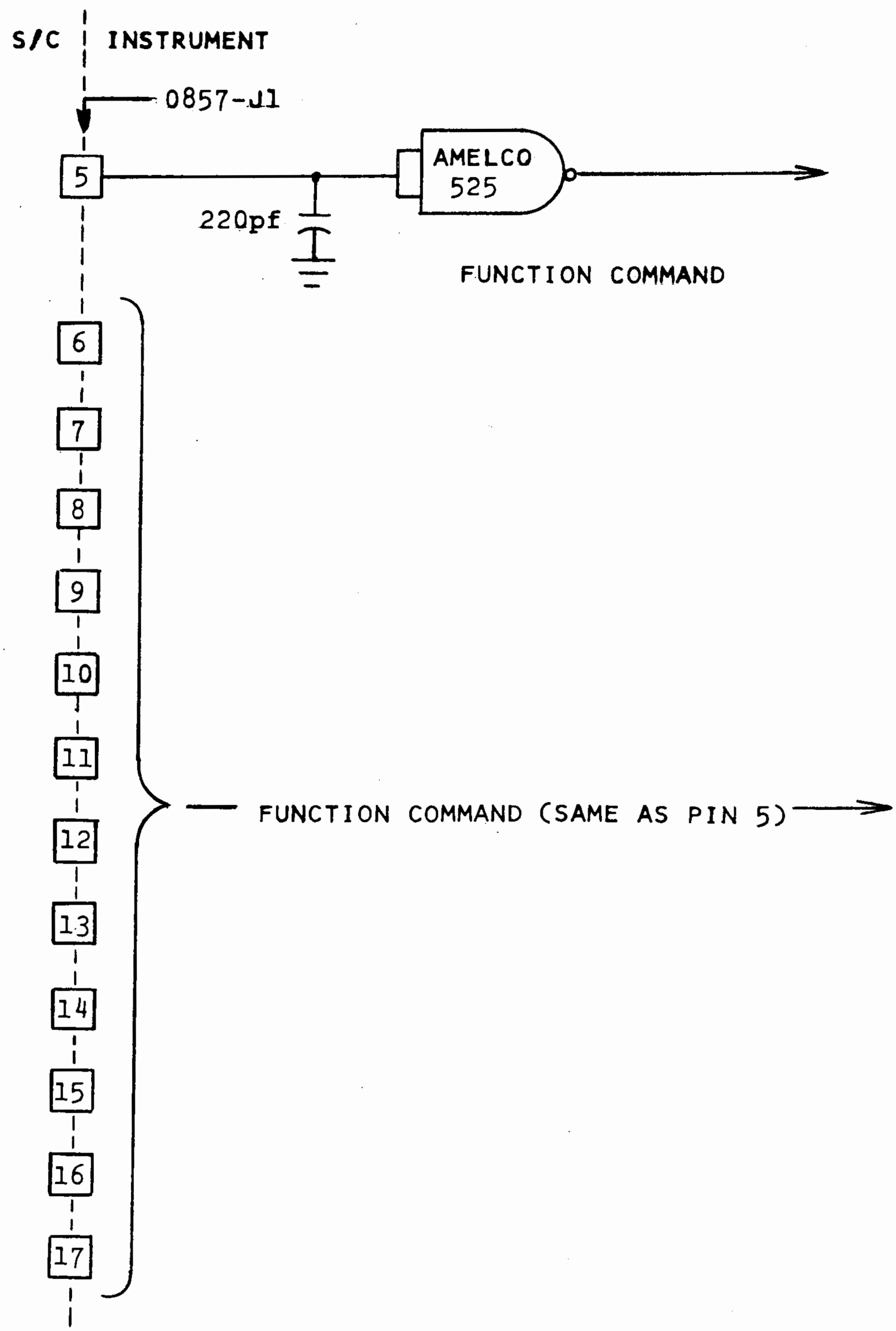
CONNECTOR	FUNCTION	TYPE
0857-J1	INTERFACE	DCM-37P
0857-J2	NOT USED	---
0857-J3	TEST	DBM-25S

NOTE: ALL CONNECTORS ARE CANNON GOLDEN D MARK I UNLESS OTHERWISE SPECIFIED.

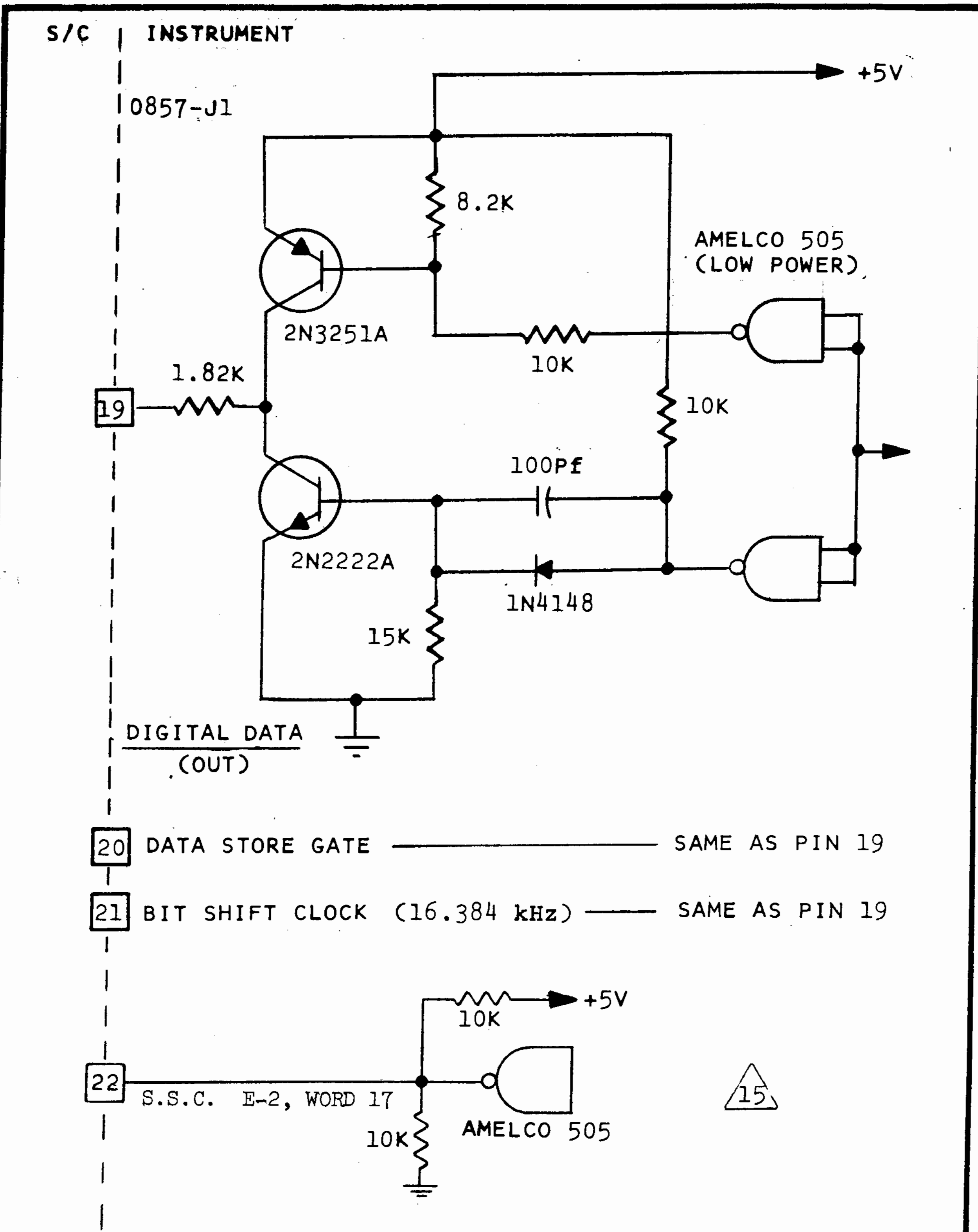
REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CONNECTOR I.D. ARIZONA IMAGING PHOTOPOLARIMETER	DOC. NO PC-220.09
		FIG. 3.2.4.2
	REV. NO. 4 / DATE 3-6-70	SHEET 1 OF 1



REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	DOC. NO. PC-220.09
		FIG. 3.2.5
	REV. NO. 14 / DATE 10-31-70	SHEET 1 OF 4



REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.09
		FIG. 3.2.5
	REV. NO. 12 — DATE 6-26-70	SHEET 2 OF 4



REPRODUCED FROM

TITLE

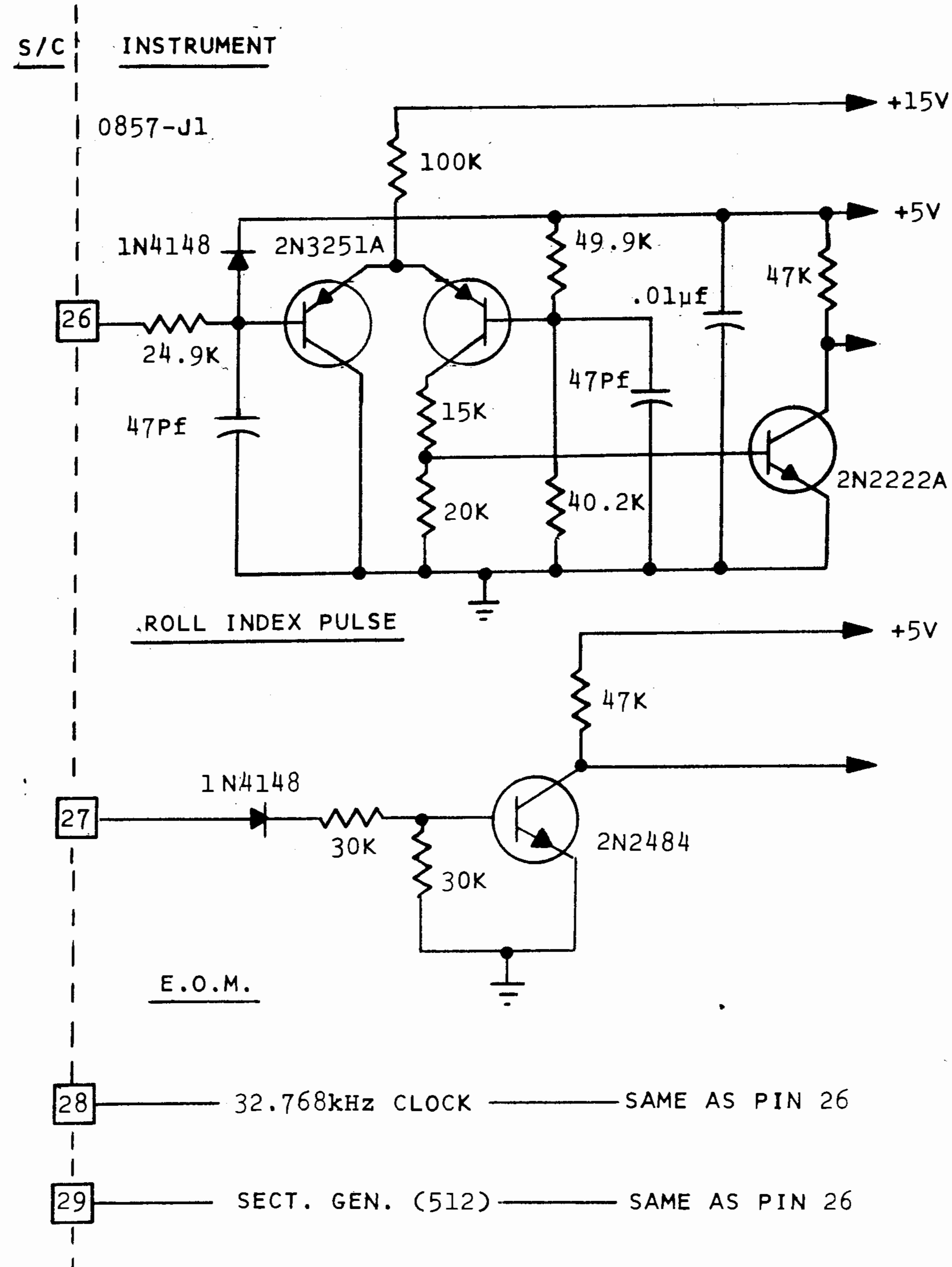
INSTRUMENT/SPACECRAFT
INTERFACE CIRCUITS

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.09

FIG. 3.2.5

REV. NO. 15 | DATE 1-30-71 | SHEET 3 OF 4



REPRODUCED FROM

TITLE

INSTRUMENT/SPACECRAFT
INTERFACE CIRCUITS

REV. NO. 12 | DATE 6-26-70

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.09

FIG. 3.2.5

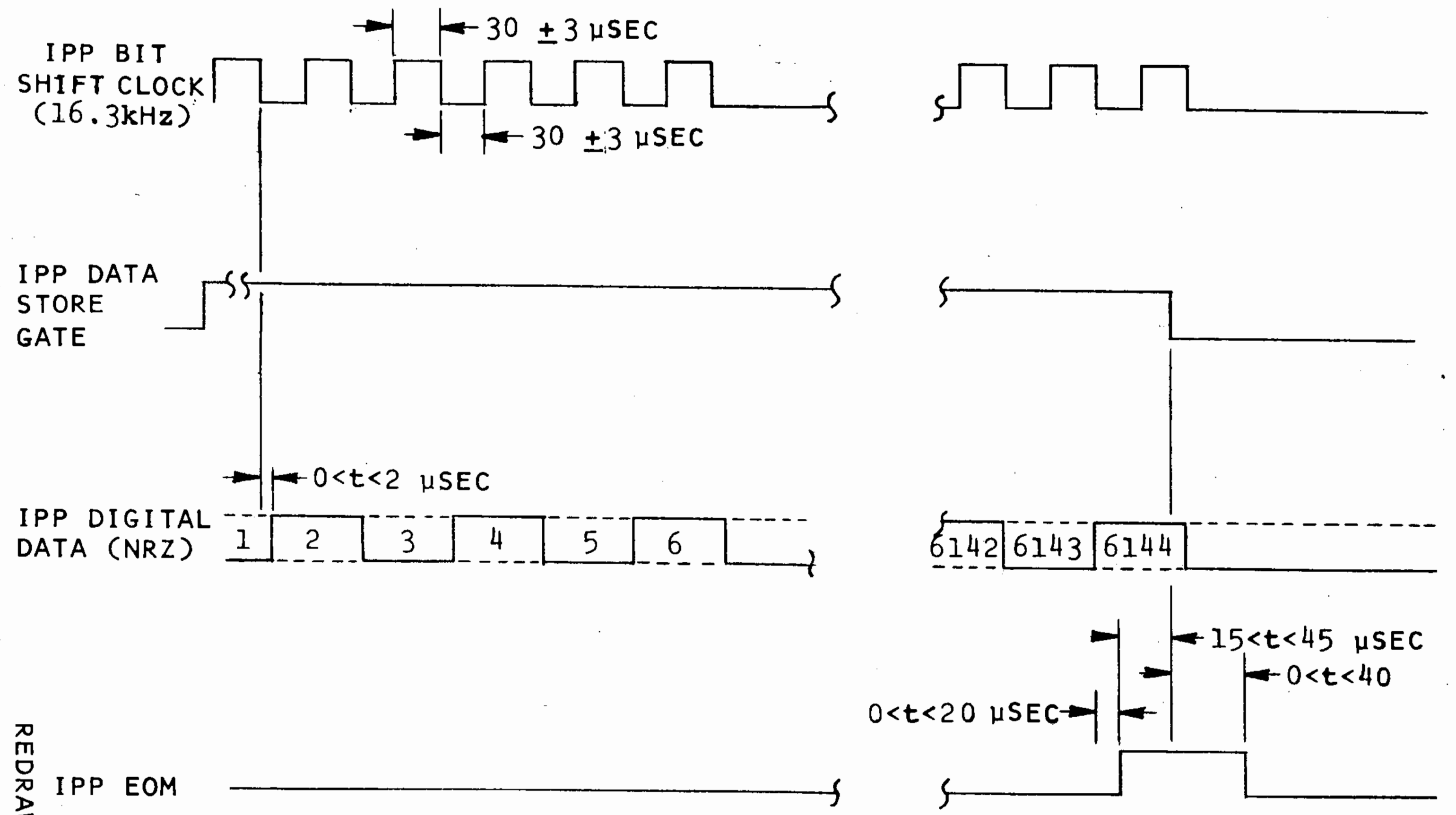
SHEET 4 OF 4

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/GSE INTERFACE CIRCUITS	DOC. NO. PC-220.09
		FIG. 3.2.6
	REV. NO. / DATE	SHEET 1 OF 1

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	BLOCK DIAGRAM ARIZONA IMAGING PHOTOPOLARIMETER	DOC. NO. PC-220.09
		FIG. 3.2.7
	REV. NO. / DATE	SHEET 1 OF 1



NOTES: △15 THE DIGITAL DATA WILL BE CLOCKED ON THE FALLING EDGE OF A CLOCK PULSE AS SHOWN. NO IPP BIT SHIFT CLOCK FALLING EDGES SHALL OCCUR WITHIN 60μS FROM THE LEADING EDGE OF AN IPP DATA STORE GATE. IPP DATA STORE GATE WILL FALL LOW AFTER GENERATION OF THE IPP EOM AS SHOWN. IPP EOM WILL NOT FALL LOW UNTIL AFTER IPP DATA STORE GATE FALLS LOW. IPP EOM IS MARKED BY THE LEADING EDGE OF BIT 6144.

REDRAWN REVISION 12

REPRODUCED FROM	TITLE: TIMING DIAGRAM UA/IPP DSU INTERFACE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.09
		FIG. 3.3.1
	REV. NO. 15 / DATE 1-30-71	SHEET 1 OF 1

CIT/INFRARED RADIOMETER

PC-220.10

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California

PIONEER PROGRAM

SPECIFICATION PC-220.10

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

CIT/INFRARED RADIOMETER

October 20, 1969

1. SCOPE

Specification PC-220.10 defines the characteristics and requirements of the CIT/Infrared Radiometer Instrument pertinent to the Pioneer spacecraft.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATIONS

PC-213.00, Scientific Instrument and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATION

PC-220.00, Spacecraft/Scientific-Instrument Interface Specification

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Configuration. The dimensions, configuration and connector locations for the instrument will be as specified in Figure 3.1.1.

3.1.2 Mass Properties.

3.1.2.1 Weight (Present). 4.2 lb (15).

Revision

3.1.2.2 Center of Gravity. The center of gravity notation will be as indicated in Figure 3.1.1. The c.g. locations will be as follows: (5)

a = 2.9 b = 1.7 c = 4.2

3.1.2.3 Moments of Inertia. The moments of inertia of the instrument about the center of gravity of the units will be as follows:

Moments of Inertia (in-lb-sec^2)

I_a = TBS I_b = TBS I_c = TBS

3.1.3 Mounting. The instrument mounting faces and methods will be as indicated in Figure 3.1.1.

3.1.4 Sensor Orientation. The IR instrument shall be positioned on the spacecraft such that the viewing requirements of Section 3.1.5 are satisfied, and that the projection of the optical axis of the telescope on the spacecraft X-Y plane forms no less than a 45° angle with the closest edge of the nearest RTG unit. The azimuthal angle between the roll index pulse fixed reference line and the projection line described above shall be known to ± 30 minutes. (16)

3.1.5 Viewing. The IR instrument requires an unobstructed view cone of 20° with the apex of the cone located approximately 8.5 inches behind the face of the sensor. (11)

3.2 ELECTRICAL (1)

3.2.1 Power Load.

	Specified	Present
Standby	0.0	TBS
Average	1.2W	1.2W
Peak	1.5W	1.7W

3.2.2 Duty Cycle. Peak power will occur for a maximum of 500 ms once per roll period during encounter. (13)

3.2.3 Converter Frequency. The converter frequency will be as indicated in Figure 3.5.1.1 of PC-220.00.

3.2.4 Connectors.

3.2.4.1 Connector Pin Assignments. Pins on the connectors for this instrument will be wired in accordance with Figure 3.2.4.1.

3.2.4.2 Connector Identification. Each connector attached to the instrument will be identified with a number in accordance with Figure 3.2.4.2.

3.2.5. Instrument Interface Circuits. Figure 3.2.5, shows the instrument input/output circuits which interface with the spacecraft/instrument interface timing, command and data lines.

3.2.6 Instrument/GSE Interface Circuits. Figure 3.2.6 shows the GSE input/output circuits which interface with the instrument thru the instrument stimulus/test connector.

3.2.7 Block Diagram. Figure 3.2.7 is a typical block diagram for the IR Instrument.

3.3 DATA HANDLING AND INSTRUMENT CONTROL (1)

3.3.1 Signals from the Instrument. The scientific instrument will provide the following signals:

Main frame - Format D_2	1 Line
Science subcom	
Digital	1 Line
Analog	2 Lines

3.3.2 Signals to the Instrument. The scientific instrument will be provided with the following signals.

3.3.2.1 Power. 2 Lines

3.3.2.2 Commands.

Power ON/OFF	1 Line
Functional	1 Line

3.3.2.3 Timing and Control.

(a) Word gate - main frame (Format D2)	1 Line
(b) Bit shift pulse	1 Line
(c) Clock - 32.768 kHz	1 Line
(d) Clock - 2048 Hz	1 Line
(e) Roll index pulse	1 Line
(f) Sector Generator (512 Sectors)	1 Line
(g) Rate pulse - science subcom	1 Line
(h) Word rate - science subcom	1 Line

3.3.3 Telemetry Word Assignments. Telemetry word assignments are specified in PC-220.01, sections 3.3.1.4.1 thru 3.3.1.4.5.

3.3.4 Instrument Words. Arrangements of instrument words within the telemetry word assignments for this instrument are as shown in PC-260.09.

3.4 THERMAL

3.4.1 Operating Limits. This instrument will be capable of operating over the following temperature range: (15)

Platform-mounted unit: -20°F to +110°F

3.4.2 Thermal Load, Platform-Mounted Unit. The platform-mounted unit of this instrument shall be exposed to the thermal environment exterior to the spacecraft while in space flight. The average thermal load supplied to the spacecraft by electrical power dissipation within the platform-mounted unit will be watts.

3.4.3 Surface Thermal Properties

3.4.3.1 Mounting Surfaces. The mounting surfaces of the instrument will be treated in accordance with PC-213.03, section 3.2.6.8.1.

3.4.3.2 Nonmounting Surfaces. The nonmounting surfaces of the instrument viewing the inside of the spacecraft will be treated in accordance with PC-213.03, section 3.2.6.8.6.

3.4.4 Mounting Surface Area. The thermal conducting area of the instrument units contiguous with the spacecraft mounting surfaces will be as follows:

Platform-mounted unit: 24.4 square inches.

3.5 COMPATIBILITY (1)

3.5.1 Electromagnetic-Special Requirements & Characteristics. This instrument is sensitive to the frequencies indicated in Figure 3.5.1.1., Pioneer Specification PC-220.00.

3.5.2 Radioactive Sources. None.

3.6 MISCELLANEOUS REQUIREMENTS & CHARACTERISTICS

3.6.1 Spin Rate. The preferred spin rate of the spacecraft for operation of this instrument is 5 rpm. The instrument will operate satisfactorily for spacecraft spin rates between 3 and 6 rpm. (1)

4. PERFORMANCE ASSURANCE PROVISIONS

Not Applicable.

5. PREPARATION FOR DELIVERY, HANDLING, SHIPPING & STORAGE (1)

5.1 HANDLING

5.1.1 General. The scientific instrument shall at all times be handled in a manner which will minimize the possibility of damage to the instrument. Grasping of the instrument by other than the base section shall not be permitted.

5.1.2. Protective Covers. This instrument employs a protective cover with the sensor. This cover shall remain in position during all systems tests except physical properties measurements, vibration, thermal vacuum, and other tests as directed by the NASA/ARC Experiment Test Engineer. The experiment test connector shall be covered with MISTIK type 7000 fiberglass or equivalent approved nonconductive tape just prior to launch. During test operations and storage, all exposed connectors shall be protected with dust covers.

5.2 SHIPPING

Except when mounted on the spacecraft, this scientific instrument shall be transported only in its custom carrying case. Movement of the instrument to and from TRW will be the responsibility of NASA/ARC.

5.3 STORAGE

Whenever the instrument is not mounted on the spacecraft platform, or not in use for bench tests, it shall be stored in the protective carrying case furnished by the experimenter and placed in the bonded stores area of TRW. The carrying case will contain suitable chemical dessiccant, the condition of which will be monitored periodically during protracted storage periods, by the cognizant NASA test engineer.

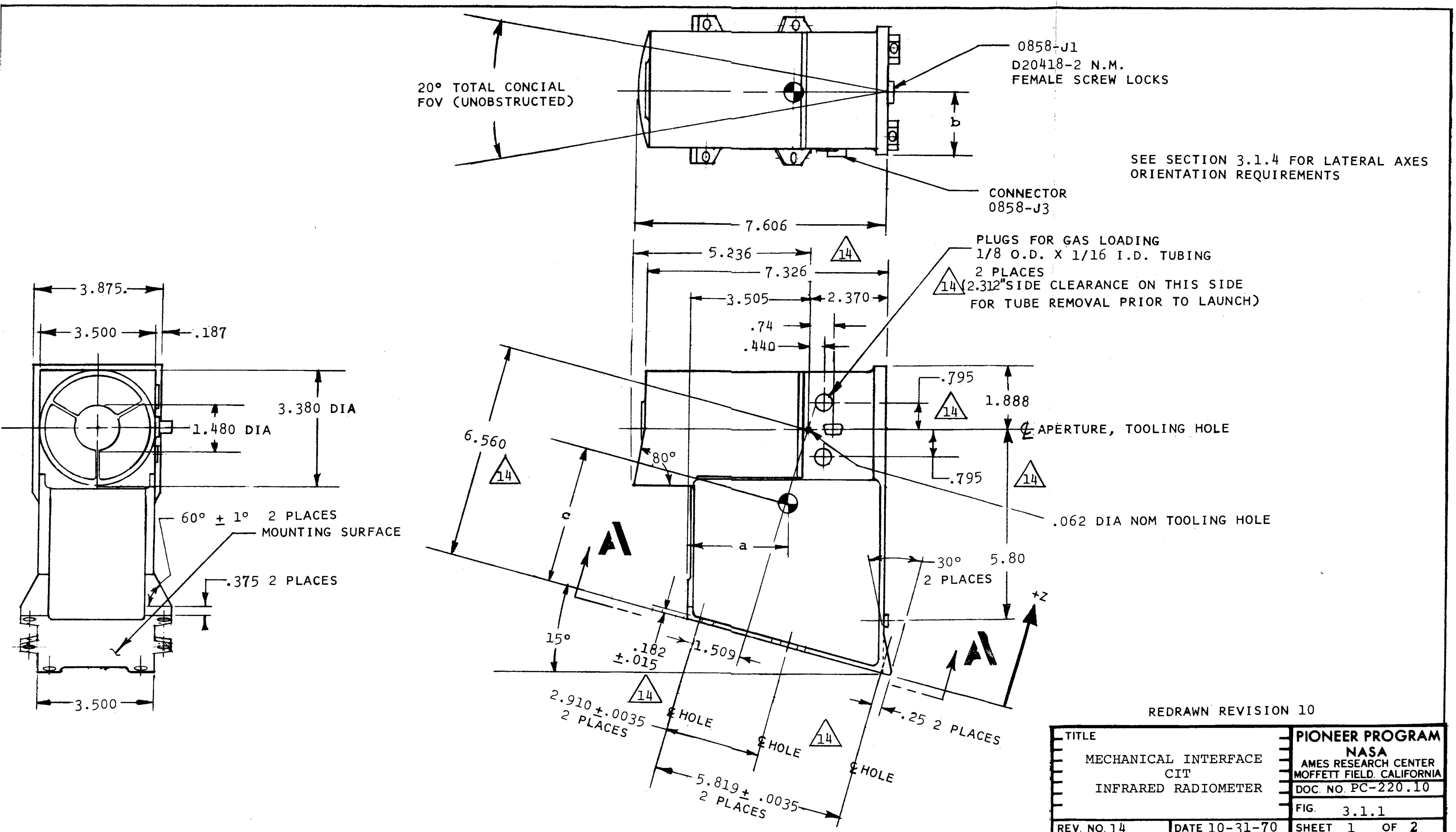
6. NOTES

6.1 DEFINITIONS

See Section 6.1 of Specification PC-220.00.

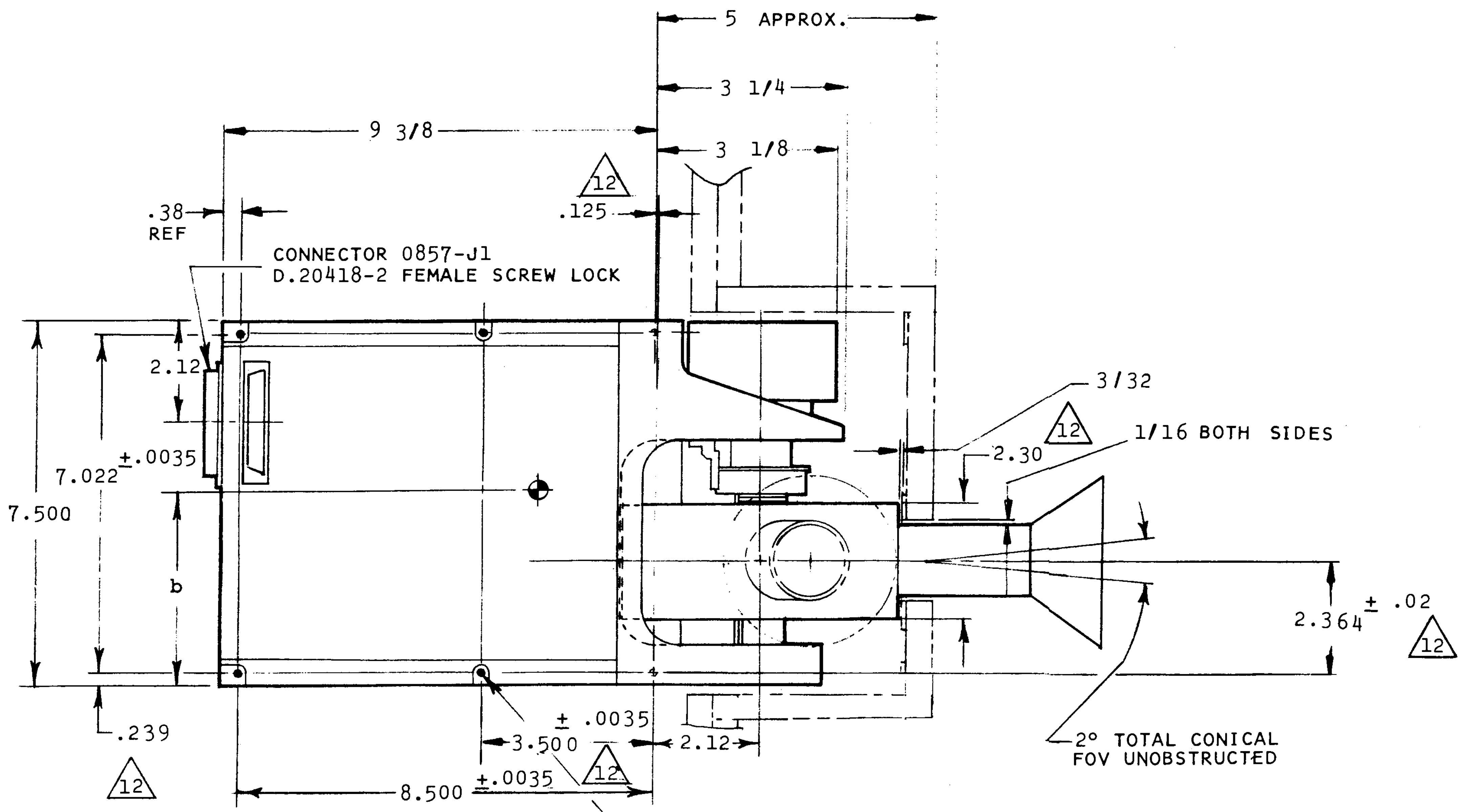
6.2 ABBREVIATIONS

See Section 6.2 of Specification PC-220.00.



REDRAWN REVISION 10

TITLE	
MECHANICAL INTERFACE CIT INFRARED RADIOMETER	**PIONEER PROGRAM** **NASA** AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.10
	FIG. 3.1.1
REV. NO. 14 — DATE 10-31-70	SHEET 1 OF 2



.177 DIA $^{+.005}_{-.001}$ 3/8 DIA SPOT FACE

.008 ±.008 FILLET RADUIS FOR #6 FLAT WASHER 6 PLACES

SEE SECTION 3.1.4 FOR LATERAL AXES ORENTATION REQUIREMENTS

REDRAWN REVISION 10

TITLE MECHANICAL INTERFACE ARIZONA IMAGING PHOTOPOLARIMETER	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	DOC. NO. PC-220.09
	FIG. 3.1.1
REV. NO. 12 DATE 6-26-70	SHEET 2 OF 2

PIN NO.	FUNCTION
1	SIGNAL RETURN (GSE USE ONLY)
2	DIGITAL DATA OUT (FORMAT D2)
3	SPARE (GROUND)
4	+28 VDC POWER
5	SPARE (GROUND)
6	CMD POWER ON/OFF
7	SPARE (GROUND)
8	WORD GATE - MAIN FRAME (Ia)
9	WORD GATE - SCIENCE SUBCOM (Ic)
10	BIT SHIFT PULSE
11	SPARE (GROUND)
12	ANALOG (SENSOR TEMP LOW) S.S.C. (E1) WORD 17
13	ANALOG (SENSOR TEMP HIGH) S.S.C. (E2) WORD 1
14	DIGITAL DATA OUT - S.S.C. (E1)
15	SPARE (GROUND)
16	RETURN FOR 4 AND 6
17	SPARE (GROUND)
18	SPARE (GROUND)
19	SPARE (GROUND)
20	RATE PULSE - SCIENCE SUBCOM
21	CMND - SPOKE WHEEL ADVANCE
22	ROLL INDEX PULSE
23	SECTOR GENERATOR (512 SECTORS)
24	32.768 kHz CLOCK
25	2048 Hz CLOCK

12

REPRODUCED FROM

TITLE

PIN ASSIGNMENTS
CONNECTOR 0858-J1

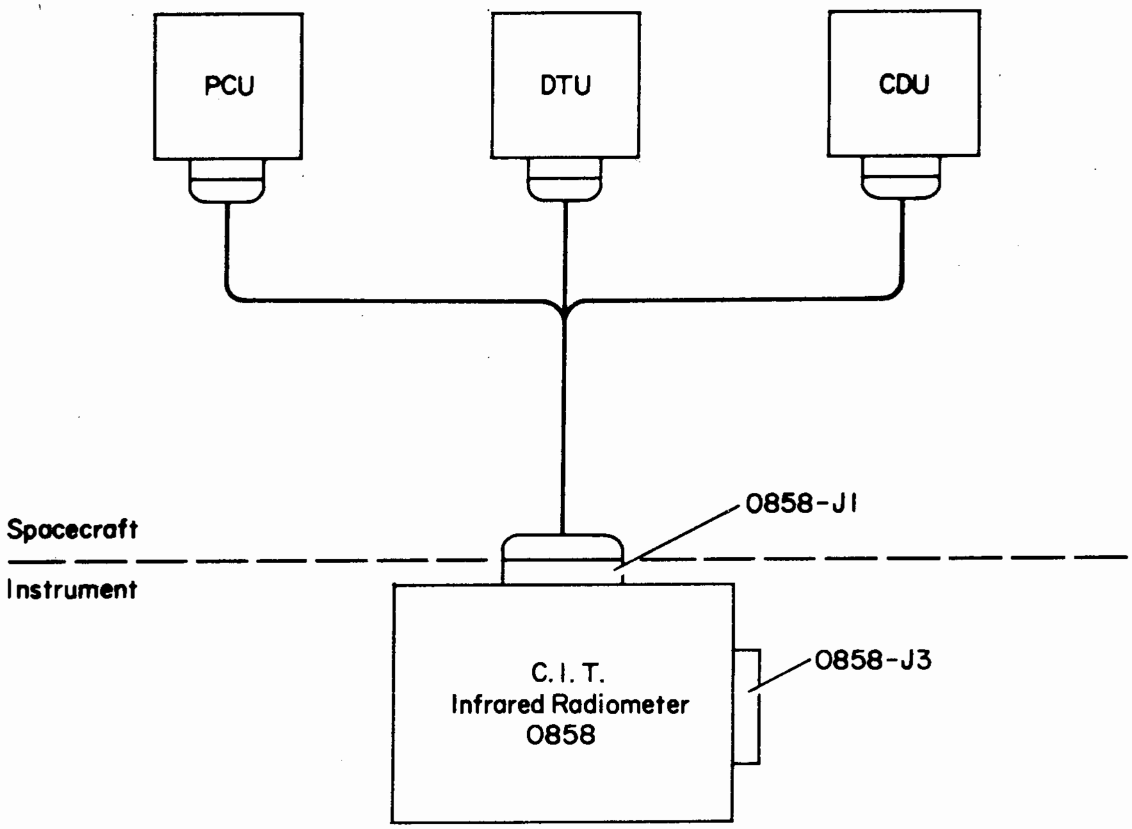
REV. NO. 12 | DATE 6-26-70

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.10

FIG. 3.2.4.1

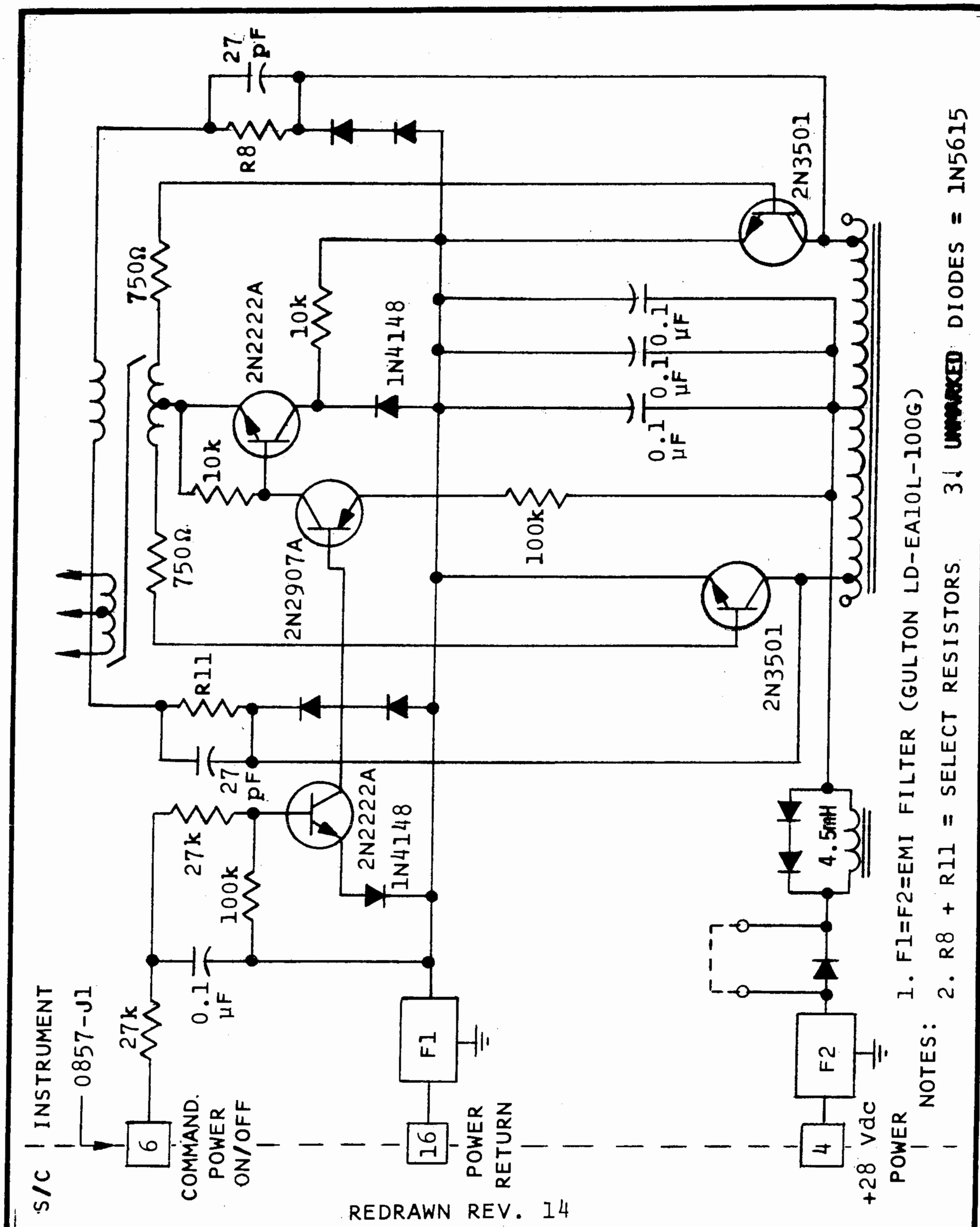
SHEET 1 OF 1



CONNECTOR	FUNCTION	TYPE
0858-J1	INTERFACE	DBM-25P
0858-J2	NOT USED	---
0858-J3	TEST	DEM-9S

NOTE: ALL CONNECTORS ARE CANNON GOLDEN D MARK I UNLESS OTHERWISE SPECIFIED.

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CONNECTOR I.D. C.I.T. INFRARED RADIOMETER	DOC. NO. PC-220.10
		FIG. 3.2.4.2
	REV. NO. 4 — DATE 3-6-70	SHEET 1 OF 1



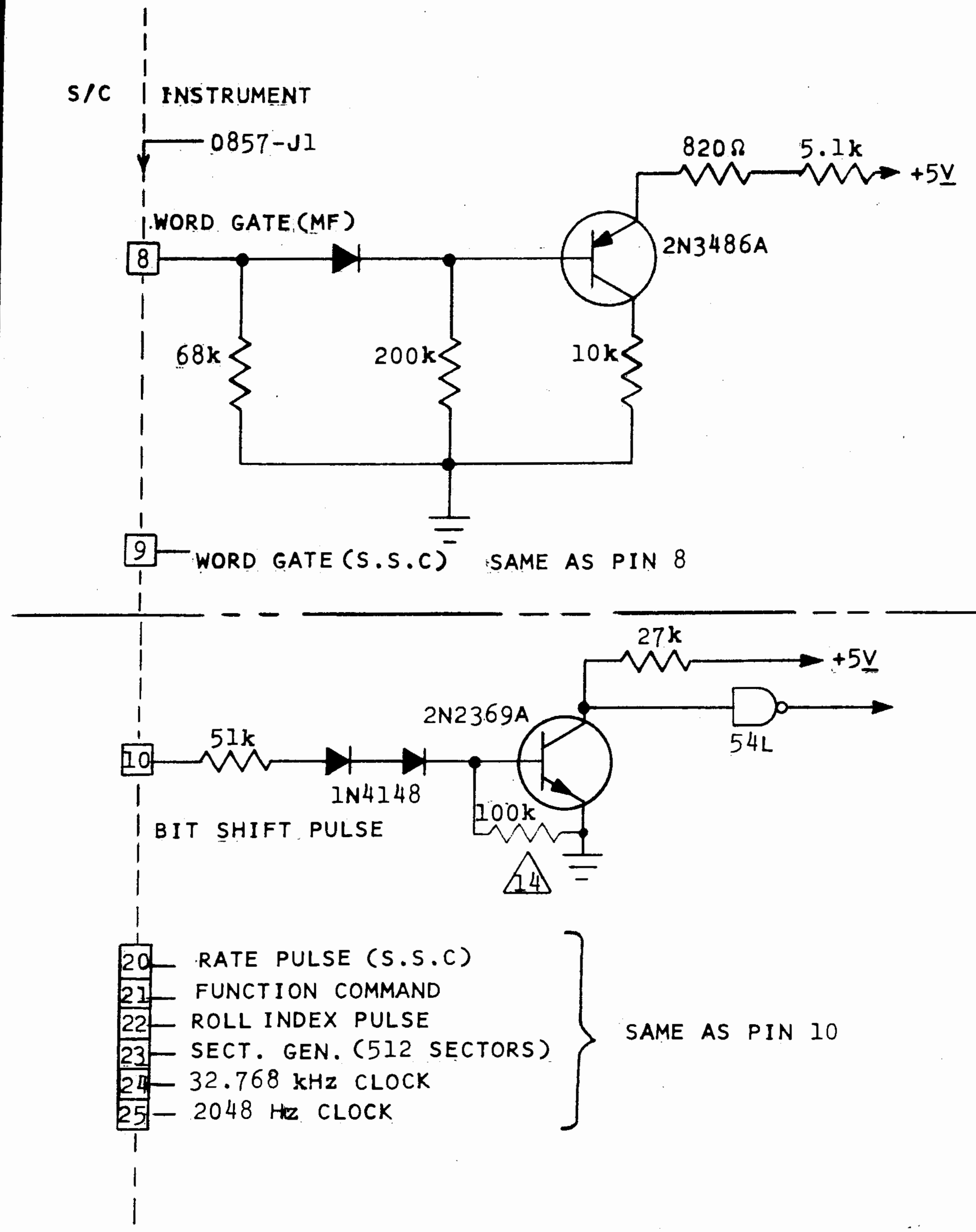
REPRODUCED FROM

TITLE

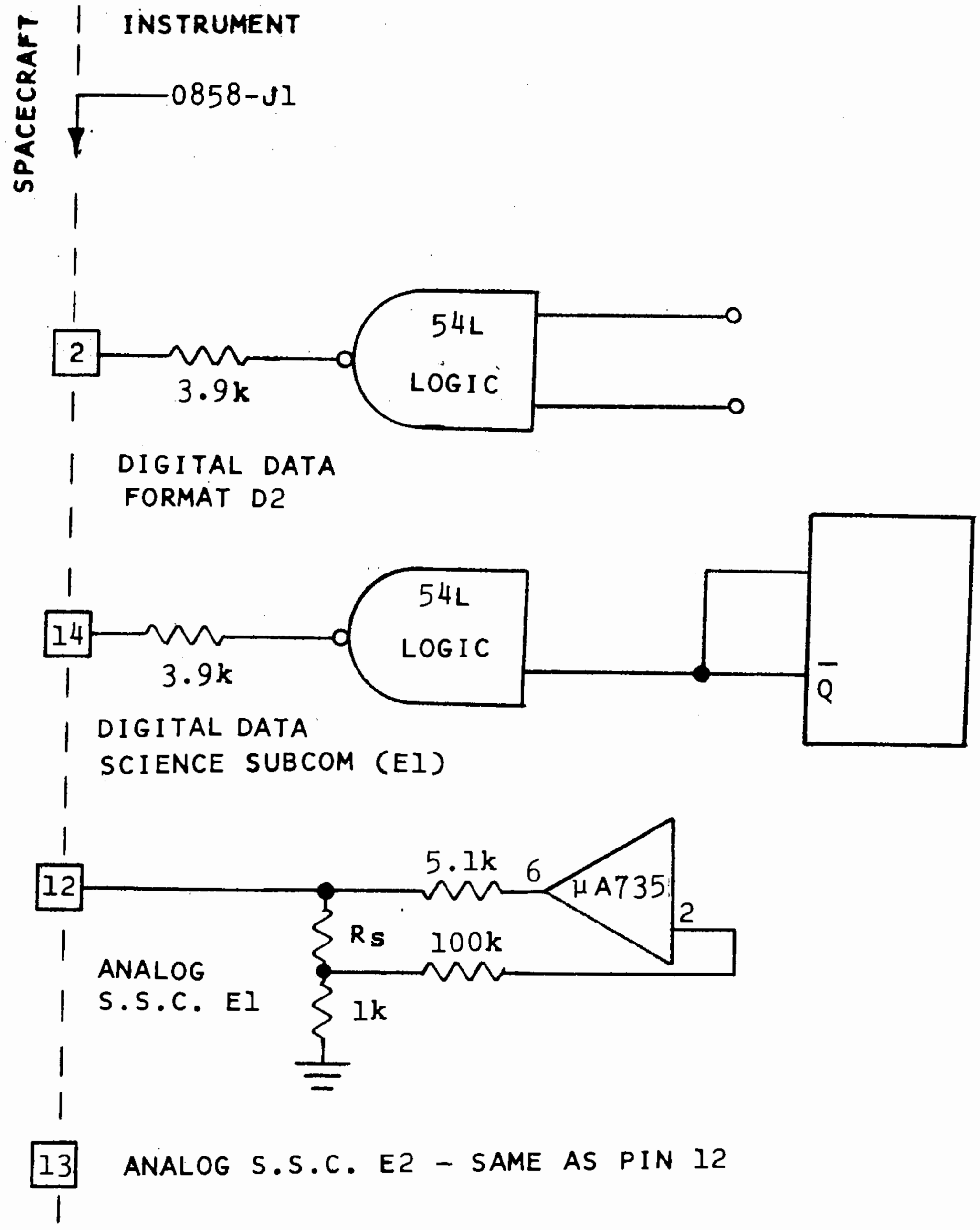
INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD. CALIFORNIA

REV. NO. 14	DATE 10-31-70	DOC. NO. PC-220.10
		FIG. 3.2.5
		SHEET 1 OF 3



REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.10
		FIG. 3.2.5
	REV. NO. 14 DATE 10-31-70	SHEET 2 OF 3



NOTE: R_s = SELECT RESISTOR

REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.10
		FIG. 3.2.5
	REV. NO. 14 / DATE 10-31-70	SHEET 3 OF 3

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/GSE INTERFACE CIRCUITS	DOC. NO. PC-220.10 FIG. 3.2.6
	REV. NO. / DATE	SHEET 1 OF 1

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM
	BLOCK DIAGRAM CIT/IR	NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.10
		FIG. 3.2.7
	REV. NO. | DATE	SHEET 1 OF 1

G. E. ASTEROID-METEROID DETECTOR

PC-220.11

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California

PIONEER PROGRAM

SPECIFICATION PC-220.11

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

G.E. ASTEROID-METEOROID DETECTOR

October 20, 1969

1. SCOPE

Specification PC-220.11 defines the characteristics and requirements of the G.E./AMD pertinent to the Pioneer spacecraft.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATION

PC-213.00, Scientific Instruments and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATION

PC-220.00, Spacecraft/Scientific-Instrument Interface Specification

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Configuration. The dimensions, configuration and connector locations for the instrument will be as specified in Figure 3.1.1.

3.1.2 Mass Properties

3.1.2.1 Weight (Present) (16)

Electronics	2.1 lb
Sensor and Cabling	3.54 lb
Sensor Shade	0.3 lb
Total	5.94 lb

Revision

3.1.2.2 Center of Gravity. The center of gravity notation will be as indicated in figure 3.1.1. The c.g. locations will be as follows: (5)

Elect.	a = 2.9 ± 0.5	b = 3.0 ± 0.5	c = 1.6 ± 0.5
Sensor	a = 0.4 ± 0.5	b = 0.0 ± 0.5	c = 0.7 ± 0.5

3.1.2.3 Moments of Inertia. The moments of inertia of the instrument about the center of gravity of the units will be as follows:

Moments of Inertia ($in\text{-}lb\text{-}sec^2$)

I_a = TBS I_b = TBS I_c = TBS

3.1.3 Mounting. The instrument mounting faces and methods will be as indicated in Figure 3.1.1, sheets 1 and 2.

3.1.4 Sensor Orientation. The four telescope array shall be positioned on the spacecraft such that the telescopes are shielded from direct sunlight during cruise mode. A GFE alignment fixture will be provided which defines the direction of the centerline of the telescope array as shown in Figure 3.1.4. The centerline of the array so defined shall form a 45° ± 30 minute angle with a line parallel to the spacecraft "Z" axis. This angle shall be measured to ± 15 minutes. The azimuthal angle between the projection of the centerline defined by the GFE fixture on the spacecraft X-Y plane and the roll index pulse fixed reference line shall be known to ± 15 minutes. (16)

3.1.5 Viewing. An unobstructed view cone of 10° is required. See Figure 3.1.5 for details. The required FOV free of scattered light is 2 π steradians. (1)

3.2 ELECTRICAL

3.2.1 Power Load(Present) (11)

Standby	~~TBS~~
Average	1.7W
Peak	2.8W

3.2.2 Duty Cycle. Peak power is required for a maximum of 0.2 seconds per event. The maximum expected event rate is one per hour.

3.2.3 Converter Frequency. The converter frequency will be as indicated in Figure 3.5.1.1. of PC-220.00.

3.2.4 Connectors.

3.2.4.1 Connector Pin Assignments. Pins on the connectors for this instrument will be wired in accordance with Figure 3.2.4.1.

3.2.4.2 Connector Identification. Each connector attached to the instrument will be identified with a number in accordance with Figure 3.2.4.2.

3.2.5 Instrument Interface Circuits. Figure 3.2.5, shows the instrument input/output circuits which interface with the spacecraft/instrument interface timing, command and data lines.

3.2.6 Instrument/GSE Interface Circuits. Figure 3.2.6, shows the GSE input/output circuits which interface with the instrument thru the instrument stimulus/test connector.

3.2.7 Block Diagram. Figure 3.2.7 is a typical block diagram for the Asteroid-Meteoroid Detector.

3.2.8 Sensor Panel Grounding. The sensor panel shall be bonded to the spacecraft to satisfy the requirements of TRW document SR1-8, Electromagnetic Interference Unit/Subsystem Specification. (14)

3.3 DATA HANDLING AND INSTRUMENT CONTROL (1)

3.3.1 Signals from the Instrument. The scientific instrument will provide the following signals: (7)

Science Subcom

Digital	1 Line
Analog	2 Lines
Bilevel	4 Lines

3.3.2 Signals to the Instrument. The scientific instrument will be provided with the following signals.

3.3.2.1 Power. 2 Lines

3.3.2.2 Commands. (7)

Power ON/OFF	1 Line
Functional	7 Lines

Revision

3.3.2.3 Timing and Control.

(a)	Sector generator (512 sectors)	1 Line
(b)	Roll index	1 Line
(c)	Word gate - science subcom	1 Line
(d)	Bit shift pulse	1 Line

3.3.3 Telemetry Word Assignments. Telemetry word assignments are specified in PC-220.01, sections 3.3.1.4.1 thru 3.3.1.4.5.

3.3.4 Instrument Words. Arrangements of instrument words within the telemetry word assignments for this instrument are as shown in PC-260.10.

3.4 THERMAL (1)

3.4.1 Limitations.

3.4.1.1 Operating Limits. This instrument will be capable of operating over the following temperature range: (15)

Platform-mounted unit: -20°F to +140°F
Externally-mounted unit: -300°F to +100°F

3.4.2 Thermal Load.

3.4.2.1 Platform-Mounted Unit. The platform-mounted unit of this instrument shall not be exposed to the thermal environment exterior to the spacecraft while in space flight. The average thermal load supplied to the spacecraft by electrical power dissipation within the platform-mounted unit will be 1.2 watts. (16)

3.4.2.2 Externally-Mounted Unit. The sensor will dissipate 0.8 watts of electrical power in the form of thermal energy. (16)

3.4.3 Mounting Surface Area. The thermal conducting area of the instrument units contiguous with the spacecraft mounting surfaces will be as follows: (4)

Platform-mounted unit: 33 square inches.
Nonplatform-mounted unit: TBS square inches.

3.4.4 Surface Thermal Properties.

3.4.4.1 Mounting Surfaces. The mounting surfaces of the instrument will be treated in accordance with PC-213.03, section 3.2.6.8.1.

3.4.4.2 Non-Mounting Surfaces. The non-mounting surfaces of the instrument viewing the inside of the spacecraft will be treated in accordance with PC-213.03, section 3.2.6.8.6.

3.5 COMPATIBILITY (1)

3.5.1 Electromagnetic-Special Requirements & Characteristics. This instrument is sensitive to the frequencies indicated in Figure 3.5.1.1, Pioneer Specification PC-220.00.

3.5.2 Radioactive Sources. None

3.6 MISCELLANEOUS REQUIREMENTS & CHARACTERISTICS

3.6.1 Spin Rate. The preferred spin rate of the spacecraft for operation of this instrument is TBS. The instrument will operate satisfactorily for spacecraft spin rates between 2 and 7 rpm.

4. PERFORMANCE ASSURANCE PROVISIONS

Not applicable.

5. PREPARATION FOR DELIVERY, HANDLING, SHIPPING & STORAGE (1)

5.1 HANDLING

5.1.1 General. The scientific instruments shall at all times be handled in a manner which will minimize the possibility of damage to the instrument. Grasping of the instrument by other than the base section shall not be permitted.

5.1.2 Protective Covers. This instrument employs a protective cover with the sensor. This cover shall remain in position during all systems tests except physical properties measurements, vibration, thermal vacuum, and other tests as directed by the NASA/ARC Experiment Test Engineer. The experiment test connector shall be covered with MISTIK type 7000 fiberglass or equivalent approved nonconductive tape just prior to launch. During test operations and storage, all exposed connectors shall be protected with dust covers.

5.2 SHIPPING

Except when mounted on the spacecraft, this scientific instrument shall be transported only in its custom carrying case. Movement of the instrument to and from TRW will be the responsibility of NASA/ARC.

5.3 STORAGE

Whenever the instrument is not mounted on the spacecraft platform, or not in use for bench tests, it shall be stored in the protective carrying case furnished by the experimenter and placed in the bonded stores area of TRW. The carrying case will contain suitable chemical desiccant, the condition of which will be monitored periodically during protracted storage periods, by the cognizant NASA test engineer.

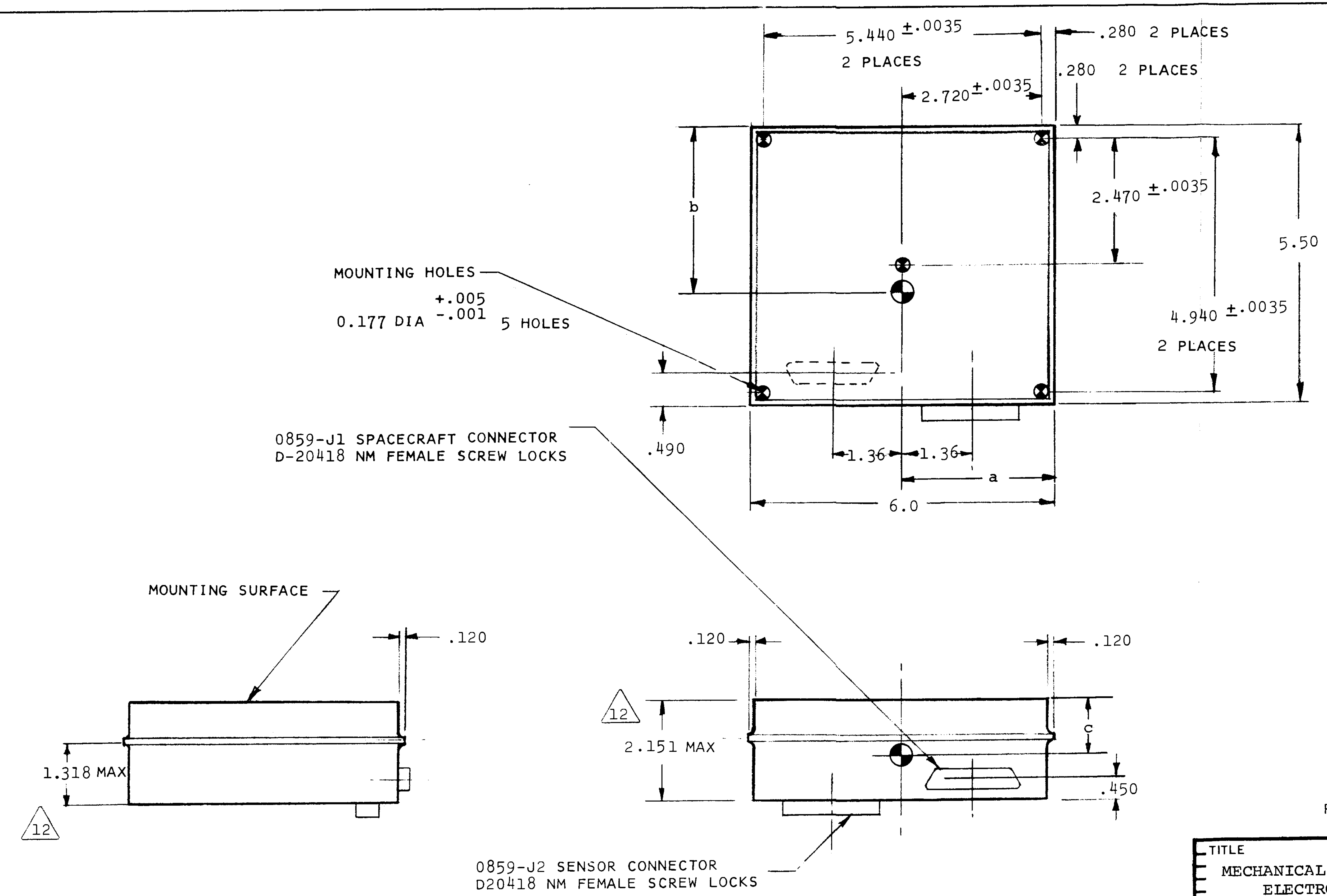
6. NOTES

6.1 DEFINITIONS

See Section 6.1 of Specification PC-220.00.

6.2 ABBREVIATIONS

See Section 6.2 of Specification PC-220.00.

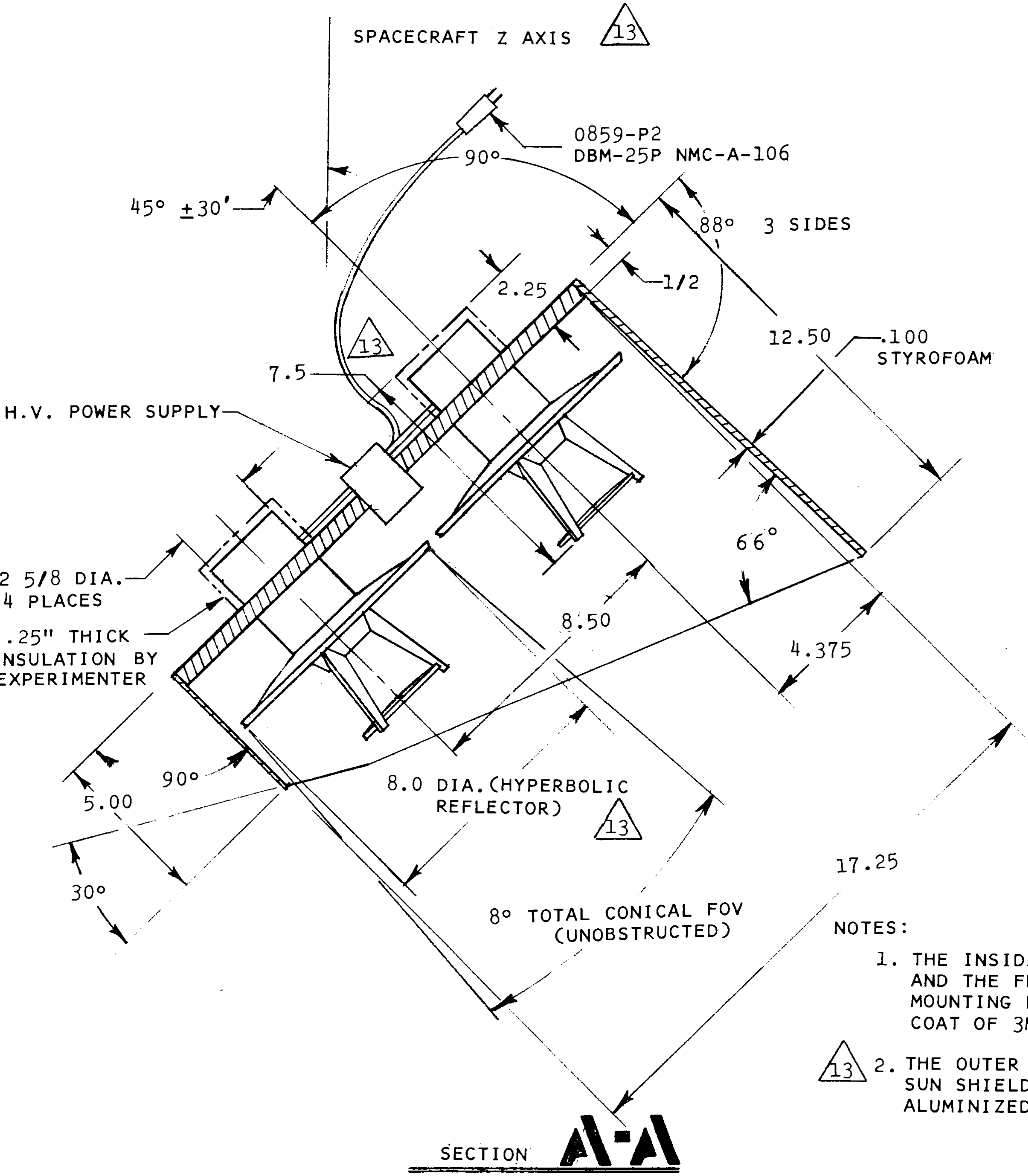


REDRAWN REVISION 10

TITLE
MECHANICAL INTERFACE
ELECTRONICS
GE/AMD

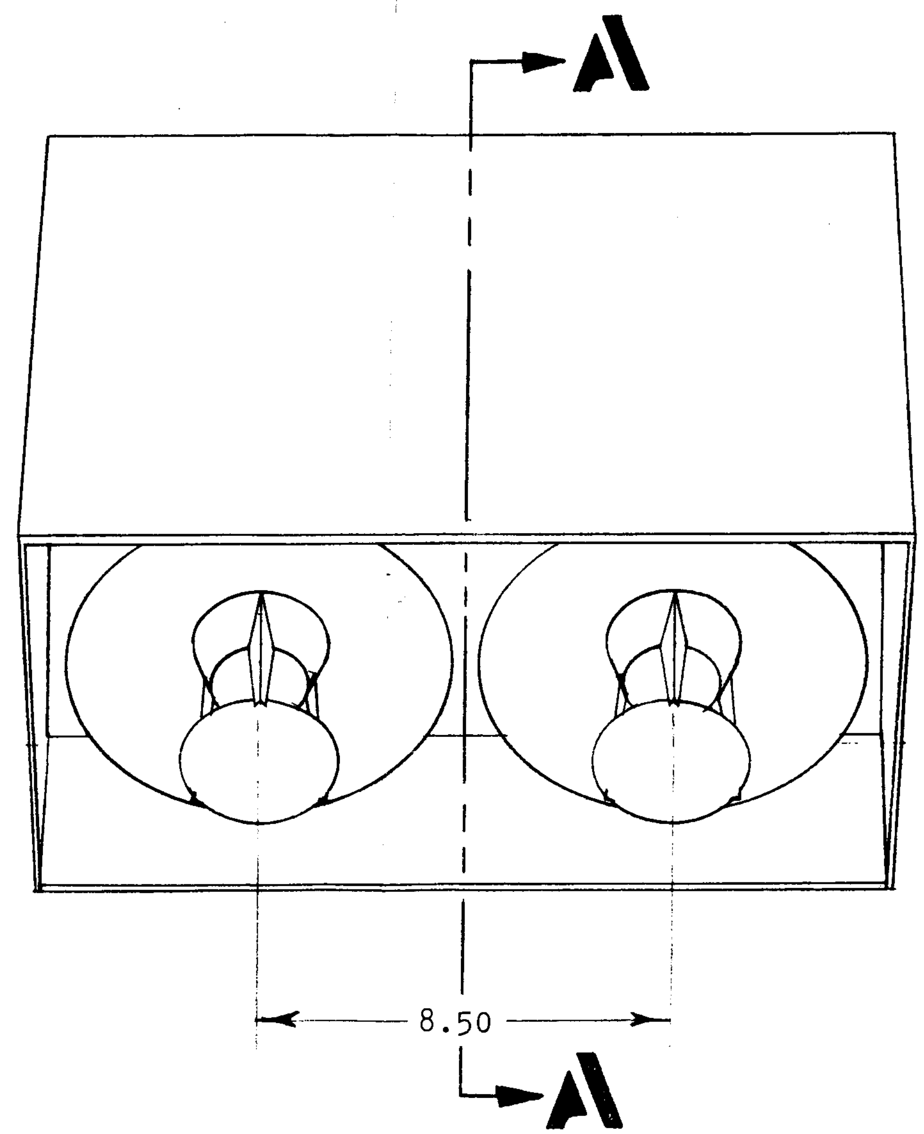
PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.11
FIG. 3.1.1
REV. NO. 12 | DATE 6-26-70 | SHEET 1 OF 2



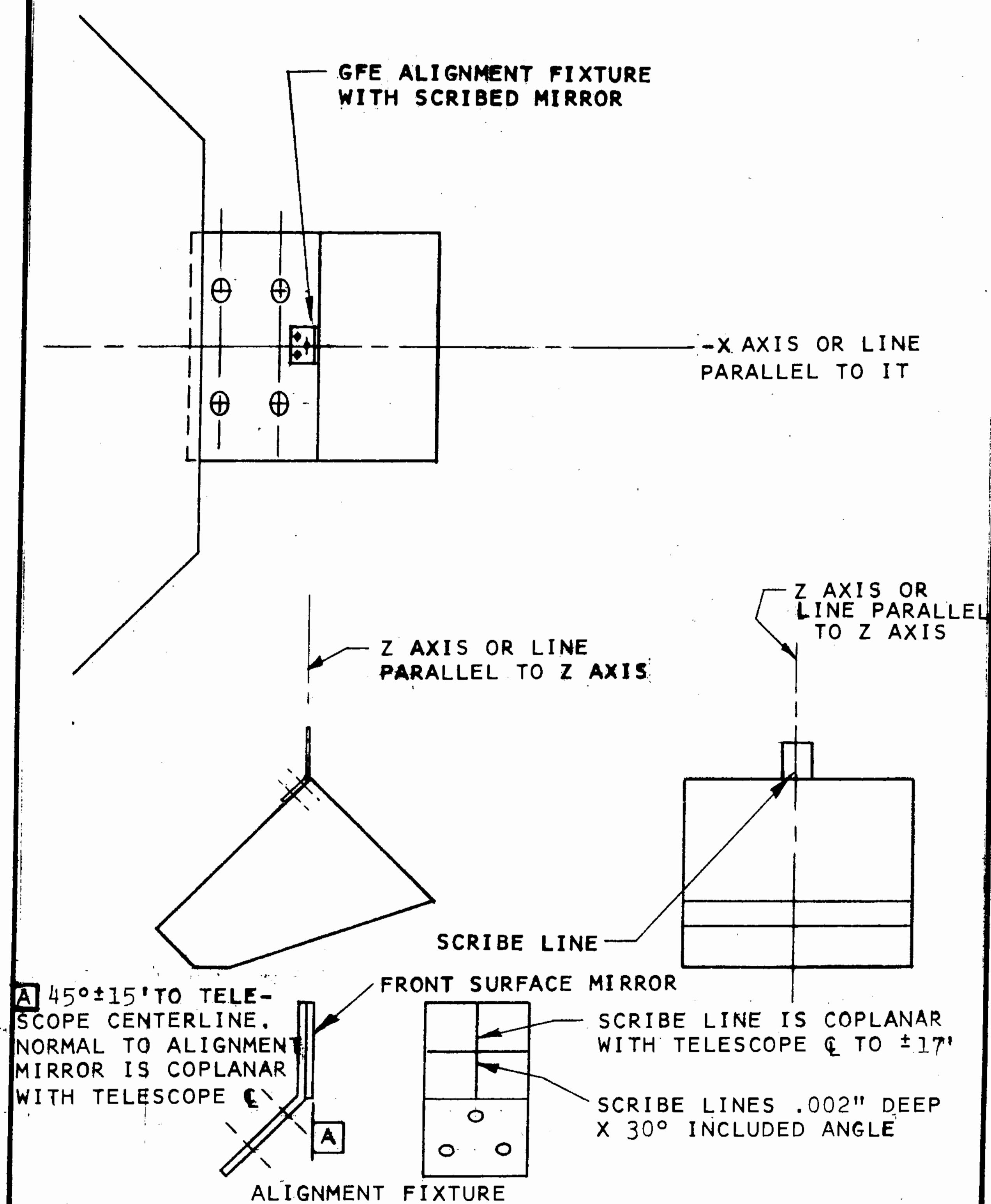
NOTES:

1. THE INSIDE SURFACES OF SUN SHIELD AND THE FRONT SURFACE ON THE SENSOR MOUNTING PLATE WILL HAVE A THERMAL COAT OF 3M BLACK VELVET NO. 401-C10.
2. (13) THE OUTER SURFACES OF THE STYROFOAM SUN SHIELD WILL BE COVERED WITH .001" ALUMINIZED MYLAR (PERMACELL EE 6600).



REDRAWN REVISION 10

TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
MECHANICAL INTERFACE SENSOR GE/AMD	DOC. NO. PC-220.11
	FIG. 3.1.1
REV. NO. 13 / DATE 8-31-70	SHEET 2 OF 2



REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	SENSOR ORIENTATION FOR GENERAL ELECTRIC ASTERIOD-METEOROID DETECTOR	DOC. NO. PC 220.11
		FIG. 3.1.4
	REV. NO. 16 DATE 4-30-71	SHEET 1 OF 1

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	VIEWING G.E. ASTEROID/METEOROID DETECTOR	DOC. NO. PC-220.11
		FIG. 3.1.5
	REV. NO. | DATE	SHEET 1 OF 1

PIN NO.	FUNCTION
1	DIGITAL DATA OUT - SCIENCE SUBCOM
2	SPARE
3	ANALOG (PREAMP TEMP) SCIENCE SUBCOM (E1) WORD 18 (J_a)
4	SPARE
5	BILEVEL (STAR EXCLUSION STATUS) S.S.C. (E1) WORD 24, BIT 3
6	CMND - MEDIUM BANDWIDTH
7	CMND - STAR EXCLUSION DISABLE/ENABLE
8	SPARE
9	ROLL INDEX PULSE
10	CMND - THRESHOLD LEVEL NORMAL
11	CMND - THRESHOLD LEVEL HIGH
12	CMND - POWER ON/OFF
13	PRIMARY POWER, +28 VDC
14	BILEVEL (THRESHOLD LEVEL STATUS) S.S.C. (E2) WORD 8, BIT 1
15	BILEVEL (BANDWIDTH STATUS) S.S.C. (E2) WORD 8, BIT 2
16	ANALOG (SECONDARY VOLTAGE) S.S.C. (E1) WORD 19 (J_b)
17	BILEVEL (DATA READOUT STATUS) S.S.C. (E1) WORD 24, BIT 4
18	CMND - WIDE BANDWIDTH
19	CMND - DATA READOUT DISABLE/ENABLE
20	CMND - NARROW BANDWIDTH
21	SECTOR GENERATOR (512 SECTORS)
22	WORD GATE - SCIENCE SUBCOM (J_c)
23	BIT SHIFT PULSE
24	DATA READY SIGNAL (FOR GSE USE ONLY) 9
25	RETURN FOR 12 AND 13

REPRODUCED FROM

TITLE

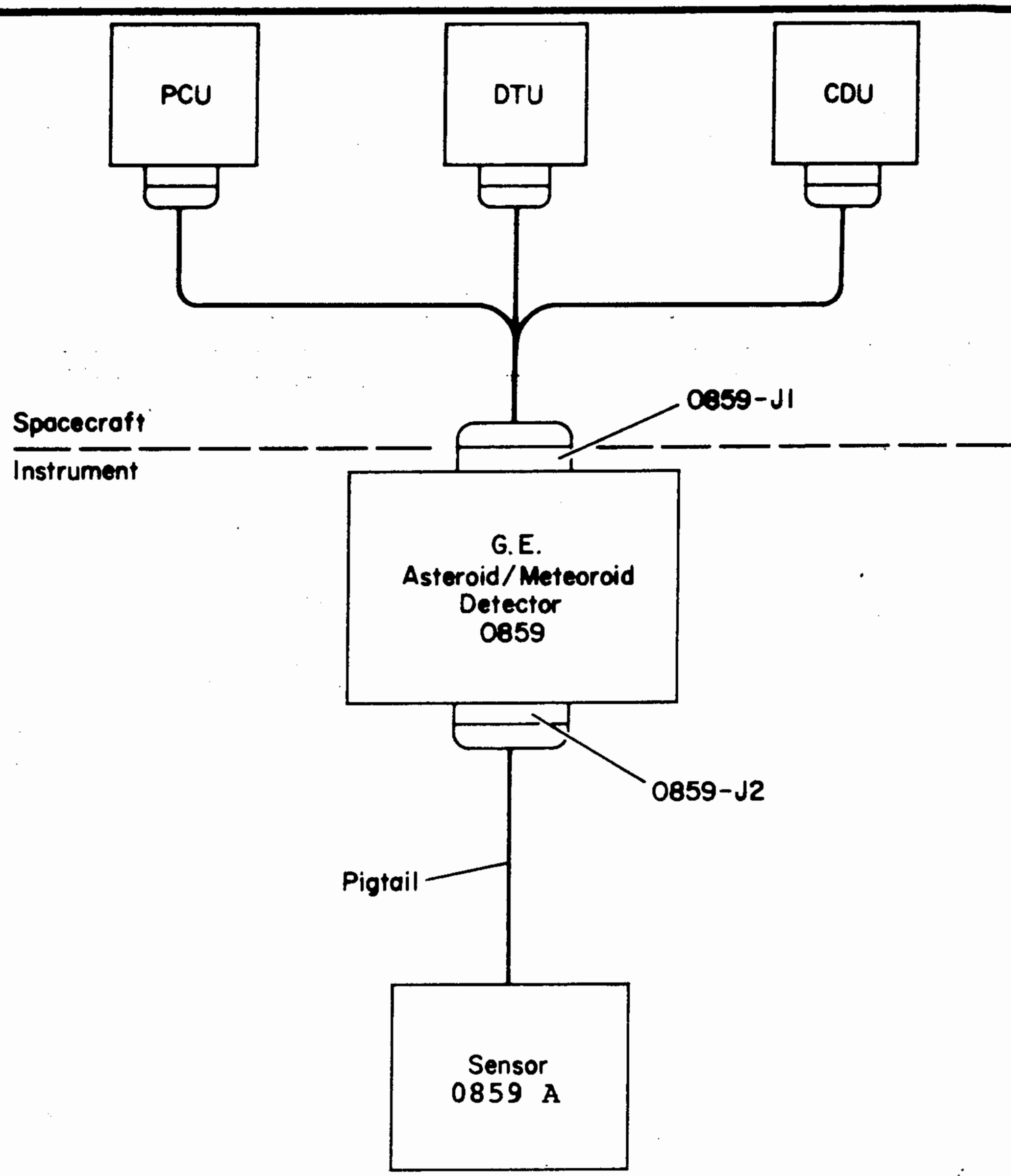
PIN ASSIGNMENTS
CONNECTOR 0859-J1
(INTERFACE)

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.11

FIG. 3.2.4.1

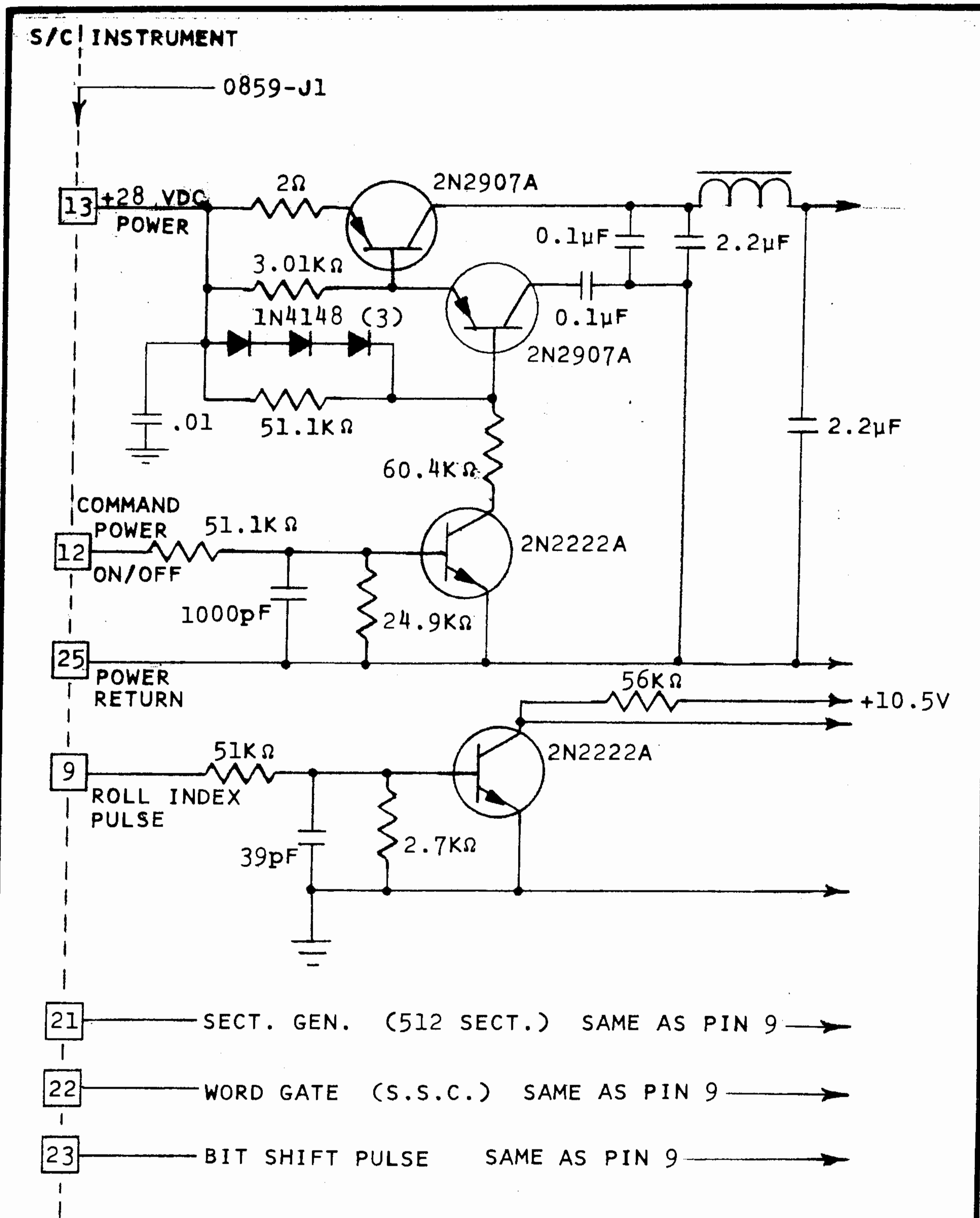
REV. NO. 9 | DATE 4-24-70 | SHEET 1 OF 1



CONNECTOR	FUNCTION	TYPE
0859-J1	INTERFACE	DBM-25P
0859-J2	SENSOR	DBM-25S

NOTE: ALL CONNECTORS ARE CANNON GOLDEN D MARK I UNLESS OTHERWISE SPECIFIED.

REPRODUCED FROM	TITLE	
	CONNECTOR I.D. G.E. ASTEROID/METEOROID DETECTOR	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.11
		FIG. 3.2.4.2
	REV. NO. 4 — DATE 3-6-70	SHEET 1 OF 1



REPRODUCED FROM

TITLE

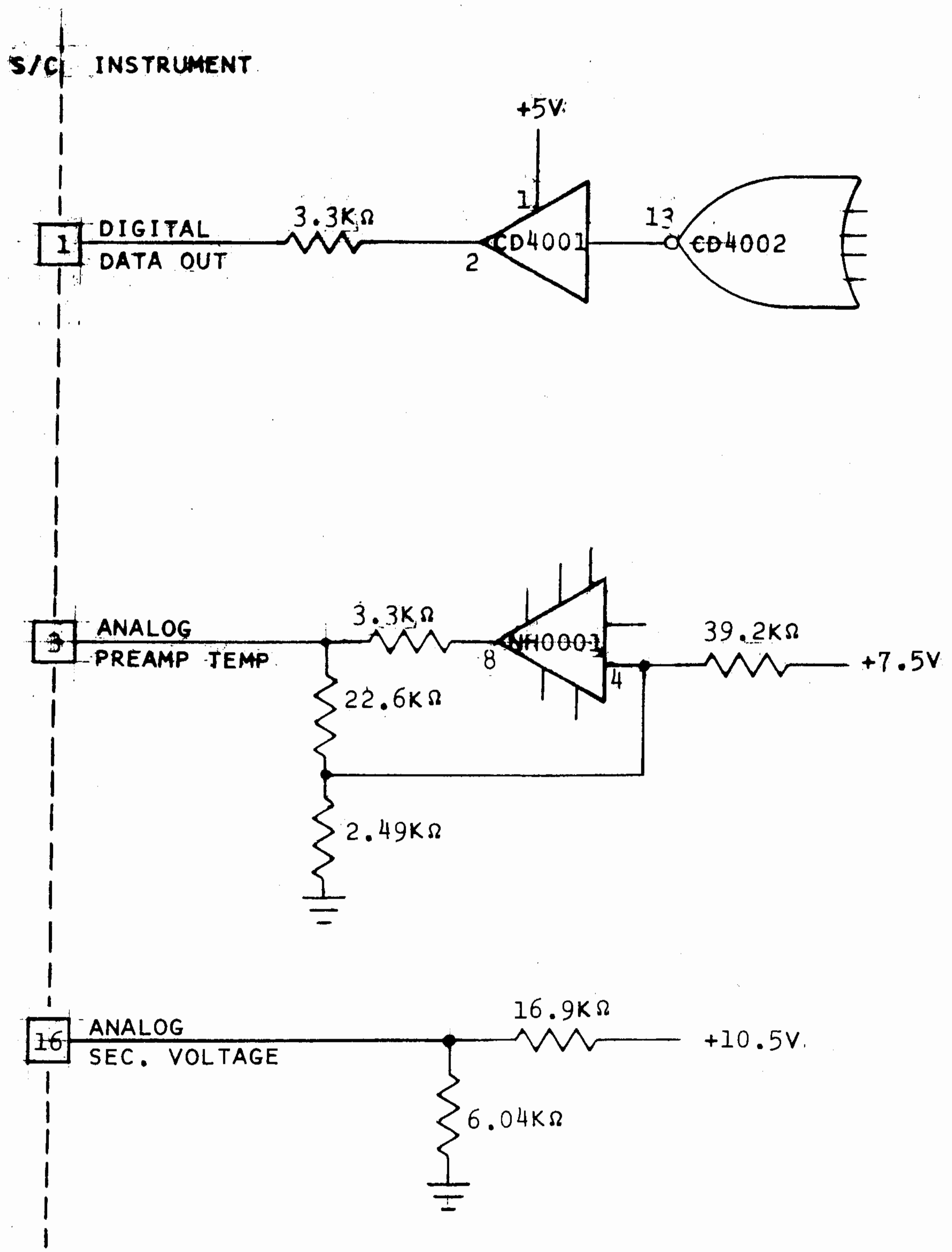
INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.11

FIG. 3.2.5

REV. NO. 16 | DATE 4-30-71 | SHEET 1 OF 2



REPRODUCED FROM	TITLE	PIONEER PROGRAM
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.11
		FIG. 3.2.5
	REV. NO. 16 / DATE 4-30-71	SHEET 2 OF 2

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	INSTRUMENT/GSE INTERFACE CIRCUITS	DOC. NO. PC-220.11
		FIG. 3.2.6
	REV. NO. | DATE	SHEET 1 OF 1

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	BLOCK DIAGRAM GE/AMD	DOC. NO. PC-220.11
		FIG. 3.2.7
	REV. NO. / DATE	SHEET 1 OF 1

LaRC METEROID DETECTOR

PC-220.12

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Moffett Field, California

PIONEER PROGRAM

SPECIFICATION PC-220.12

SPACECRAFT/SCIENTIFIC-INSTRUMENT INTERFACE SPECIFICATION

LaRC METEOROID DETECTOR

October 20, 1969

1. SCOPE

Specification PC-220.12 defines the characteristics and requirements of the LaRC Meteoroid Detector pertinent to the Pioneer spacecraft.

2. APPLICABLE DOCUMENTS

2.1 NASA/ARC SPECIFICATION

PC-213.00, Scientific Instruments and Related Requirements

2.2 NASA/ARC INTERFACE SPECIFICATION

PC-220.00, Spacecraft/Scientific-Instrument Interface Specification

3. REQUIREMENTS

3.1 MECHANICAL

3.1.1 Configuration. The dimensions, configuration and connector locations for the instrument will be as specified in Figure 3.1.1.

3.1.2 Mass Properties.

3.1.2.1 Weight (Present) (16)

Electronics		1.0 lb	
Remote Sensor		1.6 lb	
	Total	2.6 lb	
Portion of Mounting Bracketry attached to sensors		0.8 lb	(Spacecraft weight budget)

Revision

3.1.2.2 Center of Gravity. The center of gravity notation will be as indicated in Figure 3.1.1. The c.g. locations will be as follows: (12)

Elect.	a = 1.46 $\pm$ 0.01	b = 1.61 $\pm$ 0.01	c = 1.52 $\pm$ 0.01
Sensor	a = 3.5 $\pm$ 0.25	b = 6.2 $\pm$ 0.25	c = 0.2 $\pm$ 0.25

3.1.2.3 Moments of Inertia. The moments of inertia of the instrument about the center of gravity of the units will be as follows:

Moments of Inertia (in-lb-sec^2)

I_a = TBS I_b = TBS I_c = TBS

3.1.3 Mounting. The instrument mounting faces and methods will be as indicated in Figure 3.1.1, sheets 1 and 2.

3.1.4 Sensor Orientation. Each of 12 sensor panels shall be mounted external to the equipment compartment such that the panel target surfaces form an angle of 60° minimum with the spacecraft +Z axis. See Figure 3.1.4. (10)

3.1.5 Viewing. Sensor panels shall be mounted onto the spacecraft such that the sensor areas shall have an unobstructed path for particles approaching parallel to the spacecraft spin axis from the -Z direction. (4)

3.2 ELECTRICAL

3.2.1 Power Load (Present) (11)

Standby	TBS
Average	.75W
Peak	1.0 W

3.2.2 Duty Cycle. Peak power will occur once per event, and duration of conduction will be from___ms to 30 minutes depending on size of penetration holes. The maximum expected event rate is one per day.

3.2.3 Converter Frequency. The converter frequency will be as indicated in Figure 3.5.1.1 of PC-220.00

3.2.4 Connectors.

3.2.4.1 Connector Pin Assignments. Pins on the connectors for this instrument will be wired in accordance with Figure 3.2.4.1.

3.2.4.2 Connector Identification. Each connector attached to the instrument will be identified with a number in accordance with Figure 3.2.4.2.

3.2.5 Instrument Interface Circuits. Figure 3.2.5, shows the instrument input/output circuits which interface with the spacecraft/instrument interface timing, command and data lines.

3.2.6 Instrument/GSE Interface Circuits. Figure 3.2.6, shows the GSE input/output circuits which interface with the instrument thru the instrument stimulus/test connector.

3.2.7 Block Diagram. Figure 3.2.7 is a typical block diagram for the LaRC Meteoroid Instrument.

3.2.8 Sensor Panels to Electronics Cables. The sensor panels to electronics cables shall be configured in accordance with the wiring diagram presented in Figure 3.2.8. (9)

Revision

3.3 DATA HANDLING AND INSTRUMENT CONTROL (1)

3.3.1 Signals from the Instrument. The scientific instrument will provide the following signals.

3.3.1.1 Science Subcom.

Digital	2 Lines

3.3.2 Signals to the Instrument. The scientific instrument will be provided with the following signals.

3.3.2.1 Power. 2 Lines

3.3.2.2 Commands.

Power ON/OFF	1 Line

3.3.2.3 Timing and Control.

Bit shift pulse	1 Line
Word gate - science subcom.	2 Lines

Revision

3.3.3 Telemetry Word Assignments. Telemetry word assignments are specified in PC-220.01, sections 3.3.1.4.1 thru 3.3.1.4.5.

3.3.4 Instrument Words. Arrangements of instrument words within the telemetry word assignments for this instrument are as shown in PC-260.11.

3.4 THERMAL (1)

3.4.1 Operating Limits. This instrument will be capable of operating over the following temperature range:

Platform-mounted unit: -22°F to +122°F.
Externally-mounted unit: -325°F to +122°F

3.4.2 Thermal Load.

3.4.2.1 Platform-mounted Unit. The platform-mounted unit of this instrument shall not be exposed to the thermal environment exterior to the spacecraft while in space flight. The average thermal load supplied to the spacecraft by electrical power dissipation within the platform-mounted unit will be ___ watts.

3.4.2.2 Nonplatform-Mounted Unit. To be supplied.

3.4.3 Surface Thermal Properties.

3.4.3.1 Mounting Surfaces. The mounting surfaces of the instrument will be treated in accordance with PC-213.03, section 3.2.6.8.1.

3.4.3.2 Nonmounting Surfaces. The nonmounting surfaces of the instrument viewing the inside of the spacecraft will be treated in accordance with PC-213.03, section 3.2.6.8.6.

3.4.4 Mounting Surface Area. The thermal conducting area of the instrument units contiguous with the spacecraft mounting surfaces will be as follows: (4)

Platform-mounted unit: 10 square inches.
Nonplatform-mounted unit: square inches.

Revision

3.5 COMPATIBILITY (1)

3.5.1 Electromagnetic-Special Requirements & Characteristics. This instrument is sensitive to the frequencies indicated in Figure 3.5.1.1, Pioneer Specification PC-220.00.

3.5.2 Radioactive Sources.

3.5.2.1 Internal Sources (On-Board). Nickel 63, 1 microcurie. (10)

3.5.2.2 External Sources (Test). None.

3.6 MISCELLANEOUS REQUIREMENTS & CHARACTERISTICS

3.6.1 Spin Rate. The preferred spin rate of the spacecraft for operation of this instrument is TBS. The instrument will operate satisfactorily for spacecraft spin rates between 2 and 7 rpm. (1)

4. PERFORMANCE ASSURANCE PROVISIONS

Not applicable.

5. PREPARATION FOR DELIVERY, HANDLING, SHIPPING & STORAGE (1)

5.1 HANDLING

5.1.1 General. The scientific instruments shall at all times be handled in a manner which will minimize the possibility of damage. Grasping of the instrument by other than the base section shall not be permitted.

5.1.2 Protective Covers. This instrument employs a protective cover with the sensor. This cover shall remain in position during all systems tests except physical properties measurements, vibration, thermal vacuum, and other tests as directed by the NASA/ARC Experiment Test Engineer. The experiment test connector shall be covered with MISTIK type 7000 fibergalss or equivalent approved nonconductive tape just prior to launch. During test operations and storage, all exposed connectors shall be protected with dust covers.

5.2 SHIPPING

Except when mounted on the spacecraft, this scientific instrument shall be transported only in its custom carrying case. Movement of the instrument to and from TRW will be the responsibility of NASA/ARC.

5.3 STORAGE

Whenever the instrument is not mounted on the spacecraft platform, or not in use for bench tests, it shall be stored in the protective carrying case furnished by the experimenter and placed in the bonded stores area of TRW. The carrying case will contain suitable chemical desiccant, the condition of which will be monitored periodically during protracted storage periods, by the cognizant NASA test engineer.

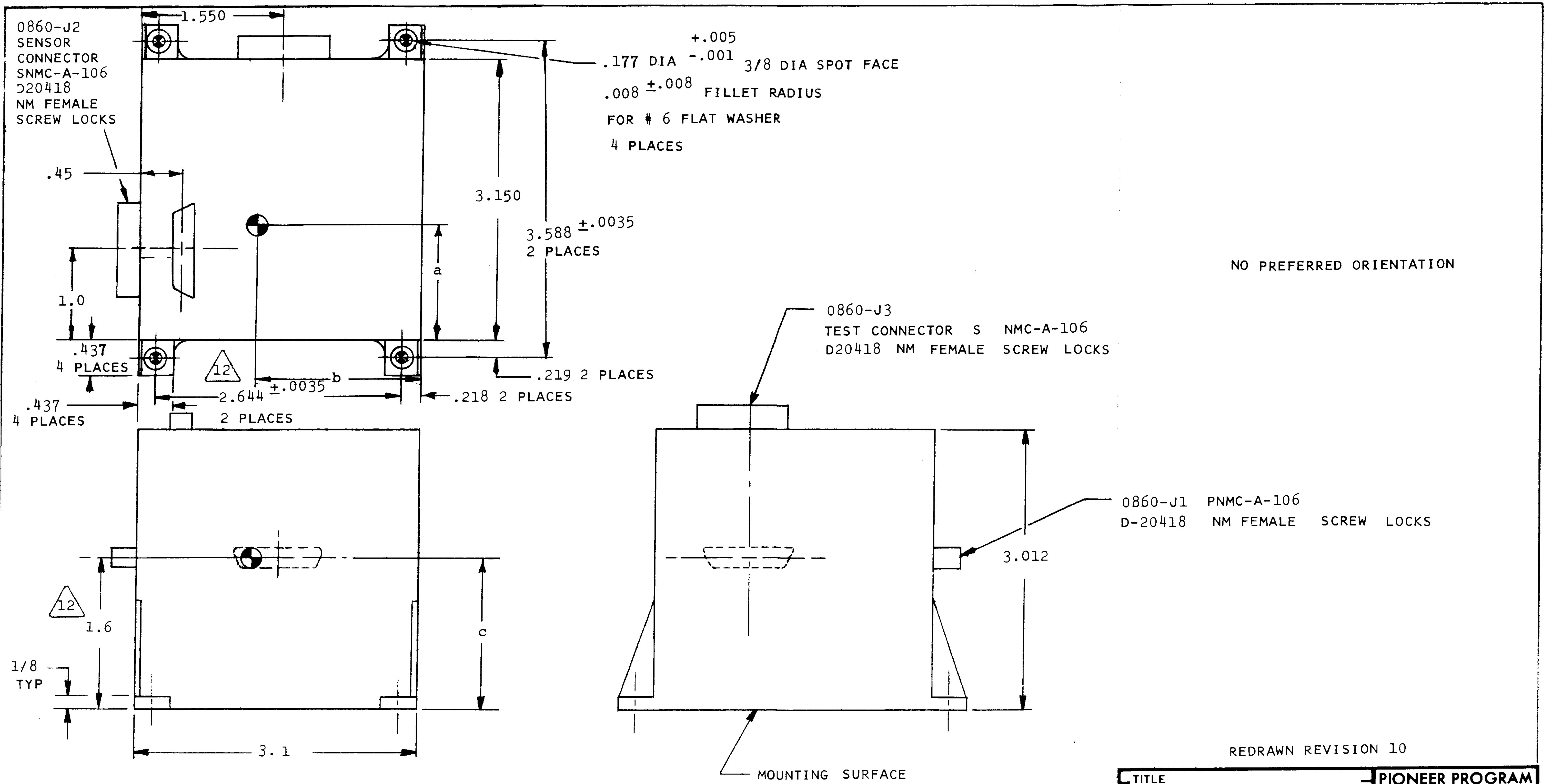
6. NOTES

6.1 DEFINITIONS

See Section 6.1 of Specification PC-220.00.

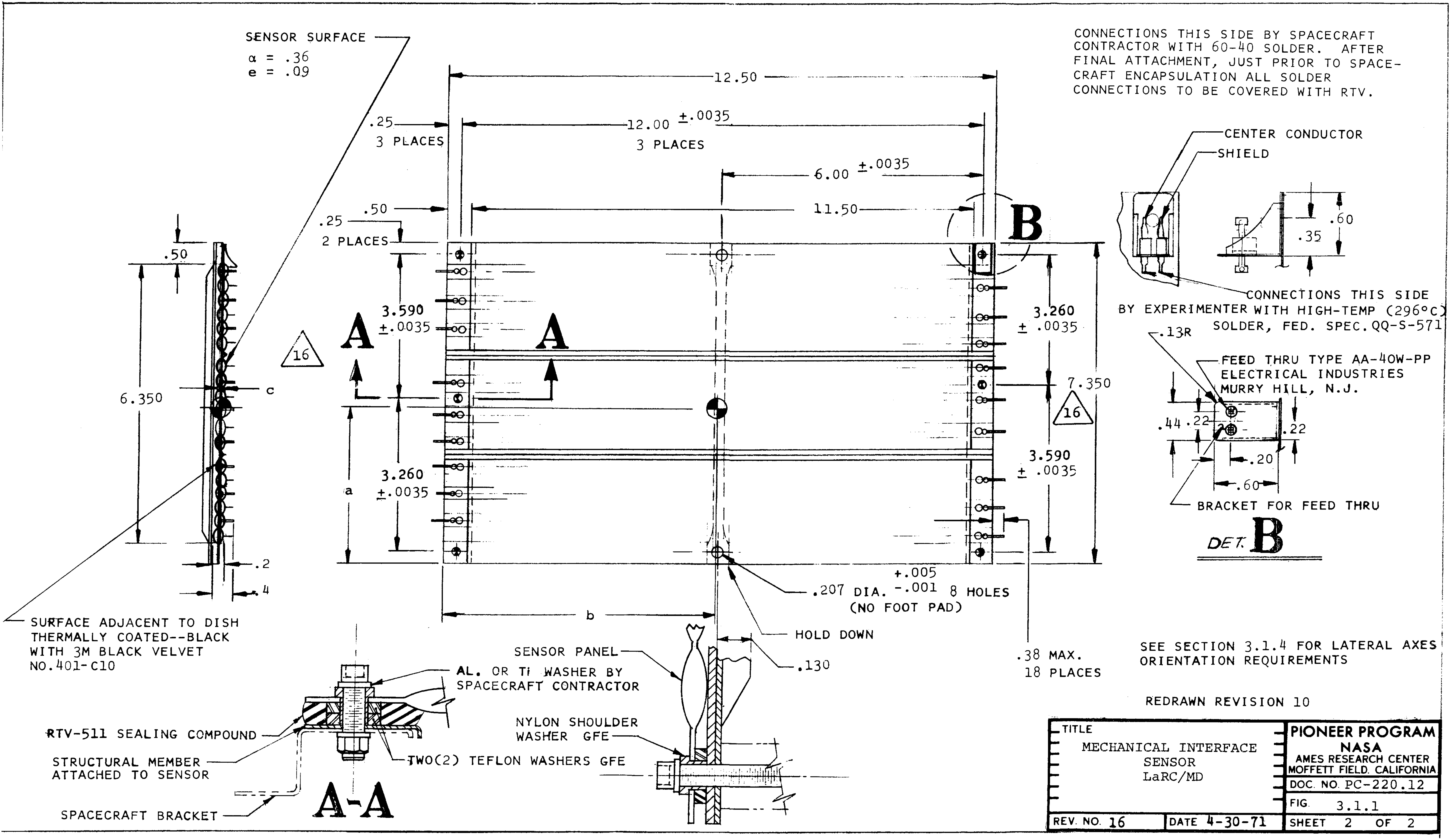
6.2 ABBREVIATIONS

See Section 6.2 of Specification PC-220.00.

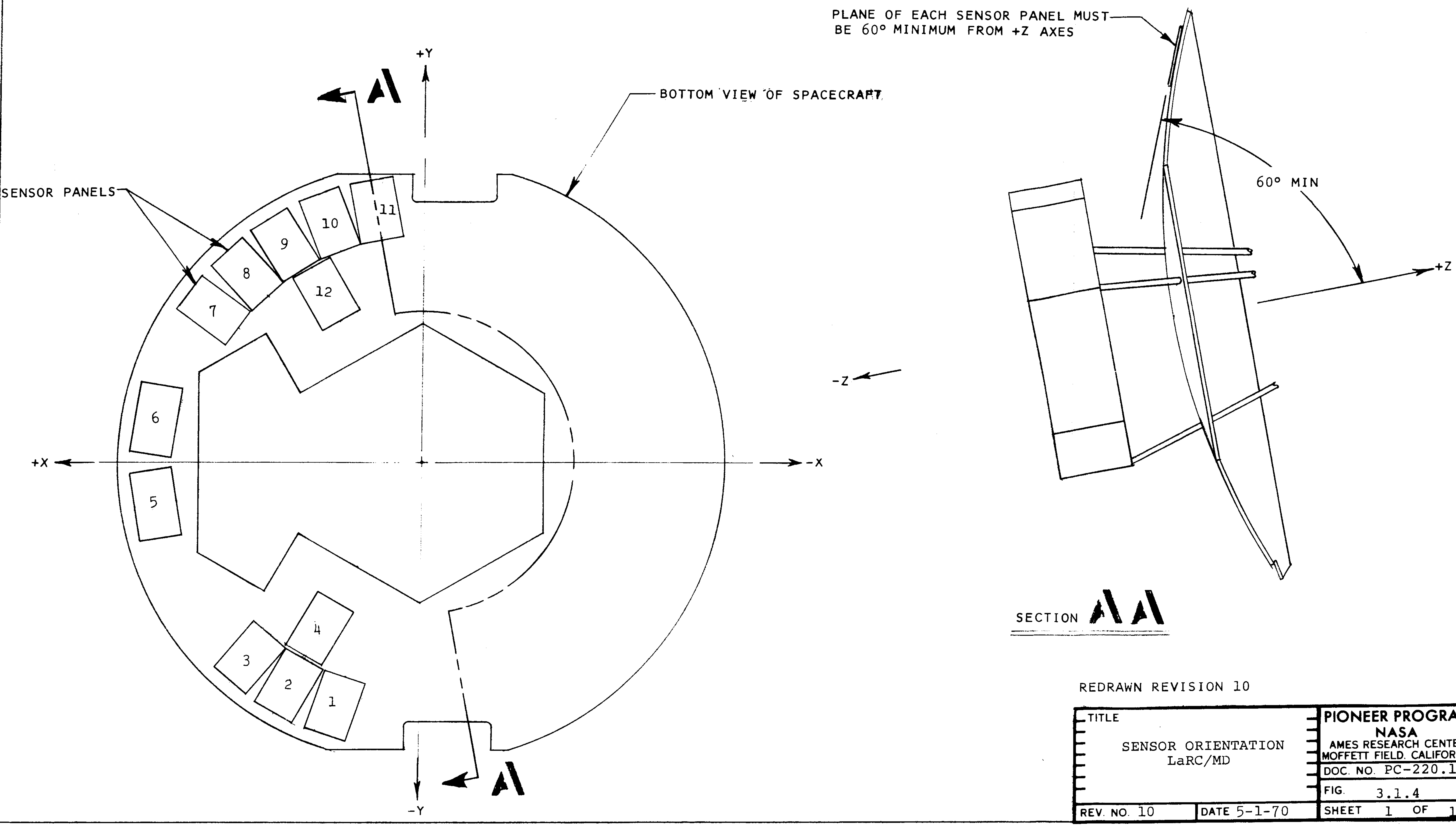


REDRAWN REVISION 10

TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
MECHANICAL INTERFACE ELECTRONICS LaRC/MD	DOC. NO. PC-220.12
	FIG. 3.1.1
REV. NO. 12 DATE 6-26-70	SHEET 1 OF 2



SENSOR SURFACE
α = .36
e = .09
12.50
.25
3 PLACES
12.00 ±.0035
3 PLACES
6.00 ±.0035
.50
11.50
.25
2 PLACES
B
.50
3.590
±.0035
A
A
3.260
± .0035
7.350
16
16
6.350
c
3.260
±.0035
a
3.590
± .0035
.2
.4
b
.207 DIA. +.005 -.001 8 HOLES
(NO FOOT PAD)
HOLD DOWN
.130
.38 MAX.
18 PLACES
SURFACE ADJACENT TO DISH
THERMALLY COATED--BLACK
WITH 3M BLACK VELVET
NO.401-C10
CONNECTIONS THIS SIDE BY SPACECRAFT
CONTRACTOR WITH 60-40 SOLDER. AFTER
FINAL ATTACHMENT, JUST PRIOR TO SPACE-
CRAFT ENCAPSULATION ALL SOLDER
CONNECTIONS TO BE COVERED WITH RTV.
CENTER CONDUCTOR
SHIELD
.60
.35
CONNECTIONS THIS SIDE
BY EXPERIMENTER WITH HIGH-TEMP (296°C)
SOLDER, FED. SPEC. QQ-S-571
.13R
FEED THRU TYPE AA-40W-PP
ELECTRICAL INDUSTRIES
MURRY HILL, N.J.
.44
.22
.22
.20
.60
BRACKET FOR FEED THRU
DET. B
SENSOR PANEL
AL. OR Ti WASHER BY
SPACECRAFT CONTRACTOR
NYLON SHOULDER
WASHER GFE
RTV-511 SEALING COMPOUND
STRUCTURAL MEMBER
ATTACHED TO SENSOR
TWO(2) TEFLON WASHERS GFE
SPACECRAFT BRACKET
A-A
SEE SECTION 3.1.4 FOR LATERAL AXES
ORIENTATION REQUIREMENTS
REDRAWN REVISION 10
TITLE
MECHANICAL INTERFACE
SENSOR
LaRC/MD
PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA
DOC. NO. PC-220.12
FIG. 3.1.1
REV. NO. 16
DATE 4-30-71
SHEET 2 OF 2

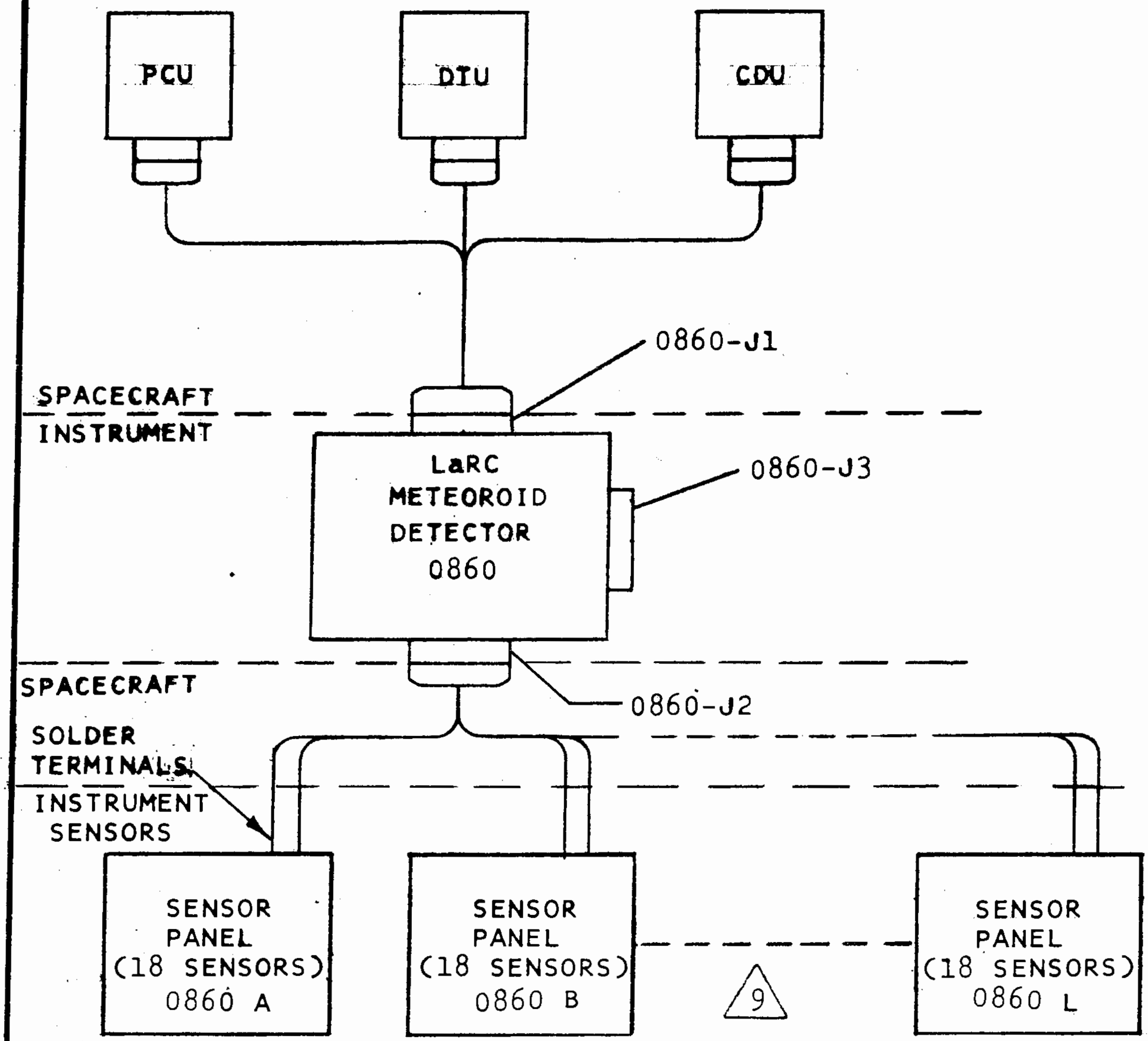


REDRAWN REVISION 10

TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
SENSOR ORIENTATION LaRC/MD	DOC. NO. PC-220.12
	FIG. 3.1.4
REV. NO. 10 — DATE 5-1-70	SHEET 1 OF 1

PIN NO.	FUNCTION
1	+28 VDC POWER
2	RETURN FOR 1 AND 9
3	SPARE
4	SPARE
5	SPARE
6	DIGITAL DATA OUT - SCIENCE SUBCOM (E1) WORD 7
7	DIGITAL DATA OUT - SCIENCE SUBCOM (E2) WORD 7
8	WORD GATE - SCIENCE SUBCOM (Ka)
9	COMMAND - POWER ON/OFF
10	SPARE
11	SPARE
12	SPARE
13	SPARE
14	WORD GATE - SCIENCE SUBCOM (Kb)
15	BIT SHIFT PULSE

REPRODUCED FROM	TITLE PIN ASSIGNMENTS CONNECTOR 0860-J1 (INTERFACE)	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.12
		FIG. 3.2.4.1
	REV. NO. 3 / DATE 2-27-70	SHEET 1 OF 1

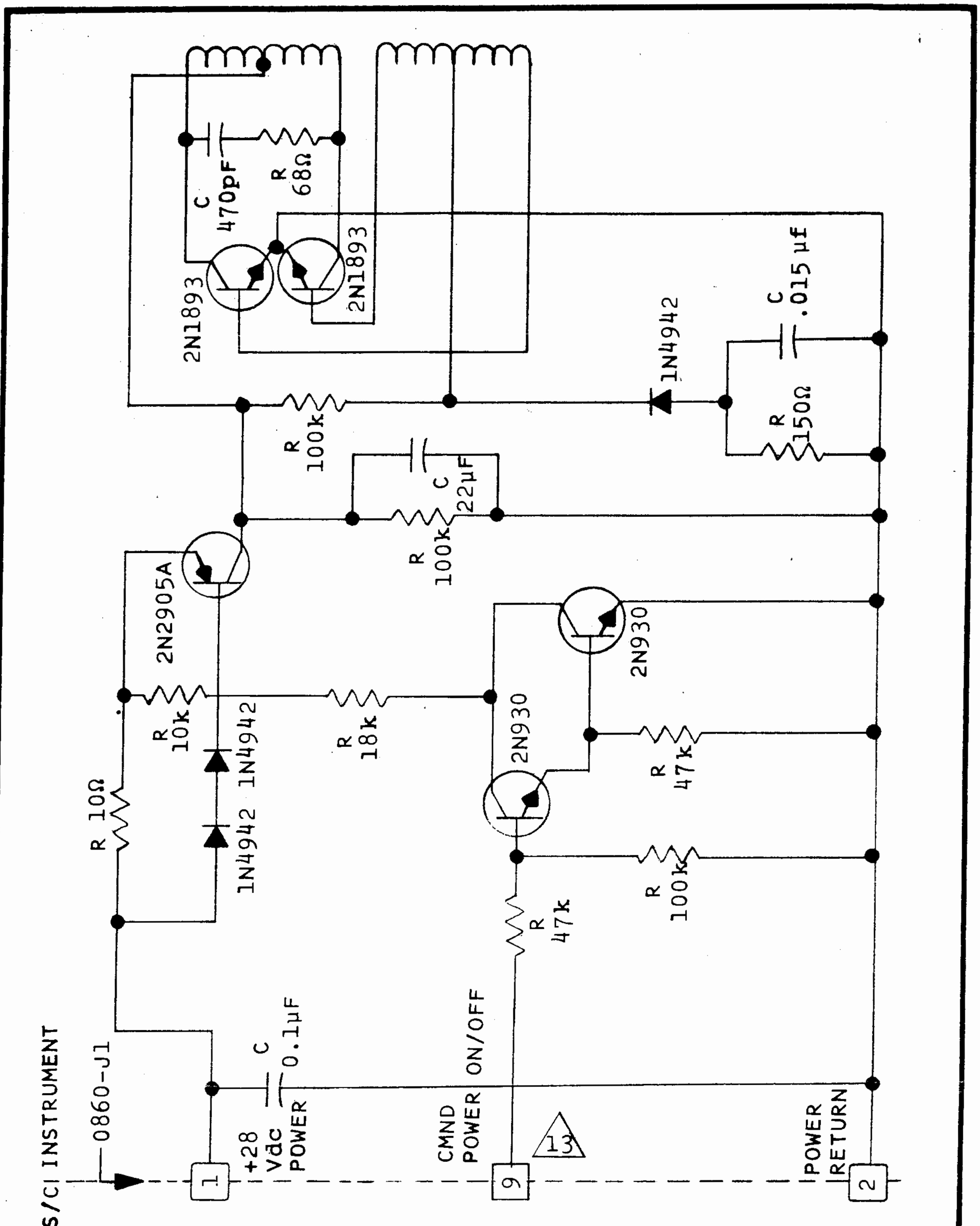


12 SENSOR PANELS (TOTAL)

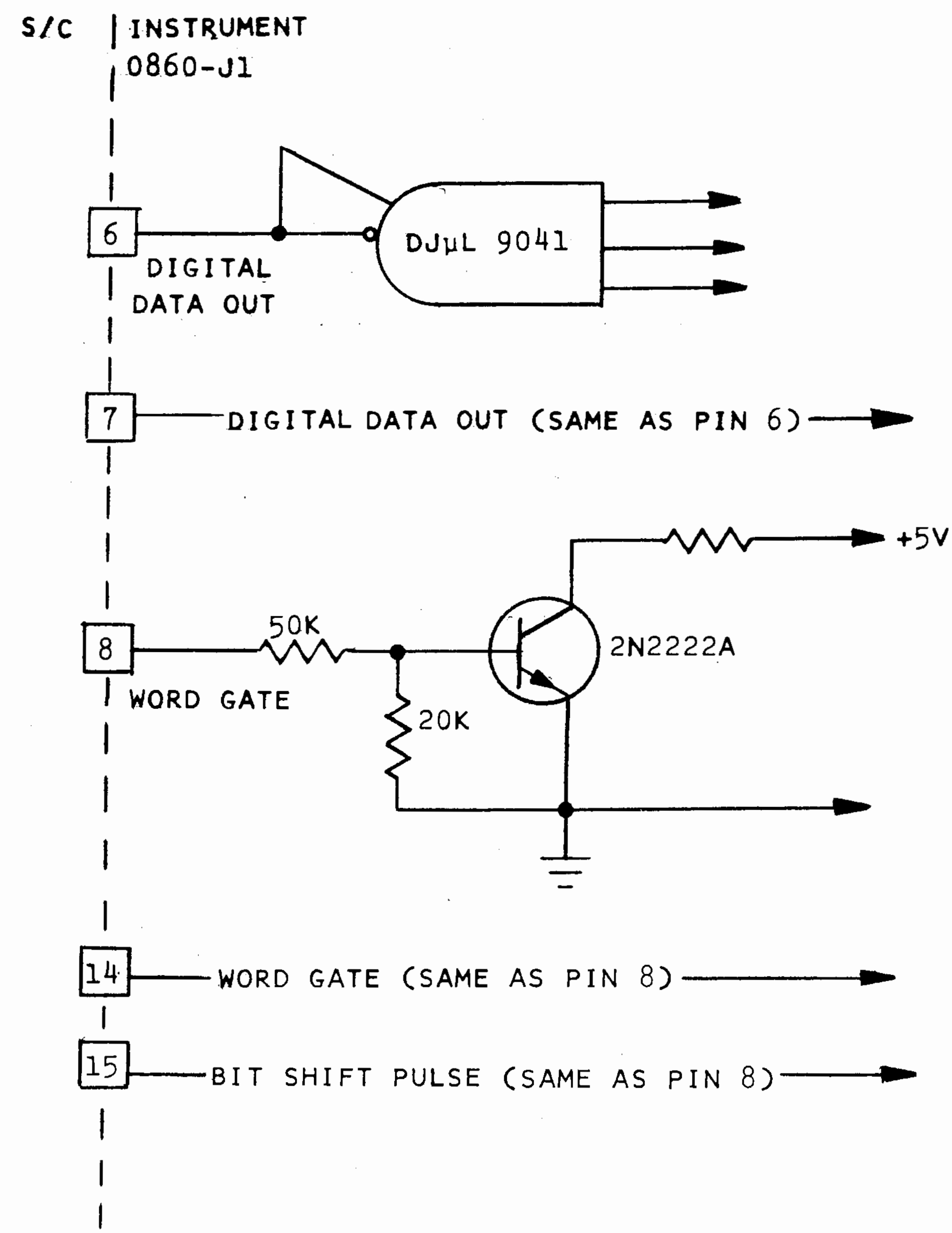
CONNECTOR	FUNCTION	TYPE
0860-J1	INTERFACE	DAM-15P
0860-J2	SENSOR	DAM-15S
0860-J3	TEST	DAM-15S

NOTE: ALL CONNECTORS ARE CANNON GOLDED D
MARK I UNLESS OTHERWISE SPECIFIED.

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	CONNECTOR I.D. LaRC METEOROID DETECTOR	DOC. NO. PC-220.12
		FIG. 3.2.4.2
	REV. NO. 9 / DATE 4-24-70	SHEET 1 OF 1



REPRODUCED FROM	TITLE	PIONEER PROGRAM
	INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.12
		FIG. 3.2.5
	REV. NO. 13 / DATE 8-31-70	SHEET 1 OF 2



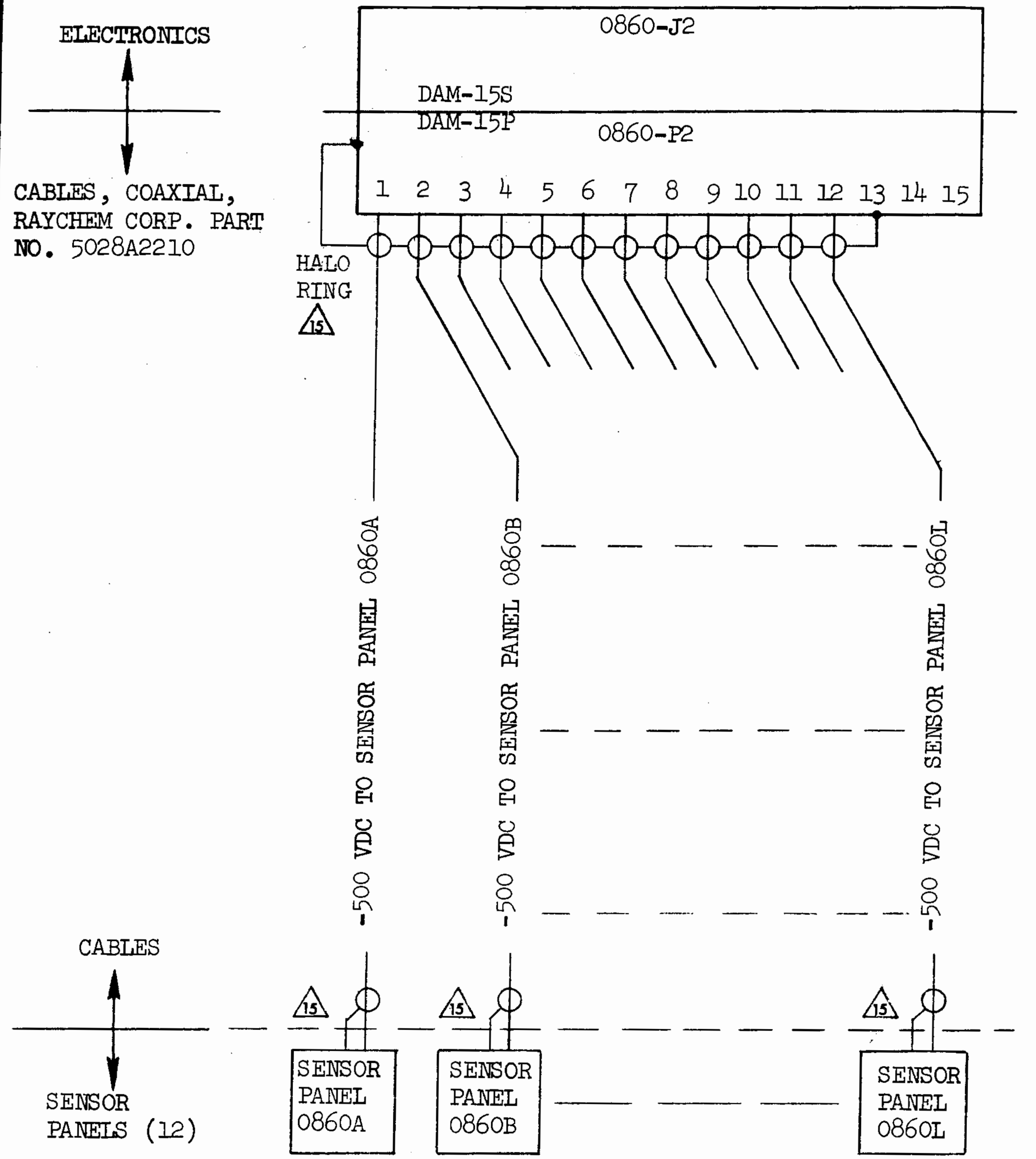
REPRODUCED FROM	TITLE INSTRUMENT/SPACECRAFT INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.12
		FIG. 3.2.5
	REV. NO. 12 / DATE 6-26-70	SHEET 2 OF 2

To Be Supplied

REPRODUCED FROM	TITLE INSTRUMENT/GSE INTERFACE CIRCUITS	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
		DOC. NO. PC-220.12
		FIG. 3.2.6
	REV. NO. / DATE	SHEET 1 OF 1

To Be Supplied

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	BLOCK DIAGRAM LaRC METEOROID DETECTOR	DOC. NO. PC-220.12
		FIG. 3.2.7
	REV. NO. / DATE	SHEET 1 OF 1



REPRODUCED FROM

TITLE

WIRING DIAGRAM
LaRC/MD
SENSOR PANEL CABLES

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC. NO. PC-220.12

FIG. 3.2.8

REV. NO. 15 | DATE 1-30-71 | SHEET 1 OF 1