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DOE/NASA CONTRACTOR REPORT

DOE/NASA CR-150588

SUBSYSTEM DESIGN PACKAGE FOR MOD II SITE DATA ACQUISITION SYSTEM: SOLAR HEATING AND COOLING

Prepared by

IBM Federal Systems Division
150 Sparkman Drive
Huntsville, Alabama 35805

Under Contract NAS8-32269 with

National Aeronautics and Space Administration
George C. Marshall Space Flight Center, Alabama 35812

For the Department of Energy

U.S. Department of Energy

Solar Energy

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16. ABSTRACT

This design package, consisting of the Performance Specification and the Acceptance Test Procedure, covers the Mod II Site Data Acquisition Subsystem being build for NASA/MSFC under Contract NAS8-32269 by the IBM Corporation. The Mod II Site Data Acquisition Subsystem (SDAS) is designed to collect data from sensors located on residential or commercial buildings using a solar heating and/or cooling system.

Additional information on SDAS installation (location and mounting) may be obtained from the "Instrumentation Installation Guidelines" (Solar/0001-77/15, published by the U. S. Department of Energy.

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INTRODUCTION

This design package consisting of the Performance Specification and the Acceptance Test Procedure covers the Mod II Site Data Acquisition Subsystem being built for NASA/MSFC under Contract NAS8-32269.

The Mod II Site Data Acquisition Subsystem (SDAS) is designed to collect data from sensors located on residential or commercial buildings using a solar heating and/or cooling system. The SDAS takes the data obtained from sensors located on the solar heating an/or cooling system, process the data into a suitable format, store the data for a period of time, and provide the capability for both telephone retrieval by the Central Data Processing System (CDPS) and manual retrieval of the data for transfer to the central site. The unit is designed so it will not degrade the operation of the solar heating/cooling system which it is monitoring.

DWG NO. 7934358

REVISIONS

CHK	ENGRG NOTICE	LTR	DESCRIPTION	DATE	APPROVED
		-	Release	6/10/77	
	66348 P	A	Revision A - Add "wind" command to test procedure and minor editing corrections.	9/22/77	M. Waligora

CONTR NO.	INTERNATIONAL BUSINESS MACHINES CORP. FEDERAL SYSTEMS DIVISION HUNTSVILLE, ALA. 35807
PREPARATION: F. L. Minyard	TITLE: SITE DATA ACQUISITION SUBSYSTEM (SDAS) MODEL II ACCEPTANCE TEST PROCEDURE
DSGN CHK	
DWG CHK	
DSGN APPROVAL: M. P. Waligora	SIZE: A; CODE IDENT NO.; DWG NO.: 7934358
	SCALE; WT; SHEET 1 of 8

955-1685-0

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1.0 SCOPE

1.1 GENERAL

This procedure defines the test conditions and required performance for the Site Data Acquisition Subsystem (SDAS) Model II. The latest revisions to this procedure are noted by a heavy line to the right edge of the modified paragraph.

1.2 PURPOSE

This test has been developed to perform the final operational test of the Site Data Acquisition Subsystem (SDAS) using its standard interface through the phone-line data-set. The test will verify the unit operability utilizing test voltage inputs to simulate the sensors and a test configured microcode processor. Attendant to this configuration will be the straight-through microboards in lieu of the operational microboards. The acceptability of unit performance will be in accordance with this procedure.

2.0 REFERENCE DOCUMENTS

7934354	Site Data Acquisition Subsystem (SDAS) Performance Specification

3.0 TEST CONFIGURATION

The test configuration (as illustrated in Figure 1) has the necessary stimulus and interrogation equipment to fulfill the needs of this procedure.

4.0 SYSTEM 7 TEST

4.1 This section describes the test setup for the SDAS/System 7 functional test.

4.1.1 Connect the SDAS to the analog input switch panel using the interface cable connectors.

4.1.2 Connect the SDAS to the telephone system coupler.

4.1.3 Set the 5 VDC power supply to 2.5 VDC and the 100 MVDC power supply to 50 MVDC. Set the switches on the input switching box to select voltage inputs corresponding to those specified in Table 1.

4.1.4 Insert a tape into the cassette tape recorder/player.

4.2 DATA ACQUISITION

Connect the prime power line to the SDAS unit under test to the convenience outlet (110 VAC).

4.2.1 The SDAS will begin acquiring data (at scan interval rate) as soon as power is applied to the SDAS. Once power is applied, allow the unit to operate until the data has been transferred to the cassette tape recorder.

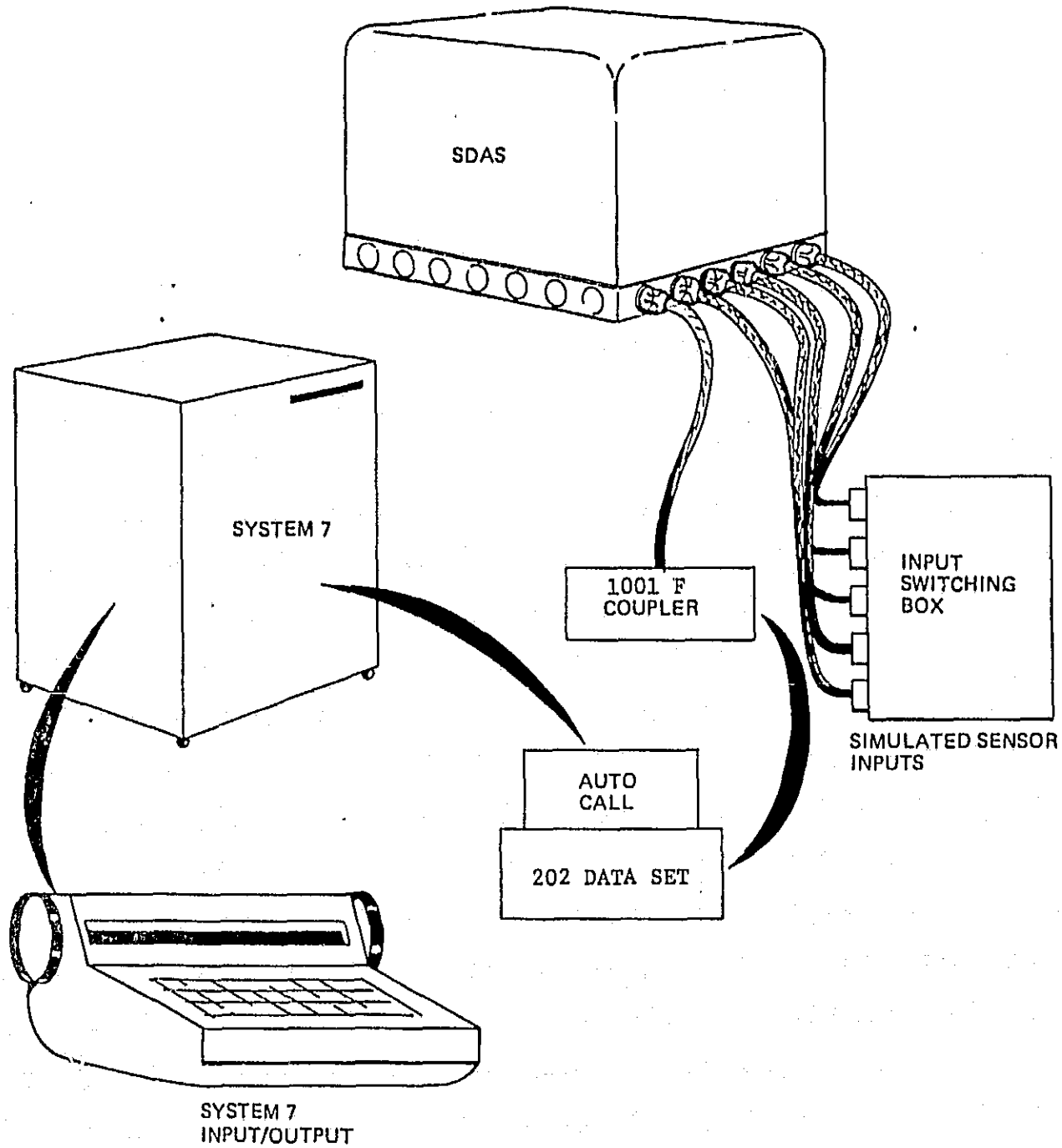

Figure 1. Acceptance Test Configuration

Table 1. SDAS I/O Pin Function and Channel Allocation

I/O CONN NO.	CHANNEL NO. OR FUNCTION	NO. INPUT WIRES	I/O PIN NUMBERS Hi	Lo	3RD	INPUT VOLTAGE ACCEPTANCE	SDAS AMP. GAIN	BITS STORED IN RAM
J102,	1 (A)*	3	1	2	3	0-100 MV	50	10
J103,	2 (A)	3	5	6	7			
J104,	3 (A)	3	8	9	10			
J105,	4 (A)	3	11	12	13			
J107,	5	3	15	16	17			
and/or								
J108.	6	3	18	19	20			
	7	3	23	24	25			
	8	3	26	27	28			
	9	3	31	32	33			
	10	3	34	35	36			
	11	3	39	40	41			
	12	3	42	43	44			
	13	3	46	47	48			
	14	3	49	50	51	0-100 MV	50	
	15	3	52	53	54	0-5 V	1	
	16	3	55	56	57	0-100 MV	50	10
	Shield	1	4					
	Spare	8	14,21,22,29,30, 37,38,45					

NOTES: (A) Asynchronous (sampled every 32 seconds)
*Channel 5 asynchronous rather than Channel 1 on mux + amplifier (Mux 1) only.
Pin function allocation is valid for all groups of 16 inputs, i.e.,
CH1=CH17=CH33=CH49=CH65=CH81,
CH2=CH18=CH34=CH50=CH66=CH82,
etc.

4.2.2 Verify the System 7 SDAS program disc on the disc drive.

4.2.3 Load the System 7 software program by executing the following actions:

4.2.3.1 Initial program load (IPL).

4.2.3.1.1 On the System 7 place the IPL switch in upper position and depress the following controls.

4.2.3.1.1.1 STOP

4.2.3.1.1.2 RESET

4.2.3.1.1.3 PROGRAM LOAD

4.2.3.1.1.3.1 At the completion of the IPL the printout "Enter Control Statements" occurs.

4.2.3.2 Load the SDAS Acceptance Test Program.

4.2.3.2.1 Enter control statement L W7TEST.

4.2.3.2.2 Using the System 7 keyboard press REQUEST pushbutton and enter time (year, day, hour, and minutes).

4.2.3.2.3 Press REQUEST pushbutton and enter control statement TSA.

4.2.3.2.3.1 Enter station address for the SDAS under test.

4.2.3.2.3.2 Enter command Y to obtain printout of commands and designation.

4.2.3.2.4 Manually enter all commands listed in Table 2 to interrogate the SDAS. An error statement is printed out on commands that are not successful. A successful run is denoted by the printout "Test Complete". When the interrogation is complete, the data will be logged and printed out.

4.2.3.2.5 Evaluate the data printout for validity and accuracy by comparing the output (hexadecimal) data to the known analog voltage input established in 4.1.3. The output value tolerance shall be 0.4 percent $\pm$ 1/2 Least Significant Bit.

5.0 TEST FAILURE

5.1 Any error in the communication link with the SDAS as denoted by the System 7 printout and any error in the output data will be considered a test failure with the following exception. If a non-compare error is due to a telephone line transmission error, the data from that particular channel will be considered invalid and will not constitute a test failure.

5.2 In the event of an error in the communication link with the SDAS unit under test, the System 7 will print out the command which is unsuccessful. Upon receipt of this data, the operator must effect correction action of that communication link then proceed with testing. Table 2 commands are available to the operator and may be executed singularly for troubleshooting purposes.

Table 2.

CMD	FUNCTION
OPEN	Open command to TPMM
CLOS	Close command to TPMM
DIAL	Dial command to TPMM
CALL	Close, open, and dial to TPMM
REOF	Read configuration and end of file to SDAS
DISC	Disconnect to SDAS
REWD	Rewind tape to SDAS
RDCN	Read configuration to SDAS
REIN	Reinitialize to SDAS
RSST	Read storage table to SDAS
WIND	Wind to SDAS

5.2.1 To initiate the SDAS acceptance test program in the manual mode perform the following actions:

5.2.1.1 Command (IPL) as specified in 4.2.3.1.

5.2.1.2 Using the System 7 keyboard enter REQUEST and control statement L W7TEST. See paragraph 4.2.3.2.1.

5.2.1.3 The program will load and wait for operator action.

5.2.1.4 Using the keyboard enter the command in question from Table 2.

5.2.2 In the event of an out of tolerance condition on the channel outputs and it is desirable to change the analog inputs for troubleshooting purposes, perform the following actions:

5.2.2.1 Remove power from the SDAS by unplugging the SDAS power cord.

5.2.2.2 Set up the analog inputs as desired.

5.2.2.3 Connect power to the SDAS by replugging the power cord.

5.2.2.4 Command through the teletype the SDAS to rewind its cassette tape recorder/player.

5.2.2.5 Continue with testing in either automatic or manual mode.

5.2.2.6 Upon successful completion of the manual mode tests and/or repair, return to applicable portion of acceptance test procedure and continue tests.

6.0 TEST COMPLETION

6.1 Disconnect the prime input power line (110 VAC) from the SDAS unit under test.

6.2 Disconnect the prime input power line from the analog input switching box.

6.3 Disconnect all cables from the SDAS unit under test.

6.4 Return the SDAS unit to stock.

DWG NO. 7934354

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REVISIONS

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	66333ZS	-	Release	6/10/77	
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CONTR NO.	
PREPARATION	J. Sleigh
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DSGN APPROVAL	J. Conley

INTERNATIONAL BUSINESS MACHINES CORP.
FEDERAL SYSTEMS DIVISION
HUNTSVILLE, ALA. 35807

TITLE
SITE DATA ACQUISITION SUBSYSTEM
MODEL II PERFORMANCE SPECIFICATION

SIZE	CODE IDENT NO:	DWG NO.
A	20234	7934354

SCALE	WT	SHEET
		1 OF 21

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1.0 INTRODUCTION

This specification establishes the requirements for the design and performance of the Model II Site Data Acquisition Subsystem (SDAS). This specification defines the requirements to be met for all configurations of the Site Data Acquisition Subsystem including critical performance, installation requirements, and the detailed configuration relative to the system which it services. The latest revisions to this specification are noted by a heavy line at the right edge of the modified paragraph.

2.0 APPLICABLE DOCUMENTS

2.1 GOVERNMENT DOCUMENTS

None

2.2 CONTRACTOR DOCUMENTS

- 7934355 SDAS Mod II Installation Drawing
- 7934358 SDAS Mod II Acceptance Test Procedure
- 7934320 48 Channel SDAS II Unit Assembly
- 7934400 64 Channel SDAS Unit Assembly
- 7934330 96 Channel SDAS II Unit Assembly

2.3 OTHER DOCUMENTS

None

3.0 GOVERNMENT FURNISHED PROPERTY

None

4.0 SITE DATA ACQUISITION SUBSYSTEM REQUIREMENTS

Requirements for the Site Data Acquisition Subsystem are contained in the following paragraphs.

4.1 SYSTEM OVERVIEW

The Site Data Acquisition Subsystem (SDAS) shall be designed to collect data from sensors located on residential or commercial buildings using a solar heating and/or cooling system. The SDAS shall take the data obtained from sensors located on the solar heating and/or cooling system, process the data into a suitable format, store the data for a period of time, and provide the capability for either telephone retrieval by the Central Data Processing System or manual retrieval of the data for transfer to the central site. The unit shall be designed so it will not degrade the operation of the solar heating/cooling system which it is monitoring.

4.2 OPERATING CHARACTERISTICS

The SDAS provides the flexibility of handling inputs from a maximum of 95 sensors as specified in Paragraph 4.5 for solar energy systems and buildings. Individual units shall be personalized for specific site inputs. A functional block diagram of the

SDAS is shown in Figure 4.2-1. The SDAS shall perform the following functions:

- Scan the input sensors, multiplex and condition the input data into a digital data format.
- Stores the data for later retrieval by the central site.
- In response to an interrogation by telephone from the CDPS, transmit the stored data to the CDPS.

The data to be transmitted to the CDPS will be encoded for transmission within the SDAS and transmitted over standard-voice-grade telephone lines. Time, synchronization and BCH (error detecting) codes will be added to the data to aid the CDPS in error detection, formatting and processing of the data from the SDAS.

The CDPS shall have a command/response interface with the SDAS to prevent unauthorized access to the SDAS. The SDAS will provide codes which enables the CDPS to detect the end of the data being transmitted.

4.3 SYSTEM REQUIREMENTS

4.3.1 Time Period

The SDAS shall be designed to operate continuously.

4.3.2 Autonomy

The SDAS shall be designed to operate unattended except for maintenance and manual collection of data.

4.3.3 Subsystem Isolation

The SDAS shall be designed such that a failure of the SDAS shall not affect the operation or performance of the installed solar heating and/or cooling system.

4.3.4 SDAS Safety

Design of the SDAS shall comply with UL certification requirements and codes specified elsewhere in this specification and the SDAS installation shall comply with Installation Drawing 7934355 to eliminate safety hazards to the occupants of the dwelling or building during SDAS installation and operation.

4.4. PERFORMANCE REQUIREMENTS

4.4.1 Data Scan Interval

A major and a minor scan interval shall be provided. The minor scan interval is 32 seconds and the major scan interval is N x 32 seconds where N = a manually selectable integer from 1 to 127. The baseline major scan interval shall be 320 seconds or 5.33 minutes. Up to four asynchronous sampling channels operating at the minor scan

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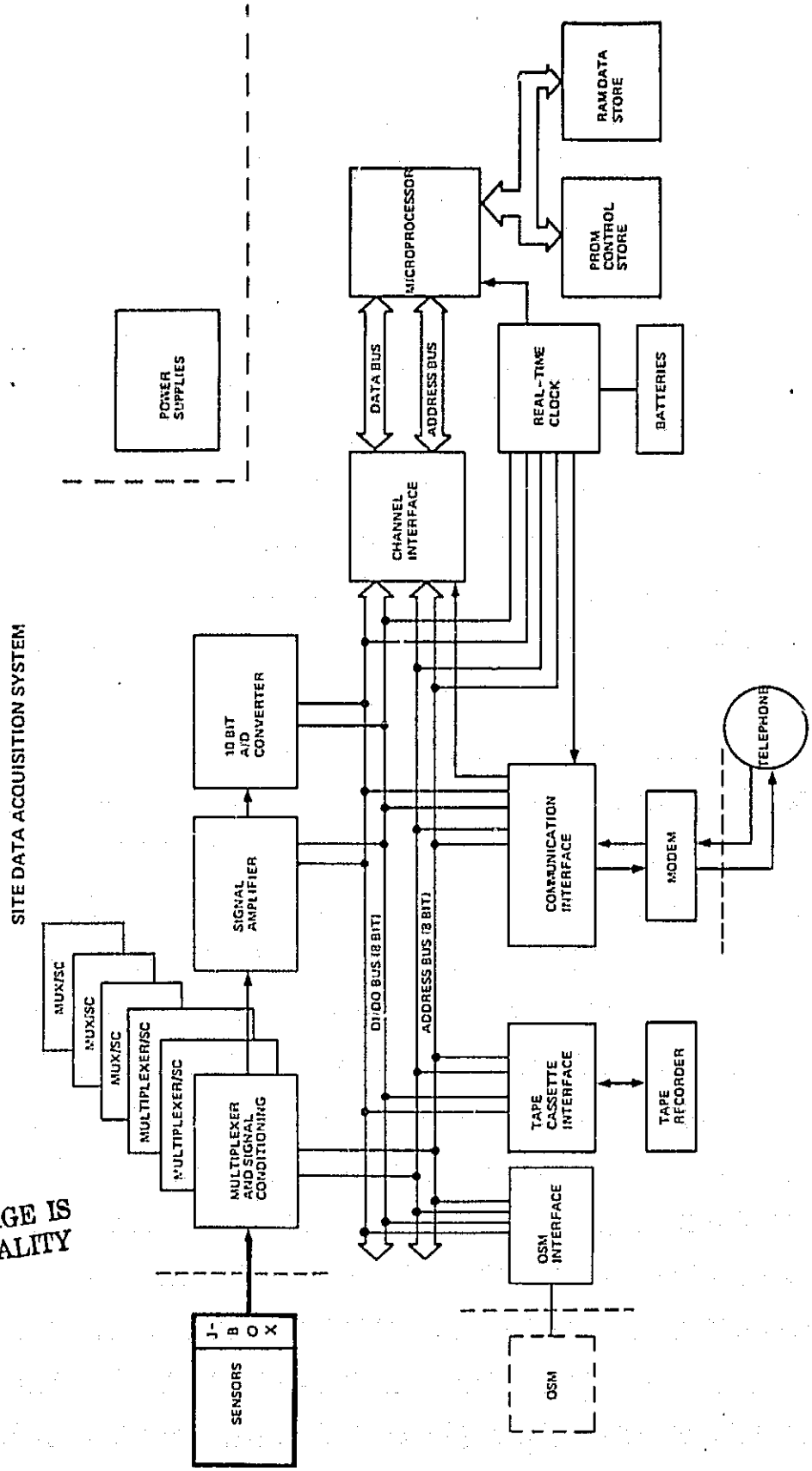

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Figure 4.2.1. SDAS Functional Block Diagram

interval (32 seconds) shall be provided for each multiplexer card installed in the SDAS, providing up to a maximum of 24 asynchronous channels in the 96 channel SDAS. Other channels shall be sampled at the major scan interval. The asynchronously scanned channels shall be temporarily stored until each major scan, when the average value over the major scan interval shall be stored. Approximately 1.5 milliseconds is required to read each sensor input channel.

4.4.2 Analog to Digital Conversion

The SDAS shall convert the analog inputs into 10-bit digital words.

4.4.3 Calibration

A zero volt calibration channel shall be included as an addressable channel (Channel No. 1) for determining the offset accuracy of recorded data.

4.4.4 SDAS Accuracy

The SDAS shall provide a maximum error from multiplexer analog switches to digital word conversion of the input parameters of 0.4 percent ±1/2 Least Significant Bit of the full scale (5 vdc or 100 mvdc). The sensor signal conditioning in the SDAS shall be included in the sensor error computations.

4.4.5 Time Tag and Coding

The SDAS shall provide a synchronization code and time tags to aid in central site processing. The real-time clock shall operate continuously and shall provide relative time in seconds (2 second resolution) which will be appended to each data scan. The time will be relative (not equal) to real time kept by the CDPS. The clock shall continue to operate during primary power interruptions.

4.4.6 Storage

The SDAS shall provide the capability for tape storage of 1.68 million bits (210 K bytes ± 10%) of data. The Random Access Memory (RAM) (used for temporary data storage and control program working space) shall have a storage capability of 1K bytes and the control program storage shall have a storage capability of 6K bytes.

4.4.7 Power Supply

The SDAS shall generate the dc voltages required by the SDAS from the 110 Vac primary power input. The dc voltages shall be generated by dc power supplies and/or voltage regulators in the SDAS.

4.4.8 Data Retrieval

The collected data can either be manually retrieved by physical removal of the tape cassette storage medium or remotely retrieved by the central site via a standard voice-grade telephone line interface as specified in Paragraph 4.5.3.

4.4.9 Data Rate and Format

The data stream shall be formatted for asynchronous transmission over standard voice-grade telephone lines. The maximum data transmission rate shall be 1.2 KBPS. The CDPS command message, SDAS reply message, SDAS data buffer (RAM Storage), SDAS tape and data transmission formats shall be provided as shown in Figure 4.4-1.

4.4.10 Scan Suspension

The SDAS shall not be required to collect data from the sensors while data is being transmitted to the CDPS site. Scans will also be suspended between writing the "End-of-File" command and the receipt of the "Disconnect" command from the CDPS.

4.4.11 Error Detection

The SDAS shall suspend the collection and processing of sensor inputs when an internal malfunction is detected by the SDAS and shall indicate this suspension when interrogated by the CDPS (SDAS status codes are included in reply messages).

4.4.12 CDPS/SDAS Interface

The SDAS shall be capable of receiving and processing the CDPS commands, performing the actions, and transmitting the reply information specified in Table 4.4-1. The data formats and information contained in the CDPS to SDAS command and reply messages shall be as shown in Figure 4.4-1.

4.4.12.1 SDAS Reply Messages

The reply frame of each SDAS reply message (Figure 4.4-1), except the Read Tape and Read Configuration command replies, shall include the following items:

- Command received
- SDAS station address
- SDAS status

The "Read Configuration" and "Read Configuration and End-of-File" replies shall additionally include the real-time-clock reading. For a normal reply message, bit 0 of the SDAS status code shall contain a "0" and for an error reply message, bit 0 of the SDAS status code shall contain a "1".

The "Read Tape" reply shall be included on the tape as shown for the buffer format in Figure 4.4-1.

4.4.13 SDAS/OSM Interface

The SDAS shall be capable of accepting an interrupt from the OSM requesting data. In response to the request, the SDAS shall collect data from all input sensors being monitored, shall condition the data to a digital format, and shall transmit the digital data to the OSM. The SDAS shall then resume normal operations. OSM data requests shall be secondary to collection of SDAS normal scans and the OSM request shall not be executed until the SDAS normal scan is completed.

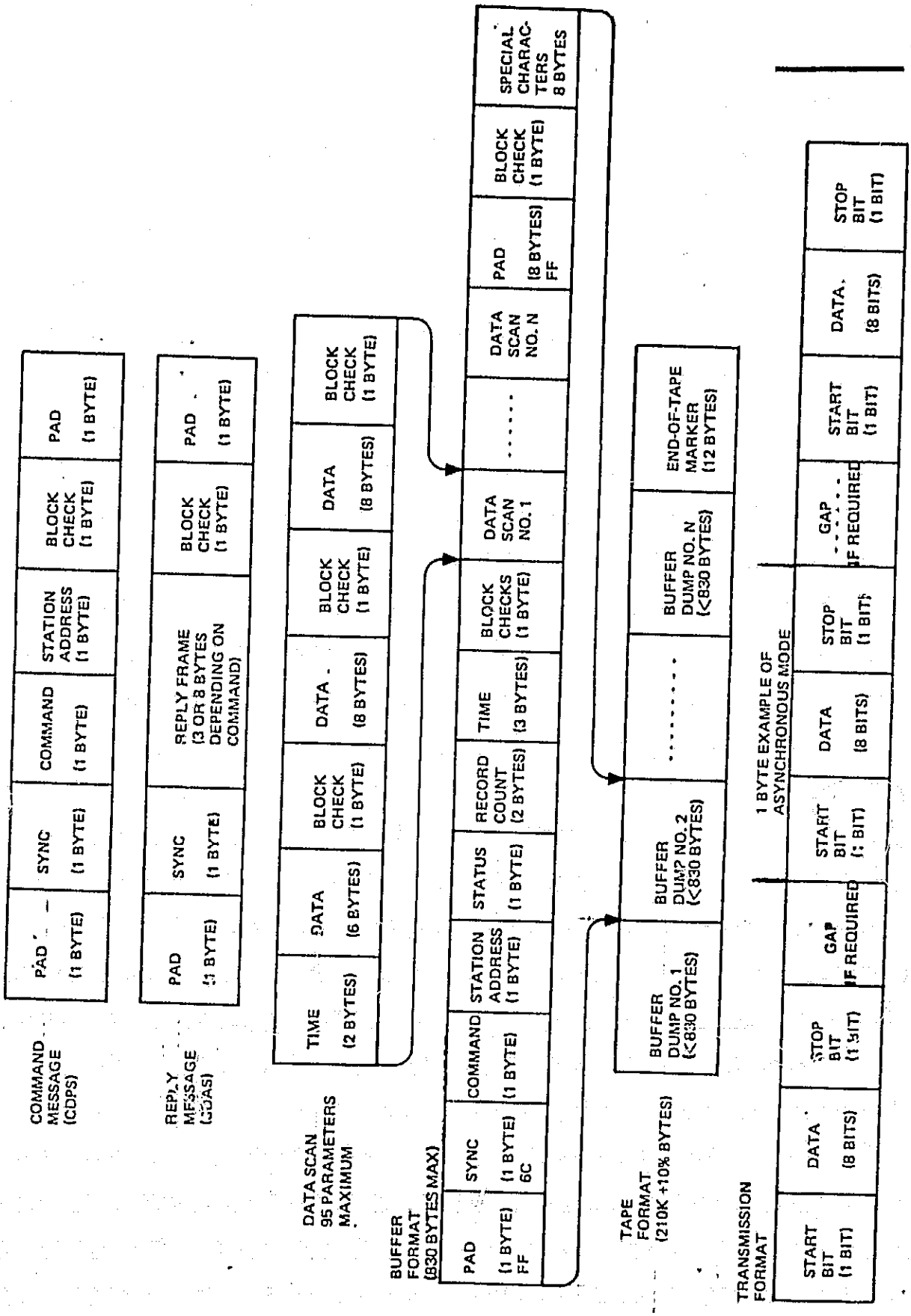

Figure 4.4-1. SDAS Data Formats

Table 4.4-1. CDPS Command and SDAS Reply Requirements

CDPS COMMAND	SDAS ACTION	SDAS REPLY
Read Configuration and End-of-File 'EF'	End of file written to tape cassette	Reply message with current Real-Time-Clock reading sent to CDPS
Rewind 'AA	Tape cassette is rewound and stops on beginning-of-tape (BOT) marker	Reply message sent to CDPS
Read Tape 'E0'	Tape cassette is placed in play back mode	Data on cassette sent as reply message
Disconnect '55'	SDAS disconnected from communications	Reply message sent to CDPS
Disconnect and Rewind '00'	SDAS disconnected from communications and tape cassette rewound	Reply message sent to CDPS
Read Configuration* '2F'	Information gathered for reply message	Reply message sent to CDPS with current SDAS Real-Time-Clock reading
Reinitialize** '1F'	A master reset of SDAS hardware and software executed	Reply message sent to CDPS
Wind '77'	Tape cassette is rewound Past end-of-tape (EOT) marker and stops	Reply message sent to CDPS

* This command useful for verifying status of SDAS
** Not used during operational data collection

4.5 SDAS INTERFACES

4.5.1 Interface Description

The SDAS shall provide interfaces for connection to the sensors, power, and telephone lines, and On-Site Monitor.

4.5.2 SDAS Primary Power

Power to the SDAS shall be standard 110-125 V, 60 Hertz, 1 Phase, 3 amps service. A standard 3 wire power cord (safety ground, power and return) shall be required.

4.5.3 Telephone

The SDAS shall interface with a standard Bell System CBS Data Access Arrangement Series 5 or later, or equivalent.

4.5.4 Sensor Interface

The SDAS shall provide the capability to accept data from a maximum of 95 sensors and to interface with the sensors and associated signal conditioning microboards specified in Appendix 1.

4.5.4.1 Sensor Signal Conditioning

The signal conditioning/multiplexer card(s) included in the SDAS shall provide the capability to accept the signal conditioning microboards described in Appendix 1. Specific voltage range and signal gain assignment for each input channel is given in Table 4.5-1. The SDAS shall be acceptance tested with straight-through wiring on all input channels. The SDAS shall accept inputs in either the 0-5 vdc or 0-100 mvdc range during testing.

4.5.4.2 Sensor Power Requirements

The SDAS shall provide a limited amount of power for use by the attached sensors. The SDAS shall be capable of supplying the following power for use by sensors:

- 18.0 watts at +15 vdc (1.2 amps)
- 0.144 watts at + 3.6 vdc (.04 amps)
- 5.0 watts at + 5 vdc (1.0 amp)

These levels are the maximum capability of the SDAS. Power utilized by the sensor signal conditioning microboards shall be considered as power supplied to the sensor and must be accounted for in computing the total power required by the sensor.

4.5.5 Detailed SDAS Physical Interfaces

The SDAS shall provide up to six 57 pin connectors (one for each 16 channels included in the SDAS) for interface with the sensors, one 37 pin connector for interface with the telephone and to provide sensor power, and one 37 pin connector for OSM interface. A standard twist-lock, 3 wire electrical power connector shall provide for primary

power interface. The SDAS I/O connectors pin function assignments for sensor inputs are given in Table 4.5-1, the sensor power and telephone interface functions are given in Table 4.5-2, and the SDAS/OSM connector pin function assignments are given in Table 4.5-3.

4.6 PACKAGING

4.6.1 Design Environment

The SDAS shall be designed to operate in an indoor environment having temperature extremes between 32°F and 100°F and relative humidity limits of 5% to 80% as long as condensation does not occur.

4.6.2 Modularity

The SDAS shall be designed using modular elements.

4.6.3 Mounting

The SDAS shall be capable of being mounted in accordance with installation drawing 7934355.

4.6.4 Physical Characteristics

The SDAS size shall be approximately 26.44" x 20.44" x 14.25" (4.46 cubic ft.) and weighs less than 75 pounds. Add 2 inches to the 20.44" dimension to include mounting flanges.

4.7 DESIGN AND CONSTRUCTION

4.7.1 Wiring

All subsystem wiring shall be in compliance with the applicable National Electric Code in effect April 30, 1976.

4.7.2 Failure Protection

UL-recognized circuit protection devices shall be used to provide fault isolation, wiring protection, and shall protect against short circuit hazards. These devices shall comply with the UL code in effect April 30, 1976.

4.7.3 Grounding

Grounding of all electrical/electronic circuitry shall be in accordance with the applicable National Electric Code in effect April 30, 1976.

4.7.4 Component Selection

The electrical and mechanical design shall utilize commercial grade components.

Table 4.5-1. SDAS I/O Pin Function and Channel Allocation

I/O CONN NO.	CHANNEL NO. OR FUNCTION	NO. INPUT WIRES	I/O PIN NUMBERS Hi	Lo	3RD	INPUT VOLTAGE ACCEPTANCE	SDAS AMP. GAIN	BITS STORED IN RAM
J102,	1 (A)*	3	1	2	3	0-100 MV	50	10
J103,	2 (A)	3	5	6	7			
J104,	3 (A)	3	8	9	10			
J105,	4 (A)	3	11	12	13			
J107,	5	3	15	16	17			
and/or								
J108.	6	3	18	19	20			
	7	3	23	24	25			
	8	3	26	27	28			
	9	3	31	32	33			
	10	3	34	35	36			
	11	3	39	40	41			
	12	3	42	43	44			
	13	3	46	47	48			
	14	3	49	50	51	0-100 MV	50	
	15	3	52	53	54	0-5 V	1	
	16	3	55	56	57	0-100 MV	50	10
	Shield	1	4					
	Spare	8	14,21,22,29,30, 37,38,45					

NOTES: (A) Asynchronous (sampled every 32 seconds)
*Channel 5 asynchronous rather than Channel 1 on mux + amplifier(Mux 1) only.
Pin function allocation is valid for all groups of 16 inputs, i.e.,
CH1=CH17=CH33=CH49=CH65=CH81,
CH2=CH18=CH34=CH50=CH66=CH82,
etc.

Table 4.5-2. Sensor Power/Telephone Connector Pin Function Allocation

I/O CONN NUMBERS	FUNCTION	NUMBER OF WIRES	I/O PIN NUMBERS
J101	+ 5 Vdc	2	12, 13
	+ 3.6 Vdc	2	2, 3
	+15 Vdc	2	5, 9
	+ 5 Vdc Return	2	23, 24
	+ 3.6 Vdc Return	1	26
	+15 Vdc Return	1	27
	Shield	1	28
	Ring Indicator	1	30
	Data Mod Ready	1	31
	Switch Hook	1	32
	Off Hook	1	33
	Coupler Cut Through	1	34
	Coupler Ground	1	35
	Data Ring	1	36
	Data Tip	1	37
	Spare	18	1, 4, 6-8, 10, 11, 14-22 25, 29

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Table 4.3-3. SDAS/OSM Interface Pin Function Allocation

I/O CONN NUMBERS	SIGNAL NAME	NUMBER OF WIRES	I/O PIN NUMBERS
J106	OSM CARD SELECT	1	9
	INTERRUPT POLL	1	10
	OSM INTERRUPT REQUEST	1	11
	OSM SELECT ACKNOWLEDGE	1	12
	AI STROBE	1	13
	FUNCTION BIT 0	1	14
	FUNCTION BIT 1	1	15
	SDAS TO OSM DBO BIT Ø	1	22
	1	1	23
	2	1	24
	3	1	25
	4	1	26
	5	1	27
	6	1	28
	7	1	29
	OSM CONNECTED	1	32
	SIGNAL RETURN	1	33
	SPARE	20	1-8, 16-21, 30-31, 34-37

4.7.5 Fungi/Mildew Resistance

Components of the system shall not support the growth of fungi, mold, and/or mildew in the presence of moisture to an extent that will impair their operational function over their intended service life.

4.7.5 Materials Compatibility

Component materials used in the subsystem shall be selected to minimize corrosion and deterioration that could degrade component performance under operating conditions.

4.7.7 Dissimilar Materials

Dissimilar materials and dissimilar materials coated with corrosion resistant finishes when used in contact with each other shall not create corrosive deterioriation which interferes with mechanical or electrical performance of the SDAS or its associated parts.

4.7.8 Interchangeability

Mechanical and electrical interchangeability and replaceability shall exist in form, fit, and function of assemblies and subassemblies of the same part numbers.

4.7.9 Marking

Marking of the SDAS shall be in accordance with good commercial practices in order to facilitiate assembly, checkout and maintenance.

4.7.10 Workmanship

Workmanship in fabrication and assembly of the SDAS shall be consistent with good commercial practice.

4.7.11 Safety

The SDAS shall be UL certified.

4.7.12 Fire Prevention

The SDAS shall conform to the fire section of applicable national fire codes in effect April 30, 1976.

4.8 RELIABILITY/MAINTAINABILITY

4.8.1 Maintenance/Replaceable Units

The SDAS shall be of a modular design to permit replacement of failed subassemblies.

4.8.2 Accessibility

The SDAS shall be designed to assure that field replaceable items shall be accessible for servicing, removal, or replacement.

4.8.3 Reliability

The SDAS shall use commercial grade components and shall be designed not to adversely affect the operation and performance of the monitored system.

4.8.4 Serviceability

The SDAS shall be capable of being serviced with a minimum amount of special equipment by a trained field technician.

5.0 GEOGRAPHICAL AREA

The SDAS shall be capable of operating in any geographical area of the United States subject to the restrictions specified elsewhere in this specification.

APPENDICES

APPENDIX 1

SDAS SITE PERSONALIZATION

1.0 INTRODUCTION

This appendix defines the SDAS design options which may be used to personalize the SDAS to meet site unique requirements which do not conform with the requirements stated in the main body of this specification.

This appendix defines the options which could be implemented into the unit assembly during personalization, into the microcode during SDAS Programmable Read Only Memory (PROM) burn-in, and defines for each sensor the microboard circuits which plug into the SDAS multiplexer/signal conditioning card and which are used to condition the sensor inputs to interface with the SDAS.

2.0 UNIT ASSEMBLY OPTIONS

The number of channels available in the SDAS can vary in increments of 16 channels from 16 to 96 by adding additional multiplexer/signal conditioning cards and associated sensor input cables. Each card/cable combination added includes 16 additional channels available in the SDAS. The three basic design options presently available for the SDAS includes 48, 64 or 96 channels.

3.0 PROM MICROCODE OPTIONS

A standard predefined microcode PROM program is used in the SDAS for as many sites as possible. Table 4.5-1 gives the standard amplifier gain, data bits stored and asynchronous channel assignments for the standard PROM. To meet site requirements that do not conform to Table 4.5-1 capability, a site unique microcode program will be used for that site. The standard microcode program may be altered by assigning an amplifier gain of 1 or 50 and/or resolution of 8 or 10 bits for each sensor channel. As an additional option, the four asynchronous channels per installed multiplexer card may be assigned to any of the 16 sensor channels per multiplexer card. No other options are available for the present microcode design.

4.0 SENSOR INTERFACE AND SIGNAL CONDITIONING MICROBOARDS

Table 4-1 lists the sensors which provide inputs to the SDAS, the sensor interface characteristics, and the microboards required to interface these sensors with the SDAS.

Four standard types of signal conditioning circuits shall be mounted on pluggable microboards which plug into mounting sockets included on the SDAS Mux card. The microboard types for each acceptable sensor are shown in Table 4-1. The following signal conditioning circuits shall be provided.

4.1 STRAIGHT THROUGH WIRING

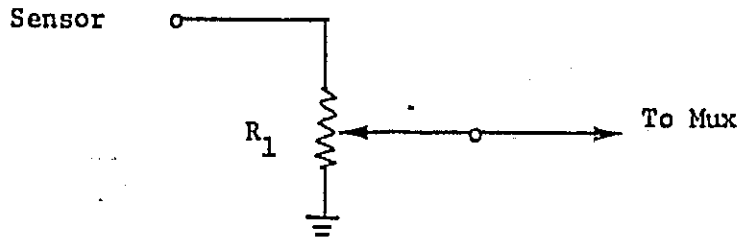
Analog or digital discrete inputs of 0 to 5 vdc or 0 to 100 millivolts dc shall not require conditioning, and microboards wiring the sensor input directly to the multiplexer input shall be provided.

Table 4-1. Sensor Interface and Microboard Requirements

CHANNEL UTILIZATION	SENSOR INPUT	SENSOR OUTPUT	SDAS AMPLIFIER GAIN	NO. WIRES	MICROBOARD TYPE
Pyranometer	---	0-12 mvdc	50	2 + S	Straight Through
Resistance Thermal Detector (RTD)	+15 vdc 15 ma	0-100 mvdc	50	2/3 + S	Temperature Bridge
Delta RTD	+15 vdc 20 ma	0-100 mvdc	50	3 + S	Delta Temperature Bridge
Target Type Flowmeter	+5.0 vdc 15 ma	0-10 mvdc	50	4 + S	Straight Through
Target Type Flowmeter	+15.0 vdc 45 ma	0-30 mvdc	50	4 + S	Straight Through
Hot Wire Anonometer (Air Flow)	115 vac	0-5 vdc	1	2 + S	Straight Through or Voltage Divider
Gas Meter	+5 vdc	0-5 vdc	1	3 + S	Straight Through
Wattmeter	---	0-50 mvdc 0-100 mvdc 0-150 mvdc	50	2 + S	Straight Through or Voltage Divider
Humidity	+3.6 vdc 10 ma	0-100 mvdc	50	4 + S	Straight Through
Wind Speed	---	13.3 vdc @ 100 mph	1	2 + S	Voltage Divider
Wind Direction	+5 vdc 10 ma	0-5 vdc	1	3 + S	Straight Through or Voltage Divider
Unused Channels	---	---	--	---	Input Shorting

4.2 DIVIDER NETWORK

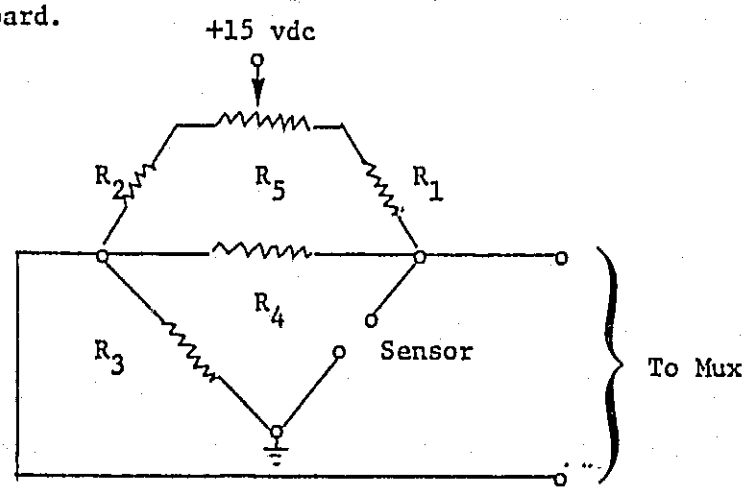
A pluggable microboard with a divider network shall be provided to condition sensor outputs to 0-5 vdc or 0-100 mvdc as specified in Table 4-1. The divider network shall be as follows:



NOTE: The specific voltage values are dependent upon the range of the input and output voltages and shall be selected to maximize output values. Currently R_1 is a potentiometer which is manually set to the required divider network ratio.

4.3 TEMPERATURE BRIDGE

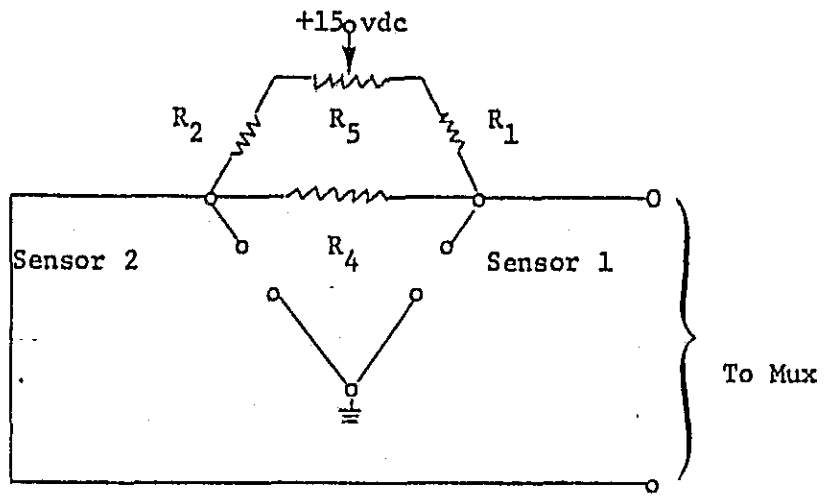
Analog inputs from a 100 ohm resistance thermal detector shall be conditioned to a 0 to 100 mvdc output using the following circuit; and the circuit shall be mounted on a pluggable microboard.



NOTE: The specific resistor values are dependent on the range of the input temperature being measured and shall be selected to meet performance evaluation accuracy requirements. Temperature range values selected for implementation include 30°F to 230°F, 30°F to 160°F, 30°F to 450°F, and -20°F to 120°F.

4.4 DELTA TEMPERATURE BRIDGE

Analog inputs from 100 ohm resistance thermal detectors used to measure differential temperatures shall be conditioned to a 0 to 100 mvdc output using the following circuit and the circuit shall be mounted on a pluggable microboard.



NOTE: The specific resistor values are dependent on the range of the input delta temperature being measured and the base value of the temperature from which the delta temperature is being measured, and shall be selected to meet performance evaluation accuracy requirements. Delta temperature range values selected for implementation include 0°F to 50°F, 0°F to 100°F and 0°F to 80°F.

4.5 INPUT SHORTING NETWORK

A pluggable microboard with wiring which ties the high and low input signals together shall be provided for input channels which are read by the microprocessor, but which have no sensor input on the channel.

4.6 TERMINATING RESISTOR

A pluggable microboard with a terminating resistor shall be used to convert a current input source to a voltage output.

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